NATIONAL INSTITUTE OF DISASTER MANAGEMENT
(Ministry of Home Affairs; Government of India)

Format for preparation of abridged Report of the Course by the Course Coordinator for uploading in the website of NIDM.

1. Name of the course: National Programme on **"Early Warning and Communication"**

2. Duration : **18-22 June 2018**

3. Venue : **YMCA, New Delhi**

4. Objectives :

i. At the end of the programme, the participants will be able to

ii. To develop better understanding about disaster risk management

iii. To assess the needs and gaps in early warning and communications for disaster situations

iv. To promote linkages among stakeholders from disaster management and nodal agencies for early warning and communication

v. To explore possibilities for disaster resilient communication systems, technologies and networks for early warning

vi. To discuss the effective implementation of early warning and communications related to disaster situations

5. Methodology : Lectures, Presentations, Videos, Group Exercise, Panel Discussion and Institute Visit to IMD

6. Schedule : Copy attached at the end of this report.

7. Participant's profile : The participants included functionaries working with State Disaster Management Authorities (SDMAs), AIR, DTRL, DDMA ,NDRF GJUST, Nagar Panchayat, NABM, and HAM etc.

List of Nominations/Participants for the National Level Training Course on"Early Warning and Communication" from 18 to 22June2018, at YMCA Jai Singh Road New Delhi

List of Confirmed Participants

S.N	Name, Designation and address	Contact Details	State / UT
1.	Mr. Awanish Kumar, IAS Dy. Commissioner, Nicobar District, Car Nicobar	Email. dcnicobar2@gmail.com ,gyansingadlog@gmail.com	Andman& Nicobar
2.	Mr. SanjivDosajh, Asst. Director of Programmes (Policy), All India Radio, AkashvaniBhawan, Parliament Street, New Delhi – 110001	Tel. 23421965, Email. dppolicy@air.org.in ,sanjivdosajh@gmail.com	Delhi
3.	Mr. Ashish Kumar, Assistant Commandant, NDRF, CGO Complex, Lodhi Road, New Delhi – 03	Email. ashishac103@gmail.com	Delhi
4.	Ms. AnithaRevi, JRF, Defence Terrain Research Laboratory Defence Research &Organisation Metcalfe House, Delhi – 110054	Email. anitatr.aaa@gmail.com	Delhi
5.	Mr. AjitBatham, Project Coordinator District Disaster Management Authority, South Delhi	Tel. 011-29531277,	Delhi
6.	Mr. R. Baskar, Professor, Department of Environmental Science and Engineering, Guru Jambheshwar University of Science and Technology, Hisar - 125001	Email. rbaskargjuhisar@yahoo.com	Haryana

S.N	Name, Designation and address	Contact Details	State / UT
7.	Ms. Meghan Ruby Kachhap, Executive Officer, Nagar Panchayat, Khunti Jharkhand		Jharkhand
8.	Mr. Kaushik Kumar Singh, Project Officer, DRDA Dumka, Jharkhand	Email. singhkaushik175@gmail.com	Jharkhand
9.	Mr. RajuMahato, District Disaster Management Officer, Dumka Jharkhand	Email. tohamajura23@gmail.com	Jharkhand
10.	Mr. Raj Kumar Mishra, Chief Security Officer, IIT Bombay	Tel. +91-022-25722545 Fax. +91-022-25723480 Email. cso@iitb.ac.in	Maharashtra
11.	Mr. Sajith K.V, Safety Officer, Dean R & D, IIT Bombay	Tel. +91-022-25722545 Fax. +91-022-25723480 Email. safetyofficer@iitb.ac.in	Maharashtra
12.	Mr. Ashok Kumar Panigrahi, Programme Executive, National Academy of Broadcasting & Multimedia, All India Radio &Doordarshan, OMFED Square, Bhubaneswar – 751017,	Tel. 0674-2303157, Fax. 0674-2301713, Email. ashokkpanigrahi@gmail.com	Odisha
13.	Mr. SubhankarSaha, Radio Officer, VU3XSO (HAM), West Bengal Radio Club (Amateur Club)	Tel. 033-2563838 Email. subhankarsaha_1@yahoo.in	West Bengal
14.	Mr. Debdatta Mukherjee, Radio Officer, VU3JXA (HAM), West Bengal Radio Club (Amateur Club)	Tel. 033-2563838 Email. vu3jxa@gmail.com	West Bengal
15.	Mr. Kumar Ravi, Dy. Commandant, 2nd Battalion, NDRF, West Bengal	Email. kumarravi1012@gmail.com	West Bengal

Photo gallery

National Institute of Disaster Management, New Delhi

National Level Training Programme on "Early Warning and Communication" from 18 to 22 June 2018, at YMCA Tourist Hostel, 1 Jai Singh Road New Delhi – 110001

Standing Row L to R	Sh. Sumit Kumar Sharma, Sh. Debdatta Mukherjee, Sh. Subhankar Saha, Sh. Sajith K.V, Sh. Raj Kumar Mishra, Sh. Ramswaroop Tiwari, Sh. Raju Mahato, Sh. Ashok K. Panigrahi, Sh. Ajit Batham, Sh. Kumar Ravi, Sh. Awanish Kumar, Sh. Ashish Kumar, Sh. R. Baskar, Sh. Sanjiv Dosajh, Sh. Kaushik Kr. Singh
Sitting Row L to R	Ms. Anitha Revi, Sh. B. H. Anil Kumar, IAS Executive Director, Sh. Rajesh Kumar Singh, Joint Director, Dr. Surya Parkash Course Director, Ms. Meghan Ruby Kachhap

Tentative Schedule for the National Level Training Course on
EARLY WARNING AND COMMUNICATION
(18 – 22 June 2018 at YMCA, New Delhi)

Day / Date	Pre-Lunch Session (Time in hours)						Post-Lunch Session (Time in hours)			
	0930 – 1000	1000 - 1100	1100-1200	Library Visit / Tea (1200 – 1215 Hrs.)	1215-1315	LUNCH BREAK (1315 – 1415 Hrs.)	1415-1515	Library Visit / Tea (1515 – 1530 Hrs.)	1530-1630	1630-1730
Monday, 18 June 2018	Registration of Participants **Mr. Sumit Kumar Sharma, DEO, NIDM**	Welcome, Course Intro, Participants Intro Ground Rules Vote of Thanks **Dr. Surya Parkash, NIDM**	Unfolding Issues and Challenges of Early Warning and Communication **Shri Kamal Kishore, Member, NDMA**		National Guidelines on Information and Communication Management **Dr. Surya Parkash, NIDM**		National Telecommunication Policy and Strategies for Redundant Communication – DM Perspective **Sh. J. S. Tyagi, DDG, Telecom**		Community Involvement in EWC – Last mile connectivity **Sh. Rajendra Chugh, Apna Radio**	Early Warning, Rumours, Media Ethics and Communication Management **Sh. Ashok Srivastava, DD**
Tuesday, 19 June 2018	Recapitulation	SOP on DM with focus on EWC **Dr. Surya Parkash, NIDM**	ICT Networks and Geoinformatics for EWC, Mass SMS **Sh. Udaya Kumar, NIC**		Impact based Early Warning and Emergency Response **Prof. Santosh Kumar, NIDM**		EWC through Social Media **Prof. Santosh Kumar, NIDM**		Dissemination / Broadcasting related to EW and Communication in Disasters Situations – Role of Media **Panel Discussion by Sh. B.S. Chauhan, Sh. Ashok Srivastava, Sh. Pradeep Thakur, Prof. Santosh Kumar and Dr. Surya Parkash**	
Wednesday, 20 June 2018	Recapitulation & Group Photograph	EWC for Earthquakes and Tsunami **Dr. G. Suresh, NCS**	Case studies of EWC for Cyclones and Storms **Dr. M. Mohapatra IMD**		Case studies on disasters – Early Warning, Communication and Response **Sh. L. Ravi Joseph, IPS, IG NDRF**		Multi-hazard Early Warning and Communication **Dr. Surya Parkash, NIDM**		HAM, Wi-Fi Technologies / HF/VHF Radio Communications / Portable AM/FM Radio **Shri Francis Rebello, HAM Expert**	
Thursday, 21 June 2018	Recapitulation, Exercise and Field Visit	EWC for Floods **Sh. Sharad Chandra, Director FFM, CWC**	VSAT, Mobile Networks, Satellite Phones, DTH **Sh. Ajay Prakash, NIC**		VSAT, Mobile Networks, Satellite Phones, DTH **Sh. Ajay Prakash, NIC**		Visit to IMD **Dr. Surya Parkash, NIDM and IMD**		Experience Sharing and Exposure to facilities, infrastructure and services with IMD **Dr. Surya Parkash, NIDM and Dr. M. Mohapatra, IMD**	
Friday, 22 June 2018	Recapitulation and Exercise	Orientation for Group Exercise **Dr. Surya Parkash**	Conduct of Group Exercise **Dr. Surya Parkash**		Presentation of Group Exercise **Sh. B.H. Anil Kumar, Dr. Surya Parkash and Dr. Saibal Ghosh**		Feedback and Evaluation **Dr. Surya Parkash and Participants**		Valediction Certification, Vote of Thanks **Dr. Surya Parkash, NIDM**	

CASE STUDIES ON DISASTERS – EARLY WARNING, COMMUNICATION & RESPONSE

PAST EXPERIENCES

- **Super Cyclone in Orissa – 1999**
  - ✓ 28-29 Oct 1999
  - ✓ One of the most devastating in the history of disasters in India.
  - ✓ 12 Districts of coastal Odisha affected.
  - ✓ Approx 10000 lives lost.
  - ✓ Communication was first casualty.
  - ✓ Basic and Critical Infrastructure Collapsed.

- **Tsunami – 2004**
  - ✓ 26 December 2004
  - ✓ Almost 10 minutes duration.
  - ✓ 12,400 deaths reported.
  - ✓ 5,640 persons missing.
  - ✓ 6,47,500 people displaced.
  - ✓ Coastline of Tamil Nadu, Kerala, Andhra Pradesh, Pondicherry and Andaman and Nicobar Islands affected.

EARLY WARNING SYSTEM

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- Is a set of capacities needed to generate and disseminate timely and meaningful warning information of the possible extreme events or disasters that threatens people's lives.
- The purpose of this information is to enable individuals, communities and organizations threatened to prepare and act appropriately and in sufficient time to reduce the possibility of harm, loss or risk.
- Early warning, how early ?
  - ✓ From few minutes to few days.

PHASES OF EARLY WARNING SYSTEMS

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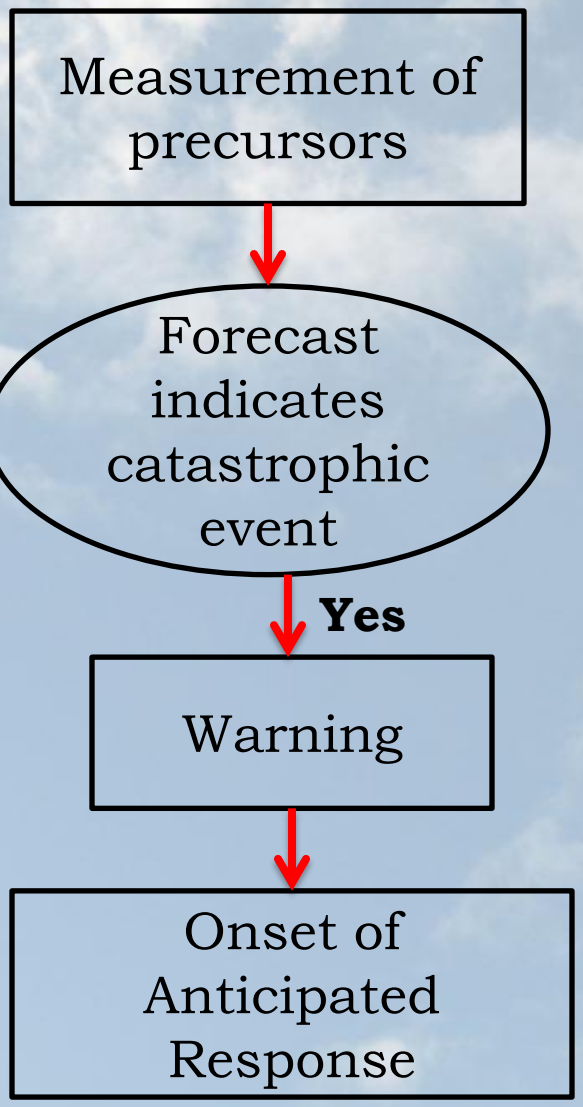

CHARACTERISTICS OF EWS

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- Effective early warning systems require strong technical foundations and good knowledge of the risks.
- Must be people centered – with clear messages, dissemination systems.
- Public awareness and education are critical; in addition, all stakeholders need to be involved.
- Effective early warning systems must be embedded in an understandable manner and relevant to the communities which they serve.

AGENCIES FOR FORECASTING

Disasters	Agencies
All Meteorological Hazards	Indian Meteorological Department (IMD)
Tsunami	Indian National Centre for Oceanic Information Services (INCOIS)
Floods	Central Water Commission (CWC)
Earthquakes	National Centre for Seismology. IMD, MoES
Landslides	Geological Survey of India
Avalanche	Snow and Avalanche Study Establishment (SASE)

CATEGORIZATION OF ALERTS

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- Depending on the gravity of the situation, early warning agencies issue alerts(an advance warning). The alerts are categorized into “Yellow”, “Orange” and “Red”.

ALERT CATEGORY	TYPES OF DISASTERS AND ALERT CATEGORIZATION					
	TSUNAMI	CYCLONE	FLOODS	EARTHQUAKES	AVALANCHES	LANDSLIDES
YELLOW	Watch	Alert	Above Normal (< DL)	Slight (< 5.0) / Moderate (5.0-5.9)	Low / Medium danger	Category-III
ORANGE	Alert	Warning	Severe (above DL but below HFL)	Strong (6.0-6.9)	High	Category-II
RED	Warning	Post landfall outlook	Extreme (above HFL)	Major (7.0-7.9) / Great(8.0-8.9) / Giant (>= 9.0)	All round	Category-I

COMMON SHORTCOMINGS NOTED

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- People tend not to act/react if early warning is too short, sighting reason that reaction time is less.
- Early warning should be properly phrased so that the community understand the gravity and actions they must take.
- Generic warning is mere formality and does not help in saving lives.
- To many advisories lesson the seriousness.
- Feedback whether the stakeholders have understood the actual gravity.
- Early warning cycle is not complete without feedback.

COMMUNICATION

- Reaching out to the people is the key.
- Communication is never one way.
- Communication is a cycle – Communication is ineffective if the cycle is incomplete.
- Communication losses importance if the last man doesn't understand the same meaning which is meant to be conveyed.

- Communication should always be multilayer.
  - ✓ Landline and mobile connectivity-Gensets on raised platforms.
  - ✓ Other means of communication like FM/HAM
  - ✓ Satellite phones.
  - ✓ HF/VHF
  - ✓ Social Media
  - ✓ Announcements
  - ✓ With multilingual experts.
  - ✓ Integrated with mobile apps, social media
- Feedback is must.

SATELLITE COMMUNICATION

Quick Deployment Antenna

+

Satellite Phone

RADIO COMMUNICATION

HF

VHF

Walkie Talkie

MHA - NATIONAL EMERGENCY RESPONSE SYSTEM

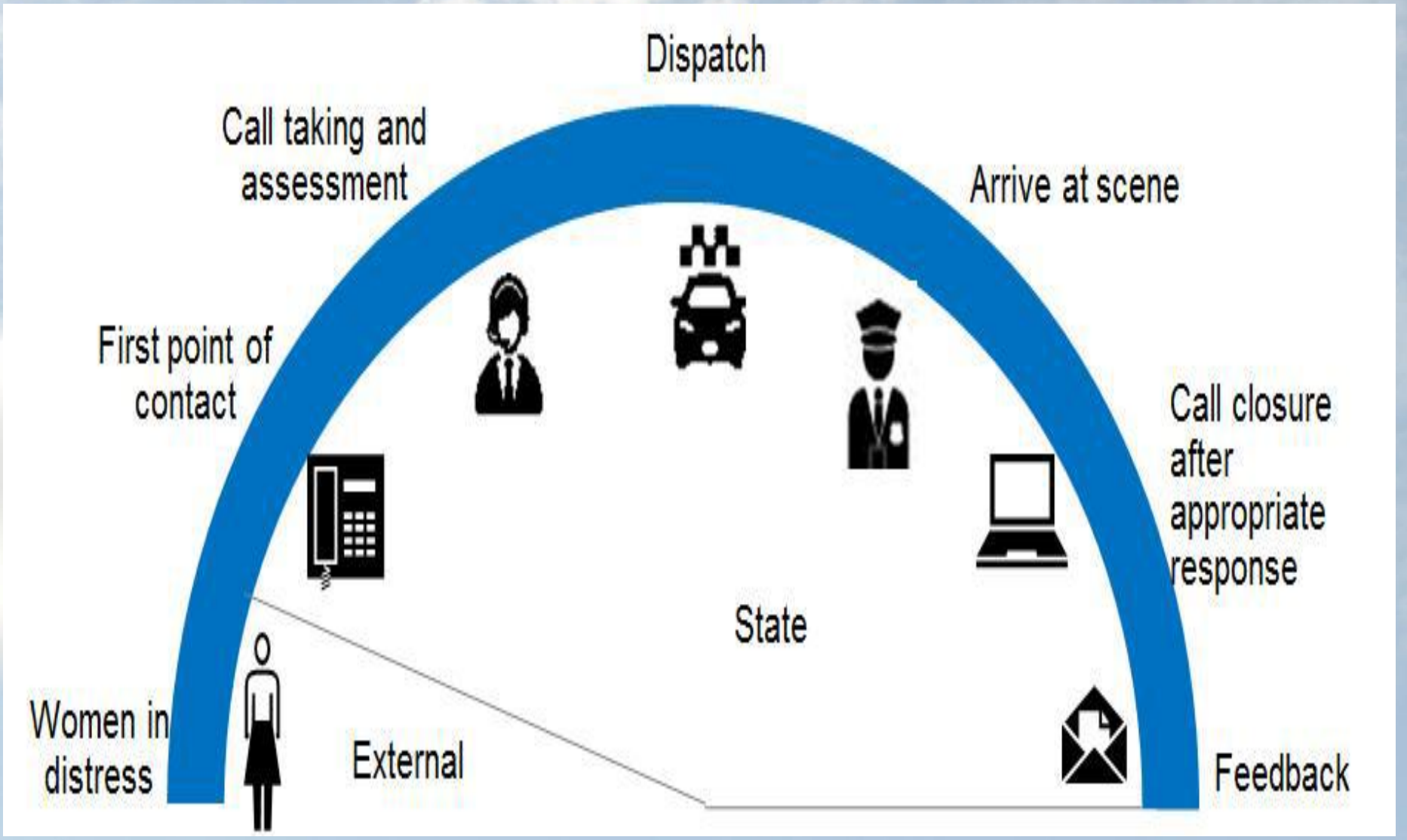
- Nirbhaya incident in 2012
- Justice J.S. Verma, (former Chief Justice of Supreme Court of India) committee recommendations
- Genesis of public emergency response system

- Emergency number ‘112’ (Integration of 100 - Police, 108 - Medical, 101 - Fire, 102 - Ambulance, 1090 - Women Helpline, 1098 - Child Helpline, 1076 - Disaster Related Emergencies.)
- Bridge the existing gaps
- Meet the current challenges being faced by Police forces in the Country for an immediate emergency response system.

FEATURES

- CAD (Computer Aided Dispatch)
- CRM (Case Record Management)
- ACD (Automatic Call Distribution)
- CTI (Computer Telephony Integration)
- Emergency Response (ER) Vehicles fitted with GPS/MDTs for effective last mile emergency service delivery in selected cities.

OVERVIEW OF THE PROCESS NERS



IMPLEMENTATION OF 112 MODEL IN THE STATES

1 DIAL

100 लगाओ - पुलिस बुलाओ

यूपी 100 UP

आपकी सेवा में सदैव तत्पर

CENTRALIZED EMERGENCY RESPONSE SYSTEM

VISION

To provide prompt integrated emergency response for public safety and security to all persons anytime, anywhere in the State

KEY OBJECTIVES

1. Provide round-the clock availability of operational phone numbers
2. All urban, semi-urban and rural, even remote areas to be covered.
3. Empathetic response to all calls
4. State-wide coverage of Police Emergency Response Services
5. Prompt Response for police emergency services
6. Same standard of service to be provided to all citizens in urban and rural areas

CENTRALIZED DIAL 100 MODEL

Caller in Distress

Non- P.S. Staff (Third Party) or P.S. Staff under Distt. Control of Distt./Non-Distt. Police Officials.

First Response Vehicle

Pure Third Party- Civilian Call Taking staff

Non- Distt. Police (Third Party) staff to dispatch response teams

Centralized Dial 100 Model comprises of Call takers and Dispatchers in same premises

OPERATIONAL MODEL

States may choose different operation models depending upon their financial conditions and policies

Out of the following four segments :-
A-Technical Assistance & B-Call Center Management should be outsourced.
C –Dispatch, Incident Management & Supervision can be done by Police officials only.
D -Fleet Management may be in-house or outsourced, depending on the State's willingness.

• Outsourced

'D' Fleet Management

'A' Technical Assistance

• Outsourced

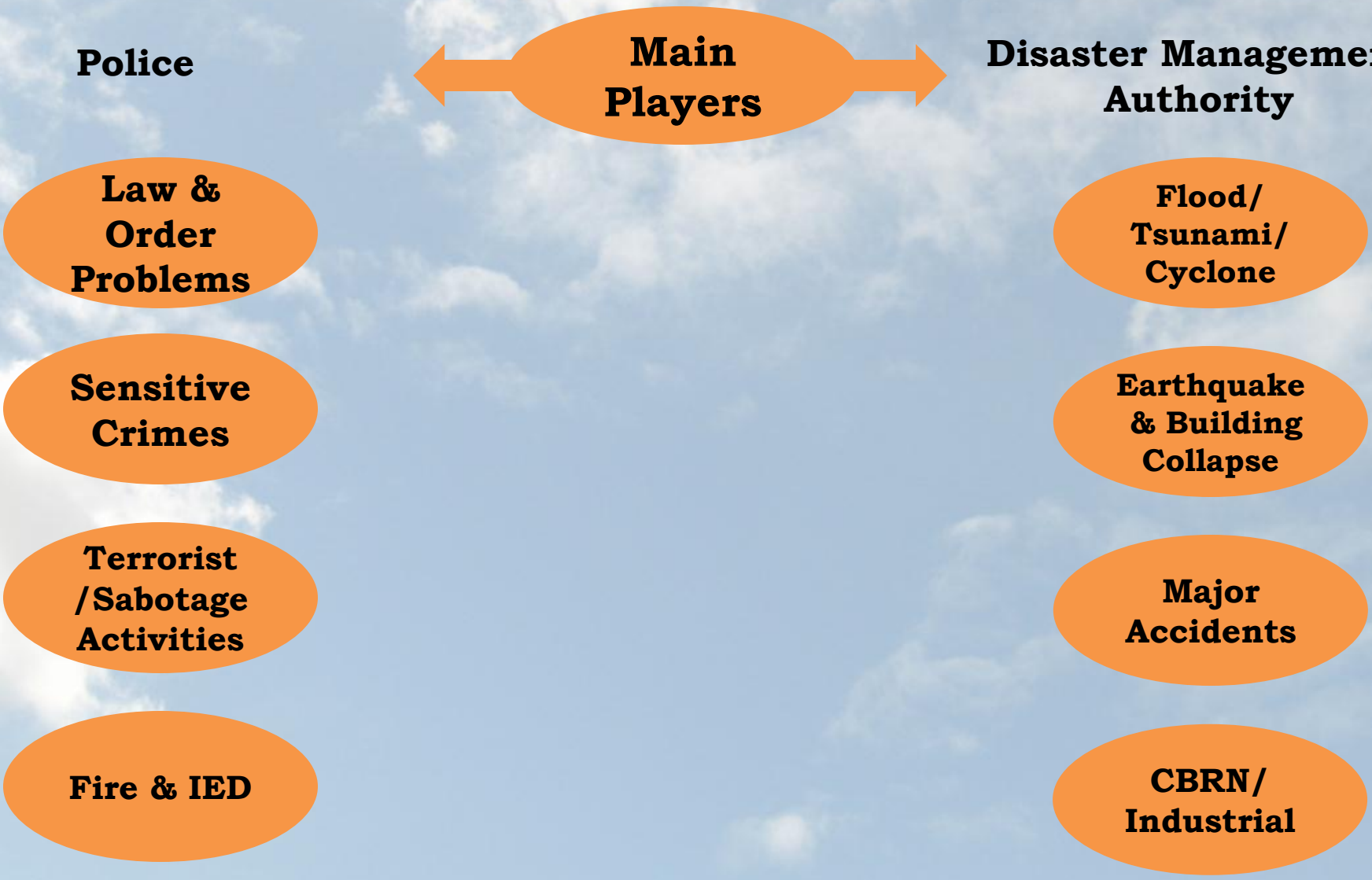
'C' Dispatch , Incident Management & Supervision

'B' Call center Management

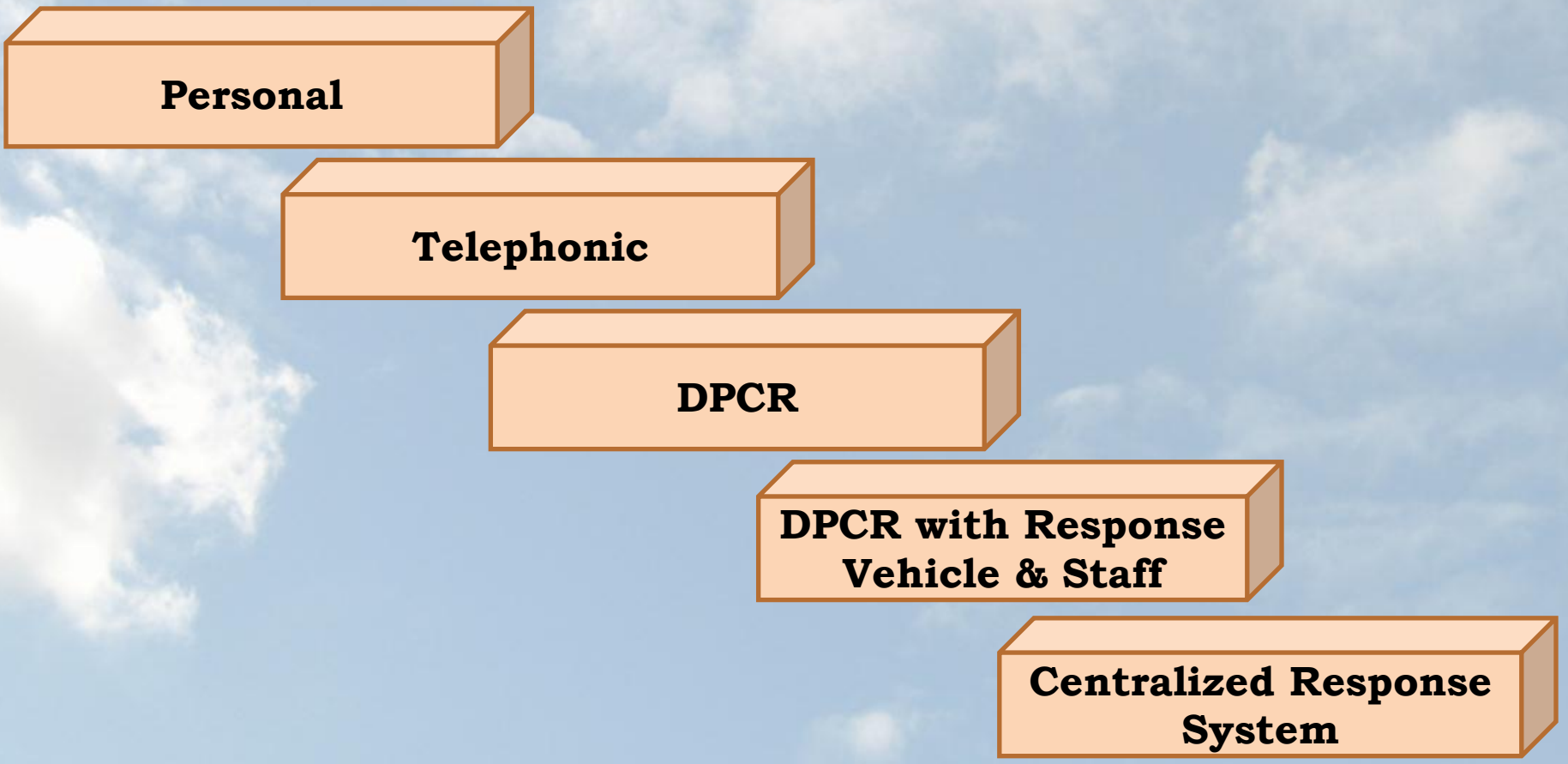
• Police department

• Outsourced

SPECTRUM OF EMERGENCIES



Emergency Contact Vs Emergency Response



CENTRALIZED TYPE EMERGENCY RESPONSE MODELS IN DIFFERENT STATES/CITIES [ILLUSTRATIVE ONLY]

Sr. No.	State	Call Taking	Dispatching	First Response Vehicles	First Response staff
1	Madhya Pradesh	Centralized – Outsourced	Centralized – Police staff as Dispatcher	Private owned and operated Vehicles – Wet Lease Model	Drawn from PS on daily basis
2	Uttar Pradesh	Centralized – Outsourced	Centralized – Police staff as Dispatcher	Govt. owned & operated Vehicles	Separate vertical drawn from Distt. for 2 /3 years
3	Delhi	Centralized - Police Staff Operated	Centralized – Police staff as Dispatcher	Govt. owned & operated Vehicles	
4	Rajasthan	Semi-Centralized	De-centralized to District Level	Govt. owned & operated Vehicles	
5	TN	Centralized	Centralized - Police	DPCR, PS – Govt owned	PS

IMPACT OF CENTRAL EMERGENCY RESPONSE SYSTEM

Availability

- ✓ Reliability
- ✓ Promptness
- ✓ From anywhere
- ✓ Anytime
- ✓ Empathy: Women outsourced communication officers

Security to citizens

- ✓ Increased patrolling by First responders
- ✓ Certainty of response
- ✓ Remote rural areas hitherto uncovered are also served

Democratization of Police Services

- ✓ Available to all, irrespective of class, caste or religion or political affiliation,
- ✓ Rural or urban areas

Citizen Empowerment

- ✓ Any body can set the process of law in motion
- ✓ Upload of evidence, inclusion in Case Diaries

IMPACT OF CENTRAL EMERGENCY RESPONSE SYSTEM ACCOUNTABILITY & REFORM

Police Accountability

- ✓ All incidents recorded prior to police intervention
- ✓ No minimization possible

Police Impartiality

- ✓ Citizens Upload evidence
- ✓ Check and balance between First responder and Police Station staff

Confidentiality

- ✓ Records being centrally stored are safe and secure

Transparency

- ✓ Recording of all calls in natural course – temper proof
- ✓ Complete automatic digital trail of all actions

Police Reform

- ✓ All call records stored for judicial purposes
- ✓ It is Fundamental police reform

DISASTER RESPONSE MECHANISM

PRESENT SET-UP

- Currently there are **four control rooms** functioning at National level one each in

  - ✓ MHA Control Room
  - ✓ DM Division Control Room
  - ✓ NDMA Control Room
  - ✓ NDRF Control Room

- State Governments are having their own **EOC (Emergency Response Centre)** and some of them are well equipped.

PROPOSED SET-UP

- ICR – ER
  (Integrated Control Room – Emergency Response at central level)

- Features –
  i. Call Centre
  ii. Early warning input system
  iii. Multi Agency Coordination Room
  iv. Analysis Group
  v. Dissemination Centre
  vi. Database Management Section
  vii. Media Room

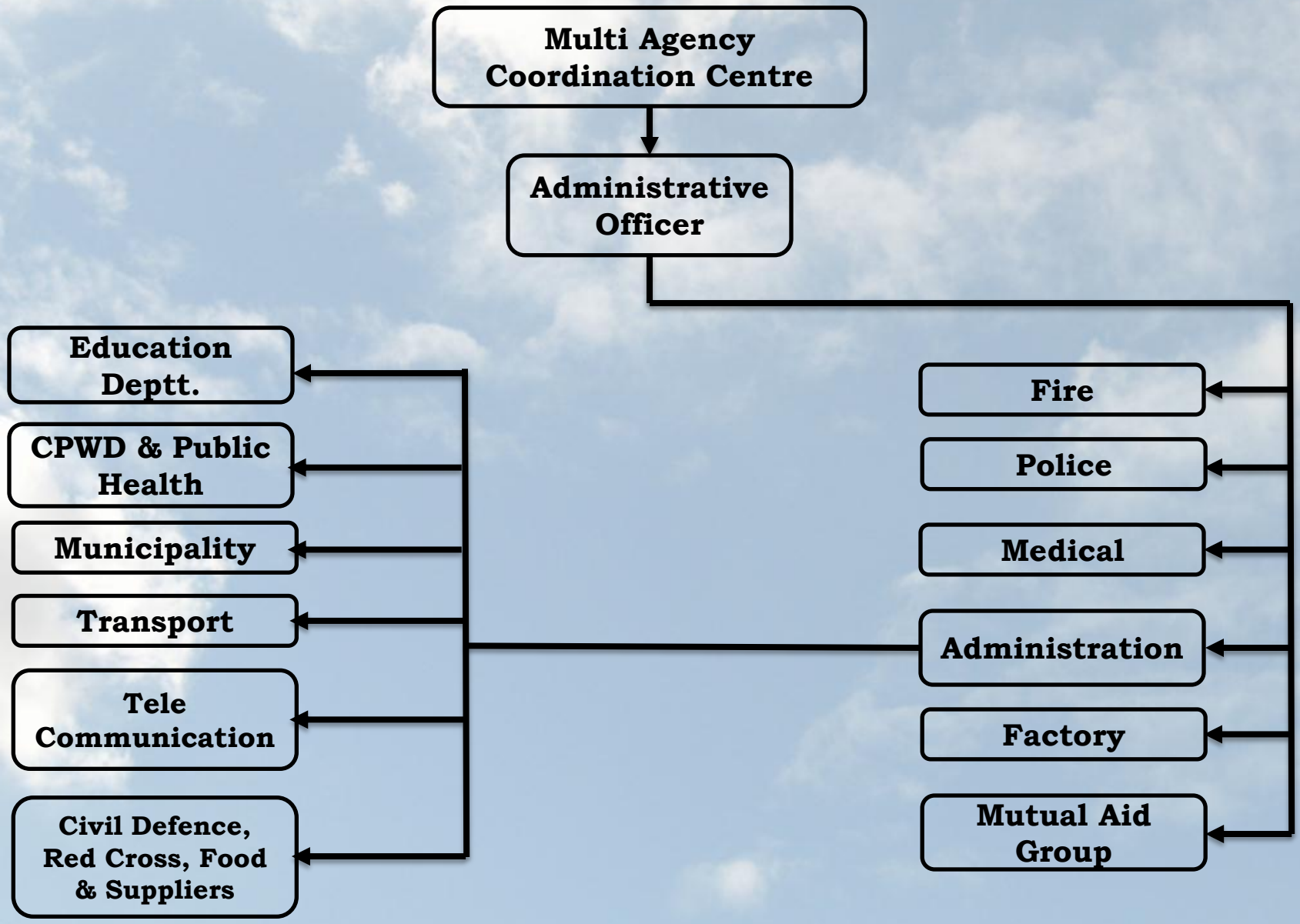
RESPONSE MECHANISM

COMPONENTS OF IRS

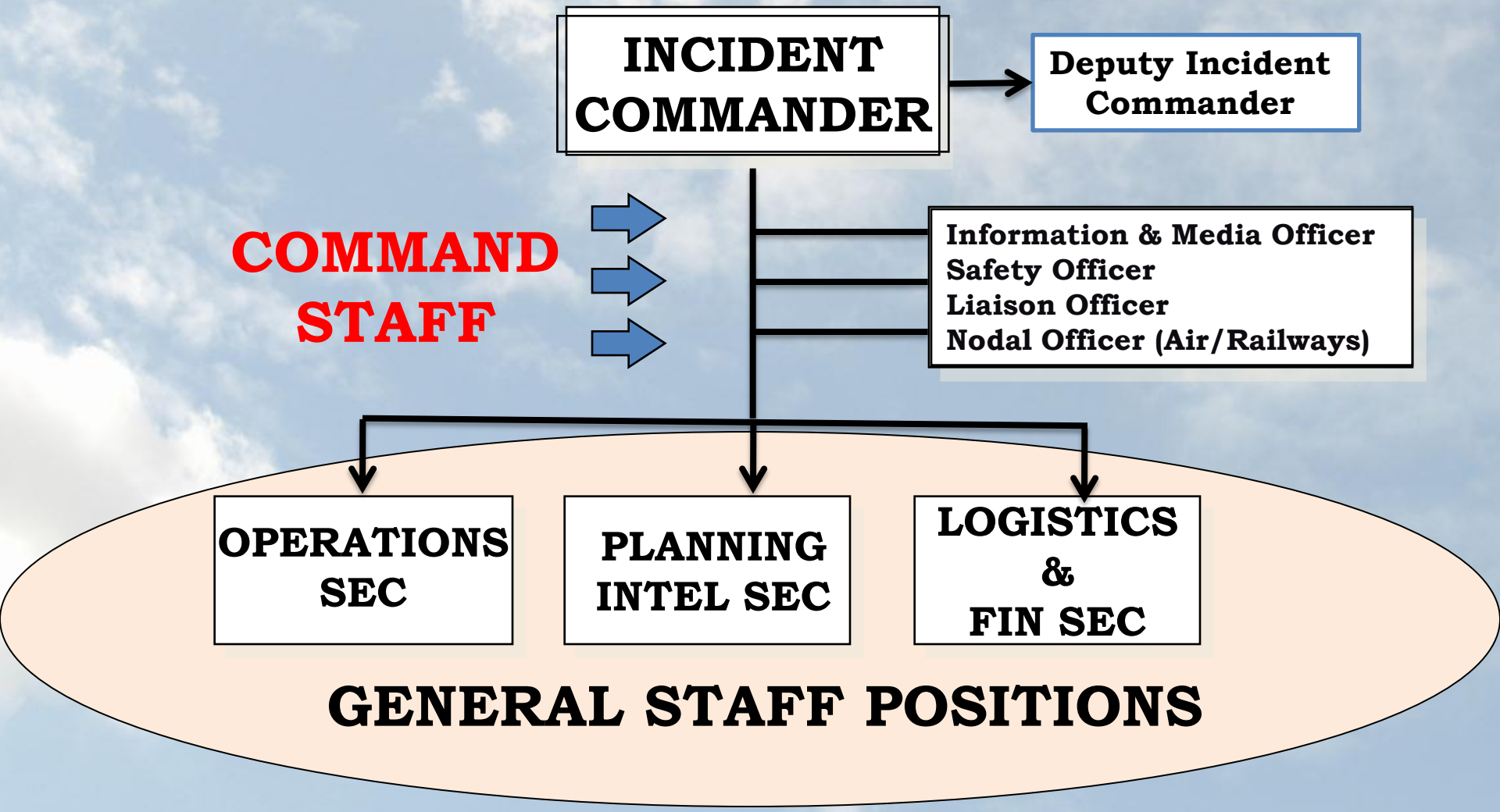
- **MAC** (Multi Agency Coordination Centre) at Monitoring level

- **Incident Command** at field level.

MAC-EOC

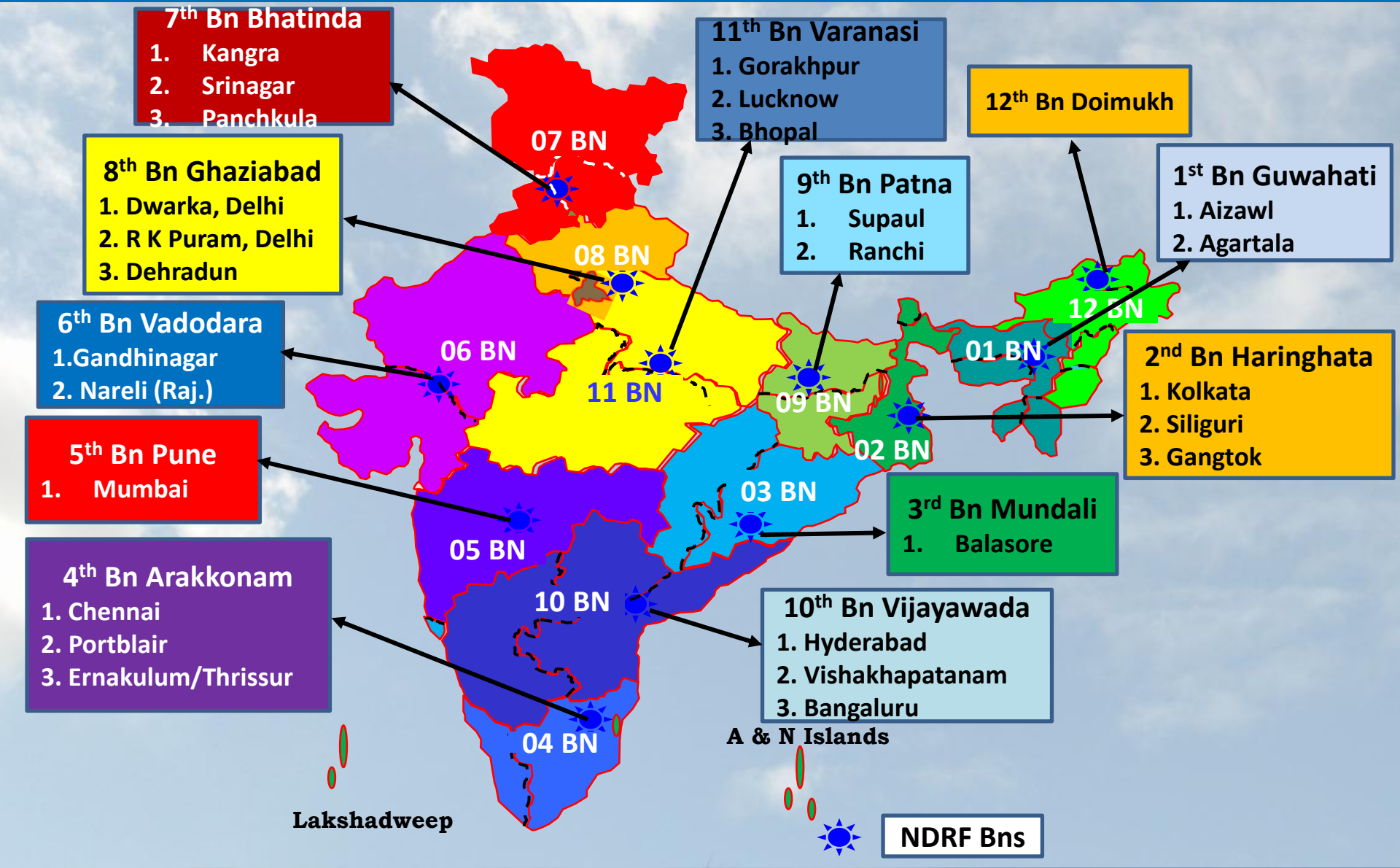

Multi Agency Coordination Centre
Administrative Officer
Education Deptt.
CPWD & Public Health
Municipality
Transport
Tele Communication
Civil Defence, Red Cross, Food & Suppliers
Fire
Police
Medical
Administration
Factory
Mutual Aid Group

INCIDENT COMMAND



NDRF

NDRF – BNS & PERMANENT TEAMS/COY LOCATIONS



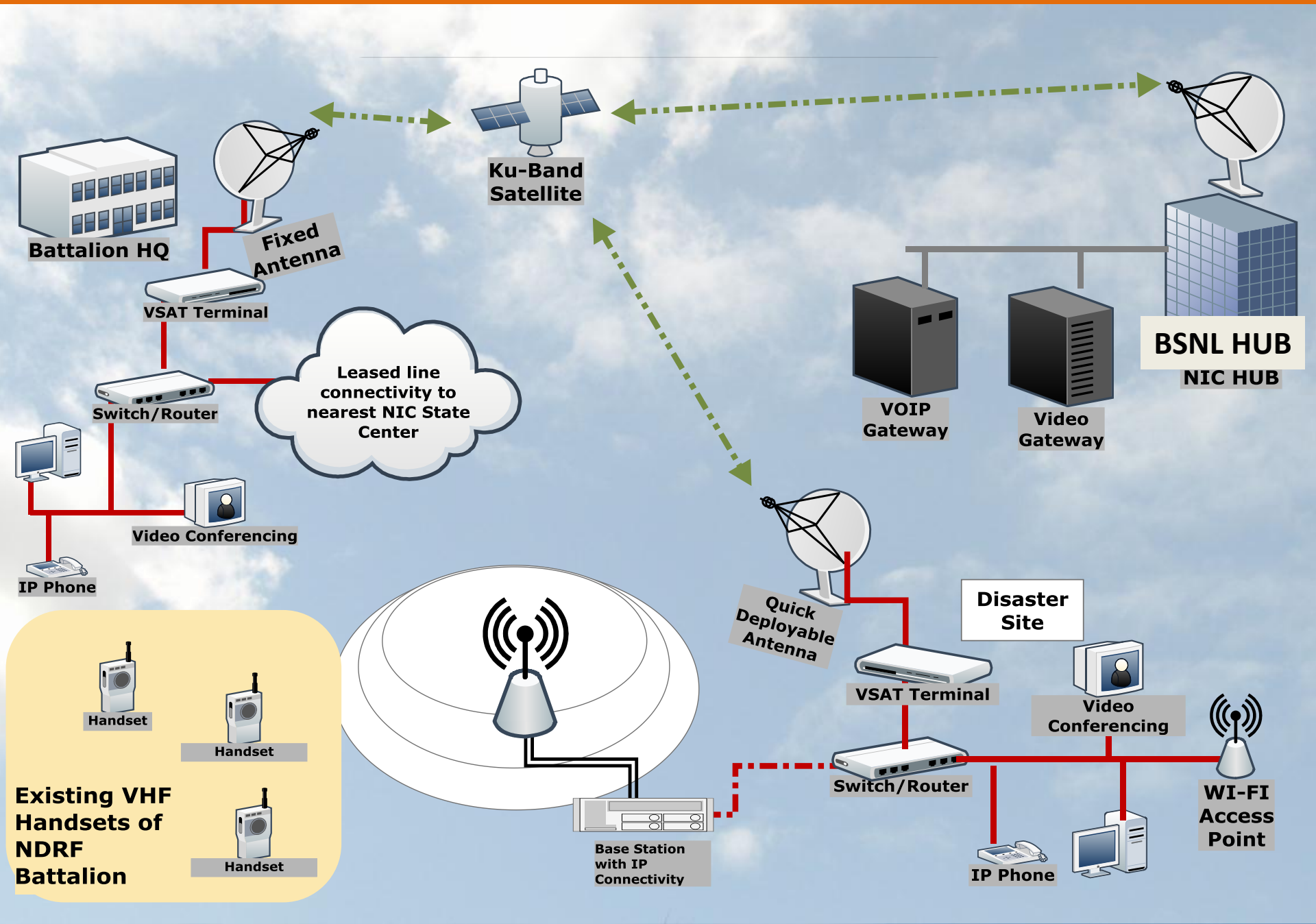
LOCATION OF NDRF BNs

LOCATION OF NDRF BN	AREA OF RESPONSIBILITY (STATE WISE)
01 BN NDRF GUWAHATI (ASSAM)	ASSAM (24 DISTRICTS), MEGHALAYA, MIZORAM & TRIPURA .
02 BN NDRF NADIA (WB)	SIKKIM & WEST BENGAL.
03 BN NDRF MUNDALI (ODISHA)	ODISHA & CHATTISHGARH.
04 BN NDRF ARAKKONAM (TN)	ANDAMAN & NICOBAR ISLANDS, KERALA, LAKSHDEEP, PUDUCHERRY & TAMILNADU.
05 BN NDRF PUNE (MH)	GOA & MAHARASHTRA .
06 BN NDRF GANDHINAGAR (GUJRAT)	DAMAN & DIU, DADAR & NAGAR HAVELI, GUJARAT & RAJASTHAN.
07 BN NDRF BHATINDA (PUNJAB)	CHANDIGARH, HIMACHAL PRADESH, PUNJAB & J&K.
08 BN GHAZIABAD (UP)	DELHI, HARYANA, UTTRAKHAND, UTTAR PRADESH (18 DISTRICTS).
09 BN NDRF BIHTA (PATNA)	BIHAR & JHARKHAND.
10 BN NDRF GUNTUR (AP)	ANDHRA PRADESH, TELANGANA & KARNATAKA
11 BN VARANASI (UP)	MADHYA PRADESH & UTTAR PRADESH (57 DISTRICTS).
12 BN ITANAGAR (ARUNACHAL PRADESH)	ASSAM (09 DISTRICTS), ARUNACHAL PRADESH, MANIPUR & NAGALAND.

