Introduction

Government of India, in its Cabinet meeting held on 9th May 2006, have approved formation of the Earth Commission and re-organisation of the Ministry of Ocean Development as Ministry of Earth Sciences. Earth Commission has been patterned on the lines of Atomic Energy Commission/ Space Commission for delegation and authority.

The 21st century is likely to be dominated by concerns of water, global climate change, environment, land use and ocean resources. The need for taking up an integrated view of Earth System Sciences, i.e. land-ocean atmosphere is being recognized across the world. The Indian efforts till recently, were being independently made by individual agencies like Ministry of Ocean Development (now Ministry of Earth Sciences), India Meteorological Department (IMD), research institutes like Indian Institute of Sciences, Indian Institute of Technology (IITs), a few laboratories of Council for Scientific and Industrial Research (CSIR), etc. There is a need to integrate these activities.

The Ministry of Earth Sciences aims to create a framework for understanding the complex interactions among key elements of the Earth System, namely ocean, atmosphere and solid earth, by encompassing the existing national programmes in meteorology, climate, environment and seismology. The Earth System Organisation (ESO) will act as an executive mechanism under the Ministry of Earth Science, consisting of two major entities – (i) Ocean Science and Technology Department, and (ii) India Meteorological Department. In addition, the Earth System Organisation would have, at its Headquarters, the Ministry of Earth Sciences office and the Programme Offices for coordination among the constituent organisations and units engaged in similar work in other departments, academic institutions and research bodies. The Ocean Science and Technology Department consists of the existing centres and attached offices of the erstwhile Ministry of Ocean Development. The Indian Institute of Tropical Meteorology (IITM) and National Centre for Medium Range Weather Forecasting (NCMRWF) would be active partners of the ESO.

The Ministry of Earth Sciences will provide the nation with best possible services in forecasting the monsoons and other weather/ climate parameters, ocean state, earthquakes, tsunamis and other phenomena related to earth systems through well integrated programmes and utilizing world class science and technology resources. In addition, the Ministry will work on science and technology for exploration and exploitation of ocean resources (living and non-living), and play nodal role for Antarctic/ Arctic and Southern Ocean research. The Ministry would closely work with other agencies both public and private to provide them scientific and technical support and assist in ensuring adequate preparedness for handling natural disasters.

The Right to Information Act, 2005
India Meteorological Department
MANUAL-(I)
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The particulars of its organization, functioning and duties.

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1. PARTICULARS OF ORGANIZATION

1.1 Historical Background:

The beginnings of meteorology in India can be traced to ancient times. The *Upanishadas* contain serious discussion about the processes of cloud formation and rain and the seasonal cycles caused by the movement of earth round the sun. Varahamihira's classical work, the *Brihatsamhita*, written around 500 A.D., provides a clear evidence that a deep knowledge of atmospheric processes existed even in those times. It was understood that rains come from the sun (Adityat Jayate Vrishti) and that good rainfall in the rainy season was the key to bountiful agriculture and food for the people. Kautilya's Arthashastra contains records of scientific measurements of rainfall and its application to the country's revenue and relief work; Kalidasa in his epic, "Meghdoot" written around the seventh century, even mentions the date of onset of the monsoon over central India and traces the path of the monsoon clouds.

Meteorology, as we perceive it now, may be said to have had its firm scientific foundation in the 17th century after the invention of the thermometer and the barometer and the formulation of laws governing the behaviour of atmospheric gases. It was in 1636 that Halley, a British scientist, published his treatise on the Indian summer monsoon, which he attributed to a seasonal reversal of winds due to the differential heating of the Asian land mass and the Indian Ocean.

India is fortunate to have some of the oldest meteorological observatories of the world. The British East India Company established several such stations, for example, those at Calcutta in 1785 and Madras (now Chennai) in 1796 for studying the weather and climate of India. The Asiatic Society of Bengal founded in 1784 at Calcutta, and in 1804 at Bombay (now Mumbai), promoted scientific studies in meteorology in India. Captain Harry Piddington at Calcutta published 40 papers during 1835-1855 in the Journal of the Asiatic Society dealing with tropical storms and coined the word "Cyclone", meaning the coil of a snake. In 1842 he published his monumental work on the "Laws of the Storms". In the first half of the 19th Century, several observatories began functioning in India under the provincial governments.

Very early in the history of IMD, the importance of the puplication of scientific results had been recognized. Blandford introduced the publication of the "Memories of the IMD" and him self authored several of them. His work on the rainfall of India is unsurpassable in clarity of thought and content. In view of the importance of foreshadowing monsoon seasonal rainfall for the agricultural economy of the country, Blandford initiated the system of Long Range Forecasting (LRF). The system of LRF of monsoon rains went through several evolutionary phases and eminent pioneers like Sir J. Eliot and Sir Gilbert Walker (Both Directors–General of Observatories) and generations of Indian researchers have made their contributions to this scientific effort. To Sir Gilbert Walker also goes the credit of linking the monsoon with global meteorological situations and his discovery of the so-called Southern Oscillation phenomenon. Swings of the Southern Oscillation were later linked by J. Bjerknes with the EI nino in the equatorial Pacific Ocean and Bjerknes also coined the term "Walker circulation" for describing the east west vertical circulation in the equatorial plane in honour of walker.

Blanford had recognized the need for inducting young Indian in IMD and the first two Indians Lala Ruchin Ram Sahni (Father of Professor Birbal Sahni) and Lala Hemraj joined IMD in 1884 and 1886 respectively. The Indianisation of IMD was accelerated under Walker, soon after World War I, and further boosted by Sir C.W.B. Normand (Director-General during 1928 to 1944) Normand was succeeded by Dr. S.K. Banerji as the first Indian DGO in 1944. During these years, many Indian scientists joined IMD and they took IMD to greater heights themselves in the post – independence era.

1.2 Development of meteorology in India

From a modest beginning in 1875, IMD has progressively
expanded its infrastructure for meteorological observations, communications, forecasting and weather services and it has achieved a parallel scientific growth. IMD has always used contemporary technology. In the telegraph age, it made extensive use of weather telegrams for collecting observational data and sending warnings. Later IMD became the first organization in India to have a message switching computer for supporting its global data exchange. One of the first few electronic computers introduced in the country was provided to IMD for scientific applications in meteorology. India was the first developing

country in the world to have its own geostationary satellite, INSAT, for continuous weather monitoring of this part of the globe and particularly for cyclone warning.

IMD has continuously ventured into new areas of application and service, and steadily built upon its infrastructure. It has simultaneously nurtured the growth of meteorology and atmospheric science in India. Today, meteorology in India is poised at the threshold of an exciting future.

2. FUNCTIONS OF IMD

IMD is the National Meteorological Service of the country and the Principal Government Agency in all matters relating to Meteorology, Seismology and allied subjects.

2.1 Major Objectives

- To take meteorological observations and to provide current and forecast meteorological information for optimum operation of weather-sensitive activities like agriculture, irrigation, shipping, aviation, off-shore oil exploration etc.
- To warn against severe weather phenomena like tropical cyclones, norwesters, dust storms, heavy rains and snow, cold & heat waves etc. which causes destruction of life and property.
- To provide meteorological statistics required for agriculture, water resource management, industries, oil exploration and other nation-building activities.
- To conduct and promote research in meteorology and allied disciplines.
- To detect and locate earthquakes and to evaluate seismicity in different parts of the country for development projects.
- To study and identify the potential consequences of an earthquake, both in relation to existing structures as well as in the planning and locating new facilities “in terms of cost effectiveness”.

2.2 Functions

- Install and maintain Departmental observatories, provide equipment and technical support for set up of observational networks of State Governments, other authorized agencies and ships of the voluntary observation fleet. Set up infrastructure for Satellite remote sensing of meteorological parameters.
- Record observations of meteorological parameters in India over land and adjoining sea areas on a routine basis. Receive and process satellite data from Indian and Foreign satellites.
- Maintain fast telecommunication links within the country and the world for dissemination of meteorological observations and exchange of meteorological products.
- Analyse and process meteorological data collected from observatories within the country and outside.
- Issue forecasts of weather events and meteorological parameters viz. temperatures, rainfall, humidity, winds and sky condition within the country for stipulated periods. Issue of forecasts and warnings of high impact weather events like Cyclonic Storms, Thunderstorms, Squalls, Tornados, Storm surge etc, and warnings of specific parameters viz. strong winds, heavy rainfall, heavy snowfall, hail storms, waves and tides, etc.

- Disseminate weather information, advisories and warnings to the Public through media, to Government Departments and District authorities,

- Scrutinise and process meteorological observations for assimilation into climatological archives.

- Design, develop, manufacture and maintain meteorological and seismological instruments and procure sophisticated equipment for modernising observatories.

- Maintain a network of seismological observatories to record earthquakes and study of the earth's crust.

- To provide a purposive turning point to guide national endeavour in mitigating the disastrous impacts of earthquake and to provide earthquake risk related knowledge products.

- Provide training facilities to all branches of meteorology, Seismology, telecommunication and instruments.

- Conduct research in theoretical and applied meteorology, Seismology and allied topics.

- International cooperation in meteorology and seismology.

- Provide hydrometeorological information and inputs for water resource management and flood forecasting.

- Maintain liaison with other scientific organisations in the country in the fields of agriculture, hydrology, oceanography, air pollution etc.

- To participate in special expeditions of meteorological interest like Antarctic Expeditions, Study of Himalayan glaciers, total Solar Eclipse, etc.

- To conduct study in Positional Astronomy, bring out related publication and issue Radio Times Signals.

3. ORGANISATION

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The Director General of Meteorology is the Head of the India Meteorological Department, with headquarters at New Delhi. He is assisted by 5 Additional Directors General and 20 Deputy Directors General. 04 Additional Directors General and 10 Deputy Directors General are located in New Delhi, 01 Additional Director General and 05 Deputy Directors General are located at Pune.

For the convenience of administrative and technical control, there are 06 Regional Meteorological Centres, each under a Deputy Director General with headquarters at Mumbai, Chennai, New Delhi, Kolkata, Nagpur and Guwahati. In addition, there are separate divisions to deal with specialised subjects. They are:

(i) Agricultural Meteorology
(ii) Civil Aviation
(iii) Hydrometeorology
(iv) Instrumentation
(v) Climatology
(vi) Regional Specialised Meteorological Centre
(vii) Positional Astronomy

(viii) Seismology
(ix) Earthquake Risk Evaluation Centre
(x) Satellite Meteorology
(xi) Telecommunication
(xii) Training

Under the administrative control of Deputy Director General, there are different types of operational units such as Meteorological Centres, Forecasting Offices, Agrimet. Advisory Centres, Flood Meteorological Offices and Cyclone Detection Radar Stations.

3.2 OBSERVATIONAL ORGANISATION

A brief description of each types of observatory is given in the following paragraphs. Details regarding observations records, their frequency, the normal component of staff employed and the distribution of the observatories among the Regional Meteorological Canters are given in the Annexure –I.

3.2.1 Surface Observatories

Surface Observatories as far as possible are located one in each district so as to meet the requirements of agricultural, transport and other operations. Of the 556 observatories, about 66.7% are manned by staff of State Governments/Schools etc. on payment of an allowance by the Department. The instruments and stores are provided by the Department.

3.2.2 Upper Air Observatories (Radiosonde, Radio wind and Pilot Balloon Observatories)

There are at present 62 Pilot Balloon Observatories, 39 Radiosonde/ Radiowind and 01 Radiosonde Observatory. The upper air meteorological data thus collected all over the country are used on real time basis for operational forecasting. These data are also processed on computer and short period averages of Radiosonde data and normal of Radio wind data have been brought out.

3.2.3 Aeronautical Meteorological Instruments

For safety of Aircraft operations, particularly at the time of landing and take off, Modern meteorological instruments "Current Weather Instruments System" (CWIS) have been installed at Mumbai, Kolkata, Chennai, New Delhi, Thiruvananthapuram, Lucknow, Hyderabad, Bangalore, Ahmedabad, Guwahati and at Nagpur for continuous monitoring of runway visibility, height of cloud base and other weather elements, such as surface wind, air temperature and dew point temperature. Two Nos. dual-baseline transmission meters are also installed at Kolkata, Airport for ILS CAT III Operations.

3.2.4 Cyclone Detection Radars

There are 11 Nos. of S-band Cyclone Detection Radar Stations viz. Kolkata,
Para deep, Visakhapatnam, Machilipatnam, Chennai, Karaikal, Kochi, Goa, Mumbai and Bhuj. Out of these 11 stations, 6 stations (except Chennai & Kolkata) are using conventional radars. Two number of S-Band Doppler Weather Radars (Metero 1500S) imported from M/s Gematronik Germany has been installed,/ commissioned and made operational at Chennai and Kolkata respectively with effect from 22.02.2002 and 29.1.2003, 8.12.2004 and 27.7.2006. One indigenous Doppler Weather Radar developed by ISRO under IMD-ISRD collaboration has been installed and made operational at SHAR Centre, SriHari Kota (Andhra Pradesh) with effect from 9.4.2004. The EFC proposal for procurement & installation of two imported Doppler Weather Radar on each at Paradeep and Mumbais is in advance stage of processing supply order has been placed on M/s Bharat Electronic Limited, Bangalore in March, 2006 for two indigenous Doppler Weather Radars to be installed at Bhuj and Kochi. The first radar is scheduled for commissioning by December, 2008. Delivery period is 24 months and 30 months respectively.

It is also planned to replace the remaining existing old conventional CDRs by the state of art S-Band Doppler Weather Radar in a phased manner. Doppler Weather Radars provide vital information on radial velocity within tropical cyclone which is not available in conventional radar. A conventional radar provides information on reflectivity and range only whereas a DWR provides velocity and spectral width data alongwith various Meteorological, Hydrological and Aviation products which are very useful for forecasters in estimating the storm's centre, its intensity, fixing its position and predicting its future path. The Doppler Weather Radar generates these products through a variety of software algorithms.

3.2.5 Storm Detection Radars

There are at present 9 X-Band, working on 3 cm. Wavelength for the purpose of storm detection, these are installed at Kolkata, Chennai, Guwahati, Ranchi, Delhi, Lucknow, Mumbai, Nagpur and Agartala airports. Also, there are two S-Band radars working on 10 cm Wavelength at Sriganganagar and Jaisalmer for warning against convective clouds and thunder storm formation and one S-Band Radar at Mausam Bhawan, Delhi for testing/training purpose.

Wind Finding Radars

There are 9 X-Band Wind Finding Radars working on 3 cm wavelength at Bhubneshwar A.P, Goa, Mangalore, Visakhapatnam, Bhopal A.P, Karaikal, Machillipatnam, Patna A.P., and Thiruvananthapuram.

Weather cum Wind Finding Radars

There are 8 X-Band radars working on 3 cm wavelength which are used for Weather Cum Wind finding purpose. These radars are installed at Ahmedabad, Bangalore, Mohanbari, Chennai & Hyderabad Airports, Delhi (HQ), Patiala and Srinagar.

Ten X Band radars (at Ahmedabad, Goa, Mangalore, Chennai, Visakhapatnam, Bhubneshwar, Kolkata, Guwahati, Ranchi & Bangalore) out of 26 X-Band radars mentioned above have been replaced by latest digital technology EEC radars. These radars have the facility of computer controlled operation with presentation of wind profile data and display of colors picture of clouds on monitor and hard copy print outs of these images. One Doppler Weather Radar imported from M/s Gematronik, Germany, Commissioned w.e.f. 0900 UTC of 27.7.2006.

3.2.6 Hydro meteorological Observatories

These observatories recording mainly precipitation data, were set up in connection with flood forecasting, river basin studies (like the Damodar Valley, Ganga, Brahamputra etc.) compilation of rainfall statistics for use in construction of dams, railways and road bridges, evaluation of snow-melt in Himalayan rivers and water balance and glaciological studies. These observatories are manned by part-time staff. The number of observatories depends upon the need of the specific project. The expenditure involved in the observatories set up for projects undertaken on behalf of other organization, is recovered from the sponsoring agency.

3.2.7 Non-departmental Rain gauge Stations

In addition to the raingauges maintained by the Department, State Governments are maintaining over 7610 raingauge stations whose data are made available to the India Meteorological Department in manuscript form.

3.2.8 Agrometeorological Observatories

These observatories supply meteorological data to the India Meteorological Department. They are maintained by the State Agricultural and Irrigation Department, Agricultural Research Institutes and research farms, The India Meteorological Department renders technical assistance to these organisations in selection of site, procurement, testing and standardization of

instruments, setting up of observatories, their inspection and training the personnel.

3.2.9 Evaporation Observatories

Standard USA open pan-evaporimeters are installed at 238 observatories to measure evaporation. Most of these are at departmental observatories and few are part-time observatories and Agromet. Observatories. The staff employed for taking other observations also record evaporation.

3.2.10 Evapotranspiration Stations

Evapotranspiration in plants is measured by means of lysimeters at 40 stations to determine the water requirement of important crops. The network of 40 stations is the representative of different agro-climatic regions in the country. Three of these evapotranspiration stations will be provided with additional instruments to undertake more intensive studies on crop weather relationship. At present three stations are functioning at Gandhi Krishi Vigyan Kendra Farm, Bangalore; Gujarat Agricultural University, Anand and Mahatma Phule Krishi Vidyapeeth, Rahuri with additional meteorological instruments.

3.2.11 Soil Moisture Observational Network

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43 soil moisture stations are at present functioning. Most of these stations are manned by departmental personnel.

3.2.12 Dew Fall Measuring Stations

Besides rainfall, dew fall is one of the secondary source of moisture available to the crops. It plays a significant role in plant growth, particularly in arid and semi-arid regions. It is measured from September to April by 76 observatories.

3.2.13 Seismological Observatories

India Meteorological Department is maintaining the National Seismological Network (NSN) consisting of 47 Seismological Observatories. Four more Seismological Observatories are also being maintained for river valley studies under the Bhakra Beas Management Board (BBMB). Twenty four of the NSN stations are equipped with state-of-the-art digital seismograph systems and matching V-SAT based communication facilities for real time downloading of earthquake waveform data. The NSN stations are also equipped with Strong Motion Accelerograph systems for recording strong ground motions expected during major earthquakes. The functioning of the Central Seismological Observatory, Shillong and Ridge Seismological Observatory, Delhi also comes under the ambit of Seismology Division at HQ.

India Meteorological Department is also maintaining a local network consisting of 16 field stations under Delhi Telemetry Network to monitor the earthquake activities in the region. These 16 field stations are connected with Central Receiving Stations (CRS) at New Delhi through V-Sat communication Systems. The ground motion data generated at these field stations is received at CRS New Delhi on real time mode. In addition IMD maintains a set of digital portable seismograph systems for specific earthquake related studies all over the country.

3.2.14 Earthquake Risk Evaluation Centre (EREC)

There are at present 16 field stations under Delhi. Telemetry Network to monitor the earthquake activities in the region. These 10 field stations are connected with Central Receiving Stations (CRS) at New Delhi through V-Sat communications Systems. The ground motion data generated at these field stations is received at CRS New Delhi on real time mode. In addition EREC maintains a set of digital portable seismograph for specific earthquake related studies all over the country.

3.2.15 Ozone Observatories

Ozone in the atmosphere is monitored through a network of observatories (Figure 3). The Observational programme consists of:

(a) Total ozone and Umkehr observations by Dobson Ozone spectrophotometer are taken daily from 4 stations viz. Delhi, Varanasi, Pune and Srinagar. At New Delhi, Kodaikanal, Maitri (Antarctica) stations, ozone is monitored with Brewer Spectrophotometer which has an additional facility to measure NO_2, SO_2 and UV-B radiation also.

(b) Vertical ozone profile by IMD-made balloon-borne ozonesonde (fortnightly) at 4 stations viz. New Delhi, Pune, Thiruvananthapuram and Maitri (Antarctica).

(c) Surface ozone measurement with electrochemical instruments at 7 stations viz. New Delhi, Nagpur, Pune, Kodaikanal, Srinagar, Thiruvananthapuram and Maitri (Antarctica).

Research facilities:- A high quality data on ozone is available at the "National Data Centre" Pune and also the National Ozone Centre established at IMD, New Delhi. This centre has been also designated as the Regional Centre for the Regional Association II (Asia) of the world meteorological organisation (WMO).

3.2.16 Radiation Observatories

(i) Surface Observatories

There are at present 45 radiation observatories (20 Principal and 19 ordinary and 6 other types) recording limited radiation parameters.

(ii) Upper Air Observatories

Besides the measurements on the surface, fortnightly airborne sounding with radiometersonde to measure directly the vertical distribution of the infra-red radiative fluxes and radiation cooling from surface upto a height of 20 Km or more in the free atmosphere, are made at New Delhi, Srinagar, Thiruvananthapuram, Pune, Nagpur, Jodhpur, Kolkata and Bhubaneswar. Radiometersonde ascents are being conducted regularly at Maitri, the Indian Antarctic station also.

3.2.17 Atmospheric Electricity Measurement

Continuous and automatic recording of surface electrical potential gradient and electrical conductivity are being done at Pune. The study of surface potential gradient is now being done at three more stations viz. Nagpur, Thiruvananthapura and Srinagar.

3.2.18 Automatic Weather Stations.

A data receiving earth station has also been installed at Pune for receiving data from Automatic Weather Stations. ISRO has also planned installation of 25 AWS to operate in TDMA mode and for trial a TDMA receiving station has also been installed at Pune for ISRO.

3.2.19 Global Atmosphere Watch (GAW) [formerly BAPMoN]

With a view to document the long term changes in chemical composition of the atmosphere and related parameters IMD established a network of 10 GAW stations under WMO's GAW monitoring program. The Indian GAW network includes Allahabad, Jodhpur, Kodaikanal, Minicoy, Mohanbari, Nagpur, Port Blair, Pune, Srinagar and Vishakhapatnam covering different geographic regions. At these stations chemical composition of precipitation and atmospheric turbidity is determined. Total suspended particulate matter is also measured for varying period at Jodhpur using High Volume Air Sampler.

Precipitation Chemistry Program: Wet precipitation samples collected at GAW stations are sent to Chemical laboratory at Pune where these are analysed for PH, conductivity, major cations (Ca, Mg, Na, K) and major anions (SO_4, NO_3, Cl). Measurements of organic acids in precipitation will be undertaken in near future.

