

CAPACITY BUILDING FOR DISASTER MANAGEMENT SUPPORT

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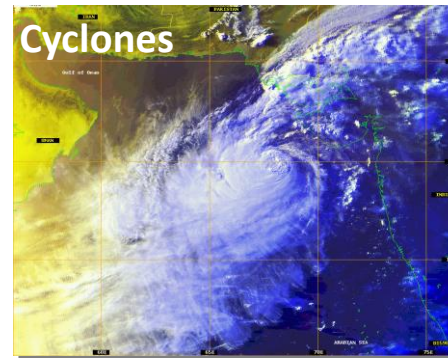
INDIA-Disaster Statistics

Indian sub-continent is one of the world's most Disaster-prone areas.

50 million people affected annually due to disaster

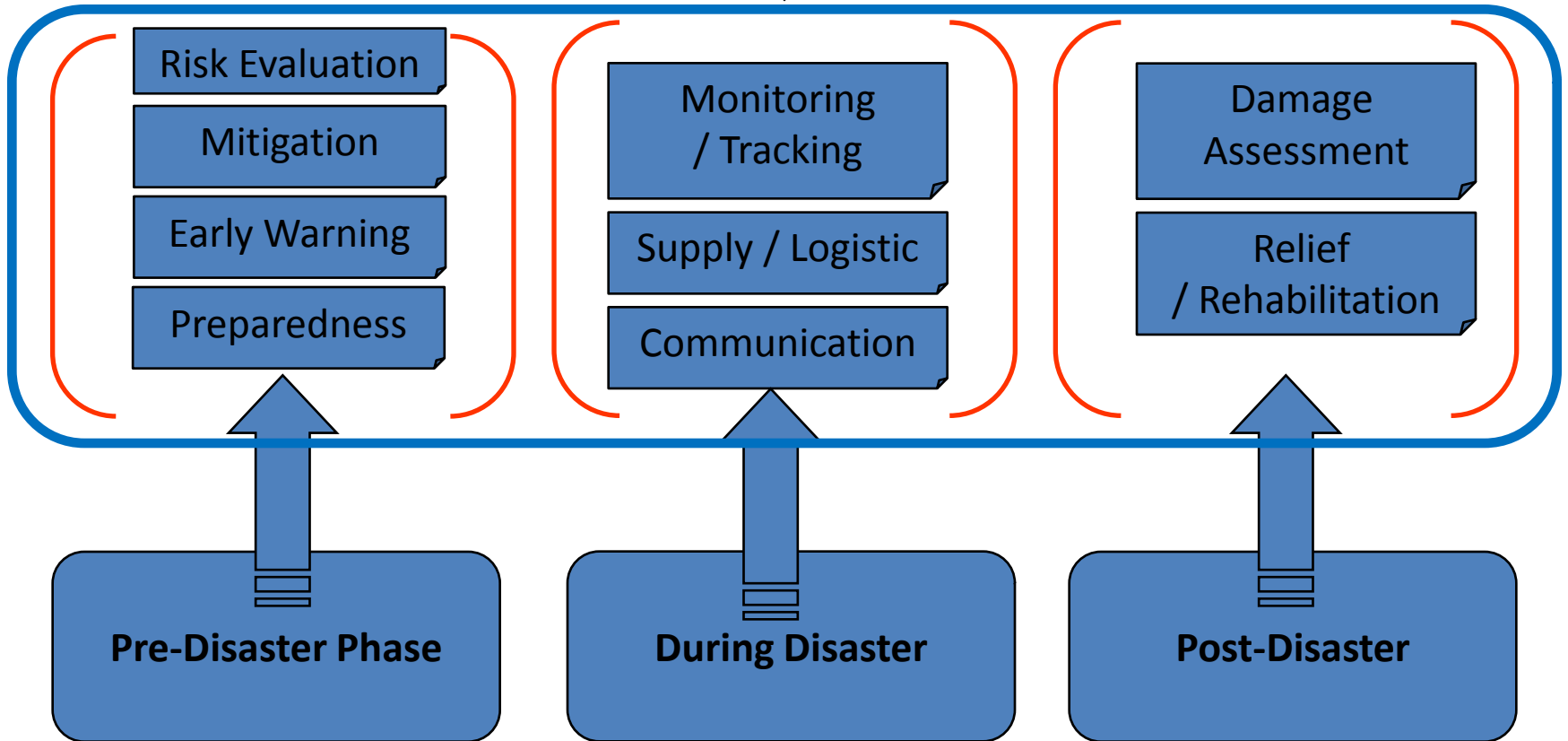
Affected Area

Floods	~ 40 M ha of total area
Cyclones	~ 8% of total area (5700 km long coastline)
Drought	~ 68% of total area (116 districts)
Landslides	~ 8% of total area (Himalayan/ Western Ghats)
Earthquakes	~ 55% of area in Seismic Zone III- & IV
Forest Fires	~ 65% of total forests under potential threat
Tsunami	East Coast, part of West Coast, A & N Islands

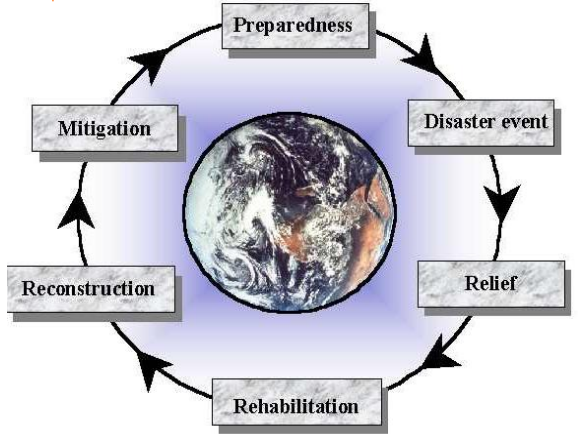


Space Technology in Disaster Management

Remote Sensing / Satellite Communication / Geospatial Modeling

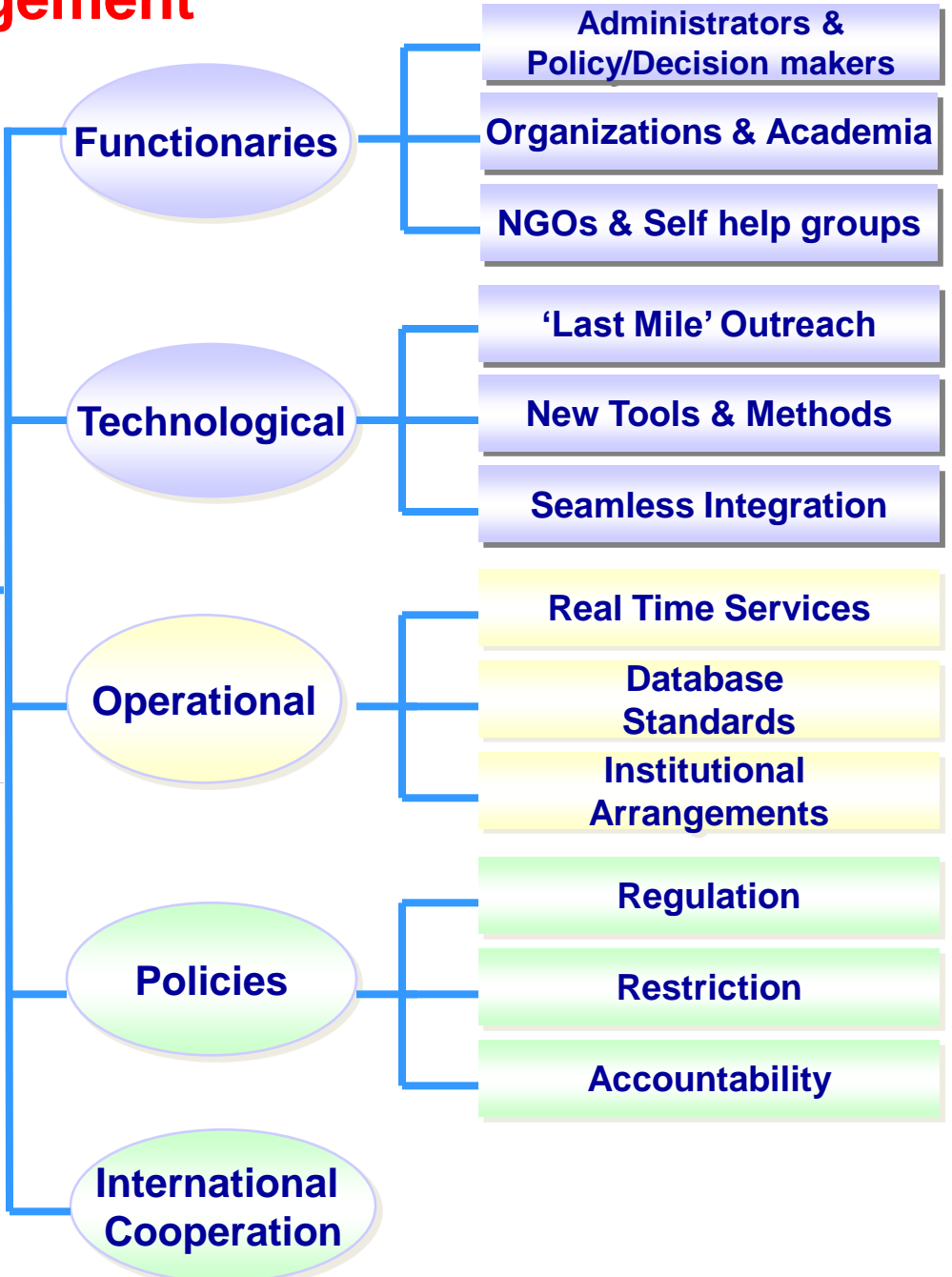
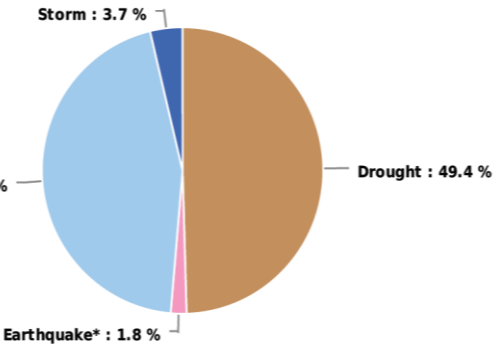


