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Greenland Ice Sheet reconstructions during the last interglacial period: Still unconstrained

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There is ongoing uncertainty about the extent to which the Greenland Ice Sheet responded to warming in the last interglacial period. A wide range of modelled ice-sheet reconstructions are now available for this period, with relatively little consensus or constraint. Arguments for minimal ice-sheet response to last interglacial warming based on the NEEM ice core (Dahl-Jensen et al., Nature 2013) suggest that Greenland will not be strongly affected by projected Arctic warming in the coming centuries. This is possible, and it would be welcome news with respect to concerns about climate warming and sea level rise. It is not clear, however, that the NEEM record offers strong constraint on this. A wide range of simulations of Greenland Ice Sheet evolution through the last interglacial period are consistent with the NEEM ice core (Rybak and Huybrechts, EGU (2013) and PALSEA (2013); results presented here). Indeed, the main lesson from this ice core is a reaffirmation that the central Greenland ice dome survived the last interglacial warming, with Eemian-aged ice from this surviving central dome flowing into the current NEEM site.

Using an energy-balance based surface mass balance model along with isotopic tracing in a 3D ice sheet model for the last interglacial period, a broad range of ice sheet reconstructions are shown to be consistent with the NEEM ice core constraints. A wide range of climatic and glaciological parameter space for the Eemian period honours the ice core record while simultaneously producing the demise of more than half of the Greenland Ice Sheet. The main conclusion is that it is still too early to assess how sensitive or insensitive the Greenland Ice Sheet may be to climate warming. Recent arguments about Greenland's resiliency to warming may prove to be correct, but the extent of the Eemian ice sheet in Greenland is still poorly constrained; the Eemian period does not yet offer quantitative insight about Greenland Ice Sheet response to future climate warming.