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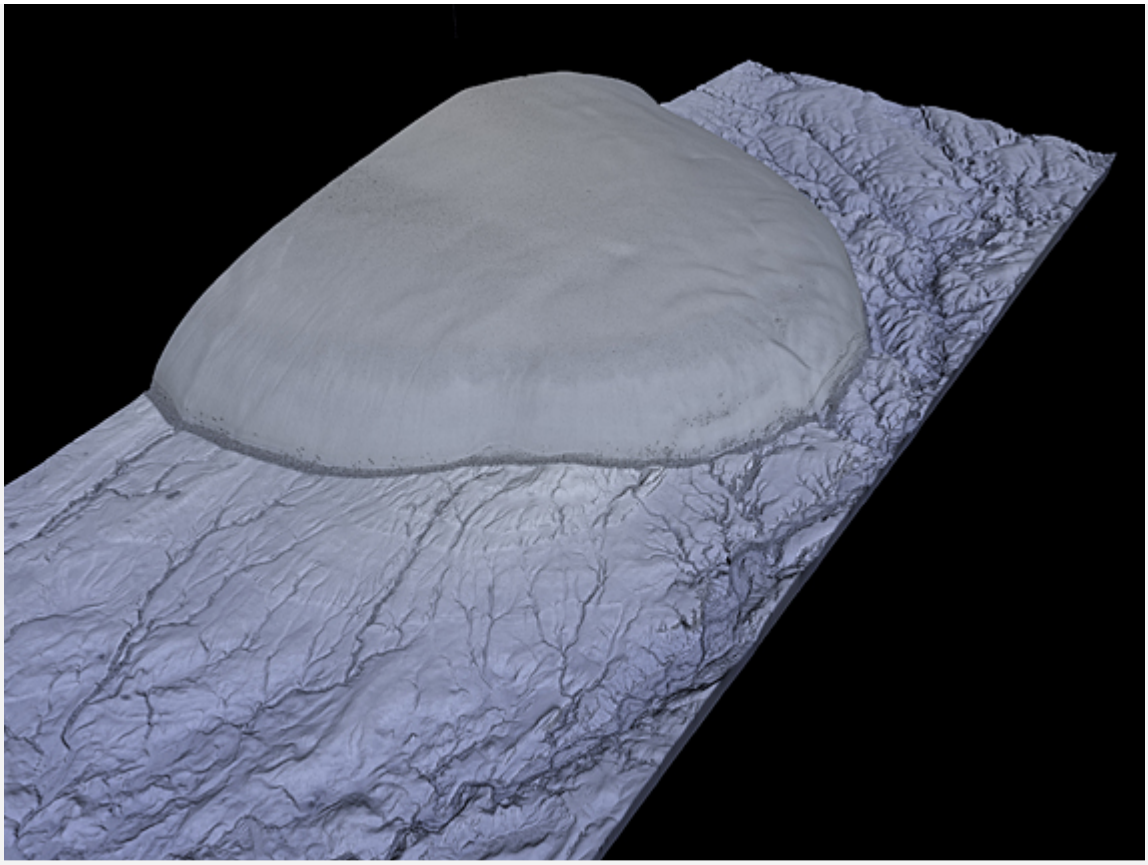
# TanDEM-X delivers first 3D images

*22 July 2010*

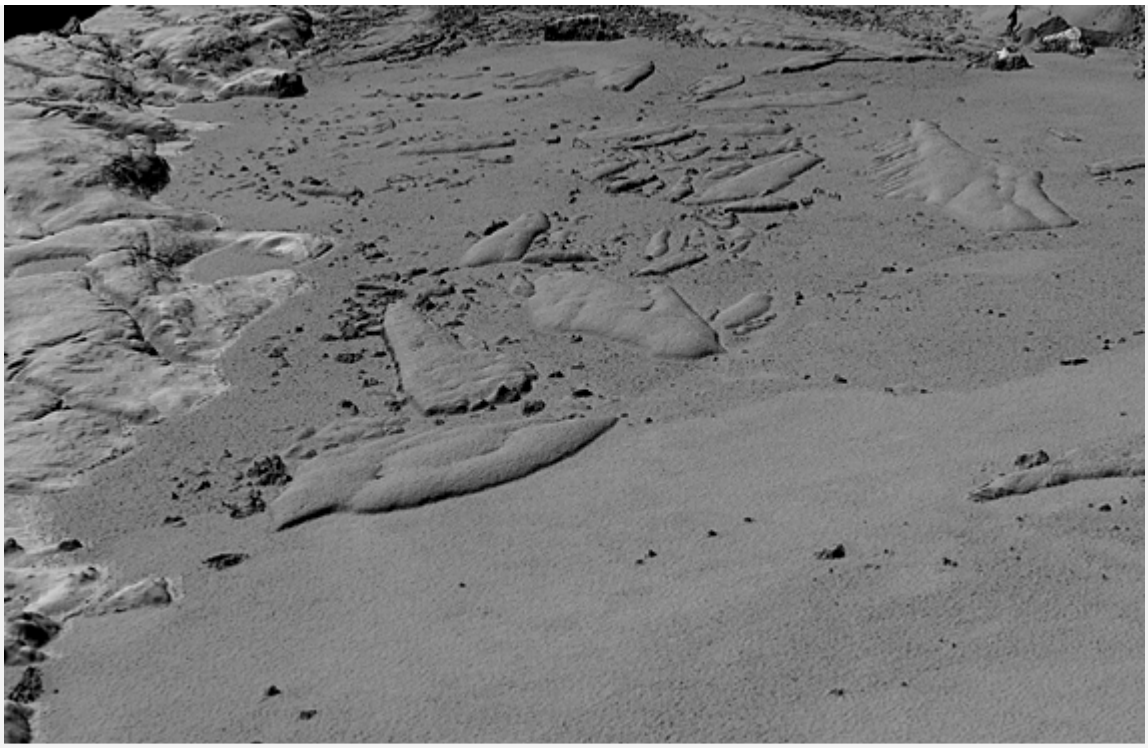
On 22 July 2010, researchers at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) facility in Oberpfaffenhofen published the first 3D images from the TanDEM-X satellite mission. Just one month after the launch of TanDEM-X (TerrraSAR-X add-on for Digital Elevation Measurement), which took place on 21 June 2010, DLR researchers have created the first digital elevation model – almost a week ahead of schedule. A group of Russian islands in the Arctic Ocean was selected for the first test.



