Space Technology for Decision Support in Natural Disaster Management Decision Support Centre (DSC) Initiatives

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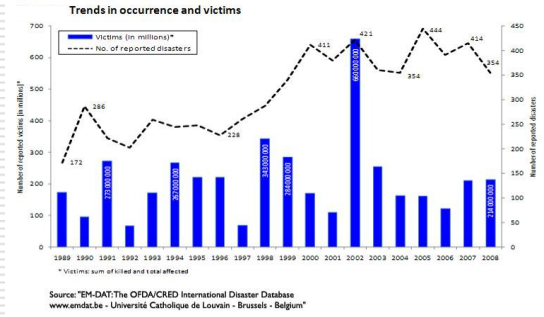
NIDM- UNSPIDER Workshop

Use of Space Technology for DRR

12 anuary 2010

Natural Disasters – Global Scenario

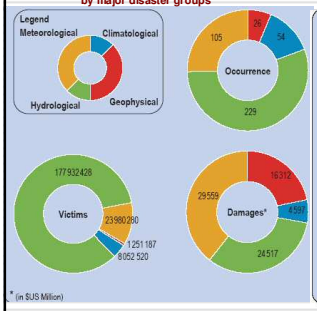


Average (1989-2008)

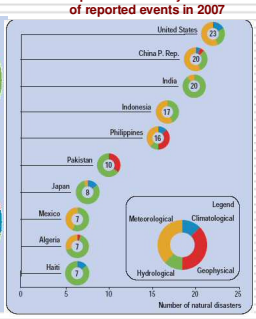
Number of events	387
Number of people killed & affected	66,813

Natural Disasters – Global Scenario

2007 Disaster occurrence and impacts by major disaster groups



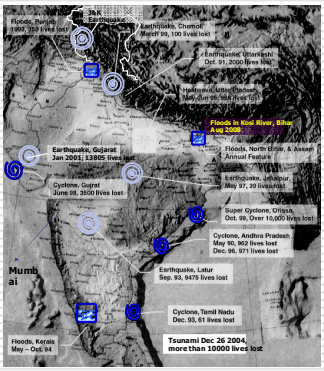
Top 10 countries by number of reported events in 2007



Max. Number of events: Hydrological
Max. Number of victims: Hydrological

Source: www.emdat.be

Natural Disasters in India



Average Annual Loss

Direct

- Loss of life: 4350
- Crop area affected: 1.42 Mha
- Houses damaged: 2.36 M
- Direct loss: 2 % of the GDP (Rs. 250,000 million)

Indirect

- Expenses on emergency response and relief
- Diversion of developmental fund
- Indirect socio-psychological losses that can not be quantified

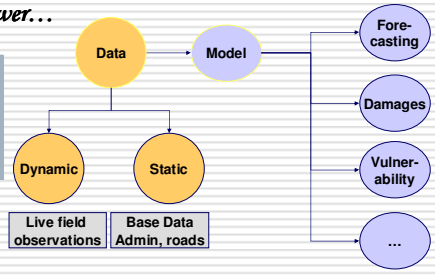
Ultimate User Needs

e.g:

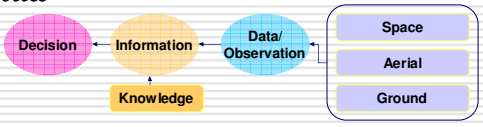
- When and Where the flood is going to hit and what is its impact? (Time and Space domain)
- What is the flood magnitude in next 24 hrs and which areas are likely to be inundated?
- What is the extent of damage caused by the flood?
- What are the suitable measures to mitigate flood?
- How I can save human lives?
- .....

