

## ***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.***

**J. Hansen et al.**

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Response to SC C5284: ‘Objection to eemian sea level account, section 2.1’, Matthew Whipple, 28 Jul 2015

We do not need to rely on uncertain ice sheet models for estimating Eemian sea level and its temporal change. We include the most relevant references for paleo evidence of Eemian sea level. We may include a few additional references in revision, but for the sake of the reader it is important not to indiscriminately list and discuss every paper

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published on the topic.

A case in point is Whipple’s suggestion that Lambeck et al. (Earth Plan. Sci. Lett, 315-316, 4-11, 2012) conclude that sea level throughout the entire Eemian could have been below present sea level. The paper he refers to has a good fundamental discussion about the difficulties that isostatic adjustment of Earth’s crust poses for efforts to infer global sea level from local or regional shoreline movement. However, in a paper written one year later (despite the 2012 publication date of both papers) in Science (Ice volume and sea level during the Last Interglaciation, Science, 337, 216-219, 2012) Dutton and Lambeck state: “We provide an internally consistent database of coral U-Th ages to assess last interglacial sea-level observations in the context of isostatic modeling and stratigraphic evidence. These data indicate that global (eustatic) sea level peaked 5.5 to 9 meters above present sea level. . .”

Assertion that maximum Greenland contribution to sea level rise was in late Eemian is wrong. If we had to rely entirely on models, there would be a large uncertainty in Greenland’s contribution to sea level, as models range from 0.5 m to 5.5 m sea level equivalent from Greenland (Vasskog et al., Earth-Science Reviews, 150, 45-67, 2015). Fortunately, NEEM and other ice core data shows that most of the Greenland ice sheet was present during the Eemian, and, more to the point, the ice core data show that while the Greenland ice sheet shrank during the first half of the Eemian, it was approximately stable in size during the latter part of the Eemian. We discuss the data in our paper. The water for the late Eemian sea level rise must have come from Antarctica.

Details of where the ice sheet mass loss occurred in Antarctica is indeed important and it is a ripe topic for investigation via a sufficient geographical distribution of ocean cores and ice cores. We point out in our paper tantalizing hints in the ice core data of zonal variations in ocean changes (based on changes in the source water for Antarctic snow) that could be related to changes in freshwater flux from the ice sheet that affect the sea surface temperature and sea ice cover.

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