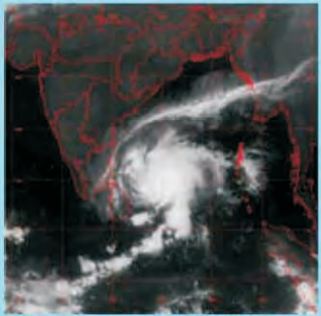
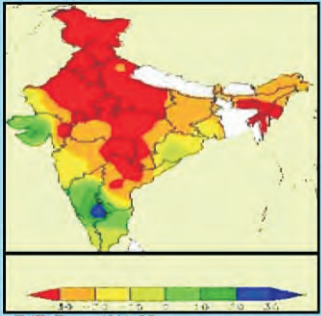
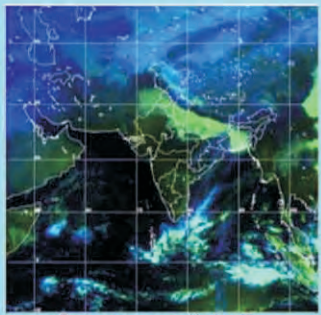




Orissa Tornado



Cyclone over Bay of Bengal



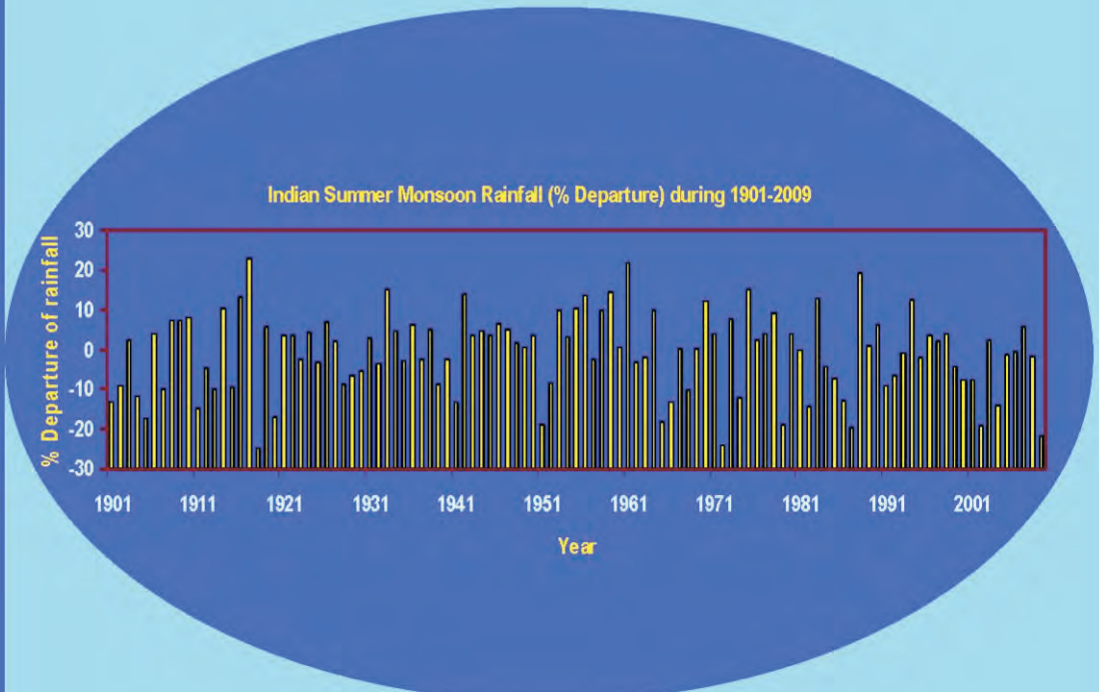
Fog over north India



वार्षिक प्रतिवेदन

Annual Report

2009



भारत मौसम विज्ञान विभाग
 INDIA METEOROLOGICAL DEPARTMENT
 पृथ्वी विज्ञान मंत्रालय, भारत सरकार
 Ministry of Earth Sciences, Govt. of India

IMPORTANT ACTIVITIES



AVM (Dr.) Ajit Tyagi, DGM addressing IMD officials on the eve of New Year Day



Symposium on "Weather, Climate and Sustainable Development" at SCOPE Complex, New Delhi



Plantation of Peepal sapling by Hon'ble Minister at CTI, Pune



Indian Delegation at WCC-3, WMO, Geneva



विभाग के कार्मिकों द्वारा प्रस्तुत संगीत कार्यक्रम



Workshop on "Weather and Climate" at M.C., Srinagar

ANNUAL REPORT 2009



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PREFACE

Looking back at the Year 2009 brings a sense of pride for the reason that India Meteorological Department has taken new strides towards modernization during this year. Needless to say that the driving force has been a constant endeavor to improve the services. The process has started with further building on the foundations of the Observational System, the Forecasting System and Integration. A range of new developments, like operation of Automatic Weather Stations, installation of Global and Regional NWP models, integrated Meteorological Analyses etc., find a mention in this Annual Report of 2009.

I should not fail to highlight a very significant event of the year 2009. Even though this Department came into existence way back in 1875 with Sir Henry Blanford, the then Imperial Meteorological Reporter at the helm, IMD has never really commemorated this event in the past. The first ever Foundation Day celebration was held on 15th January 2009 in the IMD premises. It was a memorable event in the august presence of the Hon'ble Minister for S&T and Earth Sciences, Shri Kapil Sibal, the Secretary MoES, Dr. Shailesh Nayak and many erstwhile stalwarts of our Department. A practice of recognizing meritorious services to the Department was instituted this year and awards were given to deserving candidates on the Foundation Day.

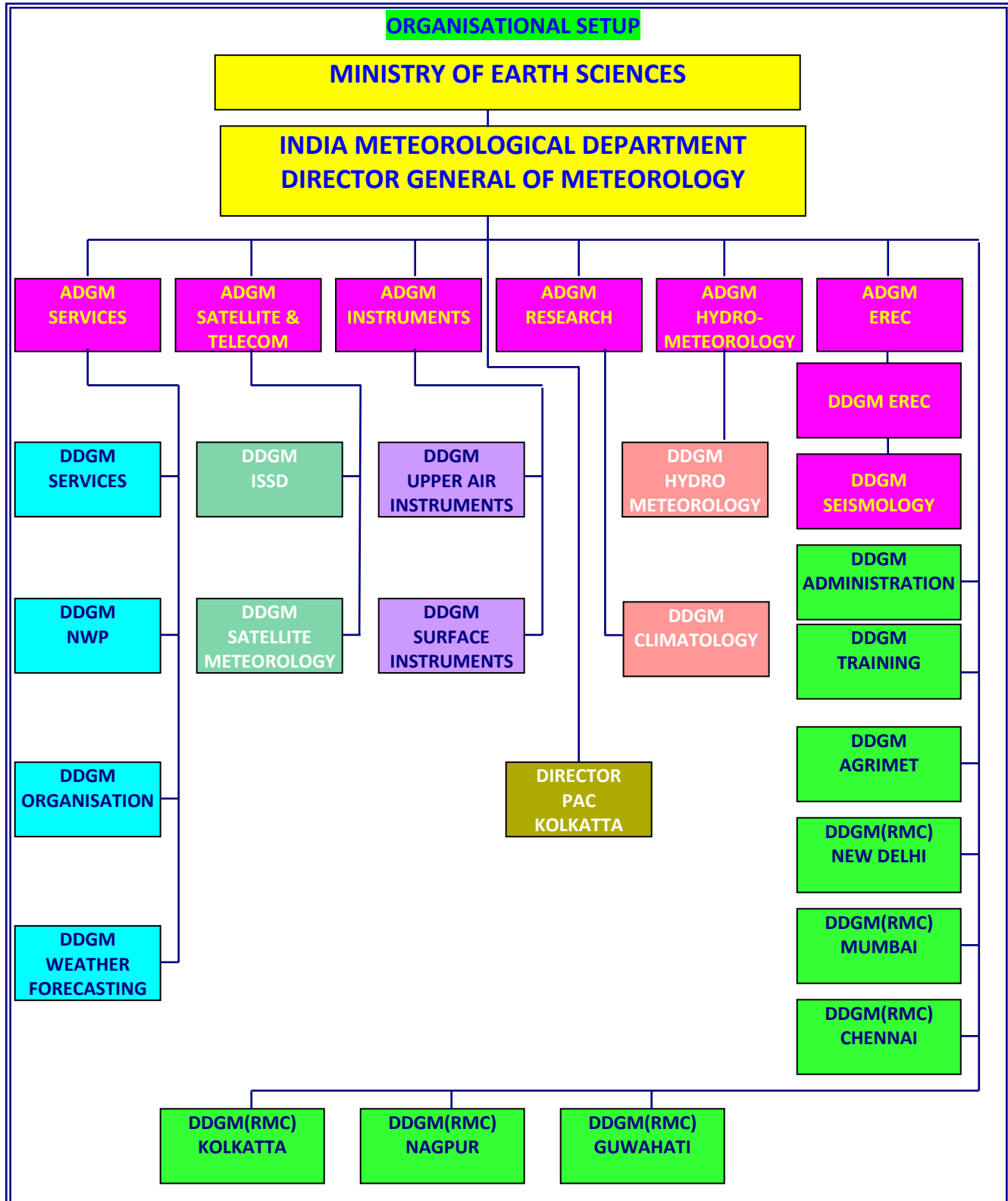
A large number of Workshops, Symposia and Conferences were organized this year by covering such diverse themes as Sustainable Development, Aviation Meteorology, Monsoon Forecasting, Tropical Storm and Local Severe Storm Forecasting, Radar Meteorology, Risk management in Agriculture and Positional Astronomy etc. The user community was engaged in dialogue by conducting user's seminars at regional level. The Annual Report makes an interesting reading on the plethora of activities pursued in this Department in this vibrant area of science.

Finally, one of the purposes of this Report is to document the state of climate experienced over the Indian territory, during the year, in a summarized fashion. The year 2009 was the warmest since 1901. This, coupled with a severe drought of rare occurrence, compounded the stress on our economy. The only solace that a scientific service like ours can have is that the near online briefing service that was provided to critical functionaries came of great avail.

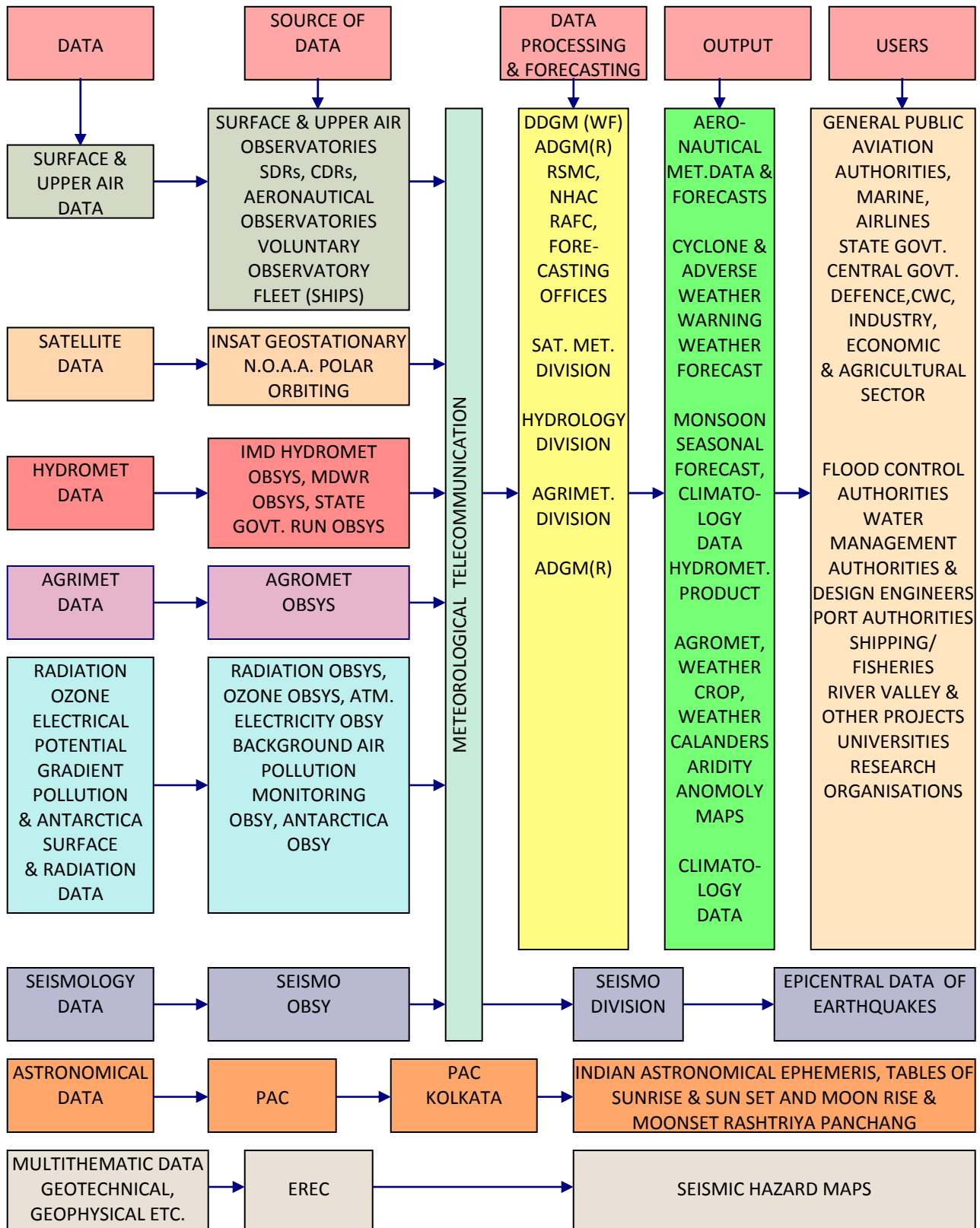
Looking back at the year through this report gives us a better perspective of the overall performance of the Department in the light of corresponding circumstances helping us to adjust the road map of future as per needs.

AVM (Dr.) AJIT TYAGI
Director General of Meteorology

1. ORGANISATIONAL AND FUNCTIONAL SETUP



FUNCTIONAL SETUP



2. WEATHER MONITORING

INDIA METEOROLOGICAL DEPARTMENT (IMD)

The India Meteorological Department (IMD) established in 1875 is the national meteorological service of the country and is responsible for monitoring and forecasting weather conditions in different scales of time. It has a network of observatories covering the landmass of the country and its surrounding sea areas from where ground-based, airborne and satellite observations are routinely taken. The services of IMD are utilized in almost all walks of national life and also provided to the international community under the charter of World Meteorological Organization.

Activities of Weather Forecasting

IMD issued weather forecasts and also precautionary warnings for hazardous weather like cyclonic storms, heavy rainfall, squalls etc. for the entire country so as to save human life, livelihood and property. Weather Central, Pune and Northern Hemispheric Analysis Centre, New Delhi are the two main forecasting Centres of the Department besides six Regional Meteorological Centres and Meteorological Centres at State headquarters. The weather reports were disseminated through media, passed on to all relevant Government agencies, hoisted on the Web and published in the Indian Daily Weather Report.

Experiencing the normal variability of weather, the year 2009 did not witness any remarkable heat and cold wave, unexpectedly heavy rainfall or persistent and widespread fog, except for a few cases of extreme weather which were successfully foreshadowed.

2.1 WINTER SEASON (JF) 2009

The season was characterized by unusual high temperatures over most parts of the country. Many stations reported record highest temperature. During the second fortnight of January, the northwestern and central parts of the country, Himachal Pradesh and Uttaranchal witnessed abnormal warmer conditions. Maximum temperatures over these areas were generally 3 to 4° C above normal during the period. While during February, warmer (unusual) conditions prevailed throughout the country. Maximum and mean temperature anomaly for the country as a whole was 2.0 and 1.6° C above normal respectively during the month. These are second highest (after the year 2006) since 1901.

Rainfall Features

During the season, out of 36 meteorological sub-divisions, 1 sub-division (Jammu & Kashmir) received normal rainfall, 4 received deficient rainfall and 24 received scanty rainfall. Remaining 7 sub-divisions did not receive any rain. Rainfall activity during the season over the country as a whole was subdued and was confined to extreme northern and northeastern region, parts of Madhya Pradesh and parts of coastal Tamil Nadu. Rainfall over these regions generally exceeded 3 cm. Extreme northern and northeastern parts of the country received more than 10 cm of rainfall. Rainfall over parts of Jammu & Kashmir exceeded 30 cm. Rainfall anomalies were negative over most parts of the country, except over parts of extreme northwestern and northeastern region and parts of Madhya Pradesh. Negative rainfall anomaly over most of the eastern parts of the country and

extreme south peninsula exceeded 2 cm. Over parts of Himachal Pradesh and Uttaranchal the negative rainfall anomaly exceeded 10 cm. Over parts of Jammu & Kashmir, Punjab and extreme northeastern region, the positive rainfall anomaly exceeded 2 cm.

Temperature

Mean seasonal maximum and minimum temperature anomalies are shown in Figs. 1(a&b) respectively.

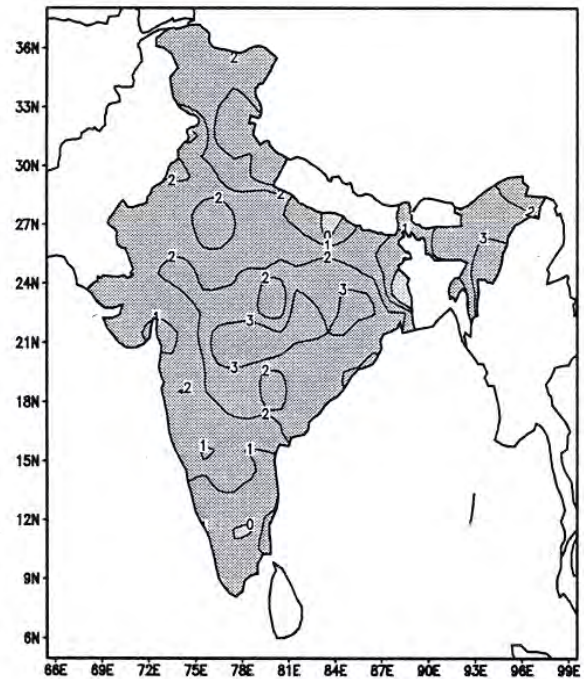
Maximum temperatures were above normal over almost throughout the country. These were above normal by more than 2° C over northern, central, eastern and northeastern parts of the country. Over parts of Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Nagaland, Manipur, Mizoram & Tripura, Vidarbha, Chattisgarh and Orissa, the anomalies in the maximum temperature exceeded the normal by more than 3° C.

Minimum temperatures were also above normal over most parts of the country except some parts of south peninsula. These were above normal by more than 2° E over western, central and northern parts of the country and parts of West Bengal, Sikkim & Bihar. Over parts of Jammu and Kashmir, Rajasthan, Saurashtra & Kutch, West Madhya Pradesh, Marathwada and Sikkim, the anomalies in the minimum temperature exceeded the normal by more than 3° C.

Outgoing Longwave Radiation (OLR)

OLR anomaly (W/m^2) over the Indian region were observed positive almost over the entire country. Over eastern parts of the country the positive OLR anomalies exceeded $10 W/m^2$.

(a) MAXIMUM TEMPERATURE ANOMALY



(b) MINIMUM TEMPERATURE ANOMALY

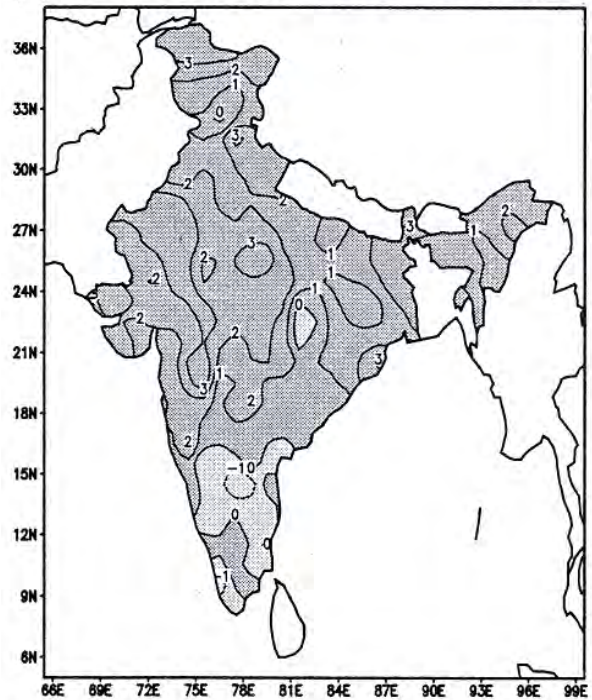


Fig. 1 (a&b). Seasonal mean maximum /minimum temperature anomalies

2.2 PRE-MONSOON SEASON (MAM)

Heat Wave Conditions

Heat wave/hot day conditions prevailed over some parts of central and peninsular India during the first three weeks of March, over the northern half of the country on many occasions during April and over northern, central and peninsular parts of the country during the second and third week of May. These conditions were severe over parts of Rajasthan on some days during the third week of May.

Rainfall Features

During the season, out of 36 meteorological subdivisions, 2 received excess rainfall, 10 received normal rainfall, 16 received deficient rainfall and 7 received scanty rainfall. One subdivision (Saurashtra & Kutch) did not receive any rain. (Fig. 2).

Rainfall activity during the season over the country as a whole was very much subdued. However, Gangetic West Bengal and Bihar received excess rainfall, almost one and half times its normal value. All India area weighted rainfall over the country as a whole this year was only 91 mm (normal 135 mm). This was the third lowest since 1950 after 1996 (80.6) and 1954 (88.8).

Rainfall activity was mainly confined to the south peninsula and extreme northern and northeastern parts of the country, which received more than 10 cm of rainfall. Rainfall over parts of extreme northeastern region and Kerala exceeded 40 cm. Rainfall over the central parts of the country was of the order of 3 to 5 cm. Rainfall anomaly was positive over parts of peninsula, central and northeastern parts of the country and was negative elsewhere. Positive rainfall anomaly exceeded by 5 to 10 cm over parts of south peninsula and eastern parts of the country viz., West Bengal and Bihar. Over parts

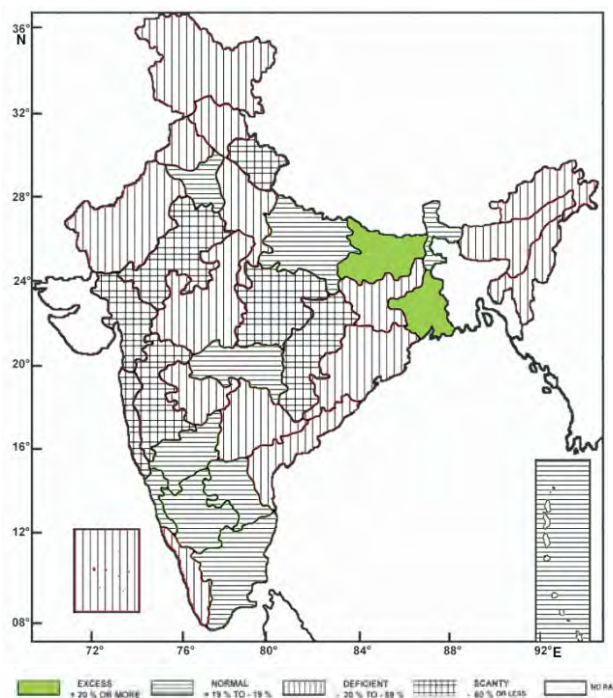


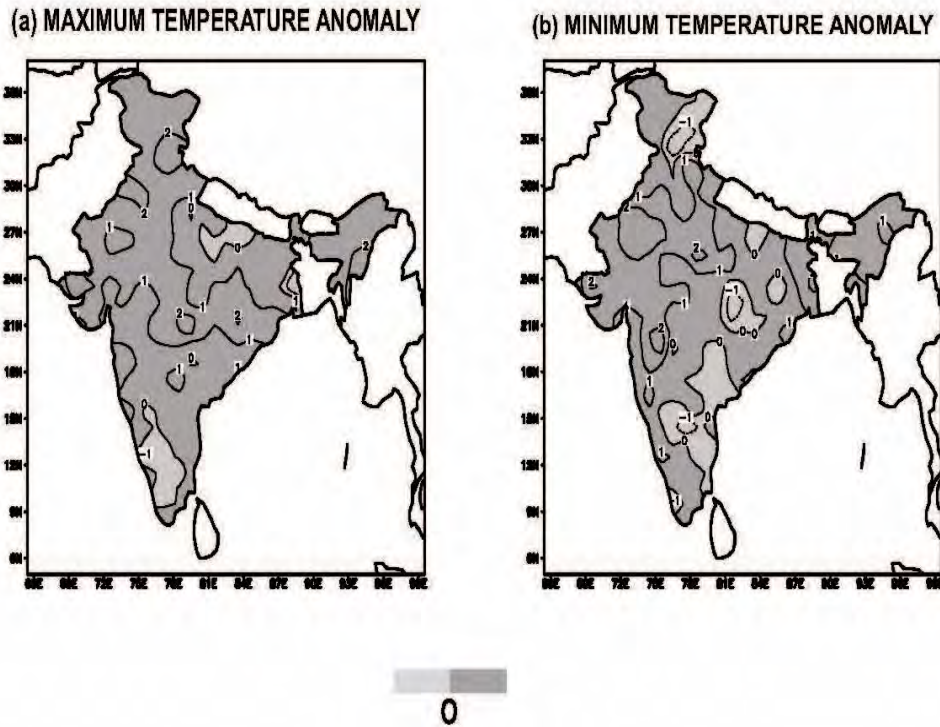
Fig. 2. Spatial distribution of rainfall

of Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Coastal Andhra Pradesh, Orissa and extreme northeastern parts of the country, rainfall deficiency was of the order of 5 to 10 cm.

Temperature

Mean seasonal maximum and minimum temperature anomalies are shown in Figs. 3(a&b) respectively. Maximum temperatures were above normal over most parts of the country except parts of south peninsula, East Uttar Pradesh and Gangetic West Bengal. Maximum temperatures were above normal by more than 1° C over some central and entire northern, northwestern and extreme northeastern parts of the country.

Minimum temperatures were also above normal over most parts of the country except parts of peninsula and some central and extreme northern parts. Minimum temperatures were



Figs. 3 (a&b). Mean seasonal temperature anomalies (°C) (a) Maximum (b) Minimum

above normal by more than 1° C over the northwestern and some northern parts of the country and parts of Marathwada, West Bengal, Jharkhand and Bihar. Over northern parts of Rajasthan, the minimum temperature anomalies exceeded 2° C.

Outgoing Longwave Radiation (OLR)

OLR anomaly (W/m^2) over the Indian region and neighborhood were negative over the southpeninsula and adjoining Arabian sea and Bay of Bengal and also over some central and northern parts of the country. Negative OLR anomalies over these regions were generally less than $5 W/m^2$.

Low Pressure Systems

During the season, two cyclonic storms(**Bijli in April and Aila in May**), formed over the Bay of Bengal (Fig. 4).

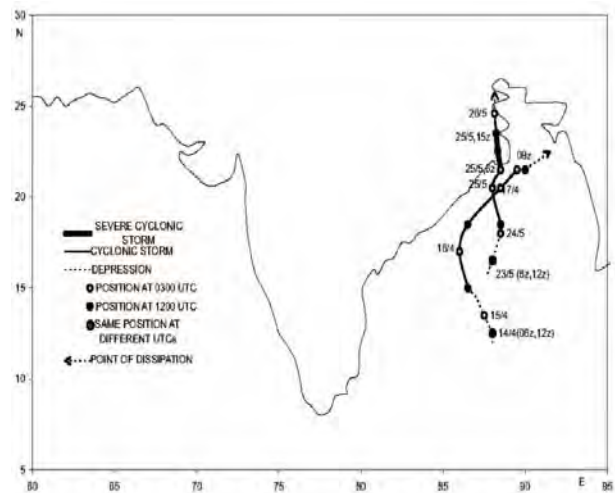


Fig. 4. Tracks of cyclonic storms formed during the pre-monsoon season

2.3. SOUTHWEST MONSOON(JJAS) 2009

1. The cumulative rainfall for the country as a whole for the season (1st June to 30th September,

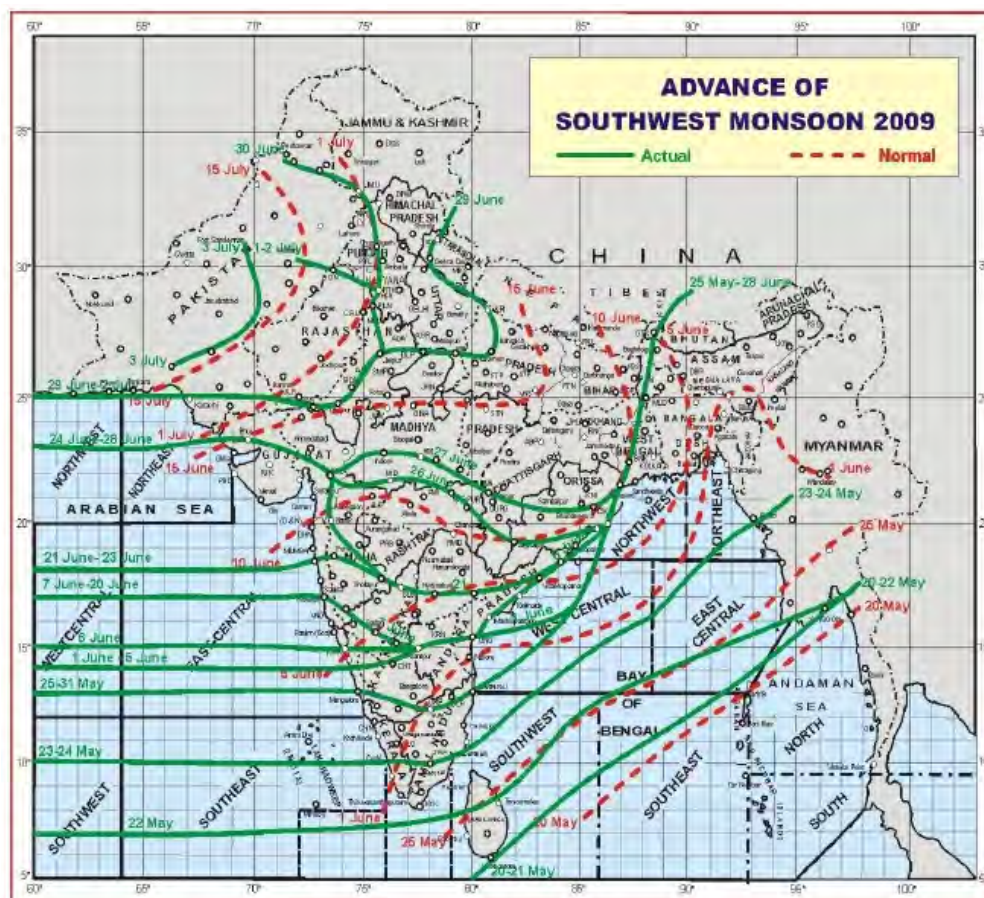


Fig. 5. Progress of Southwest Monsoon – 2009

2009) was 78% of its long period average (LPA).

2. Seasonal rainfall was 65% of its LPA over Northwest India, 80% of its LPA over Central India, 94% of its LPA over south Peninsula and 77 % of its LPA over Northeast India.

3. Monthly rainfall was 53% of LPA in June, 96% of LPA in July, 73% of LPA in August and 80% of LPA in September.

4. The monsoon set in over Kerala on 23rd May, one week before its normal date of 1st June. During 8-20 June, there was hiatus in the advance of the monsoon. However, later monsoon advanced rapidly and covered the

entire country by 3rd July, compared to its normal date of 15th July. As in the previous two years, the withdrawal of monsoon from west Rajasthan was delayed and it commenced only on 25th September compared to its normal date of 1st September.

5. Out of 511 meteorological districts for which data are available, 217 districts (42%) recorded excess/normal rainfall and the remaining 294 districts (58%) recorded Deficient/deficient rainfall during the season.

6. The operational forecast for monsoon onset over Kerala for this year was correct, which is the fifth consecutive correct forecast for this event since issuing of forecast for the event which started in 2005.

7. The operational long range forecast over the country as a whole and over four homogeneous regions except south peninsula have not been accurate. The forecast for August rainfall over the country as a whole has also not been accurate. All these forecasts were overestimate to the actual rainfall situation. However, the forecast for seasonal rainfall over south peninsula and that for July rainfall over the country as a whole have been accurate.

2.3.1 Onset of Southwest Monsoon

The Southwest monsoon set in over Andaman Sea around its normal date of 20th May. It set in over Kerala on 23rd May, about a week earlier than the normal onset date (1st June).

Subsequent to the onset over Kerala, a Severe Cyclonic Storm (Aila) formed over the Bay of Bengal. In association with it the advance of monsoon over the northeastern states including West Bengal & Sikkim occurred earlier than normal. Thereafter, the cross equatorial flow became weak. After a hiatus of about a week, monsoon further advanced along the west coast and advanced up to around 17° N latitude on 7th June. A prolonged hiatus in the further advance of monsoon occurred during 8th – 20th June, which may be mainly attributed to the weak cross equatorial flow and non formation of low pressure systems over the Bay of Bengal. Severe heat wave conditions prevailed over many parts of northwest, central and adjoining eastern parts during this period.

Associated with the formation of a Depression over the Arabian Sea during 23rd – 24th June, Southwest monsoon advanced as a weak current over some more parts of peninsular India and parts of central India during 21st – 27th June. Subsequent monsoon advance was very rapid and by 30th June, most parts of the country, outside parts of west Rajasthan was covered by the monsoon current. Monsoon covered entire country on 3rd July, about 12 days earlier

than its normal date of 15th July, when the interaction between monsoon flow and mid-latitude westerlies resulted in copious rainfall over Rajasthan. Fig. 5 depicts the isochrones of advance of southwest Monsoon – 2009.

2.3.2. Chief synoptic features

The north-south surface pressure gradient across the country was mostly weak throughout the season. The monsoon trough was also very shallow and during many occasions was situated to north of its normal position. During 30-31 July and 13-19 September, the trough was close to the foothills of Himalayas. The cross equatorial flow was weaker than normal during major part of the season except for a brief period from last week of June to third week of July. Due to these anomalous features, the activity of monsoon low pressure systems (lows and depressions) during this year was very much subdued compared to previous years. Only 4 depressions (2 each formed over the Arabian Sea and the Bay of Bengal) and 5 low pressure areas formed during the season. The life duration of most of these systems over land was short and therefore did not help in persistent rainfall activity.

During June, two depressions and a low pressure area were formed. The low pressure area which formed over the northeast Bay of Bengal during 4 - 7 June and did not contribute much to the monsoon activity. However, the depressions caused very heavy rainfall along the west coast and Saurashtra & Kutch. One depression formed over the east central Arabian Sea, moved northwards along the west coast and weakened after crossing the South Gujarat coast during 23 – 24 June. Subsequently the remnant of this system re-emerged over the northeast Arabian Sea and after concentrating again into a depression moved northwards over the land during 25 – 26 June and weakened over Kutch and neighborhood.

भारत मौसम विज्ञान विभाग INDIA METEOROLOGICAL DEPARTMENT

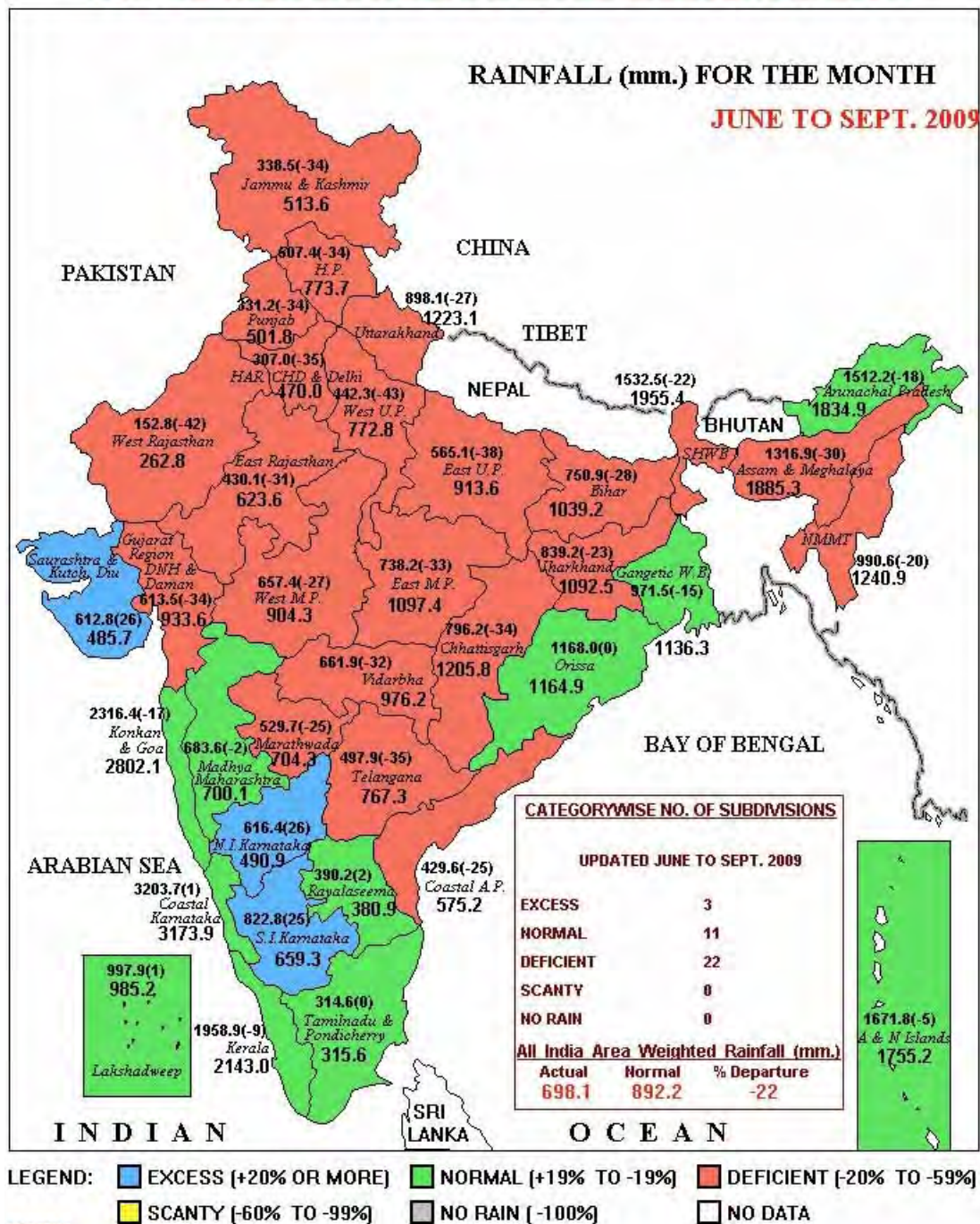
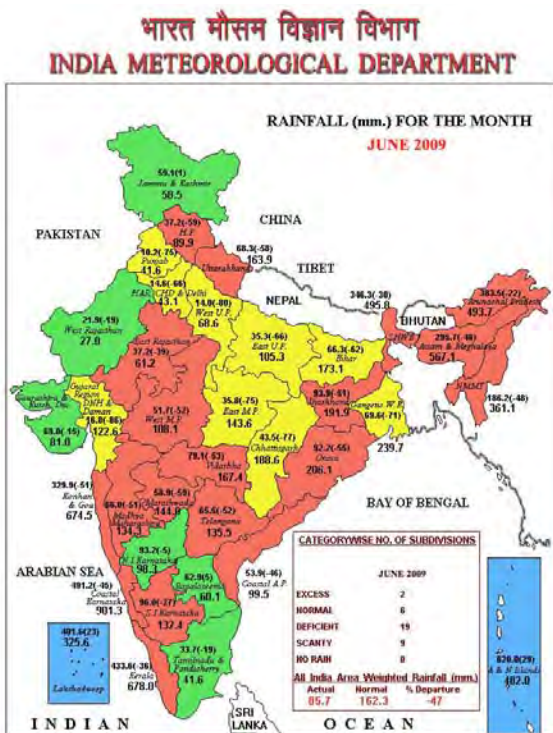


Fig. 6. Sub-divisionwise rainfall distribution over India during southwest monsoon season (June to September) – 2009



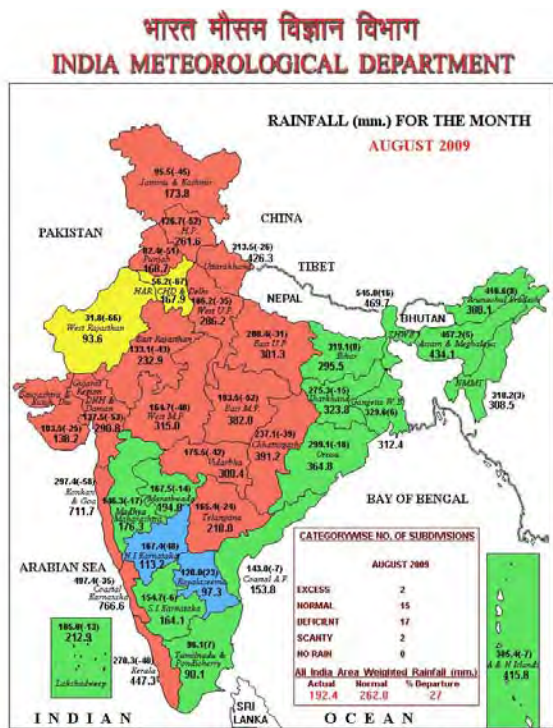
LEGEND: ■ EXCESS (+20% OR MORE) ■ NORMAL (+19% TO -19%) ■ DEFICIENT (20% TO -59%)
■ SCANTY (-60% TO -99%) ■ NO RAIN (-100%) ■ NO DATA

NOTES:
 (a) Rainfall figures are based on operational data.
 (b) Small figures indicate actual rainfall (mm.), while bold figures indicate Normal rainfall (mm.)
 Percentage Departures of Rainfall are shown in Brackets.



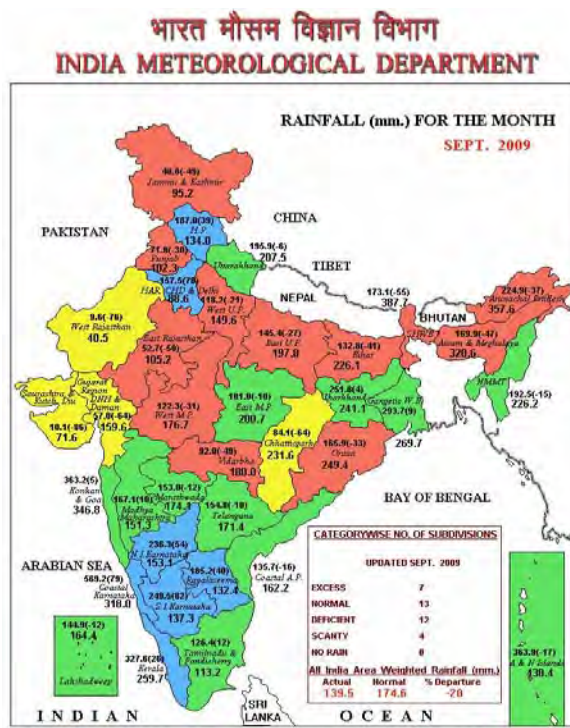
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NOTES:
 (a) Rainfall figures are based on operational data.
 (b) Small figures indicate actual rainfall (mm.), while bold figures indicate Normal rainfall (mm.)
 Percentage Departures of Rainfall are shown in Brackets.

Fig. 7. Sub-divisionwise monthly rainfall distribution over India during southwest monsoon season – 2009

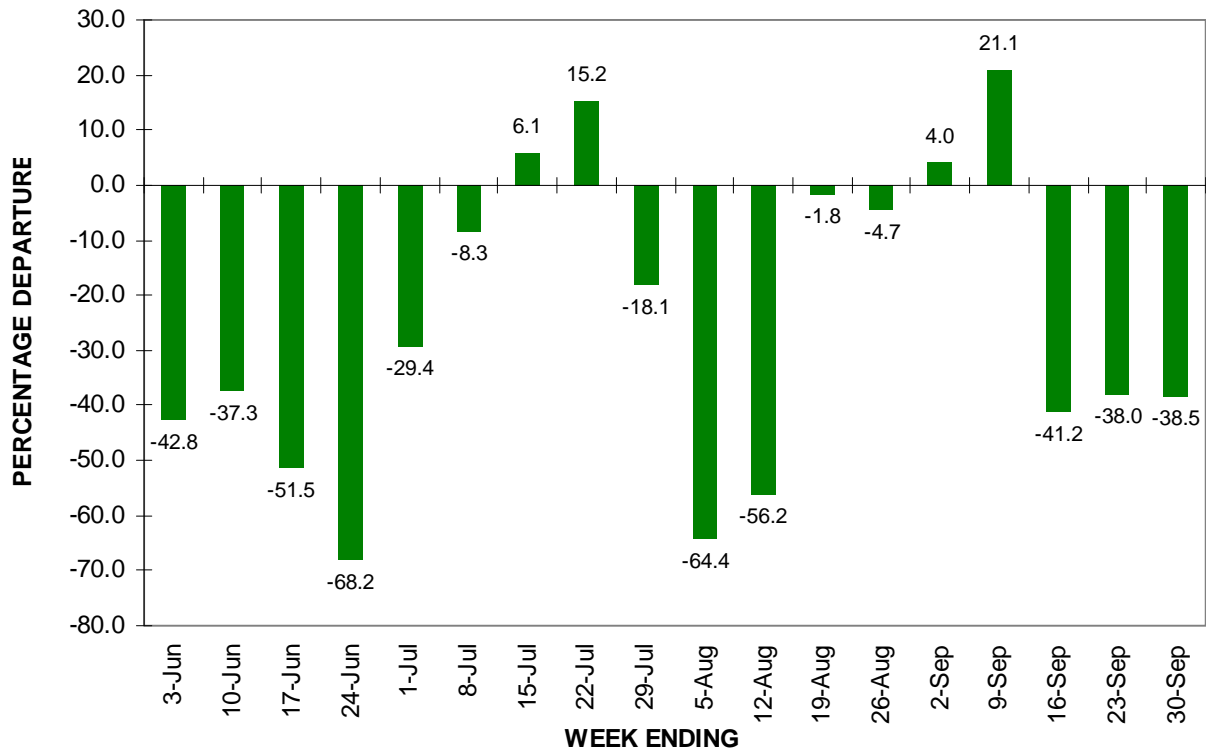


Fig. 8. Week - by - Week Progress of the Monsoon Rainfall – 2009

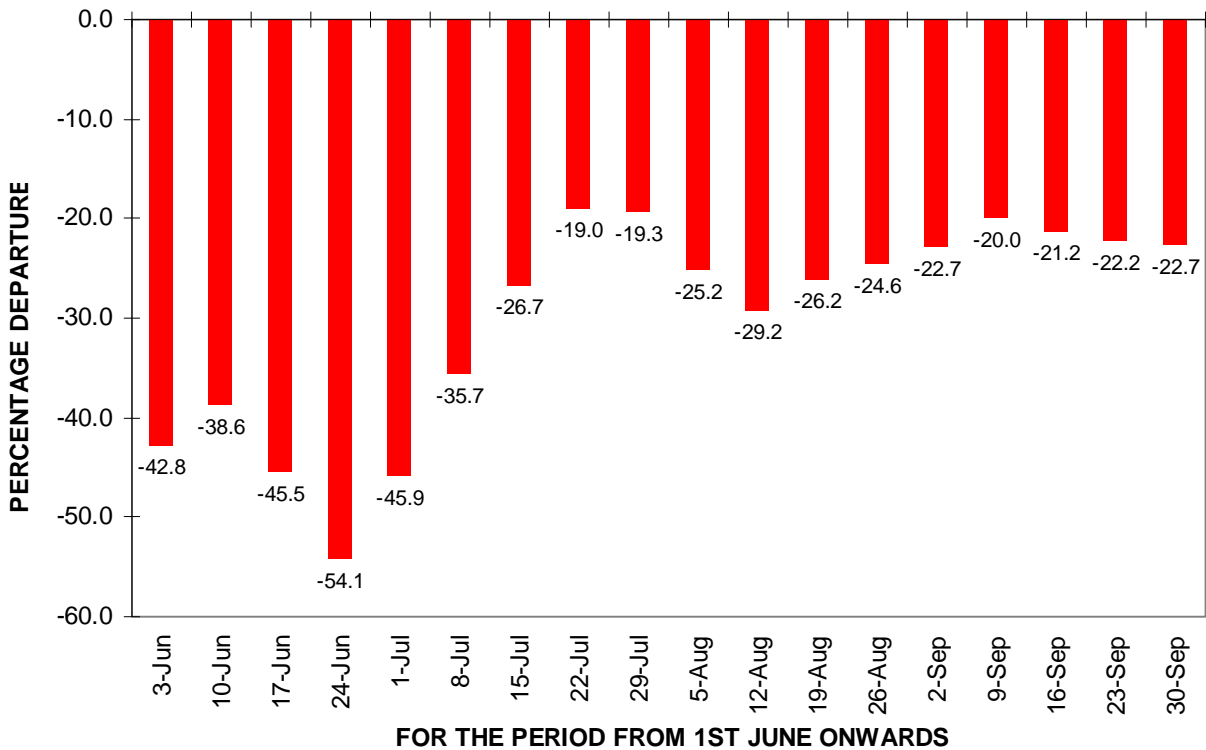


Fig. 9. Week - by - Week Progress of the Monsoon Rainfall - 2009 (Cumulative)

During July, the synoptic activity was near normal. Two low pressure areas and a deep depression formed during the month. One of the low pressure areas (13 – 16 July) and the deep depression (20 – 21 July) formed over northwest Bay of Bengal, moved west northwestwards along the monsoon trough zone and caused normal to excess rainfall along west coast and over central parts of the country.

In August, only one low pressure area formed. This system (25 – 29 August) which formed over northwest Bay of Bengal and adjoining coastal Orissa moved west northwestwards and contributed to excess rainfall over the central and peninsular India especially over Gujarat and Rajasthan.

In September, one deep depression and one low pressure area formed. The deep depression which formed over the northwest Bay of Bengal off Orissa coast (5 – 7 September) initially moved northwestwards and then westnorthwestwards resulting in active monsoon conditions all along the west coast and central India. The interaction of the remnant of this system with trough in upper air westerlies also caused good rainfall activity over north India. Towards the end of the season, a well marked low pressure area formed over the west central Bay of Bengal and persisted during 28 – 30 September. Tracks of the system in Fig. 10.

Flood situations

During the season, some flood incidents were reported in some states viz., Karnataka, Assam, Meghalaya, Arunachal Pradesh, West Bengal, Orissa, Bihar, Jharkhand, Uttar Pradesh, Uttarakhand, Haryana, Punjab, Himachal Pradesh, Gujarat, Maharashtra, Madhya Pradesh, Kerala and Andhra Pradesh.

2.3.3. Withdrawal of southwest monsoon

Like last two years, this year also there was delay in the withdrawal southwest monsoon due

to rainfall activity over north India in associated with the mid latitude westerly activities. The withdrawal of SW Monsoon from west Rajasthan started only on 25th September (a delay of more than 3 weeks). The normal date of withdrawal to start from extreme western parts of Rajasthan is 1st September. Subsequently, it withdrew from most parts of the northwestern states and from the northern parts of Gujarat on 28th September.

