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Continuous monitoring of ground deformational scenario of Veneto region (Italy) through Sentinel-1 data

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Continuous monitoring of the Earth surface is fundamental for the development and the evolution of the society, to reduce the risks posed by major geo-hazards like landslides, subsidence and sinkholes, which have a large impact on urban areas and can cause direct and indirect socio-economic losses. The start of spaceborne Synthetic Aperture Radar systems represented a milestone for the control of the territory, since SAR-based monitoring enables accurate measurement of the surface deformation over large areas, with a frequency dependent on the revisit time of the satellites. In this sense, the launch of the European Space Agency Sentinel-1 mission, characterized by a 6-days repeat pass, portrayed a great innovation and a step towards near-real-time monitoring. In this work, we present the first results of the continuous monitoring of the Veneto region (Northeastern Italy) performed by means of Sentinel-1 data, in the framework of an operational monitoring service. The procedure applied is based on a systematic processing chain made of four steps: i) Continuous generation of Sentinel-1 ground deformation maps, providing Measurement Points (MP) characterized by annual average velocity (mm/yr) and displacement Time Series (TS); ii) TS screening and classification, applied after each new satellite acquisition, to identify any change in the deformation pattern, according to a selected threshold; iii) constant update of the “anomalies” and their classification, according to the type of deformation; iv) warning to local authorities, in case of persistent and significant anomalous trends which require further investigations and field surveys. Its first application on the Veneto region shows promising outcomes, evidencing those areas characterized by movements that can be detected by SAR satellites. A few examples of this operational procedure are here shown, such as the cases of Lamosano, where a translational slide involves the local village, or of Recoaro Terme, where the Mt. Rotolon landslide is constantly studied. Moreover, subsidence is also a major threat in Veneto region, testified by the long-term phenomena of the NE plain (Verona and Vicenza provinces) and by the city of Venice, where the interaction of tides and subsidence causes the periodical flooding (“acqua alta”) of the renowned UNESCO site. The presented results want to demonstrate that the constant and continuous monitoring of the territory through Sentinel-1 data represents a best practice for the detection of ground deformation events, aiming at the natural risk mitigation for the development of the human environment.