# Local processes modifying atmospheric humidity in an Arctic fjord environment

Lennéa Hayo (1), Rosa Gierens (1), Vera Schemann (1), Theresa Kiszler (1), Marion Maturilli (2), Christoph Ritter (2), Kerstin Ebell (1)

(1) Institute for Geophysics and Meteorology, University of Cologne, Germany
(2) Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Potsdam, Germany

Water vapor plays an important role in the hydrological cycle, and relative humidity effectively determines whether cloud formation is possible. The Arctic lower atmosphere is influenced by large heterogeneity in surface latent and sensible heat fluxes, occasional humidity inversions, and transport of moisture and heat from the lower latitudes. Locally, the atmospheric humidity content is modified by evaporation and condensation, taking place at the surface and in the atmosphere in regions with clouds or precipitation. Recognizing the role of water vapor as a link between surface properties and cloud formation, we investigate local-scale variability in humidity by using measurements and high-resolution modeling carried out at the AWIPEV research base in Ny-Ålesund, Svalbard. By studying the influence of orography, heterogeneous surface properties (glaciers, seasonal snow cover, and open water), and local atmospheric conditions on the spatial distribution of humidity, we aim for a better understanding of the processes modifying atmospheric moisture and low-level cloud formation around Ny-Ålesund.

We study the spatial variability in integrated water vapor by utilizing azimuth scans performed by the microwave radiometer HATPRO. Since October 2016, two scans per hour are performed at a 30º elevation angle. Furthermore, we use the highly resolved numerical model ICON-LEM to describe the evolution of the boundary layer in the fjord. Evaluation of case studies suggests that boundary layer dynamics are a key factor explaining the spatial distribution of humidity in the presence of surface heterogeneity (snow-covered land vs. open water in the fjord). In a statistical analysis, we will associate the variability in humidity detected in the HATPRO scans with wind direction, boundary layer stability, and surface conditions. In the future, the HATPRO scans will also be used to study the variability of cloud liquid water around Ny-Ålesund, providing further insights on linkages between surface-atmosphere interactions, humidity, and clouds.