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## Arctic Freshwater in CMIP6: Declining Sea Ice, Increasing Ocean Storage and Export

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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. 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. In the historical simulation, few models agree closely with 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 exhibiting 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 by the end of the 21st century. 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 changes are driven by compensating salinity and volume changes. In the straits west of Greenland (Nares, Barrow, and Davis straits), the models disagree on whether there will be a decrease, increase, or steady liquid freshwater export in the early to mid 21st century, although they mostly show increased liquid freshwater export in the late 21st century. The underlying cause of this is a difference in the magnitude and timing of a simulated decrease in the volume flux through these straits. Although the models broadly agree on the sign of late 21st century storage and flux changes, substantial differences exist between the magnitude of these changes and the models' Arctic mean states, which shows no fundamental improvement in the models compared to CMIP5.