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Detecting slab structure beneath the Mediterranean

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The presence of subducted slabs in the Mediterranean has been well documented with seismic tomography, however, these images, which are produced by smoothed, damped inversions, underestimate the sharpness of the structures. The position and extent of the slabs and the presence possible tears or gaps in the subducted lithosphere are still debated, yet the shape and location these structures are important for kinematic reconstructions and evolution of the entire subduction zone system. Extensive distribution of broadband seismic instrumentation in the Mediterranean (Italian National Seismic Network in Italy and the NSF-PICASSO project in Spain and Morocco) has allowed us to use alternative methodologies to detect the position of the slabs and slab tears beneath the Central and Western Mediterranean. Using S receiver functions we are able to identify S-to-p conversions from the bottom of the subducted slab and a lack of these signals where there are gaps or tears in the slab. We also analyze broadband waveforms for changes in P wave coda from deep (> 300 km depth) local earthquakes. The waveform records for stations in southern Italy and around the Betic-Rif show large amplitude, high frequency (f > 5 Hz) late arrivals with long coda after relatively low-frequency onset. High frequency arrivals are the strongest from events whose raypaths travel within the slab to the stations where they are recorded allowing for mapping of where the subducted material is located within the upper mantle. These two methods, along with inferring the slab position from fast P-wave velocity perturbations in tomography and intermediate depth seismicity, provide additional geophysical evidence to aid in interpretation of the complex, segmented slab structure beneath the Mediterranean.