To Answer…

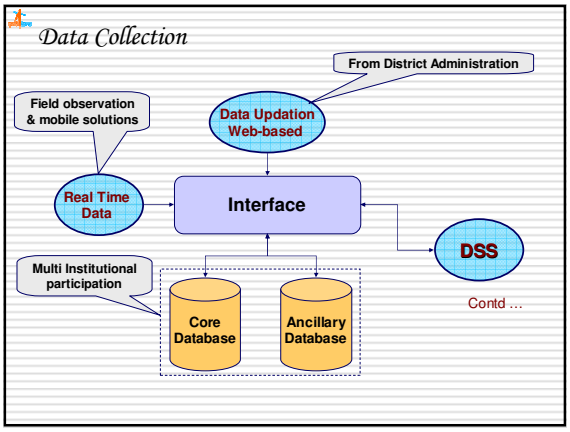
Most of the computer based Decision Support Tools demands organization of data in a specific format



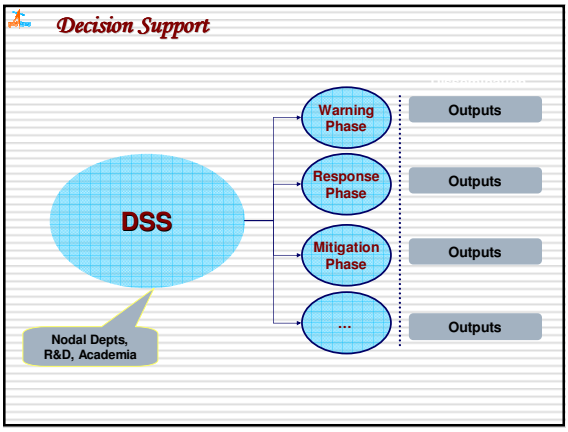
Process



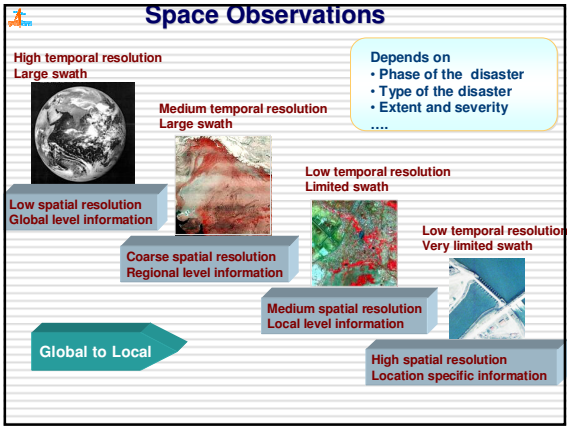
Data Collection



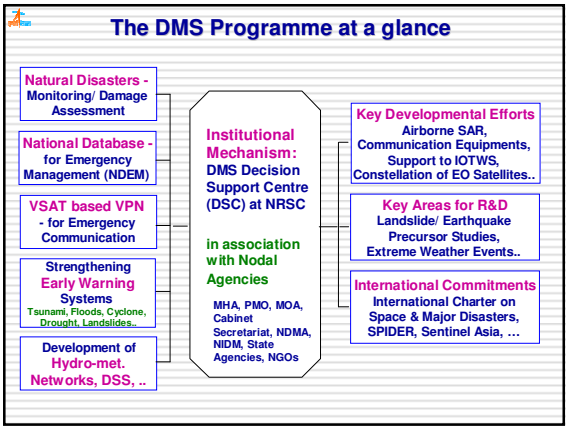
Decision Support



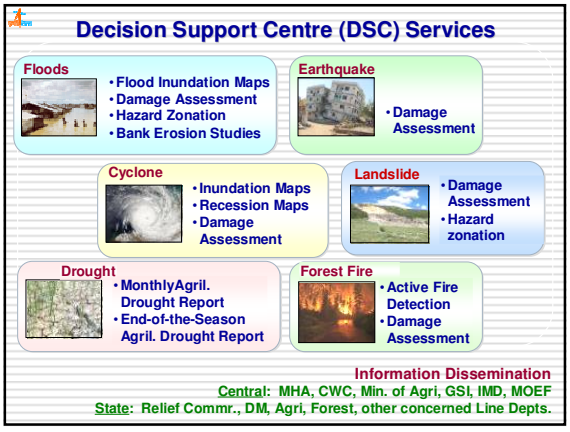
Space Observations



The DMS Programme at a glance

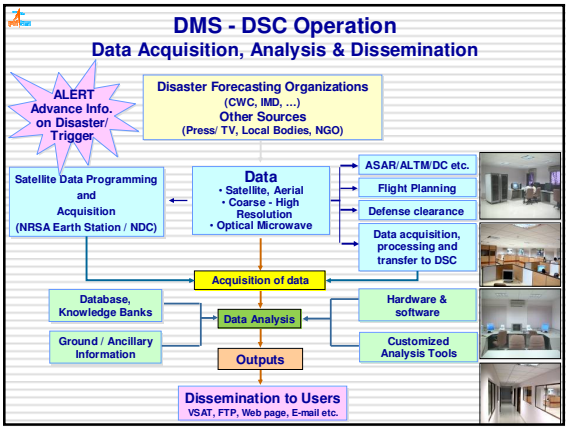


Decision Support Centre (DSC) Services

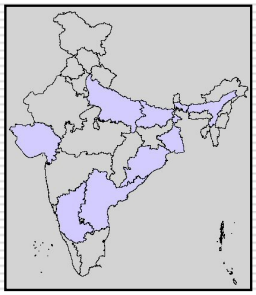


DMS - DSC Operation

Data Acquisition, Analysis & Dissemination



Floods-2009



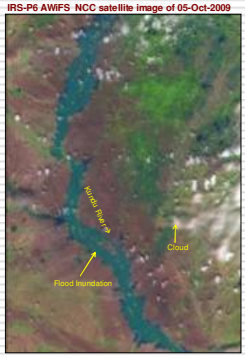
State	Jul	Aug	Sep	Oct	Total
Bihar	/1	/72	/55		/128
Assam	/22	/14			/36
Orissa	/56		/6		/62
Uttar Pradesh		/16		/12	/28
West Bengal			/9		/9
Gujarat	/2				/2
Andhra Pradesh				/7	/7
