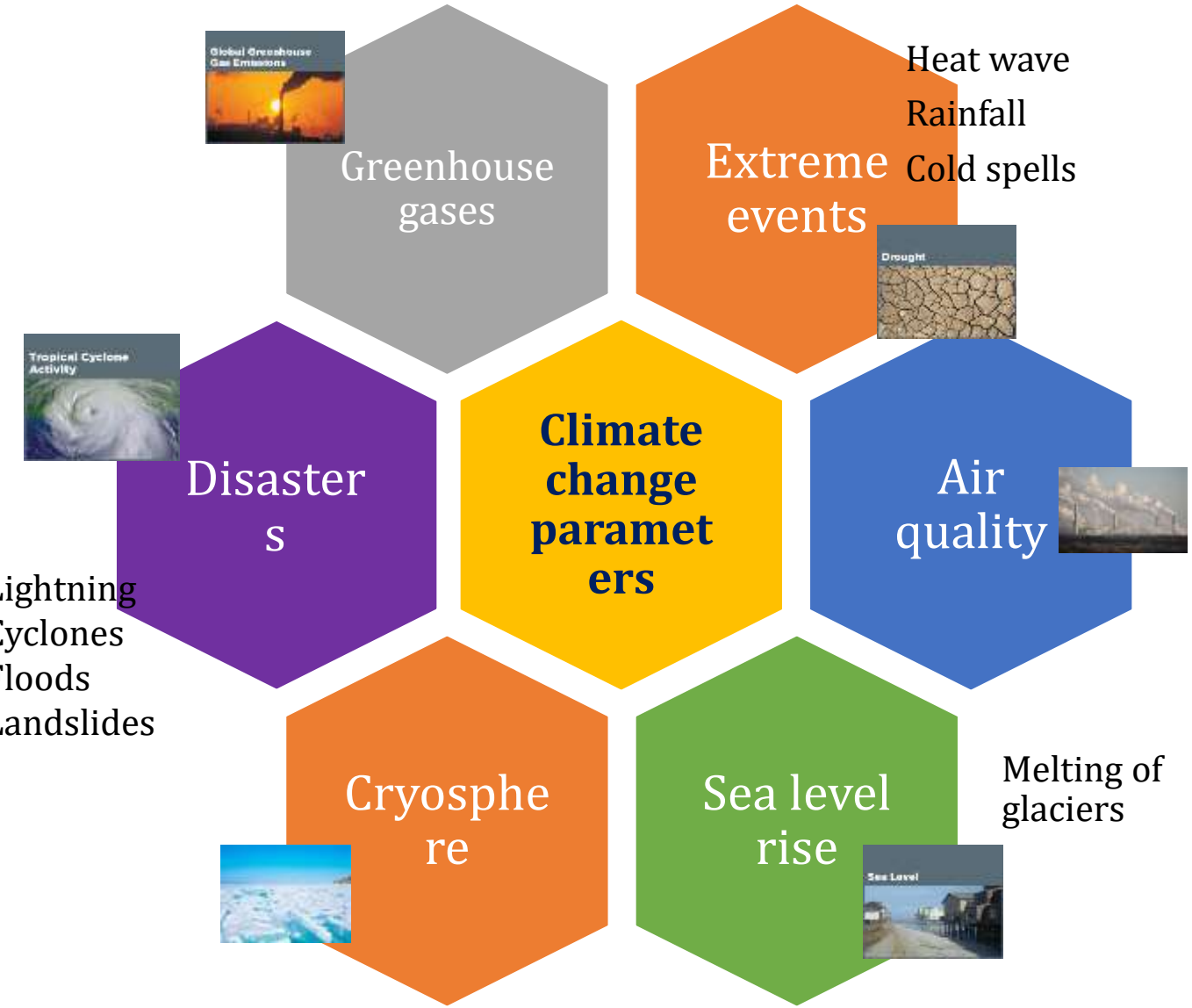
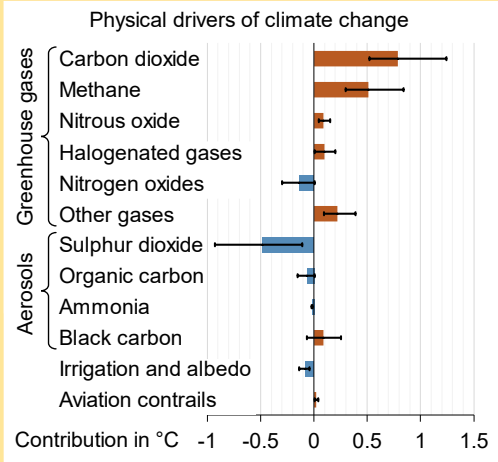


Driving forces to study climate change ?

