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Three-dimensional visualization of Santorini caldera wall point cloud displacements

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Slope instabilities along steep caldera walls of active volcanoes pose a significant hazard, especially when the human factor is also present. Synthetic Aperture Radar (SAR) interferometry is a well-established geodetic imaging technique for monitoring ground displacements.

The circular shape of calderas introduces some restrictions for the global visualization of point-like displacement measurements, dictating the inspection, independently of each approximate linear segment of the terrain slopes.

In the present study, Persistent Scatterers Interferometry (PSI) ground displacements from Copernicus Sentinel-1 mission are manipulated in such a way to "unfold" and visualize the entire caldera walls on a single vertical planar surface. Point cloud analysis tools, originated from Terrestrial Laser Scanning (TLS) techniques, are explored for the manipulation of PSI point clouds in three-dimensional space and projection into pre-selected planes.

Such approach simplifies the actual inspection of the caldera walls, while allowing building a geospatial link between coordinates of the selected planar projection and the actual geolocation grid. Furthermore, the view of PSI in unfolded elevation grids is more effective, in particular to render displacement induced by gravity.

It is demonstrated that the utilization of advanced analysis and visualization tools throughout disciplines can improve the assessment of the SAR interferometric results and lead to a more effective decision making process.

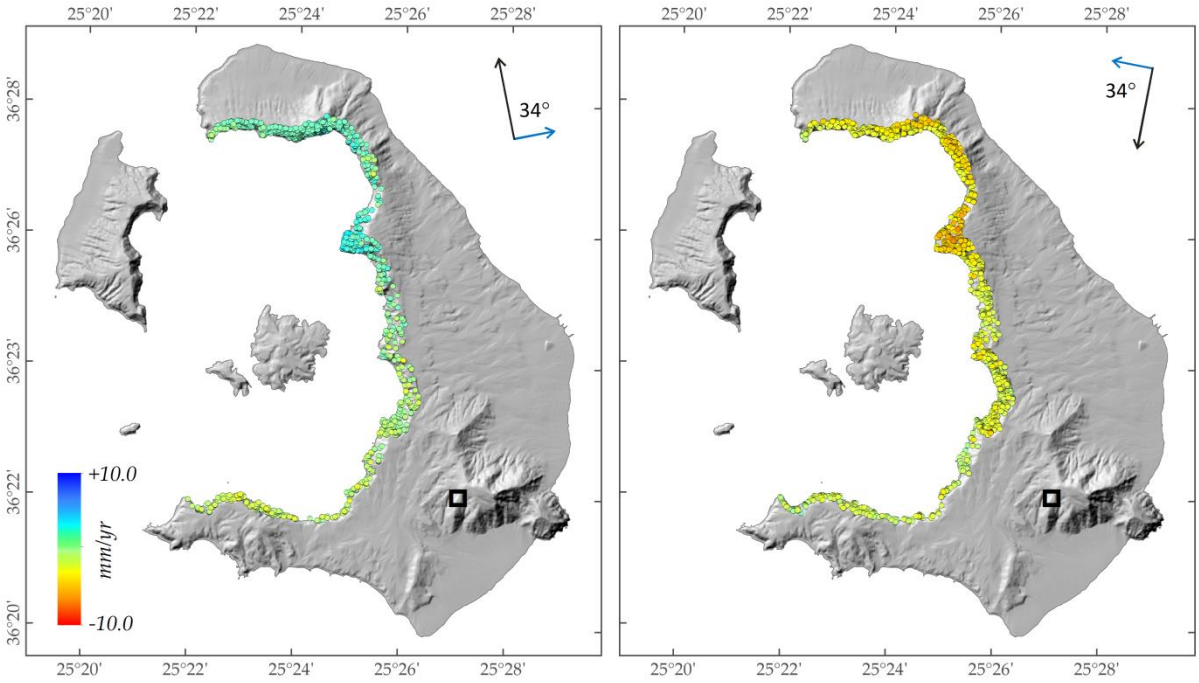

Figure 1. PSI displacement rates along the Santorini caldera walls from ascending (left) and descending (right) acquisition geometries. Reference point marked as square.

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