2.3.4. Rainfall distribution

The southwest monsoon season (June to September) rainfall for the country as a whole and the four broad geographical regions are as follows:

Region	Actual (mm)	Long Period Average (LPA) (mm)	Actual % of LPA	Coefficient of Variation (CV) % of LPA
All - India	698.1	892.2	78	10
Northwest India	394.6	611.6	65	19
Central India	795.0	993.9	80	14
South peninsula	682.4	722.6	94	15
Northeast India	1098.1	1427.3	77	8

The season rainfall is classified as normal when the actual rainfall is within $LPA \pm CV$. The CV for season rainfall over various regions is given in the table above. Similarly season rainfall is classified as deficient when the actual rainfall is less than $(LPA - CV)$ and as excess when the actual rainfall is more than $(LPA + CV)$. Accordingly the 2009 season rainfall over the country as a whole was deficient (77% of LPA), and was the lowest recorded rainfall in recent decade. Similarly season rainfalls over NW India (64% of LPA), Central India (80% of LPA), and NE India (73% of LPA) were also deficient and that over South Peninsula (96% of LPA) was normal. The sub-divisionwise season

rainfall is shown in Fig. 6. The rainfall recorded over 22 out of 36 sub-divisions was deficient. Out of the remaining 14 sub-divisions, only 3 sub-divisions (Saurashtra & Kutch, North Interior Karnataka and South Interior Karnataka) recorded excess rainfall and remaining 11 sub-divisions recorded normal rainfall. Out of 511 meteorological districts for which data are available, 217 districts (42) % of the meteorological districts received excess/normal rainfall and the remaining 294 districts (58%) received deficient/scanty rainfall during the season.

The monthly monsoon rainfall over the country as a whole during all the months was below the respective LPA. However, the rainfall during July (96% of LPA) was within the normal limit. Monsoon rainfall over the country as a whole was 53% of LPA during June, 73% of LPA in August and 80% of LPA during September. The spatial distribution of monthly rainfall is shown in Fig. 7.

In June, large rainfall deficiency was observed over most parts of the country due to prolonged hiatus in the monsoon advance over central and northern parts of the country. During July, rainfall over most of the sub-divisions along the foothills of Himalayas and few in the eastern side of the Peninsula were highly deficient. The rainfall over most of the sub-divisions along the monsoon trough zone region and along west coast was normal/excess due to the strengthening of monsoon over these regions in association with the passage of fast moving synoptic scale systems from Bay region along the monsoon trough zone. In August rainfall over most of the subdivisions along the west coast and that over NW India & neighboring central India were highly deficient. In September the rainfall over all subdivisions from south Peninsula & neighboring central India and that over few sub-divisions from north was normal or excess. Rainfall over other subdivisions was deficient or scanty.

Figures 8 and 9 depict the monsoon rainfall as received week by week and the cumulative rainfall during the season. The weekly rainfalls were below normal during most of the season except four weeks. These are two middle weeks of July, last week of August and first week of September. The cumulative rainfall distribution shows that the large deficiency in rainfall during early part of the season caused the cumulative seasonal rainfall over the country as a whole to remain below normal by 19% or more during every weeks of the season.

2.3.5. Summary LRF of verification

Using an indigenously developed statistical model, IMD predicted that monsoon onset over Kerala would take place on 26th May with a model error of ± 4 days. This year, the monsoon onset over Kerala was on 23rd May, 3 days earlier than the forecasted date and hence within the forecast range.

The Table below gives the summary of the verification of the long range forecasts issued for the 2009 Southwest monsoon.

Region	Period	Issued on	Forecast	Actual
All India	June to September	17 April, 2009	96% \pm 5% of LPA	78% of LPA
		24 June, 2009	93% \pm 4% of LPA	
All India	July	24 June, 2009	93% \pm 9% of LPA	96% of LPA
All India	August	24 June, 2009	101% \pm 9% of LPA	73% of LPA
Northwest India	June to September	24 June, 2009	81% \pm 8% of LPA	65% of LPA
Northeast India			92% \pm 8% of LPA	77% of LPA
Central India			99% \pm 8% of LPA	80% of LPA
South Peninsula			93% \pm 8% of LPA	94% of LPA

actual rainfalls over NW India, central India, NE India and south Peninsula were 65%, 80%, 77% and 94% of the LPA respectively. Thus although the actual rainfalls were less than the LPA values as expected, the forecast over south Peninsula was only correct. The forecasts for other three regions were not correct as the actual rainfalls were very much less than the lower forecast limits.

2.4 POST MONSOON SEASON (OND) 2009

Northeast Monsoon Activity Southwest monsoon withdrew from the entire country on 22 October and the northeast monsoon rains commenced over the peninsular parts of the country on 29th October. Rainfall activity over the south peninsula (northeast monsoon region comprising of 5 subdivisions viz., Coastal Andhra Pradesh, Rayalaseema, Tamil Nadu & Pondicherry, South Interior Karnataka and Kerala) during the season as a whole was normal (101% of LPA). It was below normal during October (52% of LPA) and above normal during November and December (175% and 119% of LPA respectively). During the season, four out of five subdivisions of south peninsula received normal rainfall and one subdivision (Coastal Andhra Pradesh) received deficient rainfall. During the season, northwestern region was abnormally warmer during the first ten days of October. Similarly, many stations of the northwestern and central India reported considerably above normal minimum temperatures during the first three weeks of the December.

Rainfall Features

Rainfall activity over the country as a whole was near normal. It was above normal over the parts of north peninsula and some central and northern parts of the country. During the season, out of 36 meteorological sub-divisions, 13 received excess rainfall, 10 received normal

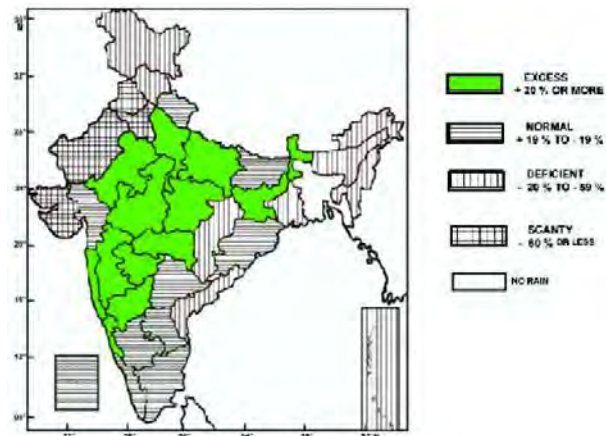
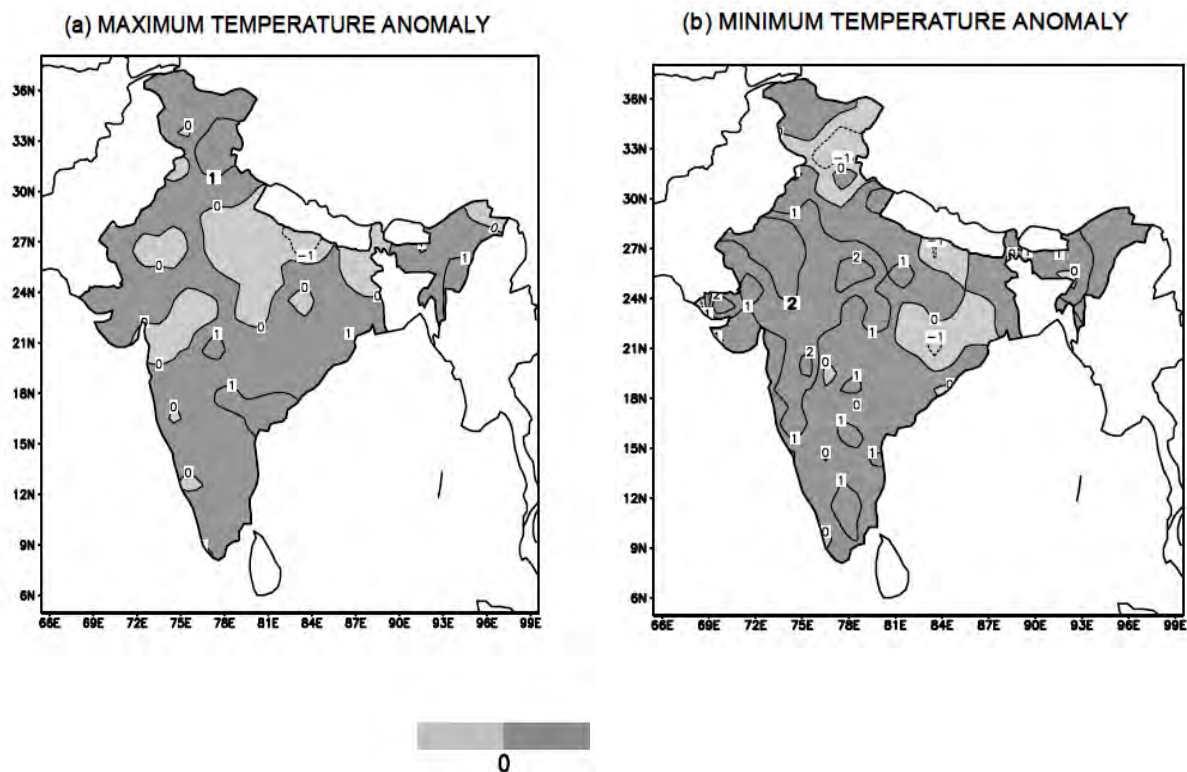


Fig. 11. Spatial distribution of Rainfall

rainfall, 9 received deficient rainfall and 4 received scanty rainfall (Fig. 11). West & East Madhya Pradesh, Konkan & Goa, Madhya Maharashtra and North Interior Karnataka received more than twice of their respective normal rainfall.

Most parts of the country except the northwestern / northern parts and some parts of Bihar and adjoining East Uttar Pradesh, received more than 10 cm of rainfall. South peninsula, some central and northeastern parts of the country and parts of Uttaranchal and Orissa received more than 20 cm of rainfall. Rainfall over extreme south peninsula and parts of west coast exceeded 40 cm, while that over eastern parts of Tamil Nadu it exceeded 80 cm. Rainfall anomaly was positive over most parts of the country, except over the parts of northwestern, northern, eastern and northeastern region. Positive rainfall anomaly was more than 10 cm over parts of extreme south peninsula, northwest peninsula, some central and north/northeastern parts of the country. Along the parts of west coast, parts of East Uttar Pradesh and adjoining east Madhya Pradesh and eastern parts of Tamil Nadu, positive rainfall anomaly exceeded the normal by 20 cm.

At the end of the post-monsoon season 2009, the rainfall for the country as a whole was 108% of



Figs. 12 (a&b). Mean seasonal temperature anomalies ($^{\circ}\text{C}$) (a) Maximum (b) Minimum

its Long Period Average (LPA) value. The normalized area weighted rainfall during the season for the country as a whole was 0.33. The rainfall over the south peninsula for the season this year was 101% of its LPA.

Temperature

Mean seasonal maximum and minimum temperature anomalies are shown in Figs. 12 (a&b) respectively. Maximum temperatures were above normal over most parts of the country except some parts of Rajasthan, northwest peninsula and some central and north/northeastern parts of the country. Over parts of Himachal Pradesh, Vidarbha, Coastal Andhra Pradesh, Telangana and Nagaland, Manipur, Mizoram & Tripura, the positive anomalies exceeded 1°C . Over parts of East Uttar Pradesh, the negative maximum temperature anomalies exceeded 1°C . Minimum temperatures were also above normal

over most parts of the country except some parts of extreme northern and northeastern region. Over most parts of northwestern region and adjoining north peninsula and central parts of the country, minimum temperatures were above normal by 1 to 2°C . The minimum temperatures were below normal by more than 1°C over parts of Jammu & Kashmir and Himachal Pradesh.

Outgoing Longwave Radiation (OLR)

Negative OLR anomaly (W/m^2) were observed over most parts of the country, Arabian sea and the equatorial Indian Ocean region. Positive OLR anomalies were observed over the east coast, northeastern region and the entire Bay of Bengal.

Low Pressure Systems

During the season, two cyclonic storms were formed. The first one formed over the Arabian

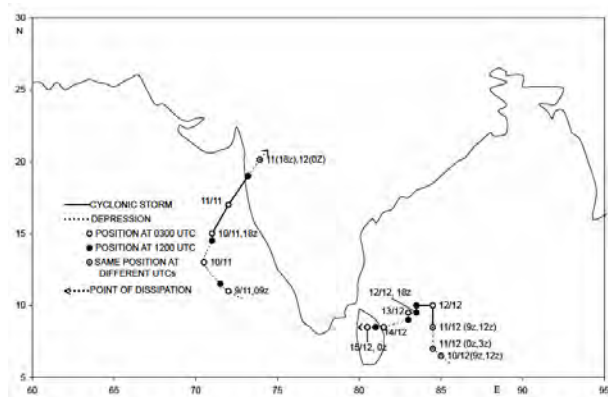


Fig. 13 Track of cyclonic storm during Post Monsoon

Sea (PHYAN) in November while the other one formed over the Bay of Bengal (WARD) in December (Fig. 13).

2.5. CYCLONE MONITORING

The North Indian Ocean witnessed the formation of eight cyclonic disturbances during 2009 including one severe cyclonic storm, three cyclonic storms, one deep depression and three depressions. Out of these disturbances, five formed over the Bay of Bengal and three over the Arabian Sea. Out of four cyclones, the Bay of Bengal witnessed cyclonic storm, BIJLI during April, severe cyclonic storm, AILA during May, cyclonic storm, WARD during December and the Arabian Sea witnessed the only cyclonic storm, PHYAN during November 2009. The months of June and August were devoid of any monsoon depression and total number of cyclonic disturbances during monsoon season was less, being significantly so over the Bay of Bengal, as there were 4 disturbances including two over the Bay of Bengal. The tracks of the cyclonic disturbances during 2009 are shown in Fig. 10. The salient features of these cyclones are discussed below:

2.5.1. Cyclonic storm, 'BIJLI' (14-17 April 2009)

(i) The cyclonic storm, 'BIJLI' developed from a persistent convective cloud cluster over

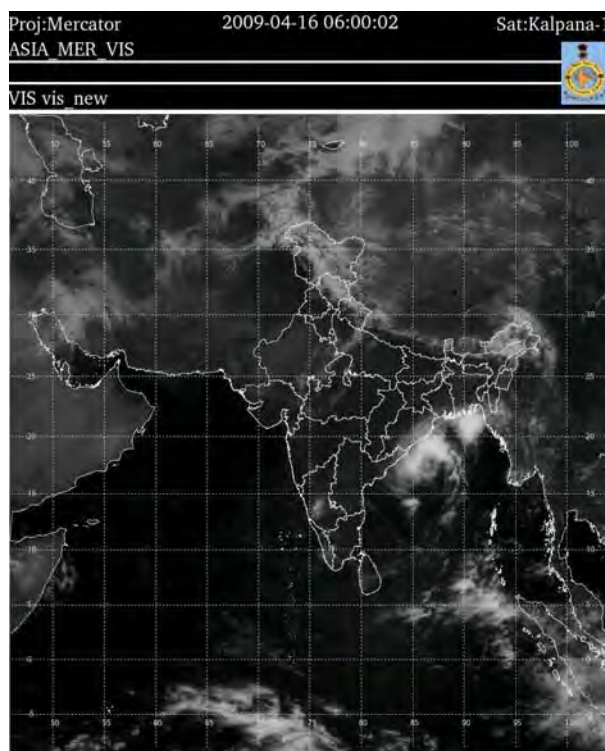


Fig. 14. INSAT imagery of BIJLI

southeast Bay of Bengal and adjoining Andaman Sea from 10th April and the system concentrated into a depression on 14th April afternoon. Moving in a northwesterly direction, it intensified into a cyclonic storm "BIJLI" over the westcentral Bay of Bengal on 15th April. It then recurved northeastwards towards Bangladesh coast on 16th April. However, it gradually weakened prior to landfall and crossed Bangladesh coast close to south of Chittagaon around 2130 hrs (IST) of 17th April 2009 as a depression. A typical INSAT imagery of the system is shown in Fig. 14.

(ii) The system developed as a depression during first fortnight of April (14th April). Climatologically, cyclogenesis during first fortnight of April is rare. Only a few number of cyclones have developed over the Bay of Bengal during 1891-2008.

(iii) The track of the system was climatological in nature as most of the storms developing in the

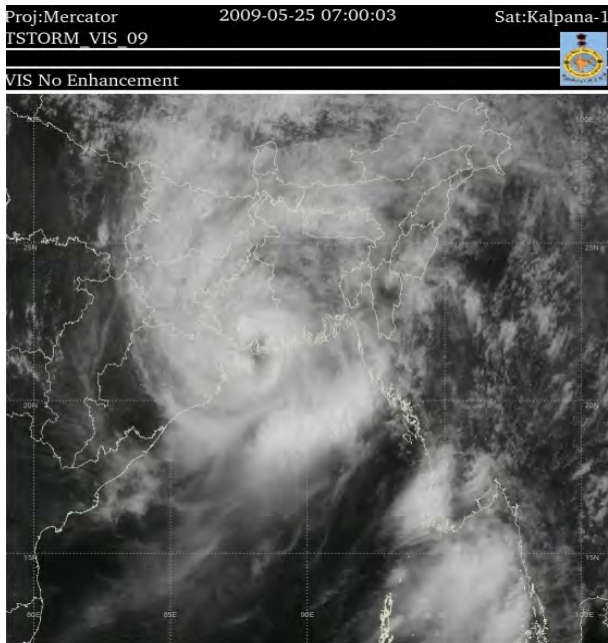
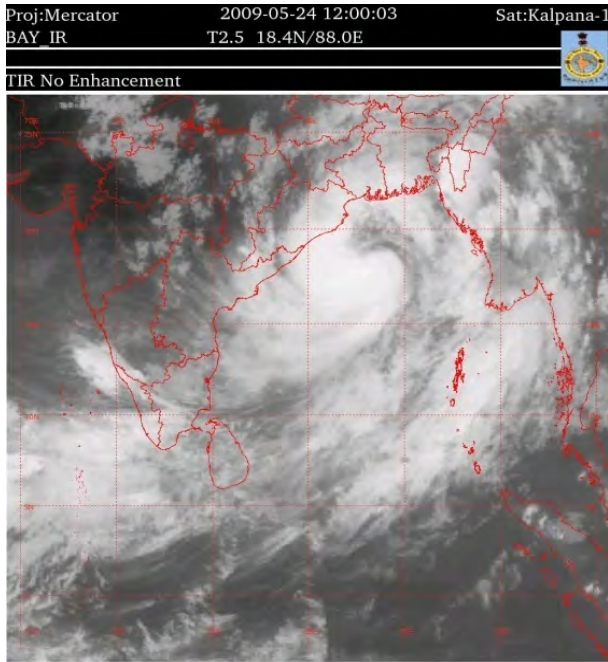


Fig. 15. Typical INSAT imageries of the cyclone AILA (i) over Bay of Bengal and (ii) at the time of landfall

month of April during 1891-2008 have recurved northeastwards.

(iv) The system weakened into a depression prior to landfall.

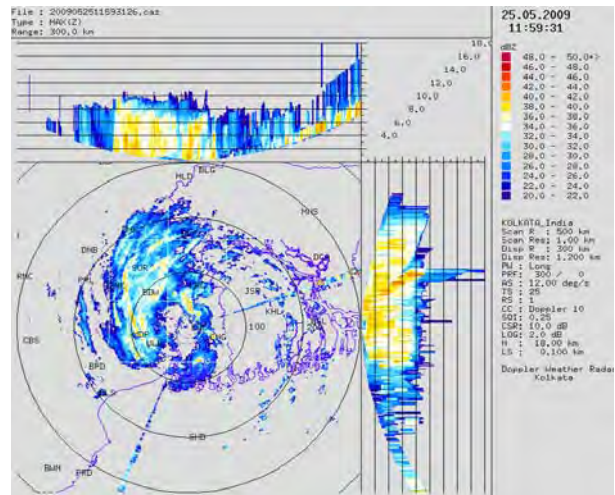
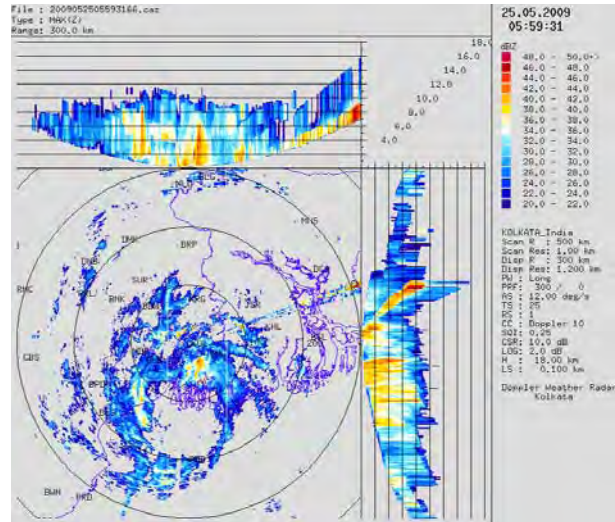


Fig. 16. Typical DWR, Kolkata imageries of the cyclone AILA (i) over Bay of Bengal and (ii) after the landfall

(v) It caused moderate damage over Bangladesh with death of 3 persons.

2.5.2. Severe Cyclonic Storm, AILA (23-26 May 2009)

(i) The severe cyclonic storm, 'AILA' developed over the Bay of Bengal in association with the onset surge of southwest monsoon. A low pressure area formed over the southeast Bay of Bengal over 22nd May morning. It lay over east central & adjoining west central Bay of Bengal on 22nd evening. It concentrated into a depression and lay centered at 1130 hrs (IST) of



Fig. 17. Damage due to cyclone, 'AILA'

23rd about 600 kms south of Sagar Island. The depression moved mainly in a northerly direction and intensified into a deep depression in the morning of 24th. It further intensified into a cyclonic storm 'AILA' in the same evening. It continued to move in northerly direction and intensified into a severe cyclonic storm in the forenoon of 25th May over northwest Bay of Bengal, close to Sagar Island. The system crossed West Bengal coast close to the east of Sagar Island between 1330 and 1430 hrs (IST) as a severe cyclonic storm with wind speed of 100 to 110 kmph. The lowest estimated central pressure was about 967 hPa at the time of landfall. After the landfall, the system continued to move in a northerly direction, gradually weakened into a well marked low pressure area over Sub-Himalayan West Bengal and neighbourhood in the afternoon of 26th and became less marked on 27th May. The typical INSAT and DWR imageries of the system are shown in Fig. 15 and Fig. 16.

(ii) The system moved in a near northerly direction throughout its life period.

(iii) Its intensification was rapid only a few hours before landfall.

(iv) The system maintained intensity of the cyclone even upto 15 hours after the landfall.

(v) Widespread rain/thundershowers with scattered heavy to very heavy rainfall and

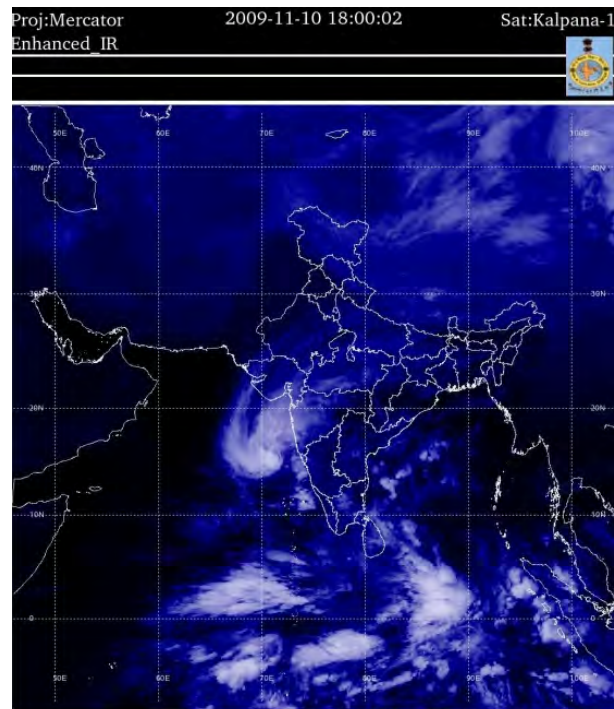


Fig. 18. INSAT imagery of PHYAN

isolated extremely heavy rainfall occurred over Orissa on 25th, over West Bengal & Sikkim on 25th & 26th. Widespread rainfall with isolated heavy to very heavy rainfall also occurred over Assam & Meghalaya on 26th & 27th May. Apart from India and Bangladesh, Nepal also could get heavy rain due to northward movement of the system.

(vi) According to satellite estimation, the sustained maximum wind at the time of landfall has been about 60 knots (112 kmph).

(vii) A storm surge of 3 m (10 ft) affected western regions of Bangladesh, and of 2 m affected Sunderban area submerging numerous villages (Fig. 17).

2.5.3. Cyclonic storm "PHYAN" over the Arabian Sea (9-12 November, 2009)

(i) The cyclonic storm "PHYAN" developed over the southeast Arabian Sea in association with active northeast monsoon surge.

(ii) A low pressure area formed over Comorin area on 7th November, 2009. It concentrated in to a depression in the afternoon of 9th over southeast and adjoining east central Arabian Sea, about 70 km west of Amini Divi. It moved initially in a north-northwesterly direction till 10th morning and then recurved north-northeastwards. It intensified into a deep depression at 0830 hrs (IST) and into a cyclonic storm 'Phyan' at 2330 hrs IST of 10th November, 2009 (Fig. 18). Continuing its north-northeastward movement, the cyclonic storm 'Phyan' crossed north Maharashtra coast between Alibag and Mumbai between 1530 and 1630 hrs (IST) of 11th November. It moved then northeastwards and weakened gradually into a well marked low pressure area over north Madhya Maharashtra and neighbourhood at 0530 hrs (IST) of 12th November 2009.

(iii) The cyclone, 'Phyan' moved faster before crossing the coast. It moved about 450 km in 12 hours between 0530 and 1730 hrs (IST) of 11th November, 2009 (about 38 kmph).

(iv) Widespread rainfall with isolated heavy to very heavy falls occurred over Goa, Konkan and Madhya Maharashtra on 10th and 11th. Fairly widespread rainfall also occurred over south Gujarat region due to the cyclone on 11th. Maximum surface wind was about 60-70 kmph along Maharashtra coast at the time of landfall. It caused loss of seven human lives and about 44 fishermen missing.

(v) Though it crossed as a cyclonic storm, it slightly weakened before the landfall.

2.5.4. Cyclone 'WARD' over the Bay of Bengal 10-15 December, 2009

(i) The Cyclone 'WARD' over the Bay of Bengal (10-15 December, 2009) formed in association with an active inter-tropical convergence zone (ITCZ).

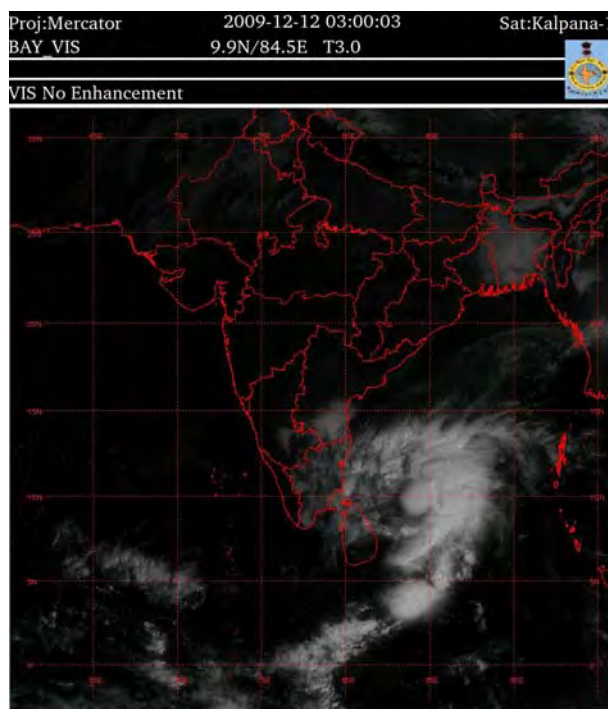


Fig. 19. INSAT imagery of WARD

(ii) A low pressure area formed over the southeast Bay of Bengal on 7th December 2009.

It slowly moved westwards and intensified into a depression in 14th December afternoon over southwest and adjoining southeast Bay of Bengal. It further intensified into a deep depression in the early morning of 11th. It then moved northward and intensified into a cyclonic storm 'WARD' in the same afternoon. It continued as a cyclonic storm and moved slowly northward till forenoon of 12th. It then moved west-southwestwards and weakened into a deep depression at midnight of 12th. Continuing to move in a west-southwesterly direction, it crossed northeast Sri Lanka coast close to the south of Trincomalee between 1330 and 1430 hrs (IST) of 14th as a deep depression. It gradually weakened further into a well marked low pressure area over Sri Lanka in the morning, emerged into Gulf of Mannar as a low pressure area in the evening of 15th December and became less marked in the afternoon of 16th

December. A typical INSAT imagery of the system is shown in Fig. 19.

(iii) Cyclone, 'WARD' followed a rare track, as it moved initially in a northerly direction and then moved west-southwestwards across Sri Lanka.

(iv) It was a slow moving system, as it traveled at the average rate of 200 km per day (8 km per hour).

(v) It weakened into deep depression over the Sea before the landfall.

(vi) In association with the cyclone, the northeast monsoon was vigorous over coastal Tamil Nadu and Puducherry during 13-16th December 2009. Widespread rainfall with isolated heavy to very heavy falls occurred over this region during this period.

Cyclone warning/ advisory bulletins issued by IMD

IMD issued Cyclone forecast and warning bulletins to various national and international disaster management agencies including National Disaster Management (NDM), Ministry of Home Affairs (MHA), concerned state Govts and other users in regular intervals. It also issued advisories to World Meteorological Organisation (WMO)/Economic and Social Cooperation for Asia and the Pacific (ESCAP) Panel member countries including Bangladesh, Myanmar, Thailand, Pakistan, Oman, Srilanka and Maldives during cyclone period. As tropical cyclone advisory centre (TCAC), it also issued tropical cyclone advisories for safety of international civil aviation.

Average landfall forecast error during 2009

The average landfall forecast error of cyclonic storms during 2009 based on the forecast issued by RSMC, New Delhi are given below.

Forecast period (hrs)	Landfall forecast point error (km)			
BIJLI	20	40	30	155
AILA	55	110	110	110
PHYAN	75	250	-	-
WARD	78	78	78	78
Average	57	120	73	114

The average landfall error was less than the long period average error for the landfalling cyclones over the north Indian Ocean. It is also very much comparable to the forecast errors over other Ocean basins including north Atlantic and Pacific Ocean basins. Considering, the intensity forecast, the average 24 hrs wind forecast error has been about 10 knots for these cyclones.

2.6. FORECASTING MODEL FOR SOUTHWEST MONSOON

2.6.1 History

India is predominantly an agricultural country. Success or failure of crops in any year is always crucial for the development of Indian economy, which in turn controls the economy of the country. In 1950s and 1960s, Indian budget was regarded as a gamble on the monsoon rains. This holds good even now.

After the serious countrywide drought and famine in 1877, the Government of India's anxiety for the earliest possible information about the progress of the monsoon grew and Sir H.F. Blanford, the first Chief Reporter of India Meteorological Department (IMD), was called upon to make attempts for estimating the prospective rains. Blanford issued tentative

forecasts from 1882 to 1885 utilizing the indications provided by the snowfall in Himalayas. The success achieved infused greater confidence and in 1885, it was decided that a monsoon forecast should thence forward be issued annually as a matter of routine. The first of the regular series of forecasts was given on the 4th June 1886. This is continuing practically till date but for changes in its format and content.

In 1892, long range forecast (LRF) for the rainfall for the second half of the monsoon season (August-September) was also started. In December 1893, the first forecast for winter precipitation over the Northern and central India was issued. Sir John Eliot who succeeded Blandford as the Head of India Meteorological Department (IMD) in 1895 applied subjective methods such as analogue and curve parallels for the LRF of ISMR. The efforts for better forecasts continued during the period (1904-1924) of Sir Gilbert T. Walker who took over as the Director General of IMD.

Sir Gilbert Walker started the forecasts based on objective techniques. He introduced correlation and regression techniques for preparing long range forecasts. Walker was well aware that seasonal prediction can be put on a scientific footing only on the basis of an accepted theory of general circulation. In his quest for identifying potential predictors for the long range forecasting of monsoon rainfall over India, Walker discovered three important large scale see saw variations in global pressure patterns. These are Southern Oscillation, North Atlantic Oscillation and North Pacific Oscillation.

From 1886, the monsoon forecasts were issued for the entire India and Burma. Walker realized that India being more or less continent cannot be considered as one homogenous area as regards the distribution of rainfall. In 1922, Walker divided India into three main homogenous areas,

namely, (i) Peninsula (ii) N.E. India and (iii) North west India. In 1935, forecast for NE India was discontinued for wants of suitable predictors and skill of model. The practice of issuing forecasts for two homogenous regions of India (NW India and Peninsula) was continued till 1987.

In 1988, India Meteorological Department introduced the 16 parameter power regression and parametric models and started issuing forecasts for the southwest monsoon rainfall over the country as a whole. Using the power regression model, quantitative forecasts were prepared and using the parametric model, qualitative forecasts (whether normal/excess or deficient) were issued. After the failure of forecast in 2002, IMD introduced a new two stage forecast strategy in 2003, according to which the first stage forecast for the seasonal (June to September) rainfall over the country as a whole is issued in April and the update for the April forecasts is issued in June. Along with the update forecast, forecast for seasonal rainfall over broad homogeneous rainfall regions of India and July rainfall over country as a whole are also issued. During the period 2003-2006, the first stage quantitative and 5 category probabilistic forecast for the season rainfall over the country as a whole were issued using 8-parameter power regression (PR) model and Linear Discriminant Analysis (LDA) model respectively. Update for the first stage forecasts were issued using 10 Parameter PR and LDA models. In 2007, IMD introduced new statistical forecasting system based on ensemble technique for the south-west monsoon season (June - September) rainfall over the country as a whole.

2.6.2 Past long range forecasts

During 1932-1988, forecasts for southwest monsoon seasonal rainfall were issued for NW India and Peninsula. These forecasts are prepared based on linear multiple regression

models, which were updated/modified from time to time.

During 1989 to 2006, the forecasts for the southwest monsoon seasonal rainfall over the country as a whole were issued based on power regression models:

2.6.3 Present forecasting system

At present, the forecast for the South-West monsoon rainfall is issued in two stages. The first stage forecast for the seasonal (June to September) rainfall over the country as a whole is issued in April and the update of the April forecast is issued in June. Along with the update forecast, forecast for seasonal rainfall over four broad geographical regions of India and July rainfall over country as a whole are also issued.

For issuing the forecast for the seasonal rainfall over the country, a new statistical forecasting system based on the ensemble technique is introduced in 2007. The six predictors are considered for the new ensemble forecast system. For the April forecast, the first 5 predictors are used. For the updated forecast in June, 6 predictors that include 3 predictors first 3 predictors are used.

In the ensemble method, instead of relying on a single model, all possible models based on all the combination of predictors are considered. For April (June) forecast With 5 (6) predictors, 31 (63) different models were developed. Out of all the possible models, best few models were selected based on their skill in predicting monsoon rainfall during a common period. Ensemble mean was computed as the weighted average of the forecast from the selected models. The weights are proportional to the multiple correlation coefficients of the models during the training period. For developing the models, two different statistical techniques namely, Multiple Regression (MR) and Projection Pursuit Regression (PPR) were considered. While the

MR technique is a conventional linear model technique and more commonly used, the PPR technique is a non-linear technique, used for the first time in forecasting Indian monsoon rainfall. The PPR method is known for its superiority in capturing the non-linear relationships between the predictors and rainfall. Verification of the results with the past data showed that the ensemble method performed better than the individual models.

The model error of the April forecast system is 5% and for the June forecast system, it is 4%.

For the forecast of July rainfall over the country as a whole, a statistical model with 6 predictors was developed using Principal Component Regression (PCR) technique. The predictors used are:

- (1) North Atlantic Sea surface temperature (December of previous year),**
- (2) NINO 3.4 Sea Surface Temperature (May + June),**
- (3) North Pacific mean sea level pressure (March),**
- (4) East Asia mean sea level pressure (February + March),**
- (5) North Atlantic mean sea level pressure (May) and**
- (6) Equatorial Indian Ocean mean sea level pressure (November of previous year).**

The model error of the model for July 2009 rainfall was 9%.

For forecasting of South-West monsoon season rainfall over the four broad geographical regions of India (NW India, Central India, South Peninsula and NE India), multiple regression

(MR) models based on separate set of predictors are used. All the four multiple linear regression models have model errors of 8% of LPA.

In view of its great potential, IMD has implemented a dynamical prediction system at the National Climate Centre under a collaborative research project between India Meteorological Department and Indian Institute of Science, Bangalore. The Seasonal Forecast Model of the Experimental Climate Prediction Center (ECPC) was adopted for this purpose. 20 year model climatology (1985-2004) was prepared by prescribing observed sea surface temperature (SST) data as boundary conditions. The validation of model hindcast suggests promising skill over the Indian region. At present, this model is used for preparing experimental long range forecasts for the southwest monsoon rainfall over India.

National Climate Centre also prepares an extended range forecast for the onset of southwest monsoon rainfall over Kerala. This forecast was first issued in 2005. The forecast is issued based on indigenously developed statistical model with 6 predictors.

In addition, IMD prepares operational long range forecasts for the Winter Precipitation (Jan to March) over Northwest India and Northeast Monsoon rainfall (October to December) over South Peninsula. For this purpose, separate statistical models have been developed.

2.6.4 LRF for 2009 South-West Monsoon Season Rainfall

India Meteorological Department (IMD) follows a two-stage forecast strategy for long range forecasting of the south-west monsoon rainfall over the country as a whole. The first long range forecast for the south-west monsoon season (June-September) rainfall is issued in April and the forecast update is issued in June.

Since 2007, IMD has been using the following statistical models for forecasting the south-west monsoon rainfall (June – September) for the country as a whole:

A 5 - parameter statistical ensemble forecasting system requiring data up to March, for the first forecast in April.

A 6 - parameter statistical ensemble forecasting system requiring data up to May for the forecast update in June. Three of these 6-parameters are same as that used for April forecast.

For preparing the first stage forecast for the 2009 South-west monsoon rainfall for the country as a whole presented here, 5-parameter statistical ensemble forecasting system was used.

Operational Statistical Forecast System

In the IMD's Ensemble Statistical Forecasting system for April forecast, the following 5 predictors are used. The model error of the April forecasting systems is $\pm 5\%$.

1. **Predictor** : North Atlantic Sea Surface Temperature, **Period** : Dec + Jan.
2. **Predictor** : Equatorial South Indian Ocean Sea Surface Temperature, **Period** : Feb + Mar.
3. **Predictor** : East Asia Mean Sea Level Pressure, **Period** : Feb + Mar.
4. **Predictor** : NW Europe Land Surface Air Temperature, **Period** : Jan.
5. **Predictor** : Equatorial Pacific Warm Water Volume, **Period** : Feb + Mar.

2.6.5 Forecast for Onset of SW Monsoon over Kerala

Since 2005, India Meteorological Department (IMD) has been issuing operational forecasts for the monsoon onset over Kerala using statistical techniques. During all the four years (2005 to 2008), the operational forecasts were correct. In 2008, IMD predicted 29th May as the date of monsoon onset over Kerala and the actual monsoon onset took place on 31st May just one day prior to the normal date of monsoon onset, i.e., 1st June.

For predicting the 2009 monsoon onset over Kerala, IMD used an indigenously developed statistical model, based on the following six predictors:

(i) **Minimum Temperature over North-west India,**

(ii) **Pre-monsoon rainfall peak over south Peninsula,**

(iii) **Outgoing Long wave Radiation (OLR) over south China Sea,**

(iv) **Lower tropospheric zonal wind over southeast Indian ocean,**

(v) **upper tropospheric zonal wind over the east equatorial Indian Ocean and**

(vi) **Outgoing Long wave (OLR) over south-west Pacific region.**

The statistical forecast model had a model error of ± 4 days. The mean monsoon onset date over Kerala was 1 June.

The onset forecast model suggests that the monsoon onset over Kerala in 2009 is likely to be on 26th May with a model error of ± 4 days.

2.6.6 Second LRF for Southwest Monsoon Season (June-September) Rainfall

India Meteorological Department (IMD) issues operational long range forecasts for the southwest monsoon rainfall in two stages. First stage forecast is issued in April and the second stage forecast is issued in June. This year, the first stage forecast for the southwest monsoon rainfall over the country was issued on 17th April, 2009 and 2nd stage forecast was issued on 24th June.

First Stage Forecast issued on 17th April, 2009

“IMD’s long range forecast for the 2009 southwest monsoon season (June to September) is that the rainfall for the country as a whole is likely to be Near Normal. Quantitatively, monsoon season rainfall is likely to be 96% of the long period average with a model error of $\pm 5\%$. The Long period average rainfall over the country as a whole for the period 1941-1990 is 89 cm.”

Second Stage Forecasts 24th June, 2009

Forecast update for the southwest monsoon season (June-September) rainfall over the country as a whole using a 6-parameter ensemble statistical model with a model error of $\pm 4\%$. Forecast for the monthly rainfall over the country as a whole for the months of July & July & August using separate principle component regression models with a model error of $\pm 9\%$. Forecasts for the southwest monsoon season (June-September) rainfall for four broad geographical regions of India using separate multiple linear regression models with a model error of $\pm 8\%$.

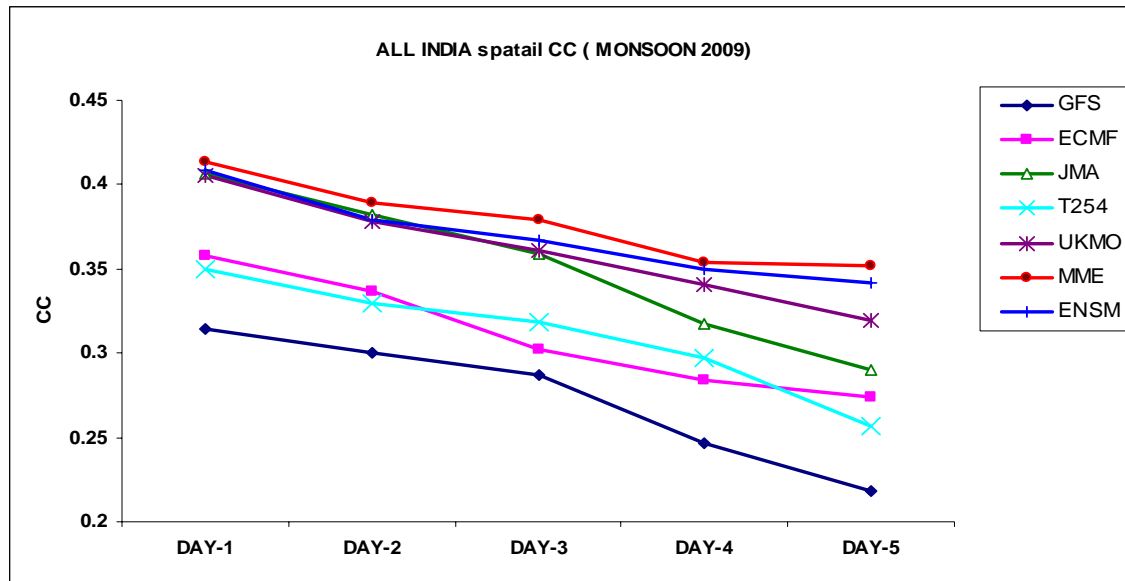


Fig. 20. Performance of MME forecast against member model during Monsoon 2009

2.6.7 Details of the Operational Statistical Models

New Statistical Forecasting System for the Seasonal Rainfall over the Country as a Whole

The 6 predictors used in the new statistical ensemble forecast model are: North Atlantic Sea Surface Temperature (December + January), Equatorial SE Indian Ocean Sea Surface Temperature (February + March), East Asia Mean Sea Level Pressure (February + March), Central Pacific (Nino 3.4) Sea Surface Temperature Tendency (MAM-DJF), North Atlantic Mean Sea Level Pressure (May) and North Central Pacific Zonal Wind at 850 hPa (May).

In the ensemble method, instead of relying on a single model, all possible models based on all the combination of predictors are considered. With 6 predictors, 63 different models can be developed. Out of these 63 models, few best models were selected based on its skill in predicting monsoon rainfall during a common period and ensemble mean was computed as the weighted average of the forecast from the

selected models. The weights are proportional to the multiple correlation coefficients of the models during the training period. For developing the models, two different statistical techniques namely, Multiple Regression (MR) and Projection Pursuit Regression (PPR) were considered. Verification of the results with the past data showed that the ensemble method performed better than the individual models. The model error of the ensemble forecasting system is $\pm 4\%$.

Principle Component Regression Models for Monthly (July & August) Rainfall over the Country as a whole

For the forecast of July rainfall over the country as a whole, a principal component regression model with 5 predictors was used. The predictors used are: East Asia mean sea level pressure (February), North Atlantic sea surface temperature (December of previous year), north America mean sea level pressure (January), North Atlantic mean sea level pressure gradient (March) and North Central Pacific zonal wind at 850 hPa (May). The model was trained using data of 1958-2000 and the independent

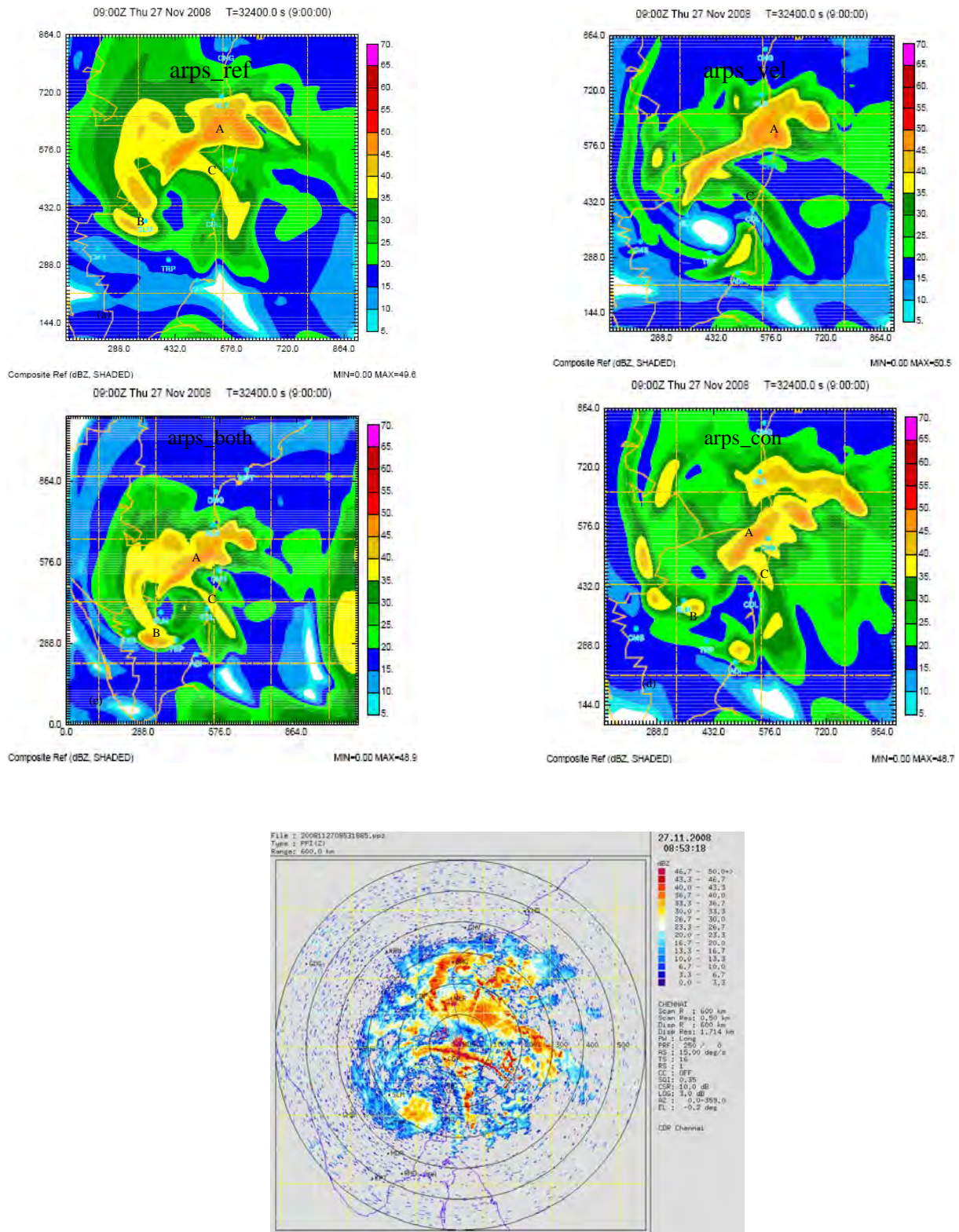


Fig. 21. Results of experiments on the assimilation of DWR observation of Chennai with ARPS model for simulation of land falling Cyclone Nisha of November 2008

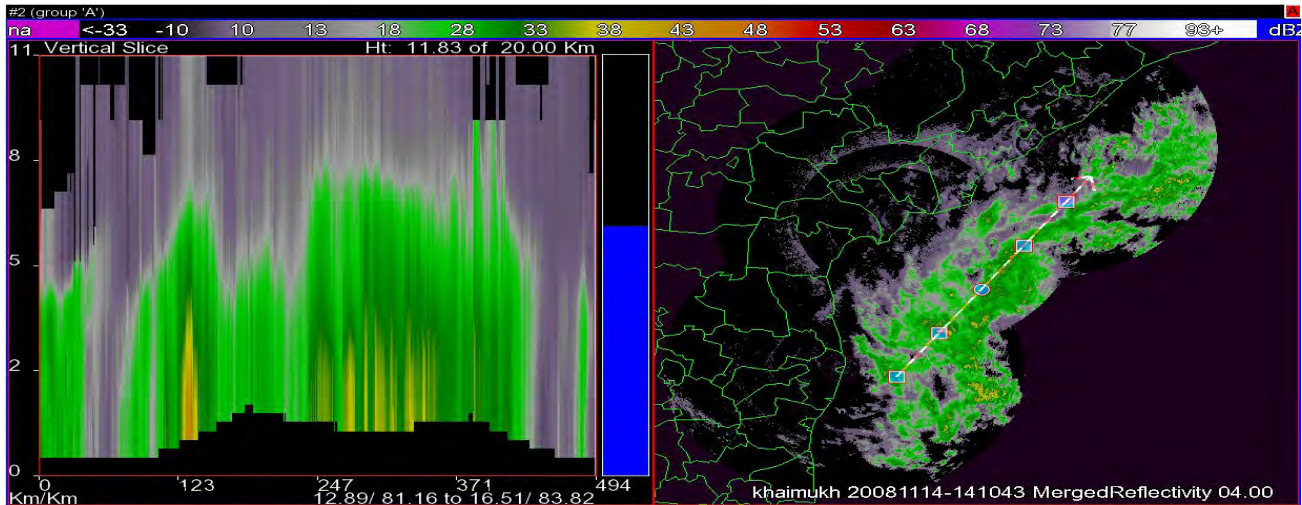


Fig. 22. Displays a sequence of mosaic images of the tropical cyclone Khaimukh of 14 November 2008, which was tracked by the three radars at Chennai, Machhilipatnam and Visakhapatnam

verifications were made using the data of 2001-2008. The model error of the model for July rainfall is $\pm 9\%$.

