

INDIA METEOROLOGICAL DEPARTMENT (IMD)

(134 YEARS OF SERVICE TO THE NATION)

Ministry of Earth Sciences (MoES)

GOVERNMENT OF INDIA

NEW- DELHI

A disastrous tropical cyclone struck Calcutta in 1864 and this was followed by failures of the monsoon rains in 1866 and 1871. In the year 1875, the Government of India established the India Meteorological Department, bringing all meteorological work in the country under a central authority. Mr. H. F. Blanford was appointed Meteorological Reporter to the Government of India. The first Director General of Observatories was Sir John Eliot who was appointed in May 1889 at Calcutta headquarters. The Headquarters of IMD were later shifted to Simla (1916), then to Poona (now Pune, 1928) and finally to New Delhi.

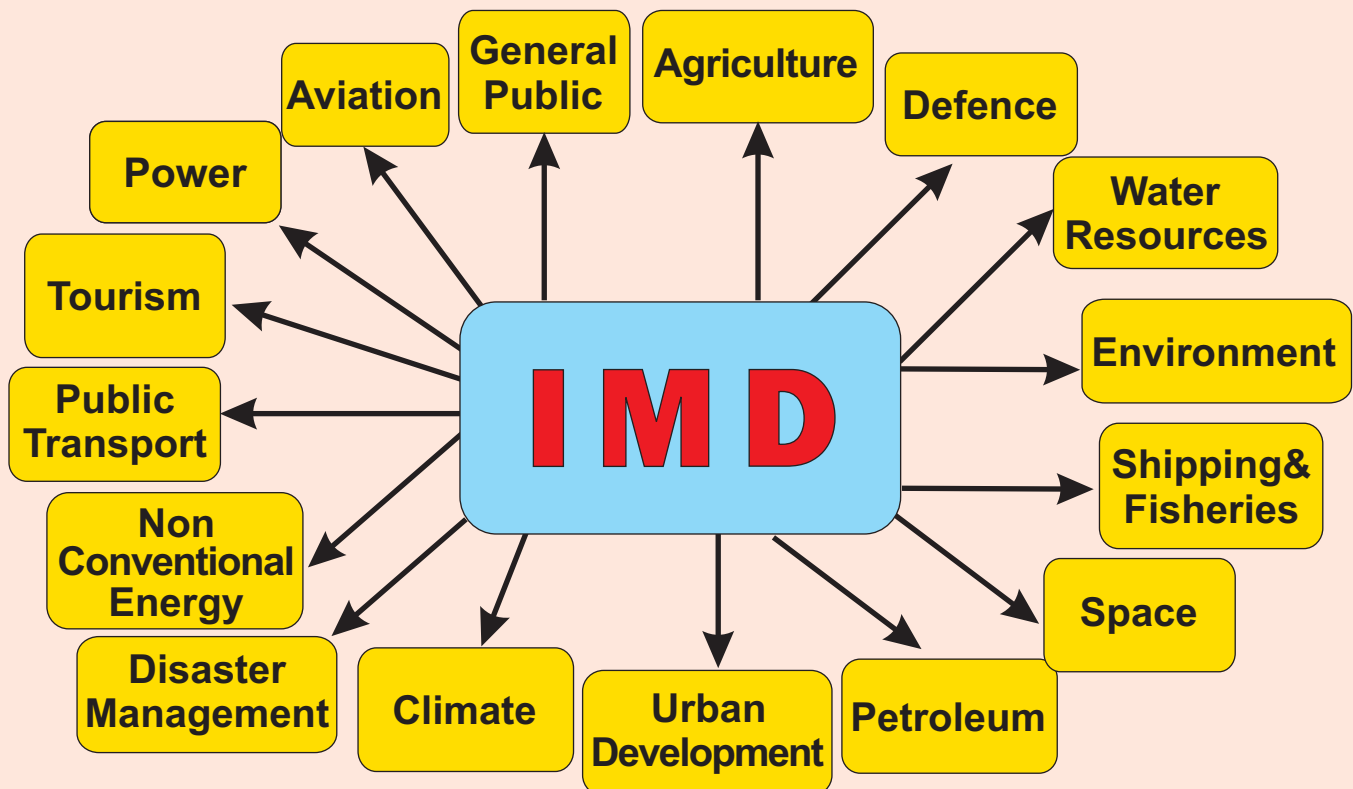


First Head Quarters (HQs) at Alipore, Kolkata (1877)



Present Head Quarters (HQs) office at New Delhi

The India Meteorological Department was established in 1875. It is the National Meteorological Service of the country and the principal government agency in all matters relating to meteorology, seismology and allied subjects. IMD provides services to different sectors.



Organisational Structure

<p>6 Meteorological Regions</p> <p>Regional Centres</p> <ul style="list-style-type: none"> North Region East Region North East Region Central Region West Region South Region 	<p>New Delhi Headquarters</p> <ul style="list-style-type: none"> ● National Weather Forecasting Centre ● National Satellite Meteorological Centre ● Telecommunication ● Hydrometeorology ● Radar and Upper Air Instrument ● Seismology and EREC <p>Pune Office :</p> <ul style="list-style-type: none"> ● National Climate Centre (NCC) ● National Data Centre (NDC) ● Weather Forecasting ● Agrometeorology ● Central Training Institute (CTI) ● Surface Instrumentation <p>Regional Meteorological Centres : Delhi, Mumbai, Kolkata, Chennai, Nagpur and Guwahati</p> <p>Under each RMC, there are Meteorological Centres.</p>	<p>Meteorological Centres</p> <table border="0"> <tr> <td>Agartala</td> <td>Ahmedabad</td> </tr> <tr> <td>Bangalore</td> <td>Bhubaneshwar</td> </tr> <tr> <td>Bhopal</td> <td>Chandigarh</td> </tr> <tr> <td>Dehradun</td> <td>Gangtok</td> </tr> <tr> <td>Hyderabad</td> <td>Itanagar</td> </tr> <tr> <td>Jaipur</td> <td>Lucknow</td> </tr> <tr> <td>Panjim</td> <td>Patna</td> </tr> <tr> <td>Raipur</td> <td>Ranchi</td> </tr> <tr> <td>Shimla</td> <td>Srinagar</td> </tr> <tr> <td>Thiruvananthapuram</td> <td></td> </tr> </table>	Agartala	Ahmedabad	Bangalore	Bhubaneshwar	Bhopal	Chandigarh	Dehradun	Gangtok	Hyderabad	Itanagar	Jaipur	Lucknow	Panjim	Patna	Raipur	Ranchi	Shimla	Srinagar	Thiruvananthapuram	
Agartala	Ahmedabad																					
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Shimla	Srinagar																					
Thiruvananthapuram																						

Existing Main Observational Networks of IMD

One of the mandates of IMD is to take meteorological observations on real time basis and to provide current and past observations for operational and research use. Surface Observatories are located one in each district (559 observatories) so as to meet the requirements of agricultural, transport and other sectors. IMD's present Upper air observational network comprises 39 radiosonde and 62 pilot balloon, 39 RS/RW observatories, 5 Doppler Weather Radar, 55 Seismological observatories etc. spread all over the country.

