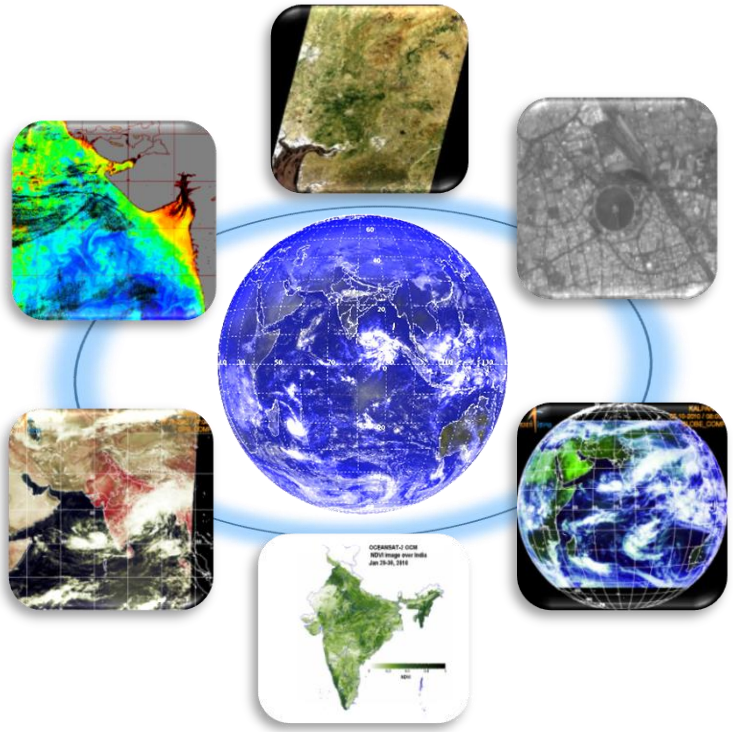
Geospatial data needs for Hazard and Risk Assessment



Nitant Dube

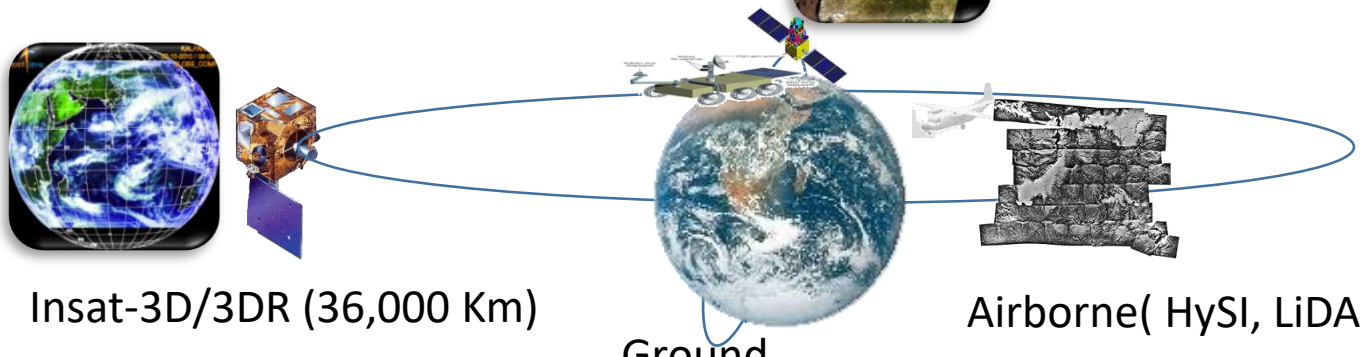
Group Head, MOSDAC Research Group

Space Applications Centre, ISRO

Geo-spatial Data Collection Platforms

IRS Series of Satellites
(600-900 Km)
- Systematic coverage
- Full Globe can be imaged
- Improved Resolutions

Rover/Landers/Robots
- Very High Resolution
- Distortions in image difficult to model



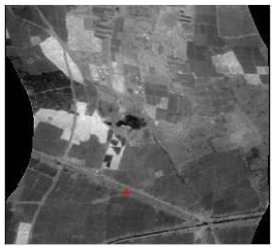
Insat-3D/3DR (36,000 Km)

- Improved Repeativity (48 acquisition in a Day)
- Large Swath

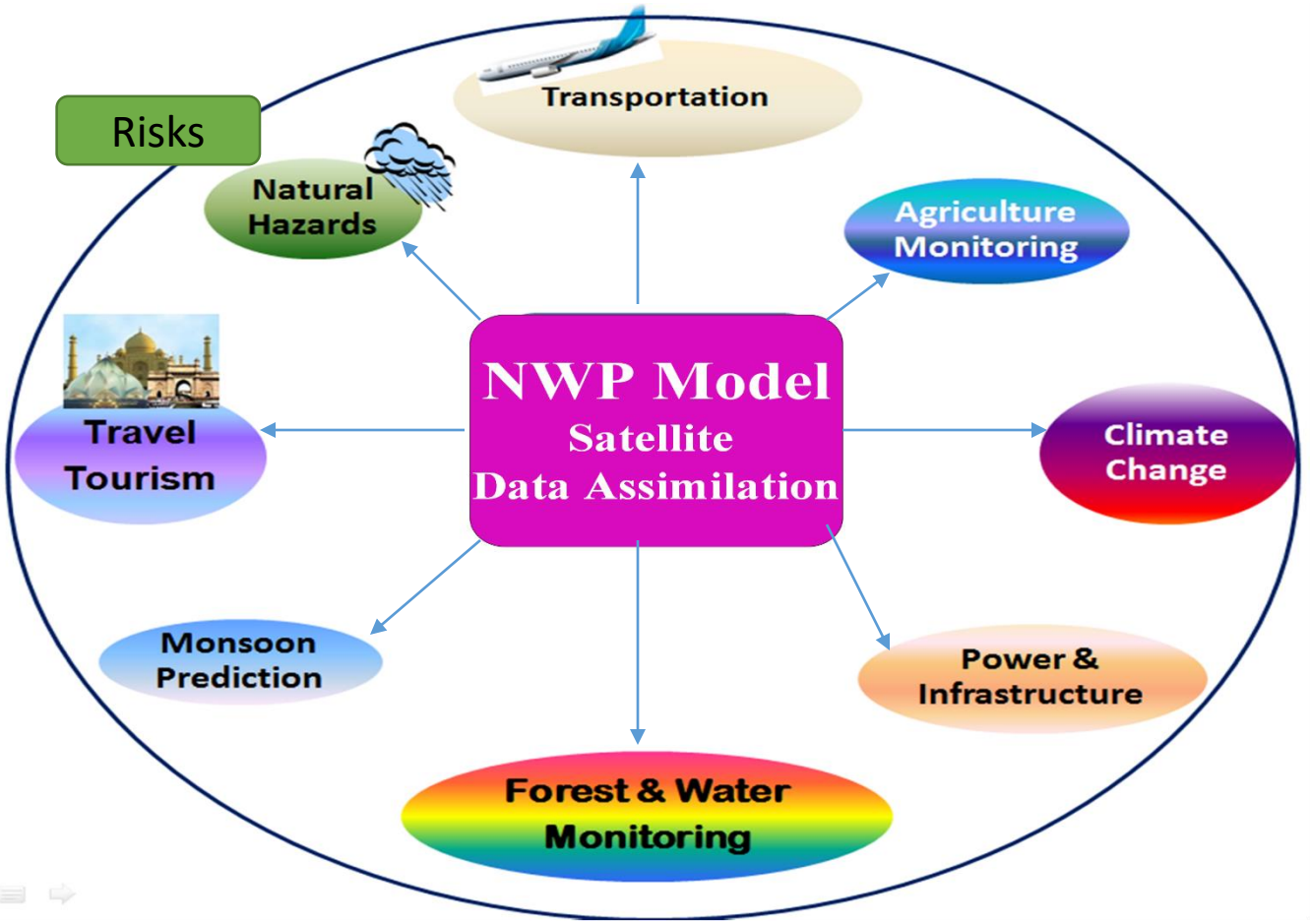
Ground Based Observations

Airborne(HySI, LiDAR) (1-8Km)