For the forecast of August rainfall over the country as a whole, a principal component regression model with 6 predictors was used. The predictors used are : South Atlantic mean sea level pressure (April), Southeast Pacific sea surface temperature (May), NINO 3.4 sea surface temperature tendency (MAM-DJF), South Pacific zonal wind at 850 hPa (April), outgoing long wave radiation over tropical North Atlantic (March), and outgoing long wave radiation over sub tropical North Atlantic (June). The model was trained using data of 1975-2000 and the independent verifications were made using the data of 2001-2008. The model error of the model for August rainfall is $\pm 9\%$.

Multiple Linear Regression Models for the Seasonal Rainfall over the four Broad Geographical Regions of India

For the forecasting of Southwest monsoon season rainfall over the four broad geographical regions of India (NW India, Central India, South Peninsula and NE India), multiple regression

(MR) models were developed using 4, 5, 5 and 4 parameters respectively. The 4 parameters used in the model for NW India are; North Atlantic surface mean sea level pressure gradient (May), South Atlantic surface mean sea level pressure (January), East Asia surface mean sea level pressure (February + March) and North Central Pacific Zonal Wind at 850 hPa (May).

The 5 parameters used in the model for Central India are; Equatorial Indian Ocean surface mean sea level pressure (November of previous year), Northwest Europe surface mean sea level pressure (January), North Atlantic sea surface temperature (December + January), North Atlantic surface mean sea level pressure gradient (May) and North Atlantic surface mean sea level pressure (March).

The 5 parameters used in the model for South Peninsula are; Southeast Indian Ocean mean sea level pressure (May), Southeast equatorial Indian Ocean sea surface temperature (October of previous year), Northwest Europe land surface air temperature (January), Southeast Pacific surface mean sea level pressure (May), Northwest Pacific zonal wind at 850 hPa (February).

The 4 Parameters used in the model for the North-East India are: South Atlantic mean sea level pressure (January), North Atlantic mean sea level pressure Pressure (April), Southwest Pacific sea surface temperature (March) and Central Pacific sea surface temperature (May). All the four multiple linear regression models have model errors of $\pm 8\%$ of LPA.

2.6.8 Experimental Dynamical Model Forecast

In 2004, a dynamical forecasting system was installed at IMD Pune. The seasonal forecast model (SFM) of Experimental Climate Prediction Center (ECPC), USA was adopted for this purpose. This model was used to prepare the seasonal monsoon forecasts for the period 2005-2008. For the preparation of experimental dynamical model forecast for 2009 monsoon season, persisting May sea surface temperatures were used as the boundary conditions. Ten ensembles were obtained using the initial conditions corresponding to 0000 UTC from 21st May to 30th May 2009. The model climatology was prepared using the observed SSTs during the period 1985-2004. The hindcasts during the period 1985-2004 suggested satisfactory performance of the model over the Indian region.

The experimental ensemble forecast for the 2009 Southwest monsoon season rainfall suggests normal rainfall is likely over most of parts of the country except some parts of west coast where the below normal rainfall is likely and northeastern most parts of the country where the above normal rainfall is likely. For the country as a whole the dynamical model suggests normal rainfall.

Conditions over the equatorial Pacific and Indian Oceans

The recent La Nina event that started in early December 2008 has ended. Since the middle of

April, 2009, ENSO neutral conditions are prevailing with positive SST anomalies observed over the equatorial Pacific from the beginning of May. The latest observations and forecasts from both dynamical and statistical models suggest high probability (about 60%) for El Nino conditions to appear during the monsoon season. The probability for ENSO neutral conditions is about 40% and that for La Nina is negligible.

It is important to note that other factors such as the Indian Ocean Sea surface temperatures also influence the monsoon rainfall over India in addition to El Niño and La Niña events. Forecasts from few climate models suggest possibility of the development of a weak positive Indian Ocean Dipole event during the 2009 monsoon season, which may not have much impact on the Indian monsoon. However, IMD is carefully monitoring the possible evolution of El Nino conditions over Pacific and the Indian Ocean Dipole.

2.6.9 Up-gradation Multimodel Ensemble based district level forecast system

Considering need of farming sector, India Meteorological Department (IMD) has upgraded the Agro-Meteorological Advisory Service from agro climate zone to district level. As a major step, IMD started issuing district level weather forecasts from 1st June 2008 for meteorological parameters such as rainfall, maximum and minimum temperature, relative humidity, surface wind and cloud octa up to 5 days in quantitative terms. These forecasts are generated through Multi-Model Ensemble (MME) system making use of model outputs of state of the art global models from the leading global NWP centres (Fig. 20). These forecasts are made available on the national web site of IMD. The method has been further updated for monsoon 2009 from the use of five NWP models namely, (i) NCMRWF T-254, (ii) ECMWF T799, (iii) JMA T859, (iv) UKMO and (v) NCEP GFS T-382.

Table : Track forecast error (km) of the Multi-model Ensemble (MME) against member models during the year 2009.

HOURL	ECMWF	GFS	JMA	MM5	QLM	MME
12 hr	72	83	86	153	77	70
24 hr	111	191	167	234	124	90
36 hr	114	193	142	320	143	147
48 hr	93	117	86	246	242	199
60 hr	168	126	85	351	447	242
72 hr	217	151	152	415	577	293

Meso-scale model WRF: The mesoscale model WRF has been implemented with the assimilation of local observations. A series of WRF Training was conducted and very high resolution WRF has been implemented at some Regional Meteorological Centres.

NWP based objective Cyclone Forecast system for prediction of genesis, intensity and track has been developed and made operational during 2009.

The storm scale model ARPS (Advanced Regional Prediction System) has been experimented at the horizontal resolution of 9 km with the assimilation of Doppler Weather Radar (DWR) observations.

Experiments for processing of DWR observations for nowcasting

For nowcasting purposes, application software called “Warning Decision Support System Integrated Information (WDSS-II)”, developed by National Severe Storm Lab, USA has been used in experimental mode. With the ingesting of Indian DWR observations, the application software is capable of detecting and removing anomalous propagation echoes. The application software could successfully track storm cells and meso-cyclones through successive scans. Radar reflectivity mosaics are created for the recent November 2009 Bay of Bengal cyclone “Khaimuk” using observations from three DWR stations namely, Visakhapatnam, Machilipatnam and Chennai. Positive impact of the radar observations in a very high resolution NWP model (ARPS) have been demonstrated for land falling cyclones.

Extended range Forecast (10-30 days) (Model, ensemble, Methodology)

Extended range forecast products generated from NCEP (CFS) and ECMWF (Ensemble) are currently used for extended range forecasts over the Indian region as a part of NWP manpower training a group of 50 IMD officials are trained on computer software by engaging a professional body.



3. CLIMATE MONITORING

3.1 2009, Warmest Year Since 1901

In 2009, annual mean temperature averaged over the country as a whole was $+0.913^{\circ}\text{C}$ above the 1961-1990 average (Fig. 1). The annual average for the country is 24.64°C . The year 2009 was the warmest year on record since 1901. The other warmer years on record in order are 2002(0.708), 2006(0.6), 2003(0.560), 2007(0.553), 2004(0.515), 1998(0.514), 1941(0.448), 1999 (0.445), 1958(0.435), 2001(0.429), 1987(0.413) and 2005(0.410).

Monthly mean and seasonal mean temperatures for the country as a whole are given in Table 1.

Trends in mean temperature for different seasons viz. winter (Jan to Feb), pre-monsoon (Mar to May), monsoon (June to Sept) and post-monsoon (Oct to Dec) season are shown in Fig. 2. **Winter and Monsoon seasons in 2009 were the warmest.**

As for as monthly temperature is concerned, mean monthly temperature over the country as a whole was the highest since 1901 for January (1.43°C) and August (1.00°C) 2009 and the second highest for February, September and December 2009 months.

Spatial pattern

Spatial pattern of trends in mean annual temperature anomalies [Fig. 3] suggests significant positive (increasing) trend over most parts of the country except over some parts of Rajasthan, Gujarat and Bihar, where significant negative (decreasing) trends were observed.

Fig. 4 shows the mean monthly minimum and maximum temperature anomalies for the country as a whole for the past five years, 2005-2009. It may be seen that positive anomaly in both the maximum and minimum temperature was highest in the five years for January, August and September 2009.

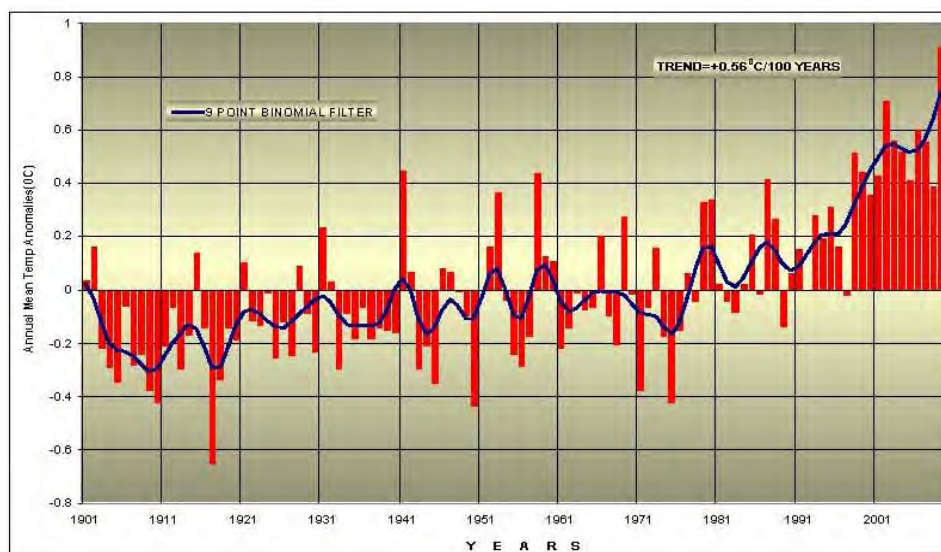


Fig. 1. Annual mean temperature anomaly

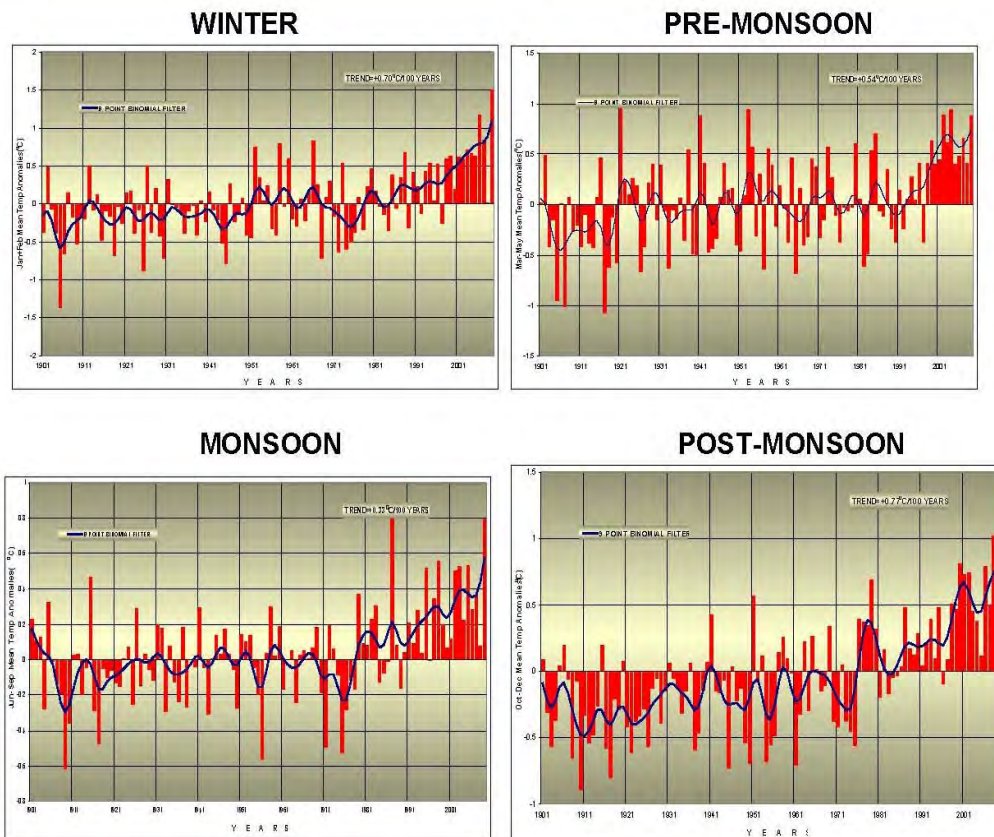


Fig. 2. Trends in mean temperature for different seasons

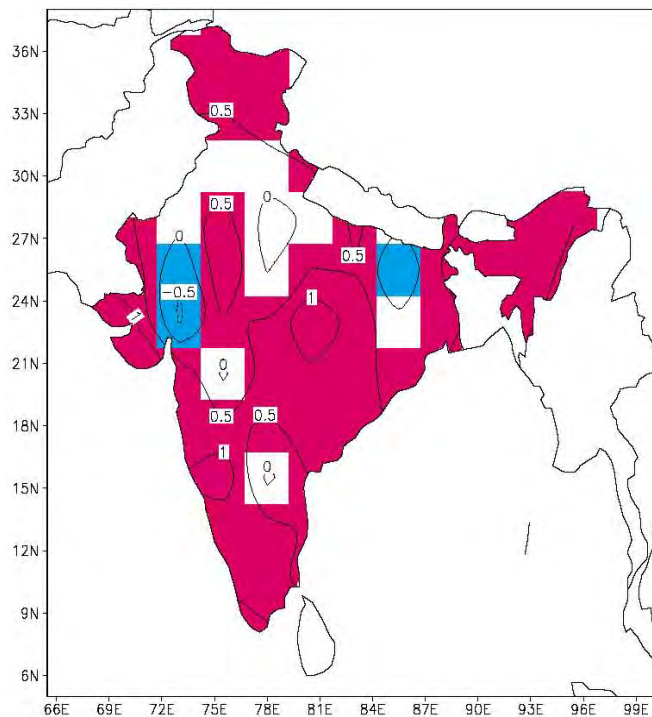


Fig. 3. Annual mean temperature trend (1901-2009)

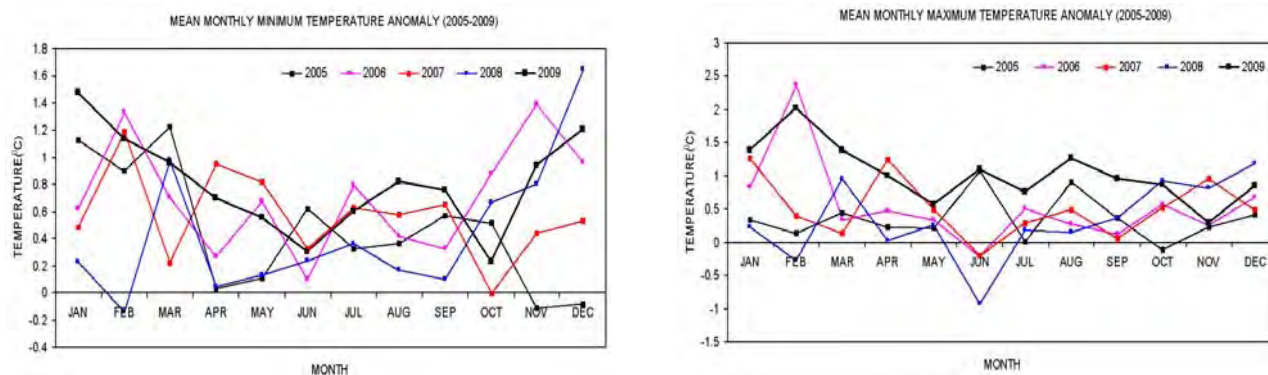


Fig. 4. Spatial pattern of trends in mean annual temperature anomalies

Extreme Temperature Events (2009)

Abnormally warm conditions prevailed over major parts of the country during the winter season. Temperature over hilly regions of the western Himalayas was 3 to 5° C above normal in the second fortnight of January, while in February; mean temperature over almost throughout the country, was above normal. However, there were cold wave conditions on few occasions in Uttar Pradesh In January, causing approximately 80 lives.

Heat wave conditions on many occasions (maximum temperature exceeding the normal by 5° C) prevailed over the peninsular/ central parts during the first three weeks of March, and over different parts of the country during April and second and third week of May. There were

approximately 150 deaths due to the heat wave in May, mainly in Andhra Pradesh.

Table 1

MONTHLY AND SEASONAL TEMPERATURE NORMAL BASED ON DATA 1961–1990

	Jan	Feb	Mar	Apr	May	Jun
Mean	18.93	20.74	24.04	27.09	28.62	28.46
Max	24.56	26.46	29.86	32.66	33.86	32.95
Min	13.33	15.03	18.24	21.56	23.40	23.98
	JUL	AUG	SEP	OCT	NOV	DEC
Mean	27.28	26.88	26.47	25.04	22.28	19.82
Max	30.95	30.46	30.61	30.11	27.82	25.32
Min	23.63	23.33	22.24	19.99	16.76	14.31
Annual	Jan-Feb	Mar-May	Jun-Sep	Oct-Dec		
Mean	24.64	19.84	26.58	27.26	22.38	
Max	29.61	25.50	32.13	31.22	27.75	
Min	19.68	14.19	21.06	23.32	17.02	

4. WEATHER SERVICES

4.1. METEOROLOGICAL SERVICES TO AVIATION

Meteorological Services for aviation are provided for National and International flights for safe and efficient operations. These services are provided through a network of four Meteorological Watch Offices (MWOs) located at the four major international airports at Chennai, Kolkata, Mumbai and New Delhi and other aviation meteorological offices located at the other airports in the country. A Tropical Cyclone Advisory Centre (TCAC) is also functioning at NHAC New Delhi to provide advisory information on tropical cyclones. The aviation meteorological offices provide current weather reports, various forecasts and warnings for safety, economy and efficiency of aircraft operations. Meteorological safety has assumed prime importance for Aviation services in the country owing to massive expansion in air traffic. IMD prioritized its modernization programme to meet the immediate demands of the Aviation Sector.

- New Integrated Automatic Aviation Meteorological Systems (IAAMS) for automatic collection, processing, display and dissemination of current weather information were installed and commissioned at Chennai and Guwahati airports. Installation of IAAMS at Amritsar airport is in progress. Procurement process for IAAMS for forty two more airports is under process.
- A new Airport Meteorological office opened at Shimla Airport.
- Aviation Circular 1/2009 regarding Issuance of 30 hour Terminal Aerodrome Forecast for International flights was sent to all departmental and extra departmental offices.

4.2. HYDRO METEOROLOGICAL SERVICES

The Hydrometeorological Division at New Delhi was established for providing the necessary technical and operational support to various Central / State Govt. Organisations and other agencies in the field of Hydromet design flood forecasting, water management and agricultural planning purposes. In the performance of these activities, this discipline carried out compilation of rainfall statistics, hydrometeorological analysis of different river catchments for project authorities and provides meteorological support for flood warning and flood control operations to field units of Central Water Commission. Research Programmes in (a) Design Storm Analysis, (b) Rainfall Frequency Analysis and (c) Quantitative Precipitation Forecast are the ongoing hydrometeorological activities. The main activities of the Division are;

Rainfall Monitoring

Real time monitoring of districtwise daily rainfall is one of the important functions of IMD. A network comprising a large number of rain gauge stations is utilized under Districtwise Rainfall Monitoring Scheme (DRMS). Based on real time daily rainfall data, weekly districtwise, sub-divisionwise and statewide / seasonwise rainfall distribution summaries are prepared in the form of rainfall tables and maps. Districtwise and sub-divisionwise rainfall statistics provides important information useful to the agricultural scientists, planners and decision makers. The software used for preparation of districtwise rainfall summary has been modified to get outputs in Excel Format.

Preparation of weekly sub-divisionwise/districtwise / statewise rainfall reports including the statistics for the country as a whole as well as for the four regions viz., North-West India, South Peninsula, Central India and North East India. During the Monsoon Season 2009 daily sub-division rainfall report (153 reports) were prepared and supplied to the Cabinet Secretary and other users. Districtwise for last 5 years were put up on IMD Website and creation of sub-divisional rainfall maps was automated.

Flood Meteorological Service

Flood Meteorological Service of IMD provides the following inputs to Central Water Commission (CWC) through their 10 Flood meteorological Offices (FMO) established in different parts of India for operation flood forecasting. FMO's are located at Agra, Ahmedabad, Asansol, Bhubaneswar, Guwahati, Hyderabad, Jalpaiguri, Luckno, New Delhi and Patna in the flood prone areas which caters to the river catchments lower Yamuna, Betwa, Ken and Chambal, Narmada, Tapi, Deman Ganga, Sabarmati, Banas and Mahi, Ajoy, Mayuraksi and Kangasbati, Mahanandi, Brahmani and Subernarekha, Brahmaputra, Dehand, Lohit, Subansiri, Manas, Dhansiri and barak, Godavari and Krishna, Teesta, Upper Ganga, Ghagra, Gomati, Rapti and Sarada, Upper Yamuna and Sahibi, Lower Ganga, Koshi, Baghmati, Gandak, Buri Gandak and Sone respectively. During the Flood 2009, 3002 QPF;s were issued by FMO's and supplied to Central Water Commission for flood forecasting purposes.

A MOS technique is being developed for QPF with a Pilot Project on Mahanadi basin.

Design Storm Studies

Design Storm Studies are being conducted to evaluate design storm estimates (rainfall magnitude and time distribution) for various

river catchments/projects in the country, for use as main input for design engineers in estimating design flood for hydraulic structures, irrigation projects, dams etc. on various rivers. This estimation of design values is required for safe and optimum design of storage and spillway capacity. On the request of Central Govt. / State Govt., Private Agencies, design storm values (Standard Project Storm, Probable Maximum Precipitation along with Time Distribution) are being provided for users as main input. For Govt. agencies, these studies are being carried out free of cost and for private / profit earning agencies on payment basis. The design storm studies for more than 500 projects have been completed and results communicated to the concerned project authority. The detailed project report are being sent in respect of the projects completed on payment basis.

During the current financial year 2009-2010 (up to 31st December 2009), 49 projects have been completed and results communicated to concerned project authorities. An amount of Rs. 19,33,300/- has been deposited in IMD's A/c for carrying out design storm study in respect of projects completed on payment basis.

4.3. AGRO METEOROLOGICAL SERVICES

- IMD continued to render Agromet Advisory Services to the State Governments and farmers by issuing Weekly / biweekly bulletins. District level weather forecast and advisories were started since June 2008 through Agromet Field Units. These advisories are tailored to meet the requirements of farmers based on past and anticipated weather conditions and were broadcast by AIR stations in the respective regions in regional languages and also telecast through DD wherever the facilities exist. Significant agronomic and logistic interventions intended for crop protection and growth are based on these advisories.

- Consolidated All India Agromet Advisory Bulletins were prepared by National Agromet Advisory Service Centre (NAASC), Pune and issued to Ministry of Agriculture and other users in the country to help policy decisions.
- The Agricultural Meteorology Division of IMD maintains a network of Agrometeorological Observatories across the country in collaboration with the Agricultural Universities and Research Institutions. The Division provided comprehensive technical assistance to its own observatory units and those of cooperating institutions by way of training, calibration and maintenance of instruments, scrutiny and archival of data etc.
- Processed agro-climatic data were supplied to end users like Ministry of Agriculture, State Departments of Agriculture, Scientists of Agricultural Universities/ Institutes for planning agricultural strategy and research work.
- Weekly Medium Range Weather Forecast for 630 districts was communicated through RMCs/MCs for preparation and dissemination of Agromet Advisory Service bulletins.
- Training pertaining to various levels of agricultural personnel (from observers to senior level officers/ scientists/professors) were conducted as per approved academic calendar. Training course on Agrometeorology towards better advisories for serving end users requirement for AMFU Scientists were organized. Preparatory workshops to Technical officers on use of crop simulation models for decision making in agro advisory at various AFMUs were also conducted.
- Annual inspection and maintenance of lysimeters & soil moisture equipments at 42 ET stations and 15 Soil moisture observatories was carried out. Annual inspection of agromet observatories under SAU set-up was carried out.
- Research work was continued in the areas of Crop Weather Relationship studies, Dry land Farming, Soil moisture and weather based forewarning of crop pests and diseases and climate change adaptation strategies for agriculture.
- A brochure (pamphlet) about the activities of Agrimet Division was prepared and circulated to all the concerned organizations / Institutions.

Drought research & crop yield formulation

Based on aridity indices, Biweekly Aridity Anomaly Reports for Southwest Monsoon Season for the whole country and for Northeast Monsoon Season for the five meteorological sub-divisions, viz., coastal Andhra Pradesh, Rayalaseema, south Interior Karnataka, Tamil Nadu & Pondicherry and Kerala, are prepared and sent to various agricultural authorities of State and Central Govts., and Research Institutes on operational basis for their use in Agricultural Planning and Research purposes. The Biweekly Aridity Anomaly maps are also uploaded in the departmental website. These Aridity Anomaly Reports help to assess the moisture stress experienced by growing plants and to monitor agricultural drought situation in the country.

The unit has developed empirical-statistical models using correlation and regression technique to forecast crop yields on operational basis for 26 rice growing meteorological sub-divisions and 16 wheat growing meteorological sub-divisions. Since meteorological parameters, particularly the rainfall is highly variable in space and because the cultural practices vary from region to region, the unit has developed a number of models for each crop on meteorological sub-divisionwise basis. The models have been developed for Kharif rice and Rabi wheat crops which are grown on a large scale in the country.

Based on the crop yield forecast models, monthly quantitative forecast of interim and final yields are prepared every year during respective crop growing season and issued to Directorate of Economics and Statistics, Ministry of Agriculture & Cooperation, New Delhi on operational basis through H.Q. New Delhi for official use for national food planning.

The first interim forecast of kharif rice yield for 26 meteorological sub-divisions comprising of 15 States is issued during August. This forecast is updated in the subsequent months and the final forecast is issued in December. In the case of wheat the first interim forecast for 16 meteorological sub-divisions comprising of 12 States is issued in January which is updated in the subsequent months and the final forecast is issued in May, every year.

4.4. EARTHQUAKE MONITORING

India Meteorological Department (IMD), the nodal agency of Government of India for monitoring seismic activity in and around the country, has rendered more than hundred eleven years of seismological service to the nation with the first seismological observatory of the country having been set up by the department at Kolkata in 1898. The operational task of the department is to quickly estimate the earthquake source parameters immediately on occurrence of an earthquake and disseminate the information to all the user agencies including the concerned State and Central Government agencies responsible for carrying out relief and rehabilitation measures.

The information relating to under-sea earthquakes capable of generating tsunamis on the Indian coastal regions is also disseminated to concerned user agencies including the Indian National Centre for Ocean Information Services (INCOIS), Hyderabad for issue of tsunami related messages and warnings. The earthquake information is transmitted to various user agencies including public information channels,

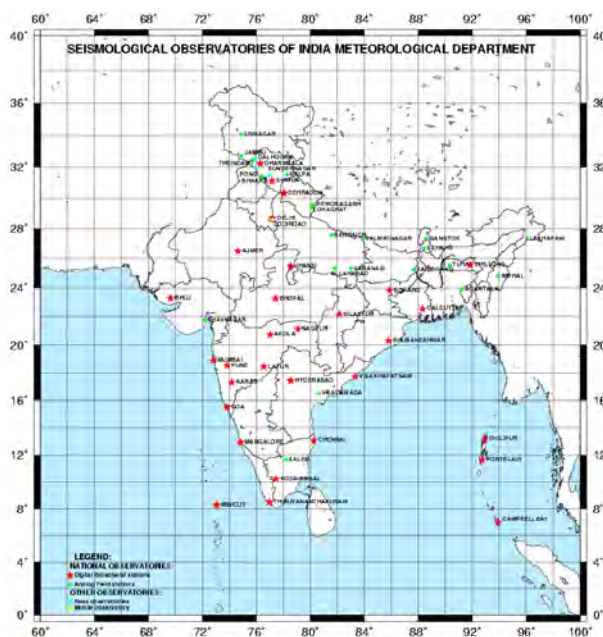


Fig. 1. Network of seismological observatories

press, media etc using different modes of communication, such as SMS, fax, email, IVRS and also posted on IMD's Website.

It is maintaining a national network of seismological observatories consisting of 55 stations (Fig. 1), which includes 17-stations of the Real Time Seismic Monitoring Network (RTSMN) set up for early warning of tsunamis. IMD is also maintaining a 16-station, V-SAT based digital seismic telemetry system around National Capital Territory (NCT) of Delhi for close monitoring of seismic activity in the region. The RTSMN system is in successful operation for over a year now and has performed well in proving accurate and timely information on significant earthquakes, comparable to other international networks such as USGS. Various products generated by RTSMN system in real time mode are shown in Fig. 2.

Other major activities in Seismology include:

- A total of 3499 earthquake events have been detected by the RTSMN system, which includes 871 events in and around India.

Autolocated hypocentral parameters with R.M.S. errors

Centroid Moment Tensor solution

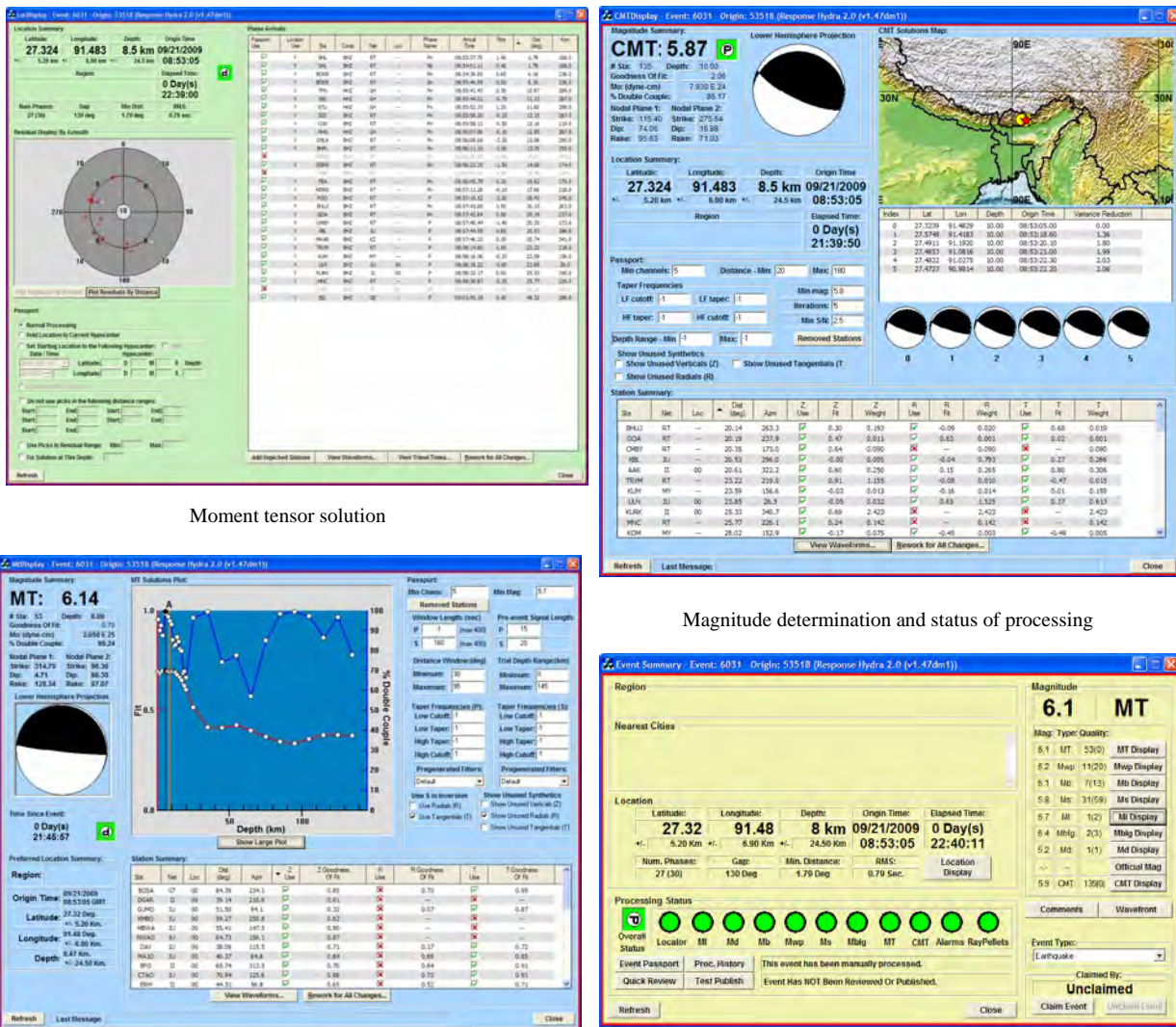


Fig. 2. Real time display of various products of RTSMN system of Bhutan Earthquake of 21 September 2009

- Earthquake data compilation, processing, systematic archival and supply to various user agencies for different purposes, such as insurance companies, industrial units, power houses, river valley projects, relief and rehabilitation measures, disaster mitigation and management, seismic zoning etc. Earthquake data is also supplied to various scientific, academic and R&D institutions in India and abroad for research purposes.
- Preparation of National Seismological Bulletin for incorporation in the ISC's

(International Seismological Center, UK) Bulletin.

- Organize periodical training programs / refresher courses to officers and station operators, including non-departmental personnel, on various aspects of earthquakes and their impacts including operation and maintenance of analog and digital seismograph systems.
- As part of international collaboration, bilateral cooperation in the fields of Seismology

and earthquake prediction research is currently being pursued with Russia and Mexico. Following are a few major contributions made in this regard:

- As part of a collaborative project with Russia, entitled “Preparation of catalogue of Indian earthquakes and test for its completeness”, earthquake data sets for different regions have been compiled and initial processing has been taken up jointly with Russian scientists.
- As part of an ongoing project with Russia on “High Resolution monitoring of geodynamic processes using borehole seismic investigations”, continuous data of borehole seismic acoustic sensors, installed at a depth of about 100 meters at Ridge Observatory, Delhi is being archived on regular basis for understanding the geodynamic processes in and around Delhi region.
- As part of a joint collaborative project with Mexico on “Near real-time estimation of (a) long-period magnitude, (b) moment tensor and (c) tsunami potential of offshore earthquakes”, preliminary analysis using the existing data sets has revealed very interesting results towards assessment of the tsunami potential of offshore earthquakes. (Dattatrayam, RS *et al.*, ‘Mausam’ Diamond Jubilee Volume, 2009).
- Towards long term preservation of seismic analog charts in electronic form for use by research community, a project proposal on “Archival and digitization of seismic analog charts” was taken up. All the hardware and software related to this project has been received and installed. Site acceptance tests are in progress and the raster scanning and vector digitization of analog charts shall commence soon.
- Towards further improvement of earthquake detection capabilities in the country,

a project on “Optimum seismological network program” has been taken up. The project envisages deploying additional 104 state-of-art seismic equipment in the existing / new observatories. Preliminary works relating to identification and preparation of sites, preparation of Expression of Interest (EoI) document, etc. are in progress.

- A National Program on Earthquake Precursors (NPEP) has been initiated by MoES as part of it’s Eleventh plan activity through a multi-institutional and multi-disciplinary mechanism under the overall umbrella of MoES and IMD as one of the lead agencies. The program is aimed at generating long term, multi-parametric geophysical database in critical geographical locations, as a basic scientific input for future earthquake prediction related studies.
- A total of 27 meetings / symposia have been attended by officers of Seismology Division on various aspects.

4.5. ENVIRONMENTAL MONITORING

Air Pollution

IMD set up a Background Air Pollution Monitoring Network (BAPMoN) programme in 1972 with the objective of documenting the long-term changes in composition of trace species of the atmosphere. The activity was brought under Global Atmosphere Watch, GAW in 1989. The monitoring stations located at Allahabad, Jodhpur, Kodaikanal, Minicoy, Mohanbari, Nagpur, Port Blair, Pune, Srinagar and Vishakhapatnam continued to collect rain samples for chemical analyses and measurement of atmospheric turbidity. Wet precipitation samples, collected at GAW stations, are sent to Central Chemical laboratory at Pune where these are analysed for pH, conductivity, major cations (Ca, Mg, Na, K, NH₄) and major anions (SO₄, NO₃, Cl).

Atmospheric Turbidity Program : Atmospheric Turbidity which indicates the columnar aerosol load of the atmosphere is measured at:

(i) 7 GAW stations (Allahabad, Jodhpur, Kodaikanal, Nagpur, Port-Blair, Srinagar & Pune) using Microtop-II multi-channel sunphotometer at 368, 500, 675, 778 & 1028 nm wavelength.

(ii) Three GAW stations (Mohanbari, Minicoy, Visakhapatnam) using Volz's Sunphotometers at 500 nm wavelength.

These data from GAW stations provide reliable long-term observations of the chemical composition of the atmosphere and related parameters in order to improve our understanding of atmospheric chemistry leading to formulating environmental policy. Chemical composition of precipitation is useful in quantifying the level of pollution due to increasing anthropogenic activities.

Environmental Monitoring Unit

Environmental Monitoring Unit of IMD provides specific services to Ministry of Environment & Forests and other Govt. agencies in the assessment of air pollution impacts likely to arise from various types of Thermal Power Generation, Industries and Mining activities. Atmospheric diffusion models developed for carrying out air quality impacts of multiple sources located in different climatic and geographical conditions are being utilized for siting of industries and adoption of air pollution control strategies.

During the year 2009, project proposal for 832 Industrial, 367 Thermal and 337 Mining projects, which were referred to this Department by the Ministry of Environment & Forests were evaluated for their impacts on atmospheric environment. IMD officers attended 43

Environmental Appraisal Committee meetings (Thermal Power Plants & Coal Mining, Industrial and Mining) as Member in the MOE&F during this period. Some other activities carried out are

- Continuous monitoring of meteorological parameters observatory at Taj Mahal Agra to support air pollution abatement measures in the Taj Trapezium.
- The project entitled “Environmental Monitoring & Research” for monitoring of green house gases (GHGs) and Aerosols is being pursued. The project aims at establishing a network of stations in India to generate primary data on GHGs and aerosols on a long term basis needed for Climate change studies and negotiations.
- A Climate Monitoring Station has been established at Hill Campus, G.B. Pant University of Agriculture & Technology, Ranichauri, Tehri Garhwal, Uttarakhand. AWS was installed in 2007. Air Quality Gas Analyzers (SO₂ & NO_x), pH Conductivity Meter and radiation equipment have been installed in 2008 & 2009 respectively.

Ozone monitoring

The importance of Ozone as an environmental parameter stems from the fact that several industrial substances are considered to be destroyers of the natural ozone layer in the stratosphere thus enabling higher dosages of Ultra violet radiation penetrating to the ground to the serious detriment of health factors. The global network of Total column ozone measurements has come up since late 1950s and India has been a pioneering country in this regard.

The routine measurements have been carried out to monitor Total column Ozone, Vertical Ozone profiles and Surface Ozone.

5. DEPLOYMENT OF STATE-OF-THE ART TECHNOLOGY

A scheme was proposed in the year 2006-07 to undertake a comprehensive upgradation of Observational and Forecasting infrastructure of IMD to enhance its capabilities in regard to meteorological services. The Cabinet Committee on Economic Affairs has approved this proposal in December 2007. The Projects under this umbrella proposal have now been taken up for implementation during 2008-2010 constituting the 1st Phase of Modernization. Some of the activities that were taken up under ongoing programmes but related to improvement of observational network have already been undertaken such as follows:

- Procurement of 550 AWS is in progress.
- Procurement of 1350 ARGs is in progress.
- Procurement of twelve Doppler Weather Radars is in progress.
- Development of indigenous Radiosonde for upper air observations has been initiated.

All equipments under VARSAMANA (Meteo France International) project have been shipped and 4 systems (Upper air, AMSS, Synergie & PWS) are already installed and running on operational basis. The new Automatic Message Switching System 'TRANSMET' of RTH New Delhi running on operational basis from 28 October 2009 is capable of exchanging 1 Tera Byte (1000 GB) of weather data and processed information every day.

The new forecasting system Synergie will have capabilities to visualize multiple layers of observation and forecast overlaid on each other

thus providing to the forecaster the capability to assimilate terabytes of information before issuing weather forecast.

Objectives of Modernization

Modernization of atmospheric observation & forecasting systems was initiated to improve the quality of meteorological services in the country with focus on the following:

- To enhance capabilities of observational systems.
- To network all existing and new observational systems
- To enable reception, processing and archival in digital form.
- To assimilate multi sector data in numerical models and prediction.
- To ensure real-time dissemination of all processed information

As a part of this and in keeping with the guidelines given by the Planning Commission, Secretary, MoES constituted an expert committee comprising of eminent scientists and experts in India under the chairmanship of Shri D. R. Sikka to specify the optimum requirements of the observational network required for Forecasting, Aviation Services, Agro-meteorology and human resource in the field of meteorology to provide a weather service of World Standard. The committee recommended the optimum observation network for IMD.

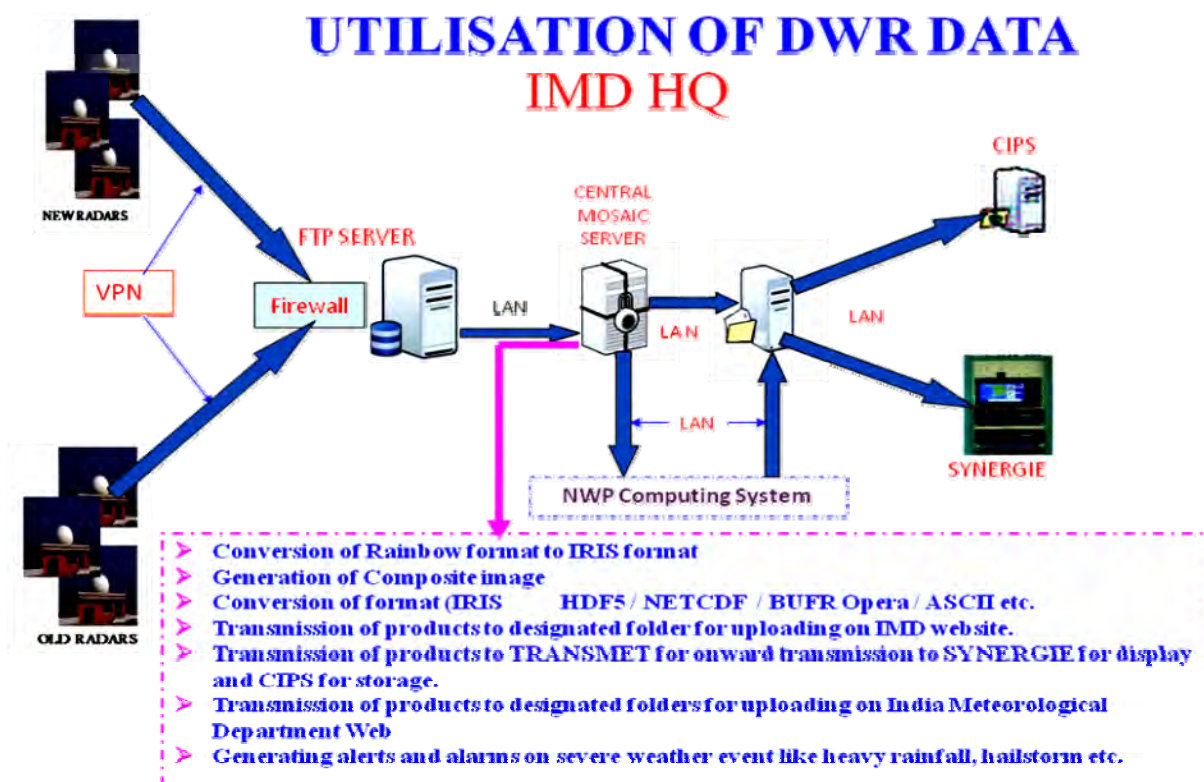


Fig. 1.



Fig. 2. Ground System with Receiver & Processor

Requirements of Optimum Observation Network

Observational Instrument	Optimum Number	Number Available / Planned with other organization after phase-I	Number remaining under Phase -II
Automatic Rain Gauge	3600	1600	2000
Automatic Weather Station	1150	750	400
Doppler Weather Radar	68	34	34
Wind profiler	15	13	2
Aeronautical Instrumentation	50	26	24*
Upgrade RS/RW	44	30	14
Upgraded Pilot Balloon	70	70	0

* May be procured under Aviation Scheme

Modernization of IMD

It was proposed to implement the complete modernization in three phases. In the first phase, it was approved to develop a network with minimum and necessary observation system consisting of existing and new instruments, appropriate connectivity with a complete end-to-end forecasting system along with High Performance Computing (HPC) for receiving, processing and archiving information at IMD Headquarters as well as their dissemination in real time to the end users in digital form. In next phases further densification of the observation network is to be undertaken. The commissioning of Doppler Weather Radars started from the first phase but all DWRs will split over to 12th five year plan as Phase III.

The Union Cabinet approved the implementation of modernisation of observation and forecasting facilities of IMD (Phase – I) on

13th December 2007, (to improve the weather forecasting services in India) at an estimated cost of Rs.920.00 crores in two years. It has been further extended till March 2011. The programme implemented in project mode and may be classified into broadly three groups:

a) Upper air instrument

1. Doppler Weather Radars
2. GPS Radio Sonde Stations
3. New Optical Theodolites
4. Indigenous development of Radio Sonde

b) Surface instruments

1. Automatic Weather Stations and Rain Gauges
2. Airport Met Systems
3. Wind Profiler
4. Lightening Detection

c) Networking, Analysis, Dissemination

1. AMSS
2. Forecasting & other systems of MFI
3. HPCS

OBSERVATIONAL SYSTEMS

5.1 UPPER AIR INSTRUMENT

5.1.1 Doppler Weather Radars

12 nos. of S-BAND DOPPLER WEATHER RADARS (DWRs) and 01 nos. of C-Band Dual Polarization DOPPLER WEATHER RADAR are to be installed in Modernisation Phase-I.

Locations of 12 S-BAND DWRs : Delhi, Hyderabad, Agartala, Goa, Patna, Mohanbari, Nagpur, Lucknow, Karaikal, Patiala, Paradeep, Bhopal.

Locations of 1 no. of C Band DWR: Delhi**Present status of 12 S-BAND DWRs:**

- Supply order placed on 30 May, 2008
- FAT of 11 systems completed in China, and one at Delhi in March 2010.
- All the 12 systems have arrived in India.
- 23 officials have been trained in operation and maintenance and 3 officials in source code.
- Installation of the systems are subject to the readiness of building construction.

Installation Schedule**S-Band DWR**

Target date	Station
➤ 30 Mar,10	Delhi (Installed)
➤ 31 May, 10	Hyderabad
➤ 31 May,10	Agartala
➤ 30 Jun,10	Patna & Goa
➤ 31 July,10	Mohanbari
➤ 31 July, 10	Nagpur
➤ 31 Aug,10	Lucknow
➤ 30 Sep,10	Karaikal
➤ 31 Oct,10	Patiala
➤ 30 Nov,10	Paradip
➤ 31 Dec, 10	Bhopal

C-Band DWR

One Number of C-Band dual polarized DWR is being procured by IMD under modernization.

5.1.2 GPS Radio Sonde

New GPS Upper Air System have been installed & commissioned at 10 places i.e., Thiruvananthpuram, Mohanbari, Chennai, Port Blair, Minicoy, Goa, Hyderabad, Visakha-

patnam, Patna and Srinagar in the upper air network of IMD. Regular ascents are being taken and data is transmitted to the RTH, New Delhi.

After the introduction of GPS MODEM radiosonde in the network at 10 places, data quality has improved substantially at these stations, which has been validated by NCMRWF & ECMWF. In all cases the quality change has been remarkable. Reports of MCMRWF and Meteo France have indicated an improvement in data quality over newly installed GPS stations.

- Status of upgradation of 25 Radiosondes stations to international standard by replacing with GPS based Radiosounding Systems in modernisation Phase-I:
- 10 nos. of GPS radiosonde stations have been established (5 each under MIMOSA and IMD Modernization) with significant improvement in the data. The data of these stations have now been accepted by ECMWF in their models (Table 1).

Table 1**Date of GPS commissioning**

S. No.	Name of station	Station Index	Date of commissioning
1	Thiruvananthpuram	43371	9 th March 2009
2	Mohanbari	42314	9 th April 2009
3	Chennai	43279	13 th April 2009
4	Port Blair	43333	16 th April 2009
5	Minicoy	43369	23 rd April 2009
6	Goa	43192	11 th May 2009
7	Hyderabad	43128	14 th May 2009
8	Visakhapatnam	43150	18 th May 2009
9	Patna	42492	21 st May 2009
10	Srinagar	42027	25 th May 2009

5.1.3. New Optical Theodolite

New optical theodolites have been installed at all the 62 PB stations in the PB network of IMD. The project has been completed. The performance of the new optical theodolites is being monitored. Five numbers of Electronic theodolites are to be installed at Guwahati, Kolkata, Mumbai, Chennai and Nagpur.



New Optical Theodolites

5.1.4. Indigenous Development of Radio Sonde

This project is regarding developing indigenously one unit of 1680 MHz Radiotheodolite (RT) system with State-of-art technology for use in upper air network of IMD and also to develop independent GPS based Digital Radiosonde with ground receiver. This will help IMD to modernise its upper air network and make IMD self sufficient and thus avoiding the import of systems in the future.

System development has been completed by M/S SAMEER Mumbai and is being tested at

RS/RW Mumbai in actual ascents for validation at site for introduction in the operational RS/RW network. Manufacturing for radiosonde set up in IMD workshop, is being upgraded to SMT assembly line for in house production of GPS radiosonde. Transfer of technology is being undertaken from SAMEER for manufacturing the GPS radiosonde. Training to staff will be imparted at SAMEER for the manufacturing processes.

5.1.5. Modernisation of Pilot Balloon Stations

Under the Modernisation of IMD-Phase I, Optical theodolites used for tracking the pilot balloon at 44 stations have been replaced with new ones providing better observations. The remaining 18 stations are being provided with the replacements.

All the 62 stations have been provided with semi-automatic computation system for Pilot balloons which enables preparation and transmission of pilot messages in WMO format using a hand held data logger, thus enabling, faster computation of upper air wind data. The unit is user friendly, rugged and has helped in reducing the computation time and message generation time. The PILOT message is available instantaneously after ascent.

The manual system of Pibal data processing consumes lot of operator's time and is prone to human errors. The new Hand Held computation system not only eliminate the computational errors but also improve the output data quality with the help of built in QA/QC procedures. The new system can also store about one-month Pibal Observations in its memory. The archived Pibal data can be sent to RMC for generating the monthly register and data archival files for NDC using memory modules/cards.



