SWIANT

Ship-based Wind Lidar Measurements of the Antarctic Boundary Layer

Principal investigator

Günther Heinemann

heinemann@uni-trier.de

Environmental Meteorology, University of Trier

Areas of contribution

Polar atmospheric processes

Sea ice processes

Summary

The group of the University of Trier will perform measurements of vertical and horizontal profiles of wind, turbulence and aerosols. We will use a wind lidar, which is a programmable scanner and can operate with a maximum range of 10 km. The wind lidar will be operated in the eastern and southern Weddell Sea during a cruise PS111 of R/V Polarstern (18 January – 14 March 2018). Radiosondes launched from R/V Polarstern will be used for comparisons of the wind profiles. The data will be used for the verification of simulations using a high-resolution regional climate model and for process studies.

Description

The representation of the atmospheric boundary layer (ABL) in the Antarctic is a major challenge for numerical weather forecast models and regional climate models. Reference data sets are rare, particularly over the ocean areas. Standard measurements on research vessels yield near-surface observations and one or two radiosonde launches per day.

We use a scanning wind lidar, which measures wind profiles in the ABL with a high vertical resolution (15 m)

and a high temporal resolution (15 min). The wind lidar can operate with a maximum range of 10 km. The used lidar is a programmable scanner which enables vertical scans in all directions. The main scan patterns are the vertical azimuth display (VAD), the range-height indicator (RHI) and horizontal scans with fixed azimuth (STARE). The VAD is used for the determination of wind profiles above the lidar. The STARE mode is used at two or three azimuth angles, which are adjusted to the heading of the ship and the wind direction. The RHI mode is generally applied together with the STARE mode and at the same azimuth angles to obtain cross-sections. This allows for measurements of e.g. the internal boundary layer at the sea-ice edge or ice-shelf front. Since the lidar is not mounted on a stabilized platform, the ship's heading, roll and pitch angles are recorded using an Attitude Heading Reference System (AHRS), an external GPS and data from the ship's navigation system.

Continuous sampling of vertical profiles will be performed during the cruise. For intensive observation periods during the cuise, RHI and horizontal scans will be performed additionally yielding cross-sections of the ABL. Of particular interest are katabatic winds at Coats Land, the flow in the area of iceberg A23A, the internal boundary layer over the Ronne polynya and over sea-ice leads. The measurements during the Polarstern cruise shall yield a data set of continuous and high-resolution vertical profiles of wind and aerosol backscatter. The data will be used for the verification of simulations using a high-resolution regional climate model and for process studies.

Timeline

2018-01-18 - 2018-03-14

Regional emphasis

Northern hemisphere: No

Southern hemisphere: Yes

Further specification

Eastern and southern Weddell Sea

Key project deliverables

Wind profiles in the atmospheric boundary layer with high spatial (15 m) and temporal resolution (15 min).

Data management

PANGAEA data base

Is data provided to WMO Global Telecommunication System

No

Real-time provision

No