Disaster Management



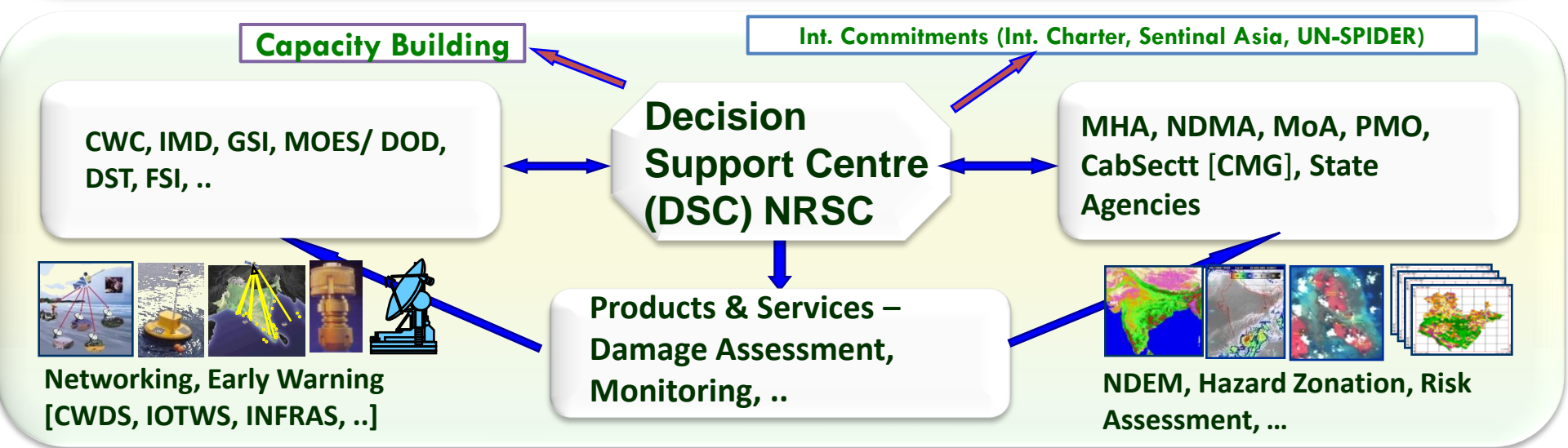
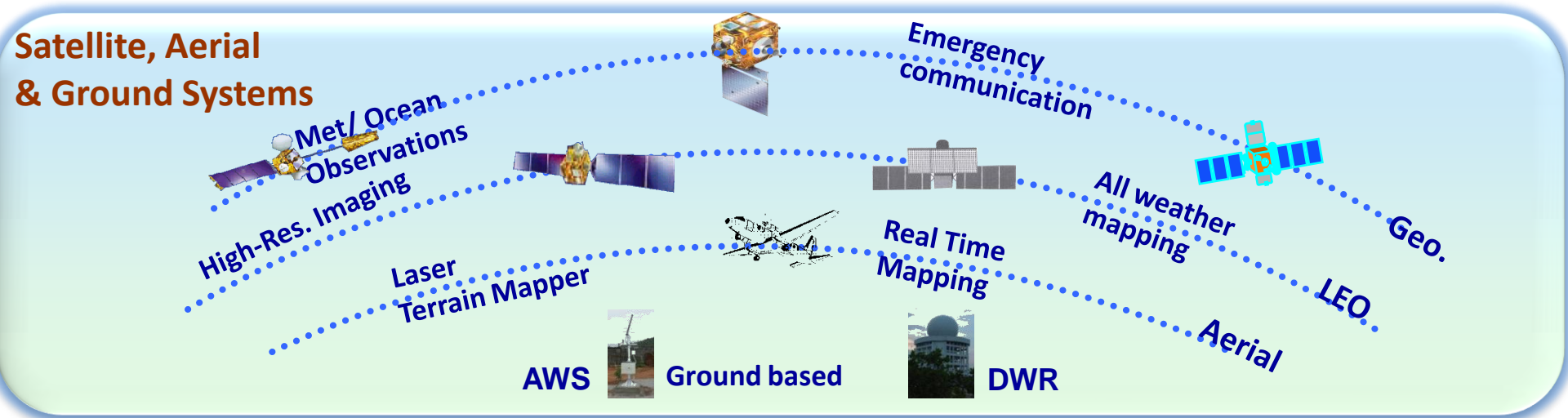
GAPS

% of reported people affected by disaster type- INDIA (1980-2009)



CAPACITY BUILDING

Disaster Management Support (DMS) Programme of ISRO: Assets and Infrastructure



Technology Development & Research Forecasting/ Simulation Models, ..

Emergency Communication Network - VPN; Support - MSS Type-D, WLL VSAT, ...

FACTORS leading to Disasters

- Increasing population & Urbanisation
- Construction on ecologically sensitive sites
- Depletion and Improper management of resources
- Deforestation
- Non conformity to bye-laws and standards (Eg: Rainwater Harvesting and Seismic Proof building norms
- Changing minds- from societal cause to economic and monetary benefits
- Ignorance and lack of responsible behavior
- Climate Change Impacts

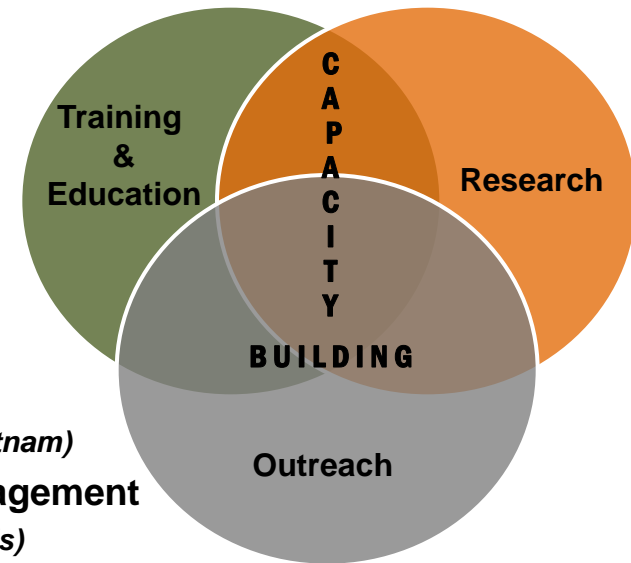
Transfer technology through Capacity Building & Research in the field of RS & GIS technology and applications

❖ Training Programmes :

- PG Diploma (10 months, 9 Specializations)
- Certificate (8 weeks, Sponsored by ITEC, Govt. of India)
- Certificate Course for Univ. Faculty (8 weeks, NNRMS–ISRO Sponsored)
- Decision Makers Course (1 week)
- Special /Tailor made Courses(1-8 weeks)

❖ Education Programmes:

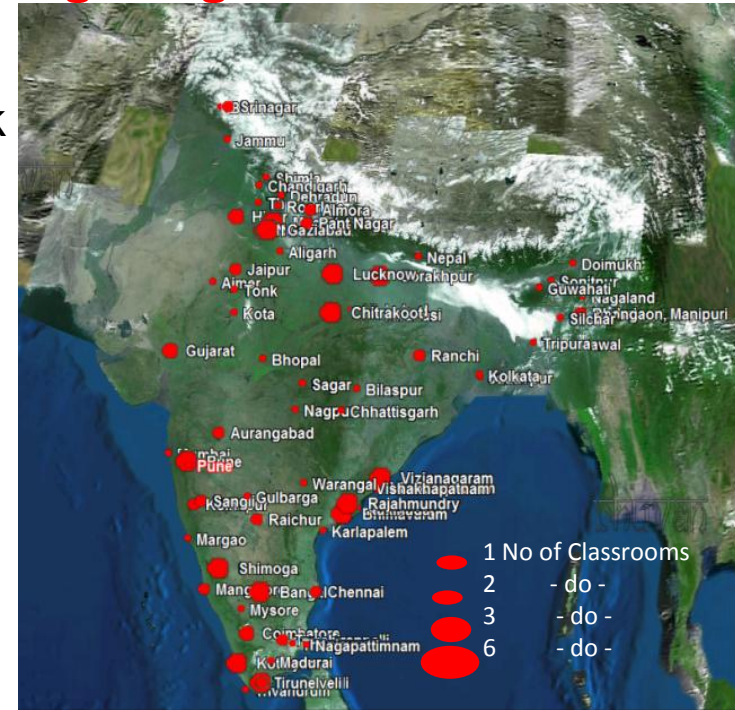
- M .Tech. in RS & GIS
(24 months and 8 Specializations; Affiliated to AU, Vishalkapatnam)
- M.Sc. in Geo-Informatics and Natural Hazards & Disaster Risk Management
(18 months JEP with ITC, Twente University, The Netherlands)



Major Highlights (until Feb. 2014)

- Professionals trained in IIRS: **9184**
- Foreign professionals trained in IIRS: **906** from **91** Countries (excluding CSSTEAP)
- Professionals trained in CSSTEAP-**1275** from **34** countries in Asia-Pacific Region and **29** from **18** (outside AP)
- M.Tech. students: **169** and M.Sc. Students:**160** (since 2002)
- Tailor Made Courses: **2854** and Certificate **4432**
- Distance Learning (EDUSAT based Program): **>10,000** from 120 Institutes/ Colleges/Univ.

EDUSAT Based Outreach & E-Learning Programs



- **11 Courses** conducted with **123 University** Network
 - 8 courses on ‘Basics of RS, GIS & GPS’
 - 1 course on ‘Advances in Geoinformatics’
 - 1 Course on ‘Advances in Hyperspectral RS’
 - 1 Course on ‘ Geo-web Services’
- e-Learning program on technology
- **2023 participants** in 11th course : 2014

Special Courses

- Geoinformatics for Disaster Response – National Disaster Response Force
- Managements of Forests - Forest Range Officers
- Geoinformatics Application in Disaster Management Support
- “Data Assimilation” in association with University of Reading.
- Indian Technical and Economic Cooperation (ITEC)

CSSTEAP (Centre for Space Science & Technology Education in Asia-Pacific – Affiliated to UN) conduct Educational programs (PGD / M. Tech. & Short Courses) in four disciplines :

- Remote Sensing & GIS (RS & GIS) at IIRS, Dehradun (18)
338(PG), 419 (SC) from 24 & 39 countries
- Satellite Meteorology (SATMET) at SAC, Ahmedabad (8)
134(PG), 25 (SC) from 22 & 10 countries
- Satellite Communication (SATCOM) at SAC, Ahmedabad (8)
126(PG), 141 (SC) from 20 & 31 countries
- Space & Atmospheric Science (SAS) at PRL, Ahmedabad (8)
86(PG), 26(SC) from 15 & 04 countries
- Navigation and Satellite Positioning System (NAVSAT)at SAC, Ahmedabad (2)
33 from 10 countries
- Small Satellite Mission (SSM) at ISAC, Bangalore & IIRS, Dehradun (2)
31 from 15 countries



Total Student Output : 1275 from 34 countries in Asia-Pacific Region and 29 from 18 (outside AP)

- Flood Risk Mapping, Modeling & Assessment using Space Technology [Funded by IWMI, UNOOSA & UNESCAP]
(19 Participants, 11 countries)
- Sub-regional training on Development of Geo-referenced Disaster Risk Management Information systems for SAARC countries [Funded by UNESCAP]
(16 Participants, 9 SAARC countries)



Sub Themes: Geodynamics & Seismicity Investigations; Vulnerability assessment of Forest Ecosystems due to Climate change; Sustainable Mountain Agriculture; Water Resources Status and Availability; Modeling Temporal & Spatial Growth of Cities & Towns; Rainfall Retrieval Using MW RS Data & Study of Extreme Rainfall Events

Preliminary Results:

▪ **Climate change impact on Maize Productivity**

Climate change appears to affect productivity of food grain crops (Rice, wheat and Maize) in Doon Valley. Marginal decline in crop yields by 2050s and drastic reduction in 2080s under moderate & extreme CO₂ scenario. Decline in crop yields in 2080s without CO₂ fertilization: Wheat (40%), Rice(20%), and Maize(14%)

▪ **Analysis in Potential shift in *Agapetis serpens species***

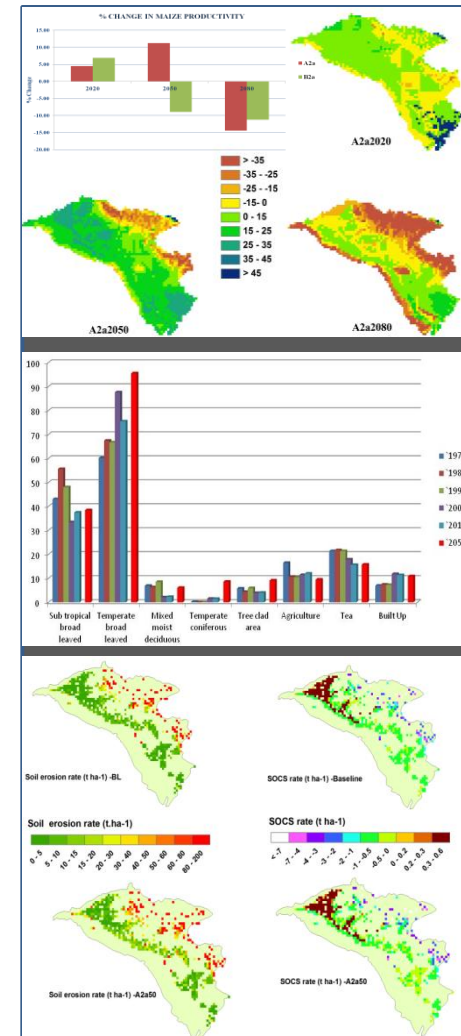
Ecological niche modeling shows shift in species range from subtropical broadleaved to temperate broad leaved for probability range between 0.9-1.0