<p>559 Surface Observatories</p> <p>Surface Observatories 559</p> <p>India Meteorological Department</p> <p>Establishment of Two primary Class I & II Observatories</p>	<p>Rainfall Network- District wise Rainfall Monitoring Scheme (DRMS)</p> <p>2500 stations</p> <p>Location of DRMS Rain Gauge Stations</p>	<p>62 Pilot Balloon Observatories</p> <p>INDIA METEOROLOGICAL DEPARTMENT</p> <p>PILOT BALLOON</p>
<p>39 RS/RW Observatories</p> <p>LEGEND-</p> <ul style="list-style-type: none"> ● WSGE - IT ● SMIER - (H-3) ● SMPF - 2 ● WRF-4 	<p>Weather Radar (DWR) Network of IMD</p> <p>INDIA METEOROLOGICAL DEPARTMENT</p> <p>CYCLOTRON DETECTION RADAR NETWORK (S-BAND)</p> <p>REFLECTIVITY RANGE - 400 KM</p> <p>VELOCITY RANGE - 200 KM</p> <p>LEGEND</p> <ul style="list-style-type: none"> ● DOPPLER WEATHER RADAR ● HYPERDOPPLER DOPPLER RADAR ● CONVENTIONAL RADAR 	<p>55 Seismological Observatories</p> <p>SEISMOLOGICAL OBSERVATORIES OF INDIA METEOROLOGICAL DEPARTMENT</p> <p>LEGEND</p> <ul style="list-style-type: none"> ● TYPICAL STATION ● SPECIAL STATION ● SPECIAL STATION (FOR SPECIAL OBSERVATIONS) ● SPECIAL STATION (FOR SPECIAL OBSERVATIONS)

Comprehensive Modernization Programme of IMD

During the past 133 years, IMD has undergone several phases of modernization helping it to harmonize with emerging technologies and societal demands. Present phase of modernization is driven by :-

- Demand for high resolution data and forecasts in all time scales with higher accuracies
- 24x7 weather surveillance and dedicated telecom systems for issuing early warnings of disastrous weather
- District specific data, forecasts and Agro advisories
- Specialized Met information to various sectors
- Delivery of Weather Information to Public

Modernization refers to adoption of technologies enabling

- **Observational Upgradation**
 - Insat-3D, Megha-Tropique, Ocean Sat 2
 - Doppler Weather Radars, Upper Air Systems
 - Automatic Rain Gauges
 - Automatic Weather Stations
 - Environment Monitoring, Seismic Network
- **Advanced data communication and processing Technology**
- **Advanced Computing Systems**
- **Installation of specific purpose Numerical Prediction Models**
 - Cyclone Warning
 - Nowcasting
 - General Weather Prediction
 - Climate Simulation
 - Environmental Predictions
- **Weather Services**
 - Agro Met Services, Aviation Met Services
 - Web Enabled Services, Weather Channel



1. Establishing connectivity (network) for various kinds of instruments across the country to Atmospheric Data Centre at Delhi.
2. The data management software for managing huge quantity (25 Terabytes) of data on continuous basis for 20000 odd sensors including DWR. This software will enable the scientists of

IMD to access relevant data from the data repository;

3. Software tools for various meteorology, climatology and public weather service applications relating to forecasting like nowcasting using DWR and other sensor data, short range forecasting using numerical models and synoptic observation, medium and long range forecasts, specialized services like agro-met advisories and aviation service, climatological software for managing 130 years of observational data of IMD and automatic public weather warning (TV, radio, newspaper, mobile) preparation and dissemination software;

4. Setting up a forecasting environment as an integrated fully automated facility in which manual synoptic weather forecasting will be replaced by hybrid systems in which synoptic method is overlaid on numerical models supported by modern graphical and GIS applications to produce (i) high quality analyses (ii) Ensemble of forecasts from numerical models at different scales - global, regional and mesoscale (iii) nowcasting with radar mosaics for severe thunderstorms and tornadoes (iv) Prediction of intensity and track of tropical cyclone and storm surge (v) Aviation forecasts (vi) Forecasts and warning for shipping (vii) High quality Agro-met Advisory Services (viii) High quality extension of the forecast upto district and village levels.

Expected Outcomes of the Programme

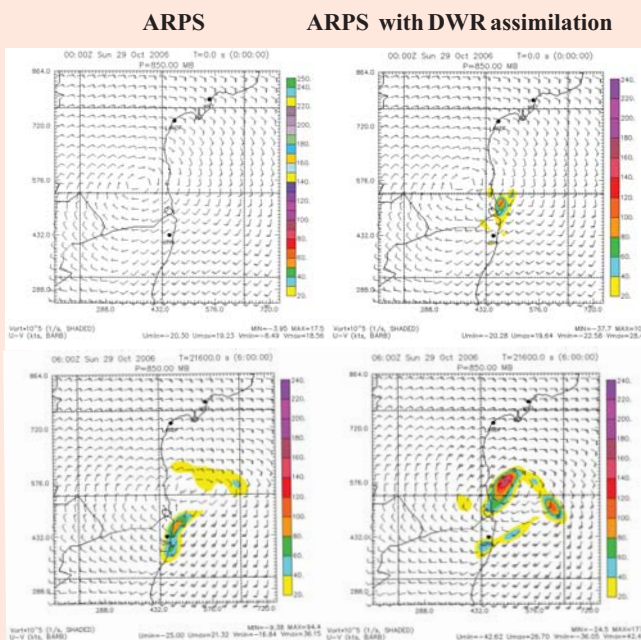
- Improved Weather and Climate Monitoring
- Real time data availability with rapid updation of data, quicker response time for management, easy accessibility, opportunities for value addition
- Improved Weather Forecasting for Nowcasting, Short, Medium and Long-range scales (months to seasons),
- Reduction in loss of life and property from weather hazards
- Understanding, assessment and prediction of climate variability and change for mitigation and adaptation measures,
- Support sustainable agriculture and horticulture and provide inputs for managing rising agricultural risks,
- Meet increasing requirements of civil aviation safety,
- Understand the effect of environmental factors on human well being, human health and ecology to make more informed decisions
- Monitor and manage Water and Energy Resources of the country.