NDRF RRCs LOCATIONS

ANDAMAN & NICOBAR	PORT BLAIR
ANDHRA PRADESH	VISHAKHAPATNAM
BIHAR	SUPAUL
DELHI	DWARKA & R K PURAM
GUJARAT	GANDHINAGAR
HARYANA	PANCHKULA
HIMACHAL PRADESH	NOORPUR (KANGRA)
J&K	SRINAGAR
JHARKHAND	RANCHI
KARNATAKA	BENGALURU
KERALA	THRISSUR (IN PLACE OF ERNAKULUM)
MADHYA PRADESH	BHOPAL
MAHARASHTRA	MUMBAI
MIZORAM	AIZAWL
ODISHA	BALASORE
RAJASTHAN	NARELI
SIKKIM	PAYONG (GANGTOK)
TAMIL NADU	CHENNAI
TELANGANA	HYDERABAD
TRIPURA	AGARTALA
UTTAR PRADESH	LUCKNOW & GORAKHPUR
UTTARAKHAND	DEHRADUN
WEST BENGAL	SILIGURI, & KOLKATA

NDRF : NATIONAL EMERGENCY COMMUNICATION PLAN



NATIONAL DISASTER MANAGEMENT SYSTEM (NDMS)

- NDMA is also implementing a pilot project called National Disaster Management System (NDMS)
- Covering 120 locations with the aim to provide fail safe communication infrastructure and technical support to EOCs in all states/UT headquarters.
- 81 selected most vulnerable districts by using space or terrestrial network are also covered under this project.

OBJECTIVES OF RESPONSE

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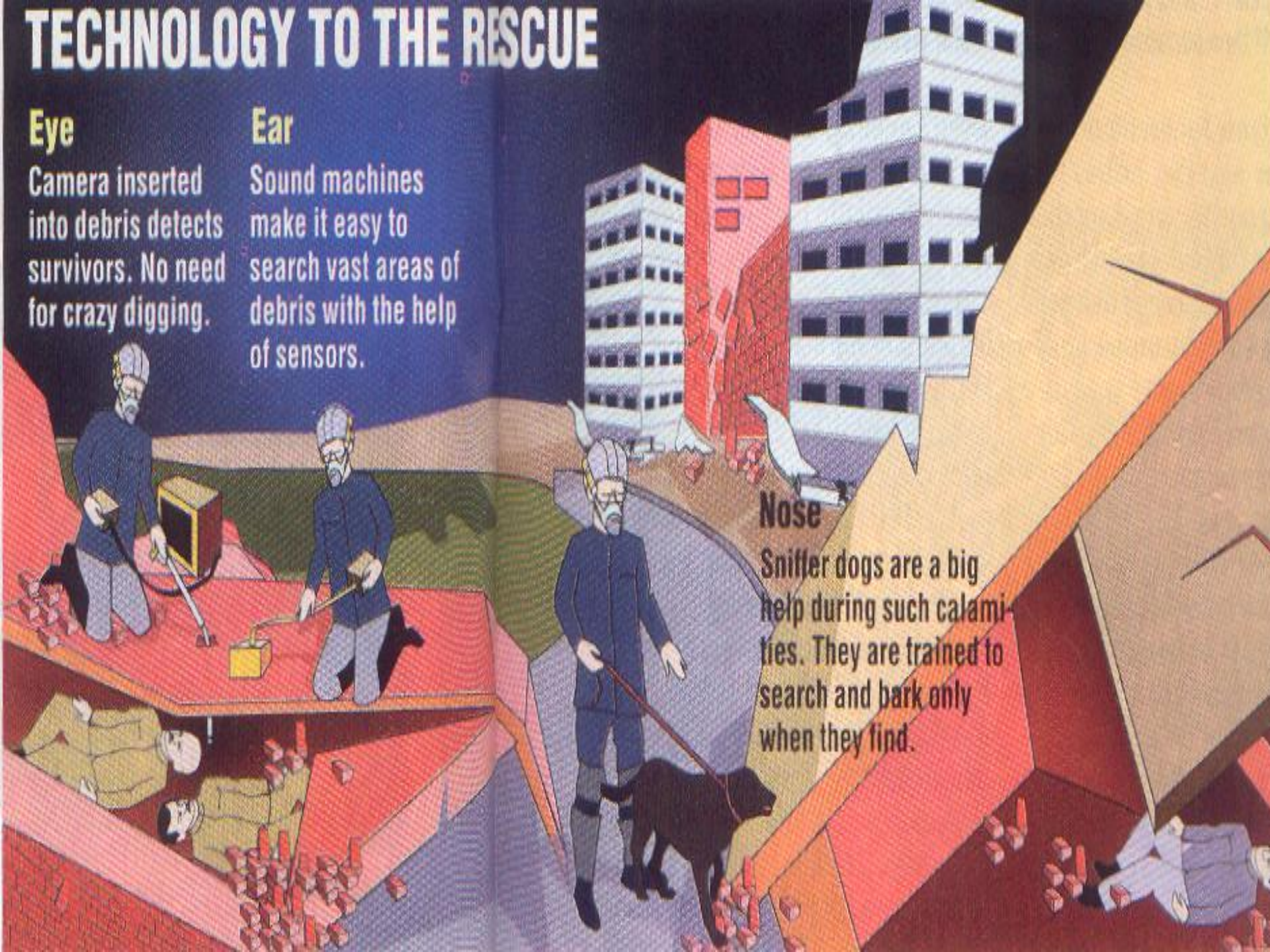
- Saving lives.
- To minimize and contain the effects of the disaster.
- To provide immediate medical attention to the victims.
- Assist in relief measures.
- Help in evacuation process and provide the public with advisories through Relief Commissioners.
- Assist in restoration of essential services.
- Facilitate the community in recovery process.
- Post disaster – evaluating the response efforts and taking measures on lessons learnt to improve preparedness.

NDRF IN ACTION - UTTARAKHAND CLOUD BURST-2013

TECHNOLOGY TO THE RESCUE



LIFE DETECTOR(LD-1)

- Help to detect vibration, movement in smoke & dust in collapse building
- It has two communicated ways system

LIFE DETECTOR (LD-2)

- The life guard works by passively detecting the ultra low frequency (ULF).
- Detect the human heart and dielectric material
- Finds only live victims.

VICTIM LOCATION SYSTEM/SEARCH CAMERA

- Used for locate and rescue the victim trapped under debris during natural calamities or in mine collapse or confined space disasters.

Deep Diving

AVALANCHE RESCUE

Rescue Drill with Avalanche Rod

SAR DOGS

- SAR Dogs are trained for air scenting, ground scenting, and avalanche rescue.
- Avalanche rescue dogs and handlers always work in tandem.

CHALLENGES IN EMERGENCY RESPONSE

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- Geo-Climatic changes.
- Increased frequency and magnitude of disasters.
- New challenges in the form of Urban flooding/Bore-well issues/colliery collapse/ forest fires.
- Uncontrolled urban development.
- Rapid industrialization leading to Chemical/ Radiological accidents.
- Growing deforestation/environmental degradation.

CASE STUDY : CYCLONE OCKHI – 2017

NDRF · INDIA
Saving Lives & Beyond...

CYCLONIC STORM "OCKHI"

Date of Incident	:	30 November, 2017 to 06 December, 2017
Forecast	:	IMD started forecast from 28/29 Nov, 2017
Affected States	:	Tamil Nadu, Kerala, Lakshadweep
Human live lost	:	Tamil Nadu-36, Kerala-75, Lakshadweep-Nil
No. of missing	:	Tamil Nadu-198, Kerala-137 Lakshadweep-Nil

NDRF DEPLOYMENT

States	No. of Teams	Locations
Kerala	04	Thrissur & Sabrimala
Tamil Nadu	04	Chennai, Kanyakumari & Cuddalore
Gujarat	07	Surat, Navsari, Valsad, Amreli, Bhavnagar & Somnath
Goa	01	South Goa
Maharashtra	03	Mumbai
TOTAL TEAMS	19	

NDRF ACHIEVEMENT

During the deployment, NDRF teams assisted in restoration of the situation by removal of fallen trees and clearing of roads.

RECOMMENDATIONS/OBSERVATIONS noticed by the PSC

CYCLONE WARNING AND FORECASTING

- IMD should focus on intensive research to develop forecasting models for the prediction of the Rapid intensification phenomenon of such cyclones.
- IMD must learn from the best practices being followed globally to improve prediction of such phenomenon.
- To develop an SOP for such unpredictable cyclones in collaboration with other developed countries and international organisation.

RECOMMENDATIONS/OBSERVATIONS

MISSING FISHERMEN

- The advisory issued on 29th Nov did not clearly predict a cyclone, therefore, it was not taken the seriousness it deserved.
- The advisory issued by the IMD was not given vide publicity in the mass media through radio stations.
- Coastal communities, like fishermen, who are at risk, may be regularly sensitized about the fact that certain natural disaster cannot be predicted well advance, hence in their own interest, strictly adhere to any advisories/warnings in future.
- Vessel tracking system of ISRO, which consists of user terminals(transponders), installed in fishing vessels and a central hub to receive the tracking information, be completed at the earliest.

RECOMMENDATIONS/OBSERVATIONS

- State Govt. of cyclone affected areas are advised to collect the mobile numbers of active fishermen. The mobile phones fitted with NavIC devices may be made available to all the fishermen in next six months.

SEARCH AND RESCUE OPERATION

- Government must make adequate arrangements for providing a viable means of livelihood to the families of missing fishermen and they should be provided livelihood assistance, as an interim measure, without any delay.

RECOMMENDATIONS/OBSERVATIONS

DEPLOYMENT OF FORCES

- There was timely prepositioning of NDRF teams and the deployment was consistent with the requisitions submitted by State govt. of the affected states.
- State Governments may not be able to make an optimal need-based assessment of requirement.
- NDMA should also make an independent assessment of the number of battalions that may be required as per circumstances prevalent in the ground level.

BEST PRACTICES

CYCLONE PHAILIN– 2013

NDRF · INDIA

Saving Lives & Beyond...

- The Very Severe Cyclonic Storm, Phailin, hit the Odisha coast on 12 October, 2013.
- Making landfall at Gopalpur, in Ganjam District, with wind velocities upto 220 kmph.
- With tidal waves upto 3.5 metres high.
- 18 Districts more than 13,200,000 people in 18,374 villages affected.
- 23 lives lost.

SUPER CYCLONE 1999 VS PHAILIN 2013

NDRF · INDIA
Saving Lives & Beyond...

- Better forecast.
- Better response to the situation at National, State & District level.
- The DEOCs were found to be fully functional.
- Better disaster preparedness.
- Better communication means.

- A toll free number (1077) and an additional telephone number were available to provide information and assistance to the people.
- Special attention was directed towards people who were most vulnerable.
- Creation of Disaster Response Force.

WAY FORWARD

- Strengthen early warning systems. Faster and accurate assessment of the situation on the ground, as it will decide the resources to be mobilized.
- Involvement of local community in planning, mitigation and response. Using community as a force multiplier.
- Strengthening and improving the state forces (SDRF/Civil Defence/Home Guards) with proper resources and training. Ex-NDRF officers who have returned to their parent forces, could be sent on deputation to the States to strengthen the SDRFs.

- To follow good practices of other response forces.
- Building State of Art Weather & Climate observing & Forecast System.
- Dynamical Impact based forecast and risk based warning system for all sectoral applications.
- Warning dissemination to last mile with simple tools and technology


Thank you!

Cyclone:
Early Warning and Communication

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m.mohapatra@imd.gov.in

भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

TYPES OF POTENTIAL DAMAGES ACCOMPANYING TROPICAL CYCLONES

CYCLONE

LOCAL TIDES

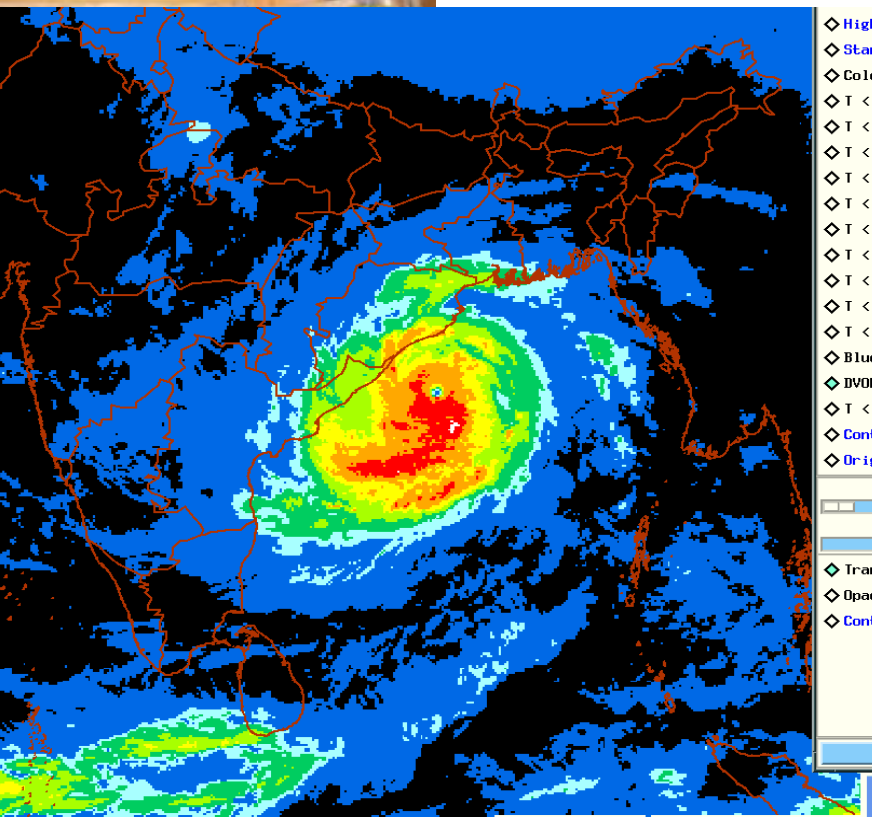
LOCAL COASTAL CONFIGURATION

STORM SURGE

WIND

RAIN

- FLOODING OF COASTAL AREAS
- EROSION OF BEACHES
- LOSS OF SOIL FERTILITY FROM SALINE INTRUSIONS
- DAMAGE TO STRUCTURES
- LOSS OF POWER/COMMUNICATION
- INJURIES & LOSS OF LIFE
- DESTRUCTION OF CROPS, VEGETATION, LIVE-STOCK
- CONTAMINATION OF WATER SUPPLY SYSTEM
- LAND SUBSIDENCE
- FLOODING OF INLAND AREA



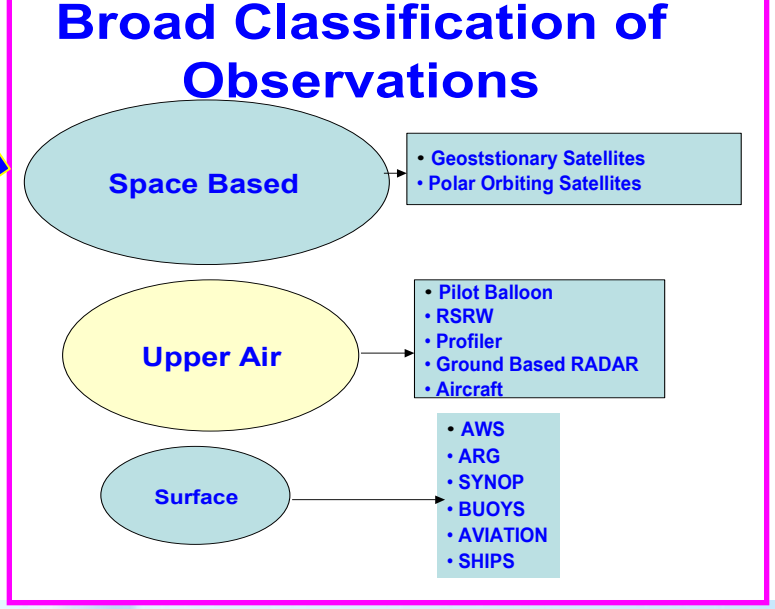
विज्ञान विभाग

LOGICAL DEPARTMENT

Cyclone Mitigation Measures

- Reduction of cyclone disasters depends on several factors including
  - hazard analysis,
  - vulnerability analysis,
  - preparedness & planning,
  - early warning and mitigation.
- The early warning is a major component as evident from a survey conducted for the south Asian region.
- The early warning component includes
  - skill in monitoring and prediction of cyclone,
  - effective warning products generation and dissemination,
  - coordination with emergency response units and
  - the public perception about the credibility of the official predictions and warnings.

Monitoring and Forecast Process



Initial conditions (Observations)

Runs of different Models,

Consecutive runs from the same model,

Ensemble runs ("choosing the best member")

Model runs

Forecaster

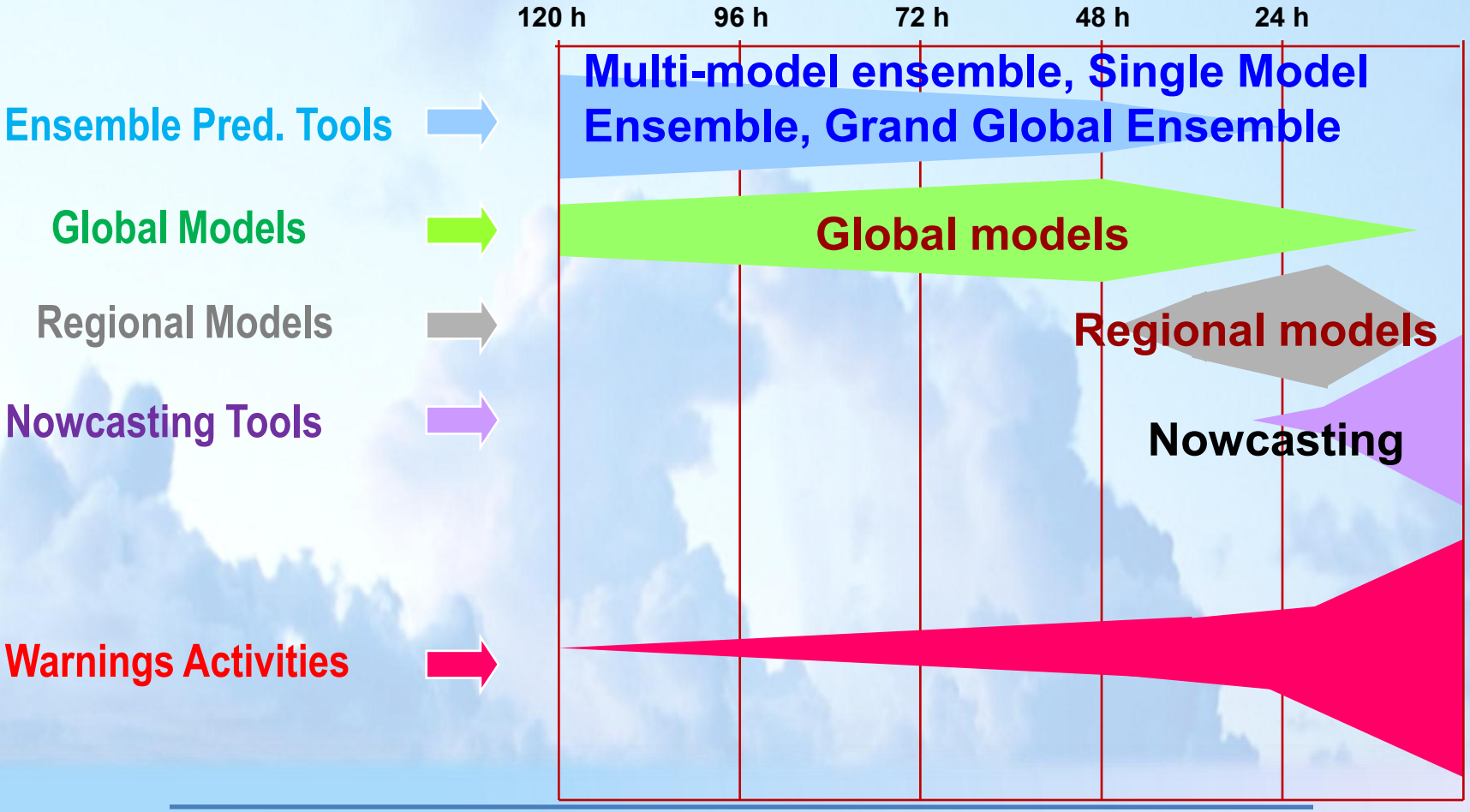
Decision maker

Numerical forecasts

End forecast

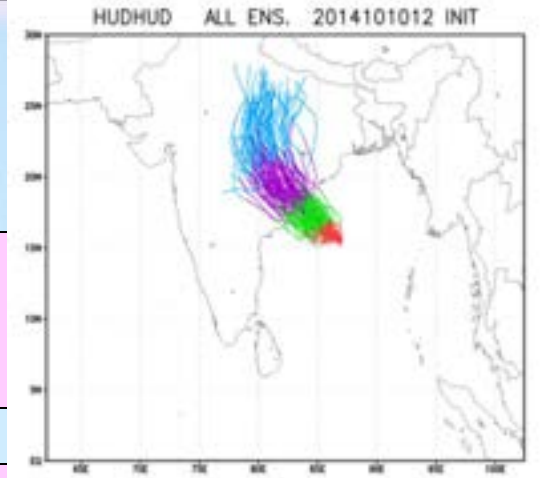
Monitoring and Forecast Process of Tropical Cyclone

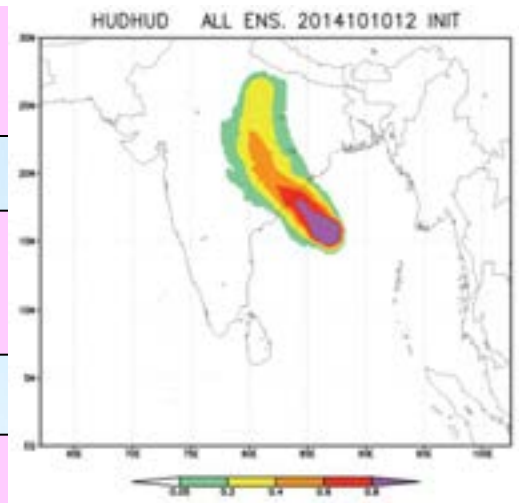
Numerical Weather Prediction (NWP) Modeling : Backbone for Early Warnings

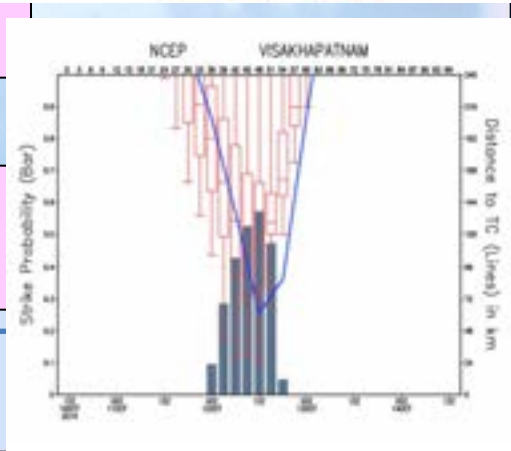


Dynamical Statistical Models for Cyclone Prediction:

STEP-I	Cyclogenesis Prediction	Genesis Potential Parameter(GPP)
STEP-II	Track Prediction	Multimodel Ensemble(MME)
STEP-III	Intensity Prediction	SCIP Model
STEP-IV	Rapid Intensification	RI-Index
STEP-V	Decay after Landfall	Decay Model







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INDIA METEOROLOGICAL DEPARTMENT

Disastrous weather forecasting: Technological limitations and capabilities

- **Storm Surge prediction -**

  Nomograms, IITD model

  INCIOS Coastal Inundation Model

- **Strong wind**

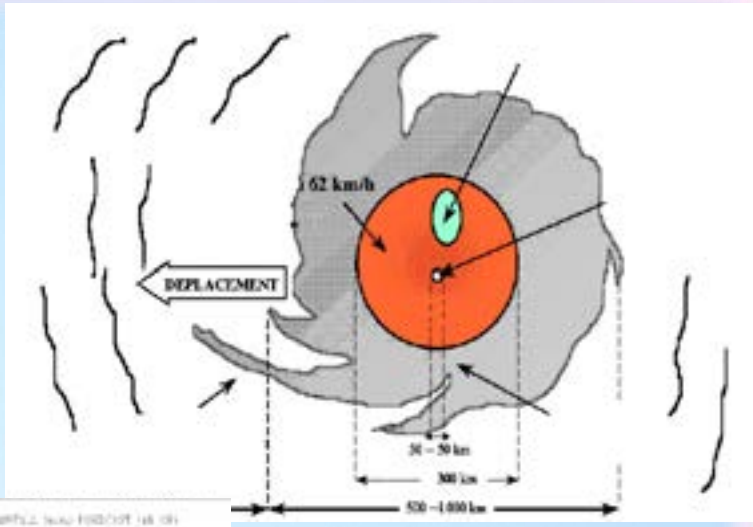
  Satellite, DWR Method, Climatology

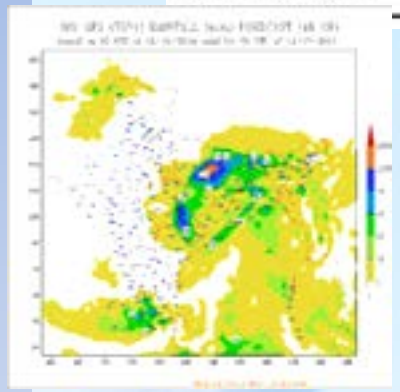
  NWP (global and regional models)

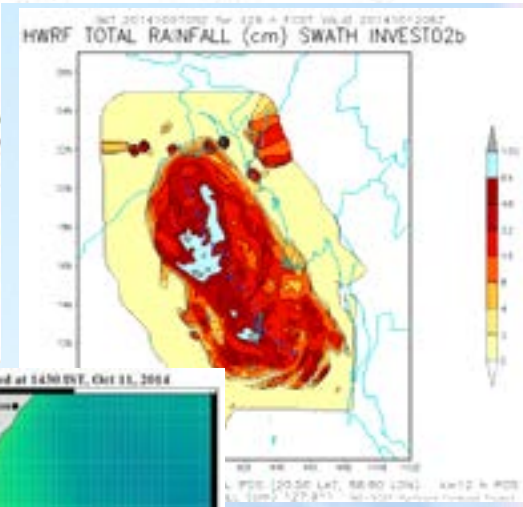
- **Heavy rainfall**

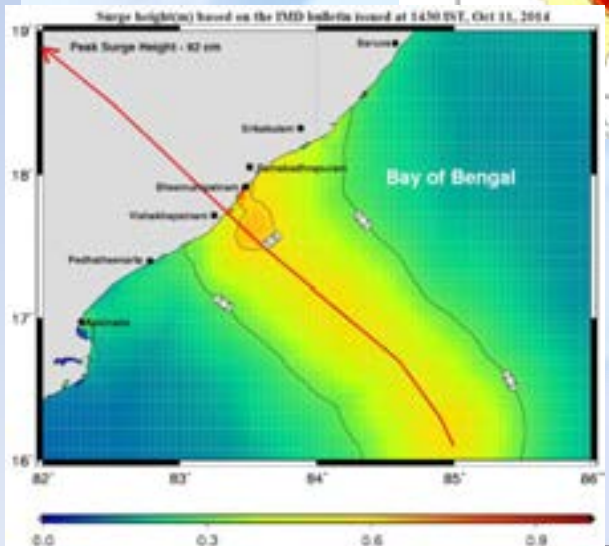
  Synoptic method, Climatological method

  Satellite, Radar and NWP Method

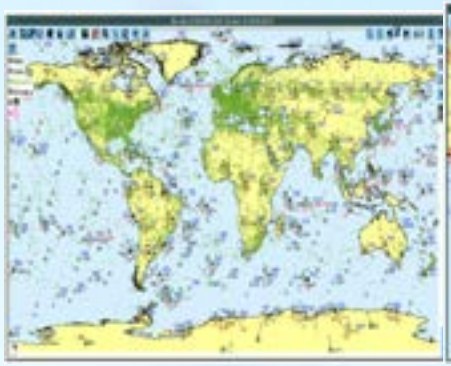








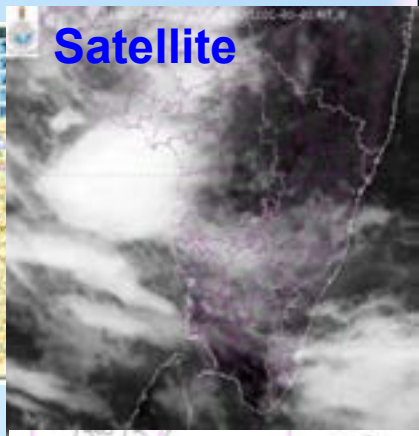
Technology for Decision Support System for Early Warning



Global plotting

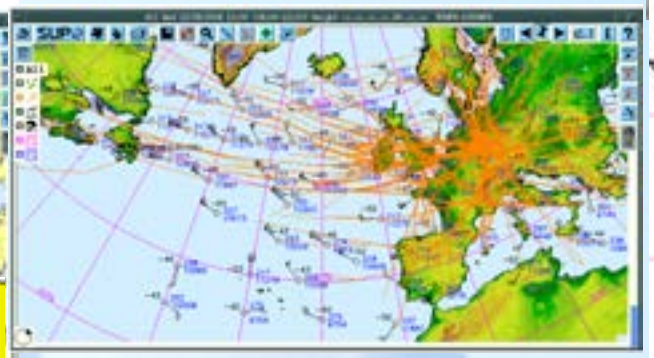
Conditional plotting

Profile

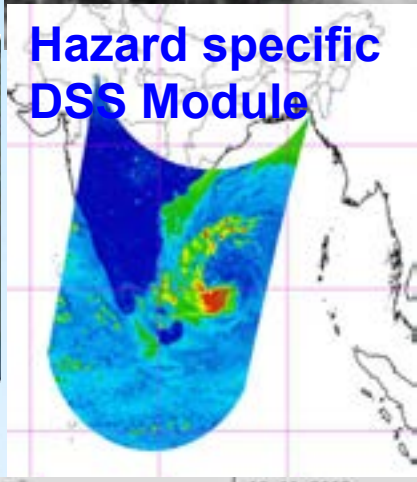


Satellite

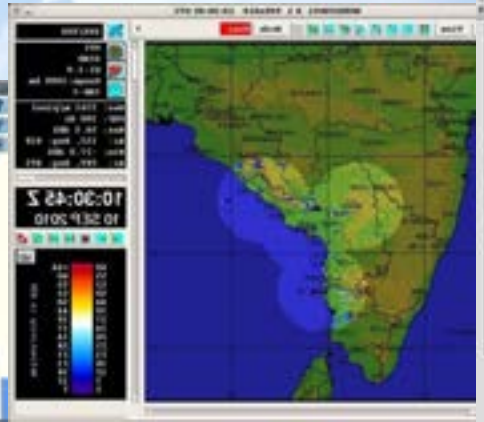
Gauges

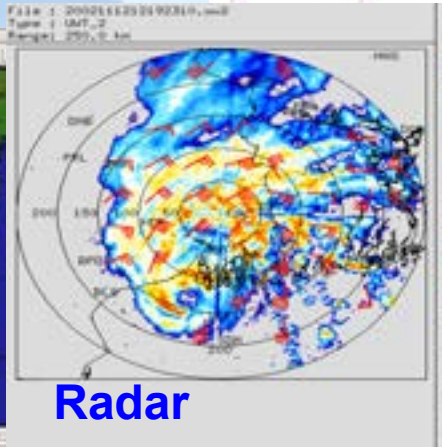


Plane trajectories



Hazard specific DSS Module





Radar

BULLETINS AND WARNINGS ISSUED BY IMD

- **Four stage cyclone warning**
- Sea area bulletin
- Coastal weather bulletin
- Bulletins for Indian navy
- Fisheries warnings
- Port warnings
- Aviation warning
- Bulletins for departmental exchanges
- Bulletins for AIR/ Doordarshan/ press
- CWDS bulletins
- Warnings for registered/ designated users.

- 1. Pre-cyclone watch(Yellow) – Issued to Cabinet Secretary and Senior Officials indicating formation of a cyclonic disturbance – potential to intensify into a Tropical Cyclone and the coastal belt likely to be affected.
- 2. Cyclone Alert(Orange)- Issued at least 48 hrs in advance indicating expected adverse weather conditions.
- 3. Cyclone warning(Red) – Issued at least 24 hrs in advance indicating latest position of Tropical Cyclone, intensity, time and point of landfall, storm surge height, type of damages expected and actions suggested.
- 4. Post-Landfall Outlook- Issued about 12 hrs before landfall & till cyclone force winds prevail; District Collectors of interior districts besides the coastal areas are also informed.
- ** Finally a 'De-Warning' message is issued when the Tropical Cyclone weakens into Depression stage.

Cyclone Warning: Dissemination Mechanism

- Telephone, Tele-fax
- Mobile Phones (SMS) through IMD severe weather network, Agromet Network, INCOIS network & to registers users
- VHF/HFRT/Police Wireless
- Satellite based cyclone warning dissemination System
- Aeronautical Fixed Terminal Network
- Global telecommunication system (GTS) : (International Telecom centres)
- Internet (e-mail), ftp
- Websites(www.rsmcnewdelhi.imd.gov.in)
- Radio/TV, News Paper network (AM, FM, Comminity Radio, Private TV)
- Social Media (Facebook and Twitter)

LINKAGE WITH DISASTER MANAGEMENT AUTHORITIES

- **NATIONAL LEVEL :**

1. CONCERNED MINISTRY INCLUDING INDIAN RAILWAYS
2. NATIONAL DISASTER MANAGEMENT AUTHORITY
3. HIGHER OFFICIALS LINKED WITH DISASTER MANAGEMENT INCLUDING PORT, SHIPPING, TRANPORT, WATER, TELECOM, RAILWAYS, AUTHORITIES
4. NATIONAL PRESS AND ELECTRONIC MEDIA

- **STATE LEVEL :**

1. CHIEF SECRETARY,SPECIAL RELIEF COMMISSIONER
2. STATE DISASTER MANAGEMENT AUTHORITY, REGISTERED WARNEES
3. FISHERMEN, FISHERY OFFICIALS, PORTS, COASTAL SHIPS
4. LOCAL PRESS AND ELECTRONIC MEDIA

- **DISTRICT LEVEL :**

1. DISTRICT COLLECTORS, REGISTERED WARNEES

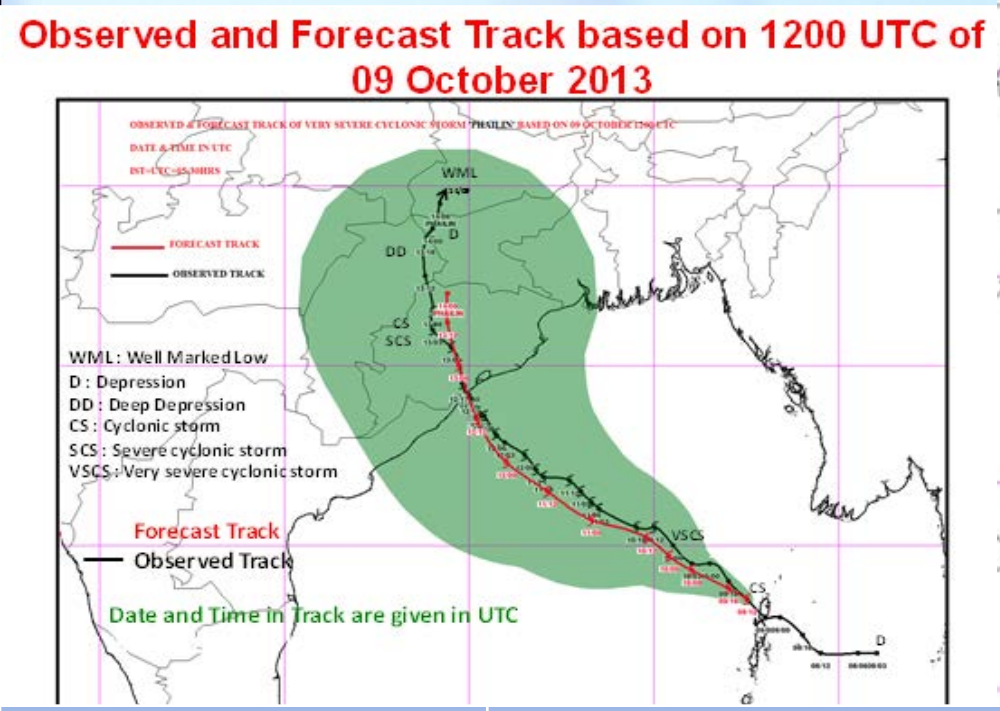
LAST MILE CONNECTIVITY :

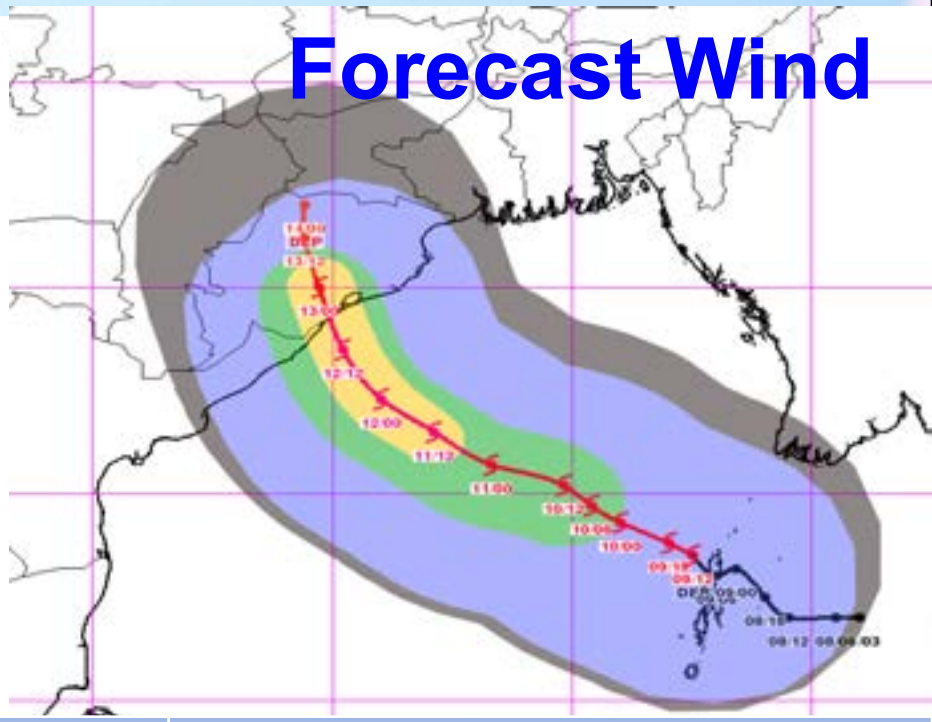
Warning System of IMD

- Goal : maximizing actions for safety
- Components of a warning system:

1. Detection, monitoring and Warning
   - Global, regional, national and local observations
   - Numerical weather prediction
   - Forecasts on different timescales (nowcasting to several days)
2. Timely issuing and dissemination of authoritative warning information
3. Communication: complete only after information received and understood (vs Fire and Forget)
4. Risk Analysis and impact assessment
   - Who and what is at risk and why? What will the impacts be?
5. Mitigation and response: Actions of recipients depend on:
   - Content and clarity of the warning
   - Credibility of issuing organization
   - State of preparedness of receiving authorities
6. Scientific knowledge alone not sufficient
   - IMD + Hazards Community (other government organizations + local officials + emergency managers + media + voluntary and NGOs+...)

Phailin : Forecast Accuracy (Landfall)





Lead Time (Hrs)	Landfall Point Error (km)	Landfall Time Error (hrs)
12	3	3 hr delay
24	13	3 hr delay
36	5	3 hr delay
48	11	3 hr delay
60	2	3 hr delay
72	6	01 hr early
84	41	01 hr early

Phailin Communication

- Triggering mechanism for disaster managers and Public
- Timely warning product (text and graphics) generation, presentation and Dissemination

All the above are carried out through

- Improved PWS capabilities of IMD
- Close liaison with all Stake holders like NDMA, MHA, NIDM, NDRF Other Government Functionaries at National, State and District level
- Press conference by IMD one each on 10th (jointly addressed by VC NDMA) and 11th Oct. and three on 12 Oct (one jointly addressed by Resident Commissioner, Odisha Govt.) and one on 13th.
- 3 hourly updates were given to all concerned authorities and also through regular media briefings for maximum coverage
- Non-stop media coverage (Electronic, print, DD ,AIR,etc)
- Hourly update on 12th October

Outcome of technological initiative

- Genesis forecast (3 days) in advance
- Track, intensity and landfall forecast : 5 days in advance

❖ Increase in confidence of disaster managers and general public

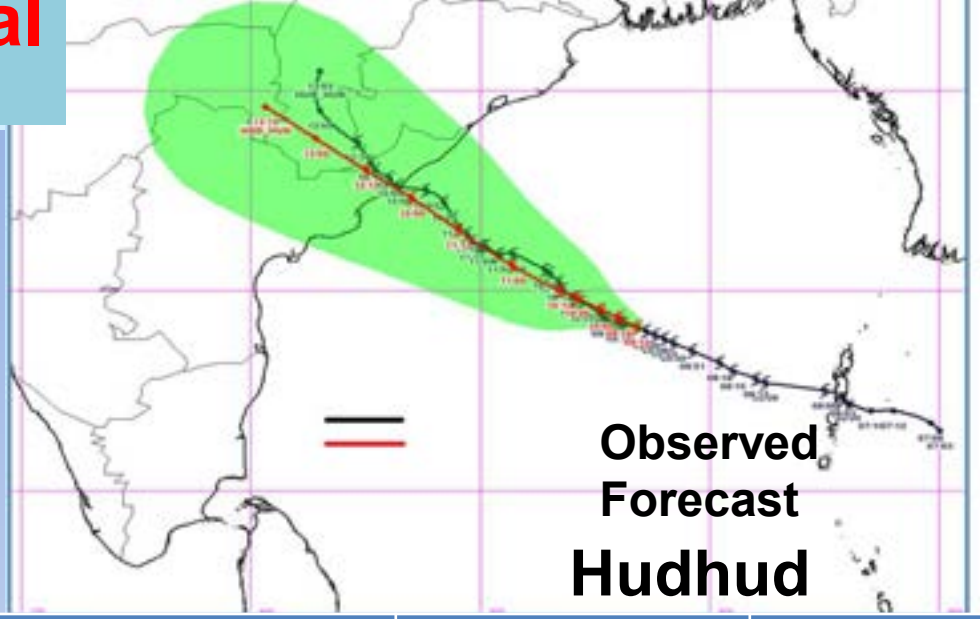
❖ Effective management of cyclone

❖ Minimum loss of lives
  - (22 in Phailin (2013) and 46 in Hudhud (2014) against 9885 in Odisha super cyclone (1999)

❖ Minimum loss of live stocks

❖ Minimum Govt expenditure towards evacuation

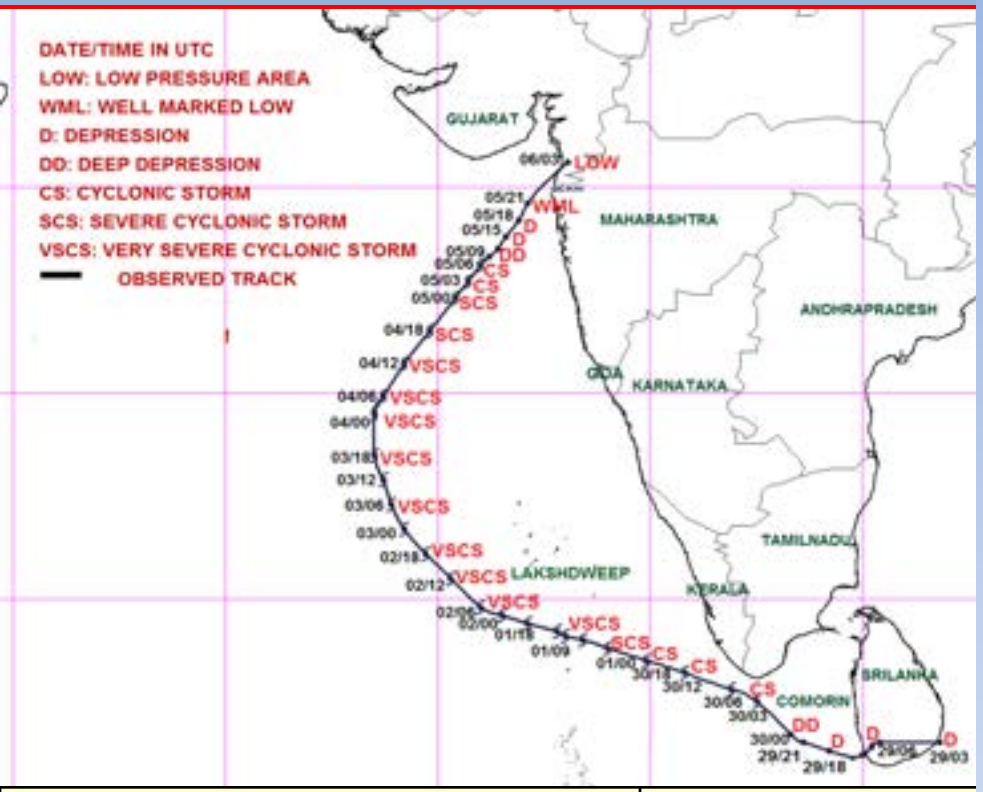
❖ Minimum Govt expenditure towards payment of exgratia for loss of lives



Parameter	Super Cyclone, 1999	Hudhud 2014
Loss of human life	9887	46
Ex-gratia paid by Govt. @ Rs 0.6 Million	Rs 5932.2 Million	Rs 27.6 Million
Area of evacuation	500 km	200 km
Cost of evacuation (10 Million/km)	5000 Million	2000 Million

Assumption: similar amounts would have been spent for evacuation and payment of ex-gratia in 1999 as in 2014

VSCS, OCKHI

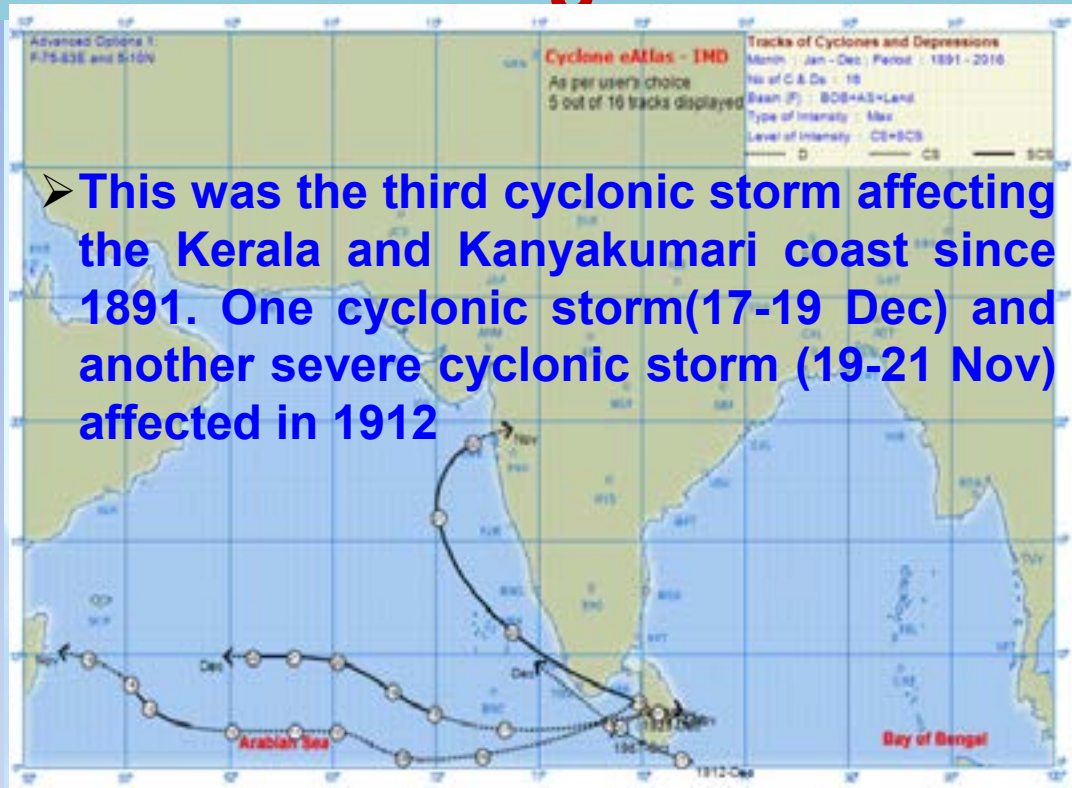


Low pressure System	Wind speed
Low (L)	Upto 31 kmph
Depression (D)	32-51 kmph
Deep Depression (DD)	52-61 kmph
Cyclonic Storm (CS)	62-87 kmph
Severe Cyclonic Storm	88-117 kmph
Very Severe Cyclonic Storm	118-166 kmph

- Geneis and intensification
- Low Pressure area: Southwest Bay off Sri Lanka on 28 Nov (0830 IST).
- Depression: Southwest Bay on 29 Nov. (0830 IST)
- Deep Depression: Comorin Area early hrs (0230 IST) of 30th.
- Cyclonic Storm: Comorin area in forenoon (0830 IST) of 30th
- Severe Cyclonic Storm: Lakshadweep in early morning (0530 IST) of 01st Dec.
- Very Severe Cyclonic Storm: Lakshadweep in afternoon(1430 IST) of 01st Dec.
- Weakening and dissipation
- Severe cyclonic storm: Eastcentral Arabian Sea at 1730 IST of 04 Dec.,
- Cyclonic Storm: 0830 IST of 5th,
- Deep Depression at 1730 IST of 5th,
- Depression: 2030 IST of 5th Nov.
- Well Marked Low at 0230 IST, 6 Dec.
- Crossed South coastal Gujarat between Surat & Dahanu early morning (0530 IST) of 6 Dec.

