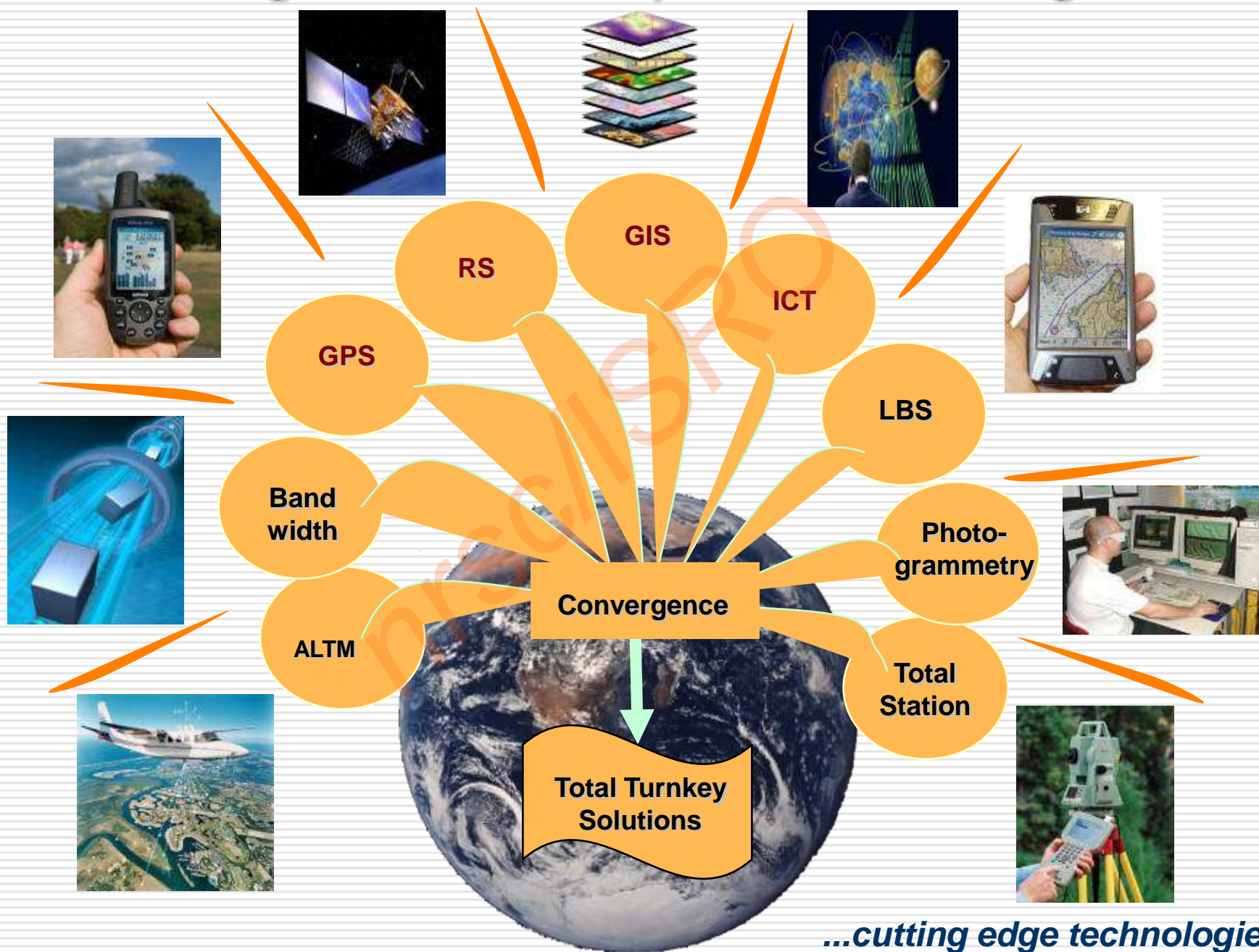


ISRO Disaster Management Support Programme Initiatives

V Bhanumurthy
bhanumurthy_v@nrsc.gov.in

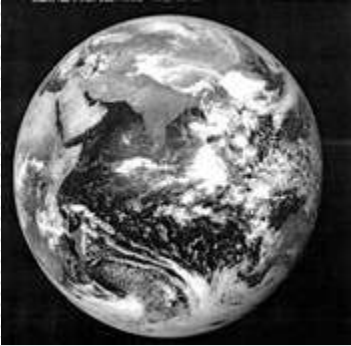
User Interaction Meet – 2014
January 20-21, 2014 NRSC, Hyderabad

Convergence of Geospatial Technologies

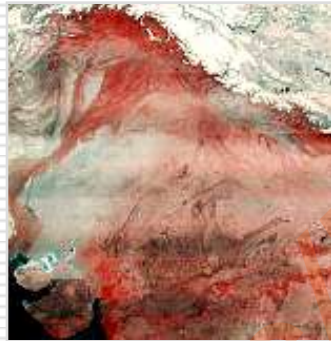


...cutting edge technologies

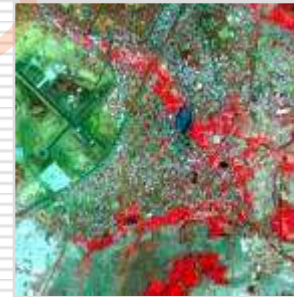
High temporal resolution
Large swath



Medium temporal resolution
Large swath



Low temporal resolution
Limited swath



Low temporal resolution
Very limited swath



Medium spatial resolution
Local level information

High spatial resolution
Location specific information

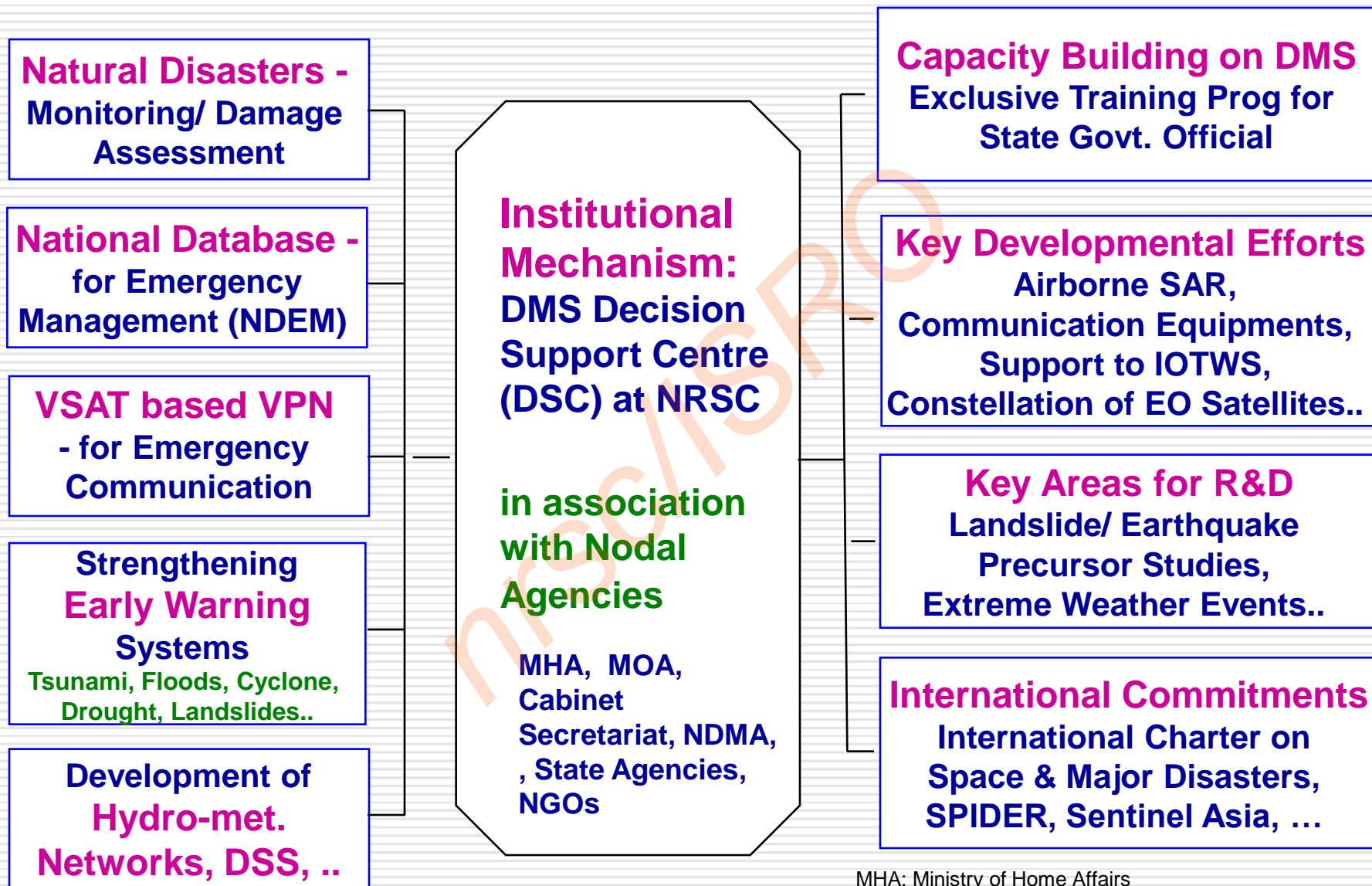
Global to Local

Depends on

- Phase of the disaster
- Type of the disaster
- Extent and severity

....

ISRO-DMS Programme at a glance



MHA: Ministry of Home Affairs

MOA: Ministry Agriculture

NGO: Non-Governmental Organisations

NDMA: National Disaster Management Authority

Decision Support Centre (DSC) Services

Seasonal Monitoring

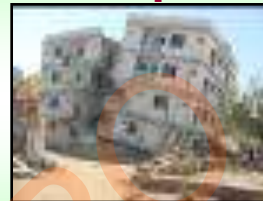
Floods



- Flood Inundation Maps
- Damage Assessment
- Hazard Zonation
- Bank Erosion Studies

Event Based Monitoring

Earthquake



- Damage Assessment

Drought



- Monthly Agril. Drought Report
- End-of-the-Season Agril. Drought Report

MNCFC

Cyclone



- Inundation Maps
- Recession Maps
- Damage Assessment

Forest Fire



- Active Fire Detection
- Damage Assessment

Landslide



- Damage Assessment
- Hazard Zonation

Information Dissemination

Central: MHA, CWC, Min. of Agri, GSI, IMD, MOEF

State: Relief Commr., DM, Agri, Forest, other concerned Line Depts.

