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Interplay between dynamic topography and flexure along the U.S. Atlantic passive margin: Insights from landscape evolution modeling

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Recent global backwards-in time models of mantle convection have resulted in vastly different interpretations of the transient state of dynamic topography on the U.S. Atlantic passive margin over the past 30 Myr (Moucha et al., 2008; Spacejovic et al., 2008; Rowley et al., 2013; Liu, 2014). A promising way of benchmarking these geodynamic models is by reconciling them with the observed offshore sedimentary record. However, it is difficult to deconvolve the erosional response produced by changes in dynamic topography from other sources of landscape change because the erosional response is a convolution of dynamic topography changes, tectonic uplift/subsidence, flexural response to erosional unloading and depositional loading, rock properties, and climate. Herein, we present results from a new landscape evolution model that is capable of producing simulations that are required at the scale and resolution necessary to quantify the landscape response to various models of dynamic topographic change on the U.S. Atlantic passive margin in the presence of flexural unloading and loading due to erosion and deposition. We focus here on the deformation of the Orangeburg scarp, a well-documented mid-Pliocene shoreline, and demonstrate that flexural effects along this margin may be comparable to changes in dynamic topography. We conclude by exploring the parameter space to find an acceptable fit to the observed warping of the Orangeburg scarp by combining dynamic topography and flexural effects changes.