Society – Effect on population due to Flash Floods, cyclones, droughts

Science– To understand, track and predict climate changes

Economy – Livelihood, energy, transportation



Future goals –

Reducing emissions

Carbon neutrality by 2070

Establishment of Sustainable ecosystem - SDGs

SDG13 – Take urgent actions to combat climate change

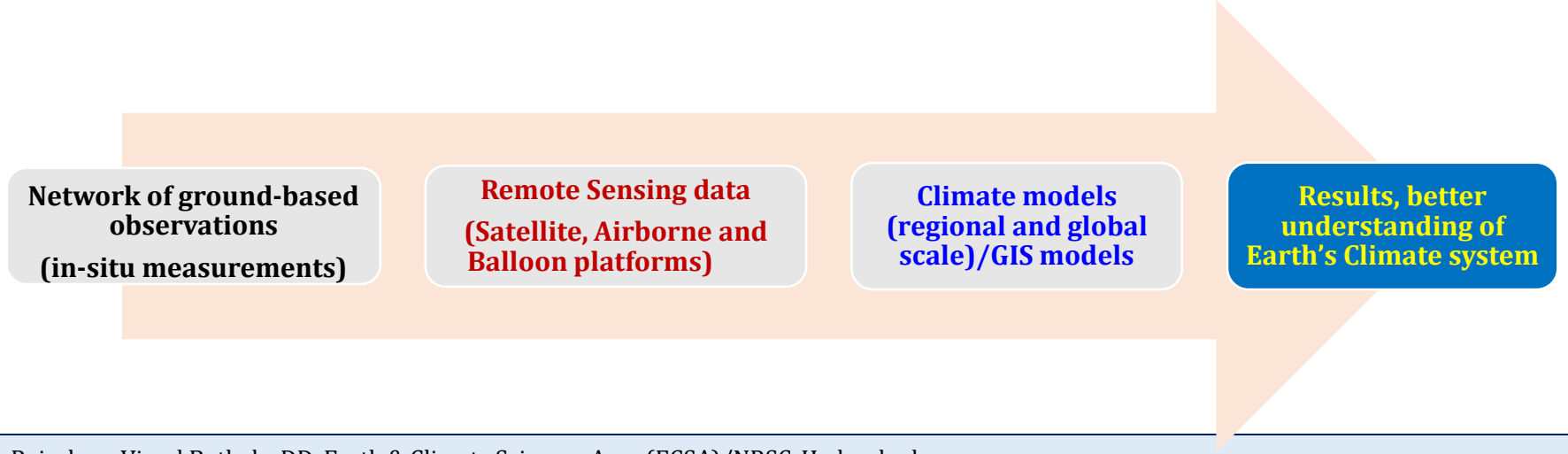
- Earth is at tipping point at the brink of calamity
- Temperature will rise by 1.5^{0}C by 2035
- Rate of sea level rise has doubled.
- Need deep, rapid and sustained GHG emission reductions by 43% by 2030 and net zero by 2050.
- 15X high disaster mortality rates