Atmospheric Turbidity Program:

Atmospheric Turbidity which indicates the columnar aerosol load of the atmosphere; is also measured at these GAW stations using Volz's Sunphotometers. This single channel Sunphotometer is being replaced in phased manner by the multichannel Sunphotometer purchased recently under Plan Scheme. In the first phase these are installed at Pune, Nagpur & Kodaikanal, Atmospheric Turbidity is also measured at Antarctica and one multichannel Sunphotometer has been handed over to the team of 23rd Antarctica Expedition.

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 and to organize assessment in support of formulating environment policy. Chemical composition of precipitation is useful in quantifying the level of pollution due to increasing anthropogenic acitivities.

Urban Climatological Units

To study the impact of industrialisational urbanisation and terrain modifications on micro-climatological features of urban areas, urban climatological studies are carried at Delhi and Kolkata by taking observations at a number of observatories in the different parts of the cities.

The existing network, a few Automatic Weather Stations (AWS) using state of the art technology are added to the existing network. These are installed at C.Ag.M.O., Pune, Chennai, Goa, Mumbai, Harnai, Ratnagiri, Cannanore, Thiruvananthapuram, Karaikal and Kolkata.

3.3 Types of Observatories

TABLE

The Observational Organization as on 1.10.2005 is as under

	Types of Observatories	**Number**
(1)	Surface Observatories	556
(2)	Pilot Balloon Observatories	65
(3) (a)	RS/RW Observatories	34
(b)	RS Observatory	1
(4)	Aviation Current Weather Observatories	73
(5)	Aviation Forecasting Offices at National & International Airports	19
(6)	Regional Area Forecast Centre	1
(7)	Storm Detection Radar Stations	17
(8)	Cyclone Detection Radar Stations	10
(9)	High Wind Recording Stations	22
(10)	Stations for receiving cloud pictures from Satellites :-	
	(a) Low Resolution Cloud Pictures	7
	(b) High Resolution Cloud Pictures	1
	(c) INSAT-IB Cloud Pictures (SDUC Stations)	25

	(d) APT Stations in Antarctica	1
	(e) AVHRR Station	1
(11)	Data Collection Platforms through INSAT	101
(12)	Hydrometeorological Observatories	633
(13)	(i) Non-departmental raingauge stations :	
	(a) Reporting	7610
	(b) Non-Reporting	4959
	(ii) Non-departmental Glaciological Observatories (Non-reporting) :	
	(a) Snowgauges	21
	(b) Ordinary Raingauges	10
	(c) Seasonal Snow Poles	6
(14)	Agrometeorological Observatories	228
(15)	Evaporation Stations	238
(16)	Evapotranspiration Stations	39
(17)	Seismological Observatories	58
(18)	(a) Total Ozone and Umkehr Observatories	5
	(b) Ozone-sonde Observatories	3
	(c) Surface Ozone Observatories	6
(19)	Radiation Observatories :	
	(a) Surface	45
	(b) Upper Air	8
(20)	Atmospheric Electricity Observatories	4
(21)	(a) Background Pollution Observatories	10
	(b) Urban Climatological Units	2
	(c) Urban Climatological Observatories	13
(22)	Ships of the Indian Voluntary Observiang Fleet	203
(23)	Soil Moisture Recording Stations	55
(24)	Dew-fall Recording Stations	75

(The Ozone Network, Radars Network, RS/RW Network, and existing Network of radiation stations are shown in Figs. 3 to 8 respectively.)

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4. MAIN DIVISIONS

4.1 WEATHER FORECASTING ORGANISATION

Weather Forecasting forms an important activity of the department and it caters to the need of a large number of interest. In India, weather forecasting at present consists of indicating the detailed weather conditions that are likely to occur in specified areas for periods upto two days. Outlook in general terms for periods upto a week is also given. The forecasts are also issued as warning to user against adverse weather.

TABLE

The Organisation for providing different types of forecasts and warnings is given in the table below :-

S.No	Category/Meteorological Offices issuing Weather	Details of Service	User Interest

	Forecasting		
1	**Aviation** Meteorological Offices at Agartala,Ahmedabad, Bangalore, Bhopal, Bhu-baneswar, Mumbai, Kolkata,Delhi(Palam),Safdarjung,Guwahati, Hyderabad, Jaipur, Lucknow, Chennai, Mohanbari, Nagpur Patna & Thiruvanantha- puram	**(i)** Forecasts of upper winds temperature etc. for flight planning **(ii)** Flight forecasts in tabular form/corresponding prognostic charts cross-sections etc. **(iii)**Terminal Aerodrome Forecast & aerodrome warnings. **(iv)** SIGMET Warning (by Met. watch offices Mumbai, Kolkata, Delhi & Chennai only)	Airlines Airlines & Air Traffic Control
	Regional Area Forecast Centre, New Delhi	Supply of SADIS , Products such as grid point prognostic charts and SIGWS charts for the region from Middle-East to South-East Asia	National & International Airlines
	Tropical Cyclone Advisory Centre, New Delhi	Advisory information on tropical cyclones to Aviation Met. offices in India and neighboring countries	National & International Airlines
2	**Marine** Cyclone Warning Centres at Kolkata (Alipore), Mumbai (Colaba), Chennai (Nungambakkam), Ahmedabad,Bhubaneswar & Visakhapatnam (6)	**(i)** Forecasts for Bay of Bengal & Arabian Sea. **(ii)** Coastal forecasts **(iii)** Cyclone Warnings. **(iv)** Port Warnings.	Ships Ships, Govt. Deptts. Maritime State & Public Ports
	Cyclone Warning Centre at Mumbai, Kolkata & ISONSHAC, Pune	Fleet Forecast twice a day, frequency of bulletins increases to four during tropical storm period for Arabian Sea, Bay of Bengal and Indian Ocean upto 10^{o} S (60^{o} E to 100^{o} E)	Indian Navy
	Global Maritime Distress and Safety System (GMDSS), ACWC Mumbai, Kolkata & INOSHAC, Pune.	Bulletins twice a day are issued for Met. area VIII N for Arabian Sea, Bay of Bengal and Indian Ocean To north of Equator. The frequency increases to six during tropical storm period	All ships
3	**Fisheries** Cyclone Warning Centres at Kolkata (Alipore), Mumbai (Colaba), Chennai (Nungambakkam), Ahmedabad, Bhubaneswar, Visakhapatnam (6)	**(i)** Adverse weather along coast, 4 times daily (including nil warnings).	(i)Fishing Craft through A.I.R.

		(ii) Cyclone Warning	(ii) Fisheries officials
4	**Agriculture** **(a)** Regional Met. Centres/Met. Centres at Ahmedabad, Bangalore, Bhopal, Mumbai, Bhubaneswar,Kolkata, Guwahati, Hyderabad, Jaipur, Lucknow, Chennai, Nagpur, New Delhi, Patna,Srinagar,Thiruvananthapuram and Chandigarh (17)	**(i)** Farmer's weather Bulletins (2 bulletins are issued daily during rainy season) (iii) Agricultural advisory message	Message for Farmer's broadcast from A.I.R. stations in local languages
	(b) Meteorological Offices at Ahmedabad, Bangalore, Bhopal, Bhubaneswar,Kolkata, Chandigarh, Shimla, Gangtok, Guwahati, Hyderabad, Jaipur, Lucknow, Chennai, New Delhi, Patna, Pune, Srinagar & Thiruvananthapuram, Dehradun and Raipur	Agromet. Advisory service Bulletins (weekly/ By-weekly)	Advisories for Farmer's broadcast/ Telecasts in local languages through AIR/Door-darshan)
5	**Floods** Agra, Ahmedabad, Asansol, Bhubaneswar, Guwahati, Hyderabad, Jalpaiguri, Lucknow, New Delhi & Patna (10)	**(i)**Quantitative precipitation forecasts **(ii)** Prevailing Synoptic situation **(iii)**Heavy rainfall warning **(iv)** Realised Average precipitation for each sub-basin during past 12/24 hours **(v)** Point rainfall data of selected stations	Water Resources Flood Forecasting Division of CWC (Total No. 19)
6	**Reservoir Management** (a) Kolkata (Alipore) (b) Bhubaneswar (F.M.O.) (c) Mumbai (Colaba)	Forecasts of rainfall in:- Damodar Valley Mahanadi Catchment Godavari Catchment	DVC Management Hirakund Dam Project Authorities Maharashtra Govt.
7	**General** Mumbai (Colaba) Pune (Weather Central) Pune (INOSHAC)	Wind, weather, visibility, sea swell and cyclone warnings All India Weather forecasts **(i)** Weather Bulletins are issued twice a day describing salient features between 20° E and 155°E and between 45° N and 5° S based on 00z and 12z. **(ii)** Fleet forecast issued twice a day for sea area between	Oil and Natural Gas Commission Newspapers and AIR Departmental Offices

		60^{o}E to 100^{o}E and 5^{o}N to 10^{o} S. The frequency increase to four during tropical Storm period **(iii)**Daily two bulletins of GMDSS originated w.e.f. 1.10.98 for Met. area VIII(N) to the north of Equator on regular basis. During tropical cyclones in four additional special bulletins are also originated.	
	Ahmedabad, Bangalore, Bhubaneswar, Bhopal, Mumbai, Kolkata, Guwahati, Chandigarh, Hyderabad, Jaipur, Lucknow, Chennai, Nagpur, New Delhi, Patna, Srinagar & Thiruvananthapuram (17) RMC New Delhi	**(i)** Forecasts for one or more States for next two days. **(ii)** Local forecasts for Capital cities. **(iii)** Warnings against adverse weather **(i)**Weather forecast is provided 3 times daily to State Govt. authorities to regulate Amar Nath ji Yatra during 40 days period. **(ii)**Weather forecast is provided to Govt. to regulate Kailash Mansarovar yatra during the 3 month period. **(iii)** Weather forecast information is provided on IVRA by dailing No.1717 from Met. Office Safdarjung for 37 important cities and all the four metros.	Public Newspapers, AIR and Govt. officials about 1500 officials registered with different offices.
8	**World Weather Watch (WWW)** Northern Hemisphere Analysis Centre (Designated as Regional Specialised Met. Centre under WWW from 1.7.1998)	Analysis and Prognosis for South Asia.	Meteoro-logical offices within the country and outside
9	**Long Range Forecasts** Meteorological Office, Pune	**(a)** Forecasts of Southwest Monsoon rainfall (June-Sept.) over India as a whole issued during mid-April. **(b)** Updated Forecast of Southwest Monsoon rainfall (June-Sept.) over India as a whole and Forecasts for Peninsular India, North-West India and North-East India	Govt. officials, Public and News papers Govt. Officials, Public and Newspapers

		issued in the first week of July	
		(c) Forecast for Southwest monsoon rainfall for the month of July over India as a whole issued in the first week of July	Govt. Officials
		(d) North-East monsoon rainfall(October-December) over South peninsula issued in the first week of October	Govt. Officials
		(e) Rabi season rainfall (Oct.-March) over North-West India issued in the first week of October	
		(f) Precipitation during winter season over North-West India issued in the first week of January.	Govt. Officials
			Govt. Officials

4.2 METEOROLOGICAL TELECOMMUNICATIONS

Meteorological telecommunication of India Meteorological Department (IMD) consists of an integrated network of point-to-point circuits and multipoint circuits which inter connect meteorological centers within the country and the world for receiving data and relaying it selectively. It is mainly organized on a two level basis, namely

I) The meteorological telecommunication network within the Global Telecommunication System (GTS) of World Weather Watch (WWW) program of World Meteorological Organization (WMO), and

II) The National Meteorological Telecommunication Network (NMTN)

IMD maintains an extensive telecommunication network with a central hub in Mausam Bhavan, New Delhi. The Regional telecommunication hub (RTH), New Delhi, located on the Main Trunk Network (MTN) is the core network of GTS. RTH New Delhi is directly connected with World Meteorological Center (WMC) Moscow (IPVPN), RTH Tokyo (IPVPN) and RTH Cairo on the MTN. RTH New Delhi is also directly connected with RTH Beijing (IPVPN), RTH Jeddah and WMC Melbourne located on the MTN, RTHs Bangkok and Tehran and National Meteorological Centers (NMCS) Colombo, Dhaka, Karachi, Kathmandu, Male, Muscat and Yangon in the Regional Meteorological Telecommunication Networks (RMTNS). Present status of circuits in the GTS connected with RTH. New Delhi is given at ANNEXURE-I.

The national meteorological telecommunication network consists of 37 high speed (64 kbps), 1 medium speed (2400 bps), 15 satellite based data reception system by using m/s. World space technology, 4 integrated data reception and analysis system,67 stations having HF/RT facility, 47 stations with vhf (including walkie- talkie) facility, internet connectivity at all important stations, 5 new VSAT (micro-earth stations), 5 stations with automatic message system (AMSS) and 4 pc based current weather display systems.

Meteorological data and processed products containing 3 hourly INSAT imageries, surface and upper air data, aerodrome forecast, Wx. Charts and model outputs, etc. Exchanged over gts are broadcast using world space ASIA STAR satellite. The broadcast covers large areas of middle- east and south- east asia.

Imd's website (http://www.imd.ernet.in) is operational since 1st june, 2000. All the forecasting products like charts, warnings, satellite imageries, rainfall information are placed and timely updated in imd's website. Another website http://www.imd.gov.in is also operational. The regional meteorological centers are also having their own websites and many stations have been provided with internet facility. On account of increasing demand of public to view imd's website and to avoid choking of these links, telecom division has already upgraded these links through service providers by increasing bandwidth from 128 kbps to 2 mbps for the website imd.ernet.in and from 2 mbps to 4 mbps for the website imd.gov.in. Additionally an internet link working at 10 mbps has been added in March 2008.

Popularly known as weather on phone, the interactive voice response system (IVRS) is functioning with effect from July, 2000. One can access current weather and forecast for major indian cities by dialing toll free number 1800 180 1717. In the new system 26 cities will be provided with IVRS with central monitoring from RTH New Delhi.

A receive only satellite data dissemination system (SADIS) is in operation at New Delhi to receive aeronautical meteorological information from International Civil Aviation Organization (ICAO) centers which are routed to four international airports of India for national and international flight briefing and for providing data in GRIB/ BUFR format for wind/ temperature and sig. Wx. Charts.

Under the marine meteorological broadcast system GMDSS (global maritime distress safety system) of WMO/ IMO, IMD bulletins are broadcast through in marsat safety net system. The message are also kept on imd web site..

Stations having departmental Telecom. facilities

(a) International Circuit **As on 31.03.2008**

Present Status of Circuits in the GTS connected with RTH, New Delhi

Circuit	speed	Procedure Application	Exchange data type
New Delhi-Moscow	128 KBPS IPVPN	TCP/IP/FTP	Message(A/N,BIN)*
New Delhi-Tokyo	128 KBPS IPVPN	TCP/IP/ socket	Message(A/N,BIN)
New Delhi-Beijing	128 KBPS IPVPN	TCP /IP/FTP	Message(A/N)
New Delhi-Jeddah	64 KBPS	TCP/IP socket	Message(A/N)
New Delhi-Cairo	64 KBPS	TCP/IP socket	Message(A/N)
New Delhi-Bangkok**	200 Baud	T/P	Message(ASCII)
New Delhi-Melbourne	Internet	TCP socket,	Message(A/N)
New Delhi-Male	Internet	TCP socket,	Message(A/N)
New Delhi-Karachi	64 KBPS	TCP socket	Message(A/N)
New Delhi-Muscat	Internet	TCP socket,	Message(A/N)
New Delhi-Dhaka	64 KBPS	TCP/IP socket	Message(A/N)
New Delhi-Yangon	Internet	TCP/IP	Message(ASCII)
New Delhi-Tehran	75 baud	T/P	Message(ASCII)
New Delhi-Colombo	Internet	TCP/IP	Message(ASCII)
New Delhi-Kathmandu	50 baud	T/P	Message(ASCII)

*A/N : Alpha-numeric
B/N : Binary
** : Being upgraded to 64 Kbps shortly

(b) National Circuits

(i)	High Speed links (upto 2Mbps)	37
(ii)	Data Circuits (2400 BPS)	01
(iii)	IVRS stations	18 out of 26 installed
(iv)	Stations provided VPN	16
(iv)	Satellite based data reception system by using M/s World Space Technology.	15
(vi)	Integrated data reception & analysis system.	04
(vii)	Stations with telefax facility.	137
(viii)	VHF (including Walkie-Talkie facility)	47
(ix)	Station with HF/RT facility.	67
(x)	VSAT Stations (MES)	out of 26 new 5 installed remaining under process
(xi)	Automatic Message Switching System (AMSS)Stations (MES)	5
(xii)	PC Based Current Weather display system.	4
(xiii)	Stations with B/ Band internet connectivity	134

4.2.1 Network within the country

Quick collection of data from a vast network of surface and upper air observing stations, ships on high seas, aircraft reports, radar observations, forecasts and warnings and their selective distribution are vitally important to the operational needs of the Department. To meet national and international requirement, the department maintains an extensive telecommunication network connecting all the meteorological offices and data collection centres.

(i) **Collection and distribution of National data**

Basic data from the observatories are collected at collection centres, which are either meteorological offices at State Capitals or Regional Centres, by means of departmental telecom facilities and land-line telegram. The stations whose data are exchanged on Global Telecommunication system are mostly connected by point to point links, telex or radio-telephony links. Important observatories have been provided with back-up telecommunication facilities so that the failure of one does not held up the flow of data.

(ii) Collection of Ships Observations

Observations from ships on high seas are collected at Regional Collecting Centres, Mumbai, Calcutta and Chennai through Coastal radio stations operated by the Department of Telecommunications.

(iii) Exchange of Aeronautical Meteorological Message

Although aeronautical meteorological messages are handled primarily by the AFTN network of the National Airports Authority of India (NAD), a limited teleprinter network exists in order to supplement the AFTN. A teleprinter loop connects the international airports at Delhi-Mumbai-Chennai-Kolkata-Delhi. Aeronautical messages and data needed for aircraft operations flow on this closed loop to make them available to all meteorological offices. T/P circuits and telex connection are used for exchange of aeronautical meteorological data with other meteorological offices.

(iv) World Space Satellite Broadcast System

India Meteorological Department has started a new meteorological data and processed products broadcasting service from 1st July 2003 using World Space "Asia Star" Satellite. This is a replacement of the HF broadcast system which has become outdated due to obsolence of the technology and non-availability of HF transmitters of required capacity. The Meteorological data presently being broadcasted are:

1) Indian Satellite images such as three hourly visible, infra red, water vapour images.
2) GTS data (SYNOP, PILOT, TEMP, METAR, TAF etc).
3) Weather charts and model outputs.

The broadcast covers large areas of Middle-East and South-East Asia at a down link frequency of 1467-1492 MHz.

(v) Current weather display system

PC-based current weather display facilities have been provided at Kolkata, Delhi Chennai,and Mumbai International airports for transmission of information to various Air Traffic Points. The information is displayed automatically at the various Air Traffic Points.

(vi) Other Telecommunication Facilities

The Department also avails of the microwave links of Railways, Wireless link of the Police and Aeronautical Fixed Telecommunication Network (AFTN) of the Airport Authority of India (NAD) to communicate warnings to the user agencies on disastrous events such as cyclones, floods, storm surge etc.

(vii) Dissemination of warnings

Apart from being the means of exchange of meteorological data, the telecommunication links are also used for dissemination of warinings. Coastal Radio Stations maintained by DOT disseminate warnings to ships on high seas while A.I.R./Doordarshan disseminate warnings for general public, fisheries and other users.

(viii) Telefax facility

Telefax facilities have been provided at important meteorological offices for transmission/reception of weather information. This facility has been extended to CDR/CWC/M.C. Stations. Very soon these will be replaced by other telecommunication facilities.

(ix) VHF/Walkie-Talkie facility

Walkie-Talkies have been provided at National/International Airports and other stations for real time exchange of Runway visibility range meteorological information for safe aircraft flights. VHF facility have been provided to additional stations for exchange of meteorological information.

(x) VSAT Network

VSATs have been installed at selected Seismological Observatories, Cyclone Detection Radar Stations, Cyclone Warnings Centres (CWC/ACWC), Meteorological Centres and at some other important Observatories where no reliable communication system exist. This network of VSATs operates utilizing communication transponders of INSAT.

(xi) **Data through Internet :**

At NMTC, current meteorological observational data is available on FTP server and can be accessed by authorized users.

4.2.2 Website of IMD

IMD's website (http://www.imd.ernet.in) is operational since 1st june, 2000. All the forecasting products like charts, warnings, satellite imageries, rainfall information are placed and timely updated in IMD's website. Another website http://www.imd.gov.in is also operational. The Regional Meteorological Centers are also having their own websites.

4.2.3 Interactive Voice Response (IVR) System

Popularly known as 'Weather on telephone' the Interactive Voice Response System (IVRS) was started by the NMTC with effect from July, 2000. One can access current weather and forecast for major Indian cities by dialing a convenient 4 digit telephone number, 1717. This is the easiest way for a common man to know the weather of a place of his choice at the cost of one local call.

4.2.4 SADIS data reception

A SADIS (Satellite Dissemination System) receive only system is in operation since November 1999. All the data and products received through it are being routed to the four AMSSs for National and International flight briefing.

4.2.5 Training in Meteorological Telecommunication

The Telecommunication Training Centre at New Delhi, which was established in September 1977, is one of the international training centres recognized by the WMO. This centre imparts training in the field of telecommunication to the departmental as well as foreign trainees sponsored under various technical programmes. This centre has trained large number of departmental trainees as well as foreign trainees sponsored by WMO. So far this centre has trained 787 departmental trainees and 99 foreign trainees. They receive training under ITEC, SCAAP, WMO, Colombo plan, UNDP etc. The centre conducts the following regular courses:

1. Level -I Course in Met. Telecom (O-Level) – 3 months duration.
2. Level -II Course in Met. Telecom (Middle Level) – 3 months duration.
3. Level- III Course in Met. Telecom (Higher level) – 6 months duration.

4. Short term course in PC applications – Four weeks duration.

In addition to regular courses 8 weeks course for directly recruited Meteorologist Grade-II (Gr-A) is also conducted as and when fresh recruitments are made in this cadre. Refresher courses of small durations are also organized from time to time to meet the immediate service requirements of the department.

