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Investigating the impact of spaceborne radar blind zone on surface snowfall statistics in polar regions

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Currently, global statistics of snowfall are only available from the CloudSat satellite launched in 2006. However, measurements of CloudSat can be only obtained at an altitude of at least 1200 m above ground, because measurements below are contaminated by ground clutter. As a consequence, global estimates of snowfall at the surface have to be estimated from observations at 1200 m above ground. In the presented study, it is investigated how this blind zone impacts snowfall statistics obtained from CloudSat observations in polar regions. For this, 12-months datasets containing observations of a vertically pointing 24 GHz Micro Rain Radar (MRR) are analyzed for three sites: the Belgian Princess Elisabeth station in East-Antarctica, and for Ny-Ålesund as well as Longyearbyen in Svalbard, Norway. Statistical comparison of CloudSat and MRR observations shows that MRRs are suited to study snowfall when reflectivity exceeds -5 dBz. To study the vertical variability of snowfall, MRR radar reflectivity profiles are analyzed with respect to changes in frequency distribution, the number of observed snow events and total precipitation. Results show that the blind zone leads to reflectivity being underestimated by up to 1 dB, the number of events being altered by $\pm 5\%$ and the precipitation amount being underestimated by 9 to 11 percentage points. In order to account for future satellite missions which feature a smaller blind-zone, also the impact of a reduced blind zone of 600 m is analyzed. Even though reducing the blind zone to 600 m leads to better representation of mean reflectivity, it does not improve the bias in event numbers and total precipitation amount.