

Space-based radar suggests North Korean nuke equivalent to '17 Hiroshimas'

November 14 2019

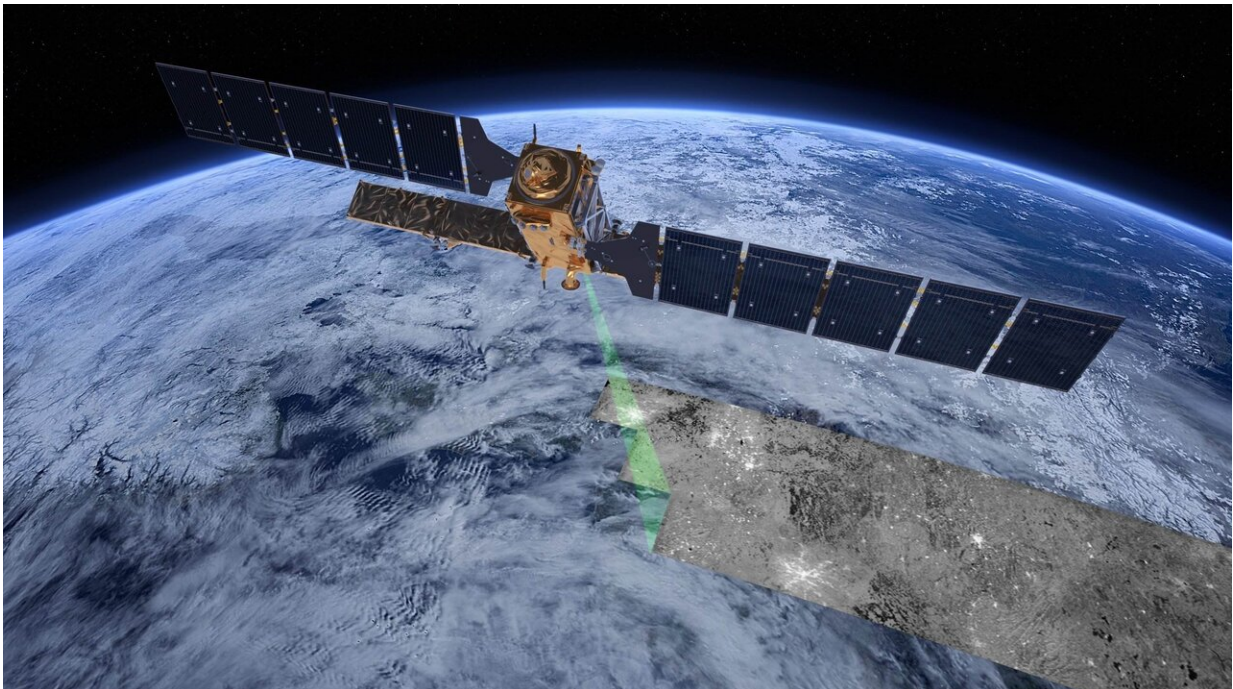


Figure 1. Digital rendering of the earth observation satellite Sentinel-1. Satellites such as Sentinel-1 and ALOS-2 carry advanced synthetic aperture radars that can provide data to map changing land cover, ground deformation, ice shelves and glaciers, and can be used to help emergency response when disasters such as floods strike, and to support humanitarian relief efforts at times of crisis. Credit: ESA / ATG medialab