To keep pace with the fast computerisation of telecommunication facilities and development in the field of networking a scheme has been undertaken to modernize the centre with latest communication software and audio-visual aids under which ten numbers of computer work stations have been installed for imparting training in PC applications.

In view of advancement of technology in telecommunication two weather data receive and analyse system (WEDRAS) are installed for imparting the training concerned with procedure of processing and analyzing the met. data in the form of imageries, raw data, charts under GTS received through Satellite.

4.2.6 International Meteorological Telecommunication – Regional Telecommunication Hub, New Delhi.

Under the Global Telecommunication System (GTS) organised as part of the World Weather Watch Plan of W.M.O., New Delhi is functioning as a Regional Telecommunication Hub (RTH) on the Main Telecommunication Network (MTN) connecting the two World Meteorological Centres, Moscow directly and Washington via Tokyo. The automated centre of RTH New Delhi is thus the Principal Meteorological Telecommunication Centres in South Asia and its zone of responsibility extends from Saudi Arabia in the west to Thailand in the East and the adjoining sea areas. It collects observational data from these areas and feeds them on to the Global Telecommunication System for Global and Regional Exchange. Other Meteorological services in the Middle East and South East Asia also depend for their data requirements on RTH, New Delhi. Accordingly, it maintains telecommunication circuits with Moscow, Tokyo, Cairo, Jeddah, Beijing, Bangkok, Colombo, Dhaka, Tehran, Karachi, Male, Yangon and Kathmandu.

(iii) Digital Satellite Broadcasts

India Meteorological Department is operating its Broadcast service through ASIA STAR satellite of World Space. GTS data, Satellite imageries and Forecast charts and model outputs are broadcast using multicast system.

4.2.7 Automation of R.T.H. New Delhi

India Meteorological Department has further modernised its National Meteorological Telecommunication Centre (NMTC) with a new state-of-the-art switching computer which has capabilities comparable with any advanced WMO Centres on the GTS (Global Telecommunication System).. The whole system has been designed to handle 128 channels (64 low speed + 64 medium speed channels or all 128 medium speed). The system is capable of handling 2200 Mbytes of data/information everyday. The system has many advanced facilities like handling VSAT links, Dial-up Telex, handling Metfax, Auto Fax in, Auto Fax out facility, Data Modem-in, Data Modem-out, exchange of T4 fax and handling sea area bulletins (under Global Maritime Distress & Safety System). RTH, New Delhi is connected to Super Computer Centre NCMRWF through Optical fibre link to transmit GTS data and also has been connected to NHAC CYBER Computer.Message Switching computers are also operational at the major International airports viz. Mumbai, Delhi, Calcutta, Chennai and Guwahati. The circuits linking New Delhi (Palam), Mumbai, Calcutta, Chennai and Guwahati Airport Computers with RTH Computer at New Delhi are working at high and medium speed.

Under the new marine meteorological broadcast system GMDSS (Global Maritime Distress Safety System) of WMO/IMO, two bulletins are broadcast at 0900 UTC and 1800 UTC everyday through INMARSAT safety Net system. Additional bulletins are broadcast during cyclone period.

4.3 INSTRUMENTATION

4.3.1 India belongs to that select group of countries who manufacture their own upper air and surface instruments. This is done by the meteorological department through in-house production facilities. The office of the Dy. Director General of Meteorology (Upper Air Instrument), New Delhi, consisting of Hydrogen Factory at Agra and Laboratories and Workshop at New Delhi, is responsible for coordination of all technical aspects related in the field of upper air instrumentation. Supply of Meteorological stores to Upper Air Network is maintained by the supply unit at New Delhi. The office of the Dy. Director General of Meteorology (Surface Instruments), Pune consisting of Laboratories and Workshop at Pune, is responsible for the surface instrumentation.

4.3.2 Production Activity

(a) The Hydrogen Factory at Agra takes up production and supply of compressed hydrogen gas filled in cylinders for its eventual use in filling of balloons at field stations throughout the network of Pilot Balloon and Radiosonde/Radiowind observatories. In addition, the factory also meets the demand of hydrogen gas from the Indian Air force and Naval Stations. During the year 2003-2004 the production of hydrogen in the H.F. Agra is targeted at 28000 cubic meters of gas costing about Rs. 153.44 lakhs. The gas production is regulated to meet the target year after year. The Hydrogen Factory Agra also supplies caustic soda, ferrosilicon and high pressure hydrogen gas cylinders to all the radiosonde/radiowind stations for in situ generation of hydrogen gas to meet the requirement to run the upper air stations operationally.

(b) Workshop at New Delhi is manufacturing various types of Radiosondes like 401 MHz radiosonde, 1680 MHz radiosonde, for the measurement of upper air pressure, temperature and humidity and arranging their supply to more than 38 stations spread throughout India, Antarctica and one in Sri Lanka.

Delhi workshop also provides necessary support in the installation of RS/RW Ground equipment and Radars as well as in servicing and maintenance of equipment at various RS/RW and Radar stations of the department. Assistance is also rendered in the installation and servicing of Radiosonde, theodolities and radars in our national network.

Repair and maintenance of pilot balloon & optical theodolites are also carried out. Manufacture of accessories for the pilot balloon observation & wind observations in lower troposphere is also taken up. Wooden stevenson screen (Single & double) which are used to house surface meteorological instruments like thermometer, are manufactured in workshop.

Workshop is taking active part in celebration of national functions by arranging balloon release programme on Republic Day at Rajpath and Independence Day at Red Fort where the President & the Prime Minister are participating.

(c) The Workshop at Pune manufactures ozone sondes, radiometer sondes and surface instruments, such as anemometers, wind vanes and self recording instruments such as anemographs, thermographs and barographs, instruments for data collection platforms and current weather instrument systems. Pune Workshop also provides support in the installation of surface and current weather instruments at field stations.

4.3.3 Maintenance

(a) Maintenance of various ground equipment (1680 MHz) Inter Met. System, 1500 Radio theodolites, SAMEER make 401 MHz Radiotheodolites and Digital Electronics make 401 MHz, Radiosonde Ground Equipment installed at 34 Radiosonde /Radiowind and 01 Radiosonde in the Upper air network are being done by upper air laboratory at Delhi.

Radar Laboratory undertakes maintenance of radars installed at 10 Cyclone Detection Radar stations and 17 Storm Detection Radar stations in the network. These laboratories also procure spares and accessories for maintenance of these equipment and also various components/items of desired quality needed in the production of radiosondes.

(b) Maintenance and servicing of airport instruments, surface instruments, data collection platforms and radiation instruments in the network is being done by the Laboratories at Pune, besides procurement of various components/items needed for maintenance and production. Stations are also inspected regularly to ensure their proper functioning.

(c) 20 High Wind Speed Recording systems state of art are installed at east and west coast of India for monitoring high wind speed and direction during cyclone are being maintained.

4.3.4 Calibration and Testing

(a) All the baroswitches manufactured in Delhi Workshop are calibrated in an environmental chamber in the Calibration Laboratory at Delhi. The complete radiosondes are then tested in the Testing Laboratory for the desired performance before sending them to outstation for use in radiosonde ascents.

(b) Calibration and testing of surface instruments such as thermometers, barometers, wind vanes, anemometers, self recording instruments etc. are done in the Surface Laboratory at Pune.

In addition to testing, calibration and repairs of the Surface Meteorological instruments received from departmental observatories, meteorological instruments received from non-departmental parties / private manufacturers are also being tested and calibrated on payment basis.

Test Chamber for manufacturing and calibration of Hygristers has been installed in Hygrister Lab. of IMD at New Delhi.

4.3.5 Special Projects

(a) For upper air radiosonde observations on Oceanographic Research Vessel SAGAR KANYA, necessary equipment and flight accessories are provided and observations taken by departmental personnel.

(b) For upper air Radiosonde / Radio wind observations for Antarctic Expedition at base station Maitri (Antarctica) necessary equipment and flight accessories are provided and observations taken by departmental personnel.

(c) Under the Voluntary Co-operation programme of WMO, Radiosondes are supplied to Sri-Lanka for taking Radiosonde Observations.

(d) Under Mountain Meteorology Project in Himalayan region (PARVAT) three RS/RW observatories have been commissioned at Manali, Jammu and Sasoma, two Mini Ectrolyser for production of hydrogen gas commissioned at Jammu and Manali in February, 2003 three latest state of art Radiotheodolites have been procured for RS/RW stations at Manali , Jammu and Sasoma. Also under the same Project twenty two Automatic Weather Stations were installed in Sub Himalayan region for continuously monitoring the Surface meteorological Observations.

(e) Special observation of Radar and Upper Air radiosonde are arranged for scientific programme like ARMEX, BOBMEX etc.

4.3.6 Some of the important instruments manufactured by the Department are listed below :

(a) All types of surface meteorological instruments.

(b) Radiosonde/Radio wind (401 MHz and 1680 MHz) balloon-borne instruments and ground equipment for the measurement of pressure, temperature, humidity, wind direction, wind speed, ozone concentration and net infrared radiative fluxes in the upper atmosphere.

(c) Design and fabrication of suitable instruments for the Automatic Weather Stations under INSAT-I.

(d) Design, development and fabrication of special instruments for the measurement of temperature, humidity, wind speed, wind direction and ozone for the Antarctic Expedition. Ten sets of Ultrasonic type High Wind Speed Recorders were installed at Puri, Chandbali, Balasore, Visakhapatnam, Machilipatnam, Ongole, Nellore, Pondicherry, Karaikal and Adinampattinam under World Bank aided Porject. Nine such stations already installed at Digha, Gopalpur, Paradeep, KalingaPatnam, Kavali and Chennai at East Coast and Okha, Veraval and Mumbai at West Coast.

4.4 SEISMOLOGY

India Meteorological Department (IMD) is the nodal agency of Government of India responsible for monitoring seismicity in and around the country. IMD has rendered more than hundred 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 determine the earthquake Parameters immediately after the occurrence of an earthquake and disseminate the information to all the concerned State and Central Government agencies responsible for carrying out relief and rehabilitation measures. The information is also transmitted to public information channels, Press media etc.

4.4.1 National Seismological Network (NSN)

The department at present, maintains a national seismological observatory network consisting of 47 permanent observatories and 4 observatories in Northern India for special studies Fig.10. As part of an upgradation programme, ten of the existing observatories under the national network located at Ajmer, Bokaro, Bilaspur, Bhopal, Bhuj, Chennai, Karad, Pune, Thiruvananthapuram and Visakhapatnam have been upgraded with GSN (Global Seismograph Network) standard digital broadband seismograph systems. Fourteen more of the remaining observatories of national network located at Akola, Allahabad, Bhubaneshwar, Goa, Jhansi, Kodaikanal, Kolkata, Latur, Mangalore, Mumbai, Nagpur, New Delhi, Shillong and Shimla have also been upgraded with broadband seismograph systems of different make. Both these systems are of the state-of the –art type having broadband sensors, high dynamic range (24-bit) digitizers, GPS time synchronization and facility to access the data remotely through telephone mode or satellite communications.(Fig-10 and Fig-11)

4.4.2 Central Receiving Station and National Seismological Data Base Centre (NSDC)

A Central Receiving Station (CRS) has been set up at IMD headquarters in New Delhi, which has the operational responsibility of keeping round-the-clock watch of seismic activity, downloading the waveform data from remote field stations through dial up facility, analyse and disseminate the earthquake information to user agencies. The data is subsequently archived at the National Seismological Database Centre (NSDC) at IMD headquarters in New Delhi in a systematic manner. The upgradation of the existing seismological network has brought out significant improvements in the operational activities of the department in terms of reduction of undetected/unlocated events in near real time mode and reducing the response time. Availability of fast communication facilities has facilitated near real-time data transmission to a centralized place for immediate processing.

The Division supplies a number of seismicity related reports for specific regions for establishment of industrial units, powerhouses etc and provides consultancy services to various state and central government agencies on earthquake related matters. All correspondence related to earthquake prediction, disaster management, supply of seismological data to various national and international organizations including research and academic institutions, river valley projects, etc are also undertaken.

4.4.3 Brief on "Real Time Seismic Monitoring Network" being set up by IMD as part of Tsunami Warning System.

Introduction

In the aftermath of the Great Sumatra Earthquake of 26th December, 2004 Government of India has initiated actions for setting up an Early Warning System for Tsunamis and Storm surges in the Indian Ocean. The proposed system will help in providing advance warnings of Tsunamis and Storm surges likely to affect the coastal areas of the country. The project is designed to be implemented through a multi-institutional participation. A National Tsunami Warning System has been established at Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, which has been identified as the nodal organization under MoES for all activities related with the issue of Early Warning for Tsunamis. Apart from INCOIS, the various other Departments/ organisatin under MoES which are involved in this endeavor are IMD (setting up of RTSMN), ICMAM (Inundation mapping, Coastal vulnerability mapping and Tsunami Modeling), and NIOT (deployment of DART System, Automatic tide/ gauges etc.), the other organizations like Survey of India (Tide Gauge Network), Department of Space (INSAT Communication plan and Coastal Topographic Mapping), CSIR laboratories and MHA are also participating in this project.

Real Time Seismic Monitoring Network (RTSMN)

As part of the Early Warning System for Tsunamis and Storm Surges in Indian Ocean being set up by Government of India, a 17 station Real Time Seismic Monitoring Network (RTSMN) is being established by India Meteorological Department (IMD). The network is designed to monitor, report, in least possible time, the occurrence of earthquakes capable of generating Tsunamis from the two probable Tsumanigenic sources viz. the Andaman Nicobar Sumatra Island are region and the north Arabian Sea area. The data from the 17 Broadband seismic field stations will be transmitted simultaneously in real time through V-SAT communication facilities to the Central Receiving Stations (CRSs) located at IMD New Delhi and INCOIS, Hyderabad for processing and interpretation. The CRSs are equipped with state of art computing hardware, communication, data processing, visualization and dissemination facilities. The earthquake information shall be disseminated through various communication channels to all concerned user agencies in a fully automated mode

The RTSMN system, when made fully operational, would be able to provide earthquake information within 10 minutes, of the occurrence of events of Tsunamigenic potential. The system is expected to be fully operational by the end of February, 2008.

4.4.4 National Seismological Bulletin

The Seismolgy Division publishes a monthly National Seismological Bulletin, containing the phase data and the processed information on epicentral parameters of all earthquakes located by the National Seismological Network. The bulletin is periodically sent to International Seismological Centre (ISC) for incorporation in the ISC's Seismological Bulletin, which contains data from all global stations.

4.4.5. International Collaboration in Seismology

India is a permanent Member of the International Seismological Centre (ISC), UK, Earthquake information, publications, bulletins are regularly exchanged by ISC and IMD. Seismological Bulletins containing processed information on earthquakes recorded by the national network are regularly supplied to the centre.

4.4.6 Indo-Russian Centre for Earthquake Research

An Indo-Russian Centre for Earthquake Research (IRCER) has been established in India Meteorological Department.

This is corollary to the signing of an MOU on 12.11.2003 by the Secretary, Department of Science and Technology, Government of India and the president of the Russian Academy of Sciences (RAS) in Moscow during the visit of Indian Prime Minister to Russia. The projects identified during the visit of the high level scientific delegation to Moscow in September, 2003 are being implemented as part of the activities of this Centre as a multi-institutional effort.

4.4.7 Seismology Training

The Division organizes periodical training programs/refresher courses to station operators with emphasis on operation and maintenance of analog and digital seismograph systems. Apart from officers and staff of the department, persons sponsored by other institutions and laboratories also attend these training courses.

4.4.8 Seismology Workshop

Development and manufacture of seismological instruments and accessories is undertaken in the departmental workshop. Besides catering to the needs of the national observatories, the department also makes a limited supply of seismological instruments to other institutions.

4.4.9 Seismic Zoning of India

Bureau of Indian Standards [IS-1893 – part – 1: 2002], based on various scientific inputs from a number of agencies, has grouped the country into four seismic zones viz. Zone-II, - III, - IV-V (fig. 12). Of these, zone V is the most seismically active region, while zone II is the least.

4.4.10 Research and Development

The upgradation of seismological observatories of IMD's national network through deployment of state-of-the-art digital seismograph systems and systematic archival of digital data at National Seismological Database Centre has created an atmosphere Conducive to carry out various research investigations on Seismology related topics. The upgraded seismological network has generated very useful and unique digital broadband and strong motion data sets for several significant earthquakes in the last decade including the Bhuj earthquake of 26th January, 2001. Analyses of these data sets have greatly helped in improving our understanding about the earthquake process in the inter-and intra-plate seismic regimes. The crust and upper mantle structure of the Peninsular shield region has also been delineated with higher resolution using the broadband data sets generated by the regional events. For the first time ground motions expected from future earthquakes have been estimated from the Jabalpur (1997) and Bhuj (2001 earthquake data.

4.4.11 Special Services offered by Seismology Division

(1) IMD provides data and relevant information pertaining to earthquakes to various users agencies including material for parliament questions, seismicity reports for river valley projects and dams etc.

(2) The division carries out micro-earthquake surveys for monitoring of aftershocks, Swarm type seismic acitivities and site response studies by deploying portable seismograph systems in the affected areas.

(3) Provide consultancy service to various State and Central Government organizations in making policy guidelines relating to seismology and establish new seismological observatories.

(4) Provide training to station operators in the operation and maintenance of seismographs of various kinds and data processing and analysis.

(5) Development and manufacture of analog seismological instruments and accessories is undertaken in the departmental workshop. Besides catering to the needs of the national observatories, the organization also makes a limited supply of seismological instruments to other institutions.

(6) Exchange of seismic data with National and International agencies & Publications of Seismological Bulletin.

4.4.12 Projects under implementation

1. As a part of the proposed Tsunami Warning System being established for the Indian Ocean region setting up of a real-time seismic monitoring and information dissemination system is in progress.

2. The National Seismological Network is being upgraded as part of up gradation program.

3. The exaction national Seismological Database Centre is being upgraded to meet the increased requirements of data analysis, information dissemination and archival.

4. An Indo-Russian Center for Earthquake Research (IRCER) has been established in IMD to coordinate and monitor various collaborative projects in Seismology being implemented by various institutions under the Integrated Long Term Programme (ILTP) of DST for cooperation between India and Russia.

4.4.13 Central Seismological Observatory (C.S.O. Shillong)

Central Seismological Observatory, Shillong was established in the year 1952. At present SEISMOLOGY, METEOROLOGY, and RADIATION units are functioning there.

4.4.14(i) Seismology

Round the clock watch in seismology unit has been started w.e.f. 24.4.1989 and seismic data are now being transmitted to Seismo. HQ, New Delhi over TELEX, TELEPHONE and MICRO EARTH STATION for all the events within epicentral distance of 25 degree of magnitude 4 and above. Shillong observatory is also equipped with a broadband system and a telephone modem connectivity to enable transmission of wave form data to CRS,New Delhi. All local low magnitude felt earthquake whose epicenter is not determined by Seismo. HQ, New Delhi due to paucity of data, are being supplied to public and press with the help of Shillong station data with prior permission from Seismo. HQ, New Delhi. 4 (Four) Seismo. Observatories i.e. AGARTALA, IMPHAL, TURA, and LEKHAPANI are also functioning in North Eastern India under the guidance of Seismo. HQ, New Delhi.

Recording of ground deformation with the help of GPS is continued from December, 2001.

Control unit and light sources required for photographic recorders are being manufactured in the Work-Shop.

4.4.14(ii) Meteorology

Meteorological observatory at CSO Shillong was established in the year 1957. Two (2) main synoptic observations are being taken now and autographic recording of Met. Parameters for Pressure, Temperature, Humidity, Rainfall and Evaporation are also being done. Met. data of 3UTC and 12UTC synoptic observations are now being transmitted to RMC, Guwahati, DGM, New Delhi; and DDGM(WF), Pune over telex and MES regularly. Met. Parameters are also now being displayed by Doordarshan Kendra Guwahati and Shillong.

4.4.14(iii) Radiation

Radiation unit was established in August, 1966 with installation of "Bimetallic Pyranograph but the recording of global and diffused solar radiation started in February, 1967. Pyrheliometer/ Pyrogeometer observations also started in February, 1967.

4.4.15 EARTHQUAKE RISK EVALUATION CENTRE (EREC)

Earthquake Risk Evaluation Centre (EREC) has been established in India Meteorological Department in 2004,

with the objective to guide in national endeavor in mitigating the disastrous impacts of earthquakes and undertake/promote the following specific tasks related to earthquake risk evaluation:

- To provide earthquake risk related ***knowledge products*** for designated areas of the national territory of India, inputs as nature and scale of earthquake hazard, vulnerability of built environment and risk maps and figures.
- To develop suitably distributed ***Information Systems*** for ready collation of primary data from different national sources, their encoding & quality indices, archival and retrieval and also develop advance level integrated databases.
- To develop a vibrant ***user Interface*** in order to constantly interact with various agencies involved in risk mitigation as well as with local communities with the objective of (a) communicating to them the knowledge products and their implications, and (b) to continually reappraise the system keeping in view the relevance and usability of these products, through specially designed feedback activities.
- To ***articulate*** well considered regulatory and legislative measures for effective mitigation of risk, and advise/request appropriate agencies to implement these.
- To ***catalyze*** development of ***evermore-effective*** risk assessment and mitigation approaches and systems by sponsoring such programs that may be warranted in the light of new emerging national priorities as well as new developments globally in exploiting up-to-date Science and Technology(S&T) systems towards mitigation.
- To **undertake/sponsor user based training/ programmes** of scientists and other relevant members of the concerned community.
- To develop and provide earthquake risk related knowledge products for designated areas
- To develop suitable knowledge products and dissemination system
- To develop vibrant user Interface in order to constantly interact with various agencies involved in risk mitigation
- To articulate well considered legislative and regulatory measures
- To take up Micro earthquake survey and microzonation related field studies
- Monitoring of local seismicity for development of seismo-tectonic maps

Thus, the Seismic Hazard Microzonation &Risk evaluation are the cardinal activities of the Center.

