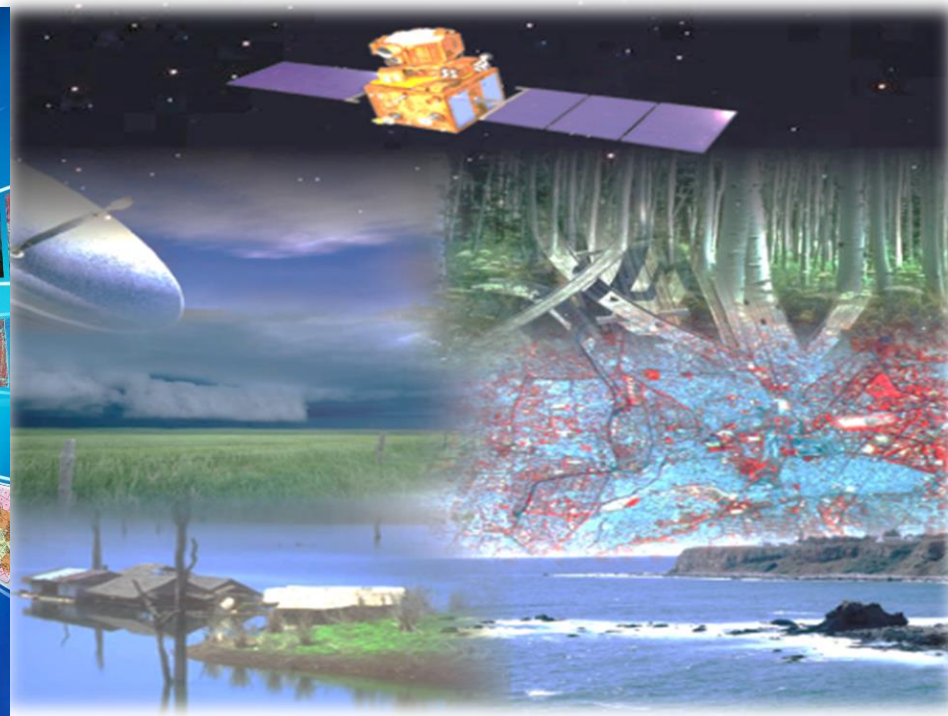




# ISRO-Disaster Management Support Programme

## *Highlights for 2022-23*



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ONE EARTH • ONE FAMILY • ONE FUTURE