Ice cap in the middle of October Revolution Island

## Precise to a few centimetres

This first elevation model shows amazing views of the icy Russian October Revolution Island, the largest island of the Severnaya Zemlya group. Details such as the height of the glaciers and individual moving ice sheets have never before been measured from space with a precision of a few centimetres. In addition, the height of a vast ice cap in the centre of the island is mapped accurately. Until now, there has been no data of this quality about this strange world. The Shuttle Radar Topography Mission, the international mission by NASA, DLR and other space agencies that flew in 2000, could not observe these polar regions – they are very important for climate research.



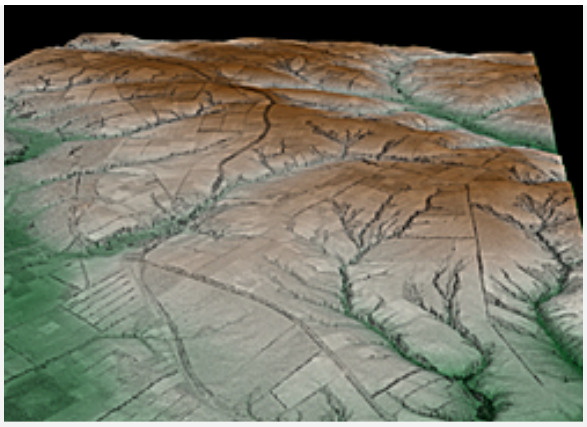
Ice floes on the coast of October Revolution Island

### 3D images by 'squinting'

In order for 3D images and elevation models to be obtained, TanDEM-X must fly in close formation with its twin satellite, TerraSAR-X, which has been in orbit since 2007. This way, the two satellites can image the same regions of Earth’s surface from different viewing angles. Close formation flying is yet to be achieved. Nevertheless, DLR researchers were able to generate the first 3D images by waiting for the optimum time when the two satellites – in their near-polar orbits – were very close together.

The ground tracks – the orbits of the two satellites projected onto the Earth’s surface – cross at the North Pole. When both satellites fly over this imaginary intersection at slightly different times, they come close to one another. On 16 July 2010, the researchers used this special arrangement and generated the first elevation model with the satellites 370 kilometres apart. Because this distance is still comparatively large, the radar experts had to reach deep into their bag of tricks and make the fullest use of the flexibility of the satellites. In order to simultaneously image the same area with both satellites, the antennas were not oriented perpendicular to the ground, but were tilted to one side. The two antennas ‘squinted’ to view the same point on Earth. The data obtained using this special antenna pointing was then transmitted to the ground.

"We are relieved that these first acquisitions have worked so well. This means that already at this first stage, the interaction between the two satellites is functioning correctly, the orbits are controlled accurately and our ground systems are also working well," said Gerhard Krieger, the TanDEM-X System Engineer — he had the idea for this particular experiment.



Kalach on Don

### Starting point for further elevation models

The first successful experiment is the starting point for more 3D images. Close approach of the satellites also allowed acquisition of test images at lower latitudes. Shortly after the first acquisition, the opportunity arose to image a 50 x 30 kilometre area in the southern Russian region of Kalach on Don, about 100 kilometres northwest of Volgograd. This area was the target of the very first TerraSAR-X radar acquisition.

"This new elevation data give an idea of the Digital Elevation Model products that will be available from the TanDEM-X mission. For the first time, one sees the small height differences in roads, field boundaries and rivers. This opens up fantastic prospects for the application of this data – for example, for the prediction of flooding areas in the event of a disaster," said the DLR engineer responsible for processing the elevation model data, Thomas Fritz.

### Slowly converging in space

In the meantime, the distance between TerraSAR-X and TanDEM-X has been reduced to 20 kilometres and this will be maintained for the next few months. Extensive system tests and calibration activities will be carried out during this time. Close formation flying will begin in the autumn of 2010. The distance between the two satellites will first be brought to 500 metres and then, for the period during which the elevation models are being recorded, it will be reduced to 200 metres.

DLR is implementing the TanDEM-X mission with funds from and on behalf of the German Federal Ministry of Economics and Technology (Bundesministeriums für Wirtschaft und Technologie; BMWi) in a public-private partnership with Astrium GmbH.

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