Ministry of Earth Sciences
Government of India

Modernisation plan of India Meteorological Department

With a view to improve Weather and Climate Monitoring and Forecasting of weather in Short,Medium and Long range time scales for the benefit of Society and to reduce loss of life and property from weather hazards , Government of India initiated a major programme to modernize India Meteorological Department in 2004

In order to achieve the target, the modernization scheme recommended by the Expert Committee is being carried out in phased manner. IMD has a network of 125 Automatic Weather Station (AWS) and a large number of manual observatories. IMD is in the process to set up 550 additional AWS and 1350 Automatic Rain Gauge (ARG) stations in the first phase of its modernization plan. With this, every district in the country will have at least one AWS and 2 ARG stations**.** In addition to this, a network of 55 Doppler Weather Radar has been planned of which 12 are to be commissioned in the first phase. Techniques have been developed to assimilate large volume of satellite derived information. A new satellite INSAT-3D is being launched next year. Through improvement in observing systems, there will be further improvement in defining the initial conditions to run the numerical weather prediction models which may lead to further improvement in skill of weather forecast.

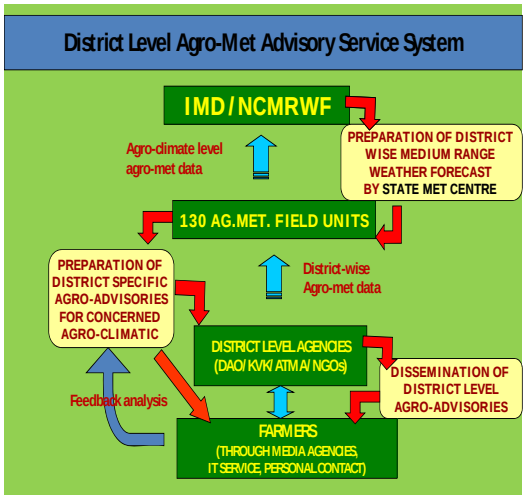
After implementation of Phase-I of the project it will enable IMD to collect sufficiently dense observational data with the help of automatic Weather Stations , Doppler Radars ,Wind Profilers etc. to run global and regional numerical prediction models with sufficient accuracy and also meso-scale models at specific geographical areas to forecast high impact weather events like severe thunderstorm and heavy rainfall causing flash flood.

District-level Agro-Meteorological Advisory Service (DAAS)

IMD has started issuing quantitative district level (612 districts) weather forecast upto five days from 1st June, 2008 using global numerical model predictions. The products comprise of quantitative forecasts for seven weather parameters viz., rainfall, maximum and minimum temperatures, wind speed and direction, relative humidity and cloudiness. In addition, weekly cumulative rainfall forecast is also provided. Since, no single numerical model at present is reliable enough over the Indian region, IMD, is also generating these products utilizing a Multi Model Ensemble technique whereby forecast outputs from the best set of numerical models available all over the world are utilized with appropriate weightage based on their individual performances. The products thus generated get subsequently disseminated to Regional Meteorological Centres and Meteorological Centres of IMD located in different states of the country. These offices upon value addition to these products communicate the same to 130 AgroMet Field Units (AMFUs) located with State Agriculture Universities (SAUs), institutes of Indian Council of Agriculture Research (ICAR) etc.