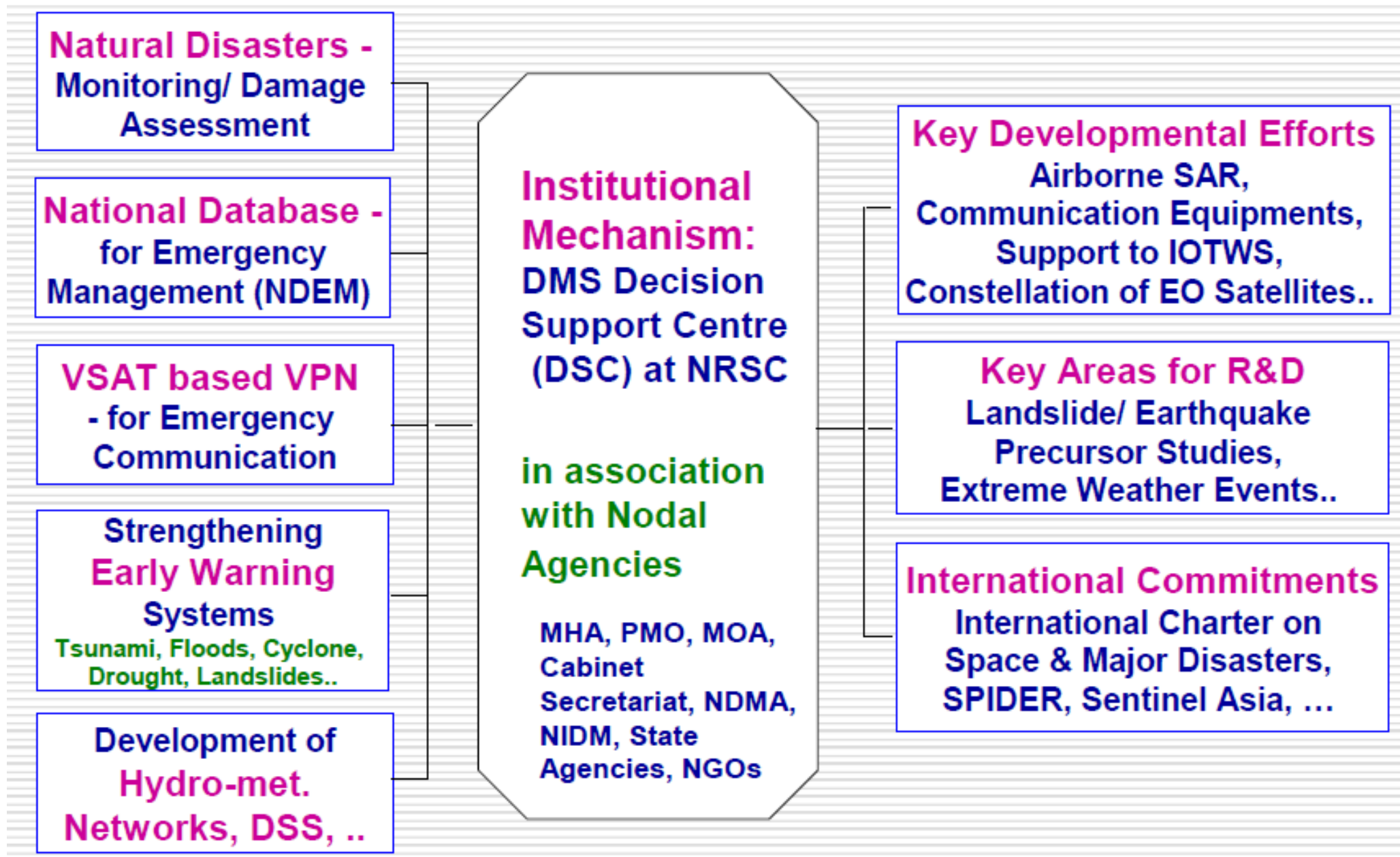


CEOS WG Disasters Meeting 20  
Mammoth Hot Springs Hotel,  
Yellowstone Park, USA

**Dr. Arijit Roy**  
**Indian Institute of Remote Sensing**  
**Indian Space Research Organization**



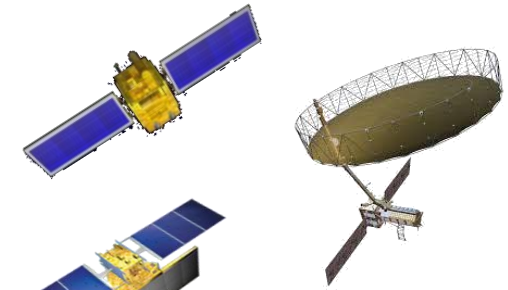
# ISRO DMS Programme



# Earth Observation Satellites Infrastructure of ISRO

## LAND & WATER

RESOURCESAT-2 series



NISAR (2024)

