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Understanding performance of GPROF precipitation retrievals over the Netherlands in relation to precipitation characteristics as derived from ground-based dual-polarization radars

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The Global Precipitation Measurement mission (GPM) is one of the recent efforts to provide satellite-based global precipitation estimates. The GPM Profiling Algorithm (GPROF) converts microwave radiation measured by passive microwave (PMW) sensors onboard constellation satellites into precipitation. Over land, precipitation estimates are obtained from high frequency PMW-channels that measure the radiance scattered by ice particles in rain clouds. However, due to the limited scattering related to shallow and light precipitation, it is challenging to distinguish these signals from background radiation that is naturally emitted from the Earth's surface.

Increased understanding of the physical processes during precipitation events can be used to improve PMW-based precipitation retrievals. This study couples overpasses of GPM radiometers over the Netherlands to two dual-polarization radars from the Royal Netherlands Meteorological Institute (KNMI). The Netherlands is an ideal setting for this study due to the availability of high-quality ground-based measurements, the frequent occurrence of shallow events, the absence of ground-clutter related to mountains, and the varying background emission related to its coastal location.

The coupling of overpasses with ground-based precipitation radars provides the opportunity to relate GPROFs performance to physical characteristics of precipitation events, such as the vertical reflectivity profile and dual-polarization information on the melting layer. Furthermore, simultaneous radiometer estimates and space-based reflectivity profiles from the dual-frequency precipitation radar (DPR) onboard the GPM core satellite are coupled to the ground-based reflectivity profiles for selected case studies. Because the a-priori database implemented in the GPROF algorithm is based on observations from the DPR, the comparison of the reflectivity profiles further unravels discrepancies between GPROF and ground-based estimates.