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INSTABILITY PROCESSES AND InSAR DATA ANALYSIS IN THE POMPEII ARCHAEOLOGICAL PARK

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The Italian Institute for Environment Protection and Research (ISPRA) – Geological Survey of Italy, in the framework of a three year agreement with the Pompeii Archaeological Park, is analyzing and interpreting ground motion measures obtained by satellite InSAR data, and is evaluating the geomorphologic processes affecting the unexcavated areas. More in detail a systematic collection of data about recent instability processes for the whole park was carried out. A preliminary morphological detailed map has been produced in order to classify types and mechanism of phenomena. Limits and constrains of InSAR technique applied to Cultural Heritage protection and conservation have been considered. A dedicated geodatabase collected all spatial information from different sources (e.g. location, description, triggering date and causes, pictures, validation) for a total amount of 35 phenomena. For the interpretation of satellite monitoring data the main target was the monthly reprocessing of ground motion data. The most critical issues highlighted during the research were: i) the limits of reflection of the electromagnetic signal on structures with thin vertical walls; ii) the short distance between adjacent walls (causing radar shadow effect); iii) the low radar reflectivity of some areas (e.g. cultivated, vegetated and unexcavated areas); iv) the fragile rupture mechanism (almost instantaneous) difficult to identify even by COSMO Sky-Med satellite revisiting time. In order to analyse the processed data provided by e-geos company, the following activities were implemented: i) back analysis on specific test sites affected by previous instability processes both on the structures and on the cliff; ii) a semi-automatic methodology definition for the identification of anomalies or accelerations in the ground displacement velocities; iii) in situ calibration in areas affected by high value of displacement/velocity of the target points. The catalogue of the instability processes was a useful tool to test how the satellite interferometry monitoring technique is able to identify pre-collapsing deformation trends for predictive purposes. The results highlighted the potential of the interferometry satellite technique, above all concerning the monitoring of the roofs in the archaeological area and the effectiveness of the shoring measures on the masonry structures. The detailed geomorphologic survey highlighted zones where to direct the instrumental monitoring and where to pay more attention for future excavations or for simple touristic exploitation. Future developments of this research will be addressed: i) to improve the acquisition and processing of satellite interferometry data by the installation of passive corner reflector; ii) to implement an operational methodology for the application of InSAR data for the Pompeii Archaeological Park; iii) to analyse rainfall data and to identify possible rainfall triggering thresholds, iv) to support the analysis of in situ monitoring data and possible implementation and integration of the current system.