

## Airborne Observations from the COMPEX Campaign for EarthCARE Validation in the Arctic

Observations of clouds and precipitation in the Arctic remain challenging due to the prevalence of shallow mixed-phase cloud systems, low-level precipitation, and complex surface conditions associated with sea ice and heterogeneous topography. These factors complicate both satellite retrievals and the representation of cloud–precipitation processes in atmospheric models. Dedicated validation measurements are therefore essential for assessing satellite retrieval performance in this environment. The airborne campaign COMPEX (Clouds over cOMPIEX environment) will be conducted in March–April 2026 from Longyearbyen, Svalbard, to provide vertically resolved reference observations of clouds, precipitation, and atmospheric thermodynamic structure and radiation. The Polar 5 research aircraft of the Alfred Wegener Institute will carry a comprehensive remote sensing payload designed to characterize cloud and precipitation microphysics, together with in-cloud and sub-cloud water vapor profiles, during research flights in the Svalbard region and the adjacent marginal sea ice zone. Coordination with EarthCARE satellite overpasses is envisioned whenever achievable.

Central to the instrument suite is a dual-frequency cloud radar system combining G- and W-band measurements, enabling enhanced sensitivity to small hydrometeors and improved characterization of cloud phase and vertical structure. In addition, the differential absorption radar technique allows profiling of water vapor within and below cloud layers. Airborne lidar, microwave radiometry, radiation measurements, hyperspectral imaging, and dropsonde observations will complement the radar observations. This presentation will introduce the COMPEX campaign and outline the dataset's expected contribution to validating EarthCARE cloud and precipitation products in the Arctic.