

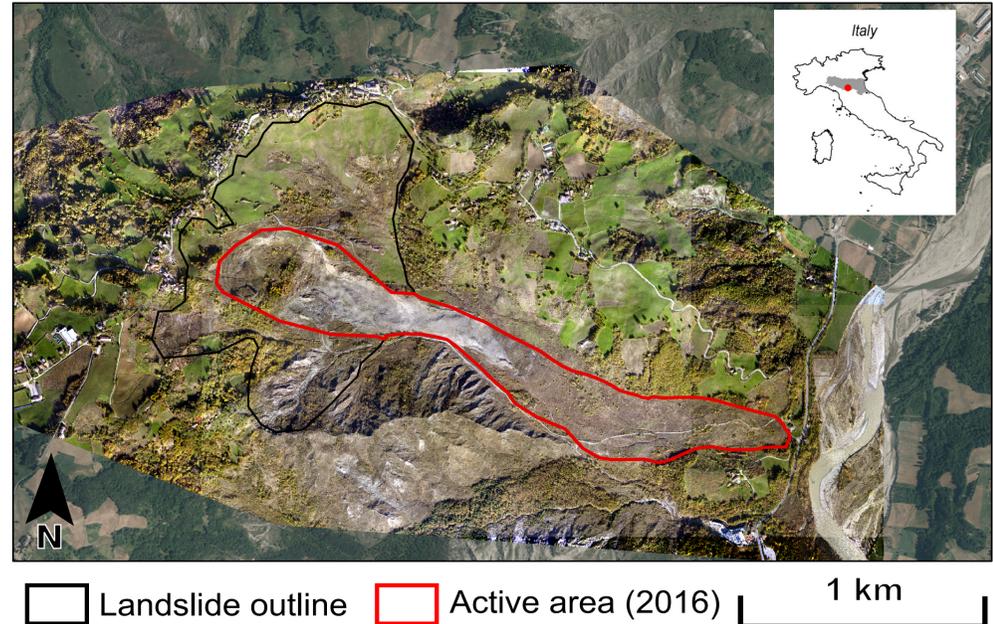
## 1. Abstract

The present study illustrates the workflow followed in order to monitor displacements occurring in large active landslides using Sentinel-2 acquisitions. The high revisit time of the Sentinel-2 mission (10 days until March 2017, 5 days with the complete fleet in orbit) helps to mitigate the requisite of clear sky above the Area Of Interest (AOI) and potentially allows the generation of detailed time-series. The extrapolation of displacement time-series from Sentinel-2 products is based on the Normalized Cross Correlation (NCC) performed on cloud free Sentinel-2 acquisitions of the selected landslide. The so-derived displacements time-series have been validated using continuous GNSS data.