Karnataka				/1	/1

52/273 No. of Datasets/ Maps generated

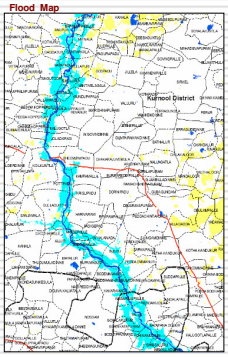
Flood Inundated Villages due to Kundu River in Part of Kurnool, AP

As observed from IRS-P6 satellite on 05-October-2009

IRS-P6 AWiFS NCC satellite image of 05-Oct-2009

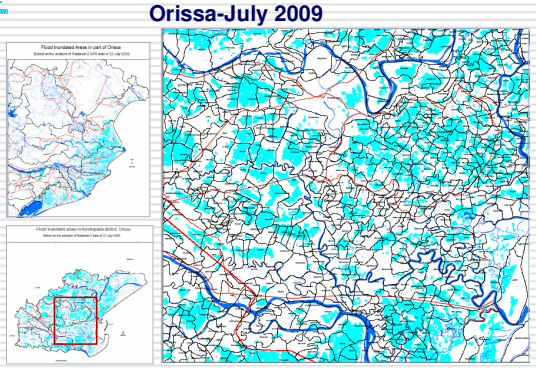


Flood Map



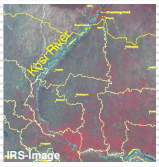
Flood Inundation | Normal River/Water Bodies | Cloud

Orissa-July 2009

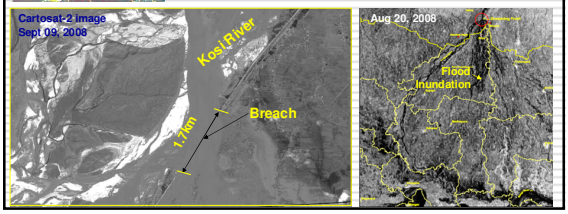


Normal River Course/ Water Bodies | Flood Inundation

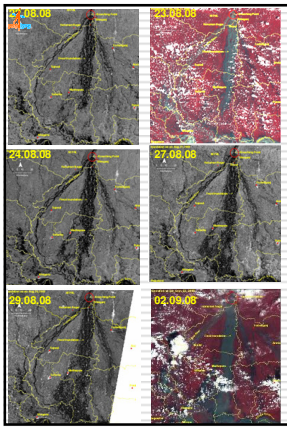
The Kosi River Breach



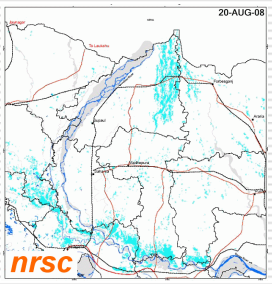
- Breach occurred on Aug 18, 2008
- Earliest Space Observation: Aug 20, 2008
- Max. Flooded area ~ 0.12 m ha
- Villages Marooned ~625
- Near real time info dissemination
- Info update ~ every 3-4 days



