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Detection of a dynamic topography signal in last interglacial sea level records

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Mantle convection driven changes in topography have been shown to warp Earth's surface on long (million year) timescales, causing flooding and widespread sea level change. We argue that changes in dynamic topography also play a role in sea level changes on the shorter timescale of glacial cycles. The Last Interglacial (LIG, $\sim$ 125 ka) serves as a testing ground for understanding ice sheet stability and sea level rise in a warmer world. Global mean sea level during this time is generally obtained by correcting the observed elevation of sea level indicators for glacial isostatic adjustment. Here we investigate the extent to which mantle convection has additionally impacted the elevation of interglacial sea level markers. We consider the full effect of mantle flow driven changes in topography, including the thermal subsidence of ocean lithosphere and conduct twelve mantle convection calculations to estimate the magnitude and uncertainty of dynamic topography change. We find coherent trends but also large variability among the different models, reflecting uncertainties in mantle density and viscosity structure, and in the appropriate coupling between mantle flow and surface plates. We make predictions for key sea level sites as well as discuss the effect of the dynamic topography correction on the observed elevation of a global database of $\sim$280 LIG sea level indicators. We find that (1) predicted deflections are significantly correlated (> 95% probability) with the elevation of sea level markers, (2) they are consistent with construction and preservation attributes across different sea level marker types, and (3) correcting for the effects of dynamic topography reduces the variability among marker elevations. We conclude that a dynamic topography signal is present in the elevation of LIG sea level records, and that the signal must be accounted for in any effort to determine peak global mean sea level during this time to within an accuracy of several meters.