Genesis Forecast and actual genesis

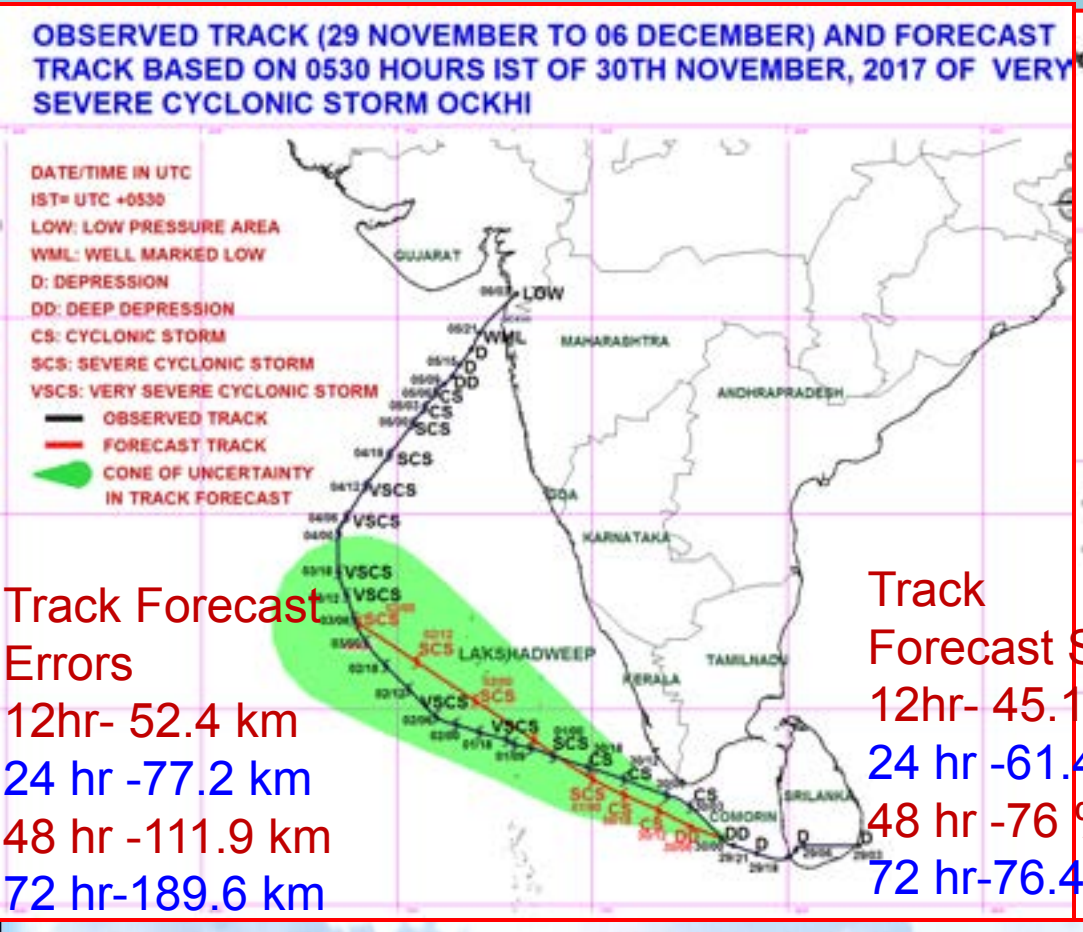
- First information regarding formation of depression during next 48-72 hours (i.e. 29th onwards) was issued at 1200 hours ISTon 28th Nov. in Tropical Weather Outlook
- The system developed into a depression in the morning of 29th.



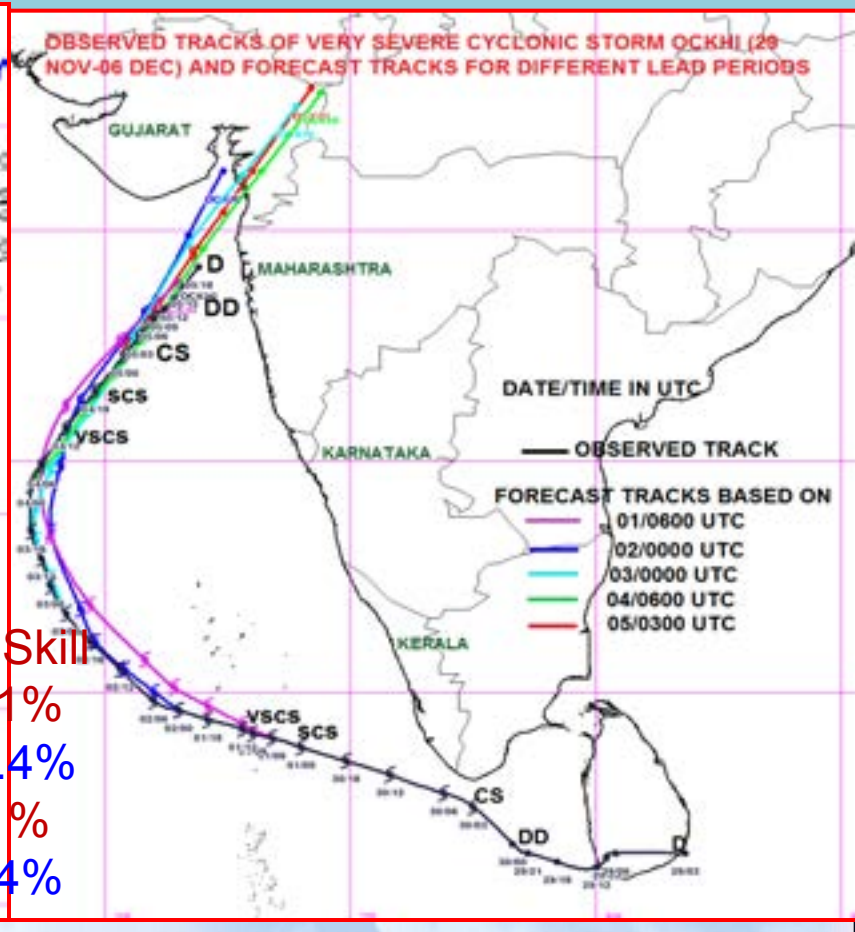
- This was the third cyclonic storm affecting the Kerala and Kanyakumari coast since 1891. One cyclonic storm(17-19 Dec) and another severe cyclonic storm (19-21 Nov) affected in 1912

- In the first bulletin based on 1150 IST of 29th Nov, IMD, New Delhi indicated the west-northwestward movement of system and its emergence into Comorin area by 30th.
- It was also mentioned that the system would intensify further.
- The system emerged into Comorin Area during night of 29th and intensified into Deep Depression in the early hrs (0230 IST) of 30th and into Cyclonic Storm in the forenoon (0830 IST) of 30th Nov. 2017.

Track Forecast



Track Forecast Errors
12hr- 52.4 km
24 hr -77.2 km
48 hr -111.9 km
72 hr-189.6 km



Track Forecast Skill
12hr- 45.1%
24 hr -61.4%
48 hr -76 %
72 hr-76.4%

- **Northwestward movement towards Lakshadweep was predicted on the first bulletin itself issued at 0830 hrs IST of 29th Nov.**
- **Northeastward recurvature of the track and its movement towards south Gujarat coast was first predicted in the morning of 01st December(five days before it hit south Gujarat coast**

Cyclone Warning

- As the deep depression after crossing over southern Sri Lanka unusually intensified into a cyclone Ockhi in 12 to 24 hrs from 29th November morning over Comorin Sea, the cyclone specific advisory was only issued from 30th Nov at 1155 hrs IST as per the protocol for south Tamil Nadu, South Kerala and Lakshadweep
- However, cyclone watch/alert could not be issued due to unusual rapid intensification over the Comorin Sea.
- It is quite different from cases of cyclone intensification that happens over central part of Bay of Bengal and Arabian Sea. In those cases, usual provision of issuing cyclone alert/watch normally exists as per SOP.
- In this case, cyclone warning was to be issued directly on 30th morning only to enhance already initiated actions taken by respective state Govt. based on the regular bulletins issued by IMD since 29th November forenoon.

Capacity Building in Cyclone Warning Services

Comparison of tropical cyclone forecast error over NIO, NW Pacific and North Atlantic Ocean

Cyclone Forecast error	Lead period of forecast	IMD, New Delhi	NHC, USA	JMA, Tokyo
Cyclone Track forecast error(km) Forecast error	24	97.2	73.6	89.8
	48	149.8	131.6	157.4
	72	202.8	190.5	239.8
	96	259.9	275.1	337.0
	120	316.4	363.2	456.8
Cyclone intensity (wind) forecast error (knots)	24	10.7	7.8	12.2
	48	15.5	11.3	17.1
	72	16.3	12.6	19.8

July 12, 2018

Target for 2024 : Reduction in error and Improvement of skill by 20% up to 7 days

Target for 2024 : Dynamical Impact based Forecast and Warning

Lessons Learnt:

- Triggering mechanism for disaster managers and Public is essential
- Timely warning product (text and graphics) generation, presentation and Dissemination is essential

through

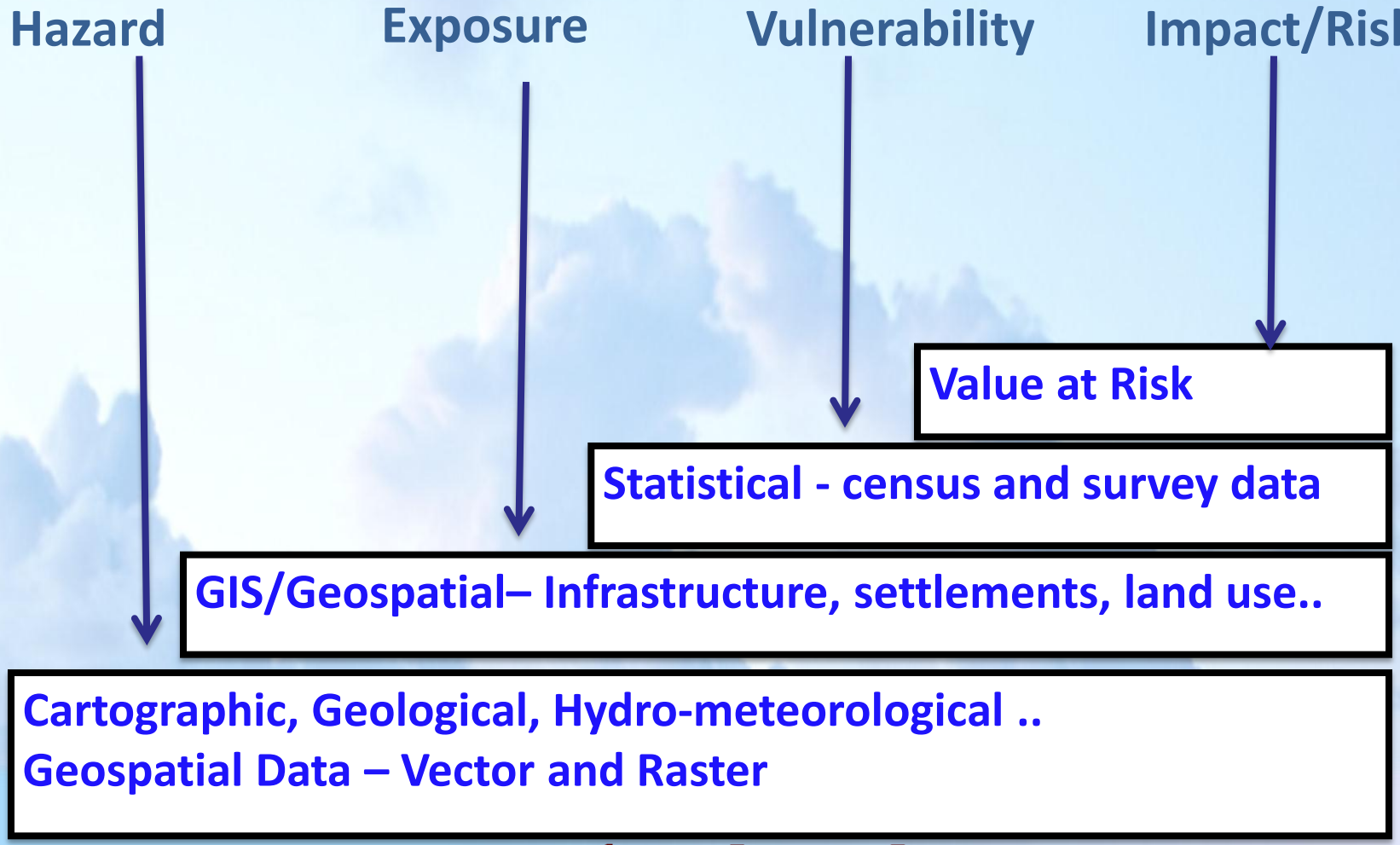
- Improved digitised public weather service (PWS) system
- Close liaison with all Stake holders like NDMA, MHA, NIDM, NDRF, Railways, surface transport, aviation, navigation, Other Government Functionaries at National, State and District level
- Press conference jointly with disaster managers
- 3 hourly updates were given to all concerned authorities and also through regular media briefings for maximum coverage
- Non-stop media coverage (Electronic, print, DD ,AIR,etc)
- Hourly update on day of landfall

Area where improvement is needed:

- Genesis forecast for the TCs near coast
- Improvement in SOP
- Last Mile Connectivity
- Communication with fishermen at deep sea (mode of communication, content of bulletin, time of issue, lead period, frequency of issue etc)
- Need for technology
- Need for increase in awareness, especially in less prone areas
- Capacity building of fishermen, other stakeholders
- Dynamical Impact based forecasting and risk based warning

Impact based Forecasting (from static to dynamic)

Translating hazard information into impact scenarios



Thank you

NIC

Network and Security for MHA, MEA and MOIA

ICT Networks, Optical Communication,

Cloud Technologies, Internet Protocols

ICT Networks

What is ICT?

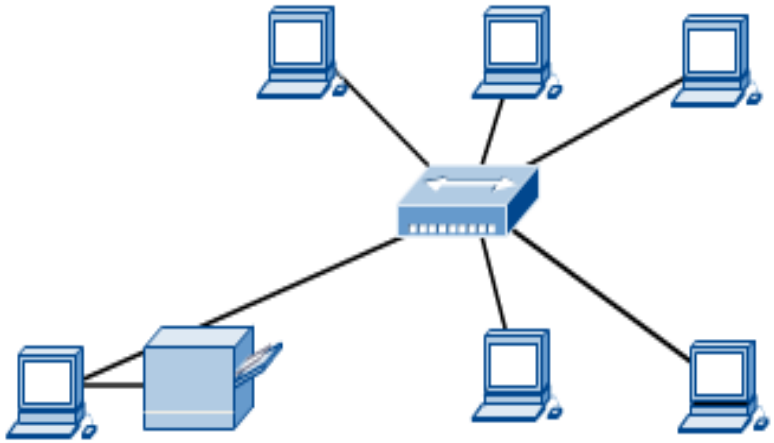
- Stands for "Information and Communication Technologies." ICT refers to technologies that provide access to information through telecommunications.
- It is similar to Information Technology (IT), but focuses primarily on communication technologies.
- This includes the Internet, wireless networks, mobile, and other communication mediums.

ICT Networks

What is ICT Networks?

- Collection of computers and devices connected via communications devices and transmission media.

- The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.

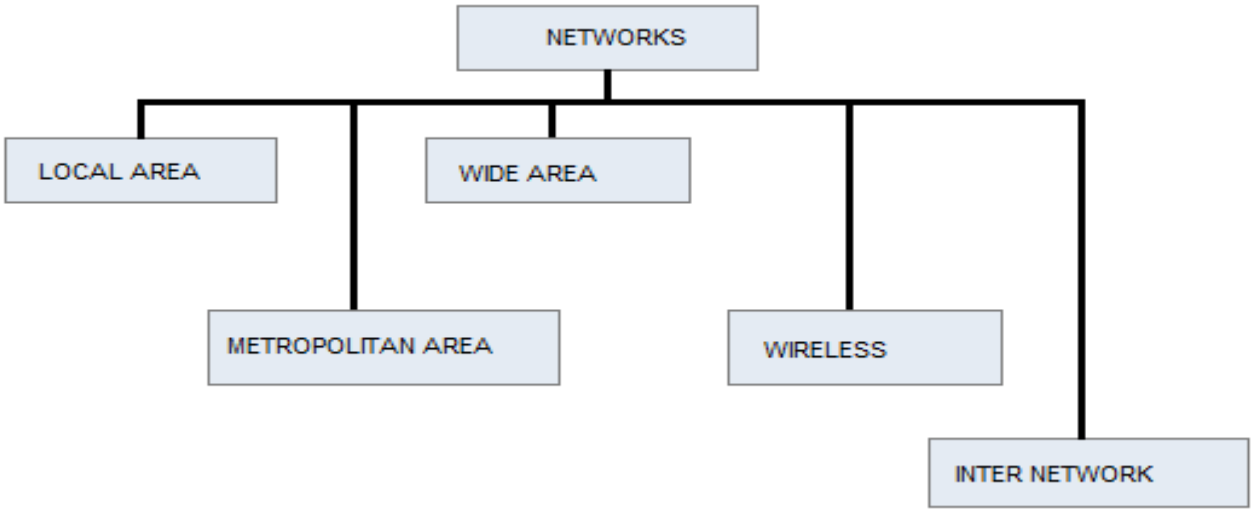


ICT Networks

What is ICT Networks?

The computers / devices can be geographically located anywhere. Based on this Network can be categorized as:

- **LAN,**
- **MAN,**
- **WAN,**
- **Wireless Network &**
- **Internet**



ICT Networks

LAN, MAN, WAN, Wireless Network & Internet

- Network in a City is call **MAN (Metropolitan Area Network)**
- Network spread geographically (Country or across Globe) is called **WAN (Wide Area Network)**
- Network in small geographical Area (Room, Building or a Campus) is called **LAN (Local Area Network)**
- **Wireless Network is** the fastest growing segment of computer. They are becoming very important in our daily life because wind connections are not possible in cars or aeroplane. We can access Internet at any place avoiding wire related troubles. These can be used also when the telephone systems gets destroyed due to some calamity/disaster.
- When we connect two or more networks then they are called **internetwork or internet**. We can join two or more individual networks to form an internetwork through devices like routers gateways or bridges.

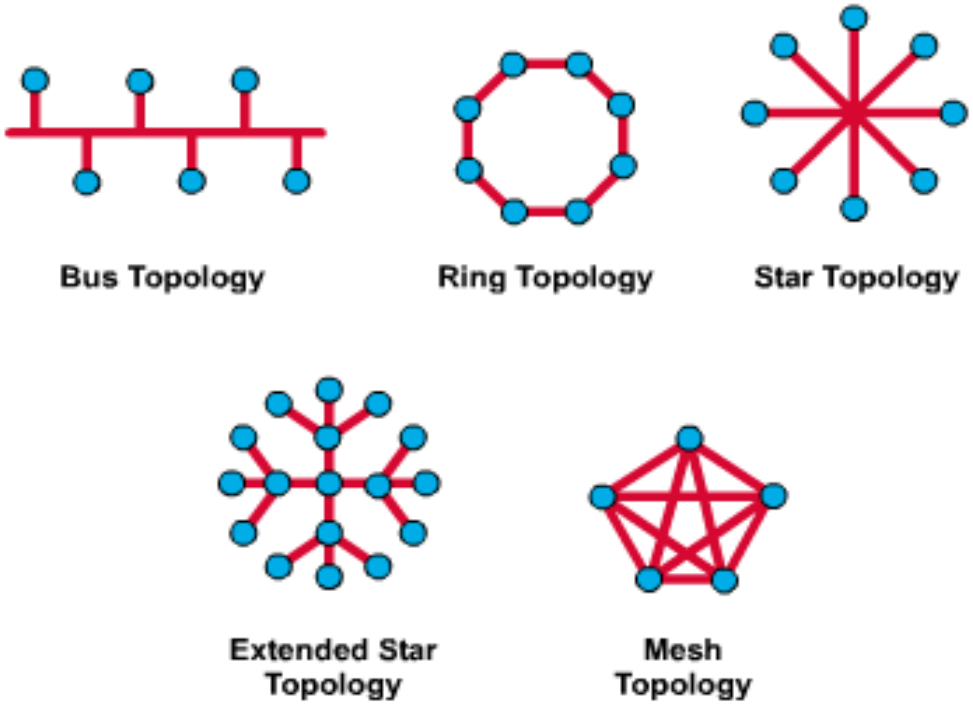
ICT Networks

Network Topology

- The network topology defines the way in which computers, printers, and other devices are connected. A network topology describes the layout of the wire and devices as well as the paths used by data transmissions.

Popular topologies:

- BUS Topology
- Ring Topology
- Star Topology
- Mesh Topology



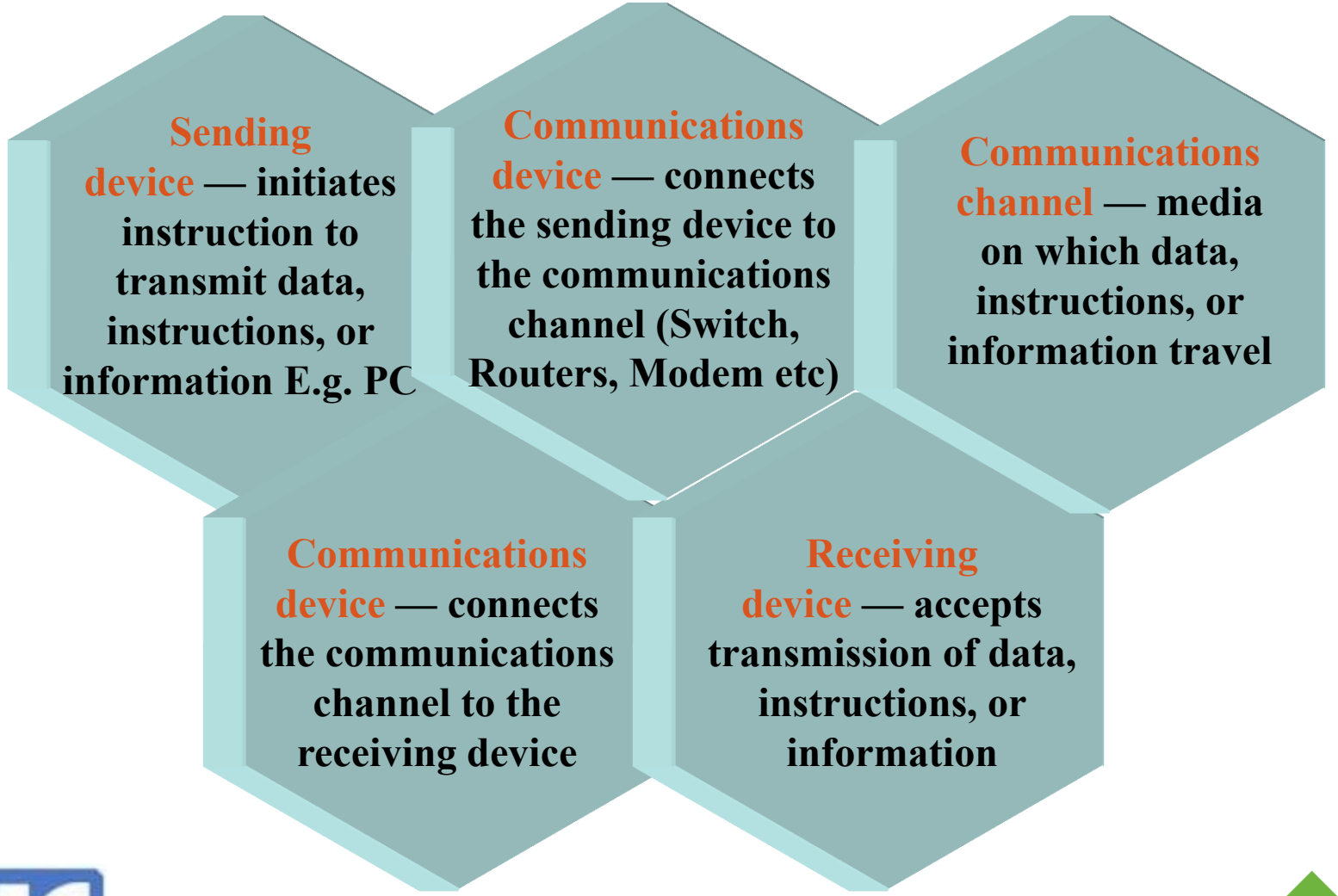
ICT Networks

What are computer Communications

- Process in which two or more computers or devices transfer data, instructions, and information

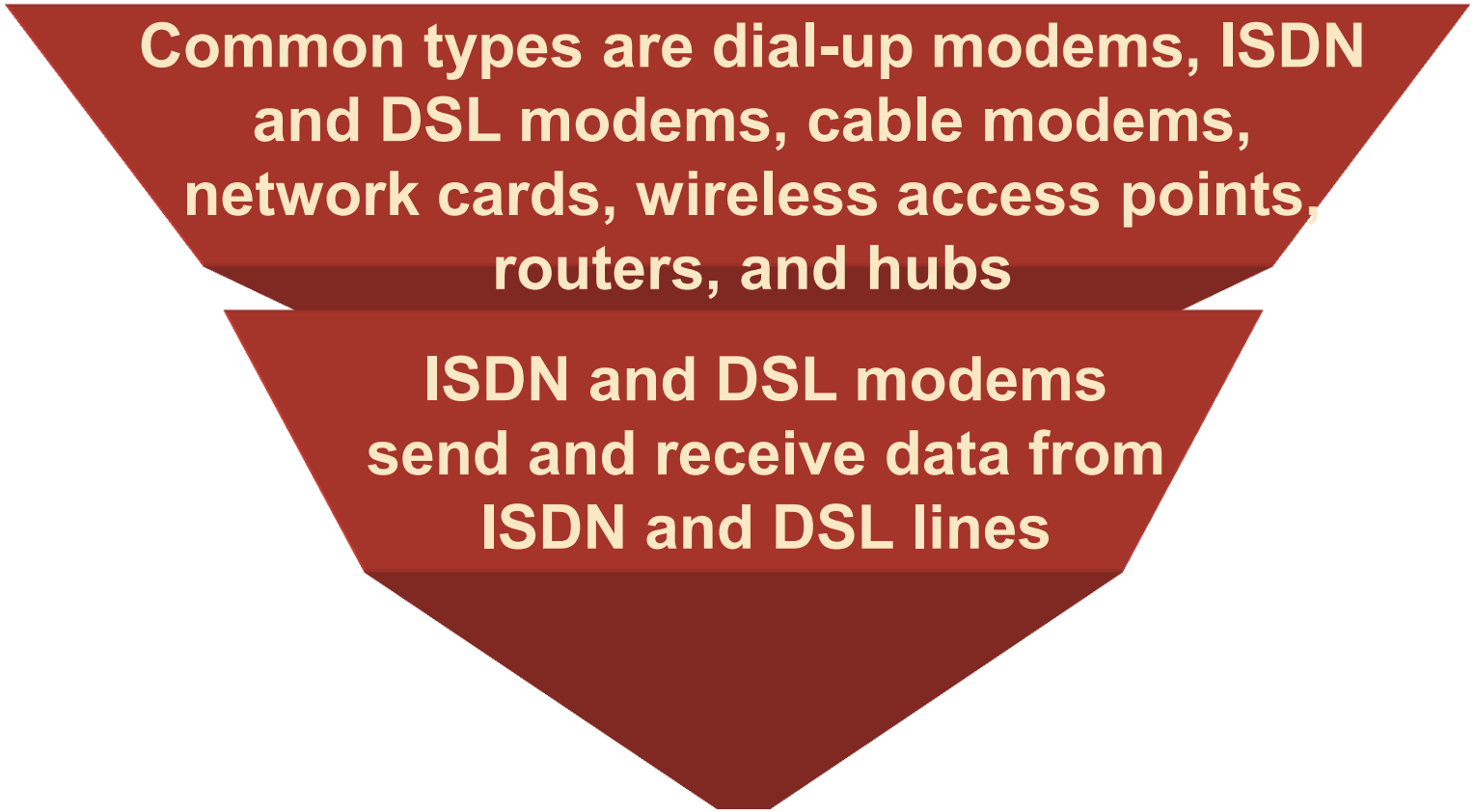
ICT Networks

What is needed for successful communications?



ICT Networks

What are examples of communications devices?



ICT Networks

What is a communications channel?

- Transmission media on which data travels in communications system

Transmission media are materials capable of carrying one or more signals

Bandwidth is amount of data that can travel over channel

ICT Networks

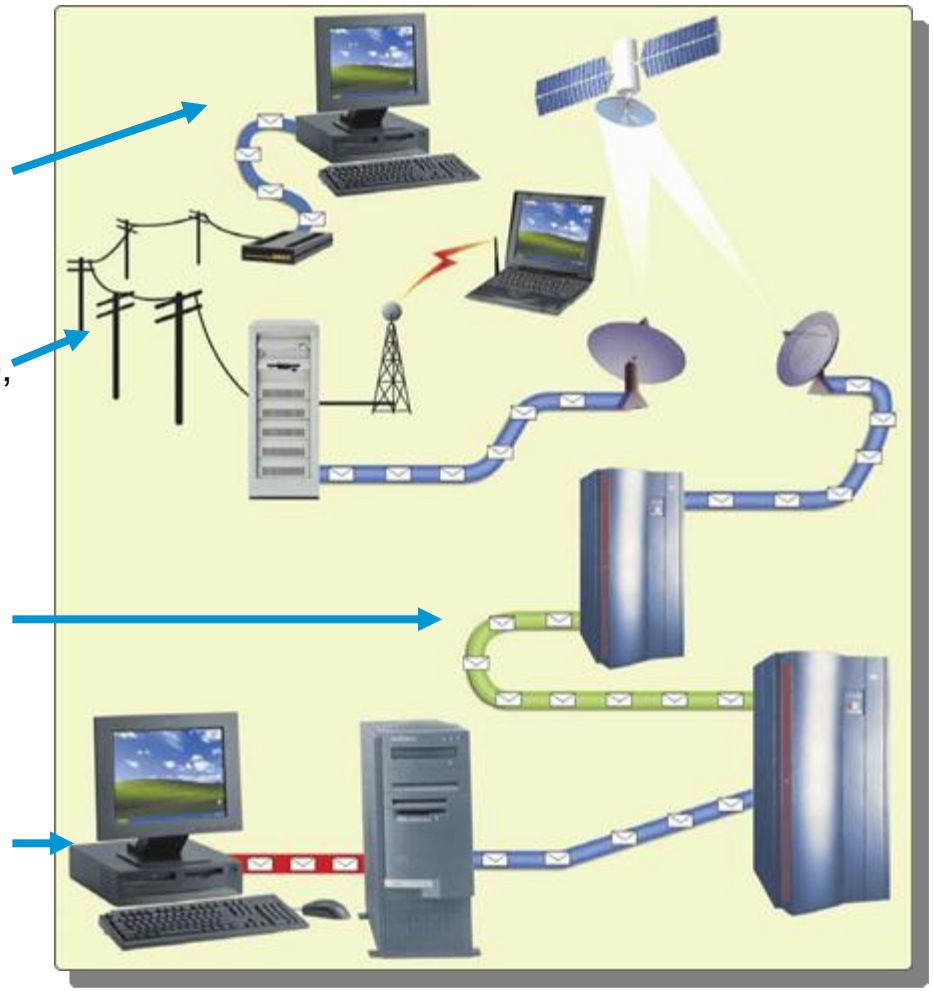
How is a request sent over the Internet using a communications channel?

Step 1. The sending device requests information using either a physical transmission media or a wireless transmission media.

Step 2. When the request leaves the ISP, it travels over T1 lines (1.54Mbps), microwave stations, earth-based stations, and communications satellites until it reaches the Internet backbone.

Step 3. The request travels over T3 lines (44Mbps) along the Internet backbone.

Step 4. The Request travels over T1 lines until it reaches the destination network server.



ICT Networks

Transmission media

What is physical transmission media?

- **Wire, cable, and other tangible materials used to send communications signals**

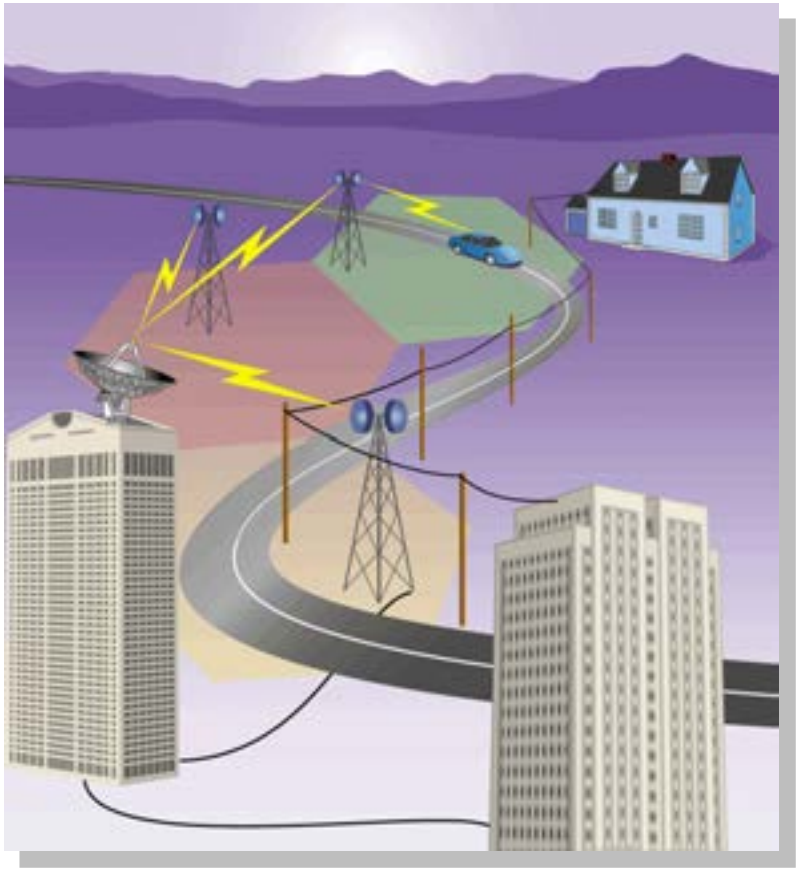
Wireless transmission media

- **Used when inconvenient, impractical, or impossible to install cables**
- **Includes Bluetooth and Infrared**

ICT Networks

Wireless transmission media

- Broadcast radio
  distributes radio signals over long and short distances
- Exa. FM Radio
- Cellular radio
  is form of broadcast radio used for mobile communications
- Exam. Mobile



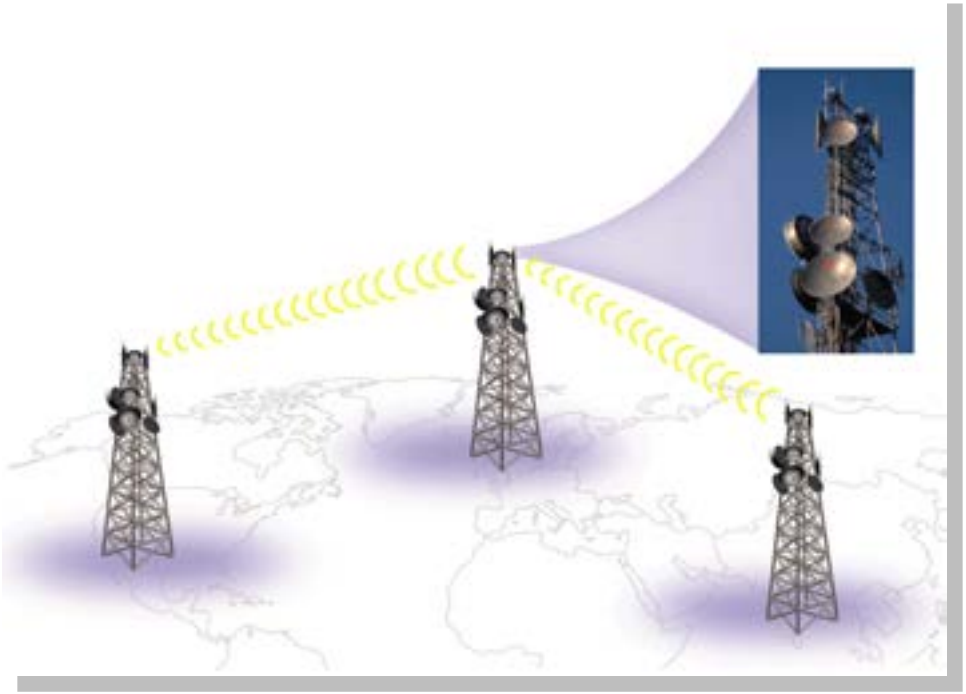
ICT Networks

Wireless transmission media

What is a microwave station?

- Earth-based reflective dish used for microwave communications

- Must transmit in straight line with no obstructions

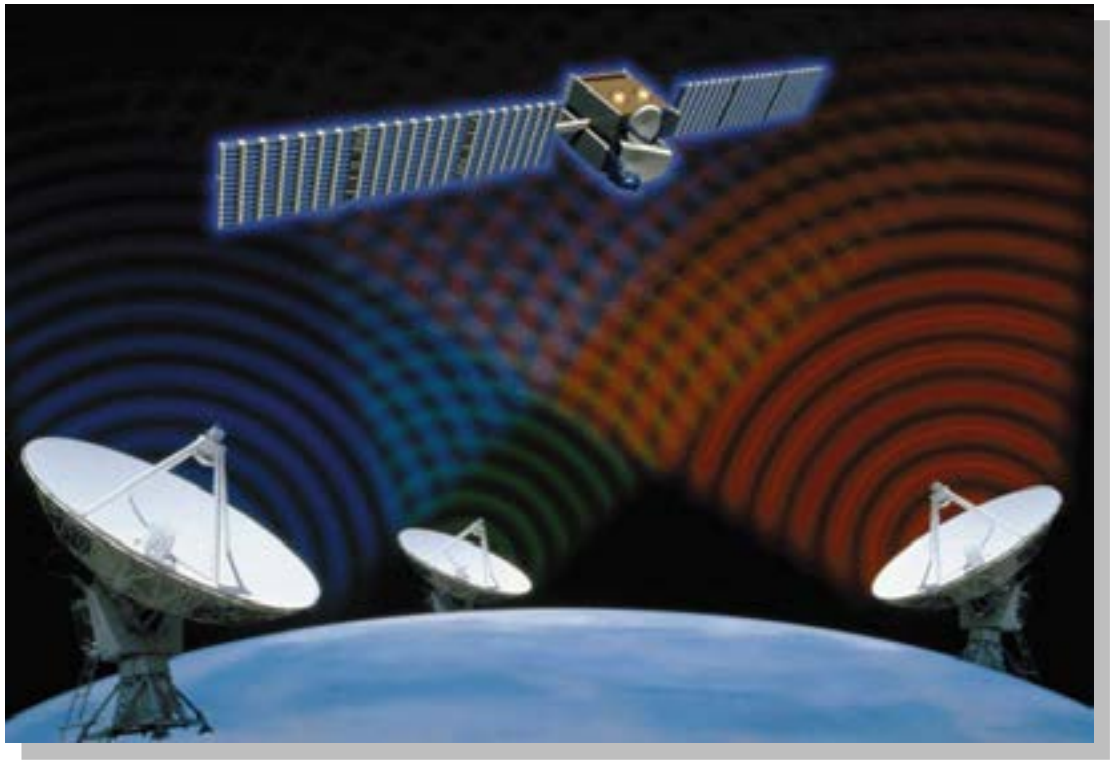


ICT Networks

Wireless transmission media

What is a communications satellite?

- Space station that receives microwave signals from earth-based station, amplifies signals, and broadcasts signals back to any number of earth-based stations.



ICT Networks

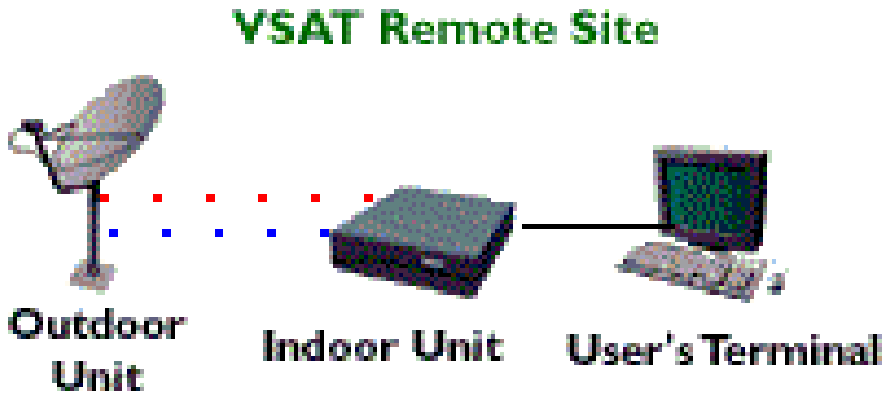
WHAT IS VSAT ?

A very small aperture terminal (VSAT) is a device (known as an earth station) that is used to receive satellite transmissions.
The "very small" component of the VSAT acronym refers to the size of the VSAT dish antenna — typically 3 to 6 feet in diameter — which is mounted on a roof on a wall, or placed on the ground.

VSAT earth station has two basic components

1.OUTDOOR UNIT (ODU)

2.INDOOR UNIT (IDU)

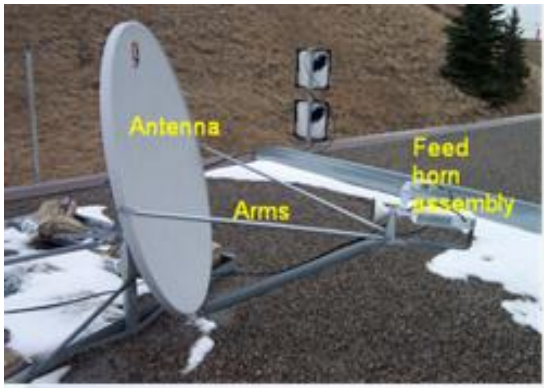


ICT Networks

VSAT Components

1.OUTDOOR UNIT (ODU)

- ANTENNA
- OMT(Ortho-Mode Transducer)
- LNA (Low Noise Amplifier)
- LNB (Low Noise Block Converter)- Receiver
- BUC (Block Up Converter) – Transmitter



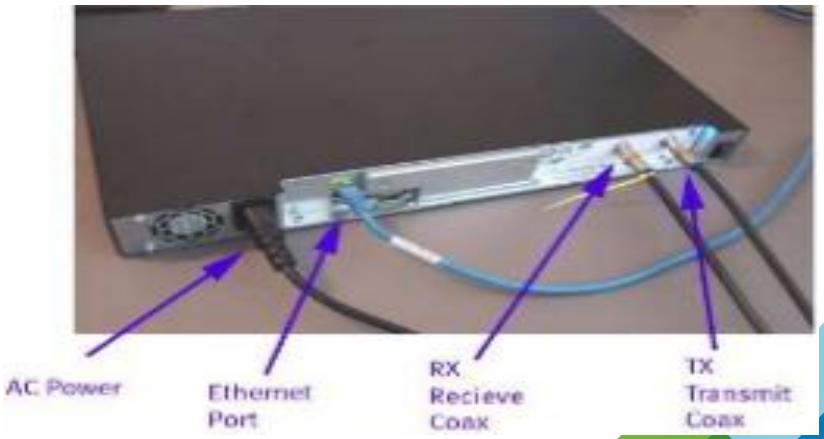
The LNB converter amplifies the received signal and down converts. The down converted signal is demodulated.

