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Extensive under-ice turbulence microstructure measurements in the central Arctic Ocean in 2015

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The Arctic Ocean is a strongly stratified low-energy environment, where tides are weak and the upper ocean is protected by an ice cover during much of the year. Interior mixing processes are dominated by double diffusion. The upper Arctic Ocean features a cold surface mixed layer, which, separated by a sharp halocline, protects the sea ice from the warmer underlying Atlantic- and Pacific-derived water masses. These water masses carry nutrients that are important for the Arctic ecosystem. Hence vertical fluxes of heat, salt, and nutrients are crucial components in understanding the Arctic ecosystem. Yet, direct flux measurements are difficult to obtain and hence sparse.

In 2015, two multidisciplinary R/V Polarstern expeditions to the Arctic Ocean resulted in a series of under-ice turbulence microstructure measurements. These cover different locations across the Eurasian and Makarov Basins, during the melt season in spring and early summer as well as during freeze-up in late summer. Sampling was carried out from ice floes with repeated profiles resulting in 4-24 hour-long time series.

2015 featured anomalously warm atmospheric conditions during summer followed by unusually low temperatures in September. Our measurements show elevated dissipation rates at the base of the mixed layer throughout all stations, with significantly higher levels above the Eurasian continental slope when compared with the Arctic Basin. Additional peaks were found between the mixed layer and the halocline, in particular at stations where Pacific Summer water was present.

This contribution provides first flux estimates and presents first conclusions regarding the impact of atmospheric and sea ice conditions on vertical mixing in 2015.