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NORTH EASTERN SPACE APPLICATIONS CENTRE
उत्तर पूर्वी अंतरिक्ष उपयोग केंद्र

REFLECTIONS

The Quarterly In-House Newsletter of the North Eastern Space Applications Centre

Dr. S. P. Aggarwal
Director, NESAC

HIGHLIGHTS:

- *Launching of SMART AXOM App by Hon'ble Minister, Revenue and Disaster Management Department, Assam.*
- *Hon'ble Minister of Soil and Water Conservation Department, Meghalaya Launches NESAC supported Projects.*
- *NESAC organizes concluding workshop of two regional level projects in Agriculture and Horticulture sectors.*
- *NESAC conducts Outreach Events under National Space Science Symposium (NSSS)-2026*

From the Director's Desk

The fourth quarter of 2025 has been a particularly productive and fulfilling period for the North Eastern Space Applications Centre (NESAC). I am pleased to share that during this quarter, NESAC achieved several significant scientific, technological, and outreach milestones that reflect our continued commitment to harnessing space technology for the sustainable development of the North Eastern Region.

Among the major scientific accomplishments, the simulation of snowmelt runoff in the data-scarce, high-altitude Upper Lohit Basin stands out as an important advancement in hydrological modelling for complex mountainous terrains. Another notable achievement was the experimental use of lightning observation data to improve rainfall forecasts over Northeast India. This innovative initiative holds immense promise for strengthening flood early warning systems and enhancing disaster preparedness across the region.

Like previous quarters, NESAC continued important capacity building and outreach activities. We conducted eight regional and national-level programmes. Special outreach programmes were organized under the aegis of NSSS-2026 at various universities and technical institutes across the North Eastern Region during October 2025 to January 2026. In addition, NESAC successfully organized a comprehensive five-day training program on disaster management sponsored by the Department of Space (DOS). I am also happy to note the successful completion of "NESPARKS," which is a unique initiative aimed at inspiring and engaging students from the North East in the domain of space technology and applications.

This quarter also witnessed strengthened collaboration with state governments and regional institutions. The Hon'ble Minister in charge of the Soil and Water Conservation Department, Government of Meghalaya, Shri Marcuise N. Marak, launched five important collaborative projects executed by the Soil and Water Conservation Department in partnership with NESAC on 20 November 2025. His appreciation of NESAC's technical contributions and emphasis on the relevance of these studies underscore the growing impact of our work at the state level.

Further, NESAC organized the concluding workshop of two major regional projects funded by the North Eastern Council (NEC)—Applications of Space Technology for Agricultural Assessment in NER (ASAAN) and Space-Based Support for Integrated Development of Horticulture in NER (SSIDH). The release of the project reports and dashboards by Shri S. K. Bhalla, Secretary, NEC, and his remarks on the pivotal role of geospatial technologies in regional development, reaffirm the strategic importance of space-based solutions for the North Eastern Region.

Another significant milestone during this quarter was the launch of the SMART AXOM mobile application developed by NESAC, by Shri Keshab Mahanta, Hon'ble Minister for Revenue and Disaster Management, Government of Assam, on 6 November 2025. This citizen-centric application provides location-based alerts, warnings, and advisories through a geo-fencing framework, and represents a meaningful step towards strengthening community-level disaster preparedness.

These collective achievements reflect the dedication and hard work of the NESAC team and our valued partners. I take this opportunity to express my sincere appreciation to all scientists, engineers, collaborators, and stakeholders who have contributed to these accomplishments. As we move forward, NESAC remains committed to advancing the application of space technology for regional development, disaster resilience, and capacity building, working together towards a technologically empowered and sustainable future for the North Eastern Region.

