



A locked subduction fault plane beneath Calabria (Southern Italy)?: historical seismicity, high resolution seismics and tsunami modeling

M.A. Gutscher (1), J. Roger (1,2)

(1) CNRS, IUEM, Univ. Bretagne Occidentale, Plouzane, France, (2) Univ. Strasbourg, France

Southern Italy has been struck repeatedly by very strong historical earthquakes (Mercalli intensity IX or greater), in 1169, 1542, 1624, 1693, 1783, 1905, 1908, often associated with destructive tsunami (Piatanesi and Tinti, 1998). Calabria is located above a 300 km wide, NW dipping subduction zone which possesses an active volcanic arc (the Aeolian Islands) and a well defined Wadati-Benioff zone, with earthquakes descending to nearly 500 km depth. The slab is imaged as a continuous, high P-wave velocity anomaly by travel-time tomography down to 660 km depth,

The 1693 Catania earthquake, caused 60000 victims in eastern Sicily and generated a 5-10 m high tsunami. The 1169 earthquake had similar intensities (X to XI) and a similar isoseismal pattern, suggesting a similar source. Because of the tsunami generated in 1693 and because the isoseismals are open to the sea, the majority of the source region appears to be offshore. The subduction fault plane is thus a strong candidate for the 1693 event. Furthermore, new evidence in the form of high-resolution seismic profiles presented here, indicates ongoing compressive deformation at the toe of the wedge. ESE-WNW convergence in the Calabrian arc at rates of 4-5 mm/yr is also indicated by recent GPS data. The lack of instrumentally recorded thrust earthquakes suggests the presence of a locked subduction fault plane.

Thermal modeling is used to determine the limits of the seismogenic zone and tsunami modeling is performed to test the hypothesis of a subduction fault plane. This source (160 x 120 km with 2 m of co-seismic slip) successfully reproduces available historical observations, with regard to earthquake magnitude, tsunami polarity and relative amplitudes. It appears only the SW segment of the subduction zone ruptured in 1693 and 1169, with a recurrence interval of roughly 500 years for similar events.