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HOW MUCH DO WE KNOW ABOUT THE WATER CONTENT OF ARCTIC CLOUDS?

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The amount of cloud liquid strongly influences their radiative effects and precipitation efficiency, yet, little is known about the average occurrence and the variability of the liquid water path (LWP) in the Arctic. The existing observations are limited to a few ground-based land stations and satellite measurements associated with specific uncertainties due to the unique conditions of the Arctic. Here, we exploit reference measurements from four airborne campaigns conducted in recent years over the Fram Strait, northwest of Svalbard during different seasons to assess the quality of various LWP products over the sea-ice-free ocean. Brightness temperature measurements from the passive sensor of the downward-looking Microwave Radar/radiometer for Arctic Clouds (MiRAC) operated onboard the research aircraft Polar 5 were used to retrieve the LWP over the sea ice-free ocean with an estimated uncertainty of ± 22 g m^{-2}. LWP was also derived from visible-near-infrared (VNIR) wavelengths, which were also performed onboard the Polar 5. While good agreement between both instruments could be found for LWP values below 150 g m−2, a strong overestimation by AISA Hawk could be identified for larger values that might be related to specific retrieval assumptions. During two campaigns, several profiles of cloud liquid were measured by in-situ probes onboard the Polar 6 aircraft, which performed coordinated flights with the Polar 5. As expected LWP variability during the ascent through the mixed-phase clouds as measured by the in-situ aircraft is high. However, the few collocated matches provide an encouraging agreement.
The airborne reference LWP measurements were used to evaluate the performance of reanalysis and satellite estimates. For this purpose, specific matching techniques for ERA5 reanalysis, the Advanced Microwave Scanning Radiometer 2 (AMSR2) and the Moderate Resolution Imaging Spectroradiometer (MODIS) were applied. The talk will highlight the differences between the different products, specifically addressing the aspect of spatial resolution that is of particular interest for marine cold air outbreaks.