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Terrain Deformation Monitoring in Granada Basin Area Using Persistent Scaterrers Interferometry (PSI)

Joaquim Sousa (1,2), Luisa Bastos (3), Antonio Ruiz (4), Ramon Hanssen (5), and Andy Hooper (5)

(1) Escola de Ciências e Tecnologia, Universidade de Trás-os-Montes e Alto Douro, Vila Real , Portugal (jjsousa@utad.pt), (2) Centro de Geologia da Universidade do Porto, Portugal, (3) Faculdade de Ciências da Universidade do Porto, Portugal (lcbastos@fc.up.pt), (4) Departamento de Ingeniería Cartográfica, Geodésica y Fotogrametría, Universidad de Jaén, Jaén, Spain (amruiz@ujaen.es), (5) Delft Institute of Earth Observation and Space systems (DEOS), TUDelft ,The Netherlands (r.f.hanssen@lr.tudelft.nl; a.j.hooper@tudelft.nl)

Interferometric Synthetic Aperture Radar (InSAR) from Earth-orbiting spacecrafts has revolutionized the crustal deformation researches since their first applications almost two decades ago. However, spatial and temporal decorrelation and atmospheric signal contributions in repeat-pass SAR interferometry often hamper the accurate measurements of surface displacements in SAR interferograms. The Persistent Scatterers Interferometry technique (PSI) was developed to detect isolated coherent targets and to tackle the problem of atmospheric delay errors using a temporal stack of SAR scenes and a sparse pixel-by-pixel based evaluation. The PSI technique has been applied to the Granada Basin area, located in the central sector of the Betic Cordillera (southern Spain) affected by active tectonic structures including extensional faults. Several ground motion processes have been identified for the first time in the study area, being the most significant concerned to a subsidence ball located over Otura village with rates up to 10 mm/yr. In spite that the region is located in a subsiding sector of the Cordillera, the available data indicate that the tectonic subsidence is extremely lower than the detected rates. Two main causes were identified to explain this unexpected phenomenon: fast infrastructure development taking place in the outskirts of the village (new residential areas) leading to soil compaction; and intensive withdrawal of water from underground originated for the increase of population in the last years.
We also tested the actual limits of InSAR techniques by applying two independent PSI approaches: DePSI (Delft PSI processing package) and StaMPS (Stanford Method for Persistent Scatterers). The expected tectonic deformation rates are in the order of $\sim$1 mm/yr, which are at the feasibility limit of current InSAR techniques.