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Seamless Integrated Rainfall Forecasts using Nowcasting and NWP-Ensembles

Wednesday 19 March 2025 12:00 (15 minutes)

Reliable and accurate short-term rainfall forecasts are crucial for effective weather warnings, particularly during the convective season. At Deutscher Wetterdienst (DWD), rainfall warnings traditionally rely on either nowcasting or numerical weather prediction (NWP). Recent advancements within the SINFONY project (Seamless Integrated Forecasting System) aim to deliver seamless ensemble forecasts of short-term rainfall. In addition, flood forecasting is an important application and has gained more focus after extreme flooding events in recent years. Here, we will present a seamless combination technique that integrates radar nowcasts from DWD's STEPS implementation with NWP forecasts from the new rapid update cycle of the ICON-D2 model. Moreover, we will show a thorough verification for a period in May and June 2016 with lots of severe convection and heavy rainfall.

The proposed method INTENSE (Integration of NWP Ensembles and Extrapolation) employs a localized Bayesian approach inspired by an ensemble Kalman filter. It begins with a stochastic extrapolation of current radar observations with a 5-minute lead time using STEPS. This is followed by a localized analysis of extrapolation and NWP ensemble spread. Next, a correction is applied to the extrapolation forecast, shifting it towards the NWP forecast. The local degree of correction depends on the comparison ensemble spreads, i.e., the higher the extrapolation spread in comparison with NWP spread, the stronger the correction towards NWP for the current lead time. This process is repeated iteratively, with the corrected data as the input for the next lead time.

INTENSE delivers combined ensemble forecasts consisting of 21 members with a maximum lead time of 12 hours at a spatial resolution of 1 km² and a temporal resolution of 5 minutes. Moreover, we provide spatial analysis of ensemble spread, exceedance probability for certain thresholds, as well as percentiles. Real-time test operations are running with a preliminary version since June 2024 and the evaluation by DWD meteorologists is about to start.

This contribution offers an overview of the seamless combination approach and presents verification results demonstrating its advantages over pure NWP and nowcasting approaches. Fraction Skill Score as well as Critical Success Index show a clear improvement in comparison with pure STEPS nowcasting and pure NWP forecasts. For short lead times, INTENSE performs similar to STEPS and for longer lead times it preserves the forecast quality of the ICON-D2-RUC model. Furthermore, we will show an example of a recent convective event and discuss shortcomings as well as future improvements.

VAT

Session

Seamless Prediction: Blending and probabilistic techniques based on nowcasting and NWP ensembles

Preferred Contribution Type

Oral Presentation

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