Satellite modulator(part of modem) converts baseband information to modulated frequency. This Modulated frequency is up converted and amplified using BUC.

2.INDOOR UNIT (IDU)

It is the –brain" of the VSAT.

It contains the interface between the VSAT & the customer's equipment through networking equipment like a satellite router/modem.

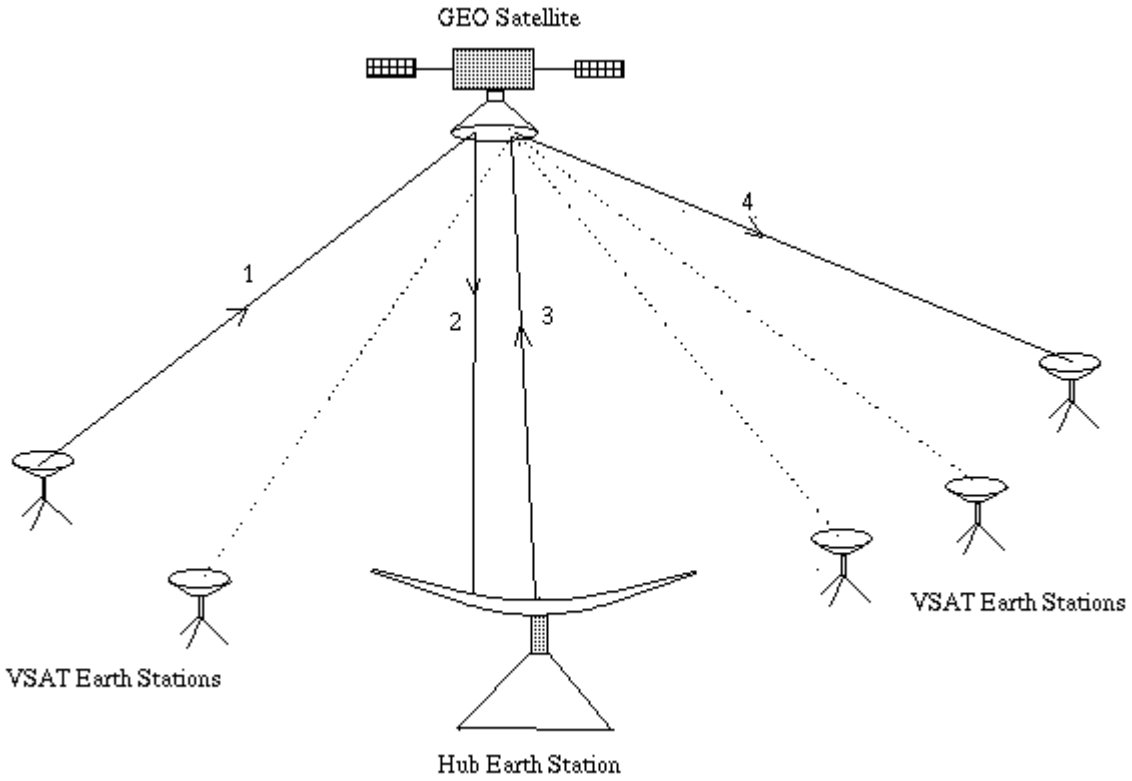


ICT Networks

WHAT IS Satellite Network ?

A Satellite network has the following components:

- A Central HUB (master earth station)
- A Satellite
- A virtually unlimited number of VSAT earth stations in various locations across the country.



ICT Networks

Satellite network Topologies

Star (hub & spoke) Networks

In a star network topology the hub connects to the remote, where all communications are passed back through the hub. Virtually an unlimited number of remotes can be connected to the hub in this topology. Smaller, lower powered BUCs can be used at the remote end since they are only connecting back to the larger hub antenna.

Mesh Networks

A mesh network topology allows one remote VSAT location to communicate with another remote location without routing through the hub. This type of connection minimizes delay and often is used for very high quality voice and video conferencing applications.

With this topology, larger antennas are required and more power is needed to transmit, thereby increasing cost.

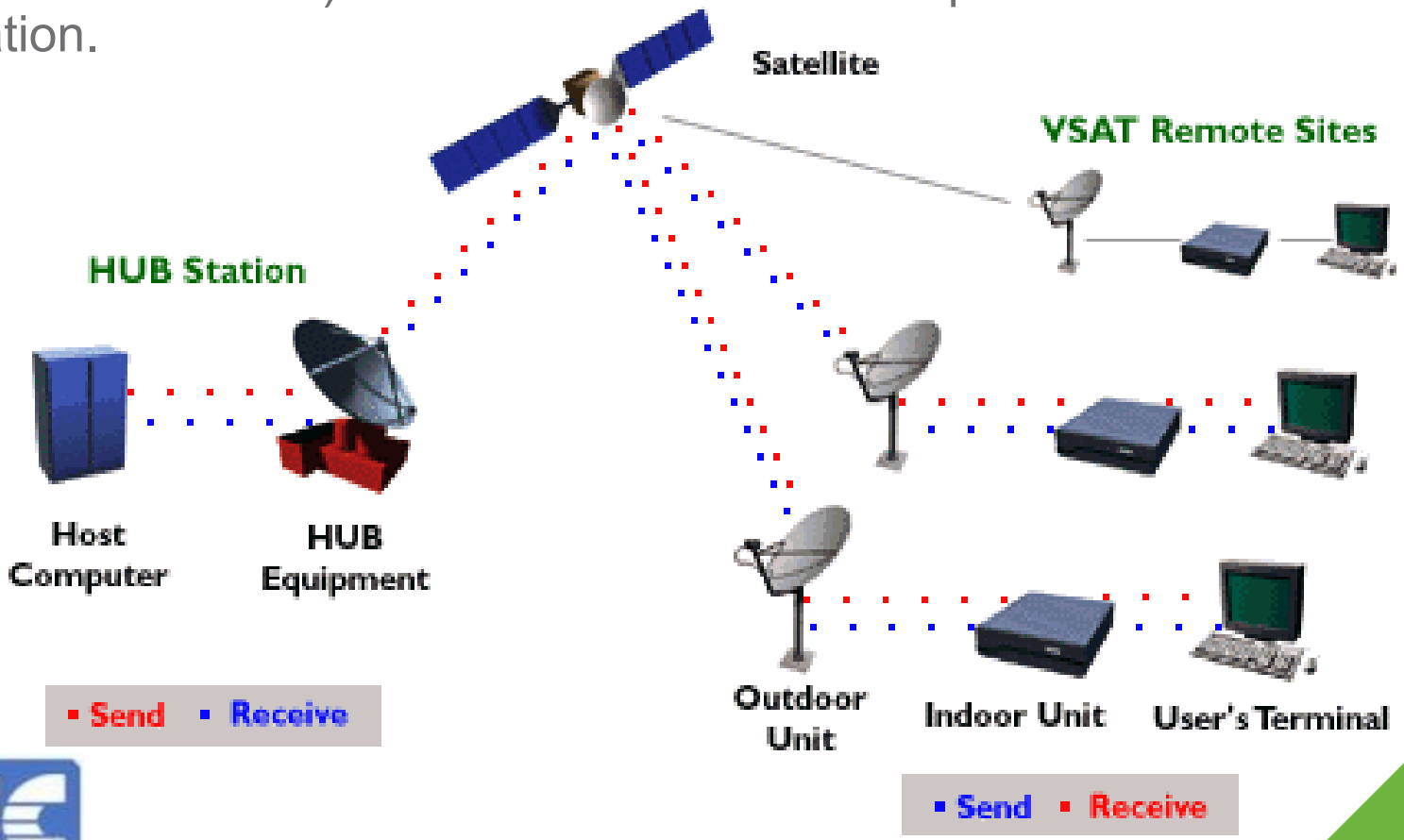
Hybrid Networks

A hybrid topology is a mix of star and mesh networking solutions. This topology allows the hub to send information to the remotes, with the remotes then able to communicate with other VSAT locations.

ICT Networks

VSAT Network Communication

Outbound information (from the hub to the VSATs) is sent up to the communications satellite's transponder, which receives it, amplifies it, and beams it back to earth for reception by the remote VSATs.
The VSATs at the remote locations send information inbound (from the VSATs to the hub) via the same satellite transponder to the hub station.



ICT Networks

Satellite VSAT communication Bands and their Frequency Range

Band	Frequency Range	Used in VSAT
C	4-8 GHz	✓Primarily used for voice and data communications. ✓due to the lower frequency range, it performs better under adverse weather conditions on the ground.
Ku	12.5 to 18 GHz	✓Ku (K band Under) band is used typically for DTH access. ✓Networks in this band are more susceptible to rain fade than C band.
Ka	26.5 to 40GHz	✓The Ka band (K band Above) is primarily used for two-way consumer broadband and military networks. ✓Due to the higher frequencies of this band, it can be more vulnerable to signal quality problems caused by rain fade.

POLNET

What is POLNET

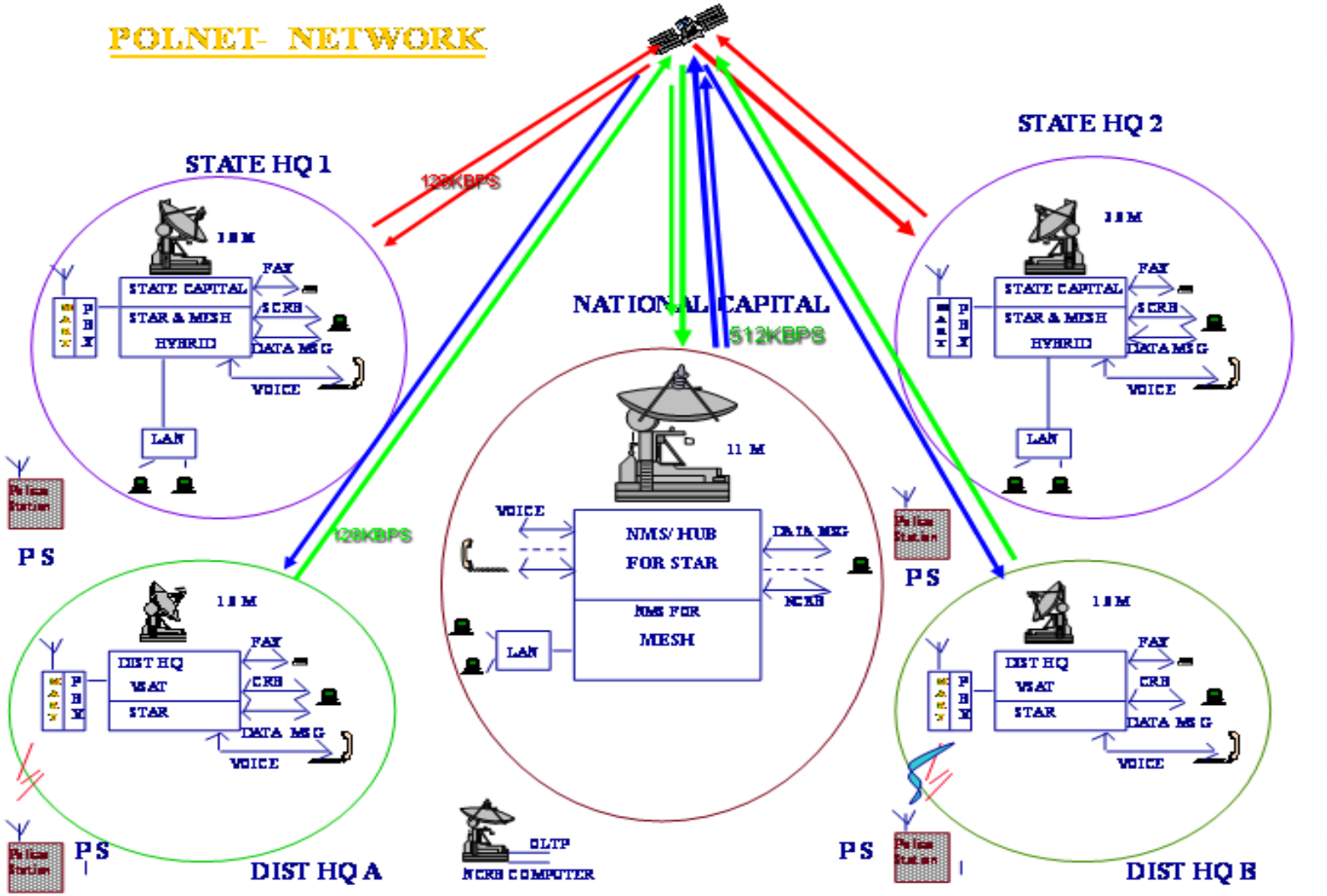
•POLNET is a satellite based wide area network for the modernization of Police Telecommunication of the country.

•POLNET is an amalgamation of different latest VSAT technologies ie TDM/TDMA, SCPC/DAMA and DVB-S. It is a huge network consisting of about 1000VSATs (Very Small Aperture Terminals at each state capital, District HQrs and selected locations of Central Forces (BSF, ITBP, CISF, CRPF, Assam Rifles, SSB) .

•At present POLNET caters to 961 no. of VSATs through a HUB installed in New Delhi with 11 mtr antenna with necessary Outdoor and Indoor equipments to support total VSAT Network of about 1500 locations for VOICE, DATA, FAX facilities.

POLNET

The POLNET Network configuration is as shown in the diagram -



ICT Networks

VSAT Vs. Leased Line

VSAT:

1. Footprint across the country
2. High initial investment
3. High reliability – Uptime of 99.5%
4. No recurring b/w costs

Leased Line:

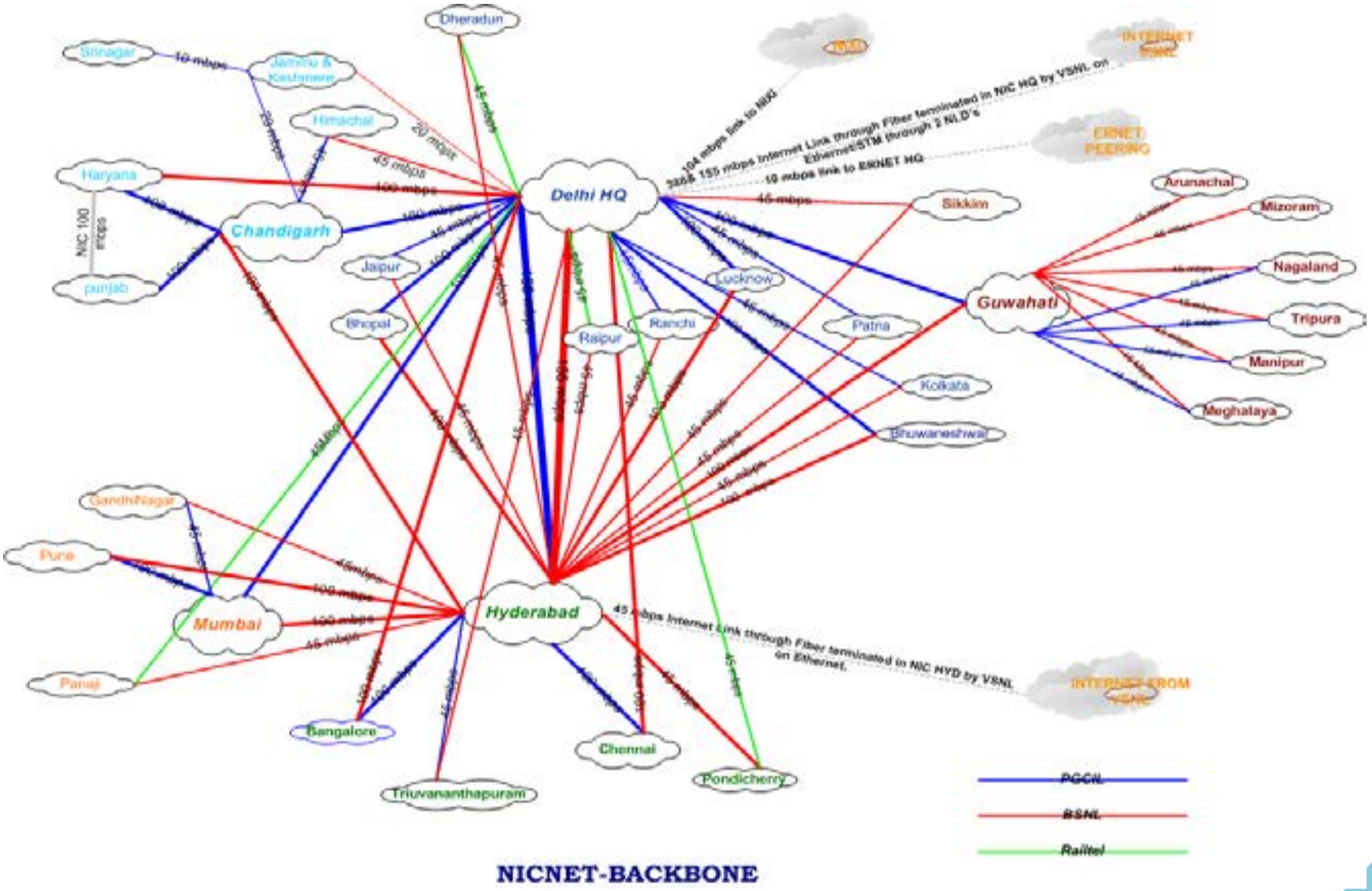
1. Option not available in all areas
2. Low initial investment
3. Dependent on the capacity of the local System
4. Recurring Bandwidth costs

ICT Networks

VSAT *Advantages*

1. **Availability:** anywhere - no limitations
2. **Fast Deployment:** Within hours!
3. **Homogeneity:** Same speed and SLA regardless of location
4. **Multicast:** broadcast schemes - allows broadcast at no additional cost
5. **Few Points of Failure:** just two on the earth!
6. **Reliability:** reliable satellite transmission of data between an unlimited number of geographically dispersed sites
7. **Flexibility:** expansion capabilities, unrestricted and unlimited reach.
8. **Network Management:** end-to-end monitoring and configuration control for all network subsystems.
9. **A low mean-time to repair:** lesser elements imply lower MTTR.

ICT Networks



NICNET-BACKBONE

Internet Protocols

Internet Protocols

What is IP (Internet Protocol)

- IP specifies the format of packets, also called datagrams, and the addressing scheme. Most networks combine IP with a higher-level protocol called Transmission Control Protocol (TCP), which establishes a virtual connection between a destination and a source.

- IP by itself is something like the postal system.

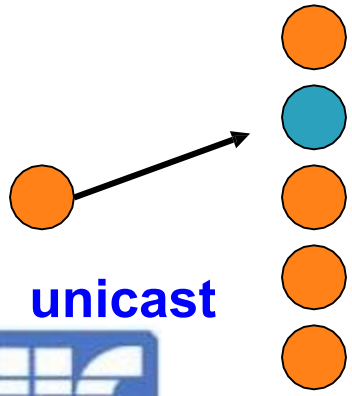
- It allows you to address a package and drop it in the system, but there's no direct link between you and the recipient.

- TCP/IP, on the other hand, establishes a connection between two hosts so that they can send messages back and forth for a period of time.

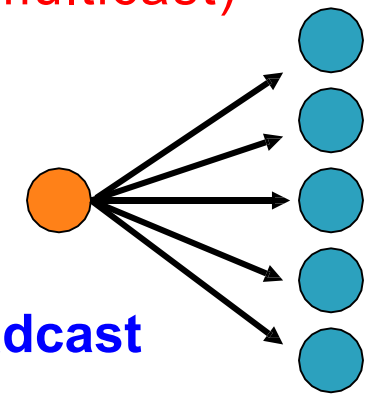
Internet Protocols

IP service

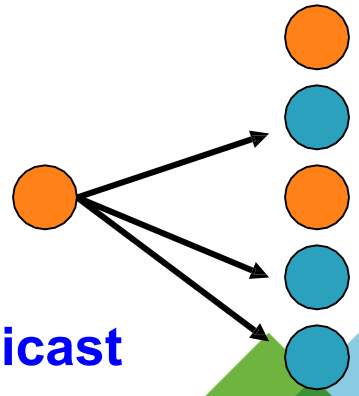
- Delivery service of IP is minimal
- IP provides an unreliable connectionless best effort service
  - Unreliable : IP doesn't make an attempt to recover lost packets
  - Connectionless : Each packet is handled independently
  - Best Effort : IP doesn't make guarantees on the service (No through output , No delay guarantee…)
- IP supports the following services
  - One-to-one (unicast)
  - One-to-all (broadcast)
  - One-to-several (multicast)



unicast



broadcast



multicast

Internet Protocols

OSI Reference Model

- Open Systems Interconnection Reference Model
- Splits communication system into seven layers
- Each layer performs their task and passes the data to the next layer

Layer 7: Application

Layer 6: Presentation

Layer 5: Session

Layer 4: Transport

Layer 3: Network

Layer 2: Data Link

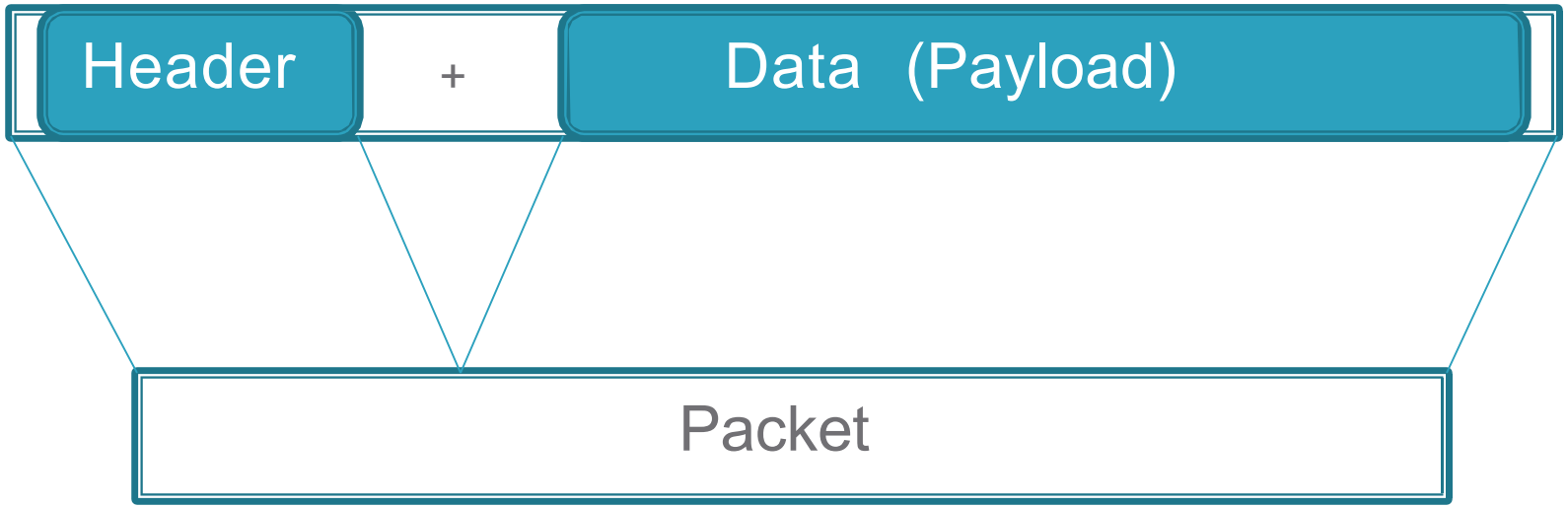
Layer 1: Physical

Internet Protocols

Construction of datagrams

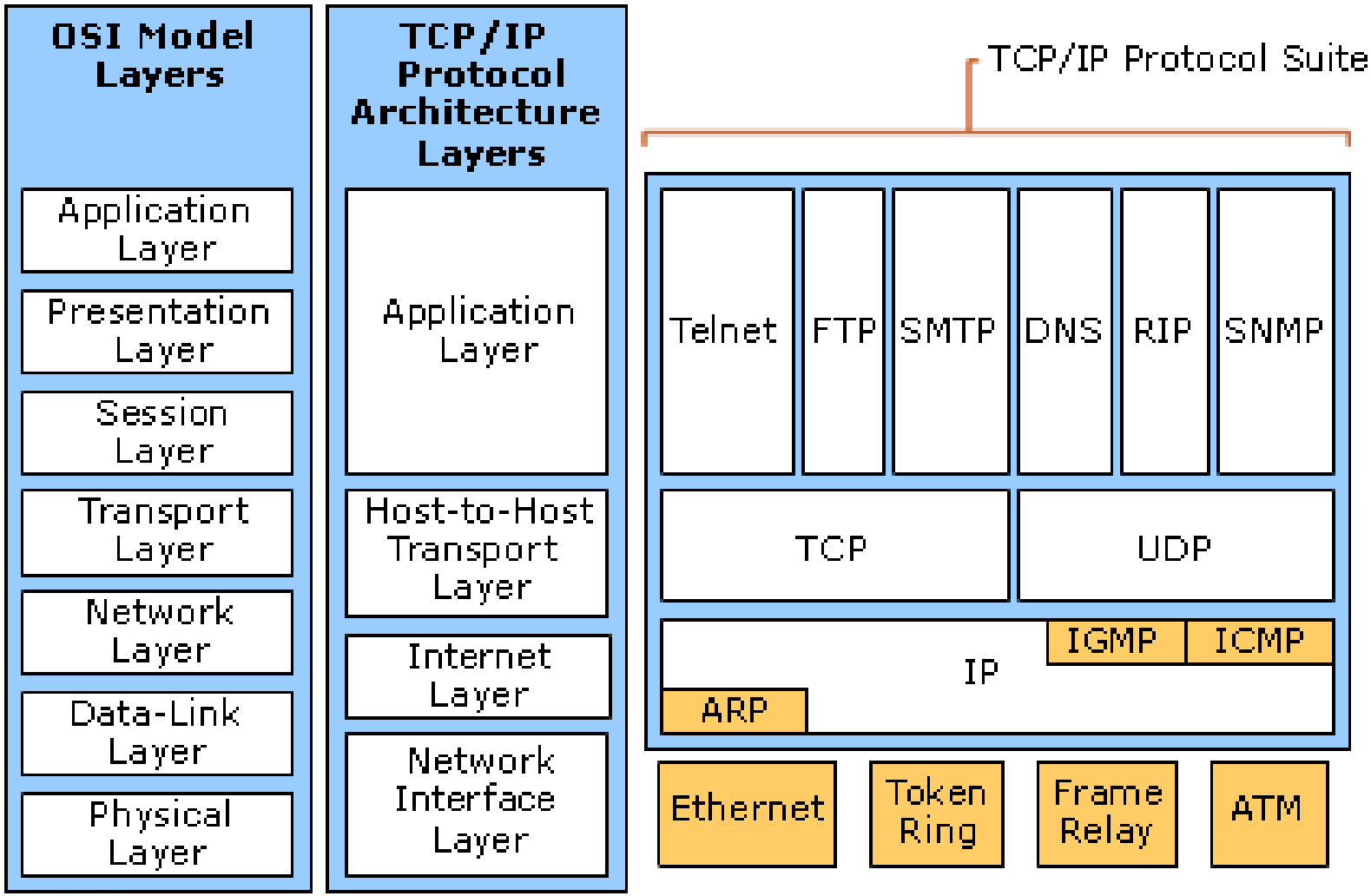
Each #datagram has two components

- Header
- Payload



Internet Protocols

Model and Protocol Suite



Internet Protocols

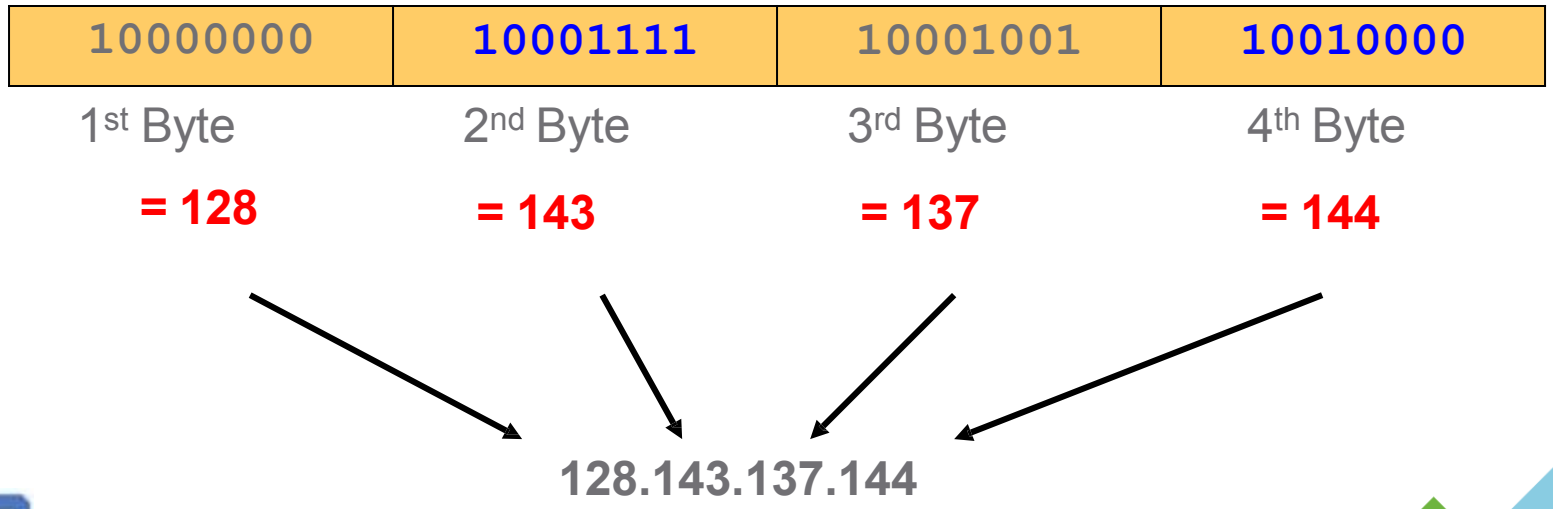
IP Address

What is an IP address…?

- An IP address is a unique global address for a network interface

-is a **32 bit long** identifier

-encodes a network number (**network prefix**) and a **host number**



MAC

MAC Address

- **What is an MAC address…?**

  - The Media Access Control (**MAC**) **address** is a unique physical address for a communication device.

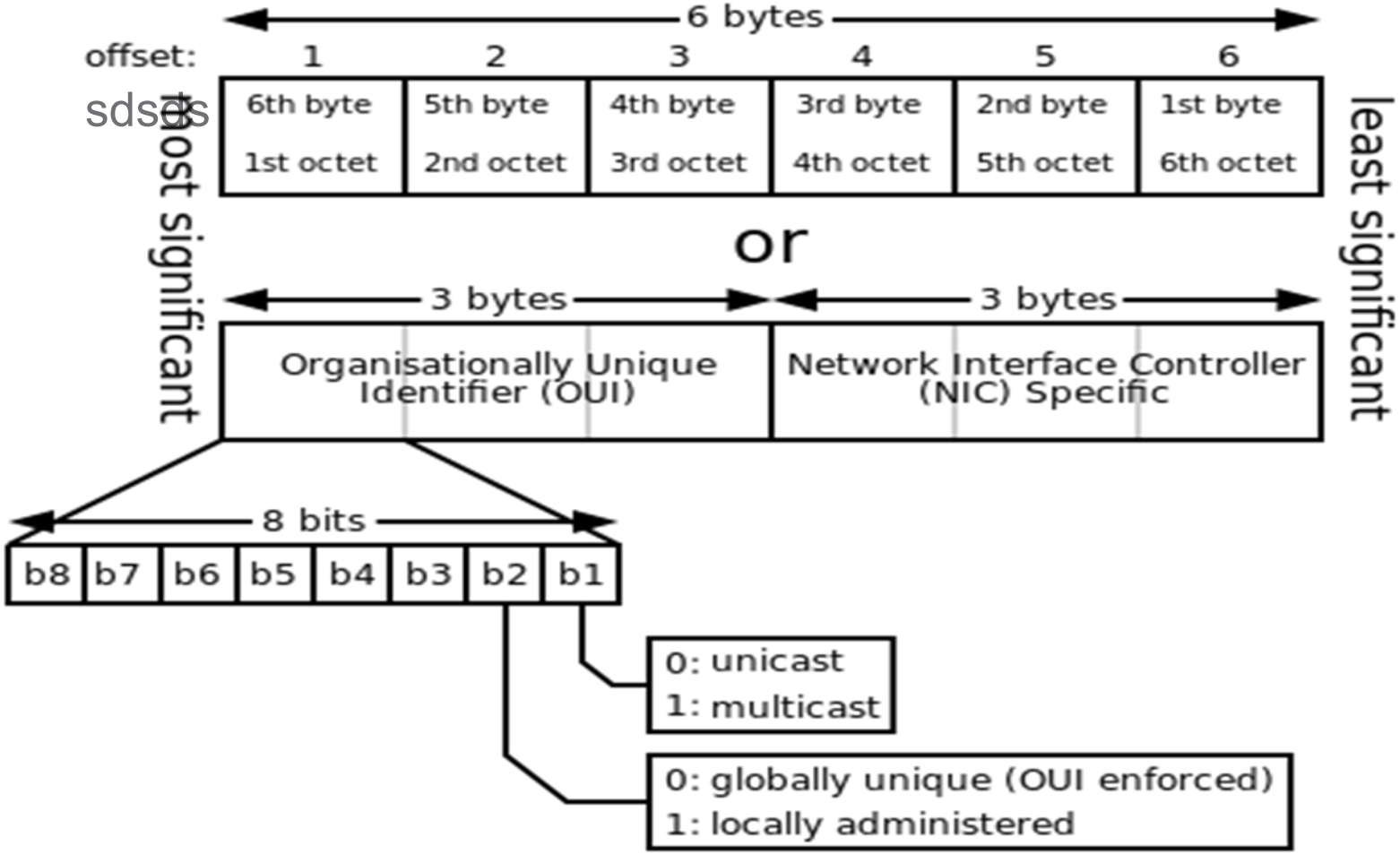
    -is a 48 bits identifier
    -Format of the MAC address:

    MM:MM:MM:SS:SS:SS
    or
    MM-MM-MM-SS-SS-SS

    The first half of the MAC address contains the ID number of the adapter manufacturer. These IDs are regulated by an Internet standards organization. The second half of the MAC address represents the serial number assigned to the adapter by the manufacturer.

MAC

MAC Address



MAC

MAC Address

ARP table :

IP address	MAC address
192.168.2.122	00:03:47:96:E0:6B
192.168.2.123	00:03:47:96:7F:EB
192.168.2.1	00:90:0B:01:1D:F4
192.168.2.111	BA:BE:69:BA:BE:69
192.168.2.235	00:04:E2:9C:C4:43
192.168.2.111	00:1A:92:3A:99:D9

Optical Communication

Optical Communication

Optical Communication

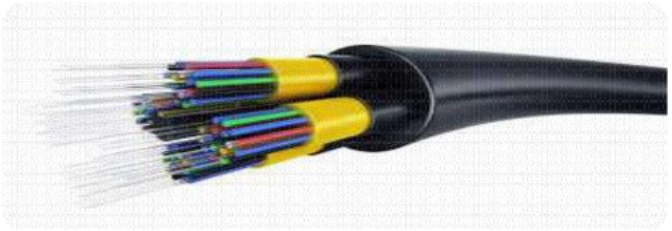
- Optical communication refers to the communication using optical media in network.

  Why Optical Network ?

  •Tremendous growth of the Internet and the World Wide Web in terms of
    - •number of users & the amount of time
    - •bandwidth taken by each user – internet traffic growing rapidly.
  - Need for more capacity in the network.
  - Need for more bandwidth and High speed network.
  - Need of providing quality of service(QoS) to carry performance sensitive applications (real-time voice, video etc.)

Optical Communication

Optical Fiber



• An Optical fiber is a flexible, transparent fiber made of high quality glass(silica) or plastic.

• It either functions as a waveguide or light pipe that transmits light between two ends of the fiber or fiber cable.

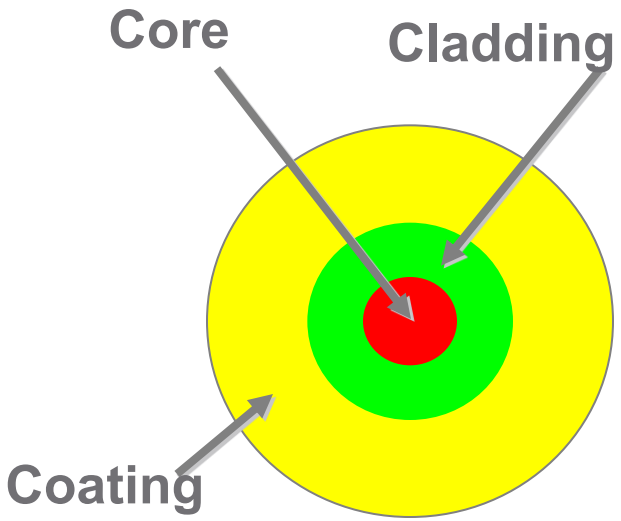
•Optical fibers are widely used in fiber-optic communication which permits transmission over long distances at higher bandwidths.

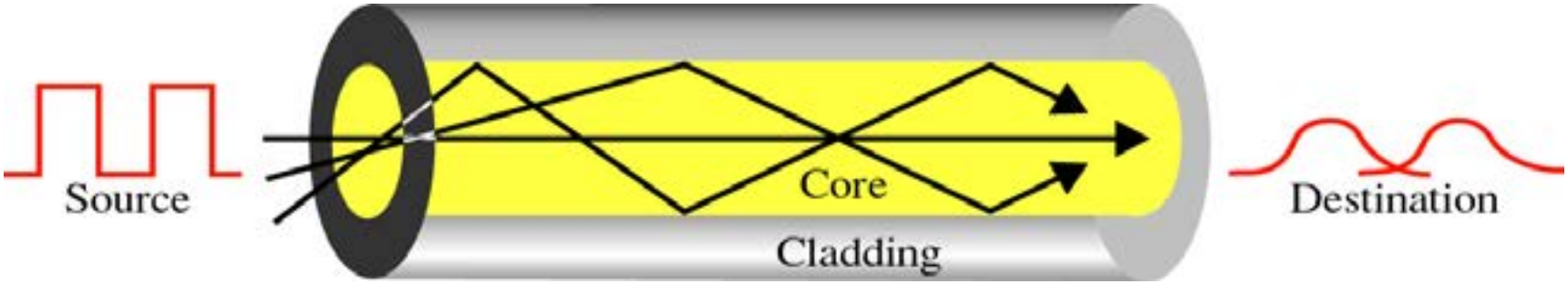
•Fibers are used instead of metal wires because signal travels along them less loss & also safe to electromagnetic interference.

Optical Communication

Optical Fiber

- Allowing transmission of information using pulses of light
- An optical fiber is made of three sections:
  - The core carries the light signals
  - The cladding keeps the light in the core
  - The coating protects the glass





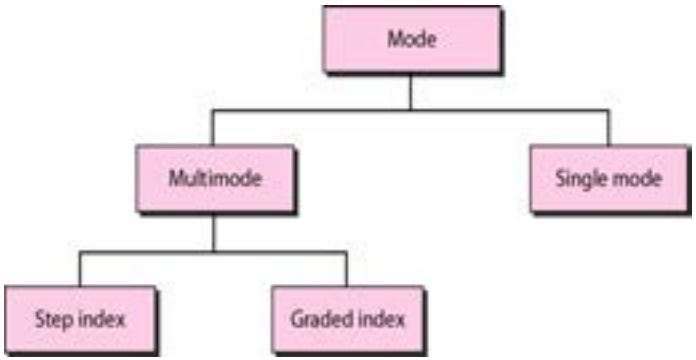
Optical Communication

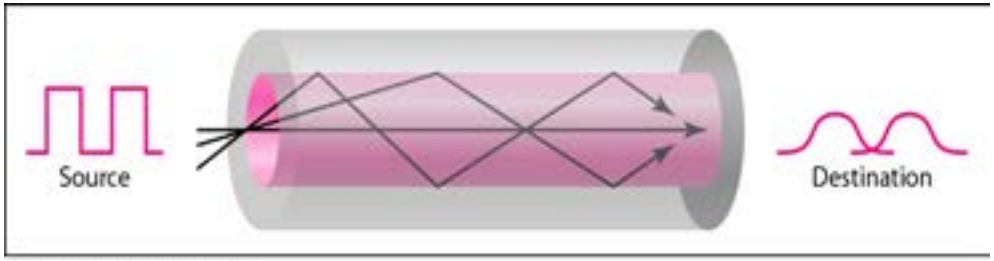
Optical Fiber Types - Single mode & multimode

- Single-mode fiber
  - Carries light pulses

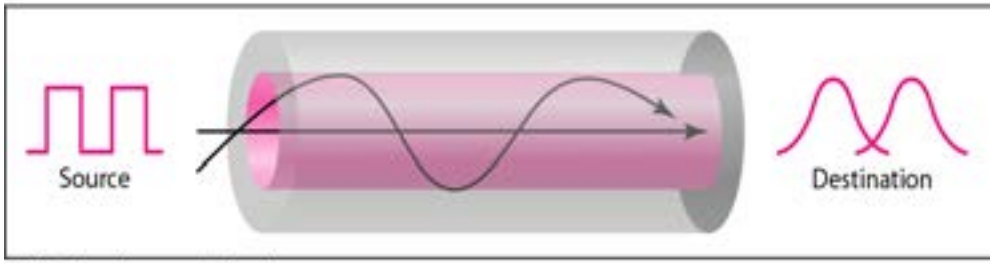
  by laser along single path
- Multimode fiber
  - Many pulses of light generated by LED

    travel at different angles

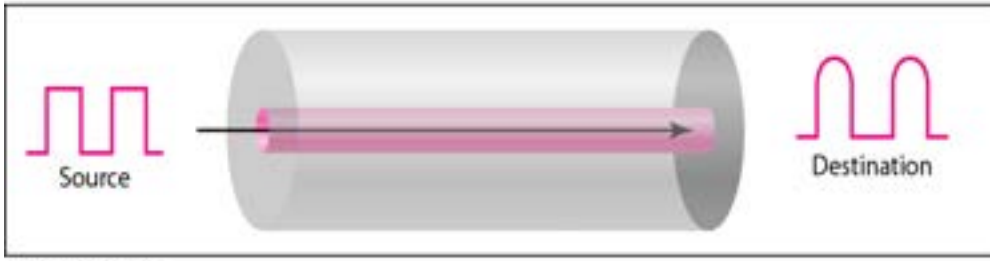




a. Multimode, step index



b. Multimode, graded index



c. Single mode

Optical Communication

Comparing Optical Fiber to UTP

Pros:

- Immune to electro-magnetic interference
  - no crosstalk
- Reduced need for error detection and correction
- Enables longer link distances
- Attenuation unaffected by transmission rate
- Easier network upgrade
- Can combine different services: telephony, TV, internet…

Cons:

- Optical components have higher cost
- Expensive deploying

Cloud Technologies

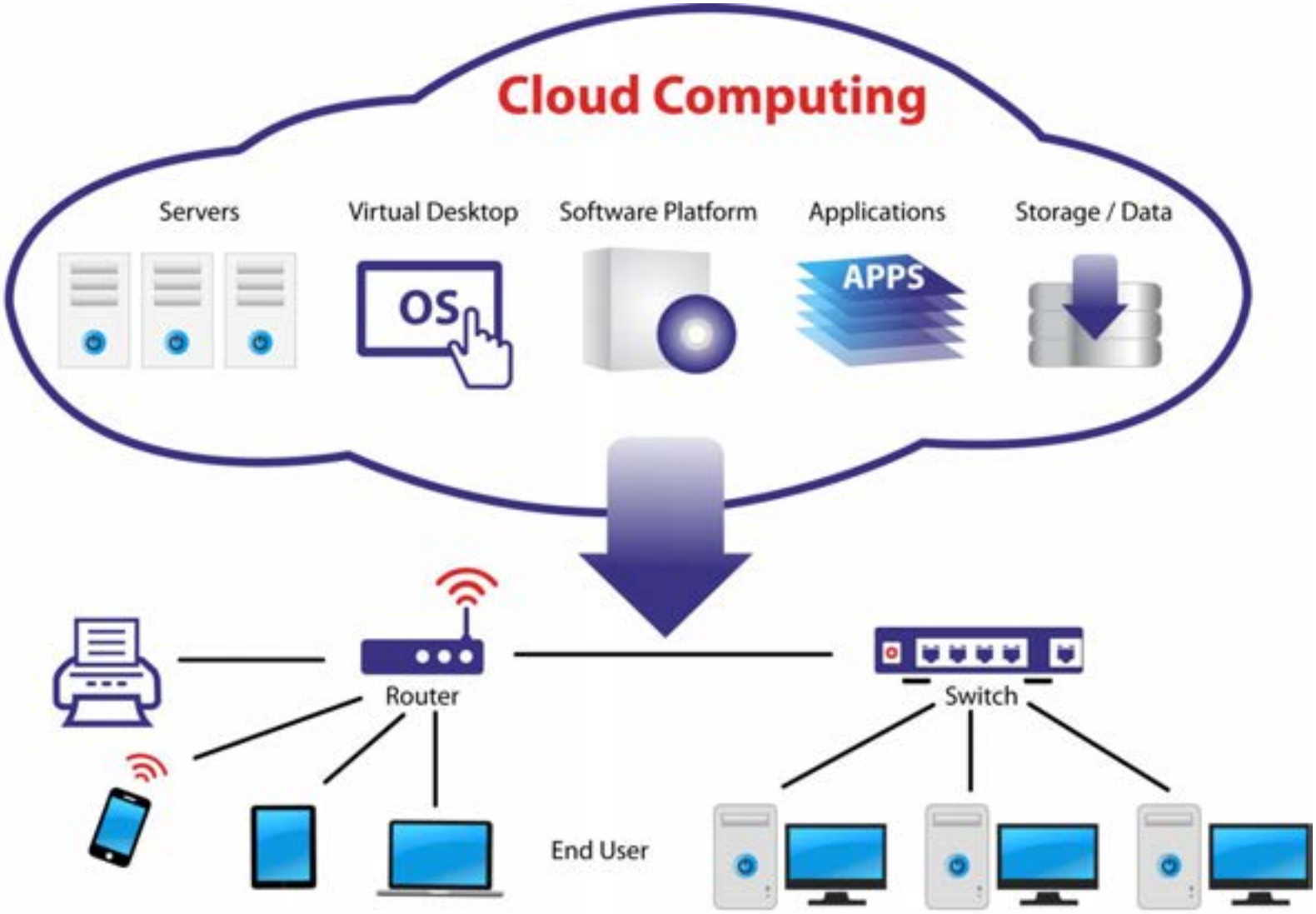
Cloud Technologies

Cloud Computing

- Simply put, cloud computing is the delivery of computing services—servers, storage, databases, networking, software, analytics and more—over the Internet (—the cloud”).