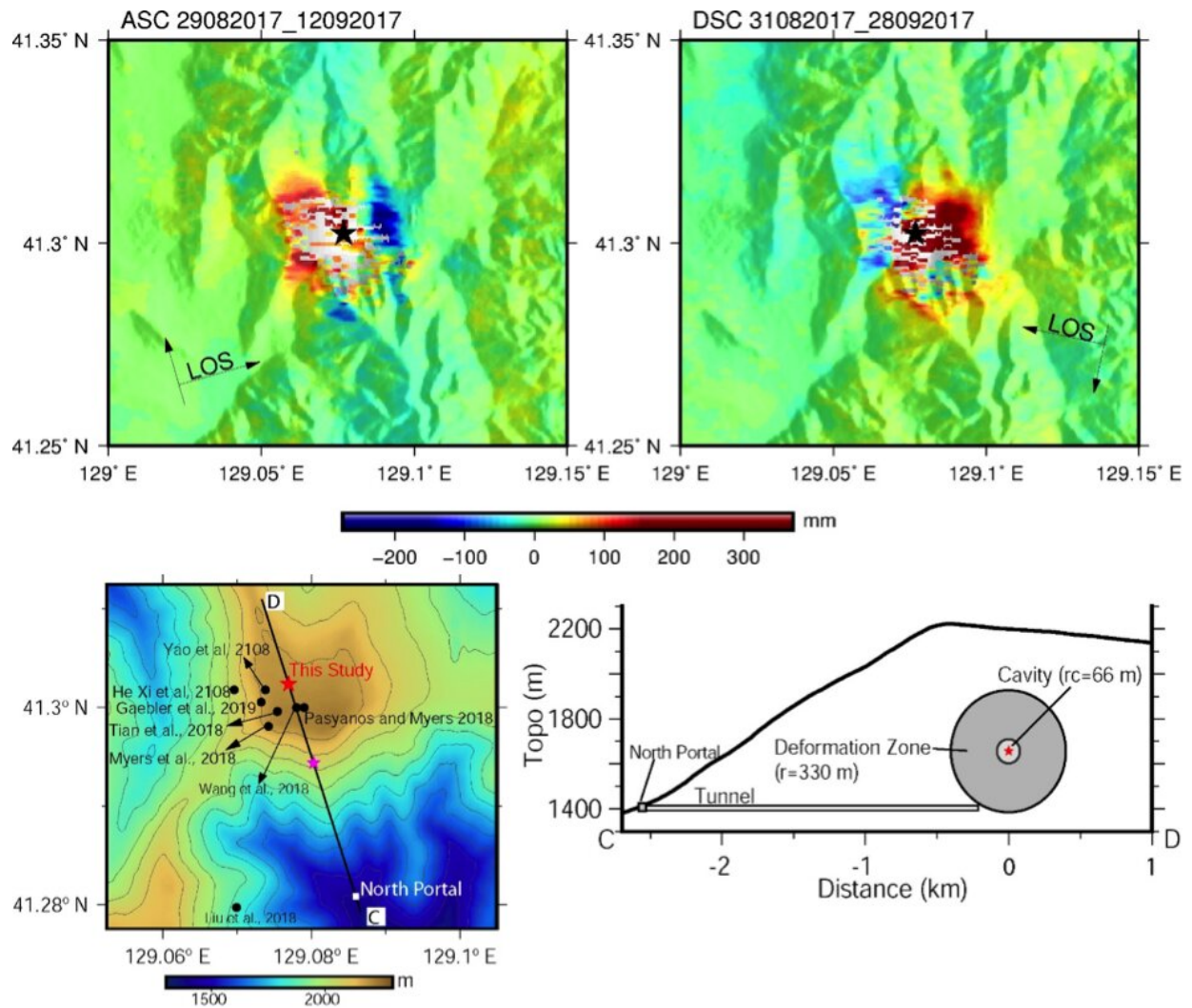
North Korea withdrew from the Treaty on the Non-Proliferation of

Nuclear Weapons in 2003. It subsequently developed nuclear weapons, with five underground nuclear tests culminating in a suspected thermonuclear explosion (a hydrogen bomb) on 3 September 2017. Now a team of scientists, led by Dr. K. M. Sreejith of the Space Applications Centre, Indian Space Research Organisation (ISRO), have used satellite data to augment measurements of tests on the ground. The researchers find that the most recent test shifted the ground by a few meters, and estimate it to be equivalent to 17 times the size of the bomb dropped on Hiroshima in 1945. The new work appears in a paper in *Geophysical Journal International*, a publication of the Royal Astronomical Society.

Conventional detection of nuclear tests relies on seismic measurements using the networks deployed to monitor earthquakes. But there are no openly available seismic data from stations near this particular test site, meaning that there are big uncertainties in pinpointing the location and size of nuclear explosions taking place there.

Dr. Sreejith and his team turned to space for a solution. Using data from the ALOS-2 satellite and a technique called Synthetic Aperture Radar Interferometry (InSAR), the scientists measured the changes on the surface above the test chamber resulting from the September 2017 explosion, sited at Mount Mantap in the northeast of North Korea. InSAR uses multiple radar images to create maps of deformation over time, and allows direct study of the sub-surface processes from space.

The new data suggest that the explosion was powerful enough to shift the surface of the mountain above the detonation point by a few meters, and the flank of the peak moved by up to half a meter. Analysing the InSAR readings in detail reveals that the explosion took place about 540 meters below the summit, about 2.5 kilometers north of the entrance of the tunnel used to access the [test](#) chamber.



Based on the deformation of the ground, the ISRO team predict that the [explosion](#) created a cavity with a radius of 66 meters. It had a yield of between 245 and 271 kilotons, compared with the 15 kilotons of the "Little Boy" bomb used in the attack on Hiroshima in 1945.

Lead author of the study, Dr. Sreejith, commented, "Satellite based radars are very powerful tools to gauge changes in earth surface, and

allow us to estimate the location and yield of underground nuclear tests. In conventional seismology by contrast, the estimations are indirect and depend on the availability of seismic monitoring stations."

The present study demonstrates the value of space-borne InSAR data for measurement of the characteristics of underground nuclear tests, with greater precision than conventional seismic methods. At the moment though nuclear explosions are rarely monitored from space due to a lack of data. The team argue that currently operating satellites such as [Sentinel-1](#) and ALOS-2 along with the [NASA-ISRO Synthetic Aperture Radar](#) (NISAR) mission, due to launch in 2022, could be used for this purpose.

More information: K M Sreejith et al. Constraints on the location, depth and yield of the 2017 September 3 North Korean nuclear test from InSAR measurements and modelling, *Geophysical Journal International* (2019). [DOI: 10.1093/gji/ggz451](https://doi.org/10.1093/gji/ggz451)

Provided by Royal Astronomical Society

Citation: Space-based radar suggests North Korean nuke equivalent to '17 Hiroshimas' (2019, November 14) retrieved 11 May 2024 from <https://phys.org/news/2019-11-space-based-radar-north-korean-nuke.html>

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