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How does overriding plate crust impact convergence zone dynamics?

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Overriding plates in convergence zones exhibit contrasted unit sizes, morphologies, thermal structures, thicknesses and rheologies of the different structural levels. Some overriding plates show very localized deformation (e.g., in the Alps) while other show distributed deformation over thousands of kilometers (e.g., in the Himalayas through the Tibetan plateau). Several studies (Heuret et al., 2007; Guillaume et al., 2009; Yamato et al., 2009; Rodriguez-Gonzalez et al., 2012; Butterworth et al., 2012; Meyer and Schellart, 2013) have already highlighted the important role played by the overriding lithosphere as a whole on the subduction zone dynamics. However, these studies were performed at the mantle scale and did not specifically included a crust in the overriding plate, whose role remains poorly understood.

In this study, we use a 2D thermo-mechanical numerical model of oceanic subduction followed by continental subduction/collision, in which the rheological properties of both the lithosphere and the crust of the overriding plate are systematically varied. We investigate the effects of parameters controlling the rheological structure (i.e. initial thermal structure of the lithosphere, thickness and nature of the material for both the crust and the lithospheric mantle) on the whole convergence zone dynamics.