NANYANG TECHNOLOGICAL UNIVERSITY

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Using radar to better predict earthquakes

NTU and NUS centres studying data to unearth clues on future quakes

By Amresh Gunasingham

LARGE earthquakes occur when faults deep beneath the ground rupture.

This, in turn, can cause the earth's surface to move several metres. To geologists, measuring this movement can provide important clues in pinpointing where and how the next severe quake will strike.

Though still not an exact science, such research has been boosted significantly since the 1980s, with the invention of high-precision instruments such as Global Positioning System (GPS) stations and satellites.

The advantage of using individual GPS stations is that they provide precise measurements of any movement of the ground within a given area, said geologist Kerry Sieh, who heads the Earth Observatory of Singapore (EOS) at the Nanyang Technological University.

The disadvantage, though, is that they cannot give the same information over a wider area, and they are also costly to maintain.

Now, researchers at the Centre for Remote Imaging, Sensing and Processing (Crisp) at the National University of Singapore (NUS) believe access to another type of satellite technology, which uses radio waves, could plug this gap.

Interferometric Synthetic Aperture Radar (InSAR) images, in a nutshell, involve Crisp buying data from the Japanese satellite Alos Palsar, which it then uses to produce interferometric maps of equatorial regions.

These maps show the displacement that occurs during an earthquake with an accuracy of within a centimetre for areas that are as large as a few hundred square kilometres, or roughly the size of Singapore.

Radar works by transmitting a radio wave signal, and measures the energy and wavelength that bounce back, said Crisp director Kwoh Leong Keong.

He added that Singapore was only the second country in Asia, after Japan, to gain access to the technology.

InSAR images have been used in the West to track quake activity since the early 1980s, but the launch of the Japanese satellite five years ago provides radar signals with a "longer wavelength".

Crisp research scientist Emmanuel Christophe explained that this was a boon for tropical terrains, where radar images had previously been hampered by the presence of thick vegetation or a high concentration of water vapour in the air.

"The challenges of measuring a few centimetres of displacement from a satellite flying at 7 km per second and 700km above the ground are particularly difficult, while the equatorial region, with its typical dense vegetation and mountainous terrain, makes the task even harder."

The technology has already been put to the test: Dr Christophe has mapped ground shifts along the disaster zone from the Jan 12 Haiti quake that struck about 25km from the capital Port-au-Prince.

Initial findings suggest that the length of the rupture was shorter than originally estimated, implying that other parts of the fault remain under strain and could jolt a quake in future.

Such information, if verified, is important for policymakers tasked with reconstruction efforts in the city, as an equally strong quake could occur in future when the section of the fault nearer the city ruptures, said Professor Sieh.

He leads a team of researchers gathering data from a network of GPS stations stretching around quake-prone Sumatra to determine the level of seismic activity going on there.

Using both technologies together makes for a "powerful combination", Prof Sieh said.

EOS is collaborating with Crisp on the study.

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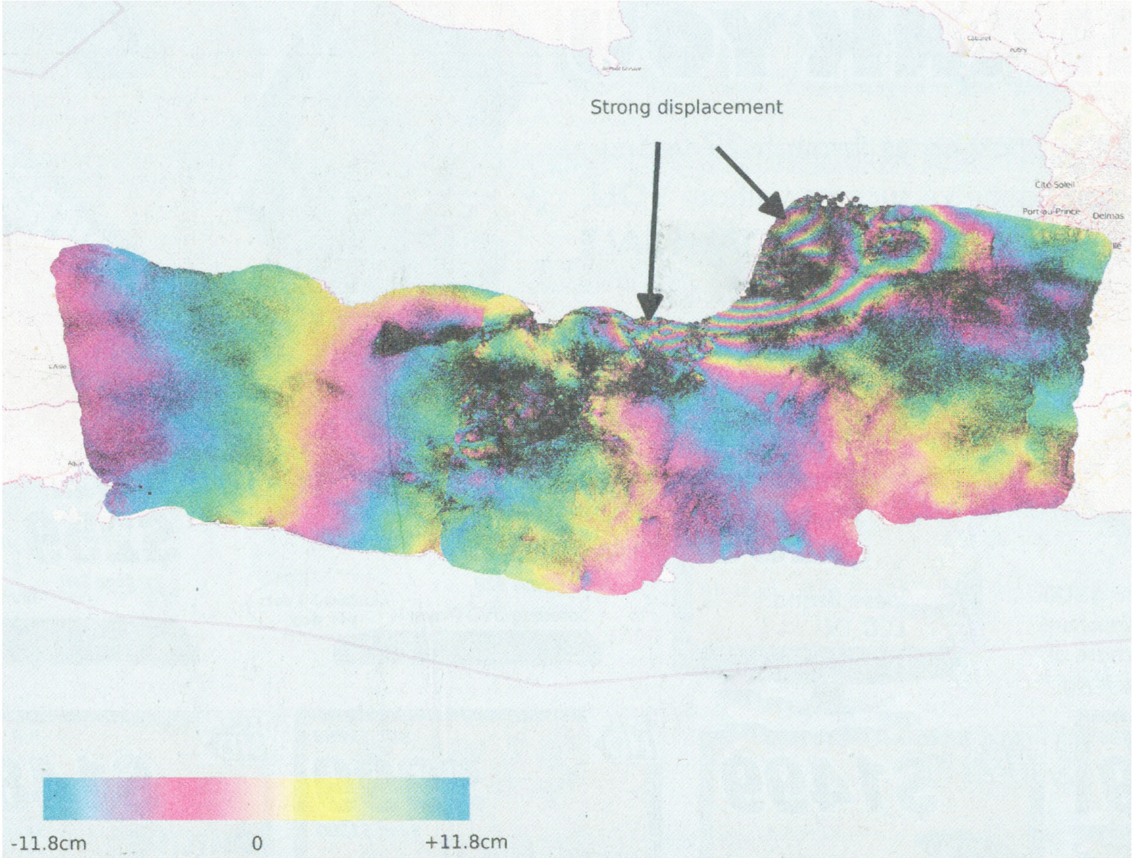

An interferogram of Haiti, obtained from the Japanese Alos Palsar satellite, showing the area hit by the Jan 12 earthquake. Each colour cycle, or occurrence, denotes a 118mm motion in the direction of the satellite's line of sight. Close fringes, or spaces between each colour cycle, denote strong displacement. PHOTO: NUS