



Projected freshening of the Arctic Ocean in the 21st century

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Using state-of-the-art models from the Coupled Model Intercomparison Project phase 5 (CMIP5), this study found the upper Arctic Ocean likely to freshen considerably in the future. Arctic Ocean average sea surface salinity is projected to decrease by 1.5 ± 1.1 psu and the liquid freshwater column is projected to increase by 5.4 ± 3.8 m by the end of the 21st century under the Representative Concentration Pathway 8.5 (RCP8.5) scenario. Most freshening would occur in the Arctic Ocean basins, i.e. the Canada, Makarov, and Amundsen basins. Anomalies in freshwater flux from sea ice melt, Bering Strait inflow, net precipitation (P–E), river runoff, and freshwater through the Barents Sea Opening (BSO) would contribute to Arctic Ocean freshening. CMIP5 historical and RCP8.5 experiments showed the respective projected contributions from BSO freshwater flux, river runoff, P–E, and Bering Strait inflow are about 6.4, 5.0, 2.7, and 2.2 times the contribution from sea ice melt averaged throughout the 21st century. Contributions from sea ice melt and Bering Strait inflow would increase and then decrease gradually, while those from BSO freshwater flux, river runoff, and P–E would increase continuously. The CMIP5 models are able to simulate the Arctic Ocean freshwater system more accurately than CMIP3 models. However, the simulated rate of increase of freshwater content ($296 \pm 232 \text{ km}^3 \text{ yr}^{-1}$) is weaker than estimated ($600 \pm 300 \text{ km}^3 \text{ yr}^{-1}$) based on observations (1992–2012). Moreover, the simulated BSO and Davis Strait freshwater fluxes still exhibit substantial intermodel spread and they differ considerably from observed values.