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Overview of the North Atlantic Waveguide and Downstream Impact Experiment (NAWDEX)

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The North Atlantic Waveguide and Downstream Impact Experiment (NAWDEX) was a highly successful field campaign conducted from 19 September to 18 October 2016. The main aims of NAWDEX are to increase the physical understanding and to quantify the effects of diabatic processes on jet stream disturbances and their consequences for downstream predictability and high-impact weather in the mid-latitudes. One of the crucial processes for the correct prediction of the mid-latitude circulation is the release of latent heat in clouds that are driven by large-scale motions in extratropical cyclones. A focus will be put on early research highlights with a demonstration of the unique capability of the suite of instruments deployed during NAWDEX to observe mid-latitude cloud systems.

We present the favorable general synoptic situation during the campaign period that was characterized by a series of deep low pressure systems that continuously moved towards Iceland. NAWDEX was an international field experiment involving scientists from Europe and North America performing airborne observations onboard four research aircraft (German HALO and Falcon, French Falcon, UK BAE-146) over the North Atlantic and Europe.

We will give an overview on the observations of water vapor, temperature, wind, clouds and precipitation in numerous jet stream disturbances featuring active diabatic processes. The research aircraft HALO and Falcon used a state-of-the-art remote sensing payload that was deployed to perform observations for the NAWDEX aims and to support the preparation of the future satellite missions ADM-Aeolus and EarthCARE. The aircraft coordination and the support by ground-based observations allowed a unique data set to be obtained, containing a number of observational highlights.

The aircraft operated from Iceland over the air traffic-dense North Atlantic in situations with limited predictability, which required focused forecasting and flight planning strategies. For the first time, measurements were taken along the track of a hurricane from the tropics all the way into the mid-latitudes. Additionally, the first detailed observations of a tropopause polar vortex were obtained using airborne lidar and radar. Several flights provide key observations of cloud and humidity structures associated with warm conveyor belts impinging upon the North Atlantic jet stream that ultimately are crucial for downstream high-impact weather over Europe.