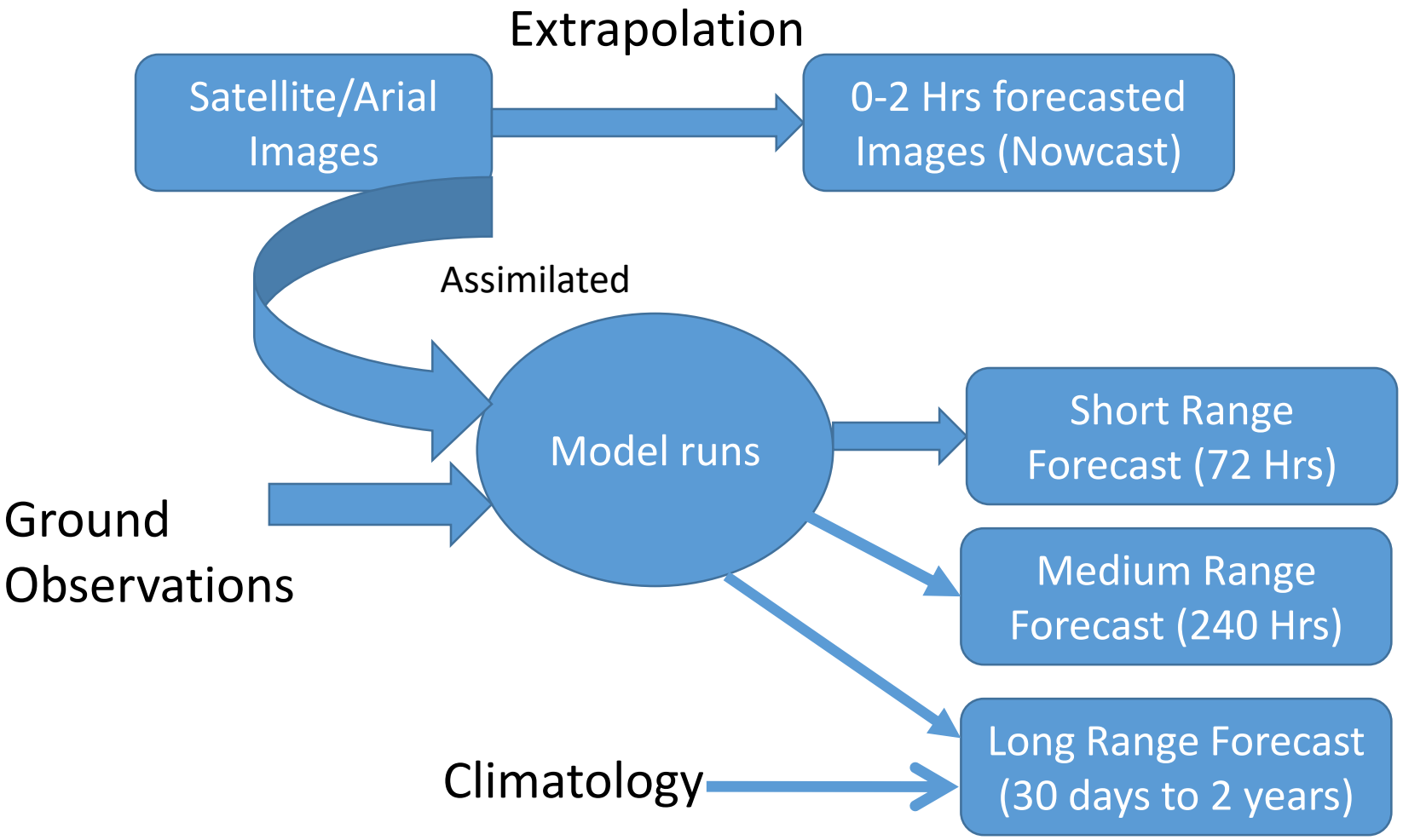
- Air-craft/Drone
- Very High Resolutions
- Area of Interest based acquisition



