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Investigation of Arctic mixed-phase clouds during VERDI and RACEPAC: Combining airborne remote sensing and in situ observations

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To improve our understanding of Arctic mixed-phase clouds in sea-ice covered areas the airborne research campaign Vertical distribution of ice in Arctic mixed-phase clouds (VERDI, April/May 2012) and the Radiation-Aerosol-Cloud Experiment in the Arctic Circle (RACEPAC, April/May 2014) were initiated by a collaboration of German and French research institutes. The aircraft operated by the Alfred Wegener Institute for Polar and Marine Research, Germany were based in Inuvik, Canada from where the research flights of in total 149 flight hours (62 h during VERDI, 87 h during RACEPAC) were able to cover a wide area above the Canadian Beaufort. The aim of both campaigns was to combine remote sensing and in-situ cloud, aerosol and trace gas measurements to investigate interactions between radiation, cloud and aerosol particles. Remote sensing instrumentation contained a backscatter lidar and spectral solar radiation measurements including a hyperspectral camera. In-situ sampling was highlighted by a suit of comprehensive cloud particle probes, aerosol particle counters and mass spectroscopy as well as trace gas detectors. While during VERDI remote sensing and in-situ measurements were performed by one aircraft (Polar 5) subsequently, for RACEPAC two identical aircraft (Polar 5 & 6, Basler BT-67) were coordinated at different altitudes to horizontally collocate both remote sensing and in-situ measurements. In this way not only the combined analysis of radiative and microphysical processes in the clouds can by studied more reliably, also remote sensing methods can be validated efficiently.

Here we will illustrate the scientific strategy of both projects including instrumentation and flight patterns of the research flights. Beside flight missions dedicated to sample low level clouds by remote sensing and in situ probing, flights were also coordinated with satellite overpasses and ground based stations. Exemplary results will be highlighted.