Contribution ID: **51** Type: **Oral**

Temporal Super-Resolution, Ground Adjustment and Advection Correction of Radar Rainfall using 3D-Convolutional Neural Networks

Thursday, June 26, 2025 10:30 AM (15 minutes)

Ground-adjustment of weather-radar derived precipitation information is a common practice to correct for a variety of errors related to for example advection, size sorting or melting processes. Historically, this is mainly achieved by using point-like rain gauge observations which have a high temporal resolution and accuracy, but lack spatial representativeness and observation density, e.g. with one rain gauge per 330km² in Germany. In this study, we combine two novel approaches to enhance quantitative precipitation estimation (QPE) with weather radars.

First, we use Commercial Microwave Links (CMLs) as an additional source of information. CMLs provide path-integrated attenuation estimates close to the ground which yields a higher spatial representativeness than rain gauges. Due to their large abundance, they also largely increase the density of near-ground observations.

Second, we present a novel probabilistic deep-learning-based framework to combine radar, rain gauge and CML data. The presented perceiver architecture is generic and can easily be extended by additional input modalities.

Our study is based on the RADOLAN-RY precipitation product, derived from the C-band radar network of the German Weather Service (DWD), and a German-wide CML network with 3900 link paths. The results are compared to ResRadNet [1], a deep-learning model that only relies on radar input for ground-adjustment.

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Yes

Author: POLZ, julius (KIT/IMK-IFU)

Co-authors: CHWALA, Christian (KIT (IMK-IFU)); KUNSTMANN, Harald (KIT (IMK-IFU)); GEBISSO, Hiob (KIT (IMK-IFU)); GLAWION, Luca (KIT (IMK-IFU)); ALTENSTRASSER, Lukas (KIT (IMK-IFU)); GRAF, Maximilian (Deutscher Wetterdienst); VOGL, Stefanie (OTH Regensburg)

Presenter: POLZ, julius (KIT/IMK-IFU)

Session Classification: OS data merging

Track Classification: OS data merging