Geo-Spatial Data Requirements

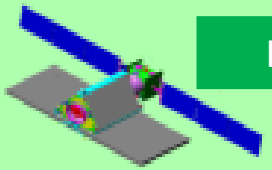


Geo-Spatial Data



Geo-Spatial Data type: Satellite Images

Land & Water



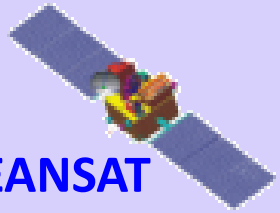
RISAT
C-SAR

RESOURCESAT
LISS 3; LISS 4; AWiFS

Cartography

CARTOSAT Series
of Satellite
PAN and MX

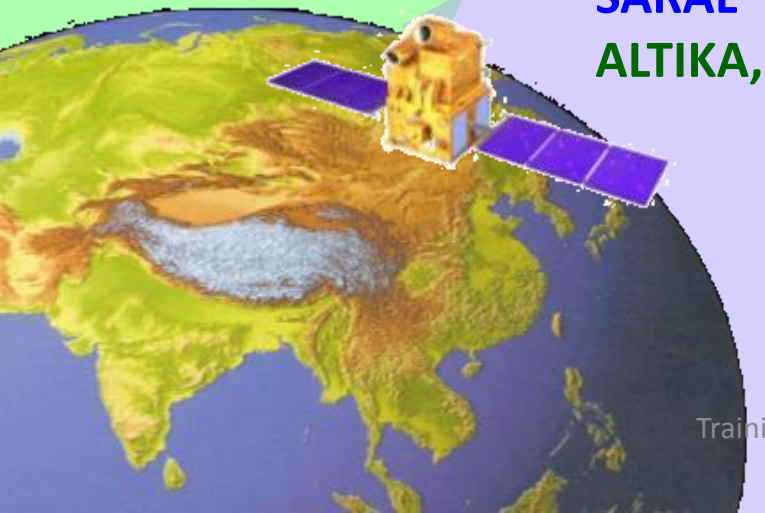
Ocean & Atmosphere



OCEANSAT
OCM , SCAT, ROSA

INSAT-3 (D,R&S)
Generation
IMAGER,
SOUNDER

SARAL
ALTIKA, ARGOS



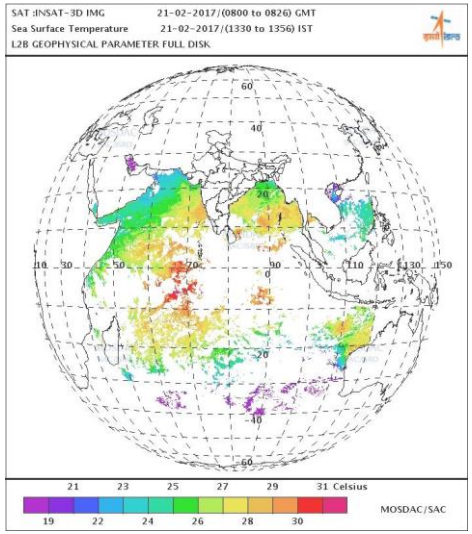
MEGHA-TROPIQUES
MADRAS, SAPHIR, SCaRaB

INSAT- 3A
VHRR, CCD

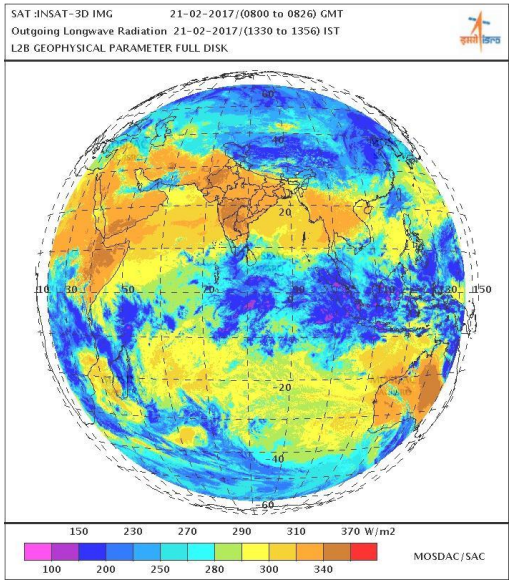
KALPANA-1
VHRR

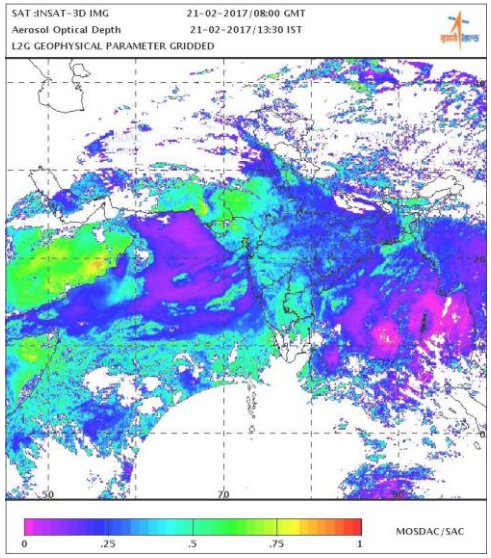
Geophysical Parameters

- **Sea Surface Temperature**

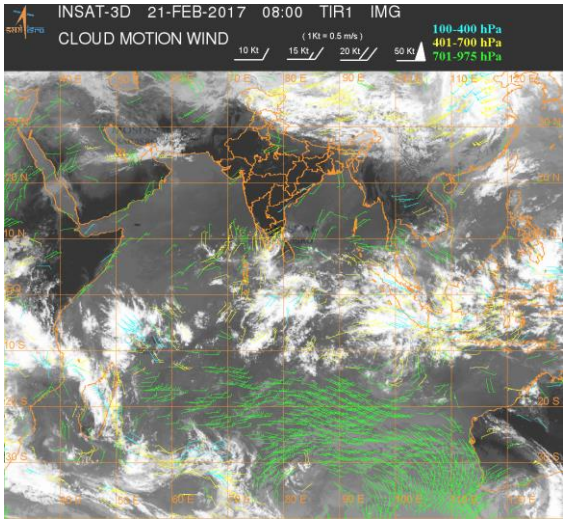


- **Outgoing Long wave Radiations**





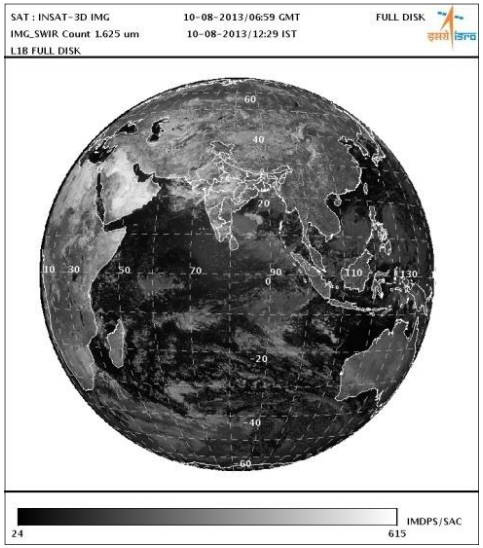
- **Aerosol Optical Depth**

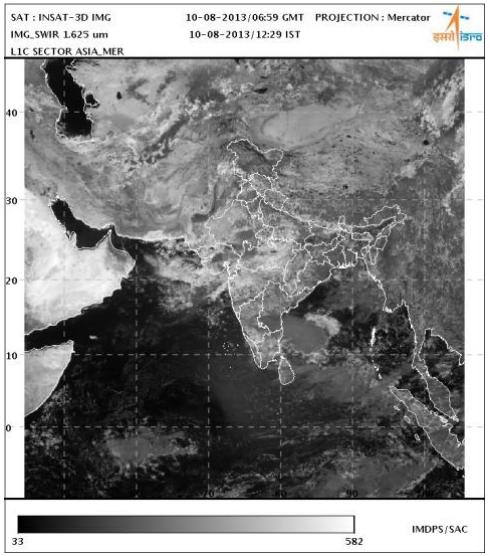


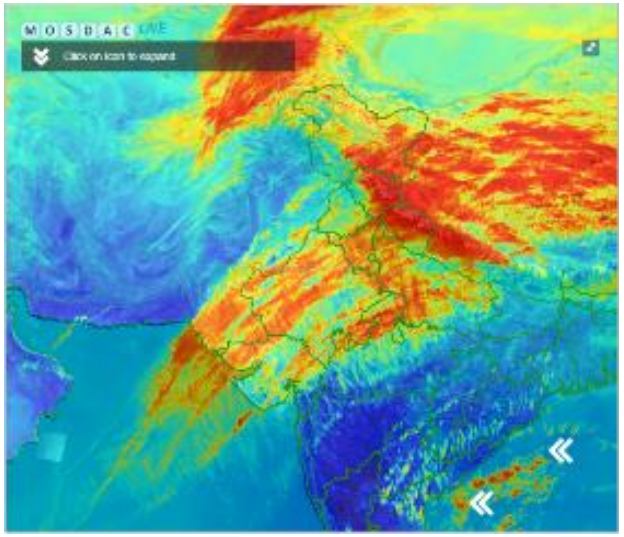
- **Cloud Motion Vectors**

Mean sea surface

Standard Products

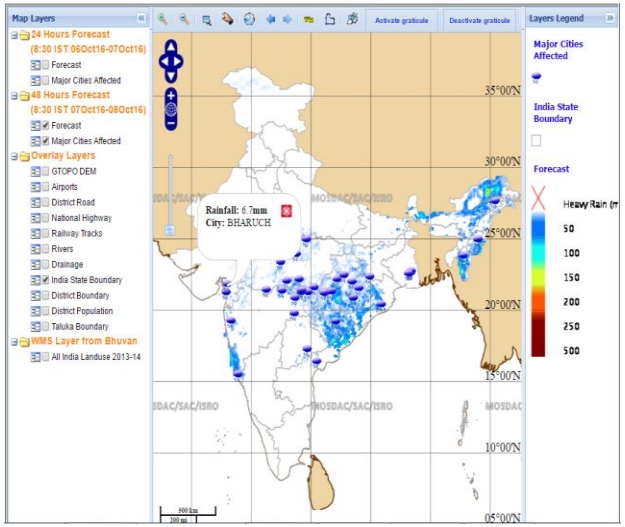


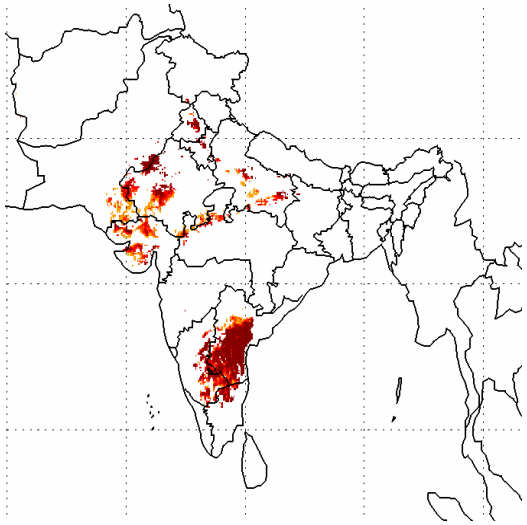


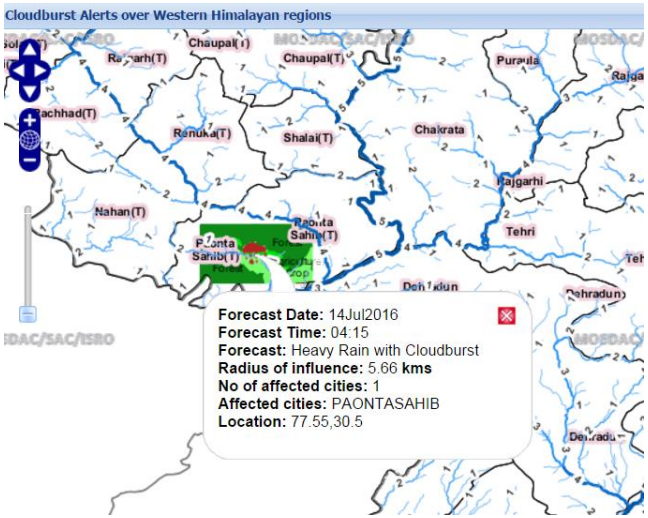


Geo-Spatial Data : Nowcast

Now-casting of Extreme weather Events



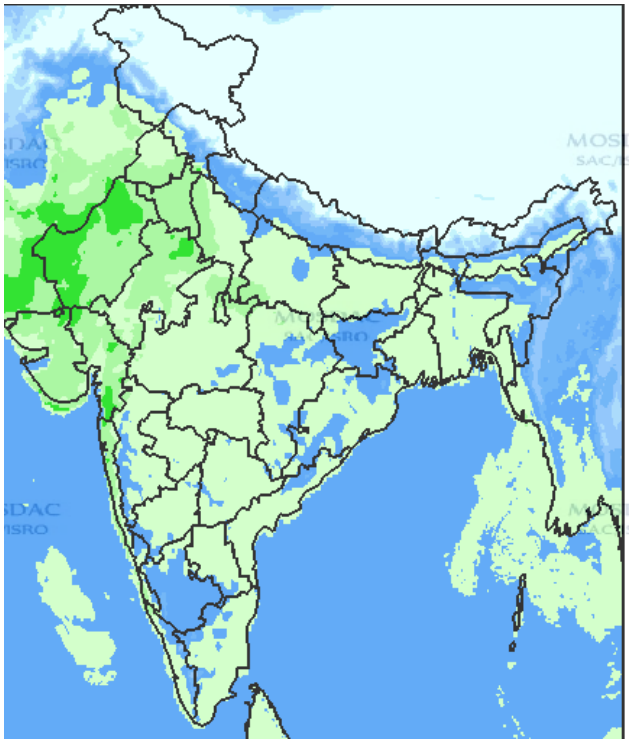




Heavy Rain | Heat/Cold wave | Cloud Burst

Geo-Spatial Data : Weather Forecast

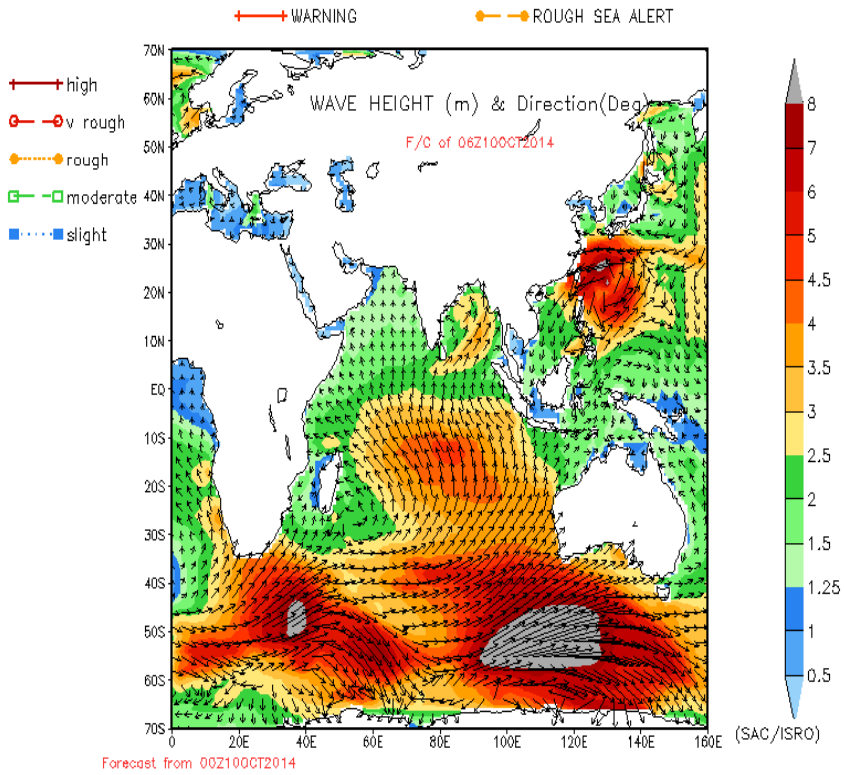
