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TANDEM-X & TANDEM-L: SETTING BENCHMARKS IN RADAR REMOTE SENSING

Abstract

The operation of two SAR satellites flying in close formation enables bistatic operation allowing for highly accurate single-pass interferometry. TanDEM-X has been successfully demonstrating this novel technique since 2010. With a typical separation between the TerraSAR-X TanDEM-X satellites of 120 to 500 m a global DEM with 1 m height accuracy at 12 m posting has been generated. Final DEMs are well within specifications and feature an extremely low percentage of void areas. Satellite resources allow for a continuation of the mission for several years. Beyond improvements of the global DEM the mission is currently dedicated to the generation of a global 3D change layer.

Tandem-L, a proposal for an innovative L-band SAR mission, is also employing bistatic interferometry aiming at the systematic observation of dynamic processes on the Earth's surface. Thanks to the novel imaging techniques and the vast recording capacity of up to 8 Tbytes/day, it will provide vital information for solving pressing scientific questions in the biosphere, geosphere, cryosphere, and hydrosphere and will make an essential contribution for a better understanding of the Earth system and its dynamics. The mission concept is based on the use of two L-band SAR satellites with variable formation flight configurations and is distinguished by its high degree of innovation. Examples are the polarimetric SAR interferometry for measuring forest height, multi-pass coherence tomography for determining the vertical structure of vegetation and ice, as well as the utilization of the latest digital beamforming techniques in combination with a large deployable reflector for increasing the swath width and imaging resolution. The systematic acquisition concept is based on two imaging modes: 1) 3-D structure mode featuring bistatic operation and 2) Deformation mode based on differential interferometry , both allowing the following mission objectives to be achieved:

- global measurement and monitoring of 3-D forest structure and biomass,
- systematic recording of small and large scale deformations of the Earth's surface with millimeter accuracy,
- quantification of glacier movements, 3-D ice structure and melting processes in the polar regions,
- fine scale measurements of soil moisture and its variations,
- systematic observation of coastal zones and sea ice,
- monitoring of agricultural fields, as well as,
- generation of highly accurate global digital elevation models.

In this presentation, we provide a summary of the TanDEM-X DEM performance and an overview of the current status and and innovations of Tandem-L and its main application areas.