RISAT-1 Series

## HIGH RESOLUTION

CARTOSAT-2 & 3 Series

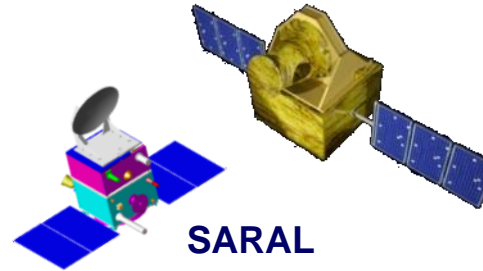


RISAT-2

CARTOSAT-1

## OCEAN

OCEANSAT-3

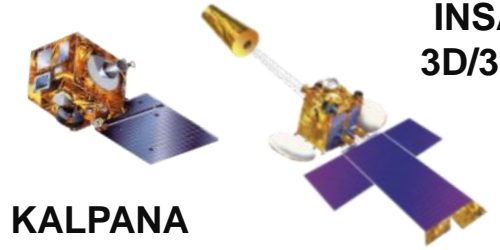


SARAL

ScatSat

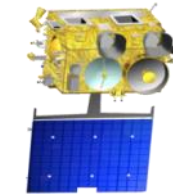
## WEATHER; CLIMATE

INSAT-3D/3DR



KALPANA

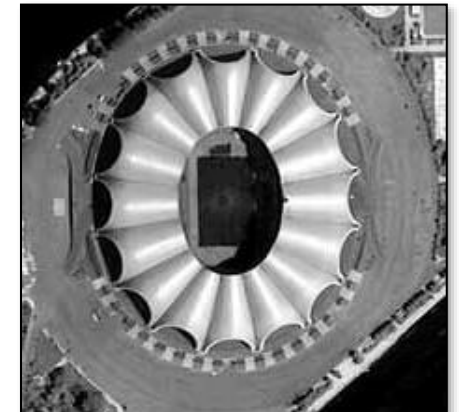
INSAT-3A



1 KM

IMAGING CAPABILITY

0.6 M

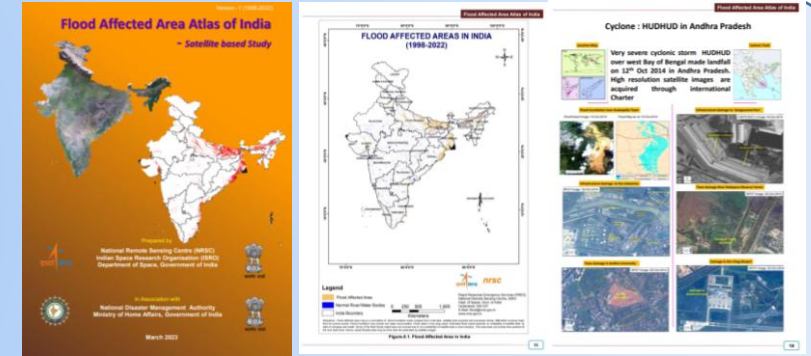


to be augmented with CARTOSAT 2/3 series; RESEOURCESAT 3series; GISAT, HRSAT, RISAT-1A/2A, OceanSat, NISAR.....

# EO based Disaster Management Support: Monitoring

## Floods (Riverine & Cyclonic) Cyclones:

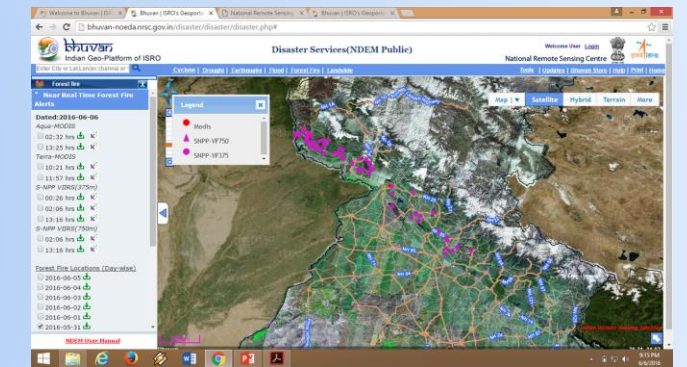
- ❖ In 2023, until July, major floods in 12 States
- ❖ 65 flood maps and 94 value added products were disseminated to all the concerned DMS organisations in near real-time.
- ❖ International Charter has been activated during Biparjoy Cyclone and during floods in North India



Flood Affected Area Atlas of India (25 years of data)

## Indian Forest Fire Response and Assessment System (INFFRAS)

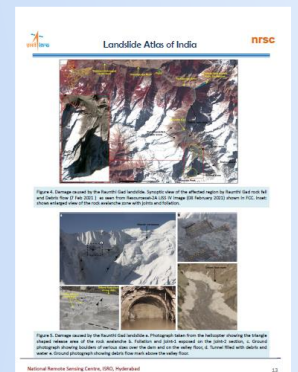
- ❖ During 2023 (till 8th Aug), forest fire alerts were given through FSI to the concerned State Forest Departments in NRT.
- ❖ Fire events are monitored in forests and agricultural residue burning.
- ❖ Fire affected area assessment is carried out using optical satellite data to identify burn scars left by the fire front.