Space Info helped in:



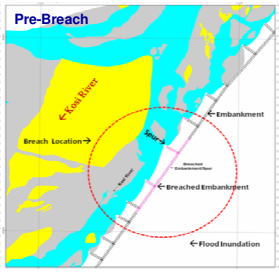
- Situation Monitoring
- Relief Management
- Impact Assessment
- Decision Making

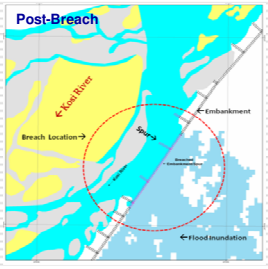


Kosi Breach Location

Pre River Course & Embankments from L4 & Cartosat data of 2007

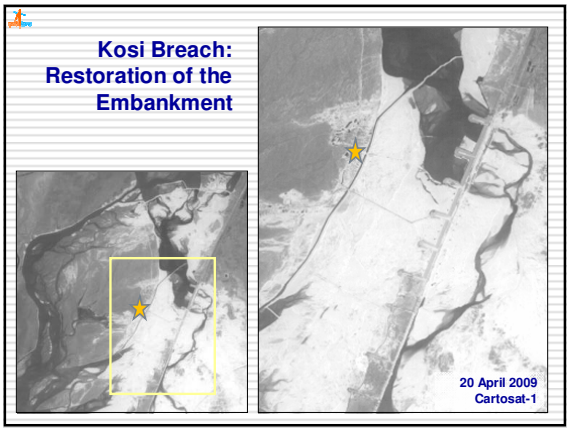
Post River Course & Embankments from L4 & Cartosat data of 2007 & 2008





Satellite data of past 15 years being analyzed
River Configuration maps being provided to GFCC

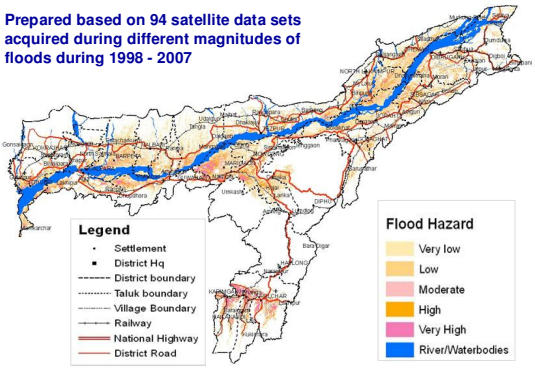
Kosi Breach: Restoration of the Embankment



Assam: Flood Hazard Zonation

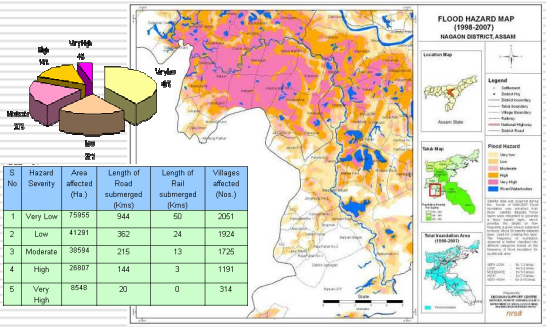
State-Level

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



Assam: Flood Hazard

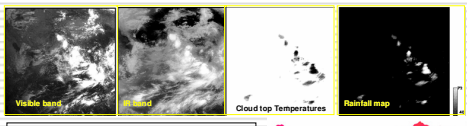
Sub-District Level



S No	Hazard Severity	Area affected (Ha.)	Length of Road submerged (Kms)	Length of Rail submerged (Kms)	Villages affected (Nos.)
1	Very Low	75955	944	50	2051
2	Low	41291	362	24	1924
3	Moderate	38594	215	13	1725
4	High	26807	144	3	1191
5	Very High	8548	20	0	314

