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Seamless Combination of Object-Based Probabilistic Nowcasting and NWP Ensemble of Convective Cells From KONRAD3D

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Convective events have long been one of the most difficult phenomena to predict, making them a major focus of the SINFONY project at the DWD. Our new product is at the forefront of this effort, designed to revolutionize short-range forecasting (up to 14 hours) for convective storms by seamlessly integrating enhanced nowcasting and numerical weather prediction (NWP) into one powerful, cohesive forecast tool.

In this work, we aim to combine convective cells detected through probabilistic nowcasting with those from numerical weather prediction (NWP). The detection of these cells is performed using KONRAD3D, a state-of-the-art method developed at the DWD to identify and track convective cells based on radar reflectivity. This approach can also be applied to cells simulated by NWP, as the model forward operator, EMVORADO, generates simulated radar data with the same structure and temporal resolution as actual radar observations.

First, the simulated cells are spatially clustered using the DBSCAN method. After clustering, each observed cell is linked to the nearest cluster of simulated objects. The properties of the simulated cells are then compared to those of the observed radar cells using a score known as the total interest. Only cells that exceed a certain total interest threshold—indicating the greatest similarity to the observations—are selected for combination. Finally, the selected simulated cells are spatially adjusted so that their centroid matches the position of the nearest observed cell. Simulated cells detected within a specific time window around the observation but not matched to an observed cell are excluded from further consideration.

We also perform ensemble nowcasting of observed cells. In this process, the position, movement, and severity are subjected to stochastic noise. Additionally, a parabolic lifecycle of cell severity is assumed.
As a result, each observed cell receives a seamless forecast of its development through ensemble nowcasting, as well as from assigned model cells.
Moreover, thanks to the model input, our approach can account for the formation of new cells, which offers an advantage over pure nowcasting.

For forecasters, we provide compact information in the form of representative members and occurrence probabilities for cells based on their severity.
Since last year, the product has been under evaluation not only by the DWD but also by the ESSL Testbed.
We present an overview of our product, along with statistical verification and a prominent case study.

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Session

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

Preferred Contribution Type

Oral Presentation

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