Source: Bhuvan, NRSC, ISRO

## Uttarakhand Landslides during Monsoon 2023

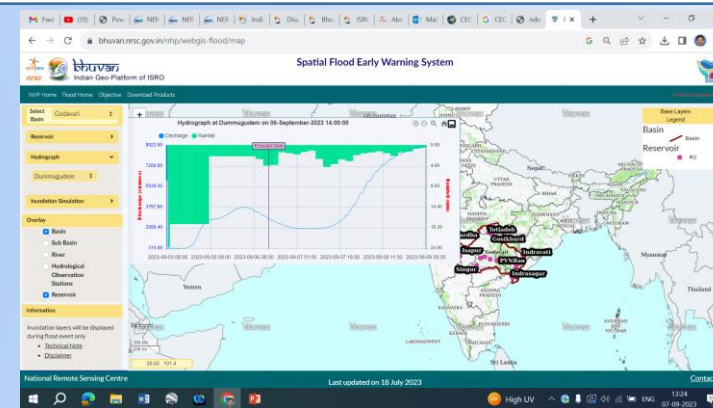
- ❖ Multi-temporal satellite data were used to prepare an event-based landslide inventory map of Rudraprayag and Chamoli districts, Uttarakhand.
- ❖ A total of 145 landslides triggered due to heavy rainfall in the first and second week of July were mapped.
- ❖ Landslide Atlas of India (1998-2022) has been published



# EO based Disaster Management Support: Alerts & Forewarning Service

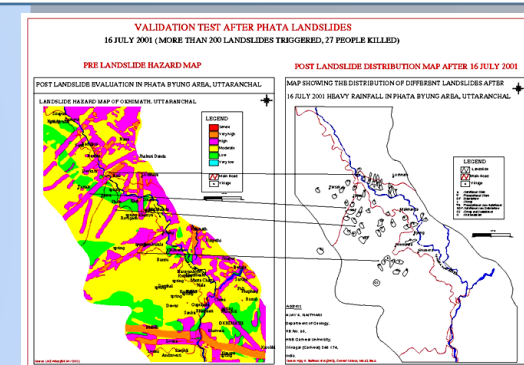
## Spatial Flood Early Warning: :

- ❖ Operational spatial flood early warning systems developed for the Assam, Godavari and Tapi using high resolution Digital Terrain Models.
- ❖ Spatial flood alerts were disseminated during floods in Assam, Godavari in July 2023. Forecast accuracy is more than 87% with lead time of 36 to 52 hours at prominent locations



## Landslide Early Warning System (LEWS)

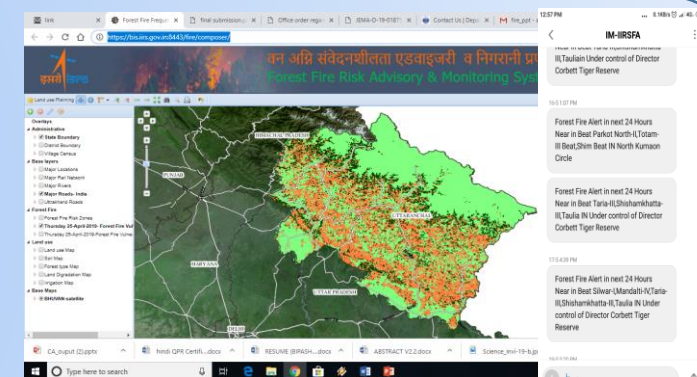
- ❖ Experimental landslide early warning system developed using rainfall threshold models along the National Highway-58 (NH-58) from Rishikesh to Mana in the Garhwal Himalaya is run and alerts were published in NDEM and Bhuvan



