

PSP SAR interferometry monitoring of ground and structure deformations in the archeological site of Pompeii

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The “Major Project Pompeii” (MPP) is a great collective commitment of different institutions and people to set about solving the serious problem of conservation of the largest archeological sites in the world. The ancient city of Pompeii with its 66 hectares, 44 of which are excavated, is divided into 9 regiones (district), subdivided in 118 insulae (blocks) and almost 1500 domus (houses), and is Unesco site since 1996. The Italian Ministry for Heritage and Cultural Activities and Tourism (MiBACT) and Finmeccanica Group have sealed an agreement whereby the Finmeccanica Group will donate innovative technologies and services for monitoring and protecting the archaeological site of Pompeii. Moreover, the Italian Institute for Environment Protection and Research (ISPRA) – Geological Survey of Italy, was also involved to support the ground based analysis and interpretation of the measurements provided by the industrial team, in order to promote an interdisciplinary approach.

In this work, we will focus on ground deformation measurements obtained by satellite SAR interferometry and on their interpretation. The satellite monitoring service is based on the processing of COSMO-SkyMed Himage data by the e-Geos proprietary Persistent Scatterer Pair (PSP) SAR interferometry technology. The PSP technique is a proven SAR interferometry method characterized by the fact of exploiting in the processing only the relative properties between close points (pairs) in order to overcome atmospheric artifacts (which are one of the main problems of SAR interferometry). Validations analyses showed that this technique applied to COSMO-SkyMed Himage data is able to retrieve very dense (except of course on vegetated or cultivated areas) millimetric deformation measurements with sub-metric localization.

By means of the COSMO-SkyMed PSP SAR interferometry processing, a historical analysis of the ground and structure deformations occurred over the entire archaeological site of Pompeii in the period from 2010 to 2014 was initially performed. Moreover, the deformation monitoring is continuing with monthly updates of the PSP analysis with new COSMO-SkyMed acquisitions both in ascending and descending geometry.

The first results of the preliminary analysis over the archaeological site of Pompeii did not show large areas affected by deformations. However, the COSMO-SkyMed PSP SAR interferometry analysis proved to be very efficient due to its capability of providing a large number of deformation measurements over the archaeological site and structures with relatively small impact and cost. Moreover, in areas affected by collapses in the recent past, deformations were detected. Recent instability processes, both for the unexcavated slopes and for the archaeological structures, have promoted this low-impact analysis, aimed at identifying deformation paths and to prevent sudden collapses.

Finally, the results obtained from the satellite techniques, will be also used to implement and improve the ground based geotechnical monitoring and warning system recently installed in selected case studies. Cross analysis between interferometric results, meteorological data and historical data of the site (e.g. collapses, works, etc.) are in progress in order to define provisional model aiming at an early identification of areas subjected to potential instability.