Experimental Weather Forecast (5 Km) for every 3 Hrs for 72 Hrs



- **Temperature**
- **Humidity**
- **Cloud**
- **Wind**
- **Rain**
- **Fog**
- **Discomfort Index**

Geo-Spatial Data : Ocean State Forecast

Experimental Ocean State Forecast at every 6 hours for next 5 days



- **Wave Height and Period**
- **Swell Height**
- **Wind Speed**
- **Sea Level Anomaly**
- **Sea Surface Currents**
- **Sea Surface Salinity**
- **Sea Surface Temperature**

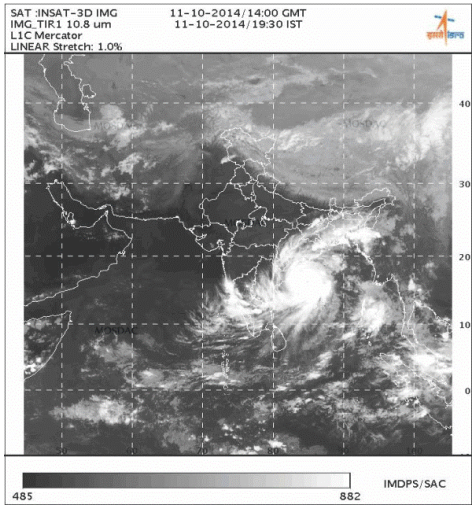
Hazard and Risk

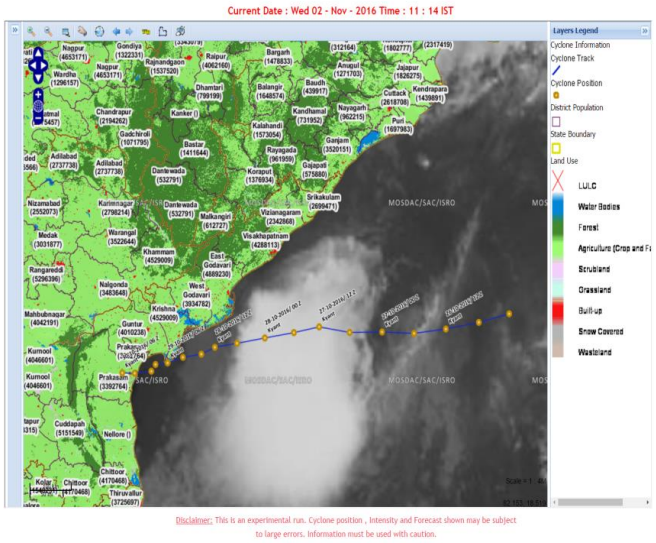
- Tropical Cyclones
- Landslide
- Forest Fire
- Floods
- Earthquake

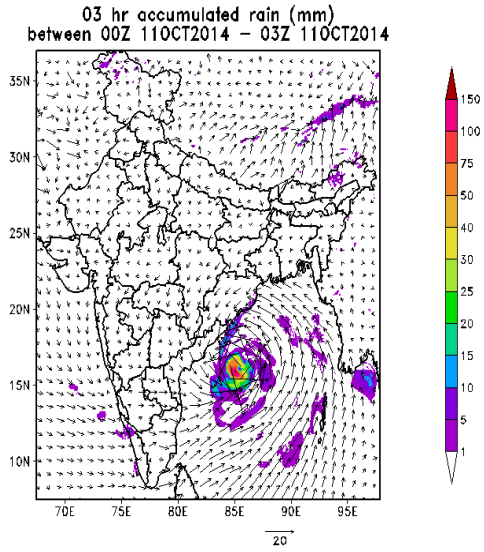
- Geospatial Data
- Satellite Images
  - Historical Images (Time Series)
    - Used for Generation of **Maps** for identification of potentially dangerous areas
  - Real time Images
    - Used for Generation of Alerts
    - Post Event: Disaster Response and Mitigation Planning
- Model Forecast
  - Alerts
- Ancillary
  - DEM

Hazard and Risk: Tropical cyclones

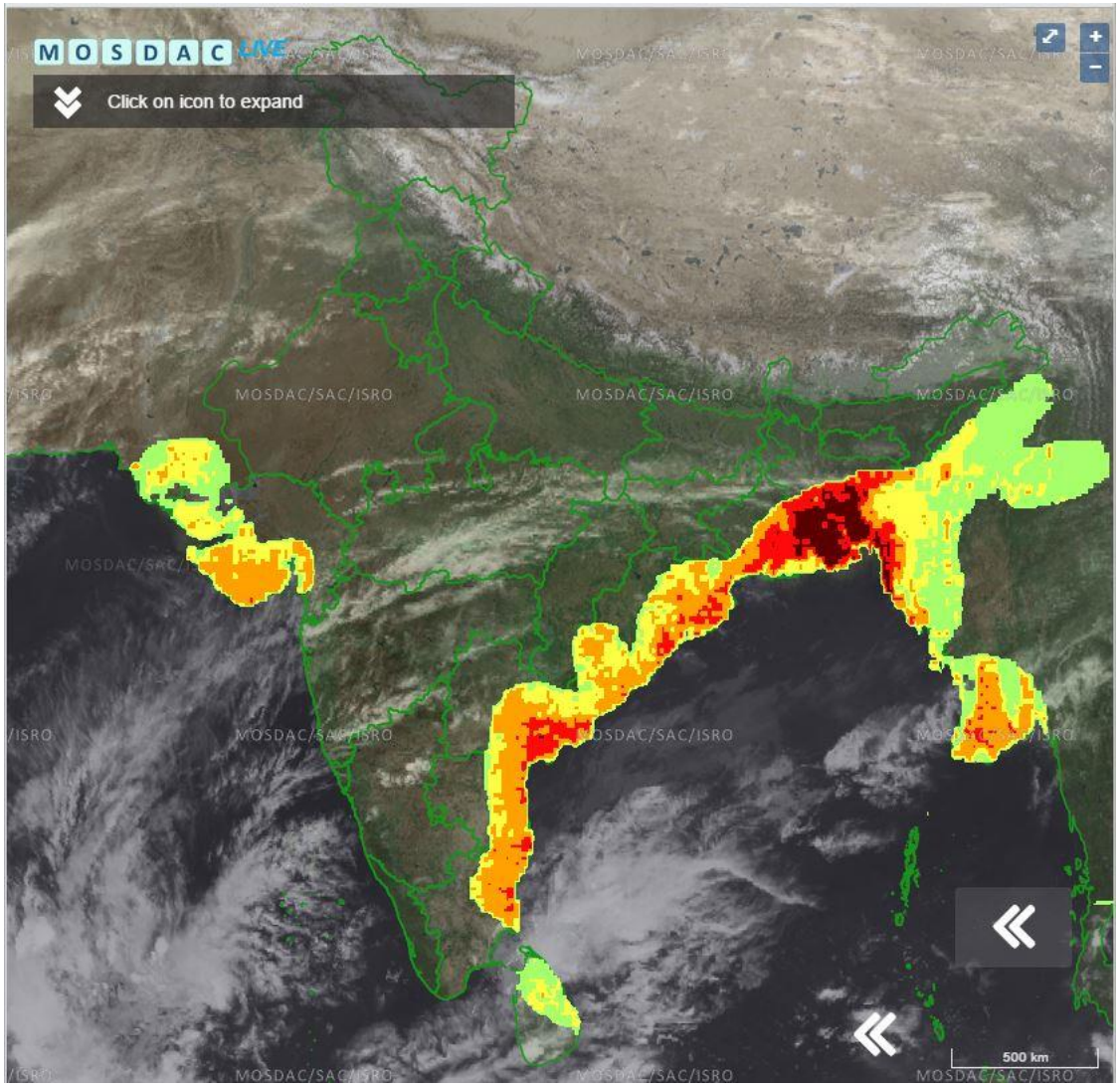
Hazard (source of potential damage)	Risk (Probability that Person/Property will be harmed when exposed to Hazard)	Geo-spatial Data
Tropical Cyclone	Life and Property	Pre Cyclone: Model Forecast During Cyclone: Model Forecast and Satellite Images, Surge Maps Post Cyclone: High Resolution Satellite Images (Damage Assessment)