In order to achieve the above goal a state-of-the-art Data Hub cum computing facility would have to be established. This Data centre or Hub known as "EDAKH"(EREC Data centre and Knowledge products Hub) has been designed based on emerging Data centre Technology of today which focuses on "Grid Computing " Technology rather than the older fashioned client-server Technology. Basic requirements of EDAKH are – availability, accessibility, scalability and reliability. In order to accomplish this, powerful Hardware like blade servers based on Itanium-2 processors, industry standard grid products such as Oracle Data base 10g, Oracle Application server 10g and Oracle Enterprise Manager 10g along with Robotic storage have been planned for .This Hub, when fully operational, will be first of its kind in the country for collation, analysis, storage, archival and dissemination/ access of earthquake related disaster and risk data base cum knowledge products.

EREC has been contributing towards Microzonation studies in the country

Benefits to be accrued:

Knowledge products to be generated by EREC have far reaching benefits to the society and the country. Some of the major beneficiaries are :

Various Govt. and semi-Govt. organizations/institutions engaged in Disaster management and mitigation .,Civic authorities & fire and emergency management services, Heath agencies, Town planners and Builders, Defence establishments, Law & order management authorities, Insurance sectors, Heavy industries and above all the general public at large.

The following projects have been earmarked / undertaken by EREC:

A .Seismic Hazard Microzonation of Delhi

- **Short term goal**

Formulation of base map, Collation of data on Geology, Geomorphology, Quaternary geology & Geotechnical characterization
Generation of new data base on Geotechnical parameters (SPT, CPT)
Land use and Land cover mapping
Site Response studies;
Preparation of first level Seismic Hazard Microzonation map

- **Long term goal**

Study & interpretation of Remote sensing data creation of new data base on Shear Wave velocity and geotechnical attributes on soil typologies (Field and laboratory studies)
Collation and interpretation of data
Integration of data in GIS format, analysis and interpretation for generating Seismic Hazard and Risk Microzonation maps of Delhi and providing inputs for planning of disaster mitigation

B. Seismic Risk Microzonation of Jabalpur and disaster Mitigation planning in consultation with Local Self Government

- **Short term goal**

Up gradation of Seismic hazard maps including additional probe holes on SPT/CPT, Site response studies, generation of ground response data, documentation and publication of report

Study and analysis of remote sensing data and preparation of footprint map of Jabalpur urban agglomeration: Engineering Seismological Survey and risk evaluation.

- **Long term goal**

Continued Engineering seismological studies and numerical modeling for ground response validation
Integration of Hazard and Engineering seismological data in GIS format and interpretation &. Preparation of Seismic Risk Microzonation of Jabalpur and providing inputs for preliminary planning of disaster mitigation.

Procurement / acquisition and establishment of EREC Database and Knowledge products & Advisory Hub (EDAKH) including EREC Website

- **Short term goal**

Finalization and approval of specification, Completion of Capital works
Procurement of Hardware and Software
Creation of EREC Website
Installation of EDAKH
Commissioning and acceptance testing

- **Long term goal**

Integration with present IMD Data Network and other national agencies / users

C. Methodology for Microzonation: standardization and preparation of manual

- **Short term goal**

Generation of documents with inputs from experts of multidiscipline involved in Microzonation

- **Long term goal**

Editing of scripts, codification and printing of the manual on Microzonation

D. Creation of national database for seismic hazard and regional risk appraisal

- **Short term goal**

Collation of multi thematic data and digitization of maps
Customization and integration ion of multi thematic data in GIS Base

- **Long term goal**

Generation of module for Seismic hazard and Risk Information; Commissioning and testing of the system
Generation of module for Seismic hazard and Risk Information; Commissioning and testing of the system

E. Pattern identification of Seismicity in different tectonic domains of India and environs

- **Short term goal**

Collation of Seismological and tectonic data and Digitization of map

- **Long term goal**

Pattern identification based on Time series Analysis and fractural based studies

Staff:

Twenty (20) posts were approved for effective functioning of EREC. These posts are:

Chief Scientist	One (Vacant)
Scientists	Six (Three vacant)
Visiting Fellows	Four (One Vacant)
Research Associates	Nine (Seven vacant)

As a local arrangement,following two units are attached with EREC:

1. Delhi Telemetry & Local Network
2. Micro Earthquake Survey (MEQ)Unit

Delhi Telemetry and Local Network

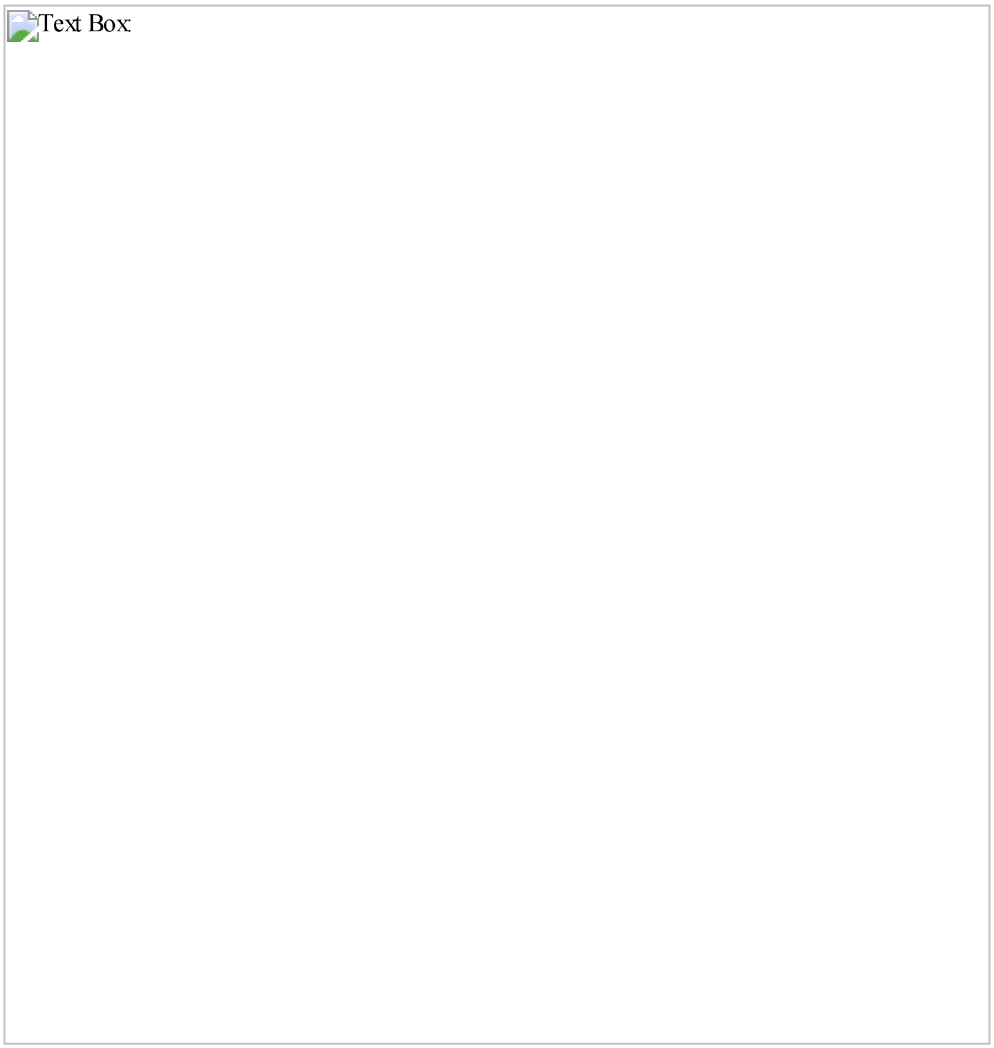
Responsibilities and Activities

Delhi and its neighborhood is bounded in the north by Indo-Gangetic plains, in the west by the extension of the Great Indian Thar Desert and in the south by the Aravalli ranges. The physiographic setup of the region includes continued extension of the Peninsular Shield in the form of both superficial as well as subterranean ridges extending transverse to the sediment filled Indo-Gangetic basin which is aligned parallel to the field and thrust belt of Himalayas. Delhi region lies in seismic zone IV as per seismic zoning map of India published by Bureau of Indian Standard (BIS). The thrust zone lies about 250-350 Km north of Delhi and has been identified as a significant seismic gap area in the Central Himalayas (Bilham et. al. 2001). The past

seismicity of the region shows that several earthquakes of magnitude 6.0 and above occurred in Delhi and its neighborhood and have caused extensive damage to properties and loss of lives. Therefore, this region is hazardous due to earthquakes of Himalayan region as well as of its own. The National Capital Region of Delhi is fast growing metropolitan city and its burgeoning population and industrial work force is at increasing risk from seismic hazard. A close monitoring of seismicity of the region is the first step towards assessment of seismic hazard of the region. All these factors provided the motivation for installation of a seismic telemetry network around the area.

Brief Network Details

A sixteen element VSAT based digital seismic array around Delhi with CRS at IMD, HQ New Delhi has been set up during September 2000 to April 2002. Of these, thirteen field stations are within 200 Km radius from CRS. Taking advantage of VSAT communication the remaining three field stations have been setup at Joshimath, Kalpa and Jaisalmer for monitoring regional seismicity and near real- time monitoring of seismicity of northern Himalayan region. The field stations are unmanned and continues ground motion data in digital form is transmitted on line to Central Receiving Station (CRS) in near real-time



4.5 SATELLITE METEOROLOGY

4.5.1 INSAT Data Reception and Processing :

India Meteorological Department is receiving and processing meteorological data from Kalpana-I, INSAT-3A and NOAA series of satellites for meteorological analysis and weather forecasting. Kalpana-I was launched on 12th September, 2002 and is presently located at 74^{o} E. INSAT-3A was launched on 10th April, 2003 and is located at 93.5^{o} E.

There is another satellite named INSAT-2 E similar to INSAT-3 A, which was launched on 2nd April, 1999. The VHRR payload of this satellite is not working due to technical problem, however its CCD payload is working satisfactorily and its data is being received and processed regularly.

One uplink station for Digital Meteorological Data Dissemination and one downlink station have been installed at New Delhi for dissemination of Satellite imageries, Synoptic Data and analyzed weather charts under the scheme "Procurement of 40 Nos. Digital Meteorological Data Dissemination (DMDD) equipment and uplink equipment".

One GPS receiving system alongwith the computation server has been installed at IMD, New Delhi for computation of Integrated Precipitable Water Vapour (IPVV) under the scheme of "Establishment of 5 GPS receivers for monitoring of IPWV".

4.5.2 INSAT Meteorological Data Processing System (IMDPS):

IMDPS is also capable of processing meteorological data from unmanned Data Collection Platforms (DCPs) and supports all operational activities on round the clock basis. The DCP stations located in the remote and inaccessible areas record and store hourly data and transmit the same to ground processing system using INSAT Data Relay Transponders (DRT). However, limited number of stations are currently operational with DRT on board Kalpana-I satellite. Cloud Imagery Data is processed and transmitted to forecasting offices of the Deptt. as well as to the other users.

Apart from generating cloud imagery, IMDPS has the capability of deriving meteorological products from the data received. The products include:

(a) Cloud Motion Vectors (CMVs) are derived using three consecutive half hourly images from the operational Kalpana-I Satellite CMVS are generated at 00 hour UTC using Infra red imagery

(b) Sea surface Temperatures (SST's) are computed from INSAT-IR imagery for 00 and 12 hrs UTC. SST are also computed from NOAA satellites using multi channel alogrithm.

(c) Outgoing Longwave Radiation (OLR) at 1.0^{0} Grid is computed from INSAT-IR data on 3 hourly/daily/weekly/monthly basis.

(d) Quantitative Precipitation Estimates (QPE) are generated at 1.0^{0} Grid from INSAT-IR imagery on 3 hourly/daily/weekly/monthly basis.

(e) Atmospheric soundings are generated from US Polar Orbiting series of NOAA series satellites. They include temperature profiles and standard level geopotentials.

4.6 AGRICULTURAL METEOROLOGY

The Agricultural Meteorology Division at Pune caters to the needs of agriculturists and conducts research in the field of agricultural meteorology. The main functions of the Division are :-

(i) Conducts experiments and evolve techniques for better understanding of processes by which weather and climate affect crop growth and yield and the incidence of crop pests and diseases.

(ii) Advise farmers by weather forecasts relevant to agricultural operations.

(iii) Supply of processed climatic data to end users for planning agricultural strategy.

(iv) Providing technical assistance to various Agricultural departments, Agricultural universities, Research Institutes for establishment, maintenance and inspection for smooth running of their Agromet. Observatories starting and inspection of soil moisture observatories and logistic, maintenance of departmental evapotranspiration observatories.

(v) Studies of inter-relation between crop pests and diseases and concurrent weather parameters in collaboration with Agricultural Universities/ Research Institutes with a view to forewarn of their outbreaks/spread on the basis of forecasted weather parameters.

(vi) Act as liaison between meteorological department and State Agricultural Departments and Agricultural Research Institutes and advise them on meteorological aspects of agricultural problems.

(vii) Conducts the training courses for Observers (from Agromet Observatories) , students, lecturers, scientists/research scholars (from Agricultural Universities and state/central research institutes) , foreign personnel under WMO, Colombo Plan, UNDP etc. and departmental group 'A' and group 'B' officers and staff.

(viii) Carry out quantitative pest observations in the experimental crop field in collaboration with Agricultural Universities for developing weather based forewarning models for the incidence of pest on an operational basis.

(ix) Development of pest weather calendar for various pests for operational crop protection. Preparation of revised crop weather calendars for the important crops grown in various districts of the country. These calendars comprise of Agriculturist's requirement of various weather warning and life history and mean dates of important epochs of crop growth.

(x) Studies on water use by crop and its irrigation planning for dry farming tract in India.

4.7 HYDROMETEOROLOGY

The Hydromet Division at New Delhi consists of different units like :-

(1) Rainfall Monitoring Unit
(2) Design Storm Unit
(3) Storm Analysis Unit
(4) Flood Met. Unit
(5) Glaciology Unit
(6) Water Balance Unit
(7) Hydrology Project Unit
(8) Central Hydromet Observatory
(9) International Hydrology Programme
(10) Project "PARVAT"

The main activities in this discipline are as follows :

Real time monitoring of district wise daily rainfall, continuous built up of rainfall statistics, hydrometeorological studies for different river catchments with a view to estimate Standard Project Storm (SPS), Probable Maximum Precipitation (PMP),

Time distribution of rainfall storm, Intensity-frequency Analysis of rainfall which is used by design engineers for construction of Dams, railways, road bridges, culverts etc. for different Central and State Government organisations, N.T.P.C., N.H.P.C. and D.R.D.O.. It also provides meteorological support for flood warning and flood control operations by the field units of Central Water Commission.

Hydromet Division also participates regularly in glacier expeditions to take meteorological observations for snowmelt glaciological studies. A multi-agency, World Bank aided Hydrology Project has been undertaken for standardisation and strengthening of observational network to create a quality data base of Peninsular India. A Central Hydrometeorological Observatory also functions in Hydromet Division, New Delhi. IMD also provides active support to the International Hydrology Programme.

A Hydrology Section also functions at Pune for rainfall registration and rainfall climatology. There are five small Hydromet Units at the five Regional Meteorological Centres for organisation and inspection of raingauge stations.

4.8 CLIMATOLOGICAL ORGANISATION

The Climatological Division of office of the Additional Director General of Meteorology (Research), Pune and the Climatological Units at the Regional Meteorological Centres and Meteorological Centres at State Capitals are entrusted with climatological functions. Scrutiny and processing of meteorological observations for assimilation into the departmental archives are the principal functions of the climatological services. They are meant to provide meteorological statistics required for agriculture, irrigation, industries and other nation-building activities. Various climatological publications, Normals for the observatory stations, 10-day wind averages were brought out and updated from time to time.

4.8.1 National Data Centre (NDC)

National Data Centre (NDC), Pune is the sole custodian of the meteorological data meticulously collected over the last 125 years. The Climatological information is a national heritage and is being preserved at NDC very carefully.

The meteorological data collected by observatories all over India are transferred to compact disks for permanent archival. About 9.36 billion characters of data are held in IMD archives at present. A powerful mainframe computer system VAX-4000/300 with a large number of peripherals viz. Tape drives, PCs, Workstations, CDROMs and CTD drives, plotters, printers with suitable software etc. have been in operation at National Data Centre. Besides meeting the needs of research and development activities, NDC also facilitates quick and efficient data processing, electronic quality control and retrieval of data for users. On an average every month 10-12 lakh records of meteorological data are being supplied to users on floppies/CDs.

4.9 AVIATION METEOROLOGY

Aviation Meteorological offices are mostly at airports to meet the requirement of aviation service. There are at present 71 Current Weather Observatories including 18 Aviation Forecasting (AFOs) Offices where different types of forecasts such as aerodrome forecasts, trend forecasts, flight forecasts are issued to serve aviation needs. 14 (AFOs) are functioning at National Airports. 4 AFOs are functioning at International Airports at Mumbai, Kolkata, Delhi and Chennai. AFOs at International Airports also serve as Meteorological Watch Office catering to flight in the respective flight information region.

One Regional Area Forecast Centre is situated in Delhi. This caters to the Aviation needs of India and neighbouring countries maintaining liaison with World Area Forecast Centre at London and Washington. "One Tropical Cyclone Advisory Centre is also functioning at New Delhi. The centre provides advisory information on tropical cyclones."

4.10 IMD COMPUTER CENTRE, NEW DELHI

The Computer Center of NHAC is equipped with Computer System Altix-350 and Origin-200. The computer system

Altix-350 was installed after the phasing out of Cyber 2000U computer system to cater the essential and ongoing operational requirements of NHAC. The Altix-350 (2 CPU, 2 GB RAM, 73 GB HDD, one plotter) system along with Work Station (Intel 2.8 GHz Processor) is being used for processing real-time incoming Global Telecommunication System (GTS) data and plotting of various operational charts. The data files generated in the workstations are also used for running the limited area analysis and forecast system. The other server Origin-200 (2 CPU, 2 GB RAM, 270 MHz processor) is used for running NWP models.

IMD has been using a Limited Area Model (LAM) on operational basis to issue forecast valid upto 48 hours based on 0830 and 1730 hours IST initial conditions. First guess field as well as lateral boundary conditions are being taken from the outputs of T-80, a global spectral model being run at National Center for Medium Range Weather Forecasting (NCMRWF). The resolution of the present version of the LAM is 75 km in the horizontal and has 16 sigma levels in the vertical. A non-hydrostatic mesoscale model MM- 5 is also run daily once for generating 72 hours forecasts with the horizontal resolution of 45 km. for cyclone track prediction, a Quasi-Lagrangian Model (QLM) at the horizontal resolution of 40 km is used for issuing 72 hours forecasts. For storm surge prediction, IMD has been using IIT-Delhi storm surge model in conjunction with the nomograms developed by IMD.

IMD's own web site is being regularly updated from IMD computer centre to give Weather information like limited Area analysis and 24 hours forecast products, daily weather bulletins and forecast (Text) for all regions including special weather warning such as Tropical Cyclones, heavy rainfall etc.

4.11 POSITIONAL ASTRONOMY CENTRE (PAC)

The Centre issues the following 16 publications annually:-

(i) Indian Astronomical Ephemeris (IAE)
(ii) Tables of Sunrise & Sunset and Moonrise & Moonset
(iii) Rashtriya Panchang in 14 languages viz. Hindi, English, Sanskrit, Urdu, Assamese, Bengali, Gujarati, Kannada, Marathi, Malayalam, Oriya, Punjabi (Gurmukhi), Tamil and Telugu.

The Indian Astronomical Ephemeris contains about 600 pages of astronomical data on the positions of Sun, Moon, Planets, Bright Stars, contains a section on the National Calendar of India (Saka Calendar) with the timings of Tithis, Nakshatras etc. and the festival dates. The publication is now in its 47^{th} issue. **Rashtriya Panchang** is a popular publication brought out with the aim to provide a standard unified Calendar for the whole country and to promote a scientific basis for Panchang calculation.

The Centre meets the specific data requirements of a large number of user agencies. Lunar data for prediction of tides are computed for the Survey of India, Sun's daily path for orientation of large civil construction/projects are computed for Civil Engineers. Architects and large public meetings, Solar positions for aligning radar and for antennas for communications, Railway and Air Force engineers and for Antarctica Expeditions, Pole Star data for aligning radio transmitters, times of rising-setting phenomena for a large number of places for newspapers, judiciary, religious bodies, defence and scientific bodies, eclipse phenomena for scientific researchers and general public etc. The centre is the national agency for attending to all matters concerning Calendar. it determines the dates of festivals of all communities in India in advance for holiday declaration by the Government, tourist promotion abroad and for use of Panchang makers.

4.12 PUBLICATIONS & LIBRARIES

4.12.1 Publication

The publications include memoris of IMD, scientific Monographs, Weather Reviews, Scientific & Technical Notes and Reports, Climatic Atlases & Charts, Climatological Tables, Forecasting manuals and other miscellaneous publications. A large number of brochures have also been published highlighting the activities of the Department.

Periodical Weather reports are also published as a part of public weather services to help to manage irrigation and Agriculture, Floods, Surface transport, Navigation, Aviation and to cater to various public works departments, research organizations and the general public. The list of periodicals is given below:

LIST OF PERIODICALS PUBLICATION

S.NO	TITLE	ISSUED BY
1.	MAUSAM (Quarterly Indian Journal of Meteorology, Hydrology & Geophysics)	DGM, New Delhi
2.	Indian Daily Weather Report (IDWR)	DDGM(WF), Pune
3.	Regional Daily Weather Report (RDWR)	Regional Meteorological Centre
4.	State Daily Weather Report (SDWR)	Meteorological Centres at State Capitals
5.	Weekly Weather Report (WWR)	DDGM(WF), Pune
6.	All India Weather Summary (AIWS) Daily	DDGM(WF)
7.	Marine Climatological Summaries (Annual), (Decadal)	ADGM(R), Pune
8.	Disastrous Weather Events (Annual)	ADGM(R), Pune
9.	Indian Astronomical Ephemeris (Annual)	PAC Kolkata
10.	Rashtriya Panchang (in 14 languages) (Annual)	PAC Kolkata
11.	Table of Sunrise & Sunset and Moonrise & Moonset (Annual)	PAC Kolkata
12.	Seismological Bulletin (Monthly)	DGM, New Delhi
13.	Climate Diagnostic Bulletins (Monthly/ Seasonal)	ADGM(R), Pune
14.	Special Daily Weather Report (During monsoon)	HQ(NHAC), New Delhi
15.	Weekly Weather Report	HQ(NHAC), New Delhi
16.	RSMC Report on Cyclonic Distrubances in the Indian Ocean (Annual)	HQ(NHAC), New Delhi
17.	Annual Snow fall Summery	ADGM(R) Pune

4.12.2 Research Journal

MAUSAM is a quarterly research journal being published by India Meteorological Department since January 1950. This was originally called the Indian Journal of Meteorology, Hydrology and Geophysics, then later called the Indian Journal of Meteorology, Hydrology and Geophysics and was finally named MAUSAM in 1979.