Snowmelt Runoff Simulation in data scarce high-altitude Upper Lohit basin

Shanbor Kurbah

Reliable snowmelt-runoff estimates are essential for flood preparedness and water resources management in the high mountains, especially in regions where ground observations are limited. In the Eastern Himalaya, this challenge is even greater because temperature and precipitation change sharply with elevation and monitoring stations are sparse at high altitude. This study implemented a zone-wise temperature index approach Snowmelt Runoff Model (SRM) for the upper Lohit River sub-basin by combining Earth-observation and reanalysis inputs. Snow cover was derived from Landsat and Sentinel-2 imagery, temperature was taken from ERA5-Land, and precipitation forcing was provided using two widely used datasets, GPM IMERG and CHIRPS. Model simulations were evaluated against observed daily discharge over a calibration period of 2010-2013 and an independent validation period of 2014-2017. The results show that the model reproduces the timing and seasonal progression of river flow well for both precipitation inputs, with consistently high correlation with observations, indicating that the annual rise-fall behavior of discharge is strongly captured. Overall model skill was generally higher when forced by IMERG than by CHIRPS, suggesting that IMERG provides a closer match to observed runoff dynamics in this basin. The analysis also indicates that snowmelt contributes a substantial but highly variable share of annual flow, ranging from roughly 11% to 36% across years, which highlights a strong snow-monsoon linkage and pronounced year-to-year variability in melt-driven runoff. Sensitivity results further show that a small set of SRM parameters exerts strong control on simulated discharge, particularly the rainfall-runoff coefficient, snow-runoff coefficient, and the degree-day factor, making them key targets for careful calibration and uncertainty reduction. Despite the strong seasonal performance, the largest peak flows tend to be underestimated, reflecting a common limitation in steep, monsoon-influenced mountain basins where short-duration intense storms dominate flood peaks and can be difficult for gridded precipitation products to represent accurately.

