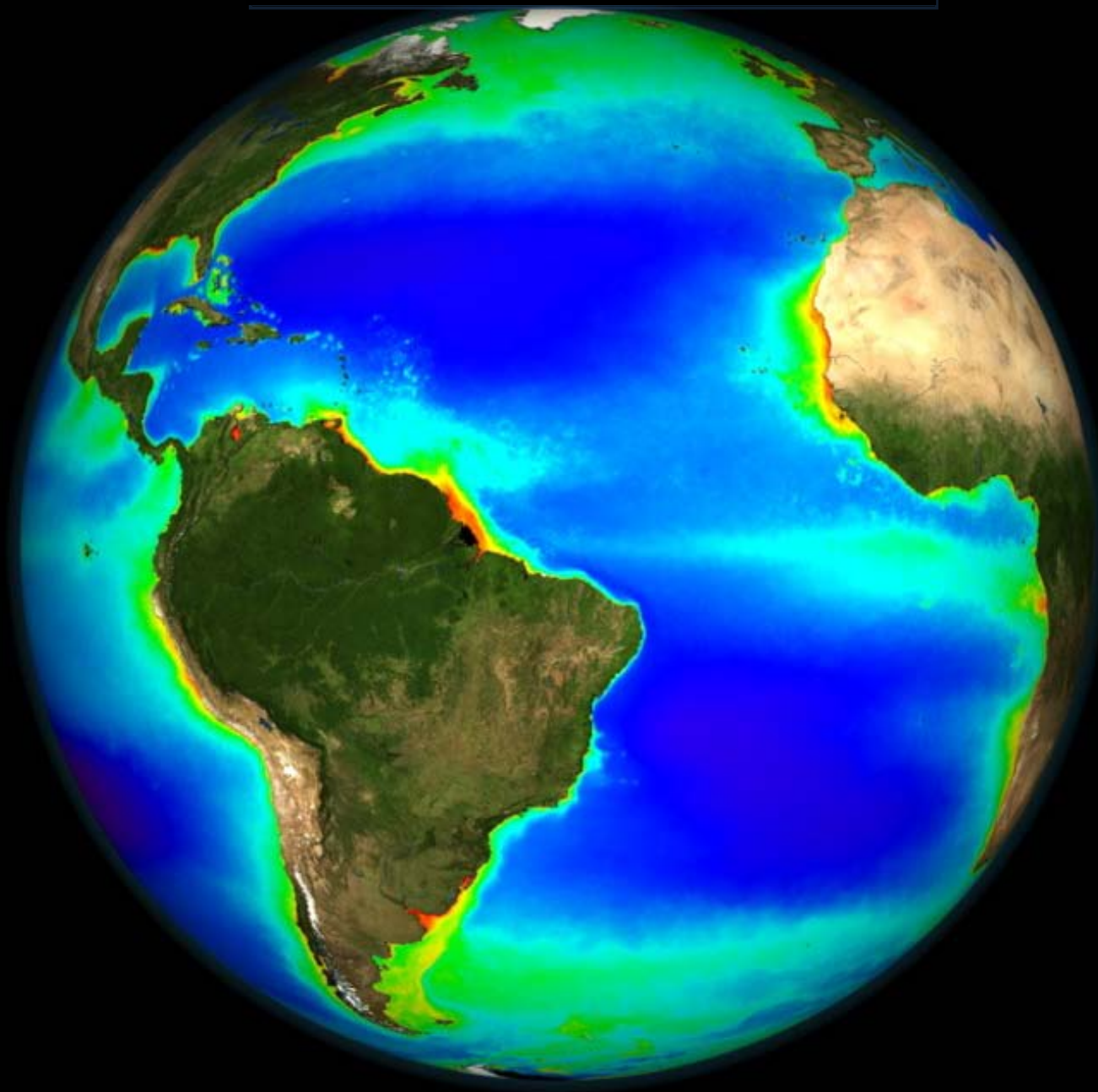# CSSTEAP- Short Course
## (Closure Report)

# Satellite Remote Sensing for Ocean Applications
## National Remote Sensing Centre (NRSC)
## 14 - 25 October 2024
## Hyderabad

**1. Overview**

The Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) is a United Nations-affiliated institution established in 1995, headquartered in Indian Institute of Remote Sensing, Dehradun, India. It is dedicated to building regional capacity in space science and technology applications for sustainable development. CSSTEAP offers postgraduate-level training, workshops, and research programs in key areas such as satellite communications, remote sensing, space science, and satellite meteorology. These programs integrate theoretical instruction with practical applications, utilizing state-of-the-art facilities and collaborations with premier space agencies like ISRO. The center aims to equip participants from member countries with advanced skills, fostering regional cooperation and innovation in space technology. Graduates, who pass out from these courses, contribute to diverse fields, including natural resources monitoring, disaster management, environmental monitoring, and other remote sensing application domains, emphasizing the center's pivotal role in addressing regional and global challenges through space-based solutions.

