Geophysical Research Abstracts
Vol. 14, EGU2012-3384-1, 2012
EGU General Assembly 2012

On the initiation of subduction by plume-induced compression: a numerical study

G. Lu (1,4), B. Kaus (2,3), L. Zhao (1), and T. Zheng (1)

(1) State Key Laboratory of Lithospheric Evolution, Insititute of Geology and Geophysics, Chinese Academy of Sciences, (4) Department of Earth Science, ETH Zurich, (2) Institute of Geosciences, Universtiy of Mainz, (3) University of Southern California, Los Angeles USA

Subduction generation is one of long-standing unresolved questions in geodynamics, and quite a bit of progress has been made in better understanding the initation of subduction zones when kinematic boundary conditions are applied. Yet, such boundary conditions are mainly applicable to explain the creation of new subduction zones along pre-existing heterogeneities (such as transform faults) once plate motion changes. Hence, they do not explain how subduction is generated on a planet that is initially in the stagnant lid mode.

Therefore, we here perform 2D numerical simulations using a Lagrangian FEM code MILAMIN_VEP to investigate the effect of plume on the formation of subduction. We investigate whether the forces induced by plumes are sufficient for the formation of subduction. A mechanism of lithospheric-scale shear localization is included in our model. Free-slip side boundary condition are used and no internal push forces are applied. For temperature boundary conditions, the side boundaries have zero flux and the top and bottom boundaries have constant temperatures. To produce a steady plume, the left corner of the bottom boundary has a higher temperature. Models with different size and amplitude of temperature anomaly and with lithospheric-scale heterogeneities in the lithosphere are simulated. Besides, models with steady cold plumes are also simulated.