4.12.3 Awards

The Government of India instituted a Biennial "MAUSAM" Award in 1960 comprising of a Citation and cash award worth Rs. 35,000/- (Rupees Thirty Five Thousand only) to each author. The award is given to the Indian/Foreign scientists for the best paper on Meteorology and allied subjects published in "MAUSAM" during a period of preceding two years.

Another Biennial Award entitled "MAUSAM Shodh Puraskar" was instituted by Govt. of India in 1993 exclusively for the best scientific research paper in Hindi, by the IMD official (including retired scientists), published in MAUSAM during the preceding two years period. The award consists of a Citation and a cash prize of Rs.10000/- (Rupees Ten thousand only) per auther.

4.12.4 Libraries

NMSDOC/ADGM(R), Pune Library

(a) In view of publications and other increasing information and documentation activities, the IMD library has now been renamed as 'National Meteorological and Seismological Documentation Centre – NMSDOC'. It has a good collection of books, periodicals and other publications. It also contains Audio Visual material, such as Video Cassettes on meteorological phenomena, which are used by the trainees and other scientists of the Department. NMSDOC provides services not only to the employees of the Department but also caters to the needs of a large number of other institutes and the Govt. agencies, viz. Centre for Atmospheric Sciences, IIT, New Delhi and NCMRWF under Department of Science & Technology, New Delhi, scientists, research scholars, students etc. It also provides excellent information, reference and reprographic services to the users.

NMSDOC at HQ subscribes 50 foreign journals and 25 Indian journals. In addition it also receives journals in exchange of Mausam and other departmental publications.

(b) ADGM(R) Pune office of this department also maintains a good library having collection in meteorology and allied subjects. The library subscribes to 25 foreign and 27 Indian journals. It also procures WMO publication directly from WMO, Geneva, Switzerland and distributes them to meteorological offices located in various parts of country and at Head Quarters at New Delhi as well.

The library subscribes to 14 foreign and 27 Indian journals on meteorology and related subject. Also this library procures WMO publications directly from WMO, Geneva, Switzerland as per standing order and distributes them to Met. Offices located in various parts of country and Air H.Qrs. New Delhi as well.

4.13 TRAINING DIVISION

The Department offers training facilities in general meteorology, instrumentation, meteorological telecommunication and agricultural meteorology. These are open not only to departmental personnel but also to officers of other departments, Defence services, Universities and to candidates from foreign countries. The training facilities of the India Meteorological Department in Pune and New Delhi were designated as WMO Regional Meteorological Training Centre (RMTC) for Regional Association II (Asia).

5. SERVICES RENDERED

The Department caters to the need of a large number of interests such as Aviation, Shipping, Fisheries, Ports, Agriculture Irrigation & Power Projects, Flood Control, Public Works, Railways, Post & Telegraphs, Public Health, Himalayan Expeditions, Defence Services, Industries, Oil & Natural Gas Commission, Indian Oil Corporation and the general public. These are briefly outlined below :-

5.1 SERVICES TO AVIATION

India Meteorological Department is the designated meteorological authority to provide the necessary meteorological services for air navigation both for National and International flights operating through Civil Aerodroms in India. The aviation meteorological services provided by India Meteorological Department confirm to international procedures as laid down in ICAO's regulatory documents. The objective of meteorological services for air navigation is to contribute towards the safety regularity, efficiency and economy of aircraft operation. Meteorological information for aviation is supplied to the airline operators, flight crew members air traffic service unit, search and rescue units, airport managements and other concerned with the conductor development of air navigation.

IMD maintains 73 Aeronautical Meteorological Offices (18 Class I + 55 Class III) at the international and national

airport in India. Four Aviation Forecasting Offices functioning at Mumbai, Kolkata, Delhi & Chennai airports also serve as Meteorological Watch Offices (MWOs) catering to flights in respective Flight Information Regions. Class I & Class III Aeronautical Meteorological Offices are shown in the attached map fig. No.13.

5.2 SERVICES FOR SHIPPING & FISHERIES

For the benefits of the ships on high seas and coastal and fishing craft, weather bulletins are issued for broadcast four times daily (more often when an actual storm or depression occurs) by the Area Cyclone Warning Centres at Mumbai, Kolkata and Chennai and the Cyclone Warning Centres at Ahmedabad, Bhubaneswar and Visakhapatnam. The officials of the Port Meteorological Liaison offices (PMLO) at Mumbai, Kolkata, Chennai, Visakhapatnam, Marmugao and Kochi visit the ships, while in harbour to calibrate meteorological instruments on board and to provide meteorological information to ships about to sail. Ships logbook containing Meteorological Observation onroute taken by Ship, is collected by these ports, Met. Liaison offices and sent to Pune for quality control and archival.

5.3 MARINE POLLUTION EMERGENCY RESPONSE SUPPORT SYSTEM (MPERSS)

In the event of a major marine pollution incident on high seas, the necessary meteorological support will be provided by India (IMD) for Met. area VIII N i.e. Bay of Bengal, Arabian Sea and North of Equator. NHAC, New Delhi is designated as Area Meteorological Co-ordinator (AMC). The Advisories/Bulletins are issued by ACWC Mumbai, Kolkata and NHAC New Delhi/INOSHAC Pune.

5.4 SERVICES TO PORTS

Meteorological Service to ports is rendered by the Area Cyclone Warning Centres at Mumbai, Kolkata & Chennai and the Cyclone Warning Centres at Ahmedabad, Bhubaneswar and Visakhapatnam. Cautionary messages are issued as soon as disturbance is located or suspected on weather charts. In the event of a cyclone development, warning messages are sent to the ports likely to be affected, as frequently as necessary. Based on these messages, the port authorities hoist appropriate storm warning signals for the benefits of ships in the harbour and near the coast.

5.5 INLAND WARNING SERVICES

The Department has been issuing heavy rainfall warnings from 1885 to District officials and offices of the Irrigation, Railway, Police, Telegraphs, Agriculture, Public works and other departments. Information about anticipated rainfall exceeding specified limits in their areas is telegraphed to these officials. Warnings are also issued for other weather phenomena like gales, frost, onset of monsoon etc. Over 19,000 warning messages are issued annually.

5.6 SERVICES TO PUBLIC

The weather services to the public are varied according to the need of the user, but most important are the forecasts and warnings against adverse weather. Every AIR station has a routine programme of broadcast of weather reports in the local language of each region. Special warnings against severe weather, like thunderstorms and dust storms based on radar observations, are broadcast by the AIR stations. The TV stations give coverage for important weather events. Weather information covering rainfall, temperature, pressure distribution and other weather events along with the weather forecasts are telecast daily in Hindi & English on National TV Programme. The latest cloud pictures from INSAT is also telecast along with this information. Many newspapers publish regional weather forecasts and local forecasts regularly. Weather reports, forecasts and telegraphic summaries are supplied to subscribers on request. The latest weather information is also made available to the public through the special information service of the telephone system at Kolkata, Mumbai, Delhi, Chennai, Lucknow, Tiruchirapalli, Begumpet, Nagpur and Pune.

5.7 SERVICES TO AGRICULTURE AND FARMERS

Prime mandate of the Division is to support agriculturists, planners and all other users by giving advance information relating to weather and crop condition for "planning agricultural operations", crop yield forecast based on meteorological data, information relating to progress of monsoon, rainfall analysis is issued for dry land farming and technical assistance to various Agricultural Departments, Universities, Research Institutes for establishment and smooth running of their Agromet observatories. Agromet Advisory Bulletins are prepared weekly/bi-weekly in consultation with the State Agricultural experts and various subject matter specialists for the benefit of farmers at 20 Agromet Centres in the country. These Advisories are tailored to meet the agronomic requirements of the farmers based on past and anticipated weather conditions. These advisories are being broadcast by AIR stations within the concerned regions in regional languages and are also telecast wherever the facilities exist. The Agricultural Meteorology division prepared crop weather calendars which to use as a guiding tool for the preparation of Farmer's Weather Bulletin issued daily by the different Meteorological Centres of the country. These calendars depict the state and stage of the weather conditions and warning to be issued based on the forecasted weather parameters. Crop weather calendars were first prepared in 1945. These calendars give in a "ready form" of weather elements detrimental to crop in various developmental and growth stages.

During 1965 & 1966, major parts of India were under prolonged and severe drought conditions due to wide-spread, deficient summer monsoon rainfall. At the instance of Planning Commission, a special unit called "Drought Research Unit" was started at Pune in June 1967. The objectives of the unit are :-

(a) Agroclimatic and synoptic study of Drought.

(b) Development of formulae for forecasting yield of principal crops in India.

The Drought Research Unit is functioning under the Office of Addl. Director General of Meteorology (Research), Pune. The Drought Research Unit has taken up the following activities to meet its objectives :-

(i) Aridity Anomaly Maps are being prepared during the Kharif Season(June-September) for the whole country and for North East Monsoon Season (October - December) for 5 Meteorological Sub-divisions, Coastal Andhra Pradesh, Rayalaseema, South Interior Karnataka, Kerala and Tamilnadu and Pondicherry on bi-weekly basis. These maps and reports are disseminated to the various Agromet. Advisory Services Units and the Agricultural Specialists. Also these bi-weekly maps and reports are being supplied to National Remote Sensing Agency, Hyderabad under the joint collaborative project on "Drought Monitoring" between IMD & NRSA, Hyderabad. These maps are useful in monitoring Agricultural Droughts over the country.

(ii) **Services to Agriculture and Farmers:** Forecasts for rice (Kharif) and Wheat crop production for the chief rice and wheat growing states as well as for total India, are prepared and sent to the Directorate of Economics and statistics, Ministry of Agriculture,New Delhi for use at their end.

(iii) A system of daily weather broadcasts for farmers, known as Farmer's Weather Bulletin, has been in operation from 1945. These bulletins are issued once a day by the Forecasting Offices, located at Regional Centres and State Capitals for broadcast in different regional languages through the stations of All India Radio in the evening. A second bulletin is issued for broadcast in the morning during the rainy seasons. The bulletins are also published in newspapers. They provide a district wise forecast of weather during the next 40 hours, with an outlook for the following 2 days and take into account the effects of weather on individual crops grown in their respective regions.

During the 70's National Commission of Agriculture reviewed the working of the Farmer's Weather Bulletins (FWS) and found that these could be made more effective if they are supplemented by Agrometeorological Advisories. The Agrometeorological Advisory scheme envisages :-

(a) Issue of weekly or bi-weekly Agromet. Advisories tailored to the needs of the farmers on their field operation.

(b) These bulletins are prepared in co-ordination with the Agricultural Expert of the State Agricultural Departments and the meteorologists from the AAS Centres.

(c) The Agromet. Advisory Services (AAS) Centres are functioning at the State Capitals at Ahmedabad, Bangalore, Bhopal, Bhubaneswar, Kolkata, Gangtok, Guwahati, Hyderabad, Jaipur, Lucknow, Chennai, Patna, Shimla Srinagar, Dehradun, Raipur and Thiruvananthapuram for respective states and at Chandigarh for Punjab and Haryana, at New Delhi for Delhi state and at Pune for Maharashtra.

(d) Consolidated All India Agromet Advisory Service Bulletins are prepared and sent to private agencies on real time basis.

(e) All India Monthly Weather and Crop Bulletin is prepared and sent to Economic amd Statistical Adviser, New Delhi and NCMRWF, New Delhi.

(iv) A Co-ordination Committee on the above AAS scheme, consisting of the officials of India Meteorological Department as well as Ministry of Agriculture, ICAR and Ministry of Information and Broadcasting, has been constituted in 1984. The Director General of Meteorology is the Chairman and the Director, Agrimet. Division, Pune is the Member-Secretary of this Committee.

An "Agroclimatic Atlas of India" was brought out in 1978. Second paper pack edition of the Atlas was brought out in 1986. These publications are being supplied to users."

Seven Pilot Balloon Observatories are functioning in West Rajasthan and adjoining areas to study and warn about the movements of Desert Locust Swarms. Special forecast of rainfall and upper wind are issued for Rajasthan and adjoining areas during swarm incidence for anti-locust operation. Studies on inter-relation between crop pests and diseases and current weather parameter have been undertaken in collaboration with some Agricultural Universities/Research Institutes with a view to predict their outbreaks/spread, on the basis of weather information. Soil moisture data are required by research workers in various fields of Agriculture, Irrigation etc. Soil moisture is being recorded on a routine basis at some Agromet Observatories and Departmental Evapotranspiration stations. 15 (Fifteen) soil moisture recording stations have also been established under the scheme "Extension of Soil Moisture Observational Network". Thus total number of Soil Moisture Recording Stations are 55. Network of Agricultural Meteorological stations, Evaporimeter stations, Evapotranspiration stations, Soil Moisture stations and Dew fall recording stations are shown in the fig. No.14

5.8 AGROMETEOROLOGY SERVICES/TECHNOLOGY MISSION

India Meteorological Department (IMD) is collaborating with National Centre for Medium Range Weather Forecasting (NCMRWF) for providing medium range weather forecast and advisories to help agriculturists in planning agricultural operations.

Rainfall Climatology for Agricultural Planning unit working under ADGM(R) brings out publication on commencement of sowing Rain for various states. Analysis of a long series of rainfall data, cropping pattern and types of soils for particular states are considered for calculating sowing dates.

5.9 HYDROMETEOROLOGICAL ACTIVITIES INCLUDING FLOOD FORECASTING SERVICES

The Department is rendering assistance on meteorological aspects in the field of Hydrology, Water management and multipurpose river valley projects. These services are utilised by the Central Water Commission (CWC), Ministries of Agriculture, Water Resources & Railways and Damodar Valley Corporation (financed by the Sponsoring Organisation),

Flood Control Authorities and the State Governments. The undermentioned special Meteorological Units are functioning in the department to cater to the needs of specific interests:-

5.9.1 Rainfall Monitoring Unit

Rainfall Monitoring Unit of IMD functions in the Hydromet Division at HQ, New Delhi.

Real Time Monitoring of District wise daily rainfall is one of the important functions of IMD. A network comprising a large number of raingauge stations is utilised under the Districtwise Rainfall Monitoring Scheme (DRMS). Based on the real time daily rainfall data, weekly district- wise, sub-division-wise and state-wise rainfall distribution summaries are prepared as a routine activity of Rainfall Monitoring Unit. Rainfall statistics is prepared in the form of rainfall tables and maps. The tables contain district- wise and sub-division-wise actual, normal and percentage departures of rainfall. Maps showing weekly and cumulative rainfall figures in 36 meteorological sub-divisions are also prepared to present a pectorial distribution of rainfall. Areas of excess, normal, scanty and deficient rainfall are depicted in different colours. Subsequently, updated weekly, monthly and seasonal rainfall distribution summaries are also prepared regularly.

District-wise and sub-division-wise rainfall statistics provides important information useful to the agriculture scientists, planners and decision makers. Therefore, this information is supplied to various Govt. agencies for official use.

5.9.2 Design Storm Unit

Design Storm studies are being conducted to study rainfall magnitude and its time distribution for use as main input for the design engineers in estimating flood for hydraulic structures, irrigation projects, dams etc. on various rivers. The Probable Maximum Precipitation (PMP) values are also evaluated for optimum utilisation of water resources.

5.9.3 Storm Analysis Unit

Based on the recommendation of Khosla Committee of Engineers, a Storm Analysis Unit is functioning to provide design estimates of short duration rainfall in different sub zones of the country for the purpose of railway and road bridge construction. Hydromet data for a number of river catchments are analysed for probable maximum storms, return periods of very heavy rainfall and run-off relationships. The studies in respect of 24 sub-zones (out of total 26 sub-zones) have so far been completed and the flood estimation reports for the 7 sub-zones have been revised the work for the preparation of All India Atlas of isopluvial maps of different return periods has been taken up. These maps can be used to derive 24 – hour rainfall estimates for specific return periods at any desired locations throughout India.

5.9.4 Flood Met. Unit

Consequent on the recommendations of High Level Ministers Committee on Floods and Flood Relief in 1972, Flood Meteorological Offices (FMO) were set up at ten locations viz., Agra, Ahmedabad, Asansol, Bhubaneswar, Guwahati, Hyderabad, Jalpaiguri, Lucknow, New Delhi and Patna. During the flood season, FMOs provide meteorological support to the Central Flood Forecasting Divisions (CFFD) of Central Water Commission (CWC) by issuing Hydromet. Bulletins. FMOs keep round-the-clock watch during the Flood Alert situations. During non-flood season other hydrometeorological activities are carried out i.e. digitisation of autographic rainfall charts, preparation of synoptic analogues and hydrometeorology of the basins and inspection of raingauge stations under the scheme is carried out. In addition, necessary hydrometeorological support and coordination is provided to other Govt. agencies like CWC, Brahmaputra Board, Damodar Valley Corporation etc.

S.No.	F.M.O.	River Catchments
1.	Agra	Lower Yamuna, Chambal & Betwa

2.	Ahmedabad	Narmada, Tapi, Mahi, Sabarmati, Banas & Daman Ganga
3.	Asansol	Ajay, Mayurakshi & Kangsabati
4.	Bhubaneswar	Mahanadi,Brahmani,Baiterini,Bruhabalang, Subernarekha, Rushkulya & Vansdhara
5.	Guwahati	Brahmaputra & Barak
6.	Hyderabad	Godawari & Krishna
7.	Jalpaiguri	Teesta
8.	Lucknow	Ganga, Ramganga, Gomti, Sai, Rapti, Ghagra, Sarada
9.	New Delhi	Upper Yamuna, Lower Yamuna, Sahibi
10.	Patna	Kosi, Mahananda, Baghmati, Kamala, Gandak and Buri Gandak, North Koel & Kanhar, PunPun Upper sone.

5.9.5 Glaciology Unit

To conduct glaciological studies, information on meteorological parameters and snow accumulation in the upper watersheds of the Himalayan rivers is being collected by ground observations. Observational network 31(thirty one) snowgauges/raingauges (21 in H.P. & 10 in Uttaranchal) which includes one class-I and class-IV departmental observatories have been installed in the Himalayas under glaciology scheme.

5.9.6 Water Balance Unit

Water balance studies are being conducted in respect of river basins taking catchment as a unit by applying the well-known techniques of Thornthwaite method of water budgeting and mass conservation equation of hydrological cycle. IMD maintains coordination with the research institutions viz. NIH, NWDA and other government organization like Central Water Commission, Central Ground Water Board, Ministry of Water Resources.

5.9.7 Central Hydromet Observatory (CHO)

CHO is a model hydrometeorological observatory which caters to the need of a variety of visitors. Every year, a large number of scientists, engineers from Govt. agencies, college and school children and teachers, general public visit CHO for general information and awareness in meteorology. Special visits are arranged on important occasions like the World Meteorological Day (23rd March) and National Science Day (28th February) every year.

5.10 CYCLONE WARNING SERVICES

5.10.1 The extensive coastal belts of India are exposed to cyclonic storms which originate in the Bay of Bengal and the Arabian Sea every year. These cyclones, which are accompanied with very heavy rain, gales and storm surges popularly known as ‘tidal waves’ cause heavy loss of human lives and cattle. They also cause extensive damage to standing crops and property.

It is the endeavour of India Meteorological Department to minimise the loss of human lives and damage to properties due to tropical cyclones by providing early warnings against the tropical cyclones. Cyclone warning is one of the most important functions of the India Meteorological Department and it was the first service undertaken by the department. The cyclone warning service of the India Meteorological Department is more than a century old. Cyclone warnings are provided by the India Meteorological Department from the Area Cyclone Warning Centres (ACWCs) at Kolkata, Chennai and Mumbai and Cyclone Warning Centres (CWCs) at Visakhapatnam, Bhubaneswar and Ahmedabad.

The Complete Cyclone Warning Programme in the country is supervised by the cyclone warning Division (CWD) at Head Quarter Ofice of the Director General of Meteorology at New Delhi. This Division provides cyclone warning bulletins to Doordarshan and AIR Stations at New Delhi for inclusion in the national broadcast/telecast. Information on cyclone warnings are furnished on a real time basis to the control room in the Ministry of Home Affairs, Government of India, besides other Ministries & Departments of the Central Government. The CWD monitors the cyclone disturbance both in the Bay of Bangal and the Arabian Sea and advises the Government of India at the Apex level. The Deputy Director General of Meteorology (Weather forecasting) Pune monitors technical aspects and reviews the Standard Practices in the area of cyclone forecasting.

Besides the above, the Cyclone Warning Division has the following functions at the international level :

(a) To serve as Regional Specialised Meteorological Centre (RSMC) – Tropical Cyclone, New Delhi

(b) To implement the Regional Tropical Cyclone Operational Plan of WMO/ESCAP Panel.

(c) To issue daily a Tropical Weather Outlook for the North Indian Ocean to the Panel Countries viz. Bangladesh, Maldives, Myanmar, Oman, Pakistan, Srilanka and Thailand.

(d) To provide Cyclone Advisories to the Panel Countries.

(e) To issue Tropical Cyclone Advisories for International Aviation at 6- hourly intervals

(f) To prepare every year a comprehensive scientific report on the cyclones in the North Indian Ocean (Bay of Bengal and Arabian Sea).

(g) To prepare WMO/ESCAP Panel Annual Review and its submission to WMO for publication and distribution.

5.10.2 The following is the list of bulletins and warnings issued by Cyclone Warning Centres for their respective areas of responsibility :-

(1) Sea Area Bulletins for ships plying in High Seas through P & T's coastal Radio stations.

(2) Coastal Weather bulletins for ships plying in coastal waters.

(3) Bulletins for Global Distress and safety system (GMDSS) broadcast through Indian Coast Earth Station.

(4) Bulletin for Indian Navy

(5) Port Warnings

(6) Fisheries Warnings

(7) Four stage warnings for State Govt. officials

(8) Bulletins for broadcast through AIRs for general public

(9) Warning for registered users

(10) Bulletins for Press

(11) Warning for Aviation (issued by concerned Aviation Meteorological Offices).

