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Coexisting shortening and extension along the "Africa–Eurasia" plate boundary in southern Italy

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We performed geodetic strain rate field analyses along the “Africa (Sicily microplate)”–“Eurasia (Tyrrhenian microplate)” plate boundary in Sicily (southern Italy), using new GPS velocities from a data set spanning maximum ten years (1998-2007). Data from GPS permanent stations maintained from different institutions and the recent RING network, settled in Italy in the last five years by the Istituto Nazionale di Geofisica e Vulcanologia, were included into the analysis. Two dimensional strain and rotation rate fields were estimated by the distance weighted approach on a regularly spaced grid (30*30km), estimating the strain using all stations, but data from each station are weighted by their distance from the grid node by a constant a=70km that specifies how the effect of a station decays with distance from the node grid interpolation. Results show that most of the shortening of the Africa–Eurasia relative motion is distributed in the northwestern side offshore Sicily, whereas the extension becomes comparable with shortening on the western border of the Capo d’Orlando basin, and grater in the northeastern side, offshore Sicily, as directly provided by GPS velocities which show a larger E-ward component of sites located in Calabria with respect to those located either in northern Sicily or in the Ustica-Aeolian islands. Moreover, where shortening and extension have mostly a similar order of magnitude, two rotation rate fields can be detected, CCW in the northwestern side of Sicily, and CW in the northeastern one respectively. Also, 2–D dilatation field records a similar pattern, with negative values (shortening) in the northwestern area of Sicily close to the Ustica island, and positive values (extension) in the northeastern and southeastern ones, respectively. Principal shortening and extension rate axes are consistent with long–term geological features: seismic reflection profiles acquired in the southern Tyrrhenian seismogenic belt show active extensional faults affecting Pleistocene strata and deforming the seafloor in the western sector of the Cefalù Basin, on both NE-SW and W-E trending faults. Combining geodetic data and geological features contributes to the knowledge of the active deformation along the Africa–Eurasia plate boundary, suggesting coexisting, independent geodynamic processes, i.e., active E-W backarc spreading in the hangingwall of the Apennines subduction zone, and shortening of the southern margin of the Tyrrhenian backarc basin operated by the “Africa” NW-motion relative to “Europe”.