▪ **Soil Erosion & SOC sequestration Modelling**

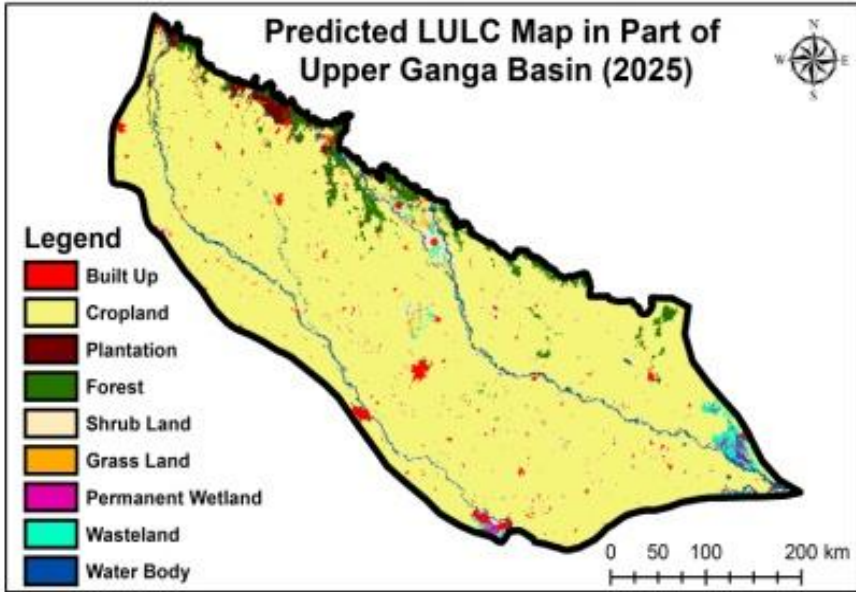
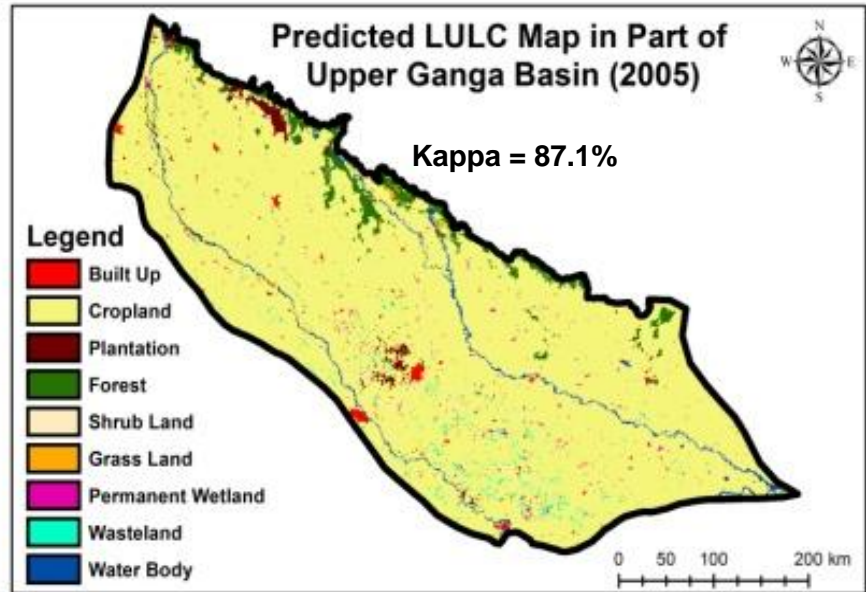
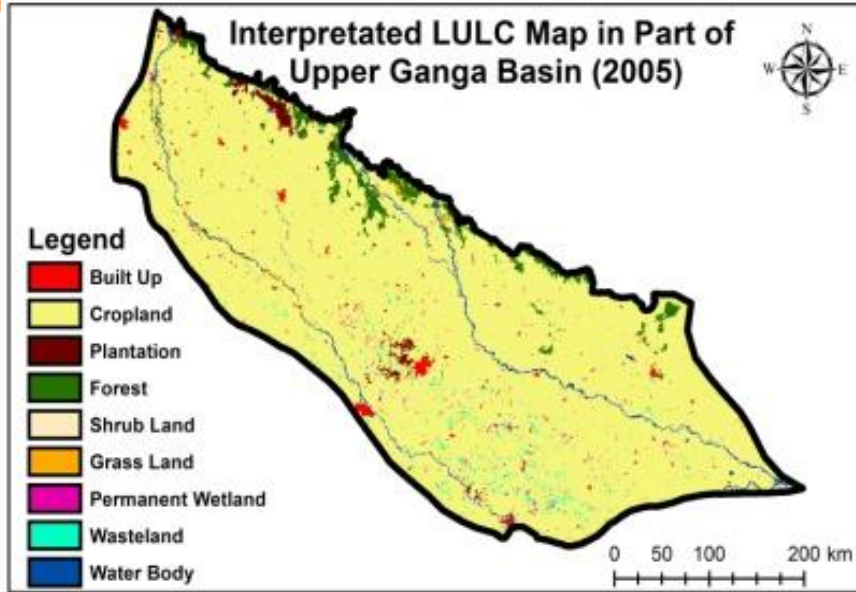
GEPIC model simulated quite well for soil erosion rate and SOC sequestration in the agricultural landscape of Doon Valley under current and future climate change scenarios

▪ **Snow-melt Runoff Modeling (SRM)**

SRM was carried out in Pindar basin following Temperature index using temporal RS & met. data. Model computed runoff volume compared well with CWC measured data.



Modeling LULC Dynamics



Legend

- Built Up
- Cropland
- Plantation
- Forest
- Shrub Land
- Grass Land
- Permanent Wetland
- Wasteland
- Water Body

Input data used for Modelling:

LULC Maps: 1985, 1995, 2005

Drivers data:

- Annual Rainfall
- Mean Annual Temperature
- Distance to Drainage
- Distance to Settlement
- Distance to Road
- Distance to Forest
- Population Density
- Agriculture Labour Density
- Elevation
- Slope
- Soil Depth

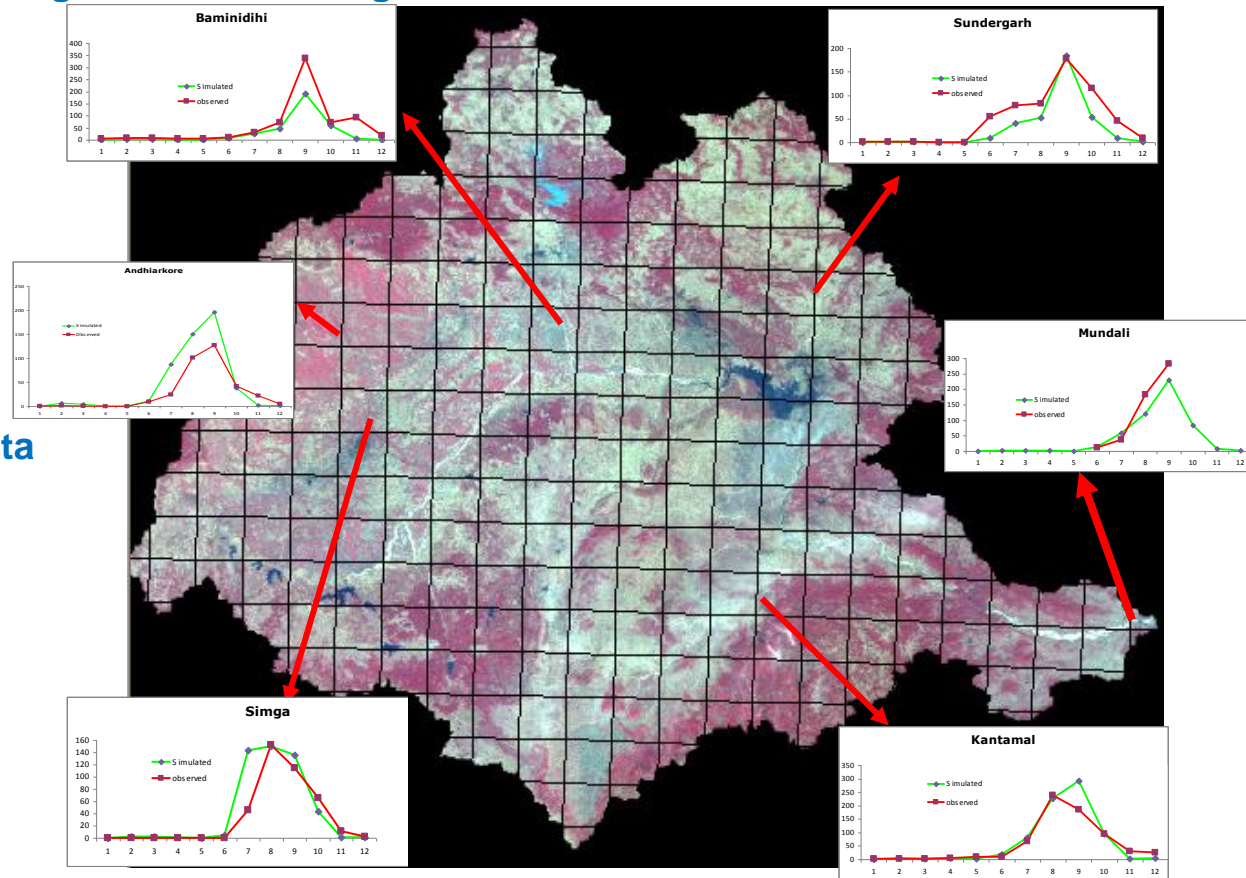
Basin scale hydrological modeling (Mahanadi Basin: Area=1.41 lakh sq.km.)

