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Arctic amplification and the Greenland ice sheet at the Last Interglacial: the role of vegetation feedback

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We calculated the climatic conditions, mass balance and the transient volume of the Greenland ice sheet in the last interglacial period using the atmosphere slab-ocean vegetation general circulation model ASVGCM MIROC-LPJ and IciES ice sheet model. Taking into account the vegetation feedback, the annual mean temperature anomaly increases from +1 K to +2 K, and of summer temperature anomaly from +4 K to +6 K in central Greenland. This is close to the +5 K at NGRIP and +8 K at NEEM as inferred from ice core isotope data, which takes into account that summer precipitation contributes more to oxygen isotope values{reference}. The vegetation feedback, also increases precipitation by 20% averaged over the entire ice sheet and by 30 % in northwestern Greenland. The combination of the sea ice-temperature feedback and the vegetation feedback amplifies both the temperature and precipitation changes in the Eemian.

The increased ablation caused by high temperatures in central Greenland is partly compensated by the increased precipitation. The ice volume loss of Greenland in the Eemian compares to present day amounts to 1 to 2.5 meters sea level equivalent depending on the inferred present day reference climate and model parameters, such as lapse rate. The spatial pattern of increased temperature and increased precipitation is supported by the fact, that the modeled Eemian Greenalnd ice sheet covers all locations of ice core cites (GRIP/GISP, NGRIP, NEEM and Dye3), for which the existence of Eemian ice is confirmed. The reconstructed sea level elevations in the Eemian range from 6 to 9 m{references} above present day sea level. Thus, our results imply that the larger part of the difference in sea level between Eemian and present day stems from the Antarctica ice sheet.