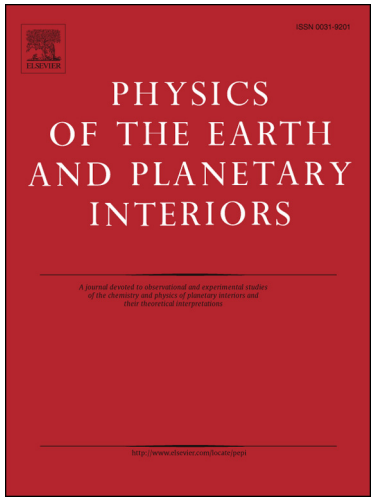

Trench dynamics: Effects of dynamically migrating trench on subducting slab morphology and characteristics of subduction zones systems

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Trench dynamics: Effects of dynamically migrating trench on subducting slab morphology and characteristics of subduction zones systems

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Abstract

Understanding the mechanisms of trench migration (retreat or advance) is crucial to characterizing the driving forces of Earth's tectonics plates, the origins of subducting slab morphologies in the deep mantle, and identifying the characteristics of subduction zones systems, which are among the fundamental issues of solid Earth science. A series of numerical simulations of mantle convection, focusing on plate subduction in a three-dimensional (3-D) regional spherical shell coordinate system, was performed to examine subduction zone characteristics, including geodynamic relationships among trench migration, back-arc stress, and slab morphology. The results show that a subducting slab tends to deflect around the base of the mantle transition zone and form a sub-horizontal slab because its front edge (its 'toe') is subject to resistance from the highly viscous lower mantle. As the sub-horizontal slab starts to penetrate into the lower mantle from its 'heel,' the toe of the slab is drawn into the lower mantle. The results for models with dynamically migrating trenches suggest that trench retreat is the dynamically self-consistent phenomenon in trench migration. The reason for this is that the strong lateral mantle flow that is generated as a sequence of events leading from corner flow at the subduction initiation to return flow of the formation of a