Appraisal made to NDMA & CWC. Appraisal for Govt. of Assam planned Flood Hazard Atlas for Assam will be released soon

Space Inputs to Flood Forecasting

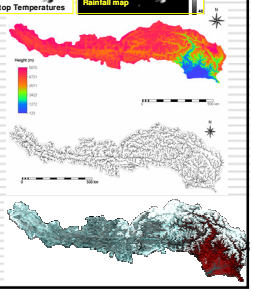


Requirements

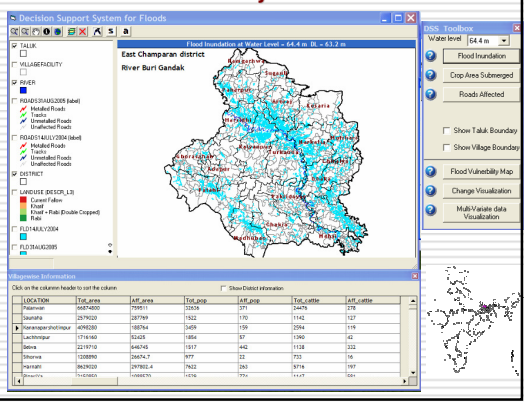
- Landuse/landcover
- Soil Map
- DEM
- Daily Rainfall Data derived from Satellite

Models

- Runoff Estimation: Modified SCS Model
- Modelling Direct Runoff: SCS Unit Hydrograph
- Flood Routing: Muskingum and SCS Lag methods



Information Systems



Web Application on Flood Shelters

An attempt to identify the suitable settlements for flood shelters

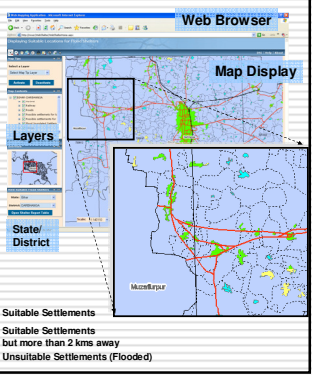
CRITERIA

- Non-flooded during severe floods
- Within 2 Km from Rail or Road

INPUTS

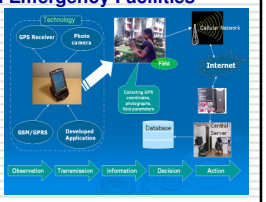
- Settlement Layer
- Flood Layer
- Transport Layer
- Elevation Layer

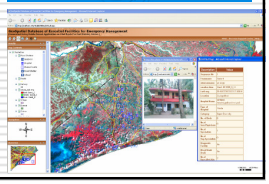
Table with suitable settlements and their elevation



Mobile based Application for
Collection of Field Data on Emergency Facilities

- Real time data collection on GPS coordinates, Digital Photos & user specified parameters and transmission from field to central processing server
- Demonstrated on pilot scale in Puri Dist, Orissa in collaboration with OSDMA for collecting Info on Relief Shelters/ Hospitals/ Civil Godowns.

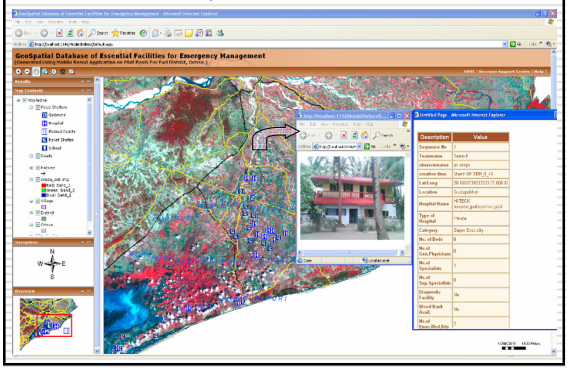




Hospitals : 334
Shelters : 265
Godowns : 31
Total : 630

Teams deployed: 2 persons/ team) x 5 teams
Time Taken for Puri Dist: 15 days

Web Application on Essential Facilities
Hospital, Puri District, Orissa



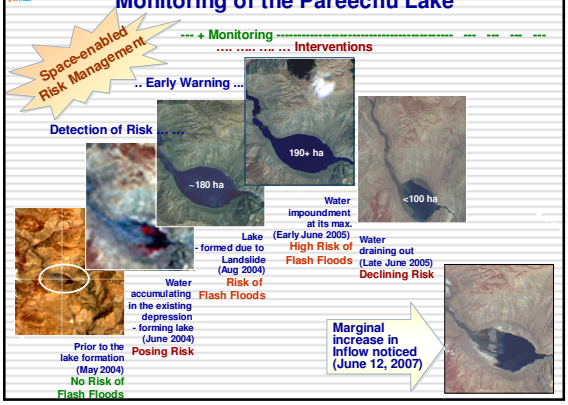
Mobile based Application
Parameters collected