As part of this program, the National Remote Sensing Centre (NRSC) organized a CSSTEAP Short Course on "Satellite Remote Sensing for Ocean Applications" from 14-25 October 2024 at the Knowledge Resource Area, IMGEOS facility Earth Station, Shadnagar. The course aimed to provide advanced training to participants from the Asia-Pacific region on the application of satellite remote sensing technologies for oceanographic studies. The program covered various aspects of ocean monitoring, including sea surface temperature (SST), sea surface salinity (SSS), Seal Level, ocean winds, SAR based ocean applications, ocean color, ocean biogeochemistry, water quality parameters, and carbon dynamics, with a focus on using satellite data for oceanographic research and environmental management. The participants were also introduced to basic concepts of utilizing remote sensing data for ocean circulation and wave modeling.

Participants were introduced to the latest remote sensing techniques, tools, and software for analyzing ocean data. Practical sessions provided hands-on experience in processing and interpreting satellite imagery for various ocean applications, such as climate change monitoring, marine ecosystem health, and coastal management. The course also emphasized the integration of remote sensing with other oceanographic data for enhanced modeling and forecasting. By fostering expertise in satellite remote sensing, the short course contributed to capacity building in the region, promoting the sustainable use of ocean resources and addressing the challenges of global marine environment monitoring.



## 2. Inaugural Session of the CSSTEAP Short Course

The Course was attended by 16 foreign officials, representing a diverse set of countries within the Asia-Pacific region. Participants represented from Kazakhstan (2), Indonesia (4), Sri Lanka (2),

Vietnam (2), Nepal (1), Mongolia (1), and India (4). This international collaboration emphasizes the significance of regional cooperation in advancing satellite remote sensing applications for oceanographic research and environmental monitoring. The course commenced with an inaugural session on October 14, 2024, marking the beginning of the training program. Dr. Prakash Chauhan, Director of NRSC and CSSTEAP, delivered the inaugural address, highlighting the critical importance of satellite-based technologies in addressing the challenges faced by the regional marine environments. In his address, Dr. Prakash Chauhan emphasized the value of capacity building in satellite remote sensing for ocean applications, with a focus on fostering regional expertise to enhance the understanding and management of oceanic resources. His welcome remarks also emphasized the collaborative nature of the course, which aims to equip participants with the tools and knowledge to apply remote sensing data to monitor and manage ocean health, promote sustainable fisheries, and contribute to climate change mitigation efforts. The course inclusive nature, with officials from diverse countries, reflects a shared commitment to enhancing regional capabilities in space-based ocean monitoring and management.



### 3. Comprehensive Training on Satellite Remote Sensing for Ocean Applications

The Satellite Remote Sensing for Ocean Applications course was meticulously designed to provide a comprehensive understanding of satellite ocean remote sensing techniques and their applications in oceanography. The program featured 26 lectures, each lasting 45 minutes, and 16 hands-on sessions of 90 minutes each. The lectures covered foundational topics, including the principles of remote sensing, data acquisition, and the fundamentals of satellite data processing, with a specific focus on ocean applications. Apart from in house experts around 10 experts from various other ISRO centers, leading oceanographic research centers and academia were invited

to share their vast experience in the field of ocean remote sensing. Participants were introduced to the theoretical aspects of remote sensing, such as the interaction of light with the ocean surface, algorithms for deriving oceanographic parameters, such as retrieval of winds from Scatterometers, Sea level from altimeters, oil-spill and ship detection from SAR data and techniques for satellite data calibration and validation. The curriculum also delved into advanced topics, including Chlorophyll-a estimation, monitoring of harmful algal blooms, and studying ocean productivity using satellite data. The laboratory sessions were designed to reinforce the theoretical knowledge gained during lectures. Participants engaged in practical exercises involving data processing, product generation, and the application of satellite-derived data for ocean monitoring. They explored real-time scenarios using specialized software tools and one-on-one interaction with experts at designated workstations. This hands-on training allowed participants to analyze satellite datasets and generate products such as chlorophyll-a concentration maps, sea surface temperature fields, Sea level trend analysis and turbidity indices. By the end of the course, participants gained both theoretical knowledge and practical expertise, enabling them to independently process ocean remote sensing data and derive valuable insights for diverse ocean applications.

