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Interpreting very slow surface movements on slopes detected by PS interferometry and GPS monitoring: case study from the Southern Apennines, Italy

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Advanced multi-temporal C-band DInSAR techniques (eg Persistent Scatterer Interferometry - PSI) can typically detect only very slow ground surface displacements (usually up to few cm/year). We argue that it may often be difficult to ascertain the exact origin of such movements, especially when they occur on hillslopes, because they can arise from different causes (eg subsidence and local settlements, shallow seasonal creep, true slope/landslide movements, volumetric changes of geological/artificial materials, tectonics, instability of structures that act as radar targets). We also draw attention to the practical limitations of PSI in the rural areas, where the density of potential radar targets is low.

These difficulties are exemplified here with a case study from the Apennine mountains of southern Italy. Although this area, which includes Potenza, capital city of the Basilicata Region, has been known for its susceptibility to landsliding, PSI analysis based on over 30 ENVISAT ASAR ascending and descending acquisitions (covering 2003 to 2009) detected only a limited number of moving radar targets potentially indicative of instable slopes. Instead, the majority of the detected moving persistent scatterers can be associated with local subsidence and settlement/structure instability processes (with average velocities up to several and a few mm/yr, resp.). Nevertheless, one case of a large landslide re-activated in a rural area in 2006 shows that GPS surveying and PSI application, respectively, monitoring the points on the landslide and on nearby buildings, can furnish complementary information useful for the assessment of relative hazard.

Thus, local knowledge (geology, geomorphology, slope history) and in situ inspections could often be essential for the correct interpretation of PSI displacement maps. Furthermore, note that the exploitation of both descending and ascending imagery — two independent analyses — not only offers the simplest form of reciprocal validation but also helps overcome interpretative difficulties linked to the 1-D nature of PSI displacement results.

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