



REFLECTIONS

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



From the Director's Desk



Dr. S. P. Aggarwal
Director, NESAC

HIGHLIGHTS OF THIS ISSUE:

Glacier Related Study
at NESAC - 2

Integrating Optical and
SAR Data for Near
Real-Time Landslide
Detection - 3

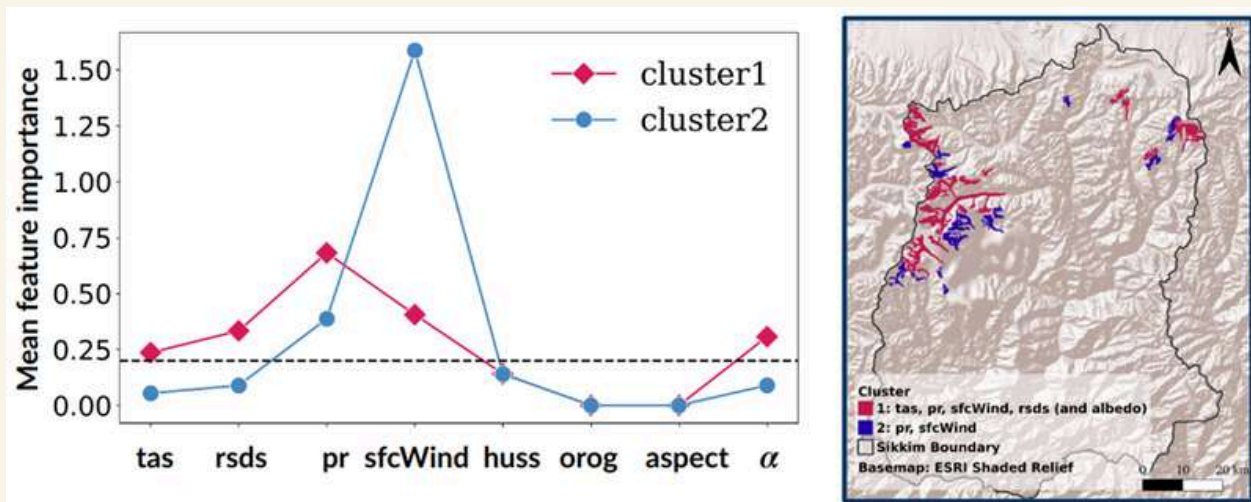
The year 2025 begins with renewed momentum, opening up new avenues of involvement and opportunities for NESAC to further contribute towards transformative development in NER. The 19th meeting of the NESAC Governing Council (GC) was held on Dec 17, 2024 which is presided over by the then Secretary, Department of Space & Chairman, ISRO and NESAC-GC Dr. S. Somanath. The 12th Meeting of the Society of NESAC was held on Dec 21, 2024 at Agartala, Tripura. The meeting was presided over by the Hon'ble Union Minister for Home and Cooperation Shri Amit Shah and President of the NESAC Society. In his remarks, Hon'ble Home Minister applauded NESAC for its support to accelerated development of the North Eastern region (NER) of India and provided a few specific actions for achieving better utilization of space-based inputs by the state user departments in the region.

During the last three months, NESAC has successfully completed more than 20 projects that mostly cover the plan of action identified projects and also organized workshops for the user department as part of some of the projects. Under outreach activity, we conducted three specialized training programs, benefiting over 60 participants from government departments, academia, and industries from different parts of India. We also organized a book exhibition at NESAC which aims to keep our employees well-informed and facilitate knowledge-sharing with users, ensuring continuous learning and innovation. Overall, we remain dedicated to extend all possible support for the development of the NER through advanced space technology solutions and support.

Development of a dynamically enhanced temperature index model for glacier mass balance modelling using explainable AI

Ritu Anilkumar

Estimating glacier melt accurately requires a comprehensive formulation of the energy balance equation. Due to its data intensive nature, computing the melt in data sparse regions using energy balance models is challenging. To address this, simplified energy balance models, temperature index models, and other empirical approaches have been developed, though they often rely on static input choices which do not explicitly account for a complete energy balance approximation.