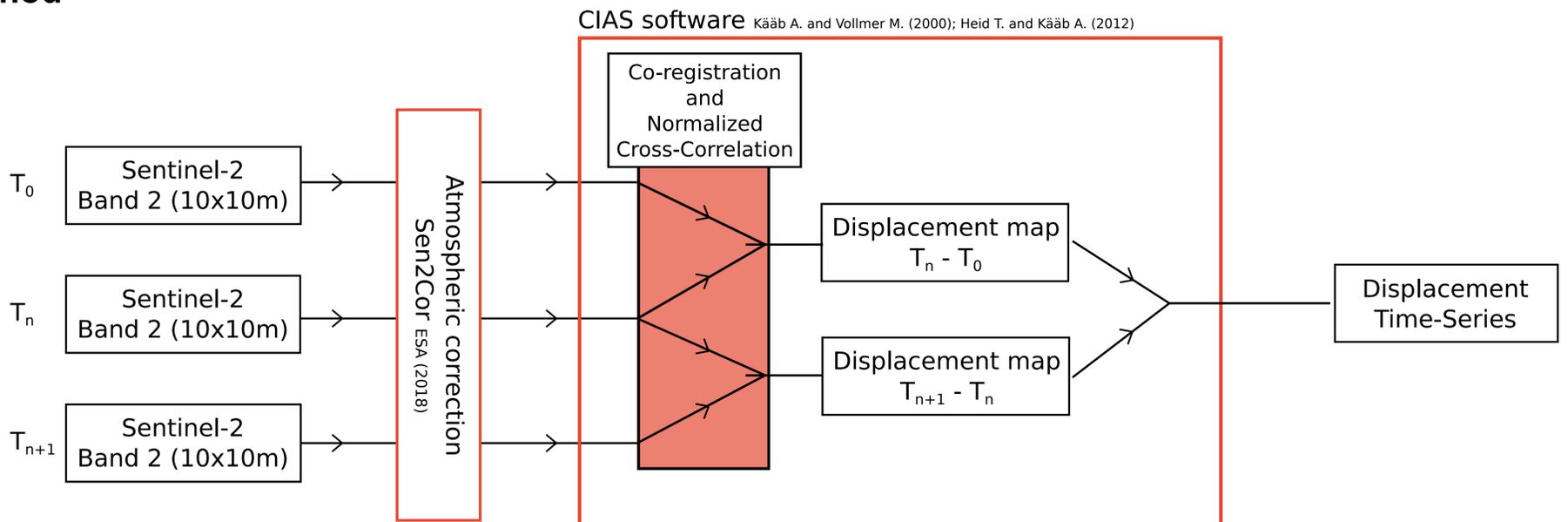


## 2. Case study

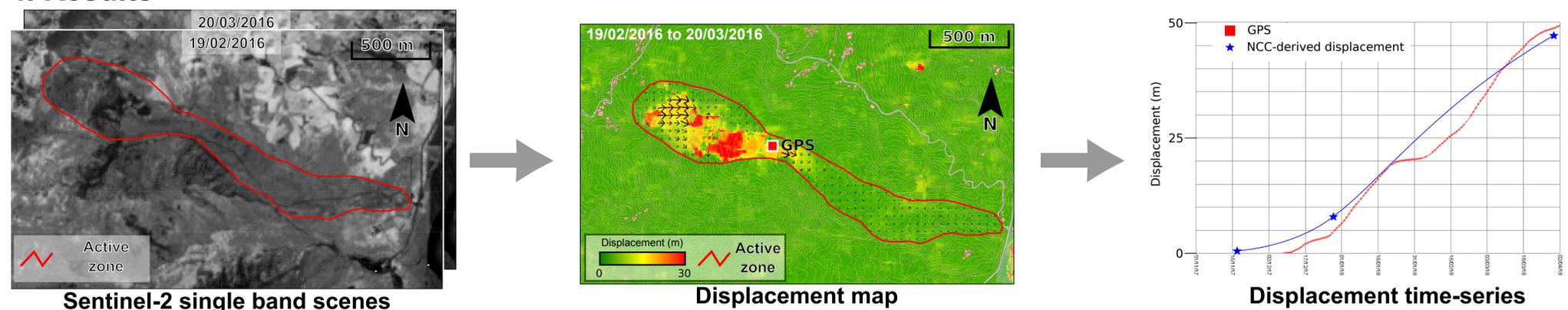
The Ca' Lita landslide is a large mass movement located in the Secchia River Valley, in the sector of the Northern Apennines falling into Reggio Emilia Province, about 70 km west of Bologna (Northern Italy). Its total track length is approximately 3 km and its maximum width is about 1.4 km in the rear scarp area, with a maximum depth of about 50 m in the upper part. Two major reactivations are documented in the last 20 years (1996 and 2004), while, after some remediation works, it was artificially stabilized. Recently, on Spring 2016, displacements up to tens of meters were recorded during a paroxysmal reactivation.



## 3. Method



## 4. Results



## 5. Discussion and further development

Displacement maps with a geometric resolution of 10 meters are retrieved using Sentinel-2 acquisitions and the results are validated by a continuous GPS located on the landslide. This technique results to be promising for retrieving displacement fields, in context of large landslides monitoring. In particular, it is foreseen to be applied during major reactivation events that, usually, reach displacement rates out of the order of magnitude for other satellite based approaches (i.e. Multi Temporal Interferometry SAR based techniques). In order to bypass the clear sky requirement the method can also be applied to amplitude Sentinel-1 SAR scenes.

## References

- ESA, (2018): Sen2Cor Software Release Note. Ref. S2- PDGS - MPC - L2A - SRN V2.5.5
- Kääb A. and Vollmer M. (2000): Surface geometry, thickness changes and flow fields on creeping mountain permafrost: automatic extraction by digital image analysis. *Permafr. Periglac. Process.* 11, 315-326.
- Heid T. and Kääb A. (2012): Evaluation of existing image matching methods for deriving glacier surface displacements globally from optical satellite imagery. *Remote Sens. Environ.*, 118, 339-355.