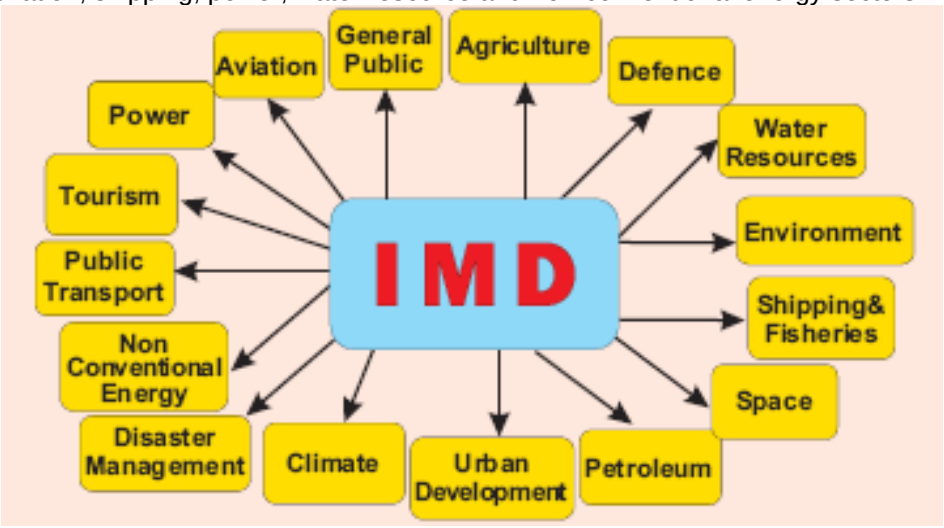
Based on the above forecast products and the crop information available from districts, the AMFUs prepare district-wise agro-advisories. The DAAS is a multidisciplinary and multi-institutional project. It involves all stake holders such as State agricultural Universities (SAUs), Indian Council for Agriculture Research (ICAR), Krishi Vigyan Kendras (KVK), Department of Agriculture & Cooperation, State Departments of Agriculture/ Horticulture/ Animal Husbandry/ Forestry (Up to District level offices), NGOs, Media Agencies, etc. This project is composed of a five tier structure which includes all the components of service spectrum. It include meteorological (weather observing & forecasting), agricultural (identifying weather sensitive stress & preparing suitable advisory using weather forecast), extension (two way communication with user) and information dissemination (Media, Information Technology, Telecom) agencies.

These weather based advisories are being disseminated to the farmers through mass media dissemination, Internet etc as well as through district level intermediaries. The advisories are communicated through multi-channel dissemination system including All India Radio (AIR), Doordarshan, private television channels, FM radios, print media (newspapers), Internet (web pages of IMD, SAUs etc) and community service centres of Ministry of Information Technology, Cell Phone-SMS, KVKs/ District Agricultural Offices (DAO), Kisan Call Centres, NGOs etc. A mechanism has also been developed to obtain feedback from the farmers on quality of weather forecast, relevance and content of agromet advisory and effectiveness of information dissemination system.



Services of India Meterological Department

The India Meteorological Department 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 with special focus in providing value added services to agriculture, aviation, shipping, power, water resource and non-conventional energy sectors.



Launch of a Weather Channel

Weather and climate information play significant role in day to day life. With fast industrial development and advancement of social environment in the country, this information assumes much more importance and value now than earlier. Recognizing the increasing demands from various weather sensitive sectors and with the rising trend in extreme weather events, IMD, Ministry of Earth Sciences has envisaged launching a dedicated Weather Channel in India. This Weather Channel would provide weather services through various communication modes like TV, Radio, SMS and Internet portal.

Public-Private Partnership (PPP) model has been planned for the launch and operations of this dedicated Weather Channel, wherein the public agency, viz. IMD, will enter into a contractual relationship with a private agency with predefined terms and conditions spelling out the respective roles and responsibilities, financial obligations, governance structure, project guidelines, risk management mechanism and other contractual obligations.

IMD, to serve as the supplier of weather related data and products according to the requirements of the industry and users. This processed and semi-processed information will then be supplied to Weather Channel Operator, who will further process and customize the information to suit the requirements of the users.

To begin with there may be the broadcast time of about 4-6 hours which will be made into 24 hours 7 days a week weather channel in a phased manner well before the commencement of Commonwealth Games- 2010, New Delhi.

Early Tsunami Warning System

In the aftermath of the Great Sumatra earthquake of 26th December, 2004, there was heavy loss of life and property. To address the issue the Government of India has set up an Early Warning System for Tsunamis in the Indian Ocean region at Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, which is operating on a 24X7 basis. The system provides advance warnings of Tsunamis likely to affect the coastal areas of the country. As part of the Early Warning System for Tsunamis, a Real Time Seismic Monitoring Network (RTSMN) is set up by India Meteorological Department (IMD). The network is designed to monitor and report, in least possible time, the occurrence of earthquakes capable of generating Tsunamis in Indian Ocean region. The data from the seismic field stations is transmitted simultaneously in real time through V-SAT communication facilities to the Central Receiving Stations (CRSs) located at IMD at New Delhi and INCOIS, Hyderabad for processing and interpretation. The CRSs are equipped with state-of-the-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 Warning System has been established by MoES as the nodal ministry in collaboration with Department of Science and Technology (DST), Department of Space (DOS) and the Council of Scientific and Industrial Research (CSIR).

