Factors influencing Multi-time scale Sea-ice Variations in the Pacific Arctic Region

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The icebreaker *Araon* has carried out hydrographic surveys in the Pacific Arctic sector since 2010. The main objective of these regularly operated expeditions is to understand the relationship between water mass distribution and sea-ice decline. Multi-year accumulation of the data reveals that the area-mean Pacific Summer Water temperature over the northern Chukchi Sea shelf region is anti-correlated with the sea-ice extent over the central Arctic to the Chukchi Sea. The monthly surface wind distribution over the Chukchi shelf area appears to control the intensity of eastward along-shelf cold current that can suppress (or weaken) the westward flow of warm summer water from the Beaufort Sea. Besides the oceanographic measurements, the basic surface meteorological observations have been made regularly on the *Araon*. Since the 2015 Arctic expedition, the *Araon* began to implement upper-air radiosonde observations at least twice a day as a pilot filed campaign for preparing continuing observations contributing to the Year of Polar Prediction project. The beginning of in-situ upper-air observations in the Arctic represents an enhancement of research on the atmosphere-ocean interaction under storm event. In the 2016 Arctic expedition, the *Araon* came across an extraordinary intense Arctic storm with a minimum central pressure of 968 hPa on 16 August. The *in-situ* atmosphere-ice-ocean observations conducted under the stormy environment made it possible to study the storm's influence on the state of sea-ice and upper ocean. The observational analyses reveal that the storm induced a cold air advection and a net sea-ice surface cooling at the observation site, while the dynamically-enhanced upper ocean mixing and induced upwelling of the warm Pacific Summer Water increased ocean-to-ice heat flux, larger than the net heat loss at the sea-ice surface. Although the relative roles of the dynamics and thermodynamics on the rapid sea ice decline cannot be quantified based on the sole field observations, the storm induced coupled air-ice-sea processes could have accelerated the sea-ice decline during and after the storm event.