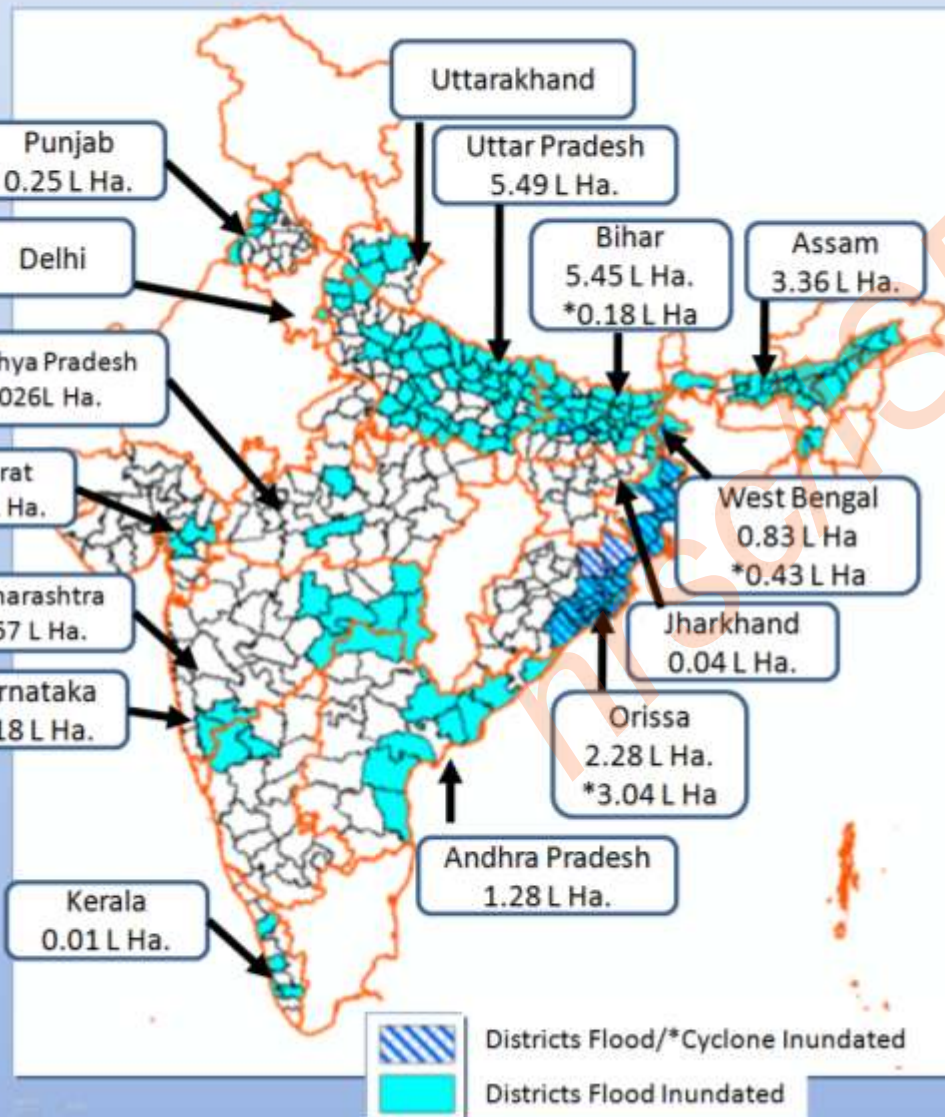
nrsc/ISRO

Case Studies

Flood Response

Mapping during Major Floods/*Cyclones in 2013

15 States -19.91/*3.65 L ha.-165/20* Districts – 122/22* Maps



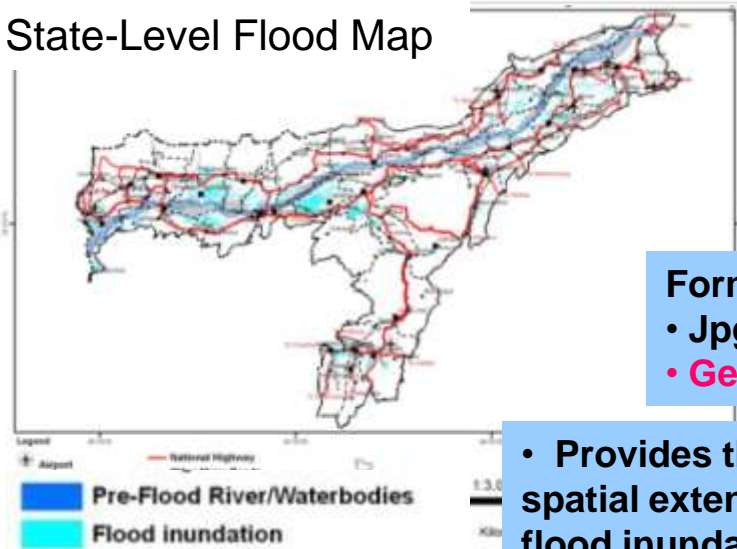
State	Maps						Total
	June	July	Aug	Sep	Oct		
Uttarakhand	17	4	-	-	-	-	21
Uttar Pradesh	4	5	11	3	-	-	23
Delhi	1	-	-	-	-	-	1
Assam	-	3	4	3	-	-	10
Bihar	-	9	11	6	-	1	27
West Bengal	-	2	-	-	1	1	4
Maharashtra	-	3	2	-	-	-	5
Andhra Pradesh	-	9	2	-	6	-	17
Jharkhand	-	-	2	-	-	-	2
Orissa	-	-	3	-	6	20	29
Karnataka	-	-	1	-	-	-	1
Kerala	-	-	1	-	-	-	1
Punjab	-	-	1	-	-	-	1
Madhya Pradesh	-	-	1	-	-	-	1
Gujarat	-	-	-	1	-	-	1
Total	22	35	39	13	13	22*	144

Users:

- Ministry of Home Affairs, State Relief Commissioners, NDMA, IMD, CWC

Flood Mapping - Products

State-Level Flood Map

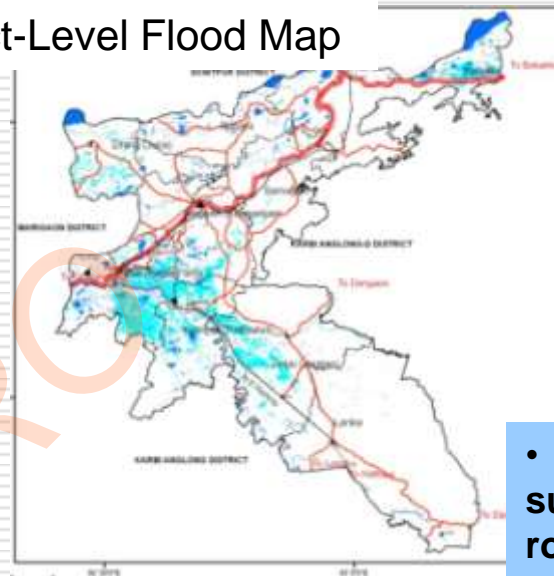


Format

- Jpg, Pdf
- **Geo-Pdf**

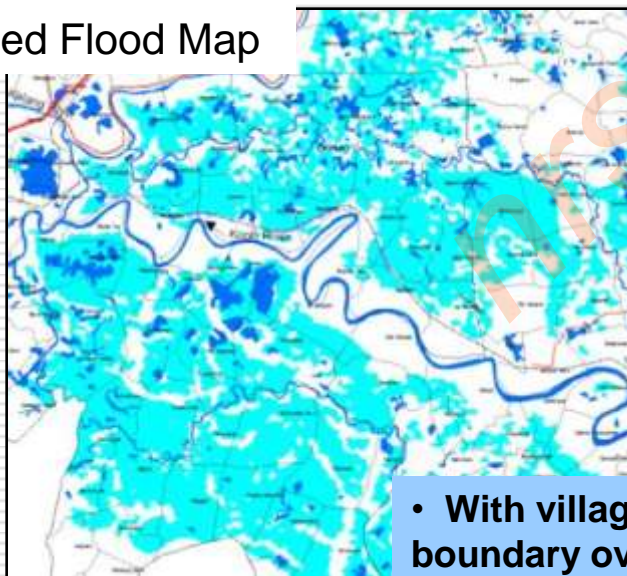
- Provides the spatial extent of flood inundation

District-Level Flood Map



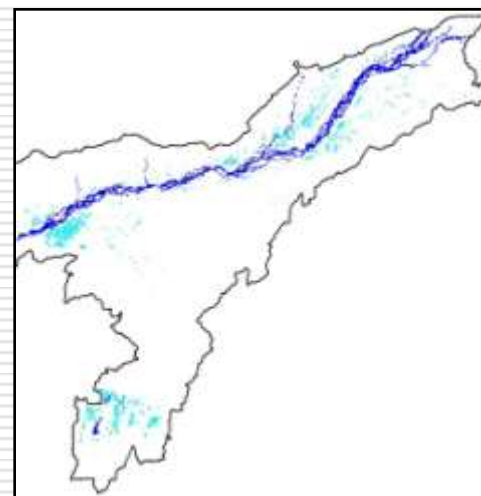
- Provides submerged roads, rails

Detailed Flood Map



- With village boundary overlay

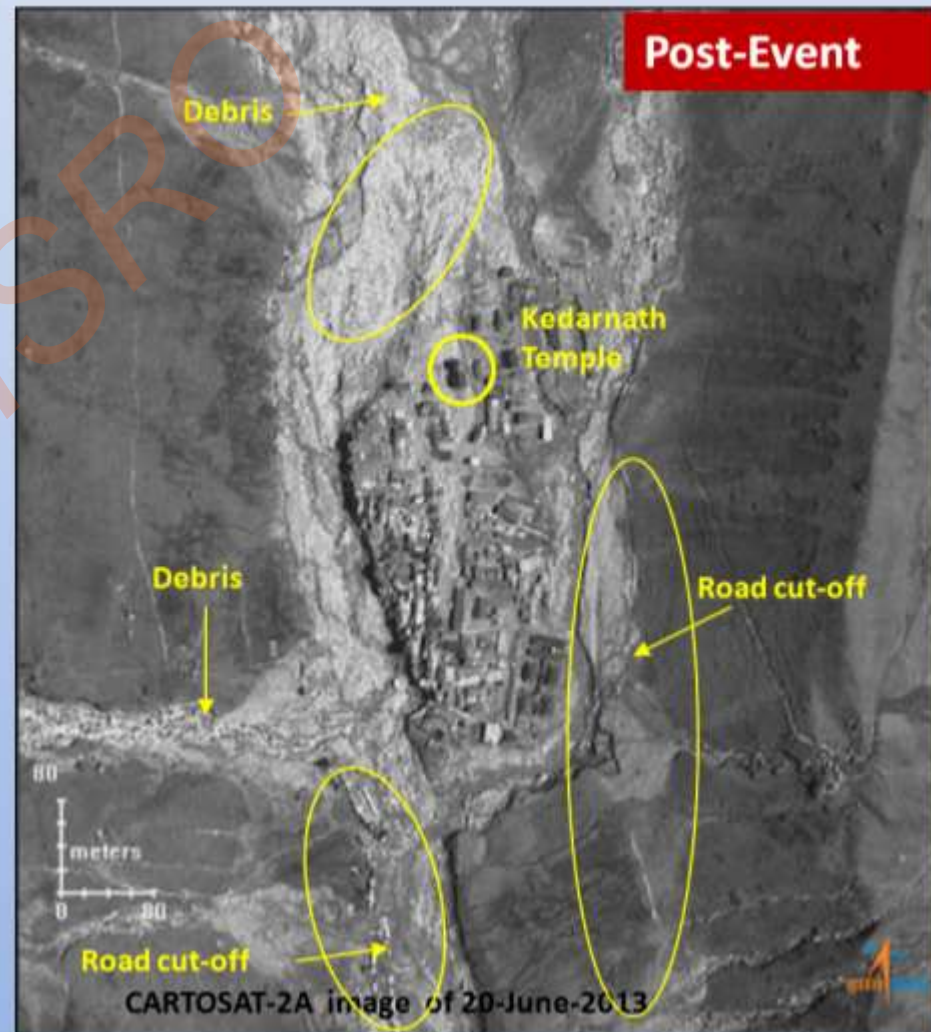
Flood Layer in GIS format



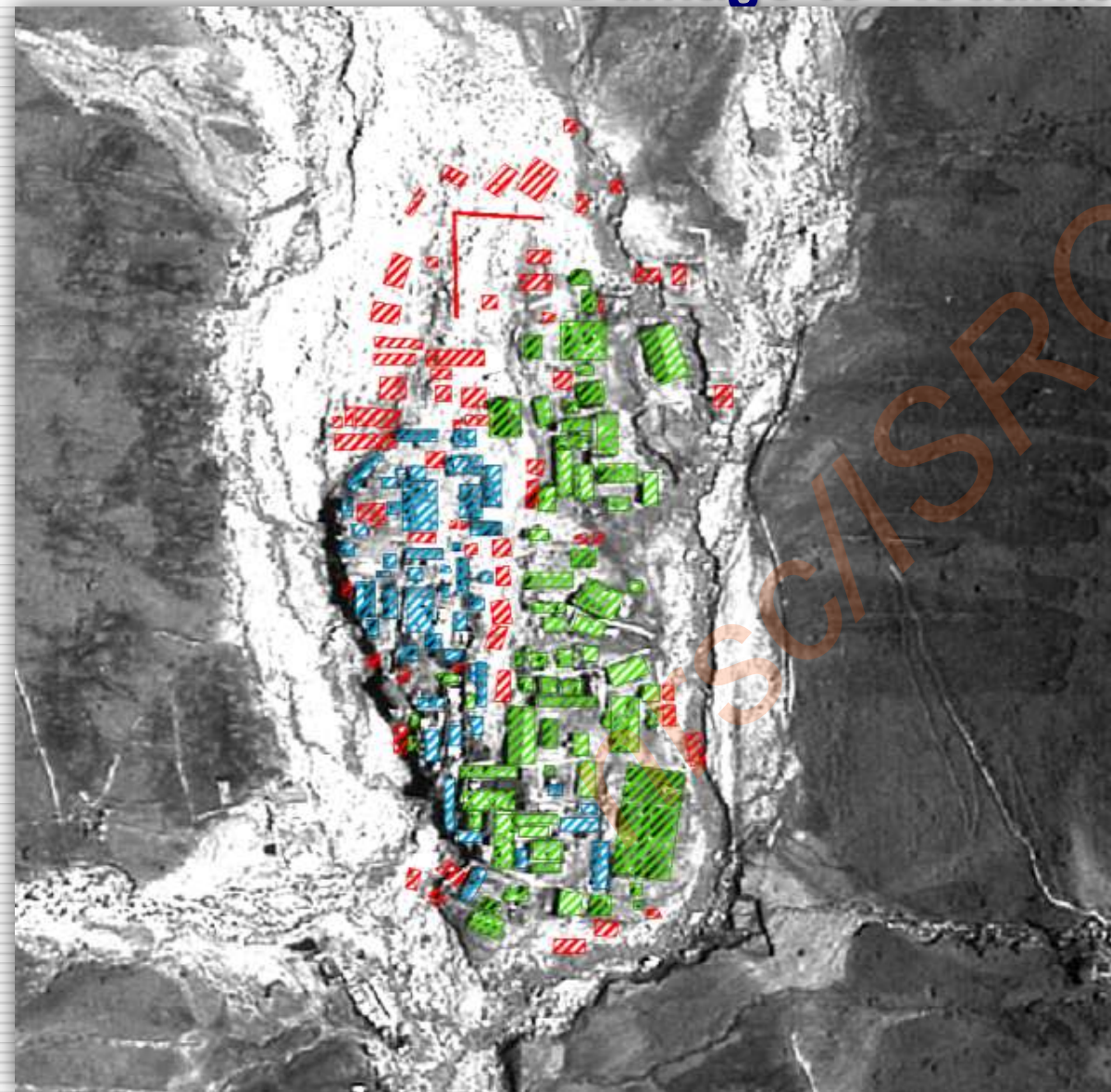
- Helps in further value addition at User end

