Surface deformation measurements on large computing infrastructures and at home

André Stumpf*[1], David Michéa[2], and Jean-Philippe Malet[1]

[1]Institut de Physique du Globe de Strasbourg, UMR7516 CNRS / Université de Strasbourg / EOST (IPGS) – Institut de Physique du Globe de Strasbourg, UMR7516 CNRS / Université de Strasbourg / EOST – France

[2]CNRS / ICUBE - Université de Strasbourg, Strasbourg, France – CNRS : UMR7357 – France

Résumé

The increasing fleet of optical Earth Observation satellites with high (e.g. Sentinel-2, Doves) and very-high spatial resolution (e.g. Pléiades) generate increasingly large time-series of monoscopic and stereoscopic images providing valuable input for deformation measurements in geomorphology, volcanolgy, glaciology and tectonics. The exploitation of larger time-series still requires considerable expertise, computational resources and specialized commercial software. To enable a large Earth Science community to process easily and rapidly large time series we have developed and implemented coregis (a open-source framework for precise image co-registration) and MPIC (Multiple-Pairwaise Image Correlation). While coregis addresses in particular the current limitations in the co-registration of Sentinel-2 and Landsat-8 time-series it also enables the correction of co-registation residuals among Digital Elevation Models and orthoimages in general. MPIC is built on top of coregis to generate stacks of partially redundant horizontal displacement fields and to compute multi-temporal indicators which allow for a more accurate detection and quantification of surface deformation, as well as a better assessment of the associated measurement uncertainties.

We report the accuracy of coregis which has been assessed through an exhaustive set of experimentats at test sites with diverse environmental settings. The MPIC processor (parallelized algorithm, processing chain, user modes) is presented in detail through examples of processing of time-series of very-high resolution (Pléiades) and high-resolution (Sentinel-2) satellite images with test cases including landslide monitoring, measurements of co-seismic slip and volcano-tectonic surface deformation.

Both processors have been integrated as processing services on the ESA Geohazards Exploitation Platform (GEP) and the A2S 'Alsace Aval Sentinel' infrastructure hosted at the high performance computing facility of University of Strasbourg (MésoCentre Unistra). We further report on our current efforts to release the code as a Python-based open source project and ongoing developments to integrate different strategies for time-series inversion.

*Intervenant