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Strain and stress fields constrained by geodetic, seismological and tectonic data: an application to the Tindari fault system (southern Italy)

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The Tindari fault system (hereinafter TFS) is part of a regional zone of brittle deformation, named Aeolian-Tindari-Letojanni fault system, located in north-eastern Sicily between Mt. Etna and the Aeolian Islands at the transition between ongoing contractional and extensional crustal compartments related to the Neogene-Quaternary convergence process between African and Eurasian plates. TFS, consists of a NNW striking set of faults characterized by steeply inclined scarps (dip $\geq 60°$) that dip mostly eastward and having predominantly extensional dip-slip kinematics and subordinately left-lateral strike-slip ones. Near the Tyrrhenian coast, the fault system has a very large morphological expression up to Capo Tindari. Some Authors indicate that the Tyrrhenian terraces along the coast are cut by the TFS with a vertical offset of about 50-60 m and the Plio-Quaternary terrains reveals right lateral movements of about 6-7 km.

Since 1994 more than 700 earthquakes ($1.0 \leq ML \leq 4.4$) was recorded by a local network managed by the Istituto Nazionale di Geofisica e Vulcanologia, sezione di Catania (hereinafter INGV-CT). Most of these events occurred as highly clustered swarms located at shallow depth (7-12 km) close the villages of Castroreale and Rodì Milici (A1) and in the Gulfs of Patti and Milazzo coastal area (A2). Minor clusters occurred western of TFS, close to the village of Patti (A3), and southern, close to the village of Novara di Sicilia (A4). Using the FPFIT code the focal mechanisms for earthquakes with at least ten P-wave first motion polarities were computed. Focal solutions computed for A1 and A2 are characterized by normal fault mechanisms, whereas focal plane solutions computed for A3 and A4 evidenced a mix of strike-slip and extensional features.

GPS monitoring of this area started on late 1995, when INGV-CT established a geodetic network consisting of seven self-centring benchmarks based on GPS technique and surveyed for the first time on October 1996. Since then, the network has been surveyed on 1998, 2002, 2003 and 2006. GPS were processed by using the GAMIT/GLOBK software. By using the GLORG module of GLOBK, we estimate a long term average velocity in a fixed Eurasian frame. The velocity field is characterized by a general N-directed motion with a fan-shaped feature, evidencing a diverging pattern between the sites located around the TFS.

Here, we present a multidisciplinary approach, which include new tectonic, morphological, seismological and geodetic data, in order to obtain a detailed spatial resolution of the horizontal strain- and stress-rate of the investigated area. In particular, in a first step, we estimate the horizontal strain- and the stress-rate field from observed GPS velocity. We compare them with the tensors of stress and strain estimated from focal mechanism inversions and neo-tectonic fault slip. Finally major results will be discussed in relation within the current active geological component.