Recent Achievements

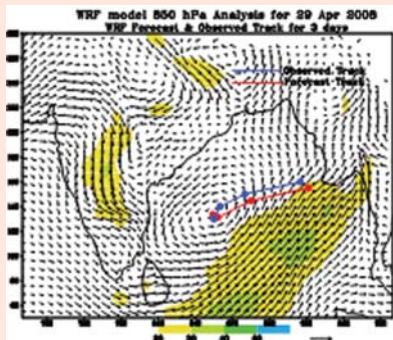
District Level Forecast System for Agro-advisory Service of India

One very specific requirement for the Integrated Agro-advisory Service of the India Meteorological Department is to provide district level quantitative forecasts in the short to medium range time scale. For generation of district level quantitative forecasts, one has to depend on the forecasts from dynamical Numerical Weather Prediction (NWP) models. As these forecasts are raw direct model outputs, the skill is likely to be poor. One conventional approach to improve these forecasts is the statistical technique such as, Model Output Statistics (MOS). Another potential approach as emerged in recent studies is the Multi-Model Ensemble (MME) technique. In the MME approach, forecasts made with different models are combined into a single forecast to partially take into account the uncertainties in the model formulation and initial conditions. IMD implemented a MME based district level quantitative forecasts in the operational mode since 1 June 2008. The forecasts prepared daily are also made available in the IMD web site (www.imd.ernet.in or www.imd.gov.in).

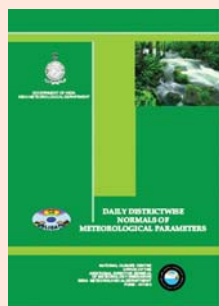
Assimilation of Doppler Weather Radar (DWR) Data in Advanced Research Prediction System (ARPS) model



Six hourly forecast wind at 850 hPa with control run and DWR run



Implementation of high resolution Weather Research Forecasting (WRF) meso-scale model at IMD Headquarters and other regional centers of IMD for short range weather forecasting



Preparation of data CD ROM for daily districtwise normals of meteorological parameters and high resolution gridded temperature and temperature by National Climate Centre (NCC), IMD, Pune.



Forecast Demonstration Project (FDP) on Landfalling Tropical Cyclones over the Bay of Bengal

A Forecast Demonstration Project (FDP) on landfalling tropical cyclones over the Bay of Bengal has been taken up. It will help us in minimizing the error in prediction of Tropical Cyclone track and intensity forecasts. The programme has been divided into three phases

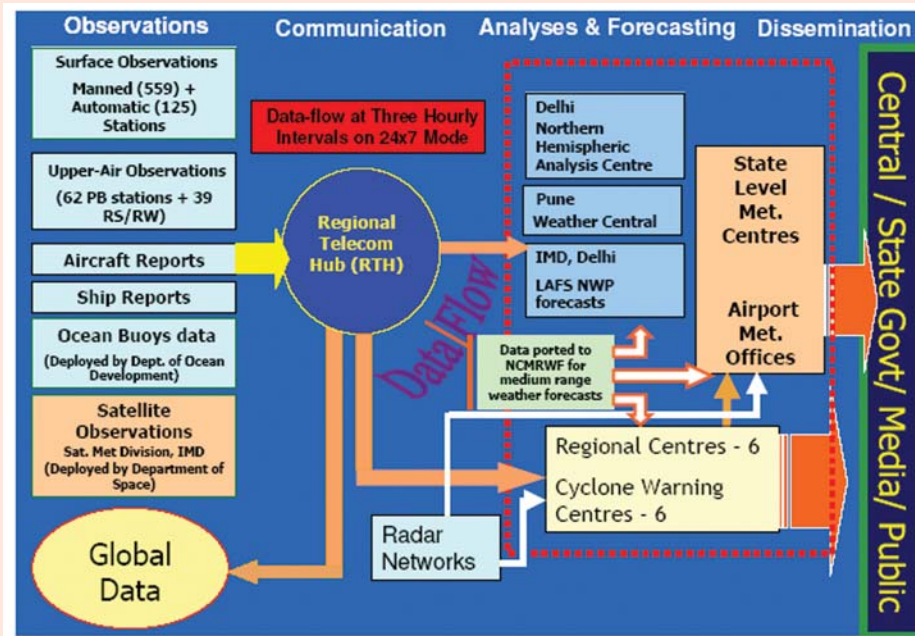
- (i) Pre-pilot phase : Oct-Nov. 2008
- (ii) Pilot phase : Oct-Nov. 2009, 2010
- (iii) Final phase : Oct-Nov 2011

During pre-pilot phase (15 Oct-30 Nov 2008), several national institutions participated for joint observational, communicational & NWP activities.

FDP on Fog forecasting for the Aviation sector has also been taken up during 2008-2009 winter.

Public Weather Forecast Services

IMD's Operational Weather Observation and Forecasting System



Observing System

- In 1997, the obsolete network of Data Collection Platform (DCP) was upgraded to Automatic Weather Station (AWS).
- In first phase, 125 AWS have been installed across India (including one at Antarctica) during the year 2006-07.
- Under modernization program of IMD, it is planned to establish a network of 1000 AWS and 3600 Automatic Rain Gauge Stations (ARG) across the country in a phased manner.



10 nos. of GPS based upper air systems will be installed at Srinagar, Mohanbari, Chennai, Thiruvananthpuram, Portblair (under modernization of IMD) and Goa, Minicoy, Hyderabad, Visakhapatnam, & Patna.