- *"The concept, quite simply, is that vast computing resources will reside somewhere out there in the ether (rather than in your computer room) and we'll connect to them and use them as needed."*

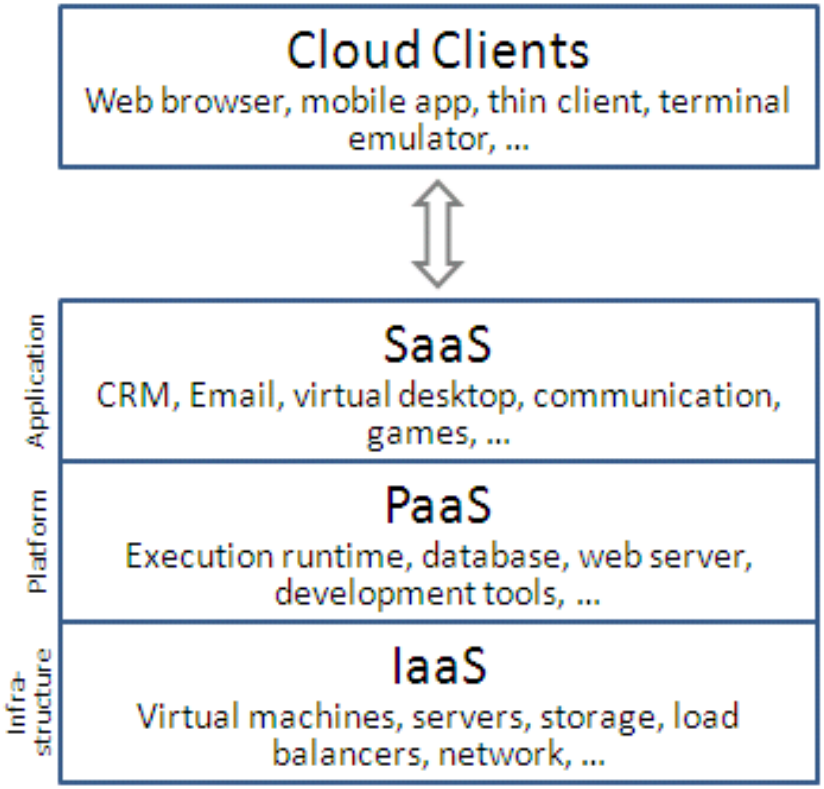
Cloud Technologies



Cloud Technologies

Cloud Computing Services

- Software as a Service (SaaS)- End Users
- Platform as a Service (PaaS)- Application Developers
- Infrastructure as a Service (IaaS)- Network



Cloud Technologies

Software as a Services (SaaS)- End Users

- Sometimes referred to as —On-demand Software”.
- Model for the distribution of software where customers access software over the Internet
- Major characteristics
  - Updates are applied automatically without customer intervention
  - The service is purchased on a subscription basis
  - No hardware is required to be installed by the customer

Cloud Technologies

Platform as a Services (PaaS)- Application Developers

- refers to cloud computing services that supply an on-demand environment for developing, testing, delivering and managing software applications.
- In the PaaS model, cloud providers deliver a computing platform and/or solution stack typically including operating system, programming language execution environment, database, and web server.
- Can run existing applications, or to design, develop, test, deploy and host applications.

Cloud Technologies

Infrastructure as a Services (IaaS)- network

- Also known as hardware as a service.
- Typically, IaaS provides hardware, storage, servers and data center space or network components; it may also include software.
- Characteristics include:
  - Automated administrative tasks
  - Dynamic scaling
  - Platform virtualization
  - Internet connectivity

Cloud Technologies

Types of Cloud Deployment

- Public Cloud
  - Computing infrastructure is hosted by cloud vendor at the vendors premises.
  - and can be shared by various organizations.
  - E.g. : Amazon, Google, Microsoft, Sales force
- Private Cloud
  - The computing infrastructure is dedicated to a particular organization and not shared with other organizations.
  - more expensive and more secure when compare to public cloud.
  - E.g. : HP data center, IBM, Sun, Oracle, 3tera
- Hybrid Cloud
  - Organizations may host critical applications on private clouds.
  - where as relatively less security concerns on public cloud.
  - usage of both public and private together is called hybrid cloud.

Thank You

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Earthquake Monitoring & EQ Information Dissemination

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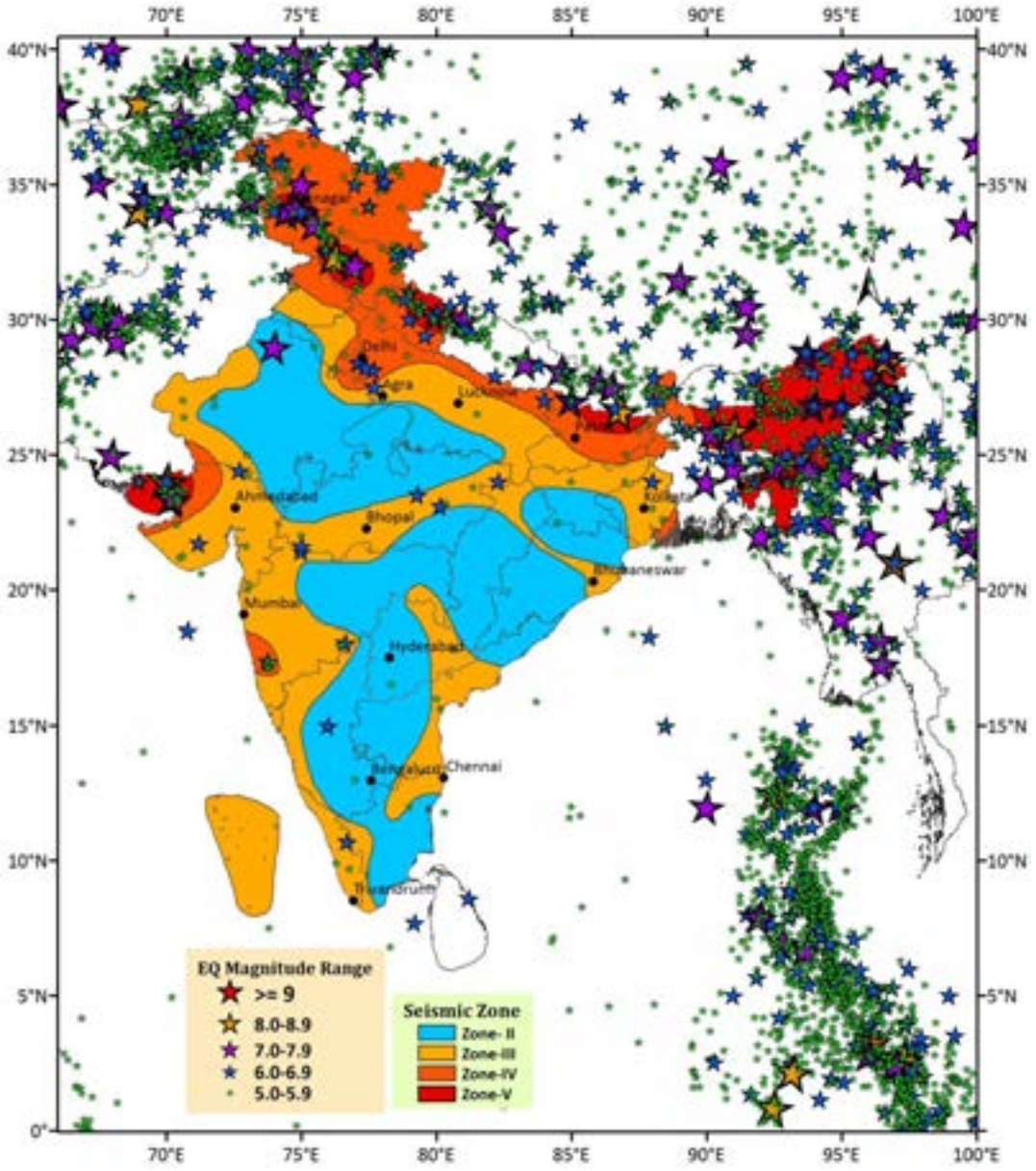
Seismicity around INDIA

(From 1505 to 2017)

Indian subcontinent is vulnerable to earthquakes because of:

- **Continent Collision in north**
- **Subduction in east**
- **intra-plate activity in peninsular domain**



Amongst all natural hazards Earthquakes have caused most Casualties and loss to Properties in India

– Manipur Earthquake (4 Jan 2016)	M:6.7 (33)
– Nepal Earthquake (25 April 2015)	M:7.9 (30)
– Sikkim–Nepal (2011)	M:6.8 (71)
– Pakistan (2005)	M:7.4 (1,309 in India)
– Sumatra (2004)	M:9.3 (10,749 in India)
– Bhuj (2001)	M:7.7 (13,805)
– Chamoli (1999)	M:6.8 (103)
– Jabalpur (1997)	M:6.0 (39)
– Latur (1993)	M:6.3 (7,601)
– Uttarkashi (1991)	M:6.6 (769)

What is Earthquake ?

Ground shaking or vibrations of earth

caused by

passage of radiated seismic energy

generated by

(most commonly)

sudden slip on a fault,

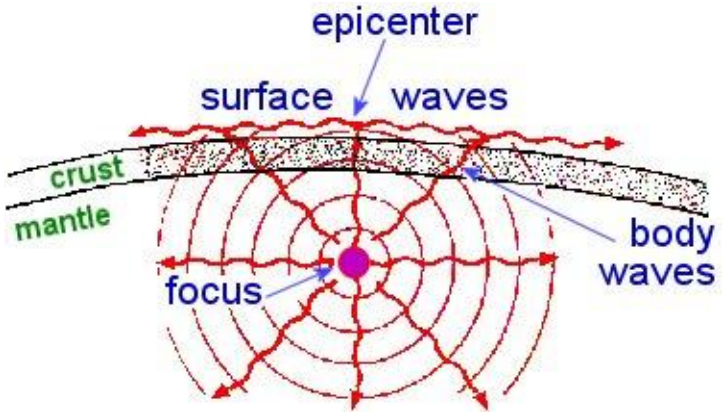
volcanic or any sudden stress change in the earth

Earthquakes release large amounts of elastic strain energy suddenly that has accumulated in the hypocentral region over decades to centuries or longer

This energy is partitioned into:

- radiated energy in the form of propagating seismic waves,
- energy consumed in overcoming fault friction,
- the energy which expands the rupture surface area or changes its properties (e.g., by pulverizing rock), and
- heat.

Note: The radiated seismic energy is a small fraction (about 7%) of the total energy budget, and it can be estimated using the recorded seismograms.

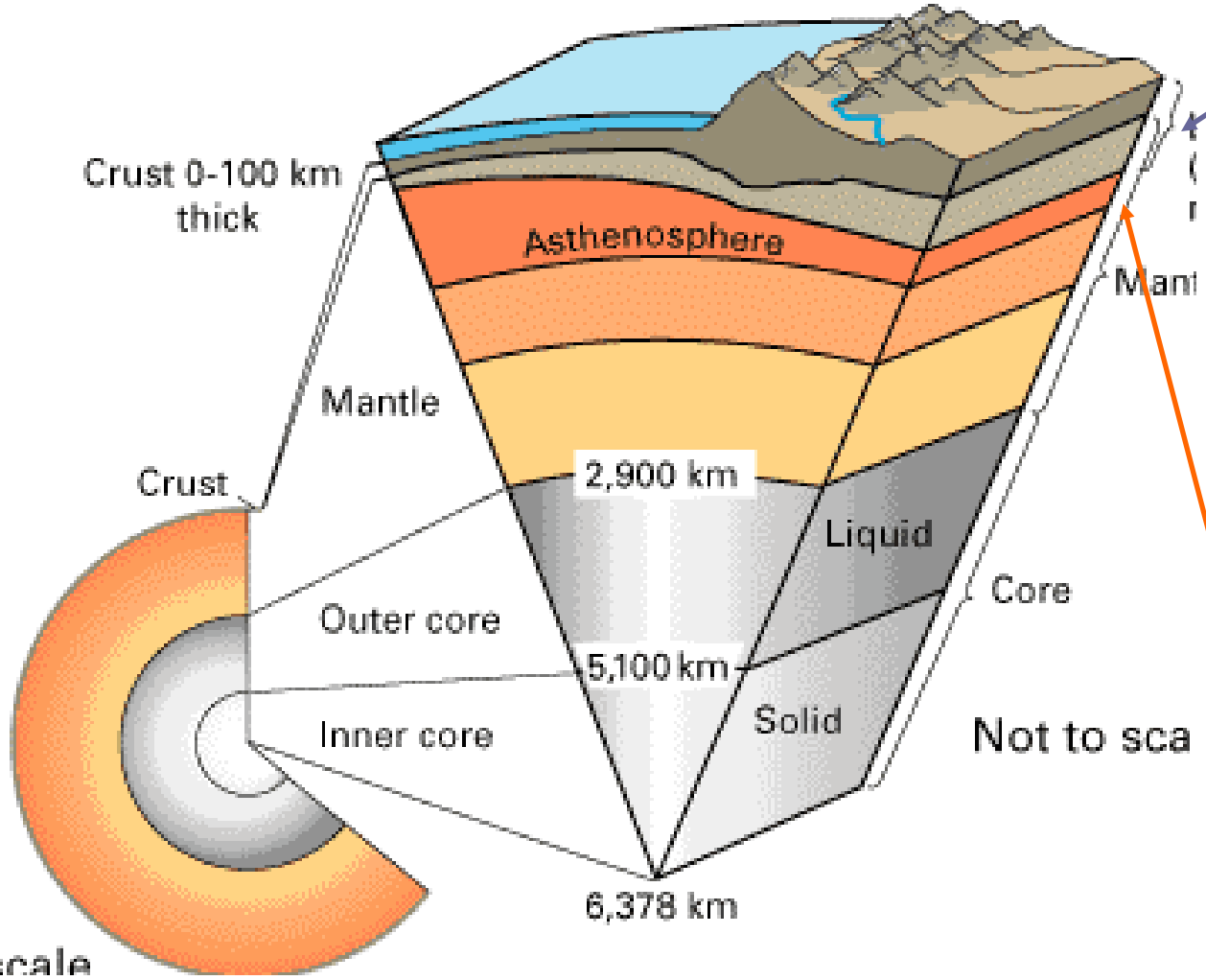


Some theoretical assumptions that explain the forces, which cause accumulation of stresses inside the earth:

- Drifting of continents and mountain building process.
- Shortening of Earth's crust due to cooling and contraction.
- Disturbance of mass distribution on the Earth's surface as a result of erosion of high lands and deposition of sediment in the sea.
- Generation of heat by radioactive material inside the Earth's crust.

Theory of Plate Tectonics:

According to the theory of Plate Tectonics, the uppermost part of the Earth is considered to be divided into two layers of distinct deformational properties.

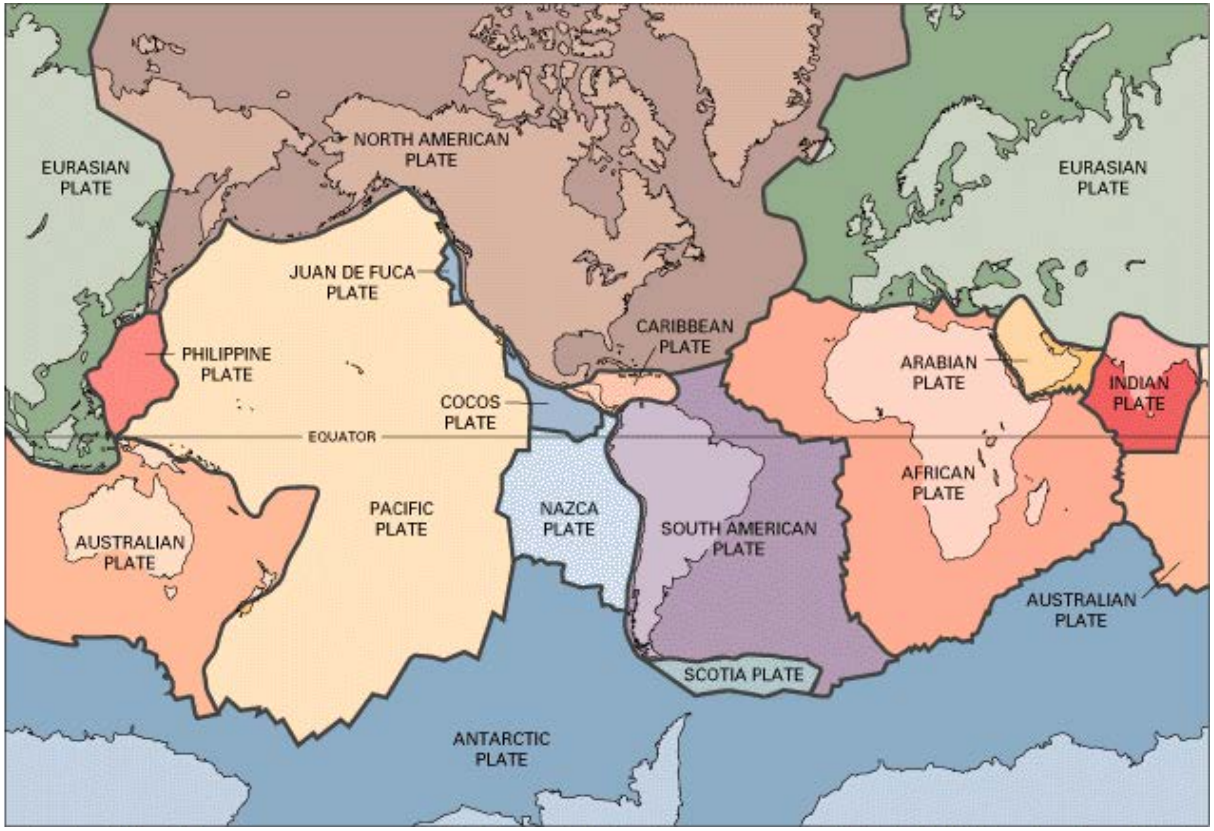


Lithosphere: The upper rigid layer (50-100 km) consists of crust + a part of rigid upper Mantle material.

Asthenosphere: The lower layer, (extends down to a depth of about 700 km)

consists of less brittle (more deformable) upper Mantle material

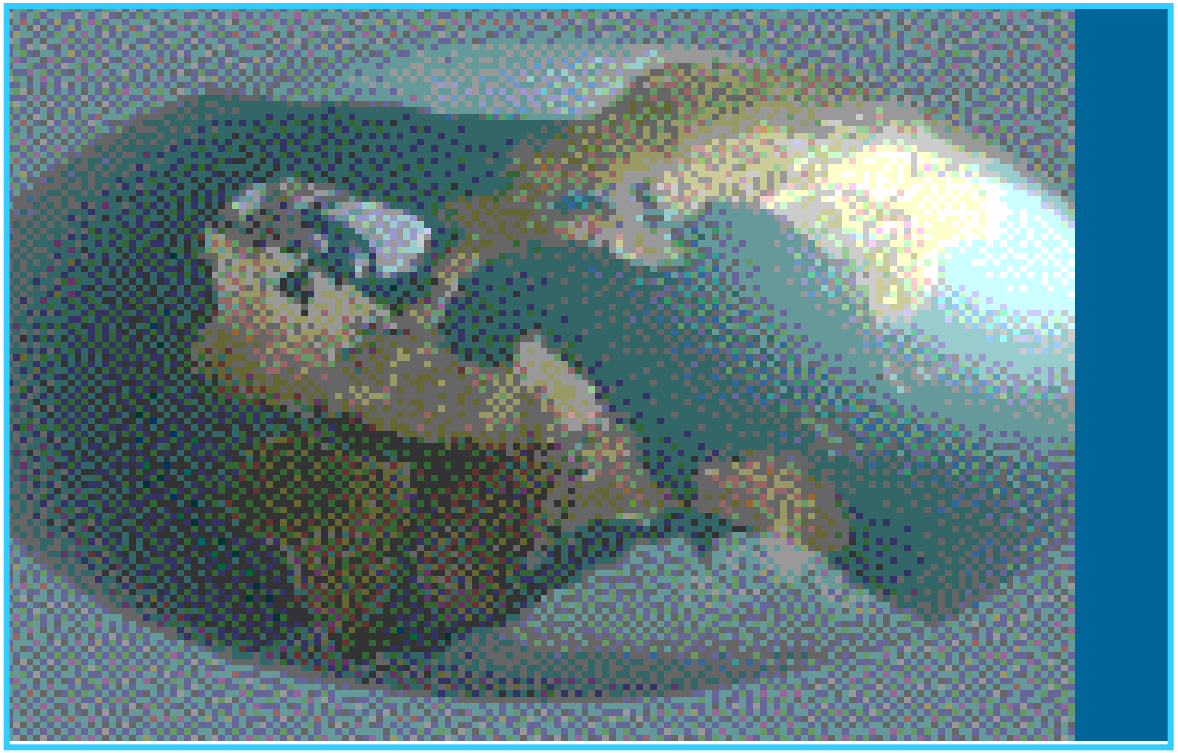
Theory of Plate Tectonics: (Cont'd)

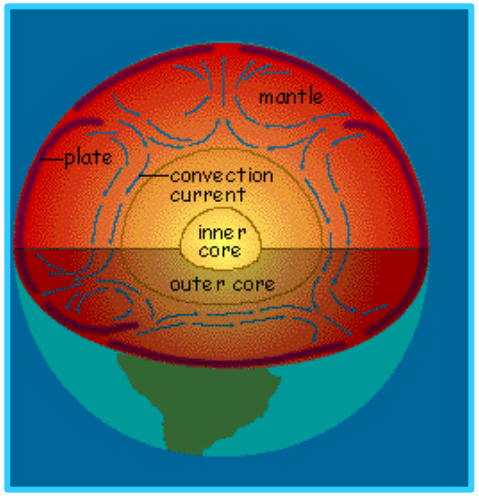


- The rigid lithospheric shell is broken into
  - Six continent sized plates and
  - about 14 of subcontinent sized smaller micro plates

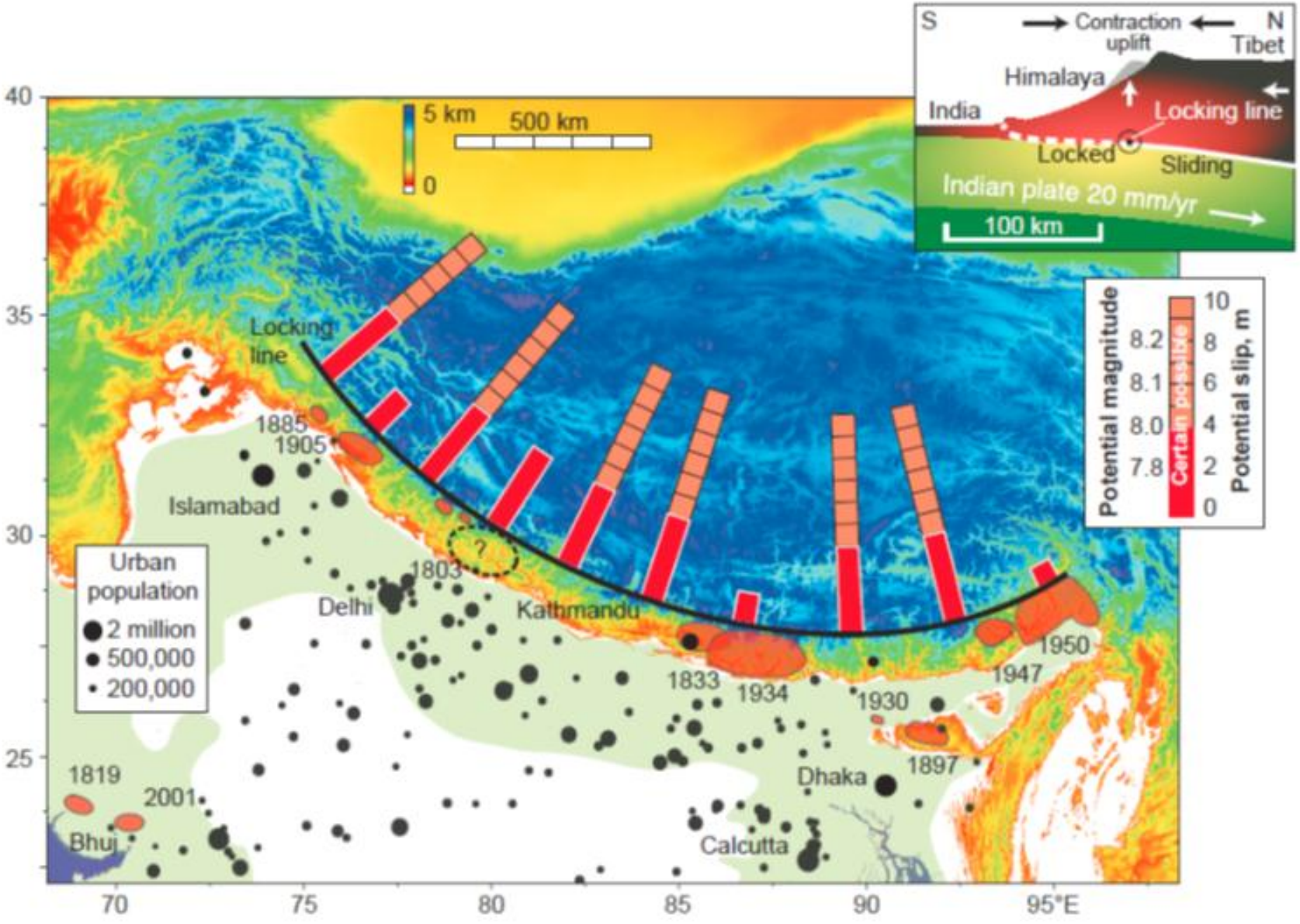
- The rigid lithospheric plates float on the less rigid, soft asthenosphere underneath
- These lithospheric plates are not stationary; constant motion with a velocity varying between 2-10 cm/year.

Theory of Plate Tectonics: (Cont'd)



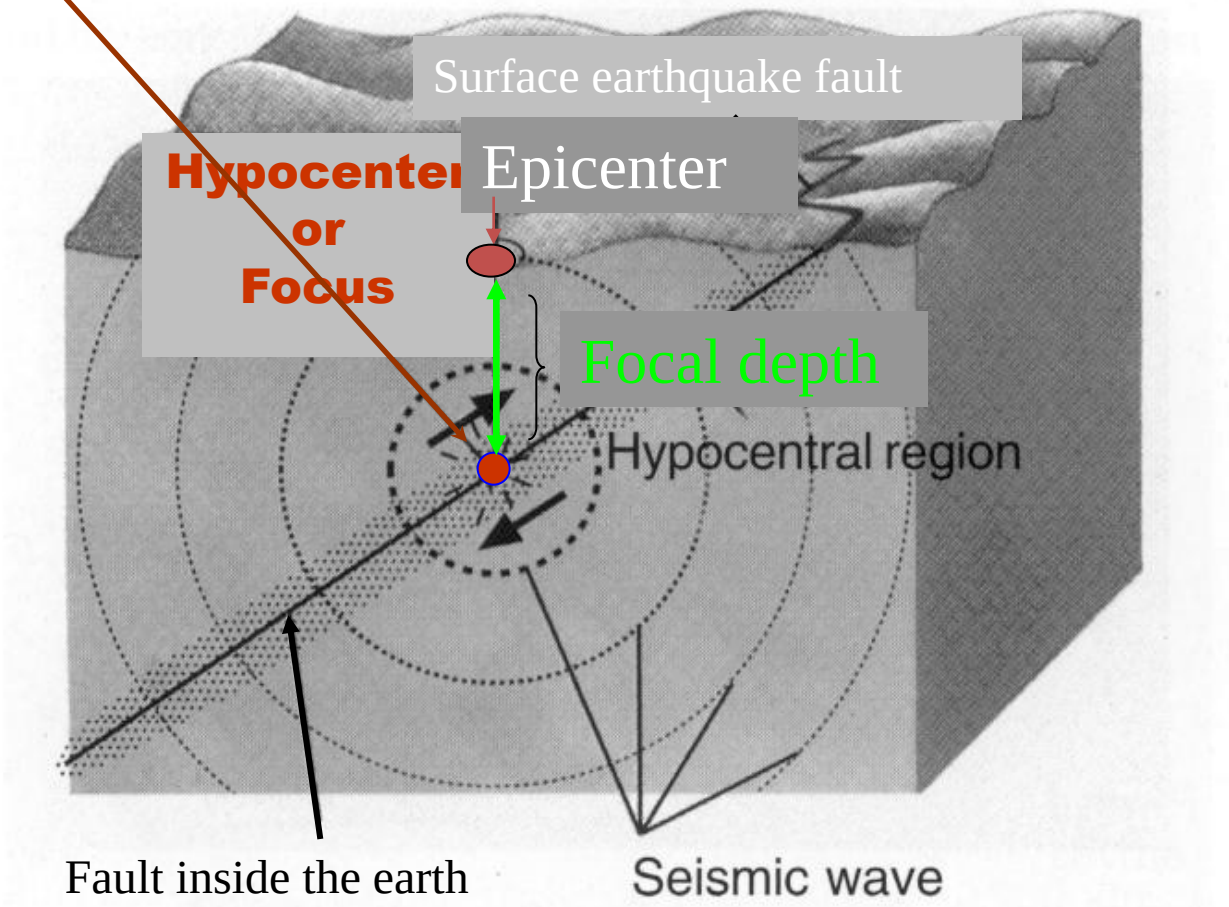


Convection currents in the semi molten rock of the Earth's mantle driven by the heat generated from within the Core is assumed to be the driving force for the movement of the lithospheric plates.


S
Contraction
uplift
N
Tibet
Himalaya
India
Locking line
Locked
Sliding
Indian plate 20 mm/yr
100 km
5 km
0
500 km
Locking line
1885
1905
Islamabad
1803
Delhi
Kathmandu
1833
1934
1930
1950
1947
1897
Dhaka
Calcutta
1819
2001
Bhuj
Urban population
2 million
500,000
200,000
Potential magnitude
8.2
8.1
8.0
7.8
Certain possible
Potential slip, m
10
8
6
4
2
0
40
35
30
25
70
75
80
85
90
95°E

Geometric representation of location of earthquake

Rupture may began from a point.



Size of Earthquakes

Qualitative description of the effect of the earthquakes:

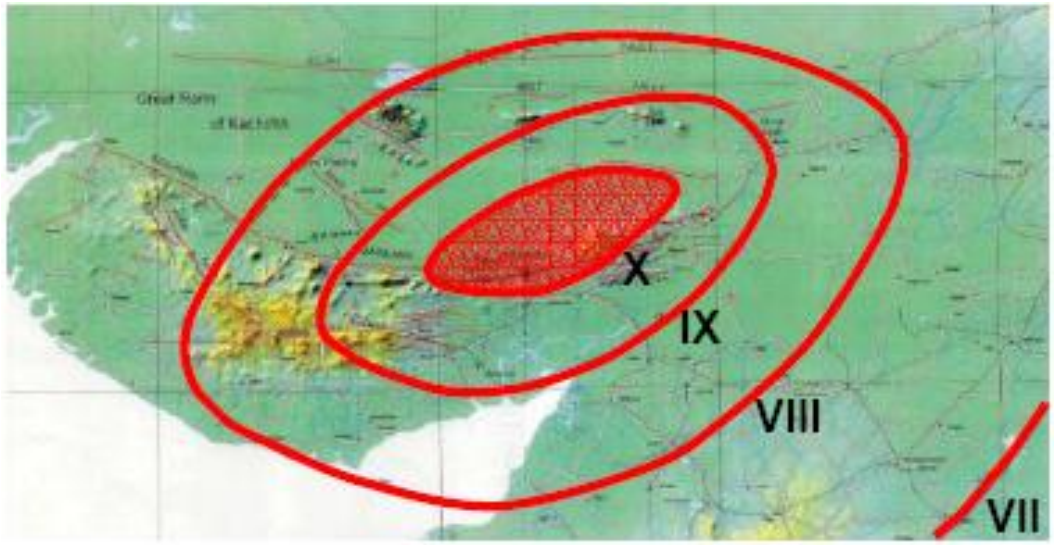
Intensity

Quantitative measures of earthquake size:

Magnitude

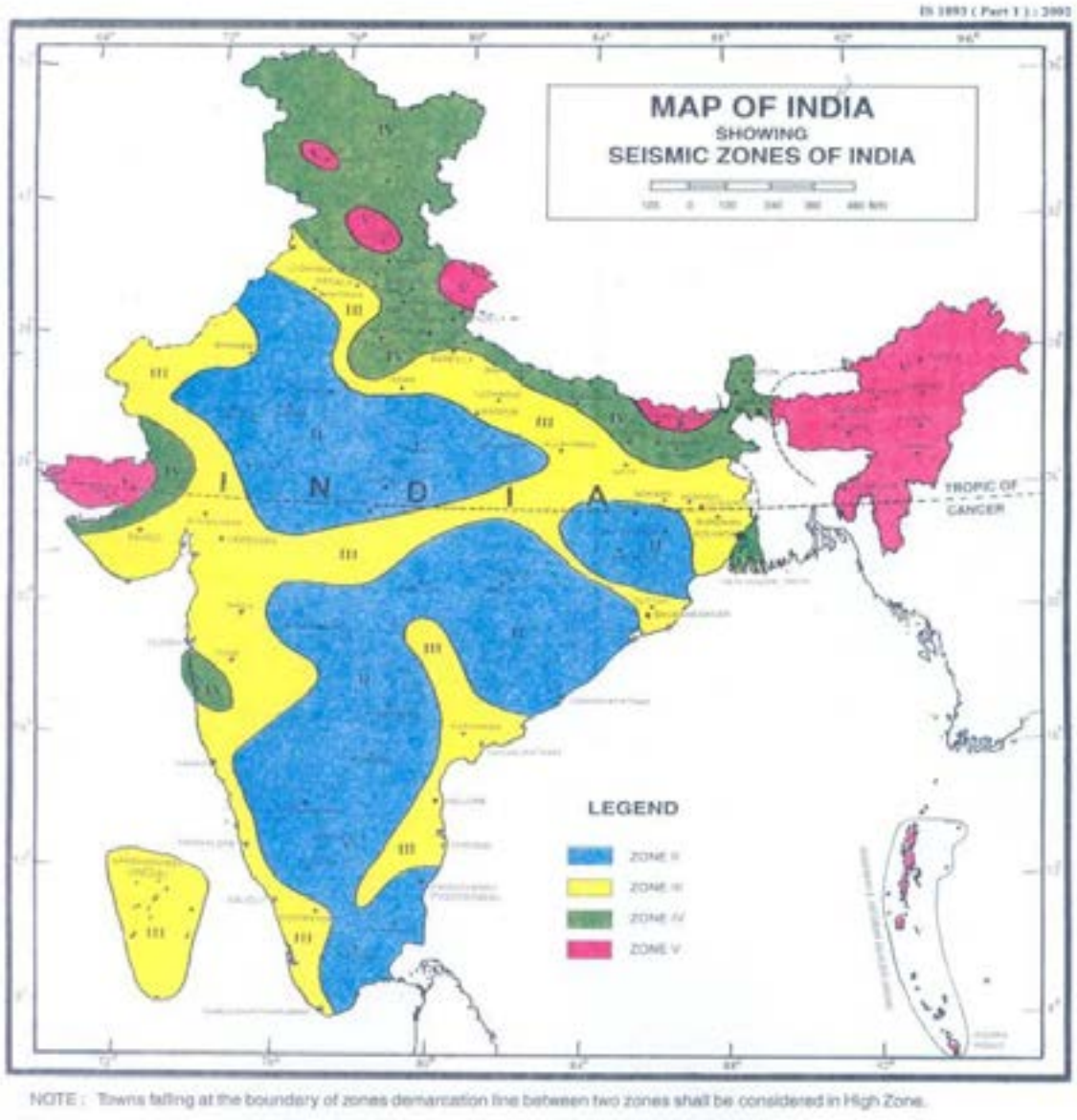
Intensity

- One of the most commonly used intensity scale is Modified Mercalli Intensity (MMI) scale. The others are (Medvedev-Sponheuer-Karnik) MSK intensity scale.
- Uses roman numeral ranging from I (generally unfelt) To XII (total destructive).
- Have advantages that it is inferred from human account, so can be determined where no seismometer was present.
- Often the best information available about the historical earthquakes.
- The variation of intensities with distance from an earthquake can be seen by plotting line of constant intensity know as Isoseismals.



Seismic Zoning Map of India

BIS [IS-1893 (Part-1): 2002]

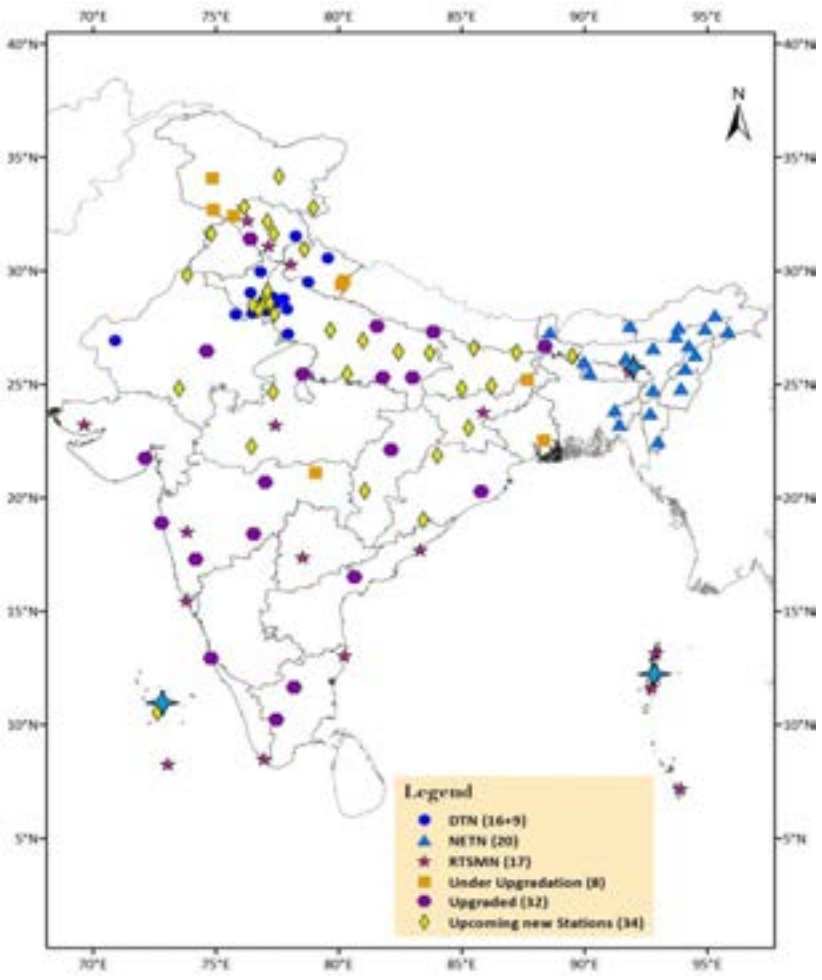


- Bureau of Indian Standards [IS-1893 (Part-1): 2002], has grouped the country into four seismic zones viz. Zone-II, -III, -IV and –V.
- Based on
  - Seismotectonics.
  - Incidences of seismicity.
  - Intensity experienced
- Of these, Zone V is the most seismically active region, while zone II is the least.

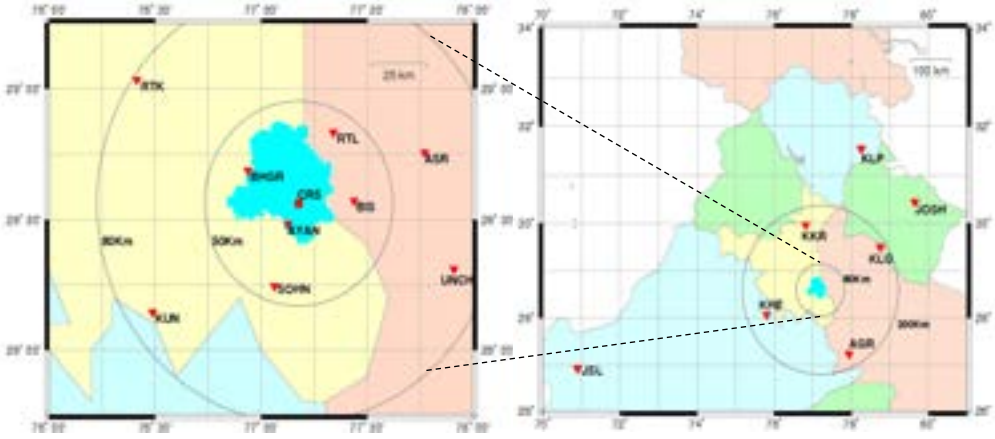
Seismic Zone	Intensity on MM / MSK intensities scales
II (Low intensity zone)	VI (or less)
III (Moderate intensity zone)	VII
IV (Severe intensity zone)	VIII
V (Very severe intensity zone)	IX (and above)

Seismic Zone	MMI PGA(g)	Area (%)
V (VERY SEVERE)	≥IX 0.49	12
IV (SEVERE)	VIII 0.25	18
III (MOD.)	VII 0.20	27
II (LOW)	≤VI 0.19	43

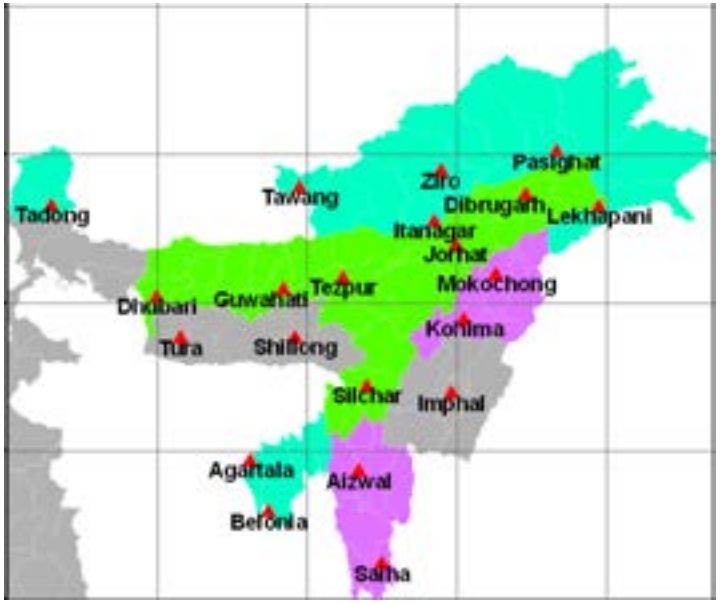
National Seismological Network



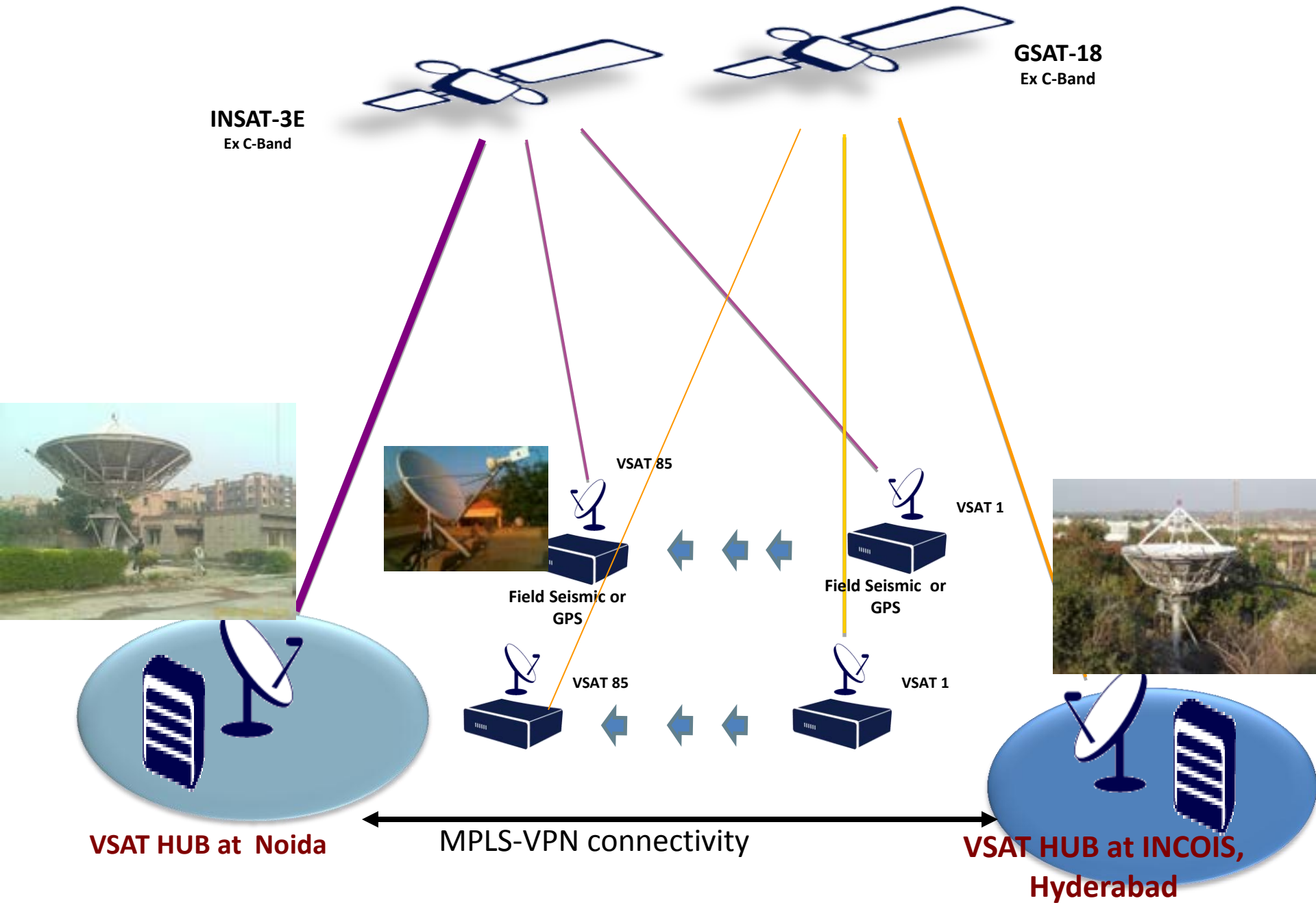
Delhi (25)



Northeast India (20)

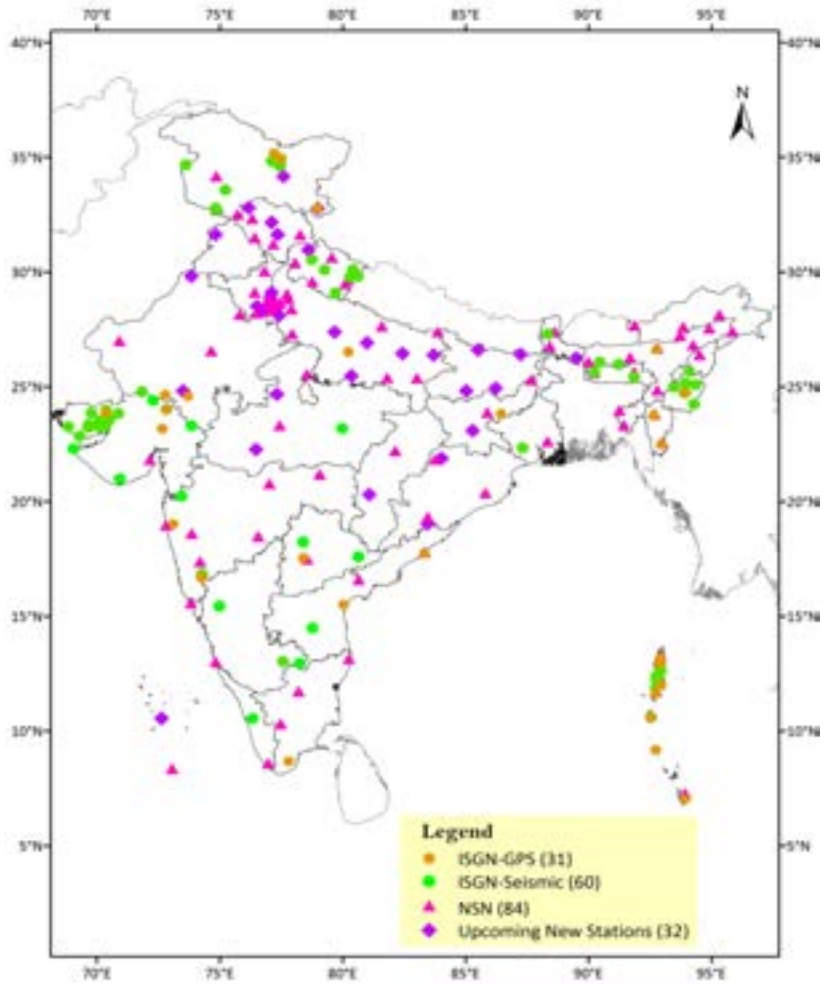


- 115 Seismological Observatories as on date.
- Transmission of continuous seismic waveform data of three seismic stations Portblair, Minicoy and Shillong to IRIS, USA.
- Monthly National Seismological Bulletins shared with ISC.
- Sharing of data with scientific community through ISGN portal (www.isgn.gov.in)


INSAT-3E
Ex C-Band
GSAT-18
Ex C-Band
VSAT 85
VSAT 1
Field Seismic or GPS
Field Seismic or GPS
VSAT 85
VSAT 1
VSAT HUB at Noida
MPLS-VPN connectivity
VSAT HUB at INCOIS, Hyderabad

Indian Seismic and GNSS Network

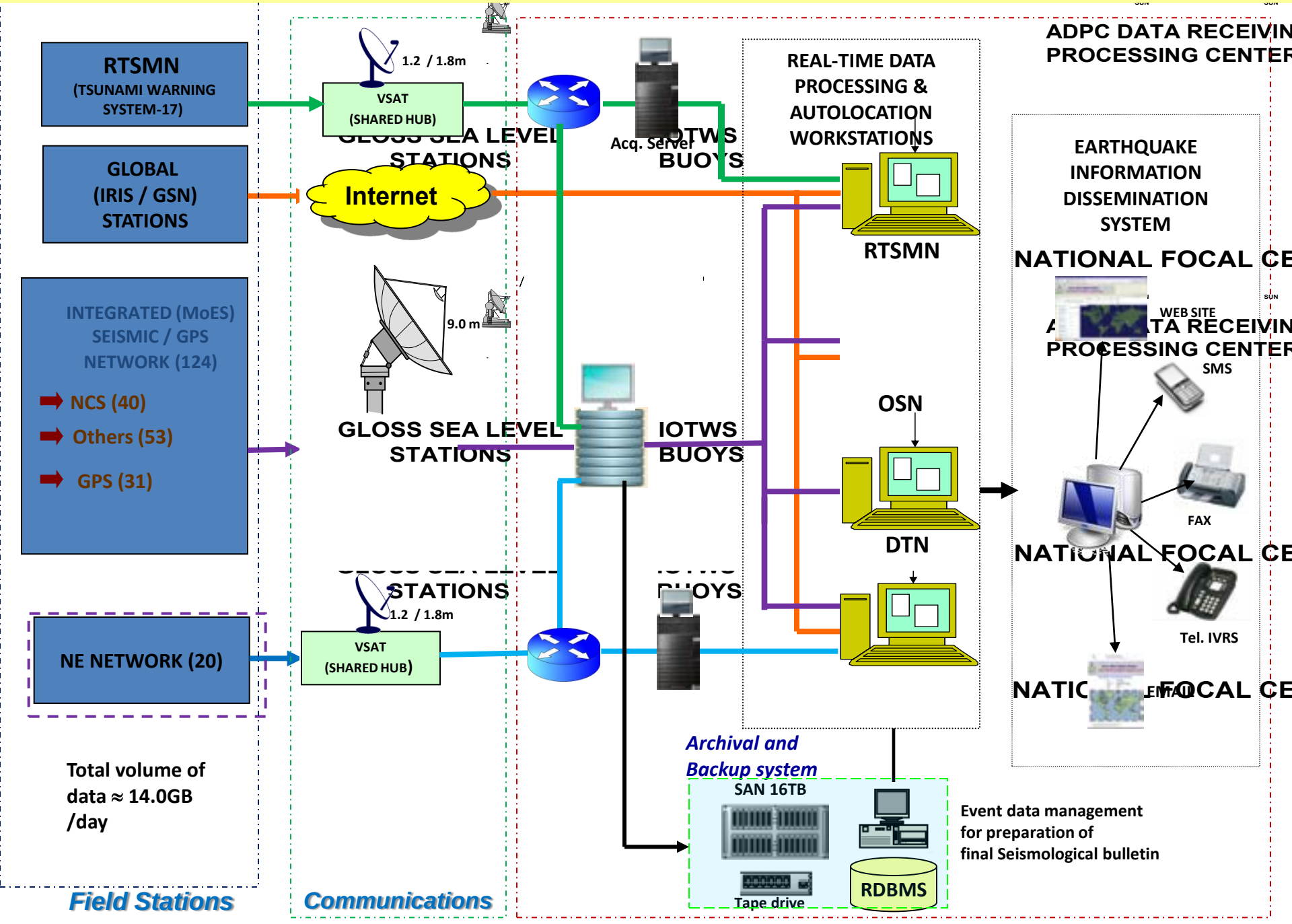
- Data from 168 stations (137 seismic + 31 GNSS) is being received at ISGN data centres.
- Currently 126 stations are through VSAT and 42 through terrestrial MPLS link.



