



TerraSAR-X satellite data reveals destruction caused by tsunami in Japan

16 March 2011

The German Remote Sensing Data Center (Deutsches Fernerkundungsdatenzentrum; DFD) and the German Space Operations Center (GSOC), both of which are part of the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR), are continuing to provide as much data as possible from the two German radar satellites, TerraSAR-X and TanDEM-X, for the assessment of damage caused by the recent tsunami in Japan. Radar data, in contrast to data from optical satellites, can be acquired independently of cloud cover or time of day and allow precise identification of the flooded and destroyed areas on the east coast of Japan.

120,000 people affected in coastal areas near Sendai

"Based on the images obtained with TerraSAR-X we can now estimate how many people have been affected by the tsunami. From the current damage map, we have been able to determine that about 120,000 people lived in the coastal area near Sendai before the tsunami," said Stefan Dech, Director of the DFD. Staff at DFD's Center for Satellite Based Crisis Information (Zentrum für Satellitengestützte Kriseninformation; ZKI), have matched the data from the radar satellites against global population statistics.

The images obtained with the Earth observation satellites on 12 March 2011, which were recently updated on 15 March at 19:28 CET, show the flooding (blue) and the destruction (cyan) caused by the tsunami in the region of Sendai. The wave's full force, which carried water several kilometres inland, flooded Higashi-Matsushima Airport, which lies directly on the coast, and the port of Ishinomaki (image above). The infrastructure of the port at Sendai (pictured below) was also severely damaged by the tsunami. Boulders and masses of mud (magenta) have accumulated north of the harbour. "To map the damage with radar satellites, you need material that is radiometrically and geometrically precise. With this, you can 'superimpose' TerraSAR-X images acquired at different times and observe the differences caused by the destruction of the tsunami," explained Richard Bamler, Director of DLR's Remote Sensing Technology Institute (Institut für Methodik der Fernerkundung; IMF).

DLR is making data and maps available to Japanese and German organisations – such as the Federal Agency for Technical Relief (Bundesanstalt Technisches Hilfswerk; THW) – in its capacity as a member of the International Charter 'Space and Major Disasters'. The charter is a consortium of space agencies and satellite operators providing a unified system of data acquisition and delivery to authorised users quickly and free of charge in the event of natural disasters. ZKI, assisted by DLR Space Management, is responsible for the operational implementation of this task. In addition to the images from TerraSAR-X and TanDEM-X, ZKI also evaluates data from the German RapidEye optical satellites and the US WorldView-2 satellite.

Extensive coverage

"The advantage of satellite data is that it allows us to assess the damage extensively and objectively. This information is particularly important to better coordinate rescue and relief efforts," explained Dech. ZKI has been active in more than 100 crisis situations worldwide since 2004; the scientists work around the clock, seven days a week.

GSOC is responsible for monitoring and controlling TerraSAR-X and TanDEM-X. "We receive specific image requirements from ZKI with short notice and programme the satellite accordingly," said Felix Huber, Director of GSOC. The commands sent to TerraSAR-X and

TanDEM-X are generally prepared 24 hours in advance; once received, these are automatically executed.

Short notice for reprogramming satellites

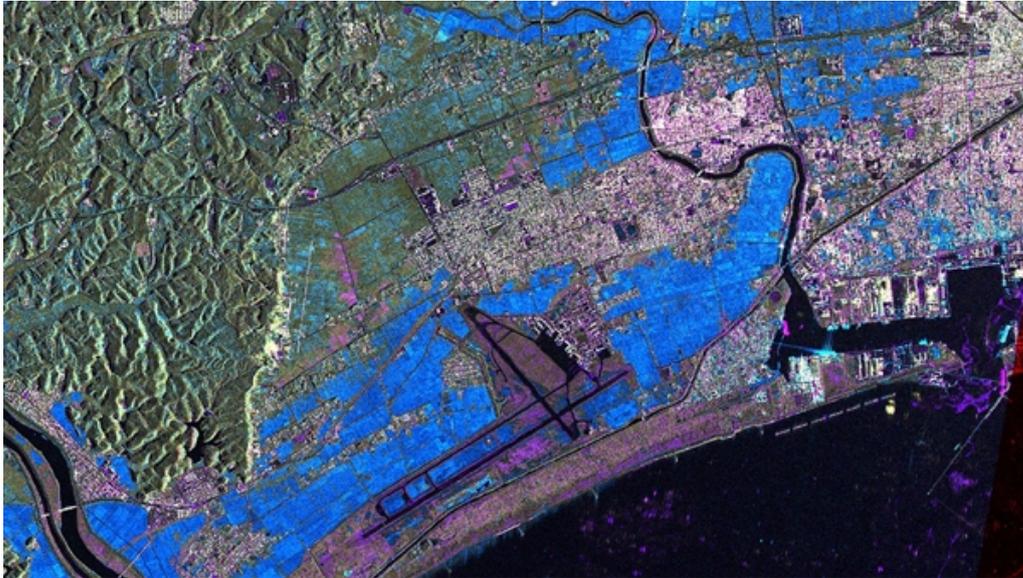
"With the earthquake and tsunami in Japan, we were faced with the need to reprogramme the satellites observations on short notice so that storage and delivery of data to Japan and Germany was possible," Huber continued.

To do this, the GSOC staff have used a double data downlink. "The data is sent directly from the satellites to the Japanese ground station in Okinawa; as soon as the satellites fly over Germany, the same data is sent via the ground station at DLR Neustrelitz to other users, including ZKI," explained Huber. In this way, the data could be made available sooner. This was only possible thanks to GSOC's 24-hour, 7-day shift system.

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The flooded Higashi-Matsushima airport, near Sendai



This radar image, acquired by the German Earth observation satellite TerraSAR-X on 12 March 2011 at 21:43 CET, shows the impact of the tsunami on Higashi-Matsushima Airport and the port of Ishinomaki, near Sendai, on the east coast of Japan. The blue areas indicate the flooding; the magenta-coloured areas show the extent of the destroyed infrastructure.

Credit: DLR.

The port of Sendai after the tsunami



This TerraSAR-X image, acquired on 12 March 2011, shows that the port of the Japanese city of Sendai has been devastated by the tsunami. The magenta-coloured areas reveal the extent of damage in the form of boulders and debris deposits; the blue areas are flooded.

Credit: DLR (CC-BY 3.0).

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