GPS Radiosonde with Dereeler

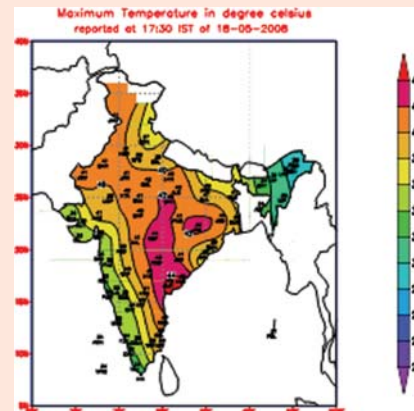
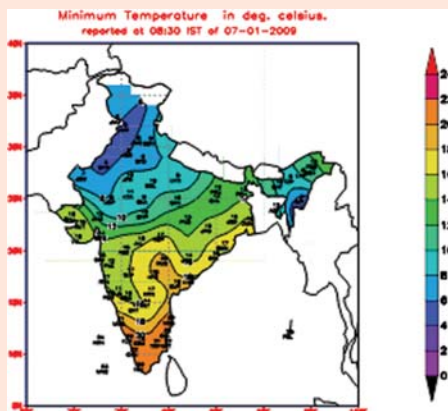


400 Mhz Antenna



GPS Antenna

Real Time Analysis of Surface Observations



Observing Weather From Space - Satellite

At present IMD is receiving and processing meteorological data from two Indian satellites namely Kalpana-1 and INSAT-3A. Kalpana-1 and INSAT-3A both have three channel Very High Resolution Radiometer (VHRR) for imaging the Earth in Visible (0.55-0.75 μm), Infra-Red (10.5-12.5 μm) and Water vapour (5.7-7.1 μm) channels having resolution of 2X2 kms in visible and 8X8 kms in WV and IR channels. In addition the INSAT-3A has a three channel Charge Coupled Device payload for imaging the earth in Visible (0.62-0.69 μm), Near Infra Red (0.77-0.86 μm) and Short Wave Infra Red (1.55-1.77 μm) bands of Spectrum. All the received data from the satellite is processed and are archived in National Satellite Data Centre (NSDC), New Delhi.

Quantitative satellite products

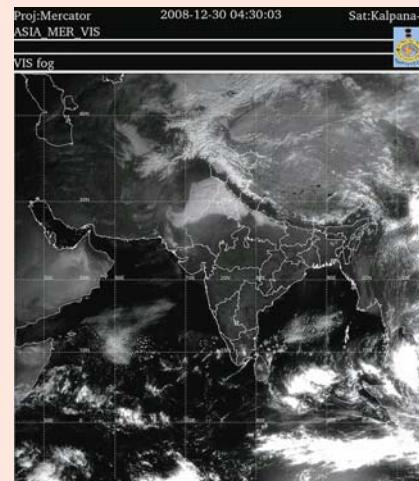
- Cloud motion vectors (CMVs)& water vapor winds (WVWs)
 - Sea surface Temperatures (SSTs)
 - Outgoing Longwave Radiation (OLR)
 - Quantitative Precipitation Estimates (QPE)
- (<http://www.imd.gov.in/section/satmet/dynamic/insat.htm>)

Future satellites for weather forecasting

- INSAT-3D is being designed by ISRO. It will have a six channel imager and a nineteen channel sounder. In addition to ground level products the vertical profiles of atmospheric temperature, moisture and ozone will be available from the satellite data of INSAT-3D. It will provide 1 Km resolution imagery in visible band, 4 Km resolution in IR band and 8 Km. in water vapor channel.
- It is planned to install three nos. NOAA/MODIS/ Metops Satellite data receiving and processing system at New Delhi, Chennai and Guwahati for obtaining Satellite derived products that are useful in weather forecasting.
- ISRO will be launching two satellites Megha Tropiques and Oceansat-II this year. It is planned to utilize the data and products from these two satellites e.g. sea surface winds, rain over oceans, humidity profile and Radiation budget etc.

Synoptic Applications unit of the satellite division issues 3-hourly satellite bulletins in normal weather conditions and issues hourly bulletins in case of a deep depression formed over Bay of Bengal and Arabian Sea. Advisories are issued in case of a severe weather events like Thunderstorms and squall etc.

INSAT Picture showing the Fog over NW India on 30th December, 2008



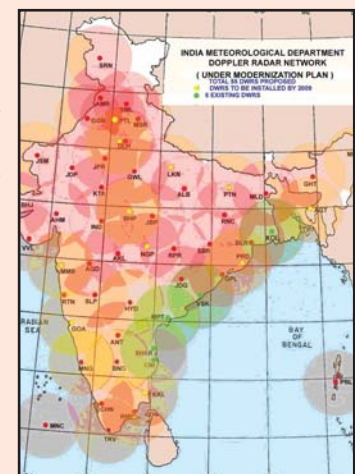
Observing Weather with RADAR

A Doppler Weather Radar (DWR) provides velocity and spectrum width data (in addition to reflectivity). This capability permits the forecaster to view weather events like thunderstorms, hailstorm, heavy rainfall etc. in greater detail. The elimination of ground clutter and anomalous propagation echoes through Doppler



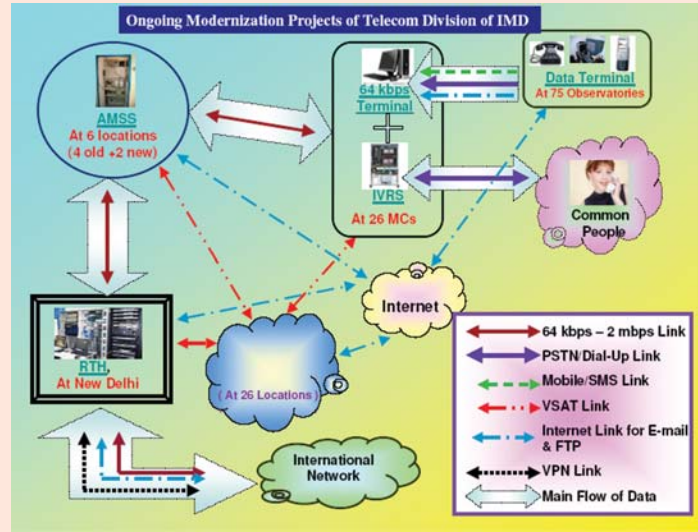
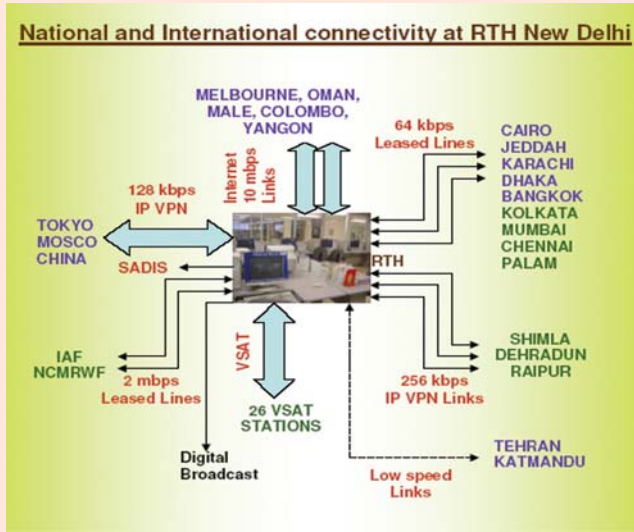
Visakhapatnam DWR

processing improves the reflectivity estimates and consequently results in better quantitative rainfall estimates. The Doppler radar shows promise in depicting wind field patterns associated with cyclones, which can be used in assessment of wind damage potential and determination of the associated storm surge affecting the coastal areas with greater accuracy. DWR provides various meteorological, hydrological and aviation products which are very useful for forecasters in estimating the storm's center, fixing its position and predicting its future path. In Numerical Weather Prediction models the Doppler data, which is in digital form, can directly be assimilated, which results in better rainfall estimation, better prediction of the storm track and point of landfall for tropical cyclones.