Needs of hour and future

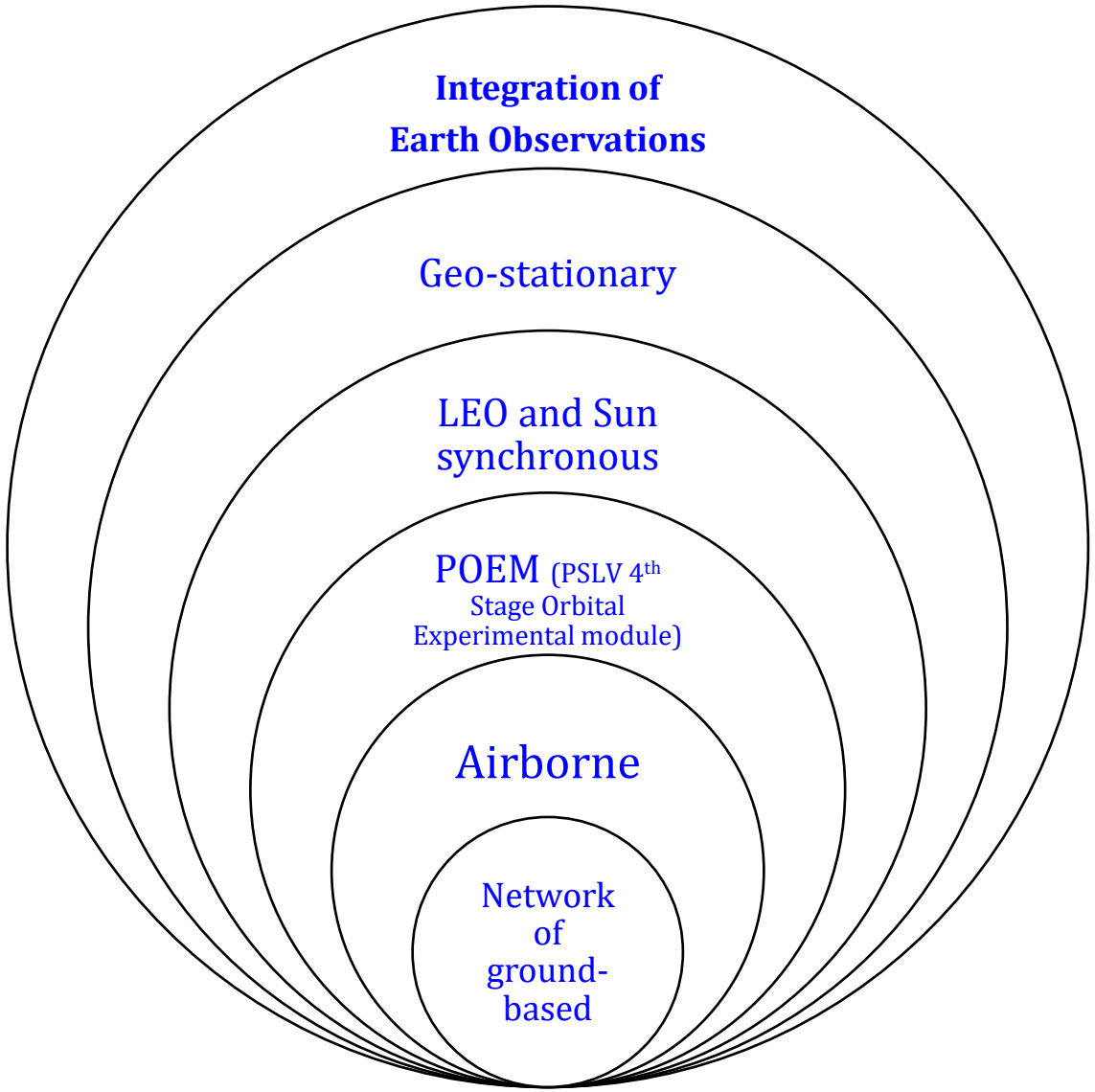
- Long term observations
- Climate Data Records
- Global observations
- Network of ground based sensors for modelling and validation
- Mobile based sensors
- Multi-institutional collaboration

- Constellation of satellites
- Improved role of geostationary satellites
- On-board processing capability for hotspot identification

