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New trends in InSAR time series analysis for wide area deformation mapping

R.F. Hanssen, M. Caro Cuenca, A. Hooper, P. Mahapatra, M. Arikan, and D. Bekaert
Delft University of Technology, the Netherlands (m.carocuenca@tudelft.nl)

Synthetic aperture radar interferometry (InSAR) is a remote sensing technique that is extensively used to measure deformation at the Earth's surface.
Although it has proven very successful to estimate small-scale (up to tens of km) deformation phenomena, InSAR still has limitations when applied to study wide areas (hundreds of km). First, radar observations are affected by atmospheric delay and errors in sensor position (also referred to as orbital errors). Both of these translate into large scale signals in InSAR estimations that can be interpreted as a non-existing deformation phenomenon.
Second, since InSAR produces deformation maps relative to an area (or pixel) that is part of the observed track, combination of adjacent tracks requires the connection of these relative measurements to a common area or reference point. This operation is, however, non-trivial and is preferably performed in combination with in situ data.

In this contribution, we explore different case studies where we address the aforementioned limitations to measure deformation in wide areas. They include the whole country of the Netherlands, the area of El Guerrero in Mexico and the North Anatolian Fault in Turkey.
Our initial strategy is to filter out atmospheric and orbital errors assuming they are uncorrelated in time. However, this assumption does not always hold. Therefore, ancillary data, such as GPS and leveling, is also used for a precise estimation of the large scale deformation signal. Furthermore, datum connection is performed with ancillary data as well where different radar tracks and other geodetic data are combined to obtain the final deformation map in a common reference system. We also explore how compact radar transponders can help to tackle the datum connection problem.