(12) Bulletins for ships in the high seas through Navtex Coastal Radio Stations.

Cyclone warnings are communicated to Govt. officials and other parties by Fax, high priority Telegrams, T/P's, Telex and Telephones. Police wireless is also used as and when required. Telegram as a mode of communication is being phased out and cyclone warnings are also disseminated through Satellite based DCWDS/CWDS system in local languages in coastal areas.

The general public, the coastal, residents and fishermen are warned through State Govt. officials and broadcast of warnings through AIRs and DD telecast programme in national and regional hook up. The cyclone warnings are issued to State Govt. officials in four stages:

The first stage warning known as "Pre-cyclone watch" issued 72 hours in advance contains early warning about the development of a cyclonic disturbance in the North Indian Ocean, its likely intensification into a tropical cyclone and the coastal belt likely to experience adverse weather. This early warning bulletin is issued by the Director General of Meteorology himself and is addressed to the cabinet secretary and other senior officers of the Government of India including the chief secretaries of concerned maritime states.

The second stage warning known as "Cyclone Alert" is issued at least 48 hours in advance of the expected commencement of adverse weather over the coastal areas. It contain information on the location of the strom direction of its movement, intensification, coastal districts likely to experience adverse weather and advice to fishermen. This is issued by the concerned ACWCs/CWCs.

The third stage warning known as "Cyclone Warning" commences at least 24 hours in advance. Landfall point is forecast at this stage. These warning are issued by ACWCs/CWCs at 3 hourly interval giving the latest position of cyclone, its intensity (maximum sustained surface wind speed) and likely time and point of landfall, impact of strong winds and heavy rain and advice to fishermen and general public.

The fourth stage of warning known as "Post Landfall Outlook" is issued at least 12 hours in advance of expected time of landfall by the concerned ACWC gives likely direction of movement of the Cyclone after its landfall and adverse weather likely to be experienced in the areas away from the coast.

During disturbed weather over Bay of Bengal and the Arabian Sea, the ports likely to be affected are warned through Storm Warning Signals. The Department also issues "Fleet Forecast" for Indian Navy and coastal bulletins for Indian coastal areas covering upto 75 Kms from the coast line.

Tropical cyclone advisories for the cyclones forming over the area West of 65^{o}E in the Arabian Sea, are also issued to Met. Watch Offices of middle East region through AFTN Channel.

5.10.3 Cyclone Warning Dissemination System (CWDS)

In addition to existing mode of dissemination of cyclone warnings to various State Governments, port officials etc. through high priority telegrams, telephones and Telex/Telefax by IMD, scheme, known as Cyclone Warning Dissemination System (CWDS) using INSAT is also in use. This communication method is more reliable as it does not use terrestrial links which are disrupted during severe weather conditions.

Total number of 252 analogue CWDS receivers have been installed in the cyclone prone areas of east and west coasts. The cyclone warning messages are broadcast in local languages of the area likely to be affected. Messages for the states 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 and Gujarat states originate from ACWC Mumbai. 100 more Digital CWDS receivers based on Digital Technology are also being 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 till 2007 and increase the network to 400 from 350 at present.

5.10.4 Disaster Management

The ministry of Agriculture, Government of India set up a High Powered Committee (HPC) at the beneet of the Prime Minister of India to review disaster management machinery in the country and to formulate a comprehensive model plan for disaster management at the National, State and district levels. This committee was constituted under the chairmanship of Shri J.C. Pant, former secretary to Government of India with 11 members including DG, IMD as one of the member. HPC framed five sub-groups to gear up the whole mechanism on Disaster management Plan and IMD was asked to prepare the plan for sub-group on water and climate related Hazards. Based on the inputs received from the member, a draft report has been prepared and submitted to HPC.

In order to give quick information on the damage potential of tropical cyclones, IMD has prepared a brochure "Damage Potential of Tropical Cyclones". It contains a table that shows the impact of tropical cyclones and suggested actions. This will benefit crisis managers and the public administrators.

Office of ADGM(R) brings out an annual publication entitled "Disastrous Weather Events" since 1967. This publication contains the information regarding loss of lives and damage to agriculture/property due to disastrous weather events like cold wave, Heat wave, snowfall, Drought, Squall, Gale, Lighting, Thunderstorms, Hail storm, Flood & heavy rain and cyclones. Efforts are on to demarcate disaster prone areas, for different events. This would ultimately help for the preparedness and effective Disaster imitative planning to the concerned officials.

5.11 CLIMATOLOGICAL SERVICES

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The surface and Pilot Balloon Observation, recorded at various observatories, are scrutinised and keyed in at Regional Met. Centres & Met. Centres at State Capitals. These data are then transferred to National Data Centre, Pune for processing and archival. All other types of data, viz. Radiosonde, Radiowind, Daily rainfall, Radiation etc. are scrutinised and keyed in at Pune. Modern key to floppy data entry machines are used for directly transferring the data from manuscripts to magnetic media for electronic data processing and archival. The department has approx. 9.30 billion characters of data in its archives which also includes ship's data and rainfall data of State Raingauges for a very long period. Computation of means, normals, frequencies and other desired parameters, their analysis and inter-pretation, preparation of district and State Climatological and other summaries and Atlases and their publications are regularly carried out. The statistics thus compiled are periodically revised and updated.

A variety of climatological data are regularly supplied by the National Data Centre, Pune and other departmental offices in response to a large number of enquiries received from Central and State Governments, Universities, Research Institutes, Public Undertakings and Private Sectors. The information supplied is used for lay-out of run-ways, town planning, air-conditioning, industry, port installations, installation of high towers, bridges and other structures, operation of multipurpose hydel projects, proper water and power management, defence operations in inaccessible regions, calibration of defence equipment, environmental studies, non-conventional energy source etc. Special studies are undertaken to brief Central and State Government authorities regarding prospects of monsoon, utilisation of wind-power and off-shore drilling operations.

The department has revised the climatological Atlas of India (originally published in 1906) and climatological Atlas of India (Abridged) was published in 1971 while Rainfall Atlas of India was published in 1971 and reprinted in 1972. Climatological Atlas of India Part-A (Rainfall) was brought out in 1981.

Marine Climatological summaries are published :

(i) Annually in respect of 17 selected representative areas for 1961-70.

(ii) Decadally in chart form for 1971-80. These summaries are pertaining to the Indian Ocean between Longitudes 20^0 E-100^0 E & latitudes North of 15^0 S. A Documentation of surface marine data 1951-99 has also been published.

National Climate centre under ADGM(R) has been established for climate monitoring purposes. It regularly published, monthly and seasonal climate diagnostics Bulletin of India on real time basis.

Under the Voluntary Observing Fleet (VOF) scheme of the World Meteorological Organization (WMO) effective from 1947, maritime member countries enlisted their cooperation for recording meteorological observations during their voyages. These observations are exchanged free of cost among eight responsible countries for the climatological work. India is one among the eight responsible countries.

The Fourth Congress of WMO in 1963 apportioned the responsibility of collecting and processing the meteorological observations, for the climatological purposes, the vast amount of meteorological (surface) data thus acquired over the seas, to eight responsible member countries. The area of responsibility assigned to India is north of latitude 15^o S and between longitude 20^o E and 100^o E of Indian Ocean. Marine Climatology Section (MCS) was established in IMD in 1971. The MCS forward the formatted observations of Indian VOF to Global Collecting Centres (GCC) on quarterly basis. The global data received from GCC are used for the preparation of climatological summaries and also for archival. Specialised observational data like Antarctica and Sagar Kanya cruises are also processed by MCS and archived at the National Data Centre.

Marine Climatological Summaries for seventeen selected areas of the Indian Area of responsibility had been compiled and published annually from 1961 to 1970. Since then, following recommendation of the WMO, preparation of decadal summaries, in chart form are taken up. The decadal summary for the decade 1971-80 is completed. In continuation of the above work, the Surface Marine Climatological Atlas 1961-90 is Published (In CD form and hard copy).

5.12 ENVIRONMENTAL METEOROLOGY AND AIR QUALITY MANAGEMENT

(i) The India Meteorological Department maintains a meteorological observatory at Taj Mahal (Agra) to monitor meteorological parameters requird for air pollution study in Agra region on behalf of the Central Pollution Control Board (CPCB), Ministry of Environment & Forests (MOE&F). The Environmental Meteorology Unit (EMU) set up at H.Q. office, New Delhi, carries out analysis andinterpretation of meteorological data collected at Taj observatory, Agra for rendering meteorological support to the Central Pollution Control Board (CPCB) in air pollution abatement measures in Agra Mathura region.

This unit also provides specific services to MOE & F and other Govt. agencies in the assessment of air pollution impacts llikely 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 geographic conditions are being utilized for siting of industries and adoption of air pollution control strategies.

(ii) During the year 2003, project proposals for 114 Industrial, 17 Thermal and 28 Mining projects, which were referred to this Department by the Ministry of Environment & Forests were evaluated for their impacts on atmospheric environment. 15 meetings were attended as member of Environmental Appraisal Committee in the MOE&F during this period.

(iii) Four quarterly reports on “Analysis of Meteorological parameters of Taj observatory, Agra for investigation of air pollution were prepared and sent to the Ministry of Environment & Forests CPCB, New Delhi.

5.13 SEASONAL FORECASTS

As per the WMO definition, long range forecast is defined as the forecast from 30 days up to one season's description of averaged weather parameters. IMD has been issuing long range forecasts of the South-west monsoon rainfall for over 100 years. In 2003, IMD has introduced several new models and adopted a two stage strategy for the long range forecast of the south-west monsoon rainfall. Accordingly the first stage forecasts are issued in mid-April. These forecasts consist of a quantitative forecast and 5 category (Drought, below normal, Near Normal, Above Normal and Excess) probabilistic forecasts for the seasonal (June to September) rainfall over the country as a whole. The quantitative forecast is based on a new 8 parameter Power Regression model and the probabilistic forecasts are based on a linear discriminant analysis model, using the same 8 parameters.

In the second stage, the forecasts issued during the first half of July consist of update forecasts for SW monsoon rainfall over the country as a whole, a forecasts for July rainfall over the country as whole and forecasts for seasonal rainfall over three broad rainfall homogeneous regions of India Viz. Northwest India, Northeast India and Peninsular India. The updated forecast is issued using a new 10 parameter power regression model. The July forecast for the July rainfall over the country as a whole and that for the seasonal rainfall over the three homogenous regions are based on new power regression models using separate set of parameters.

IMD also prepares long range forecasts for winter (Jan-March) precipitation (prepared in January) & rainfall during rabi season (October to March) over Northwest India (prepared in October) and northeast monsoon (October-December) rainfall over Southern Peninsula (Prepared in October).

5.14 SERVICES TO DEFENCE

The Department provides meteorological services to all the three wings of the Defence Services, viz. Air Force, Navy and Army and to other organisations under the Ministry of Defence. Of these, the Indian Air Force is the largest user of the services. The meteorological observations, forecasts, bulletins, routine publications, training facilities etc. are made available to the Defence Services. The Indian Air Force and the Indian Navy maintain a number of observatories at their operational stations. These observatories are inspected by the India Meteorological Department. Certain specific services like operation of teleprinter channel connecting departmental Meteorological Offices to Indian Air Force and Naval Meteorological Offices, supply of meteorological instruments, chart, forms, hydrogen gas and some publications are made on payment.

6. SUPPORT TO MAJOR NATIONAL PROGRAMMES

6.1 HYDROLOGY PROJECT UNIT

Aided by World Bank, the multi-agency Hydrology Project (HP) is aimed at upgradation, expansion and standardisation of observational network to create a reliable data base for effective water resource management in Peninsular India. The project is being implemented by nine different states of India (Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Chhatisgarh, Maharashtra, Orissa and Tamilnadu) and five central agencies (IMD, CWC, CGWD, CWPRS & NIH). The project Phase-I has ended on 31st December, 2003.

Hydrology project will improve technical activities and facilities of the participating agencies in respect of data collection, validation, analysis, transfer of Hydrological/Hydrometeorological and water quality data. This will develop comprehensive, interactive and easily accessible data base.

As a nodal agency for the Hydrometeorological activities, IMD has undertaken the following important tasks :

- Designing raingauges and climatological network.

- Training of about 2686 State Govt. personnel in observational & analysis work. So far IMD has imparted training to

2050 state personnel.

- Technical assistance to State Govts. for procurement, testing, calibration and installation of meteorological instruments.

- Annual inspection/maintenance of about 2333 State Govt. raingauges. Most of the stations have been inspected 1415 station have been installed

- Data monitoring, evaluation and archival of data at the centres in each participating state, National Data Centre (IMD), Pune and Data Centre at IMD HQ New Delhi have been made operational.

6.2 PROJECT "PARVAT"

Project "PARVAT" is a joint venture of five years w.e.f. August 1999 to August 2004 of DRDO(SASE), Ministry of Defence (ARMY, Air Force) and DST (IMD & NCMRWF). The project is framed to improve Weather and Avalanche Forecasting over startegic areas in Western Himalayas and also to cater peoples needs. For this purpose the following activities are being carried out.

(a) Under Expansion of upper air observational network three state of art equipments IMS-1500 Radiotheodolite have been installed at Manali, Sasoma and jammu on 4.6.2003, 21.6.2003 and 18.9.2003 respectively.

(b) Twenty Two (22) surface met. observatories and three (3) upper air stations have been equipped with state-of-art instruments. Data so received is being utilized for issuing weather bulletins/analysis.

(c) Research and Development work so as to achieve target of issuing weather forecast at a resolution of 50 Km., 5 days in advance with minimum 80% accuracy initially Western Himalayan region.

6.3 ARABIAN SEA MONSOON EXPERIMENT (ARMEX)

Arabian Sear Monsoon Experiment is a National Observational Programme under Indian Climate Research Programme (ICRP) being Co-ordinated by the Department of Science & Technology, New Delhi. The focus of the ICRP is to improve our understanding about the variability of the Indian Monsoon and its coupling to the seas around India. The issue involved are multi-disciplinary and they require co-operative efforts of the scientific groups and organisations in the country, working on monsoon-climate related problems. Insight has also been gained on the fluctuation of the monsoon between active spells and dry spells which have large effect on the agriculture. These fluctuations within the monsoon season are in turn linked to the year to the year-to-yer variation between good and poor monsoon. ARMEX is aimed at elucidating the link between the Arabian Sea and the monsoon climate over the Indian sub-continent, which are very important to predict the vagaries of the monsoon.

The objectives of ARMEX is Study of the Arabian Sea convection associated with intense rainfall events on the west coast of India. To achieve the objectives of ARMEX, a large number of institutions (24) including IMD have participatd in the field phase programme. IMD network particularlay along the west coast was fully utilised to gather surface and upper air observatiosn. Additional observations were also made during five Intensive Observations Periods (IOPs) identified during the period of ARMEX IMD made special arrangements for augmenting its observational network with AWS set up at 5 stations on the west coast and 4 times a day Radiosonde ascents during IOPs DGM,DDGM (CW) and Director (NHAC) were actively associated with the field phase programme and weekly meetings of the Science Team were held under the Co-chairmanship of DGM, RMC Mumbai had set up a special management centre and provided liaison with Navy, Coast Guard and other agencies. Data sets in respect of observations made from different platforms are being prepared and distributed amongst the scientific community for detailed research studies.

6.4 PARTICIPATION IN OCEAN RESEARCH VESSEL

IMD continues to participate in multi-disciplinary scientific cruises of Ocean Research Vessel in the Arabian Sea, Bay of Bengal and Indian Ocean etc. during pre-monsoon, monsoon and post-monsoon seasons of the year. These cruises are planned to collect meteorological data over the adjoining sea areas for the study of various aspects of monsoon circulation and other important weather systems affecting the country and also to validate satellite data of meteorological parameters on board the Indian Remote Sensing Satellite (IRS-P4) as and when required.

6.5 CYCLONE WARNING DISSEMINATION SERVICES (CWDS)

In addition to existing mode of dissemination of cyclone warnings to various state Govts. Port officials etc. through high priority telegrams, telephones and telex/telefax by IMD, a scheme called Cyclone Warning Dissemination System (CWDS) using INSAT has been established for coastal areas with 250 CWDS receivers. The scheme makes use of the S band broadcast capability of INSAT satellite. The system is being extensively used on operational basis during cyclone season. State Govt. officials of coastal states found this scheme very useful as the scheme is more reliable during sever weather conditions and cyclones particularly when terrestrial links are disrupted. The cyclone warning messages are originated from ACWC Chennai, Kolkata and Mumbai whenever a storm is observed depending upon the location of the storm warnings are originated from one or more ACWCs and the warnings addressed to the appropriate coastal area likely to be affected. Warning messages are received in local languages directly by CWDS receivers located in areas likely to be affected by the cyclone. The system is upgradation on the basis of latest digital technology. 100 CWDS receivers based on Digital technology are being deployed in Andhra Pradesh

6.5.1 Data Collection Platform (DCP)/INSAT-AWS

During 1985-86, one hundred Data Collection Platforms (Automatic Weather Stations) were installed at various sites throughout India. These will be replaced by AWS of latest technology during 10^{th} five year plan at the cost of Rs.10.64 crores, as the existing DCPs have outlived their useful life, under the scheme "Replacement 100 old and obsolete INSAT-Data Collection platforms (DCP) at field stations and establishment of an Earth Station at Pune for data reception and processing".

6.5.2 Establishment of a Network of 500 Automatic Raingauge Stations

A proposal for establishment of a Network of 500 Automatic Rain gauge Stations has been approved by CMAS in its 57^{th} meeting held on 19.8.2003 Procurement process in progress.

6.6 ENVIRONMENTAL IMPACT ASSESSMENT

IMD provides scientific and technical services in the area of Environmental Management to the Ministry of Environment and Forest (MoEF), Govt. of India. There is cooperation on matters of scientific policy in regard to norms and practices, which are evolved after detailed interactions with the Central Polllution Control Board of the Ministry of Environment and Forests. In addition to that, MoEF has a mechanism of assessing the impacts of proposed industrial activity in the country in the form of referring the cases to experts in various fields. IMD is a member in the Panel of Experts formed by MoEF in regard to clearance of Industrial proposals, Power Plant proposals and Mining proposals. Its function is to evaluate estimations made for air pollution impacts.

6.7 NATIONAL DATA BUOY PROGRAMME (NDBP)

The Department of Ocean Development, Government of India has established a National Data Buoy Programme (NDBP) at National Institute of Ocean Technology (NIOT), Chennai, with the following main objectives:

- To collect met-ocean parameters in Indian seas
- To monitor the marine environment
- To generate and supply data products
- To improve the weather and ocean state prediction
- To validate satellite data
- Indigenization of buoys and software

The data buoys carry the sensors to measure Wind speed and Wind direction, Atmospheric pressure, Air temperature, Conductivity, Sea surface temperature, Current speed, Current direction and Wave parameters. The buoys are equipped with global positioning system, beacon light and satellite transceiver and are fitted with solar panels to charge the battery pack.

The SEAWATCH buoy is designed to carry more sensors to measure additional parameters like Radioactivity, Turbidity, Chlorophyll-A, Hydrocarbon and Dissolved Oxygen.

NDBP has a shore station to receive the data transmitted from the data buoys. The shore station shall serve for data receiving, structuring, processing, checking, analysis and storage. The data will be disseminated to user agencies on real-time basis, wherever required. Apart from this, situation reports will also be prepared by NDBP.

The programme was launched at Chennai Port on 21st August, 1997. The programme is being supported by India Meteorological Department, National Institute of Oceanography, Ports, Central and State fisheries and other scientific Communities for the utilisation of data acquired through these buoys. Coast Guard is extending its full support for the safety of the buoys in sea.

Environmental Impact Assessment:-The Data collected from this programme will be useful for continuously monitoring coastal and marine environment.

Meteorology: The real-time meteorological data obtained by these buoys is vital to develop reliable operational weather forecasting model and to alert the coastal population about impinging natural disasters such as depressions and cyclones.

Oceanography: The long term oceanographic data collected by this programme will enhance our understanding of Indian Ocean circulation.

Fisheries: The sea surface temperature and water quality parameters obtained by moored buoys in Indian seas would be useful in identifying the potential fishing zones.

Validation of Satellite Data: The in-situ data collected by data buoys will be used to validate satellite data like sea surface temperature, waves, etc. and assimilation of this data into operational sea state models.

Offshore Installations, Ports and Coastal Structures: The availability of reliable data on waves, winds and currents will be highly useful in the design of various coastal and offshore structures.

Shipping Industry; The data on sea state particularly wind, wave and currents could be used in the navigation.

6.8 CLIMATE RELATED ENVIRONMENT MONITORING (CREM)

India Meteorological Department has initiated implementation of CREM a multi-agency project for monitoring of greenhouse gases (GHGs) and aerosols on which policy decision regarding climate change could be based in future. The project aims at establishing a network of stations in India to generate primary data on these gases (GHGs) and aerosols on a long-term basis. Such data are of vital interest to our country with regard to climate change studies and to create a sound database which can

be used in future climate change negotiations in the UN framework.

CREM is a programme of DST to be implemented by India Meteorological Department as a Nodal Agency in a collaborative mode involving the following participating agencies.

1. India Meteorological Department

2. Indian Institute of Tropical Meteorology (IITM), Pune:

3. Jawaharlal Nehru University (JNU), New Delhi:

4. Regional Research Laboratory (RRL), Bhubneshwar:

Initially a Pilot Project-CREM is being implemented by establishing insitu monitoring station at Hill Campus, G.B. Pant University of Agriculture & Technology, Ranichauri, Tehri Garhwal Uttaranchal GHGs and at Delhi for aerosols in the first year. The purpose of pilot project is to establish the viability of continuous operations at distant locations with desired level of accuracy conforming to International Standards.

7. SUPPORT TO INTERNATIONAL PROGRAMMES

7.1 INTERNATIONAL COOPERATION

India is a founder member of the International Meteorological Organization (IMO), which was later, constituted as World Meteorological Organisation (WMO), a specialised agency of the United Nations. Members of the WMO are grouped into 6 Regional Associations. India is grouped with other Asian Countries in Regional Association-II. Director General of Meteorology acts as permanent Representative (PR) of India with WMO and representing on WMO Executive Council, which is the highest Executive Body of the WMO, continuously since its inception. Shri R.C. Bhatia, DG, IMD and PR of India with WMO, is an elected Member of Executive Council of WMO. The WMO Executive Council is responsible for implementation and coordination of the Programmes of WMO and its constituent bodies i.e. 6 Regional Associations, 8 Technical Commissions and the Congress.

