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Scanning Microwave Radiometry for Investigating Water Vapor and Cloud Distributions (*Invited*)

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Ground-based microwave radiometry (MWR) is one of the most promising methods for observing cloud liquid, humidity and temperature as it is a robust, highly automated technique for nearly all weather conditions. Typically, multi-frequency observations between 20 and 90 GHz are performed in zenith direction. The major limitation of such MWR observations is the limited vertical resolution providing only 2-3 independent pieces of information for water vapor and temperature (Löhnert et al., 2009). For cloud liquid the situation is worse due to the relatively low dependance of cloud emissivity on temperature. In principal only the total column - the liquid water path (LWP) can be retrieved. Elevation scanning is commonly used to improve the vertical resolution of temperature profiles in the boundary layer assuming its horizontal homogeneity. Volume scanning, i.e. azimuth and elevation scanning has the potential to investigate the 3D distribution of water vapor and clouds. During the deployment of the ARM Mobile Facility in the Murg Valley, Black Forest, Germany routine azimuth scanning MWR could reveal the increase in average LWP above hill crests compared to the standard zenith observations within the valley. Recently, we could demonstrate the feasibility of detecting horizontal humidity gradients from a single scanning MWR (Schween et al., 2010). Another interesting application of scanning MWR is the use of azimuthal water vapor variability as a proxy for convective activity. For example during fair weather conditions the increase in turbulent mixing after sunrise building up the boundary layer can be detected well from the azimuthal water vapor variations at low elevation angles.
The presentation will provide an overview of the capabilities of MWR for the detection of 3D structures by analyzing the information content of the measurements and deriving retrieval methods. In addition, examples from multi-year scanning observations at different locations will be shown to illustrate their potential for deriving water vapor and cloud distributions.

Löhnert et al., 2009. J. Appl. Meteorol. Clim. 48(5):1017-1032.

Schween et al., 2010. IEEE Geoscience and Remote Sensing Letters, accepted.

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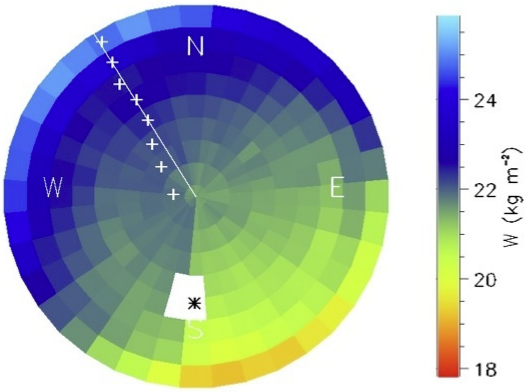

Examplary volume scan of integrated water vapour.