Tsunamigenic zones that threaten the Indian Coast have been identified by considering the historical tsunamis, earthquakes, their magnitudes, location of the area relative to a fault, and also by tsunami modelling. The Indian Tsunami Early Warning System comprises a real-time network of seismic stations, Bottom Pressure Recorders (BPR) and tide gauges to detect tsunamigenic earthquakes and to monitor tsunamis.
The Early Warning Centre receives real-time Seismic data from the national seismic network of the Indian Meteorological Department (IMD) and other International seismic networks. The system detects all earthquake events of more than 6 Magnitude occurring in the Indian Ocean in the less than 20 minutes of occurrence. BPRs installed in the Deep Ocean are the key sensors to confirm the triggering of a Tsunami. The National Institute of Ocean Technology (NIOT) has installed 4 BPRs in the Bay of Bengal and the 2 BPRs in Arabian Sea. In addition, NIOT and Survey of India (SOI) have installed 30 Tide Gauges to monitor the progress of tsunami waves. Integrated Coastal and Marine Area Management (ICMAM) has customised and ran the Tsunami Model for 5 historical earthquakes and the predicted inundation areas. The inundated areas are being overlaid on cadastral level maps of 1:5000 scale. These community-level inundation maps are extremely useful for assessing the population and infrastructure at risk. High-resolution Coastal Topography data required for modelling is generated by the National Remote Sensing Agency (NRSA) using ALTM and Cartosat Data. INCOIS has also generated a large database of model scenarios for different earthquakes that are being used for operational tsunami early warning.

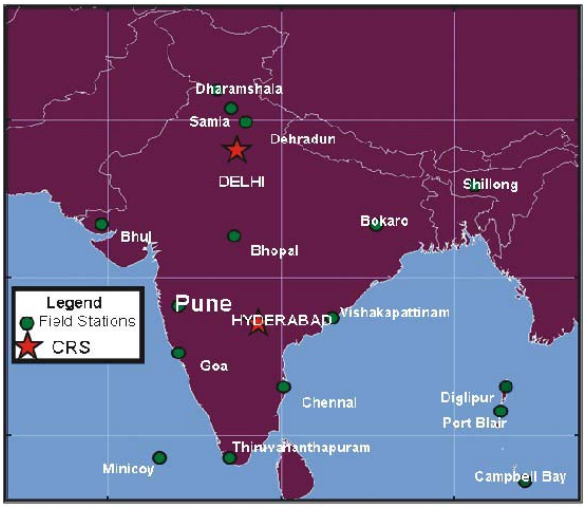
Communication of real-time data from seismic stations, tide gauges and BPR's to the early warning centre is very critical for generating timely tsunami warnings. A host of communication methods are employed for timely reception of data from the sensors as well as for dissemination of alerts. Indian Space Research Organisation (ISRO) has made an end-to-end communication plan using INSAT. A high level of redundancy is being built into the communication system to avoid single point failures.

A state-of-the-art early warning centre is established at INCOIS with all the necessary computational and communication infrastructure that enables reception of real-time data from all the sensors, analysis of the data, generation and dissemination of tsunami advisories following a standard operating procedure. Tsunami warnings/watches are then generated based on pre-set decision support rules and disseminated to the concerned authorities for action, following a Standard Operating Procedure.

