MONITORING A TUNNELLING IN AN URBANIZED AREA
WITH TERRASAR-X INTERFEROMETRY
– SURFACE DEFORMATION MEASUREMENTS AND ATMOSPHERIC ERROR TREATMENT

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ABSTRACT

We present results from a deformation monitoring to demonstrate potential and limitations of TerraSAR-X interferometry to measure vertical displacements due to the tunnelling of main sewerage pipes along the river Emscher in Germany. In spite of higher sensitivity for deformation gradients the potential for deformation monitoring benefits from high spatial and temporal resolution of the TerraSAR-X data.

We analyzed a large stack of TerraSAR X stripmap scenes to derive regional pattern of vertical displacements with differential SAR Interferometry (dInSAR) and small-scale displacements and deformation of objects (infrastructure and houses) in time series of SAR-scenes with Persistent Scatterer Interferometry (PSI). We show deformation measurements with artificial Corner Reflectors based on time series of consecutive interferograms in comparison with results from PSI. Consecutive interferograms with short-time intervals (11 or 22 days) show high coherence for large areas and therefore are likely less infected by unwrapping errors. First results from PSI are promising with a great number of detected PS.

Atmospheric errors are important for X-Band SAR. Expected deformation in our application are in the range of mm to cm, similar to tropospheric delay features in their spatial and temporal extent. The atmospheric phase screen (APS) in PSI smoothes the non-uniform deformation-history of the progressing tunnelling. We analysed the spatial structures of atmospheric error component in detail.

We validate the deformation measurements with levelling data and with the tunnelling progress in a GIS environment.