Source: Bhuvan, NRSC, ISRO

## Forest Fire Risk Index:

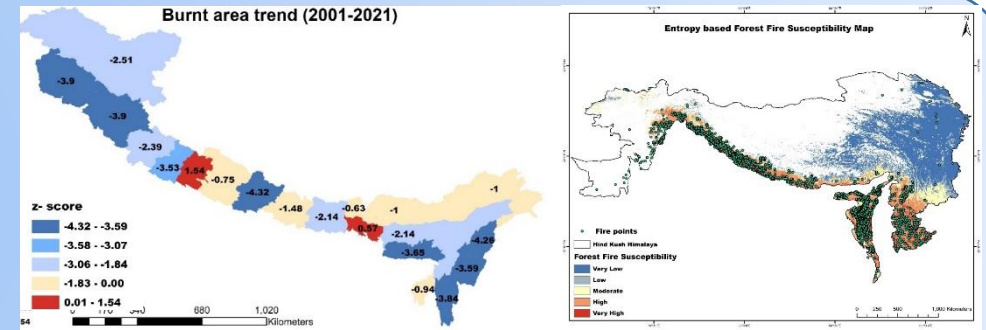
- ❖ Using space based fire weather index and the vegetation and topographic characteristics the daily forest fire risk information is developed and disseminated to stake holders through web-portal and SMS alerts.
- ❖ The Model is calibrated for western Himalaya and efforts are on for calibrating this model for the Entire Himalayan region as well as Indian landmass



# EO based Disaster Management Support: Advance Research

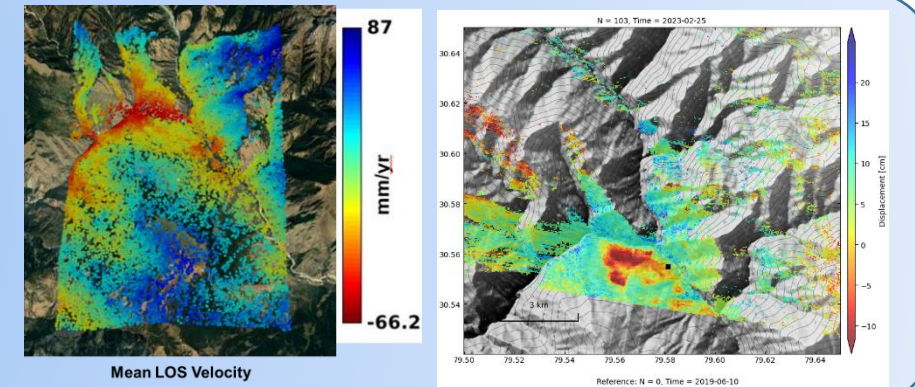
## Long term studies on forest fire in Hindu Kush Himalaya:

- ❖ Analysis of long term burnt area patterns in the Hindu Kush Himalaya (HKH) and development of forest regime based on climatic, topographical and edaphic factors.
- ❖ Modeling forest fire susceptibility in the HKH region



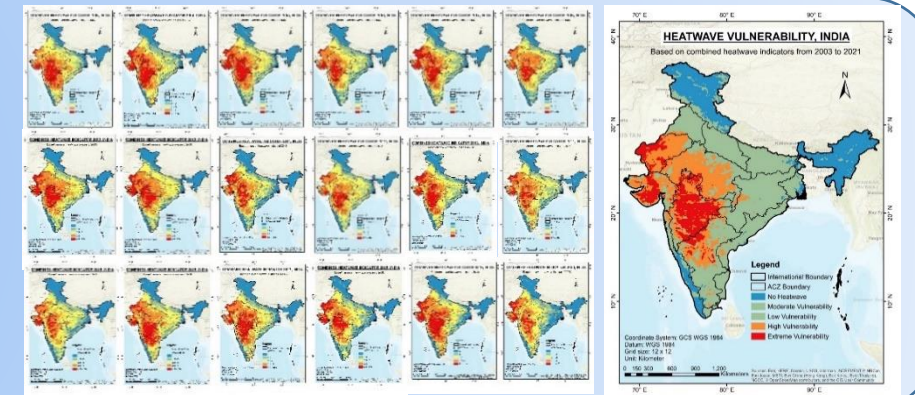
## Advances InSAR techniques for land deformation (PS-InSAR & SBAS)

