SORS/WomenInBSC: "Dynamic topography inferred from global continental hiatus surfaces as a tool for constraining global mantle circulation models"

Abstract

Mantle convection is a fundamental process governing the evolution of our planet. Buoyancies in the mantle induce horizontal and vertical motion of the Earth's lithosphere which leave an imprint on the geological record. Positive surface deflections induced by mantle convection create erosional/non-depositional environments which lead to gaps (hiatuses) in the stratigraphic record, while negative deflections provide accommodation space for sedimentation to occur. Thus, by mapping hiatus and no-hiatus signals on inter-continental scales at timescales of geological series (ten to tens of millions of years), one gains a proxy for the long-wavelength uplift and subsidence associated with dynamic topography.

Here, we present the the global continental hiatus surfaces since the Upper Jurassic and their links to known mantle dynamic events. For example, we tend to observe the appearance of a hiatus surface, indicating an uplift of the lithosphere, before the arrival of a mantle plume. In Europe, we mapped a large-scale sedimentary hiatus during the Paleocene (~66-56 Million years ago), prior to the arrival of the Iceland plume. We then use these maps as a constrain on mantle circulation models (MCMs), which make predictions of the history of dynamic topography. To make such comparison, we filter the modelled dynamic topography through the geological lenses and obtain the synthetic hiatus maps which are directly comparable to the true maps. By generating synthetic hiatus maps for a variety of high-resolution TERRA MCMs, we show that such maps alow for falsification or verifications of MCMs based on their prediction of dynamic uplift/subsidence events. Our results imply that a key property of time-dependent geodynamic Earth models must be a difference in timescale between mantle convection itself and resulting dynamic topography. Moreover, they highlight the importance of continental-scale compilations of geological data to map the temporal evolution of mantle flow beneath the lithosphere.

**Short Bio**

Berta Vilacís is a PhD student in global geodynamics at the Ludwig-Maximillians-Universität München (LMU Munich). She studied Physics at the University of Barcelona, focusing during her last year in the field of applied seismology. At the same time, she obtained a collaboration grant with the seismic network of Catalonia. After graduating, in 2017, she worked in the Institute of Catalan Studies (LEGEF) maintaining seismic stations and processing their data. At the end of that year, she moved to Munich, where she obtained a master's degree in geophysics from the joint program of the Technical University of Munich and LMU Munich, the two leading German research universities.

At the end of 2019, she started her doctorate in the group of Prof. Hans-Peter Bunge and is part of the the UPLIFT research training group funded by the Deutsche Forschungsgemeinschaft (DFG). Her research focuses on the use of geological information such as geological maps and stratigraphic studies as a way to observe, map and track changes in topography due to mantle convection. She uses these observations to verify and further develop analytical and global geodynamic models to study unknown rheological properties of the Earth's mantle.

Speakers

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