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## Physical properties and spatial distribution of the sea ice surface layer (SSL/snow) during the autumn phase of the MOSAiC expedition

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Snow cover dominates the thermal and optical properties of sea ice and the energy fluxes between the ocean and the atmosphere, yet data on the physical properties of snow and its effects on sea ice are limited. This lack of data leads to two significant problems: 1) significant biases in model representations of the sea ice cover and the processes that drive it, and 2) large uncertainties in how sea ice influences the global energy budget and the coupling of climate feedback. The MOSAiC research initiative enabled the most extensive data collection of snow and surface scattering layer (SSL) properties over sea ice to date. During leg 5 of the MOSAiC expedition, we collected multi-scale (microscale to 100-m scale) measurements of the surface layer (snow/SSL) over first year ice (FYI) and MYI on a daily basis. The ultimate goal of our measurements is to determine the spatial distribution of physical properties of the surface layer. During leg 5 of the MOSAiC expedition, that surface layer changed from the surface scattering layer (SSL), characteristic for the melt season, to an early autumn snow pack. Here, we will present data showing both a) the physical properties and the spatial distribution of the SSL during the late melt season and b) the transition of the sea ice surface from the SSL to the fresh autumn snowpack. The structural properties of this transition period are poorly documented, and this season is critical for the initialization of sea ice and snow models. Furthermore, these data are crucial to interpret simultaneous observations of surface energy fluxes, surface optical and remote sensing data (microwave signals in particular), near-surface biochemical activity, and to understand the sea ice processes that occur as the sea ice transitions from melting to freezing.