- ❖ Advanced Interferometric technique has been developed using open-source tools viz. PS-InSAR and SBAS to identify the slow subsidence in the Mountainous regions of India
- ❖ The technique has the ability to identify the land deformation and movements as less as few mm per year.



## Spatial Heat Wave Hazard Modelling

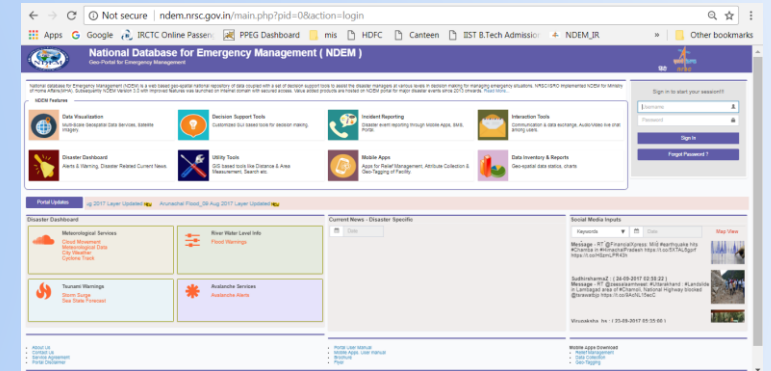
- ❖ Novel approach using space based EO data for identification of Spatio-temporal variation in heatwave hazard
- ❖ Impacts of LULC and LULC transformation on heatwaves events
- ❖ Establishment and modelling of hazard and vulnerability parameters on Heatwave Risk (Risk regions)



# EO based Disaster Management Support: Geoportals

## National Database for Emergency Management (NDEM)

- ❖ Geo-portal to disseminate space-based inputs along with services of forecasting organizations addressing all natural disasters in all phases at PAN India level
- ❖ Amalgamation of multi-scale geospatial database coupled with decision support system tools.
- ❖ Assist the stakeholders for preparedness, hazard/risk zonation, damage assessment and emergency response.



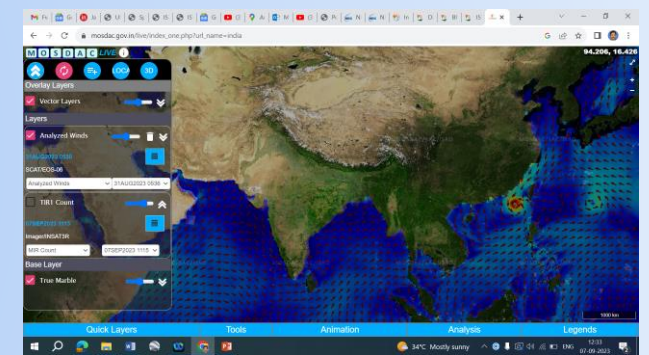
## North Eastern Regional Node for Disaster Risk Reduction (NEDRR)

- ❖ A web based system for effective geospatial data dissemination and exchange to facilitate effective disaster management activities
- ❖ Provide information on Thunderstorm now-casting, Lightning early warning, flood forecasting, flood inundation, extreme precipitation, forest fire and landslide.
- ❖ Updated and user-friendly NER-DRR dashboard