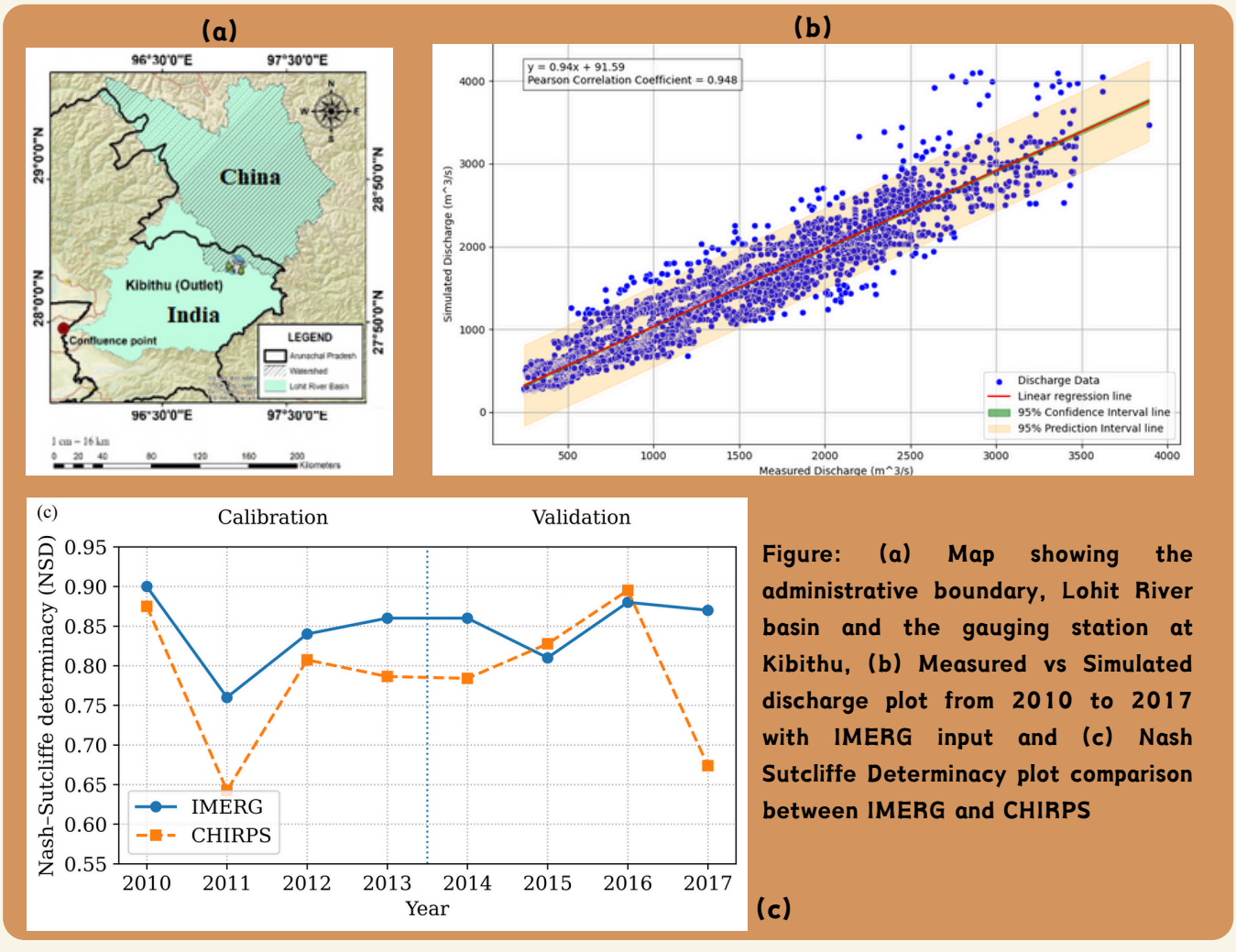


Figure: (a) Map showing the administrative boundary, Lohit River basin and the gauging station at Kibithu, (b) Measured vs Simulated discharge plot from 2010 to 2017 with IMERG input and (c) Nash Sutcliffe Determinacy plot comparison between IMERG and CHIRPS

Experimental use of Lightning observation data to improve Rainfall Forecasts in Northeast India

Arundhati Kundu, Dr. Rekha B. Gogoi, Dr. Abhay Srivastava, and Dr. Shyam S. Kundu

Accurately predicting rainfall in regions with complex terrain remains one of the toughest challenges in weather science. Limited observations, gaps in initial conditions, and incomplete knowledge of model physics often make forecasts less reliable. In this study, an innovative solution to improve rainfall predictions using lightning data was explored. In tropical environments, water vapor distribution plays a critical role in driving storms, but it is notoriously difficult to represent in models. To address this, we generated pseudo–water vapor fields from lightning observations and assimilated them into the Weather Research and Forecasting (WRF) model during the pre-monsoon and monsoon months of 2024 using the 3DVAR framework. The lightning data was taken from the Indian Lightning Location Network (ILLN) operated by IITM-Pune, while cloud-top height information from INSAT-3DR satellites helped define the upper boundary of Pseudo-water vapor fields. Final run precipitation product from Integrated Multi-satellite Retrievals for GPM (IMERG) was used for forecast verification. Results showed that assimilating lightning-derived water vapor can capture heavy rain cells and significantly improved convective rainfall forecasts, especially in the short term. While the benefits decrease with longer lead times, this approach demonstrates strong potential for enhancing operational weather forecasting in data-sparse regions like northeast India. By leveraging advanced meteorological methods and earth observation data, we can anticipate extreme events well in advance and strengthen preparedness at the community level. This proactive approach fosters innovation and resilient infrastructure (SDG 9), supports safer and more sustainable cities and communities (SDG 11), and safeguards ecosystems and biodiversity on land (SDG 15). Together, these efforts create a holistic framework that protects people, nature, and development from weather and climate-related risks.