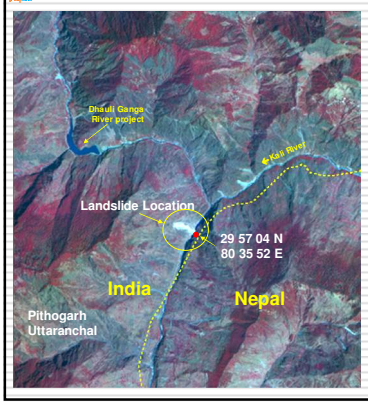
Parameter	Observations
Type of building	Relief shelter/Hospital/Godown (option)
Name of the building, if any	
	For Hospital
Type	Private/Government (option)
Category	PHC/Govt. hospital /super specialty (option)
Inpatient facility	Yes/No
If Yes,	Number of beds ☐ (dropdown menu) 20,40,60, 80,100 , specify
Number of doctors	General physicians ☐ Specialists ☐ Super specialists ☐
Availability of Diagnostic facility	Yes/No (option)
Availability of blood bank	Yes/No (option)
Availability of Emergency Medical kits	Yes/No (option) If Yes, No. of kits ☐
Availability of ambulance facility	Yes/No (option) If Yes, No. of ambulances ☐
Whether affected by disaster anytime	Yes/No (option)
If Yes,	Year ☐ dropdown menu (1996-2007)
Type of disaster	☐ dropdown menu (Flood, Cyclone, Earthquake, others, specify)

For Relief Shelters	
Capacity	☐ (enter value)
Available facilities	
Lighting	Yes/No (option)
Drinking water	Yes/No (option)
Sanitation	Yes/No (option)
Cooking	Yes/No (option)
Storage	Yes/No (option)
Whether affected by disaster anytime including accessibility	Yes/No (option)
If Yes,	Year ☐ dropdown menu (1996-2007)
Type of disaster	☐ dropdown menu (Flood, Cyclone, Earthquake, others, specify)

For Godowns	
Available storage space	☐ (enter value in cubic meters)
Items generally stored	List of all the items (provide input) Firewood, kerosene, rice, wheat, water bottles, blankets, clothes, utensils, pickles, readymade tin food, cooking items, etc