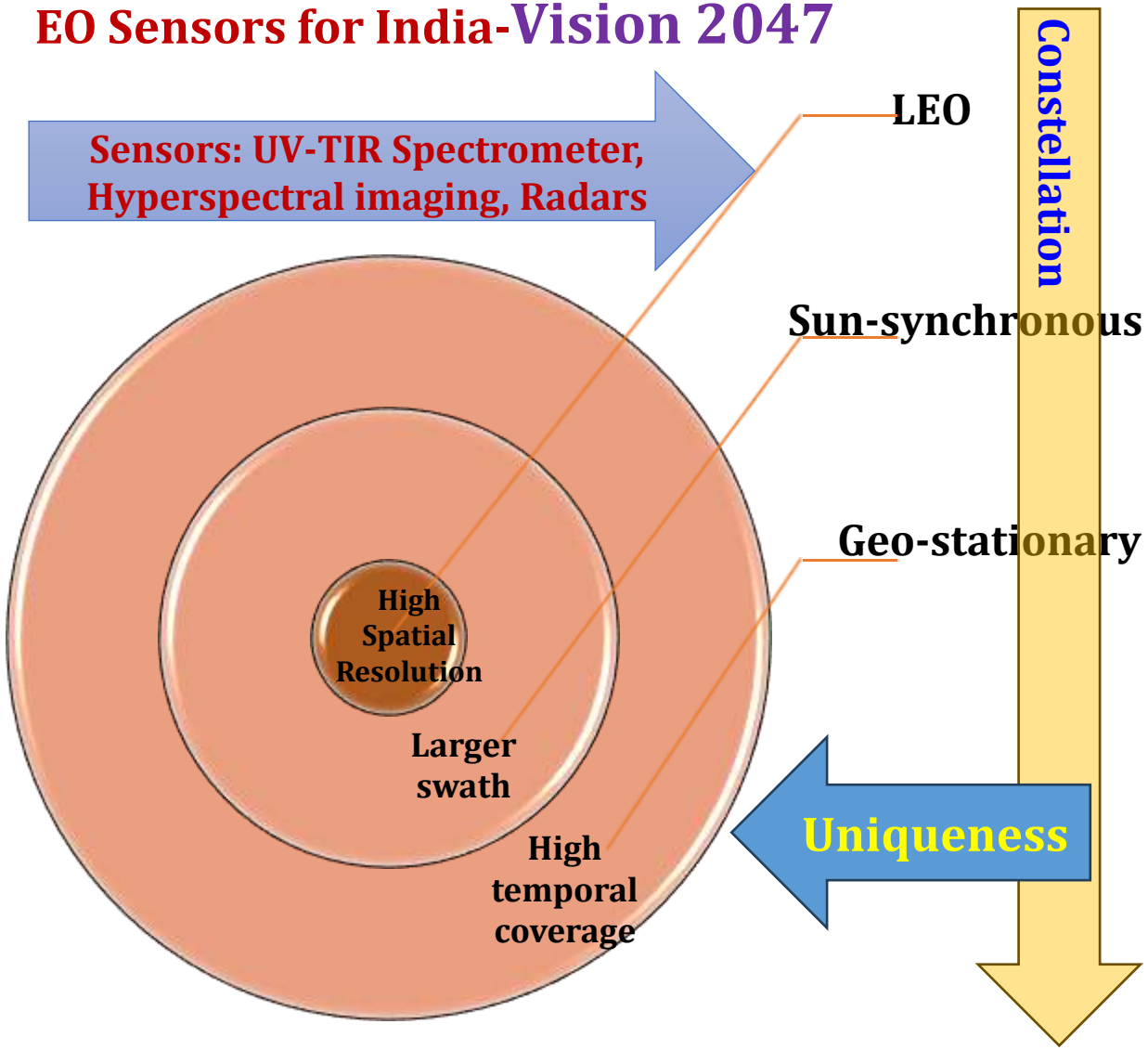
- Short term and long term prediction/projections of climate parameters
- Modelling parameters with improved accuracy
- Fast processing algorithms



Platforms

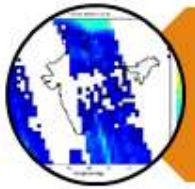


EO Sensors for India-Vision 2047

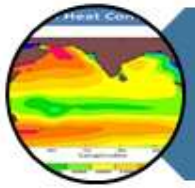


Road map for Spatial Analytics for climate research & services

Input Data



Atmosphere



Ocean

Terrestrial

Cryosphere

Processing

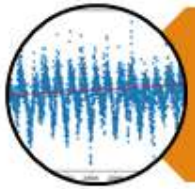
Pre-Processing

- Large datasets
- Data Formats
- Re-sampling and Interpolation

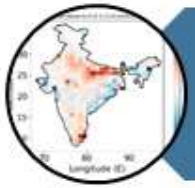
Processing

- **Long term trends**
- **Stationarity Test**
  - **Adfuller**
- **Slope estimation**
  - **Linear Regression**
  - **Sens Slope**
  - **Man Kendall**
  - **RANSAC**
- **Anomaly Detection**
  - **LSTM**

