Geophysical Research Abstracts
Vol. 18, EGU2016-10026, 2016
EGU General Assembly 2016

Climatology of clouds and precipitation over East Antarctica using ground-based remote sensing at the Princess Elizabeth station

Niels Souverijns (1), Alexandra Gossart (1), Irina Gorodetskaya (1), Stef Lhermitte (1), Kristof Van Tricht (1), Alexander Mangold (2), Quentin Laffineur (2), and Nicole Van Lipzig (1)

(1) Earth and Environmental Sciences, KU Leuven, Heverlee, Belgium (niels.souverijns@ees.kuleuven.be), (2) Royal Meteorological Institute of Belgium, Uccle, Belgium (mangold@meteo.be)

The surface mass balance of the Antarctic ice sheet is highly dependent on the interaction between clouds and precipitation. Our understanding of these processes is challenged by the limited availability of observations over the area and problems in Antarctic climate simulations by state-of-the-art climate models. Improvements are needed in this field, as the Antarctic ice sheet is expected to become a dominant contributor to sea level rise in the 21st century.

In 2010, an observational site was established at the Princess Elisabeth (PE) Antarctic station. PE is located in the escarpment area of Dronning Maud Land, East Antarctica (72°S, 23°E). The instruments consist of several ground-based remote sensing instruments: a ceilometer (measuring cloud-base height and vertical structure), a 24-GHz Micro Rain Radar (MRR; providing vertical profiles of radar effective reflectivity and Doppler velocity), and a pyrometer (measuring effective cloud base temperature). An automatic weather station provides info on boundary-layer meteorology (temperature, wind speed and direction, humidity, pressure), as well as broadband radiative fluxes and snow height changes. This set of instruments can be used to infer the role of clouds in the Antarctic climate system, their interaction with radiation and their impact on precipitation.

Cloud and precipitation characteristics are derived from 5-year-long measurement series, which is unprecedented for the Antarctic region. Here, we present an overview of the cloud and precipitation climatology. Statistics on cloud occurrence are calculated on annual / seasonal basis and a distinction between liquid / mixed phase and ice clouds is made. One can discriminate between liquid-bearing and ice-only clouds by investigating the ceilometer attenuated backscatter, since liquid phase clouds have a much higher signal. Furthermore, by using pyrometer measurements, we are able to identify the range of temperatures at which liquid / ice clouds are observed over Antarctica. Precipitation numbers are determined from MRR reflectivity. We discriminate between virga (precipitation not reaching the surface) and snowfall (reaching the surface). The use of a rain radar is preferred over snow accumulation measurements, since there are multiple other processes regulating snow depth. The most important example is snowdrift, i.e. high winds over Antarctica which attribute for the redistribution of snow. Results show that precipitation numbers over East Antarctica have high interannual variability and total yearly accumulation depends on a few strong snowfall events every year.