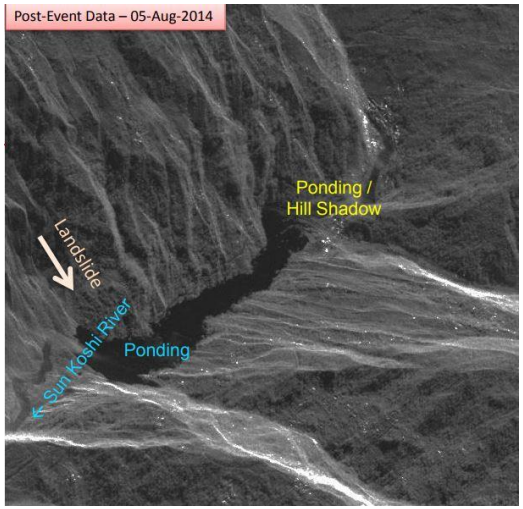
Cyclone Risk Map

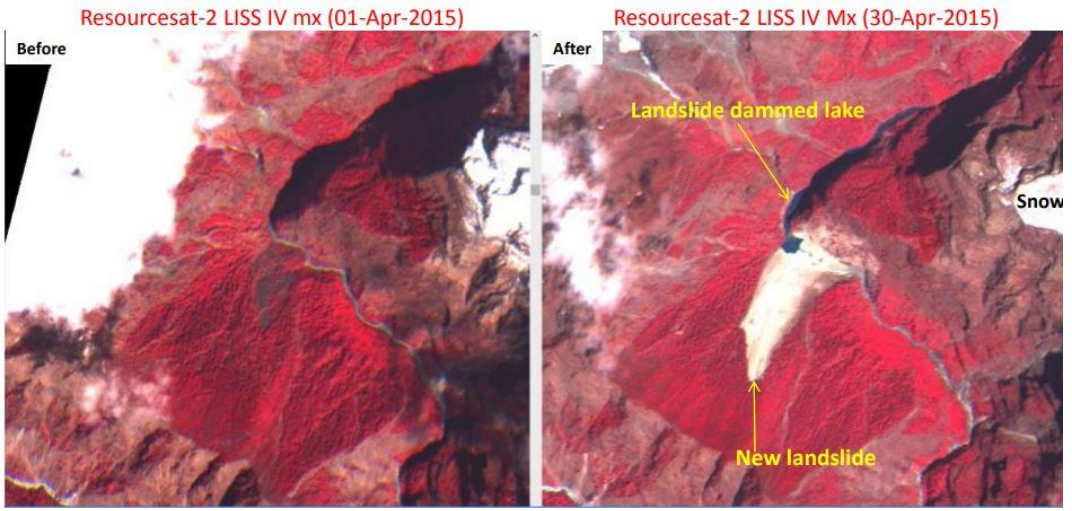


- Generated Using Historical Information (Cyclone Track, Intensity and Landfall)
- Helps in identifying areas, which have higher risk.
- Used in planning for infrastructure and National Projects

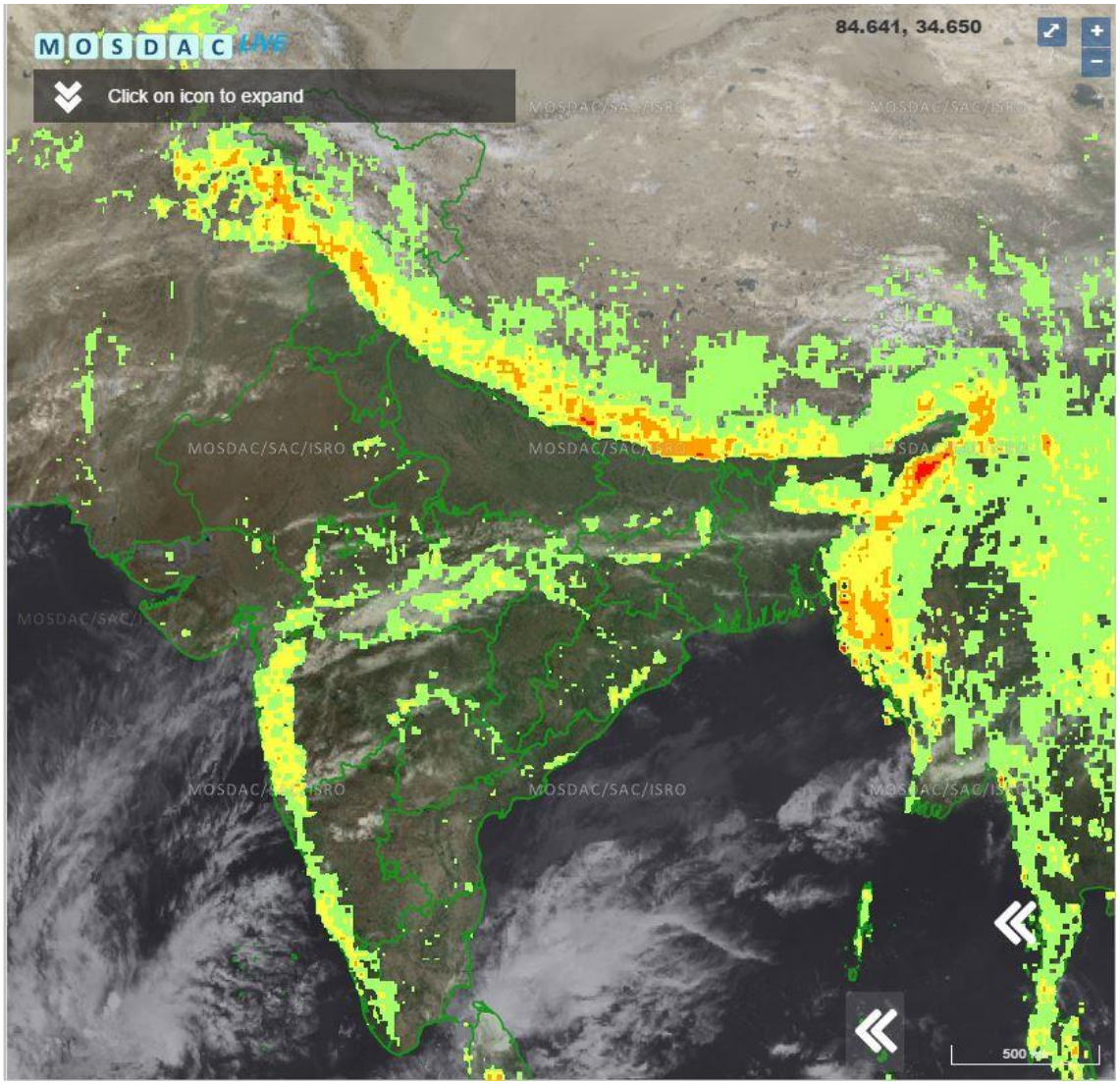
Hazard and Risk: Landslide

Hazard (source of potential damage)	Risk (Probability that Person/Property will be harmed when exposed to Hazard)	Geo-spatial Data
Landslide	Life and Property	Pre Phase: Satellite Derived DEM and other information for Hazard Zonation Alert: Rainfall triggered Slope Failure initiation (Landslide Early warning system) Post Phase: High Resolution Satellite Images (Damage Assessment)





