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Opposite polarity subduction in adjacent plate segments

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The goal of this work is to understand the dynamics of a subduction system characterized by two adjacent subducting plates with opposite retreating directions as recently proposed for the Westernmost Mediterranean. A series of analogue models based on viscous syrup (representing the mantle) and silicone putty (representing the subducting plate) have been designed to simulate the evolution of a double subduction system. The basic setup contains a pair of plates subducting in opposite directions. The plates are fixed at their back edge to enforce a slab rollback behavior and subduction is started by deflecting manually the leading edge of the plate (i.e. initial slab pull, phase 1). Different setups were designed to test the influence of two variables on the system: i) the width of the plates, that varies from 10 cm to 30 cm (1 cm in model corresponds to 60 km in nature) and ii) the lateral distance between the two subducting plates, that varies from 10 to 0.5 cm. Our results show that trench velocities increase during the stage of approaching trenches (phase 2) and then decrease after trenches pass each other (phase 3). This behavior indicates an interaction of the mantle flows produced by the two retreating slabs. On the other hand, the trench curvature increases linearly during the entire evolution and the lateral distance between plates remains constant along time, indicating that no effective lateral stress is produced when the opposing plates have similar dimensions. In addition, we have reproduced numerically some of the laboratory experiments.
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