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Dynamics of subduction interplate: Influence of lithosphere-asthenosphere interaction in the vicinity of the volcanic arc and possible relations to the interface seismogenic behavior

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The subduction interplate plane (likely to correspond rather to a channel in some settings), corresponds to an interface of both kinematic decoupling and seismogenic coupling. The behavior of this very particular interface remains poorly known, while it is likely to influence not only the seismogenic potential of the subduction area but also the overall process of subduction, by affecting the system stability. For instance, the significant variability of the maximum interplate depth, encompassed between 35 and 70 km (Pacheco et al., 1993) is not completely understood yet. This depth should be controled by the brittle-ductile transition occuring along the subduction channel, and could thus depend on many parameters, such as temperature, pressure, compositional variations, strain rate,...This suggests a self-consistent equilibrium state of the subduction interplate, whose characteristics should depend on the subduction setting.

Numerical simulations are performed to model the equilibrium state of the subduction interplate while the diving lithosphere interacts with both the upper plate and the underlying convective mantle. Our thermomechanical model combines a non-Newtonian viscous rheology and a pseudo-brittle rheology, as a function of depth, temperature and stress, both for an oceanic crust and the mantle. We showed that an increase of convergence velocity induced a shallowing of the maximum interplate depth, while it was generally thought that faster subductions promoted cooler interplate structures. This results from the plate interactions with the convecting mantle wedge. We also simulate the time evolution of the interplate thermal state, and study how it interacts with the global force budget of the subduction system. In some cases, a shallowing of the subduction interface, by decreasing frictional stresses resistant to subduction, is able to trigger backarc spreading, even if the tectonic regime was initially compressive. We will also present the influence of the subducting lithosphere age we model on the interplate maximum depth. These results will be discussed in relation to a global database recently compiled describing the subduction interplate characteristics and its statistical behavior (Heuret et al., 2010, G3, in press).