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Flexure in response to sedimentation and erosion along the US Atlantic passive margin; reconciling dynamic topography, sea level change and paleoshorelines

Robert Moucha (1), Gregory Ruetenik (2), and Bas de Boer (3)

(1) Syracuse University, Earth Sciences, Syracuse, United States (rmoucha@syr.edu), (2) Georgia Institute of Technology, Earth And Atmospheric Sciences, Atlanta, United States, (3) Institute for Marine and Atmospheric research Utrecht, Utrecht University, Utrecht, Netherlands

Reconciling elevations of paleoshorelines along the US Atlantic passive margin with estimates of eustatic sea level have long posed to be a challenge. Discrepancies between shoreline elevation and sea level have been attributed to combinations of tectonics, glacial isostatic adjustment, mantle convection, gravitation and/or errors, for example, in the inference of eustatic sea level from the marine δ18O record. Herein we present a numerical model of landscape evolution combined with sea level change and solid Earth deformations (glacial isostatic adjustment and dynamic topography) to demonstrate the importance of flexural effects in response to erosion and sedimentation along the US Atlantic passive margin. We quantify these effects using two different temporal models. One reconciles the Orangeburg scarp, a well-documented 3.5 million-year-old mid-Pliocene shoreline, with a 15 m mid-Pliocene sea level above present-day (Moucha and Ruetenik, 2017). The other model focuses on the evolution of the South Carolina and northern Georgia margin since MIS 11 ($\sim$ 400 Ka) using a fully coupled ice sheet, sea level and solid Earth model (de Boer et al, 2014) while relating our results to a series of enigmatic sea level high stand markers.

de Boer, B., Stocci, P., and van de Wal, R. (2014). A fully coupled 3-d ice-sheet-sea-level model: algorithm and applications. Geoscientific Model Development, 7:2141–2156.

Moucha, R. and Ruetenik, G. A. (2017). Interplay between dynamic topography and flexure along the US Atlantic passive margin: Insights from landscape evolution modeling. Global and Planetary Change, 149: 72-78