Hand Held computation system



AWS installed in the premises of CDR, Karaikal, Tamil Nadu

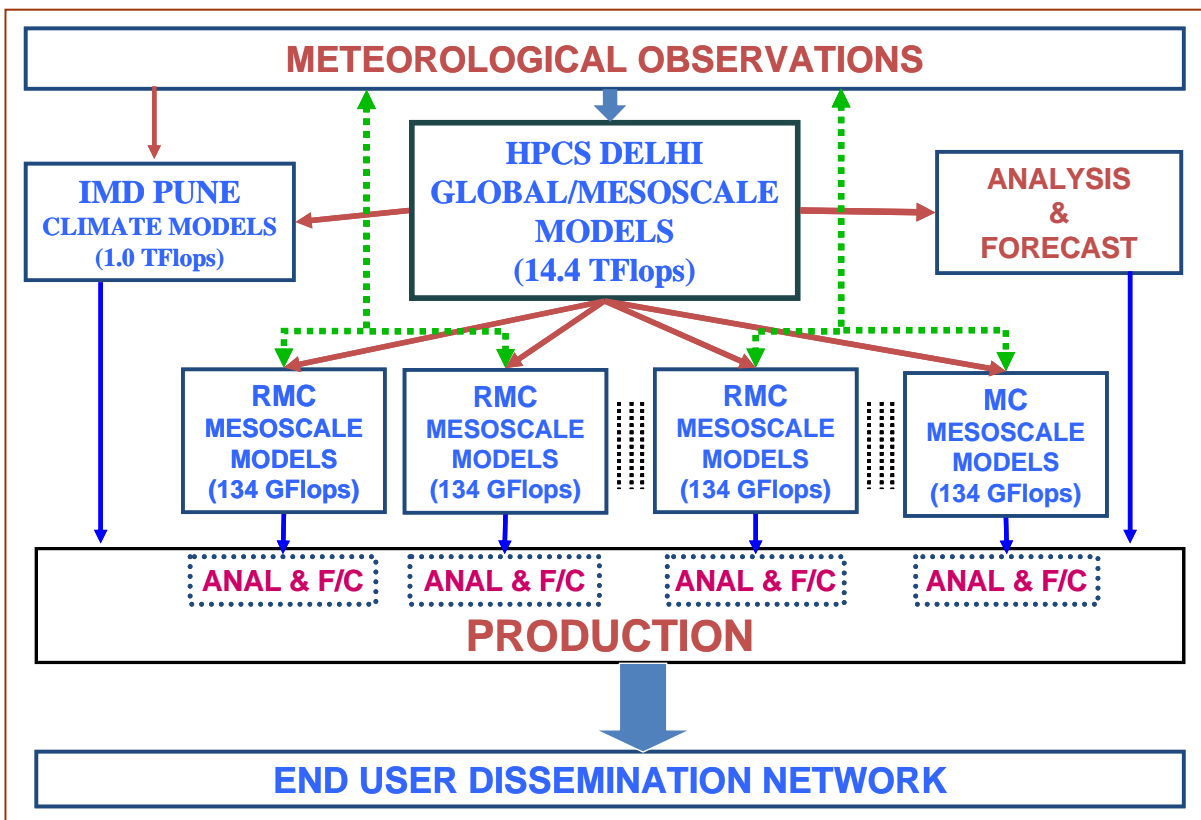
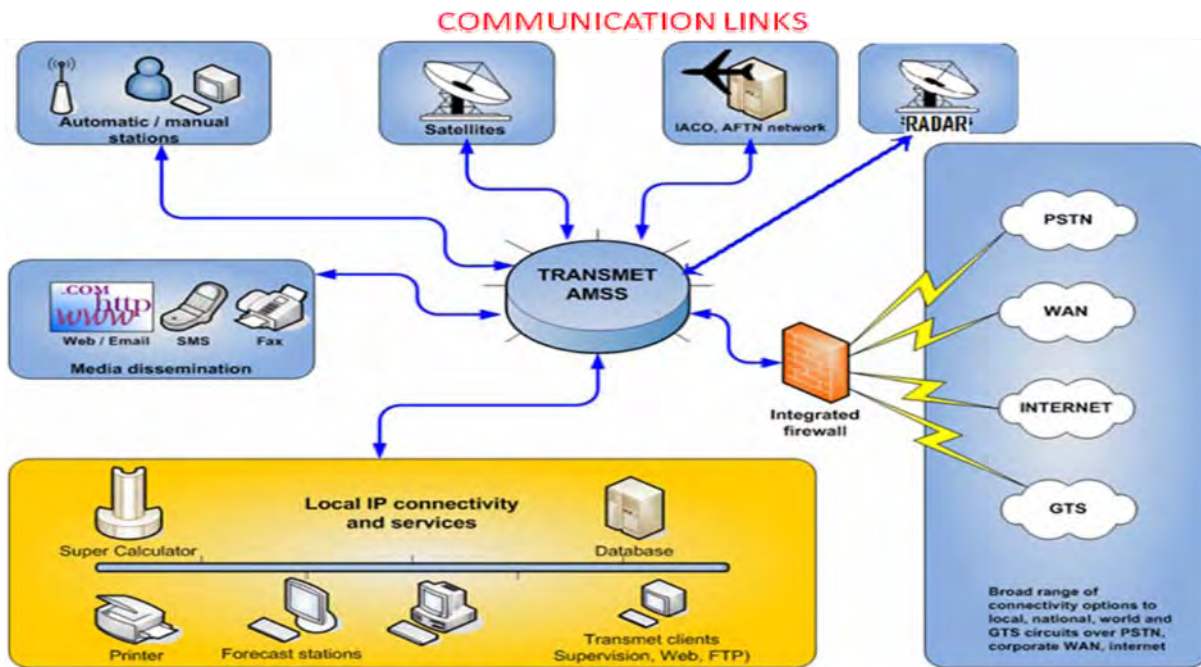
AWS & Agro-AWS planned in each state

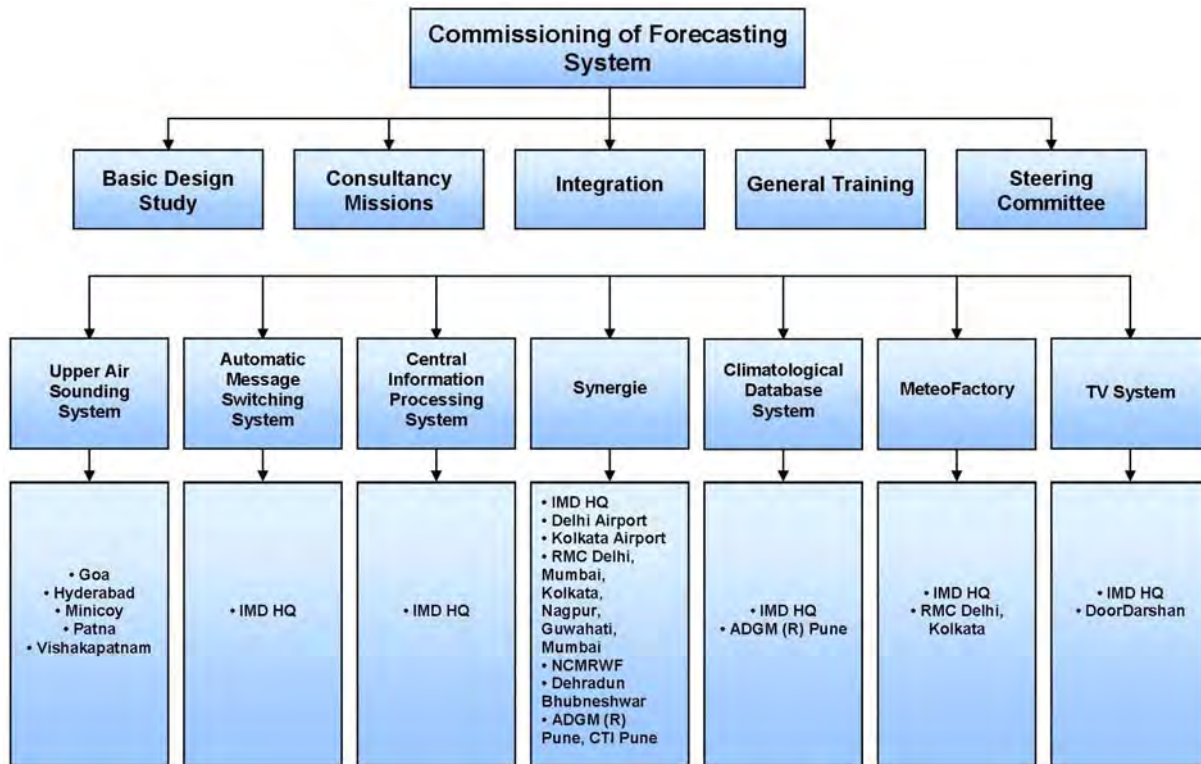
State/UT	AWS	Agro-AWS
Andaman & Nicobar	6	1
Andhra Pradesh	18	7
Arunachal Pradesh	7	1
Assam	21	6
Bihar	14	3
Chattisgarh	14	3
Gujarat	21	8
Haryana	30	2
Himachal	21	4
Jammu & Kashmir	18	2
Jharkhand	20	3
Karnataka	21	10
Kerala	16	5
Madhya Pradesh	30	9
Maharashtra	37	9
Manipur	10	1
Meghalaya	7	1
Mizoram	8	1
Nagaland	8	1
New Delhi	10	1
Orissa	43	10
Punjab	21	5
Rajasthan	29	9
Sikkim	1	0
Tamilnadu	29	8
Tripura	6	1
Uttar Pradesh	52	8
Uttarakhand	10	3
West Bengal	28	6

5.2. SURFACE INSTRUMENTS

5.2.1 Automatic Weather Stations and Rain Gauges

Under the modernization schemes of IMD 550 Automatic Weather Stations (AWS) and 1350 Automatic Rain gauge Stations (ARG) are to be installed for up-gradation of observational network. For this purpose, 500 AWS and 1350 ARG have been procured. Out of these, 200 AWS and 168 ARG have been installed at field sites. One earth station has also been installed at AWS Lab Pashan, Pune. 125 AWS (Sutron make) already installed are maintained by Pune office. Data transmitted by AWS is available at GTS and IMD Websites of Pune and Delhi.





Trasmissometer at airport



Automatic Rainguage

No. of AWS installed till March 2010

State/UT	AWS
Chhattisgarh	18
Gujarat	26
Haryana	26
Himachal Pradesh	22
Daman	1
Goa	1
Madhya Pradesh	43
Maharashtra	37
New Delhi	11
Punjab	25
Rajasthan	1
UP	7
Total	218

Installation of AWS

- Out of 50 Automatic Weather Stations (AWSs) 24 in Haryana, 23 in Punjab and one in Chandigarh (in the premises of Meteorological Centre, Chandigarh) have been installed till 30th September, 2009 under Modernization Plan of India Meteorological Department in addition to already installed one each at Chandigarh (SASE), Kapurthala (Pushpa Gujaral Science City) and Gurgaon. One AWS at Ambala (Haryana) and one at Moga (Punjab) could not be installed due to water logging in the fields after rain.
- Automatic Weather Station installed in the premises of M.C. Chandigarh and became functional on 8th March 2009.
- 15 AWS commissioned so far under M. C. Ahmedabad.
- 6 AWS (Automatic Weather Stations) have already been installed in Kerala Region.

Proposed ARGs in each state

State/UT	ARG	State/UT	ARG
Andhra Pradesh	54	Manipur	5
Arunachal Pradesh	14	Meghalaya	12
Assam	43	Mizoram	14
Bihar	26	Nagaland	5
Chhattisgarh	28	New Delhi	10
Gujarat	57	Orissa	187
Haryana	38	Punjab	70
Himachal Pradesh	76	Rajasthan	66
Jammu and Kashmir	14	Sikkim	11
Jharkhand	19	Tamil Nadu	75
Karnataka	96	Tripura	8
Kerala	23	Uttar Pradesh	110
Madhya Pradesh	86	Uttarakhand	4
Maharashtra	102	West Bengal	20

No. of ARGs installed till March 2010

State/UT	AWS
Maharashtra	67
Gujarat	20
Orissa	178
Goa	5
Total	270

5.2.2 Airport Met Systems

Under Modernisation Phase-I 26 airports are to be equipped with state-of-art Aviation Weather Support system. These are : Ahmedabad, Gaya, Imphal, Lilaban, Bhubaneshwar, Ranchi, Raipur, Lengpui, Lucknow, Udaipur, Bhopal, Kandala, Patna, Agartala, Madurai, Porbandar, Dibrugarh, Calicut, Pondicherry, Rajkot, Trivendrum, Mangalore, Cochin, Coimbatore, Nagpur, Varanasi.

- Aeronautical Met. instruments installed at 79 airports were maintained.
- Integrated Current Weather Instrument System has been commenced at Chennai Airport w.e.f. 8th November 2009.
- Skypograph along with other AMI (Airport Met. Instruments) was installed and commissioned in January, 2009 at Jaipur Airport.
- Digital Current Weather Indicating Systems (DCWIS) were installed at Calicut International Airport and A.M.O Ahmedabad.
- As a part of modernization of airport Met. Instruments, Integrated Automated Aviation Met. systems were installed and commissioned at Jodhpur, Chennai and Guwahati airports. The procurement of Automated Weather Observing System for 42 airports was initiated under phase I of Modernization of IMD.

Lightening Detection

A Regional Network has been planned to installed around Delhi and Kolkata. The objective is nowcasting for severe weather for Aviation, sports activities etc and for climatological studies.

Wind Profilers

The Tropospheric Wind profiler gives wind profile upto 8-10 kms. height and works at frequency between 420-435 MHz whereas Boundary layer upto 3 km height and 1300 MHz frequency 4 Nos. of Wind Profilers are to be procured under modernisation. It was decided by the scientific committee to procure tropospheric types of Wind Profilers. Same are planned to be installed at Manglore, Balasore, Machilipatnam and New Delhi. In addition to this, 3 nos. of



Proposed sites for the wind profilers

Wind Profilers are being procured to install at Allahabad, Agra and Jaipur under commonwealth Games. Agra and Jaipur Profilers would be of Boundary Layers and Allahabad of Tropospheric type.

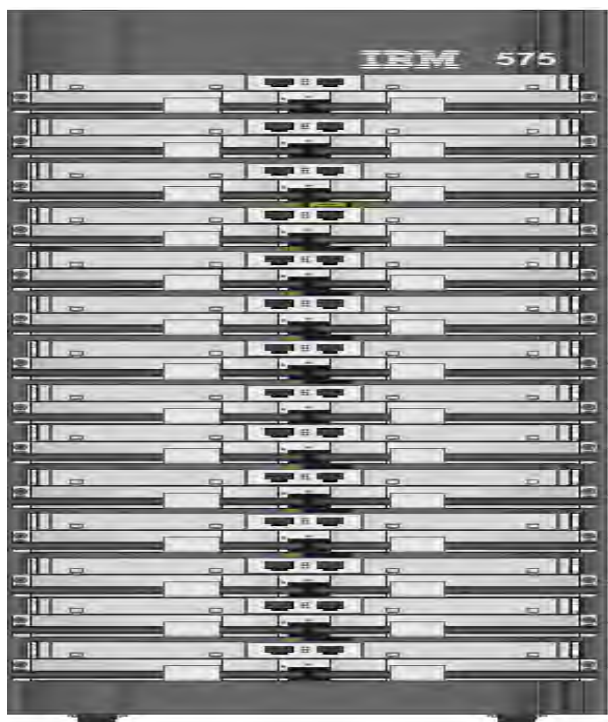
5.3 NETWORKING, ANALYSIS, DISSEMINATION

5.3.1 AMSS (Automated Message Switching System)

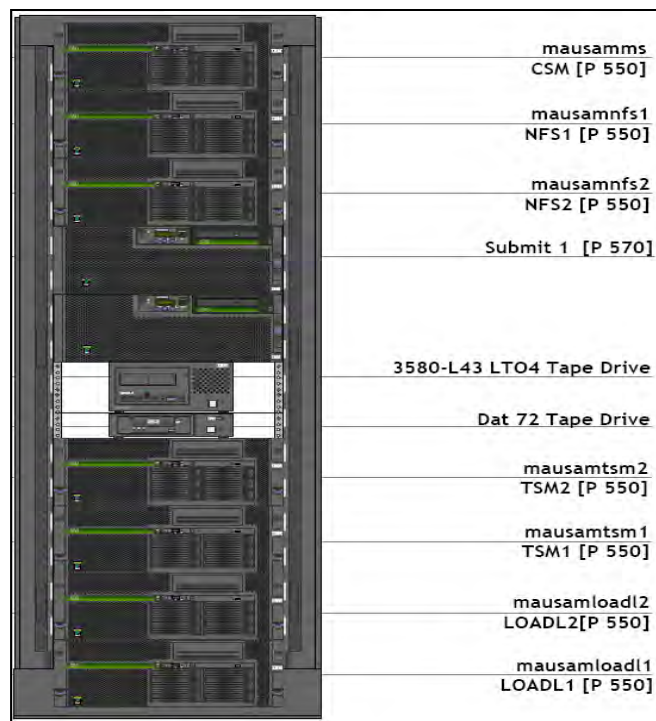
AMSS (TRANSMET) at Delhi has already been installed under MFI Project and the procurement of other systems is in progress.

Presently these Automatic Message Switching Systems are to be installed at

- RTH New Delhi
- RTH Pune (Mirror)
- AMSS Nagpur
- AMSS Guwahati



Computing Racks (2 nos)



High End Servers (4 nos)

5.3.2 Forecasting & Other Systems of MFI

The objectives of the system are to:

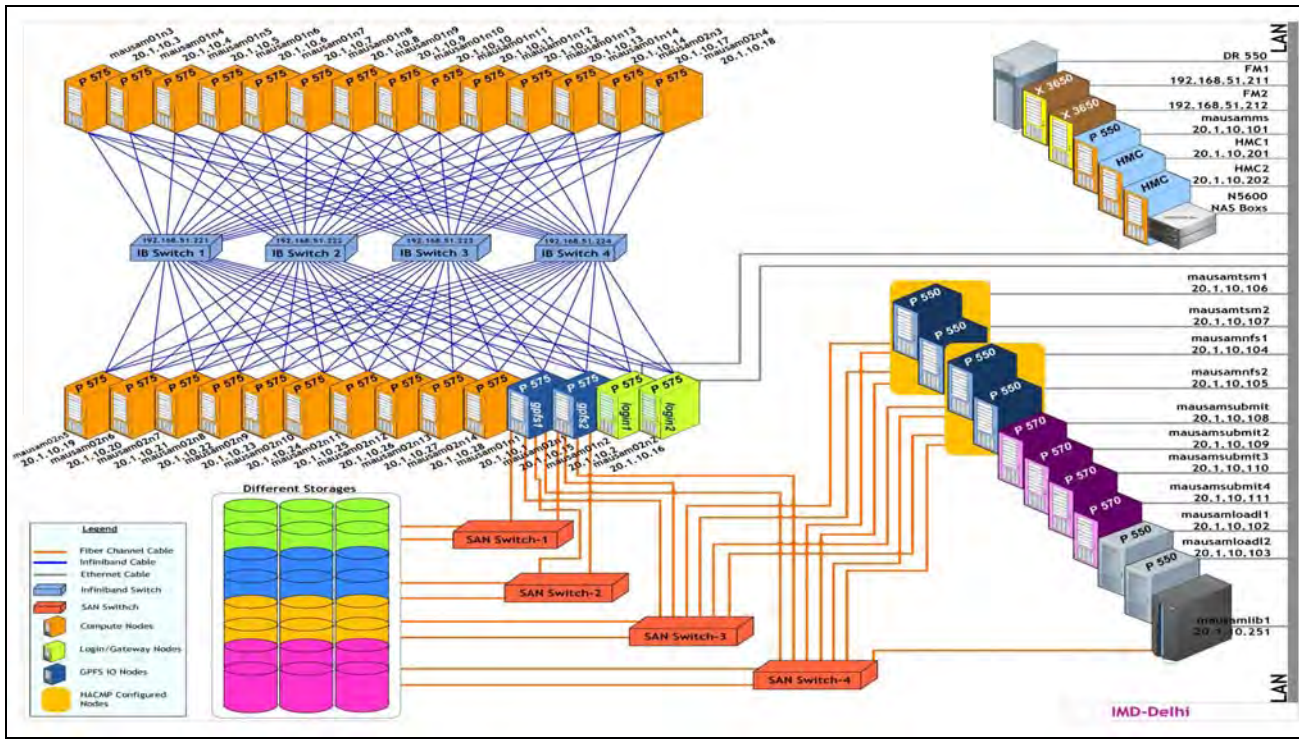
- Establishment of End-to-end Integrated Digital Framework.
- Transfer of Knowledge and Technical Know-How of Digital Forecasting Techniques.
- Leap-frog to operational efficiency level of Met Services of USA, Europe, Japan & Australia in 2 years.
- The system includes 5 Upper-Air Systems, TRANSMET, CIPS, CLYSIS, SYNERGIE & PWS. Out of these 5 Upper-Air Systems and TRANSMET at New Delhi have been installed and are operational.

- Central Information Processing System (CIPS) comply with the spirit of WMO Information system (WIS) and upgradeable to future operational WIS requirements.

5.3.3 HPCS (High Performance Computing System)

High Performance Computing or HPC as it is popularly known as is a concept to extend the Computing Performance. HCL Infosystems and their partner IBM using IBM Compute boxes have implemented this HPCS in IMD Delhi (14.4 Tera FLOPS) along with one HPCS in IMD Pune(1 Tera FLOPS). In addition, high end servers at 12 different locations across the country (Pune; Regional Met. Centres Delhi, Kolkata, Chennai, Mumbai, Guwawati and Nagpur; Met. Centres Ahmedabad, Bangalore,

COMMUNICATION LAYOUT OF HPCS



AVM (Dr.) Ajit Tyagi, DG addressing the media while inaugurating the HPC system at ACWC RMC Chennai

Chandigarh, Bhubaneswar and Hyderabad) are installed (10 completed and 2 under progress).

HPCS server feeds regional servers through automated ftp via VPN circuits. Data and

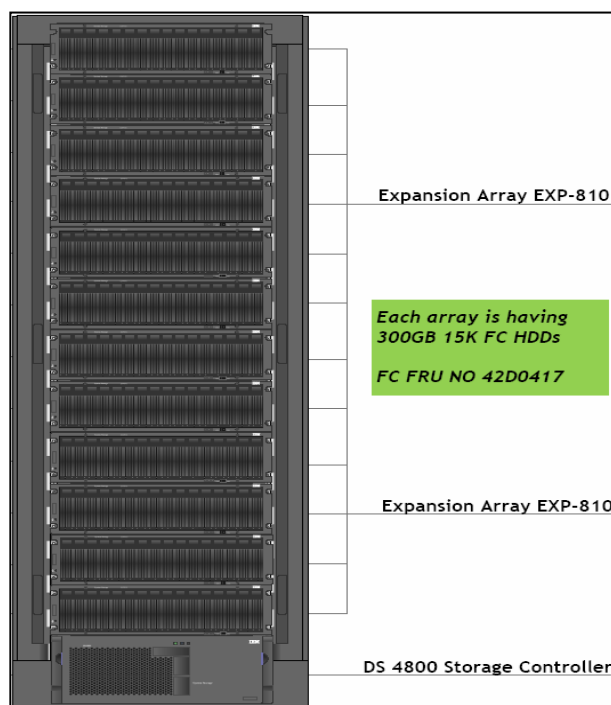
products are exchanged with other users like Indian Air Force, Indian Navy and others.

A new Global Forecast System (GFS) at T382L64 resolution has been implemented at NHAC, IMD HQ on IBM based High Power Computing Systems (HPCS). The new GFS is running in experimental real-time mode since 15th January 2010.

Connectivity

- At the incoming end the HPCS is connected to the central message switching computer called “TRANSMET”.
- The products are seamlessly connected to the operational forecasting system of IMD called “SYNERGEE”. It directly flows through the manual value addition stages to product generation platforms which create the dissemination products.

- HPCS server feeds regional servers through automated ftp *via* VPN circuits. Data and products are exchanged with other national users like Indian Navy, Indian Air force etc.
- The analysis and forecast for 7 days is performed using the HPCS installed in IMD Delhi. One GDAS cycle and seven day forecast (168 hour) run takes about 30 minutes on IBM Power 6 (P6) machine using 24 nodes with 7 tasks (7 processors) per node.
- The regional mesoscale analysis system WRF-Var is installed on High HPCS at Head Quarter, IMD, Delhi with its all components i.e., preprocessing programs (WPS and REAL), observation assimilation program (WRF-Var), boundary condition updation (update_bc) and forecasting model (WRF).
- IBM & HPCS servers installed in July to run WRF model at Bhubaneswer under modernization scheme Upgradation at MC Bhubaneswar.
- High Performance Computing System have been Installed in M.C. Chandigarh, MC Bangalore.
- High Speed Data Terminal connecting at PBO, Hyderabad has been activated since 19th January 2009.
- High speed data terminal (standby system of Hyderabad) connecting PBO Hyderabad with AMSS Chennai has been activated since 19th February 2009.
- High Power Computing system was commissioned at Area Cyclone Warning Centre, RMC Chennai on 8th October and, at M.C. Ahmedabad on 3rd September-2009.



Storage Racks (8 nos)



Robotic Tape Library (1 No)

5.4 MODERNIZATION OF TELECOMMUNICATION SYSTEM

Under IMD Modernization Plan, TRANSMET system (The new AMSS-Automatic Message Switching System), Supplied by MFI (Meteo France International) with latest state of the art technology has been installed at Regional Telecommunication Hub (RTH) New Delhi and put in operational test. The system is compliant to all the requirements of WMO. MFI engineers imparted operational/System administration training to IMD officials on TRANSMET and SYNERGIE systems. Four officers proceeded on foreign deputation to MFI, Toulouse, France in connection with training on operation and system administration of CIPS (Central Information Processing System). IMD's Internet bandwidth from M/s Tata Communications and M/s Bharti Airtel upgraded to 20 Mbps. Installation VPN (Virtual Private Network) links through M/s BSNL Chennai has been started at 38 field locations to strengthen the present Telecommunication network of IMD. Under IMD Modernization Plan, a project for Installation of mirror RTH at Pune and two AMSS at Guwahati and Nagpur is in progress. MFI Synergie system was installed at Area Cyclone Warning Centre, RMC Chennai on 6th November 2009.

Meteorological Telecommunication Network

This includes all satellite based communication system (DMDD, VSAT, WS Radio, CWDS) as well as land based communication system such as HSDT (High Speed Data Terminal) with 256 kbps VPN line, IVRS (Interactive Voice Response System), broadband internet, phone and fax.

India Meteorological Department maintains a very extensive Telecommunication network with Central Hub in its National Meteorological Telecommunication Centre (NMTC), connected with State-of-the art Regional Automatic



**New Automatic Message Switching System
'TRANSMET'**

Message Switching System (AMSS) at Delhi , Kolkata, Chennai and Mumbai . AMSS at RTH New Delhi is being upgraded by the latest – state-of the art technology. New system complies to all WMO requirements. For collection of Meteorological Data from the entire country and the neighbouring NMTC, various modes of communication viz. dedicated leased line circuits, fax, internet, high speed data terminals, VPN connectivity, VHF/Walkie-Talkie have installed at various locations dispersed throughout the country.

The Regional Telecom Hub (RTH) New Delhi maintains point-to-point (nine links) and six circuits through internet connectivity on Global Telecom System.

5.4.1 Interactive Voice Response System (IVRS)

For public weather information's interactive Voice Response System (IVRS) popularly known as "Weather on Telephone". The system is used for daily updating of weather information and forecasts pertaining to various stations and such data can be accessed from anywhere through any landline/mobile phone either as toll free or paid up calls. Two numbers of telephone lines (incoming only) has been attached to the system for accessing the weather

information. And weather information may be accessible by any interested party. The weather information that can be accessed through this IVRS is mainly advance weather warning, maximum and minimum temperatures, daily 24 hours cumulative rainfall, forecast for next 24 hours that include maximum/minimum temperature and rainfall forecasts.

The system mainly consists a Line sharing EPABX device, a line sharing SMPS device, Dialogic Card, modem, Router and switch connected to IVRS servers. The system will be on line 24hours and can be accessed throughout the day.

IVRS have been installed at 26 stations (mainly state capitals) through out the country. One can access current weather and forecasts for major Indian cities by dialing a Toll free number 18001801717.

VPN connectivity have been provided at 39 stations which are mainly MCs, CDR, DWR stations and some important MOs/AMOs.

5.4.2 Very Small Aperture Terminal

VSAT is an abbreviation for a Very Small Aperture Terminal. It is basically a two-way satellite ground station with a less than 3 meters tall (most of them are about 0.75 m to 1.2 m tall) dish antenna stationed. The transmission rates of VSATs are usually from very low and up to 4 Mbit/s. These VSATs' primary job is accessing the satellites in the geosynchronous orbit and relaying data from terminals in earth to other terminals and hubs. They will often transmit narrowband data.

A network of 26 V-SATs is being installed at selected seismological observatories, Cyclone Detection Radar Stations, Cyclone Warning Centres for reception of Observational data Utilizing communication transponder of INSAT.



V-SATs

5.4.3 High Speed Data Terminal

High Speed Data Terminal. meant for transmission and reception of all weather related information at 256 kbps speed. The system works on high speed leased line of 256 Kbps leased line provided by BSNL and has Virtual Private Network 256 Kbps bronze type set up for working. Using these High Speed Data Terminal regular meteorological observations recorded at various observatories functioning under India Meteorological Department can be sent to HQ on real time basis.. The system mainly consists of a high-speed modem, router, switch and personal computer that support all the application software "METCONNECT". A GPS/EGPRS data modem with SIM has also been provided with the system to access data from various landline/mobile phone for meteorological data reception on real-time basis.

A new Public Weather Service System called 'Meteofactory' is now operational at IMD Hq. New Delhi. It will enable the forecaster to generate in custom required presentation form the automatic delivery of products to the newspaper, TV, commercial airlines, farmers, shipping etc.



Automatic Radiation Instruments

5.5 RADIATION

Automatic Radiation Instruments were installed at 45 radiation observatories. Out of these 30 stations were commissioned. Special observations were taken during solar eclipse (22nd July 2009) from Varanasi, Patna and Sindhkhed. The observations were pertaining to surface ozone, ultraviolet radiation, global, defused radiation etc. Regular upper air observation were continued.

Radiation Instruments, i.e., Pyranometers, Pygeometers Solar Trackers have been procured from M/s SGS Weather & Environmental Systems (Pvt.) Ltd., New Delhi by O/o DDGM (SI), Pune for installation. These instruments have been installed at 20 stations and the work is under process for remaining stations. Data of Global radiation (both scattered & direct), Diffuse radiation (only scattered radiation) and Direct radiation are stored automatically in data logger.

Pyrheliometer observations taken at stipulated airmass timings daily and linke turbidity calculated. Pyrheliometer observations taken daily before and after sunrise and sunset respectively at stipulated time and Terrestrial radiation calculated. Condensed atmospheric moisture samples for isotopic analyses are collected, stored and transported with utmost care

to Physical Research Laboratory under National Programme on Isotope Fingerprinting of Waters of India (IWIN). Weather parameters recorded during the moisture sampling period.

Automatic Radiation Station for monitoring ultra violet radiation, total radiation, global radiation, diffuse radiation, direct radiation, terminal radiation and net radiation installed and commissioned at M. C. Jaipur, RS/RW building, Chennai M.C. Ahmedabad and CSO Shillong.

Maintenance of Surface Instruments

The defective surface met. Instruments wear repaired. Large number of instruments both departmental and non-departmental were tested and calibrated. Revenue to the tune of Rs.29 lakh approx. has been earned during the year by calibrating and selling the instruments to outsiders. Standard barometers were supplied to all RCs and MCs for calibration of station barometers. Classical Thermograph, Hair Hygrograph and Barograph were converted into digital Thermograph, Hair Hygrograph, and Barograph. One system is installed at Central Agriculture observatory, Pune for testing.

This office has done R & D work on Current Weather Instruments System (CWIS) by

converting the existing analog CWIS in to Digital CWIS at 2 airport stations. Similarly IMD developed High Wind Speed Recorders (HWSR) were installed at seven coastal stations. Distant Indicating Wind Equipments (DIWE) were also converted to Digital Distant Indicating Wind Equipments (DDIWE) and installed at two Airport Met. stations. The conversion of cup generator anemometer into optical anemometer has also been done by DDGM(SI)PUNE office. Also Pune office imparted training of maintenance and operation of all Surface Met. Instruments to departmental and non-departmental persons.

Upgradation of Pressure Standard

Two numbers of Dead Weight Testers (DWT) operating over the pressure range 14 hPa Absolute to 1700 hPa Absolute were procured to



replace primary standards and commissioned. Also 100 numbers of Digital Standard Barometers (DSB) were procured as replacement of PAB's. These DSBs will now be used by inspectorate sections of RMCs and MCs for annual comparison of Station Barometers.

Digital Standard Barometers (DSB) employ resonance pressure transducer that is very accurate and stable thus provides Accuracy of 0.05 hPa, resolution of 0.01 hPa and stability of 0.1 hPa/year.

RTSMN (Real Time Seismological Monitoring Network)

RTSMN (Real Time Seismological Monitoring Network) system is networked through satellite based VSAT to Seismology division of IMD and INCOIS Hyderabad for issue of tsunami warning. Satellite imageries, Radar products, meteorological data and multi super ensemble products are disseminated to this office through DMDD (Digital Meteorological Data Dissemination) system and World space satellite radio receiver system. In the event of breakdown of all landline communication system, another well secured data exchange mode through ftp is also adapted through VSAT system. Cyclone Warning Dissemination System (CWDS) is utilized for the dissemination of Severe Disaster warning (CYCLONE WARNING) to district collectors of coastal districts. Communication through all the above systems are not susceptible to disruption by natural disasters.



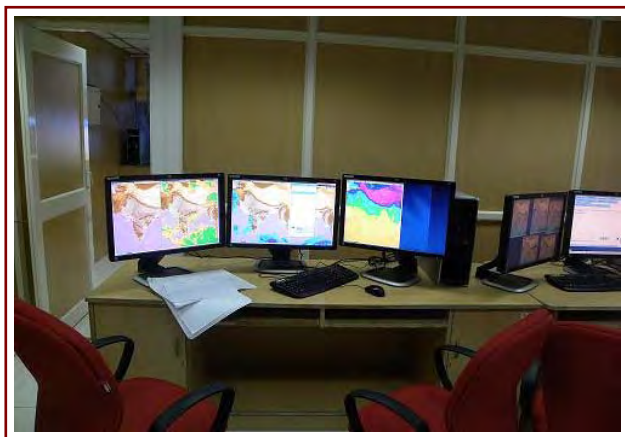
RTSMN Seismometer

5.6 SATELLITE APPLICATIONS

INSAT Data Reception and Processing

At present India Meteorological Department (IMD) is receiving and processing meteorological data from two Indian satellites

namely Kalpana-1 and INSAT-3A. Kalpana-1 was launched on 12th September, 2002 and is located at 74° E. INSAT-3A was launched on 10th April, 2003 and is located at 93.5° E. Kalpana-1 and INSAT-3A both have three channel Very High Resolution Radiometer (VHRR) for imaging the Earth in Visible (0.55-0.75 μm), Infra-Red (10.5-12.5 μm) and Water vapour (5.7-7.1 μm) channels having resolution of 2×2 kms. in visible and 8×8 kms. in WV and IR channels. In addition the INSAT-3A has a three channel Charge Coupled Device payload for imaging the earth in Visible (0.62-0.69 μm), Near Infra Red (0.77-0.86 μm) and Short Wave Infra Red (1.55-1.77 μm) bands of Spectrum. The Resolution of CCD payload in all the three channels is $1 \text{ km} \times 1 \text{ km}$. At Present about 48 nos. of satellite images are taken daily from Kalpana-1 which is the main operational satellite and 9 images are taken from INSAT-3A. Imaging from CCD is done 5 times during daytime only. All the received data from the satellite is processed and archived in National Satellite Data Centre (NSDC), New Delhi.



'Synergie' work station at IMD Hq. New Delhi

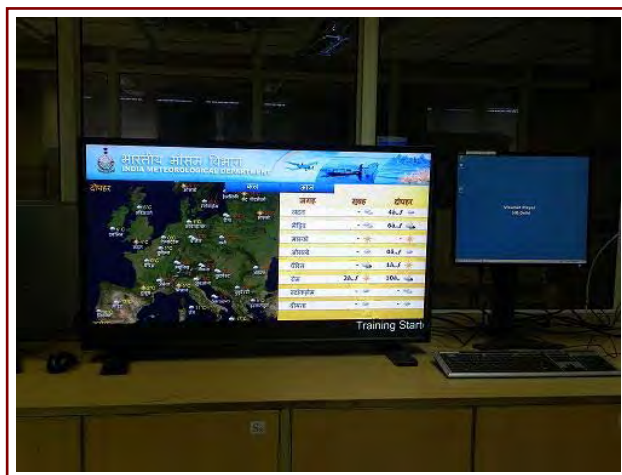
INSAT Meteorological Data Processing System (IMDPS)

IMDPS is processing meteorological data from INSAT VHRR and CCD data and supports all operational activities of the Satellite

Meteorology Division on round the clock basis. Cloud Imagery Data is processed and transmitted to forecasting offices of the IMD as well as to the other users in India and foreign countries.

Apart from generating half hourly cloud imagery, IMDPS produces Satellite Data derived products from the processed data as follows:

- (i) Cloud Motion Vectors (CMVs) are derived using three consecutive half hourly images from the operational Kalpana-I Satellite. CMVs are generated at 0000, 0300, 0600, 0900, 1200, 1500 & 1800 UTC using Infrared imagery daily.
- (ii) Water Vapor Winds (WWVs) are derived using three consecutive half hourly images from the operational Kalpana-I Satellite. CMVs are generated at 0000, 0300, 0600, 0900, 1200, 1500 & 1800 UTC using water vapour imageries data.

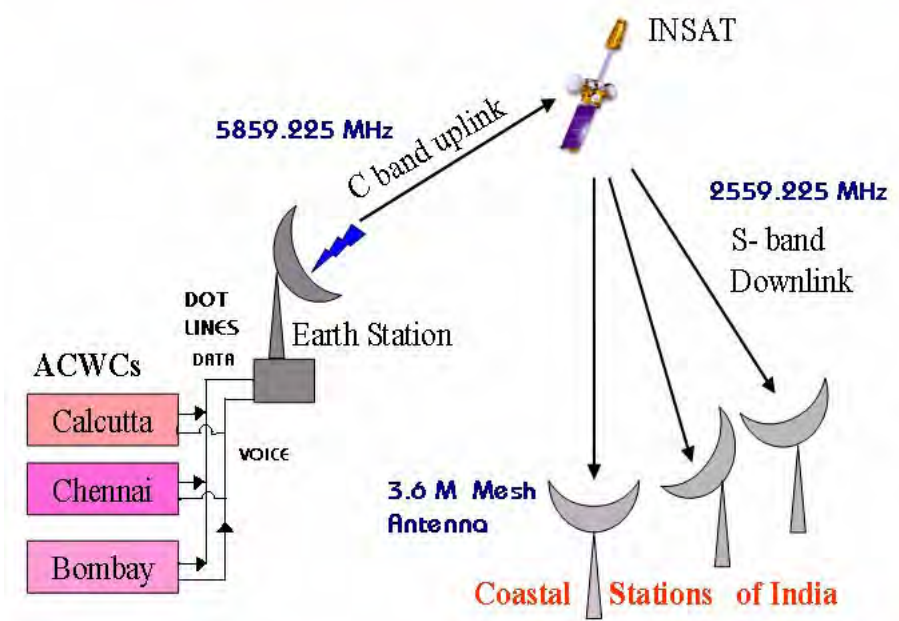


Public Weather Service System 'Meteofactory'

(iii) Sea surface Temperatures (SSTs) are computed at $1^\circ \times 1^\circ$ grid intervals from all Kalpana-I data on half hourly /daily /weekly/monthly basis.

(iv) Outgoing Longwave Radiation (OLR) at $0.25^\circ \times 0.25^\circ$ grid intervals from all Kalpana-I

Cyclone Warning Dissemination System (CWDS)



data on half hourly /daily /weekly/monthly basis.

(v) Quantitative Precipitation Estimates (QPE) are generated at $1^\circ \times 1^\circ$ Grid from Kalpana-1 imagery on half hourly/daily/weekly/monthly basis.

(vi) Special sector images are created for special events such as Amarnath Yatra, Cyclones, other special weather phenomena, and Satellite launches from SHAR center, Sriharikota.

(vii) Synoptic unit has prepared a report on 'Interpretation and Application of Satellite Imageries/ Products in Weather Analysis' under DGM's guidance .

(viii) During the last two years tropical cyclone centers and intensity determination by Dvorak technique has improved. At present in India, this

technique is widely used but manually applied. Recently efforts have been made for automization of this technique. Automated Dvorak technique is running in experimental mode at Synoptic Application Unit, Satellite Meteorology Division.

(ix) The unit provided concerned satellite images, products etc. for different projects like Severe Thunderstorm Observations and Regional Modeling (STORM), Forecast Demonstration Project for Tropical Cyclones and Continental Tropical Convergence Zone (CTCZ).

(x) Satellite Application Unit is issuing three hourly bulletins in general and hourly and half hourly in case of severe weather events like tropical cyclone, thunderstorm etc. The unit has modified these bulletins and included the forecast part also.

(xi) Designed and built the Web Archival System- A system developed at SATMET for KALPANA/INSAT3A data products imageries on Linux platform and made operational since January 2009.

Many new products have been added to the satellite page of IMD website.

Under the establishment of Ground receiving and data processing system for INSAT 3D, the Factory Acceptance Test (FAT) was conducted during September 2009 at MCF Hassan, Karnataka for antenna system of INSAT 3D.INSAT 3D/3A/Kalpana-1 Ground Data receiving and processing system

Automatic Picture Transmission (APT) System

A Satellite data reception and Processing system has been set up in Sat. Met. Division for receiving the data from the operational Polar Orbiting NOAA satellites. Synoptic Application Unit is using the system operationally for image interpretation using the AVHRR data. The APT images are displayed on IMD website also.

5.7 DIGITAL METEOROLOGICAL DATA DISSEMINATION

The system is designed for direction reception of satellite imageries in three different channels, namely, Visible, Infrared and water vapor from Indian Satellite System and also for reception of weather charts and satellite images in fax format from the Meteorological Data Processing System of Satellite Meteorological Division, Mausam Bhavan, Lodi Road, New Delhi.. The system mainly comprises 120 Cm receiver antenna, S-band LNBC, 2 band power divider, PC based demodulator Card, Ethernet convertor and DMDD work station and MetGIS software. 3 hours satellite images and hourly satellite images in fax format and analyzed weather charts/forecasts along with GTS data through the system was received.

Under the supervision of Shri A. K. Sharma DDGM, Sat Met the Digital Meteorological Data Dissemination (DMDD) system was installed at Kathmandu Nepal on 10th February 2009, at Male (Maldives) by Shri D. K. Malik Director and Shri P.C. Chaturvedi Director on 30th March 2009, and at Colombo Sri Lanka on 28 November 2009 by Shri G. N. Saha Director And Sh. Viri Singh AM-I in addition to 37 DMDD Stations at various places in India. With this installation the project of establishment of 40 nos.

Meteorological Data Dissemination (MDD)

The processed INSAT cloud imageries are broadcast through INSAT-3C, an Indian communication satellite using S band broadcast capability in digital mode every three hours. Meteorological data consisting of satellite cloud imageries, T/P data (conventional Met. Data) and Fax charts (Analyzed weather charts) are provided to various field stations through this MDD network. At present there are 37 MDD receiving stations in India. In addition to IMD, IAF and Navy also receive signals. Conventional Met. Data satellite bulletins based on analysis of satellite cloud imageries are transmitted at synoptic hours, heavy rainfall advisories are also sent over MDD. During cyclone situations, actual position of system and its intensity and related forecast are also being transmitted to field stations every hour. MDD units have also been provided with work stations for detailed analysis of cloud imageries. The system transmits data in International LRIT/HRIT format through own transmitting station at New Delhi. DMDD receiving stations have also been set up in NEPAL, SRILANKA and MALDIVES in 2009.

Cyclone Warning Dissemination System (CWDS)

Total numbers of 252 analogue Cyclone Warning Dissemination System (CWDS)

receivers have been installed in the cyclone prone areas of east and west coasts of India. The cyclone warning messages are broadcast in local languages of the area likely to be affected. Messages for the state of West Bengal and Orissa are broadcast from ACWC Kolkata. Andhra Pradesh, Tamilnadu, Kerala and Karnataka are covered by ACWC Chennai. The broadcast for Maharashtra, Gujarat and Goa states originate from ACWC Mumbai. 101 more Digital CWDS receivers based on Digital Technology have been deployed in Andhra Pradesh under the World Bank Project in the year 2003. It is planned to replace all the 252 analogue CWDS receivers by the Digital CWDS in the current year 2009-10 and increase the network to 400 from 352 at present.

National Satellite Data Centre

A National Satellite Data Centre (NSDC) has been commissioned in the Sat. Met. Division w.e.f. 26 October 2005 for the archival and supply of processed INSAT VHRR data and derived products to the users and research community.

Key initiatives in Satellite Division for 2010-2012

A new Geostationary Meteorological Satellite INSAT-3D is being designed by ISRO. It will have a six channel imager and a nineteen channel sounder. In addition to satellite imagery in six channels several new derived products will be available after processing the data from INSAT-3D. These products will be useful in NWP and in day-to-day weather forecasting. In addition to ground level products the vertical profiles of atmospheric temperature, moisture and ozone will be available from the satellite data of INSAT-3D. It will provide 1 km resolution imagery in visible band, 4 km resolutions in IR band and 8 km. in water vapor channel. This new satellite is scheduled for launch in fourth quarter of 2010 and will provide much improved capabilities to the meteorological community and users. A new ground segment facilities to receive and process data from INSAT-3D is being installed. This will consist of the establishment of an Earth Station & Data Reception and processing systems through M/s Antrix Corp., ISRO, Bangalore.



6. OTHER SERVICES

6.1. CLIMATE MONITORING AND INFORMATION SERVICES

- IMD undertakes real time climate monitoring and publication of Climate Diagnostics Bulletins for Indian region and reporting of major anomalous climate events.
- Detailed special monsoon reports are being published every year.
- High resolution daily gridded rainfall data ($1^\circ \times 1^\circ$) & ($0.5^\circ \times 0.5^\circ$) has been brought out.
- High resolution daily gridded temperature data ($1^\circ \times 1^\circ$).
- Studies are conducted for development of new objective methodologies for drought monitoring over India.
- Prepares Climate related databases, Data Products and atlases for the user community.
- High-resolution gridded terrestrial climate of India has been recently released to the user community.
- Climatological Summaries for districts and states are regularly updated.

6.2. NATIONAL DATA CENTRE (NDC)

The NDC is the national repository of all meteorological data collected on a routine basis and through special campaign programmes. The total holding of meteorological data in the archives as of date is 103.5 million records.

NDC received a lot of queries and requests for data supply from numerous parties that include Government, private institutions, industries, research and operational users. The required data were retrieved from the computer archives, within a short time and supplied to the users on CDs, in printout forms in the desired formats, following the usual formalities and as per department policy. During the period under consideration 1080.6 million records were retrieved and supplied (during 2009-10) to different users as shown below.

	Commercial	Non-commercial	Free of cost
Foreign Parties	1	-	-
Indian Parties	175	74	26
Departmental	-	126	-

6.3. MARINE METEOROLOGY SERVICES

- The India Meteorological Department continued to maintain Voluntary Observing Fleet (IVOF), through six Port Met. Offices viz., Kolkata, Visakhapatnam, Chennai, Kochi, Goa and Mumbai. IVOF consist of ships of Merchant Navy, Indian Navy and Foreign ships. Meteorological Observations from the oceanic area are being collected on real time basis for operational forecasting. The ship weather logs are scrutinized in Marine Section and data is sent to Marine Climatological Section of the O/o ADGM(R) for archival.
- DDGM (WF) has attended the meeting at the Directorate under the chairmanship of the Director General of Shipping (DGS) to discuss matters relating to proposed Audit of India under Voluntary IMO Member State Audit Scheme (VIMSAS).

- For Antarctica Expedition and Sagar Kanya Cruise, necessary training was given for recording and transmitting meteorological observations on High Seas. Data received from Sagar Kanya is scrutinized and sent to ADGM (R)'s office for archival.
 - Excellent Award in the form of books and Certificate of Merit were given to the ships' officers, for their meritorious meteorological work, who were involved in collecting routine as well as valuable Meteorological information from High Sea.
 - IMD is also supporting various ongoing WMO programmes like Global Ocean Observing System (GOOS), Global Maritime Distress Safety System (GMDSS), Marine Pollution Emergency Responses Support System (MPERSS) and Ships of Opportunity (SOT) etc.
 - Meteorological observations are being recorded and transmitted by the Voluntary Observing Ships (VOS) on real time basis as well as in delayed mode.
 - Lists of Selected, Supplementary and Auxiliary ships in XML (Extensible Markup Language) format were sent to WMO on a quarterly basis for inclusion in "WMO publication no.47".
 - Sea Surface Temperature from ship and buoy observations from Arabian Sea and Bay of Bengal regions are collected and their weekly/monthly mean/anomalies are prepared in the section.
- 6.4. INDIAN OCEAN AND SOUTHERN HEMISPHERE ANALYSIS CENTRE**
- Indian Ocean and Southern Hemispheric Analysis Centre(INOSHAC) prepares Synoptic Charts for the region covering 50° S to 45° N and 20° E to 155° E.
 - For the safety Net. Met. Area VIII(N), IMD issues daily two GMDSS bulletins in fair weather. In disturbed weather (cyclone etc.) extra bulletins are issued every three hours. These bulletins are then transmitted to DGM (Telecom) New Delhi through NHAC New Delhi for its onward transmission on Global Channel through Land Earth Station (LES) Arvi via INMARSAT/ NAVTEX. From 1st September 2009, a GMDSS bulletin with 48 hrs validity period is also being issued in addition to the bulletin valid for 24 hrs.
 - Two bulletins are issued in fair weather for Indian Navy in the form of fleet forecast for the area 10° S to 5° N and 60° E to 100° E. In case of disturbed weather (depression onward) frequency is increased and additional bulletins (2 to 6) are also issued depending upon the need.
 - Two sea weather bulletins are also issued daily for the South Indian Ocean and Northwest Pacific for departmental exchange.
 - A report was generated comprising the following features for the period June to September 2009 for inclusion in AMR meeting:
 - a. Cross Equatorial flow from the southern hemisphere week by week.
 - b. Systems in the Northern Pacific and South China Sea and South Indian Ocean week by week.
 - c. Strength of Mascarene and Australian Highs month wise and their anomalies.
 - d. Movement of upper air troughs at 500 and 300 hpa levels in the upper air westerlies, penetrating from both the hemisphere between 30° N to 30° S over Indian region.

6.5. ANTARCTIC SCIENTIFIC PROGRAMME

IMD continues to operate its Meteorological Observatory at Maitri, (Index No. 89514) local Antarctica. Observational data and forecasts are regularly updated on IMD's web site.

One Automatic Weather Station has been installed and commissioned at Maitri.

A two member IMD team is participating in the current 29th Antarctic Expedition.



Meteorological Programme continues to be an integral part of the Indian Scientific Expedition to Antarctica since the very first expedition to the icy continent during 1981-82. The main objectives of the meteorological programme have been (i) to prepare the climatology of the area and to study the influence of Antarctic weather, if any, over the weather of Indian subcontinent in general and over Indian monsoon in particular. (ii) to measure and study the ozone-hole phenomenon over Antarctica and (iii) to provide weather forecasting support for the various logistic and scientific activities of the expedition.

