

Airborne remote sensing of cloud properties with the German research aircraft HALO

Martin Hagen

Institut für Physik der Atmosphäre, Deutsches Zentrum für Luft- und Raumfahrt, Oberpfaffenhofen,
Germany

Lutz Hirsch (Max-Planck Institute for Meteorology, Hamburg, Germany)

Heike Konow, Felix Ament (Meteorological Institute, University of Hamburg, Germany)

Mario Mech, Emiliano Orlandi, Susanne Crewell (Institute for Geophysics and Meteorology, University of
Cologne, Cologne, Germany)

Silke Groß, Andreas Fix, Martin Wirth (Institut für Physik der Atmosphäre, Deutsches Zentrum für Luft- und
Raumfahrt, Oberpfaffenhofen, Germany)

E-mail: martin.hagen@dlr.de

The new German research aircraft HALO (High Altitude Long range) can be equipped with a remote sensing payload to study cloud properties and water vapor profiles of the atmosphere. This package, first flown during the NARVAL (Next-generation Aircraft Remote sensing for VALidation studies) mission in December 2013 and January 2014, consists of a cloud radar, microwave radiometers and a lidar system.

HALO is a for atmospheric measurements modified Gulfstream G550 business jet with a maximum payload of about 3 tons, an endurance of more than 10 hours and a maximum ceiling of about 15 km. The HALO microwave package (HAMP) consists of the cloud radar and the microwave radiometers. The cloud radar is a nadir pointing Ka-band radar (35 GHz) adapted from the METEX Mira-36 radar. While the radar electronics resides in the cabin of the aircraft, the 1 m diameter antenna (0.6° beam width) is mounted inside the belly pod beneath the fuselage. The microwave radar radiometers build by Radiometer Physics (RPG) are operating at 26 frequencies in the K-band (22 GHz, water-vapor line), V-band (58 GHz, O₂ line), W-band (90 GHz, window channel), F-band (118 GHz, O₂ line), and G-band (183 GHz, water-vapor line). The radiometers are mounted inside the belly-pod in three containers with five nadir pointing antennas (beam width 2.7 to 5°). The lidar is the DLR WALES system with a water-vapor DIAL (935 nm) and a HSRL (1064 and 532 nm) for cloud and aerosol properties.

The focus of the NARVAL campaign was on the characterization of precipitation from shallow clouds in the North Atlantic trade wind zone (NARVAL-South, December 2013) and on post-frontal mesoscale precipitation systems over the North Atlantic near Iceland and Greenland (NARVAL-North, January 2014). For intercomparison, additionally several patterns over ground stations like Jülich, Lindenberg, Leipzig, Mace-Head, and Chilbolton were flown. Also a number of under-passes of Cloudsat and Calipso were performed. A joint flight was also together with the French Falcon operating the 95 GHz cloud radar.