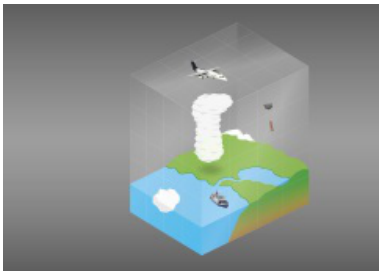

Contribution ID: **7** Type: **Oral presentation**

Airborne active remote-sensing observations of the extratropical troposphere and lower stratosphere with a special focus on the NAWDEX field experiment

Monday, 10 June 2019 14:00 (30 minutes)

In the past decade, the German Aerospace Center was involved in a series of observational campaigns with various objectives, e.g. on atmospheric dynamics, cloud microphysics or atmospheric chemistry. This presentation gives an overview of active remote-sensing lidar and radar profile observations of winds, humidity, ozone, aerosols and clouds; i.e. parameters of potential relevance for numerical weather prediction (NWP).

The focus of the talk will be set on the North Atlantic Waveguide and Downstream impact EXperiment (NAWDEX), a multi-aircraft field campaign that was conducted over the North Atlantic Ocean in autumn 2016. NAWDEX was the first field experiment with synergistic airborne and ground-based observations from the entrance region to the exit region of the storm track, and was undertaken to investigate the role of diabatic processes in altering jet stream disturbances, their development, and their effects on high impact weather (HIW) downstream. We will illustrate how ECMWF deterministic and ensemble forecasting products were used to define the scientific goals, the experimental design and flight planning.

NAWDEX provides an excellent opportunity to study forecast errors as the campaign period contained episodes of reduced predictability, indicating that uncertainties originating in the estimated atmospheric state and model formulation grew rapidly. Weather features expected to be associated with forecast errors were extensively probed by accurate high resolution cross sections. As an example of systematic meteorological analysis errors, a study of the representation of jet stream winds during the NAWDEX period will be presented. A comprehensive set of wind profile observations across the tropopause from airborne lidar, dropsondes and a ground-based wind profiler was compared with analyses of ECMWF's IFS and MetOffice's Unified Model. The results look pretty similar for both models and revealed increased uncertainty of winds and wind speed gradients at and directly above the tropopause, especially in situations of elevated tropopauses downstream of mid-latitude cyclones. Short-term forecasts showed radidly growing errors in this region with an underestimation of wind speeds.

Additional to this study on winds, we will discuss previous results on the representation of lower tropospheric humidity together with plans for future work on validation of NWP models. Based on the described airborne observations, we aim to identify areas with potential for improved collaboration between the NAWDEX community and ECMWF.

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