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Ground deformation analysis of the Italian Peninsula through space-borne SAR interferometry and geophysical modelling: the IREA-CNR/MiSE-DGS-UNMIG agreement

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This work intends to present the main activities and the most significant results that the Institute for Electromagnetic Sensing of the Environment (IREA) of the National Research Council (CNR) has retrieved within the framework of its collaboration with the Ministry of Economic Development (MiSE) – Directorate-General for Safety of Mining and Energy Activities National Mining Office for Hydrocarbons and Georesources (DGS-UNMIG). In particular, the IREA-CNR/MiSE-DGS-UNMIG agreement aims at investigating surface deformation affecting the areas of the Italian territory of particular interest for the DGS-UNMIG through space-borne Differential SAR (Synthetic Aperture Radar) Interferometry (DInSAR) analysis and multi-parameters and multi-physics modelling. To this aim, we exploit SAR data acquired from the first- and second-generation sensors, processed via the advanced DInSAR technique known as SBAS (Small BAseline Subset) approach, to detect and follow the temporal evolution of the surface displacements via the generation of mean deformation velocity maps and corresponding time-series. More specifically, we focus on the SAR data collected along ascending and descending orbits by the Sentinel-1 constellation of the Copernicus Program of the European Union to map the whole Italian Peninsula during the 2015-2018 time interval, thus providing information on the spatial distribution of the retrieved ground displacements and their temporal evolution.
Moreover, we model the geological and geophysical processes that characterize the geothermal reservoir of Casaglia site (Northern Italy), which is the selected study area. In particular, we proceed to the definition and implementation of a geological / structural database and the building of a 3D stratigraphic-structural model of the Casaglia area. This model represents the basis from which a model of circulation of fluids will be developed with the Finite Element method, which will mainly concern the study of spatio-temporal variations of stress and strain in the region outside the reservoir, and the evaluation of any correlations between seismicity and the circulation of fluids.