



## **High precision Earthquake locations and an adaptive mesh seismic tomography of the Messina Strait (Italy)**

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The Messina Strait intersects the southernmost part of the Alpine-Apenninic orogenic belt, known as the Calabro-Peloritan Arc. This region is interested by a considerable seismic activity which mirrors the geodynamic processes due to the convergence between the African and the Eurasian plates. In the last two centuries a considerable number of disastrous earthquakes originated along the part of the Arc between the Gulf of S. Eufemia (Calabria) and the Gulf of Patti (Sicily). In this frame the Messina Strait area forms the most important of the tectonic discontinuities which cut the southern part of the Arc and is the theatre of violent earthquakes. Among these, the most noteworthy one is the event on December 28, 1908 (known as the Calabro-Messina earthquake), which caused a large tsunami and more than 100,000 casualties. In the present study, high precision earthquake locations and the seismic velocity modeling of the Messina Strait and surrounding areas were carried out by applying the “tomoADD” algorithm to a dataset of more than 300 local earthquakes ( $1.0 < ML < 3.3$ ) recorded in the area from 1999 to 2007. The algorithm determines the 3D velocity model and event locations by using a combination of absolute and differential arrival times. In “tomoADD” the spacing of the velocity grid varies over the volume under study, taking into account the local ray density. In this way, this method is able to produce more accurate event locations and velocity structure near the source region than standard tomography. The obtained velocity images highlight vertical and lateral heterogeneities which can be associated with the main tectonic features. In particular, the sharp velocity contrasts are consistent with previously recognized active faults and a striking correspondence between areas ruptured by earthquakes and velocity anomalies is observed. The imaging of the 3D velocity structure yields an improved picture

of the geometry of these structures situated at depth.