Proposed DWR Networks of IMD

Met Communication



High Performance Computing (HPC) System

IMD, under its modernization program of observational and forecasting system, has undertaken the project of procurement High Performance Computing System (HPCS) in November 2006 for high resolution weather modeling. Under the program, HPCS is being procured with the peak performance of 10 TF at IMD HQ and 1TF at National Climate Centre, IMD, Pune along with high-end servers and graphic workstations. In addition, it is also proposed for providing High-end servers of 100 GF capacities with minimum of 32 CPUs to each of 12 major Meteorological Centres (Delhi, Mumbai, Chennai, Nagpur, Kolkata, Guwahati, Ahmedabad, Bangalore, Bhubaneshwar, Chandigarh, Hyderabad and weather forecasting unit, Pune) for regional data base management, mesoscale data assimilation and high resolution local area modeling. The purchase process and installation is expected to be completed by the end of February 2009 and the system is likely to be available for operational use during the Monsoon-2009.

Nowcasting and Meso-scale Modelling

Nowcasting Using Radar Products

Displays a mosaic creation of the tropical cyclone Khai-muk of 14 November 2008 from the three radars at Chennai, Machilipatnam and Visakhapatnam when the cyclone was located close to Tamilnadu coast.

Short Range Forecasting Using MM5 Mesoscale model

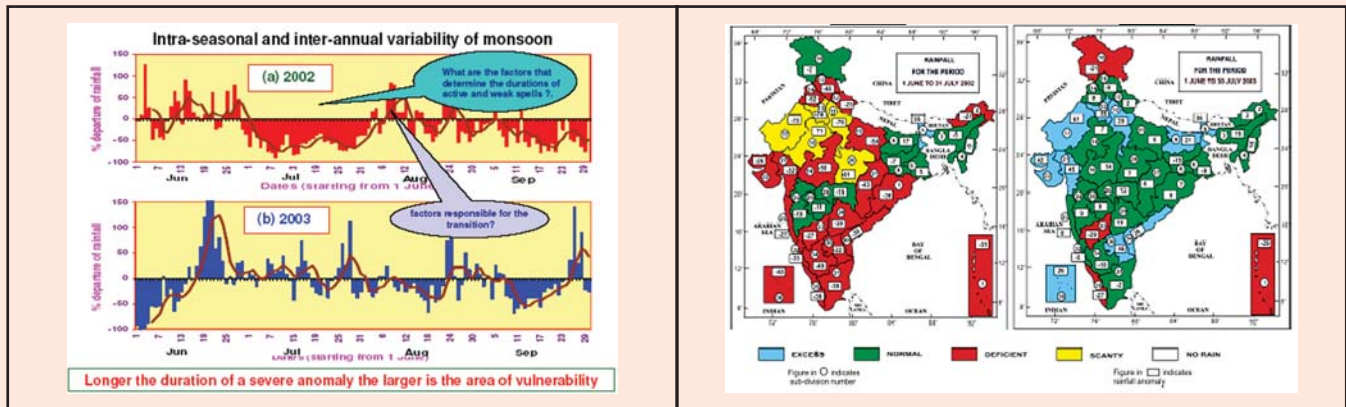
850 hPa wind **Rainfall**

Forecast wind and rainfall using MM5 mesoscale model run operationally at IMD. The other model products are provided on real time basic and is available.

(<http://www.imd.gov.in/section/nhac/dynamic/welcome.htm>)

Monsoon and Climate Research - Monitoring and Prediction

Seasonal prediction of monsoon rainfall is very crucial for an agricultural country like India. The extended range forecast beyond 10 days to monthly scale in tropics is one of the most challenging tasks in tropics. The forecasting of precipitation and temperature in the extended range time-scale has significant implications in policy decision making in areas such as agriculture, water resources, etc. especially for India. At present the dynamical-statistical methods for the forecast of precipitation and temperature in the extended range is in the research and development mode and many centres in India (including different offices of IMD in Delhi, Pune and other regional centres) as well as out side India are engaged in this research.



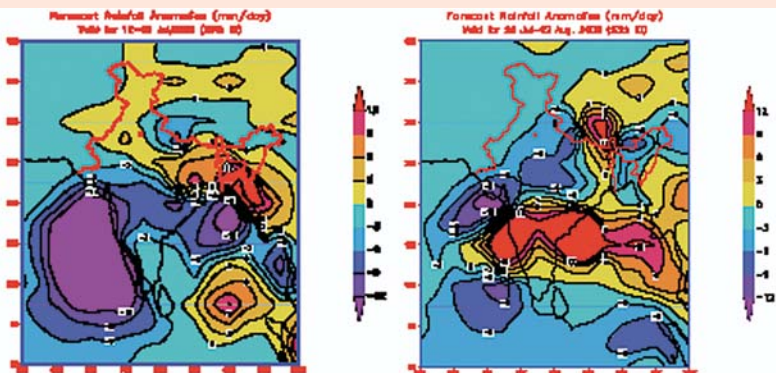
Climate monitoring and analysis: IMD publishes monthly, seasonal climate diagnostic bulletins and annual climate summaries for Indian region. Also publishes yearly special reports on south west monsoon and Hazardous weather over India.

Climate data products: IMD provides climate data products for smaller spatial and temporal scales for various user communities such as researchers, planners, agriculturists etc. The data products already developed include high resolution daily gridded rainfall and temperature data over Indian region, district wise normal for various surface parameters etc. are available in National Climate Centre, IMD Pune.

<http://www.imdpune.gov.in>



India Meteorological Department, Pune



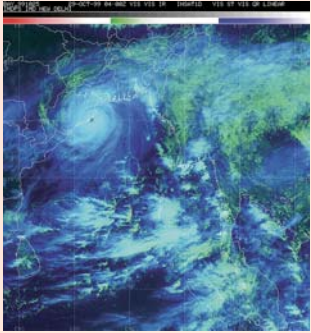
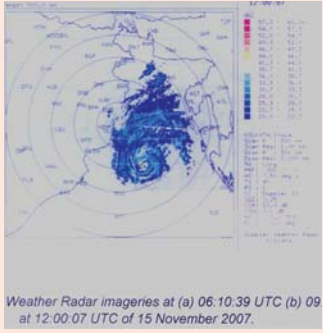

Bias corrected weekly forecast rainfall anomalies (mm/day) using the coupled model output from CFS based on the initial condition of 9th July and 23rd July, 2008 respectively showing week monsoon and revival of monsoon respectively.