Objectives:

1. Calibrate VIC model at outlet of Mahanadi river for the observed flow data of 2003
2. Validate the model on other five sub-basins of Mahanadi river basin
3. Simulate the runoff at six sites for 1972 (based on LULC of 1972)
4. Assess the impact of landuse change on runoff during 1972 to 2003

Model Inputs:

1. Resourcesat Awifs
2. Landsat MSS
3. Modis LAI
4. Modis albedo
5. GTOPO 30 DEM
6. NBSSLUP soil map
7. Daily Rainfall IMD gridded data
8. NCDC temperature data
9. Discharge from CWC



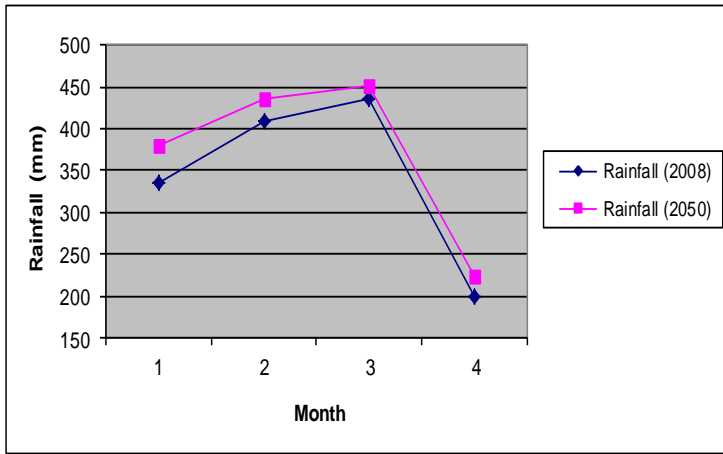
Results:

1. Simulation found to be reasonably accurate With R^2 :0.836, Ns:0.821 and RE:8.5%
2. An increase of surface runoff by 4.53% (24.44 mm) in 2003 compared with 1972 (351.4 million m³). This may be attributed to loss of forest by 5.71%.

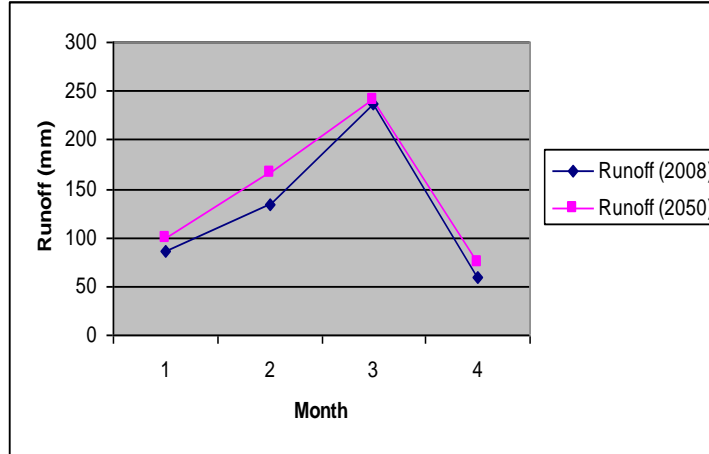


THE RESPONSE OF **HYDROLOGICAL PROCESSES** TO CLIMATE CHANGE IN *MAHANADI* BASIN OF INDIA USING A MACROSACLE VIC MODEL

Precipitation Change



Runoff Change

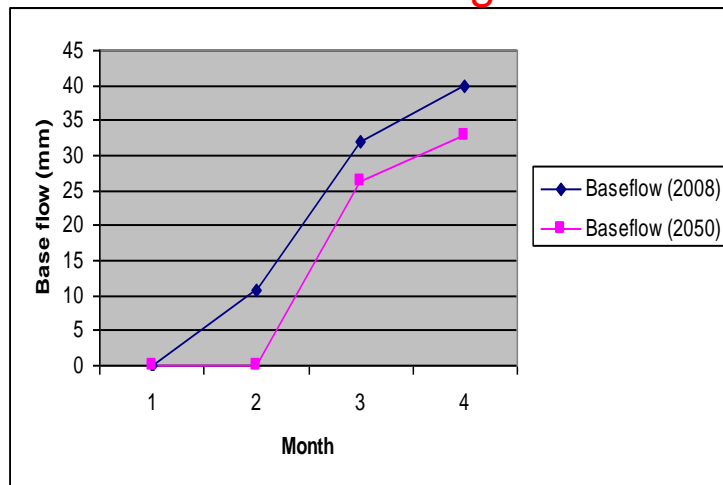


Climate change: based on IPCC 4th report 2007 on climate change

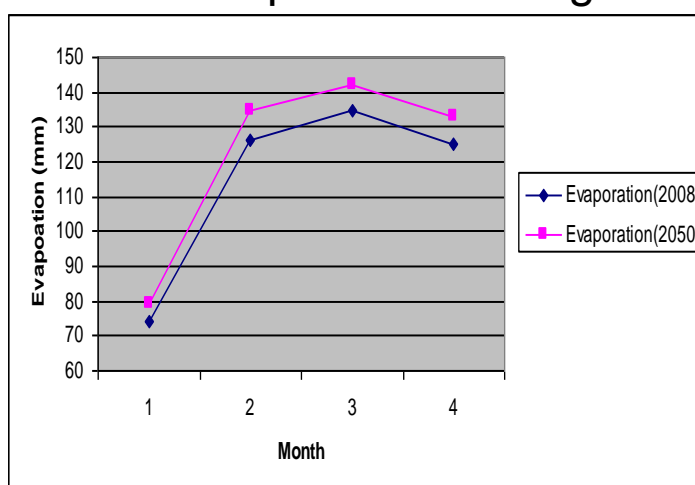
Temperature; (2050 year):
Winter; 3 .25°C, Summer;
2.19°C

Precipitation: (2050 year) :
Winter; -2.1% , Summer;
6.6%

Baseflow Change



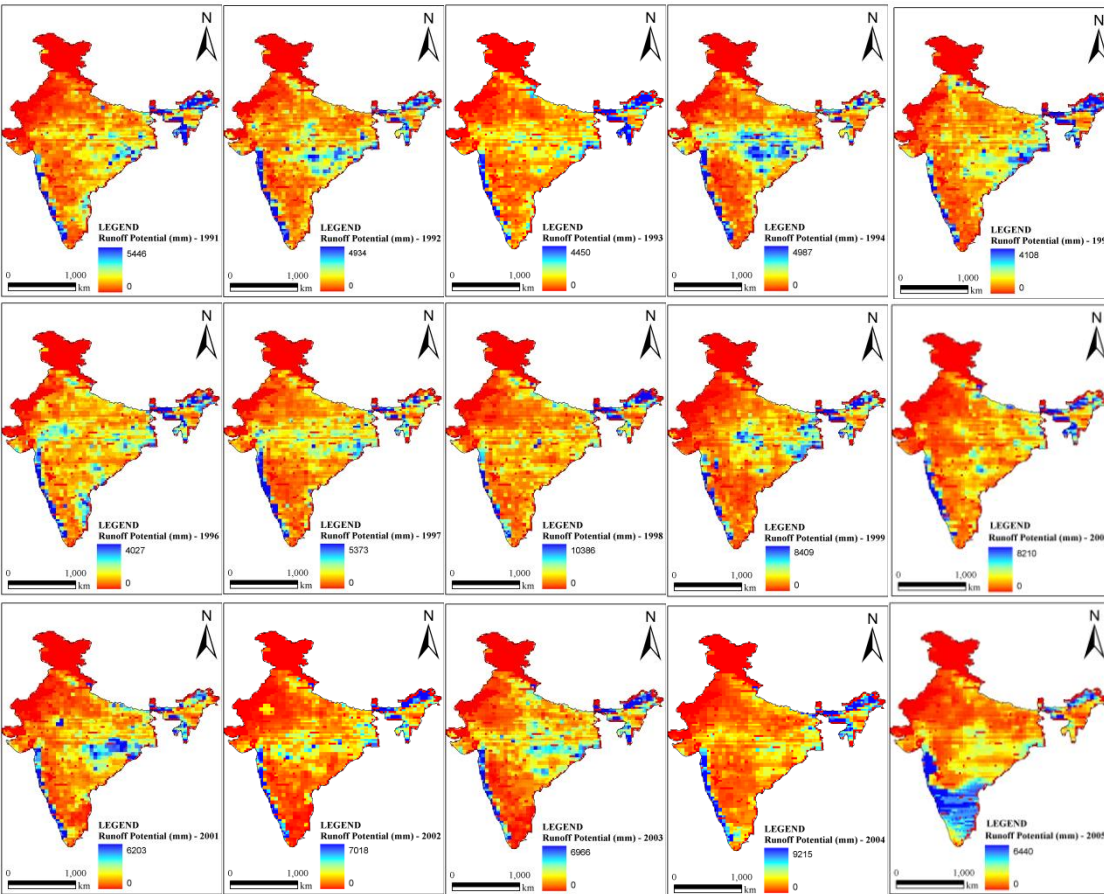
Evaporation Change



Results:

Surface runoff and ET will increase as predicted rainfall and temperature is high in 2050. However, base flow will decrease. This is attributed to increased ET.

