

EGU21-3783

<https://doi.org/10.5194/egusphere-egu21-3783>

EGU General Assembly 2021

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Freshwater under the MOSAiC floe: implications of under-ice melt ponds for mass balance

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During the melt season in the Arctic, freshwater ponds can accumulate under ice floes as a result of local snow and sea ice melt, far from terrestrial freshwater inputs. Under-ice freshwater ponds have been suggested to play a role in the summer sea ice mass balance both by isolating the sea ice from salty, warmer water below, and by driving formation of ice 'false bottoms' at the interface of the under-ice pond and the underlying ocean.

The MOSAiC drift expedition in the Central Arctic observed the presence of under-ice ponds and false bottoms beginning early in the melt season (June - July) at primarily first-year ice locations on the floe. We examine the prevalence and drivers of these ponds and resulting false bottoms during this period. Additionally, we explore the impact for mass balance using observations from ablation stakes and a 1D model, where freshwater ponds can not only delay summer melt but also result in growth. We speculate that the unique history of the MOSAiC floe likely led to a relatively high occurrence of these features, but the results also suggest that freshwater under-ice ponds and false bottoms may be more common and more persistent in early summer in the Arctic than previously thought. Both have implications for the broader ice-ocean system, for example by reducing fluxes between the ice and the ocean, isolating the primary producers in ice from pelagic nutrient sources, and altering the optical properties.