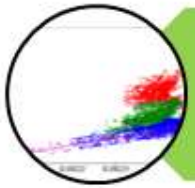
Output



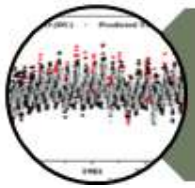
Pixel Wise Maps



Spatial Relationships



Temporal Variations



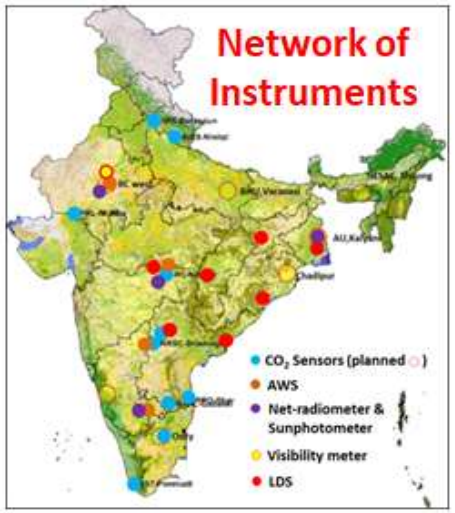
Anomaly Maps

Role of Geospatial technology

- Time for Green Economy Transition (Focus on renewable energy)
- AI-Accelerated Climate Action (Large amount of data)
- Support Climate Resilience through Platforms and Services
- Model to Address Climate Risk through national/international collaboration
- Water and Food Security

National Information system for Climate & Environment Studies

- National level long term, geo/bio-physical products pertaining to Terrestrial, Ocean and Atmosphere
- Multi-Institutional Endeavour
- Observational network, calibration & validation sites
- NICES portal
- Essential Climate Variables (ECVs) for impact assessment, vulnerability, adaptation, mitigation, etc.



Global Climate Observing System
Essential Climate Variables (ECVs) 54

Available through NICES portal

Terrestrial (35)

Geophysical: Albedo, Normalised Difference Vegetation Index (4)

Hydrology: Surface water body, Soil moisture, Evapotranspiration, Runoff (4)

Land cover: Mesoscale Model-5, Weather Research Forecast (WRF) compatible, Veg Fraction (3)

Terrain and Soil: Organic Carbon, Inorganic Carbon, f-soil depth, f-soil texture, f-water erosion, f-wind erosion, f-salt affected, Soil moisture (8)

Vegetation and Ecosystem: Average annual forest fire density, SD of Ave Annual Forest Fire Density (AFFD), length of fire, fraction of forest, forest types, Net Sown Area (Total, Kharif, Rabi), f-Fallow Area, Net Ecosystem Productivity & Primary Productivity (11)

Cryosphere (5): Snow melt and freeze (Indian Himalaya & Antarctica) (2), Snow cover fraction (1), Himalayan glacial lakes and water bodies (1), snow albedo (1)

Ocean (29)

Ocean Heat Content satellite & model derived (2), Tropical Cyclone Heat Potential (2), Ocean Mean Temp (1) = 5

Ocean surface winds (2), Wind stress (2), Wind curl, Ekman currents, geostrophic current, Sea Surface Height Anamoly, ocean surface current, Eddy Kinetic Energy, Monthly mean sea level anomaly (7) = 11

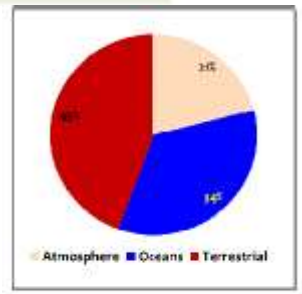
Co-tidal map (2) = 2

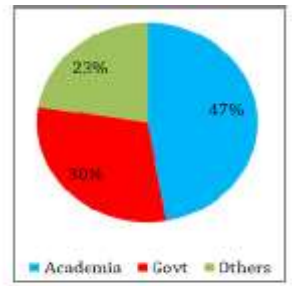
Model derived: Sea level pressure (1) = 1

Ocean color: Chlorophyll concn (4), Water transparancy (2), Total Alkalinity, Dissolved Inorganic Carbon, pCO_2 (4) = 10