Monitoring of the Pareechu Lake

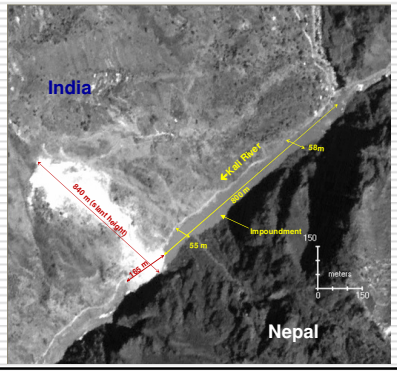


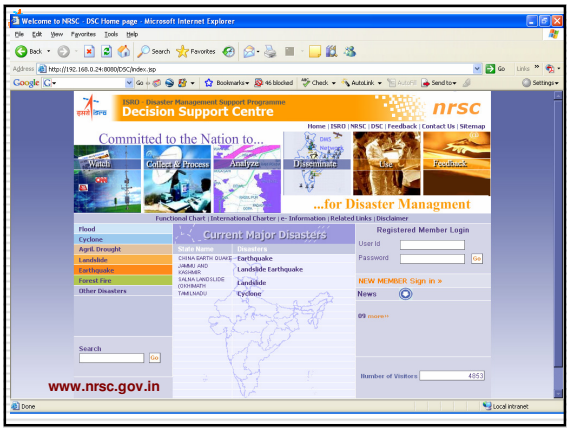


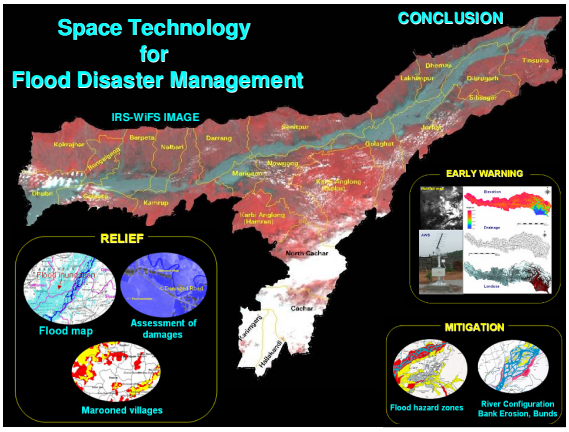
Landslide on Kali River In Pithoragarh District, Uttaranchal

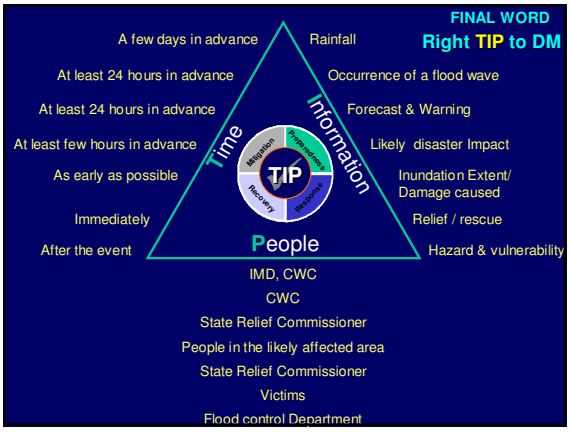
Based on the satellite observations it was discerned, the landslide occurred during 4-15 Feb 2009

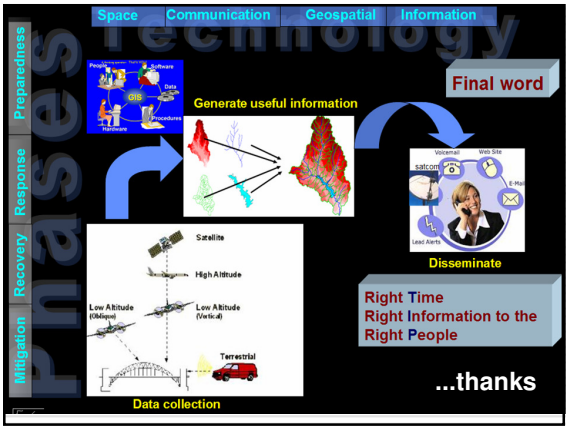
Measurements of the Landslide
as seen from Cartosat-1 data of April 11, 2009




Welcome to NRSC - DSC Home page - Microsoft Internet Explorer
Decision Support Centre
nrsc
Committed to the Nation to...
...for Disaster Managment
Current Major Disasters
Registered Member Login
www.nrsc.gov.in


Space Technology
for
Flood Disaster Management
CONCLUSION
IRS-WiFS IMAGE
EARLY WARNING
RELIEF
Flood map
Assessment of damages
Marooned villages
MITIGATION
Flood hazard zones
River Configuration Bank Erosion, Bunds


FINAL WORD
Right TIP to DM
A few days in advance
Rainfall
At least 24 hours in advance
Occurrence of a flood wave
At least 24 hours in advance
Forecast & Warning
At least few hours in advance
Likely disaster Impact
As early as possible
Inundation Extent/ Damage caused
Immediately
Relief / rescue
After the event
Hazard & vulnerability
Time
Information
People
TIP
IMD, CWC
CWC
State Relief Commissioner
People in the likely affected area
State Relief Commissioner
Victims
Flood control Department


Space
Communication
Geospatial
Information
Preparedness
Response
Recovery
Mitigation
Generate useful information
Final word
Disseminate
Right Time
Right Information to the
Right People
Satellite
High Altitude
Low Altitude (Oblique)
Low Altitude (Vertical)
Terrestrial
Data collection
...thanks