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Mid-Pliocene shorelines of the US Atlantic Coastal Plain: an improved elevation database with constraints from Earth model predictions

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For more than half a century, the Atlantic Coastal Plain (ACP) of the southeast United States has been the focus of studies investigating Pliocene and Pleistocene shorelines where the mapping of paleo-shorelines was carried out mainly by using elevation contours on topographic maps. Here we review published geologic maps and compare them to paleoshoreline traces obtained through geomorphometric classification and satellite data. We further present the results of an extensive field campaign that measured the mid-Pliocene ($\sim$3.3 – 2.9 Ma) shorelines of the ACP using high-accuracy GPS and Digital Elevation Models. We compare our new dataset to positions and elevations extracted from published maps and find that the extracted site information from previously published maps results in large uncertainties, not only in the location, but also more critically, in the elevation of the paleoshorelines. Lastly, we investigate the causes and rates of post-depositional displacement of the shoreline from Georgia to Virginia. To do this we correct the elevation of our shoreline for glacial isostatic adjustment (GIA) and then compare the corrected elevation to predictions of mantle flow-induced dynamic topography (DT). We find a discrepancy between the GIA-corrected shoreline and the predictions of DT models, which suggests that either (i) the DT and GIA models presented here do not capture the full range of uncertainty in the input parameters and /or (ii) other influences, such as sediment loading and unloading, may have caused additional post-depositional deformation of the mid-Pliocene shoreline that are not captured in the models. In this context, our field measurements represent an important observational dataset with which to compare future generations of geodynamic models. Improvements in models for DT, GIA and other relevant processes will ultimately be the key to obtaining more accurate estimates of eustatic sea level not only for the mid-Pliocene but across the broader Cenozoic.