East *vs*. West: Contrasting Snowpack Properties in the Weddell Sea, Antarctica

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ABSTRACT

As Antarctic snow cover persists during most of the year, it contributes significantly to the sea ice mass and energy budgets due to comprehensive seasonal transition processes within the snowpack. The Weddell Sea has a particular role in this respect as it consists primarily of perennial sea ice in the west, while seasonal sea ice is dominant in the east, as reflected in the respective snow characteristics. However, the spatial and seasonal variability of the snow properties associated with, for example, prevailing atmospheric conditions and the corresponding influence on the underlying sea ice have not yet been investigated in detail.

To do so, we present here a comprehensive compilation of *in situ* snow pit observations of physical seasonal and perennial snowpack properties obtained during numerous expeditions in the Weddell Sea since the 1990s, covering spring, summer, autumn, and winter conditions.

First results show a highly heterogeneous snow microstructure in the eastern Weddell Sea in late summer, ranging from small wind slab crystals (<0.5 mm) to large depth hoar crystals (>4 mm). From north to south there is a dominant slush fraction in the north due to the relatively thin sea ice beneath. In contrast, observation further south indicate widespread temperature gradient snow metamorphism evidenced by a high fraction of depth hoar due to colder atmospheric conditions. In contrast, widespread wet snow metamorphism dominates the snowpack in the northwestern Weddell Sea at this time of year, indicated by a high fraction of melt-freeze clusters caused by latitudinally higher solar radiative fluxes. Preliminary seasonal comparisons in the northwestern Weddell Sea show higher mean bulk densities up to 350 kg m^{-3} associated with high proportions of compacted wind slab and faceted crystals in spring and early summer, while high proportions of depth hoar crystals result in lower bulk densities in winter and early autumn.

Combining these snow observations with atmospheric and oceanic conditions along the previous drift trajectories of the sampled ice floes will provide substantial insight into the associated regional difference in the seasonal sea ice mass and energy budgets in the Weddell Sea.

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