## Coupled Lithosphere Mantle Circulation Models

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High resolution computer models of deep Earth circulation coupled to models of the lithosphere now provide unprecedented opportunity to study the linkages between deep-seated dynamic processes in the Earth's interior and their tectonic and topographic response at the surface. Mass anomalies in the Earth's mantle are a key controlling factor, because they initiate up- and downwelling flow and thereby elevate or depress the surface over extended regions for prolonged periods of time.

To model tectonic evolution in response to deep-seated solid-earth processes, it is essential to combine detailed mass budget considerations of the mantle with the dynamic considerations embedded in modern models of the mantle circulation. There exists well-known a-priori information on the mass budget of the mantle in the form of density models derived from histories of subduction. Here we report on one such effort to directly quantify the thermally induced mantle density structure from a history of plate motion assimilated in global mantle circulation models. Key advances to the dynamic model include (1) a thermodynamically self-consistent formulation of the mantle mineralogy and (2) a very high numerical resolution sufficient to resolve (for the first time) global mantle flow at Earthlike convective vigour. The latter is needed to resolve thermal boundary layers at the appropriate time- and length-scales. We apply our model to compute global plate motion, and focus in particular on the evolution of plate boundary forces. We will show results for the Nazca / South America plate boundary, demonstrating the recent changes in plate motion of that region can be modeled accurately from our approach.