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Drivers of past and future Arctic Ocean warming in CMIP5 models

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We investigate modeled changes in the Arctic Ocean energy budget to understand if the past and future Arctic Ocean warming is primarily driven by changes in the net atmospheric surface flux or by changes in the meridional oceanic heat flux. We use data from 26 general circulation models run in the Coupled Model Intercomparison Project 5 (CMIP5), covering the period 1960 to 2099.

We find that in 11 models, the Arctic Ocean warming is driven by positive anomalies in the net atmospheric surface flux, while in 11 other models it is driven by positive anomalies in the meridional oceanic heat flux. In the four remaining models, the Arctic Ocean warming is driven by positive anomalies in both energy fluxes.

The different behaviors between the models are mainly driven by the different changes in the meridional oceanic heat flux. We find that the magnitude of increase in the mass transport into the Barents Sea as well as the increase in temperature at the Barents Sea Opening and the Fram Strait influence the sign of change in the meridional oceanic heat transport. Additionally, we find that changes in the meridional oceanic heat flux and changes in the net atmospheric surface flux are strongly linked together through the atmospheric turbulent heat fluxes.

In summary, our results show that the multi-model ensemble mean is not representative for a consensus behavior of the models.