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Preliminary microphysical characterization of precipitation at ground over Antarctica coast

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The primary mass input of the Antarctic ice sheet is snow precipitation which is one of the most direct climatic indicators. Climatic model simulations of precipitations over Antarctica is an important task to assess the variation of ice sheet over long temporal scale. The main source of precipitation information in Antarctica regions derive from satellite observations. However, satellite measurements and products need to be calibrated and validated with observations from ground sensors. In spite of their key role, precipitation measurements at ground are scarce and not appropriate to provide the specific characteristic of precipitation particles that influence the scattering and absorption properties of ice particles.
Recently, different stations in Antarctica (Princess Elizabeth, McMurdo, Mario Zucchelli) are equipping observatories for cloud and precipitation observations. The setup of the observatory at the Italian Station, Mario Zucchelli (MZ) plans to integrate the current instrumentation for weather measurements with other instruments specific for precipitation observations, in particular, a 24-GHz vertical pointing radar and a laser disdrometer Parsivel. The synergetic use of the set of instruments allows for characterizing precipitation and studying properties of Antarctic precipitation such as dimension, shapes, fall behavior, density of particles, particles size distribution, particles terminal velocity, reflectivity factor and including some information on their vertical extent.

Last November, the OTT Parsivel disdrometer was installed on the roof of a logistic container (at 6 m of height) of the MZ station (Latitude 74° 41’ 42" S; Longitude 164° 07’ 23E") in the Terranova Bay. The disdrometer measures size and fall velocity of particles, passing through a laser matrix from which the Particle Size Distribution (PSD) is obtained. In addition, some products such as reflectivity factor, snow rate and snow accumulation can be inferred by properly processing PSD spectra. Software provided by disdrometer manufacturer assumes spherical shape to compute the size and the fall velocity of the particle. In the case of solid precipitation, this assumption can be unrealistic. However, averaging over a long time the influence of irregular shape of the particles can be reduced. Despite this limit, the Parsivel disdrometer has been used in several study to measure falling snow.

In this work, some preliminary measurements from OTT Parsivel at MSZ are presented. In particular, the PSD collected during summer season 2016-2017 are analyzed in order to infer microphysical characteristics of snows in Antarctica. A specific methodology to estimate the reflectivity factor and the snow rate from snow size spectra collected by Parsivel is investigated. Microphysical properties of Antarctica precipitating clouds, in particular PSD, are compared to measurements collected by disdrometer during snow events in other regions, such as the data collected during the GPM Cold-season Precipitation Experiment (GCPEx) in Ontario, Canada.