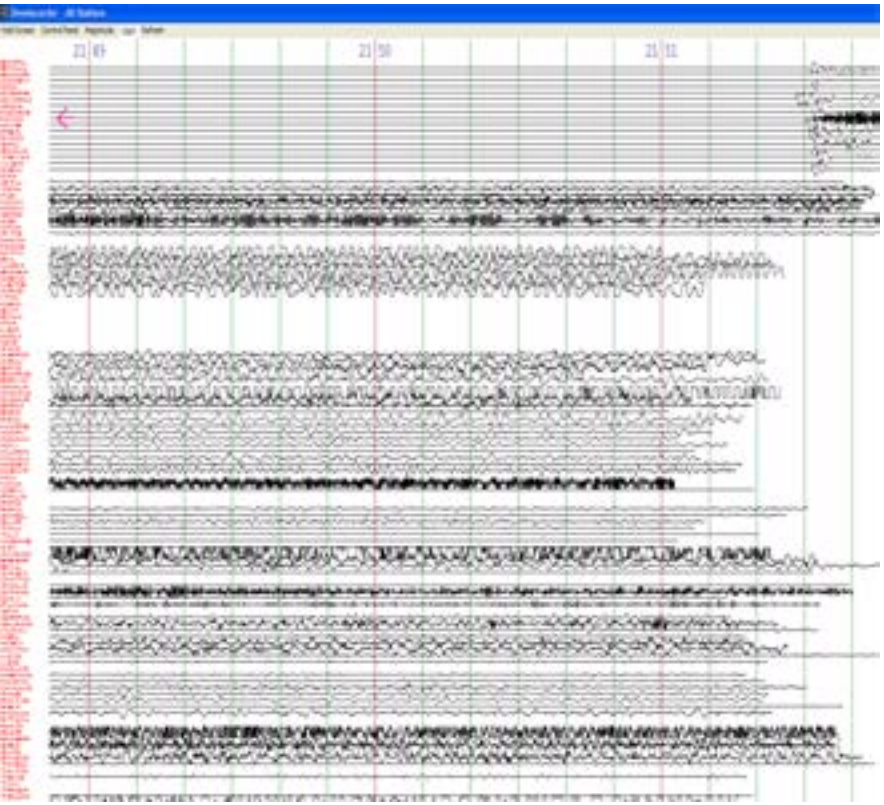
- At present 100 stations of NCS, integrated with VSAT
- Historical Data Archived at INCOIS & IMD: 4.5 TB (seismic)
- Data available via Web: (1.5 TB seismic + 320 GB GPS)
- No. of Users: 98 (PIs: 25 + Other users:73)
- Data provided to each PI per month: 5 to 10 GB in ftp

- Network is capable of accommodating 500 stations
- Andaman Network (GPS+SMA, 35 stations) by INCOIS: Procurement of VSATs in progress

SCHEMATIC OF SEISMOLOGICAL OPERATIONS



Real time earthquake monitoring on 24x7 basis

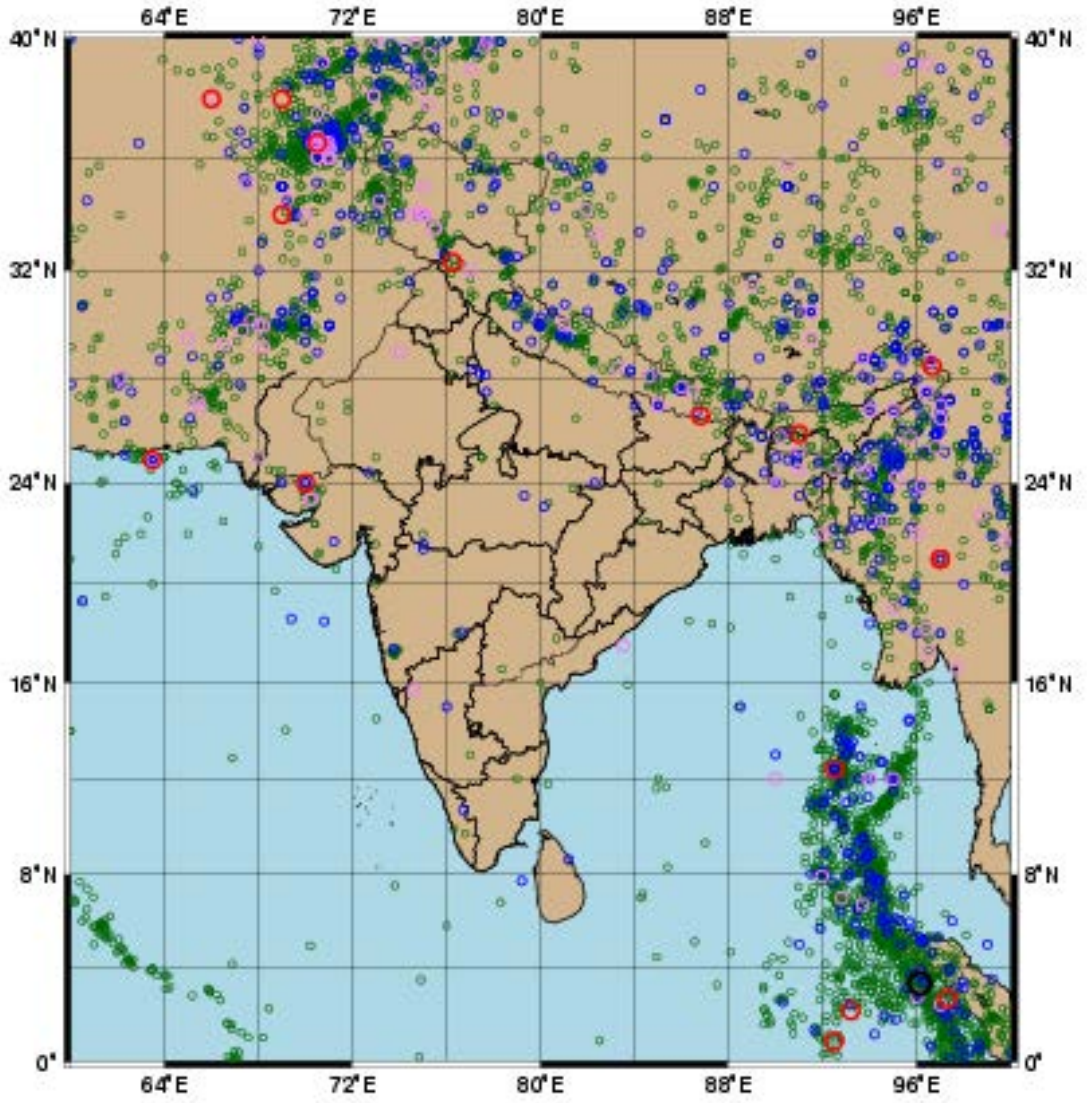


- Warning for future earthquakes is not possible. Timely dissemination of earthquake information, plays a very important role in dealing with the post-disaster relief and rehabilitation.
- National Center for Seismology, MoES maintains round-the-clock monitoring of seismic activity in and around the country.
- Operational task is to quickly estimate the source parameters, immediately after the occurrence, of earthquakes occurring in and around the country and disseminate the information to all concerned State and Central Government agencies responsible for carrying out relief and rehabilitation measures.
- A Control Room/CRS is in operation, on 24X7 basis, at IMD Headquarters in New Delhi with state-of-the-art facilities for data collection, processing and dissemination of information to the concerned user agencies.

Operational Capability of existing National Seismological Network

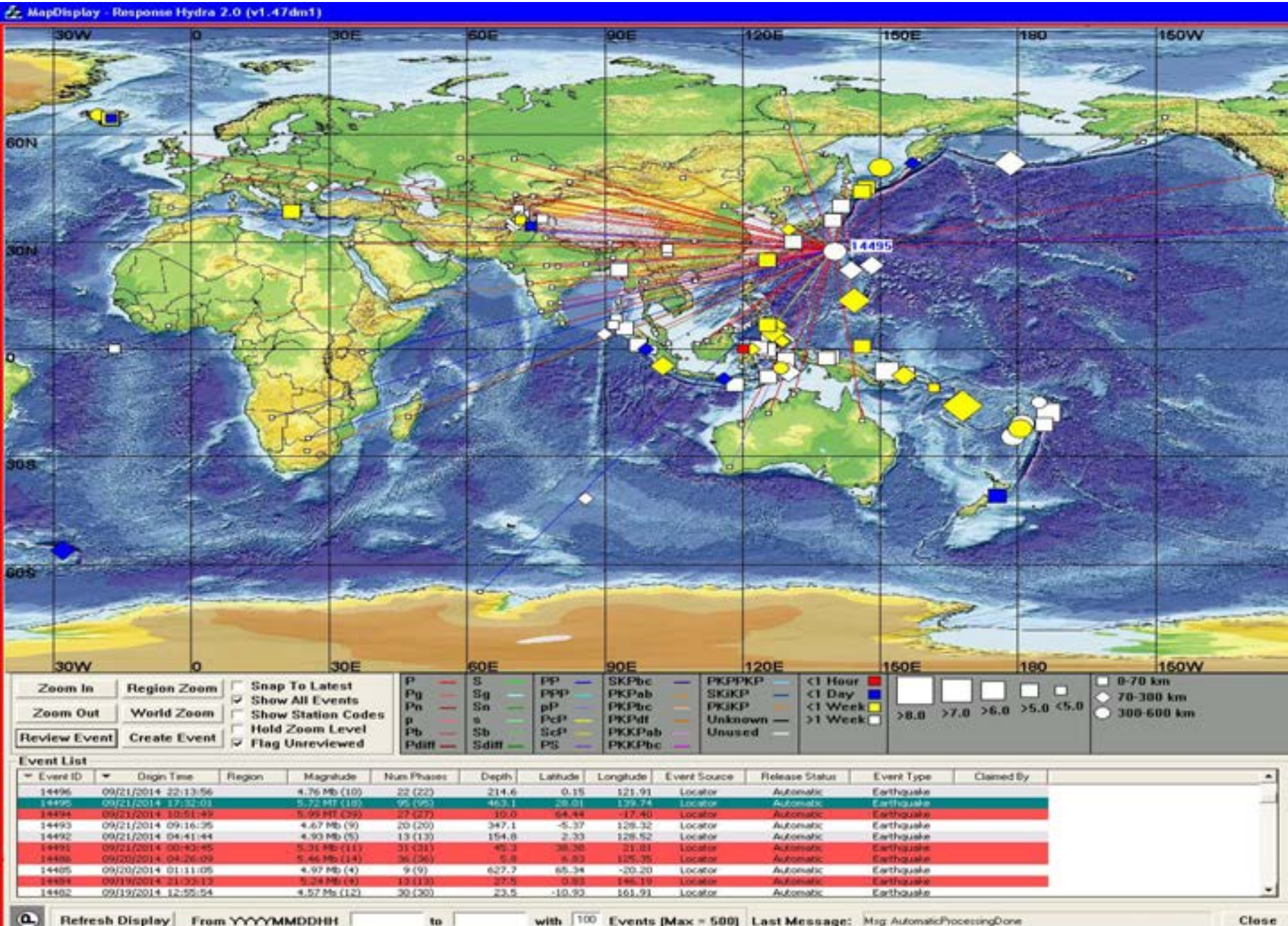
- *M≥3.0 - Peninsular Shield region.*
- *M≥3.0 – A&N Islands*
- *M≥3.0 - Extra-Peninsular Shield region.*
- *M≥3.0 - Border regions.*
- *M≥2.5 - Delhi and surroundings.*
- *M≥3.0 - North East India region.*
- *M≥6.0- EQ's of tsunami-genic potential in any part of the world.*

The present National Seismological Network earthquke detection capability is M≥3.0 for entire part of the country

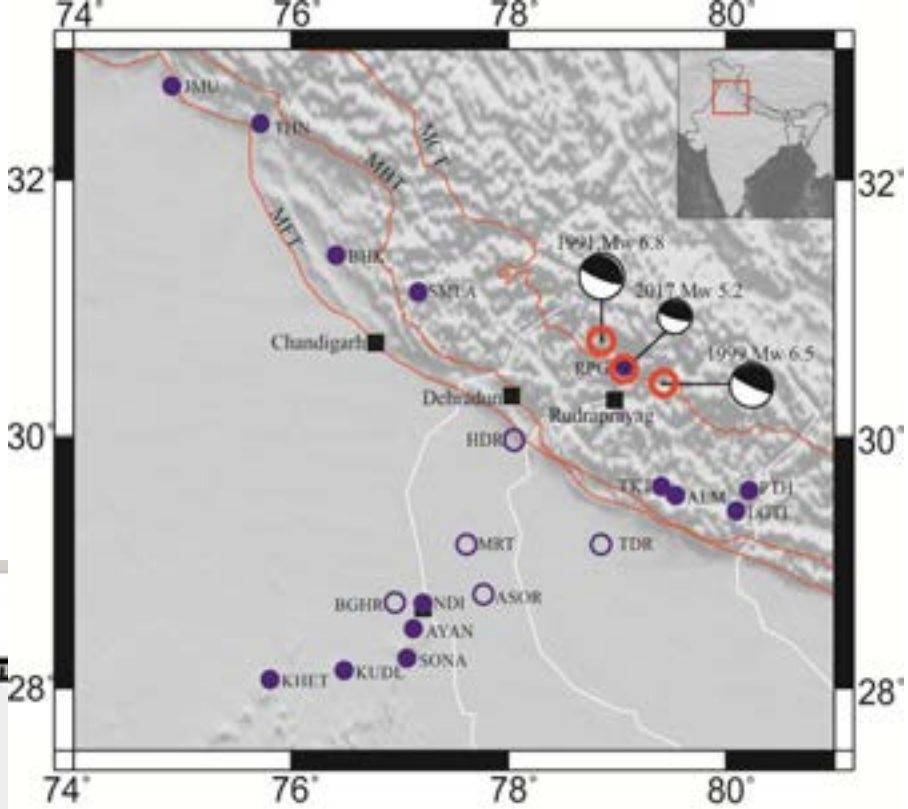


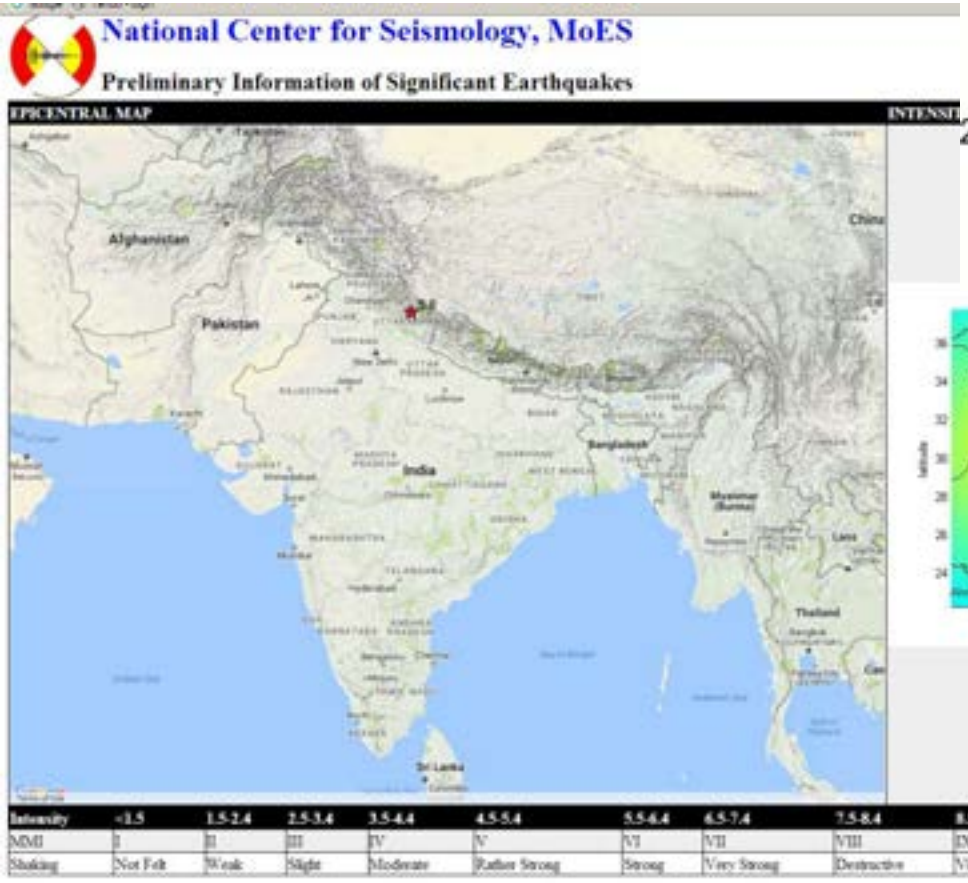
Seismicity (M ≥ 5.0 and above) in and around INDIA
(From 1505 to May 2018)

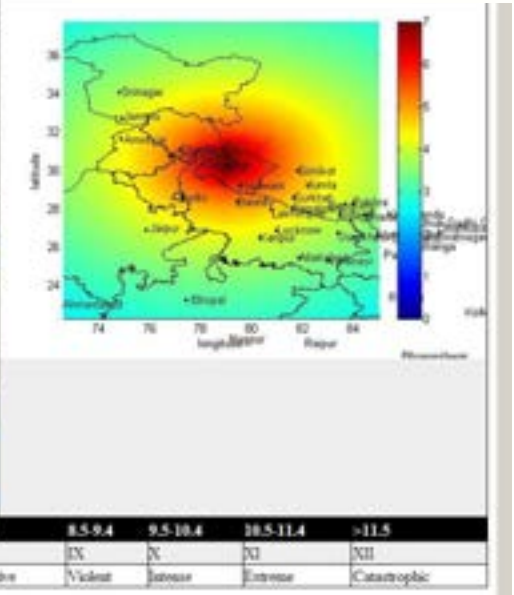
DISPLAY MAP OF EARTHQUAKE LOCATIONS



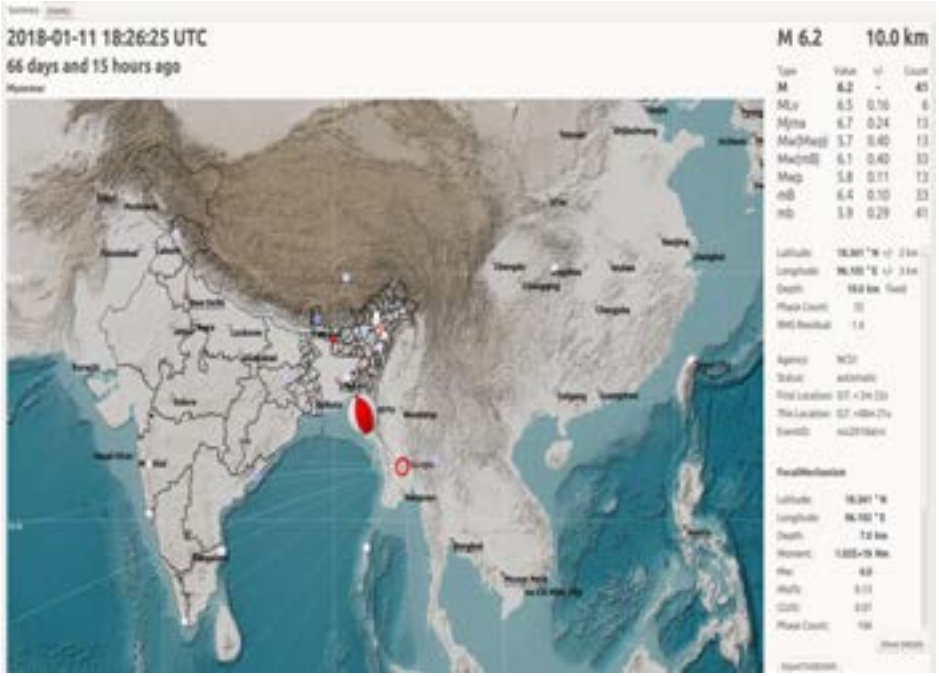
Location of Rudraprayag (6 February, 2017; Mw5.2) and five other earthquakes in/near the Uttarakhand region (4.6≤Mw≤6.8). Located at a depth of 14 km at an epicentral distance of 2.5 km south of the station RPG. Main Frontal Thrust (MFT), Main Boundary Thrust (MBT), and Main Central Thrust (MCT) are shown by red lines.

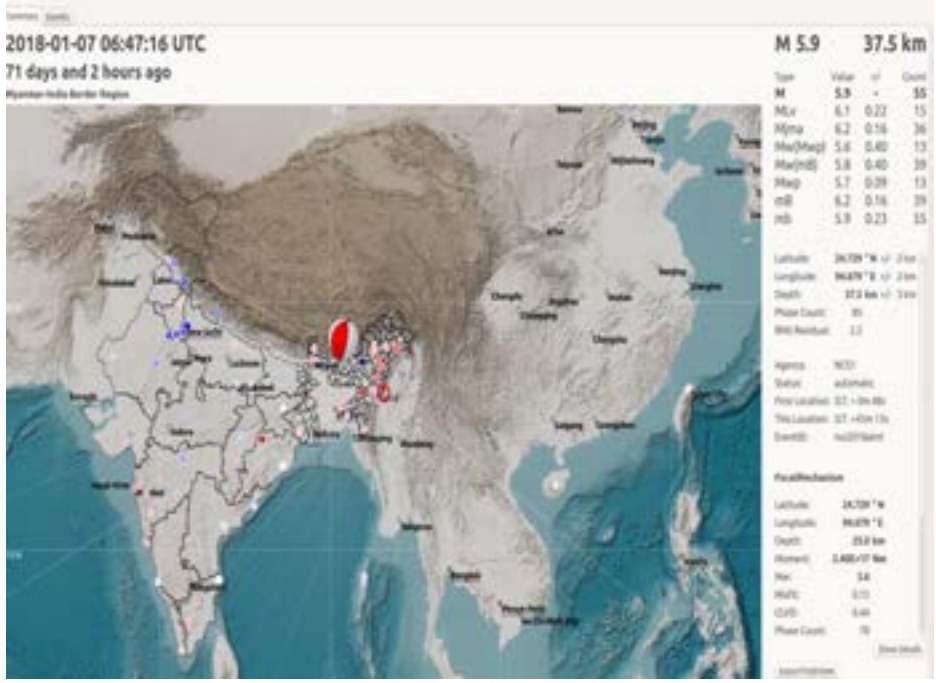


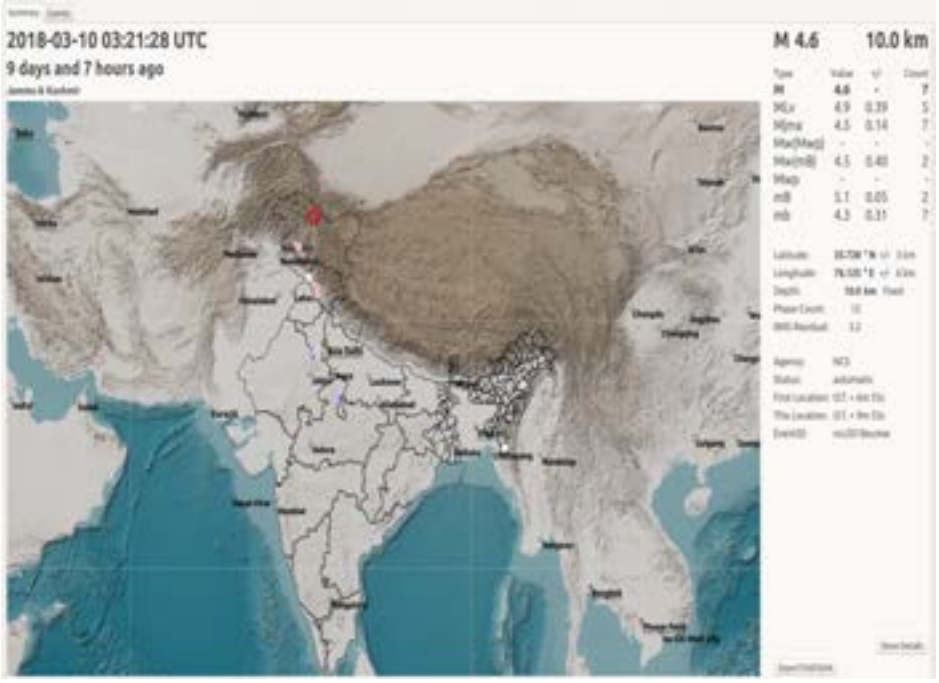





2018-01-14 09:19:28 UTC
64 days and 0 hours ago
M 5.7
179.1 km


2018-01-11 18:26:25 UTC
66 days and 15 hours ago
M 6.2
10.0 km

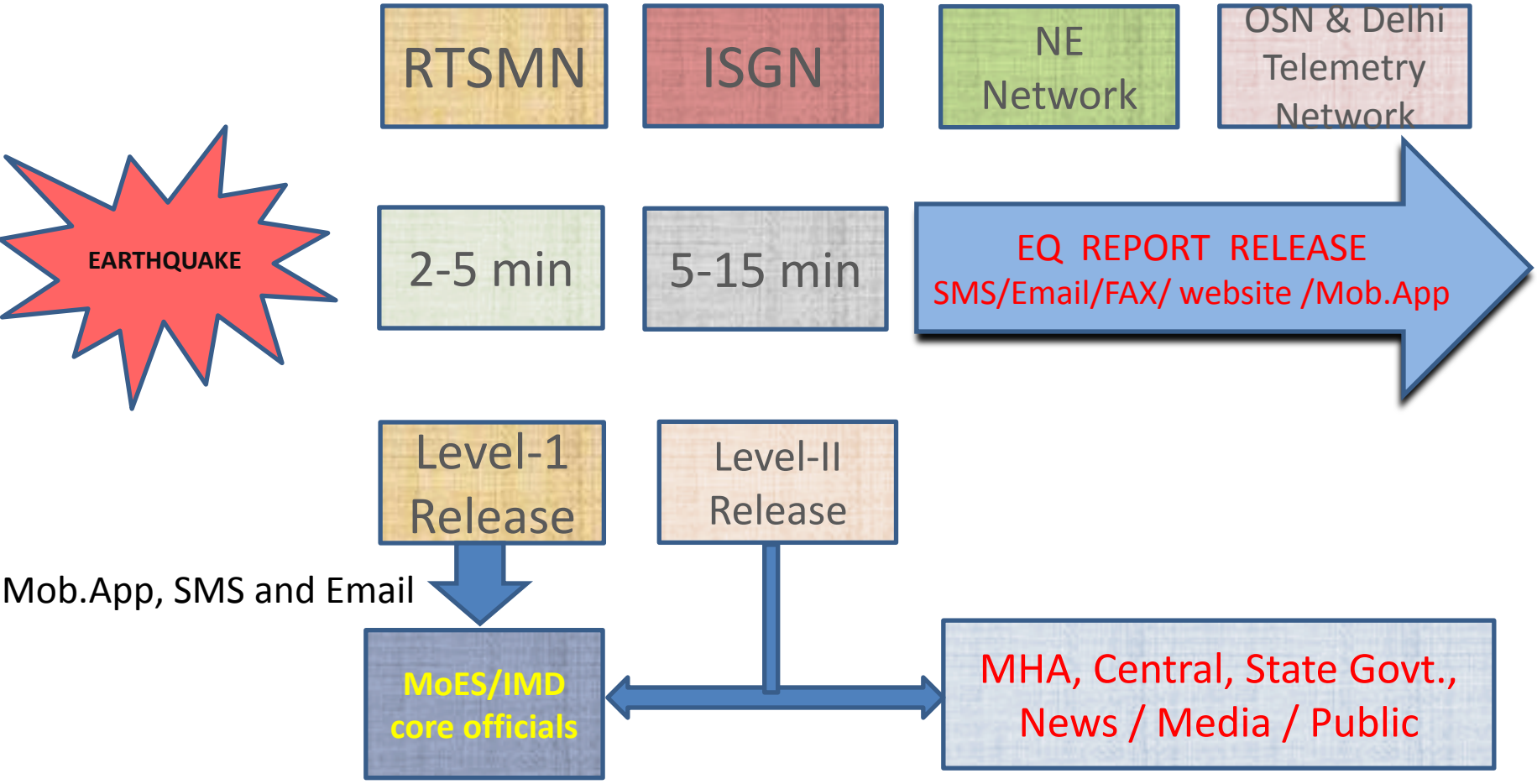

2018-01-07 06:47:16 UTC
71 days and 2 hours ago
M 5.9
37.5 km


2018-03-10 03:21:28 UTC
9 days and 7 hours ago
M 4.6
10.0 km

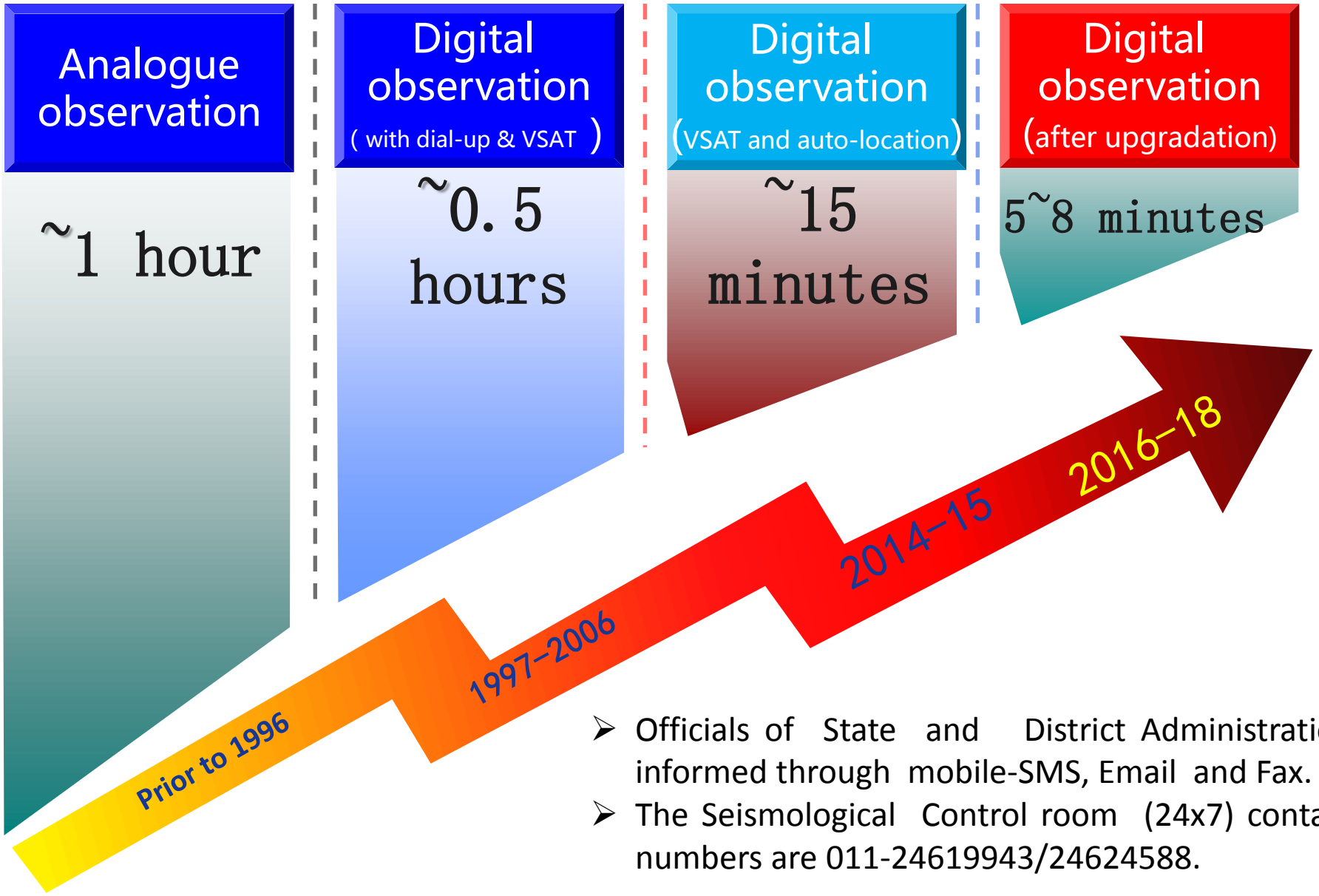
INDIA QUAKE is a free app for Android and iPhone users

- Provides EQ alerts with earthquake parameters.
- Location of Epicentre on a map & distance and direction of epicentre from important cities/towns.

EQ Report Release

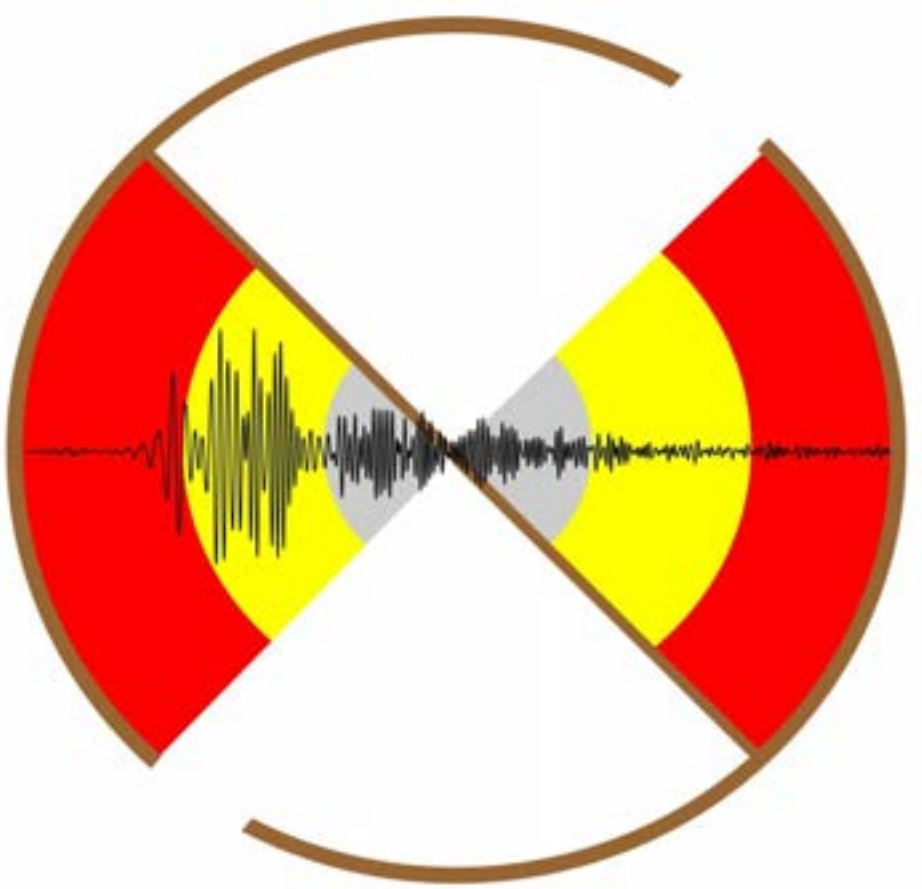


Response time - Status



- Officials of State and District Administration informed through mobile-SMS, Email and Fax.
- The Seismological Control room (24x7) contact numbers are 011-24619943/24624588.

T H A N K Y O U



NCS

National Centre for Seismology
Ministry of Earth Sciences
Lodhi Road, New Delhi

- **Earthquakes are amongst several natural events that severely affect the human habitation and the economic activities.**

- **Unlike the other natural events like cyclones, floods and draughts earthquakes strike without any notice.**

- **There is no proven scientific technique available, as yet, to precisely forecast the occurrence of earthquakes in terms of location, magnitude and time.**

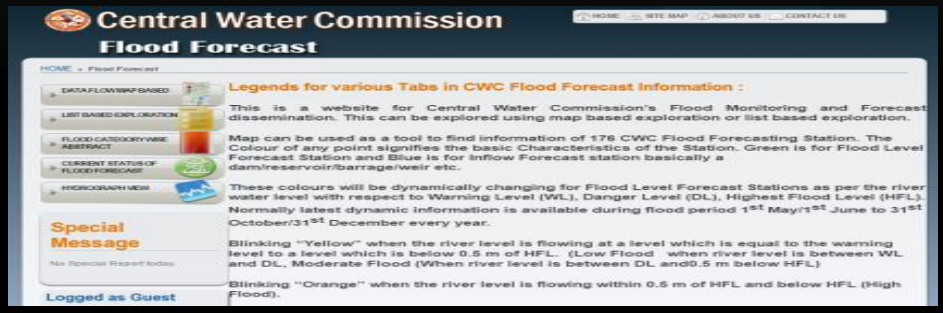
- **Insufficient preparedness measures convert these natural hazards into disasters, leading not only to immediate loss of life and property but also long term adverse impact on the overall economy of the country.**

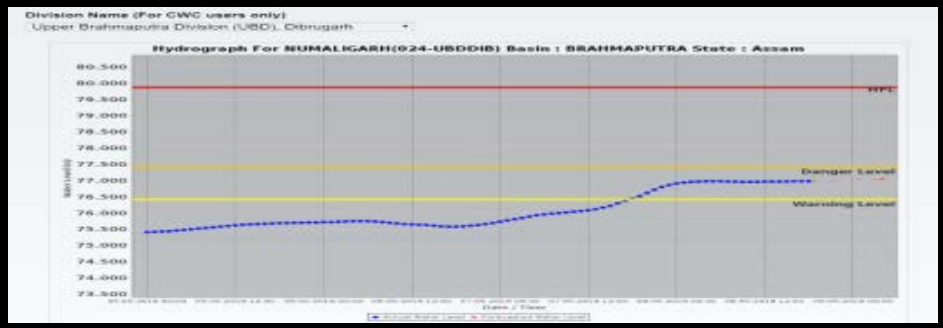
- **Earthquakes do happen and there is no way that they can be stopped, at least for the time being.**

- **So we have to learn to live and deal with them, a process which involves three essential and inter-dependent components –**
  - **(i) Comprehensive understanding of the earthquake generation processes and the internal structure of the earth**
  - **(ii) Disaster mitigation and preparedness measures and**
  - **(iii) Forecasting the earthquakes – the ultimate goal. Better understanding of the earthquake generation processes and the internal structure of the earth is an on-going activity for which vigorous R&D efforts are in place.**

TRAINING PROGRAMME ON 'FLOOD RISK MANAGEMENT'

FLOOD MITIGATION MEASURES – STRUCTURAL & EARLY WARNING IN INDIA





SHARAD CHANDRA
DIRECTOR, CWC, NEW DELHI
PH: 011-26182836, Email: fmdte@nic.in
http://india-water.gov.in/ffs

13th June 2018

WHAT IS FLOOD ?

