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Analysis of morpho-dynamics of South Tyrol, using filtered Permanent Scatterers.

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The study of morpho-dinamycs at regional scale often involves large data sets. This is particularly true in the case of Permanent Scatterers Interferometry (PSI). Concerning the reduction of data with this respect, to filter the most significant ones is a crucial point, influencing the whole geological analysis process that has to be carried out. PSI data provide a mono-dimensional displacement measured along the Line of Sight of the satellite acquisition geometry and in certain conditions, even data apparently not significant, could result relevant for the comprehension of the slope dynamics. In addition, due to the different satellite geometry acquisition, the interpretation of slope dynamics by using Permanent Scatterers, is not immediately intelligible.
This contribute refers to an upgrade of a widely used model for extracting field velocity maps combining ascending and descending orbital geometries from PSI products. The improved procedure is based on vector data model instead of grid data model, as more frequently documented in the literature, and exploits geometric relationships between adjacent points as well as morphological conditions in the slope. The procedure is meant to improve the geomorphic significance of the resulting reduced dataset, so to produce velocity field maps that are depurated of measurements referring to uncorrelated morpho-dynamic conditions.
The procedure has been applied to a large PS dataset covering 10.000 km2 in the western sector of South Tyrol. The dataset derives from application of SqueeSAR^{TM} PSI analysis, that enabled to detect Permanent Scatterers (PS) and Distributed Scatterers (DS) from different C-band data sources: Radarsat-1, EnviSat and ERS. The procedure presented, consists on a vector-based estimation of the East-West and Vertical components (as displacements along the North-South direction, cannot be measured, due to the intrinsic limitation imposed by the satellite orbital geometries). In the dataset reduction procedure, PS and DS are analyzed on the basis of geometric and geomorphological rules, such as aspect classes and 50 m distance radius between adjacent points. Moreover, filtered data are re-projected in E-W and H dimensions according to conditional rules. The application of this model reduced the input dataset ($\approx$ 1.2 Million PS/DS) by about 83%. Remaining PSI data turned out to be in good agreement with slope dynamics evidenced by field and optical remote observations. This approach result very useful in the perspective of having to deal with even larger datasets, such as those that can be created by exploiting high spatial and temporal resolution SAR dataset that will contain enormous amount of PS data.