Expedition

28th InSEA

Two IMD team members (S/shri Kuldeep Wali, AM-I & P. Radhe Syam, AM-II) of 28th InSEA

were deputed to participate in this expedition. One IMD member of 28th InSEA, Shri Kuldeep Wali, AM-I of DGM's Office (CPU Unit) passed away on 1st June 2009 at Indian Research Base Maitri Station Antarctica due to acute myocardial infarction. Cremation of late Kuldeep Wali was done on 9th June 2009 near Maitri Campus with full honour & dignity to the departed soul. On 4th December 2009 the ashes of late Kuldeep Wali was brought by the Hon' Secretary of MoES, Dr. Shailesh Nayak & Shri Rasik Ravindra, Director (NCAOR), Goa and handed over the ashes of late Kuldeep Wali to his family at Delhi airport for performing the last rite at Haridwar. DGM, AVM Dr. Ajit TYagi, Dr. S. K. Peshin, DDGM(NOC) and some other colleagues of late Mr. Kuldeep Wali also attended there to express the last respect and honour to the departed soul. IMD team member Shri P. Radhe Syam, AM-II of DDGM (UI), New Delhi (Radar Unit) returned to India on 6th December 2009 after successful completion of the meteorological work at Maitri (Antarctica).

29th InSEA

During this financial year this division has selected two IMD team members namely S/Shri N. Chandrahas, Scientific Assistant from CWC Visakhapatnam (RMC Chennai) and Tushar V. Pawar, Scientific Assistant from AMO Mumbai (RMC Mumbai) have been selected as IMD team members for participating in the 29th Indian Scientific Expedition to Antarctica (InSEA). They have flown to Maitri, Antarctica from Cape Town (South Africa) by ALCI flight D2(IL76) and reached at Maitri Station on the morning of 12th November 2009. They will cover the scientific activities during both summer & winter parts of the expedition till March 2011.

Weather summary Maitri for 2009

Highest Max. Temp. 5.5° C, dated 16th Jan.
Lowest Min. Temp. -36.2° C, dated 23rd Jun.
Warmest Month (Avg. Temp.) -0.9° C, Jan.
Coldest Month (Avg. Temp.) -21.0° C, Aug.
Windiest Month (Avg. Wind) 27 knots, Jun.
Max. Pressure 1016.8 hPa, dated 30 Apr.
Min. Pressure 951.4 hPa, dated 13th Aug.
Blizzard 32
Wind Gust 110 knots, dated 5 Jul.

Southern Ocean Expedition

S/shri Suman Saha, SO from RMC Kolkata and Shri H. R. Mahajan, S.O. from Agrimet, Pune participated in Southern Ocean Expedition No. 3 by NCAOR, Goa started from 9th February 2009 to 15th April 2009. They have taken meteorological observations during their expedition period enroute Goa to Mauritius.

6.6 POSITIONAL ASTRONOMY

The objective of the centre is to generate accurate data on positional astronomy of celestial bodies i.e. positions of the Sun, Moon, Planets, Bright Stars etc and to provide a unified National calendar, both for civil as well as religious purposes in order to unify various divergent practices of Calendar making. The Center routinely publishes the Indian Astronomical Ephemeris which provides authentic data on positions of celestial objects with the desired accuracies for various applications in Astronomy, Space Engineering, Geodetic and other Survey work, etc. It also publishes the Rashtriya Panchang in 14 Indian languages. The Centre also supplies lunar data for prediction of tides for Survey of India, Sun-Moon rise/set data for a large number of places for newspapers, judiciary, religious bodies, defence and scientific bodies, eclipse phenomena for scientific researchers and general public etc. and also acted as national agency for

determination of dates of festivals of all communities in India, for declaration of official holidays.

The centre contributed in popularising astronomy by displaying Star-Charts, Astronomical Bulletins, information on panchang matters and current astronomical events etc. on website and by organising sky viewing and other popular programmes. Some other activities carried out by the centre in 2009 are listed below.

Weather Information on Web

IMD continued to provide weather information to public and other users through its highly popular website “ www.imd.gov.in “

Weather Information Through Telephone

For public weather informations, Interactive Voice Response Systems (IVRSs), popularly known as ‘Weather on Telephone’ have been installed at 26 stations (mainly state capitals) through out the country. One can access current weather and forecasts for major Indian cities by dialing a toll free number 1800 180 1717 or 1717.

6.7. PUBLICATION, LIBRARY AND INFORMATION SERVICES***Publication Unit******Research Journal “MAUSAM”***

Publication Section at H.Q. publishes a departmental quarterly research journal “MAUSAM” since January 1950. It was originally called the “Indian Journal of Meteorology & Geophysics”, then later called

the “Indian Journal of Meteorology, Hydrology & Geophysics” and was finally named “MAUSAM” in 1979. MAUSAM is a renowned Indian Scientific Research Journal published in the field of Meteorology, Hydrology & Geophysics. The four issues appear in January, April, July & October every year. All the four quarterly issues of MAUSAM for the year 2009 have been brought out. Besides the regular issues, a special Diamond Jubilee issue on invited topics was also brought out.

From January 2008 onwards, IMD has started publishing a quarterly Newsletter “IMD NEWS” highlighting the activities of IMD. During 2009 all the four issues of quarterly newsletter “IMD News” have been brought out in time.

A Biennial Award Instituted by the Govt. of India in 1960 is given to the authors of the best scientific research paper contributed by the Indian/foreign scientist(s) published in MAUSAM during a two year period.

The Award is aimed to encourage scientific research of high quality especially in the field of meteorology and allied subjects, so far, twenty four distinguished contributions have been found worthy of this Award now known as the MAUSAM Award. Presently, the award value consists of a Citation and a sum of Rs.50,000/- (Rupees Fifty thousand only) in Indian currency for Indian scientists & its equivalent amount in foreign currency for International scientists per paper of the award winning paper.

To encourage the use of Hindi language in writing scientific research paper on meteorology and allied subjects, another Biennial Award named MAUSAM Shodh Puraskar was instituted by Govt. of India in 1993. The said award is restricted to the departmental Scientists including retired scientist of IMD. However, if the research paper selected for this award is co-

authored by scientists of IMD and scientists from other organizations, all the authors are eligible for the Award. Presently, the Award value consists of a Citation and a sum of Rs.20,000/- (Rupees Twenty thousand only) per paper of the Award winning paper.

Seminar/lectures covering various activities of IMD were organized by Publication Section every month.

Editorial Committee

The Editorial Committee consisting of 10-12 scientists in the field of Meteorology & allied subjects is nominated by the Editor & Chairman once in every three year period. The Director General of Meteorology serves as Ex-officio Editor & Chairman of the Editorial Committee. In order to improve the referral process the journal MAUSAM a panel of subject Editors for different subject domains/areas has been constituted.

Annual Report

Annual Report is also being brought out by officers/staff of Publication Section of H.Q. New Delhi.

Library Services

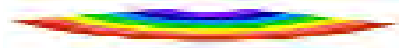
During this year 237, number of books in English, 192 in Hindi and other publications were added in the Library. 650 numbers of Journals were added to the Library. Reprographic services were provided to 71 visitors. 287 journals were bounded. Four Library Advisory Committee meetings were held under the chairmanship of ADGM (EREC).

50 Foreign Journals and 22 Indian Journals were subscribed during the year. 2558 visitors visited the Library.

Information Services

Rashtriya Panchang 1932SE (2010-11 A.D) in 14 different languages were published by PAC, Kolkata and put on sale for public. Press release on the events occurred during 2009 was sent to Press Information Officer, Shastri Bhawan, New Delhi:

- WMO day was celebrated on 23rd March 2009.
- Total Solar Eclipse occurred on 22nd July 2009. Pamphlet on Total Solar Eclipse 22nd was published.



7. ACTIVITIES

IMD FOUNDATION DAY -15th JANUARY

In the history of India Meteorological Department 15th January 1875 is a momentous day as on this day Mr. H.F. Blanford took charge as the Meteorological Reporter to the Govt. of India. During 134 year of its existence, IMD has contributed immensely for the development of science of meteorology over the sub-continent region and has served the cause of safety and well being of Indian population against weather related hazards and to economic development of the country. IMD considered 15th January as an opportune moment to celebrate this day under dynamic leadership of AVM (Dr.) Ajit Tyagi, Director General of Meteorology.



Quiz Contest

On this occasion a school quiz contest was organized in IMD Telecom Training Centre (TTC). Six schools (Tagore International School, Hans Raj Model School, St. Francis School, Carmel Convent School, Modern Vidya Niketan School, Kendriya Vidyalaya School) were participated in the quiz contest. 1st Prize was awarded to Hans Raj Model School and 2nd Prize given to Carmel Convent School by Hon'ble Minister of MoES, Sh. Kapil Sibal on 15th January 2009



MESSAGE FROM HON'BLE UNION MINISTER SHRI KAPIL SIBAL

I am happy to note that IMD is celebrating its foundation day on 15th January, 2009 for the first time in their 134 year of history. This should provide inspiration to all of you to rededicate yourself to the progress of the department and work towards a single objective of providing best meteorological service to the nation. I convey my warm greetings to entire IMD family on this occasion and wish them a great success in the time to come.

Best RMC for 2008

On the occasion of IMD foundation day celebration a documentary film and brochure was brought out. Certificates of merit were awarded to 19 officials of this Department for meritorious services rendered in the year 2008. RMC, New Delhi was awarded best RMC offices for excellent work.

**AWARDS****SAARC Scientist Award**

Dr. Dutta receiving the Award from Hon'ble Minister Shri Kapil Sibal

SAARC Senior Scientist Award for year 2006 and SAARC Junior Scientist Award for the year 2007 were conferred to Shri D. Pradhan, Director and Dr. S. N. Dutta, Director respectively, on the occasion of IMD Foundation Day.

Young Scientists Award

On the occasion of MoES foundation day (the 22nd July 2009) celebrations at Vigyan Bhawan, New Delhi, National Award for Ocean Sciences and Atmospheric Sciences were given by Chief Guest, Prithviraj Chavan, Hon'ble Minister of State for Science and Technology and Earth Sciences. In addition, Certificate of Merit for young scientists/engineers for outstanding contributions, best employee awards, science quiz prizes and prizes for drawing competitions were also given to mark the occasion.



Dr. N. Chattopadhyay receiving Young Scientist Award from Hon'ble Minister

Dr. M. Mohapatra, Director and Dr. N. Chattopadhyay, Director were awarded "Certificate of Merit for young Scientist" by Hon'ble Minister. Shri Abraham Philopose, A.M.-II O/o ADGM(R), Pune, Shri A. Kundu, S.A., RMC, Kolkata & Shri Hari Singh, Met. Attendant, HQ, New Delhi were also conferred with the best employees award.

24th Biennial Mausam Award

On the occasion of Diamond Jubilee celebration, on “MAUSAM” a 24th Biennial Mausam Award has been conferred on Dr. S. N. Dutta Director, CTI PUNE for the paper entitled, “Parameterization of momentum flux and energy flux associated with orographically excited internal gravity waves in a baroclinic background flow” published in October 2007 issue of MAUSAM. This award consists of a citation and a cash prize of Rs.35,000/-.



Dr. Somenath Dutta receiving Award from Hon'ble Minister

National Innovative Award

Congratulations to Master Yatharth Saxena (S/o Shri Sanjai Saxena, an IMD member posted at Airport office, Pantnagar) recipient of first prize in the IGNITE-09 National Award for innovation among school children instituted by National Innovation Foundation, Ahmedabad. IGNITE-09 is the National competition for student's technological ideas and innovation to bring out the hidden creativity in the children and make them think beyond their text books, organized in partnership with CBSE, Navodya Vidyalaya Samiti and Society for Research and Initiatives in Sustainable Technologies and Institutions (SRISTI) and others.



(Left) Master Yatharth Saxena receiving award from Dr. A.P.J. Abdul Kalam, (Right) Model of Wheel designed

Master Saxena, who is a class Vth Student from Udham Singh Nagar, Uttarakhand, was awarded first prize for his idea about triangular wheels in luggage, which would facilitate in its movement over stairs. The prize was conferred on him by former President of India Bharat Ratna Dr. A. P. J. Abdul Kalam at a function at IIM, Ahmedabad on 30th November 2009.

Meteorological Co-operative, Credit Society Ltd., Airport Nagpur



On the eve of completion of 50 years of Society's working Golden Jubilee celebrations held on 06th to 08th March 2009 at Nagpur. Mayor of Nagpur city Smt. Mayatai Iwanathe was the chief guest of honour, Shri S. Krishnaih, D.D.G.M. RMC, Nagpur presided over the main

function and Dr. P.K.Nandankar, Director M.O. Nagpur, Dr. D. P. Dubey, Director M.C. Bhopal and other officials attended the function. Shri S.K.Konge, President of the society felicitated the dignitaries, addressed and concluded with vote of thanks.

Weather Forecast

Kailash Mansarovar Yatra

Meteorological Centre, Dehradun started issuing Weather forecast for the Kailash-Mansarovar Yatra from 5th June onwards. Shri Sanjay Singhal (IPS) Deputy Inspector General, Indo Tibetan Border Police (ITBP), has appreciated the accuracy of weather forecast issued by the Meteorological Centre which has proved very useful.

Amarnath Yatra

IMD is actively involved in issuing sector-wise weather forecast including weather warning for safe and secure journey of Amarnath pilgrims. They are provided Cloud Imagery of the route. Advance information of snowfall is very important for planning forward journey.

Air Quality Forecasting

IMD plans to develop capability for Air Quality Forecasting for major Indian cities and implementation the same during 10th Commonwealth Games at Delhi. A Meeting was held in Pune between officials of IMD, CDAC, CPCB and NEERI. Shri B. Mukhopadhyay, DDGM (DM) re-presented India Meteorological Department.

Agromet Advisory Bulletin

Five days rainfall forecast are prepared daily based on WRF and MM5 models run at 10 km

resolution for 332 Raingauge stations and 32 districts in Tamilnadu for putting up in the website for the purpose of value addition for the issue of biweekly Agromet Advisory Bulletin issued by AASU Chennai.

Appreciation for Weather Forecast

(a) Shri Rajesh Arya (IPS), Deputy Director, Lal Bahadur Shastri National Academy of Administration, Mussorie praised the timely and accurate Weather forecast provided by Meteorological Centre, Dehradun, in connection with the visit of Hon'ble President of India to Mussorie on 4th July 2009.

(b) Met. Centre Srinagar was awarded a memento on 30th August 2009 by Shri N.N. Vohra, Governor J & K as a token of appreciation for their services for issuing accurate sector specific weather forecasts, which helped Shri Amarnath Shrine Board/State Administration to conduct smooth Yatra during 2009. Shri Sonam Lotus, Met-II I/C MC Srinagar received the memento in presence of various state dignitaries. On this occasion Shri B. A. Sofi and Shri Malik Mobin, Scientific Assistants were awarded letter of appreciation by the state administration for their valuable services.



Shri Sonam Lotus (Met-II) receiving Memento From Shri N. N. Vohra (Governor J&K)

PROGRAMME

Post Tsunami Sustainable Livelihood Programme

As a part of IFAD Assisted Post Tsunami Sustainable Livelihood programme (exposure visit) for School children of Thiruvallur District, Tamil Nadu organized by District Implementation Office, Thiruvallur, six lectures and field visit by Officers/staff of RMC Chennai were arranged at RMC Chennai on 18th – 26th June 2009. A total of 377 students visited. The Inaugural function was held on 18th which was presided over by Dr. Y. E. A. Raj, DDGM, RMC Chennai.

Pooja Ceremony of HPCS at Mausam Bhavan, New Delhi



Dr. Ajit Tyagi, DGM performing the Pooja

Pooja Ceremony was held on 25th August, 2009 before start of the installation process of the high power computer system (HPCS) at NHAC (Computer Centre), Mausam Bhavan, New Delhi. Dr. Ajit Tyagi, DGM took part in the Pooja Ceremony along with other senior officers from IMD, MoES and HCL. DGM wished for the successful installation of the System. Sweet as PRASAD was distributed to all officers and staff after the Pooja Ceremony.

SPORTS

10th All India IMD Sports Meet

10th All India IMD Sports meet was organized by All India Sport Committee. It was held at M.C. Ahmedabad during 27th Feb. to 2nd March–2009 at Sports Authority of India Gandhinagar. During the meet a souvenir was released by DGM on the inaugural ceremony. The inaugural ceremony was attended by DDGM (RMC) Mumbai, Guest of Honour was Shri S.C. Mathur, Chief Nautical Officer from Gujarat Maritime Board and Chief Guest was Director General of Meteorology. The Valedictory dinner was organized on 1st March 2009 and the closing ceremony on 2nd afternoon was attended by DDGM (A&S), DDGM (RMC) Mumbai and DGM.



On this occasion, Officers and Staff of IMD from all over the country alongwith counterparts IITM, CSIR, Survey of India participated and displayed their sports skill in different sports events.

Bridge Championship 2009

Shri S.K. Deswal, AM-II and Shri R. P. Gautam, AM-II participated in the 40th Summer National Bridge Championship (2009) held at Pune during 19th to 26th April 2009, as members of the



team representing Central Civil Services Cultural and Sports Board (CCSCSB), New Delhi and secured third position. They have been awarded certificates of appreciation by DGM.

IMD Cricket IMD Cricket Team Wins The Championship Trophy



AVM (Dr.) Ajit Tyagi, DGM and IMD Cricket Team Members with Championship

Team under the captainship of Mr. J. K. Sood of DGM's Office, participated in the Quadrangular Series of Cricket Tournament organized by Survey of India, Dehradun from 2nd to 5th June, 2009. The final match against the home team Survey of India was played on 5th June, 2009.

IMD won the final match by 3 wickets and lifted the Championship Trophy. Mr. Radhey Shyam of DDGM(UI) New Delhi office declared as the Best Bowler of the Tournament who took 12 wickets in the tournament whereas Mr. S. S. Naik of RMC Mumbai declared as the Man of the match in the final match who scored 45 valuable runs for IMD victory.

11th All India IMD Sports Meet 2009 - Chandigarh

11th All India IMD Annual Sports Meet was organized by All India Sports Committee and M.C. Chandigarh. It was held at Chandigarh during 26th to 29th November, 2009. A souvenir was released by Chief Guest Prof. Ranbir Chander Sobti, Vice Chancellor, Punjab University during the inaugural ceremony.



Release of Souvenir by Chief Guest

The inaugural ceremony was attended by Shri D. Chakrabarty, ADGM (ISSD & SM & Welfare Officer), Shri Rajiv Sharma, DDGM (A&S) and Shri B.L. Verma, DDGM (RMC), New Delhi.

During the 4 days sports event, officers and staff of IMD from all regions along with sports persons from DST, CSIR, SOI & IITM participated and displayed their sports skills in different sports. Approx. 500 sports person

participated in this Meet. The closing ceremony was held at M.C. Chandigarh building.

Shri A.K. Bhatnagar, ADGM (EREC) & Chairman All India Co-ordination Committee was the Chief Guest of the closing ceremony.



Handing over of Sports Flag by Chairman to Secretary, All India Annual Sports Meet

Runner Trophy in Badminton

IMD women badminton team won runners – up trophy in Inter-Ministry tournament 2009-10 held during 7-16 December 2009. DGM office women and men team also won badminton championship trophy in 11th All India IMD sports meet held at Chandigarh in November, 2009. Shri H. N. Singh of DDGM (UI) was the champion in the men's single.



DG, IMD with Badminton Team

Sports Meet at Agartala

M.C. Agartala organized “Annual Sports Meet - 2009” on 26th December 2009. All officers, staff members and their family members participated in this event. This Annual Sport Meet was inaugurated by Shri D. Saha, Director, M.C. Agartala and Shri Bishnu Swarup, Dy. Commandant, CSIF, Agartala Airport was the Guest of honour.



Sports Team of MC Agartala

हिन्दी पखवाड़ा / हिन्दी दिवस 2009

भारत मौसम विज्ञान विभाग के महानिदेशक के कार्यालय, नई दिल्ली में हिन्दी पखवाड़ा/हिन्दी दिवस 2009 समारोहपूर्वक मनाया गया। हिन्दी पखवाड़ा 2009 के दौरान हिन्दी निबन्ध, हिन्दी टिप्पण और मसौदा लेखन, हिन्दी टंकण, स्वरचित हिन्दी कविता पाठ और हिन्दी वाद-विवाद प्रतियोगिताएँ आयोजित की गईं। हिन्दीत्तर भाषी कार्मिकों को विशेष रूप से प्रोत्साहित करने हेतु उनके प्राप्तांको के 10 प्रतिशत अंक बोनस के रूप में दिए गए।

हिन्दी दिवस समारोह 14 सितम्बर 2009 को मुख्यालय के सेमिनार हॉल में आयोजित किया गया। समारोह की अध्यक्षता मौसम विभाग के महानिदेशक ए.वी.एम. डॉ. अजित त्यागी ने की। समारोह में सर्वप्रथम हिन्दी अधिकारी सुश्री रेवा शर्मा ने अध्यक्ष महोदय तथा सभी वरिष्ठ अधिकारियों एवं सभागार में उपस्थित सभी कार्मिकों का स्वागत किया। इसके उपरांत अध्यक्ष महोदय ने दीप प्रज्ज्वलित किया। इसके साथ ही मौविअमनि (भू.जो.मू.केन्द्र) श्री ए. के. भटनागर और निदेशक (प्रकाशन) श्री यू. पी. सिंह द्वारा भी संयुक्त

रूप से दीप प्रज्ज्वलित करके समारोह का शुभारम्भ किया गया। दीप प्रज्ज्वलित करने की प्रक्रिया के साथ साथ ही विभाग के कार्मिकों ने सस्वर सरस्वती वंदना प्रस्तुत की। सस्वर सरस्वती के उपरांत निदेशक, श्री यू. पी. सिंह ने अध्यक्ष महोदय का स्वागत करते हुए विभाग में हिन्दी की प्रगति का विवरण प्रस्तुत किया। स्वागत भाषण के उपरांत स्वरचित हिन्दी कविता पाठ प्रतियोगिता में प्रथम, द्वितीय एवं तृतीय स्थान प्राप्त करने वाले प्रतियोगियों ने उनकी स्वरचित हिन्दी कविता प्रस्तुत की।



स्वरचित हिन्दी कविता पाठ – श्रीमति पूनम सिंह

सांस्कृतिक कार्यक्रम

श्री बलदेव सिंह, प्रशासनिक अधिकारी एवं संयोजक – सांस्कृतिक कार्यक्रम, की देखरेख में सांस्कृतिक कार्यक्रम प्रस्तुत किए गए।



सभी कलाकारों के साथ महानिदेशक एवं अन्य अधिकारी

इस अवसर पर कुमारी मेघा डे ने ओड़िसी नृत्य प्रस्तुत करके सभी दर्शकों का मन मुग्ध कर दिया।

महानिदेशक महोदय ने कु. मेघा डे को कुशल नृत्य के बधाई एवं पुरस्कार प्रदान किये।

इसमें विभाग के कार्मिकों ने शिक्षाप्रद झलकियाँ, हास्य झलकियाँ, नृत्य, गीत एवं संगीत का रंगारंग कार्यक्रम प्रस्तुत किया।



विभाग के कार्मिकों द्वारा प्रस्तुत संगीत कार्यक्रम

पुरस्कार वितरण समारोह

इसके बाद पुरस्कार वितरण समारोह आरम्भ किया गया। हिन्दी निबन्ध, हिन्दी टिप्पण और मसौदा लेखन, हिन्दी टंकण, स्वरचित हिन्दी कविता पाठ और हिन्दी वाद-विवाद प्रतियोगिताओं में प्रथम, द्वितीय, तृतीय एवं दो सात्वना पुरस्कार प्रदान किए गए। अध्यक्ष महोदय द्वारा मौसम विज्ञान के उपमहानिदेशक (प्रशासन एवं भंडार) के कार्यालय को वर्ष 2008-2009 के लिए विभाग में हिन्दी भाषा में सबसे अधिक पत्राचार करने पर राजभाषा चलशील्ड प्रदान की गई।



चलशील्ड ग्रहण करते हुए श्री राजीव शर्मा, मौसम विज्ञान के उपमहानिदेशक (प्रशासन एवं भंडार)



महानिदेशक द्वारा अध्यक्षीय भाषण

अध्यक्ष महोदय ए.वी.एम. डॉ. अजित त्यागी ने अपने अध्यक्षीय भाषण में कहा कि हिन्दी पखवाड़ा/हिन्दी दिवस के आयोजन का मुख्य उद्देश्य सरकारी कार्य में हिन्दी को बढ़ावा देना है। अध्यक्ष महोदय ने विभाग के सभी कार्मिकों को कार्यालय का कार्य अधिक से अधिक हिन्दी में करने की सलाह दी तथा राजभाषा विभाग द्वारा निर्धारित किए गए लक्ष्यों को प्राप्त करने के लिए और अधिक प्रयास करने का अनुरोध किया।

मौसम मंजूषा का विमोचन



बाएं से डॉ. अजित त्यागी., श्री ए. के. भटनागर एवं श्री यू. पी. सिंह

इस अवसर पर मौसम मंजूषा के चौदवें संस्करण का महानिदेशक द्वारा विमोचन किया गया। मौसम मंजूषा

में कार्यालयों के कार्मिकों द्वारा लिखे गए विविध प्रकार के स्वलेख एवं स्वरचित कविताओं का संग्रह है।

अखिल भारतीय विभागीय हिन्दी निबन्ध प्रतियोगिता में प्रथम, द्वितीय एवं तृतीय स्थान प्राप्त करने वाले कार्मिकों को प्रमाण-पत्र प्रदान किए गए।

Drawing Competition

An art competition and Quiz contest was organized on 14th December 2009 at IMD (H.Q.), Mausam Bhawan, Lodi Road, New Delhi. Students from many prestigious schools of Delhi participated in the competition with great enthusiasm.



Exhibition

ITC participated in 2nd ASOM International Trade Fair 2009 from 3rd to 6th February 2009 at Guwahati. Shri J.P.S. Bhullar, A.M.-II performed the duties at this exhibition.

ITC participated in Sunderban Gramin Mela at Sarberia, North 24 Pargana, Kolkata from 13th to 16th February 2009 at Kolkata. Shri R.K. Sandil, S.A. performed the duties at this exhibition.

ITC participated in Exhibition organized by Friendz Exhibition & Promotors Pvt. Ltd, New

Delhi at Hissar from 5th to 8th March 2009. Shri R. K. Sandil, S.A. performed the duties at this exhibition.

ITC participated in Northern India International Trade Fair (NIITF 09) from 8th to 14th June 2009 at Ludhiana. Shri J.P.S. Bhullar, A.M.-II was deputed for the exhibition.

IMD participated in the 7th Infra Educa 2009 exhibition on 4th & 5th July 2009 at Chandigarh.

ITC participated in “15 All India National Expo 2009” Exhibition under MoES held w.e.f. 23rd to 27th August at Barasat, Kolkata, West Bengal, organized by Dr. B.R. Ambedkar Memorial Committee, Dist. Nadia, West Bengal. Shri J.P.S. Bhullar, A.M. II was deputed for the exhibition.

Trade Fair

The Ministry of Earth Sciences and Meteorological Centre Dehra Dun participated in the trade fair held at Dehra Dun from 6-13 October 2009. The various activities of the Ministry of Earth Sciences were disseminated to general public through the stall put up at the trade fair. Shri Anand Kumar Sharma, Director was the Guest of Honour at the closing ceremony.

International Exhibition “Krishi Vikas 2009

International exhibition “Krishi Vikas 2009” was held at College of Agriculture, Indore, Madhya Pradesh during 6th to 8th November 2009. The exhibition was organized by the Confederation of Indian Industry (CII), Government of Madhya Pradesh along with Directorate of Farmer's Welfare and Agriculture Development. The officials of Agrimet Pune participated in this exhibition.



“Krishi Vikas 2009” held at Indore, Madhya Pradesh during 6th to 8th November 2009

Shri R A Pednekar, S.A, Shri K G Kanade, S.A from Agrimet Division, IMD, Pune and Dr. S. K Sharma, Nodal Officer from AMFU, Indore, participated in the above exhibition and explained.

Krishi-2009



Krishi 2009” held at Nashik, Maharashtra during 26th to 30th November 2009

Krishi 2009” International agricultural Trade Fair & Conference was held at Nashik, Maharashtra during 26th to 30th November 2009. Dr. M. Rajavel, Met-I, O/o DDGM (Ag.), Dr. V. S. Patil, Nodal Officer AMFU, Igatpuri, Shri J.P.S. Bhullar, AM-II, O/o DDGM(UI), New Delhi, Shri M. R. Badwaik, S.A. & Shri K. G. Kanade, S.A. O/o DDGM (Agrimet), Pune had participated in the exhibition.

Kisan Mela

The National level Kisan Mela was organized in Pune at Moshi, Pune during 14th to 18th December 2009. The exhibition was organized by Kisan Forum Pvt. Ltd., Pune with sponsorship from Ministry of Agriculture, Government of India, Department of Agriculture, Government of Maharashtra, ICAR, CSIR and KVKs. Agrimet Division, IMD, Pune participated in exhibition.

One of the mandates of the is to improve the dissemination system and make awareness of

the services. Farmers, traders researchers and others involved in agriculture were explained about various activities of the Division particularly about district agromet advisory services. Farmers were particularly interested about knowing how and where from the district forecast and agromet advisory information will be available for their districts. They have been advised that the forecast and advisory for their districts are regularly issued in the form of bulletin twice a week and it is available on internet, local news paper, nearest KVK, Radio and on television. Feedback was obtained from the farmers.



8. EVENTS

ECLIPSE DURING 2009

During 2009, two solar and three Lunar Eclipses occurred as under :

26 January : Annular Solar Eclipse

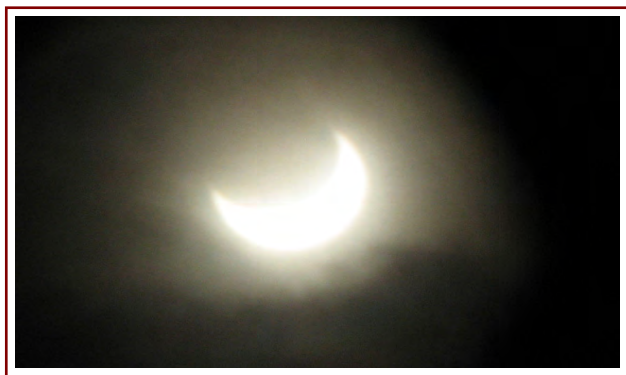
22 July : Total Solar Eclipse

09 February : Penumbral Lunar Eclipse

07 July : Penumbral Lunar Eclipse

06 August : Penumbral Lunar Eclipse.

Annular Eclipse of The Sun January 26, 2009 Monday 6, Magha, 1930 Saka Era



26th January 2009, Partial Solar Eclipse

An annular eclipse of Sun occurred on 26th January 2009. The phenomenon of this partial solar eclipse was visible from southern part of India, eastern coast, Andaman & Nicobar Islands and Lakshadweep.

This Solar Eclipse occurred in the afternoon of Monday, the 26th January 2009 (6 Magha, 1930 SE).

Considering the Earth as a whole, the eclipse began at 10h 27m IST when the shadow of the moon first touched the Earth at local sunrise at a point in the South Atlantic Ocean close to Namibia in South of African continent. The eclipse ended at 16h 31 m IST when the Moon's shadow finally leaves the Earth at local sunset at a point very close to south of Cambodia in the South China Sea. The annular phase begins in the South Atlantic Ocean at 11h 36 m IST. The annular path passed through south of African continent, curving to the north east, the path crosses the southern Indian Ocean, finally it entered the land of southern Sumatra and Western Java, crosses central Borneo and ends at 15 h 22m IST at a point close to south of Philippines in the Celebes Sea. The Greatest Phase of the eclipse with magnitude 0.929 occurred at 13h 29m IST at a point in the Indian Ocean. The maximum duration of annular phase is 7m 51s. which was longest duration in 21st century. This Eclipse was of special interest for the scientists and general public of India as its path of totality passes through thickly populated regions of west, central, east and north-east India.

Lunar Eclipse February 2009

This was the deepest penumbral eclipse of the year with a penumbral. It was not visible in India.

Lunar Eclipse July 2009

This eclipse was only of academic interest.

Total Solar Eclipse 22 July

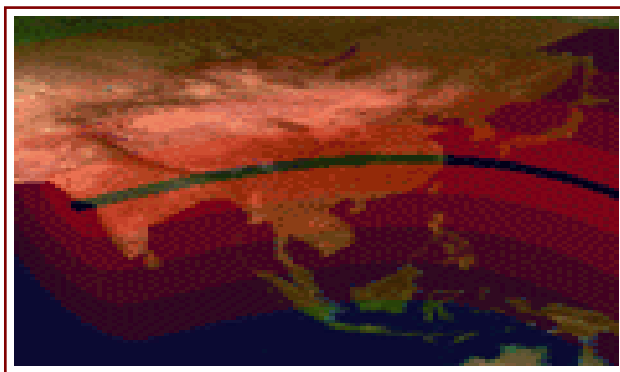
The Eclipse began at 5h 28m IST when the shadow of the moon touches the Earth at local sunrise at a point in the Arabian Sea close to the western coast of India. The eclipse ends at 10h 42m IST when Moon's shadow finally leaves the Earth at local sunset at a point in the South Pacific Ocean. At approximately 6h 23m IST, the umbra of the eclipse touched the earth at sunrise at a point in the Gulf of Khambhat in the Arabian Sea near the southern coast of Gujarat. At this time, the path of totality was about 200 km wide and the duration of totality at the central line was about 3 minute 30 seconds. The shadow crosses over central India, passed through south-east of Nepal, crosses North Bengal, southern part of Sikkim, most of Bhutan and north-western tip of Bangladesh. Then shadow entered Assam and Arunachal Pradesh, touched Myanmar and enters China. The maximum duration of totality of 6 minutes 44 seconds occurred at 8h 05m IST in the north Pacific Ocean where the width of the path was about 258 km. It curved south-east through Pacific Ocean hitting some small atolls in the Polynesia. The totality ended at 9h 48m IST when the umbral cone leaves the earth at a point in the Pacific Ocean.

IMD Observational Programme

Special observational was taken at three specially selected location viz., Sindh Khera, Varanasi and Patna falling in the path of totality of the Solar eclipse. Positional Astronomy Centre, Kolkata had planned to take photographic and videographic observations of the entire phenomenon and flash spectrum for times of beginning and end of totality phase. PAC had selected Patna as their observational base.

Realising the significance of weather conditions especially cloud cover for eclipse observation and rain occurrence in the 200 km wide path of

the totality of the eclipse for the movement and logistics arrangements of Scientists and general public, India Meteorological Department issued daily special weather forecast for different locations / sectors for the area of interest from 17th - 22nd July.



Solar eclipse's annular path on July 22, 2009

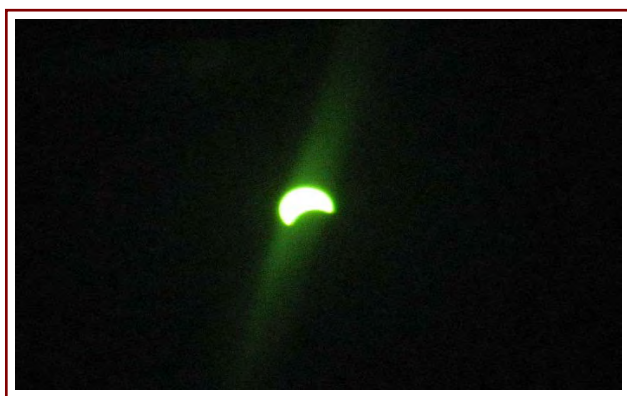
A team of seven members from PAC, Kolkata, Dr. G. S. D. Babu from MPBIFR Bangalore, Prof. A. Bandopadhyay from Birla Planetarium Kolkata and Dr. Lalitha from ISRO Bangalore reached the total solar eclipse (TSE) observation site i.e., on the roof top of Indian Institute of Health education and research, Hospital Institute Road, Beur, Patna at around 0400 hrs (IST). On reaching the site it was found the sky was cloudy and the cloud amount was estimated around 6 to 7 oktas.



Total solar eclipse observation on 22nd July at Patna

Special Surface observation was recorded at 10 minutes interval starting 2 hours before & 2 hours after the totality of Solar eclipse on 22nd July 2009. A press release containing a brief about the eclipse including its path in Indian regions, was released to media, press, AIR & TV channels etc. for the public.

However all equipments were installed for carrying out scientific experiments with the hope that the sky condition will improve with the progress of the event. The partial eclipse had already started at 5h 29m 57s IST. However the sky remained cloudy and wind speed started increasing. Rain had started around 0600 IST. All equipments had to be dismantled. The totality started at 6h 24 m 38s IST and duration of totality period was for 3m 47s for Patna. Although it was raining, the effect of totality could not be realized du to sudden fall of darkness all around. The weather started improving after the totality and the partially eclipsed Sun was visible at 0643 hrs (IST). Only Video recording and still photography of the partisl phase could be done at the end of the event.



Solar eclipse at Delhi, 22nd July, 2009

The partial eclipse was visible till 0630, afterwards it was obscured by clouds and rain too at Patna. However it was visible at Varanasi through the entire event.

Satellite Meteorology Division at New Delhi took half hourly picture during the eclipse period to capture the umbral shadow falling on the earth. The movement of the umbra on the surface of the earth was tracked with the Indian Geostationary Satellites - Kalpana-1 and INSAT-3A. Both satellites were operated on a sector scan mode (7 minute duration scans) for the period that the ecliptic shadow was traceable on the earth surface facing the satellite. The attached image displays the visible (0.55 to 0.75 μm) data with suitable enhancements for the period when it was tracked by Kalpana-1 satellite.

Lunar Eclipse August 2009

This eclipse occurred 15 days after the total solar eclipse. Since its magnitude was very low. It was not visible from naked eye.

National Science Day

The Day is celebrated to honour nobel laureate Sir C.V. Raman for his invention of the 'Raman effect on 28th February 1928. There was an overwhelming response from public. The day attracts many young minds and creates awareness about Meteorology. The celebrations of this day include showcasing IMD competence in the field of Meteorology.

World Meteorological Day

The WM day is celebrated throughout the world commemorating the formation of World Meteorological Organization (WMO) on 23 March, 1950. The theme of this year was **Weather, climate and the air we breathe.**

The wind, temperature precipitation and other meteorological parameters play a leading role in

air pollution. The green house gases have a warming effect and thus can exacerbate air pollution. The air pollution is linked with respiratory and cardiovascular illness, cancer, nervous disorder as well as air borne disease and heat stroke. The number of people suffering from respiratory ailment is rising alarmingly in cities.

IMD is providing advance warning forecast for sand and dust storm in order to mitigate its effect on public. In environmental related issues IMD plays a vital role towards environmental. An Interview of AVM Dr. Ajit Tyagi, Director General of Meteorology was telecasted on Doordarshan, National Channel as well as Broadcasted over All India Radio on Rajdhani Channel on this day. His Hindi interview was also broadcasted on All India Radio Indraprastha Channel on 21st March 2009.

On the occasion the 23rd March of World Meteorological Day, Indian Meteorological Society conferred upon the 50th fellowship to Dr. Shailesh Nayak, Secretary, MoES for his pioneering contribution and long support to atmospheric and oceanic sciences.



Dr. Shailesh Nayak, Secretary, MoES receiving fellowship award

On this occasion Dr. B. Sengupta, former member Secretary of the Central Pollution

Control Board, Delhi delivered a lecture on the topic “The Air, We Breathe” in the seminar hall of the DGM’s Office, New Delhi. A press release was also issued on this occasion.



Dr. B. Sengupta, delivering lecture

On that day, the general public and the school children visited the meteorological observatories situated at different cities throughout the country. An exhibition showing the key role of IMD in issuing weather forecast progress towards modernization program, prediction of meteorological phenomena through Satellite imagery, the formation and movement of Weather systems was also organized. The visitors took keen interest in IMD activities and appreciated IMD’s effort towards attaining forecast accuracy. A film show was also arranged at conference hall for the visitors.

भारत रत्न बाबा साहेब डॉ. भीमराव अम्बेडकर की 118वीं जयंती का आयोजन

दिनांक 23 अप्रैल 2009 को भारत मौसम विज्ञान विभाग, नई दिल्ली के प्रांगण में विभाग की अनुसूचित जाति और जनजाति कल्याण संस्था द्वारा भारत रत्न बाबा साहेब डॉ. भीमराव अम्बेडकर की 118वीं जयंती का आयोजन किया गया। विभाग के महानिदेशक डा. अजित त्यागी मुख्य अतिथि के रूप में समारोह में शामिल हुए।



विभाग के सभी अधिकारियों/कर्मचारियों को महानिदेशक महोदय एवं संस्था के महासचिव श्री ब्रह्म प्रकाश ने संबोधित करते हुए कहा कि इस समय विभाग के सभी कर्मचारियों को एक रहकर विभाग को मजबूत करने और बाबा साहेब के पदचिन्हों पर चलने

की आवश्यकता है। मौसम विभाग की सभी यूनियनों के पदाधिकारियों ने भी पुष्पाजंली अर्पित की। तत्पश्चात् भंडारे का आयोजन किया गया। बाबा साहेब के इस कार्यक्रम में विभाग के सभी अधिकारियों/कर्मचारियों ने उत्साहपूर्वक भाग लिया और कार्यक्रम को सफल बनाया।

Sadbhavana Divas

The 'Sadbhavana Divas', commemorating the birth anniversary of Late Shri Rajiv Gandhi was observed in India Meteorological Department on 20th August 2009 and Director General of Meteorology administered pledge to the employees. The theme of Sadbhavana Divas was to promote national integration and communal harmony among people of all religions, languages, regions and to eschew violence and to promote goodwill among the people.



9. WORKSHOPS & CONFERENCES

Northeast User Conference

The NE Users' Conference on weather services was organized on 21st January 2009 along with the Annual Plan Review. In the conference hall of Assam Administrative Staff College, Guwahati. The program started with a welcome address by Shri S. N. Roy, Deputy Director General of Meteorology, RMC Guwahati.



Later on followed by an address by Shri A. K. Bhatnagar, Additional Director General of Meteorology, in which he said that sharing of information plays a vital role in reducing the impact of extreme weather events and natural disasters like earthquakes. In his key note address, AVM Dr. Ajit Tyagi, Director General of Meteorology, mentioned the steps taken by IMD to meet the challenges specific to the region under various schemes/projects.

Shri V. K. Piparsania, Principal Revenue Secretary and Relief Commissioner, Government of Assam, mentioned that disasters resulting from floods and earthquakes in NE region have large weather related vulnerability.

Plan/Monsoon Review Meeting



3-day review meeting for 4th Plan Review, Annual Monsoon Review and Annual Cyclone Review meetings were held during 22nd – 24th January 2009 in the conference hall of Assam Administrative Staff College, Guwahati. These meetings were attended by Directors-in-charge of various field offices, DDGMs and ADGMs under the Chairmanship of AVM (Dr.) Ajit Tyagi, DGM. In the Annual Monsoon Review meeting, various aspects of Monsoon-2008 were elaborately discussed along with the forecast verification and in the light of these; the topics that need in-depth assessment were identified.

राष्ट्रीय राजभाषा कार्यशाला

श्री ए. बी. लाल, ज्येष्ठ हिन्दी अधिकारी एवं श्री बीरेन्द्र कुमार ने 2-3 फरवरी 2009 को इंस्टिट्यूट ऑफ पब्लिक एडमिनिस्ट्रेशन, बंगलुरु द्वारा मैसूर में आयोजित दो दिवसीय राष्ट्रीय आवासीय प्रयोजनमूलक राजभाषा कार्यशाला में भाग लिया।

Steering Board Review Meeting

Dr. Shailesh Nayak, Secretary MoES, AVM (Dr.) Ajit Tyagi, Director General of Meteorology and Shri D. Chakraborty, DDGM

visited Toulouse, Paris, France from 4 to 8 February 2009 for Steering Board Review of items under Statement of Work (SOW) Packages for commissioning of forecasting system under modernization of observation and forecast facility of IMD-phase I.



DG, IMD at MFI in Toulouse

The committee was satisfied to see the hardware procurement, integration, configuration, test and development which are in progress in MFI Lab in Toulouse. It was recommended to set-up NWP based Electronic Forecasting approach of Meteo France with strong emphasis on applied research to improve each forecast as a customer driven high quality product.

Awareness about Meteorology

Met. Centre Hyderabad has conducted full day interactive session for creating awareness about Meteorology and weather prediction among student community on 8th February 2009 at IMD Campus, Hyderabad. Over 100 students from about 50 schools have attended the workshop along with many eminent scientists including Padmasree Prof. Dikshitalu from Central University Hyderabad and from NRSC, CWC, ANGARU, INCOIS, IMD etc.

INTROMET 2009

An International Conference (INTROMET 2009) on “Challenges and opportunities in Agro-meteorology” was organized in New Delhi

during 23-25 February 2009. The conference was attended by about 300 experts from India and abroad including international organization like WMO including 28 officers from IMD.



The inaugural address was delivered by Dr. Mangala Rai, Secretary, DARE and Director General ICAR. Award ceremony was conducted by Dr. S.D. Attri, Convener INTROMET 2009 and Secretary, IMS. Dr. L. S. Rathore and Dr. H. N. Srivastava were conferred upon fellowship of IMS. Abstract volume and souvenir were also released. Sir Gilbert Walker Gold Medal was awarded to Prof. U. C. Mohanty. Prof. A. D. Vernekar Award was given to Prof. S. K. Dash. The Dr. B. N. Desai Award was given to Dr. O. P. Singh on this occasion.



The conference was followed by a three day meeting of the WMO Commission for

Agriculture Meteorology (CAGM) implementation/coordination team on support systems for Agrometeorological services.

हिन्दी कार्यशाला का आयोजन

मुख्यालय में दिनांक 5.3.2009 से 6.3.2009 तक दो दिवसीय हिन्दी कार्यशाला का आयोजन किया गया जिसमें मुख्यालय, प्रादेशिक मौसम केन्द्र नई दिल्ली तथा मौ.वि.उ.म.नि. उ.वा.उ के कार्यलय के कुल 23 कार्मिकों ने भाग लिया। इस कार्यशाला में भाग लेने वाले सभी कार्मिकों को प्रमाण पत्र प्रदान किए गए।

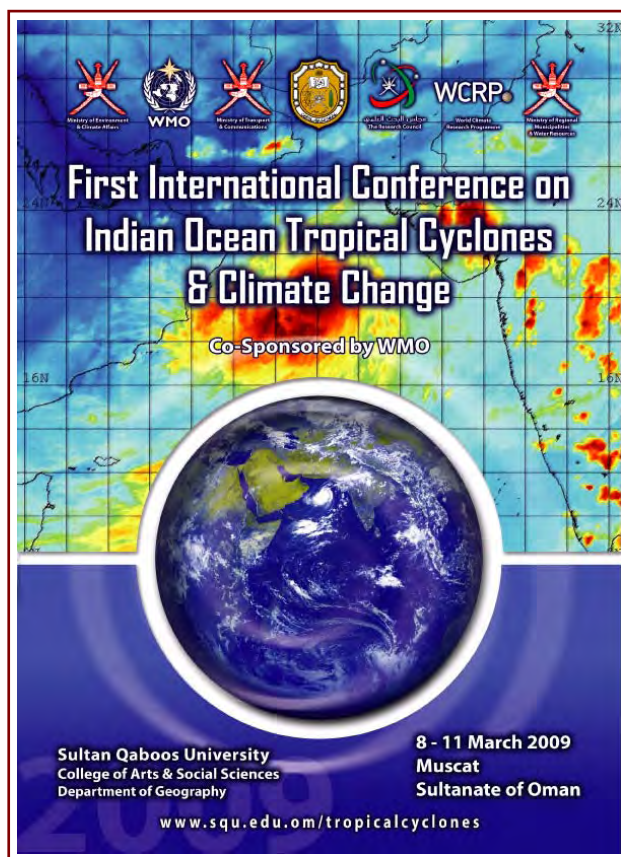
Advisory Committee Meeting

Dr. R. Suresh, Director attended 1st meeting of Scientific Advisory Committee on Aviation Meteorology held at New Delhi on 5th March 2009 and the 2nd meeting of Scientific Advisory Committee on Aviation was held on 27th May 2009 at O/o DDGM(WF) Pune under the chairmanship of Dr. R. R. Kelkar, Ex. DGM.

Conference on 'Indian Ocean Tropical Cyclones and Climate Change'

The first international conference on 'Indian Ocean Tropical cyclones and Climate Change' was organised during 8-11 March 2009 by Sultan Qaboos University (SQU), Muscat, Sultanate of Oman in collaboration with the Ministry of Transport and Communication Director General of Meteorology and Air Navigation, the Ministry of Environment and Climate Affairs, the Ministry of Regional Municipalities and Water Resources, Oman and the World Meteorological Organization.

Dr. Ajit Tyagi, DGM chaired one of the technical sessions of the conference. He was a member of the Panel in the concluding session of the conference and presented India's views on



impact of climate change on tropical cyclones. DGM alongwith four other officers from India Meteorological Deptt. attended the conference. Nine research papers from IMD were selected by the organizers for presentation in the conference.

20th SAC – PAC Meeting



20th meeting of the Standing Advisory Committee of Positional Astronomy Centre was held on 19 and 20 March 2009 at PAC office in Kolkata under the Chairmanship of Prof. G. M. Ballabh of Osmania University, Hyderabad. The meeting was attended by Shri A. K. Bhatnagar, ADGM (EREC) and other distinguished members of SAC. The Committee made some important recommendations for overall improvement in the functioning of PAC in future. Dr. Ajit Tyagi, DGM was also present on 20 March for a discussion with Committee members regarding various aspects on future progress of Positional Astronomy Centre and observational matter related to total solar eclipse which occurred in July 2009.

National Seminar on Utilization of Doppler Weather Radar Products

A National Seminar on “Utilization of Doppler Weather Radar products in Weather Nowcasting, Aviation Safety and Numerical Weather Prediction” (SDWR-2009) was organized by Cyclone Detection Radar and Regional Meteorological Centre Kolkata at the Conference Hall of National Library, Alipore Kolkata during 20-21 March 2009. Dr. Shailesh Nayak, Hon’ble Secretary, MoES, inaugurated the seminar on 20th March 2009. AVM (Dr.) Ajit Tyagi, Director General of Meteorology presided over the inaugural function.



This was the first seminar on DWR applications in various fields of meteorology, Numerical Modelling and aviation. About 75 Scientists from IMD, IAF, IITM Pune, DRDO, ISRO, NESAC, IIT New Delhi and Kharagpur, C DAC Pune & Air India participated in the seminar.

Performance Review Meeting

A meeting of all nodal officers, DDGM’s & Project Directors was held on 8th & 9th April 2009 at the H.Q., New Delhi. Detailed discussions were held in the meeting on the points (i) The performance of Plan Schemes during Financial Year 2008-09 (ii) Their current status (Physical & Financial) (iii) Planning of objective and realistic targets of schemes in qualitative and quantitative terms and requirements of funds and expenditure management.

Storm – International Program



(Left to Right) Shri A. K. Bhatnagar, ADGM, AVM (Dr.) Ajit Tyagi, DGM & Chairman, Dr. Kheya Bhattacharya, Jt. Secretary (SAARC) and Dr. Someshwar Das, Director, SMRC Dhaka

India Meteorological Department has organized a two-day meeting of Severe Thunderstorm Observation and Regional Modelling (STORM) – International Program Committee (IPC) at Mausam Bhawan, India Meteorological Department, New Delhi on 13 – 14th April, 2009. A Weather Advisory Group has been set up & has started working from IMD, New Delhi.

Meeting of STORM-IPC was inaugurated by AVM (Dr.) Ajit Tyagi, DGM and he also chaired the meeting in absence of Director, SMRC Dhaka, who could not come for the meeting. Dr. Kheya Bhattacharya, Jt. Secretary (SAARC), Ministry of External Affairs, made a brief address at the inaugural function. She emphasized the India's pivotal role in the SAARC activities at the end of the closing session. Secretary, MoES chaired the closing session and assured full support to SAARC – STORM Project.