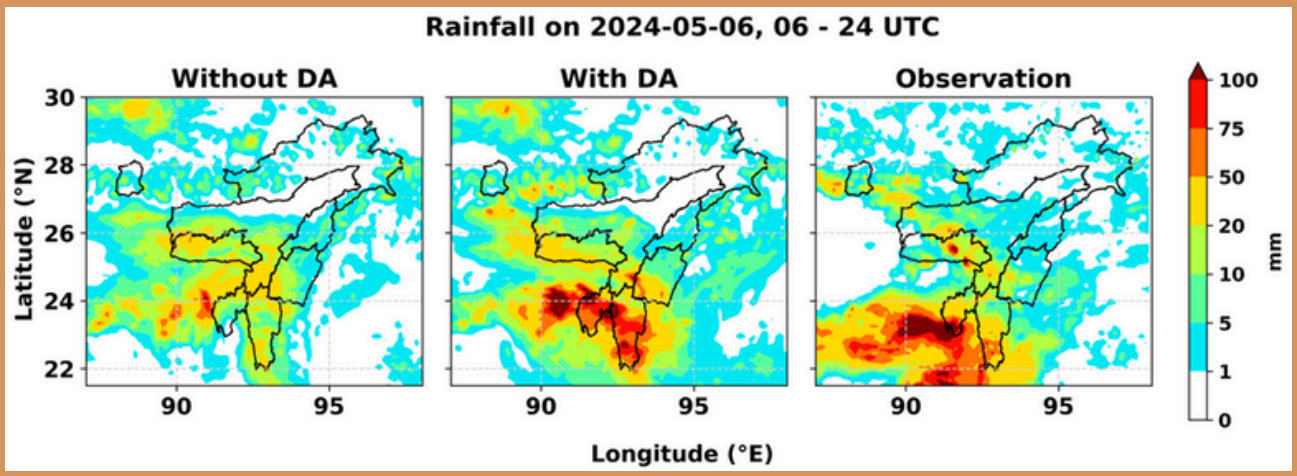
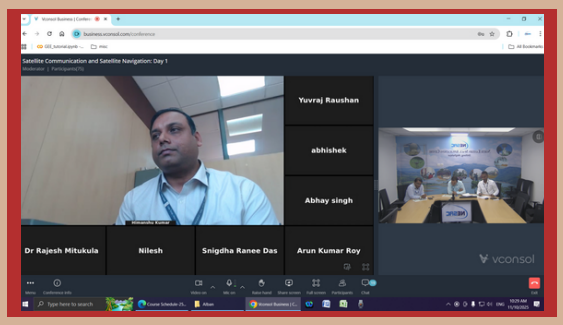


Figure: Accumulated precipitation from left to right —model forecast from the control run without data assimilation, model forecast with data assimilation, and satellite-derived precipitation product.

Capacity Building and Outreach

Satellite Communication & Satellite Navigation: Technologies & Applications

The course was conducted at NESAC during November 10th-14th,2025 via Online mode with 156 participants registered from NITs and other Engineering Colleges. The course covered topics like Basics of Satellite Communication & Navigation, Ground Station, RF, Baseband technologies and applications of SATCOM & SATNAV with special emphasis to High Throughput Satellites (HTS) for Internet Services, Mobile Satellite Services (MSS) applications for Disaster Management & NaVIC Applications.



Applications of Remote Sensing and GIS in Water Resources and Flood Management

The Course was conducted during November 10-21, 2025 with participants from government departments and academic institutions across different parts of India. Course covered theory as well as hands-on practical sessions on topics such as basics of remote sensing and GIS, hydrological modeling, , hydrodynamic modeling, dam break modeling, flood management and basics of soil erosion estimation, Flood Early Warning System, Climate changes and its impact, LiDAR and microwave remote sensing.

UAV Remote Sensing & Applications for Central Armed Police Forces (CAPFs)

NESAC organized a one-week training programme on "UAV Remote Sensing and Applications" for officials of the Central Armed Police Forces (CAPFs) from December 1 to 5, 2025 at the NESAC Outreach Facility, Umiam. The participants from BSF, SSB and ITBP attended the program. The training was designed to enhance the operational and technical capabilities of CAPF personnel in the use of Unmanned Aerial Vehicles for surveillance, mapping, situational monitoring and decision support in challenging field environments.

Conclusion of NESPARKS 2025

Sixth, Seventh & Eighth batch of NESPARKS students visited various ISRO Centres & facilities during 30-31 October, 25-26 November & 29-30th December,2025 respectively. The students visited ISTRAC, URSC, Indian Deep Space Network (IDSN), Mission Operations Complex (MOX), Satellite Control Centre (SCC), ISRO Satellite Integration & Test Establishment (ISITE). They also visited the Jawaharlal Nehru Planetarium (JNP).

On September 18, 2025, the Hon'ble Minister for Communication & Development of North Eastern Region Shri Jyotiraditya M. Scindia fruitfully interacted with students from the first four batches to gather their feedback and perspectives on the programme's progress. The interactive concluding session held at ISRO Headquarters, Bengaluru on 29th December 2025 was chaired by Dr. V. Narayanan, Chairman, ISRO in presence of distinguished dignitaries from ISRO/DoS/NEC.

