

Quality of the TanDEM-X DEM

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TanDEM-X (TerraSAR-X add-on for Digital Elevation Measurements) is an Earth observation radar mission that consists of a SAR interferometer built by two almost identical satellites flying in close formation. With a typical separation between the satellites of 120 to 500 m a global Digital Elevation Model (DEM) with 2 m relative height accuracy at 12 m posting is being generated. While the main mission phase for DEM data acquisition has been finished in 2014, the processing of the global TanDEM-X DEM will be concluded mid-2016. Final DEMs are well within specifications and feature a low percentage of void areas.

After the launch in June 2010 and the subsequent commissioning phase, global DEM acquisitions started in December 2010. The first and second global coverages (except Antarctica) were completed in January 2012 and March 2013 respectively. After some gap-filling, Antarctica was mapped for the first time under local winter conditions. In early August 2013 the helix formation was changed to allow imaging of mountainous areas from the opposite viewing geometry. Due to lack of SNR, desert areas had to be re-acquired as well, but at steeper incidence angles. Afterwards the satellites were maneuvered back to the original formation and Antarctica was covered again at larger baselines. The primary data acquisition program was concluded mid-2014.

Since the end of 2013 the final calibration and mosaicking chain is fully operational and is about to complete the global DEM consisting of more than 19,000 one by one degree tiles. The cumulated absolute height error is with 1.3m outstanding and one order of magnitude below the 10m requirement. As the system is very well calibrated and tilts and trends are negligible, the relative height accuracy is well described solely by the random errors in the system. It can be calculated from the interferometric coherence and the resulting phase error. It is specified as the point-to-point error within a one by one degree tile. More than 98.5% of all DEM tiles fulfil the relative height error specification of 2 m (4 m) for flat (steep) terrain. Dense forests and ice covered terrain is excluded from this analysis as volume decorrelation effects deteriorate the coherence estimates. Finally, compared to SRTM the TanDEM-X DEM features a much lower percentage of void areas, especially in desert areas, a result of the re-acquisition at steeper incidence angles and hence better SNR.

As both satellites are still working very well and have plenty of resources left, an agreement to continue the mission beyond 2015 was concluded between DLR und AIRBUS Defence & Space. Acquisition of interferometric data for and generation of local DEMs of even higher accuracy level (posting of 6 m and relative vertical accuracy below 1m) is the key objective for this new mission phase. If the baseline geometries are suitable further scientific experiments will be included in the timeline as well.