The domain of the SAARC–STORM pilot experiment, enhanced observations from existing network, IOP etc. of affected SAARC countries under Phase-I viz. Bangladesh, Bhutan, Nepal & India were discussed in depth. The committee also suggested that the data gap region may be filled by inducting new AWSs & at least one GPS System in the neighboring states.

The first pilot phase experiment was conducted from 13th April to 31st May 2006 for better planning & optimal use of recourses for the full phase during later years. The second phase of STORM was also successfully implanted last year. This year pilot experiment has been planned from 15 April to 31st May 2009.

A Weather Advisory Group has been set up & operated from IMD, New Delhi. The group is receiving inputs from IMD & they prepare summary and also declare IOP during which hourly observation taken of Surface, Satellite & Radars. Prof. U.C. Mohanty, Professor in CAS, IIT Delhi is the nominated Chairman of STORM-IPC of India.

4th ESO Council Meeting

AVM (Dr.) Ajit Tyagi, DGM, Shri A.K. Bhatnagar, ADGM and Dr. L.S. Rathore, Head Agromet attended the 4th ESO Council Meeting held on 16th - 17th April 2009. The meeting was

held under the Chairmanship of Dr. Shailesh Nayak, Secretary, MoES and Chairman Earth System Organization (ESO). Dr. Tyagi, DGM made detailed presentation including the 11th Plan allocation and programmes of IMD including various elements of the modernization of IMD. Shri A. K. Bhatnagar talked about seismology and earthquake risk evaluation centre. Dr. L. S. Rathore gave a brief about Agro. Advisory Services (AAS) and highlighted the achievements particularly the district level forecast.

Climate & Risk Management in Agriculture



Dr. L. S. Rathore, AVM (Dr.) Ajit Tyagi, and Dr. P. Raghava Reddy sitting (left to right)

International Training cum Workshop on Climate Risk Management in Agriculture was organized jointly by Indian Institute of Technology (IIT), New Delhi, India Meteorological Department and Acharya N.G. Ranga Agricultural University (ANGRAU) at Hyderabad from 27th to 30th April 2009 to frame the implementation plan for the Agriculture Climate Risk component of the Extended Range Forecasting System Project which is funded by the Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India. Eleven Principal Investigators from different State Agricultural Universities and Resource Persons from, IRI Columbia

University, New York, ICAR Centres, IMD, IIT, ICRISAT attended the workshop. AVM (Dr.) Ajit Tyagi, Director General of Meteorology, Dr. L. S. Rathore, Head of Agromet and Advisor, MoES, Dr. R. P. Samui, DDGM (Agrimet), Dr. N. Chattopadhyay, Director, Agrimet, Dr. K. K. Singh, Sci.-E for MoES participated.

Second Joint Meeting ISRO – IMD Working Group

Second Meeting of Joint Working Group (ISRO-IMD) under the Chairmanship of AVM (Dr.) Ajit Tyagi, DGM was held on 1st May, 2009. Modernization of Infrastructure in the country and develop skills in advanced modeling was discussed. Senior IMD Officers including ADGM (Sat & ISSD), ADGM (H & I), DDGM (Sat. Met.) and Director (Sat. Met.) also participated in the meeting.

Use of Communication in Agrometeorological Products, Services for Sustainable Agriculture

The workshop on the Content, Communication and Use of Weather and Climate Products and Services for Sustainable Agriculture brought together more than 80 scientists mainly from Asia and the Pacific, and representatives of the agricultural sector, both from academic world and the farming community. Dr. L. S. Rathore, Head Agromet and Vice President of Commission on Agrometeorology and Dr. N. Chattopadhyay, Director, Agrimet Division, IMD, Pune and Expert Team member for Regional Association II participated in the workshop held from 18th to 20th May 2009 in Toowoomba, Queensland, Australia. Farmers from the region also actively participated and opined that free and accurate weather and climate forecasts were more important than free seed and fertiliser. “You can always buy seed and fertiliser, but you can’t buy the right sort of climate you need for your farming operation”, said a farmer.



The workshop adopted recommendations aimed at remedying the communication gap between providers and users of agricultural information and at enhancing the effective use of weather and climate services for sustainable agriculture. Improving weather and climate information for farmers by integrating climate projections into agrometeorological products and by enhancing knowledge sharing between countries was also given the consideration.

WMO Executive Council Meet

AVM (Dr.) Ajit Tyagi, DGM & Permanent Representative of India with WMO, was on tour to Geneva to attend the 61st Session of the WMO Executive Council which was held at WMO Headquarters in Geneva from 3rd to 12th June 2009. The WMO Executive Council is responsible for implementation and coordination of various scientific and operational programmes of WMO. Several issues of vital importance, globally as well as for India, were discussed in the meet.

He gave a presentation on Indian Thorpex programme, to improve the predictability of high impact weather events, the observational network and to develop data assimilation strategies and improve the ensemble prediction system. During this meeting he was elected as member of the Executive Council.

Varsamana Project

The second meeting of VARSAMANA Steering Committee was held in IMD, Delhi from 25-26th June, 2009 between the delegates of Ministry of Earth Sciences & India Meteorological Department representing the Government of India and the Directors of Meteo France International.

The meetings were attended by Dr. Shailesh Nayak, Secretary, MoES, Dr. Ajit Tyagi, DGM, IMD, Mr. D.P. Singh, Joint Secretary, MoES, Dr Swati Basu, Advisor, MoES, Mr. Dulal Chakrabarti, VARSAMANA Project Director, IMD and senior officers from IMD. Mr. Patrick Benichou, Chairman and Mr. Herve Grimaud, Project Director attended the meeting from MFI side.

The meeting was inaugurated by Dr Tyagi, DGM, IMD on 25th June, 2009 and informed the Committee about the “100-day Program” launched by the new Government in place. IMD would be keen on showing some VARSAMANA achievement, especially in the field of Public Weather Services, before the end of 100-day period, i.e. mid-September 2009. Discussions were held on the Progress made in the VARSAMANA Phase-I related to the Integration, Training, Installation of Upper Air Stations & Transmet, CIPS, CLYSIS, Synergie and Meteofactory & TV and action points to complete the project in time.

Storm Surge Forecasting and Modus Operandi

AVM (Dr.) Ajit Tyagi, DGM, Shri B. K. Bandyopadhyay, DDGM (S) and Dr. M. Mohapatra, Director (CW) participated in Advisory Workshop on enhancing forecasting capability for north Indian Ocean Storm Surges (IITD storm surge model upgrade) organized by IOC-UNESCO at IIT, Delhi, during 14-17th July, 2009. Dr. M. Mohapatra, Director (CW) made a presentation on “Current Status of

Operational Storm Surge Forecasting and Modus Operandi” of the IITD model on 14th July 2009.

User's Conference on Environmental Meteorology

The User's Conference on “Environmental Meteorology” was organized by Environmental Monitoring and Research Centre (EMRC) on 20th July, 2009 in India Meteorological Department, New Delhi. The conference was attended by about 50 participants from the Ministry of Environment and Forests, Ministry of Earth Sciences, Central Pollution Control



Board, I.M.D., IIT Delhi, Public Sector undertakings, Industries, and Environmental Consultants. The inaugural session was chaired by Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences. AVM (Dr.) Ajit Tyagi, DGM, welcomed the participants and gave brief view of IMD. The Atlas on” Hourly Mixing Height and Assimilative Capacity of Atmosphere in India” was released by the Secretary, MoES. Shri J. Moskar, Addl. Secy., Ministry of Environment and Forests addressed the delegates and complimented India Meteorological Department (IMD) for the publication and their support in environmental management for the last 3 decades and also chaired panel discussion. The users appreciated the publication and expressed their views on the various environmental issues, data support and requirement from IMDs.

A One-Day Colloquium on Solar Eclipse



A one-day colloquium was held by Indian Meteorological Society, Kolkata Chapter in collaboration with Positional Astronomy Centre on 20th August, 2009 at the Seminar Hall of new building of the Centre at Salt Lake, Kolkata on 'Total Solar Eclipse and related astronomical events'. The colloquium was attended by Shri A. K. Bhatnagar, ADGM (EREC), Smt. Vasudha Gupta, Director (Admin) of MoES, Shri A. K. Das, LACD DDGM of RMC Kolkata, Shri Amalendu Bandopadhyaya Senior Scientist of M. P. Birla Planetarium, Kolkata and many other distinguished persons from different Institutes.

World Climate Conference - 3



Indian Delegation at WMO, Geneva

An Indian Delegation led by Dr. Shailesh Nayak, Secretary, MoES, AVM(Dr.) Ajit

Tyagi, Director General of Meteorology, Dr. Swati Basu, Scientist-G, Dr. Akhilesh Gupta, Scientist-G & Dr. L. S. Rathore, Head (Agromet) attended the World Climate Conference-3 during 31st August to 4th September 2009 at WMO, Geneva, Switzerland.

The Conference was organized by WMO to bring about a paradigm shift towards delivering user-oriented climate information. More than 2000 climate scientists, sectoral experts and decision-makers which established a Global Framework for Climate Services “to strengthen production, availability, delivery and application of science-based climate prediction and services.” for reduction of greenhouse gases emission.



Dr. Shailesh Nayak, Secretary, MoES

Dr. Shailesh Nayak, Secretary MoES and leader of the Indian delegation, complimented WMO decision to establish a Global Framework for Climate Services. Reliable and accurate information on future climate is one of the prerequisites to adapt to climate variability and to achieve sustainable economic growth. He emphasized the need to improve the quality of climate predictions and their dissemination to users for formulating policy and effective planning.

He expressed India's firm commitment to participate actively in the development and implementation of the Global Framework for Climate Services.

IMD-ISRO Meeting

An organizing committee meeting for organizing INSAT-3D Users Conference at New Delhi was held on 18th September 2009 under the chairmanship of Shri D. Chakraborty, ADGM (Sat. and ISSD). It was attended by Dr. B. Manikiam, Senior Scientist ISRO, Shri A. K. Sharma, DDGM (Sat. Met.), Shri L. R. Meena, DDGM (ISSD) and other senior officers of Satellite Meteorology Division. It has also been decided to publish relevant material for information of participants.

Half Yearly Plan Review Meeting



A meeting of all ADGMs, DDGMs and selected Project Directors was held on 29th & 30th September 2009 at Conference Hall, 6th Floor, Mausam Bhawan, New Delhi to review the performance of Plan Schemes and their current status (Physical & Financial) till 31st August 2009, Planning of objective and realistic targets of schemes in qualitative and quantitative terms and requirement of funds and expenditure management strategy for the remaining period of financial year 2009-2010. During the inaugural

speech, Dr. Ajit Tyagi, DGM welcomed all officers and presented a concept paper on vision document of IMD followed by discussion on Plan schemes by individual project Directors.

Dissemination of Agromet Advisory Services

Two days workshop on "Dissemination of Agromet Advisory through SMS & IVR technology" held at M. C. Ahmedabad on 30th September and 1st October 2009. 12 Nodal officers from various AMFUs in Gujarat attended the workshop. Lectures were imparted by representative from (i) Thomson Reuters India Private Limited and (ii) Handygo, New Delhi on "Mobile value added services based crop Advisory" and "Training on RML services".

Recent Advancement in Agro-Meteorology



Dr. Mrs. N. Jayanthi, ADGM (Retd.) presenting a bouquet to the Chief Guest in the Agromet Seminar

A state level seminar on Recent advances in AgroMeteorology and Space Technology for Sustainable Food Security in Tamilnadu was held at RMC Chennai during 8-9 October 2009. The seminar was inaugurated on 8th by AVM Dr. Ajit Tyagi, DGM, IMD. Shri Kosalaram, Commissioner of Agriculture, Government of Tamil Nadu was the 'Guest of Honour'.

The inaugural function was attended by nearly 150 guests and the same was received good coverage in the media. 55 number of registered

delegates participated in the seminar and 21 contributory papers and 9 invited talks were presented in the seminar which was spread over five sessions.

Panel of Hydrology

The first meeting of panel of Hydrology was held at Bureau of Indian Standards on 30th October 2009 at Manak Bhawan, New Delhi. The panel has decided to bring out publication on “Hand Book on Water Resource Management” in Hygrometry. Dr. P. Guhathakurta has been invited to write a section “Precipitation Measurement including remote sensing methods.

Users’ Requirement of Weather and Climate in Western Himalayas



A workshop was organized by Meteorological Centre, IMD, Srinagar on 3rd November 2009 at SKICC, Srinagar. The workshop was inaugurated by the chief guest of the function Shri Ghulam Hassan Mir, Hon’ble Minister for Agriculture, Govt. of J&K. He appreciated the work being done by Meteorological Centre, Srinagar.

The key note address was delivered by AVM (Dr.) Ajit Tyagi, Director General, India Meteorological Department. Apart from DGM, Dr. L. S. Rathore, Head Agrimet Shri B.L.Verma, DDGM RMC, New Delhi and officers from other MCs, members from scientific communities / media personalities, actively participated in the workshop.

Inauguration of Office Building Cum Users Conference



DGM addressing the delegates of the User Conference

Inauguration function for newly constructed building of Met Centre Chandigarh was held on 12th November 2009. Building was inaugurated by AVM (Dr.) Ajit Tyagi, Director General of Meteorology, India Meteorological Deptt and Shri D. P. Singh, Joint Secretary, Ministry of Earth Sciences, Govt of India. AVM (Dr.) Ajit Tyagi also Commissioned High Performance Computing System installed in this office for issuance of forecast at mesoscale. Inaugural function was followed by Users Conference on Weather and Climate Services in North West, India especially In Punjab and Haryana organized at Dr. B. R. Aambedkar, Institute of Hotel Management Catering and Nutrition. About 175 delegate from different Deptt in the region participated in the conference. Shri Rohan Lal Financial Commissioner cum Principal Secretary, Agricutre Govt of Haryana was Chief Guest of the conference.



DG, IMD & J.S., MoES inaugurating the building

AVM (Dr.) Ajit Tyagi, DGM welcomed the chief guest and addressed the conference. DGM along with Shri D. P. Singh, Joint Secretary MoES inaugurated the newly constructed building of M.C. Chandigarh.

Workshop on “Aviation Meteorology”

A workshop on “Aviation Meteorology” was held at CTI, Pune from 9th to 13th November 2009 for 23 persons (17 departmental and 2 each from Indian Navy, Indian Air Force and Indian Coast Guard offices). Shri S. K. Prasad, DDGM (Training) delivered a lecture on “Aviation Meteorology training worldwide”. Dr. H. R. Hatwar, ADGM(R) also delivered a lecture in the workshop on Aviation Meteorology.

WMO Workshop on Climate Monitoring

Dr. D. R. Pattanaik, Met Gr-I was representative from India to participate in the “WMO Workshop on Climate Monitoring including the implementation of Climate Watch Systems in RA-II with focus on monsoon affected areas during 10-13th November 2009” held in Beijing China. During the workshop Dr. Pattanaik delivered two lectures entitled.



- (i) Regional Climate Activities of IMD and
- (ii) Status and priority needs of monitoring and predicting climate anomalies and extremes over India.

Performance of Southwest Monsoon, 2009

IMD convened two days Brainstorming Workshop on 20 & 21 November 2009 under the Chairmanship of Secretary MoES in the Conference Hall, Mausam Bhawan, Lodi Road, New Delhi-3 to review the performance of Southwest Monsoon, 2009.

Users’ Interactive Fog Workshop at Met Office Palam



Airport Met Office Palam

Users’ Interactive workshop on “Fog monitoring, Forecasting and Dissemination System” was organized at Airport Met Office Palam on 4th December, 2009. Fifty participants from various agencies like DIAL, Airlines, IAF, Indian Railways participated in the workshop.

AVM (Dr.) Ajit Tyagi, DGM, IMD inaugurated the workshop and delivered the Key Note address. S/Shri B.L. Verma, DDGM and Mr. Peter Nyce, Chief Operating Officer, DIAL addressed the workshop. IMD-DIAL joint Fog Browser was also released by AVM (Dr.) Ajit Tyagi and Mr. Narayan Rao, Director (DIAL) on this occasion.

Review Meeting of Agromet Field Units

Agrimet Division organized Annual Review Meeting of Agromet Field Units during 10-12 December 2009 at IIT, Roorkee. Activities and progress made at each AMFU had been reviewed and suggestions made to improve the services for the farming community.



AVM (Dr.) Ajit Tyagi, DGM participated and chaired the session. Many Scientists from IMD Delhi & Pune participated in Annual Review Meeting and made presentation.

Symposium on "Weather, Climate and Sustainable Development"



The quarterly research Journal 'MAUSAM', which was started in Jan, 1950, has completed 60 years of its uninterrupted publication in 2009.

To commemorate the occasion a National Symposium on "Weather, Climate and Sustainable Development" was organized during 17-18 December 2009 at SCOPE Convention Centre, CGO Complex, New Delhi. Its objective was to understand the needs of meteorological information and products in the sectors like Water Resources, Agriculture, Health, Environment, Natural Hazards, Energy and Emerging Societal Services.



Lighting the Lamp

Representatives from WMO, DST, ICAR, AIIMS, CPCB, IITM, IARI, NCMRWF, NIH, NCAOR, etc. participated in the symposium and presented their views on various topics related to the weather and climate and its effects on sustainable development. Hon'ble Minister of Earth Sciences, Shri Prithviraj Chavan alongwith other dignitaries lighted the lamp of wisdom and formally inaugurated the symposium. He also released the Diamond Jubilee issue of 'MAUSAM'. On this occasion Dr. Ajit Tyagi, DGM, IMD said that the organization is on its way to improving the weather prediction by bringing in more technical advancements. Also, IMD is working towards effective dissemination of information to end users. Dr. R.K. Kolli, representative from WMO presented the concept of Global Frame work for climate services.

Dr. Akhilesh Gupta from DST presented national strategy for capacity building in climate change in India. He discussed the National Missions on strategic knowledge for climate change which is one of the missions of National action plan on climate change.



Shri Prithviraj Chavan Hon'ble Minister of Earth Sciences releasing the Diamond Jubilee issue of MAUSAM

Shri R.D. Singh from NIH emphasized the role of hydro-meteorological information and forecasts and effective interactive coordination mechanism between the hydro-meteorological services and the water management bodies to deal with hydro-meteorological disasters and planning activities. He was of the opinion that urban planners should consider the hydro-meteorological aspects to avoid urban flooding and other hydro-meteorological disasters.

The aims of National Solar Mission were also presented. The need was felt to take necessary steps to improve air quality in Delhi NCR, through industrial pollution control, emission reduction from the vehicle etc. Since aerosol plays a major role on earth-atmosphere radiation balance, environmental pollution and hydrological cycle, the better understanding of the role of aerosols and gases in global climate scenario and geosphere - biosphere process is necessary.

Public health response to climate change was an interesting presentation. It was highlighted that there should be an interactive mechanism between the hydro-meteorological services and the Health services for better adaptation & mitigation strategies in view of possible impact of climate change. Like the meteorological data, a mechanism to be developed to standard quality control and archive the health related data and the same should be available to researchers for modeling purposes.



The various aspects of agricultural research for sustainable development and food security was also presented. It was emphasized that the value addition to the advisories, farmers' traditional knowledge to Agromet Advisory Services (AAS) capacity building may be considered for more effective AAS. In response to passive climate change, effectiveness and awareness of Agro met Advisories is needed. More R&D is essential for adaptation & mitigations strategies for effective AAS. The conceptual frame of AAS, District level Weather F/C system, Advisory Preparation System and Advisory Dissemination System was broadly discussed. The plan for integrated AAS needed for crop specific district and village level need was also presented.

Seven senior officers of IMD delivered talks on contemporary topics / issues during different sessions. A talk on "S & T initiatives on

Earthquake Risk Reduction in India was delivered by Shri A. K. Bhatnagar". He explained earthquake auto location and display by India Meteorological.



Dr. R.K. Kolli from WMO interviewed by Media

In the concluding session Dr. Senthil Kumar, from M. S. Swaminathan Research Foundation gave a presentation on the role of ICT in extension services of rural India. The concept of Village Knowledge Centre (VKC) and how the awareness program on Sustainable Fisheries and Marine Biodiversity Conservation was presented by him. The use of mobile phones in disseminating fisheries information rural villages of Tamilnadu was also discussed.

The symposium was a great success. It provided IMD an opportunity for better cooperation with various participating organizations / institutions and thereby providing better services to the nation.

Workshop on "NSDI For E-Governance" 22 - 24 December, 2009

NSDI is organizing annual events providing a platform for exchange of ideas on Spatial Data Infrastructure amongst the professionals, Government organizations, Research and Academic communities.

This year NSDI-9 is being held at Pune under the aegis of IMD from 22-24 December, 2009. National Spatial Data Infrastructure (NSDI) is the National Agency mandated to develop standards for spatial data as well as to promote Spatial Data Infrastructure at all levels. The NSDI Metadata Standard developed to facilitate spatial data discovery, reduce duplication and data redundancy. It will also enable prospective users to explore and access the data.



**Shri Prithviraj Chavan, Hon'ble Minister,
MoES releasing CD**

Shri Prithviraj Chavan, Hon'ble Minister of State for S&T and Earth Sciences inaugurated the National Spatial Data Infrastructure (NSDI-9) Workshop on 22nd December 2009 organized jointly by IMD and DST at YASHADA, Pune. Dr. Shailesh Nayak, Secretary, MoES and AVM (Dr) Ajit Tyagi, DGM, IMD were also present on this occasion. The Hon'ble Minister visited IMD, Pune and addressed Officers and Staff of IMD. He also released a CD containing the Climatological normals for the period 1961-1990 on 23rd December.

Other Workshops

Dr. A. K. Shukla, Technical Director attended the conference of Security and Disaster management co organized by NDMA on January 22nd, 2009.

Shri N. Meenatchinathan, Met.-II participated in the orientation workshop on Effective Management titled 'Tomorrow Begins Today' organized by MoES in collaboration with centre for Marine Living Resources and Ecology [MLRE], Kochi held from 6th to 8th February 2009.

Shri A. K. Das, DDGM (LACD), had a meeting on 10th February at PAC regarding handing over of Training Unit of RMC Kolkata at PAC New Building, Salt Lake, Kolkata.

The second meeting on **Revamping of training** "the Atmospheric Science in IMD" was held at CTI on 11-12 February, 2009 under the chairmanship of Prof. J. Srinivasan, Scientist, I.I.Sc., Bangalore.

A meeting of '**Forecast Demonstration Project on FOG**' was held on 13th February 2009 in Mausam Bhawan, New Delhi. C-MMACS, MoES, NARL, NCMRWF, IAF, JNU, IIT-Delhi and IMD were participating institutes.

Dr. A. L. Koppar, DDGM (QAPPS) was on tour to attend a preparatory workshop on CAIPEEX at IITM, Pune on 4th March 2009. He also chaired the post tea session. The cloud and rain formation was two main area of thrust. He emphasized the coordination among different agencies for the experiment.

Shri U. P. Singh, Director, Publication was on tour to attend a conference on Open Access to Science Publication : Policy perspective, opportunities and challenges at India Habitat Centre, New Delhi on 24th March which was organized by CSIR, New Delhi.

Dr. Ajit Tyagi, Director General of Meteorology, participated in Megha Tropique International Conference held at ISRO Bangalore on 25th March 2009. He also participated in ISRO-CNES Joint Science Committee meeting there on 26th March 2009.

Dr. M. Mohapatra, Director (Cyclone Warning) participated in international conference on 'Disaster Risk Reduction' on 30th - 31st March organized by Asia - Pacific Broadcasters Union and NDMA.

The participants of the above workshop visited IMD on 31st March 2009. They were shown various warning facilities and briefed about the early warning system in IMD by Dr. M. Mohapatra, Director.

Shri Anand Kumar Sharma, Director, Meteorological Centre, Dehra Dun, organised and participated in the seminar on Scientific explorations under the aegis of Indian Science Writers Association, Uttarakhand Chapter on 5th April, 2009.

Shri P. A. Kore, Met.-I participated in the workshop on user's feedback on 'WISDOM Software' at NWA Pune during 8-9th April 2009 conducted by CWC Delhi.

Dr. R. P. Samui, DDGM (Ag) and Dr. N. Chattopadhyay Director, attended International Training cum Workshop on climate Risk Management in Agriculture at ANGRAU, Hyderabad from 27th to 30th April, 2009.

Shri A. K. Srivastava, Director attended IBSA Ocean workshop at Goa on 5-6 May 2009 and gave a presentation on "Climate Change".

AVM (Dr.) Ajit Tyagi, DGM, Dr. H.R. Hatwar, and Shri A. K. Srivastava attended the National Workshop on "Climate Change : Status and Future Plans" at IITM, Pune on 18-19th May 2009.

Shri S. B. Thampi, Director, CDR Station, Chennai attended Workshop on 'Role of Government Departments in Disaster Management' on 28th May, 2009 organized by the Disaster Management and Mitigation Department, Govt. of Tamil Nadu.

Shri U. P. Singh, Director (APEC) attended two-day Workshop on “Evaluation of Research Projects for Planning the Indian Scientific Expedition to Antarctica” held on 11-12th June 2009 at NCAOR, Goa, and presented Scientific Programme of IMD for 29th InSEA and a review of earlier work.

Dr. R. P. Samui, DDGM (Agrimet) attended two days National workshop on ‘Role of Gyan chaupals in spreading climate literacy and in building sustainable food and water security systems’ and acted as panelist in the session and presented a paper on ‘Role of Agricultural meteorology Division, IMD in promoting climate literacy under climate change’ held on 2nd and 3rd September, 2009 at New Delhi.

Shri P. A. V. Nampootheri, Met.-I was on tour to Goa to attend the de-briefing function at NCAOR, Goa to felicitate the expedition members of winter team of 25th INSEA and 26th INSEA on 15th September 2009 and on 18th December 2009.

Shri A. K. Das, DDGM (LACD) attended Agromet Advisory Science Work Shop at Seminar Hall on 6th October along with other Officers.

Shri M. K. De, AM-I (APEC) has been deputed on tour to NIOT Chennai from 27th October 2009 to 29th October 2009 to present IMD’s FDP Cyclone Project. He presented the project on 28th October 2009.

Requirements for Helicopter Operations

Director General of Meteorology, has constituted a committee to look into the Meteorological requirements for Helicopter Operations under the chairmanship of Dr. A. B. Mazumdar DDGM (WF), Pune. The committee has representatives from DGCA, IAF & Pawan Hans Helicopter Ltd., as members and Shri M.K. Bhatnagar, DAS as member secretary.

First meeting of the committee was held on 5th November 2009 at New Delhi. For reviewing the safely oversight of helicopter operations, DGCA convened a meeting on 1st October 2009 at DGCA (HQ), New Delhi. Dr. A. B. Mazumdar, DDGM (WF) and other officers from HQ New Delhi took part in the meeting.

Dr. S. C. Sahu, Director I/C, MC Bhubaneswar, attended the 2-days’ Consultative Workshop on Disaster Risk Reduction in Orissa, organized by Indian Red Cross Society on 16th and 17th November, at DTPC Red Cross Bhavan, Bhubaneswar.

Dr. A. K. Kashyapi, Director and Shri J. P. Sabale, S.A. participated in the National Seminar on “Agrometeorology - needs, approaches & linkages for Rural Development” held at CCS Haryana Agricultural University, Hissar during 26-27th November 2009.

Dr. R. P. Samui, DDGM (Agrimet) participated in the National Seminar on “Climate Change Adaption Strategies in Agriculture and Allied Sectors” held during 3-4 December 2009 at Kerala Agricultural University, Thrissur, Kerala and presented a paper.

Dr. Y. E. A. Raj, DDGM participated in the workshop on ‘Information Tools and Analysis’ jointly organized by MoES and M/s Elsevier at NIOT Chennai on 3rd December 2009.

Dr. R. P. Samui, DDGM (Agrimet) participated in the National Seminar on “Climate Change Adaption Strategies in Agriculture and Allied Sectors” held during 3-4th December 2009 at Kerala Agricultural University, Thrissur, Kerala and presented paper entitled “Integrated Agromet Advisory Services for the Coastal Region of Kerala-Future Projection under Climate Change.”

Dr. G. C. Debnath, Director, participated in ‘APN Workshop on Climate Change and its

effect on pests and diseases of major crops' at Bidhan Chandra Krishi Viswavidyalaya, Kalyani, WB, during 15th - 16th December.

Dr. R. P. Samui, DDGM (Agrimet) participated in the International Conference on "Food Security and Environmental Sustainability" held at IIT, Kharagpur during December 17-19 and presented paper entitled "Indian Agriculture under Climate Change Scenario - Adaption Strategies."

Dr. (Mrs.) Kamaljit Ray, Director, presented a paper on "Climate Variability over Gujarat, India" at the International Workshop on "Impact of Climate Change on Agriculture" organized by S.A.C. (ISRO) Ahmedabad on 17-18 December, 2009.

"Impact of Climate Change on Agriculture"
Organized by S.A.C. (ISRO) Ahmedabad on

17th & 18th December-2009. A Paper entitled "Climate Variability over Gujarat India" was presented by Dr. (Mrs.) Kamaljit Ray, Director and Smt. Manorama Mohanty, Met.-I & Shri J. R. Chicholikar, S.A. at this international workshop.

Dr. H. R. Hatwar, ADGM(R) attended and chaired the Technical Session in the International Workshop on 'Impact of Climate Change on Agriculture' organized by SAC at Ahmedabad on 19th December.

Deputation for WMO

Forty three IMD officers were sent on deputation to attend various WMO meetings, Conferences, and other workshops/ Seminars etc during the year 2009.



10. LECTURES & SEMINARS

Shri S. K. Prasad, DDGM (Trg.), delivered a lecture on “Climate Change” on 1st January 2009 on the occasion of the 28th Convocation ceremony of Deendayal Upadhyay Gorakhpur University, Gorakhpur.

Dr. R. Suresh, Director conducted doctoral committee meeting at the Department of Physics for the award of Ph.D degree to Shri Venkateswara Rao on 9th and delivered two lectures on Doppler Weather Radar for M.Tech/M.Sc. students under the aegis of Physical Society on 10th January 2009.

Dr. Naresh Kumar, Met.-II delivered a lecture on Mathematical modeling of Orographic waves 14th January.

Dr. A. K. Shukla, Technical Director attended the conference of Security and Disaster management co organized by NDMA on January 22, 2009.

Dr. R. Suresh, Director delivered a special lecture on “Our response to Global Warming – whether it is true or a myth” on 22nd January and chaired a session on the inauguration day of National Conference on “Effect of Climate Change and Sustainable resource Management” [ECCSRM 2009] organized by SRM University, Chennai during 22-23 January 2009.

Shri R. D. Ram, Director delivered a lecture on Temporal & spatial distribution of rainfall during 2008 on 28th January.

Shri R. K. Singh, Met-I attended the NSDI Workshop on “Geospatial Technologies in India – Challenges & Opportunities” organized by FICCI during January 2009.

Dr. K. K. Singh, Scientist “E”, Agromet Advisory Services Cell, IMD, New Delhi delivered lectures on crop growth simulation model (DSSAT) to officers and staff members of the Division during 2nd - 4th February, 2009.

Shri N. Meenatchinathan, Met. Gr.-II participated in a workshop on Effective Management titled ‘Tomorrow Begins Today’ organized by MoES & Centre for Marine Living Resources and Ecology (MLRE), Kochi during 6th to 8th February.

Dr. Duane E. Waliser, Jet Propulsion Laboratory, MS 183-505 California Institute of Technology delivered a lecture on “Developing and Implementing Operational Prediction of the MJO” on 9th February 2009 at IMD, H.Q., New Delhi.

General Functioning of IMD System

A lecture cum demonstration programme on “General Functioning of IMD System” was conducted on 10th February 2009. This was a part of the training programme by the Centre of Disaster Management, YASHDA. Dr. A. B. Mazumdar, DDGM (WF) and Dr. Medha Khole, Director, delivered a lecture on “Natural Disasters & Organization structure for Disaster Management” on the event of visit of YASHADA trainees in workshop on that day.

Shri R. Baidy, Director, delivered a lecture Seismological observational capabilities : Status & Future Plan on 11th February.

Dr. H. R. Hatwar, ADGM(R), Shri A. K. Srivastava, Director, Dr D. S. Pai, Director and Shri O. P. Sreejith, Met.-II attended the Climax Workshop organized by Ministry of Forest, at Tata Technologies Campus, Hinjewadi, Pune on 16th February.

Dr. R. Suresh, Director delivered 4 lectures on Monsoon-Basics, Climatology and Semi permanent systems and on Tropical Cyclones to the newly recruited J.R.Fs of National Atmospheric Research Laboratory (NARL), Gadanki during 17-18 February.

Dr. H. R. Hatwar, ADGM(R), Dr. J. Sarkar, Director, Dr. P. Guhathakurta, Director, Shri V. K. Soni, Met.-I, Shri P. A. Kore, Met.I and Shri N.T. Niyas, Met.II attended International conference on, “Challenges and Opportunities in Agrometeorology” (INTROMET 2009) held at New Delhi during 23-25 February and presented a paper.

Shri A. K. Herode, S.O. attended 2 days workshop on, ‘Legal software and using Linux’ at National Water Academy, Khadakwasala, Pune during 26-27 February.

Shri G. N. Raha, Meteorologist-in-Charge attended a seminar on “Flood forecasting activities on North Bengal rivers and other water resources development issues” held on 27th February 2009 at Teesta Paryatak Avas, Jalpaiguri.

Dr. R. Suresh, Director delivered an inaugural lecture on ‘Digital Image Processing’ in the National level technical symposium, GENICS 09 held at Sri Venkateswara College of Engineering and Technology, Tiruvallur on 18th March 2009.

Dr. Rahul Saxena, Director delivered a lecture “Application of G.I.S. in Meteorology” on 25th March 2009.

Dr. R. Suresh, Director delivered a lecture on ‘Cyclone Disaster Management’ at Anna Institute of Management, Chennai on 31st March 2009.

Shri S. B. Thampi, Director, CDR, Chennai was on tour to Air Force Administrative College Coimbatore, on 15th April 2009 for delivering a guest lecture on “DWR principle, components and products”.

Pre-cyclone exercise

Three days lecture series were organized on operational cyclone warning as pre-cyclone exercise during 22-24 April 2009. S/Shri B. K. Bandyopadhyay, DDGM (S), Dr. M. Mohapatra, Charan Singh, Dr. Y. V. Rama Rao and Dr. S. K. Roy Bhowmik, Directors delivered lectures on various subjects. The Officers from NHAC, Hydrology, Satmet, Radar Divisions of IMD, IAF and Indian Navy participated in the lecture series.

Shri Anand Kumar Sharma, Director In charge, Meteorological Centre, Dehra Dun delivered invited lecture on “Inter - annual Climate Variability and land use - land cover change” on 23rd April to the Master trainers at Forest Research Institute Dehra Dun.

Dr. P. Khare, Director and Shri S.I.M. Rizvi, Met.-I delivered lectures in the three week seminar/workshop organized by Agrimet Division, Pune in C.T.I. during April.

Dr. Medha Khole, Director delivered a lecture on the subject “Rain in India” on 19th May 2009 at the Institution of Engineers, Shivajinagar, Pune, organized by Marathi Vigyan Parishad, Pune Chapter and Institution of Engineers, Pune.

Shri K. V. Balasubramanian, A.M.-II, RMC Chennai delivered a lecture “Meteorology and Climate Change” at Periyar Science & Technology Centre, Chennai on 22nd May 2009.

Dr. S. N. Dutta, Director of DDGM (Training) was on tour to H.Q. New Delhi for delivering lecture for “Trainer’s Guide“ on 23rd May 2009.

Shri N. Y. Apte, DDGM (H) delivered lecture on “Quantitative Precipitation Forecast for Flood Forecasting” at National Institute of Disaster Management, New Delhi on 26th May 2009.

Dr. S. R. Ramanan, Director, RMC Chennai delivered lecture on “Cyclone Disaster Management” on 2nd June 2009 in Disaster Management Training Programme for Home Guards and Civil Defence Officials organized by Anna Institute of Management.

Dr. S. C. Sahoo, Director delivered lecture on the Role of warning of heavy rainfall and dissemination thereof on combating flood on 2nd June 2009, on a training course conducted by Gopabandhu Academy, Bhubaneswar.

Shri Anand Kumar Sharma, Director In charge, Meteorological Centre, Dehra Dun delivered lecture on “Air Pollution and Weather” on 5th June 2009 on occasion of World Environment Day at the Doon University Dehra Dun.

Dr. Medha Khole, Director delivered a talk on “Coming monsoon & forecast” which was broadcast on All India Radio, Pune on 9th June 2009.

Shri K. Ramachandra Rao, Director, CDR Machilipatnam delivered a lecture on “Significance of youth in Disaster Management and Mitigation” on 13th June 2009 in National Integration Camp held at Machilipatnam.

Dr. S. K. Roy Bhowmik, Director delivered a talk entitled "District Level Forecasts for Integrated Agro-advisory Service" on 29th June 2009 in the National Workshop on "Climate and Development" organised by Kerala Agricultural University, Thiruvanthapuram.

Shri K. Seetharam, Director M.C.Gangtok attended a seminar on Disaster Management and Delivered a lecture “Tropical cyclones in General and AILA in particular” on 18th June 2009.

Shri K. Santhosh, Director gave a lecture on “Agromet Advisory Service at District Level” in the National Workshop on Climate and Development organized by State Planning Board and Kerala Agricultural University on 30th June 2009.

Dr. S. R. Ramanan, Director, RMC Chennai delivered a lecture on Global Warming on 04th July 2009 in a program Event Hour Earth Hour organized by Turn On event management company, Chennai.

Mrs. Sunitha Devi, Met. I delivered lecture on the topic, “Marine met. procedures an overview for Refresher Course on 13th July 2009 at CTI Pashan, Pune

Shri A. K. Srivastava, Director gave a presentation on, “Monsoon Study & Research and Regional Climate Centre” on 14th July 2009 followed by discussions regarding plan scheme and HPCS projects at H.Qtrs. New Delhi.

Dr. A. B. Mazumdar, DDGM (WF) delivered lectures on the topic “Tropical Cyclones, disaster preparedness/ Management” for refresher course on 15th July 2009 at Central Training Institute (CTI), Pashan, Pune.

Dr. Medha Khole, Director delivered an invited talk on the topic ‘Rains in Maharashtra and security of drinking water’ at the seminar organized by the Groundwater Survey and Development Agency on the occasion of their foundation day on 16th July 2009.

Dr. R. Suresh, Director delivered lectures on Aviation Weather Phenomena, Applications of Remote Sensing in Meteorology and a special lecture on Nowcasting to the participants of Refresher course for Naval Met. Officers conducted by CTI Pashan, Pune during 19th to 21st July 2009.

Dr. O. P. Singh, Scientist-E delivered lecture entitled "Changes in the frequency and intensity of tropical disturbances in the Bay of Bengal and the Arabian Sea" at International Union of Geodesy and Geophysics (IUGG) General Assembly held at Montreal, Canada during 19-29 July, 2009.

Shri K. Ramachandra Rao, Director, CDR Machilipatnam delivered lecture on "Cyclones and Preparedness" on 21st July 2009 in a training programme on Disaster preparedness organized by World Vision at Machilipatnam.

Dr. M. Mohapatra, Director (CW) delivered a lecture on "Cyclone Forecasting Process and Cyclone Warning Service" at NIDM, New Delhi on 21st July, 2009 under training programme on Cyclone Risk Mitigation and Management. Dr. Naresh Kumar, Met. Gr.-II briefed the trainees from NIDM who visited IMD in the afternoon of 21st July 2009.

Dr. Medha Khole, Director delivered a lecture on the topic 'Inter and intra-seasonal variability of monsoon' at Central Training Institute, Pashan, Pune on 21st July 2009 at the Refresher Course for Naval Met. Officers during 13th to 24th July 2009.

Dr. P. Lyamperumal, Executive Director, Tamil Nadu Science and Technology Centre, delivered a scientific talk on "Total Solar Eclipse on 22nd July 2009 over India" at Chennai on 21st July 2009.

Dr. S. D. Attri, Director addressed the delegates during "Inaugural Session" and delivered a lead talk on "Climate Change & Agriculture" in the International Colloquium on "Global Warming and its consequences on Weather and Environment" on 25th July, 2009 which was jointly organised by University of Kolkata and IMS Kolkata at Kolkata.

Dr. R. Suresh, Director delivered an invited lecture on 'Application of Remote Sensing in Meteorology at the Academic Staff College of University Teaches of Tamil Nadu at the University of Madras on 25th July 2009.

Shri G. K. Mohanty, Director delivered lecture on 27th July on "Role of IMD for Disaster Management" at Srikrishna Institute of Public Administration, Ranchi.

Shri P. S. Kannan, Met. Gr.-I, RMC Chennai delivered a lecture on "Cyclone Disaster Management" at RMC Chennai on 27th July 2009 in Disaster Management Training Program for Urban Local Body Officials organized by Anna Institute of Management, Chennai.

Dr. Y. E. A. Raj, DDGM, RMC Chennai delivered a lecture on 'Tropical Cyclone and Disaster Mitigation' on 27th July 2009 in a Training Workshop on Disaster Mitigation conducted by Tamilnadu Science and Technology Centre, Chennai.

Dr. S. Balachandran, Director delivered a lecture on 'Cyclone Warning Procedures by IMD' on 28th July 2009 in a Training Workshop on Disaster Mitigation conducted by Tamilnadu Science and Technology Centre, Chennai.

Dr. R. Suresh, Director attended the selection committee meeting as an expert member as nominated by the Vice-chancellor of SVU, Tirupathi, for the recruitment of Junior Research Fellow [JRF] for DST & ISRO projects during 31st July 2009 and 1st August 2009.

Dr. S. Balachandran, Director, RMC Chennai delivered lectures 4th August in a Disaster Management Training Program for organized by Anna Institute of Management, Chennai.

Shri G. K. Mohanty, Director delivered lecture on 5th August regarding “Early warning system for flood management” at Shri Krishna Institute of Public Administration, Ranchi.

Shri Anand Kumar Sharma, Director In charge, Meteorological Centre, Dehra Dun delivered lecture on “Role of Weather observation and forecasting in natural resources and Environmental Management” on 7th August 2009 to the Doon University, Dehradun.

Dr. Paul Menzel of CIMSS, Wisconsin, U.S.A, delivered a lecture on the derivation of vertical profiles of temperature and humidity from satellite on 27th August, 2009 in the Conference Hall, Mausam Bhawan, New Delhi which was attended by the officers of Sat. Met. Division.

Dr. S. R. Ramanan, Director delivered lecture on “Cyclone Disaster Management” at RMC Chennai on 18th August 2009.

Shri P. R. Baidya, Director had delivered a series of four lectures on seismology discipline for Met. Officer trainees in the initial forecasters course (30IFC) & basic professional knowledge course (02 BPKC Met) conducted by Air Force Administration College (AFAC), Coimbatore during 19-20th August, 2009.

Dr. S. Balachandran, Director, RMC Chennai delivered lecture on “Role of Indian Meteorological Department in Disaster Management” on 25 August 2009 in a Special training course on Disaster Management for MCOs and JLOs of Public Works Department, Chennai.

Dr. R. Suresh, Director delivered a lecture on “Principles of Satellite Remote Sensing” on 27th August 2009 in the 5 day regional level workshop on ‘Model Rocketry’ organized by Tamil Nadu Science and Technology Centre, Chennai.

Dr. R. Suresh, Director delivered a lecture on ‘Rainfall Variability and Water Resources Management’ in the one day awareness programme under Hydrology Project conducted by Central Ground Water Board, Chennai on 24th September 2009.

Lecture on Stress Management



Shri B. K. Piush, Director, Brahma Kumaris Ishvariya Viswavidyalay Lodhi Road, New Delhi delivered a very useful talk on stress management at DGM office Conference Hall on 29th September 2009 in presence of Senior officers of the department. Each officer realized the strength of meditation in realising the stress.

Shri G. K. Mohanty, Director delivered lecture on 6th October and 26th October regarding “Role of IMD for Disaster management” at Srikrishna Inst. of public administration (SKIPa) at Ranchi Interaction of Shri G. K. Mohanty, Director with Principal Nodal officer of AFMU, Birsa Agriculture Univ. held at Ranchi on Dist. Level Agromet forecast.

Dr. P. K. Nandankar, Director has delivered a talk on weather & climate in 'National training workshop for weather and climate study activities' on 9 to 11th October 2009 at Nagpur.

Shri D. Pradhan, Director was on deputation to Jakarta, Indonesia from 18th October 2009 to 23rd October 2009 as guest lecture to deliver lecture on DWR products interpretation & their utilization in now casting in the weather radar workshop organized by BMKG (Agency for meteorology, climatology & geophysics).

Dr. G. C. Debnath, Director delivered a lecture on cyclone, its formation, movement, tracking and warning & its devastation effect, Nor'wester, its prediction and devastating effect in a training programme on cyclone Risk management organized by the Disaster management Dept. (Govt. of West Bengal) at the Administrative training institute, Kolkata on 21st October.

Dr. R. Suresh, Director delivered lecture on 'Cyclones: Scientific tit-bits and Disaster management' at Centre for Environmental Sciences, Academic Staff College, University of Madras, Chennai on 3rd November 2009. He also delivered lecture in the "Advanced refresher course" on Aviation Meteorology conducted by CTI, IMD Pune during 9-13 November 2009.

Shri C. S. Patil, Met.Gr.-II, MC Bangalore delivered lecture on "Weather forecast and its importance in Agriculture" at Zonal Agriculture Research Station (ZARS), Hiriyur on 4th November 2009.

Dr. R. Suresh, Director delivered lectures at Workshop on aviation Meteorology at CTI, Pune on 10th November 2009 on the following topics : (a) Nowcasting of Aviation related severe weather events (b) Online aviation Met. Briefing (c) SIGMET and Aerodrome warning procedures and tools (d) Preparation of National sig. wx. Charts.

Shri Anand Kumar Sharma, Director Meteorological Centre, Dehra Dun was invited to deliver a lecture on "Environmental Security" to senior civil and defense officials at Lal Bhadr Shastri National Academy of Administration Mussoorie on 18th November 2009.

Smt. Neetha K. Gopal, Met.-I delivered a lecture on "Medium Range forecast "at Basic Agromet Course held at DDGM (Agrimet.), Pune on 20th November 2009.

Dr. S. Balachandran, Director delivered lecture on "Role of IMD in Disaster Management" to the Engineers of Tamilnadu Electricity Board at the Staff Training College, TNEB Chennai on 23rd November 2009.

Shri D. Pradhan, Director I/C CDR Kolkata, attended the 'Science and Technology Fair' and delivered a lecture on "DWR Utilization in Prediction of Severe Weather Events" held at Central Park, Salt Lake, Kolkata on 23rd November.

Miss B. Amudha, Met Gr.-I delivered lecture on "Cyclone disaster Management" for Home Guards and Civil Defense Officials at RMC Chennai on 27th November 2009.

Shri N. Meenatchinathan, Met.-I delivered lecture on "Modern Observing Systems" on 30th November 2009 to School Students of Sathya Higher Secondary School at RMC Chennai.

Dr. S. C. Sahu, Director I/C, MC Bhubaneswar, delivered a presentation on the topic "Role of IMD in forecasting various meteorological hazards and their warning system" organized by Gopabandhu Academy of Administration on 1st December.

Dr. S. C. Sahu, Director I/C, MC Bhubaneswar, attended as a panel member and delivered a presentation in 12th Odisha Bigyan Congress on

the topic “Combating Climate Change”, organized by Indian Science Congress Association Bhubaneswar Chapter, at Bhubaneswar on 6th December.

Shri S. B. Thampi, Director, CDR Chennai delivered two invited-talks on 09th December 2009, on ‘Use of Doppler Weather Radar as a primary aviation weather sensor’ and ‘Diagnosis of weather phenomena using radars’, in the 5th SERC School on Aviation Meteorology, organized at Air Force Administrative College, Coimbatore.

Dr. S. R. Ramanan, Director delivered lecture on “Cyclone disaster Management” at RMC Chennai on 8th December in a Disaster Management Training Program.



Dr. R. Suresh, Director gave an invited guest lecture at Hindustan University Chennai on ‘Aviation Weather Services for Air Traffic Management’ to the MBA aviation Management students on 10th December 2009.

Dr. R. Suresh, Director delivered lecture in the 5th SERC School on Aviation Meteorology conducted at AFAC Coimbatore on 12th

December 2009 on (i) Local Severe Storms (ii) Forecasting Clear Air Turbulence (CAT).

Dr. S. K. Roy Bhowmik, Scientist E delivered a talk on the Status of Global Forecast System on 12th December 2009 at the Annual Review Meeting of Agro-meteorology at IIT Roorkee.

Shri R. Asokan, Director, RMC Chennai delivered a lecture on “Cyclone Disaster, Mitigation and Management” on 16th December 2009 at Anna Institute of Management, Chennai.

Shri A. K. Das, DDGM (LACD), attended lectures at CDR Kolkata in ‘DWR Training of Group-A Officers’ on 21st December.

Shri Anand Kumar Sharma, Director In Charge, Meteorological Centre, Dehra Dun delivered lecture on “Atmospheric Hazards Monitoring and Prediction” to senior scientists of various research institutes at the Lal Bahadur Shastri National Academy of Administration Mussoorie on 21st December.



Standing 1st L to R - Dr. Indrajit Pal,
Dr. Anand Sharma



11. TOURS/VISIT

Distinguished Foreign Delegations

Dr. William K. M. Lau, from NASA has visited IMD, New Delhi and delivered a lecture on “Aerosol and Monsoon” on 9th January 2009 at H. Q Conference Hall.

Dr. Dunne Waliser and Dr. Susan, USA visited IMD, Pune on 10th February. A meeting of all Heads of Offices was held with them and they were apprised of the activities of IMD.

Mr. Steve Coffey, Vice President, Strategic Relations, Japan visited Met. Office, Pune on 11th February and he was apprised of the activities of IMD.

Dr. Taiichi Hayashi, Dr. (MS) Fumie Murata and Dr. Yusuke Yamane of Disaster Prevention Research Institute, Kyoto University, Japan visited Met. Office, Pune on 20th February and they were apprised of the activities of IMD.

Chinese Delegation



A-Ten member delegation participating in Indo-Chinese Workshop from National Climate Centre (NCC), Institute of Atmospheric Physics

(IAP), Climate Academy of Sciences, Beijing and Nanjing University, China visited, IMD, New Delhi on 20th March, 2009 for familiarization with facilities at IMD.

After the welcome address, the delegation was shown various facilities available at NHAC & Computer/Sat. Met./Seismology etc.

German Research Scholars

A group of German Research Scholars visited the CSO Observatory, Shillong on 8th April 2009.

Afghanistan Delegation

Mr. Abdul Qadeer Qadir, President of Afghanistan Meteorological Authority & PR of Afghanistan with WMO and Mr. Luc A. Chang-Ko, Senior Meteorology Expert, ICAO TC Project, UNDP Office, Kabul visited IMD, New Delhi for two days from 14th - 15th July 2009 for familiarization with Aviation meteorology and facilities at I.G.I Airport New Delhi and to discuss bilateral cooperation program.



The delegation was welcomed by DGM on 15th July 2009 in the Conference Hall. They also

visited at RTH and Sat. Met. Division etc. along with respective divisional head. The delegation also visited IMD Pune offices from 15th to 16th July 2009 for familiarization with the instrument division and facilities available training at RMTC, Pune and had a discussion there.

