



Satellite stations • More accurate way to measure land sinking | A18

Earth Observatory of Singapore to use satellite tech to study land sinking

Reference stations will provide data on changes in land height and sea levels

Lynda Hong
Senior Environment Correspondent

To further measure the extent of land sinking in Singapore, the Earth Observatory of Singapore (EOS) at Nanyang Technological University is harnessing the use of satellite technology to improve the accuracy of data on land height and sea levels.

EOS set up the first of four reference stations on Lazarus Island in May. The next station will be located in Punggol, pending approvals from the Singapore Land Authority (SLA) and National Parks Board.

The remaining two stations are likely to be set up in Tuas and near Sungei Buloh, with the installations of all four stations targeted to be completed in the next two years.

The four are global navigation satellite system (GNSS) stations. GNSS is a collective term for various satellite navigation systems, including the widely recognised Global Positioning System.

Measuring land-height levels can help determine land subsidence, which in Singapore is at a relatively low rate, at about 1mm/year on average. Sea-level rise relative to local land height provides an indication of how quickly coastal land gets submerged in the sea.

The EOS reference stations are perched on top of tripods on a foundation of between 0.6m and 2.5m below ground for stability.

Direct signals beamed straight from satellites to reference stations

will furnish data on changes in land height, which is the height above mean sea level.

As radio signals are transmitted from satellites, some of the signals received by the reference stations will bounce off the ocean's surface and then return to the satellites, furnishing data on sea-level changes.

EOS researcher Nurdin Dahlan, who surveyed Singapore for suitable areas to locate the GNSS stations, said the stations are located near the sea and under open skies

WHY DATA IS NEEDED

Reliable, suitable projections are crucial for coastal management and adaptation. However, predictions of future sea level are often based on global models that incorporate very little information for South-east Asia. So it is important to quantify the changes in land height change and sea-level rise from climate change.



EARTH OBSERVATORY OF SINGAPORE RESEARCHER PENG DONGJU

in order to optimise estimates on both sea and land height levels.

Under a four-year collaboration that is expected to contribute to Singapore's National Sea Level Programme (NSLP), nine existing reference stations set up by SLA across the island would help to provide more data.

EOS researchers will use the data from SLA and EOS stations, including over a decade of SLA's archived historical GNSS data, to produce more accurate estimates of sea-level changes in Singapore, and help in the national projections of future sea levels under the NSLP.

EOS researcher Peng Dongju said: "By analysing their (SLA's) data, we might be able to know whether Singapore (land) is subsiding, and at what rates."

In 2022, EOS published a study with findings that land sinking is happening faster in many coastal cities in South-east Asia than anywhere else in the world. Land subsidence, Dr Peng said, can be caused by tectonics, earthquakes, land reclamation and extraction of underground resources such as water, oil and gas.

She added that land subsidence will happen even faster with the rise of sea levels induced by climate change, increasing the risk of flooding, especially in coastal areas.

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lyndahong@sph.com.sg



The Earth Observatory of Singapore set up the first of four reference stations on Lazarus Island in May. The stations are perched on top of tripods on a foundation of between 0.6m and 2.5m below ground for stability. PHOTO: NTU SINGAPORE/EOS