EGU22-5553
https://doi.org/10.5194/egusphere-egu22-5553
EGU General Assembly 2022

Summer snowfall in the Sør Rondane Mountains, Antarctica: characterization using a transect of K-band Doppler profilers

Alfonso Ferrone and Alexis Berne
Environmental Remote Sensing Laboratory, EPFL, Lausanne, Switzerland

Measurements of precipitation in inland Antarctica are scarce, with estimates often derived by indirect means. This scarcity contrasts with the importance of snowfall, which constitutes, together with water vapor deposition, the main water mass input to the Antarctic ice sheet.

During the austral summer 2019-2020, a transect of three vertically-pointing K-band Doppler radars (MRR-PRO) was deployed across the Sør Rondane Mountains, directly south of Princess Elisabeth Antarctica (PEA). The instruments have been placed at different stages of the interaction between the typical flow of the precipitation systems and the orography. A vertically-pointing W-band Doppler cloud radar was also deployed at the base.

Using the data collected by these four radars, alongside information derived from the ERA5 reanalysis and a set of high-resolution WRF simulations covering the previous three years, we investigated the behavior of precipitation across the transect.

A significant difference in the proportion of virga and precipitation has been observed between the three locations. One of the three MRR-PRO was deployed in a valley, connecting the plateau to the lower plains, at the lowest elevation among the radars in the transect. At this location we observed the highest amount of virga. This behavior is consistent with the presence of a thick dry layer, whose height has been estimated to approximately 1.2 km above the level of PEA. Its existence was noticed in both the reanalysis and the simulations, and the reflectivity factor recorded by the cloud profiling radar decreases with height for most of the layer.

The other two MRR-PRO were deployed at higher altitudes, and both of them recorded a lower fraction of virga. We hypothetize that the higher elevation implies a shorter time spent by precipitating particles in the dry layer, limiting the sublimation of hydrometeors. However, despite being at a slightly lower elevation than the MRR-PRO on the plateau, the MRR-PRO installed amid the mountains recorded precipitation reaching the ground for a higher amount of time steps. This may be caused by the localized precipitation systems frequently observed near the top of the mountains south of PEA.

This study shows that complex terrain in the vicinity of PEA increases the variability in precipitation occurrence, depending on the relative position with respect to the incoming flow and to the dry katabatic layer. This variability questions the representativity of measurements

collected at a few stations in the mountainous regions of Antarctica.