



Satellite monitoring of ground and structure deformations applied to Colosseum archaeological park

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Archeological sites and cultural heritage are considered as critical assets for the society, representing not only the history of region or a culture, but also contributing to create a common identity of people living in a certain region. In this view, it is becoming more and more urgent to preserve them from natural and anthropogenic hazard as well as from negative effects due to climate changes. In the present paper, we will focus on ground deformation measurements obtained by satellite SAR interferometry and on the methodology adopted and implemented in order to use the results operatively for conservation policies in the Colosseum Archaeological Park (PAC). The integrated monitoring project of the PAC was inspired by the desire to build a system of protection and conservation at the service of sustainable exploitation. With these objectives, the PAC has launched a static and dynamic monitoring project consisting of five pillars: i) a dedicated database of all the historical and archaeological data of the monuments, (digital documentation archive implementation); ii) implementation of visual monitoring activities, (a dedicated app will allow to send data to the central system); iii) satellite monitoring program (historical and routine analysis of the satellite data) that will flow directly into the system and will be analysed in order to monitor possible ground deformation; IV) in situ monitoring from traditional ground diagnostic instruments; v) experimental activities, such as the use of H-BIM applications. Basically, the project carried out the creation of a multi-parameter system of permanent monitoring of the whole archaeological area, with associated indicators of risk level, for which it is necessary the combined use of new technologies. Some examples of satellite monitoring application will be presented and illustrated in order to stress the roles of new Earth Observation technologies in the field of conservation and maintenance polices. Considering the limitations of all the interferometric techniques, in particular the fact that the measurement is along the line of sight (LOS) and the geometric distortions, in order to obtain the maximum information from interferometric analysis, both ascending and descending geometry have been used. The interferometric techniques need to use a stack of SAR images to separate the deformation phase contributions from other spurious components (atmospheric, orbital, etc.). The objective is to find a nominal behavior of the site in response to critical events and/or related to natural degradation of infrastructures in order to prevent damages and guide maintenance activities. The first results of this cross correlated analysis showed that some deformation phenomena are identifiable by SAR satellite interferometric analysis and it has also been possible to validate them on field through a direct survey.