Damage to Kedarnath

- Information Provided – Flood Inundation, Damaged Roads, Landslides
- Information Dissemination – NDEM – VPN, Bhuvan Portal



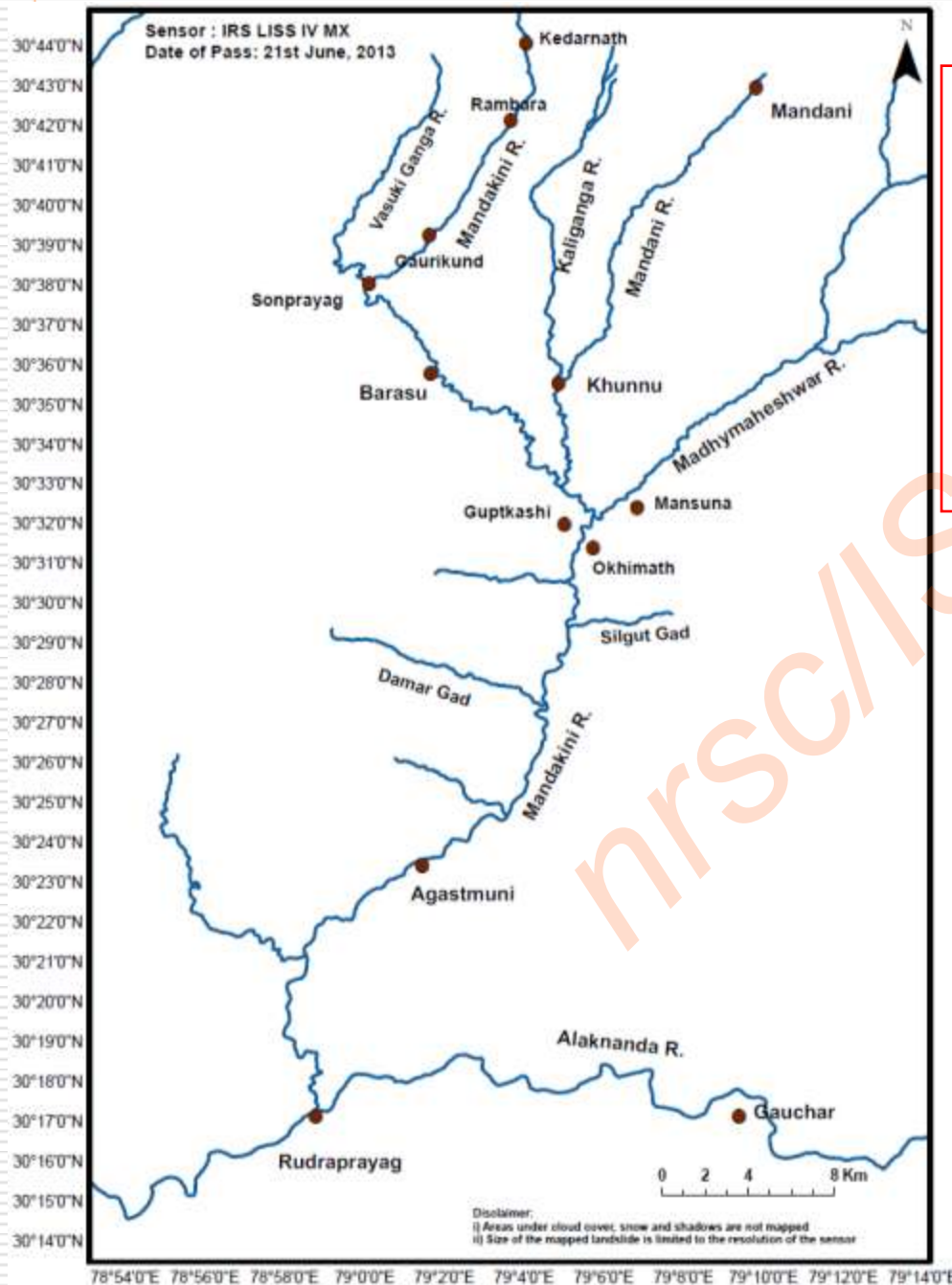
Damage to Kedarnath



Description	Count
Structures Intact	66
Damaged	47
Washed away	63
Retaining wall (washed away)	1
Total	177

Infrastructure damage between Kedarnath and Rudraprayag

S no.	Name of Stretch	Roads damaged /locations
1	Kedarnath-Sonprayag	6 kms (at 16 locations)
2	Sonprayag-Bamsu	1.2 Kms (at 3 locations)
3	Bamsu -Pandrola	9 kms (at 14 locations)
4	Pandrola- Papdasu	5 km (at 4 locations)
5	Papdasu - Swit	0.5 Km (at 1 location)



Summary of landslide inventory

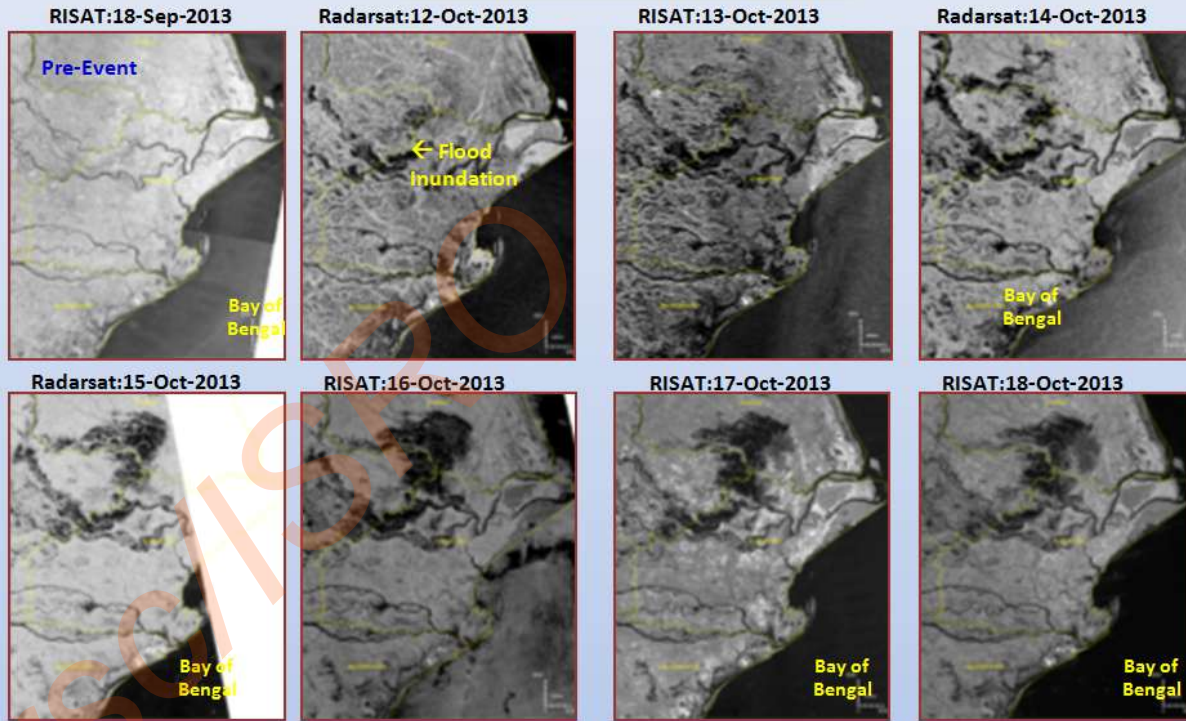
- Entire Mandakini valley and parts of Alaknanda valley were mapped.
- Major towns covered are Kedarnath, Gaurikund, Sonprayag, Okhimath, Agastmuni, Rudraprayag and Gauchar
- Total no. of landslides : 1163 (*note: not field validated*)
- Landslide inventory maps are updated in Bhuvan



Highlights

- Daily information on (Oct 12-17) Inundation extent to OSDMA
- 12-Hourly updates for floods in Balasore district by using RISAT-1 ascending and descending modes
- OSDMA used it for relief operations.

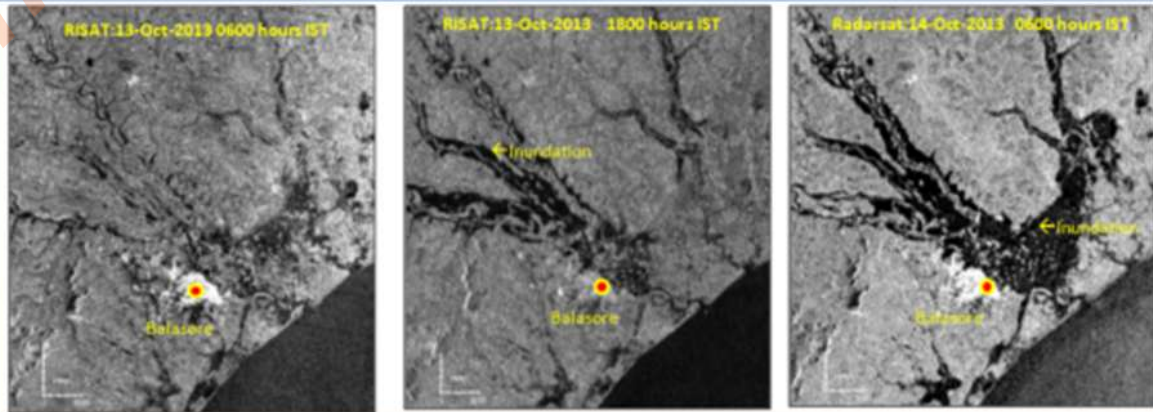
Daily Inundation Extent



Inundation Oct 12-16, 2013



12-Hourly Inundation Extent



FLOOD HAZARD MAP (1998-2010) BIHAR STATE Flood Hazard Map of Bihar



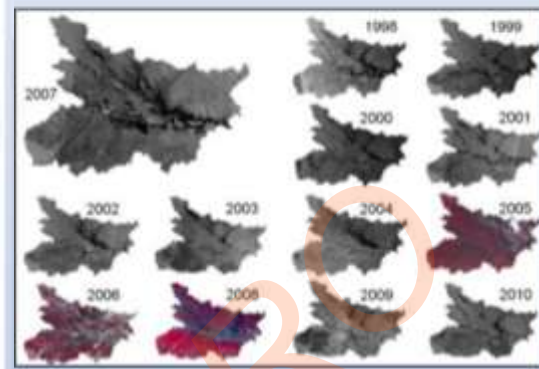
Flood Hazard

- Very Low
- Low
- Moderate
- High
- Very High

Atlas released on June, 2013

Sl No	Hazard Severity	Flood Hazard Area (ha)	% Flood Hazard (wrt State Geographic Area)	% Crop Area Under Different Flood Hazard Categories (wrt State Geographic Area)
1	Very High	83,280	0.88	0.43
2	High	1,22,905	1.31	0.78
3	Moderate	2,70,579	2.87	1.77
4	Low	5,24,862	5.57	3.60
5	Very Low	14,55,278	15.45	10.26
TOTAL		24,56,904	26.09	16.83