Landslide Risk Map



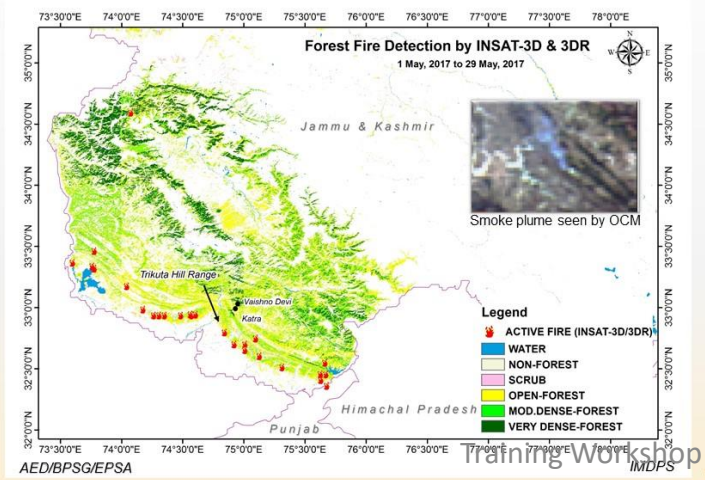
- Generated Using Ground Information and Satellite Image Processing Techniques
- Helps in identifying areas, which have higher risk.
- Used in mitigation planning

Hazard and Risk: Forest Fire

Hazard (source of potential damage)	**Risk** (Probability that Person/Property will be harmed when exposed to Hazard)	**Geo-spatial Data**
Forest Fire	Forest and their biodiversity	Pre Phase: Landuse and Landcover maps (LULC) Alert: Forest fire monitoring using INSAT Images (updated in 15 mins) Post Phase: High Resolution Satellite Images (Damage Assessment)

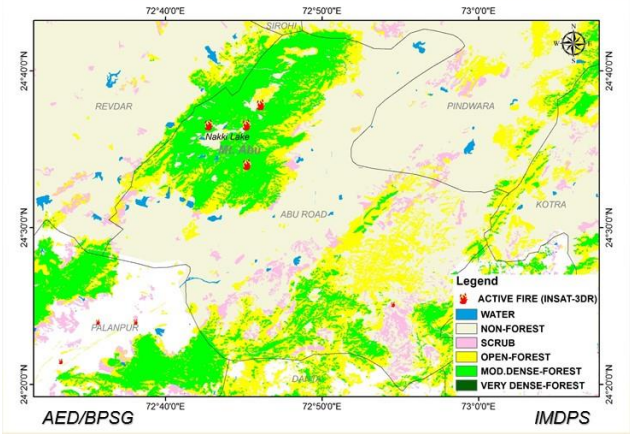
Forest Fire in J&K detected by INSAT-3D/3DR Imager

A forest fire broke in the Trikuta Hills (Reasi District, Jammu & Kashmir), Near Vaishno Devi, Katra, Jammu which is captured by fire product from INSAT-3D & 3DR.



Forest Fire in Mt. Abu detected by INSAT-3DR Imager

A forest fire broke in the hills of Mount Abu on Friday morning (14th April, 2017) which is captured by fire product from INSAT-3D.



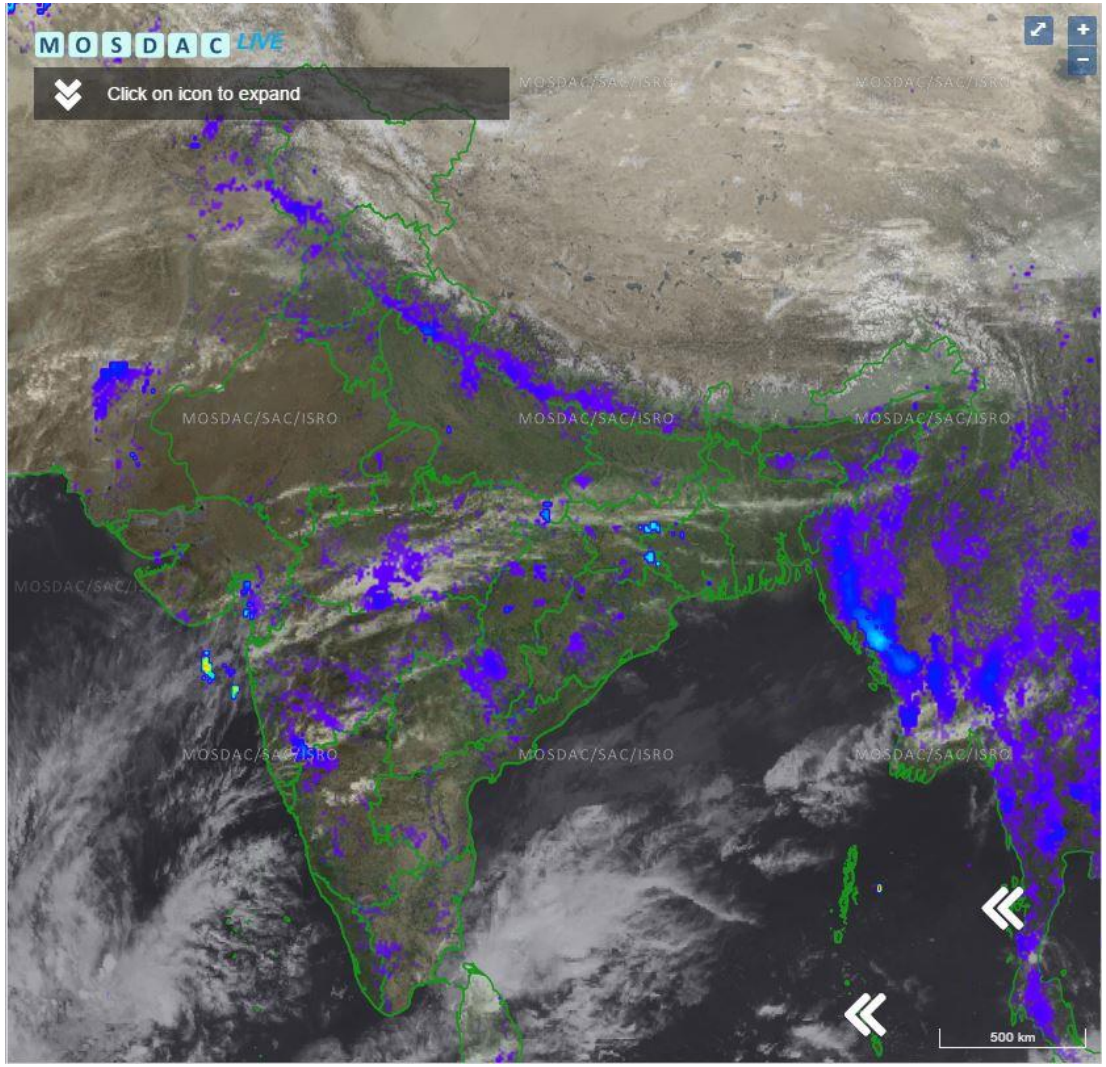
Fire Detection Time (3DR)

13-APR-2017 23:03:55 UTC
14-APR-2017 00:33:56 UTC
14-APR-2017 12:03:55 UTC
14-APR-2017 12:33:55 UTC
14-APR-2017 13:33:55 UTC
14-APR-2017 14:33:54 UTC
14-APR-2017 15:03:55 UTC
14-APR-2017 17:03:54 UTC
14-APR-2017 22:33:54 UTC