Seasonal and Intra-seasonal forecasts: *IMD Issues operational long range forecasts for seasonal rainfall for winter, monsoon rainfall and northeast monsoon rainfall. These forecasts are prepared using indigenously developed empirical models. IMD has also implemented a dynamical prediction system based on an atmospheric GCM for monthly and seasonal forecasts for the monsoon season. IMD also uses coupled models outputs from other centers.*

Research and development: Carries out research on topics such as monsoon and climate variability and predictability, air pollution, extreme events like droughts & floods, heat and cold waves, depressions and cyclones and publishes various research papers and reports.

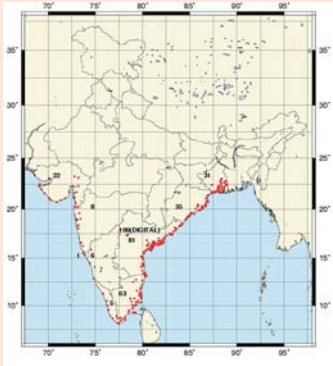
Tropical Cyclone Forecasting

Cyclone warning is one of the most important functions of the India Meteorological Department. It was the first service undertaken by the department as early as in 1865 and thus the service started before the establishment of the department in 1875. India Meteorological Department (IMD) monitors and predicts cyclonic disturbances over north Indian Ocean (NIO) and provides early warning services for management of cyclone impact. IMD, New Delhi acts as a Regional Specialised Meteorological Centre (RSMC)- Tropical Cyclone for the World Meteorological Organisation (WMO)/ Economic and Social Cooperation for Asia and the Pacific (ESCAP) Panel Member countries viz. Pakistan, Oman, Bangladesh, Sri Lanka, Thailand, Maldives and Myanmar.

<p>Monitoring of cyclone by Satellite</p>  <p>Satellite image of Orissa Super cyclone of 29 October, 1999 hitting the coast.</p>	<p>Monitoring of cyclone by Radar</p>  <p>Weather Radar imagery from Kolkata at 1730 hrs IST of 15th Nov 2007 showing eye and spiral bands of SIDR.</p>	<p>Cyclone warning organization of IMD</p>  <p>(ACWCs) at Chennai, Mumbai and Kolkata and Cyclone Warning Centre at Bhubaneswar, Visakhapatnam and Ahmedabad are responsible for originating and disseminating the cyclone warnings at regional level.</p>
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Cyclone warning and dissemination

The complete Cyclone Warning Programme in the country is supervised by the Cyclone Warning Division (CWD) at Head Quarter Office at New Delhi. The CWD monitors the cyclonic disturbance both in the Bay of Bengal and Arabian Sea and advises the Government of India at the Apex level. Information on cyclone warnings is 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. This Division provides cyclone warning bulletins to Doordarshan and All India Radio (AIR) station at New Delhi for inclusion in the National broadcast/telecast. Bulletins are also provided to other electronic and print media and concerned state Govts.

<p>Bulletins issued by IMD at the time of cyclone</p> <ul style="list-style-type: none"> ● Sea area bulletins for ships plying in High Seas. ● Coastal weather bulletins for ships plying in coastal waters. ● Bulletins for Global Marine Distress and Safety System (GMDSS). Broadcast through Indian Coastal Earth Stations. ● Bulletins for Indian Navy. ● Port Warnings. ● Fisheries Warnings. ● Four stage warnings for Central and State Govt. Officials. ● Bulletins for broadcast through AIRs for general public. ● Warning for registered users. ● Bulletins for press. ● Warnings for Aviation (issued by concerned Aviation Meteorological Offices). ● Bulletins for ships in the high seas through Navtex Coastal Radio Stations. <p>Training - RSMC, New Delhi imparts training on cyclone warning to the WMO sponsored forecasters of various countries every year.</p> <p>Research and Publication - RSMC, New Delhi has two annual publication on regular basis viz, (i) 'RSMC - Report on Tropical cyclone over north Indian Ocean' and (ii) WMO/ESCAP Panel on Tropical Cyclone Annual Review. Apart from these publications, Met monographs on important cyclones are published.</p> <p>Cyclone page of IMD website http://www.imd.gov.in/section/nhac/dynamic/cyclone.htm</p> <p>As part of the Regional Specialised Meteorological Centre (RSMC) responsibility under the World Meteorological Organisation (WMO) IMD had provided an advance information of landfall of "Nargis" in Myanmar prior to 36 hrs. The same was appreciated by the WMO.</p>	<p>Cyclone Warning Dissemination System (CWDS)</p>  <ul style="list-style-type: none"> ● Introduced in mid-eighties ● 252 analogue type receivers installed along the east and the west coasts ● 100 digital CWDS receivers installed along Andhra coast through World Bank assistance ● Future plans ● To replace all analog systems by digital ones ● Increase the existing network to 500 to cover more coastal areas.
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Agricultural Meteorology

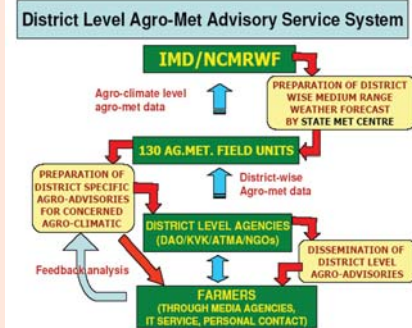
Indian agriculture has, for centuries, been solely dependent on the weather and vagaries of the monsoon in particular. The object of agriculture meteorology is to minimize the impact of adverse weather on crops and to make use of crop weather relationship to boost agricultural production. The Agricultural Meteorology Wing of the IMD, was established at Pune in 1932. Forecast and advisories for farmers are issued by Agrometeorological Field Units at Agroclimatic zone level, IMD's forecasting offices of State capital and National Agromet Advisory Service Centre, Pune.

District level Agromet Advisory Service System

Considering the high variability of weather in time and space and need of farming sector, IMD has upgraded the Agro-Meteorological Advisory Service from agroclimatic zone scale to district level. From 1st June, 2008, IMD has started issuing district level (612 districts) weather forecast for meteorological parameters up to 5 days in quantitative terms. These are disseminated through Regional Meteorological Centres after value addition to these products.



