Active deformation in southern Italy from GNSS velocities: updated results of the PTGA

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The PTGA network consists of 72 sites installed in southern Italy with the aim of detecting the orogenic interseismic strain, which were measured during 1995, 1997, 2000 e 2008. Results of the last measurement session, presented here, provide new insights into active deformation processes detected in previous analysis (FERRANTI *et alii*, 2008).

Data were processed using the GAMIT/GLOBK (version 10.35) software developed at the Harvard Smithsonian Center of Astrophysics of the MIT, and at the Institute of Oceanography, University of California. The software involves multi-step routines for processing and modeling of GNSS observations (HERRING *et alii*, 2006). Firstly we created and processed the double differenced iono-free observables that were used to estimate the daily loose-constrain solutions with the stations coordinates, the orbits and the atmospheric delays, and the variance-covariance matrix. For a better estimate of the parameters of each solution we used precise ephemerides calculated by the International GNSS Service (IGS) and the earth rotation parameters provided by the International Earth Rotation Service. We inserted in the processing the data of ten IGS permanent sites (AJAC, CAGL, GRAS, GRAZ, LAMP, MATE, MEDI, NOT1, NOTO e ZIMM). Then, the loose constrained daily solutions were combined (on a daily base) with the regional solution (IGS1, IGS2, IGS3, IGS4, EURA and EUREF) provided by SOPAC (Scripps Orbit and Permanent Array Center) and EPN (EUREF Permanent Network) by a Kalman filter GLOBK to create an unconstrained daily net solution. Using the GLORG module of GLOBK, the solutions were aligned into the International Terrestrial Reference Frame (ITRF) 2005 (ALTAMIMI *et alii*, 2007) by a Helmert transformation (estimate of 3 rotation parameters, 3 translation parameters and 1 scale factor) to generate time series of the Nord, East and Up components of each station and the velocity field. This ITRF2005 velocity field was aligned with a stable Europe reference frame (NOCQUET & CALAIS 2003) by a further Helmert transformation.

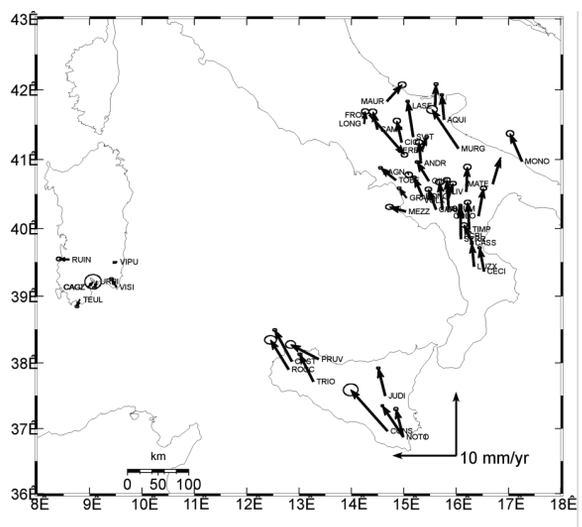

Fig. 1 - GNSS velocities of the PTGA network relative to stable Europe.

Relative to Europe, all the sites of the net, except for Sardinia, move toward the northern quadrants, with a significant internal variability that underline the existence of different deformation domains (Fig. 1). For a better understanding of distributed deformation, velocities were referred to permanent IGS sites (Matera for the southern Apennines, Noto for Sicily and Cagliari for Sardinia). In southern Italy (Fig. 2), the updated GNSS velocities confirm the presence of two adjacent deformation zones (FERRANTI *et alii*, 2008): an extensional domain in the west, where Campania and Calabria sites move away from MATE with increasing westerly velocities from 2 to 5 mm/a; and a transpressional domain in the east, Adriatic and Ionian area of

