

AGU Fall Meeting 2023, 11-15 December 2023

Abstract submission for session:

C014 - Coupled-system Processes of the Central Arctic Atmosphere-Sea Ice-Ocean System: Harnessing Field Observations and Advancing Models

Abstract Title (max. 300 characters):

Water vapour in the central Arctic: How well do satellite products, reanalyses and reference observations from the MOSAiC expedition agree?

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Abstract (max. 2000 characters, excluding spaces but including punctuation):

In the Arctic, warming is enhanced compared to other parts of the globe, a phenomenon known as Arctic amplification. As the warmer atmosphere can hold more water vapour before saturation, the downward terrestrial radiation is increased which, in turn, increases near-surface air temperatures. Therefore, higher water vapour content is both a result and a driver of Arctic amplification. To better understand the role of water vapour, its variability and trends need to be known. In the Arctic, only few reliable water vapour observations exist because of the sparsity of ground stations and challenges in satellite remote sensing (i.e. related to sea ice, clouds, polar night). The vertically integrated water vapour (IWV) differs among different satellite products and reanalyses, resulting in high uncertainties regarding water vapour trends and variability.

In our study, we investigate whether reference water vapour measurements from the MOSAiC expedition can explain the differences in the satellite

products and reanalyses. The MOSAiC expedition features unique data sets covering the full annual cycle in the central Arctic. Newly developed water vapour retrievals combining radiances measured by ground-based microwave radiometers at low and high frequencies (22-340 GHz) and radiosonde observations serve as reference data. The reference data is augmented by further measurements regarding cloud and sea ice conditions. We evaluate IWV from satellite products (IASI merged product combining infrared and microwave observations, and a product based on AMSR-E/2 microwave observations) and reanalyses (ERA5, CARRA, and MERRA-2) with the reference data, and analyze the representation of humidity profiles with a focus on inversions. We also quantify the uncertainties of the downward terrestrial radiation resulting from different humidity profile representations among the satellite products and reanalyses.

Presentation Format Request:

- Have the programme committee decide whether it'd be an oral, eLightning or poster presentation
- Request only to be considered for a poster