Central Radiation Laboratory of the Instruments Division, Pune has been designated as one of the two Regional Radiation Centres for RA-II.

The Department is actively participating in the international Cooperation Programme of Meteorology and allied subjects between the Government of India and the Governments of USA, Russia, Japan, China, Australia, Mauritius, France, Sri Lanka, Bangladesh, Maldives, Nepal, Iceland, Myanmar, etc.

India is participating in the implementation of the strategic plan for further enhancement of services of National Meteorological Services (NMSs) in the Asian Region. For implementation of the strategies Plan IMD has nominated its experts, for assessment of National GTS upgrade related to Indian Ocean Tsunami Warning System for effective exchange of warnings and other related information and warnings for Natural Disaster Hazards and Disaster issues.

The Department is actively associated with South Asian Association for Regional Cooperation (SAARC) Programme and is a member of its Technical Committee on Science and Technology & Meteorology. DGM, IMD is member of Governing Board of SAARC Meteorological Research Centre (SMRC), Dhaka, Bangladesh.

7.2 TRAINING OF INTERNATIONAL METEOROLOGIST

IMD has well organised training centres in General Meteorology, Meteorological Telecommunications, Agricultural Meteorology, Instrumentation & Radio Meteorology etc. These facilities in IMD have been recognized by WMO as one of the Regional Meteorological Training Centres (RMTC) in RA-II. The Training Division of the Department has been renamed as Central Training Institute of IMD since July, 1999. A number of candidates from South East Asia, Africa and Middle East countries have availed these training facilities in the Department under various Technical Cooperation

Programmes, namely Colombo Plan, ITEC, SCAAP, UNDP, Voluntary Cooperation Programme of WMO etc. A number of departmental officers have received training abroad in specialised areas. A number of officers have also participated in International Workshops/Seminars/Meetings and delivered lectures on meteorological subjects.

7.3 VOLUNTARY OBSERVING SHIP CLIMATE PROJECT (VOSCLIM)

India is a participating in WMO's Voluntary observing Ship Climate Project (VOSCLIM). The main purpose of project is to provide a high quality set of marine observations and detailed information on high seas. Such observations are of great value to operational marine forecasting. These observations will also be used for improving climate models and for providing ground truth for validation of satellite observations.

7.4 NORTHERN HEMISPHERIC EXCHANGE CENTRE (NHEC), NEW DELHI

NHEC (Northern Hemispherical Exchange Center) came into existence in year 1945. In 1971 India got the responsibility of running RTH (Regional Telecommunication Hub) but it was manual. In 1976 RTH was computerized with the help of Phillips DS 714 computer donated by WMO. Since then the name NHEC was replaced by Telecom Division. This Phillips system was replaced by a VAX11/750 system in 1988 which was ultimately replaced by SUN system in the year 2000. After the installation of this new system and also installation of internet web severs and SADIS a new name NMTC (National Meteorological Telecommunication system) came into existence.

RTH New Delhi is the one of the 18 designated RTH on Main Telecommunication Network of WMO and is connected directly to Tokyo (64 Kbps), Moscow (4.8 kbps), Melbourne (Through Internet), Oman (Through Internet), Karachi, Dhaka, Kathmandu, Colombo, Jeddah, Tehran, Male, Yangon, Bangkok on its own regional centers for real time exchange of global data. It is responsible for collection of data from neighbouring countries like Pakistan, Sri Lanka, Nepal, Bangladesh etc. for further distribution and also providing global data to these countries. RTH New Delhi also broadcasts the data, fax charts and satellite pictures through MDD (Meteorological Data Dissemination). This center is also responsible for releasing weather warning bulletins two times a day through GMDSS (Global Maritime Distress and Safety System) to the ships in Indian Ocean.

This system utilizes the latest communication means like TCP/IP Protocol, ftp, email for dissemination of meteorological data. It provides the facility of retrieval of data through dedicated circuits, Telex, VSAT and PSTN.

Under the Global Telecommunication System organized as part of the World Weather Watch Plan by WMO, New Delhi is functioning as a Regional Telecommunication Hub (RTH) on the Main Telecommunication Network (MTN) connecting the two World Meteorological Centres, Moscow directly and Washington via Tokyo. The automated centre of RTH, New Delhi is thus the Principal Meteorological Telecommunication Centres in South Asia and its zone of responsibility extends roughly from Saudi Arabia in the west to Thailand in the East and the adjoining sea areas. It collects observational data from these areas and feeds on to the global Telecommunication System for Global and Regional Exchange. Other meteorological services in the Middle East and South East Asia also depends for their data requirements on RTH, New Delhi. Accordingly, it maintains telecommunication circuits with Moscow, Tokyo, Beijing, Cairo, Jeddah, Bangkok, Colombo, Dhaka, Tehran, Karachi, Male, Oman, Yangon and Kathmandu. The circuit with Tokyo, Moscow & Beijing are working through 128 kbps IP/VPN Link; Karachi, Jeddah, Cairo, Dhaka are working on TCP/IP 64 kbps; Male, Colombo, Oman, Yangon & Melbourne are working through Internet using socket communication. Future plans includes up-gradation of Tehran through 64 kbps TCP/IP; Kathmandu through Internet or through 64 kbps lease line.

(i) Meteorological Broadcasts

IMD has switched over its Meteorological Broadcast from HF to satellite Digital Broadcast in the year 2004. For this purpose Meteorological products [GTS data, Analysed Charts and Satellite imageries] are sent every hour from RTH, New Delhi to World Space up-linking station at Singapore through Internet and these products are up linking to Asia Star Satellite at World Space. This satellite broadcasts these products at every full hour UTC in L-Band and receiving system comprise of L-Band Yagi Antenna, FM receiver, Digital Data Adapter (DDA) and a PC with customizes and software.

7.5 REGIONAL SPECIALISED METEOROLOGICAL CENTRE, (RSMC)

In view of the increased awareness of the importance of use of weather information to support various national developmental activities in the field of agriculture, water management, shipping, aviation, etc. NHAC has been on the forefront to provide the relevant information particularly for meeting requirements of Disaster Management Agencies, Historically speaking; Regional Meteorological Centre (RMC) was established in the Headquarters Office of India meteorological Department, New Delhi in 1968 under the World Weather Watch programme (WWW) of World Meteorological Organization. The main functions of RMC were to prepare analysis and forecast weather charts for standard isobaric levels and broadcast them for use of the neighbouring courntries in its area of responsibility.

NHAC also functioned as an Area Forecast Centre (AFC) to provide documentation services for aviation. With the reorganization of WWW to provide activity oriented services, the RMC New Delhi was re-designated as Regional Specialized Meteorological Centre (RSMC) with Geographic Specialization. WMO, after recognition of the capabilities of RSMC, New Delhi, also designated the Centre as RSMC with Activity Specialization in Tropical Cyclones (RSMC-Tropical Cyclones) in 1988 to provide advisories and tropical weather outlook for the north Indian Ocean. RSMC (Tropical Cyclones) commenced issuing annual report on Cyclonic Disturbances in north Indian Ocean since 1989. It is now implementing WMO Tropical cyclone programme and also providing the 3-hourly advisory bulletins to all the Member Countries of WMO/ESCAP Panel region.

The Centre was also re-designated as RAFC under the reconstituted World Area Forecast System of ICAO. Apart from fulfilling the international responsibilities under WWW/WAFC, NHAC also assumed greater responsibilities to meet increasing user requirements at the national level.

WMO introduced a programme known as Marine Pollution Emergency Response Support System (MPERSS), whereby in the event of major marine pollution incident occurring on the high sea clean-up or other marine response operations are required to be undertaken. Meteorological/Oceanographic support is to be provided to the relevant authorities in an efficient, timely and co-ordinated manner. IMD accepted the responsibility to participate in this programme. NHAC New Delhi is designated as Area Meteorological Co-ordinator.

NHAC is now actively engaged in day-to-day and round the clock weather surveillance over India and neighbourhood. It is closely involved in inter agency groups on crop weather watch, monsoon monitoring and provides information to interested users to support the disaster mitigation and early warning systems operated by central and state Govt. agencies on disaster management. It has established good institutional arrangements with disaster management agencies and participates in the crisis management meetings called by the Centre and States. A noteworthy and welcome aspect of the services provided by NHAC has been to handle the increased public awareness and demand for weather information. Dissemination of weather information through the television media has become a highly professional and challenging task for which special efforts have been initiated by NHAC to improve the quality and quantity of weather information provided to the public.

The use of numerical products has gained special importance in the short and medium range weather forecasting where their capacity to foreshadow the events on these time-scales has improved considerably. NHAC has not only been using its own model outputs but also the outputs available from National Centre for Medium Range Weather Forecast, European Centre for Medium Range Weather Forecast, National Centre for Environmental Prediction and occasionally from U.K. Meteorological Office.

7.6 INDO- RUSSIAN COOPERATION (Seismology)

An MOU was signed on 12.11.2003 between Government of India and Russian Federation, the Indo-Russian Centre for Earthquake Research (IRCER) during the visit of Hon'ble Prime Minister of India to Russia in November 2003. The MOU was signed by Secretary, Department of Science & Technology and Academician President, Russian Academy of Sciences (RAS) to establish, the IRCER in India at IMD, New Delhi for carrying out research in basic, applied and S&T related studies through joint project implemented under Integrated Long Term Programmes. 17 research projects in the field of seismology have been identified for joint collaboration between various institutions in India and Russia.

An MOU in Seismology was also signed on 12th November 2003 between DST and Russian Academy of Sciences

(RAS) for effective coordination and monitoring of various collaborative projects being implemented in India with their counterpart agencies in Russia. Under this arrangement IMD is implementing Eight projects.

- Establishment of two sets of testing and calibration system
- Joint production of Seismic / Geophysical systems
- Design and testing of Portable seismic stations
- Development and Implementation of Algorithms and expert systems for Recognition of events
- High resolution of Monitoring of Geodynamic process using borehole seismic investigations
- Experimental evaluation of about 100 critical structures in urban India and production of detailed report
- Adoption and complementation of GIS based software for prognostification of Earthquake hazard related impacts
- Establishment and operationalisation of Indo-Russian Centre for Earthquake Research (IRCER)

Under the above cooperation programmes, Indo-Russian Centre for Earthquake Research (IRCER) has been established on November 2003 in IMD, New Delhi.

7.7 International / Bilateral Cooperation

7.7.1 Indo – Australia Cooperation Programme

An MOU between India and Australia was signed in New Delhi on 10th February 1989 for Cooperation in Meteorology. This was reviewed every year (up to 1998) by the Heads of the two services during the meet (in Geneva, Switzerland) attending WMO Executive Council Meeting.

Under this arrangement, the areas of cooperation include Numerical Weather Prediction (NWP), Tropical Meteorology, Satellite Meteorology and GTS Links. IMD received a software programme on CD-ROM of Australia Tropical Cyclone Workstation (ATCW) from Bureau of Meteorology (BoM), Australia.

Short-term exchange visits (10 Nos.) of working scientists from both sides took place.

7.7.2 Indo – China Cooperation Programme

An MOU between India Meteorological Department (IMD) & China Meteorological Administration (CMA), China was signed in March, 1997. As a part of this MOU, the third meeting of Indo-China Joint Working Group was held in November, 2004 at IMD, New Delhi. An agreed work plan was signed for future cooperation in nine (9) scientific areas for a period of two years. Several Institutions / Departments from the sides are involved for joint research work.

- Asian Monsoon Studies
- Climate Variability and Change
- Tropical Cyclones
- Ground Based Observation Systems including Radars
- Data exchange communication Links
- Satellite Meteorology
- Numerical Weather Prediction
- Environmental Meteorology and Atmospheric Chemistry
- Exchange of Publications (English version)

A telecommunication digital data circuit of 9.6 kbps speed for exchange of meteorological data between New Delhi and Beijing has been established in 2002 and subsequently upgraded to 64 kbps Frame Relay and 128 Kbps IP/VPN Links.

7.7.3 Indo – Mauritius Cooperation Programme

An MOU in the field of Meteorology between India & Mauritius was signed on 4th September 1998 at Port Louis. IMD is providing Cyclone advisories for the South Indian Ocean Region. Joint Research activities in the field of Tropical Meteorology and Monsoon were identified including transmission of INSAT Satellite imageries on near real time basis.

7.7.4 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. IMD installed such a system at Male in February 1992 and the system was upgraded in June 1999. The entire project was on gratis from Govt. of India. IMD continues to provide technical support for maintenance of the system and also calibrated the meteorological equipments free of cost. At present Male is receiving INSAT pictures through Internet. A new Digital MDD System is proposed to be installed in Male during 2008 to replace the old non-functional analog system.

7.7.5 Indo – Nepal Cooperation Programme

IMD has signed an MOU on 9th September, 2004 with Department of Hydrology & Meteorology (DHM), Nepal for cooperation in the field of Weather Forecasting. Under this arrangement an INSAT/METSAT Meteorological Data Dissemination (MDD) receiving system will be setup in Kathmandu by IMD. As a follow up MoU, a four member Nepalese delegation visited IMD New Delhi in November 2006. IMD provided training and familiarization with the existing MDD equipment in New Delhi. The New Digital MDD System is proposed to be installed in Kathmandu in early 2008. The entire project is on gratis from Govt. of India.

7.7.6 Indo – Sri Lanka Cooperation Programme

An MOU for cooperation in Meteorology was signed on 10th September 1997 between India and Sri Lanka for setting up data receiving system in Colombo. IMD installed such a system at Colombo in December 1998. IMD continues to provide technical support for maintenance of the system and also supplies Radiosonde Ground Equipment, radiosonde and consumables etc. to Sri Lanka on gratis basis as per terms of MOU.

7.7.7 Indo – Russia Cooperation Programme

An MOU on Science and Technology Cooperation between India Meteorological Department (IMD) & Russian Federal Services for Hydrometeorology and Environmental Monitoring (ROSHYDROMET) was signed in Moscow on 30th June, 1994 establishing the Sub – Working Group in Meteorology. So far five Meetings of the Indo-Russian Sub Working Group have been taken place, the last one held in October 2002 in Moscow, Russia. Seven themes on problems of Monsoon, Climate Change and Atmospheric Ozone, Instrumentation and design & fabrication of radiosonde have been identified for further cooperation between the two sides. Exchange visits of Working Scientists took place on all the themes and significant progress made in the area of Atmospheric Ozone.

7.7.8 Indo – US Cooperation Programme

Satellite Meteorology Programme

IMD has been receiving data from GOES satellites of USA in IMD, New Delhi. The exchange of satellites data between the two countries use to take place earlier through a dedicated link. Now the data is transmitted onto an FTP server from IMD. NOAA(USA) also transmits its data onto the IMD ftp site. As per the request of IMD, 3 hourly GOES High Density Winds in BUFR format are made available by NOAA/NESDIS. These winds are currently being utilized by the NCMRWF models. IMD has also acquired a license for McIDAS software and installed it at IMD, New Delhi. Training for the same has been given to the meteorologists at IMD. India Meteorological Department has now come under the new Ministry of Earth Sciences (MoES) formed by the Government of India. In order to have better interaction between IMD and USA, the modalities are being worked out to sign a new MOU between MoES (India) and NOAA/NASA of USA.

7.7.9 INDO-USAID on Climate Forecasting System

Current Status of USAID Project on Climate Forecasting System. The Climate Forecasting System (CFS) Component was included as a part of the GOI-USAID Disaster Management Support Project (DMSP). The following five sub-projects of Climate Forecast System (CFS) component of Indo-US collaborative project for improving and modernization of Hydro-meteorological Forecasting and Early Warning System in India was formulated as a part of GOI-USAID Disaster Management Support Project (DMSP).

- Tropical cyclone forecasting & warning
- Local severe storms (including flash floods)
- Extreme temperatures
- Flood forecasting
- Forecast communications

20 short-term training components (IMD 15, NCMRWF 2, SAC 1, IIT-D 2) were identified on the advanced data assimilation, numerical weather prediction and its application for severe weather prediction. The training also includes technology transfer. Training processes started from July 2006. Till today 18 trainees (IMD 14, NCMRWF 2, IIT-D 1, SAC 1) have already completed training, returned to India and working towards implementation of their technical expertise and experience that they gained in USA and remaining 2 training components are yet to begin. According to the original programme, the project was up to September 2007, however, the project has been extended till 31 December 2008.

7.7.10 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. DGM, IMD is currently Member of Governing Board of SAARC Meteorological Research Centre (SMRC), Dhaka, Bangladesh. Indian Scientists have served SMRC, Dhaka at various levels. The center is doing research in Climatology and NWP models for the SAARC region and have brought out several research publications. 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.

7.7.11 PDUS Data Receiving System

The system is being used operationally by Synoptic Application Unit for image interpretation in visible, infra-red and water vapour channels. Since Meteosat-5 is now replaced by Meteosat-7, efforts are being made to receive the Meteosat-7 data from the same ground equipment.

7.7.12 HRPT Data Receiving Station

High Resolution Picture Transmission (HRPT) data receiving system based on Sun Computer Systems is operational since August, 2000. This system is capable of receiving HRPT data from NOAA series of satellites till NOAA-16. The system is being upgraded to receive data from NOAA(KLM) series of satellites with advanced capabilities to derive profiles of temperature, humidity, ozone etc., from Advance Microwave Sounding Unit (AMSU).

7.8 ANTARCTIC METEOROLOGY

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 scientific activities of the expedition members.

7.9 GLOBAL ATMOSPHERE WATCH (GAW) PROGRAMME

Under Global Atmosphere Watch (GAW) Programme of WMO the network of different stations have been established in different centres for monitoring the pollution level.

The Background Pollution Monitoring Network (BAPMoN) is an international effort with a strong national component. In India, there are 10 BAPMoN stations taking observations on aerosol loading of the atmosphere and the chemical composition of rainwater from the following places:

Allahabad, Jodhpur, Kodaikanal, Minicoy, Mohanbari, Nagpur, Port Blair, Pune, Srinagar and Vishakhapatnam.

This network is a part of a Global Network of Stations under the WMO and was started in India in 1973. The main purpose of this network is to document changes in the pollution level of the atmosphere as a result of human activities and changes in land use patterns. The indicating parameters for these trends are the reduction of solar radiation due to increased aerosol content and the acidity of rainwater, which is caused by industrial emissions.

The findings of these studies are very well documented in international and national scientific literature and have been used to assess the assimilative capacity of atmosphere in various geographic locations within India and in the adjoining ocean areas.

7.10 METEOROLOGICAL DATA DISSEMINATION (MDD)

The processed INSAT cloud imageries are broadcast through INSAT using S band broadcast Capability of the satellite, in analog mode every three hour. Meteorological data i.e. SDUC satellite cloud imageries, T/P data (conventional Met. Data) and Fax charts (Analysed weather charts) are provided to various field stations through MDD network. At present there are 33 MDD stations in India and one each in Maldives and Sri Lanka. Apart from this MDD signals are also received by IAF, Navy, SASE, IITM, SAC, DRDO & IITs. Along with conventional Met. data, satellite bulletins relating to analysis of satellite cloud imageries 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. All MDD units have also been provided with work stations for detailed analysis of cloud imageries.

7.11 INTERNATIONAL HYDROLOGY PROGRAMME UNIT

IMD has been actively rendering its support to the International hydrology services. International Hydrology Programme (IHP) of the United Nations Educational Scientific and Cultural Organisation (UNESCO) for a five-year duration of i.e. 2002 to 2007 aiming, to intensify the study of all aspects of hydrology. IMD is one of the members of Indian National Committee on Hydrology (INCOH) for implementation of IHP. IMD is invaded in one of the Regional Association-II (RA-II) for working group of Hydrology for Asian region viz. Droughts etc in the region.

IMD has also contributed some components on hydrometeorology in the Hydrological Operation Multi-purpose system (HOMS) reference manual which is a technology transfer system of WMO for operational hydrology.

8. FINANCIAL RESOURCES

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(a) **<u>Eleventh Five Year Plan (2007-2012):</u>**

Financial Budgetary support of Rs. 301.00 Crores has been provided to IMD under plan during the first year

2007-08 of Eleventh Five Year Plan (2007-20012) for implementation of various Plan Schemes.

(b) Annual Budget 2007-2008 :

The Budget Estimates included in the Demand No.29 of Ministry of Earth Sciences (MoES) for the year 2007-08 are as follows :

Rs./Thousands

	PLAN	NON-PLAN	TOTAL
Revenue Budget	448890	1530700	1979590
Capital Budget	2561110	6000	2567110
Total :-	**3010000**	**1536700**	**4546700**

The estimates under Non-Plan are mainly meant for running the existing network of observatories and forecasting offices, maintaining the routine operational services and other "On-going" activities and for paying India's contribution to World Meteorological Organization.

The provision for Revenue and Capital Budget Outlay is included in the Demands for Grants of the Ministry of Earth Sciences (MoES).

(c) Revenue Receipts under Major Head "1475" of IMD :

IMD is providing different kinds of services to different agencies (Govt. as well as civil agencies) by charging nominal amounts for its services. The major chunk of the revenue comes from Airport Authority of India for aviation services. The total revenue accrued is approx. Rs.122.47 crores as on 1.1.2008 during the year 2007-2008. Details is given below :

Services.	**Revenue accrued during 2007-2008 (As on 1.1.2008) (Amount in Rupees)**
Services to aviation	120,00,00,000
Supply of data	1,94,60,553
Sale of equipment	14,89,207
Testing Charges	7,11,868
Other receipts	30,39,607
Total :-	**122,47,01,235**

(f) Budget allocated to each agency for the year 2007-2008 (Plan) :

Plan Budget allocation for the year 2007-08 made available to all its Offices and Sub-offices for the proposed plan schemes/activities during the year 2007-08.

Major Thrustarea-wise allocation of funds under Capital Outlay

(Plan) for the year 2007-2008.

