SAR interferometry monitoring along the ancient Rome City Walls: the PROTHEGO Project case study

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This work is focused on ground deformation measurements of the ancient Rome City Walls obtained by satellite SAR Interferometry Permanent Scatterer (PS) and interpretation of results. The research activities are carried out jointly by Sovrintendenza Capitolina ai Beni Culturali and by ISPRA - Geologic Survey of Italy. The analyzed satellite data are based on the processing of COSMO-SkyMed images, spanning from 2011 to 2014, provided by the Italian Environmental Ministry (Extraordinary Monitoring Project, PISTA).

The preliminary analysis on the ancient Rome City Walls points out four features with peculiar concurrence, both in location and in time, of "Ruptures" and PS movements. Maps and graphs show location and time history of selected PS that had different deformations (mainly lowering) with respect to the neighbors PS, i.e. in a 50 meters buffer around a Rupture.

Starting from these firsts results, PS analysis from COSMO-SkyMed SAR Interferometry seems to be very efficient due to its capability of providing a great amount (both in time and space resolution) of deformation measurements over the whole site with relatively low cost and without impact.

Cross analysis among PS movement detection, natural hazard and Historical data of the site (e.g. collapses, restoration works) are still in progress in order to define a forecasting model aiming at an early identification of areas prone to potential instability or sudden collapse.

1. First of all a GIS platform has been implemented as a unique repository for data and geographic elaborations. The ancient City Walls (both Mura Aureliane and Mura Gianicolense) were digitized and georeferenced. All the wall elements (gates, towers and wall sections) were characterized in order to obtain a map of exposed elements.

2. Then a detailed historical analysis has been performed on last twenty years’ ruptures, i.e. ground and structure damages. A specific data sheet was created and fulfilled in order to produce an inventory map. The ruptures’ data sheet contains following attributes: triggering time, rupture typology, dimensions, triggering mechanisms, presence of restoration works. More than thirty events were collected. Most frequent ruptures refers to damage, detachment and falls.

3. Finally the ruptures layer was compared with the PS monitored points and with analysis of different local hazard map (e.g. landslide, subsidence, earthquake).