Central Agromet Observatory, Pune

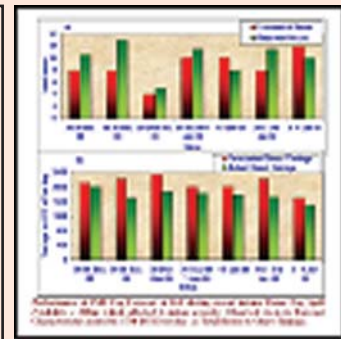
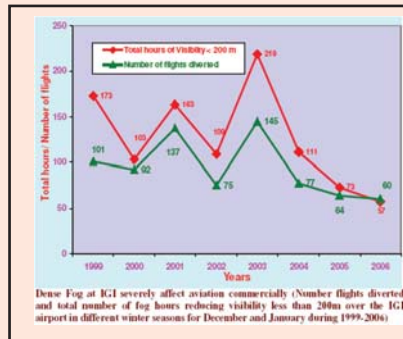


Meteorological Services to Aviation

IMD provides a crucial service to the national and international civil aviation sector in fulfillment of the requirements prescribed by the International Civil Aviation Organisation (ICAO) and the Director General of Civil Aviation of India (DGCA). These services are provided through 17 Aerodrome Meteorological Offices (AMO) and 51 Aeronautical Meteorological Stations (AMS) located at various national and international airports of the country.

Services Provided by IMD

- Integrated Automatic Aviation Meteorological Systems for:
 - Current weather observations
 - Dissemination of observations
 - Display of observations
- Web based Meteorological briefings to pilots
- Use of WAFC products
- Tropical Cyclone Advisories
- Landing, Route and Take-off Forecasts
- Terminal Aerodrome Forecast (TAF)
- Area/Local Forecast
- Significant Weather Forecast



Environmental Monitoring

ENVIRONMENT MONITORING & RESEARCH CENTRE

ACTIVITIES

- Monitoring of Greenhouse Gases (CO₂, CH₄ & N₂O), Aerosols and Ozone.
- Set up Standards for measurements, calibration and data quality
- Archival of environmental data, meta data and data products
- Environment Impact Assessment of Thermal Power, Industrial & Mining Projects.
- Environmental research programmes Carbon-Cycle modeling, acid rain threats, impacts on health etc.
- Climate Change

Met Monograph No. Environ. Meteorology- 01/2008

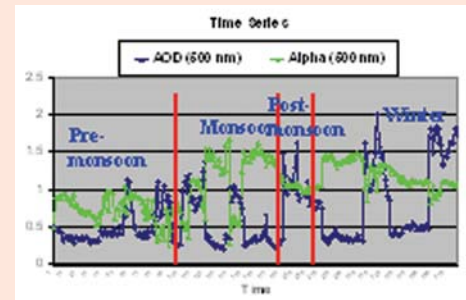
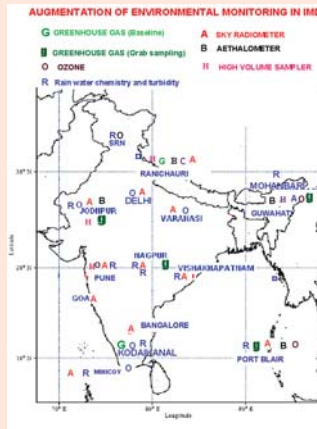
GOVERNMENT OF INDIA
INDIA METEOROLOGICAL DEPARTMENT

ATLAS
OF
HOURLY MIXING HEIGHT AND
ASSIMILATIVE CAPACITY OF ATMOSPHERE
IN INDIA

2006

EMRC, India Meteorological Department,
New Delhi

RANICHAURI OBSERVATORY (2000m) SKY RADIOMETER NEW DELHI APS, LAB PUNE



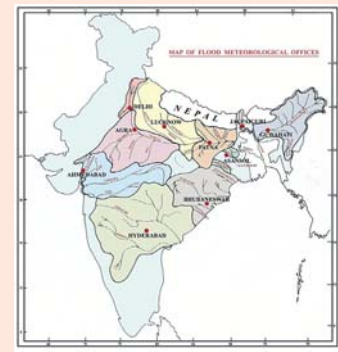
Flood Forecasting

Role of IMD (40 million hectares of Land in India is prone to floods)

- Observation and Collection of Hydro-meteorological Data.
 - Transmission of data to forecast centers
 - Analysis of data and formulation of forecast (QPF) & issue of heavy rainfall warnings.
 - Dissemination of forecasts/warnings to Central Water Commission (CWC)/State Govts.
- IMD caters this service through its 10 Flood Meteorological Offices (FMOs) in flood prone areas. These FMOs issue daily Flood Met Bulletin during Flood Season for respective catchments under their jurisdiction.

Flood Met Bulletin contains prevailing synoptic situation, areal rainfall occurred during past 24 hrs, heavy rainfall warnings, station wise significant rainfall ($\geq 5\text{cm}$) observed and the important component QPF sub catchment wise. FMOs keep round the clock watch during the period of flood and work in close coordination with CWC and State Governments. Hydromet Division at HQ is also making efforts to improve QPF by using NWP products.

Flood Meteorological Offices (FMOs)



Training - Capacity Building

Human resource development has always been one of the prime thrust areas of the India Meteorological Department for capacity building and to keep pace with latest trends in various activities of the Department. The Central Training Institute (CTI) of the IMD is a World Meteorological Organization (WMO) rated Regional Meteorological Training Centre (RMTc), headed by Deputy Director General of Meteorology (Training), and is situated in Pune. Facilities for meteorological training at Pune and New Delhi have been recognized by the WMO to function as RMTc in all the four main disciplines namely, General Meteorology, Radio-meteorology, Telecommunication and Agro-meteorology.

The Central Training Institute of IMD has a distinguished history dating back to 1942 when it had a humble beginning as an outcome of World War II wherein the need for meteorological training to the personnel of IMD was acutely felt and, consequently, a formal training course started in that year. In 1943 a full-fledged training school started in Pune, India. Since then this training institute (CTI) has undergone dramatic changes in its training capabilities, composition, objectives, contents, etc, in catering to personnel covering all levels from Class I to Class IV. IMD also opened training centres at New Delhi for Upper Air Instrumentation and Meteorological Telecommunication in mid seventies.



