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Geodynamic physical models of subduction with an overriding plate and an interplate rheology

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Subduction zones are the main driver of plate motions and a fundamental component of mantle convection. Understand the force balance at subduction zones is therefore crucial to comprehend how plate tectonics works. In this communication, we will present a review of the results of laboratory models of subduction with an overriding plate and an interplate rheology. These models use viscous materials to simulate plates and the upper mantle and a visco-plastic material to simulate the subduction interface. We have tested and varied several parameters, including the strength of the subduction interface, the strength of the upper plate and its far field boundary conditions. Main results suggest that subduction zone interfaces are always weak and that in narrow subduction systems the overriding plate always undergoes back-arc extension, whereas the forearc may experience extension or shortening depending on the far-field boundary conditions. Finally, we demonstrate that the main driver of back-arc extension is the sub-lithospheric mantle return flow.

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