Atmosphere (6)

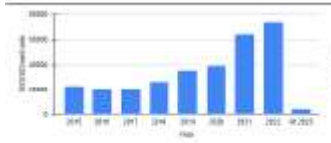
Derived tropospheric Ozone (1), Boundary layer height (1), Cloud fraction (2) & cloud top temperature (2), Lightning (1) = 6

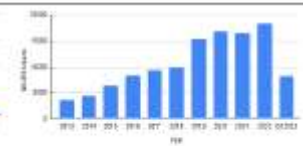




Type of product downloads

Type of users





Year wise total downloads

Unique users over the years

Geosmart India 2023

Environment and Climate Change - Collective Climate Data Actions for Sustainable Future

Climate Research Laboratory for Atmosphere - Instruments


Sky radiometer


Micro-Meteoro-logical tower


Nephelometer to measure SSA


High volume Sampler to measure PM


All Sky imager


CO_2/H_2O analyzer


CO_2 isotopic analyzer


Greenhouse gas analyzer (CO_2, CH_4 & H_2O)


LDS


Network of UV sensors


MRR


FTIR Spectrometer


Portable FTIR Spectrometer


Air Quality station


HVS for PM

Lab and field instruments - Ocean

High Pressure Liquid Chromatography (HPLC)
- Lab Instrument
- Measures different Chlorophyll pigment concentrations of water column

Hyperspectral Underwater Radiometer
- Field Instrument
- Measures underwater Light Fields, nLw, Rrs, Chlorophyll, CDOM

Inherent Optical Profiler
- Field Instrument
- Measures Absorption & backscattering, Chl of water column

905 Titrando
- Lab Instrument
- Used for Potentiometric titration for Total Alkalinity

Fast Repetition Rate Fluorometer
- Field Instrument
- Measures photosynthesis parameters of water column, (σ_{PSII}), σ_{PSII}, PAR

Conductivity Temperature & Depth Sensor (CTD)
- Field Instrument
- Measures temperature and salinity profiles of water column

LI-COR 840A
- Field Instrument
- Gives Atmospheric concentration of CO_2

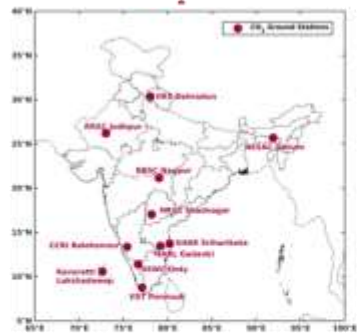
Thermo Scientific Pacific Pri (Milli-q)
- Lab Instrument
- High Purity water for Lab titrations

Nutrient Analyzer
- Lab Instrument
- Nutrient concentrations of water samples (N, P etc)

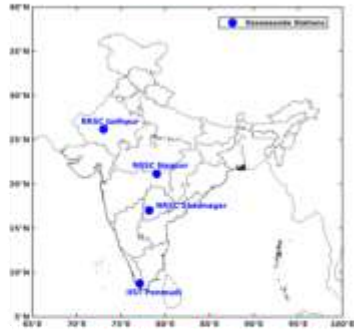
Coulometer
- Lab Instrument
- Measures Dissolved Inorganic Carbon in water samples

