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The Topographic evolution of the African continent, constraints from coupling deep mantle, climate and surface processes models

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The African continent is characterized by an anomalous topography made of long (1000 km) wavelength features that cannot be easily explained by variations in crustal and lithospheric thickness and for which we possess relatively few constrains on the timing of surface uplift and subsidence. We have attempted to use the sedimentary record from the marginal basins surrounding the continent to constrain the timing and amplitude of the various phases of vertical movement responsible for this anomalous topography, in the hope of gaining more insight on the mechanism(s) responsible for its formation. By its nature (amplitude, timing and dimensions) the anomalous topography seems to be linked to dynamical processes originating in the underlying mantle. However, the sedimentary record must be deconvolved of the effects of long-term, continental-scale climatic variations before it can be used to provide constraints on the topographic evolution. To this effect, we have combined numerical models of the past climate constrained by geology with a large-scale surface processes model for erosion and sediment transport (TopoSed; Simoes et al., 2010) in which the long-term tectonic uplift and subsidence is retrodicted by a global mantle convection model (Moucha et al., 2011). We focused on the topographic evolution of the late Cenozoic African continent and quantified the relative contributions of climate, rock erodibility, mantle rheology, and present-day mantle heterogeneity in terms of the modeled sediment supply to the margins and compare this with the observed sedimentary fluxes inferred from the geological record.