Geophysical Research Abstracts
Vol. 18, EGU2016-9227, 2016
EGU General Assembly 2016
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Upper Ocean Evolution Across the Beaufort Sea Marginal Ice Zone from Autonomous Gliders

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The observed reduction of Arctic summertime sea ice extent and expansion of the marginal ice zone (MIZ) have profound impacts on the balance of processes controlling sea ice evolution, including the introduction of several positive feedback mechanisms that may act to accelerate melting. Examples of such feedbacks include increased upper ocean warming though absorption of solar radiation, elevated internal wave energy and mixing that may entrain heat stored in subsurface watermasses (e.g., the relatively warm Pacific Summer (PSW) and Atlantic (AW) waters), and elevated surface wave energy that acts to deform and fracture sea ice. Spatial and temporal variability in ice properties and open water fraction impact these processes.

To investigate how upper ocean structure varies with changing ice cover, and how the balance of processes shift as a function of ice fraction and distance from open water, four long-endurance autonomous Seagliders occupied sections that extended from open water, through the marginal ice zone, deep into the pack during summer 2014 in the Beaufort Sea. Sections reveal strong fronts where cold, ice-covered waters meet waters that have been exposed to solar warming, and O(10 km) scale eddies near the ice edge. In the pack, Pacific Summer Water and a deep chlorophyll maximum form distinct layers at roughly 60 m and 80 m, respectively, which become increasingly diffuse as they progress through the MIZ and into open water. The isopynal layer between 1023 and 1024 kgm^{-3}, just above the PSW, consistently thickens near the ice edge, likely due to mixing or energetic vertical exchange associated with strong lateral gradients in this region. This presentation will discuss the upper ocean variability, its relationship to sea ice extent, and evolution over the summer to the start of freeze up.