Instruments in network

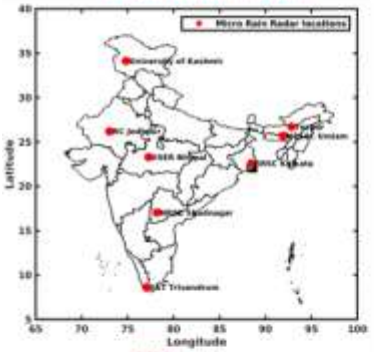
CO_2



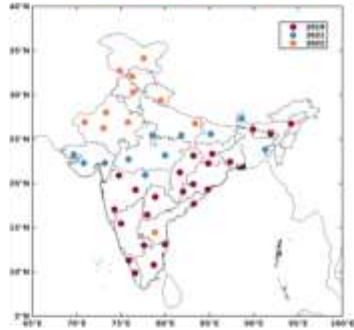
Ozonesonde



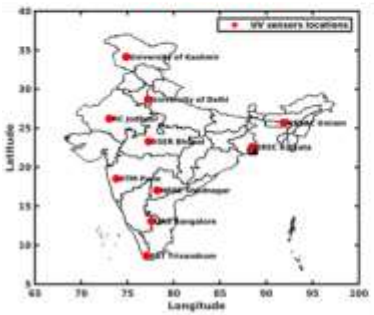
Micro Rain Radar



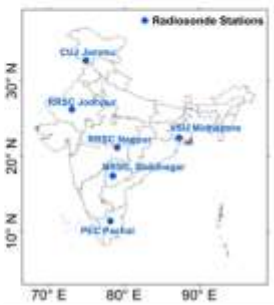
Lightening Detectors



UV sensors



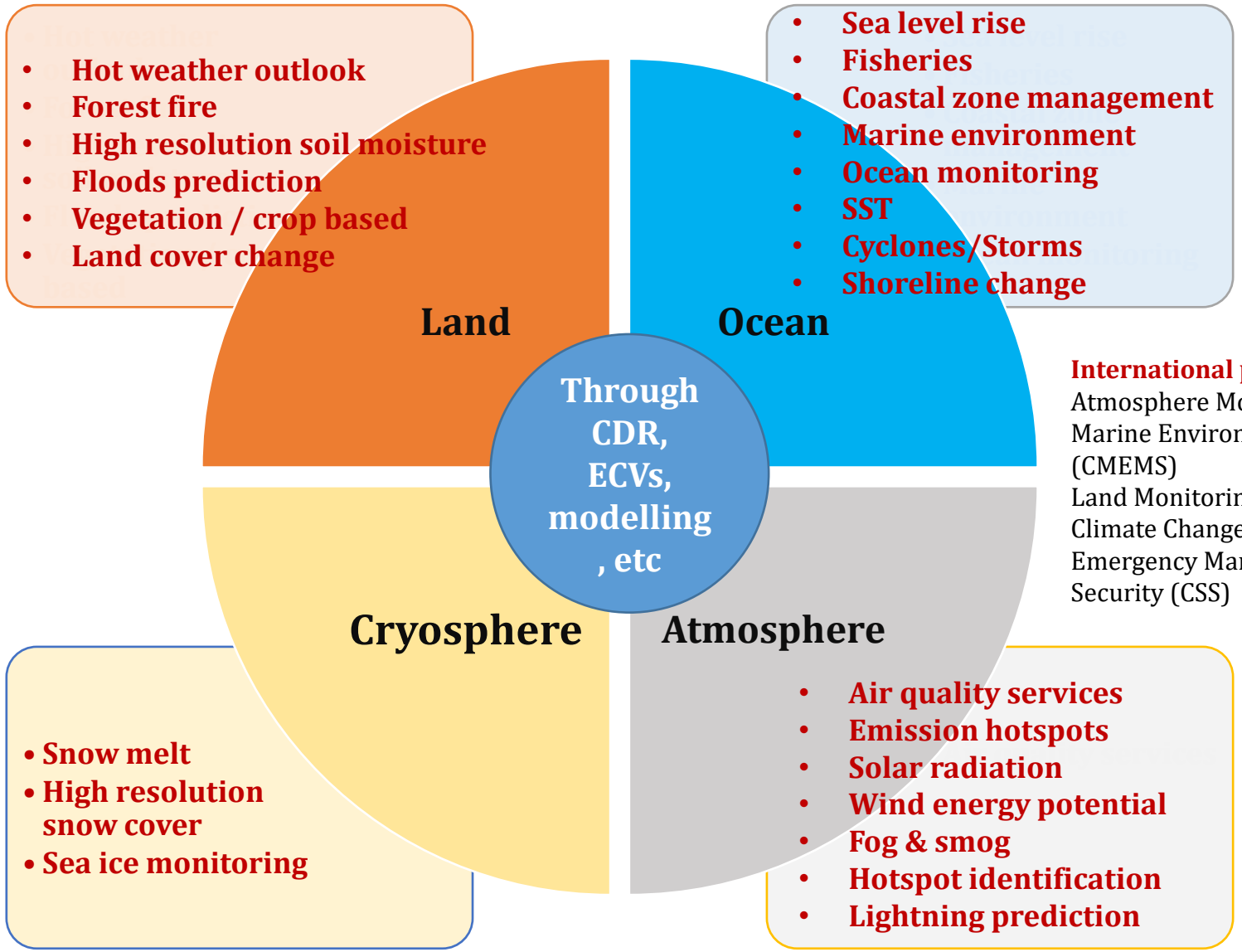
Radiosonde stations



Dr Rajashree Vinod Bothale, DD, Earth & Climate Sciences Area (ECSA)/NRSC, Hyderabad