Rs./Lakhs

Offices	Major Thrustarea	BE 2007-2008
ADGM (R) Pune	Climatology	40.00
DDGM (Ag) Pune	Agricultural Meteorology	10.00
DDGM(SI),Pune	i) Observational Organization	293.00
	ii) Mod. of IMD Weather Services	500.00
DDGM(UI) New Delhi	i) Mod. of IMD Weather Services	1000.00
	ii) Mountain Meteorology (PARWAT)	49.00
DDGM(Telecom.)	Met. Telecommunication	332.00
DDGM (Sat. Met.)	Space Meteorology	428.10
DDGM (EREC)	Earthquake Risk Evaluation Centre	845.00
DGM(HQ) New Delhi.	i) Mod of IMD Weather Services	18862.00
	ii) Agricultural Meteorology	590.00
	iii) Research and Development Programme.	162.00
DGM(HQ) New Delhi.	Major Works	500.00
	Major Works (Mod of IMD)	2000.00
		Grant Total Capital Outlay (Plan)

25611.10

First year of Eleventh Five Year Plan (2007-2012):

IMD has planned to provide financial support to number of projects during the 2007-2008. The major projects which are proposed to be given priority for effective implementation are as under :

1. Procurement of Digital MDD along with associated uplink equipment.
2. Transcription of magnetic tapes containing INSAT Data.
3. Replacement of old and obsolete INSAT-DCPs with Automatic Weather Stations (AWS) and establishment of Earth Station at DDGM(SI), Pune.
4. Replacement of Automatic Message Switching Systems (AMSS) at Guwahati And installation of New AMSS at Nagpur.
5. Mod. of Telecom facilities-Provision of High Speed Data Terminals.
6. Establishment of Integrated Voice Response System (IVRS).
7. Procurement of AMI for Mumbai Airport.
8. Augmentation of Radiation Network of India-procurement of radiation instruments.
9. Mod of Central Agromet Observatory at Pune and 3 ARUs at Banglore, Anand and Rahuri.
10. Augmentation of VSAT based Delhi Seismic Telemetry Network.
11. Microzonation of Five Cities and NCT Delhi.
12. Creation of National Database for Seismic Hazard and regional risk appraisal and 1st Level misrozonation.
13. Procurement of High End Server for NWP modeling and R & D Works and Upgradation of automated data processing and chart plotting system.

Modernization of IMD Weather Services:

14. Establishment of Network of (850+500) Automatic Rain Gauge Stations And 500 AWS.

15. Procurement of 12 S-band Doppler Weather Radars.
16. Procurement of New Optical Theodolites and Optical Electronic Theodolites.
17. High Performance Computing System (HPCS) for global data processing and Numerical Weather Prediction (NWP).
18. Installation of integrated AMIs at 7 Airports.
19. Establishment of VSAT based Seismic Telemetry Network in NE India.
20. Establishment of 20+20 New Seismo observatories in Western Himalayas and coastal island regions of India.
21. Modernization and up gradation of Agromet Advisory Services.
22. Replacement of RTH computer system at New Delhi.
23. Procurement of Digital Standard Barometers (100 Nos.) and 2 dead weight testers.

9. HUMAN RESOURCES DEVELOPMENT

India Meteorological Department is the National Meteorological Service of the country and the Principal Govt. Agency in all matters relating to Meteorology, Seismology and allied subjects. For this purpose, Observations of Meteorological parameters all over the country both at the surface and Upper air are recorded by maintaining observatories and sophisticated equipments. The officers and staff of the department are deployed at various field stations in the length and breath of the country. There are 453 Group 'A' and 2550 Group 'B' officer along with 5392 supporting staff in the Department. To meet the requirements they are equipped with modern equipment and provided the necessary training also. There are approximately 260 field stations in all over the country.

ANNEXURE – I

9.1 MAN POWER PROFILE OF IMD

Statement showing Sanctioned Strength, Men in Position and Vacancies of India Meteorological Department as on 1.1.2008.

S.No.	Designation & scale of Pay	Sanctioned Strength	Men in Position	Vacancies
I.	**Group 'A' (Gazetted)**			
1.	DGM (Rs.24050-650-26000)	1	0	-1
2.	ADGM (Rs.18400-500-22400)	5	4	-1
3.	DDGM (Rs.14300-400-18300)	20	16	-4
4.	DDGM(A&S) (Rs. 14300-400-18300)	1	0	-1
5.	Finance Officer (Rs. 14300-400-18300)	1	0	-1
6.	*Director (Rs. 12000-375-16500)	40}	166}**	
7.	*Met. Gr.I (Rs.10000-325-15200)	166}424	65}276	-148
8.	*Met. Gr.II (Rs.8000-275-13500)	218}	45}	
9.	Sr. Hindi Officer (Rs.8000-275-13500)	1	1	NIL
	Total	453	297	-156

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II.	**Group 'B' (Gazetted)**				
1.	Asst. Met. Gr.I (Rs.7500-250-12000)	426	418	-8	
2.	Sr. Pr. Secretary (Rs. 7500-250-12000)	1	1	NIL	
3.	Private Secretary (Rs. 6500-200-10500)	5	5	NIL	
4.	Admin. Officer (Rs. 6500-200-10500)	21	20	-1	
5.	Hindi Officer (Rs. 6500-200-10500)	3	1	-2	
6.	Asst. Met. Gr.II (Rs. 6500-200-10500)	732	673	-59	
7.	Asst. Met. Gr.II (Foreman/Industrial)	11	8	-3	(Rs. 6500-200-10500)
8.	Asst. Met. Gr.II (Foreman/Non-Industrial) (Rs. 6500-200-10500)	6	2	-4	
		------	------	-----	
	Total	1205	1128	-77	
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* Under Flexible Complementing System, there is a complete interchangeability in the posts in the cadres of Director, Met. Gr.I and Met. Gr.II

** One Director is on Deputation.

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Statement showing sanctioned strength and effective vacancies as on 01.01.2008 in India Meteorological Department Group 'B' Non-Gazetted), Group 'C' and Group 'D'

Sl. No.	Name of post	Sanctioned effective	Men in position	Posts under ban, cut etc.	Posts utilized for GFR	Effective vacancies
		Group 'B'(N/G) (Scale Rs.5500-9000)				
1.	Supdt.	16	10	-	-	06
2.	Sc. Assistant	1305	1128	-	-	177
3.	Steno.Gr.I	20	18	-	-	2
4.	Senior Translator	4	3	-	-	1
	Total Gr. 'B'(N/G)	**1345**	**1159**	-	-	**186**
Group 'C'		**(Scale Rs.5000-8000)**				
1.	Steno.Gr.II	10	7	-	-	3
2.	Admn. Assistant	114	103	-	1	10
3.	Senior Observer	1749	1044	-	2	703
4.	Junior Translator	13	7	-	-	6
5.	Staff C. D. (Spl.Gr.)	3	-	-	-	3
6.	Library & Information	2	1	-	-	1

	Asstt.					
	(Scale Rs.4500-7000)					
1.	S.I.	1	-	-	-	1
2.	Mech.Assistant(Ind.)	25	10	-	-	15
3.	Mech.Assistant(C.Ind.)	2	2	-	-	-
4.	Mech.Assistant(N/I)	10	4	-	-	6
5.	Staff C. D. (Gr.-I)	19	-	-	-	19
6.	Lab.Asstt Gr.I	70	7	-	-	63
	(Scale Rs.4000-6000)					
1.	Carp.Gr.I(Ind.)	33	23	-	-	10
2.	Carp.Gr.I(N/I)	4	2	-	-	2
3.	Mech.Gr.I(Ind.)	215	203	-	-	12
4.	Mech.Gr.I(N/I)	69	44	-	-	25
5.	Electrician	4	-	-	-	4
6.	Radio Mech.	65	54	-	-	11
7.	Steno.Gr.III	21	13	-	-	8
8.	U.D.C.	224	204	-	-	20
9.	D'man	56	30	-	-	26
10.	S.S.I.	1	1	-	-	-
11.	Manager	2	1	-	-	1
12.	Staff C. D. (Gr.-II)	17	12	-	-	5
13.	Lab.Asstt Gr.II	70	18	-	-	52
	(Scale Rs.3200-4900)					
1.	Lab. Assistant Gr.III	72	89	-	-	+17
2.	Assistant Manager	2	1	-	-	1
3.	Manager-cum-sale	2	-	-	-	2
4.	Halwai	4	-	-	-	4

*** The (337+306) Posts in r/o Gr. 'B', 'C' & 'D' which are likely to be abolished have also been included**

	(Scale Rs.3050-4590)					
1.	L.D.C.	167	82	-	-	85
2.	Hindi Typist ssw	11	3	-	-	8
3.	Mech.Gr.II(N/I)	31	7	-	-	24
4.	Mech.Gr.II(Ind.)	133	44	-	-	89
5.	Carpenter Gr.II(N/I)	1	1	-	-	-
6.	Carp.Gr.II(Ind.)	11	4	-	-	7
7.	Staff Car Driver (O.G)	16	37	-	-	+21
8.	M.C. Driver	1	1	-	-	-
9.	Record Keeper	1	1	-	-	-
10.	Assistant Halwai	2	2	-	-	-
11.	Cook	2	1	-	-	1
12.	Counter/Kitchen Clerk	12	3	-	-	9
13.	Coupon/Reserve Clerk	4	-	-	-	4
	Total Gr. 'C'	**3271**	**2066**	**-**	**3**	**1202**
	Group 'D' **(Scale Rs.2650-4000)**					

1.	Mate	67	56	-	-	11
(Scale Rs.2610-4000)						
1.	Record Sorter	2	-	-	-	2
2.	Printer	1	1	-	-	-
3.	Book Binder	2	1	-	-	1
4.	Met. Attendant	1075	917	-	-	158
5.	Daftri	11	10	-	-	1
6.	Sr. Peon	1	1	-	-	-
7.	Head Chowkidar	4	4	-	-	-
8.	Mukhya Safaiwala	2	2	-	-	-
9.	Head Mali	2	1	-	-	1
10.	Tea/Coffee Maker	12	5	-	-	7
11.	Bearer	19	10	-	-	9
(Scale Rs2550-3200)						
1.	Chowkidar	245	173	-	-	72
2.	Frash	22	13	-	-	9
3.	Peon	404	189	-	-	215
4.	Mazdoor	84	37	-	-	47
5.	Safaiwala	129	81	-	-	48
6.	Gardner	22	18	-	-	4
7.	Cleaner	1	1	-	-	-
(Scale Rs.2550-3200)						
1.	Wash Boy/Dish Cleaner	14	5	-	-	9
2.	Safaiwala (Canteen)	2	1	-	-	1
	Total Gr. 'D'	**2121**	**1527**	**-**	**-**	**594**
	Total **Gr. 'B'(N/G), 'C' & 'D'**	**6737**	**4752**	**-**	**3**	**1982**

9.2 TRAINING

In order to develop Human Resource to IMD, the following training programmes are taken by the department.

9.2.1 Training in General Meteorology

The Regional Meteorological Training Centre,(RMTC) Pune RMTC (WMO) provides professional training in meteorology to the staff of different categories in IMD and officers of other department, Defence services and to candidates from foreign countries. It conducts the following courses of training in General Meteorology:

(i) Basic training in General Meteorology of 4 months duration three batches per year, simultaneously at New Delhi, Kolkata and Chennai under the over-all supervision of the Regional Meteorological Training Centre at Pune.

(ii) Condensed Basic Training Course in General Meteorology of two months duration at Pune, one batch per year. This training is meant for advance trainee in General Meteorology.

(iii) Intermediate training in General Meteorology of 4 months duration, three batches per year at Pune and New Delhi.

(iv) Advanced training in General Meteorology of one year duration inclusive of one month attachment for on-the-job training to operational officers at Pune, one batch each year.

(v) A special course for direct recruit Class I officers of duration of 12 months, with 23 Met.-II trainees was completed during November 2003

(vi) Special training course of 43 Lakshadweep Government officials conducted during the year at Chennai.

9.2.2 SPECIAL TRAINING COURSES UNDER HYDROLOGY PROJECT

Under the World Bank Aided Hydrology Projects, the Primary objective is to improve the facilities and staff capabilities of the Central and State Agencies involved in Surface Water and Ground Water hydrology for water resources evaluation. During 2003, one batch of basic course with 8 candidates and one batch for senior level refresher course with 4 candidates were completed. The World Bank aided Hydrology Project closed on 31.12.2003, completing target of training.

9.2.3 TRAINING IN INSTRUMENTATION

Training in the operation, maintenance and servicing of meteorological instruments like Radiosonde/Radiowind instruments, Radiotheodolites, Radars, Satellite Met. Instrument Training Centre at New Delhi. This centre was established in 1962. The following courses are conducted at this centre :

(i) Intermediate Training Course (Instrumentation)

(ii) Advanced Training Course (Instrumentation)

(iii) Training in Meteorological Instrumentation (For Met.Gr.II Trainees)

(iv) Special Refresher Course in Instrumentation :

(v) Special Courses

Special courses are also conducted for officers/staff participating in Scientific/Oceanographic/Antarctica Expeditions and for extra departmental/ foreign nominees depending upon their requirements.

(vi) Exhibition Cell:

An Exhibition Unit functioning at present under Director (I.T.C.) regularly participates to project and highlight IMD's developmental activities in the exhibitions organized/sponsored by DST during Indian Science Congress and other national festivities.

9.2.4 Training in Meteorological Telecommunication

The Telecommunication Training Centre at New Delhi, which was established in September 1977, is one of the

international training centres recognised by the WMO. This centre imparts training in the field of telecommunication to the departmental as well as foreign trainees sponsored under various technical programmes. This centre has trained large number of departmental trainees as well as foreign trainees sponsored by WMO. So far this centre has trained 644 departmental trainees and 99 foreign trainees. They receive training under ITEC, SCAAP, WMO, Colombo Plan, UNDP etc. The centre conducts the following regular courses.

1. Operators Course in Met. Telecom (O-Level) – 4 months duration
2. Intermediate Course in Met. Telecom. (Middle Level) – 4 months durations
3. Advance Course in Met. Telecom – 6 months duration
4. Level-II Training Course in Meteorological Telecommunication – 2 months duration
5. Short term course in PC applications – Two weeks duration

In addition to regular courses 8 weeks course for directly recruited Meteorologist Grade-II (Gr.-A) are also conducted as and when fresh recruitments are made in this cadre. Refresher courses of small durations are also organized from time to time to meet this immediate service requirements of the department.

To keep pace with the fast computerization of telecommunication facilities and development in the field of networking a scheme has been undertaken to modernize the center with latest communication software and audio-visual aids under which ten numbers of computer work stations have been installed for imparting training in PC applications.

In view of advancement of technology in telecommunication two weather data receive and analyse system (WEDRAS) has been installed for imparting the training concerned with procedure of processing and analyzing the met. data in the form of imageries, raw data, charts under GTS through Satellite.

9.2.5 Training in Agricultural Meteorology

The Agricultural Meteorology Division at Pune has been imparting training in observational techniques and other aspects in Agricultural Meteorology to the staff of State Agricultural Meteorology, to the staff/officers Scientists of state Agricultural Department, I.C.A.R. and Agricultural Universities. To meet the increasing demand in this regard a training centre exclusively for Agricultural Meteorology is functioning at Pune since 1976. Many trainees from abroad have also undergone specialized training in Agricultural Meteorology under W.M.O., Colombo Plan and UNDP etc.

9.2.6 Training in Computer Programming and Climatological Data Processing

National Data Centre, Pune conducts regular classes in computer programming, software languages, PC based training and use of various utility software operating system and climatological data processing for the departmental personnel and foreign trainees (sponsored under WMO/UNDP/VCP and Colombo Plan etc.). 624 persons have been trained so far including 53 foreign trainees.

9.3 RESEARCH AND PUBLICATION

The Departmental as well as the officers and staff in their individual capacity have contributed substantially to knowledge in the field of Meteorology ever since the inception of the Department. There are units engaged in research and development activities attached to the offices of Additional Director General of Meteorology (Research), Pune and Deputy Director General of Meteorology (Weather Forecasting), Pune, Instruments (Pune and New Delhi), the six Regional Centers, the Division of Hydrometeorology (New Delhi), Seismology (New Delhi), Satellite Meteorology (Pune), Satellite Meterology (New Delhi), Northern Hemisphere Analysis Centre (New Delhi), Monsoon Activity Centre, Indian Ocean and Southern Hemisphere Analysis Centre (Pune) and Cyclone Warning Research Center (Chennai), Local Telecommunication also undertakes development and improvement of Meteorological Telecommunication equipment.

A quarterly research journal entitled “MAUSAM” formerly known as “Indian Journal of Meteorology, Hydrology and

Geophyusics" is published by the Department since 1950 to encourage the Indian and foreign scientists to carryout research work in Meteorology and allied subjects.

Department permits its employees for publication of scientific research papers in extra-departmental journal for wider circulation of research studies in the field of Meteorology and allied disciplines.

Officers of India Meteorological Department working on meteorological problems get Ph.D from different universities. The University of Delhi has recognised IMD for allowing IMD Scientists/employees to carry out research work, while in service, for the award of Ph.D. degree of the University of Delhi. Efforts are being made to get recognition of India Meteorological Department for the same at other reputed Universities of India.

9.4 ANTARCTIC & PROJECT EVALUATION CELL (APEC)

APEC Section deals with Antarctic Expedition, Sagar Kanya Cruises and Evaluation of Scientific Project received from Department of Sciences & Technology (DST) and provide financial support as Grant-in-aid to different university/scientific intuition for scientific research on Meteorology and Atmospheric Science on receipt of proposals.

Antarctic & Project Evaluation Cell (APEC)

APEC Section deals with Antarctic Expedition, Sagar Kanya Cruises and Evaluation of Scientific Project received from Department of Sciences & Technology (DST) and provide financial support as Grant-in-aid to different university / scientific intuition for scientific research on Meteorology and Atmospheric Science on receipt of proposals.

IMD Grant-in-aid Programme

The India Meteorological Department (IMD) is providing financial support for some selected research projects in the field of Meteorology and Atmospheric Science being conducted at University / Academic Institution and Government Organization under its grants-in-aid programme. The programme of funding the research projects in the field of Meteorology and allied sciences is to involve and encourage the young scientists working in research Institutes / Univer sities / Organizations to take-up research in the field of Atmospheric Sciences, which will enhance the existing knowledge in these subjects with particular reference to the Indian region and also to supplement the in-house research in IMD.

Some guidelines are laid down to submit the research project which are as follows :-

Six copies of the proposal can be submitted any time during the year in the prescribed format. Topics of the project should be related to advancement of knowledge in the field of meteorology and Atmospheric Science with particular reference to the Indian region. Staff salaries, equipment, consumables, internal travel, charges of data procurement and analysis, contingencies and overheads are the components of grant, whereas infrastructure, buildings, laboratories and furniture are not allowed under the grant. The project proposal is referred to experts for its evaluation and liability. Based on the recommendation of experts, the project is considered for sanction. The principal investigator (PI) is required to submit annual progress reports, which are evaluated by experts. Four copies of the Project Completion Report (PCR) are to be submitted PCR is referred to experts for their comments. A copy of each of the PCR is kept in the IMD Library at New Delhi & Pune.

Following are the funds allocated to different university/Institute for the last five years:

Name of the University Institute **Amount Sanctioned**

	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-01.01.08
CAS,IIT NEW DELHI		**18,90,000**		**NIL**	**NIL**	
JADAVPUR	3,01,614	4,05,012	3,17,721	NIL	NIL	NIL

UNIVERSITY KOLKATA						

No. T-301/2023 E-20006
भारत सरकार / Government of India
पृथ्वी विज्ञान मंत्रालय / Ministry of Earth Sciences
भारत मौसम विज्ञान विभाग / India Meteorological Department
मौसम विज्ञान के महानिदेशक का कार्यालय / Office of the Director General of Meteorology
मौसम भवन, लोदी रोड़ / Mausam Bhavan, Lodi Road
नई दिल्ली–110003 (भारत) / New Delhi - 110003 (India)

Dated : 17.04.2023

कार्यालय ज्ञापन

Subject: Establishment of Meteorological Centre in North-Eastern States.

It has been decided by the Government of India to establish new Meteorological Centres (MCs) at Imphal, Kohima and Aizawl for the states of Manipur, Nagaland and Mizoram respectively

2. The new MCs will cater to all the operational meteorological services of states of Manipur, Nagaland and Mizoram and issue weather forecast and adverse weather warnings etc. as per the mandate of IMD in close liaison with RMC Guwahati and State Government authorities.

3. All matters related to establishment, general administration, financial and technical matters for the MCs will be dealt with by RMC Guwahati.

4. This office order is issued in pursuance of the approval accorded by Ministry of Earth Science vide SFS Note #8, E-file Number E 20006 dated 18.03.2023

Ranju Madan 17-4-2023

(Ranju Madan)
Scientist'G'
Deputy Director General (Admin)
For Director General of Meteorology

No. T-301/2023 E-20006
भारत सरकार / Government of India
पृथ्वी विज्ञान मंत्रालय / Ministry of Earth Sciences
भारत मौसम विज्ञान विभाग / India Meteorological Department
मौसम विज्ञान के महानिदेशक का कार्यालय / Office of the Director General of Meteorology
मौसम भवन, लोदी रोड़ / Mausam Bhavan, Lodi Road
नई दिल्ली–110003 (भारत) / New Delhi - 110003 (India)

Dated : 17.04.2023

कार्यालय ज्ञापन

Subject: Establishment of Meteorological Centre at Port Blair.

1. It has been decided by the Government of India to establish new Meteorological Centre (MC) at Port Blair, the capital of Union Territory (UT) of Andaman & Nicobar Islands, to meet the need of meteorological services of the UT and to install a Doppler Weather Radar (DWR). This meteorological centre will be headed by an officer of Group 'A' level, who will function directly under the control of RMC Kolkata.

2. This new MC will cater to all the operational meteorological services of Andaman & Nicobar Islands and issue weather forecast and adverse weather warnings etc. as per the mandate of IMD in close liaison with RMC Kolkata and Government authorities.

3. All matters related to establishment, general administration, financial and technical matters for the MC will be dealt with by RMC Kolkata.

4. This office order is issued in pursuance of the approval accorded by Ministry of Earth Science vide SFS Note #8, E-file Number E 20006 dated 18.03.2023

17-4-2023

(Ranju Madan)
Scientist'G'
Deputy Director General (Admin)
For Director General of Meteorology