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NARVAL-North: Comparison of Cloud Properties from Aircraft Measurements with COSMO Simulations

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The representation of cloud and precipitation processes is one of the largest sources of uncertainty in climate and weather predictions. To validate model predictions of convective processes over the Atlantic ocean, often satellite data are used. However, satellite products provide just a coarse view with poor temporal resolution of convection over the Atlantic.

The new research aircraft HALO (High Altitude Long Range Research Aircraft) is operated by the German Aerospace Center (DLR). It provides the unique opportunity to exploit regions of the atmosphere that can not be easily accessed otherwise as it is able to reach remote regions and operate from higher altitudes than other aircraft. These measurements provide more detailed insights than would be possible to get from satellite data. Therefore, this measurements platform bridges the gap between previous airborne measurements and satellites.

To investigate cloud and precipitation properties in post-frontal mesoscale convective systems at high latitudes above the Atlantic ocean, the NARVAL-North (Next-generation Aircraft Remote-Sensing for Validation Studies) campaign was conducted in January 2014 out of Keflavik (Iceland). This campaign was one of the first that took place on the HALO aircraft. During the experiment's two week time period five research flights and two transfer flights were conducted. Flight durations were between five and nine hours, amounting to roughly 49 flight hours overall. During these flights, a broad range of cloud regimes from shallow cumuli to cumulonimbus and cold fronts was investigated. During the NARVAL campaign, HALO was, amongst others, equipped with the HALO Microwave Package (HAMP) which consists a suite of passive microwave radiometers at a range of frequencies and a cloud radar at 36 GHz. 47 dropsondes were deployed.

Comparison of cloud properties derived from COSMO simulations with measurements taken during the NARVAL campaign will be presented. We will demonstrate what new insights we can learn from this novel type of observations. Model biases, the representation of cloud structures compared to the observations, performance of forward operator and the relation to ambient air conditions, which are measured by dropsondes and in-situ sensors of the aircraft, will be analysed. This comparison study enables to identify possibilities for improvement of modeling clouds and precipitation of weather systems over oceans at higher latitudes.