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Constraining eclogitization kinetics at large scale: the Indian lower crust

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Earthquakes occurring in the Indian lower crust underthrusting Tibet (at ca. 60-80 km depth) can be related to eclogite facies metamorphism reactions. These intermediate-depth events are most likely an expression of the physical processes which accommodate the ca. 15% volume change during dehydration reactions. While such eclogitization reactions are described in the field and in laboratory experiments, their kinetics at large spatial scales has hitherto not been investigated.
We propose to fill this gap and constrain the extent and kinetics of Indian lower crust eclogitization at large spatial scales using 2-D thermokinematic and petrological models constrained by gravity anomaly data. We derive lithospheric density profiles by coupling a thermokinematic model with a realistic multi-layer petrological model determined based on mineralogical composition, pressure and temperature. These density estimates are then used to compute the associated Bouguer anomalies, which are constrained by field data acquired along orogen-perpendicular profiles.
We explore model parameters (geometry, composition, water content) to best fit observations along 10 profiles crossing the Himalayas, spanning from NW India to Bhutan, and discuss lateral variations in eclogitization processes along the orogen in relation with seismic activity in the region. Our first results (from 2-D models) yield metamorphic kinetics rates similar to those of regional metamorphism known from field samples. We plan to refine our 2-D models and then perform 3-D calculations to cover the Himalayan arc.