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Commercial Microwave Link (CML) Data Assimilation with the LETKF

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In this study, we examine the assimilation of a novel data source, namely commercial microwave link (CML) data. Originally, CMLs are employed for the interconnection of cell phone towers operated by mobile network providers, however, CML data also contain valuable information about atmospheric conditions at the ground level due to interactions of the transmitted radiation signal with, for example, raindrops. In fact, CML data are already successfully used for the purpose of quantitative precipitation estimation with high spatio-temporal resolutions and are becoming an important complement to radar data in this respect.

Here, we deal with the assimilation of CML attenuations in NWP models and investigate whether CML data are also able to improve precipitation forecasts and how the effects of a CML data assimilation compare to those of an assimilation of other observation types, such as radar data. An important building block of this work is the use of EMVORADO, originally a radar forward operator, to compute a simulated model equivalent for each CML observation. Furthermore, the state-of-the-art, convective-scale ICON-KENDA ensemble data assimilation framework—based on an implementation of the LETKF and the regional NWP model ICON-D2 covering central Europe—is employed for our numerical calculations.

Performing single-time assimilation experiments, we study internal details of the LETKF assimilation process, spatial distributions of increments for the temperature and specific humidity, and the behavior of the NWP model in short-time periods directly following an assimilation—and compare these results with those obtained from an assimilation of conventional or radar data. We are able to show that an assimilation of CML data, even on top of an assimilation of either conventional or a combination of conventional and radar data, is able to accurately initiate new convection and to significantly improve the fractional skill score by up to 10%.

Presenting Author

Klaus Vobig

Email Address of Presenting Author

klaus.vobig@dwd.de

Affiliation of Presenting Author

Deutscher Wetterdienst

Address of Presenting Author

Frankfurter Str. 135, 63067 Offenbach, Germany

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Author: VOBIG, Klaus (DWD)

Co-authors: CHWALA, Christian (KIT (IMK-IFU) / Uni Augsburg); POLZ, Julius (KIT/IMK-IFU&IMK-ASF); POTTHAST, Roland (Deutscher Wetterdienst, Data Assimilation Unit, Frankfurter Str. 135, 63067 Offenbach, Germany)

Presenter: VOBIG, Klaus (DWD)