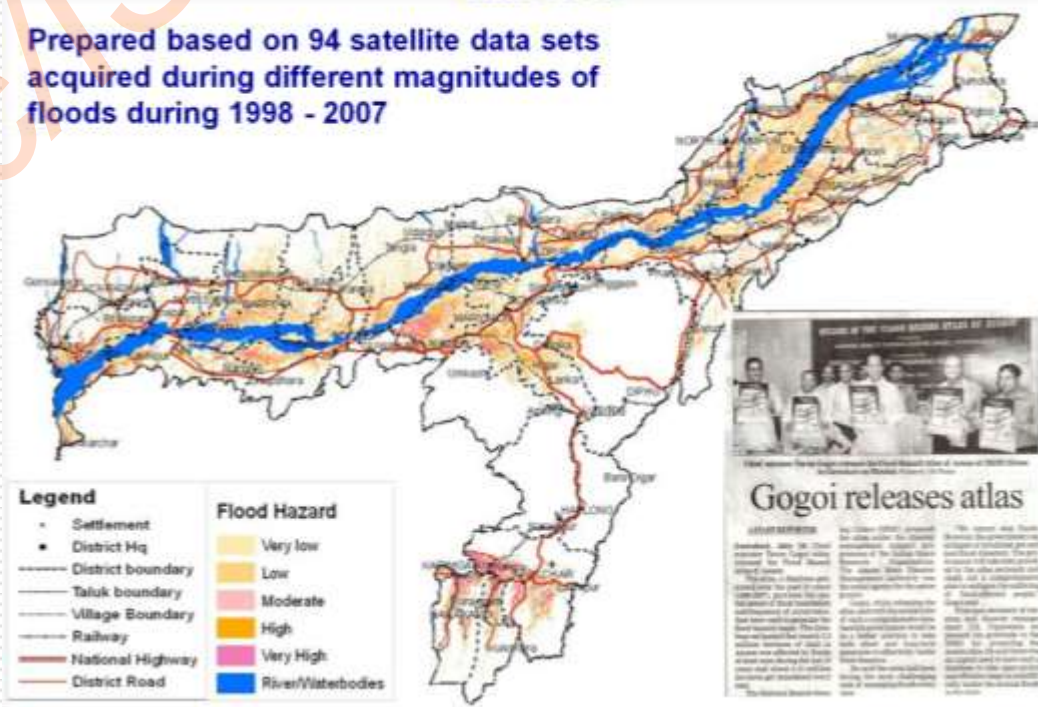
13 Years (1998-2010): 128 satellite datasets



Hon'ble Chief Minister of Bihar with Bihar Flood Hazard Atlas

Assam: Flood Hazard Zonation State-Level

Prepared based on 94 satellite data sets acquired during different magnitudes of floods during 1998 - 2007



Gogoi releases atlas

Assam Flood Hazard Atlas
The Assam Flood Hazard Atlas is a state-level map showing the flood hazard zonation of Assam. It is based on 94 satellite data sets acquired during different magnitudes of floods during 1998 - 2007. The atlas is a valuable tool for flood mitigation and disaster management in Assam.

FLOOD HAZARD MAP

MORIGAON DISTRICT



Extract from Flood Hazard Atlas for Assam State - A Geospatial Approach prepared by National Remote Sensing Centre, Indian Space Research Organisation, Dept. of Space, Govt. of India



FLOOD HAZARD MAP

MORIGAON DISTRICT

4.0 UTILITY OF FLOOD HAZARD MAPS

The Flood Hazard Maps for different districts of Assam will be of immense help to the administrative machinery in identification of flood risk areas and thereby help in the planning of a more effective emergency response. For example, areas that are likely to require evacuation can be identified, and evacuation routes can be planned and clearly signposted so local communities are made aware in advance of an emergency. The identification of flood risk areas will also help in the location of flood shelters for evacuees.

The flood hazard maps can also support planning and development by identifying high risk locations and steering development away from these areas.



Shed in Assam, June 2007

This will help in minimizing the impacts of flood in the State of Assam and also encourages sustainable development. In order for this to occur, the consideration of flood hazard maps must be integrated into planning procedures.

3.0 BENEFITS OF FLOOD HAZARD MAPS

- Residents will have a better sense of flooding risks and the safety precautions that they need to take.
- Community planners and local officials will gain a greater understanding of the flood hazards and risks and can therefore improve local planning activities.
- Builders and developers will have access to more detailed information for making decisions on where to build and how construction can affect local flood hazard areas.
- Home and business owners will have the ability to make better financial decisions about protecting their properties.

FLOOD HAZARD MAP

MORIGAON DISTRICT

FLOOD HAZARD MAP

1998 - 2007

MORIGAON



VERY LOW
LOW
MODERATE
HIGH
VERY HIGH

Flood Hazard Statistics

- Geographical Area: 2021 Sq Km
- Total Flood Hazard Area: 2376.24 Sq Km
- % Flood Hazard Area: 11.75%
- Flood Hazard Area under different Flood Hazard Zone

Flood Hazard Zone	Area (Sq Km)	Percentage (%)
Very Low	101.12	4.95
Low	101.12	4.95
Moderate	101.12	4.95
High	101.12	4.95
Very High	101.12	4.95

- Total No. of Revenue Circles (as per census 2011): 8 nos.
- Total No. of Villages (as per census 2011): 426 nos.
- No. of Villages under very high & high flood hazard category: 201 nos.

Graph showing the percentage of various Flood Hazard categories



FLOOD HAZARD MAP

MORIGAON DISTRICT

5.0 SUGGESTIVE APPLICATION OF FLOOD HAZARD ATLAS BY DISTRICT ADMINISTRATION / DEPARTMENTS

- Special emphasis should be given by the district administration to these high risk flood affected villages while planning and carrying out developmental activities.
- District Administration should make available the list of high and very high flood hazard villages to all the departments so that the departments can take adequate measures for mitigating the impact of floods.
- District administration should publicize that houses in the high risk flood affected areas should be constructed above the high flood level of previous years.
- District administration should preposition the rescue and relief teams in the high risk flood affected areas to minimize response time for evacuating the people.
- District administration should instruct the agriculture department to propagate the use of flood tolerant crops in these high risk flood affected villages.
- District administration should pre-identify the raised platforms and shelter places for sheltering the villagers and livestock for reducing the life and property.
- In the flood contingency / response plan, the high risk flood affected villages should be accorded priority and a nodal officer be designated during the flood season for monitoring and coordinating the activities of the various departments.
- District Administration should instruct the Health Department to form mobile medical teams and with adequate medicines and preposition these teams in the high risk flood affected areas to prevent the outbreak of epidemics.
- District Administration should instruct the PHE department to raise the hand pumps above the high flood level in the high risk flood affected areas to avoid contamination of water.
- District Administration should instruct the Food & Civil Supplies Department for maintaining sufficient stock of the food commodities and store these commodities at appropriate places.

Utilisation of Assam Flood Hazard Atlas

Assam State Disaster Management Authority (ASDMA) extracted the district-wise content and incorporated the suggestions for utilization by Dist Admn and provided a comprehensive booklet to all Districts.

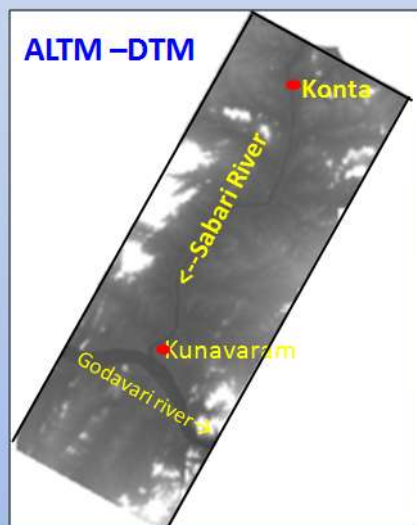
FLOOD EARLY WARNING - Flood Inundation Modelling

Objective:

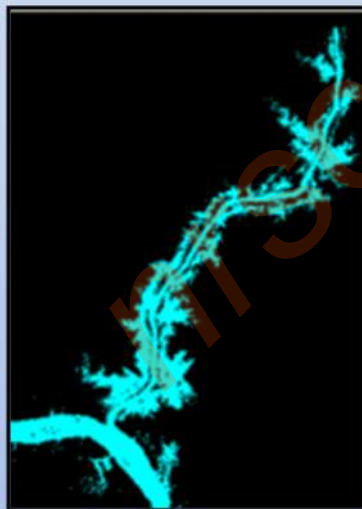
To simulate flood inundation for part of Sabari river in Godavari River basin using HEC Hydraulic model using ALTM DTM and to validate the results with Satellite data.

Input data: ALTM-DTM, Hydrological data
LU/LC data, Contour interval -0.5m

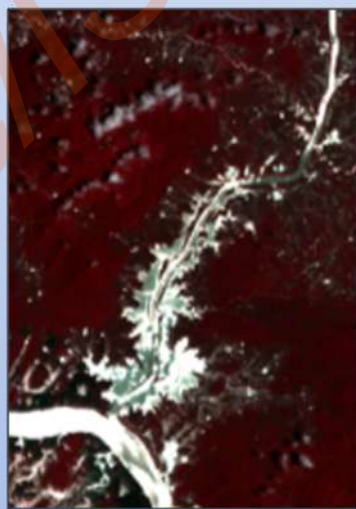
Study area : Sabari tributary from Konta to Kunavaram (35 km) stretch.



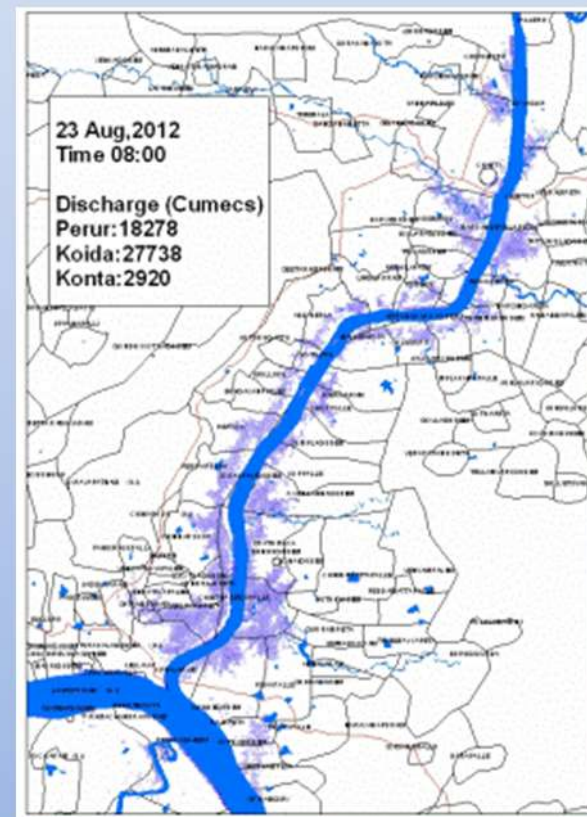
Study area



Simulation Results
23 Aug, 2012
Time 06:00



Resoursesat-2
23 Aug, 2012
Time 10:30



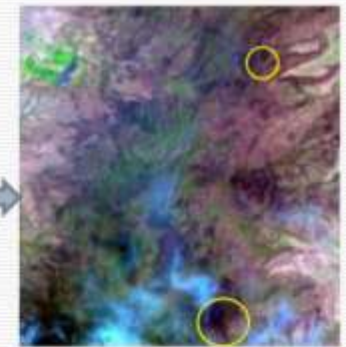
Daily Active Forest Fire Alerts During Feb-June Every Year based on TERRA/AQUA MODIS Data



