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Multiple-pairwise image correlation for the detection and monitoring of slow-moving landslides from optical satellite image time-series: the MPIC service of the ESA Geohazards Exploitation Platform (GEP)

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Slow-moving landslides are widespread in many landscapes with significant impacts on the topographic relief, sediment transfer and human settlements. While in situ geophysical methods and terrestrial remote sensing are indispensable for a detailed monitoring and understanding of individual landslides, their area-wide mapping and monitoring is still challenging. SAR interferometry has proven useful for the detection and monitoring of very slow movements (< 1.6 m.yr-1) but limitations are encountered for the investigation of slow-moving landslides (1.6 m.yr-1 – 30 m.month-1). Such limitations can be addressed through the analysis of archives of optical remote sensing images.

To make better use of the increasingly available optical time-series, this study proposes a multiple pairwise image correlation (MPIC) technique for the analysis of optical satellite image time-series. The processing technique generates stacks of partially redundant horizontal displacement fields and computes multi-temporal indicators for a more accurate detection and quantification of surface displacement.

The processing technique is implemented as an on-line processing service on the ESA Geohazards Exploitation Platform (GEP) to allow, for selected users, the analysis of satellite optical time-series. The MPIC service (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 at study sites in France, Italy and North America. The accuracy of the derived inventories and displacement time-series and their implications for the understanding of the seasonal landslide dynamics are discussed.