National Scale: IIRS Initiatives

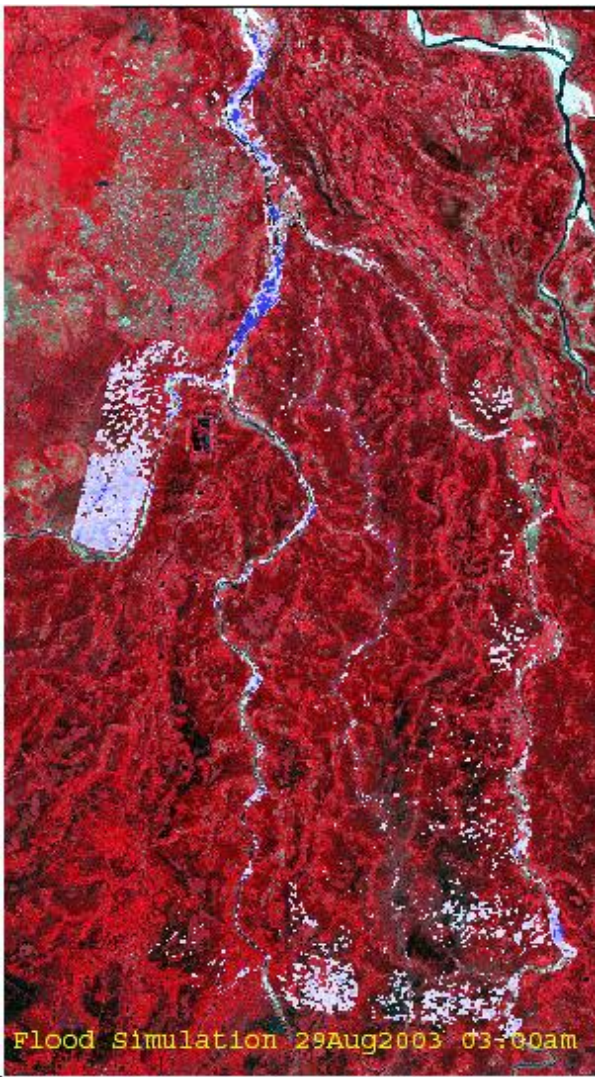


- 15 years Runoff potential maps of India(1991-2005)
- Wet year and dry years are visible
- Runoff can be estimated on daily basis
- ET and soil moisture can also be simulated

Aggarwal, S.P., Garg, V., Gupta, P.K., Nikam, B.R., Thakur, P.K. and Roy P.S. (2013). Runoff potential assessment over Indian landmass: A macro-scale hydrological modeling approach. *Current Science, in press.*

Flood Simulation

(Daya River, Odisha)

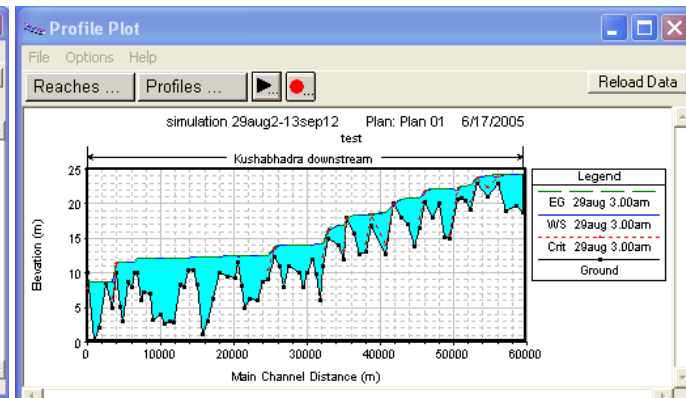
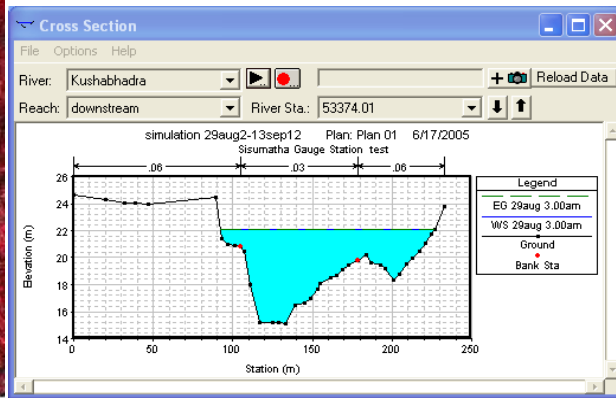


Software

- HEC HMS
- HEC RAS

Output

- Flow wave progression
- Inundation Area

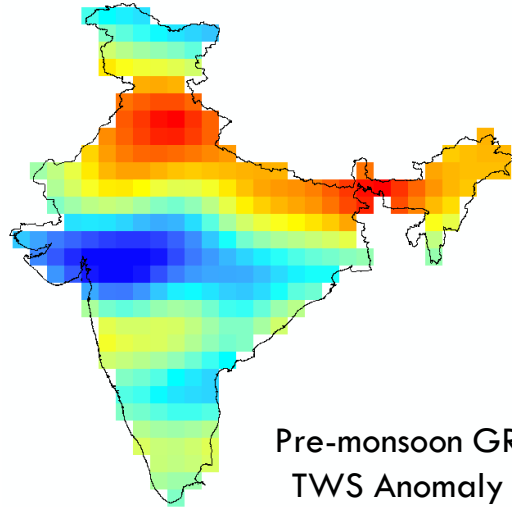


Sisumatha

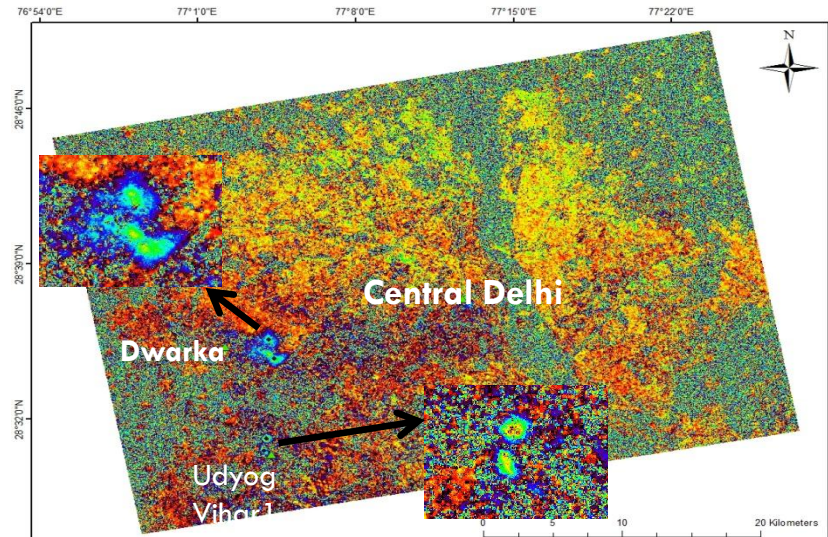
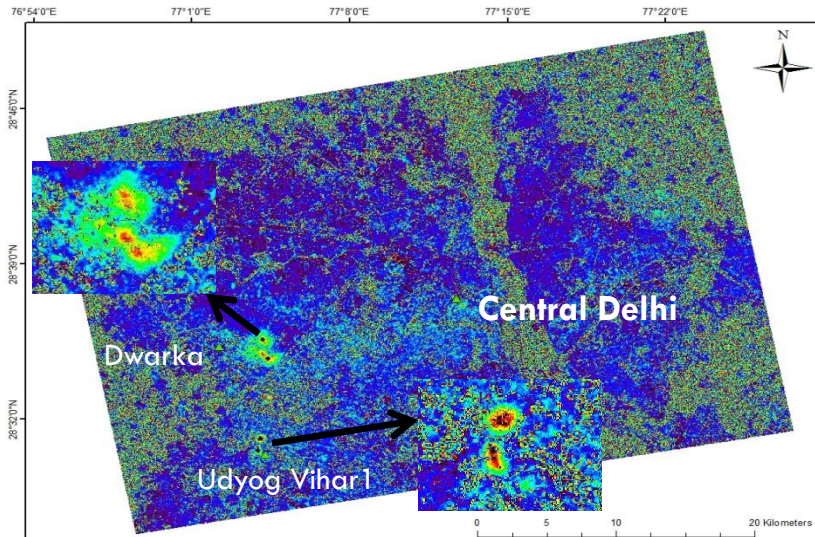
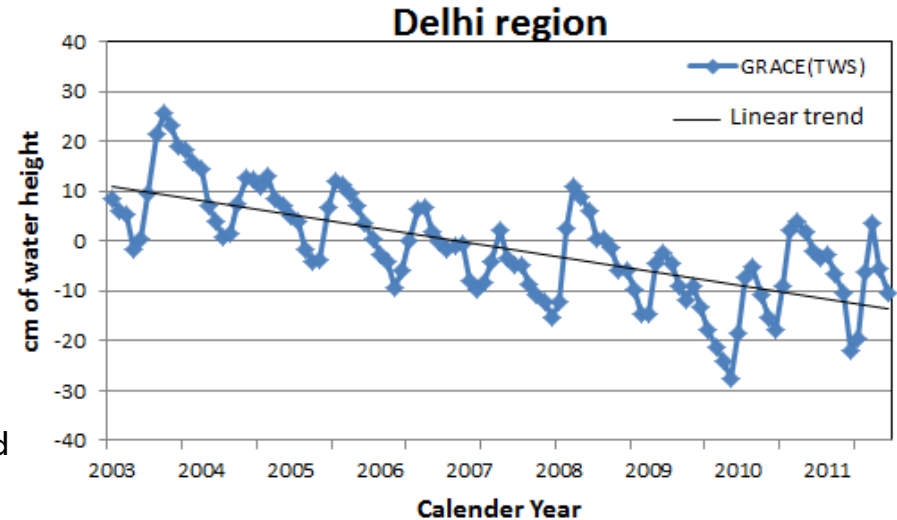
Cross section at Sisumatha Gauge Station

