Liquid water path derived from airborne observations over the sea-ice-free Arctic ocean

Mario Mech, Maximilian Ringel, Nils Risse, and Susanne Crewell

- Universität zu Köln, Institut für Geophysik und Meteorologie, Köln, Germany (mario.mech@uni-koeln.de)

Arctic Amplification is most evident in the rise of the near-surface air temperature observed in the last decades, which has been at least twice as strong as the global average. The mechanisms behind that are widely discussed. Many processes and feedback mechanisms still need to be better understood, especially those connected to clouds and their role in the water and energy cycle. Thereby, the cloud liquid water path (LWP) is an important cloud parameter, and it is important to know its occurrence and spatial variability. However, observing LWP is prone to high uncertainties, especially in the Arctic, leading to about a factor of two difference in satellite retrievals between microwave and near-infrared retrievals. Moreover, weather and climate models show significant differences in Arctic regions.

Within this contribution, we will present LWP observations over the sea-ice-free Arctic ocean from measurements conducted during four airborne campaigns conducted within the framework of the "Arctic Amplification: Climate relevant atmospheric and surface processes and feedback mechanisms (AC)3" during the last years over the Fram Strait West of Svalbard. The LWP has been derived by statistical retrieval approaches based on brightness temperature measurements of the Microwave Radar/radiometer for Arctic Clouds (MiRAC) operated onboard the Polar 5 research aircraft of the Alfred-Wegener Institute for Polar and Marine Research (AWI). The consistent LWP product has been used in a comparison study to validate satellite estimates from the Moderate Resolution Imaging Spectroradiometer (MODIS) and the Advanced Microwave Scanning Radiometer 2 (AMSR2) and the one from the ERA5 reanalyses. It could be seen that the various products reveal a characteristic shape of the LWP distribution, but their overall performance varies with season and synoptic situations, i.e., ERA5 does not produce larger LWP values and an over- or under-estimation for specific flights and too high LWP values for MODIS and too low for AMSR2 during cold air outbreak events.