- Origin: Old English word "*Flod*" means – *flow of water/ tide*
- Flood: Overflow of large amount of water beyond normal limits, banks, esp. over dry land
- Seasonal flooding, flash flooding, urban flooding, tidal flooding induced by typhoons in coastal areas

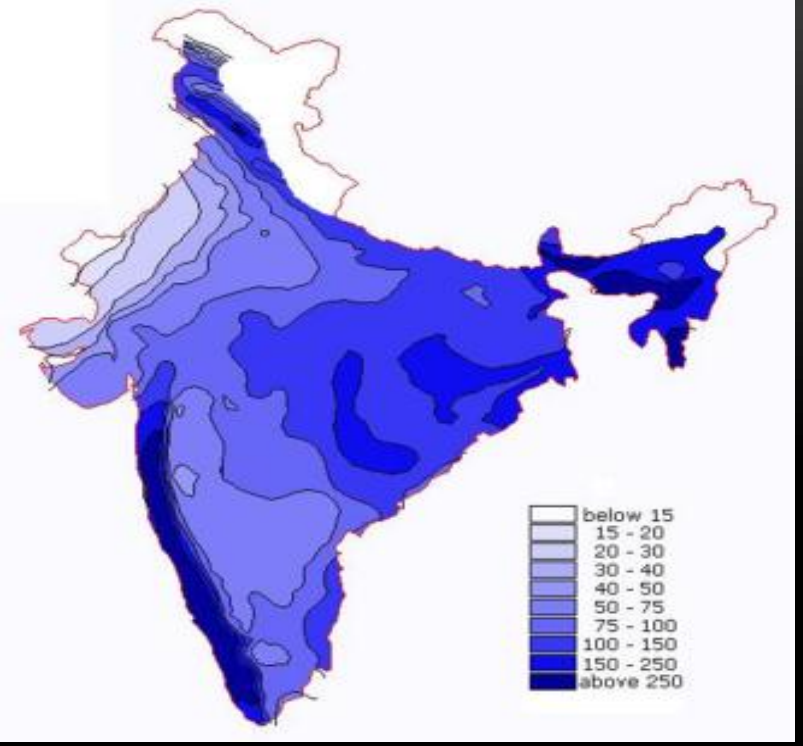
FLOOD TERMINOLOGY

Flood	Return Period	Remarks
Low	1 in 2 yr	Water level at least 1 m below Plinth
Medium	1 in 10 yr	Submerges Agricultural Areas, Drainage Congestion for not more than 6 hrs. in Residential Areas, Water level below Plinth
High	> 1 in 10 yr	Always above Danger Level
Very High	> 1 in 100 yr	Near to HFL

Danger Level: 0.3 m below plinth level

MAIN REASONS FOR FLOODS

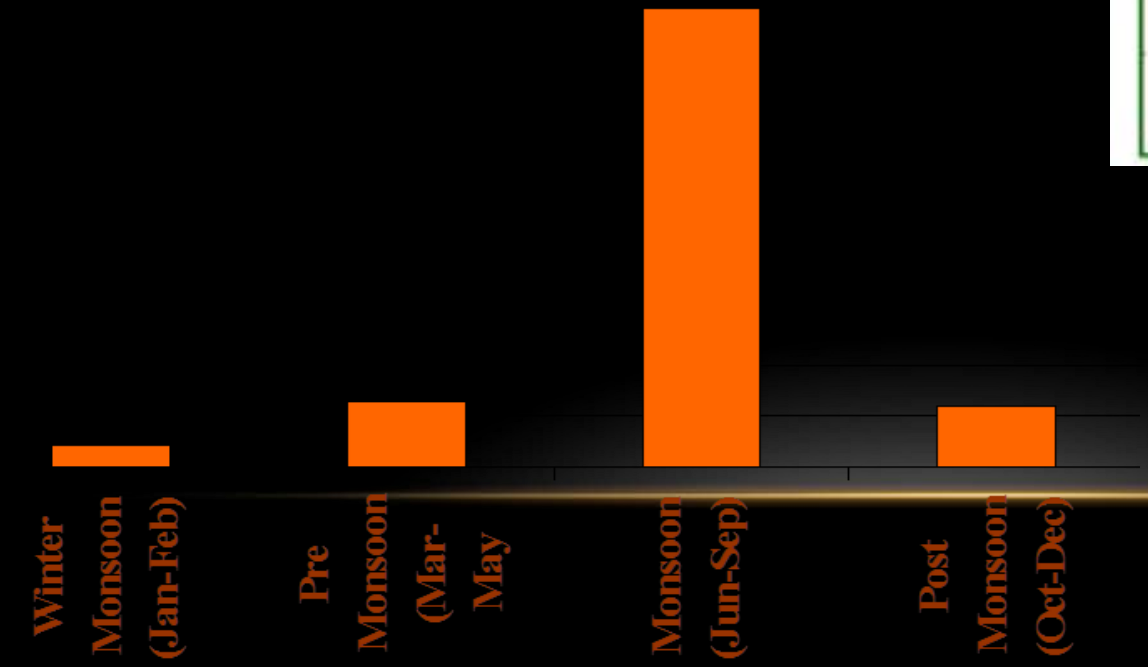
- Excessive precipitation
- Natural processes like cyclones, snowmelt, avalanches, etc.
- Obstructions to flow of water in tributaries & catchment drains
- Poor management / maintenance of flood control structures – failure of levees & dams
- Erosion of river banks during monsoon
- Insufficient bank full capacity
- Inadequate design of Urban Drainage networks: urban Floods
- Policy lacunae: Encroachment of urban & agricultural development onto floodplains
- Accelerated erosion & deforestation in catchment



RBA (1980) - 40 Mha (12-13%)

Ganga Brahmputra

Assam Bihar UP WB



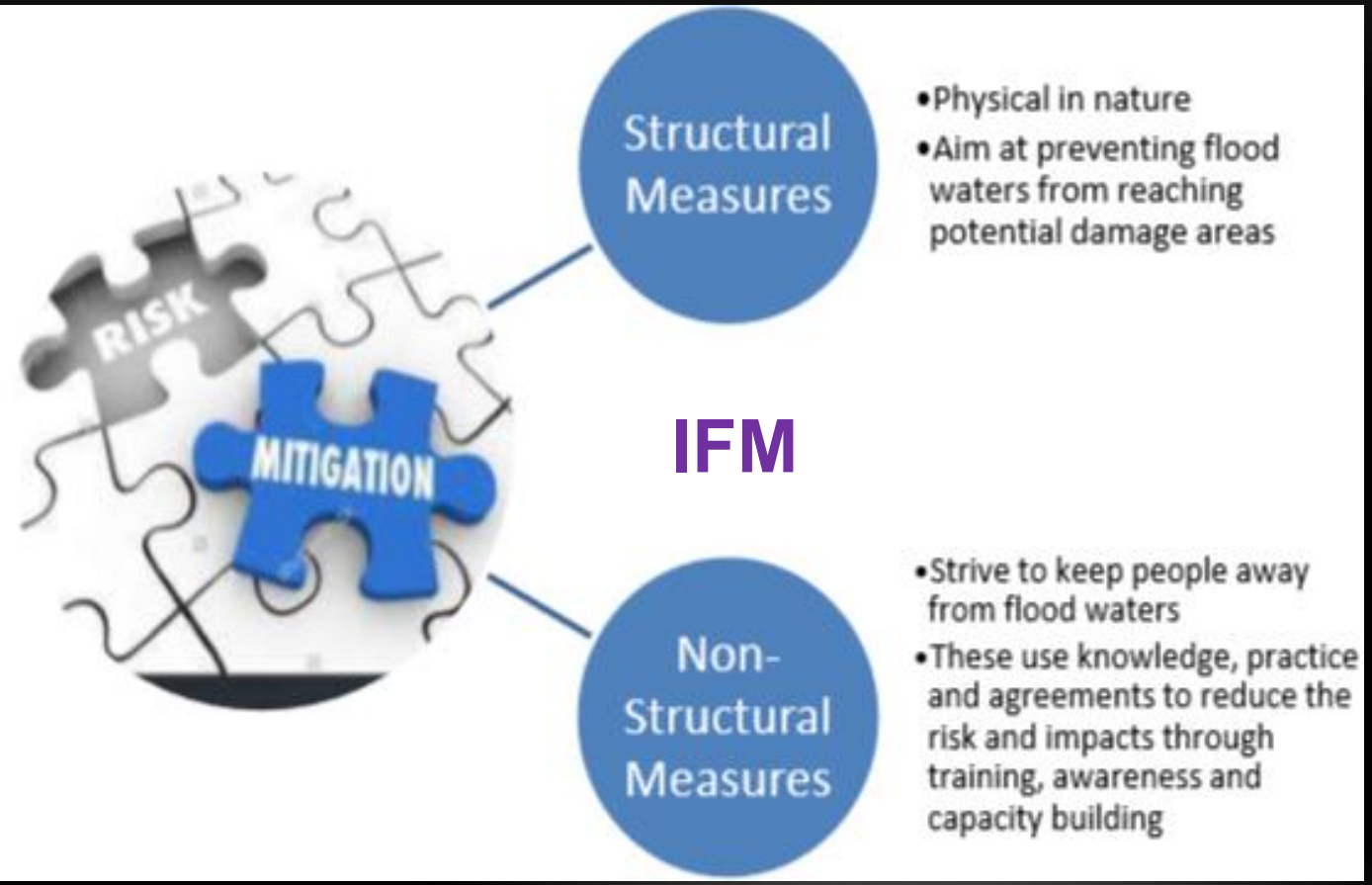
- **Average annual Flood Damage**
  - **7.19 mha (2-3 %) area affected**
  - **31.88 m (2-3%) population affected**
  - **3.92 mha (2-3%) crop area affected**
  - **Damage of Rs. 5431 cr**

DAMAGE DATA COLLECTION

Sl. No.	Year	Area Affected in mha	Population affected in million	Damage to crops		Damage to houses		Cattle lost (No.)	Human Lives Lost (No.)	Damage to public Utilities (Rs. Crore)	Total Damages (Rs. Crore)
				Area (mha)	Value (Rs crore)	Nos.	Value (Rs crore)				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12) = (6) + (8) + (11)

NEED FOR FF.....

- Floods – largely natural phenomena
- Complete immunity not possible; impacts can be minimised



- **FF – most cost effective non-structural measures for FM**
- **CWC (MoWR, RD & GR) – line department for FF**

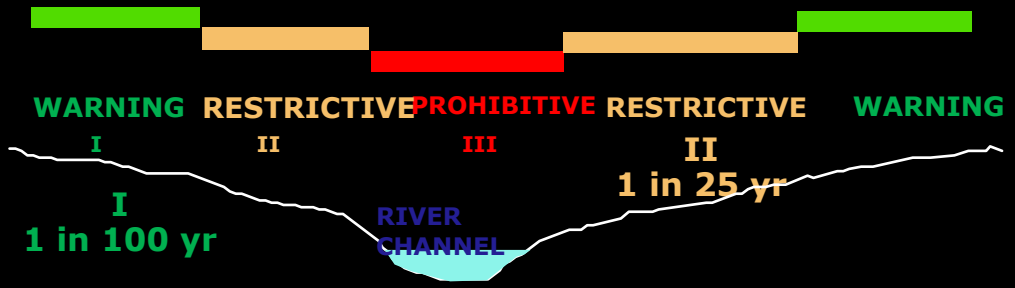
FF - future stages/ flows & time sequence at selected points along river during floods

STRUCTURAL MEASURES

- Dams & Reservoirs – Flood Cushion/ storage of flood waters
- Embankments, Sea Walls - restricting flow of water
- Natural Detention Basins - retarding & absorbing flood waters
- Channel Improvement - increasing flood carrying capacity of rivers
- Drainage Improvement
- Flood Ways/ Spill Channels - diversion of flood water from one channel to another

NON-STRUCTURAL MEASURES

- Flood Forecasting & Warning, temporary evacuation
- Flood Plain Zoning/ management – regulation of land use
- Flood Proofing & removal of flood prone structures
- Disaster Preparedness & Response - Planning
- Public Awareness campaigns & people participation drills
- Financial Mechanism - Disaster Relief, Rehabilitation & Flood Insurance



STATUTORY PROVISIONS

- **Flood control**, unlike irrigation, not part of any of three legislative lists of Schedule –VII of Indian Constitution. **Drainage & Embankments** are two of subjects specifically mentioned in Entry 17 of List II (State List)

- **Entry 17 of List II (State List)**

*"Water, that is to say, water supplies, irrigation and canals, **drainage and embankments**, water storage and water power subject to the provision of entry 56 of List I (Union List)"*

- **Entry 56 of List I (Union List)**

"Regulation and development of inter-State rivers and river valleys to the extent to which such regulation and development under the control of the Union is declared by Parliament by law to be expedient in the public interest"

- **Role of Central Govt. - technical, catalytic & promotional (also financial)**

FMP – Scope/ Activities

- State sector scheme under Central Plan to provide CA to State Govts.

Works

- River management
- Anti-erosion
- Drainage Development
- Flood Proofing
- Flood Prone Area Development
- Restoration of flood control/ management works damaged due to force majeure like conditions
- Anti- Sea erosion
- Catchment Area Treatment (having objectives of flood management)





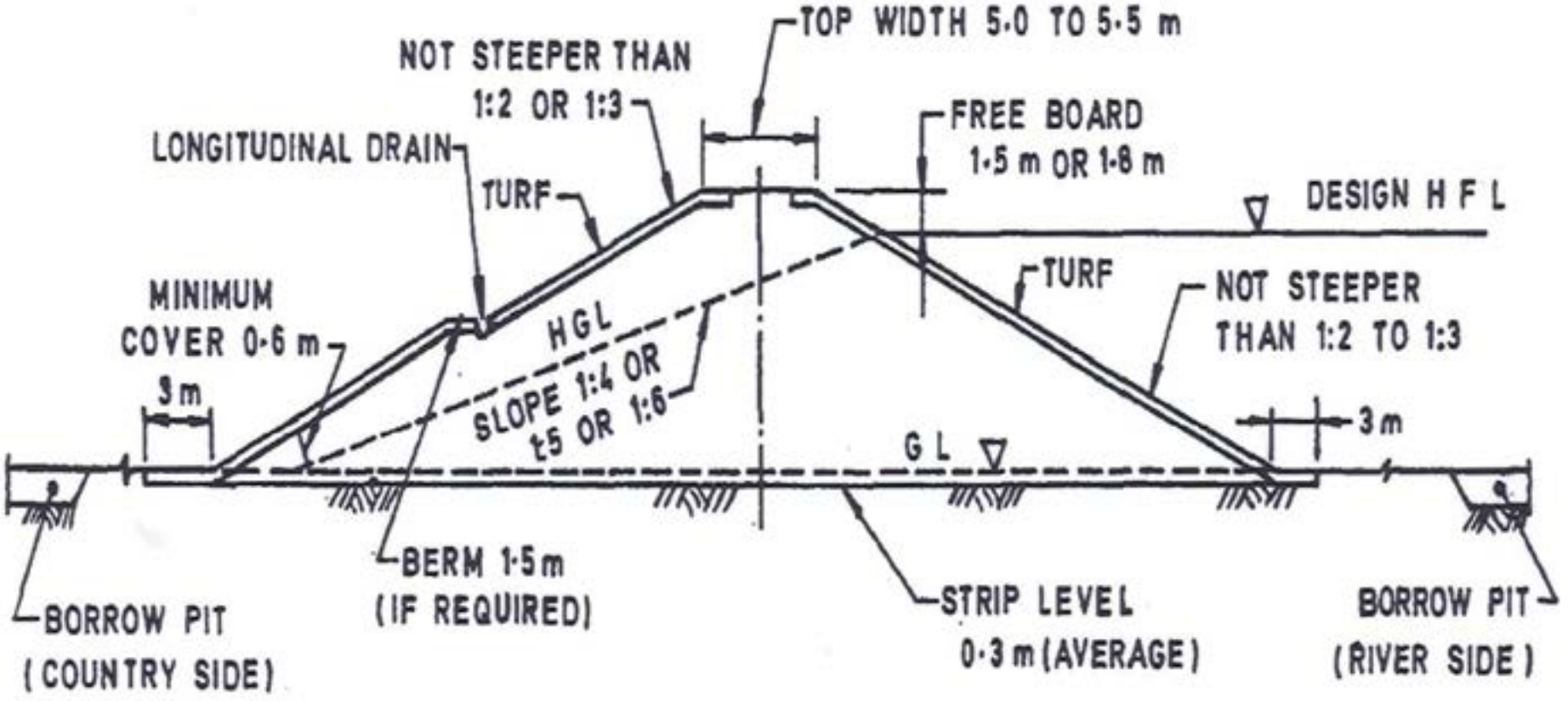



Design of Flood Embankment

H > 6 m; stability analysis needed

Low Embankment	Height < 10 ft (3 m)
Medium Embankment	10 ft (3 m) <Height> 30 ft (9 m)
Major Embankment	Height > 30 ft (9 m)

Typical cross-section



DESIGN CRITERION

- Planning & Design of River Embankment (IS 12094-2000)

Spacing of embankment: 3 times of Lacey wetted perimeter

$$P = 4.75 * \{Q_{design}\}^{1/2}$$

- Design High Flood Level - G-D Curve, HEC-RAS (Afflux Study)
  - Protection of agriculture land - 25 year flood
  - Protection of township, Industrial area - 100 year flood
- Free Board
  - 1.5 meters over design HFL (for Q<3000 cumecs)
  - 1.8 m over design HFL (for Q≥ 3000 cumecs)
- Top width - 5.0 meter (to accommodate 2- lane traffic) + turning platform 15 to 30 m long & 3m wide at every km
- Hydraulic gradient – never allowed to cross country side slope Min. cover- 0.6 m (V)/0.9m (H)
  - Clayey soil – 1V : 4H; Clayey sand – 1V : 5H; Sandy soil – 1V : 6 H
- River side slope: 1V : 2H to 1V : 3 H; Country side slope: 1V : 2H to 1V : 3H

Contd….

DESIGN CRITERION

- Planning & Design of Revetment (IS 14262:1995)
  - Wt. of stone/boulder in Kg

    $W = (0.02323 \times S_s \times V^6) / [(K \times (S_s-1)^3]^3$

    Where $K = [1-(\sin^2\theta/\sin^2\Phi)]^{1/2}$

    S_s = Specific gravity of stone (For crates $S_m=(1-e)*S_s$))

    $e = 0.245 + 0.0864/(D_{50})^{0.21}$

    Φ = Angle of repose of material of protection works

    θ = Angle of sloping bank

    V = Mean Velocity at bank
  - Size of Stone/ Boulder in mm

    $Ds = 0.124 * (W/S_s)^{1/3}$
  - Thickness of protection layer

    $T = V^2/[2g \times (S_s-1)]$

Contd….

DESIGN CRITERION

- Planning & Design of Groynes/Spur (IS 8408-1994)
  - Design discharge: equal to that for which any structure in close proximity is designed or 50 year flood whichever is higher
  - Length/ Spacing of spur: Normally effective length < $1/5^{th}$ * width of flow and > 2.5*D. Spacing is normally 2 to 2.5 time of effective length
  - Top level: Depends on type namely submerged, partially submerged or non-submerged & will be best decided by model experiment
  - Top width: 3 to 6 meters as per requirements
  - Free board : 1 to 1.5 meter above design flood level
  - Side slope: Between 2H :1V & 3H :1V
  - Weight of stone & Thickness for pitching: Same as revetment
  - Launching apron
    - Scour depth below HFL: $D = 0.473\ (Q/f)^{1/3}$ or $1.33(q^2/f)^{1/3}$

      Where Q= discharge in m^3 /s; q = discharge per unit width;

      f = silt factor = $1.76d$;

      d = mean dia of river bed material in mm
    - Width of Launching apron = $1.5D_{max\ below\ LWL}$

      Where $D_{max\ below\ LWL}$: Depths of maximum scour below LWL

      D_{max} = 1.5*D

      Contd….
    - Thickness of Launching apron = 1.5*T

DESIGN CRITERION

- Planning & Design of Guide Bank (IS: 10751-1994)
  - Alignment - Best decided by model studies
  - Length of guide Banks
    - Upstream = 1.0 L to 1.5 L
    - Downstream= 0.2 L to 0.4 L

    Where L= Length of structure between abutments
  - Radius of curve
    - Head – 0.45 L
    - Tail – 0.0 to 0.5 time radius of covered head
  - Top Width: 6 to 9 m
  - Free board: 1 to 2 m
  - Side slope: 2:1 to 3:1
  - Weight of stone & Thickness for pitching: Same as revetment

FLOOD FORECASTING FOR DISASTER MANAGEMENT

Data Collection & Monitoring

CWC/ IMD/ Project Authorities

Data Processing

Dissemination (SMS/emails/ web)

Response

Review & Improvement

Expansion of Network/ Modernization

Activation of SDMA/DDMA/ NDRF/SDRF etc.

Disaster Manager / Project Authorities

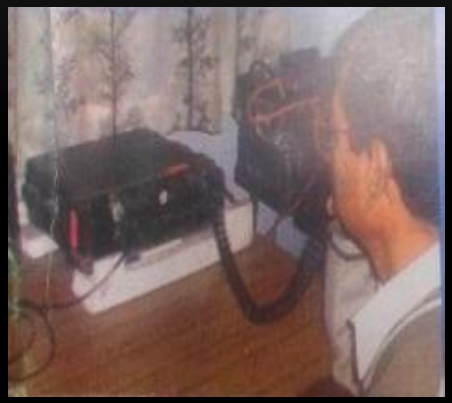
DATA COLLECTION

- **Conventional Methods - Manually**

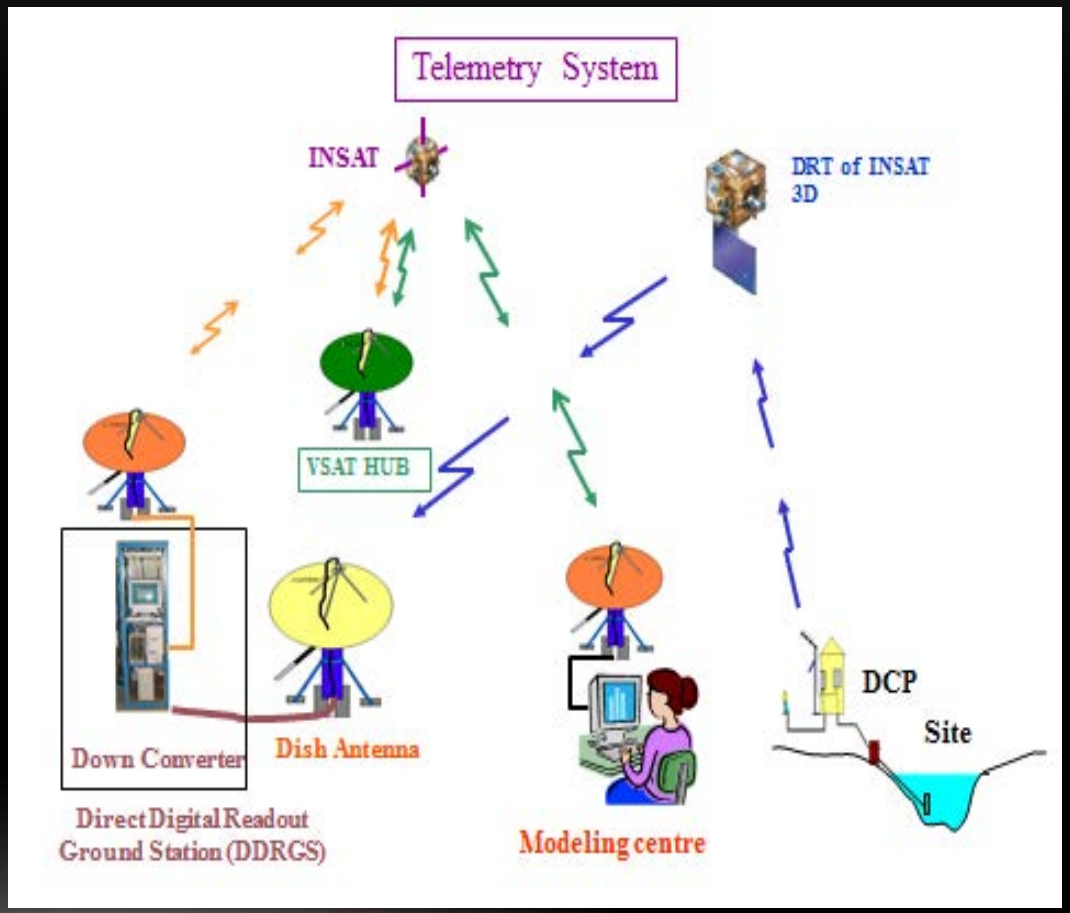
- **Modernisation - Sensors**

TRANSMISSION - SITE TO MODELLING CENTRE

Conventional Method -Wireless, Telephone, Mobiles

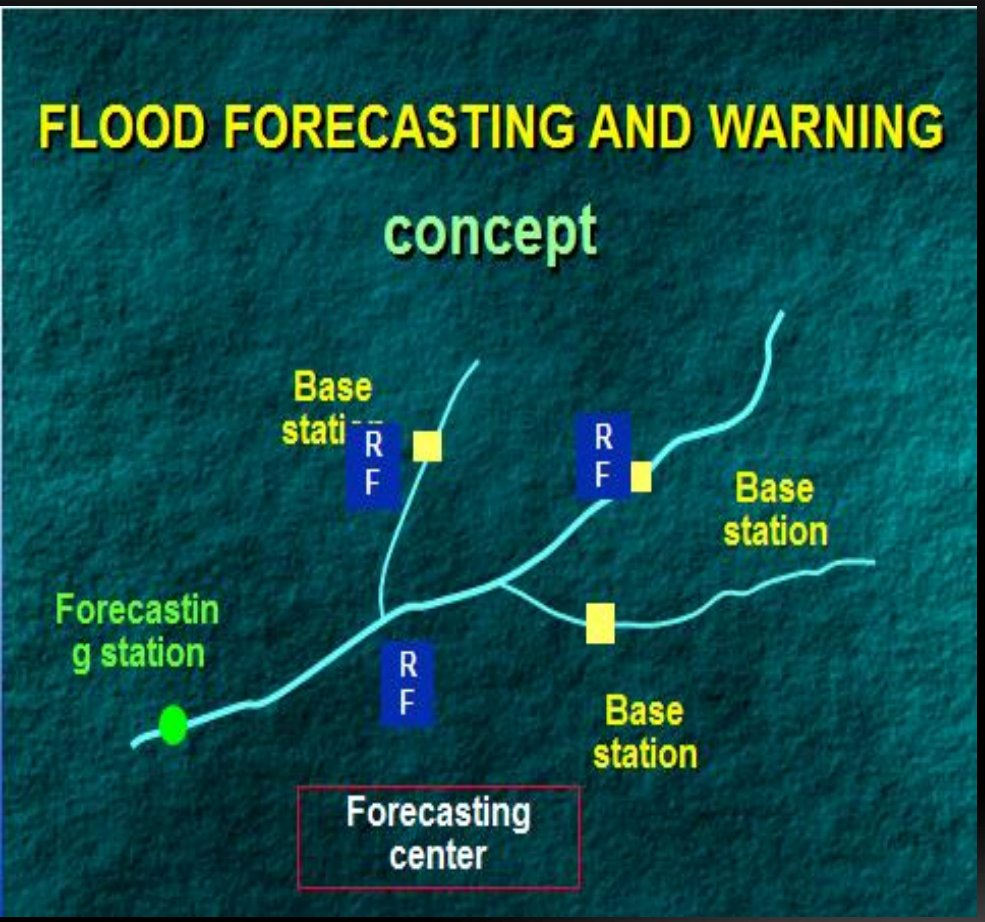


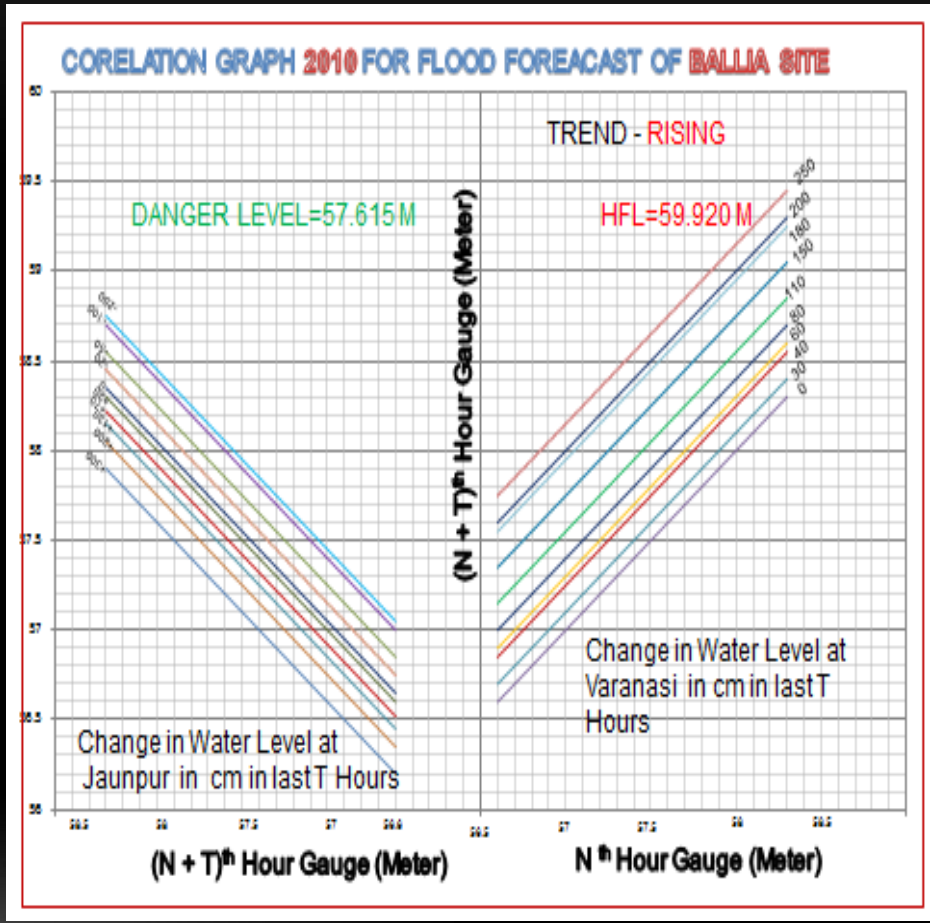
Modernisation – Real Time Data Acquisition System (RTDAS)



FORECAST FORMULATION

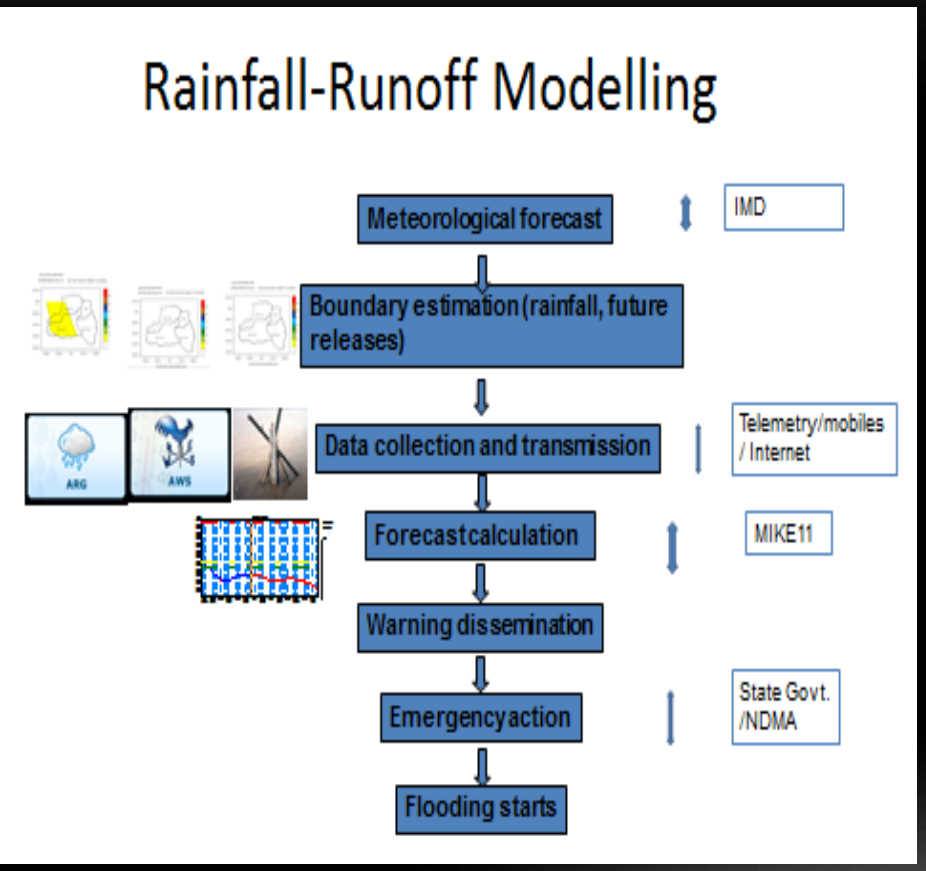
- **Forecast formulation - Statistical Correlations using gauge to gauge, Gauge - discharge data - Multiple coaxial correlations using gauge, rainfall, API data**





FORECAST FORMULATION

MATHEMATICAL MODELS LIKE MIKE, RAINFALL RUNOFF MODULE, HYDRODYNAMIC MODULE, FLOOD FORECAST MODULE



FORECAST DISSEMINATION

- **Mode of communication**

★ – Like @cwccfcr

★ http://india-water.gov.in/ffs

★ – Emergency Flood Messages

★ – Follow @FFM_CWC

★ http://120.57.32.251/

★ -Google Public Alerts
(www.cwc-captool.appspot.com)

★ Special Messenger, Email, SMS

- **Beneficiaries**
  - District Administration, Defence, Railways/ Highways, Industrial & other important establishments located in areas
  - Media, Press

ACTIONS BY CWC

Real time data acquisition system since 1999

- **Manual**
- **Automatic**

Forecast Formulation

- **Statistical Correlations based forecasting since 1958**
- **Medium Range 3-day Advisory Forecast based on Rainfall since 2017** (Rainfall-Runoff Modelling)

Inundation Forecast

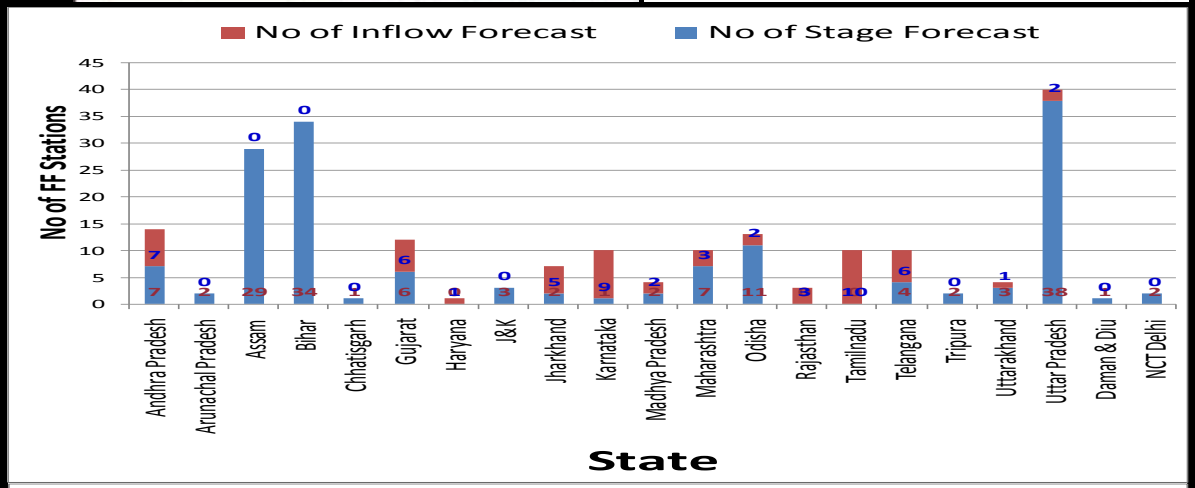
For Brahmaputra from 2018

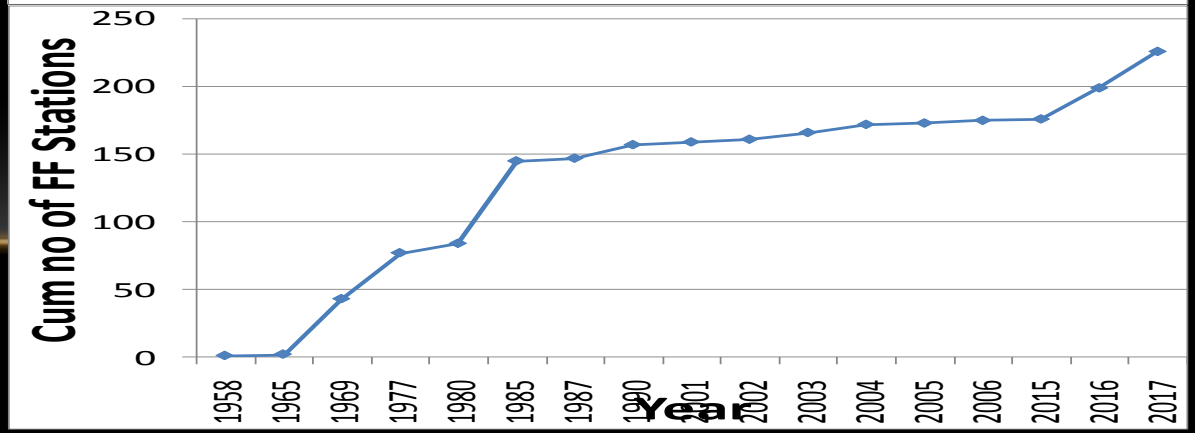
Dissemination

- **Web Portal for statistical based Forecast since 2014**
- **Web Portal for advisory forecast since 2017**
- **Use of Social Media from 2018 (Twitter, Facebook)**

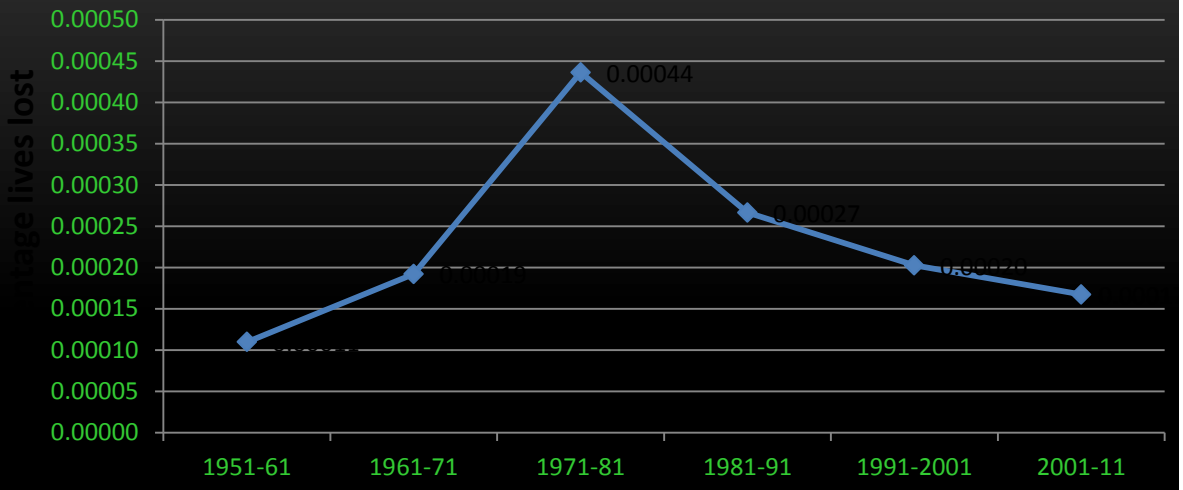
FF NETWORK OF CWC

- 13 Regional Field Offices
- 19 Major River Basins
  - 22 States/UTs
- Present network - 226 FF stations (166 WL+60 Inflow)
- During 2018
  - another 49 FF stations
  - 24 State/Uts
- Upto 2020
  - Additional 50 FF stations covering 25 States/Uts

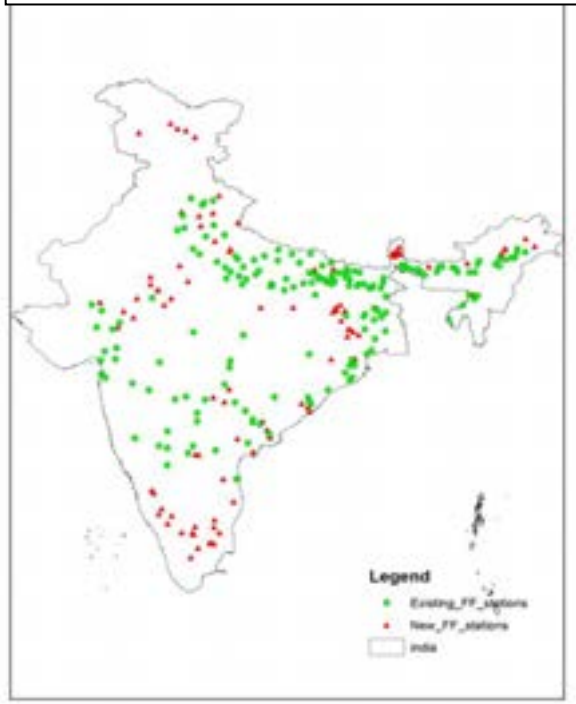


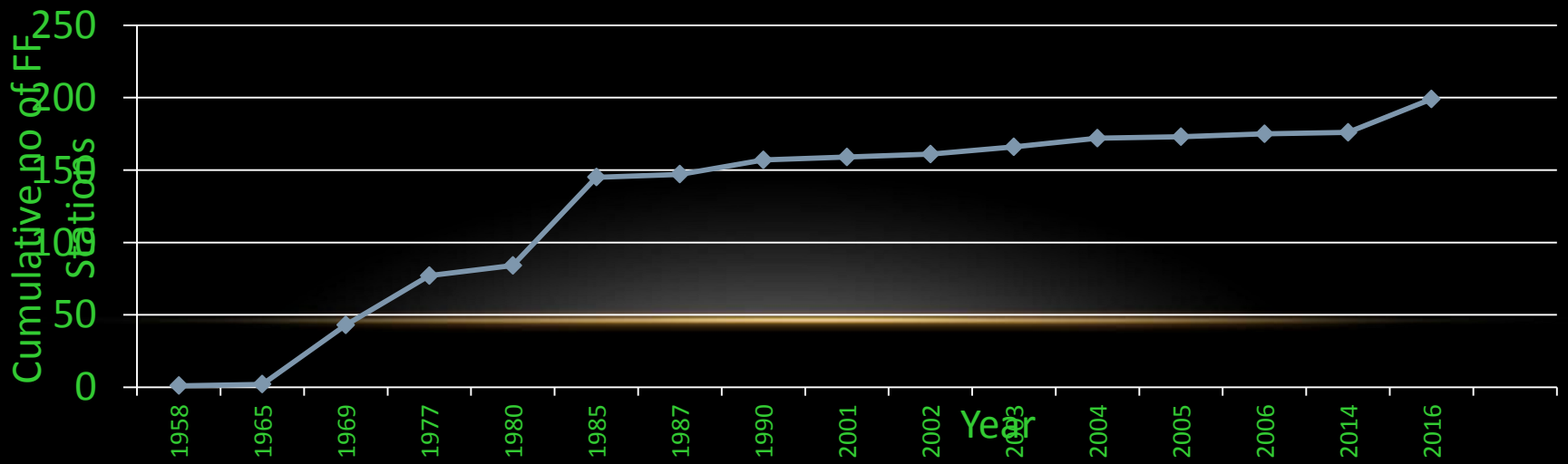


Decade-wise Percentage lives lost due to flood in India vis-à-vis Expansion of FF Activity

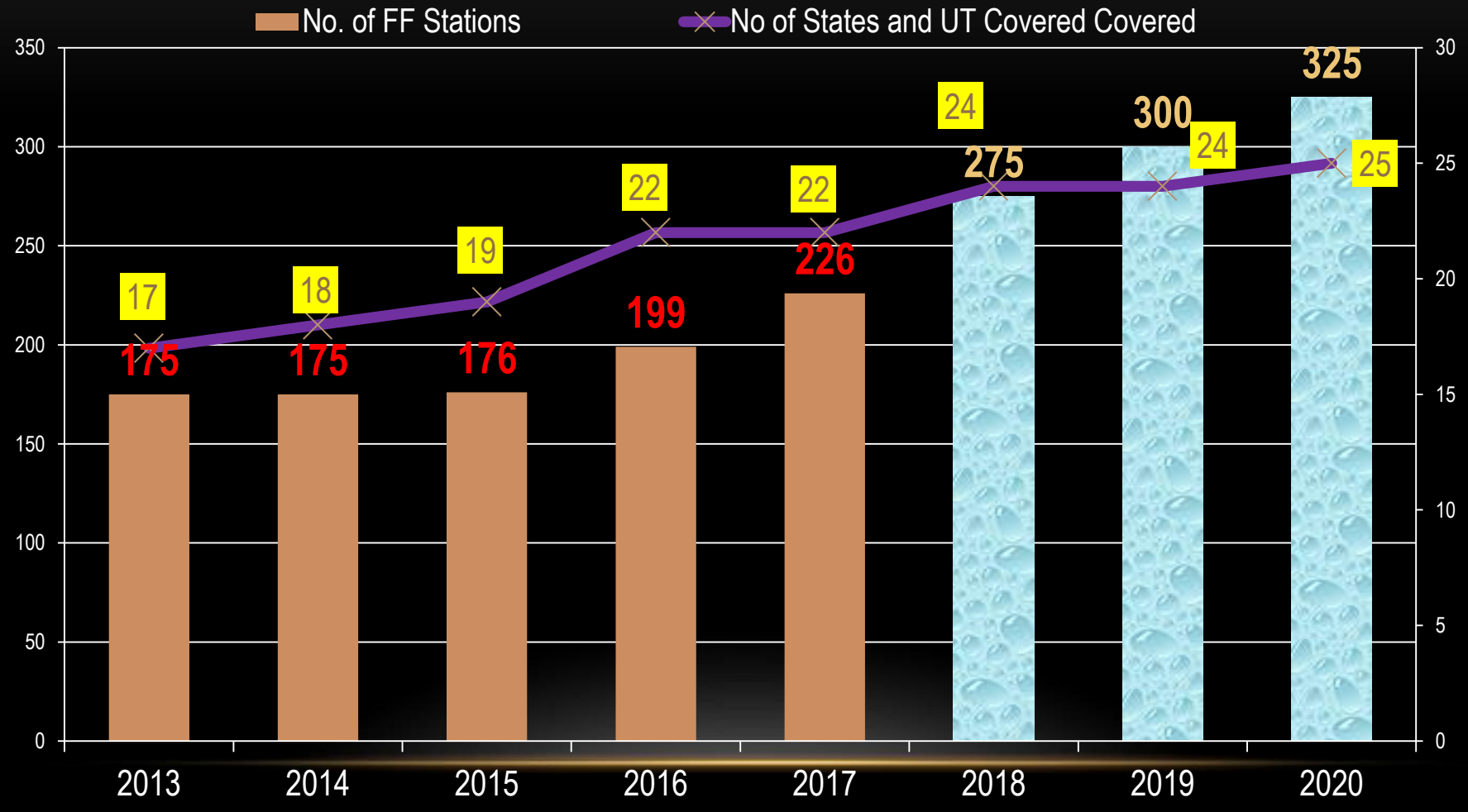


Map showing Flood Forecasting Network just before and after 12th Plan

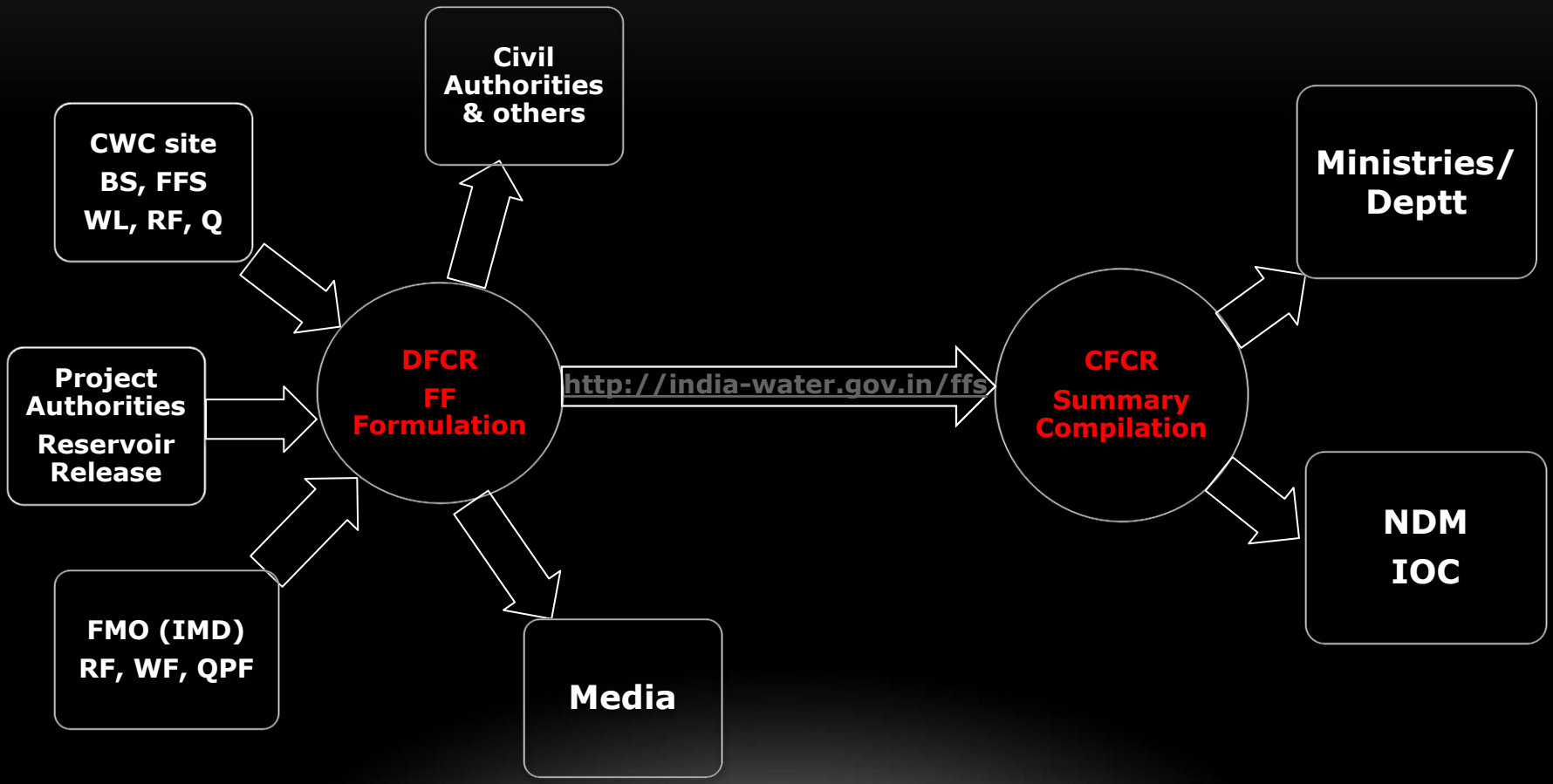




Flood Forecasting Expansion - 2018



FF SET UP


Civil Authorities & others
CWC site BS, FFS WL, RF, Q
Ministries/ Deptt
Project Authorities Reservoir Release
DFCR FF Formulation
http://india-water.gov.in/ffs
CFCR Summary Compilation
NDM IOC
FMO (IMD) RF, WF, QPF
Media

FLOOD PERIOD

#	Basin	Modified Period
1.	Brahmaputra Basin	1st May to 31st Oct
2.	All other Basins upto Krishna Basin	1st June to 31st Oct
3.	Basins South of Krishna Basin (Pennar, Cauvery and Southern Rivers)	1st June to 31st Dec

In case of floods beyond designated period due to unexpected rain/releases from dams or other reasons, FF activity shall be resumed by concerned organisation/division till water level falls below threshold limit & necessary bulletins shall be disseminated.