Capacity Building and Outreach

NESAC conducts Outreach Events under National Space Science Symposium (NSSS)-2026

Outreach events have been conducted under the aegis of NSSS-2026 at various Universities & Technical Institutes of North East during the months of October, 2025- January,2026. The new initiative has been started to strengthen scientific awareness & research capacity across the region. A total of nine such events had been planned covering Universities of all eight NER States. Eight such events have already been successfully conducted in NER states, featuring expert lectures, demonstrations, interactions & student idea presentations. Some of these students will be selected to present their ideas at NSSS-2026.

One-Day Training Programme on Remote Sensing, GIS and Space Technology

Training Programme was conducted at NESAC, on 14 January, 2026 for 40 officers of the Works Audit, Regional Capacity Building and Knowledge Institute (RCB&KI), Shillong, under the Indian Audit & Accounts Department. The programme aimed at enhancing understanding of satellite remote sensing, Geographic Information System (GIS), UAV-based data acquisition, and the applications of space technology in planning, monitoring, and auditing of infrastructure and development works.

One-Week Training Programme on Space Technology in Disaster Risk Management

Training programme was organised from 19 to 23 January 2026 sponsored by Department of Space (DOS). 36 participants from various State Departments along with faculty members and research scholars from various colleges and universities across the country attended the training. The course covered a wide spectrum of topics including an overview of geospatial tools, techniques and their applications across various disaster, UAV-based data acquisition and applications and live demonstrations of decision-support dashboards and web portals developed by NESAC for disaster management.

NESAC hosts brainstorming meeting on "Farm Boundary Mapping in NE States"

The Ministry of Agriculture & Farmers Welfare (MoA&FW), Government of India, organized a brainstorming meeting on 'Farm Boundary Mapping in North-Eastern States' on 9th January 2026 at NESAC, Umiam, Meghalaya to review the current status, challenges, and future roadmap for farm-level boundary mapping in NER. The meeting witnessed participation from officials and experts of MoA&FW, Mahalanobis National Crop Forecast Centre (MNCFC), NESAC, and officials from relevant departments from all NE states. Identification of various key action points was the highlight of the meeting.

NEWS & EVENTS

NESAC organizes the concluding workshop of two regional level projects in Agriculture and Horticulture sectors

NESAC organized the concluding workshop of the two regional level projects funded by North Eastern Council (NEC) viz., Applications of Space Technology for Agricultural Assessment in NER (ASAAN) and Space-Based Support for Integrated Development of Horticulture in NER (SSIDH) on 9th December 2025 at the Assam Administrative Staff College, Guwahati. Shri S. K. Bhalla, Secretary, NEC, applauded the projects and emphasized the critical role of geospatial technology in the development of the North Eastern Region. He also released the ASAAN and SSIDH project reports along with the dashboards.

NESAC organizes Book Exhibition

NESAC Library organized a book exhibition with the theme "Explore, Engage and Enrich" on 12 December, 2025 at its Outreach Facility. A total of fourteen reputed publishers and distributors participated in the exhibition, showcasing the latest editions of textbooks and reference materials relevant to NESAC's core areas of research, development, and applications. As part of the exhibition, a presentation on RFID (Radio Frequency Identification) technology was conducted. Scientists, Research Scientists, Research Scholars, and students of NESAC visited the exhibition.

Launching of SMART AXOM App by Hon'ble Minister, Revenue and Disaster Management Department, Assam

Shri Keshab Mahanta, Hon'ble Minister for Revenue and Disaster Management, Government of Assam, launched the SMART AXOM mobile application on 6th November, 2025 during the programme on "Building Collaborative Resilience for the Future" held in Guwahati. The SMART AXOM app has been developed by NESAC under a project sponsored by the Assam State Disaster Management Authority (ASDMA) for citizen-centric disaster preparedness. The app provides location-based alerts, warnings, and advisories through a geo-fencing framework. It seamlessly integrates near-real-time information issued by various government agencies. The Hon'ble Minister also released the project report titled "Flood Scenario Generation and Discharge-Based Downstream Impact Study for Ranganadi, Doyang, and Kurichu Dams", a study carried out by NESAC with funding support from ASDMA. On this occasion, Dr. Kasturi Chakraborty, Head, FED, was also felicitated by the Hon'ble Minister for her role as a Mentor under the AYIP 2025 programme of ASDMA.

