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Slab narrowing in central Mediterranean: the Calabro-Ionian subduction zone as imaged by high resolution seismic tomography

Luciano Scarfì (1), Graziella Barberi (1), Giovanni Barreca (2), Flavio Cannavò (1), Ivan Koulakov (3), and Domenico Patanè (1)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Etneo - Sezione di Catania, Italy (luciano.scarfi@ingv.it), (2) Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Università di Catania, Sezione di Scienze della Terra, Italy, (3) Institute of Petroleum Geology and Geophysics, Novosibirsk, Russia

The dynamics of the subduction processes have a great influence on the tectonic evolution and the geologic structure of an area, as well as on its seismicity and magmatism. This is the case of the western-central Mediterranean region whose tectonic framework is mostly the result of the subduction towards the NW of the Ionian oceanic lithosphere and of a more recent southeastward slab retreat and its progressive detachment. Indeed, currently subduction is recognized to be confined beneath the Calabro-Peloritan Arc. With the aim of improving the image of such subduction system and surrounding zones, we performed a detailed 3D image by means of a seismic tomography. We exploited a large dataset of about 20,100 local earthquakes, recorded between 1981 and 2014, and computing algorithms which are able to build a dense grid of measure nodes (LOTOS) and to improve the relative position of clustered events (tomoDDPS). Results show that the slab is in-depth continuous below the southern sector of the Calabro-Peloritan Arc but the deformation processes developing at its edges are leading to its progressive narrowing, influencing tectonics and magmatism at the surface, and with possible stress concentration at the tip zones. In particular, in the southwest, deformations occurring at a free slab edge propagate a lithospheric vertical tear in the upper plate, which extends along a NW-SE fault system (Aeolian-Tindari-Letojanni) up to about 30 km in the Ionian Sea; further southeast, lithosphere appears flexured. In the northeast, the slab seems progressively to break parallel to the trench. Finally, northwest of Mt. Etna, tomography highlights low VP which can be related to an upwelling of deep mantle material likely flowing laterally through the window opened by the complete slab detachment in the western Tyrrhenian Sea.