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1 Dynamical effects of subducting ridges: Insights from 3-D laboratory models

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We model using analogue experiments the subduction of buoyant ridges and plateaus to study their effect on the dynamics of oceanic subduction. Experiments suggest that buoyant subducting segments must be large enough to influence the geometry of the slab, evidencing that 1D (local) isostatic considerations are not appropriate to predict slab behaviour. Oceanic ridges parallel to the trench have a stronger effect on the process of subduction because they simultaneously affect a longer trench segment. Sufficiently large buoyant subducting segments sink more slowly into the asthenosphere. Their subduction may result in a diminution of the velocity of subduction of the plate. We observe a steeping of the slab below those buoyant anomalies, resulting in smaller radius of curvature of the slab, that augments the energy dissipated in folding the plate and further diminishes the velocity of subduction. When the 3D geometry of a buoyant plateau is modelled, the dip of the slab above the plateau may diminish, as a result of the larger velocity of subduction of the dense "normal" oceanic plate on both sides of the plateau. Such a perturbation of the dip of the slab maintains long time after the plateau has been entirely incorporated into the subduction zone. Comparison of experiments with the present-day subduction zone below South America suggests that buoyancy anomalies within the oceanic plate may be responsible for some aspects of the geometry of the Nazca slab at depth.