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InSAR Based Ground Motion Service for Germany – Natural and Anthropogenic Implications

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Area-wide detection of land subsidence is important information for well-timed hazard mitigation and comprehensive geoscientific understanding of natural and anthropogenic impacts on land surface changes. Using conventional measurement techniques (GNSS, leveling campaigns) remains a challenge due to limitations in spatial coverage and temporal resolution. Advanced multi-temporal remote sensing techniques such as SAR interferometry, allows for the detection of surface movements with large spatial coverage and high temporal resolution. The intention of this contribution is to show how the information content of InSAR can be optimized for a hazard mitigation approach. Though the beneficial use of InSAR methods in tectonics, earthquake analysis and other geologic and geophysical branches is widespread in the scientific community it is still almost nonexistent in the day-to-day business of federal, state and municipal work and planning. Therefore and due to considerably expressed demand from user panels the German government entrusted BGR (Federal Institute for Geosciences and Natural Resources) to keenly foster the integration of national space data together with scientific developments from the InSAR-community in every-day work of German administrative bodies [1].

In collaboration with the State Authority for Mining, Energy and Geology (LBEG) and the German Aerospace Center (DLR) a pilot study focusing on the application of the InSAR technique for detection of land subsidence at natural gas extraction sites with special respect to seismic, paleoseismic and tectonic aspects was performed. Subsequently an area of interest covering approximately 16,000 km² located in the state of Lower Saxony containing several natural gas extraction sites was selected as a pilot area. The calibration of the InSAR based dataset is among others based on the integration of geologic and tectonic knowledge. Tectonically Northern Germany is regarded to be stable, but it turned out that there might be recent slow movements along faults that are generally assumed non active today. Recent slow movements became evident through the longtime measurements of the regional GNSS-Network and calculative considerations of the traces of Fault-Zones in the processing of the InSAR product line. Additionally for a geohazard approach in the German federal state of Rhineland-Palatinate an InSAR study based on ERS/ENVISAT and TerraSAR-X was performed. The extent and the timelines of the mass movements show that the majority of surface movements show a clear correlation to the local geology and geomorphology. Another area for detailed investigation is located in an abandoned underground basalt mining area where locally sinkholes occur.

To mitigate impacts for the living environment and infrastructure protection anthropogenic and natural influences triggering land surface movements need to be understood, detected and monitored. Thus a national ground motion database for Germany based on Copernicus Sentinel 1 data [2] under the auspices of BGR is under construction.

References:

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