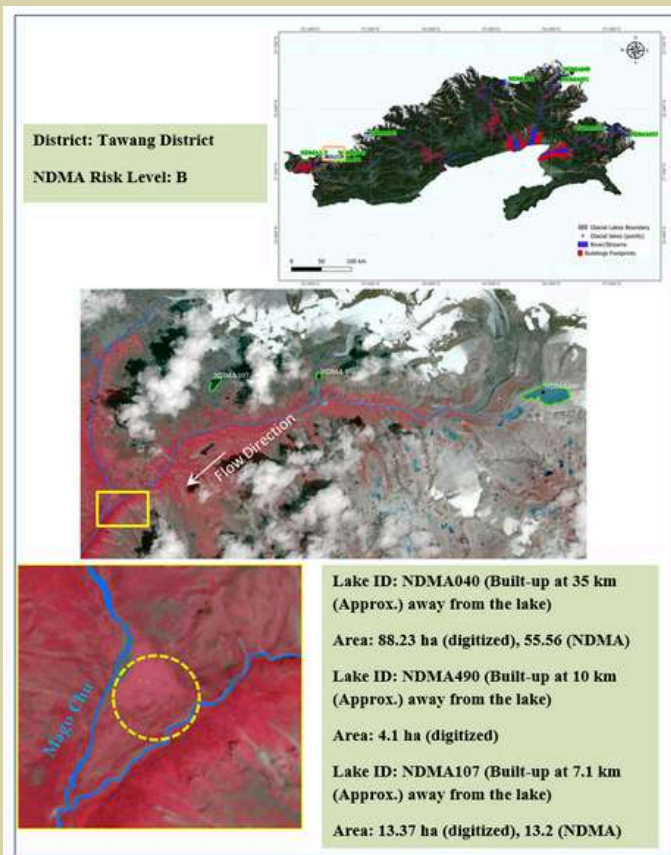
Left: Feature importance of meteorological variables Right: Two glacier clusters in Sikkim Himalayas with similar feature importance

In our study, we combined the strengths of these various techniques by leveraging the explainable AI concept of post-hoc explanations, specifically feature importance using inherently interpretable models, LIME, SHAP, and permutations. We first develop an ensemble of feature importance associated with key meteorological variables: near-surface air temperature (tas), precipitation (pr), downwelling shortwave solar radiation (rsds), albedo (α), specific humidity (huss), and wind speed (sfcWind). Using these feature importance values, we select the most critical features for each glacier and apply an enhanced temperature index model driven by these selected features. We have developed this for all glaciers larger than 2 km x 2 km in the Sikkim Himalayas. Through this study, we showcase our results on the (i) Development of a robust zero dimensional empirical glacier melt model, and (ii) Understand the dynamic variations in features that drive glacier melt over the Sikkim Himalayas.

Preliminary assessment of risks associated with glacial lakes in Arunachal Pradesh

NER-DRR Team

The National Disaster Management Authority (NDMA) has classified glacial lakes in India into three risk categories: Category A (Highest Risk), Category B (High Risk), and Category C (Significant Risk). In Arunachal Pradesh, 29 glacial lakes have been identified, with 9 categorized as high-risk (Category B) and the remaining under Category C. When such a high risk glacial lake breaches, there is a sudden and rapid release of the large volume of water leading to catastrophic downstream flooding. This can result in the loss of human lives, the destruction of infrastructure such as bridges, roads, and buildings, and the disruption of communities through the displacement of residents. Therefore, identification of the nearest settlements downstream and their distance from the lakes helps us understand which lake poses more threat to the settlements downstream.



This study focuses on the high-risk (Category B) glacial lakes, aiming to:

1. Delineate their boundaries.
2. Identify downstream built-up areas and measure their distances from these lakes.

Cloud-free satellite imageries from Sentinel-2A/2B were utilized for accurately detecting settlements or built-up areas near high-risk glacial lakes. The boundaries of these nine lakes were delineated using geospatial tools and visual image interpretation. Additionally, drainage paths were mapped using satellite imagery and building footprint data from Google Earth Engine to identify at-risk settlements.

The results for Tawang district are presented in the accompanying figure, highlighting the high-risk lakes and vulnerable settlement areas based on the mapped flow direction.

