Geophysical Research Abstracts
Vol. 19, EGU2017-15780, 2017
EGU General Assembly 2017

Where does subduction initiate and die? Insights from global convection models with continental drift

Martina Ulvrova (1), Simon Williams (2), Nicolas Coltice (3), and Paul Tackley (4)

(1) Laboratoire de Geologie de Lyon, Universite Claude Bernard Lyon 1, Villeurbanne, France (mulvrova@gmail.com), (2) EarthByte, School of Geosciences, University of Sydney, Sydney, New South Wales, Australia (simon.williams@sydney.edu.au), (3) Laboratoire de Geologie de Lyon, Universite Claude Bernard Lyon 1, Villeurbanne, France (nicolas.coltice@univ-lyon1.fr), (4) Department of Earth Sciences, ETH Zurich, Zurich, Switzerland (ptackley@gmail.com)

Plate tectonics is a prominent feature on Earth. Together with the underlying convecting mantle, plates form a self-organized system. In order to understand the dynamics of the coupled system, subduction of the lithospheric plates plays the key role since it links the exterior with the interior of the planet. In this work we study subduction initiation and death with respect to the position of the continental rafts.

Using thermo-mechanical numerical calculations we investigate global convection models featuring self-consistent plate tectonics and continental drifting employing a pseudo-plastic rheology and testing the effect of a free surface. We consider uncompressible mantle convection in Boussinesq approximation that is basaly and internaly heated.

Our calculations indicate that the presence of the continents alterns stress distribution within a certain distance from the margins. Intra-oceanic subudction initiation is favorable during super-continent cycles while the initiation at passive continental margin prevails when continents are dispersed. The location of subduction initiation is additionally controlled by the lithospheric strength. Very weak lithosphere results in domination of intra-oceanic subduction initiation. The subduction zones die more easily in the vicinity of the continent due to the strong rheological contrast between the oceanic and continental lithosphere. In order to compare our findings with subduction positions through time recorded on Earth, we analyse subduction birth in global plate reconstruction back to 410 My.