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Shear Velocity Structure from Surface Wave Modeling of Southern Italy

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Microplate tectonics in the region between the converging African and Eurasian Plates during the last 30 million years shaped the major tectonic units of the Italian peninsula and the Western Mediterranean Sea. Subduction, trench migration and collision caused substantial deformation in the crust, such as thrust and fold belts, and upper mantle beneath the southern Italy. The complex history of the region has been largely imprinted onto the seismic velocities beneath the region.

During the 2003-2005 Calabria-Apennine-Tyrrhenian/Subduction-Collision-Accretion Network (CAT/SCAN) project, two moderate-sized regional earthquakes occurred in the Ionian and southern Tyrrhenian seas. By analyzing the resulting Love and Rayleigh waves at different frequency ranges (0.03-0.06 Hz and 0.05-0.2 Hz), we were able to determine the detailed shear velocity structure down to $\sim$60 km. Our best-fit models from the event southern Tyrrhenian sea show a well-defined low velocity zone in the lower crust, whose orientation is parallel to the strike of the Apennines mountain belt. This feature is not clearly observed beneath Calabria, where the overall crustal velocity is relatively high. The boundaries of Apulia, the southern Apennines and Calabria are cleared delineated by our path-averaged models. We also observe a shallow low-velocity zone (3-9 km) beneath the southern Apennines, consistent with recent studies using body-waves and receiver functions. The main observations from these earthquakes, especially the structural difference between the Southern Apennines and Calabria, are supported by our recent correlation study of ambient seismic noise in this region.