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Harmonized and quality-controlled microwave radiometer observations in the ACTRIS cloud remote sensing network

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Ground-based microwave radiometers (MWR) are an established tool for continuously measuring vertical profiles of temperature and humidity, as well as integrated quantities like cloud liquid water path (LWP) and integrated water vapor, at a high temporal resolution of 1 s. An elevation scanning capability can be utilized to add angular information to the spectrally resolved measurements in order to enhance the accuracy of temperature profiles in the atmospheric boundary-layer (ABL).

During the last two decades, these instruments proved their network suitability and robustness for unattended long-term deployment. Currently, two initiatives are implementing observation networks of MWR all over Europe. The Aerosol, Clouds and Trace Gases Research Infrastructure (ACTRIS) is establishing a remote-sensing network of ground-based cloud observing stations to provide long-term records of cloud parameters for different scientific applications, such as climate monitoring, satellite validation and model evaluation. Furthermore, EUMETNET's profiling network E-PROFILE is implementing a network of MWR for real-time atmospheric monitoring and as an input for data assimilation into weather forecast models.

MWR data products have already been utilized to study cloud properties across multiple sites. The retrieved LWP has been used over many years in the Cloudnet cloud classification scheme (Illingworth et al., 2007) for deriving profiles of the cloud liquid water content and estimating liquid water attenuation of cloud radars, which are also involved in the Cloudnet scheme in addition to lidars and rain gauges. Yet, so far, no centralized quality assurance and retrieval methods exist for the data products, including LWP and vertical profile information from MWR. Therefore ACTRIS is developing harmonized data streams and quality control of Cloudnet suitable instrumentation, including MWR, which will be performed by the MWR unit in the ACTRIS Center for Cloud Remote Sensing (CCRES). The ACTRIS-CCRES network is planning to include about 30 stations in Europe, some of which have already been operational for more than one decade. Tasks of the MWR unit consist of providing guidelines and monitoring tools for instrument operation and calibration, as well as implementing a newly developed data processing and quality control at the CCRES data center.

For a better cross network compatibility, a common data format was developed in close collaboration with E-PROFILE. With that, standardized retrieval algorithms based on common methods across all sites in the network are prepared to generate a high-quality and long-term homogeneous MWR dataset suitable for evaluating models or satellite derived products. By utilizing quality controlled data of other CCRES instruments, synergistic products with a focus on ABL thermodynamic processes and cloud microphysical properties are derived.

Illingworth et al. (2007). Cloudnet. Bulletin of the American Meteorological Society, 88(6), 883-898.

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