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Linkages between rift evolution and deep mantle flow

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Rift evolution offers a unique opportunity to study the linkage between deep-seated dynamic processes in the Earth's interior and their 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 trace, quantify and forecast topography evolution in response to deep-seated processes, it is essential to combine mass budget considerations of the mantle with the dynamic considerations embedded in 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. We will report on ongoing efforts to quantify the thermally induced mantle density structure from a histories of plate motion assimilated in global mantle circulation models. Key advances to the dynamic model include a very high numerical resolution sufficient to resolve (for the first time) global mantle flow at Earthlike convective vigour, which is necessary to resolve thermal boundary layers at the appropriate time- and length-scales. We will apply our model to gain better insight on the impact of hot thermal upwellings on the evolution of major rifts.