

Analyzing aircraft radar observations of Arctic clouds in case of artifacts and clutter

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The Microwave Radar/Radiometer for Arctic Clouds (MiRAC) has been flown on the Polar 5 aircraft during the campaign “Arctic CLOUD Observations Using airborne measurements during polar Day” (ACLOUD) to characterize arctic clouds in spring 2017. The active part of MiRAC consists of a Frequency Modulated Continuous Wave (FMCW-) Radar measuring the profile of radar reflectivity with high vertical resolution by pointing downward with a zenith angle of about 25°. To the best of our knowledge this was the first time that a FMCW-Radar has been used for down looking cloud observations from aircraft.

The special measurement technique involves many challenges for the analysis of the measurements. Caused by the measurement technique and the strong backscatter signal of the surface, artifacts occur close to the surface within the vertical profile. Within time height cross sections these appear as horizontal structures with radar reflectivity's which are in the order of those produced by cloud particles. Therefore, a procedure is developed to exclude these artifacts as well as to eliminate noise. Here, the special characteristics of the Radar signal and a clutter filter to assign and to exclude these artifacts are exploited.

In addition, to the Radar processing the absolute calibration is also highly important to arrive at high quality radar reflectivity profiles. Therefore, a possible bias is investigated by a comparison of the radar reflectivity between MiRAC and JOYRAD located at the Ny Ålesund station. It has been found that the observations of MiRAC and JOYRAD agree qualitatively well, but the comparison strongly depends on flight direction and wind conditions. After all improvements it is planned to upload the data to PANGAEA and to analyze the data. The aim is to improve the knowledge of cloud microphysics, especially of mixed-phase clouds in the Arctic.

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