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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2 °C global warming is highly dangerous" *by* J. Hansen et al.

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Response to SC C5419: 'Mega-tsunamis from Greenland Ice Sheet disintegration?', John Nissen, 29 July 2015

Nissen suggests that the Greenland ice sheet should be subject to the same kind of non-linearity as West Antarctica. Indeed, ice sheets subjected to the type of forcing envisaged under business-as-usual GHG increases will likely begin to shed mass in a non-linear fashion. However, the powerful feedbacks that we have identified in the

Southern Ocean may be less effective for Greenland. Shutting down or slowing down Antarctic Bottom Water Formation speeds up the melting of ice shelves, but shutting down or slowing down AMOC reduces ocean transport of heat to the North Atlantic. Also there is more ice in Antarctica sitting on retrograde beds and subject to direct contact with the ocean.

That said, there are surface ice feedbacks on Greenland, meltwater effects, albedo effects, so Greenland's response is surely going to be nonlinear. It is easy to imagine melting taking off if the hemisphere warms substantially. On the other hand, if the North Atlantic cools, as it has in the past couple of years, it is unclear what that means for Greenland weather. Greenland melt on the near-term seems to be a complicated problem – see our discussion. The comment in our paper was only meant to indicate that the characteristic time for nonlinear decay could be different for Greenland than for Antarctica.

Our conclusion that the rapid late-Eemian sea level rise indicated by coral reef back-stepping must have from Antarctica meltwater provides a clear indication that Antarctica is capable of a rapid multi-meter contribution to sea level. We know of no similar evidence for Greenland.

The fact that storms can move mega-boulders is discussed in our response to SC C5885, and will be made clearer in the revised paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 20059, 2015.