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Object-based verification of radar reflectivities on the convective scale

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Germany is exposed to various kinds of high-impact-weather (HIW) phenomena. Strong impacts are expected from convective events during summer time which happen to be especially hard to predict. The pilot project SINFONY at DWD has the goal to improve forecasts of such events in the short range up to 12h. On one hand, predictions of convective cells from Nowcasting systems currently outperform NWP systems for very-short range weather forecasts. On the other hand, NWP forecasts are superior to Nowcasting predictions after a few hours of forecast lead time. Therefore, the goal is to optimally integrate both approaches in a seamless prediction system. On the observation side, high-resolution reflectivities from the German radar network are used. Such reflectivities give the instantaneous state of the current hydrometeor situation, where HIW is correlated with high reflectivities. On the model side (COSMO-DE-EPS) reflectivities are derived from the forward operator EMVORADO (Zeng et al. (2016), Quarterly Journal of the Royal Meteorological Society, 142, 701, 3234-3256). Further, we take nowcasting ensembles into account.
Our investigations focus on radar reflectivities in a selected case study period of four weeks in summer 2016 with strong convective activity in which small and large convective cells could be identified. We propose to consider object-based methods for the verification of radar reflectivities in NWP and Nowcasting, where objects are identified by the DWD-internal product KONRAD3D. Object-based methods potentially help to circumvent the well-known double-penalty problem. We will make use of the Median of Maximum Interest (MMI), an object-based verification method from Davis et al. (2009), Weather and Forecasting, 24, 1252-1267. One advantage of the MMI is that matching between certain objects, which is often unreliable, is not mandatory. It rather measures the similarity of objects from observation and forecasts. It has been found that the location errors between forecasted objects and observed objects are most indicative for forecast quality. Therefore, the MMI has the potential to be a suitable measure for developers and forecasters, as well.
We will present verification results for different experiments, NWP and nowcasting, in our test case period. To highlight the capabilities of the verification approach, we will compare nowcasts with forecasts using the 1-moment and the 2-moment microphysics scheme. As the latter is able to produce higher reflectitivies, it is expected to better capture extreme events. Additionally, we try to apply these methods to ensemble forecasts, as well.