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## Pseudo-3D ground deformation map of Sicily derived from Sentinel-1 InSAR time-series

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Since the Neogene, the Central Mediterranean geodynamics is controlled by the migration of narrow orogenic belts, driven by fast slabs retreat, and the slowly converging Nubian and Eurasian plates. Nowadays, the Calabrian Arc continues its southeast migration in response to the Ionian oceanic plate rollback but at a much slower rate. The Sicilian kinematics has reached a transient state between the ending subduction-collision phase that formed the island, and the steady-state convergence between Africa and Eurasia. This setting explains why Sicily is among the most seismically active region of the Mediterranean, gathering the most destructive historical events recorded in Italy, such as the Noto (1693,  $M_w \approx 7.4$ ) and Messina earthquakes (1908,  $M_w \approx 7.1$ ). Such tectonic activity has led to numerous studies aimed at evaluating current surface motions at a regional scale using GPS networks. To improve the spatial coverage, we built the first 3D geodetic velocity field over the whole Sicily Island by processing from the Sentinel-1 InSAR time-series.

Averaged velocities along the ascending and descending satellite line-of-sight (LOS) were obtained using the Permanent-Scatterer approach (PS-InSAR) over the 2015-2020 period. We converted PS velocity fields into the Nubia reference frame, with the ITRF2014 vertical reference, by adjusting PS to 3D-GPS mean velocities. Reliable GPS velocities were retrieved from time-series of the MAGNET GPS network, leading to about 40 selected sites covering Sicily and south-west Calabria. On all tracks, the agreement between PS and GPS LOS velocities is excellent ( $rms < 1 \text{ mm/yr}$ ), and derived orbital corrections are robust, except for the western descending track that is only constrained by five GPS data. Since the projected north-south GPS velocity difference along the LOS is about  $0.5 \text{ mm/yr}$ , we assumed that the north-component of the ground displacement is negligible. By reducing the problem to a 2D estimation (East and Up component) and using both ascending and descending LOS velocities, we derived the East and Up component of the ground deformation within the Nubia-ITRF2014 reference frame. Uncertainties are estimated in the order of  $1 \text{ mm/yr}$ .

The results show that the Up-component is consistent with previous works indicating a significant uplift of the Peloritani range ( $\sim 1 \pm 0.5 \text{ mm/yr}$ ) in north-eastern Sicily. Together with the East-component, the whole Peloritani block appears, however, as a coherent tectonic unit and does not show any dislocation along the Tindari line, as suggested by previous structural field

observations. Interestingly, PS-InSAR data evidence an eastward tilting of the Hyblean Plateau, with about 1.5 mm/yr of subsidence of the Augusta bay relative to the Vittoria plain, and a 1 to 2 mm/yr of differential vertical motion along the southern coast, between Agrigento and the Licata and Sciacca locations. Although the reconstructed ground motion only captures a short time-window of the seismic cycle, these data represent a major milestone to evaluate the seismic hazard of Sicily.