Abstract for RFI workshop 2022 under the URSI in collaboration with ECMWF

Detected RFI from ground-based Microwave Radiometers and its Possible Implications

Ground-based microwave radiometers (MWRs) like HATPRO (Humidity And Temperature PROfiler) operate within the K-band and V-band spectra and are used to obtain temperature profiles (T) and rather coarse humidity profiles (H) of the troposphere. HATPRO measures microwave radiances, expressed as brightness temperatures (TB), in zenith and other angles over an area of ~10 km radius with a temporal resolution in the order of seconds. The brightness temperatures can be used to retrieve the T-profiles and H-profiles. Ground-based MWRs are also among the best instruments to measure path integrated values like IWV (Integrated Water Vapor) and LWP (Liquid Water Path), with excellent uncertainties up to 0.5 kg/m^2 and 20 g/m^2, respectively.

Driven by the E-PROFILE program, a business case proposal was recently accepted by EUMETNET to continuously provide MWR data to the European meteorological services. Also, the European Research Infrastructure for the observation of Aerosol, Clouds, and Trace gases ACTRIS and the European COST action PROBE (PROfiling the atmospheric Boundary layer at European scale) currently focus on establishing continent-wide quality and observation standards for MWR networks for research as well as for NWP applications.

Radio frequency interference (RFI) can occur in the MWR observations and have an impact on the quality of the obtained atmospheric profiles. Therefore, identifying and coping with RFI is one important part of the quality control, especially for MWRs deployed in larger cities. We will present a method to identify low-level RFIs, and show an exemplary application: clear-sky azimuth scans at 30° elevation at JOYCE (Jülich Observatory for Cloud Evolution) show RFI signals within one K-band channel at distinct angles, probably caused by communication links. Frequent RFI have also known to disturb MWR observations e.g. in the city of Berlin.

RFI intrusion effects pose the threat of losing one or more channels used for profile retrievals. We will show a channel denial study where a large loss of accuracy for zenith temperature profile retrievals is observed when excluding two V-band channels. When only one channel is excluded, the loss is milder but still significant. High RFI power levels produced by strong Ka-band emitters for 5G-mobile can theoretically lead to loss or the offset of a whole band, even if the intrusion only happens in one channel. This is due to saturation of the broad-band low-noise-amplifier (LNA) which covers the full bandwidth of all channels of either the K- and or the V-band respectively.