The Multi-Pairwise Image Correlation (MPIC) processing chain, an end-to-end online service for ice motion monitoring using optical imagery

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Documenting ground deformation is important for a range of areas in Earth and environmental sciences (such as earthquake, volcanoes, landslides and glaciers/ice sheets monitoring). In particular monitoring the deformation of the cryosphere is key to understand its evolution in a context of global changes, through the creation of long-term ice velocity datasets, but also possibly detect failure onsets. The availability of optical satellite constellations with a frequent revisit time at medium to high spatial resolution and an open access policy (e.g. Sentinel 2, Landsat 7/8) provides the potential to contribute to ice monitoring on a global basis. However, this observational capability also represents a challenge in term of storage capacity and computing resources which together with the complexity of the tuning of the different parameters, may prevent users from exploiting the data.

Here we propose a new version of the Multi-Pairwise Image Correlation for OPTical images (MPIC-OPT) algorithm. The new version of the algorithm offers a complete chain to process optical images including data download, image pairs creation and advanced analysis of the displacement field. It offers the choice to compute the ground displacement associated to image pairs with two correlation techniques (MicMac, developed by IGN; GéFolki developed by ONERA). Finally, the Time-Series Inversion for Opical image (TIO) algorithm is integrated to provide displacement time series.

The processing chain is accessible through the Geohazards Exploitation Platform (GEP) in the framework of the Thematic Exploitation Platform initiative of the European Space Agency and the
runs are performed using the High Performance Computing facility at the A2S/Mesocentre of University of Strasbourg.

We present the results of the chain in various cryospheric areas: the European Alps glaciers (France, Italy, Switzerland), the Astrolabe ice shelf (Antarctica) and the Gangotri glacier (India). We define some relevant strategies for an operational use of the service for regional monitoring of land-ice from satellite images. We compare the results of the MPIC-OPT-ICE service to in-situ dataset and/or results obtained with similar strategies (e.g. GoLive or ITS-LIVE products, etc.). We discuss the influence of the pair network and the inversion strategy to retrieve short-term to long-term kinematic regimes.