JOINT NEWS RELEASE

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NTU Singapore and Singapore Land Authority collaborate to use satellite data for environment research

Nanyang Technological University, Singapore (NTU Singapore) and the **Singapore Land Authority (SLA)** are collaborating to use Global Navigation Satellite System (GNSS) data for scientific studies.

Leading NTU Singapore's efforts in this collaboration is its **Earth Observatory of Singapore (EOS)**, which will see its researchers access GNSS data collected by SLA's Singapore Satellite Positioning Reference Network (SiReNT), and more than a decade of archived historical GNSS data.

Together with the development of new coastal GNSS reference stations in Singapore led by EOS, this will allow research into more accurate ways to measure land-height and sea-level changes around Singapore, as well as the effect of the atmosphere on the weather and climate on the island nation.

GNSS encompasses different types of satellite navigation systems including the commonly known Global Positioning System (GPS) which can be used by systems such as SLA's SiReNT - to produce precise positioning data up to an accuracy of 3 cm.

An agreement was signed between EOS and SLA on Monday at NTU to establish the four-year collaboration, which is expected to contribute to the Singapore National Sea Level Programme (NSLP) by the Centre for Climate Research Singapore,[1] supported by the National Research Foundation and the National Environment Agency.

Associate Professor Emma Hill, Acting Chair, Asian School of the Environment (ASE) and Principal Investigator at EOS, said, "Having access to Singapore's historical Global Navigation Satellite System data is crucial for understanding how the

[1] Launched in 2020, the Climate Science Research Programme Office is set up under the Centre for Climate Research Singapore. It coordinates climate research grant programmes such as the NSLP, which aims to address key knowledge gaps in the understanding and modelling of the physical mechanism of sea level rise and variability.

land and coast have changed over the years. Leveraging NTU's strengths in areas such as sustainability and earth sciences, this collaboration also provides us with valuable data to contextualise more accurate projections to augment the Singapore's climate change response."

Dr Victor Khoo, Director of Survey & Geomatics at SLA, said, "Beyond positioning and mapping, leveraging precise positioning technology such as SLA's SiReNT can open up significant possibilities to tackle the increasingly complex issues relating to climate and environmental changes. With the combined expertise of SLA and EOS, we look forward to harnessing the rich historical data to co-create solutions for a new era in predicting and preparing for coastal and land changes to manage and mitigate climate change impact on Singapore."

The collaboration between NTU and SLA is an example of a research initiative that supports the university's **NTU 2025 strategic plan**, which seeks to address humanity's grand challenges on sustainability, and accelerate the translation of research discoveries into innovations that mitigate human impact on the environment.

Scope of collaboration

During the period of collaboration, EOS will process historical GNSS data provided by SLA to assess how land-height has changed at specific locations. This will help improve the accuracy of elevation results obtained from Interferometric Synthetic Aperture Radar (InSAR) – the current technique NTU uses to map ground deformation over Singapore and other cities in the region.

To develop innovative techniques to monitor both land-height and sea-level changes, EOS and SLA will install up to four new coastal GNSS stations across Singapore for data collection. They will also be integrated into the SiReNT infrastructure and services to maximise the use of resources. Data from existing SiReNT stations will be included to support this objective.

At the same time, EOS will look at novel ways to use data from existing GNSS, such as using the information to investigate the amount of water vapour in the atmosphere. By characterising the atmospheric processes that affect Singapore at various timescales, scientists can find out where and when localised weather systems are likely to produce intense precipitation.

EOS researchers will also aim to utilise the GNSS data in local meteorological research. Through detailed comparison and analysis of GNSS and meteorological data, the scientists aim to better understand precipitation and severe weather events.

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Media contact:

Ms Junn Loh
Manager, Media Relations
Corporate Communications Office
Nanyang Technological University, Singapore
Email: junn@ntu.edu.sg

Mr Adrian Tan
Manager
Communications & Engagement Division
Singapore Land Authority
Tel: 9857 5976
Email: Adrian_cy_Tan@sla.gov.sg

About Nanyang Technological University, Singapore

A research-intensive public university, Nanyang Technological University, Singapore (NTU Singapore) has 33,000 undergraduate and postgraduate students in the Engineering, Business, Science, Medicine, Humanities, Arts, & Social Sciences, and Graduate colleges.

NTU is also home to world-renowned autonomous institutes – the National Institute of Education, S Rajaratnam School of International Studies, Earth Observatory of Singapore, and Singapore Centre for Environmental Life Sciences Engineering – and various leading research centres such as the Nanyang Environment & Water Research Institute (NEWRI) and Energy Research Institute @ NTU (ERI@N).

Under the NTU Smart Campus vision, the University harnesses the power of digital technology and tech-enabled solutions to support better learning and living experiences, the discovery of new knowledge, and the sustainability of resources.

Ranked amongst the world's top universities, the University's main campus is also frequently listed among the world's most beautiful. Known for its sustainability, over 95% of its building projects are certified Green Mark Platinum. Apart from its main campus, NTU also has a medical campus in Novena, Singapore's healthcare district.

For more information, visit www.ntu.edu.sg

About SLA

Singapore Land Authority (SLA) is a statutory board with the Ministry of Law. Its mission is to optimise land resources for the social and economic development of Singapore. SLA manages some 11,000 hectares of State land and about 2,700 State

properties, which have largely been tenanted out for a variety of uses. It also manages land sales, leases, acquisitions and allocation, developing and marketing land-related information, and maintaining the national land information database through digitised land information services. Being the national land registration authority for property transactions, SLA issues and guarantees land titles in Singapore. It also manages and maintains the national land survey system, where boundaries or legal limits of properties are defined, based on a coordinated cadastre survey system. The use of geospatial information is also spearheaded by SLA through a national collaborative environment where geospatial data, policies and technologies are established and defined, thereby fostering innovation, knowledge and value creation for the Government, enterprises and community.

For more details, visit www.sla.gov.sg or find us on Facebook and Instagram @SingaporeLandAuthority.

About the Earth Observatory of Singapore

The Earth Observatory of Singapore (EOS) conducts fundamental research on earthquakes, volcanic eruptions, tsunamis, and climate change in and around Southeast Asia, toward safer and more sustainable societies.

Created in 2008 as a Research Centre of Excellence at Nanyang Technological University, Singapore (NTU Singapore), EOS has never been more important for Singapore and Southeast Asia. Disasters connected with natural hazards affect increasingly large populations, and in many cases are compounded by the threat of climate change and rising sea levels. EOS generates scientific breakthroughs that meet our societal needs and improve the lives of those that live in the region.

For more information, visit www.earthobservatory.sg

ANNEX A - SiReNT

Developed by SLA in 2006, the Singapore Satellite Positioning Reference Network (SiReNT) is a national reference network infrastructure that supports real-time high precision Positioning, Navigation and Tracking (PNT) of up to 3cm. The technology is used by both Government agencies and private companies in applications that precising positioning is required. This includes in self-driving vehicles, construction automation and high accuracy mapping. More information on SiReNT can be found on https://app.sla.gov.sg/sirent/