## Meteorological and Oceanographic Satellite Data Archival Centre (MOSDAC)

- ❖ Meteorological and Oceanographic Satellite Data Archival Centre (MOSDAC) operationally provide earth observation data from Indian meteorology and oceanography satellites, to cater to national and international research requirements.
- ❖ Critical Information on Now casting and WRF based modelling output for meteorological and oceanographic parameters viz. extreme precipitation, heat waves, fire, wind, etc



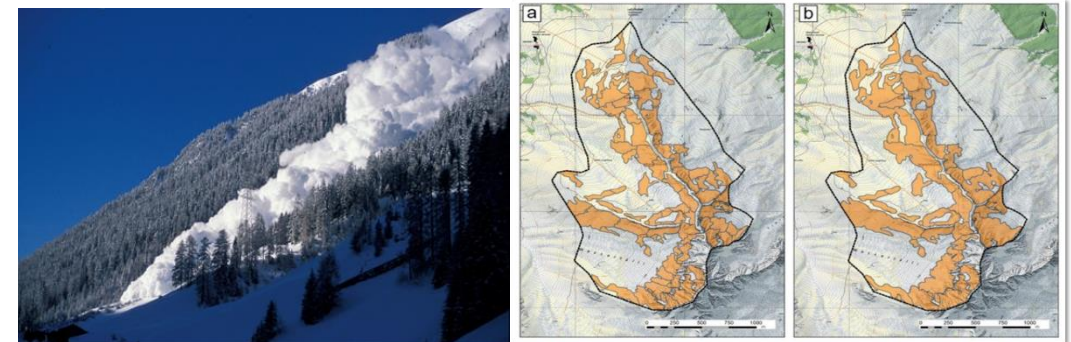
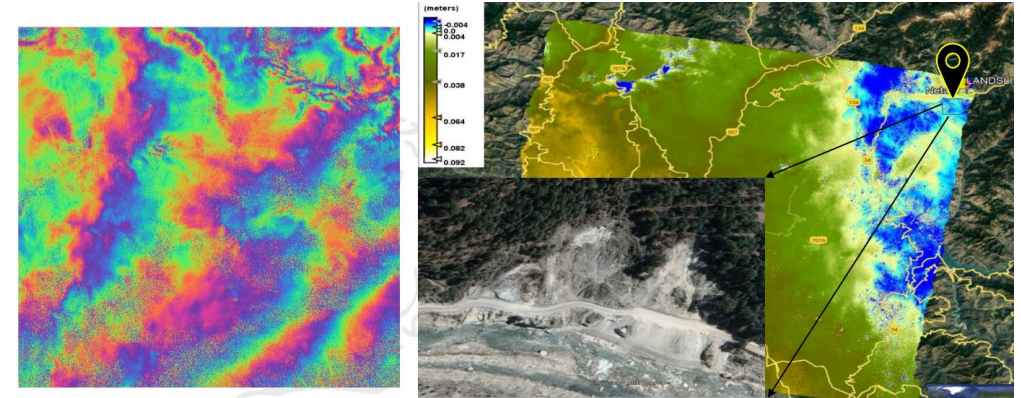
# Advance Studies (AS) in Space Based Disaster Management Support

**DMS-Advance Studies program is effort by ISRO to include the premier institutions in the country to develop advance research areas for application of in space technology for disaster management in the country.**

- ❖ New methodologies
- ❖ New algorithms for hazard detection
- ❖ Application of AI and ML in DMR
- ❖ Early warning systems
- ❖ Multi-hazard and vulnerability assessment

- ❖ IIT-Roorkee; IIT Bombay
- ❖ IIT Patna, IIT Ropar, IIT Mandi
- ❖ GBPUAT, NIT Karnataka; Central University Jharkhand
- ❖ IIRS; NESAC, SAC, RRSC-NRSC
- ❖ CBRI, IISER-Mohali