FORECAST FREQUENCY & ADVANCE WARNING TIME

- **Major rivers (Travel time >24 hours) – 45% FF Stations**
  - **Forecasts formulation based on 0800 hrs/ 0900 hrs WL**
  - **Forecast issued once in a day at 1000 hrs with advance warning time from 24 hrs to 36 hrs**
- **Medium rivers (Travel time 12-24 hours)**
  - **Forecasts formulation based on 0600 hrs & 1800 hrs WL**
  - **Forecast issued twice in a day at 0700 hrs and 1900 hrs with advance warning time from 12 hrs to 24 hrs**
- **Flashy rivers (Travel time < 12 hours)**
  - **Forecasts formulation based on any hr WL**
  - **Forecast issued multiple times (more than twice) in a day with advance warning time less than 12 hrs**

SOP – FLOODS CATEGORY & ALERT COLOUR CODES

Category	Levels	Stage	Communication
I	Extreme L ≥ HFL	Red	PMO/ Cabinet Sect. – 1 hr. or frequent
II	Severe HFL > L ≥ DL	Orange	PMO/ Cabinet Sect. – 3 hr. or frequent
III	Above Normal DL > L ≥ WL	Yellow	Not to PMO/ Cabinet Sect.
IV	Normal L < WL	Green/ Blue	

DISSEMINATION

Central Water Commission

HOME | SITE MAP | ABOUT US | CONTACT US

Flood Forecast

HOME » Flood Forecast

- DATA FLOW MAP BASED
- LIST BASED EXPLORATION
- FLOOD CATEGORY WISE ABSTRACT
- CURRENT STATUS OF FLOOD FORECAST
- HYDROGRAPH VIEW

Special Message

No Special Message today

Logged as Guest

User

Pass

Submit

Legends for various Tabs in CWC Flood Forecast Information :

This is a website for Central Water Commission's Flood Monitoring and Forecast dissemination. This can be explored using map based exploration or list based exploration or Hydrograph View.

Map can be used as a tool to find information of 226 CWC Flood Forecasting Station consisting of 166 Level Forecasting Stations for towns/important villages and 60 Inflow Forecasting Stations for Dams/Reservoirs. List Based exploration or Hydroghraph view should be used for information of all flood monitoring stations around 700 including Flood Forecasting Stations. The Colour of any point signifies the basic Characteristics of the Station. Green is for Flood Level Forecast Station basically important towns/villages and Blue is for Inflow Forecast station basically a dam/reservoir/barrage/weir etc.

These colours will be dynamically changing for Flood Level Forecast Stations as per the river water level with respect to Warning Level (WL), Danger Level (DL), Highest Flood Level (HFL). Normally latest dynamic information is available during flood period 1st May/1st June to 31st October/31st December every year.

"*Yellow*" when the river is flowing in *Above Normal Flood*: when river water level is at or above WL but below DL

"*Orange*" when the river is flowing in Severe Flood : when the river water level is at or above Danger Level and below HFL.

"*Red*" when the river is flowing in *Extreme Flood* : when the river water level is at or above HFL

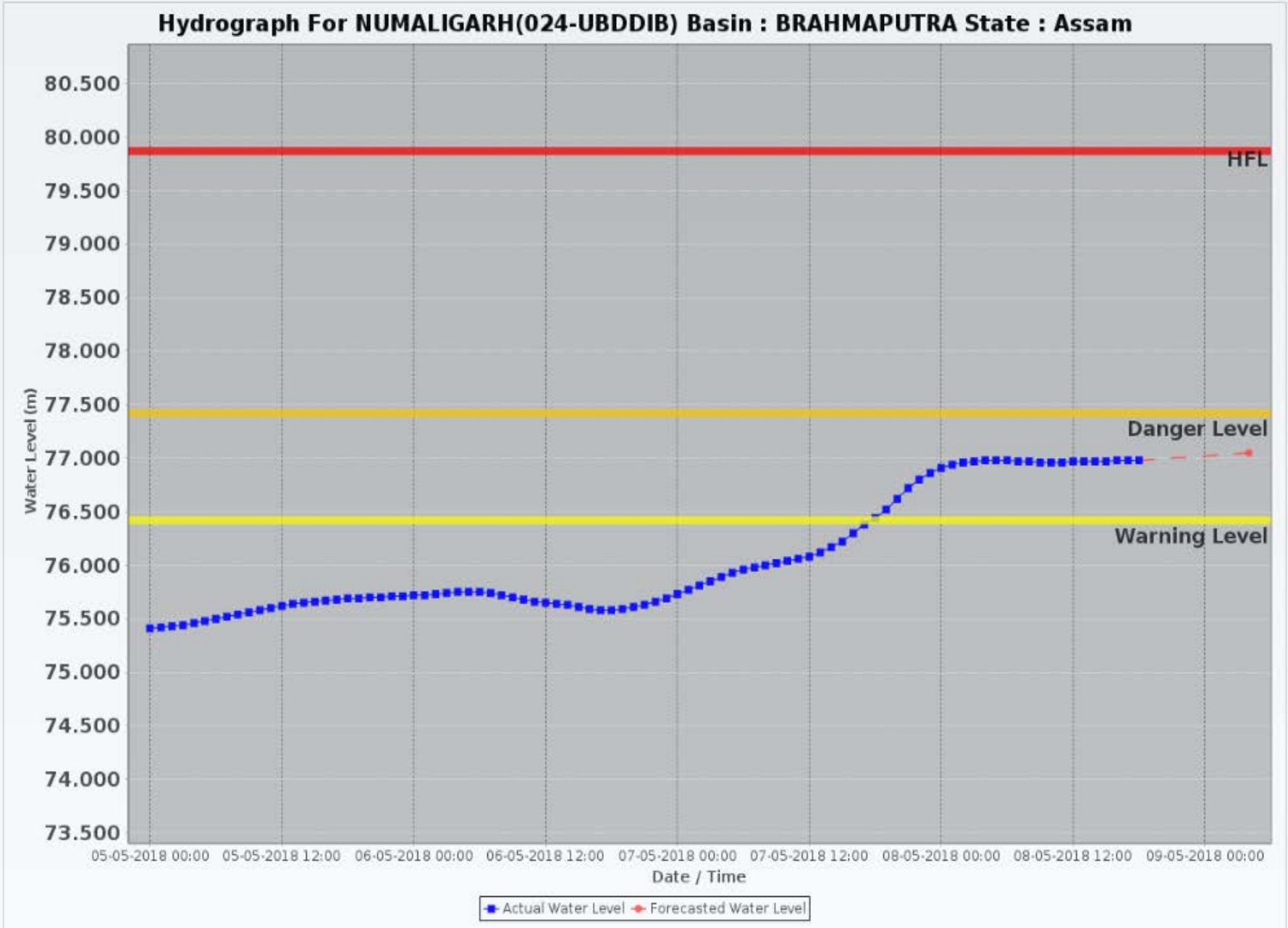
HFL is updated on an yearly basis before start of the flood season. Newly attained HFL during the flood season of a particular year in any station will be updated in the next year before start of the flood season.

On clicking a particular station, a window opens showing the static information of the station. The latest available dynamic information such as water level and flood forecast issued are also displayed in the window.


Safapora
Rishikesh
Banbasa
Dhansa
Kannauj
Bansi
Turtipar
Bisalpur Dam
MIRZAPUR
Dharoi Dam
Bansagar Dam
Subhash Bridge
Mandla
Garudeshwar
Gosikhurd Dam
MADHUBAN DAM
Balharsha
Kaleswaram
Gunupur
Ujani Dam
Musi Dam
Kurnool Town
Bhadra Dam
Sathanur Dam
UPPER ANICUT
Jaldhaka NH-3
Numaligarh
Namsai
SUNDAR DAM
Karimganj
Maithon Dam
Harinkhola
PANGKHUAH
Mathani Road Bridge
Alipingal

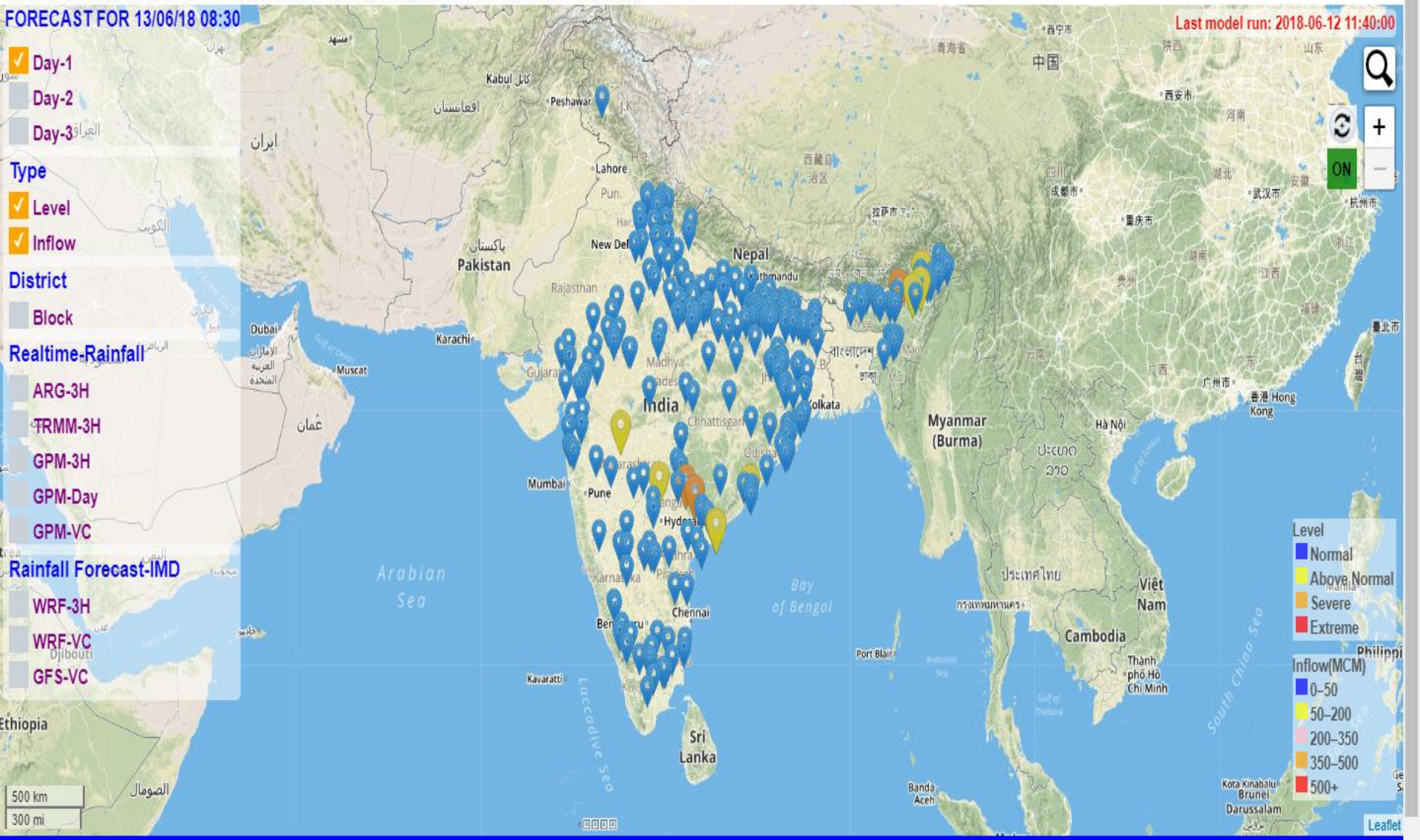
Division Name (For CWC users only)

Upper Brahmaputra Division (UBD), Dibrugarh



THREE DAY ADVISORY FLOOD FORECAST

CENTRAL WATER COMMISSION



Disclaimer :

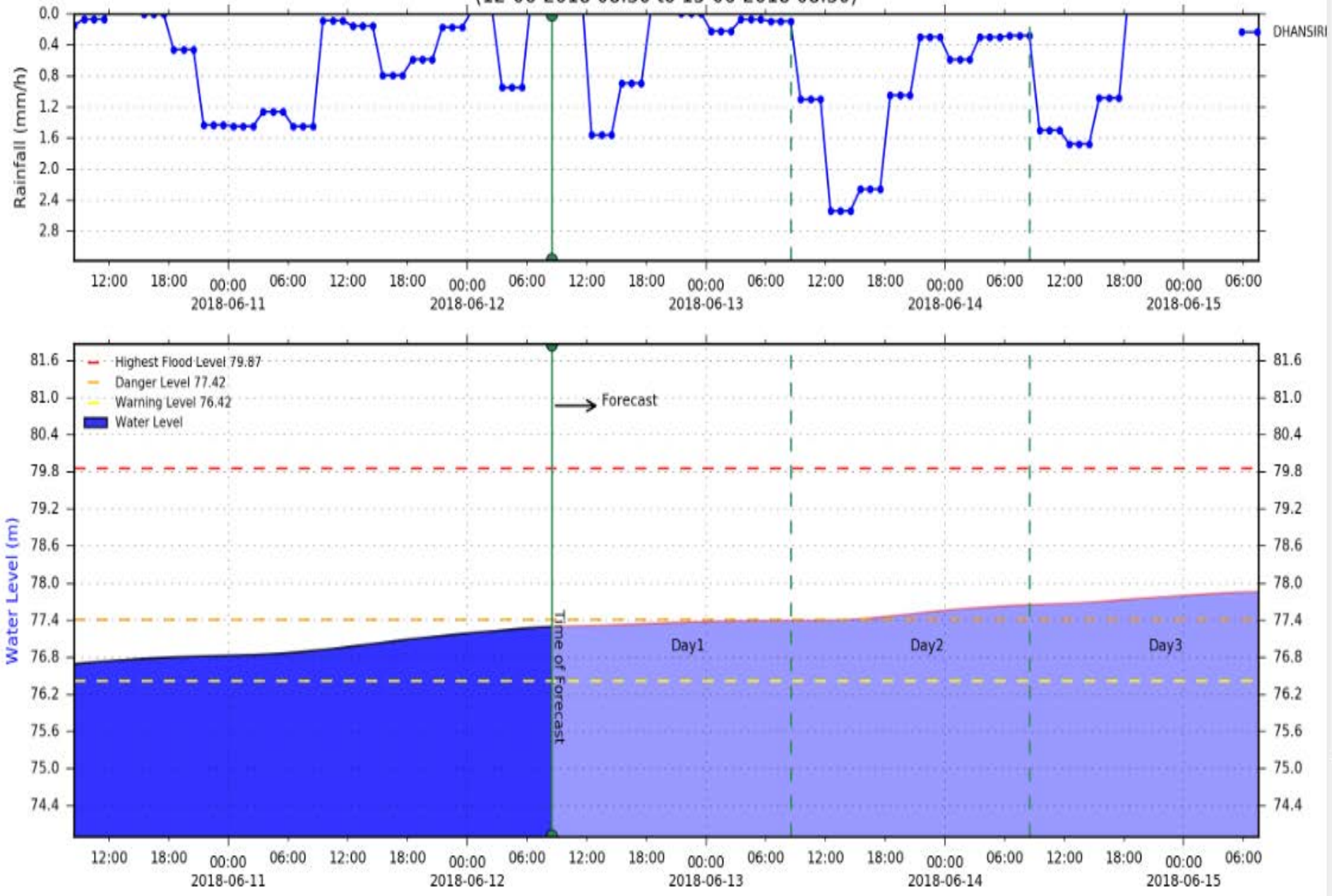
1. Forecast is subject to uncertainty due to errors in measurment , rainfall forecast, model parameters ,lack of information on reservoir operating rules/real time releases and other unknown factors such as landslide, glacier outburst embankment breach etc

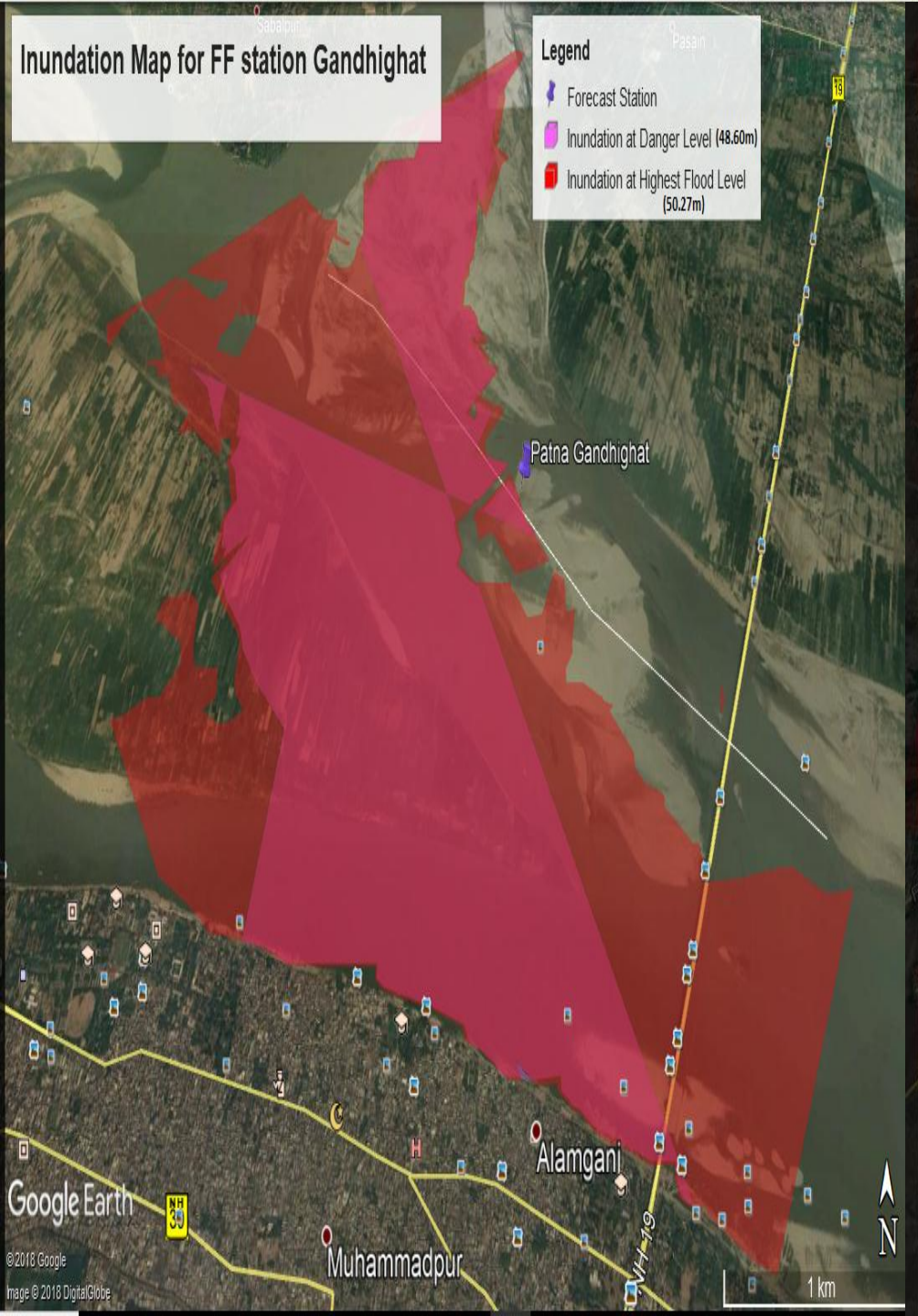
Details of likely Flood condition at various gauging stations of CWC

CWC gauging stations	Station Details				Day-1 Forecast			Day-2 Forecast			Day-3 Forecast		
S.No	Site name	River	State	District	Date	Flood condition	Max WL	Date	Flood condition	Max WL	Date	Flood condition	Max WL
1	JIABHARALI_NT_X	Jiabharali	Assam	Sonitpur	13/06/18 06:30	Severe	77.15	14/06/18 03:30	Severe	77.22	14/06/18 23:30	Severe	77.46
2	NEAMATIGHAT	Brahmaputra	Assam	Jorhat	12/06/18 09:30	Above Normal	84.15	14/06/18 07:30	Above Normal	84.26	15/06/18 07:30	Severe	85.18
3	NUMALIGARH	Dhansiri (S)	Assam	Golaghat	13/06/18 07:30	Above Normal	77.4	14/06/18 07:30	Severe	77.64	15/06/18 07:30	Severe	77.86
4	BEKI_ROAD_BRG	Beki	Assam	Barpeta	13/06/18 07:30	Normal	43.87	14/06/18 07:30	Above Normal	44.4	15/06/18 04:30	Above Normal	44.42
5	DIBRUGARH	Brahmaputra	Assam	Dibrugarh	13/06/18 07:30	Normal	103.82	14/06/18 07:30	Above Normal	105.01	15/06/18 07:30	Above Normal	105.52
6	PASSIGHAT	Siang	Arunachal Pradesh	East Siang	13/06/18 07:30	Normal	152.17	13/06/18 17:30	Above Normal	153.06	14/06/18 17:30	Above Normal	153.2
7	MATIZURI	Katakhal	Assam	Hailakhandi	13/06/18 07:30	Normal	19.1	14/06/18 07:30	Normal	19.25	15/06/18 06:30	Above Normal	20.09
8	KASHINAGAR	Vamsadhara	Odisha	Gajapati	13/06/18 07:30	Above Normal	53.7	13/06/18 14:30	Above Normal	53.8	14/06/18 09:30	Above Normal	53.69
9	ALIPINGAL	Mahanadi	Odisha	Jagatsinghpur	12/06/18 09:30	Normal	4.25	14/06/18 04:30	Normal	4.26	14/06/18 09:30	Normal	4.26
10	NARAJ	Mahanadi	Odisha	Cuttack	13/06/18 00:30	Normal	21.05	13/06/18 09:30	Normal	21.05	15/06/18 07:30	Normal	21.03
11	NIMAPARA	Mahanadi	Odisha	Puri	12/06/18 09:30	Normal	3.58	13/06/18 09:30	Normal	3.51	14/06/18 09:30	Normal	3.46
12	BAMNI				12/06/18 09:30	Normal	166.81	13/06/18 09:30	Normal	165.99	14/06/18 09:30	Normal	164.59
13	BHADRACHALAM	Godavari	Telangana	Kothagudem	13/06/18 07:30	Normal	37.74	14/06/18 07:30	Normal	38.54	14/06/18 09:30	Normal	38.53
14	DUMMUGUDEM	Godavari	Telangana	Kothagudem	13/06/18 07:30	Normal	45.76	14/06/18 07:30	Normal	46.36	14/06/18 10:30	Normal	46.36
15	ETURUNAGARAM	Godavari	Telangana	Jayashankar	13/06/18 07:30	Normal	68.96	13/06/18 18:30	Normal	69.07	14/06/18 09:30	Normal	68.93
16	GANGAKHED	Godavari	Maharashtra	Parbhani	12/06/18 09:30	Normal	366.57	13/06/18 09:30	Normal	365.57	14/06/18 09:30	Normal	364.99
17	JAGDALPUR	Indravathi	Chhattisgarh	Bastar	12/06/18 09:30	Normal	535.53	13/06/18 09:30	Normal	535.22	14/06/18 09:30	Normal	535.06
18	KALESWARAM	Godavari	Telangana	Jayashankar	12/06/18 19:30	Normal	98.1	13/06/18 09:30	Normal	97.94	14/06/18 09:30	Normal	97.24
19	KOPERGAON	Godavari	Maharashtra	Ahmednagar	12/06/18 09:30	Normal	485.3	13/06/18 09:30	Normal	485.3	14/06/18 09:30	Normal	485.3

ADVISORY FLOOD FORECAST FOR NUMALIGARH ON RIVER DHANSARI

(12-06-2018 08:30 to 15-06-2018 08:30)




Inundation Map for FF station Gandhighat
Legend
Forecast Station
Inundation at Danger Level (48.60m)
Inundation at Highest Flood Level (50.27m)
Patna Gandhighat
Alamgani
Muhammadpur
NH-19
Google Earth
© 2018 Google
Image © 2018 DigitalGlobe
N
1 km


Inundation Map for FF station Mantralayam
Legend
Budadinni
Mantralyam
Chickmanchal
Mantralayam
Manchala
Google Earth
Image © 2018 DigitalGlobe
© 2018 Google

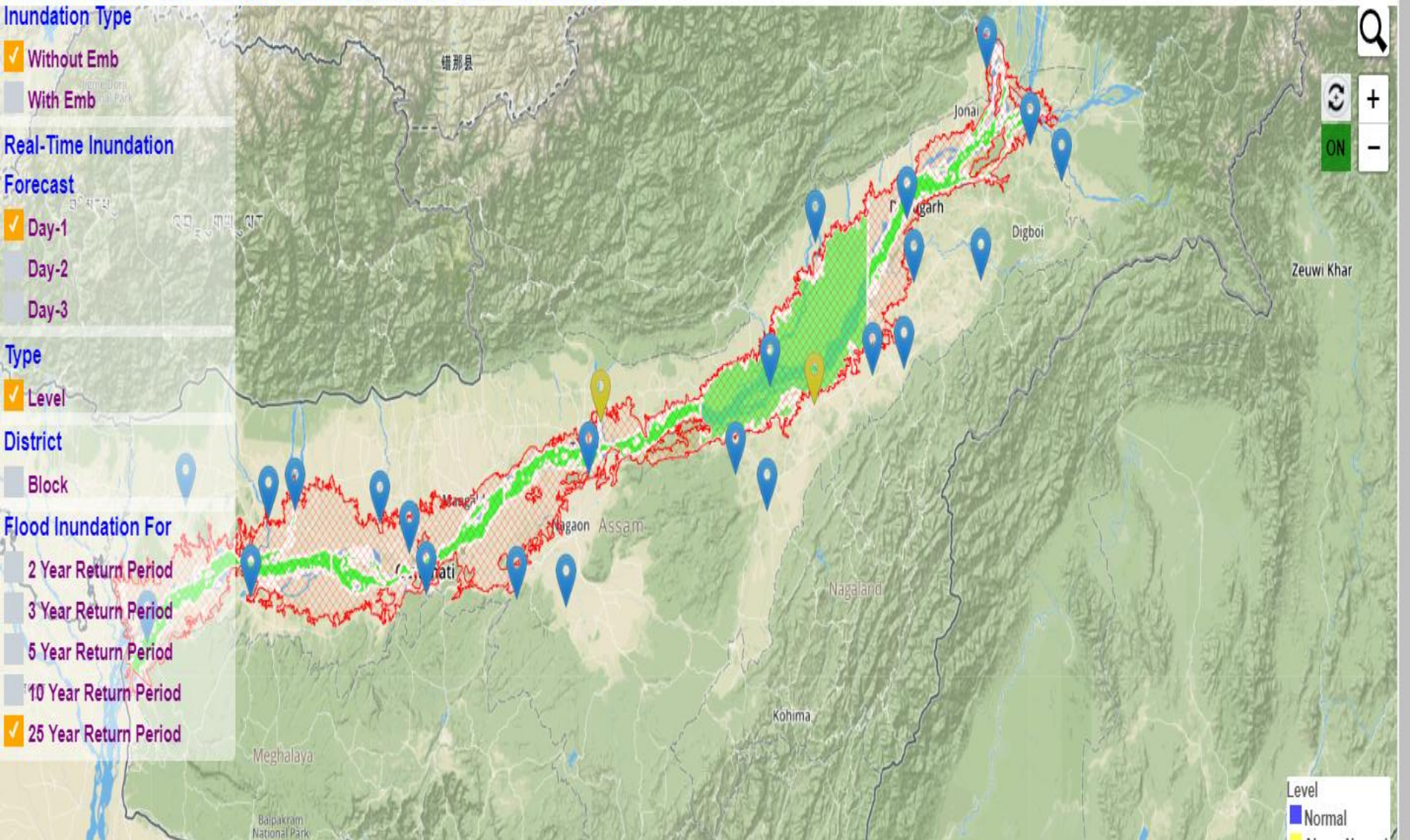
CWC AFF (Beta)

120.57.32.251/index_atlas1.php

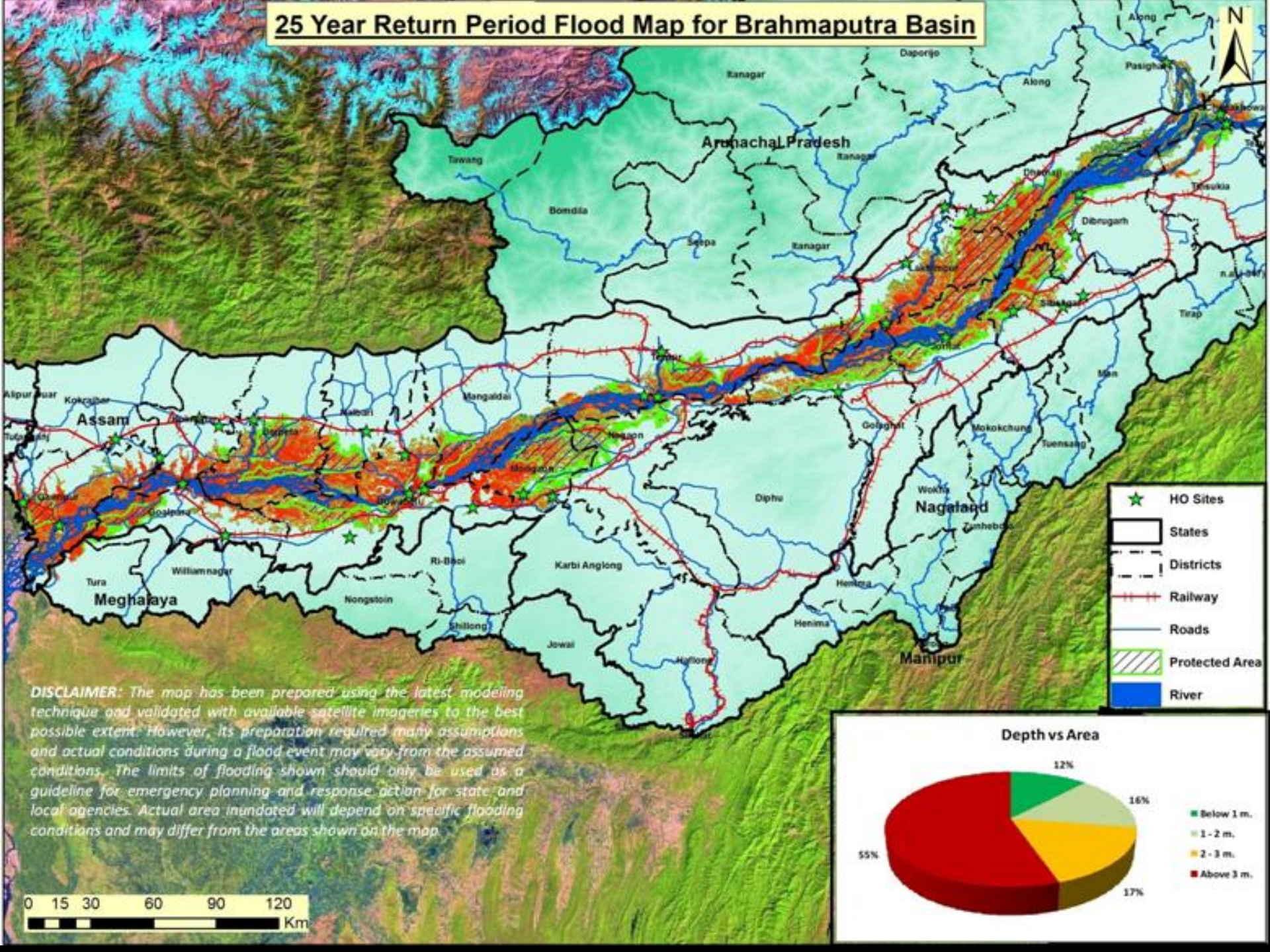
FLOOD INUNDATION FOR BRAHMAPUTRA RIVER

CENTRAL WATER COMMISSION

Home Inundation Methodology Forecast-Hydrograph Tabular-View Contact

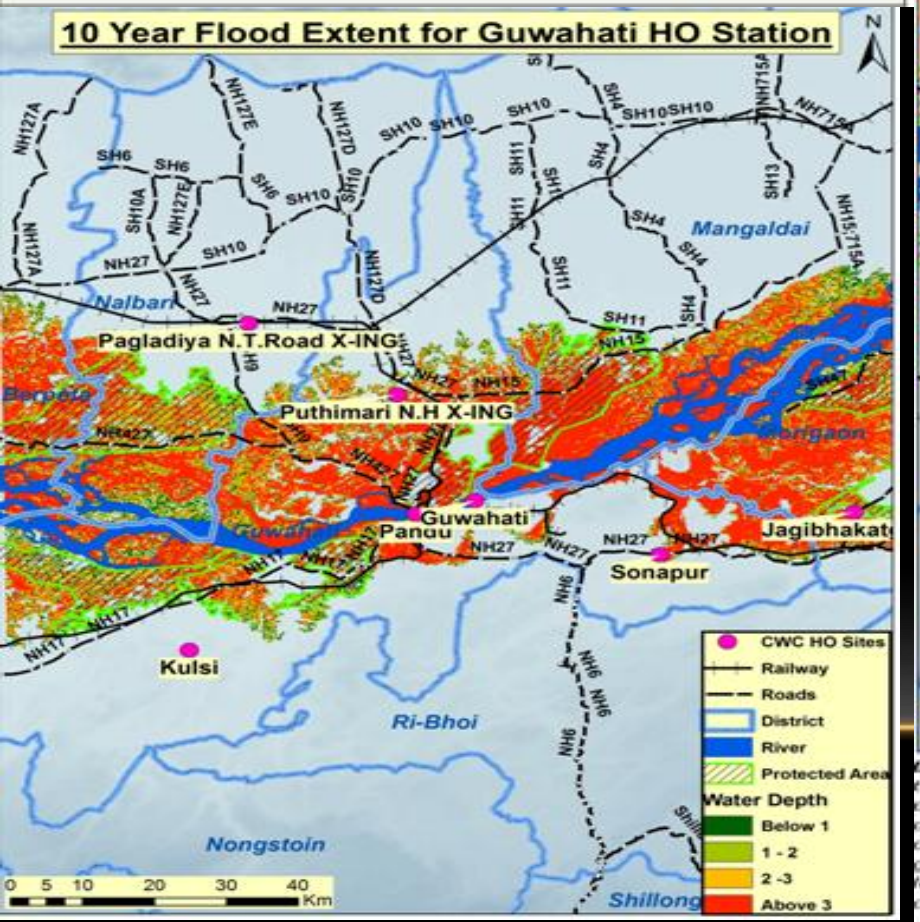


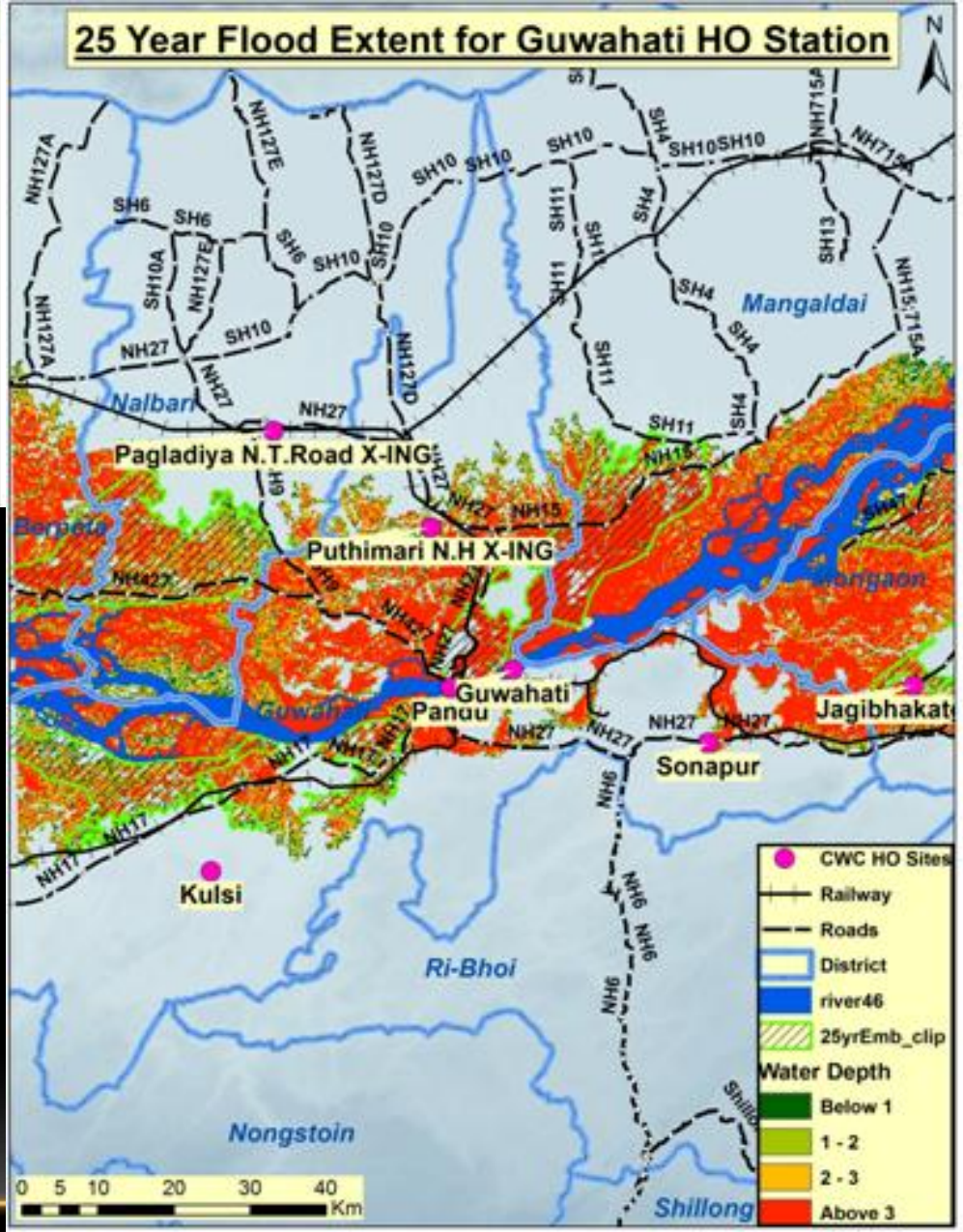
25 Year Return Period Flood Map for Brahmaputra Basin



DISCLAIMER: *The map has been prepared using the latest modeling technique and validated with available satellite imageries to the best possible extent. However, its preparation required many assumptions and actual conditions during a flood event may vary from the assumed conditions. The limits of flooding shown should only be used as a guideline for emergency planning and response action for state and local agencies. Actual area inundated will depend on specific flooding conditions and may differ from the areas shown on the map.*

Station name	Critical levels	Flood effected districts
GUWAHATI	WL (48.68m) 3 Yr Flood	Guwahati
	DL (49.68m) 10 Yr Flood	Marigaon
	HFL (51.46m) 25 Yr Flood	Mangaldai
		Nalbari
		Berpeta

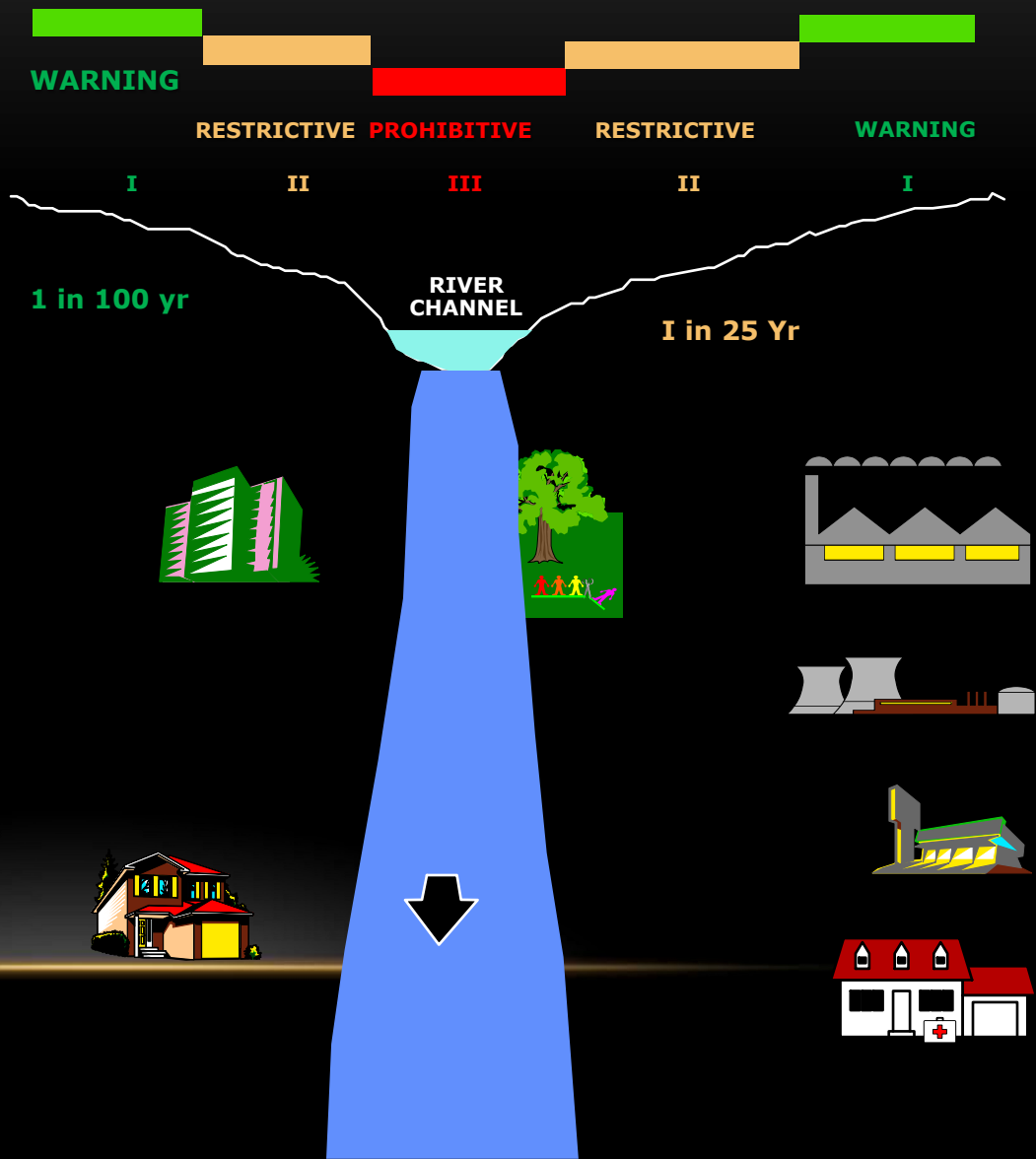




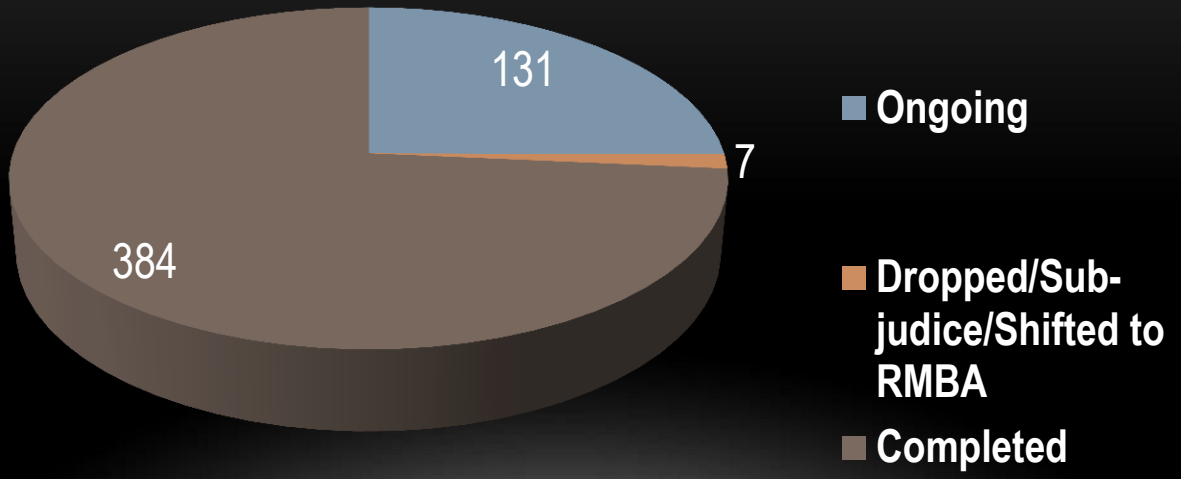
DISCLAIMER: *The map has been prepared using the latest modeling technique and validated with available satellite imageries to the best possible extent. However, its preparation required many assumptions and actual conditions during a flood event may vary from the assumed conditions. The limits of flooding shown should only be used as a guideline for emergency planning and response action for state and local agencies. Actual area inundated will depend on specific flooding conditions and may differ from the areas shown on the map.*

ISSUES NEEDING ATTENTION BY STATE

- Review of DL & WL of FF sites
- FPZ
- Sharing of flood information by upper riparian states with lower ones for release of water from reservoirs
- Flood Damage statistics may be updated regularly during monsoon followed by confirmation copy after season is over for record
- Latest Mobile of nodal officers for receiving SMS in case of High & Unprecedented Floods



STRUCTURAL MEASURES
PLANNED FMP SCHEMES 2018-20



- 131 ongoing FMP schemes to be completed during 2018-20
- Central share to be released Rs. 4022 cr

INTEGRATED RESERVOIR OPERATION (IRO)

- River Valley Projects developed by State Govts. are being operated as single entity in most cases
- Sudden release from dams in one State creates inundation in other State resulting loss of lives & economic losses to population & infrastructure
- States don't have institutional mechanism to operate reservoirs in integrated manner
- CWC have its monitoring network in almost all inter-state rivers & is also having experience of integrated operation in Damodar Valley Corporation (DVC)
- MoWR, RD & GR has taken up this issue on priority for other River Basins from Disaster Management angle

Way Forward

1. Basin wise/ system wise regulatory authorities involving concerned states/ stakeholders- **CWC prepared plan for 8 basins**

2. Development of DSS for IRO basin wise/ system wise- **data from states being collected**
   - System wise interstate/ intra-state Team formation
   - Development of trial rule curves

THANKS !!

RAINFALL-RUNOFF MODELLING