HIGH RESOLUTION INTERFEROMETRIC STACKING WITH TERRASAR-X

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ABSTRACT

The German radar satellite TerraSAR-X was launched in June 2007. Radar interferometry (InSAR) is supposed to be one of the major applications of this sensor. It allows the three- dimensional mapping of the Earth's surface (InSAR) or even its displacement effects using differential interferometry (D-InSAR) or the more advanced persistent scatterer interferometry (PSI). All InSAR-applications are well-supported by the sensor, the SAR-processor and the mission design. DLRs operational interferometric system PSI-GENESIS has been adapted to cope with the new sensor and the innovative acquisition modes. Interferometric example applications could be shown already in the early stage of the six months commissioning phase.

The interferometric assessments from the commissioning phase indicate that many interferometric aspects change for the deformation monitoring using stacking techniques. The spotlight mode and the high radar bandwidth of 300 MHz provide a resolution of 1.1 m x 0.6 m. Together with the short radar wavelength of about three centimetres surfaces of man made features e.g. roads and building roofs and fronts provide a long time coherent radar return based on distributed scattering. Complementary, the number of point scatterers which are candidates for a high precision long time deformation monitoring increases significantly compared to the data from radar sensors used so far. The precision their distance to the sensor can be measured improves. This enhancement is based on a better signal to clutter ratio (SCR) compared to recent sensors and the doubled sensitivity caused by the short radar wavelength. Additionally, data stacks can be build up much faster. The repeat cycle of 11 days only can be the basis for an improved modelling of displacements or can provide even a model free phase unwrapping in time. A now feasible spatial phase unwrapping allows to support the temporal phase unwrapping.

All these new aspects allow innovative applications for the deformation monitoring. However the implemented techniques and algorithms need to be adapted. Examples for advanced deformation measurements are shown and the presentation will comprise practical tips and guidelines for the deformation monitoring algorithms which are based on the TerraSAR-X standard products. These basic products are generated by the TerraSAR Multi Mode SAR Processor (TMSP) and are offered by the TerraSAR-X payload ground segment (PGS) to commercial and scientific users.