

A Proof of Concept for Boundary-Layer Moisture Data Assimilation Using Scanning Microwave Radiometer Observations

Ground-based profilers provide continuous information on atmospheric boundary-layer (ABL) temperature and humidity, but zenith-only observations suffer from large representation errors in heterogeneous environments. This contribution explores the potential of **scanning Microwave Radiometer (MWR) brightness temperatures (TBs)** to better constrain **ABL water vapor** and to reduce representation error relevant for **convection-permitting data assimilation**. It especially aims to eventually evaluate the synergy of scanning MWR humidity observations with the already planned Differential Absorption Lidar (DIAL) network LIDIA by DWD.

As a proof of concept, radiosonde profiles are combined with co-located ground-based HATPRO MWR observations from recent field campaigns in Germany, including **FESSTVaL (2021)**, **Socles (2021–2022)**, and **Vital I (2024)**. For each radiosonde launch, temporally matched MWR measurements are extracted for several viewing geometries. The evaluation by TB forward modeled from radiosondes gives first promising results.

The presentation highlights how low elevation azimuth scan **TB information, especially combined with the upcoming LIDIA network** can provide additional constraints on horizontal gradients and boundary layer humidity. The next steps are: assimilation experiments with data from the upcoming **Vital II campaign (summer 2026)**, where combined **zenith-pointing DIAL** and **scanning MWR** observations will be assimilated into **ICON-D2** to quantify their impact on short-range forecasts of humidity and convective initiation on convection-permitting resolution.

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