



Airborne Campaigns for the Validation of ESA's Aeolus Mission

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Knowledge of vertical wind profiles on a global scale is a priority need to improve the quality of numerical weather prediction (NWP). The Earth Explorer mission Aeolus from ESA, to be launched in 2018, will for the first time deliver such profiles based on the spaceborne wind lidar ALADIN (Atmospheric LAsER Doppler INstrument). The ALADIN Airborne Demonstrator (A2D) which was developed at DLR is the key instrument for the planned calibration and validation activities as it features a high degree of commonality with the satellite instrument (e.g. the same laser wavelength of 355 nm and a highly representative optical and electronic receiver design).

The A2D was deployed in a series of ground and airborne campaigns to support the Aeolus mission by validating retrieval algorithms, the instrument concept and operation procedures. In May 2015, the joint ESA - DLR - NASA airborne campaign WindVal I was conducted from Iceland. For the first time four Doppler wind lidars (DWLs) plus dropsondes (DSs) were operated together, two each on board the NASA DC-8 and the DLR Falcon research aircraft. Aside from A2D specific instrument studies, one objective was to compare co-located NASA wind lidar and DS observations with measurements obtained from the A2D and the DLR coherent 2- μm DWL on-board the Falcon.

As a second preparation phase, WindVal II was performed in September and October 2016 from Iceland within the international campaign NAWDEX (North Atlantic Waveguide and Downstream Impact Experiment). NAWDEX provided the framework to extend the wind and calibration data-set of the A2D and the 2- μm DWL on-board the DLR Falcon under highly dynamic meteorological conditions. With a focus on aerosol and cloud signals, coordinated flights were performed together with the German HALO research aircraft deploying an aerosol and water vapour lidar, cloud radar and a DS-unit as well as with the French Safire Falcon with an on-board cloud radar, UV aerosol and wind lidar and DSs. Additional DLR Falcon flights were conducted in the Mediterranean area which aimed at aerosol detection using the A2D in October 2016.

After the launch of Aeolus it is envisaged to perform one airborne campaign with operation base at DLR Oberpfaffenhofen and one from Iceland in the 2018/2019 timeframe with durations of 3-4 weeks each. The unique combination of airborne measurements of the A2D, and the 2- μm DWL on-board the DLR-Falcon coordinated with a ground-based observational program (radar wind profilers, aerosol and wind lidars) will be a major contribution to the validation phase of the satellite mission.

An overview of the conducted airborne campaigns and specific results from instrument comparisons will be presented together with an outlook on the ALADIN performance assessment by validation of wind and aerosol products. Opportunities for future airborne campaigns contributing to a continuous success of the Aeolus mission will be outlined as well.