Hon'ble Minister of Soil and Water Conservation Department, Meghalaya Launches NESAC Supported Soil and Water Conservation Projects in Meghalaya

Hon'ble Minister in charge of the Soil and Water Conservation Department, Government of Meghalaya Shri Marcuise N. Marak, has launched five important projects executed by Soil and Water Conservation Department in collaboration with NESAC on 20th Nov, 2025 at State Convention Centre, Meghalaya. These projects aim at strengthening soil and water conservation planning in the State. The programme was attended by the senior scientists from NESAC consisting of Dr. Jenita M. Nongkynrih, Smti. Pratibha Thakuria Das, and Shri Ranjit Das.

Observance of Samvidhan Diwas (Constitution Day) at NESAC

NESAC observed Samvidhan Diwas (Constitution Day) on 26 November 2025, commemorating the 76th anniversary of the adoption of the Constitution of India with active participation of NESAC staff. The observance was held at the NESAC Auditorium, Umiam. Shri Avaneesh Shukla, Controller of Administration, NESAC, led the gathering in reaffirming the fundamental values enshrined in the Constitution. He delivered an enlightening lecture on the theme "Hamara Samvidhan – Hamara Swabhiman."

Inauguration of High Performance Computing (HPC) Facility at NESAC

The High Performance Computing (HPC) system of NESAC was inaugurated by Dr. S. P. Aggarwal, Director, NESAC, on 23rd December 2025, in the presence of Dr K.K. Sarma, Group Head, RSAG, Heads of Divisions, scientists of the Centre as well as the representatives from the vendor who supplied the system.

The HPC system has been procured, installed and commissioned with the technical support from Centre for Development of Advanced Computing (CDAC), Pune to support compute-intensive scientific research and operational activities, including numerical weather prediction, lightning research, flood modelling, as well as large-scale geospatial data processing, particularly involving high-volume satellite and drone-based datasets.

NESAC celebrates World Hindi Week, 2026

With a view to promoting the official language NESAC celebrated the World Hindi Week during Jan 10-16, 2026. Director, NESAC administered the Official Language pledge to all staff. On this occasion, he delivered a very impactful address, highlighting the importance & relevance of the Hindi language at the global stage and emphasizing on its increased use in official work. An array of activities & competitions was organized for NESAC Staff during the week. The program came to a close on 16th through the valedictory program where prizes were distributed to the winners of various competitions.

NEWS & EVENTS

NESAC Celebrates 77th Republic Day of the Nation

The 77th Republic Day of the nation was celebrated at NESAC on 26th January 2025 with a colorful program. Dr. B.K. Handique, Head, ASD & PPEG, NESAC hoisted the tricolor. He addressed the staff of the Centre with an informative speech, highlighting the significance of Republic Day celebration and briefed about the activities and achievements of ISRO and NESAC in recent times. Following this, an enjoyable weapons drill exercise was exhibited by the CISF Unit of NESAC. At the end, a colourful cultural program was organized by the NESAC Sports & Recreation Committee at NESAC auditorium.

Student Visits to NESAC

19 B.Sc. (Agriculture) 3rd-year students of Biswanath College of Agriculture, AAU attended a One-Day Training on "Basics of Remote Sensing" at NESAC on November 28, 2025.

34 BSc Agriculture (3rd year) students of CAU, Kyrdemkulai visited NESAC on 11th December, 2025 coordinated by Dr. Francis Duta.

39 students of class IX along with 4 teachers from Modern Public Academy, Pakarkona visited NESAC on 20.01.2026. Shri Rahul Pratap, Scientist, NESAC coordinated the visit.

Upcoming Events

43 students from Loreto Convent, Shillong visited NESAC on 12th December, 2025. Sri Rosly Lyngdoh, Scientist, NESAC Coordinated the visit.

NSSS-2026

The National Space Science Symposium (NSSS) is a biennial event organized by the Indian Space Research Organization (ISRO). The 23rd National Space Science Symposium will be held at Umiam, Shillong during February 23-27 and hosted by the North Eastern Space Applications Centre (NESAC).

REFLECTIONS

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