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Cloud detection methods for a stand-alone ground based microwave radiometer

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The project "Pilotstation" at DWD employs a test bed setup to assess data availability, quality, observation impact and operational sustainability for five different ground based remote sensing instruments. The instruments in question, also referred to as "profilers", are designed to continuously measure vertical profiles of thermodynamic and cloud/aerosol related variables.

A ground based microwave radiometer (MWR) is one of the instruments evaluated in the project "Pilotstation". MWR primarily measure downwelling radiation in the K-band and V-band in the form of brightness temperatures (TB). All-sky temperature and low-resolution humidity profiles as well as high-accuracy liquid water path (LWP, ΔLWP: ± 10-20 gm^{-2}) and integrated water vapour (IWV, ΔIWV: ~ ± 0.5 kgm^{-2}) are secondary products, which can be derived from the TB.

The adaptation of the fast radiative transfer model RTTOV for ground based instruments enabled weather services to go forward with directly assimilating MWR TB rather than secondary products. First assimilation experiments of MWR TB at DWD were successful. Alongside other quality checks, the data assimilation (DA) relies on a cloud detection beforehand. The most frequent reason for rejecting data from DA is the suspected presence of clouds, consequently reliably identifying clouds without excessively rejecting clear-sky data is especially important for a high availability of suitable data.

The study presented focuses on the requirements of operational DA and a stand-alone setup of an MWR. The work compares the performance of cloud detection algorithms used in scientific publications based on MWR observations. The comparisons include methods using TB, LWP and their variability. For this the CloudNet classification time series at Lindenberg and observation minus model background statistics serve as references. The presentation will also include progress made on refining the cloud detection schemes at hand in order to achieve a higher precision and to better meet the requirements of DA.