Delegation from WMO



Dr. Ajit Tyagi, DGM and Dr. Avinash C. Tyagi, Director, Climate and Water Department, WMO

Head of Technical support unit and Director of Climate and Water Department, World Meteorological Organization, Dr. Avinash C. Tyagi, visited India Meteorological Department on 15th July 2009. He discussed with DGM and Senior Officers about various aspects related to regional climate change, and the need for closer cooperation between India Meteorological Department and World Meteorological Organization.

Loughborough University, U.K. Delegation

Prof. R. L. Wilby, Chairman of Hydroclimatology, Loughborough University, U.K. and his team visited IMD, New Delhi on 31st July 2009 to discuss and explore possibility of regional Scientific cooperation to reduce vulnerability and enable adaptation to risks by climate variability and changes.



The delegation was welcomed by DGM in the Conference Hall, Mausam Bhawan, New Delhi followed by a meeting with senior officers of the department. The concerned heads of the divisions were also present during the meeting to discuss the basic purpose to facilitate research collaborations between Indian and UK research communities on various subjects.

Dr. Russ Schnell, Dy. Director GMD, NOAA, USA visited India Meteorological Department, New Delhi and delivered lecture on “Emerging Atmospheric Trends over the Globe” on 8th October 2009.

MFI Delegation

The MFI delegation team comprising Mr. Patrick Benichou, Chairman and Mt. Hubert Brunet, Senior Forecaster, visited DDGM (WF), Pune on 8th October 2009. A meeting was held with DDGM (WF), Pune along with Dr. Medha Khole and Sunitha Devi. The delegation was briefed about ongoing activities and day-to-day function of weather systems. In this context a sub committee report on “Thresholds of weather warning in Meteo Factory” was submitted to DGM office, New Delhi.

DG Met. Dept. Sri Lanka

Mr. G. B. Smarasinghe, DG, Sri Lanka Meteorological Department and Permanent Representative with WMO visited IMD, New Delhi from 18 to 22 November, 2009, sponsored by WMO for study tour/ familiarization with the activities and programmes including training facilities of IMD.

Russian Federation

A 6 member Russian delegation visited IMD, New Delhi for the 6th meeting of the Indo-Russian Sub-Working Group in Meteorology during 7 to 10 December, 2009.

Foreign Visits

Shri A. K. Sharma, DDGM, Sat. Met. visited, Kathmandu, Nepal, regarding installation of INSAT / MET SAT, Digital Meteorological dissemination (DMDD) receiving system in Nepal from 4th to 10th February 2009.



DMDD receiving system at Kathmandu

Dr. M. Mohapatra, Director participated in WMO Assessment Mission at Myanmar in the restoration of Hydro Meteorological network affected by Cyclone “NARGIS” during period from 9-13 February 2009.

Shri B. K. Bandyopadhyay, DDGM (S) was on tour to Muscat, Oman to participate in the WMO/ESCAP Panel meeting and High Level Policy working group meeting during 27th February to 3rd March, 2009.

Dr. M. Mohapatra, Dr. Y.V. Rao, Dr. O.P. Singh & Dr. A.K. Srivastava, Director were deputed to Muscat, Oman to participate in the International Conference on Tropical Cyclone and Climate Change from 8-11 March 2009.

Shri B. Mukhopadhyay, DDGM visited Switzerland, Geneva to participate in IInd Session of Security Council Working Group on WMO strategic and Operational Planning from 16-18 March 2009.

Dr. G. C. Debnath, Director and Shri G. K. Das, Met-II, proceeded on tour to Toulouse, France on 13th for attending synergic training under MFI project during 16th March to 16th April 2009.

Dr. L. S. Rathore, Head, Agromet and Dr. N. Chattopadhyay, Director were deputed to attend International Workshop on Content, Communication and use of Agrometeorological product and services and sustainable agriculture at Toowoomba, Australia from 18-21 March 2009.

Shri D. K. Malik and Shri P. C. Chaturvedi, Director were deputed to Maldives from 25-29 March 2009 for Commission digital MDD.

Shri L. R. Meena, DDGM was deputed to attend 14th Session of the WMO Commission for basic Systems from 29 March - 2 April at Dubrovnik, Croatia.

Shri Thakur Prasad, DDGM (C), Pune was deputed to Beijing, China to participate in the 50th Session of the Forum on Regional Climate Monitoring Assessment and Prediction for Asia (FOCRA II) from 6th to 8th April 2009.

Dr. Somenath Dutta, Director (Training), Pune was deputed to Seoul, Republic of Korea to attend the Regional Training Seminar for National trainers of RA-II and RA-V on National Training, Coaching and Monitoring practices from 27th April to 1st May 2009.

Dr. M. Mohapatra, Director was on deputation to National Climate Data Centre, NOAA Asheville, USA to participate in the International Best Track Archives for Climate Stewardship (IBTrACS) workshop during 5-7th May, 2009.

Dr. S. D. Attri, Director was deputed to Geneva, Switzerland to participate in Global Atmospheric Watch Workshop during period from 5-7th May 2009.

Shri B. Mukhopadhyay, DDGM(DM) on deputation to Dublin, Ireland from 13-15th May 2009 to participate in the 1st Joint Committee Meeting of the Working Group on Science & Technology Co-operation.

Dr. N. Chattopadhyay, Director attended the International Workshop on 'Content, communication and use of Agrometeorological products and services for sustainable agriculture' and expert team meeting on 'Contents and use of Agrometeorological Products by farmers and extension services (ETCUAP)' at Toowoomba, Australia during 18-21 May, 2009.

Shri S. K. Banerjee, ADGM (H&I) was on Ex-India deputation to Birmingham, U.K. to attend Group Meetings of ISO-TC-113 'Hydrometry', as part of the Indian Delegation from 17th - 23rd May 2009.

Dr. Ajit Tyagi, DGM visited Geneva, Switzerland to attend 61st Session of Executive Council Meeting of WMO from 3-8 June 2009. The WMO Executive Council addressed a range of WMO programme on topics that

promise to enhance the capability of NMHSs of its 188 member to provide critical weather, water, climate assessment and services.

Dr. A. B. Mazumdar, DDGM (WF) attended the seminar on "Interaction between westerly and easterly troughs and their impacts on weather over the SAARC region", held at Islamabad (Pakistan) from 8-9th June 2009.

Shri C. N. Shaligram, S.O. was deputed to Hanoi, Vietnam for Training Workshop on Climate variability and prediction for South Asia eastern and South eastern Africa for the period 22-29 June 2009.

Dr. K. Ghosh, Met.-I and **Shri O. P. Sreejith**, Met. Gr.-II proceeded on deputation to International Research Institute (IRI), Columbia University, New York, USA for training in the Development and Application of Extended Range Forecast System (ERFES) for Climate Risk Management System in Agriculture for six months from 6th July 2009.

Dr. Ajit Tyagi, DGM visited Tokyo, Japan to participate in the Tokyo Climate Conference for better climate information for safe and sustainable society from 6-8 July 2009. Under the auspices of World Meteorological Organisation. Over 70 prominent scientist and experts participated in this conference, including representatives from National Meteorological and Hydrological Services (NMHSs) and user organizations of climate information in 24 Asia-Pacific countries and 8 relevant International organizations. The discussions were made to facilitate the provision and application of user-oriented climate information through the enhanced collaboration between climate service providers and users.

Shri N. Y. Apte, DDGM (H) was deputed to attend Expert Group Meeting on Innovative Strategies for Urban Flood Management Considering Climate Change in Asia-pacific from 21-23 July 2009 at Bangkok, Thailand.



DG, IMD 8th from right

Dr. O. P. Singh, Director Satmet participated in MOCA-2009 Symposium at Montreal, Canada during 19th to 29th July 2009. He delivered a lecture on Indian ocean tropical cyclones.

Dr. S.C. Sahu, Director, M.C. Bhubaneswar, was deputed to attend the Planning Meeting on Health Warning System from 21-24 July 2009 at Shanghai, China.

Shri B. K. Bandyopadhyay, DDGM(S) was deputed to Dhaka for attending International Programme Committee during 2-3rd August 2009.

AVM (Dr.) Ajit Tyagi, Director General of Meteorology visited Trieste, Italy during period from 5-7 August 2009 to attend WMO sponsored meeting of Director General of National Meteorological Services in South Asia for development and Implementation of south Asian Climate outlook Forum during Targeted Training activity held on 6th August 2009.

Shri A. K. Das, Met.-II was deputed to Dhaka, Bangladesh from 4-8 October 2009 to attend SAARC Training Workshop on “Weather, Research and Forecasting”.

Dr. S. K. Roy Bhowmik, Director, NHAC (Computer) was deputed to participate in the WMO CBS Expert Team on Ensemble Prediction ... Exeler, U.K. during the period 5-9 October 2009.

Shri D. Jordar, Director, was deputed to participate in 15th WMO International Symposium on “Data Assimilation” at Melbourne, Australia during 5-9 October 2009.

Dr. M. Mohapatra, Director was deputed to attend 2nd International Workshop on Tropical Cyclone Landfall Processes (IWTCLP-II) during the period from 19-23 October 2009 at Shanghai, China.

Shri D. Pradhan, Director, CDR Kolkata was on deputation to Jakarta (Indonesia) to attend Radar workshop organized by BMKG (Agency of Meteorology, Climatology and Geophysics, Indonesia) during 19-24 October, 2009. Shri Pradhan, Director delivered a series of lectures on Doppler Weather Radar, interpretation of its derived products and their utilization in Nowcasting.



Shri A. K. Bhatnagar, ADGM was on deputation to Dhaka, Bangladesh to attend 15th Governing Board of SMRC, Dhaka from 26-27th October 2009.

Shri B. K. Bandopadhyay, DDGM(S) was on deputation to Australia from 2nd to 5th November 2009 to attend the Sixth Tropical Cyclone (TC) RSMCs/TCWCs Technical Coordination Meeting (TCM-VI) in Brisbane.

Dr. Jayanta Sarkar, Director attended an Inter-Regional Workshop on “Indices and Early Warning Systems for Drought” held at Lincoln, Nebraska, USA during 8-11 December 2009 and presented a paper entitled “Drought indices in South Asia”.

Dr. (Mrs.) Surinder Kaur, Scientist (E) was deputed to attend the 5th Meeting of the GEOSS Asia Water Cyclone Initiative (AWCI) International Coordination Group(ICA) and Satellite data Training Course and Workshop during the period 15-18 December 2009 at Tokyo, Japan.

Shri N. K. Pangasa, Director attended WMO – ITU Seminar on Use of Radio Spectrum for Meteorology for Weather, Water, and Climate Monitoring and Prediction at Geneva, Switzerland.

Training Abroad Under Modernisation Programme

Dr. G. C. Debnath, Director and Shri G. K. Das, Met-II, proceeded on tour to Toulouse, France on 13th for attending training under MFI project during 16th March to 16th April 2009.

Shri V. K. Soni, Met I deputed to Germany for GAWTEC (Global Atmosphere Watch Training & Education Centre) Training Course at Environmental Research station Schneefernerhaus (UFS) in Germany from 22nd March 2009 to 4th April 2009.

Training on O&M of DWR

Y.V. Younus, Director, CDR, Mumbai, Manik Chandra, Director, R.C. New Delhi, J.P. Gupta, Director, M.C. Lucknow, Rakesh Kumar, Meteorologist, II DDGM(UI), New Delhi, G.D. Sonaware, S.O, J.B. Lone, S.O. Y.G. Salam, S.O., Anoop K. S.O., Lokesh Kumar, S.O, W. Khan, S.O., from IMD were deputed for twelve week Familiarization Training on operational and maintenance of DWR at Beijing with effect from 8th February – 4th May, 2009.

Shri A. Chandra, Director, P. Sunil, R.P. Jayanti, S.M. Metri, Sanjay O. Neill, P.S. Biju, Y.V. Pathak, Pillulla S. Sastu, K.M. Gedam, A. Velappan, R.S. Tambe, R.K. Pichuka, were deputed for 12 weeks training in operation and maintenance of Dopplar Weather Radar (B-II) in Beijing, China from 30th September 2009.

Transmit (FAT) and Synergy (FAT) Training

14 officials from IMD were deputed for Technical Training Cum (FAT) Batch II and transmit (FAT) and Synergy (FAT) training to Toulouse, France. They are Dr. S.L. Singh, Saurav Adhikari, Shankar Nath, Ms S. Sarkar, from 9-22nd March 2009, Shri Ganesh Das, D. Saha, Naresh Kumar, M.L. Sahu, Sunil Das, S.

Stella, Ms Sunitha Devi period from 16th March to 10th April 2009 and Dr. K. S. Devi, Medha Khole, G.C. Debnath for the period 16th March – 16th April.

‘RTSMN System’ Training

A team of IMD officers comprising Shri R. S. Dattatrayam, Shri P. R. Baidya, Shri G. Suresh and Shri J. L. Gautam visited the factory site of M/s. Nanometrics Ins. Inc. at Kanata, Canada during the month of April, 2009 for hands on training on various hardware and software related aspects of Real Time Seismic Monitoring Network (RTSMN) system established by IMD as part of Indian Tsunami Early Warning System.



Training for O&M Automatic Rainuage

Training for Operational and Maintenance Automatic Rainuage (ARG) M/S Jinyang Industrial, M/s Jinyang Co. Ltd., Ansung, Republic of Korea was conducted from 15th June 2009. 10 Officers S/Shri Rudra Pratap, Director, A. Anjan, Met. Gr. II, S.M. Natu, Asstt. Met. II, S. Ganamurthy, Asstt. Met., S.G. Nanaware, S.A., B. K. Panda, S.A. R.K. Mohapatra, S.A. Ravi Bhatt, S.A., S. Chakraborty, S.A. and Sanjiv Kumar, S.O.

Dr. D. S. Pai, Director went on deputation to ICTP, Trieste, Italy to attend the Targeted Training Activity (TTA): Predictability of Weather and Climate Theory and Applications to Intra-seasonal variability from 27th July 2009 to 7th August 2009.

Shri Anand Kumar Sharma, Director, Meteorological Centre, Dehradun and other nine IMD officers, were deputed to France for MFI – Synergy Forecasting Training from 30th Aug to 25th Sep 2009.

Dr. M. Mohapatra, Director (Cyclone Warning) was deputed for MFI training at France during 30th August to 25th September 2009.

Shri Rajiv Sharma, DDGM(A&S) and Shri D.K. Nim, Finance Officer were deputed at M/S Toulouse, Paris, France for Evaluation of administrative, Technical Training and Smooth Timely implementation of the project during 31st August - 4th September 2009

Dr. S. Balachandran, Director, RMC Chennai has proceeded for training on “Synergie Forecaster Training” for about one month from 31st August 2009 at Toulouse, France.

Dr. S. C. Sahu, Director was deputed to MFI Toulouse, France for training on Synergie forecasting from 31st August to 25th September 2009.

Shri P. N. Prasad, A.M.-II of Bangalore was deputed for 12 week Software Source Code training for Doppler Weather Radar at M/s Sigmet Vaisala, USA during September-November 2009.

Dr. S. R. Ramanan, Director, ACWC Chennai was deputed to France for “MFI Administrator training”.

Shri B. P. Yadav, Director was deputed to Toulouse, Paris, France for MFI training on “Public weather service and TV System”.



**Dr. Anand Sharma, with trainer at MFI France
Ms. P. Dupoy and Ms. N. Cerisier
during lecture on Radar Synergier**

Factory Training Under Varsamana Project



IMD officers at Toulouse France

Four Officers, Shri Shiv Ganesh, Director, Shri K. G. Suresh Kumar, Director, Shri A. D. Tathe, Met. Gr.-I and Shri Kuldeep Srivastava, Met. Gr.-II went on deputation to Toulouse, France from 24th August to 18th December 2009 for CIPS Factory Training and Technical Involvement under VARSAMANA Project.

Shri R. P. Sharma, A.M.-II proceeded for Synergie Administration training at Meteo France International (MFI), Toulouse in France during 29th November - 4th December, 2009.

Tours

Dr. P. Guhathakurta, Director was on tour to Delhi to participated in a seminar at TERI, New Delhi on 3rd February 2009.

Dr. R. Suresh, Director was on tour to AMO Hyderabad during 4 to 6th February to get familiarized with the functioning of Integrated CWIS.

Dr. A. B. Mazumdar, DDGM (WF) was on tour to O/o DGM, New Delhi to attend review and brainstorming meeting during 19-21st February 2009 & presented Salient feature of monsoon 2008.

Shri N. Y. Apte, DDGM (H) was on tour to attend the 30th meeting of Working Group of NIH on 8-9th April, 2009 at Roorkee.

Dr. A. Kashyapi, Dir. and Shri. I.J. Verma, Dir. were on tour to B.A.U. Ranchi in connection with training to Technical Officers on use of crop simulation model to develop application tools for decision making in agro-advisory from 12th to 15th May, 2009.

Shri Gajendra Kumar, Met.-I of DDGM (UI), New Delhi along with MFI team was on tour to M C Patna from 21-23 May 2009 regarding GPS instruments at MC Patna.

Mr. Y. K. Reddy, Director, MC Hyderabad was on tour to CDR Chennai from 28-29th May in connection with restoring serviceability of DWR Machilipatnam.

Shri R. S. Dattatrayam, Director (Seismo), New Delhi was on tour to Shillong and visited the Observatory on 24th June 2009.

Shri A. C. Lyngdoh, Meteorologist incharge, CSO, Shillong was on tour to DGM (Seismo), New Delhi during 1st week of July 2009 in connection with Familiarization of Hydra software.

Shri J. Tamil, Mech Gr.-I was on tour to Seismo, Tura for installation of MEQ Recorder/Sensor from 10th to 13th July 2009.

Dr. H. R. Hatwar, ADGM (R) was on tour to Delhi during 28th to 30th July for attending meeting in the Office of Planning Commission.

Shri G. K. Das, Met.-II, Shri P Roy and A Kundu SAs were on tour to DGM, New Delhi to attend NWP man power training during period 12th August to 12th September, 2009.

Dr. R. Suresh, Director was on tour to Hyderabad to participate in a contemplated Indo-Japan project titled “Information Network for Natural Disaster Mitigation and Recovery” and attended a meeting held at Indian Institute of Technology, Hyderabad on 21st August 2009.

Shri A. C. Lyngdoh, Meteorologist in charge, CSO, Shillong was on tour to IMD HQ New Delhi from 19th August 2009 to 22nd August 2009.

Shri S. B. Thampi, Director, CDR Station Chennai, was on tour to New Delhi on 4th and to Bangalore on 24th & 25th August, 2009 for attending the 1st & 2nd meetings in connection with preparation of document on ‘Expression of Interest’ related to procurement of DWRs under Phase II.

Shri P. A. V. Nampootheri, Met.-I was on tour to Goa to attend the de-briefing function at NCAOR, Goa to felicitate the expedition members of winter team of 25th INSEA and 26th INSEA on 15th September 2009 and on 18th December 2009.

Dr. A. B. Mazumdar, DDGM(WF) was on tour to New Delhi from 18 - 20 October 2009 to attend meeting organised between representatives of Meteo France and IMD on the subject to define the “Early warning and heat wave management in India.

Dr. H. R. Hatwar, ADGM(R), was on tour to Delhi during 3rd to 5th November to attend the second India Disaster Management Congress (IDMC-2) held at Vigyan Bhawan, New Delhi. He delivered a talk on “Challenges in tropical Cyclone forecasting” in the same and chaired the session – IV under the thematic session “Cyclone & Severe Local Storm”.

Dr. (Mrs.) Kamaljit Ray, Director attended state level meeting called by Chief Minister, at Sachivalaya Gandhinagar on 11th November and briefed about latest position & action taken on “PHYAN” cyclone.

Shri A. C. Lyngdoh, Meteorologist in charge, CSO, Shillong was on tour to Imphal, Manipur in connection with supervision of construction of Seismic Pillar from 15th – 17th November 2009.

Dr. A. B. Mazumdar, DDGM (WF) was on tour to New Delhi to attend forecast verification committee meeting on 9th and 3rd Annual Review meeting of the Integrated Agromet Advisory Services (IAAS) during 10-12th December 2009 at IIT, Roorkee, Uttarakhand.

Distinguished Indian Visitors

Dr. Narendra Jadhav, Vice Chancellor, University of Pune visited Pune, Meteorological Office on 29th April 2009. He had discussions with ADGM (R) and all Heads of offices at Pune.

Dr. Shailesh Nayak, Secretary, MoES, visited Satellite Meteorology Division on 29th April 2009 and had detailed discussion with Senior Officers of the Division. He gave valuable suggestions for improving the functioning of the Satellite Division.

Visit of Hon'ble Minister of State, MoES



The Hon'ble Minister of State, MoES Shri Prithviraj Chavan, alongwith Secretary, MoES, Dr. Shailesh Nayak, visited India Meteorological Department on 23rd June 2009. AVM (Dr.) Ajit Tyagi, DGM, and other senior officers of the department welcomed him. DGM apprised him of the current status of summer monsoon. He also gave a brief presentation on various activities of IMD.

DGM's visits at Pune

DGM visited Pune office during period from 21-24 December 2009. He discussed about ongoing training programs, MFI related CPWD work,

NAL computer, training to NAQI, Scientists at Pune and about guest faculties who are invited for next 3-4 months for the Advanced Met. Training course of batch no. 170.

Prof. M. C. Varshneya, Vice Chancellor of Anand Agricultural University, Gujarat visited ADGM(R) office, Pune on 22 July 2009 to discuss regarding the scheme Rainfall Forecasting, prepared and submitted by him to the MoES for approval. A meeting was convened under the chairmanship of ADGM (R) on 22 July 2009 which was attended by all the Heads of the offices and a few officers from Pune offices.

Dr. M. K. Gupta, Member (BBMB)

Dr. M. K. Gupta, Member (Irrigation), Bhakra Beas Management Board (BBMB), visited Pune Met. Office on 21st April 2009, and had discussions with Dr. H. R. Hatwar, ADGM (R), and all Heads of offices at Pune. Dr. G. Krishnakumar, Director and Dr. P. Guhathakurta, Director also attended the meeting with members of Bhakra-Beas Management board on "Hydrology Project II activities – Data Management" and briefed about NDC activities.



12. INTERNATIONAL COOPERATION IN METEOROLOGY

India is a founder member of the International Meteorology Organization (IMO), which was later, constituted as World Meteorological Organization (WMO), a specialized agency of the United Nations. The WMO Executive Council is responsible for implementation and coordination of the programmes of WMO and its constituent bodies.

IMD continued to provide data services to the international community through the Regional Telecommunication Hub of WMO located at New Delhi. The Regional Specialized Meteorological Centre for Tropical Storms continued to provide advisories and warnings for all the tropical storms formed in the north Indian Ocean. The WMO recognized Regional Meteorological Training Centres (RMTC), Pune provided training to candidates from South East Asia, Africa and Middle East countries.

Indo-Maldives Cooperation Programme

An MOU for cooperation in Meteorology was signed on 15th January, 1990 between India and Maldives for setting up data receiving system in Male. The entire project was on gratis from Govt. of India. IMD continues to provide technical support for maintenance of the system. A new Digital Meteorological Dissemination (MDD) receiving system was installed in Male, Maldives in July 2009 and training provided to their officers and staff.

Indo-Nepal Cooperation Programme

IMD has signed an MOU on 9th September, 2004 with Department of Hydrology & Meteorology, Nepal for cooperation in the field of Weather Forecasting. Under this arrangement an INSAT/METSAT Digital Meteorological

Data Dissemination (DMDD) receiving system has been installed by IMD in Kathmandu in February, 2009.

Indo-Sri Lanka Cooperation Programme

IMD under Indo-Sri Lanka Sub-Commission in Science and Technology supplied Meteorological Data Dissemination System in 1997. The system was functioning till 2004. A new digital MDD receiving system has been installed in Colombo, Sri Lanka by IMD in October, 2009 on gratis from Govt. of India. The training has also been imparted to officers and staff of Sri Lanka Meteorological Department.

Indo-US Cooperation

An MOU was signed on 16th December, 1997 between DST/DOS (India) and NOAA/ NASA (USA) for cooperation in Earth Atmospheric Sciences. Under the implementation of this MOU an INDO-US data exchange Center was established in Satellite Meteorological Division of IMD in 1998 for exchange of satellite data with USA. NASA, USA has provided a dedicated communication link of 512 kbps with full duplex capability. IMD has been transmitting INSAT cloud imagery data every three hours to USA as per terms of agreement of the above referred MOU. IMD, New Delhi has been receiving data from GOES satellites of USA. The exchange of scientific data between the two countries also takes place through the same link. India Meteorological Department has now come under the new ministry named Ministry of Earth Sciences (MoES) formed by Government of India. In order to have better

interaction between IMD and NOAA/NASA of USA, a fresh MOU was signed on 16th April, 2008 between MoES (India) and NOAA/NASA(USA) for cooperation in Earth Atmospheric Sciences.

Indo-Russian Cooperation Programme

The Memorandum of Science & Technology Cooperation between India Meteorological Department (IMD) and the Russian Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET) was signed in Moscow on 30th June, 1994, establishing the Sub Working Group on Meteorology. The 6th Meeting of the Indo-Russian Sub-Working Group on Meteorology within the framework of MOU took place in New Delhi during 7 to 10 December, 2009. Dr. Vladimir Trukhin, Director, Department of Hydrometeorology and Human Resources, led the Russian delegation and AVM (Dr.) Ajit Tyagi, DG, IMD led the delegation from Indian side. The two sides considered the results the bilateral cooperation for the period since the 5th meeting of Sub-Working Group (Moscow, 15-18 October, 2002) and expressed their satisfaction with the progress made as well as with the joint activities that were implemented successfully for this period despite different obstacles including financial ones. Several areas viz., Tropical meteorological studies; Study of atmospheric Ozone, aerosols and UV-radiation; Weather modification studies; Ocean data assimilation; Predication of high impact weather events; Air pollution prediction and Green house gases (GHGs) monitoring and Marine Meteorology were identified for further development and implementation of cooperation. It was also agreed to organize cooperation on the implementation of the Global Information System Centres (GISC) at New Delhi and Moscow and exchange of data. Both sides also agreed for establishing cooperation in the field of hail suppression activities in India.

INDO-USAID on Climate Forecasting System

Under the collaboration programme, five sub-projects for improving Hydro Meteorological forecasting and Early Warning system in India were identified/ approved for scientific studies.

- Tropical cyclone forecasting & warning
- Local severe storms (including flash floods)
- Extreme temperatures
- Flood forecasting
- Forecast communication

15 short-term training components related with IMD were identified on the advance data assimilation, numerical weather predication and its application for severe weather predication. The training also includes technology transfer. Training processes started from July, 2006. Till date, 15-trainees from IMD have already completed training, returned to India and working towards implementation of their technical expertise and experience that they gained in USA. Two more officers participated in Panel discussions and Workshop on the Management of Hydro meteorological disaster in India at Colorado, USA during July, 2008.

SAARC-Activities

The Department is actively associated with South Asian Association for Regional Cooperation (SAARC) Programme and is a member of its Technical Committee on Science & Technology and Meteorology. DG, IMD is currently Member of Governing Board of SAARC Meteorological Research Centre (SMRC), Dhaka, Bangladesh. SAARC Disaster Management Centre (SDMC) has been established at National Institute of Disaster Management (NIDM), New Delhi, under

Ministry of Home Affairs. IMD has close cooperation with the Centre. IMD organized a workshop on “Use of Satellite Products in day to day Weather Forecasting Techniques” from 1 to 14 March, 2008 which was attended by 15 participants from SAARC member countries.

The first meeting of the International Programme Committee (IPC) of SAARC STORM (Severe Thunderstorm Observation and Regional Modeling) Project was held in IMD,

New Delhi during 13-14 April, 2009 and the 2nd meeting in , Bangladesh from 2 to 3 August, 2009. Under the project three pilot experiments have been conducted during April-May, 2006, 2007 and 2009. India has offered installation of 50 Automatic Weather Stations (AWS); 3 to 5 GPS (Global Position System) receivers for upper-air observation and one Doppler Weather Radar (DWR) (with breakup as follows: 25 AWS, 1 GPS receiver for Bangladesh; 10 AWS, 1 GPS receiver for Bhutan; and 15 AWS, 1 GPS receiver and 1 DWR for Nepal).



Representation of SCs, STs and OBCs

Group	No. of Employees				No. of appointments made during the calendar year 2009										
					By Direct Recruitment				By Promotion			By deputation			
	Total	SCs	STs	OBCs	Total	SCs	STs	OBCs	Total	SCs	STs	Total	SCs	STs	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Gr. 'A'	265	37	16	24	-	-	-	-	67	11	07	-	-	-	
Gr. 'B' Gazetted.	1050	158	68	-	-	-	-	-	632	110	26	-	-	-	
Gr. 'B' N/G	2145	377	80	230	-	-	-	-	70	14	04	-	-	-	
Gr. 'C'	2327	861	182	215	15	03	01	02	70	17	09	-	-	-	
Total	5787	1433	346	469	15	03	01	02	839	152	46	-	-	-	

PWD REPORT I

Statement showing the representation of the persons with disabilities in service
(01 January 2010)

Group	Number of Employees				
	Total	In Identified Posts	VH	HH	OH
1	2	3	4	5	6
Group 'A'	265	218	-	-	-
Group 'B' Gaz*	1050	732	-	-	-
Group 'B' N/G	-	401	-	-	02
Group 'C'	-	562	01	02	62

Note:- (i) VH stands for Visually Handicapped (persons suffering from blindness or low vision)
(ii) HH stands for Hearing Handicapped (persons suffering from hearing impairment)
(iii) OH stands for Orthopadeically Handicapped (persons suffering from locomotor disability or cerebral palsy).

* There is no DR in Group B Gazetted

ANNEXURE-III

PWD REPORT II

Statement showing the number of persons with disabilities appointed during the year (2009)

Group	Direct Recruitment								Promotion							
	No. of vacancies reserved			No. of Appointments Made					No. of Vacancies reserved			No. of Appointments Made				
	VH	HH	OH	Total	In identify Posts	VH	HH	OH	VH	HH	OH	Total	In identify posts	VH	HH	OH
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Group 'A'	*	3	3	6	-	-	-	-	NIL	NIL	NIL	-	-	-	-	-
Group 'B' Gaz	-	-	-	-	-	-	-	-	NIL	NIL	NIL	-	-	-	-	-
Group 'B' N/G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Group 'C'	-	02	10	13	-	-	-	01	-	-	-	-	-	-	-	-

Note:- (i) VH stands for Visually Handicapped (persons suffering from blindness or low vision)
(ii) HH stands for Hearing Handicapped (persons suffering from hearing impairment)
(iii) OH stands for Orthopadeically Handicapped (persons suffering from locomotor disability or cerebral palsy).

* Since no post found suitable for VH, it is therefore two posts reserved for VH will be utilized in HH and OH in Group 'A' level.



13. RESEARCH PUBLICATIONS

13.1 DIVISIONAL PUBLICATIONS

- The publication entitled “**Monsoon 2008 – A Report**” was published as an IMD Met. Monograph No “Synoptic Meteorology No. 7/ 2009”.
- Monthly “**Climate Diagnostics Bulletin of India**” for all the month year 2009 was brought out
- **Astronomical Bulletins** for all the 12 months of the year 2009 were issued.
- A report on **cyclonic disturbances over the north Indian Ocean during 2008** has been published by RSMC Tropical Cyclones, New Delhi.
- The follow up action report on **WNO/ESCAP Panel on Tropical Cyclones (PTC)-35** for the 36th meeting of PTC which was held during 2-6 March at Muscat.
- Two Biweekly Aridity Anomaly Reports for Northeast monsoon 2009 for the period 19th November to 2nd December and 3rd December to 16th December, 2009 were prepared. Quantitative crop yield forecast for Kharif rice was prepared for 26 meteorological sub-divisions for December, 2009 and issued.
- Ten Biweekly aridity Anomaly Reports for the Southwest monsoon season 2009 for the period 4th June 2009 to 21st October 2009 and Four biweekly Aridity Anomaly Reports for Northeast monsoon season 2009 for the period 22nd October 2009 to 16th December 2009 for five meteorological sub-divisions viz. Coastal Andhra Pradesh, Rayalaseema, South Interior Karnataka, Kerala and Tamil Nadu & Pondicherry were prepared and sent to various users and also uploaded in the departmental website.
- Twenty Weekly aridity anomaly maps for the period 4th June 2009 to 21st October 2009 were prepared and distributed to users.
- Quantitative Crop yield forecast for Wheat of 16 meteorological sub-divisions for the months of January to May 2009 was prepared and distributed to users.
- Quantitative Crop yield forecast (preliminary) for Kharif Rice for 26 meteorological sub-divisions for the months of August to December 2009 was prepared and distributed to users.
- Seventeen weekly Drought Outlook Maps for the period 4th June to 14th October 2009 were prepared and distributed to users.
- The Crop Yield forecast for Rabi wheat for 16 sub-divisions for February were prepared and sent to HQrs., New Delhi.
- National Climate Centre (NCC) Research Report No.10 “Impact of MJO on the Intraseasonal variation of summer monsoon rainfall over India” by D.S. Pai, Jyoti Bhate, O.P. Sreejith and H.R. Hatwar was published.
- Climate of West Bengal has been broughtout alongwith CD.
- The crop yield forecast for wheat for 16 Meteorological sub-divisions for April 2009 were prepared.

- A pocket-size, card-type calendar containing celestial events and compulsory holidays during the year 2010 was brought out.
- A special publication, in the form of a booklet on Total Solar Eclipse of 22nd July, 2009, which was the longest duration eclipse of the century and whose path of totality passed through India, was published by the Positional Astronomy Centre (PAC). The booklet contained various information on the event which was very useful to astronomers, sky watchers and all other users.
- An interactive dynamic web page was developed by the Positional Astronomy Centre (PAC) to generate data on sunrise-sunset and moonrise-moonset of any place if latitude and longitude of the place is supplied by the users.
- The Indian Astronomical Ephemeris for the year 2010, an annual publication of Positional Astronomy Centre, which mainly contains positional data of the Sun, Moon and planets, basic data on yearly positions of fundamental stars, diary of celestial events, calendric data, eclipse data, explanatory text and other useful information on astronomy, was published.
- The Centre brought out monthly star charts for 12 months during the year 2009 for giving a useful guidance for watching celestial objects in the night sky. The booklet contained brief texts explaining positions of objects in the sky and celestial diagrams showing positions for practical demonstrations.
- Publication of Atlas of “Hourly Mixing Height & Ventilation Coefficients in India” has been brought out which was released in the User’s Conference by the Hon’ble Secretary, MoES during July, 2009.
- Computation of Monthly Aridity Anomaly Indices for January 2009 was completed. Rastriya Panchang for 1931 SE in 14 different languages and for 1932 SE in 2 languages were published.
- The website of PAC was enlarged by incorporating a web page on Sunrise-set and Moonrise-set where data are generated in interactive mode by feeding latitude and longitude of any place.

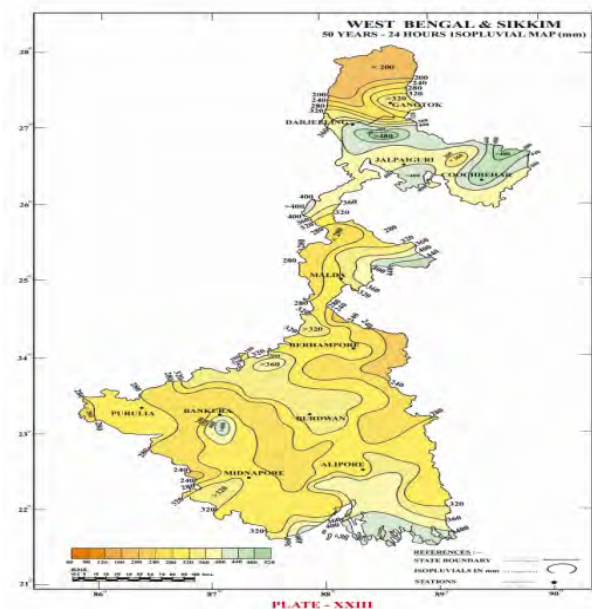
Archival of Manual Weather Charts



Under the plan scheme ‘Archival of manual weather charts into digital form, ADGM(R) office launched an online initiative on 17th July 2009 wherein “priceless” weather charts will be available at the click of a mouse. The weather charts are digitized and available in digital form since 1931. The charts can be accessed at <http://210.212.173.104>. M/s Midas Web Technologies Pvt. Ltd., New Delhi have completed uploading of 50,000 INOSHAC charts on NAS. The DVD’s were released on 17th by Dr. H.R. Hatwar, ADGM (R) in the presence of Smt. Prabhavati Akashi, Principal Information Officer, MOES/MSCT, New Delhi, Mr. Lue Chang-Ko, ICAO technical committee project development officer and Mr. Abdul Quadeer Quadir, President, Afghanistan Meteorological Authority.

Isopluvial Atlas of Eastern India Part II

Isopluvial Atlas has been issued by Hydrology Division, H.Q. New Delhi. It contains isopluvial maps of 2 year, 5 year, 10 year, 25 year, 50 year and 100 year, 24 hour rainfall for the states of West Bengal & Sikkim, Bihar, Jharkhand and North-Eastern States. This atlas provides fairly reliable estimates of rainfall at a particular point/area for different return periods. These maps may be used by design engineers of various public and private sector organizations for construction of small & medium hydraulic structures, like, dams, culverts, rail/road bridges, irrigation and drainage system etc.



Design Storm Study

Design Storm Study of Gondhala HE Project, Himachal Pradesh and Kharda Barrage, Maharashtra, have been completed and result intimated to the concerned project authority. Hadgaon (Wardha), Pulgaon Takli Dolari, Manjarpada, Gungashi, Takli Dolari Project, including Adan Project, Maharashtra Hidkal Project, Karnataka have been completed and result intimated to the concerned project authority.

Metnet : An Intra-IMD Portal

IT Division, now functioning as a Unit under ISS Division of IMD, was set up on 15th May 2008 to initiate a coordinated approach to standardize various in-house IT related activities, to implement e-governance concepts, create a suitable platform for availability and sharing of various information of the department and create an organisational setup which is tuned to use IT to optimize administrative and scientific activities. As a first e-governance initiative, an Intra-IMD portal named METNET was developed and operationally launched earlier with the URL <http://metnet.imd.gov.in>. The portal facilitated creation of a database for use in HR management and a suitable platform to initiate various e-governance applications.

Hindi Magazine Pavandoot

The first issue of annual Hindi magazine “Pavandoot” was released at the inaugural function of Hindi Fortnight celebration held at RMC Chennai on 1st Sep 2009. Smt. Radha Ramakrishnan, Member Secretary, Tolic/Dy. General Manager was the chief Guest for the inaugural function.



Weather Information on Web

MC Thiruvananthapuram has designed a website www.imdtvm.gov.in and has hosted the same during 2009. The site is updated with

daily weather report, weekly weather report, seasonal/weekly rainfall distribution (pictorial and tabulation form) and weather warnings like HRW and fishermen warning as and when necessary. Information about special phenomena like eclipse, earthquake etc. are uploaded.



As a routine, uploading daily city weather, local forecast and climatological normals in IMD's national portal.

Weather Information Through Telephone for cities of Kerala

Giving daily city weather information and local forecast and information about special phenomena like eclipse, earthquake and weather warnings etc to the media viz. T.Vchannels, Radio (AIR) and Newspaper (PTI and UNI). Uploading daily and forecast weather information comprising temperature and rainfall of major cities of Kerala in Interactive Voice Response System (IVRS).

13.2 LIST OF PUBLICATIONS / REPORTS / MET. MONOGRAPH, REPORTS ETC. DURING 2009

1. General Guidelines for Aviation Forecast (AG091/11 March 2009 issued by O/o DDGM (WF), Pune.
2. Revival of forecast manual for Vidharbha, Chattisgarh and Madhya Pradesh issued by O/o M.C. Bhopal.
3. Estimation of weekly potential evap-transpiration and Climate soil water balance for 144 locations in India, issued by O/o DDGM (Ag.), Pune.
4. Brochure on "Agro Meteorological Services in India" issued by O/o DDGM (Ag.), Pune.
5. Met. Monograph No. Climatology 23/2008 "A Fortran based software – CWCDSTAT to generate statistics on cyclones and depressions of North India Ocean" issued by O/o RMC, Chennai.
6. Atlas of state wise generalized isopluvial (return period) maps of northern India Part – IV" issued by O/o Hydromet Division.
7. Hydrometeorology of Yamuna Basin, 2009 issued by O/o Hydromet Division.
8. Manual of Hydrometeorology (Part-I), IMD, 1972, revised edition 2009 issued by O/o Hydromet Division.
9. Met. Monograph, No.17/2005 "Variability of Sowing dates over Andhra Pradesh" with CD ROM issued by O/o ADGM(R), Pune.
10. Monsoon – 2008 – A Report issued by O/o ADGM (R), Pune.
11. Climate Diagnostic Bulletin of India issued by O/o ADGM(R), Pune.
12. Monsoon – 2008 & Changing scenario over Gujarat issued by O/o M.C. Ahmedabad.
13. Indian Astronomical Ephemeris 2010 issued by O/o PAC, Kolkata.

14. Rashtriya Panchang 1931SE (2010-11 AD) in 14 languages and 1932 SE (2010-11 AD) in 2 languages issued by O/o PAC, Kolkata.
15. Sunrise Sunset and Moonrise Moonset tables for the year 2010 issued by O/o PAC, Kolkata.
16. Preliminary reports on cyclones BIJLI, AILA, PHYAN and WARD issued by O/o NHAC (CWC), New Delhi.
17. RSMC Report – 2009 issued by O/o NHAC(CWC), New Delhi.
18. Annual Review on Tropical Cyclones – 2007 issued by O/o DGM's Office (NHAC), New Delhi.
19. Met Monograph on Super Cyclone – “GONU” issued by O/o DGM's Office (NHAC), New Delhi.
20. Tropical Cyclones Operational Plan (TCP-21) – 2009 issued by O/o DGM's Office (NHAC), New Delhi.
21. Atlas on hourly mixing height and assimilative capacity of Atmosphere in India issued by O/o DGM's Office (EMU).
22. Meteorological Perspective of Air Quality Modelling issued by O/o DDGM(UI), New Delhi.
23. Manual for Balloon Releasing Ceremony on Republic Day and Independence Day issued by O/o DDGM(UI), New Delhi.
24. NCC Report No.10 issued by O/o ADGM(R), Pune.
25. Climate Diagnostic Bulletin of India (Monthly/Seasonal) for 2009 issued by O/o ADGM(R), Pune.
26. MAUSAM Vol. 60, Issues 1, 2, 3 & 4 (formerly Indian Journal of Meteorology, Hydrology & Geophysics) issued by O/o DGM (Publication), New Delhi.
27. Indian Daily Weather Report (IDWR) DDGM (WF), Pune.
28. Regional Daily Weather Report (RDWR) Regional Meteorological Centre.
29. State Daily Weather Report (SDWR) Meteorological Centres at State Capitals.
30. Weekly Weather Report (WWR) DDGM(WF), Pune.
31. All India Weather Summary (AIWS) (Daily) DDGM (WF), Pune.
32. Marine Climatological Summaries (Annual), (Decadal) ADGM(R), Pune.
33. Disastrous Weather Events (Annual) ADGM (R), Pune.
34. Seismological Bulletin (Monthly) DGM New Delhi.
35. Special Daily Weather Report (During Monsoon) H.Q. (NHAC), New Delhi.
36. Weekly Weather Report H.Q. (NHAC), New Delhi.
37. RSMC Report on Cyclonic Disturbances in the Indian Ocean (Annual) H.Q. (NHAC), New Delhi.
38. IMD NEWS-Quarterly News bulletins for 2009 issued by O/o DGM (Publication), New Delhi.

13.3 NON-DEPARTMENTAL PAPERS/ARTICLES

Paper entitled “A high resolution daily gridded rainfall dataset (1971-2005) for mesoscale meteorological studies” by M. Rajeevan and Jyoti Bhate was published in “current science, Vol.96, No., 25 February 2009”.

Water requirement and water use efficiency of groundnut by C.S. Patil, Met. Gr. II. Published in Journal of Agro meteorology.

Physical condition favourable for unusual excess rainfall over east coast over India during north east monsoon of 2005 by A. Muthuchami, S. Sridharan published in Journal of Association of Hydrologist India.

Meteorological perspective of Air quality modeling by S. D. Attri published in CETAS-2009, 297-300.

Dr. R. Suresh, Director as a co-author published a paper entitled, “Urban effects of Chennai on sea breeze induced convection and precipitation” in the Journal of Earth System Science 2008, Vol 117, p897-909.

Shri K. V. Balasubramanian, A.M.-II has submitted an article in Tamil on phenomena of occurrence of Total Solar Eclipse on 22 July 2009 to ‘Tamil Chudhar’ for publication.

Shri K. V. Balasubramanian, A.M.-II has submitted an article in Hindi on phenomena of occurrence of Total Solar Eclipse on 22nd July 2009 to ‘Rajasthan Patrika’ for publication.

S. K. Roy Bhowmik and V. R. Durai, has submitted Application of multi-model ensemble technique for real-time district level forecasts over Indian region in short range time scale, Meteorol. Atmos. Phy., 106, 19-35.

Soma Sen Roy, V. Lakshmanan, S. K. Roy Bhowmik and S. B. Thampi, Doppler Weather Radar-based Nowcasting of the Bay of Bengal Cyclone – Ognl of October 2006, J., Earth Sci. Sys, 119(2),183-199.

Kuldeep Srivastava, S. K. Roy Bhowmik, Soma Sen Roy, S. B. Thampi and Y. K. Reddy, Simulation of high impact convective events over Indian region by ARPS model with assimilation of Doppler Weather Radar radial velocity and reflectivity, Atmosfera, 23, 53-74.

S. D. Kotal, P. K. Kundu and S. K. Roy Bhowmik, An analysis of cyclo-genesis parameter for developing and non-developing low pressure systems over the Indian Sea, Natural Hazards, 50,389-402

S. D. Kotal, P. K. Kundu and S. K. Roy Bhowmik, An analysis of Sea Surface Temperature and Maximum Potential Intensity of Tropical Cyclone over the Bay of Bengal, Met Application, 16, 169-177.

Research paper entitled ‘Impacts of the floods on Indian Agriculture during south west monsoon’ by A. Kashyapi and Archana P.Hage presented in International Conference in Jammu on ‘Geo-environment-challenges ahead.’

Research paper entitled “Effect of diurnal variation of atmospheric and elevated levels of carbon-di-oxide (CO₂) and photosynthetically Active Radiation (PAR) on intercellular CO₂ concentration and rate of photosynthesis in maize (cv. Panchganga) and safflower (cv.Phule Kusuma) crops” by M.Rajavel et al.was accepted for publication in Journal of Agrometeorology, Anand.

The following abstracts of research papers were presented and published as the proceedings of the National seminar on ‘Agrometeorology-Needs, Approaches and Linkage for Rural Development’ organized by the Association of

Agrometeorologist (Hissar Chapter) and CCS Haryana Agricultural University during 26-27 November, 2009.

13.4 PUBLISHED AS PROCEEDINGS OF SYMPOSIA/WORKSHOP

- Climate variability over Gujarat by Dr. Kamaljit Ray Director, et al., published in Proceeding on International Workshop on Impact of Climate Change on Agriculture by ISRO, Ahmedabad.
- Monitoring and Prediction of Cyclonic Disturbances over North Indian Ocean by Regional Specialized Meteorological Centre, New Delhi (India) : Problems and Prospective, by M. Mohapatra, Ajit Tyagi and B.K. Bandyopadhyay – 2009 Proceeding / published in First International Conference on Indian Ocean Tropical cyclones organized by WMO at Muscat.
- The first ever super cyclonic storm “ Gunu” over the Arabian sea during 01-07 June, 2007 – A case study, Ajit Tyagi et al., - 2009 Proceeding / published on First International Conference on Indian Ocean Tropical Cyclones and Climate Change organized by WMO at Muscat.
- Characteristics of very severe cyclonic storm SIDR” over the bay of Bengal during 11-16 November 2007 by Ajit Tyagi et al., - 2009 proceeding / published on First International Conference on Indian Ocean Tropical Cyclones and Climate Change organized by WMO at Muscat during March 2009.
- Characteristics of very severe cyclonic storm “NARGIS” over the Bay of Bengal during 27th April to 3rd March 2008 by Ajit Tyagi, et al., - 2009 proceeding / published on First International Conference on Indian Ocean Tropical Cyclones and Climate Change organized by WMO at Muscat during March 2009.
- Inter-annual variation of frequency of cyclonic disturbances land falling over WMO/ESCAP Panel member countries by Ajit Tyagi et al., - 2009 proceeding / published on First International Conference on Indian Ocean Tropical Cyclones and Climate Change organized by WMO at Muscat during March 2009.
- Availability and quality of best track data sets of cyclonic disturbances over the north Indian ocean : Role of Regional specialized meteorological centre, New Delhi by Ajit Tyagi et al., - 2009 proceeding / published on First International Conference on Indian Ocean Tropical Cyclones and Climate Change organized by WMO at Muscat during March 2009.
- Forecast techniques and early warning system for land falling tropical cyclones over the north Indian Ocean by Ajit Tyagi et al., - 2009 proceeding / published on Second International Workshop on Tropical cyclone landfall processes (IWTCLP-II) organized by WMO and Shanghai Typhoon institute at Shanghai, China during 19-23 October 2009.
- Strategies for early warning of tropical cyclone to maximize relevance and effectiveness over India by Ajit Tyagi et al., - 2009 proceeding / published on Second India Disaster Management Congress organized by National Institute of Disaster Management at New Delhi during 4-6 November 2009.
- Characteristics features of land falling cyclones and cyclone prone districts of India by M. Mohapatra, G.S. Mandal, B.K. Bandyopadhyay and Ajit Tyagi – 2009 proceeding / published on Second India

Disaster Management Congress organized by National Institute of Disaster Management at New Delhi during 4-6 November 2009.

- Challenges in Tropical cyclones forecasting by H.R. Hatwar, Y.V. Rama Rao, M. Mohapatra and D.R. Pattanaik – 2009 proceeding / published on Second India Disaster Management Congress organized by National Institute of Disaster Management at New Delhi during 4-6 November 2009.

- Research paper entitled ‘Integrated Agromet Advisory services for coastal region of Kerala- Future Projection under Climate Change’ by R.P. Samui, M.V. Kamble and J.P. Sable was presented in the National seminar on ‘Climate change adaptation strategies in agriculture and allied sectors’ held at KAU during 3-4 December, 2009. The research paper was published in the proceedings of the National seminar.

- The publication entitled ‘Estimation of weekly potential evapotranspiration and climatic soil water balance for 144 locations in India’ was brought out.

- ‘Population dynamics of stem borer in relation to inter and intra-seasonal variation of weather and operational rice protection at Pattambi, Kerala’ by R. P. Samui, N. Chattopadhyay, J.P. Sable and P.V. Balchandran, pp-512-519. Published in ‘Journal of Agrometeorology’ Special issue- 2008 (Part II):

- ‘Some aspects of heavy rainfall activities associated with duration and intensity of floods over NE India’ by Sunit Das and R.P. Samui pp361-364. Published in ‘Journal of Agrometeorology’ Special issue-2008 (Part II)

- Crop Weather Calendars of Delhi, Punjab and Haryana were completed. By O/o DDGM (Ag) Pune.

