



The role of ocean and sea-ice feedbacks in 1.5°C and 2.0°C warmer worlds

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A number of studies have investigated the effect of global warming of 1.5°C and 2.0°C relative to pre-industrial conditions using the multi-model data set provided by the Half a degree Additional warming Prognosis and Projected Impacts (HAPPI) project. While the HAPPI simulations provide useful insights, important feedbacks are neglected because the sea surface temperature and sea-ice cover are held fixed.

We investigate the role of ocean and sea-ice feedbacks under 1.5°C and 2.0°C warming by comparing results from the subset of HAPPI simulations which were carried out with the Norwegian Earth System Model (NorESM) to simulations in which the model is run with active ocean components. Results show that the response is amplified in the simulations with an active ocean. The Arctic amplification in 1.5°C warmer worlds is 54% stronger when the NorESM is run with a full ocean model and 27% stronger with a slab ocean model compared to in the HAPPI simulations. The slab-ocean version, which partly corrects for a cold bias in the model version with a deep ocean, moreover simulates Arctic ice-free summers to occur 18% of the time under 2.0°C warming whereas they are rare under 1.5°C warming.