Daily acquisition of TERRA/AQUA MODIS data
Day & Nighttime passes

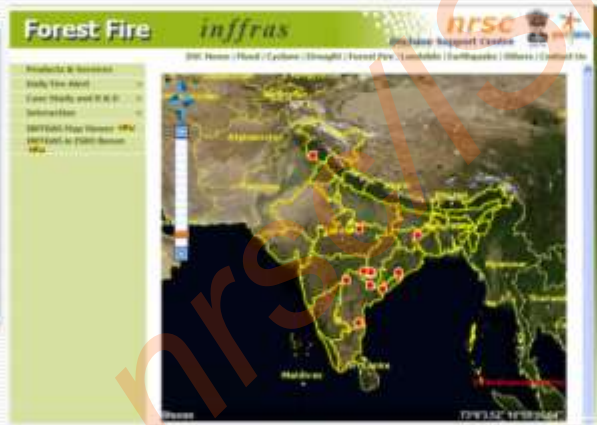


Generation of ~ 4 daily Active Fire Alerts
MODIS contextual Fire Algorithm-MOD14

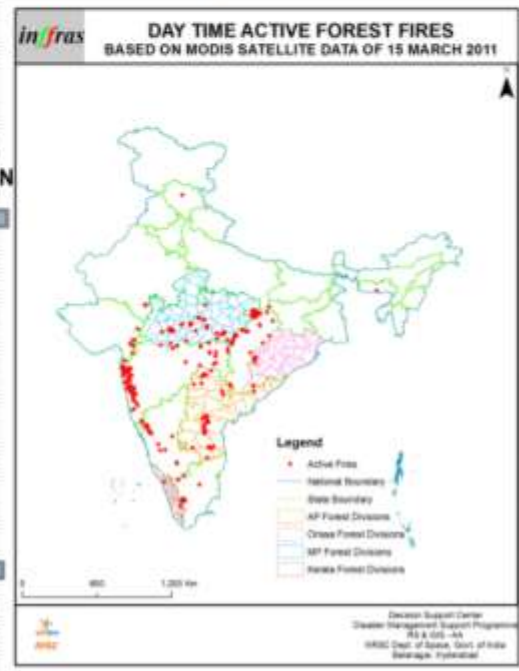


Value additions
•Forest Mask
•Forest Admin. overlay

Disaster Management Support Programme
Decision Support Center
Indian Forest Fire Response and Assessment System (INFRAS)



2D and 3D Visualization through BHUVAN



Feedback



Information to ground personnel for fire mitigation

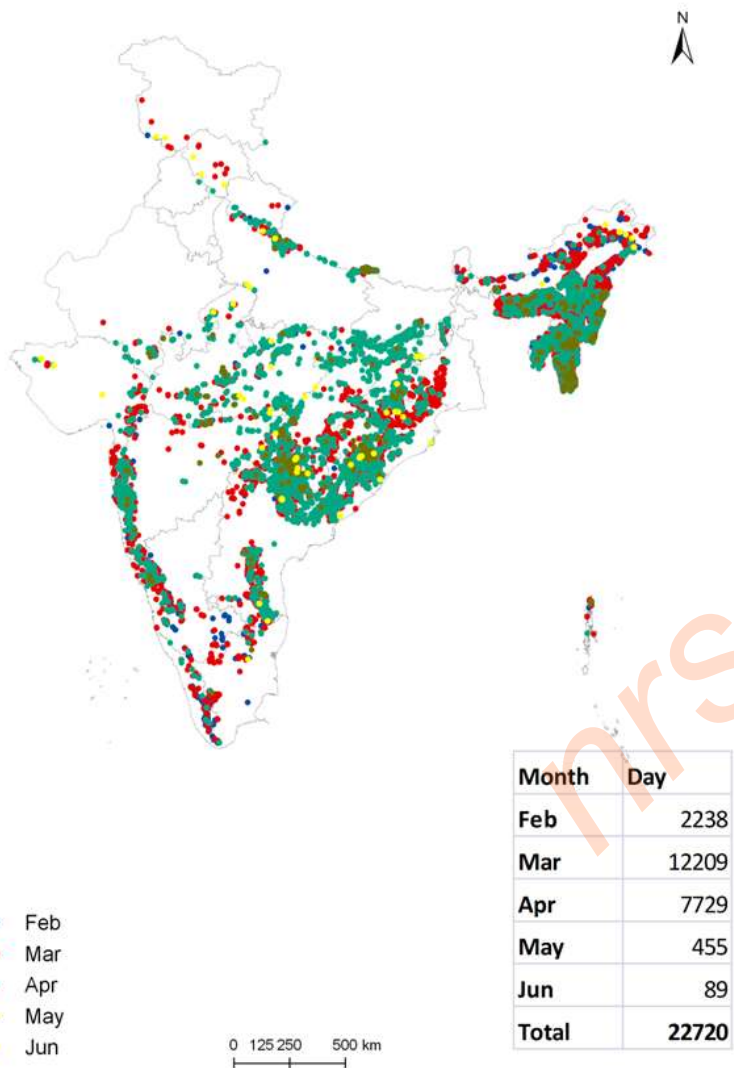


Email Dissemination to ~400 nodal officers

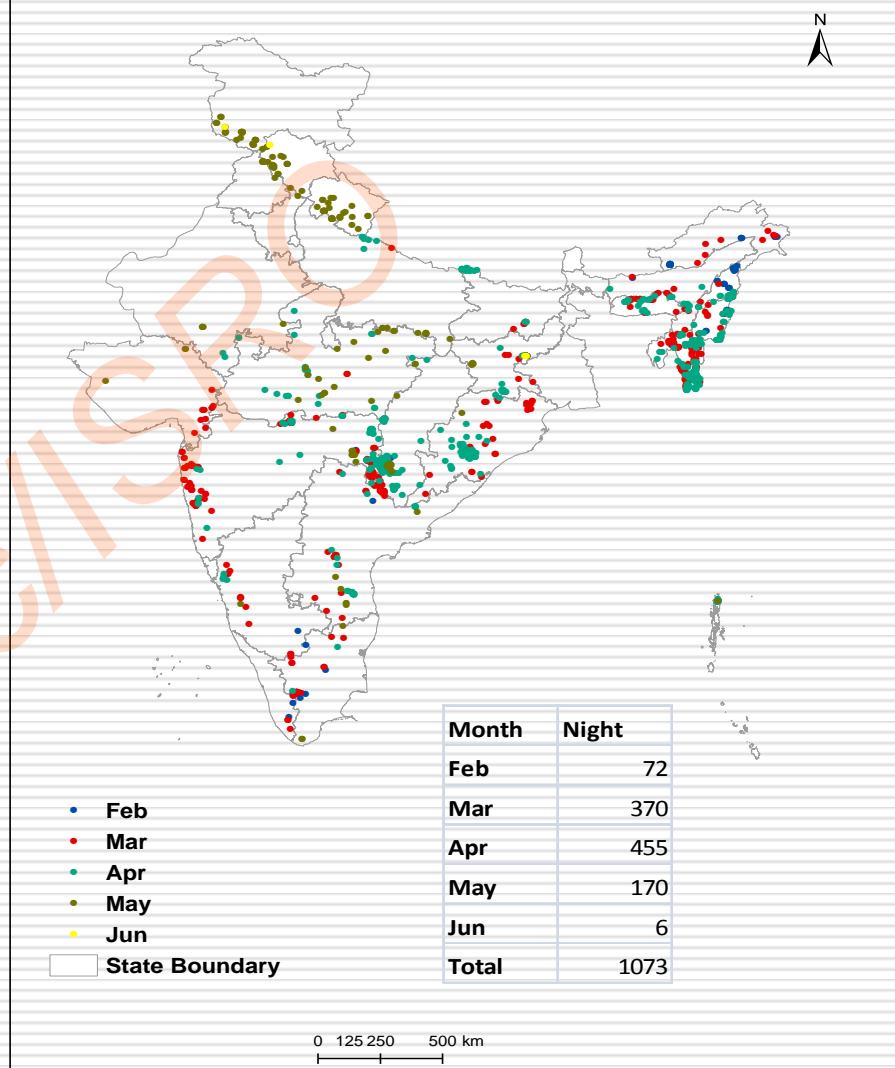
Turn-around time of less than 1/2 hr from satellite overpass

Active Forest Fire Detections during 2013

MODIS Day Time Active Forest Fire Detections - Fire Season, 2013

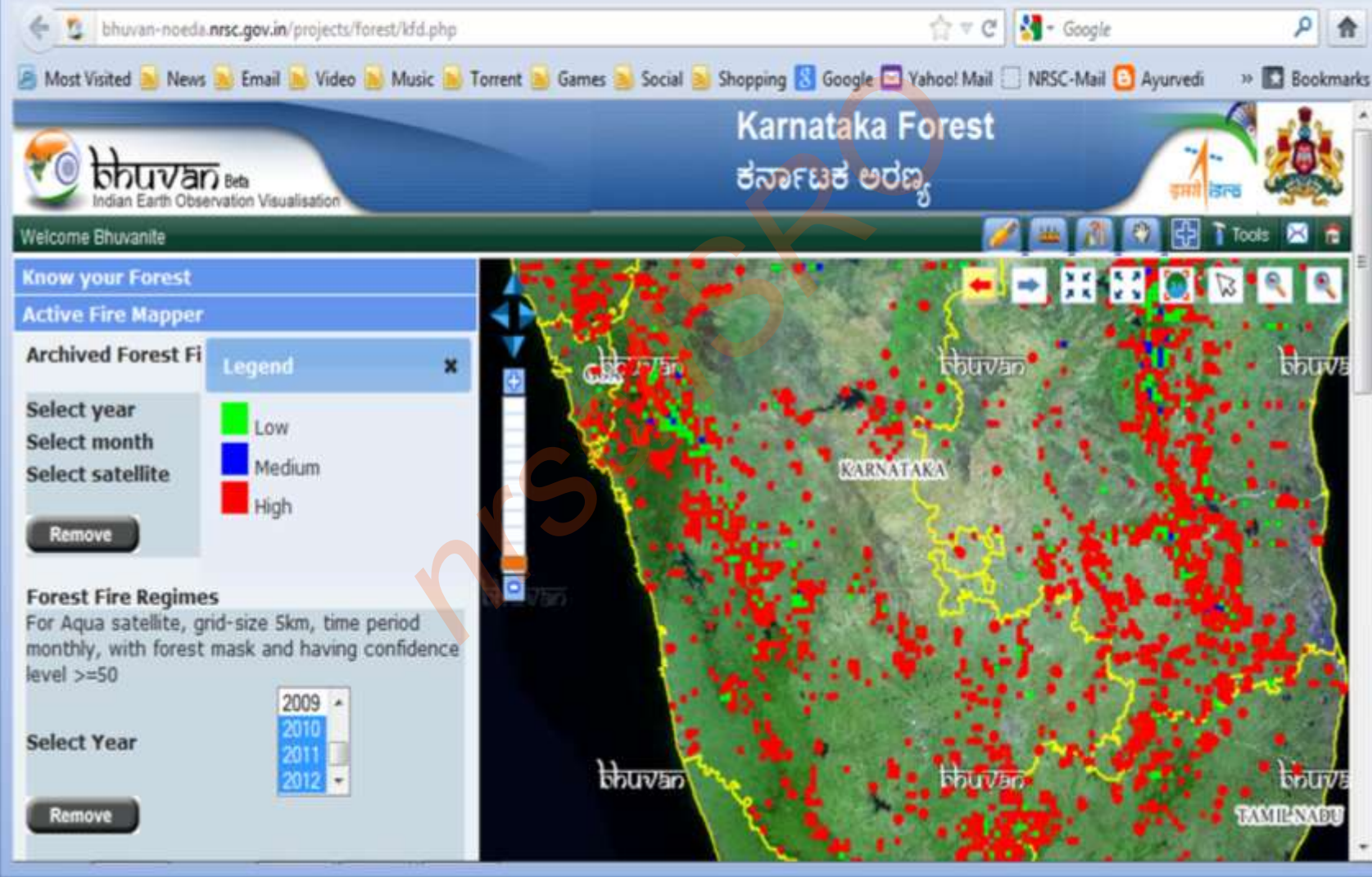


MODIS Night Time Active Forest Fire Detections - Fire Season, 2013



Karnataka FSI – Forest Fires

- With Karnataka Forest Survey of India – Forest Fire Services launched



National Database for Emergency Management (NDEM)

