RES-NRSC-2024-002

Name of ISRO/DOS Centre/Unit
National Remote Sensing Centre, Hyderabad

Title of the research proposal
Impact of the Indian Summer Monsoon by Atmospheric Constituents.

Area of Research
Remote Sensing & GIS, Earth Observations

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Summary of the Proposed Research

The variation in surface heating between continental land and oceans, due to interactions between turbulent heat fluxes and latent heat from rainfall and deep convection, creates significant pressure gradients between land and sea. These gradients drive the large-scale circulation patterns that shape the monsoon climate. Monsoon-related precipitation is crucial for the social and economic well-being of billions of people. Consequently, monsoons have been a major research focus for the scientific community for fifty years. This has been started with Monsoon Experiment (1978–1979), which primarily investigated the Asian monsoon system. Indian summer monsoon (ISM) and winter monsoon features economies that are highly sensitive to weather and climate variations driven by the monsoon. As one of the most dramatic and significant climatic phenomena on Earth, the ISM profoundly influences the planet's energy budget and hydrological cycle. The Monsoon region is distinct due to its unique geography, topography, demographic characteristics, and developmental history. The monsoon affects the all spheres of lives of over a billion people by driving the agriculture and Gross Domestic Product of the region. As the Indian region experiences rapid population and economic growth, there is increasing concern about how monsoon convection and surface emissions impact air quality. The uplift of pollutants enhances aerosol-cloud interactions, which could alter monsoon behavior. Satellites show that the monsoon system effectively transports pollutants into the stratosphere, linking regional air quality with climate change and global chemistry-climate interactions. Accurate representation of the monsoon system in global chemistry-climate models is crucial for predicting how this evolving region might influence future changes. To fully understand and quantify its impact, an integrated approach is needed, incorporating both in situ and remote sensing observations across the troposphere and stratosphere, as well as regional and global modeling.

Scope of the work:

The effects of the Indian summer monsoon and stratospheric intrusion of air pollutants is not studied much by the research community. The tropopause is obvious in observations or analyses of these dynamical changes. By using the various data sets available publicly (NCEP/NCAR Reanalysis data, ERA5 data, CPCB data Satellite Data, ISM Index, etc.) will be useful to address the objectives.

Linkages to Space Programme:

- Atmospheric constituents play a major role on the monsoon rainfall variability. The use of real-time data from future ISRO satellites (G20), as well as the integration of satellite and ground-based observations, allows for more timely and region-specific action to follow weather patterns and pollutant dissemination throughout the monsoon.

Expected Deliverables:

1. Emissions and air quality in the Asian monsoon region.
2. Aerosols, clouds, and their interactions with the Asian monsoon.
3. Impact of monsoon convection on chemistry.
4. UTLS Response to the Asian Monsoon.
5. Study of trace gases exchange between UTLS during strong convective systems.
6. Seasonal Photochemical impact of OH radical on methane removal as a function of ozone precursors.
7. Radiative impact of atmospheric constituents using RT model.

RES-NRSC-2024-003

Name of ISRO/DOS Centre/Unit
National Remote Sensing Centre, Hyderabad

Title of the research proposal
Integration of polar and geostationary EO datasets for a synthesized hourly LST product

Area of Research
Earth Observation

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Summary of the Proposed Research

The Land Surface Temperature (LST) is an Essential Climate Variable (ECV), long-term records of which are crucial for characterizing the climate change. Satellite-based LST datasets are a critical input for various applications including radiation and energy budget at the surface, evapotranspiration, heat stress and urban heat island studies. The LST also serves as a proxy variable for near-surface air temperature, which is not directly measured through satellite-based remote sensing. The baseline requirements for LST ECV are 6 hourly temporal and 1 km spatial resolutions.

Long-term uninterrupted records of LST from polar-orbiting satellites over the Indian region are available at 1 km or better spatial resolution, twice daily. These are from MODIS (Aqua & Terra; since 2000), NOAA's VIIRS (S-NPP & NOAA-20; since 2015) and ESA's SLSTR series (ATSR-1&2, AATSR & SLSTR; since 1995). LST from geostationary-orbiting satellites, viz., INSAT-3D series is available since 2013 at half-hourly intervals.