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Strike-slip deformation related to the slab tear of the Calabrian subduction: using analog modeling to test the kinematic boundary conditions of geodynamic models

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The Calabrian accretionary wedge in the Ionian Sea is the site of slow deformation related to the overall convergence between Africa and Eurasia and the subduction zone beneath Calabria. High-resolution swath bathymetric data and seismic profiling image a complex network of strike-slip faults offshore Sicily. Ongoing normal faulting occurs in the straits of Messina area (1908 M7.2 earthquake). We applied analog modeling using granular materials in a compression box to test the predictions of certain geodynamic models regarding the location and kinematics of a major lateral slab edge tear fault. One experiment, using two independently moving backstops, shows that the relative kinematics of two blocks can produce a zone of dextral transtension and surface collapse in the model wedge. This experiment also produces a dextral offset in the deformation front. However, this offset is not observed in the morpho-bathymetry of the Calabrian accretionary wedge. In fact counterclockwise material flow is observed along an internal boundary between two corresponding lobes of the Calabrian wedge. A second experiment features an inner frictional (sand) wedge and an external visco-elastic wedge (sand and silicone) to attempt to model the interaction between the internal clastic portion and the external evaporitic portion of the Calabrian accretionary wedge. We interpret a major dextral offset in the limit between the external (evaporitic) wedge and the internal (clastic wedge) in the natural example, as well as other large-scale structural elements (elongate basin and a network of slip-lines) as indicating the current primary kinematic boundary passes along the Alfeo fault system and that the entire accretionary wedge remains tectonically active.