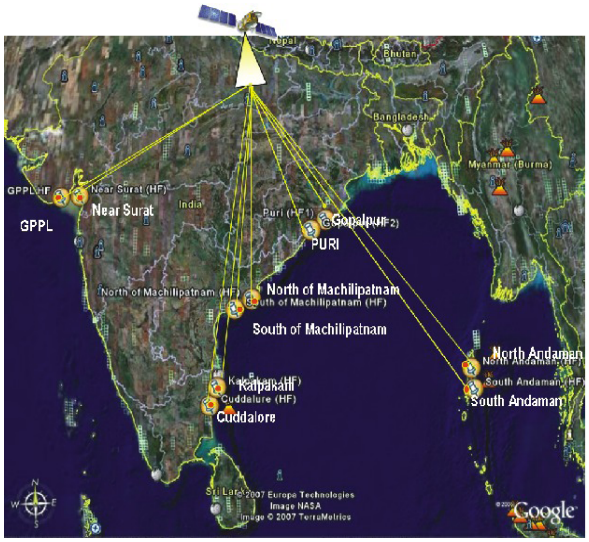
The National Early Warning Centre generates and disseminates timely advisories to the Control Room of the Ministry of Home Affairs for further dissemination to the Public. For the dissemination of alerts to MHA a satellite-based virtual private network for disaster management support (VPN DMS) has been established. This network enables early warning centre to disseminate warnings to the MHA, as well as to the State Emergency Operations Centres. In addition, Messages are being sent by Phone, Fax, SMS and e-mails to authorised officials. In case of confirmed warnings, the National Early Warning Centre is being equipped with necessary facilities to disseminate the advisories directly to the administrators, media and public through SMS, e-mail, Fax, etc. The cyclone warning network of IMD and electronic ocean information boards of INCOIS could be effectively used for dissemination of warnings directly to the public.

Periodic workshops are being organized for the user community to familiarize them with the use of tsunami and storm surge advisories as well as inundation maps. Easily understandable publicity material on earthquake, tsunami and storm surges has been generated for distribution to the general public.

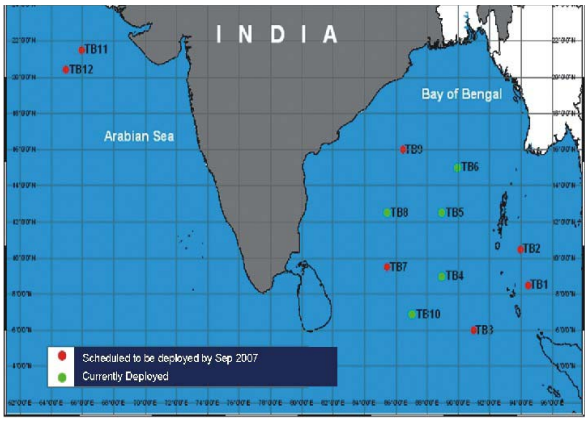
TSUNAMI NETWORK



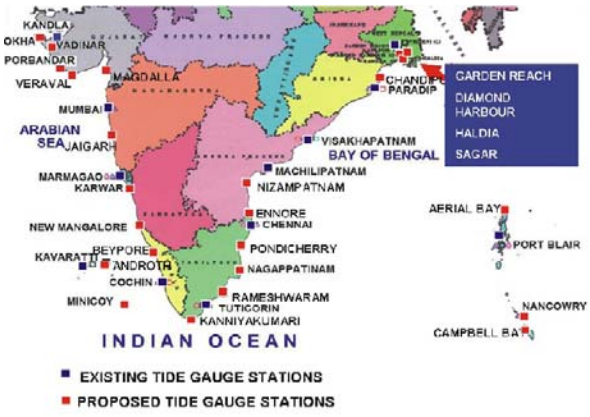
Network of 17 broadband seismic stations for real-time Earthquake detection