EPSA, Space Applications Centre, ISRO, Ahmedabad

cpsingh@sac.isro.gov.in

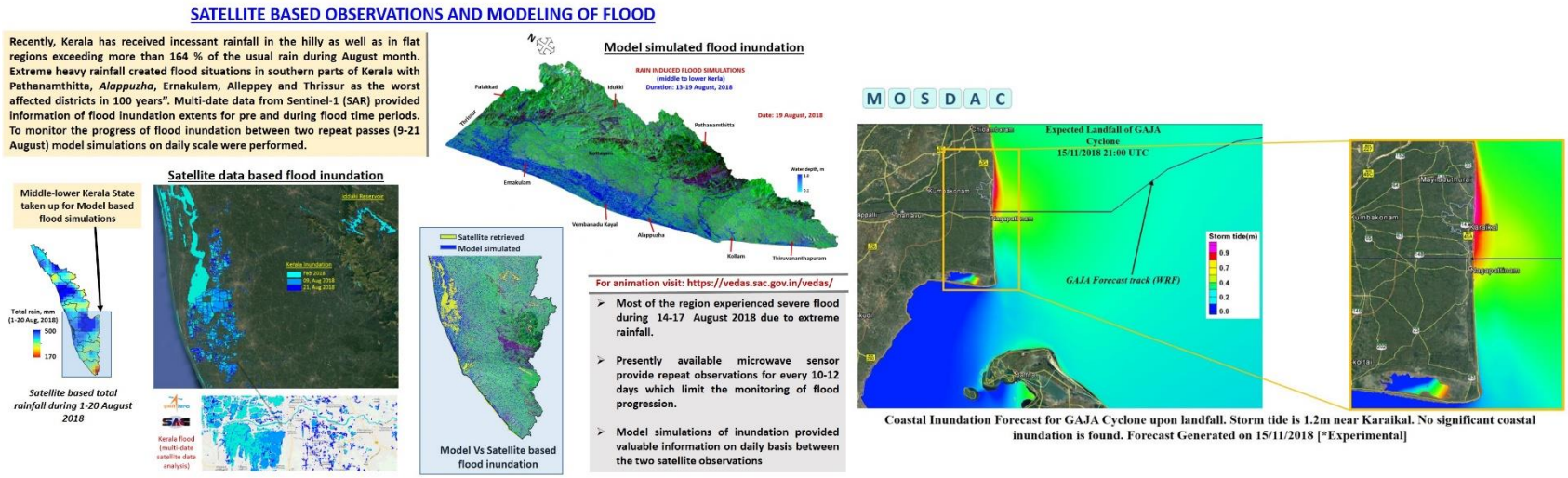
Forest Fire Risk Map



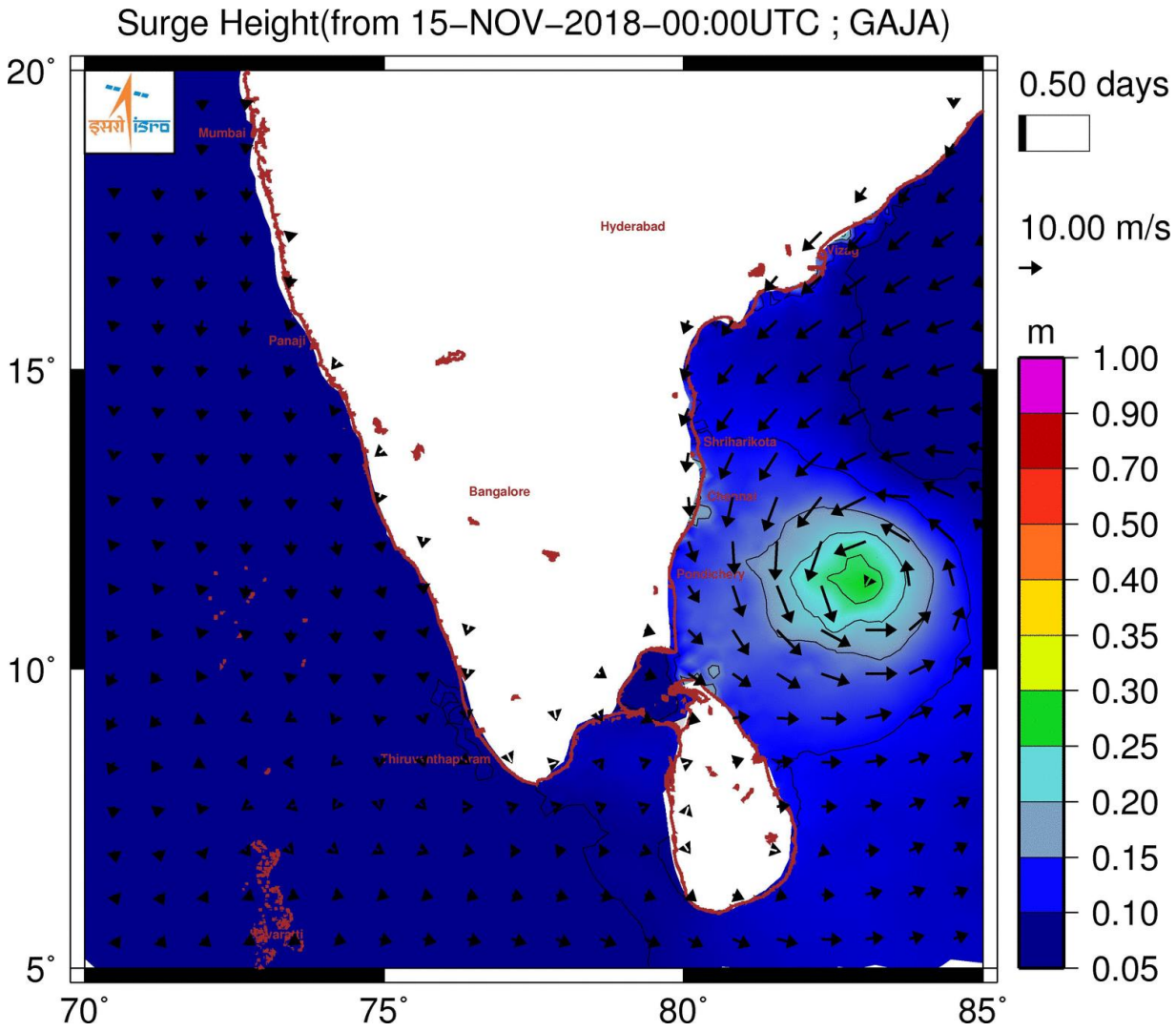
- Generated Using Ground Information and INSAT-3D/3DR Satellite Images and LULC
- Helps in identifying areas, which have higher risk.
- Used in mitigation planning

Hazard and Risk: Floods

Hazard (source of potential damage)	**Risk** (Probability that Person/Property will be harmed when exposed to Hazard)	**Geo-spatial Data**
Floods	Life, Property and Natural resources	Pre Phase: DEM and River Drainage Alert: Possibility of Flooding using Rainfall, DEM, Drainage pattern Post Phase: High Resolution Satellite Images (Damage Assessment)



Surge inundation



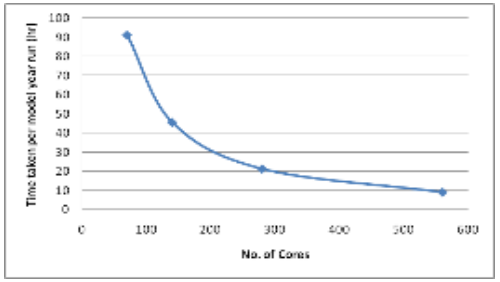
- Generated Using Ocean model forecast
- Helps in identifying areas, which have higher risk of inundation on cyclone landfall.
- Used in mitigation planning

Hazard and Risk: Earthquake

Hazard (source of potential damage)	**Risk (Probability that Person/Property will be harmed when exposed to Hazard)**	**Geo-spatial Data**
Earthquake	Life, Property	Pre Phase: Risk Maps Alert: NIL Post Phase: High Resolution Satellite Images (Damage Assessment)

Computational for Model Run Requirements

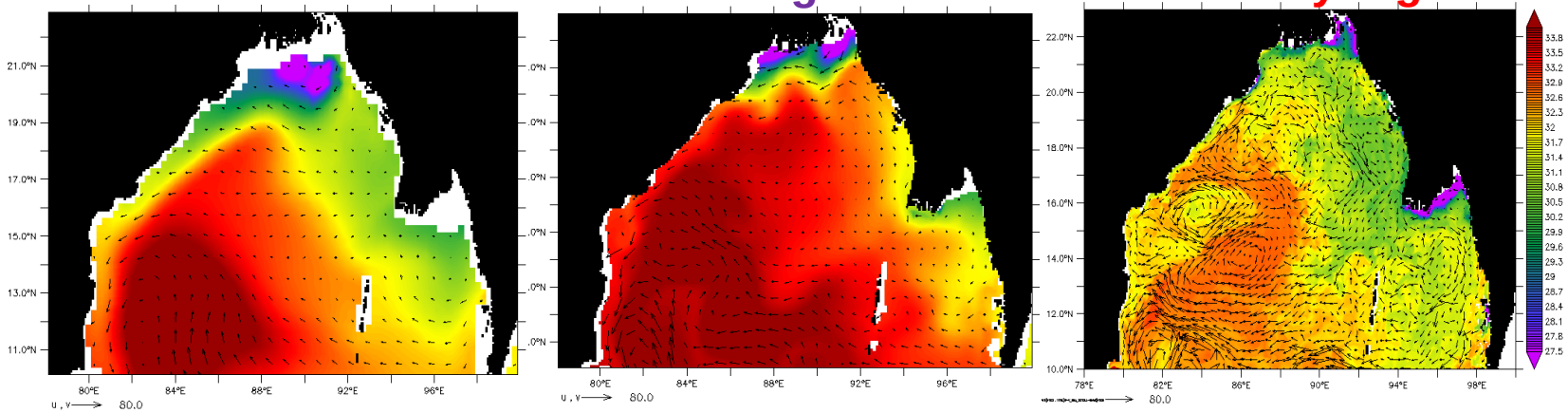
Scaling of 2km OGCM on HPC



- **Performance up to 560 cores has been tested (16 nodes) with resulting optimum scalability**

- Simultaneous sensitivity experiments using various Physics options are being performed towards an optimum configuration

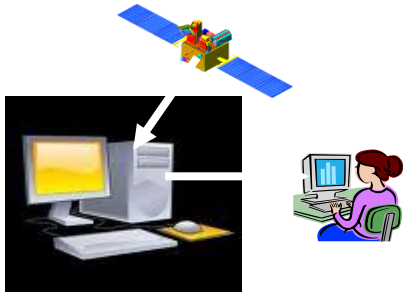
Moderate **High** **Very High**



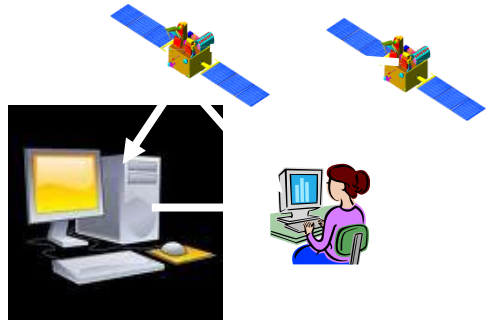
25km x 25 km **10km x 10 km** **2 km x 2 km**

Sea surface salinity with surface current overlaid from different model configurations.