Concept

Event Reporting

Real-time Field Info

Situation Assessment

Resource Identification

Mobilization

Nodal Depts
+

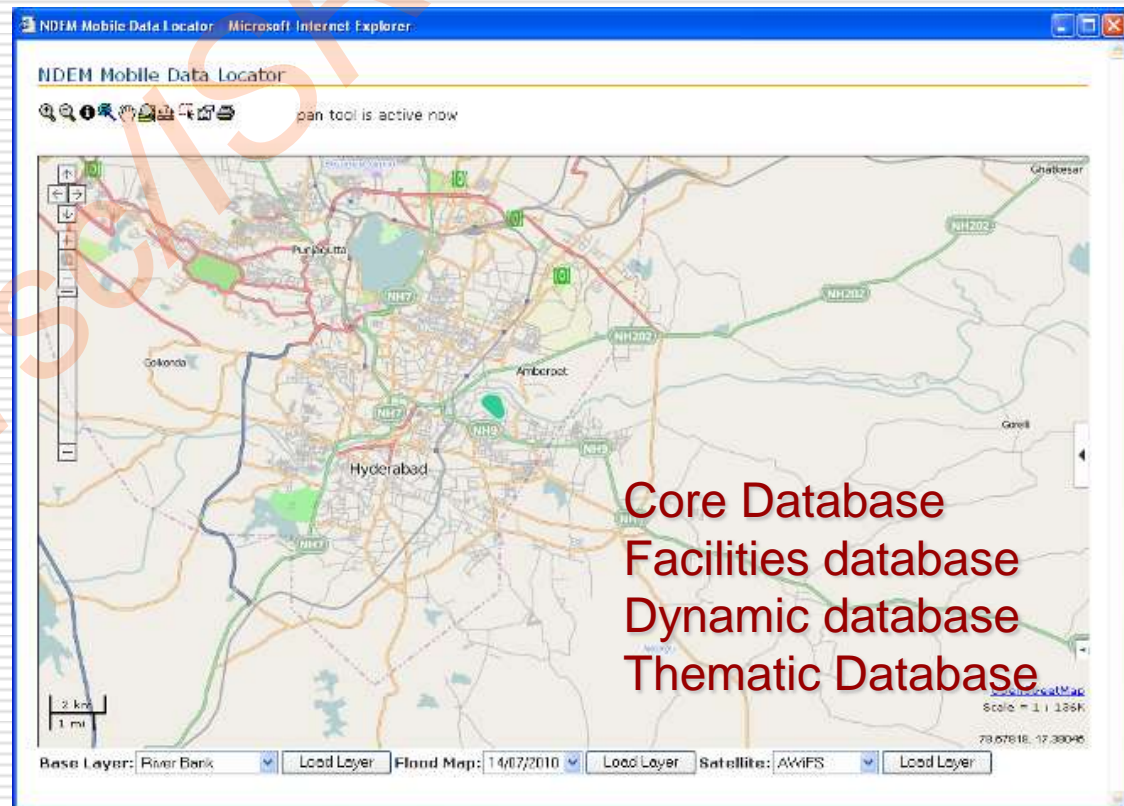
Commn Channels
+

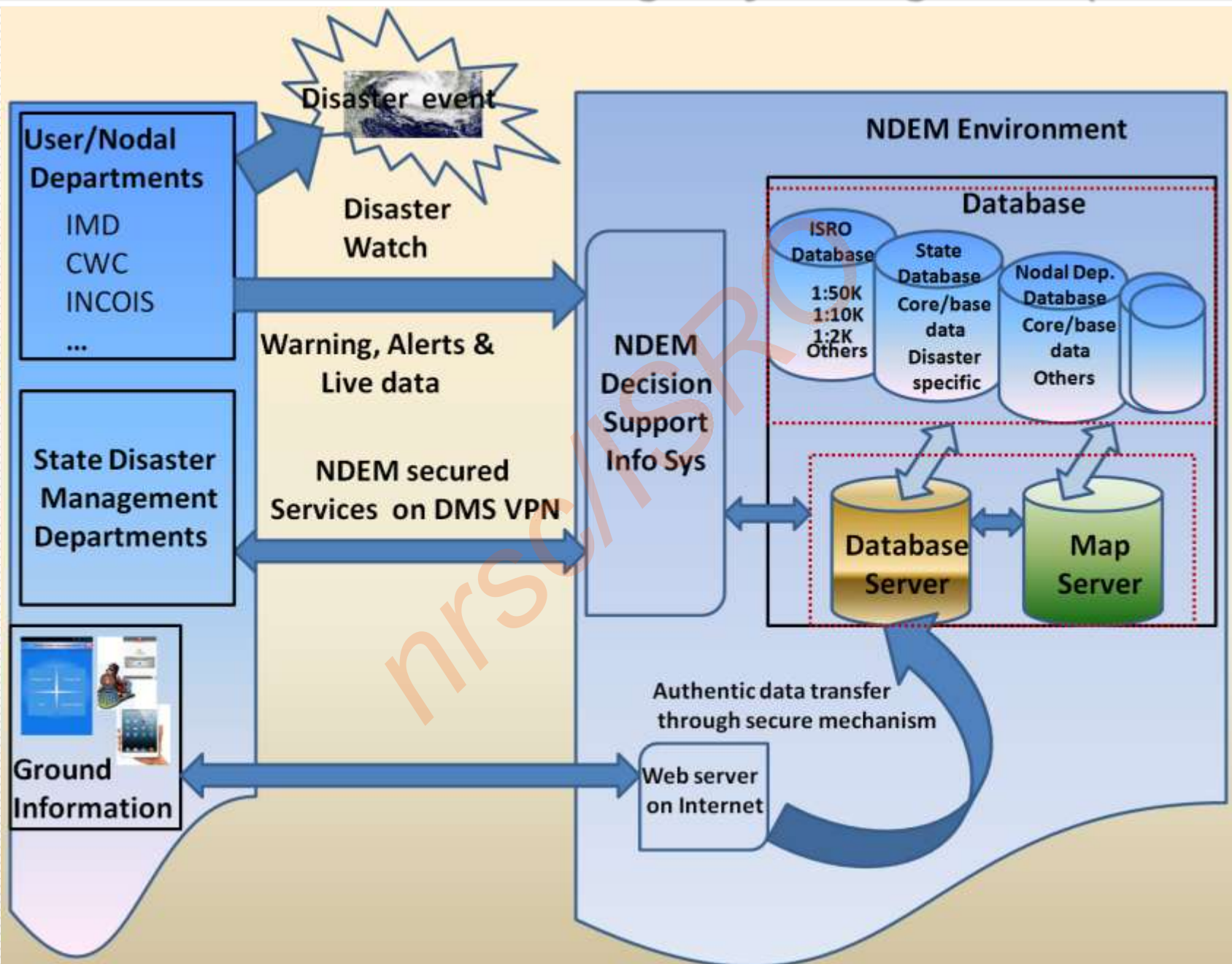
Database integration, Visualization
Decision Making, Actions



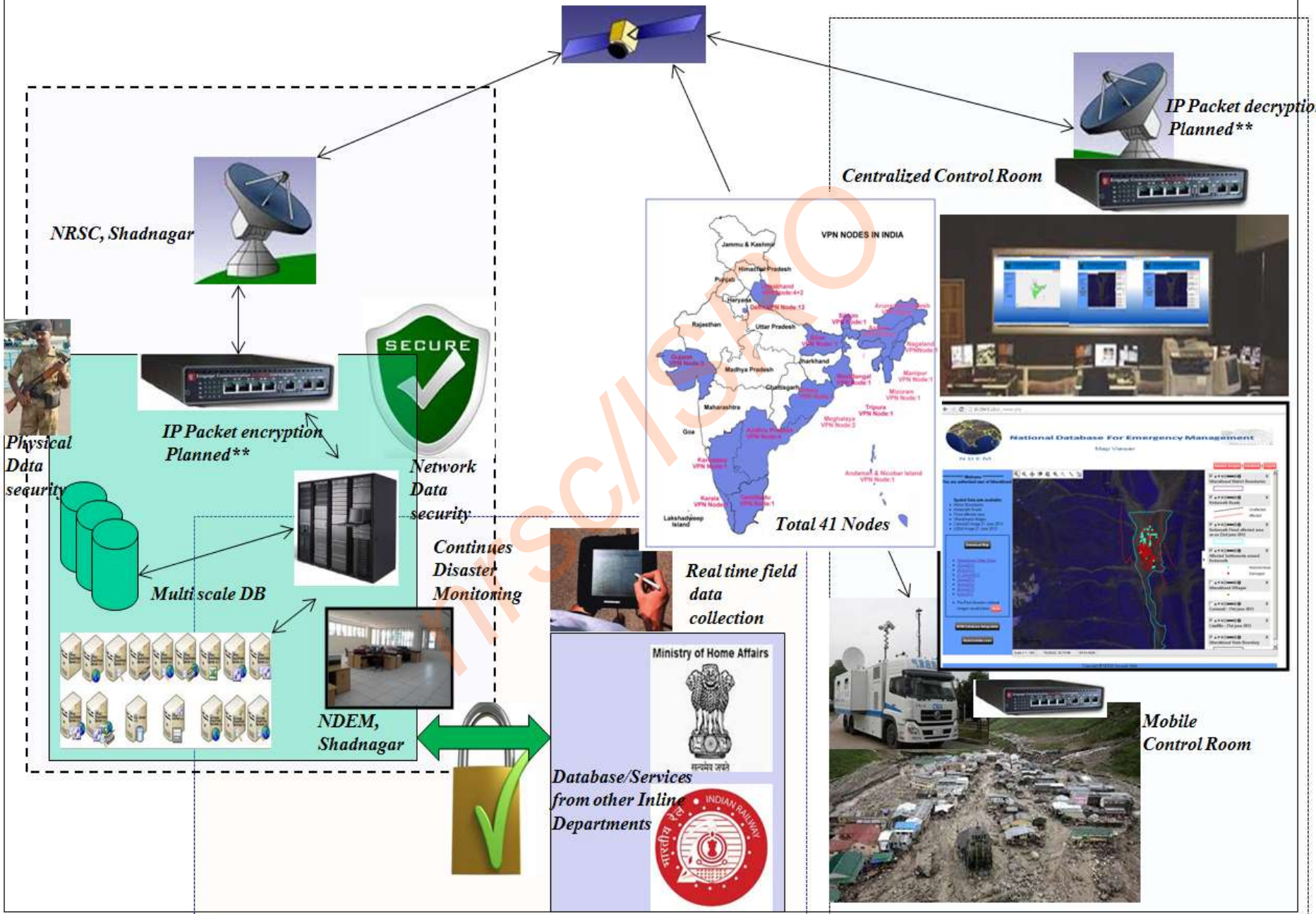
Decision Support System

1. Built-in core & Static data
2. Live data reception
3. Scenario visualization
4. Probable options to deal
5. Choosing best option
6. Means to implement
7. Broadcasting capability





