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Persistent Scatterer SAR Interferometry (PSI) for Airport Runways monitoring

Luca Bianchini Ciampoli[(1)], Valerio Gagliardi[(1)], Fabio Tosti[(2)], Alessandro Calvi[(1)] and Andrea Benedetto[(1)]

[(1)] Department of Engineering, Roma Tre University, Rome (IT) – luca.bianchiniciampoli@uniroma3.it [(2)] School of Computing and Engineering, University of West London, London (UK)– Fabio.Tosti@ac.uwl.uk

BACKGROUND

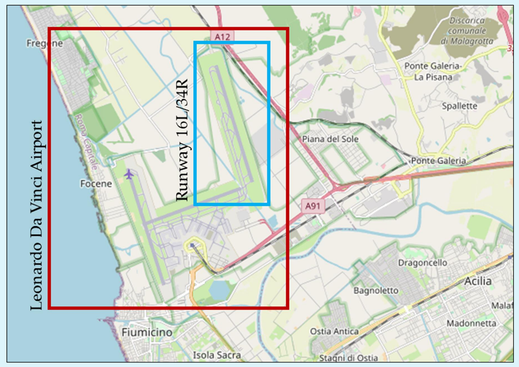
In the last decades, monitoring the regional-scale deformation of international airports has become a priority, in order to ensure the highest operational security and safety standards.

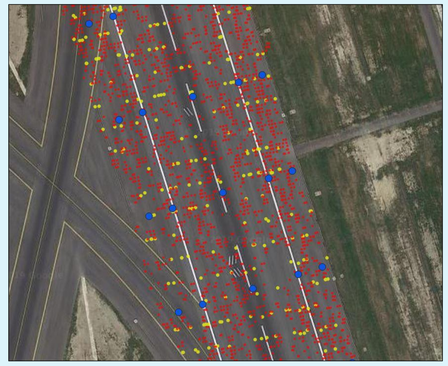
Within this context, among the most innovative and suitable techniques for transport infrastructures monitoring purpose, Persistent Scatterer SAR Interferometry (PSI) technology has proven to be an effective technique to investigate ground deformations [1-3]. However, the application of PSI to effectively and continuously monitor settlement in airports is an open challenge.

METHODOLOGY

In this study, a long time-series analysis of a high-resolution COSMO-Skymed satellite image-stack, acquired from September 2011 to October 2019, was collected and processed by PSI technique to retrieve the mean deformation velocity and time series of surface deformation of Runway 16L/34R of Leonardo Da Vinci-International Airport.

The mean PS velocity information is compared to the ground-based levelling-data, collected on the runway using a total station, in order to validate and increase the feasibility of the monitoring processing. Finally, various Deformation maps using the Natural Neighbor Geostatistical interpolation algorithm [4], were created and demonstrated a maximum subsidence rate is up to 15.3 mm/yr during the investigated period. The results confirmed the well-known major down-lifting phenomenon over an area, which has undergone routine maintenance.





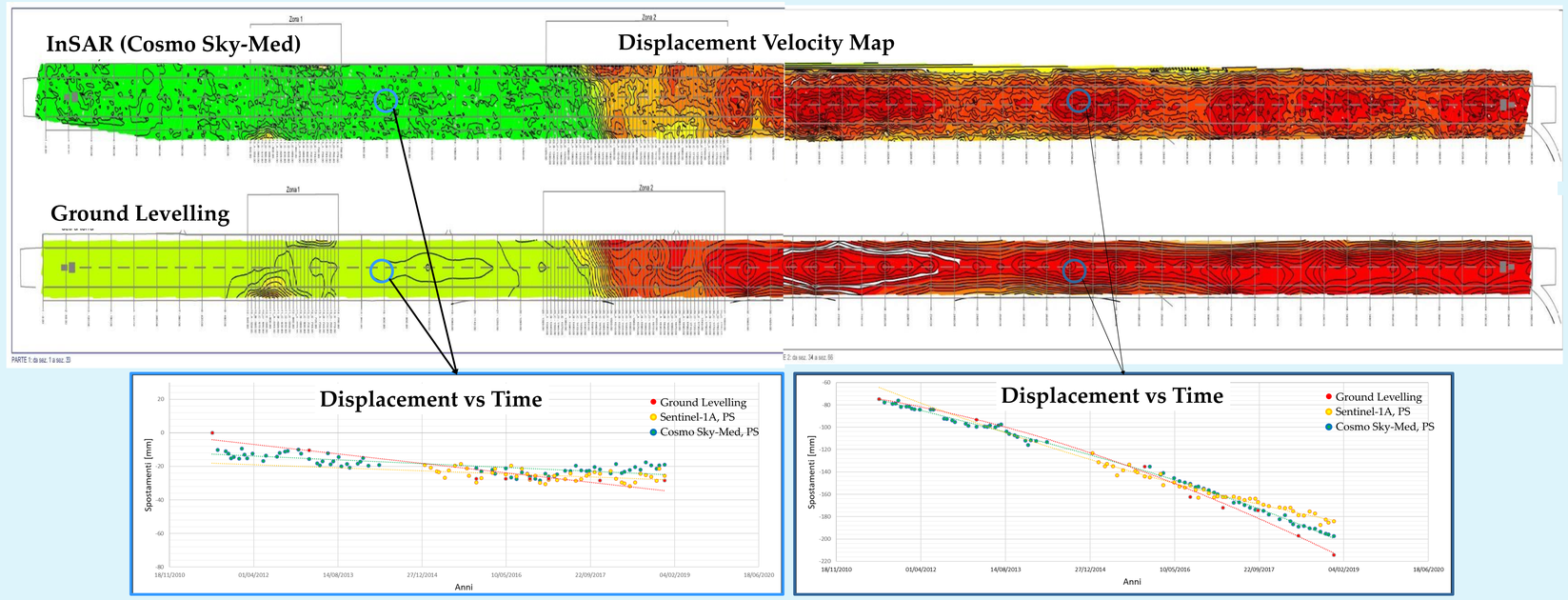
- Ground Levelling
- Sentinel-1A, PS
- Cosmo Sky-Med, PS

RESULTS & DISCUSSIONS

The comparison between spatial distribution of the velocity of displacement have shown the PSI methodology to be effective in detecting deformation trends within the inspected runway.

Moreover, punctual displacement-time analysis of specific levelled points and the PS in their surrounding have stressed out a very good fitting between the deformation behaviours observed by the different sensors.

In general, results have demonstrated the viability of integrating InSAR and topographical in-situ survey methods, paving the way to future implementations in prioritizing maintenance activities and helping for decision-making to have a comprehensive and inclusive information data system for the investigation of survey sites.



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