Mid-winter transport of subsurface warm water in western Arctic Ocean

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Ocean heat transport is a possible important factor for recent sea ice decline, especially in the western Arctic Ocean. It has been indicated that vertical hydrographic profiles in the Canada Basin were characterized by three temperature maxima. The near-surface temperature maximum was the shallowest one arising from summer solar heat absorption and subsequent autumn Ekman downwelling. The subsurface temperature maximum reflected intrusion of Pacific summer water. The deepest maximum was located in the Atlantic layer. Substantial parts of upper ocean heat would eventually affect sea ice freezing/melting. However, spatial and temporal variabilities of these warm layers still remain uncertainties. Recently, year-long moorings in Chukchi Abyssal Plain detected mid-winter subsurface warming, plausibly caused by lateral advection of shelf-origin water. In this study, a pan-Arctic sea ice-ocean modeling was performed to address overwinter transport of subsurface warm water. The horizontal grid size was approximately 5 km to resolve mesoscale eddies and narrow jets. The interannual experiment from 2001 to 2014 demonstrated that Barrow Canyon throughflow and westward shelf-break jet established primary pathways of subsurface heat transport toward Chukchi Borderland. Shelf-break heat was partly lost by event-like wind mixing but remained under highly stratified surface layer until mid-winter.

Keywords: Arctic Ocean, Subsurface temperature maximum, Shelf-break jet

