The dynamics of convergent boundaries over a convecting mantle

L. Husson (1,2)

(1) CNRS UMR6118, Geosciences Rennes, Rennes, France (laurent.husson@univ-rennes1.fr), (2) CNRS UMR6112, Laboratoire de Planétologie et Géodynamique de Nantes, France

Attempts to explore the dynamics of convergent boundaries are essentially based on the confrontation of the observed kinematics to the intrinsic dynamic properties of subduction zones. Which often mismatch. On the basis of the mantle flow model of Conrad and Behn (2010), I explore the role of the often neglected basal drag that the flowing mantle exerts underneath each plate. After computing the total torque underneath each plate, I find that (i) net torque due to basal drag systematically drives plates away from their ridges and towards subduction zones, conformably to the plate circuit; (ii) compressive zones are found where the net drag forces from upper and lower plates are converging, and diverging for extensive zones; (iii) trench migration is dictated by the difference between the upper plate drag force and lower plate drag force. In other words, trenches advance where upper plates pulls the subduction zones and the lower plate pushes it. These results indicate that differences in the dynamics of plate boundaries arise from the global mantle circulation more than the from the local properties of subduction zones. The often neglected drag force thus appears crucial to reconcile the kinematics and dynamics of subduction zones.