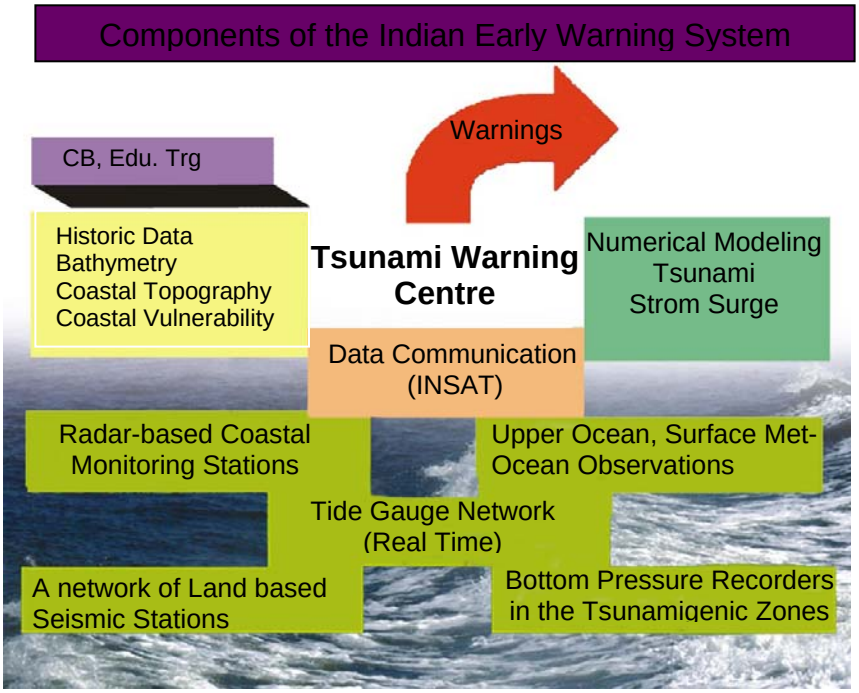
Network of 5 Coastal RADARs to monitor the Coastal currents and waves



Network of 12 Deep Ocean Assessment and Reporting Systems (DOARS) for detection of Tsunami Waves



Network of 50 Automatic tide gauges for monitoring the progress of Tsunami Waves



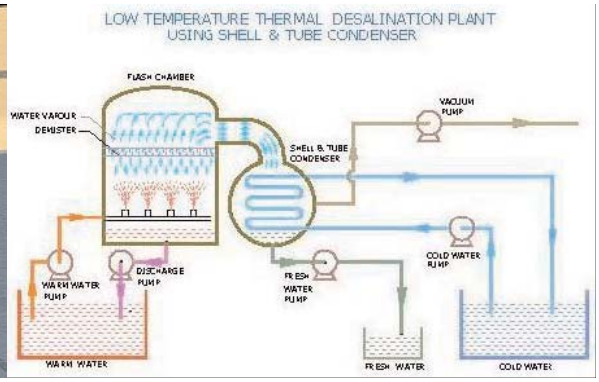
DESALINATION: A BOON FOR THE ISLAND

National Institute of Ocean Technology (NIOT), Chennai, an autonomous body of Ministry of Earth Sciences (MOES) has been working towards producing fresh water out of seawater using the concept of low temperature thermal desalination (LTTD). The LTTD is a process by which fresh water is produced by flashing warm surface seawater under low vacuum conditions and condensing this vapour using deep-sea cold water. Though the process of LTTD is fairly well understood, the challenge lies in drawing the cold seawater using long pipes

Fresh water is an essential requirement of mankind for drinking, agriculture and Industrial purpose and is amongst one of the most important input for man's survival. The rapid increase of world's population and nonuniform distribution of potable water has forced mankind to develop new techniques to generate potable water. Fresh water rivers, lakes and other natural sources are not able to meet the over growing demand of potable water forcing the scientists to look towards the sea to fulfill the need. Sea water is available in abundance; however, its conversion to fresh water is limited and restricted due to high cost of conversion. The salt content in the sea water is very high making it unfit for human consumption and industrial use. Various processes are being developed to reduce the salinity of sea water so as to make it fit for human consumption and use. The most popular processes presently being used are distillation, reverse osmosis and electro dialysis. The selection of the right process depends upon the initial capital investment, plant capital, operation and maintenance costs etc. Scientists all over the world are constantly working on developing economical process so as to generate fresh water.