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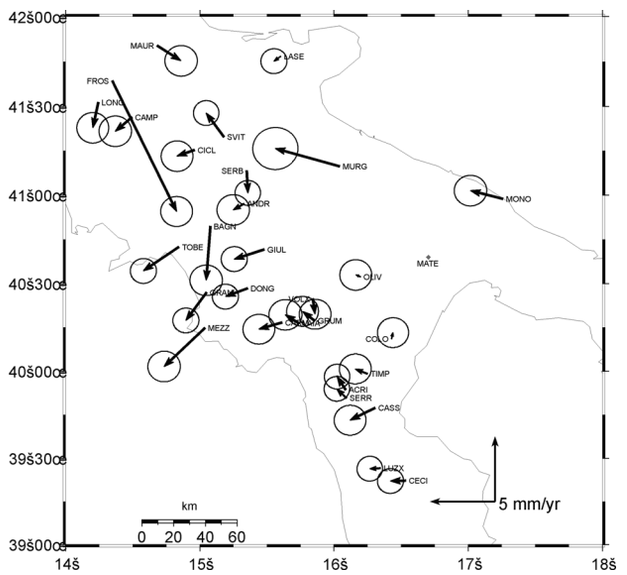

Fig. 2 - GNSS velocities of the PTGA network in southern Appennines relative to permanent IGS site Matera.

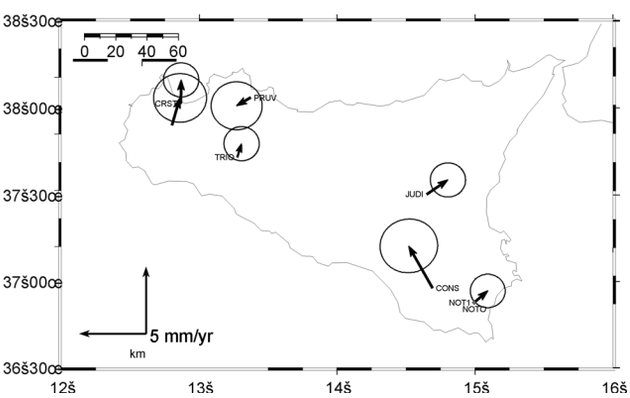

Fig. 3 - GNSS velocities of the PTGA network in Sicily relative to permanent IGS site Noto.

Puglia, Basilicata and Calabria, more markedly between Gargano and northern Murge, where sites show convergence or oblique movement relative to MATE, consistent with a right lateral displacement between the two blocks.

In Sicily, motion relative to NOTO (Fig. 3) suggests right lateral transpression between the frontal thrust belt and the northern Hyblean margin. In central-western Sicily a broad contractional belt is detected. Sicily sites convergence with Sardinia sites (Fig. 1), in agreement with the seismic activity between the islands. In southern Sardinia (Fig. 4), site residuals velocities relative to CAGL are small and very close to the associated error. On the whole, the western side of the Campidano moves toward W-SW, while the eastern site (VISI) moves toward NW. These data are consistent with a shear deformation related to a NNW-SSE shortening.

By interpolation, we derived the horizontal strain field starting from the velocity values, the net geometry and the associated covariance matrix. Significant compressional strains (up to 0.04 μstrain/a) are found in northern Calabria and Puglia, and similar values of extensional strain occur in western Campania. The compressional strain axes are oriented NW-SE between Gargano and Murge and NE-SW in northern Calabria. Tensile axes are oriented NE-SW in western Campania, consistent with the seismic record, and NW-SE in north-eastern Basilicata. Similar-magnitude, non uniaxial strain (NW-SE compression and NE-SW extension) are found between Campania and Molise, consistent with recent earthquake.

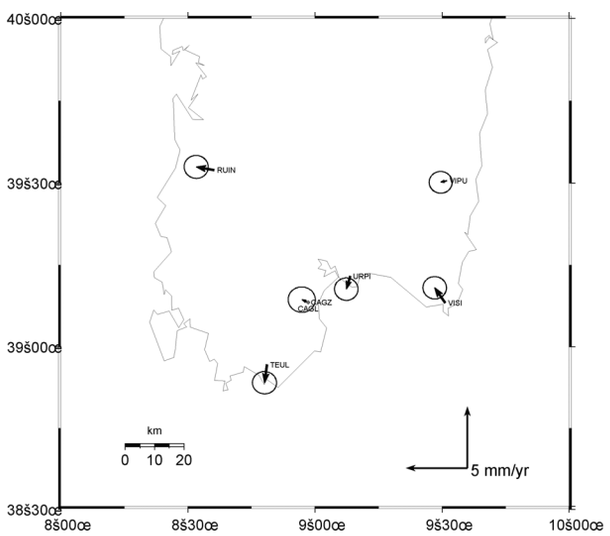

Fig. 4 - GNSS velocities of the PTGA network in southern Sardinia relative

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