Kushabhadra River Profile

Space borne GRACE Gravity Observation showing TWS Anomaly & DInSAR showing possible Land Subsidence



Pre-monsoon GRACE gravity based TWS Anomaly (March, 2003-12)



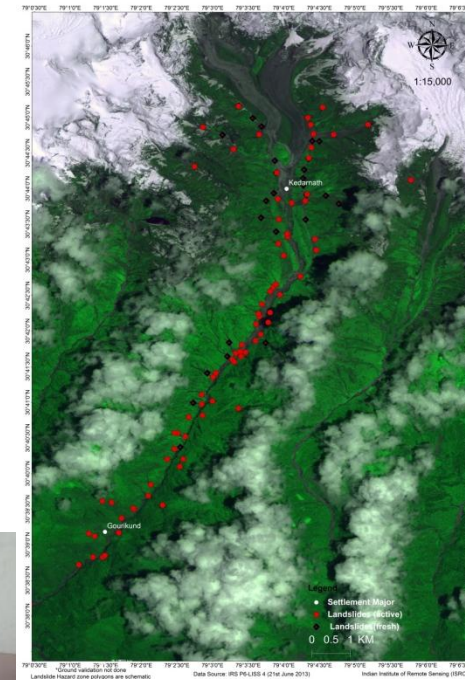
L-band ALOS PALSAR Differential Interferograms of 2008-2010 showing suspected land subsidence fringes in Delhi

In the aftermath of devastating floods & landslides in Uttarakhand in June this year, IIRS in association with ISRO HQ, SAC, Ahmedabad and NRSC, Hyderabad, provided possible support to State on priority.

Satellite Communication Support: INSAT MSS-Type-D terminals (12 no.) - 1007 calls made during 20th June 2013 to 9th July 2013; 6 DMS hub & user nodes using C_{Ext.} 1.8m VSAT for Telephony voice communications, Video conferencing and Data communication

Satellite Image Support: Pre & post event Satellite image maps annotated with details on landslides, trekking route, potential landslide and settlement locations on 1:10,000 scale - From Bhuvan

Other Supports: GPS instruments to state Police Dept. to aid in rescue and relief operations.



Crowdsourcing / VGI for Disaster Management - **MANU** (Map the Neighborhood in Uttarakhand) Department of Science & Technology, GOI, Initiative

- Development of appropriate tools for field data collection & integration with **Bhuvan geoportal data**
- Capacity Building for field data collection in disaster affected areas of Uttarakhand (Char-Dham & Pinder Valley) by student and teacher community (**WIHG, KU, HNBSU**)



(Photograph courtesy: Kashmir University)



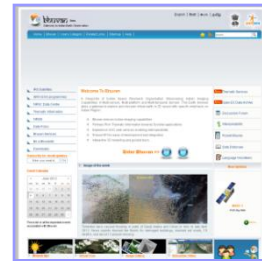
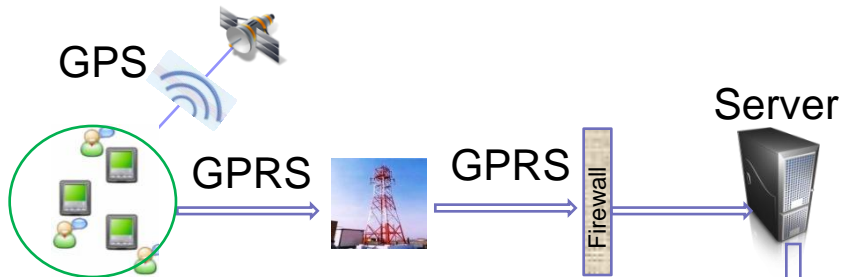
(courtesy: Garhwal University)

Team IIRS : Capacity Building
Team NRSC : Technology
Team SOI : Support

Primary Mode of Field Data Collection

Bhuvan Portal

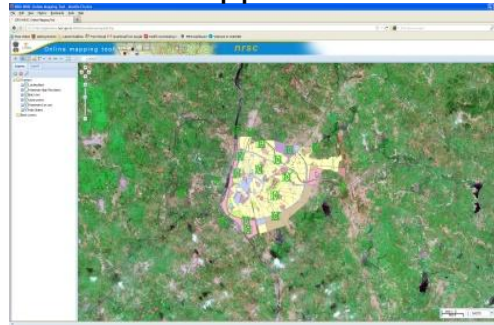
- Multi-sensor time-series satellite data;
- Satellite data Download;
- Thematic Services;
- User response and discussions;
- VGI data and information;
- Terrain profile and other data and information services



Mobile Device with App

Server

MANU App on Bhuvan



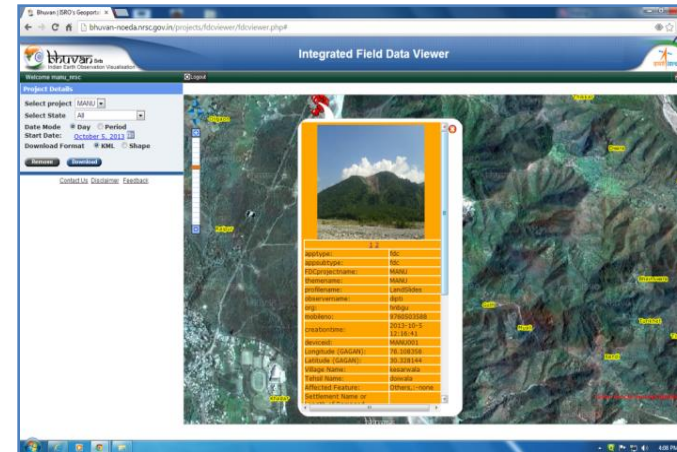
Consume Bhuvan Services

Internet

Visualisation on Bhuvan @ Client end



Internet users



Mobile Device with Application developed by NRSC

Structure of Field Data Collection Proforma through Mobile App

- Damage to buildings and infrastructure
 - 1a. Damage to Buildings
 - 1b. Damage to Infrastructure
 - 1b1. Roads
 - 1b2. Bridges and Culverts
 - 1b3. Other Infrastructure
- Landslides
- River Bank Erosion
- Damage to Land-cover and Natural Resources
- Points of Interest

Disclaimer: *This proforma has been designed to collect data for the scientific analysis of damage caused due to disaster and is not intended to be used for making claims or for any legal purpose, whatsoever.*



1st Batch of Training Prog. :
27-29 September, 2013



2nd Batch of Training Prog. : 3-5 October, 2013

1st Batch of Training Prog.
27-29 September, 2013
(Collaborators: WIHG + KU)