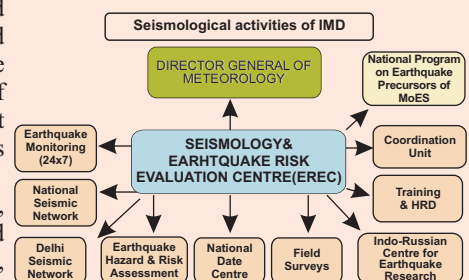
Central Training Institute, Pune

Seismological Service of IMD

IMD is the nodal agency of Govt. of India, responsible for providing information, on 24X7 basis, relating to occurrence of earthquakes in and around the country to various state and central government agencies including those dealing with relief and rehabilitation measures and other user agencies including, press, media etc. The information is also posted on IMD's Website (www.imd.gov.in). Information related to significant earthquake activity in the country may also be obtained from the Control Room (Tel. No.: **011-24619943 / 24624588**) and Interactive Voice Recording System (IVRS) at: **011-24657879**.

Towards fulfilling its mandate, a network of 55 seismological observatories spread over the country is operated by IMD. IMD is also operating a 16-station V-SAT based digital seismic telemetry system around National Capital Territory of Delhi for close monitoring of seismic activity in the region. In the aftermath of the Sumatra earthquake of 26 Dec., 04, a 17-station Real Time Seismic Monitoring Network (RTSMN) has been set up by IMD to monitor and report, in least possible time, the occurrence of earthquakes capable of generating Tsunamis that are likely to affect the Indian coastal regions.

IMD maintains a national archive of seismological data spanning over a century, based on which earthquake / seismicity reports of specific regions are prepared and issued to various user agencies, such as industrial units, power houses, insurance companies, river valley projects, etc. **A chart showing various important activities of Seismology Division of IMD and Earthquake Risk Evaluation Centre (EREC) is shown.**



Positional Astronomy Centre (PAC)

The preparation of the Indian Ephemeris and Nautical Almanac along with Rashtriya Panchang were taken up by the India Meteorological Department from the Council of Scientific and Industrial Research on 1st December, 1955 and was brought under control of the Regional Meteorological Centre, Calcutta as one of its sections named 'Nautical Almanac Unit'. Later, the Nautical Almanac Unit was made an independent centre with the name as "Positional Astronomy Centre" (P.A.C.) directly under the control of the Director General of Meteorology, New Delhi with formal inauguration of the Centre took place on the 26th April 1980. (<http://www.packolkata.org>).



Milestones

- 1793** First Astronomical and Meteorological Unit started at Madras
- 1875** Establishment of IMD by Govt. of India
- 1878** First weather charts were printed in the Indian Daily Weather Report
- 1888** Seismogram of the disastrous Quetta Earthquake
- 1905** The launching of the Pilot Ballon
- 1932** The first field unit at Pune for Agricultural Meteorology
- 1954** First Cyclone Detection Radar was installed at Visakhapatnam in 1970
- 1955** Publishes Astronomical Ephemeris and Rashtriya Panchang
- 1957** First Environmental (Ozone) measurement at Kodaikanal
- 1964** Image received from India's own satellite INSAT
- 1969** Creation of Central Training Institute (CTI) in Pune
- 1970** Directorate of Telecommunication was set up
- 1973** Starting of Numerical Weather Forecasting in IMD New Delhi
- 1977** Creation of National Data Centre (NDC) in IMD, Pune
- 1982** Unmanned Data Collection Platform
- 1983** First Meteorological station at Antarctica (Dakshin Gangotri)
- 1996** First Global Seismological Network (GSN) standard broad band seismological observatory was set up in Pune
- 2000** Use of Internet to provide better services
- 2002** The first Doppler Weather Radar (DWR) was commissioned at Chennai
- 2003** Launch of Meteorological data and INSAT imagery through World Space Digital Data Broadcast System
- 2006** Modernization of observing system
- 2008** Use of multimodel ensemble technique for providing Agricultural advisories on district level.

Publications

- Indian Daily Weather Report
- Regional Daily Weather Reports
- State Daily Weather Reports
- Weekly Weather Reports
- Special Daily Weather Report (during monsoon season)
- Agromet Advisory Bulletins
- Monthly Seismological Bulletins
- Climate Diagnostic Bulletins
- Disaster Weather Events
- Annual Snowfall Summary
- Astronomical Ephemeris
- Sunrise Moonrise Tables
- Rastriya Panchang (in 14 languages)
- Marine Climatological Summary
- Climatological Tables
- State Climatological Summaries
- Storm Track Atlas
- Research Reports
- Annual Monsoon Reports
- Met. Monographs
- Annual RSMC Report for Tropical Cyclone over north Indian Ocean

Director Generals

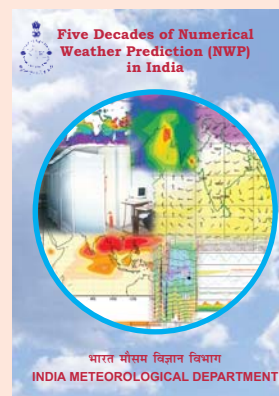
	Name	Period
1.	Mr. H. F. Blanford	1875-1889
2.	Sir John Eliot	1889-1903
3.	Sir Gilbert Walker	1904-1924
4.	Mr. J. H. Field	1924-1928
5.	Sir C.W.B. Normand	1928-1944
6.	Dr. S.K. Banerji	1944-1950
7.	Shri V. V. Sohoni	1950-1953
8.	Dr. S.C. Roy	1953-1954
9.	Shri S. Basu	1954-1959
10.	Shri P. R. Krishna Rao	1959-1965
11.	Dr. C. Ramaswamy	1965-1966
12.	Dr. L. S. Mathur	1966-1969
13.	Dr. P. Koteswaram	1969-1975
14.	Shri Y.P. Rao	1975-1978
15.	Dr. P. K. Das	1979-1983
16.	Shri S. K. Das	1983-1986
17.	Dr. R. P. Sarker	1986-1988
18.	Dr. S. M. Kulshrestha	1989-1992
19.	Dr. N. Sen Roy	1992-1997
20.	Dr. R. R. Kelkar	1998-2003
21.	Dr. S. K. Srivastava	2004-2004
22.	AVM (Dr.) Ajit Tyagi	2008 onward

Quarterly Research Journal MAUSAM

Formerly known as Indian Journal of Meteorology and Geophysics (IJMG) was published regularly from January 1950

Later the name was changed to Indian Journal of Meteorology, Hydrology & Geophysics (IJMH & G) in 1975.

Five year later, it was given a concise Hindi name "MAUSAM".



Book Published by IMD in 2008 to celebrate five decades of NWP in India

For further details Kindly contact

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<http://www.imd.gov.in> or
<http://www.imd.ernet.in>

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