- ‘Need based Agromet Services through better connectivity’ by R.P.Samui, L.S. Rathore, N. Chattopadhyay and M. V. Kamble published in ‘Journal of Agrometeorology’ Special issue-2008 (Part II):

- ‘Influence of weather factor on light trap catches of green leaf hopper at Pattambi, Kerala’ by J.P. Sabale, Chandana Karmakar and R.P. Samui. published in ‘Journal of Agrometeorology’ Special issue- 2008 (Part II):

- ‘New Challenges in dissemination of Agromet Advisory Services in India’ by N. Chattopadhyay, R.P. Samui and L.S. Rathore. published in ‘Journal of Agrometeorology’ Special issue- 2008 (Part II):

- Climate variability and adaptation in different regions of Asia with reference to Agriculture’ by A. Kashyapi, Deepa A. Kulkarni and Archana P. Hage. published in ‘Journal of Agrometeorology’ Special issue- 2008 (Part II):

- ‘Extreme weather events during southwest monsoon and mitigation through AAS’ by R. Balasubramanian, K. Ghosh, N. Chattopadhyay, R. P. Samui, M. Rajavel and B. Kurtkoti. Published in ‘Journal of Agrometeorology’ Special issue- 2008 (Part II):

13.5. INTROMET 2009

The following research papers were presented in INTROMET 2009, International Conference on Challenges and Opportunities in Agrometeorology held at New Delhi during 23-25 February, 2009;

- “Drought risk mitigation under climate change scenario in India” by R. P. Samui.

- “Weather based – crop protection stewardship in India with reference to rice pest management” by R. P. Samui.

- “Strategies for minimizing crop loss due to pest and disease incidences by adoption of weather based plant protection techniques through operational Agromet advisory services by Chattopadhyay *et al.*
- “Comparative study of diurnal rate of photosynthesis at various levels of carbon dioxide concentration for different crops” by A.Kashyapi *et al.*
- “Variation in consumptive use of water, crop coefficient and heat unit requirement of soybean crop at various growth stages in different agroclimatic zones ” by A.Kashyapi *et al.*
- “Influence of weather parameters on occurrence of early shoot borer of sugarcane at Anakapally, Andhra Pradesh” by Ghosh *et al.*
- “Use of crop models for water management in AAS ” by R. Balasubramanian *et al.*
- “Trends in climate variability and its impact on agriculture in Tamil Nadu” by M. Rajavel *et al.*
- “National Initiative to build S&T Capacity and Knowledge System for climate change in India” by Dr. Akhilesh Gupta, Adviser/Scientist-G, Department of Science & Technology.
- “Agrometeorology, Sustainable Agriculture and Food security”, by Dr. Anil Kumar Singh, Deputy Director General (ICAR), New Delhi.
- “In situ Urban Floods in India”, by Shri N.Y. Apte, India Meteorological Department, New Delhi.
- “Climate Change Impact on Water Resources in India”, by Dr. R.D. Singh, Director National Institute of Hydrology, Roorkee.
- “Controlling Kala-azar in Bihar by Ameliorating the Soil pH with Zinc Sulphate in House hold plastering materials”, by Prof. Sarman Singh, AIIMS, New Delhi.
- “Climate Change and Vector Borne Diseases in India”, by Dr. Ramesh C. Dhiman, ICMR, New Delhi.

13.6. Symposium on Weather Climate & Sustainable Development

The following research papers were presented in Symposium on Weather Climate & Sustainable Development held during 17-18 December 2009 at SCOPE Complex, New Delhi.

- “Global Framework for Climate Services” by Dr. R. K. Kolli, World Meteorological Organization, Geneva, Switzerland.
- “Weather and Climate Services in India” by AVM (Dr.) Ajit Tyagi, Director General of Meteorology, New Delhi.
- “Solar Resource Utilization in India”, by Dr. B. Bandyopadhyay, Director, Solar Energy Centre, New Delhi.
- “Developments in Environmental Meteorology”, by Dr. S. D. Attri and Shri B. Mukhopadhyay, IMD, New Delhi
- “Air Quality Management with Reference to Climate Change issues in India”, by Dr. B. Sengupta, Central Pollution Control Board, New Delhi.
- “Aerosols and Climate Change”, by Dr. P.C.S. Devara, IITM, Pune.

- “Integrated Agrometeorological Advisory Service”, by Dr. L.S. Rathore, IMD, New Delhi.
- “S&T Initiatives for Earthquake Risk Reduction in India”, by Dr. A.K. Bhatnagar, EREC, New Delhi.
- “Hydro-meteorological Disasters and Development of Early Warning Systems in the context of climate change”, by Shri D.R. Sikka, Retd. Director, IITM, Pune.
- “Tropical Weather Disturbances over the north Indian ocean and Climate Change”, by Dr. O.P. Singh and Dr. M. Mohapatra, IMD, New Delhi.
- “Past variability of the Indian summer monsoon : Records from the Arabian Sea”, by Dr. Manish Tiwari, NCAOR, Goa.
- “Strategic Implications of climate change”, by Dr. Ajay Lele, IDSA, New Delhi.

13.7 Books/Reports

- Utility of Automatic weather station (AWS) data for monitoring and prediction of monsoon circulations by M. Mohapatra, A.K. Sharma and Suman Goyal – 2009 published by IMD as Meteorological Monograph on Southwest Monsoon – 2008, 7/2009.
- Semi permanent systems and synoptic features by A.B. Mazumdar, Medha Khole, M. Mohapatra and S. Sunitha Devi – 2009 published by IMD as Meteorological Monograph on southwest Monsoon – 2008, 7/2009.
- Weather summary, analysis and preliminary evaluation of mesoscale model during pilot experiment of Severe Thunderstorms : Observations and regional modeling (STORM) Programme – 2009 by U.C. Mohanty et al., including Ajit Tyagi, B.K. Bandyopadhyay, B.P. Yadav and M. Mohapatra – 2009 published Research report by Ministry of Earth Sciences and Department of Science and Technology, Govt. of India.



14. PAPERS PUBLISHED IN MAUSAM DURING 2009

MAUSAM, 60, 1 (January 2009)

Pattern of meteorological parameters during severe thunderstorms- A frequency domain analysis

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Application of Neural Network Technique to improve the location specific forecast of temperature over Delhi from MM5 model

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Excess and deficient summer monsoon rainfall over Orissa in relation to low pressure systems

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Climatology of blizzards over Schirmacher Oasis, east Antarctica

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Meteorological conditions associated with very sluggish advance of Indian summer monsoon in 2002

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Variability in dynamic and thermodynamic parameters in cyclogenesis over north Indian ocean

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Incomplete Gamma distribution of rainfall for sustainable crop production strategies at Palampur, Himachal Pradesh

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Determining earthquake epicentre from a single 3-component seismological station

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Evaluation of different convective schemes on simulation of thunderstorm event over Delhi by ARPS Model

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Employment of MM5 in simulating MCSs developed in and around Bangladesh

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Evaluation of bias free rainfall forecasts and Kalman filtered temperature forecasts of T-80 model over Indian monsoon region

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Simulations of frequency, intensity and tracks of cyclonic disturbances in the Bay of Bengal and the Arabian Sea

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Verification of heavy rainfall warning over Bihar and Uttar Pradesh

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Precipitation regionalization of southwest monsoon by hierarchical cluster analysis

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Assessment of scale of hazards due to pool fire for a fossil fired power plant in India

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A study on parameters controlling water requirement of rice (*Oryza sativa* L.) at various phenophases in different agroclimatic zones

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Simulation of storm surge associated with cyclones land falling Bangladesh coast

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Hemispheric sea ice extent dynamics as observed from MSMR

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Secular variations and trends in the occurrence of monsoon synoptic systems and its impact on central India rainfall

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Role of mesoscale low and urbanization on exceptionally heavy rainfall event of 26th July 2005 over Mumbai : Some observational evidences

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An account of low level wind shear over Chennai airport - Part II : Turbulence and eddy dissipation

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Influence of actual evapotranspiration, growing degree days and bright sunshine hours on yield of finger millet

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Designing of a Quadrature Oscillator

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MAUSAM, 60, 4 (October 2009)

A diagnostic study on the energetics aspects of hiatus in the advance of southwest monsoon

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Sunshine duration climatology and trends in association with other climatic factors over India for 1970-2006

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Frequencies of drought at Ranchi regions, Jharkhand

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Characteristics of thunderstorms and squalls over Indira Gandhi International (IGI) airport, New Delhi - Impact on environment especially on summer's day temperatures and use in forecasting

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Evaluation of heavy rainfall warning over India during summer monsoon season

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Quantitative Precipitation Forecast (QPF) for Teesta basin and heavy rainfall warning over Teesta basin & adjoining areas in north Bengal & Sikkim using synoptic analog method

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Role and impact of Siberian High on the temporal variation of Indian northeast monsoon rainfall

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Simulation modeling of rice genotypes of yield and yield attributes at different nitrogen levels and different dates of transplanting using CERES 3.5 v for eastern Uttar Pradesh

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Journey of Mausam during last six decades

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Seamless prediction of weather and climate : A new paradigm for modeling and prediction research

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Development of Numerical Weather Prediction in India

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Simulation of extreme weather events over Indian region with the advancement of NWP systems

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Strategic implications of climate change

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Earth system science and its role in India's sustainable development in the context of climate change

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Climate change impact on water resources in India

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Role of agrometeorology in the context of climate change and variability

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Antecedents of the dry spells of the Indian summer monsoon

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Seasonal prediction of monsoon rainfall over India

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Local severe storms

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Role of aerosols in monsoon clouds and precipitation : An observational perspective

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Emerging trends in Environmental Meteorology

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Evolution of radar meteorology in India and latest trends in Radar Meteorology world over

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Evolution of Satellite Meteorology and its future scope

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A review of Indian contribution to the study of Polar Meteorology

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Forecasting the oceans : The oceanographic services from the Indian National Centre for Ocean Information Services

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Field experimental studies on Land-Ocean-Atmosphere interactions over the Indian region during 1999-2009

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Real time earthquake monitoring for early warning of Tsunamis in Indian Ocean region

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15. TRAININGS

Human resource development has always been one of the prime thrust areas of the India Meteorological Department for capacity building and to keep pace with latest trends in various activities of the Department. The Central Training Institute (CTI) of the India Meteorological Department (IMD) is a World Meteorological Organization (WMO) rated Regional Meteorological Training Centre (RMTTC), headed by Deputy Director General of Meteorology (Training), and is situated at a pleasant location at Pashan in Pune. IMD is the national meteorological and hydrological service of the country and the principal government agency in all matters relating to Meteorology, Seismology and allied subjects. Facilities for meteorological training at Pune and New Delhi have been recognized by the WMO to function as RMTTC in all the four main disciplines namely, General Meteorology, Radiometeorology, Telecommunication and Agrometeorology.

15.1 Training Courses at CTI, Pune

16.1 The Central Training Institute of IMD has a distinguished history dating back to 1942 when it had a humble beginning as an outcome of World War II wherein the need for meteorological training to the personnel working in IMD was acutely felt and, consequently, a formal training course started in that year. In 1943 a full-fledged training school started in Pune, India. Since then this training institute (CTI) has undergone dramatic changes in its training capabilities, composition, objectives, contents, etc, in catering to personnel covering all levels from Class I to Class IV. IMD also opened training centres at New Delhi for Upper Air Instrumentation and Meteorological Telecommunication in mid seventies. Since its

inception its mission has always been to achieve excellence in education researcher and service to meteorological community and thereby to the society.

Disciplines

General Meteorology, Hydro Meteorology, Telecommunication, Instrumentation, Agro meteorology, Data Processing.

Regular Courses

LAs Modular, Intermediate, Forecasters Training Course, Advanced Met. Training, Integrated Basic Met.

Special Courses

Hydrometeorology, Refresher Courses, Special Courses

AMFU scientists of 3 weeks duration was conducted from 02 March to 20 March 2009 at CTI, Pashan by Agrimet Division. AVM Dr. Ajit Tyagi, Director General of Meteorology inaugurated the training course. Total 30 candidates in the rank of Assistant Professor, Associate Professor from different SAUs working as Technical officers, Nodal officers, Advisory Board members from different AMFUs participated in the course. 70 lectures were delivered on different topics of atmospheric sciences including Agrometeorological data processing and drought study, crops, their agro-climatic requirement, irrigation scheduling and crop simulation modeling, Advisory services for the benefit of farmers, extreme events, livestock, pests & diseases and remote sensing.

Instrumentation Training

IMD instrument division has conducted three training courses during the calendar year 2009. They are :

1. Intermediate Course (Instrumentation) batch XXXIII commenced on 20 March 2009 and concluded on 17 July 2009.
2. Advanced Course (Instrumentation) Batch No. XXI commenced on 20 July 2009.
3. Intermediate Course (Instrumentation) (Special Batch) batch no. I commenced on 16 November 2009 for two months for Mechanical Assts. I.

Training on Crop Simulation Model and DSS

Training on use of crop simulation model to develop application tools for decision making in agro-advisory to Technical Officers for AMFUs was conducted in two states (i) Birsa Agricultural University, Ranchi during 12-15 May 2009 & (ii) Acharya N. G. Agricultural University, Hyderabad, Andhra Pradesh during 22-25 June 2009. The purpose of this training was to make users run DSSAT software for different crops in their zones/states and create data base for different cultivars of major crops, soil and weather parameters to support decision making in agriculture risk evaluation and assessment and adapt suitable management practices to use the resources judiciously and to minimize the adverse impact on agricultural production.

OLB System Training

A two day training workshop was held during 18-19 February 2009 on “Timely Dissemination and Briefing Aviation Weather through OLBS” at AMO Palam for officers/staff of AMO/AMS under RMC New Delhi. It was inaugurated by Mr. M. K. Bhatnagar, Director Aviation Service. There were fifteen participants from various Aerodrome Meteorological Offices/Stations from Northern India

Training in Agricultural Meteorology

Division of Agricultural Meteorology at Pune has been conducting following training courses in Agrometeorology for personnel from India and abroad.

- (i) Course for observers of agrometeorological observatories and short duration familiarization courses for the supervisors.
- (ii) Courses in agrometeorology for teachers of Agricultural Universities and Technical officers of Agrometeorological Field Units.
- (iii) Courses for meteorological personnel of Class III and Class IV from other countries under WMO fellowship and other programmes.
- (iv) Course for Class I Agrometeorologists (1 year duration).
- (v) Basic Agromet Course.

Training course on ‘Agrometeorology towards better advisories for serving end users requirement’ for AMFU Scientists/Technical officers was conducted during 18th January to 5th February, 2010. Moreover, other courses in connection with IAAS have also been planned.

Training course on 'Agrometeorology towards better advisories for serving end users requirement' for AMFU scientists was conducted from 02 March 2009 to 20 March 2009 at CTI, Pashan by the Agrimet Division.

Training Programmes at CTI, Pune for 2009-10

- Advanced Met. Training Course including newly recruited Gr. A officers
- Forecaster's training Course (2 batches /year)
- Intermediate General Met. Training Course (3 batches/year)
- Basic Integrated Training Programmes for new recruited scientific staff (2 batches /year)
- Lab. Assistant Modular Course
- Under HP II, training programmes for Hydrology for Basic, Supervisor and Senior Level officers from different state Governments, participating in the programmes.
- Conduction of Refresher/specialized training programmes for Aviation meteorology, Hydrometeorology, Mount Meteorology for Army and SASE ,NWP and Astronomy. Training Programmes for Radio Mechanics/Mechanics etc in Basic General Meteorology and Observational procedures.

Training cum Learning Program

Two days training cum learning program me to In charges of Agromet Field Unit in Punjab and Haryana was organized by M.C. Chandigarh in June and October 2009 for dissemination of District Agromet Advisory Services through SMS and IVRS.



Representative of Handygo and Reuter Market Light private operator already working in information system with whom IMD initiated Public Private Partnership imparted training to In charges of AFMU about the mechanism of dissemination of agromet information /services through IVRS and mobile phones to farmers of Punjab and Haryana.



Representative of the company imparting training to AMFU Incharges of Punjab and Haryana

Training at AMO Chennai

Eight duty officers (communication) and eighteen AMSS operators were imparted retraining on 3rd, 6th and 8th April 2009 at A.M.O Chennai. **Twelve Advanced Met Trainees** along with instructor from AFAC Coimbatore were imparted training on 7th May, 2009.

Hydromet Observer Course

A three week basic Hydromet observer course batch no. 1 (under Hydrology Project II) commenced w.e.f. 15th June 2009 with ten candidates from Goa.

Familiarization Training

RMC Mumbai had organised two days familiarization training for part time observers in Maharashtra on 17-18th June and M.C. Ahmedabad had organised familiarization training for PT observers in Gujarat on 23-24th June.

PC Applications

A short term course in fundamental of IT & PC applications, Batch-26, organized by Telecom Training Centre. Twelve IMD staff members attended this course

Refresher Course

A Refresher course for 10 Naval Met. Officers (Commanders) was conducted at C.T.I. during 13th and 24th July 2009.

Three trainees of 29th Antarctica Expedition were suitably instructed about recording of Meteorological observations on board ship. Software 'Turbowin' which is related to ship weather data was also explained to them.

Training in Doppler Weather Radar

Shri Manik Chandra, Director; Shri Rakesh Kumar, Met-II and Lokesh Kumar, SO from DDGM (UI) New Delhi and Shri A.K.Sen Director from RMC Kolkata have been imparted familiarization training in Doppler Weather Radar during 07-11th January.

Trainees from NIDM

About 25 trainees from NIDM visited NHAC on 18th March 2009. They were briefed about the role of IMD during occurrence of disaster

weather events, like, cyclones etc.. A presentation on Early Warning System was provided by Dr. M. Mohapatra, Director

15.2 IMD Officers in other Training program

Dr. R. P. Samui, DDGM (Ag) attended the inaugural function of the training programme on 'Fundamentals of Agricultural Meteorology' organized by the College of Agriculture, Pune on 08 January 2009 as chief guest and delivered a lecture on 'Indian agriculture under climate change scenario' to the trainees.

Dr. R. P. Samui, DDGM (Ag) attended the inaugural function of the training programme on 'Basic principles of Crop Micrometeorology' at CASAM, College of Agriculture, Pune on 18 February 2009 as chief guest.

Dr. S. C. Sahu, Director-I/C, participated as chief speaker for Orientation Training Programme to teachers of PROBE, Orissa at Jaipur, Orissa on 13th March.

Shri Dal Singh, Director and **Dr. A.P. Pandey**, Met-II participated in the SAARC training program on "Earthquake Disaster Mitigation" conducted and organized jointly by SAARC Disaster Management Centre New Delhi and I.I.T. Roorkee during March 30 – April 04, 2009 at I.I.T. Roorkee.

Shri G. K. Das, Met II, **S/Sri P Roy** and **A Kundu** SAs completed successfully of NWP Manpower training at New Delhi till 13th September 2009.

Shri A. C. Lyngdoh, Meteorologist in charge, CSO, Shillong was on familiarized training tour for Hydra software to DGM (Seismo), New Delhi.

15.3 Foreign Training of IMD officers

IMD is modernizing its observational facilities and infrastructure under its Modernization

Program Phase-I and a contract was awarded to M/s Meteo France International (MFI), a subsidiary of Meteo France, the national Meteorological Service of France for establishment of an end-to-end forecasting system comprising of Basic Design of the System, Consultancy & Integration, General Training, 5 Upper – Air Systems, Automatic Message Switching System (AMSS), Central Information Processing System (CIPS), Climatology System (CLISYS), Forecaster Graphic Workstation (SYNERGIE) & Public Weather Service (PWS). Sixty three IMD officers including a few officers from NCMRWF and Door Darshan, New Delhi were sent for training to France in various components of forecasting system.

Under modernization, IMD is procuring 12 nos. S-Band Doppler Weather Radar (DWRs) systems with the latest state-of-art technology for detection and monitoring of thunder storms, heavy rainfall, cyclones and severe weather events, to replace the existing 12 nos. old and ageing conventional type radars in its existing network. Twenty three IMD officers were sent for 12 weeks technical training in operation & maintenance of DWRs at the supplier's factory in Beijing, China during 2009. Factory Acceptance Test (FAT) was also conducted by two IMD officers in batches in Beijing, China during February to April 2009.

IMD is also procuring Satellite linked Automatic Raingauge (ARG) system (1350 nos.) with a TDMA type receiving Earth Station facility. Ten IMD officials were sent for 4 week technical training in operation & maintenance on ARG system at the supplier's factory, in south Korea w.e.f. 15th June, 2009.

To provide meteorological services for mega events of Common Wealth Games-2010 in New Delhi, a team of five IMD officers was sent to China Meteorological Administration (CMA),

Beijing, China for familiarization with the existing system used in Beijing Games-2008.

15.4 Nomintion of IMD officers

Dr. S. Balachandran, Director,RMC Chennai nominated for Board of studies (Physics), Bharathiar Unviersity as 'Industrial Expert' for the period 01 January 2009 to 31 December 2011.

Dr. R. Suresh, Director, AMO Chennai nominated as member of the Research Advisory Committee [RAC] of Society for Applied Microwave Electronics Engineering and Research [SAMEER] during May 2009.

Dr. R. Suresh, Director attended the selection committee meeting as an expert member as nominated by the Vice-chancellor of SVU, Tirupathi, for the recruitment of Junior Research Fellow [JRF] for DST & ISRO projects during 31st July 2009 and 1st August 2009.

Dr. A. Muthuchami, Director, MC Bangalore was nominated for participation in Seventh Annual NIAS –DST Training Programme on "Multidisciplinary Perspectives on Science, Technology and Society held during 10-22 August 2009.

Dr. R. Suresh, Director had been nominated as expert member of the Preliminary Design Review [PDR] committee constituted by Director, ISTRAC for C. Band Polarimetric Doppler Weather Radar of ISRO and attended meeting at M/S BEL, Bangalore during 12-13 October 2009.

Shri K. Ramachandra Rao, Director,CDR Machilipatnam nominated as 'Nominee Chairman' of the Vidya Management Committee of the Kendriya Vidyalaya, Machilipatnam.



16. PLAN SCHEME 2009-10

16.1 BUDGET ESTIMATE FOR F.Y. 2009-10 (NON PLAN)

	Rs./Thousand	
	Grant	Expenditure
Revenue Budget	2610534/=	2532773/=
Capital Budget	25000/=	8736/=
Total	2635534/=	2541509/=

16.2 BUDGET ESTIMATE FOR F.Y. 2009-10 (PLAN)

Revenue : 5850 Lakhs
Capital : 25188 Lakhs
Total : 31038 Lakhs

Plan Schemes Under Taken During 2009-10

00.101 Satellite Services

- (i) On goings projects on Space Meteorology continued from previous Five Year Plan.
- (ii) Installation and maintenance of DCWDS/CWDS.
- (iii) Establishment of INSAT-3D Met. Data Processing system and maintenance.
- (iv) Establishment of INSAT-3D Earth Station and maintenance.
- (v) Establishment & Maintenance of National Satellite Data Centre.
- (vi) Establishment & Maintenance of 5 GPS and peripherals and also augmenting the network to another 50 nos. GPS stations.

(vii) Establishment of Metop Satellite Data receiving and processing system and maintenance.

00.102 O W S, 01.01 Operation and Maintenance

On goings projects under Operation & Maintenance continued from previous Five Year Plan

ISSD

- (i) Modernization of communication facilities at field station at field observatories of IMD – High Speed Data Terminals.
- (ii) Establishment of Satellite based data receiving system.
- (iii) Procurement of 2 display systems for Main Gate of IMD and Palam.
- (iv) Interactive Voice response System.
- (v) Procurement of unified threat management system (Network Security Solution of IMD).
- (vi) Procurement of Trend Micro neat suite premier antivirus solution.
- (vii) Establishment of MPLs VPN Connectivity , Antivirus solution/LAN Security.
- (viii) Strengthening of internet band width and security and upgradation of LAN.

Hydrometeorology

- (i) Hydrology Project Phase-II.

(ii) Up gradation of Hydromet services of IMD.

ADGM(R) Pune

(i) Development of LRF capabilities and Upgrading of L&ERF capabilities -Upgradation of existing LRF unit.

(ii) Upgrading the L&ERF capabilities & Climate monitoring activities of NCC.

(iii) Archival of Manual Weather Charts into digital form.

(iv) Climatological Data Rescue Scheme.

DDGM (SI) Pune

(i) Establishment of UV radiation network.

(ii) Upgradation of existing Radiosonde/ozondesonde.

(iii) Procurement of radiation standard (Cavity radiometer).

(iv) Augmentation of radiation network: Installation of radiation instruments and procurement of Sunshine recorders.

(v) Various construction & rennovation works for Radiation, Surface and Airport Instruments workshops and Laboratories at Pune.

(vi) EMRC: Procurement of Sky radiometer, Aethalometer, Surface Ozone analysers.

(vii) Procurement of Hand held dataloggers-200 nos.

Forecasting Services (HQ)

(i) Forecast Development Programme.

(ii) Integrated Himalayan Meteorology (Project-PARVAT).

DDGM (UI)

(i) Procurement of 2 DWR (BEL) for Bhuj and Kochi.

(ii) Upgradation of calibration facilities & Establishment of testing facilities for digital Radiosonde.

00.200 O M S, 01 Agro Met Advisory Services

(i) Integrated Agromet Advisory Services.

(ii) Modernization of CAgMO, Pune.

00.800 Other Expenditure

01 Seismic Hazard and Risk Evaluation

E R E C

(i) Operation and Augmentation of VSAT based Delhi Telemetry Network.

(ii) Establishment of a VSAT based seismic telemetry network in NE India.

(iii) Continuation of E R E C.

(iv) Upgradation and replacement of old equipment related with Micro Earthquake (MEQ) survey.

Seismology

(i) Augmentation of NSN and NSDC facilities.

(ii) Optimum Seismological Network Programme.

(iii) Archival and digitization of seismic analogue charts.

03 Mod of IMD

- (i) Mod. of IMD Phase-I.

Multidisciplinary Schemes

- (i) M F I.
- (ii) High Performance Computing System (HPCS) for global data process and Numerical Weather priction (NWP) for weather forecasting Services in IMD.
- (iii) Regional, Zonal and field maintenance Centres for ARG and AWS.

DDGM (SI) Pune

- (i) Installation of Integrated AMI (additional sensors) at Hyderabad, Delhi, Chennai, Amritsar and Guwahati.
- (ii) Wi-Fi System for integrated and automated systems at 20 airports.
- (iii) Commissioning of automated weather stations AWS-550.
- (iv) Procurement of Digital Scrolling display-25 Nos.
- (v) Commissioning of automatic raingages (ARGs) 1350 Nos.

DDGM (UI)

- (i) Procurement of GPS system.
- (ii) Improvement of data quality at 13 Nos of existing stations by deployment of improved quality GPS radio sonde.
- (iii) Improvement of data quality through indigenous development/production.

(iv) Indigenous development of Radio theodolite and GPS Radiosonde along with Ground system.

(v) Design development and fabrication of MEMS sensors read about ASIC and conditioning electronics for IMD Radiosonde.

(vi) Design and development of MMIC transmitter at 1680 MHz for IMD radiosonde.

(vii) Commissioning of 65 Nos. of optical theodolite.

(viii) Commissioning of 5 Nos. Optical Electronic Theodolite.

(ix) Procurement of 12 imported DWR for Mumbai, Paradip, Goa, Karaikal, Delhi Airport, Patna, Lucknow, Nagpur, Mohanbari, Agartala, Patiala, Bhopal.

(x) Procurement of C-Band Polarized DWR at Delhi under Mod Programme and at Jaipur Under Common Wealth Games.

DDGM (ISSD)

- (i) AMC of AMSS at various locations.
- (ii) Web-based Briefing system at International Airports and Video wall for NWFC briefing room at New Delhi.
- (iii) Replacement of AMSS GHT and installation of new AMSS at Nagpur and Pune.
- (iv) Commonwealth Games and dedicated Weather Channel.
- (v) Metropolitan Weather Information and Forecast system for NCR of Delhi & CWG 2010.

17. IMPLEMENTATION OF OFFICIAL LANGUAGE POLICY

IMD is actively engaged in promoting the progressive use of Hindi, which is the Official Language of our country. Hindi Section at HQ, New Delhi is responsible for the implementation of the Official Language policy of the Government. It maintains coordination and liaison with the Department of Official Language (DOL), Ministry of Science and Technology, Ministry of Earth Sciences (MoES), Central Translation Bureau (CTB) and other Government offices.

In order to review, monitor and ensure progressive use of Hindi in IMD, Official Language Implementation Committee has been set up at HQ New Delhi and also at the other sub-offices outside Delhi. These committees at their quarterly meetings review and suggest means and measures to promote the progressive use of Hindi in IMD. The targets fixed in the Annual-programme issued by DOL discussed during these meetings and decisions taken to achieve the same.

The Department has been carrying out the important function of training its officials in Hindi, Hindi Typing, Hindi Stenography under the Hindi Teaching Scheme. In accordance with the government instructions and orders, adequate incentives and awards are being given to the officials who qualify Hindi examinations according to the prescribed standards. This has definitely generated among them encouragement and interest to complete the stipulated training courses successfully.

In addition to all major routine translation work, translation of Departmental website, telephone directory, annual activity report, press brief in respect of IMD foundation day, notification regarding recruitment rules of

A.M-I and Scientific Assistants etc. was prepared by Hindi Section.

Hindi workshops are being conducted periodically at HQ, New Delhi and sub-offices outside Delhi in order to impart training to the officials to enable them to do their administrative and technical work in Hindi.

Quarterly progress reports of HQ for all the four quarters were consolidated and submitted to the Ministry of Earth Sciences as well as Department of Official Language.

Quarterly progress reports of sub-offices reviewed and necessary guidelines issued. Minutes of the OLIC meeting of sub-offices reviewed and guidelines issued.

Total 36 officials were granted cash/lumpsum award for passing Hindi Prabodh/Praveen/Pragya/Typing/Stenography Examination meritoriously under Hindi Teaching Scheme.

"AAJ KA HINDI SHABD SCHEME" continued for giving valuable knowledge of words, idioms, phrases and sayings in Hindi.

Director (Publication/Hindi) Senior Hindi officer/Hindi officer regularly attended the OLIC meetings of MoES. DGM and Senior Hindi officer regularly participated in Joint Hindi Advisory Committee meetings of DST and Ministry of Earth Sciences.

Abstracts of the Sixty five research papers were translated in Hindi for the quarterly departmental research journal "Mausam".

All India Departmental Hindi Essay competition 2009 organised and results declared on the basis of recommendations of the evaluation committee constituted by DGM. In total eight officials working in different sub-offices and HQ participated in it.

Fourteenth Edition of Departmental Hindi Magazine "Mausam Manjusha" was printed and sent to all the sections, sub-Offices and other Ministries/ Departments.

Offices of Met Office Santacruz, Puri & Rs/RW Jodhpur were notified in the Gazette under the rule 10(4) of Official Language Rules 1976.

In order to review the progressive use of Hindi inspection of six sections were carried out by the Senior Hindi Officer and necessary guidelines issued.

Material of total 17 Departmental Manuals has been sent to Govt. press for printing.

Hindi software "Akshar Naveen" was installed in 06 computers of various sections of HQ in DGM's office.

Hindi pakhwara was celebrated at HQ from 1 September 2009 to 15 September 2009. Hindi Diwas was celebrated on 14 September 2009. The function was presided over by DGM. On this occasion besides other programmes, Certificates and prizes were given by DGM to the winners of various Hindi competitions organised during Hindi pakhwara. During this period Various competitions namely Hindi Essay, Hindi Typing, Hindi Noting and Drafting, Self-Composed Hindi poetry and Hindi Debate were organised for encouraging the use of Official Language.

Raj Bhasha Rolling shield for the year 2008-09 was given by DGM to DDGM (Administration and stores) for the overall best performance in Official Language.



18. IMPORTANT TELEPHONE LINKS IN IMD

NAME	DESIGNATION/OFFICE	EPABX New Delhi	OFFICE TELEPHONE NO. / FAX
AVM (Dr.) Ajit Tyagi	DGM	4201	011-24611842
Shri T.D. Chacko	Senior PS to DGM	4253	011-24611842
Shri Jagmohan Sharma	PS to DGM, New Delhi	4225	011-24611842
Shri A.K. Bhatnagar	ADGM(EREC), New Delhi	4548	011-24697473
Dr. L.S. Rathore	Head, Agro. Met. & ADGM, New Delhi	4240	011-24617518
Shri D.K. Nim	Finance Officer, IMD	4502	011-24623210
Shri Rajiv Sharma	DDGM (A&S), New Delhi	4210	011-24621472
Smt. Mamta Negi	PA to DDGM(A&S), New Delhi	4302	011-24621472
Shri L.R. Meena	Scientist 'F' (ISSD), New Delhi	4314	011-24616051
Shri A.K. Sharma	Scientist 'F' (Sat. Met.), New Delhi	4415	011-24626021
Shri B. Mukhopadhyay	Scientist 'F' (DM), New Delhi	4266	011-24615815
Dr. R.S. Dattatrayan	Scientist 'F' (Seismo), New Delhi	4405	011-24611305
Dr. S.K. Roy Bhowmik	Scientist 'F' (NWP), New Delhi	4266	011-4615815
Shri N.Y. Apte	DDGM(H&A), New Delhi	4223	011-24619167
Shri Surya Bali	DDGM(EREC), New Delhi	4579	011-24626814
Shri B.K. Bandyopadhyay	DDGM(S), New Delhi	4334	011-24611068
Shri S.Krishnaiah	Scientist 'F', LACD DDGM(SI), Pune		020-25535211
Dr. A.B. Majumdar	DDGM(WF) & LACD ADGM (R), Pune		020-25535886
Dr. R.P. Samui	DDGM(Agrimet.), Pune		020-25533420
Shri S.K. Prasad	DDGM(Training), Pune		020-25893330
Dr. A.L. Koppar	DDGM(Climatology), NDC, Pune		020 - 25535797
Shri B.L. Verma	DDGM, RMC, New Delhi	4213	011-24690279

Dr. R.V. Sharma	DDGM, RMC, Mumbai		022-22174706
Dr. Y.E.A. Raj	DDGM, RMC, Chennai		044-28276752
Shri S.N. Roy	DDGM, RMC, Kolkata		033-24793782
Dr. P.K. Nandankar	LACD DDGM, RMC, Nagpur		0712-2288554
Dr. H.G. Pathak	LACD DDGM, RMC, Guwahati		0361-2840206
Dr. Smt. S. Kaur	Scientist 'E', (Hydrology), New Delhi	4460	011-24693505
Shri M.C. Rastogi	Scientist 'E', (ISSD), New Delhi	4227	011-24624486
Shri M.K. Bhatnagar	Scientist 'E', (Organisation), New Delhi	4310	011-24619196
Shri A.A. Farqui	Scientist 'E', (Publication), New Delhi	4554	011-24642432
Dr. O.P. Singh	Scientist 'E', (Sat. Met.), New Delhi	4429	011-24698247
Shri Satish Bhatia	Scientist 'E', (DGM Sectt.), New Delhi	4513	011-24611710
Dr. A.K. Shukla	Scientist 'E', (EREC), New Delhi	4576	011-24616309
Dr. S.K. Peshin	Scientist 'E', (EMRC), New Delhi	4235	011-24635797
Dr. Mrs. Suman Goyal	Scientist 'E', (Sat. Met.), New Delhi	4434	011-24616835
Dr. S.D. Attri	Scientist 'E', (EMRC), New Delhi	4309	011-24620701
Shri B.P. Yadav	Scientist 'E', (NHAC), New Delhi	4398	011-24629798
Dr. M. Mohpatara	Scientist 'E', (CW), New Delhi	4304	011-24652484
Shri S. K. Kundu	Scientist 'E', LACD DDGM (UI), New Delhi	4245	011-24611451
Shri D.P. Mishra	Scientist 'E', (Radar Lab.), New Delhi	4224	011-24632234
Dr. G. Krishna Kumar	Scientist 'E', (NDC), Pune		020-25530992
Dr. Somenath Dutta	Scientist 'E', (CTI), Pune		020-25861161
Dr. J. Rajendra Kumar	Scientist 'E', (AMO), Palam, New Delhi		011-25654335
Shri S.C. Bhan	Scientist 'E', (DGM Sectt.), New Delhi	4513	011-24611710
Shri L.A. Siddiqui	Director (Finance), New Delhi	4487	011-24697640
Shri Vivek Sinha	Director (Establishment), New Delhi	4442	011-24693661
Shri A.K. Bansal	Director (Vigilance), New Delhi	4254	011-24652318

Shri R.P. Lal	Director (Planning), New Delhi	4260	011-24625917
Shri U.P. Singh	Director (Publication), New Delhi	4262	011-24651287
Shri K.N. Katyal	Director (Admn.), New Delhi	4204	011-24602480
Shri Shiv Ganesh	Director (IT), New Delhi	4388	
Shri S.K. Jain	Director (CPU), New Delhi	4236	011-24698247
Caretaker, Mausam Bhawan	-	4372	
Guest House (H.Q.)	-	4472	

New Exchange – Airtel Telephone

Dialing from Delhi : 4382XXXX

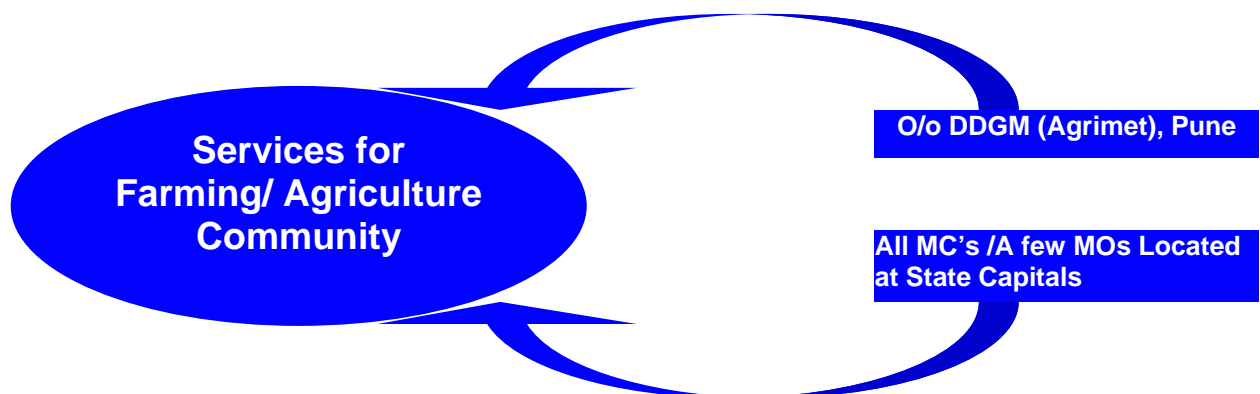
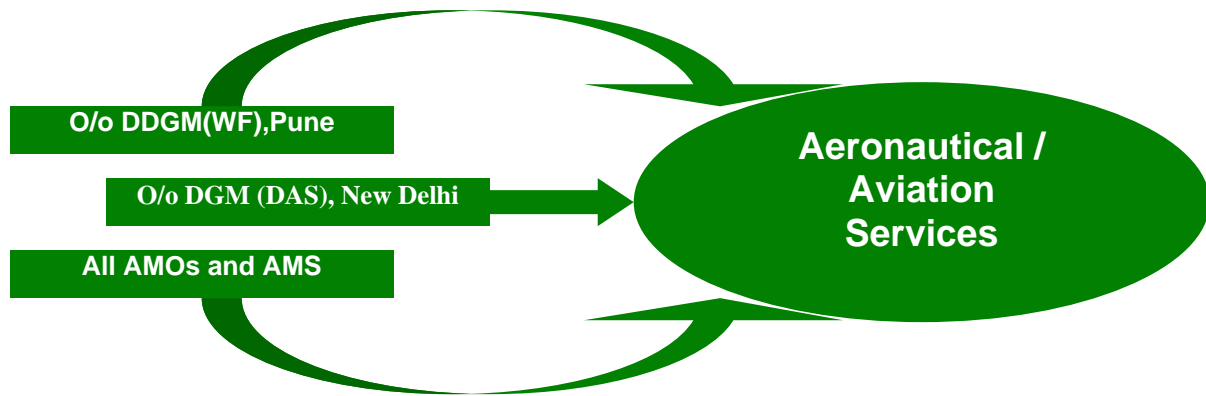
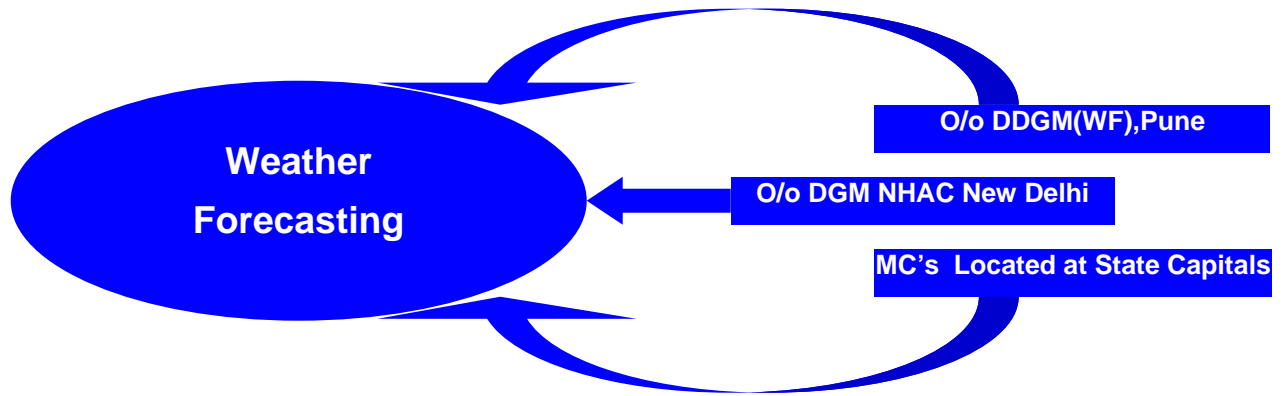
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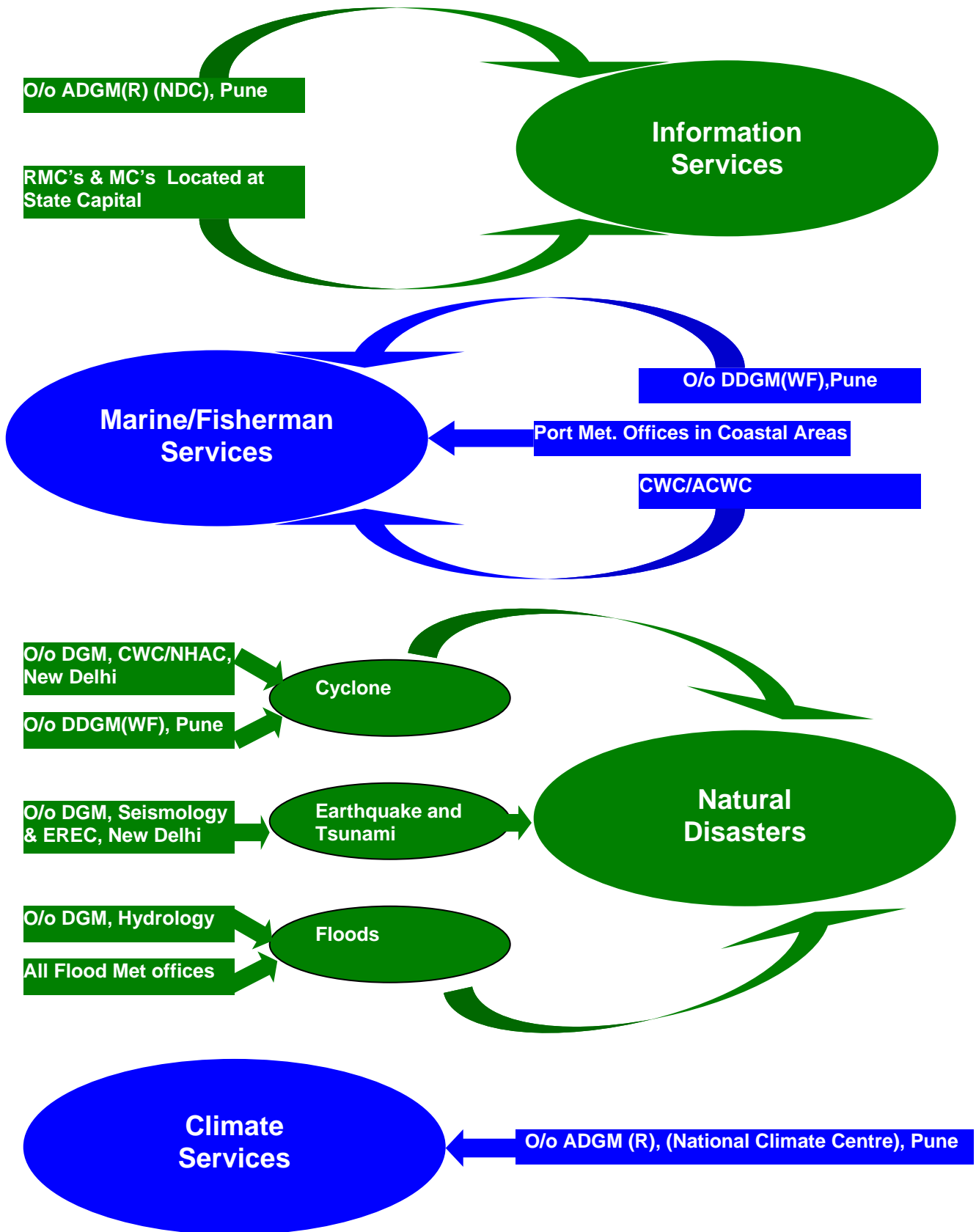
Where XXXX stands for 4 digit EPABX number

Telefax : 91-11-24699216, 91-11-24623220

**Website : www.mausam.gov.in
www.imd.gov.in**

19. IMD's SERVICES





REGIONAL METEOROLOGICAL CENTRES



Regional Meteorological Centre, Lodi Road,,
New Delhi

Under the administrative control of RMC, New Delhi, there are operational units such as Met. Centres at state capitals of U.P., H. P., Punjab, Haryana, J&K and Uttarakhand, Forecasting Offices, Agrometeorological Advisory Service Centres, Flood Meteorological Offices.

Regional Meteorological Centre at Chennai was started on 1 April 1945 to supervise and coordinate meteorological services in the Southern Region, which now covers the states of Tamilnadu, Andhra Pradesh, Karnataka, Kerala and Union Territories of Pondicherry and Lakshadweep.



Regional Meteorological Centre, Chennai

The Regional Meteorological Centre Guwahati was started at Guwahati Airport on 23 July 1949. It was upgraded to Meteorological Centre on 25 March 1974 and further upgraded to RMC on 01 April 1997. All Met Offices of North-East region except that in Tripura are under administrative & technical control of RMC Guwahati.



Regional Meteorological Centre, Guwahati Airport, Guwahati

Regional Meteorological Centre, Kolkata located at 4, Duel Avenue, Kolkata - 700027 is the nodal office for the public to obtain any information pertaining to India Meteorological Department and its various offices located in the states of West Bengal, Orissa, Jharkhand, Bihar, Sikkim, Tripura and Andaman and Nicobar Islands.

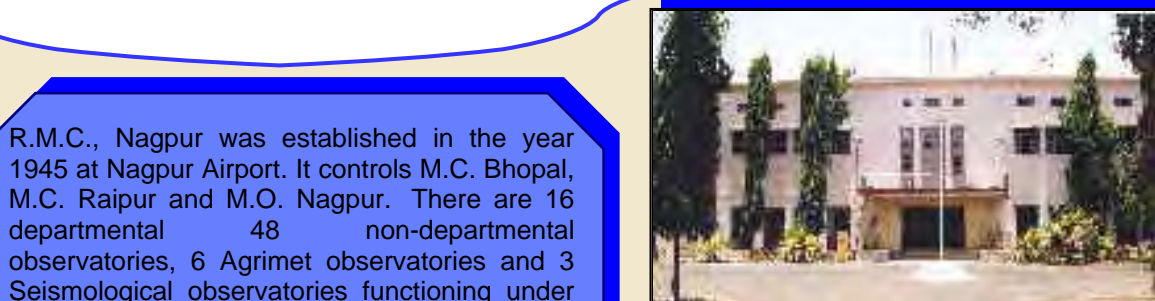


R.M.C. Alipore, KOLKATA



R.M.C., Colaba, Mumbai

The R.M.C., Mumbai was established in April 1945 for providing weather Forecasting and related services to the states of Maharashtra, Goa and Gujarat excluding Vidarbha region of Maharashtra State. The centre is also responsible for the monitoring of tropical cyclone formation in Arabian Sea and cyclone warning work, which is carried out by Area C.W.C. Mumbai and C.W.C. Ahmedabad.



R.M.C., Sonagaon Aerodrome, Nagpur

R.M.C., Nagpur was established in the year 1945 at Nagpur Airport. It controls M.C. Bhopal, M.C. Raipur and M.O. Nagpur. There are 16 departmental 48 non-departmental observatories, 6 Agrimet observatories and 3 Seismological observatories functioning under RMC Nagpur. RMC Nagpur covers Madhya Pradesh, Chhattisgarh and Vidarbha region.

METEOROLOGICAL CENTRES

DELHI REGION

Director
Meteorological Centre,
SCO-2455-56, (First Floor),
Sector 22 C,
CHANDIGARH - 160 022.

Director
Meteorological Centre,
7A & 7B, Infront of Kamal Coach Company,
Devnagar, Tonk Road,
JAIPUR - 302 015.

Director
Meteorological Centre,
Civil Aerodrome, Amausi,
LUCKNOW - 226 009.

Director
Meteorological Centre,
Ram Bagh Complex,
SRINAGAR – 190 015.

Director
Meteorological Centre,
Survey of India Compound,
17, E.C. Road, Karanpur,
DEHRADUN-248 001.

Director
Meteorological Centre,
Bibra House, Cliffend Estate,
SHIMLA – 171 001.

CHENNAI REGION

Director
Meteorological Centre,
Central Observatory, Palace Road,
BANGALORE – 560 001.

Director
Meteorological Centre,
Hyderabad Airport,
HYDERABAD – 500 016.

Director
Meteorological Centre,
Observatory,
THIRUVANANTHAPURAM – 695 033.

KOLKATA REGION

Director
Meteorological Center,
P.O. Agartala Aerodrome,
AGARTALA

Director
Meteorological Centre,
Civil Aerodrome,
BHUBANESHWAR - 751 009.

Director
Meteorological Centre,
Ladaki Mansion,
Baluwakhan,
GANGTOK – 737 101.

Director
Meteorological Centre,
Civil Aerodrome,
PATNA – 800 014.

Director
Meteorological Centre,
Civil Aerodrome,
RANCHI – 834 002.

BOMBAY REGION

Director
Meteorological Centre,
Civil Aerodrome,
AHMEDABAD - 380 012.

NAGPUR REGION

Director,
Meteorological Centre,
Mausam Vigyan Kendra,
Area Hills, Satpura Post Office,
BHOPAL 462 004.

Director
Meteorological Centre,
Lalpur,
RAIPUR

GUWAHATI REGION

Director
Meteorological Centre,
Naharlagun Helipad complex,
ITANAGAR – 791 110.

STATE-OF-THE-ART INSTRUMENTS



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INSAT 3D Meteorological Data Processing System



World Space Satellite Radio



Interactive Voice Response System



Automatic radiation instruments



Automatic Weather Station



Disastrous events during 2009

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(पृथ्वी विज्ञान मंत्रालय, भारत सरकार)
मौसम भवन, लोदी रोड़, नई दिल्ली – 110 003, भारत

INDIA METEOROLOGICAL DEPARTMENT
(Ministry of Earth Sciences, Govt. of India)
Mausam Bhawan, Lodi Road, New Delhi – 110 003, India