NDEM implementation on Space based secured DMS VPN





Submerged Rai & Villages in Balasur Dist Orissa Due to Cyclone Phailin nrsc

Based on analysis of October 14, 2013 satellite data



National Database For Emergency Management

आपातकालीन प्रबंधन हेतु राष्ट्रीय डाटाबेस

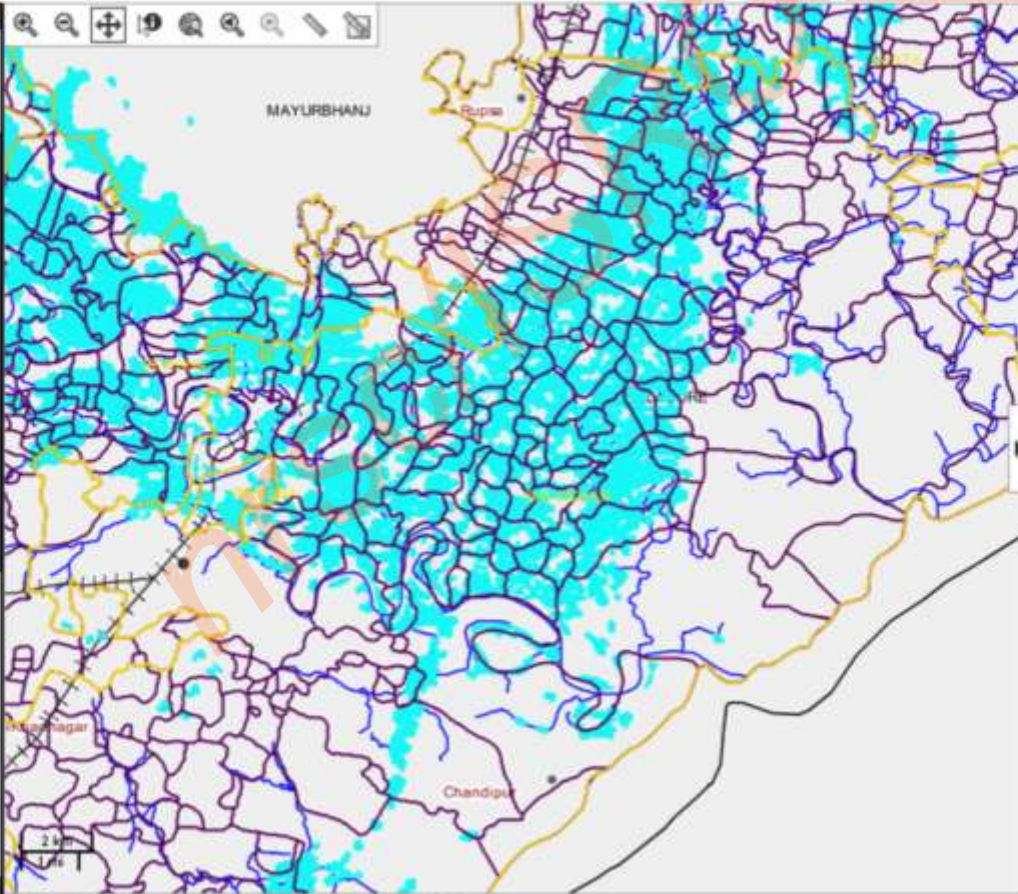
Map Viewer



Welcome Odisha

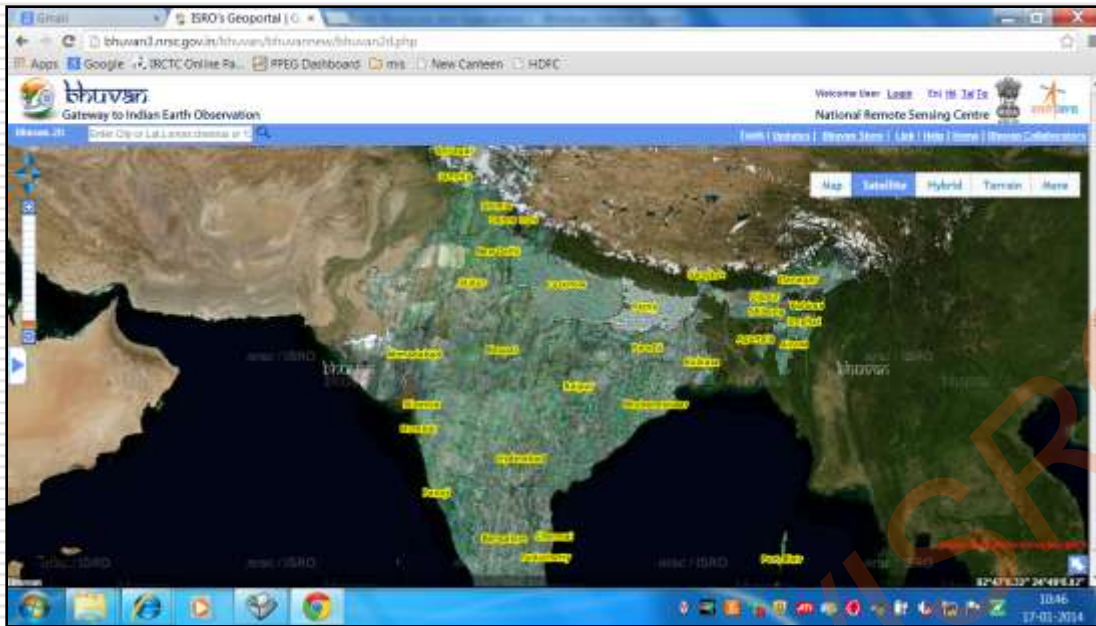
[Home](#) || [HelpLine](#) || [State Disaster Management Plan-Aug2013](#) || [Feedback](#) || [Logout](#)

- Super Cyclone 1999
- Admin Layers**
- Villages Boundaries & HQ
- Taluk
- Districts
- Settlements
- Road Layer
- Railway Lines
- [OdishaFloodMap-14Oct13](#)
 - Oct 14 StateMap(pdf) [Download](#)
 - Oct 14 StateMap(ppg) [Download](#)
 - Oct 14 Report [Download](#)
 - Oct 14 Balasore Map [Download](#)
 - Oct 14 Balasore Map Detailed [Download](#)
 - Oct 14 Ganjam Map [Download](#)
 - Oct 14 Ganjam Map Detailed1 [Download](#)
 - Oct 14 Ganjam Map Detailed2 [Download](#)
- [OdishaFloodMap-13Oct13 evening](#)



Scale = 1 : 123K 97.24018, 21.58971 EPSG:4326

- Taluk:Coastal Area
- Villages
- Cyclone: 14 Oct 2013
- Cyclone: 13 Oct 2013 evening
- Cyclone: 13 Oct 2013
- Cyclone: 12 Oct 2013
- Roads
- Railway



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

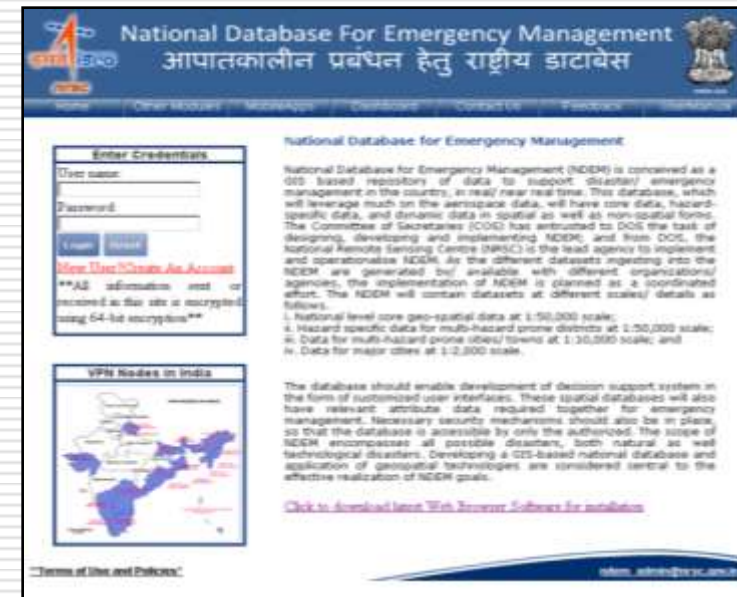


Disaster Products Dissemination Mechanism

Products for

- Download
- Visualization
- Analysis
- Customization

<http://10.254.5.13> on DMS-VPN



Decision Support Tools

nrsc/ISRO

NDEM Map Viewer for Relief Shelters & Hospitals (Puri,Orissa)

pan tool is active now

Feature Details

Type	Relief Shelter
Sequence No	1
Teamname	Team-5
observername	Mr.J.K. Rautray
creation time	March 08 2009_11_35
Lat/Long	19.8299051666667,85.69356548333
Location	rahadmalla, brahamgiri
Relief Shelter Name	brundaman hs
Capacity (In Persons)	1000
Available facility	yes
Lighting	Yes
Drinking water	Yes
Sanitation	Yes
Cooking	Yes
Storage	Yes
Year of disaster	1999
Type of disaster	Cyclone
Ambulance Avail.	Yes
Year of Disaster	1999
Type of Disaster	Cyclone

Scale = 1 : 545K

06-53274, 19-52397

Observer name	Location
pk singh	malasahi
pk singh	malasahi
pk singh	ketaki patna
pk singh	ketaki patna
Mr.B.K Behera	patapur
	Gobindpur
P K singhi	kumarf gobindpur
Mr.Kesab	JAINABAD NIMAPARA
Mr.S.Rautray	sadangoi
pk singh	Dandmukundpur
Mr.J.K. Rautray	REBANAR
PK Singh	mangalpur
Mr.S.Rautray	arisal
PK Singh	PIPLI
pk singh	sahajpur
Mr.B.K Behera	chitreswari
Mr.B.K Behera	kurujanga
Mr.B.K Behera	balidokan
Mr.B.K Behera	kotanga
Mr.B.K Behera	kotanga
pk singh	satsankha
Mr.S.Rautray	delang
Mr.J.K. Rautray	BENTAPUR
Mr.J.K. Rautray	BRAHMAGIRI
Mr.B.K Behera	othaka u.g.u.p school
Mr.J.K. Rautray	KHAJURIA
Mr.J.K. Rautray	SUNAMUNHI
Mr.J.K. Rautray	RAIBIDARPUR
Mr.J.K. Rautray	KAPILESWAR

Click at any point then set the buffer distance then select feature. *Team wise Shelter Search(Select Team then select feature).

Buffer distance (in KM):

Select Observer for Shelter:

1. Click anywhere on the map	3. Click here for hospital/relief shelters
2. Enter the radius (eg. 50 km)	4. Click on any point for details
Relief Shelters with details within 50 km radius of selected point	



Integration of India Disaster Resource Network Database with NDEM

CHOOSE LOCATION

Your State: Please Select the Activity:

CHOOSE ITEMS

Please Select the District: Please Select the Category:

Please Select the Item:

Emergency Resources Inventory

Name	District	Activity	Item Category	Item Name	Department Name	Department Address	Contact Person Name	Contact Person Address	Contact Number	Contact Number	Validity
...

Query results in table & on map

- | | |
|--------------------|--|
| 1. Select state | 5. Select Item |
| 2. Select District | 6. Click on button "Show Detail" for details in tabular form |
| 3. Select Activity | 7. Click on button "Show on Map" for details over the map |
| 4. Select Category | |

IDRN database for complete India with query builder

1. Relief Management
2. Application for geospatial data collection on emergency facilities
3. Geo-tagging of emergency facilities using online maps
4. SMS based event reporting system

Mobile device at field

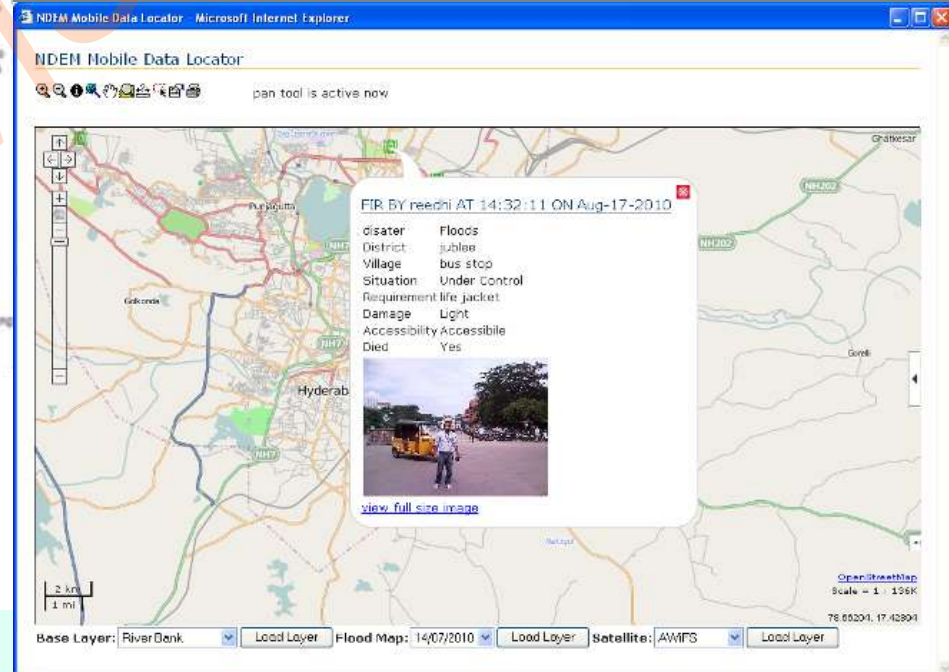


Communication



<input type="checkbox"/> Distress Module	Field Officer in Trouble (Built in Msg/ Audio)	<input type="checkbox"/> First Information Report	Overall situation (in qualitative terms with audio/video)
<input type="checkbox"/> Emergency Module	Immediate Requirement (in short Msg)	<input type="checkbox"/> Summary Report	Detailed report (in quantitative terms with audio/video)

Visualization of Field Data on Spatial Map Viewer



Mobile Application for Accident Reporting



Short Reporting

IR Accident Reporting System

Latitude 176980 Longitude 783442

System ID: 51f9c6147e1741bd

System date: 28Aug2013

System time: 11:08:196

Dt of Accident: 28-8-2013

Train No: 1234

Accident type: Collision

Accd. type other:

Camera Sendfiles Sendlater SendS_Files Close

Detail Reporting

IR Accident Reporting System

Latitude 174689 Longitude 787422

System ID: 51f9c6147e1741bd

System date: 28Aug2013

System time: 11:08:152

Dt of Accident: 28-8-2013

Time of Accident: 11-51

Train Type: Passenger

Train No: 1234

W/M: 500

Camera Sendfiles Sendlater SendS_Files Close

IR ACCIDENT REPORTING SYSTEM

Member Logout

ACCIDENT REPORTED

First Information Reporting

Sys. ID	Sys. Date	Sys. Time	Acc. Date	Acc. Time	Lat	Lon	Train Type	Train No	KM	Blk/Sec	Acc Typ	Coach EM	Coach Der.	Coach Cap.	Pe
51f9c6147e1741bd	28Aug2013	11:08:196	28-8-2013	11:08:196	176980	783442	Passenger	1234			Collision				

Emergency Reporting

Sys. ID	Sys. Date	Sys. Time	Acc. Date	Lat	Lon	Train No	Acc Typ	Download	2D	Response
51f9c6147e1741bd	28Aug2013	11:08:152	28-8-2013	174689	787422	1234	Passenger	500		

Attended calls will be listed here.