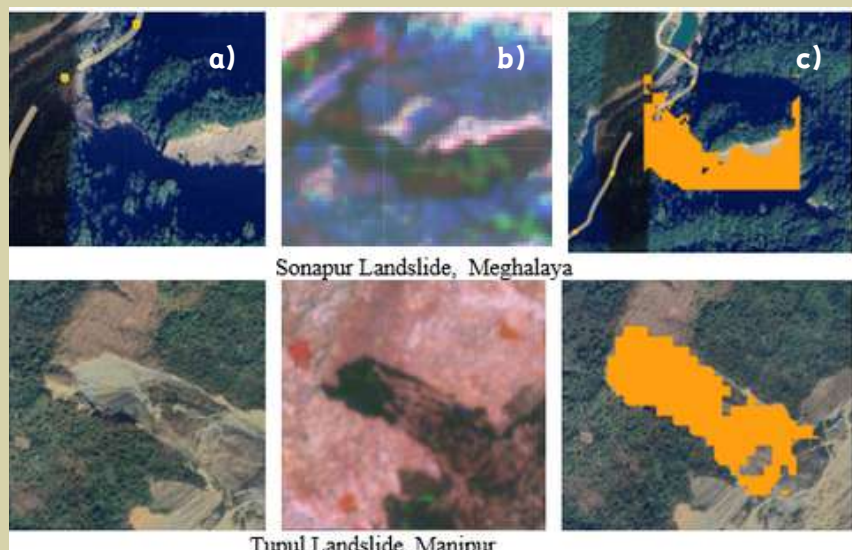
Integrating Optical and SAR Data for Near Real-Time Landslide Detection: A Remote Sensing Approach

Shashank Bhaskar & Victor Saikhom

In this study, we have tried to detect the landslides in near real time in different regions of northeastern states of India. We developed a methodology for detecting landslide using remote sensing data, combining the power of optical and radar imagery, vegetation indices like NDVI and NDWI.

By leveraging advanced Earth observation methods,

this study attempts to improve the accuracy of landslide detection and provide timely information for disaster response and risk management in vulnerable regions. The workflow integrates Sentinel-1 and Sentinel-2 data, applies indices like the Normalized Difference Vegetation Index (NDVI), Normalized Difference Built-up Index (NDBI), and Normalized Difference Water Index (NDWI), and includes slope data derived from DEM. Additionally, the BSI helps identify bare soil areas prone to landslides. The figure shows two landslides, one each in Meghalaya and Manipur detected to a large extent by this methodology.



Landslides detected by using all of spectral indices (a) Google Earth Satellite Imagery (b) Fusion Image and (c) detected landslide in Meghalaya & Manipur

Capacity Building

One-week course on “UAV Remote Sensing and its Applications” for Central Armed Police Forces (CAPFs)” during 4-8 Nov, 2024.

A tailored one-week course on “UAV Remote Sensing and its Applications” was organized for Central Armed Police Forces (CAPFs) as part of a capacity-building and outreach initiative during Nov 4-8, 2024.

NESAC conducts a two-week course on Applications of Remote Sensing and GIS in Water Resources and Flood Management



NESAC successfully conducted a two-week training on “Applications of Remote Sensing and GIS in Water Resources and Flood Management” during Nov 18-29, 2024 at the NESAC Outreach Facility. In total, 18 participants from government departments and academia from different parts of India attended the course.



Two Week short course on “Remote Sensing and GIS Applications in Forestry and Ecology”



A two-week short course on “Remote Sensing and GIS Applications in Forestry and Ecology” was conducted by the Forestry and Ecology Division (FED), NESAC from Dec 02-13, 2024 at the NESAC Outreach Facility. A total of 27 participants attended the course which included officials from Forest departments of NER, faculties from government institutes, professionals from private companies and research scholars.

Workshop on In-situ Conservation of Muga Silkworm in Meghalaya held at Directorate of Sericulture and Weaving, Meghalaya

The concluding workshop for the project titled “Applications of Geospatial Technology for In-situ Conservation of Muga Silkworm in East Jaintia Hills District, Meghalaya” was organized jointly by NESAC and the Directorate of Sericulture and Weaving, Government of Meghalaya, on Jan 23, 2025, at the Nokrek Building, Lower Lachumiere, Shillong.

NESAC scientists delivered a comprehensive technical presentation on the project outcomes, leading to the formal launch of the project report.



Capacity Building

Training conducted on use of CPR for Staff of NESAC

A training session was organized on the use of Cardiopulmonary Resuscitation (CPR) by NESAC Centre Safety Committee (CSC) on Jan 23, 2025.



One-week course on “Basics of Geo Web Services & Spatial Data Analytics Platform using open-source tools”

NESAC successfully conducted one-week training on “Basics of Geo Web Services & Spatial Data Analytics Platform using open-source tools” during Jan 20-24, 2025 at the NESAC Outreach Facility. In total, 18 participants from government departments, academia, and industries from different parts of India attended the course.