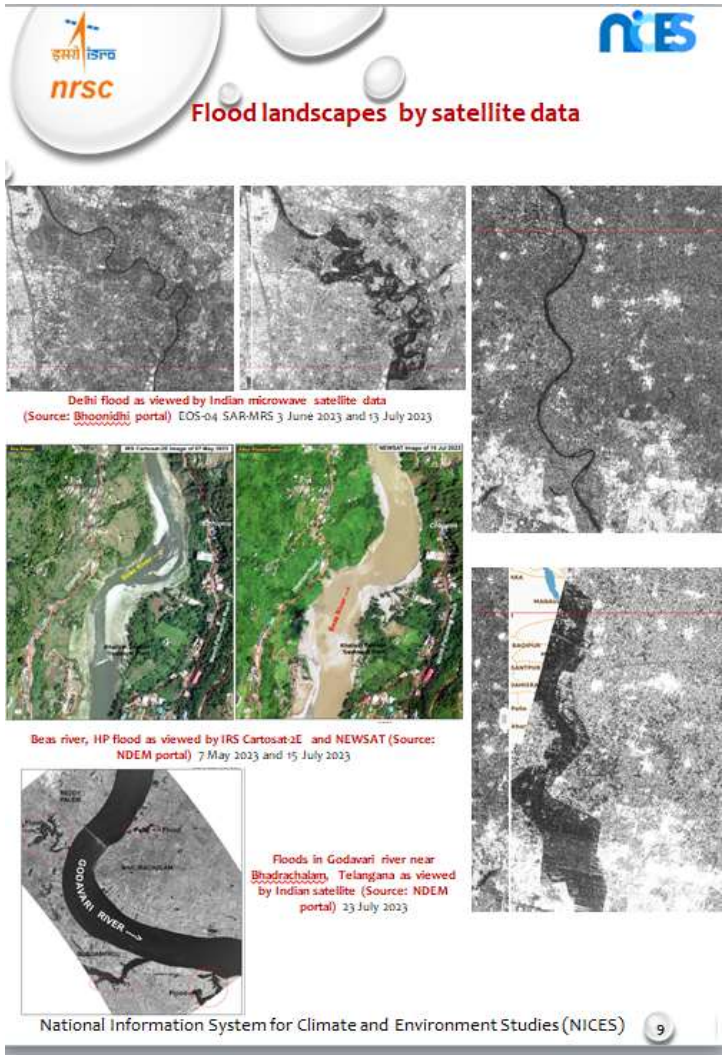
Climate Services

- Critical for making decisions in climate-sensitive societal areas.
- Respond to societal and environmental challenges associated with climate change.
- Information content will flow from space based, ground based observations and model derived outputs.
- An end to end plan from acquiring data, processing, analytics to make the climate information available to decision support mechanism.
- Information regarding risk and opportunities to be made available.
- NICES decadal plan is aimed towards generating climate services.
- A continuation of such plans is the major requirement.



International programmes
Atmosphere Monitoring (CAMS)
Marine Environment Monitoring (CMEMS)
Land Monitoring (CLMS)
Climate Change (C3S)
Emergency Management (CEMS)
Security (CSS)

NICES Newsletter – October 2022 onwards



nices@nrsc.gov.in

Programme Director (NICES)
National Information System for Climate and Environment Studies

National Remote Sensing Centre
Indian Space Research Organisation
Department of Space, Govt. of India,
Hyderabad 500 037
Phone:+91-040-23884212 +91-08542225521/22
ddecsa@nrsc.gov.in rbothale@gmail.com

For NICES data
https://bhuvan-app3.nrsc.gov.in/data/download/index.php?c=p&s=NI&g=all
For newsletter – nices@nrsc.gov.in

THANKS