IR Mobile Data Center

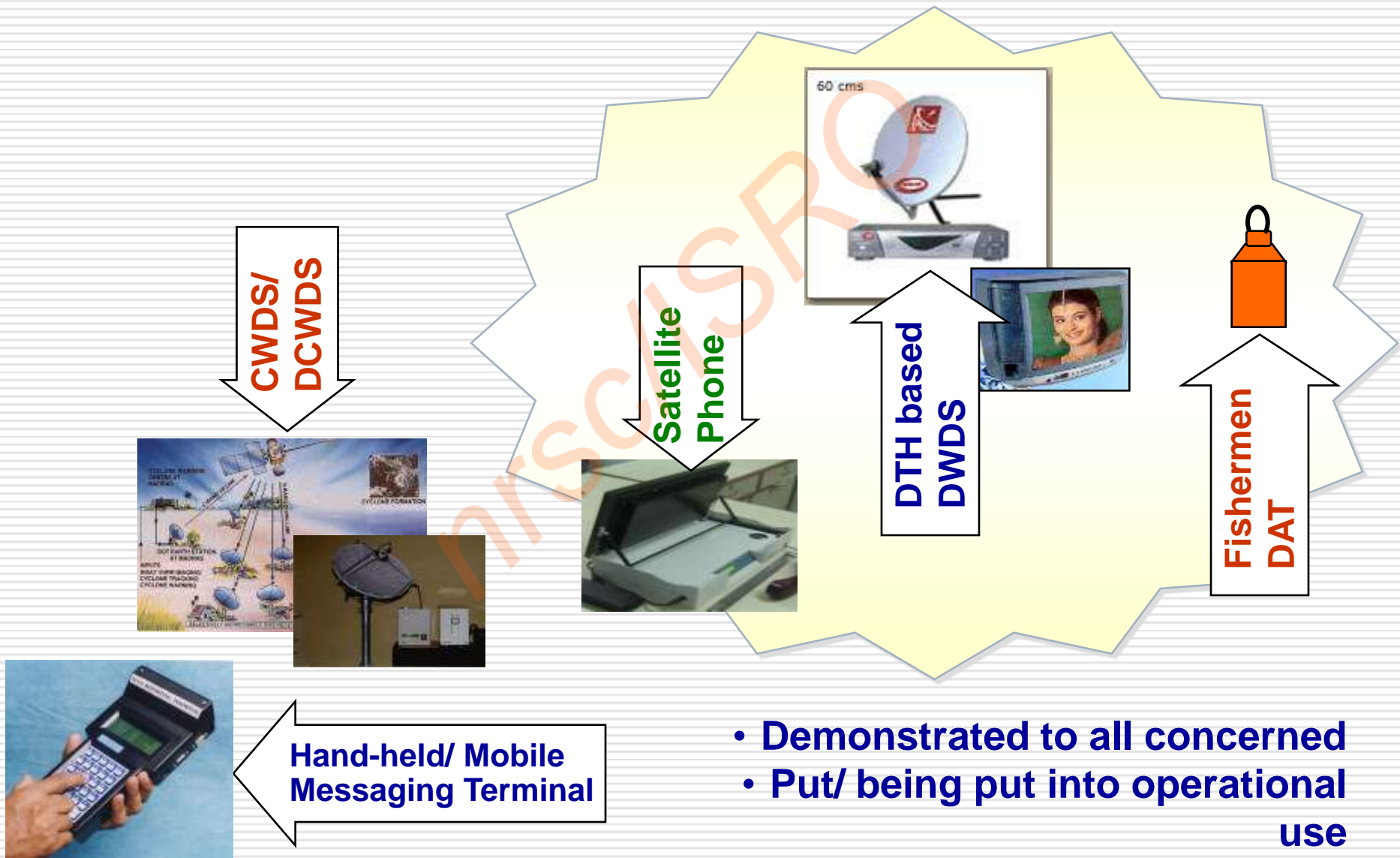
Map not in active

Station/Block section	0.0	0.0
Type of Accident	0.0	0.0
No. of Coaches/Trains affected	0.0	0.0
No. of Coaches Delayed	0.0	0.0
No. of Coaches Expensed	0.0	0.0
No. of People Injured	0.0	0.0
No. of People Killed	0.0	0.0
Loss of Life	0.0	0.0
Loss of Property	0.0	0.0
Loss of Revenue	0.0	0.0
Loss of Material	0.0	0.0
Other Info	0.0	0.0

NRSC Efforts Towards Disaster Support for Social Security...

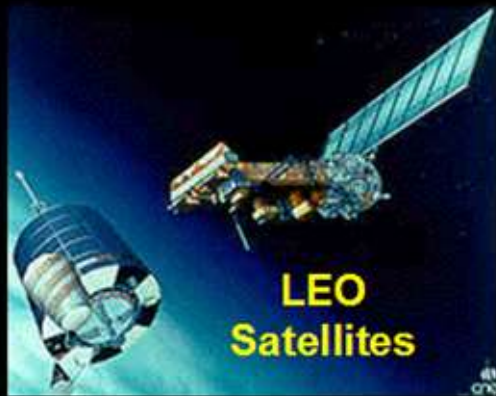


Satellite (INSAT) based Emergency Communication Systems



Search & Rescue

System Operation

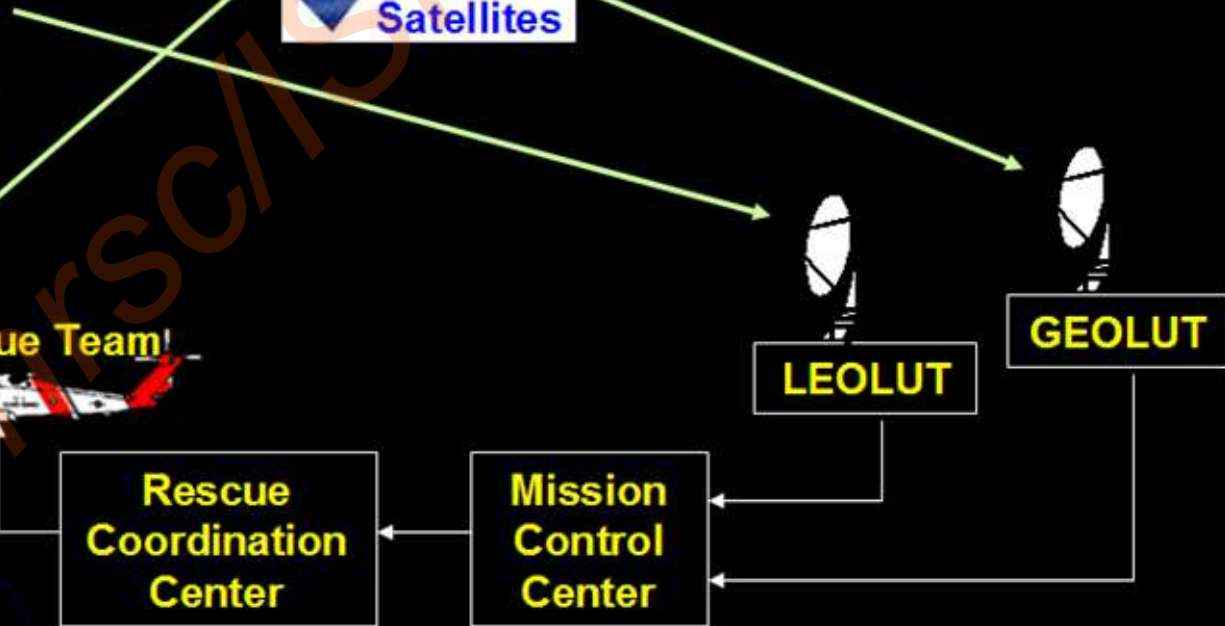


Rescue Coordination Center

Mission Control Center

LEOLUT

GEOLUT



WCDR, Kobe, 2005

**Hyogo Framework
for Action**

- Development of indicators to assess possible impacts

Disaster Charter



ISDR, 2005
**International Strategy
for Disaster
Reduction**

- To develop robust, practical methods sound enough to withstand critical scientific scrutiny

UN SPIDER



UNOOSA

Sentinel Asia

UNESCAP



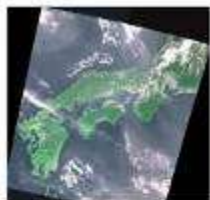


Support to Sentinel Asia

- A dedicated Sentinel Asia server established at NRSC, Hyderabad

- Pre disaster AWiFS data uploaded in SA Server for 14 countries

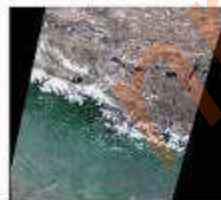
- Responded to Disaster emergency requests



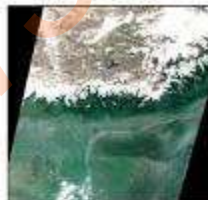
JAPAN



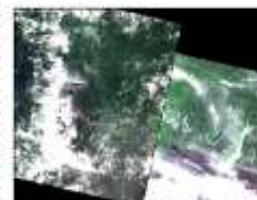
BANGLADESH



NEPAL



BHUTAN



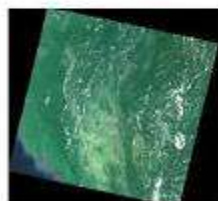
Indonesia



Srilanka



Singapore



MYANMAR



VIETNAM



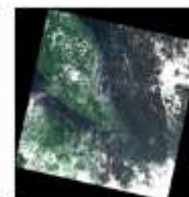
KOREA



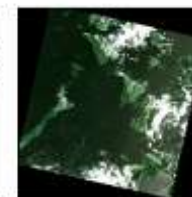
THAILAND,
CAMBODIA, LAOS



Brunei



Malaysia



Philippines



INTERNATIONAL CHARTER SPACE AND MAJOR DISASTERS

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Flood in Bihar State, India

[← Back to Charter Activations](#)



Type of Event	Flood
Location of Event	India
Date of Charter Activation	17/09/2010
Charter Requestor	Indian Space Research Organisation
Project Management	NRSC

Description of the Event

Breached embankment in Gandak River of Bihar State (India)

Images and/or Image product Delivered under the Charter



Flood in Bihar, India due to the Saran embankment breach

Source: Pre-event: Spot Image, Cartosat-1, ALOS PALSAR, RADARSAT. Post-event: RADARSAT-2, Cartosat-2, RADARSAT, ENVISAT, RADARSAT, IRS LISS-III

Acquired: Pre-event: Spot Image on 12/05/2010, Cartosat-1 on 10/03/2010, ALOS PALSAR on 18/09/2010, RADARSAT on 22/05/2010

Post-event: RADARSAT-2 on 20/09/2010, Cartosat-2 on 22/09/2010, RADARSAT on 20/09/2010, ENVISAT on 21/09/2010, RADARSAT on 22/09/2010, RADARSAT on 24/09/2010, IRS LISS-III on 30/09/2010, RADARSAT on 22/09/2010

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DMS PROGRAMME (DMSP)

The Vision

*to evolve and execute a programme,
integrating operationally
the aero-space inputs and services,
on a reliable and timely basis,
to support the country's resolve
towards disaster management*

...thanks