Achievements

NESAC, representing ISRO, received the Best Technology Pavilion award at India International Science Festival (IISF), 2024, organized by Council of Scientific & Industrial Research (CSIR) at IIT, Guwahati during Nov 30-Dec 03, 2024.



Dr. Pradesh Jena, Sci/Eng ‘SD’, ASD, NESAC was awarded the first prize in oral presentation for the research paper "Farm level monitoring through UAV remote sensing - A novel approach towards precision farming" at the 2024 IEEE India Geoscience & Remote Sensing Symposium, organized at NIT, Goa, during Dec 02-05, 2024.

Director, NESAC honored with the ISG Fellow at the ISG-ISRS National Symposium on “Remote Sensing for Sustainable Future: A Road Map Towards VIKSIT Bharat”, held at Lucknow on Dec 11, 2024.

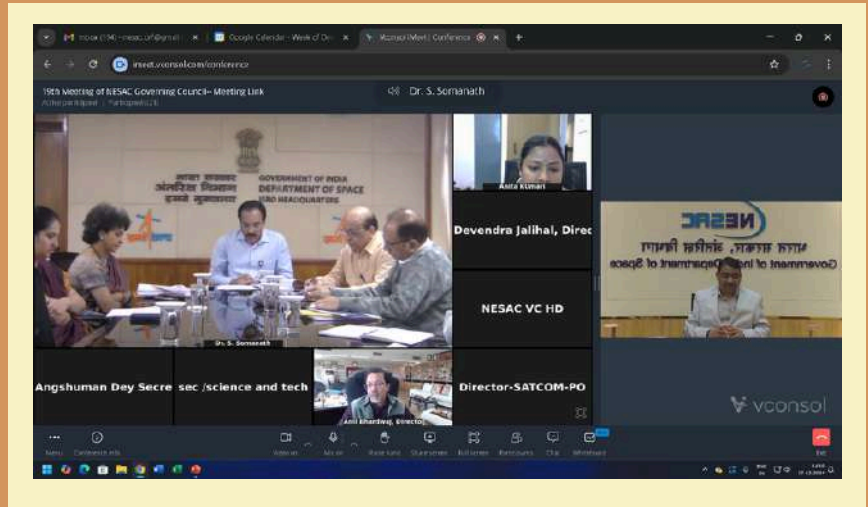


NEWS & EVENTS

19th NESAC Governing Council Meeting held on Dec 17, 2024

The 19th meeting of the NESAC Governing Council (GC) was held on Dec 17, 2024 via online mode. The then Secretary, Department of Space & Chairman, ISRO & NESAC-GC, Dr. S. Somanath presided over the meeting. The meeting was attended by the Secretaries of Science & Technology from NE states, Additional Secretary (Personnel), DOS, Joint Secretary & Financial Adviser, Scientific Secretary, ISRO, Director National Remote Sensing

Centre, Hyderabad, Director, IIT Guwahati, in addition to the senior officials from ISRO/DOS and other central government organizations in NER.



12th Meeting of NESAC Society held under the Chairmanship of Hon'ble Union Home and Cooperation Minister held on Dec 21, 2024



The 12th Meeting of the Society of NESAC was held on Dec 21, 2024 at Agartala, Tripura. The meeting was presided over by the Hon'ble Union Minister for Home and Cooperation Shri Amit Shah and was attended by the Hon'ble Union Minister of Ministry of DoNER, Shri Jyotiraditya M. Scindia , Hon'ble Minister of State for Ministry of DoNER Dr Sukanta Majumdar, Hon'ble Chief Ministers from Arunachal Pradesh, Assam, Manipur, Sikkim, and Tripura, the Secretary to the Home Ministry, Dept. of Space, Ministry of DoNER, NEC, Chief Secretaries from NE states, and other distinguished members and invitees.

The then Secretary, Department of Space, Chairman, ISRO & Vice-President of NESAC Society, Dr. S. Somanath welcomed the President, Members, and all invitees to the meeting and felicitated the guests.

12th Meeting of NESAC Society held under the Chairmanship of Hon'ble Union Home and Cooperation Minister held on Dec 21, 2024

He assured that ISRO/DoS would provide continued support in every possible way to assist the states in their development and governance efforts. This was followed by a technical presentation by Dr. S.P. Aggarwal, Director, NESAC and Secretary of the Society on the major achievements and scientific activities of the centre during last year.



