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Sea-ice growth from the top: Meteoric ice and snow in the northwestern Weddell Sea, Antarctica

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Summer sea ice extent in the Weddell Sea has increased overall during the last four decades, with large interannual variations. However, the underlying causes and the related ice and snow properties are still poorly known.

Here, we present results of the interdisciplinary Weddell Sea Ice (WedIce) project carried out in the northwestern Weddell Sea on board the German icebreaker R/V Polarstern in February and March 2019, i.e. at the end of the summer ablation period, focusing on 21 ice cores sampled for texture, salinity and isotope analysis.

The ice at the coring sites had an average thickness of 178 cm with an average snow depth of 13 cm and a consistently positive freeboard. Isotope and salinity analyses revealed an average meteoric ice fraction of 23%. This included about 17% (22cm) snow-ice, saline sea ice formed by flooding and refreezing of snow at the snow/ice interface. In contrast, superimposed ice, fresh sea ice formed through melting and refreezing of snow only, account for about 6% (11cm) of the sea-ice thickness. The comparison of our results with previous expeditions to the same region shows that the thickness of superimposed ice has hardly increased, indicating no dominant changes in the amount of surface summer melt/thaw, despite the observed sea ice decline in the northwestern Weddell Sea during summer in recent years.

However, we consider the evolution of snow properties, and in particular the proportion of meteoric ice in the snow cover, as a critical indicator for significant changes in the coupled atmosphere/sea ice/ocean system.