Data Processing



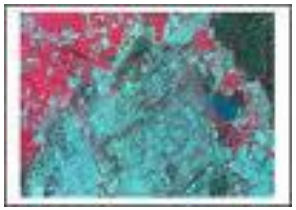
Ground Based Processing



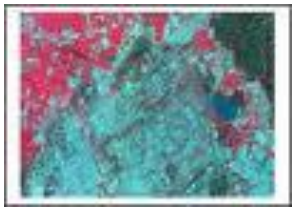
Ground + On Board Processing

Reduction in Data Volume

Improved Turnaround Time



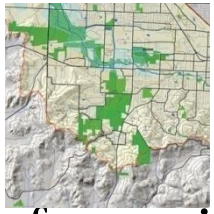
Standard Product



Climate Quality Product

Science Requirements for Modeling

Data



Information

Knowledge

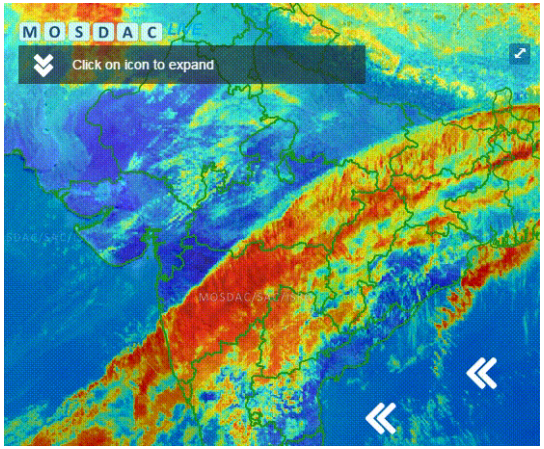
Reaching out to public at large and Better ROI

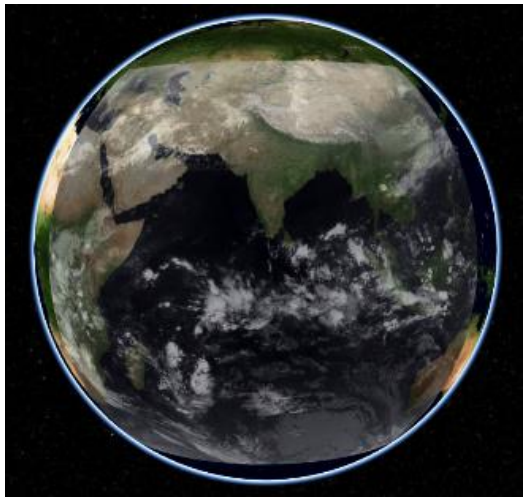
Data Analytics

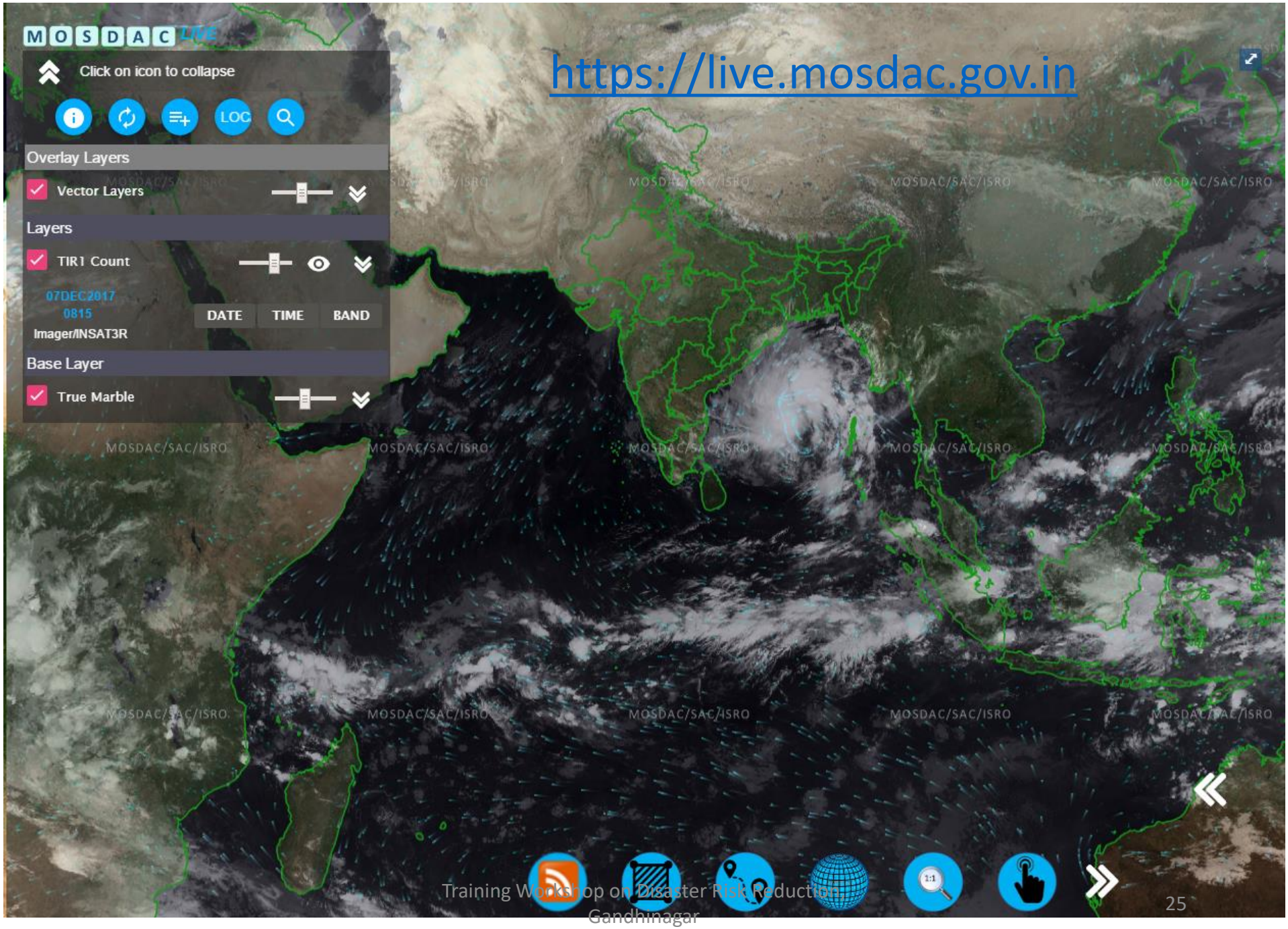
- Data Analytics
  - As Earth Observation Data becomes increasingly voluminous and unmovable, the only way to analyze it is “in place” i.e. moving code to data
  - Big data and Advanced analytics to cater to requirements of insurance industry.
  - Pattern recognition based techniques for Event detection
  - Geospatial feature extraction using deep learning techniques
  - Automated event tracking (Cyclone, dust storm, etc.) using machine learning techniques
  - Region growing algorithms for identification and tracking of meteorological and oceanographic events (Fog, bloom, convective initiation, etc.)

Data Visualization and Web Processing

- Advanced data rendering and fast visualization techniques of 2D and 3D satellite data.
- Fast Tiling and caching techniques for visualization of satellite Images
- Development of techniques for automatic on-demand web mashup generation.
- Cloud and Semantic enabling of Web Processing Services






MOSDAC LIVE
Click on icon to collapse
LOC
Overlay Layers
Vector Layers
Layers
TIR1 Count
07DEC2017
0815
Imager/INSAT3R
DATE
TIME
BAND
Base Layer
True Marble
https://live.mosdac.gov.in
MOSDAC/SAC/ISRO

Thank you

nitant@sac.isro.gov.in