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Seismic attenuation tomography beneath the retreating Southern Tyrrhenian Sea subduction system

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We investigate the seismic attenuation structure of the Ionian slab and surrounding mantle beneath the Southern Tyrrhenian subduction system. We present a high-resolution Vp, Vp/Vs, Qp and Qs models obtained by the inversion of high quality P- and S-waves t* from slab earthquakes. In our analysis we first located 304 earthquakes with M>= 2.8 , depth >= 30 km and azimuthal gap <= 200° and we used a 3D a priori Vp and Vp/Vs model. Then, t* values were measured from spectra of P and S waves. For computing t* we have determined the corner frequency (fc) which has been estimated using a grid search over the frequency range 1 - 10 Hz using all the recordings for each event. The obtained t* values are then used in the inversion for the 3-D attenuation structure using, and kept fixed, the 3-D velocity model. Tomographic inversion show high-attenuation regions corresponding to the crustal layers with low values of Qs (values down to 200) but high values of Qp. The subducting slab is identified as a body of low attenuation, but heterogeneous in the Qs and Qp structure (Qs values up to 1100; Qp values up to 1200), surrounded by high-attenuation regions beneath the Aeolian magmatic arc. At 100 km depth the high Qp and Qs body is well reconstructed beneath the Calabrian arc and at 200 km depth it is extended offshore the Southern Tyrrhenian Basin beneath the Aeolian Islands. Between 100 and 200 km depth, the Ionian slab is characterized by intermediate depth seismicity, but Qp and Qs models clearly show the existence of high-attenuation region, with low values of Qs and high Qp/Qs structure. The observed low Qp and Qs anomalies could likely due to the fluids released from dehydrating minerals associated to the slab metamorphism. The observed low Qs anomalies regions between the slab and the Aeolian volcanic arc could be indicative of melting processes in the mantle and also of the large-scale serpentinization.