## 4.   Industry visit to INCOIS

As part of the Satellite Remote Sensing for Ocean Applications course, an industry visit to the Indian National Centre for Ocean Information Services (INCOIS) was organized on October 17, 2024. This visit provided participants with a comprehensive understanding of INCOIS pivotal role in operational oceanography and its diverse range of services, products, and datasets. The participants were introduced to the mission and vision of INCOIS, which includes providing accurate and timely ocean information and advisory services to support societal needs, research initiatives, and industrial applications. A detailed presentation showcased the suite of services offered by INCOIS, including Tsunami Early Warning Systems, Potential Fishing Zone (PFZ) advisories, Ocean State Forecasts (OSF), and Marine Fishery Resources Mapping. The Tsunami Early Warning System, a flagship initiative, integrates real-time seismic and oceanographic data to predict and disseminate tsunami alerts to mitigate disaster impacts. PFZ advisories are generated using satellite-derived parameters such as sea surface temperature and chlorophyll concentration, aiding the fishing community in identifying lucrative fishing areas. The ocean state forecast (OSF) service provides predictions of sea surface conditions, including wave height, currents, and wind speeds, crucial for maritime navigation, port operations, and disaster

management. The participants also learned about INCOIS Calibration and Validation (Cal/Val) activities, which ensure the accuracy of satellite-derived oceanographic datasets. This includes in-situ measurements and their integration with satellite data to refine models and products. Furthermore, participants were exposed to the extensive array of datasets generated by INCOIS, such as high-resolution oceanographic maps, climate monitoring data, and seasonal variability trends. They also toured state-of-the-art facilities, including data centers and visualization tools, which highlighted how real-time data is processed and transformed into actionable insights.



The visit emphasized the synergy between satellite technology and operational oceanography, reinforcing the participants understanding of practical applications and how scientific advancements can address societal and environmental challenges.

## 5.  Enhancing Learning Beyond the Classroom

As part of the NRSC-CSSTEAP program, educational tours were organized to Ramoji Film City and historical landmarks in and around Hyderabad on October 19-20, 2024. These visits were designed to provide participants with a unique blend of learning, cultural exposure, and relaxation, complementing the intensive training sessions. Ramoji Film City recognized as the world largest integrated film studio complex, offered participants insights into advanced filming technologies, large-scale production environments, and innovative design methodologies. The guided tour showcased how visual storytelling and technology can synergize, reflecting parallels in remote sensing and geospatial visualization. Exploration of historic destinations, such as the iconic Charminar, Golconda Fort, and the Salar Jung Museum, allowed participants to delve into Hyderabad rich heritage, architecture, and history. These experiences helped international attendees understand the socio-cultural fabric of India, fostering cross-cultural appreciation and

mutual support. Such tours not only provide a break from technical sessions but also enhance learning by linking technology, culture, and history. They promote team-building, global networking, and a comprehensive understanding of India, enriching participant's professional and personal perspectives.

## 6. Concluding session

On October 25, 2024, the Satellite Remote Sensing for Ocean Applications course culminated with a comprehensive project presentation by participants, feedback, and concluding session. During this session, participants presented their individual or group projects, showcasing the knowledge and skills they had acquired throughout the course. These presentations covered a variety of topics related to SAR based remote sensing, long-term Sea-Level trend analysis, ocean color and SST applications, and satellite data processing, highlighting the participant's ability to apply theoretical concepts to real-world scenarios. The feedback session provided a platform for open discussions, where participants and instructors exchanged insights and suggestions for improvement. The constructive feedback aimed to refine participants understanding of the subject matter and encourage further research and innovation in satellite-based ocean applications. The valedictory address was delivered by Dr. Prakash Chauhan, Director of NRSC/CSSTEAP, who commended the participants for their hard work and dedication throughout the course.



Dr. Prakash Chauhan emphasized the importance of continued learning in the rapidly evolving field of remote sensing and oceanography and encouraged participants to contribute to the global community by applying their newfound knowledge in their respective countries. As a mark of recognition for their efforts, Certificates of Completion were presented to all participants by

Dr. Prakash Chauhan. This moment served as an acknowledgment of their achievements and the successful culmination of their learning journey. The session concluded with a note of gratitude towards all participants for their active engagement, and an invitation to remain connected for future collaborations.