Current endeavours: Considering the requirement of fresh water for both island territories and coastal mainland of India, two types of desalination plants have been developed — Land Based Plant and Offshore plant. The land based plant is suitable for Lakshadweep islands while the offshore plants suitable for mainland India. The islands of the Lakshadweep are very small with no fresh water bodies such as ponds, lakes and rivers. The major source is mainly from the rainfall occurs during the monsoon. The borewells are often contaminated with sea water. Thus an efficent desalination technique such as LTTD is one of the potential alternatives to the islanders.

Land based Plants: A land based plant of one lakh liter per day capacity plant was installed in Kavaratti in May 2005. This LTTD desalination plant was developed indigenously by National Institute of Ocean Technology (NIOT), which was commissioned at Kavaratti in May 2005. Since then, the plant has been working continuously without any interruption and contributing significantly to the needs of the Kavaratti population. This has improved the quality of life of the population in Kavaratti. To date, this plant has produced over nine crore litres of water and the production often exceeds the designed capaity. On March 3, 2006, the Low Temperature Thermal Desalination Plant (LTTD) at Kavaratti was successfully handed over to the administration of Lakshadweep for operation, maintenance and supply of drinking water to the people of the island. Now, due to the safe and unpolluted drinking water which is being supplied by the Desalination Plant in Kavaratti since May 2005, the waterborne diseases, especially in children, have come down to less than 10 per cent. Besides, the cold water being brought from a depth of 350m to the surface is nutrient-rich, and Kavaratti Island is evolving into a new marine ecosystem with the coastal line bursting with ornamental fish.



This would be a big boon for tourism industry of the island. Based on all these benefits to the society, the Lakshadweep administration plans to have more desalination plants in each of the islands. Currently three more plants are being setup at Minicoy, Agatti and Androth which are expected to be completed by June 2009.
Offshore Plant: In April 2007, a 10 lakh liter per day capacity plant indigenously designed and developed was commissioned on a barge, about 40 kms off Chennai. This Offshore demonstration plant was successfully run continuously for a period of several weeks. This was the first ever offshore LTTD plant with a single point

mooring in 1000 meter water depth and lay cold water pipe vertically suspended below the vessel. Currently an offshore plant of 10 million liter capacity per day is being designed.

Basic principle of LTTD Plant: The surface sea water at about 28°C to 30°C is pumped into flash chamber which is maintained under low pressure of about 25 mbar absolute (below the saturated vapour pressure of water). The warm sea water in the flash chamber evaporates due to low pressure being maintained, taking latent heat of evaporation from the warm water stream itself. The evaporated water vapours move towards the shell and tube condenser and the return water, losing temperature by about 7°C is returned back to the sea. The main condenser has a circulation of cold sea water at a temperature of 12°C to 13°C, pumped from the lower layers of sea and is used for the condensation of the evaporated water vapour. LTTD method of producing fresh water from sea water consists of flash evaporator, main condenser, fresh water and warm water pump and a vacuum pumping system. The major components are few so the system requires low maintaenance giving long operational life.

Financial Implications: As the size of the plant increases the overall cost per litre of water reduces. Due to the requirement of the cold seawater, such plants will necessarily have to be offshore plants particularly for providing fresh water to the mainland. The efforts would be made to reduce the unit cost further by generating non-conventional energy like OTEC/ wind power on the platform itself. There have been several desalination plants installed and operational in various parts of the world for generation of fresh water from the seawater. Most of these desalination plants are located in advanced countries which are based on the reverse osmosis technology, which is power consuming and difficult to maintain, particularly for developing countries like India. On the other hand, the LTTD for desalination developed by NIOT is suitable for the tropical countries like India, where sufficient vertical temperature gradient exists.

Implementation Status: Currently the detailed design of the plant is being carried out for further analysis. The Ministry is also exploring the possible public private partnership for operation and maintenance of the Plant after the commissioning. A project proposal is being prepared for seeking the approval of the Government for implementation along with industry participation. NIOT is in the process of finalising a Detailed Project Report. In the case of Renewable energy sector like solar and wind energy generation, there are good incentives from the Government for promoting and nurturing new technologies. Such incentives could be considered for Low Temperature Thermal Desalination (LTTD) based desalination projects, since they are environmental friendly and consume less power (less carbon emission) compared to alternate desalination technologies.