EGU21-10798, updated on 30 Jul 2021
https://doi.org/10.5194/egusphere-egu21-10798
EGU General Assembly 2021

Seasonal evolution and salt/freshwater fluxes of first-year sea ice: Comparison between pack ice and landfast sea ice

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Sea ice affects the exchange of energy and matter between the atmosphere and the ocean from local to hemispheric scales. Salt fluxes across the ice-ocean interface that drive thermohaline mixing beneath growing sea ice are important elements of upper ocean nutrient and carbon exchange. Sea-ice melt releases freshwater into the upper ocean and results in formation of melt ponds that affect gas and energy transfer across the atmosphere-ice interface. The Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) provided an opportunity to follow sea-ice evolution and exchange processes over a full seasonal cycle in a rapidly changing ice cover. To this end, approximately 25 sea-ice cores were collected at 2 distinct sites, representing first-year and multi-year ice, to monitor physical, biological and geochemical processes relevant to atmosphere-ice-ocean exchange processes. Here we compare the growth and decay of first-year ice in the Central Arctic during the winter 2019-2020 to that of landfast first-year ice at Utqiaġvik, Alaska, from 1998 to 2016. Ice stratigraphy was similar at both sites with about 15 cm of granular ice on top of columnar ice, with a comparable growth history with a similar maximum ice thickness of 1.6-1.7 m. We aggregated the sea-ice bulk salinity and temperature profiles using a degree-day approach, and examined brine and freshwater fluxes at lower and upper interfaces of the ice, respectively. Preliminary results show lower sea-ice bulk salinity during the growth season and greater desalination at the ice surface during the melt season at the MOSAiC floe in comparison to Utqiaġvik.

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