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CGD Seminar Series

Arctic Freshwater Storage and Export in CMIP6 Models

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Time: 11am – 12pm

For Zoom information, please contact Tracy Baker tbaker@ucar.edu

For live stream information, visit the CGD Seminar Webpage

ABSTRACT

Recently, the Arctic has undergone substantial changes in sea ice cover and the hydrologic cycle, both of which strongly impact the freshwater storage in, and export from, the Arctic Ocean. The fate of Arctic Ocean freshwater is of global relevance, as it can impact North Atlantic Deep Water formation and potentially the strength of the Meridional Overturning Circulation. Here we analyze Arctic freshwater storage and fluxes in 7 climate models from the Coupled Model Intercomparison Project phase 6 (CMIP6) and assess their agreement over the historical period (1980-2000) and in two future emissions scenarios, SSP1-2.6 and SSP5-8.5. Rather than focusing on a single realization of each experiment, ensembles from each model are used in order to understand model internal variability and to better constrain inter-model differences.

In the historical simulation, few models agree closely with freshwater storage and flux observations over 1980-2000. In both future scenarios the models show an increase in liquid (ocean) freshwater storage in conjunction with a reduction in solid storage and fluxes through the major Arctic gateways (Bering Strait, Fram Strait, Davis Strait, and the Barents Sea Opening) that is typically larger for SSP5-8.5 than SSP1-2.6. The liquid fluxes through the gateways exhibit a more complex pattern, with models showing a change in sign of the freshwater flux through the Barents Sea Opening and little change in the flux through the Bering Strait in addition to increased export from the remaining straits. A decomposition of the liquid fluxes into their salinity and volume contributions shows that the Barents Sea flux changes are driven by salinity changes, while the Bering Strait flux is driven by compensating salinity and volume flux changes. Overall, though the models broadly agree on the sign of future storage and flux changes, substantial differences exist between the magnitude of these changes and the models' Arctic mean states.