The Hon'ble Home Minister applauded NESAC for its diverse and extensive contributions across all states and affirmed that the centre is on course to support the accelerated development of the North Eastern region of India.

He urged NESAC to broaden its scope and enhance its range of activities to address the region's specific needs more effectively. He expressed satisfaction that 109 departments from the eight North Eastern states were utilizing NESAC's

services and encouraged the organization to proactively engage with more departments. He also urged NESAC to brainstorm on how the best practices of utilizing the space technology can be integrated with the existing systems in NER to address the major problems faced by the region and submit related proposals to the Ministry of Home affairs. He suggested planning for preparation of high-resolution digital elevation models, space-based support for minerals, oil, and coal reserves in the NE states, and extensive space technology-based outreach and training activities to cater to the students, women, and tribal population of NER.

The Chief Ministers attending the meeting praised NESAC for its technical support to user departments through state-level space applications and remote sensing centres. They also provided an update on the progress and outcomes of the large number of projects undertaken as part of the Plan of Action activities. They also requested the initiation of new projects in areas such as natural resource management, disaster management support, infrastructure planning, and other areas relevant to their respective states.



NEWS & EVENTS

NESAC BOOK EXHIBITION 2025

The NESAC Library successfully organized a Book Exhibition on Jan 9, 2025. Dr. Shyam S Kundu, Sci./Engr 'SG' & Head, SASD, NESAC inaugurated the program.



A total of 11 reputed publishers, distributors, and booksellers participated in the exhibition, showcasing the latest editions of textbooks and reference materials relevant to NESAC's fields of research, development, and applications.



All NESAC Scientists, members of the Library Advisory Committee (NLAC), Research Scientists, Research Scholars and students participated enthusiastically and visited the exhibition to explore the books related to their research field.



World Hindi Day Celebration



In line with the official language policy of the Government of India, World Hindi Day was celebrated at NESAC on Jan 10, 2025. To enhance awareness and engagement among NESAC staff, various competitions were also organized.



Republic Day Celebration at NESAC



The 76th Republic Day of the nation was celebrated at NESAC on 26th Jan 2025 with a colorful program.

Dr. S.P. Aggarwal, Director, NESAC hoisted the tricolor amidst singing of national anthem by the staff of NESAC at 09:00 am. The CISF unit of NESAC offered a guard of honour to Director, NESAC, and performed Republic Day parade. Director, NESAC, addressed the staff of the Centre with an informative speech where

he highlighted the significance of Republic Day celebration and briefed about the activities and achievements of ISRO and NESAC in recent times. Following this, a one minute weapons drill exercise was exhibited by the CISF Unit of NESAC. A colourful cultural program was organized by the NESAC Sports & Recreation Committee at the NESAC auditorium.

NEWS & EVENTS

Student Visits to NESAC



Students and staff from Star Public School, Lumshnong, Meghalaya, at NESAC on Nov 4, 2024, during the facility visit.



48 students along with faculty members from Inspire Academy Junior College, Assam, visited NESAC on Nov 8, 2024.



Students from the Department of Earth Sciences, IIT Roorkee, visited NESAC on Jan 6, 2025.



38 BSc Sericulture students from the College of Sericulture, Chintamani, Karnataka, visited NESAC on Jan 27, 2025.

Know more about various training and capacity building programmes

Course Calendar 2024-25 ← NEW



REFLECTIONS

The Quarterly In-House Newsletter of the North Eastern Space Applications Centre
VOL. 18, ISSUE 1, January 2025

Published by

North Eastern Space Applications Centre
Department of Space, Government of India
Umiam-793103, Shillong, Meghalaya
Ph: +91 364 2570141/2570140
Fax: +91 364 2570139
Web: www.nesac.gov.in

Editor

Dr. Rekha Bharali Gogoi,
Sci/Eng 'SF',
Focal Scientist (Coordinator), NERDRR

Editorial Team

Shri Anjan Debnath, Sci/Eng SF, SUD
Dr. Gopal Sharma, Sci/Eng SE, GSD
Shri Siddhartha Bhuyan, Sci/Eng SD, GID
Shri Sumanth B C, Sci/Eng SD, URD
Shri Shanbor Kurbah, Sci/Eng SD, WRD
Dr. Francis Dutta, Sci/Eng SD, ASD
Dr. Dhruval Bhavsar, Sci/Eng SC, FED

Published by