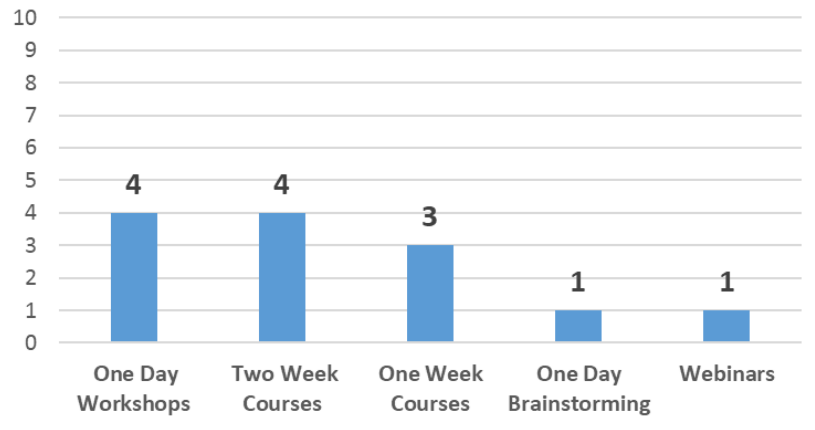
- ❖ Avalanche Hazard and early warning
- ❖ Early warning system for landslides
- ❖ AI based Lightning and Hailstorm Alerts
- ❖ SAR based Algorithm for partially inundated vegetation
- ❖ Landslide characterization and debris flow modelling
- ❖ Permafrost destabilization induced mass wasting
- ❖ Extreme rainfall modelling
- ❖ AI /ML modelling for crop disease
- ❖ Multi-hazard analysis: Earthquake induced landslide



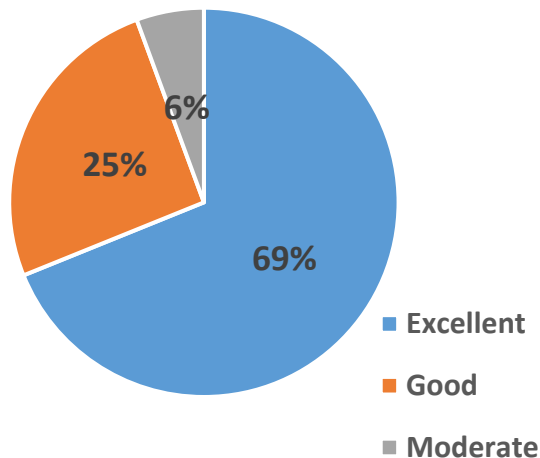


# ISRO DMS Capacity Building Program

Type of Programs Conducted



Feedback



- **Total Programs Conducted:13**
- **Total Participants Benefitted :521**
- **Institutes Involved:**
  - IIT, Roorkee
  - Punjab Remote Sensing Centre Ludhiana
  - Punjab Engineering College (Deemed to be University) Chandigarh
  - Symbiosis International (Deemed University), Pune, Maharashtra
  - Sathyabama Institute of Science and Geoinformatics, Chennai
  - Pillai HOC College of Engineering and Technology, Maharashtra
  - Institute of Science and Technology for Advanced Studies and Research (ISTAR)
  - Sathyabama Institute of Science and Geoinformatics, Chennai
  - Department of Geology, Patna University, Patna
  - Department of Geology, University of Kerala
- **Theme of Training Programs:** Environmental Hazards, Hydro Metrological Disaster, Stubble burning, Air Pollution, Flood hazard, Landslide hazards, Hydro-climatological Extremes, InSAR for Disaster Preparedness, Locust Surveillance, Urban Flood Risk and Earth Observation Portals

Contribution in Technical Advisory Mission to Philippines as part of UN-SPIDER programme on use of space technology for DRR

Post Symposium Tutorial on “Space-based Data for Climate Monitoring and Climate Change Impact” as part of UN/Austria Symposium 2022 - Space for Climate Action Training on 19th September 2022 conducted by CSSTEAP with UNOOSA (73 participants from 18 countries)

CSSTEAP is involved in Curriculum Development in “Access to Space for All” which focuses on

- ❖ Hyper-gravity and Microgravity;
- ❖ Satellite Development





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# Thanks