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The influence of mantle convection on the evolution of South American topography during the Miocene

Nicolas Flament (1), Michael Gurnis (2), and Dietmar Müller (1)

(1) Earthbyte Group, School of Geosciences, The University of Sydney NSW 2006, Australia (nicolas.flament@sydney.edu.au), (2) Seismological Laboratory, California Institute of Technology, Pasadena, California 91125, USA

The effect of mantle convection on the topography, dynamic topography, has been the subject of considerable interest over the past few years. South America is a key area to study this phenomenon since it has been drifting west over subducting oceanic lithosphere for the last $\sim$ 130 Ma.

To quantify the evolution of dynamic topography, a workflow has been developed that consists of imposing kinematics from tectonic reconstructions developed using the software *GPlates* as a surface boundary condition in global mantle convection models computed with *CitcomS*. Using this workflow for South America, *Shephard et al. (2010)* suggested that changes in dynamic topography over the last 30 Myr contributed to the establishment of the eastward drainage of the Amazon River. Nevertheless, both geodynamic models and tectonic reconstructions can be improved to gain further insights on the contribution of mantle flow to the evolution of the topography of South America. In purely viscous geodynamic models, subducting slabs can be obtained by running an initial velocity boundary condition for $\sim$ 100 Myrs or by using an adjoint method in which the present-day mantle seismic structure of the mantle is assimilated in time-dependent models. Both of these methods are computationally expensive, and adjoint methods depend on the resolution of tomography models that is limited for South America. We introduce a new slab assimilation method in which the thermal structure of the slab, derived analytically, is progressively assimilated in the upper mantle into the dynamic models. In addition, this method allows us to model flat slab segments that have been proposed for the Andean margin and that are particularly relevant for dynamic topography. Furthermore, our new models account for continental deformation. They include a reconstruction of the tectonic shortening along the Andean margin that affects the evolution of the location of the trench. In addition, we divided the South American plate into nine individual rigid blocks, as suggested by recent reconstructions of the opening South Atlantic Ocean. Finally, we model tectonic extension along the Eastern margin of South America, which allows us to calculate the tectonic subsidence due to both continental stretching and to dynamic topography.

Reference:

Shephard, G. E., Müller, R. D., Liu, L. & Gurnis, M., 2010. Miocene drainage reversal of the Amazon River driven by plate–mantle interaction. *Nature Geosci.* **3**, 870-875.