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Vertical mixing and oceanic heat transport in the Arctic Ocean

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We are experiencing a transformation to “a new Arctic Ocean”: observations show significant arctic warming and declining sea ice extent and thickness, implying a stronger energy exchange and seasonal cycling of the upper ocean heat content. It has been a challenge to identify the role of oceanic heat transport in the changes in the Arctic system. The magnitude of vertical mixing and turbulent fluxes pushes the limits of our observational capability. It is shown, however, that even small changes in the ocean heat transport to the overlying sea ice cover can have substantial impacts. As the ice volume declines, increased levels of vertical mixing are expected from more wind energy input over vast areas of open water that can energize the interior ocean. The observational evidence has been contradictory between several studies. I first review the ocean mixing processes relevant to the Arctic with emphasis on tidal and wind forcing, double-diffusive fluxes, and processes over topography and shelves. I then present observations from two geographically distinct regions of the Arctic, from the central Arctic, near the North Pole, and from drifts north of Svalbard conducted under the Norwegian young sea ICE (N-ICE2015) experiment.