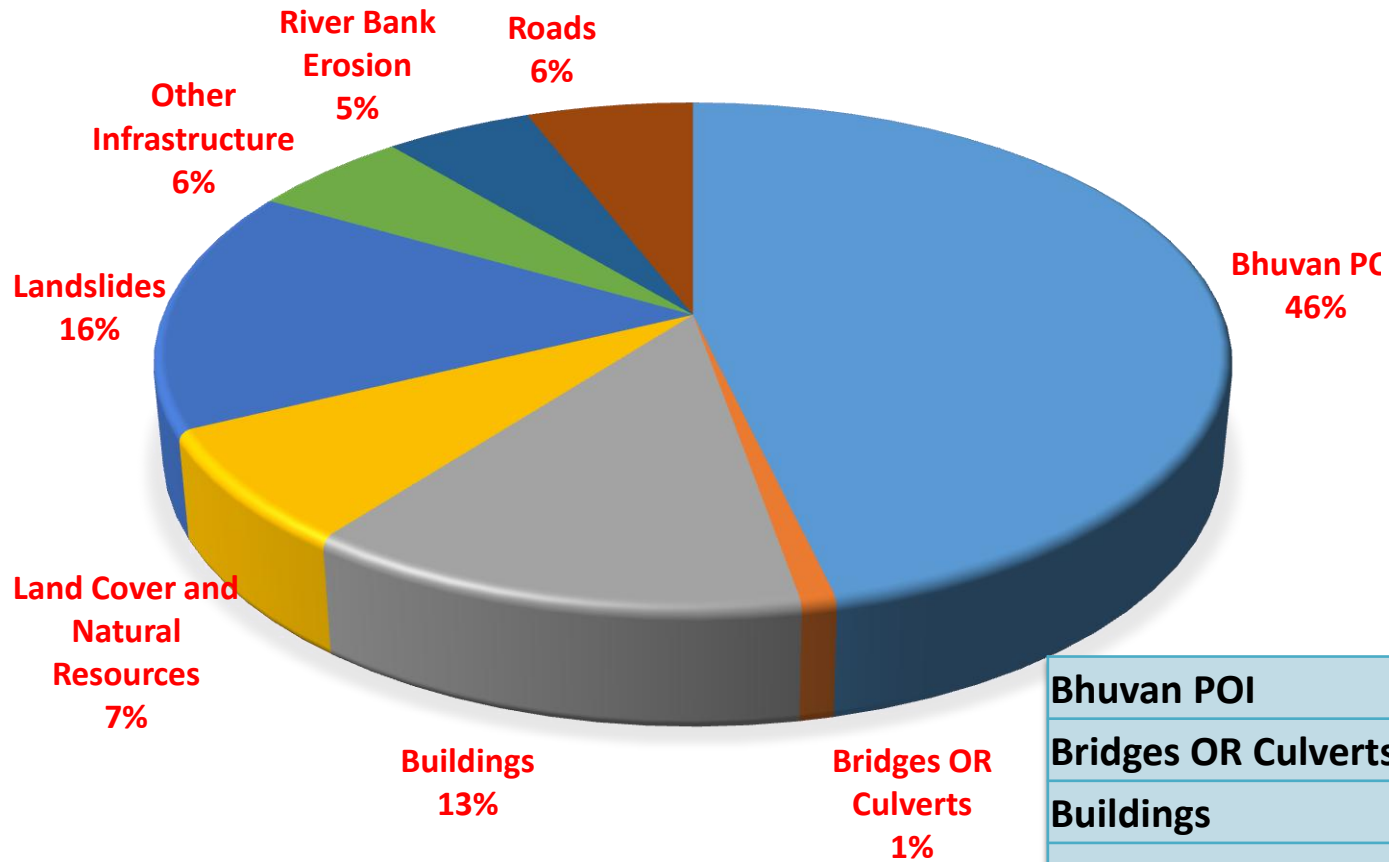
2nd Batch of Training Prog.
3-5 October, 2013
(Collaborators: WIHG + HNBGU)



	Students
HNB Garhwal University	65
Kumaun University	35
Wadia Institute of Himalayan Geology	49
Total	149

Feature-wise data collected in field

(11th Oct. 2013 to 19th Feb. 2014)




Valley	Points Received
Pinder, Kali	7960
Yamuna/Bhagirathi	7677
Alaknanda/Mandakini	3900

Bhuvan POI	9084
Bridges OR Culverts	179
Buildings	2588
Land Cover and Natural Resources	1442
Landslides	3052
Other Infrastructure	1100
River Bank Erosion	1018
Roads	1150


Total points – 19,613 (till 19th February 2014)

Reported Landslide Locations



Indian Earth Observation Visualisation

Integrated Field Data Viewer



Welcome iirs3 Logout

Project Details

Select project: MANU

Select Profile: LandSlides

Select State: All

Date Mode: Day Period

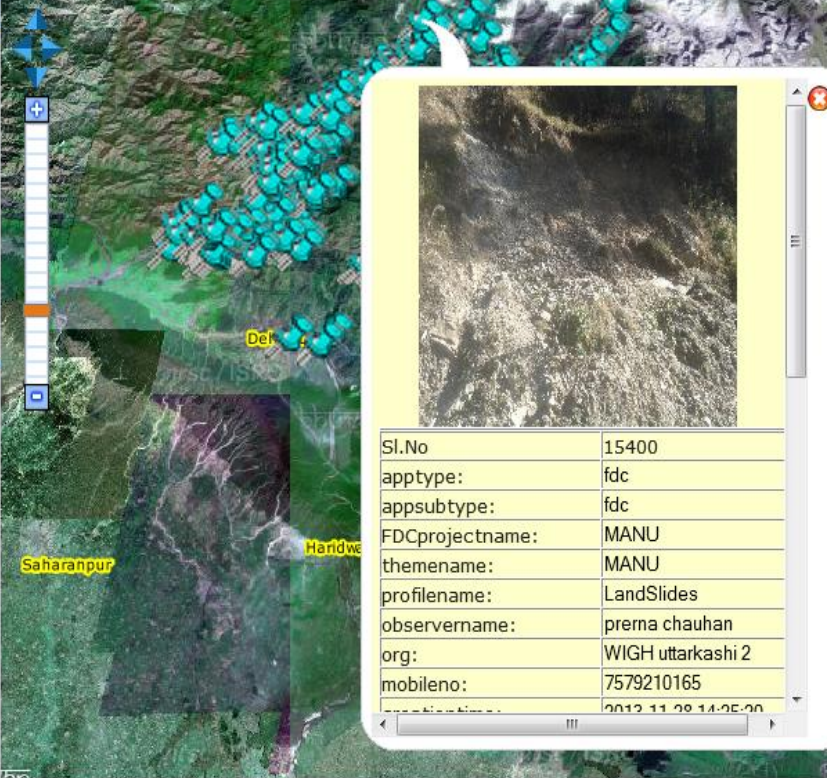
Start Date: [Select Date](#)

End Date: [Select Date](#)

Download Format: KML Shape

Accepted Points Rejected Points

[Contact Us](#)
[Disclaimer](#)
[Feedback](#)



SI.No	15400
apptype:	fdc
appsubtype:	fdc
FDCprojectname:	MANU
themename:	MANU
profilename:	LandSlides
observername:	prema chauhan
org:	WIGH uttarkashi 2
mobilen0:	7579210165
creationtime:	2013-11-28 14:25:20
uuid:	3d796c933f81f90a
deviceid:	WIGH-uttarkashi 2
Village Name:	naald
Tehsil Name:	bhatwari
Affected Feature:	Road,Forest,
Settlement Name or Length of Damaged Road/Bridge(approx in meters):	5mts
Extent of Damage:	Partially Damaged
Slope:	Moderate
Lithology:	Loose Material
Land Use / Land Cover:	Scrub and Grass
Landslide Status:	New
Landslide Material:	Debris
Type of Movement:	Slide
Nature of Failure Surface:	Concave
Anthropogenic Activity:	Road
Remarks:	due to heavv rainfall the

Total Landslide points – **3052**

Out of total points – **19,613**

(till 19th February 2014)

Changing Emphasis

... from 2-D description to 4-D interaction

Past

- ❖ 2-D flat map displays
 - ▣ User as observer **from 2-D description to 4-D interaction**

Future

- ❖ Effective 3-D visualization
- ❖ 4-D incorporation of time: *“The time has come for time.”*
 - ✓ Via agent-based modeling / cellular automata? Or how?
 - ✓ agents (e.g. vehicles, fires or people) interacting over time in a raster (cell)-based environment according to established rules
- ❖ 5, 6 and 7-D incorporation of *touch* (pressure, texture, temperature), *sound* and *smell* into modeling/simulation environment
- ❖ **User as participant**
 - ✓ Users (researchers, professionals, the public) interact with the model;
 - ✓ Participatory Information Systems: the public as the planner .

Technological Support – EO & Insitu observations

Constitutional Amendments – 73rd & 74th

Remote sensing Data Policy, Map Policy, Geospatial Data Policy, National GIS

NNRMS, NRDB, NSDI, NDEM, BHUVAN...

Developmental Programs/Schemes of Govt:

IWMP, MGNREGYA, PMGSY, NLRMP, HADP, IAP.....

Crop Insurance, Other Insurance, Health, Infrastructure Development & Management, Facility Management....

Capacity Building



THANK YOU

www.iirs.gov.in