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Satellite Data to Bolster Singapore's Environmental Research

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The Earth Observatory of Singapore (EOS) will lead the [collaboration](#) between the Nanyang Technological University (NTU Singapore) and Singapore Land Authority (SLA) in using Global Navigation Satellite System (GNSS) data for scientific studies.

The EOS, as the NTU Singapore Research Centre of Excellence, provides researchers with access to GNSS data collected by SLA's Singapore Satellite Positioning Reference Network (SiReNT), as well as to its archived historical data.

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 Singapore's climate change response.

– Associate Professor Emma Hill, Acting Chair, Asian School of the Environment and Principal Investigator, Earth Observatory of Singapore

Hill acknowledged that Singapore's GNSS data from the past is very important for understanding how the land and coast have changed over time. Using precise positioning technology like SLA's SiReNT can help with more than just positioning and mapping. It can also open a lot of new ways to deal with the increasingly complicated problems caused by climate and environmental changes.

With the combined knowledge of SLA and EOS, they want to use the rich historical data to co-create solutions for a new era of predicting and preparing for coastal and land changes to help Singapore deal with and lessen the effects of climate change.

The collaboration between NTU and SLA supports the university's NTU 2025 strategic plan, which aspires to address humanity's great issues on sustainability and speed the translation of academic discoveries into solutions that lessen the human effect on the environment.

Together with EOS's development of new coastal GNSS reference stations in Singapore, this will enable research into more accurate methods of measuring land height and sea-level changes around the country, as well as the effect of the atmosphere on the weather and climate on the island nation.

GNSS refers to various satellite navigation systems, including the well-known Global Positioning System (GPS), which can be used by systems such as SLA's SiReNT to produce precise positioning data with a 3 cm accuracy.

The NTU-SLA agreement will establish four-year cooperation that will contribute to the Centre for Climate Research Singapore's National Sea Level Programme (NSLP), which is supported by the National Research Foundation and the National Environment Agency.

Furthermore, during the duration of the collaboration, EOS will analyse previous GNSS data provided by SLA in order to determine how certain places' land height has changed. This would increase the accuracy

of elevation measurements generated from Interferometric Synthetic Aperture Radar (InSAR), the technique currently employed by NTU to map ground deformation over Singapore and other cities in the region.

In Singapore, EOS and SLA will deploy up to four additional coastal GNSS stations for data gathering to develop innovative approaches for monitoring both land height and sea-level changes. Additionally, they will be incorporated into the SiReNT infrastructure and services to maximise resource utilisation. Also, the existing SiReNT station data will be incorporated to assist this goal.

Simultaneously, EOS will study unique ways to use data from existing GNSS, such as investigating the amount of water vapour in the atmosphere. By characterising the atmospheric processes that impact Singapore at different timeframes, scientists may determine where and when localised weather systems are likely to cause heavy precipitation.

EOS researchers will also attempt to employ GNSS data in regional meteorological studies. By comparing and analysing GNSS and meteorological data in detail, the scientists hope to gain a deeper understanding of precipitation and extreme weather events.