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Quelques défis de la prévision des précipitations intenses avec des ensembles à échelle convective

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Lien visio : https://meteo.webex.com/meteo-fr/j.php?MTID=m091d726ab481f9709257c8ee53b80c3a

Convective-scale ensembles provide multiple high-resolution weather forecasts simultaneously. This ensemble of predictions, also called members, enables these forecasting systems to assess weather predictability and suggest possible future states of the atmosphere, as well as unlikely yet not impossible scenarios. Their high resolution makes them well-suited to predicting deep convection. This combination of design features makes them intended for predicting low-predictable and high-impact events, such as Mediterranean heavy precipitation events. However, the extent to which they can be used to predict significant weather events is a matter ofdebate among forecasters, who regularly highlight the challenges associated with using them under operational constraints.

One challenge for forecasters on duty is to be able to quickly extract relevant information from these forecasting systems, as it is simply not possible to carefully review each ensemble member under a constrained schedule. In this context, ensemble-based summary products, particularly probabilities and quantiles, are commonly used. However, both of these statistics have limitations when it comes to heavy precipitation. One issue is their sensitivity to the spatial and temporal spread between ensemble members, which can significantly affect the relevance of the information extracted from convective-scale ensembles. Another issue is the difficulty of determining the quantile or probability levels on which the expertise of forecasters should be based, particularly with respect to rare events.

A second challenge arises from the complete lack of clarity surrounding the use of successive ensemble runs. It is common practice for forecasters to pay particular attention to how forecasts evolve as the potential event approaches, especially with regard to decisionmaking. However, this approach remains fairly empirical, and more easily applicable to deterministic models. Conversely, according to the current literature, there is little evidence to suggest that forecasters should rely on how a given forecasting system behaves from one run to another. But the corresponding state of the art is rather limited, particularly with regard to convective-scale ensembles.

This PhD thesis explores these two challenges using AROME-EPS, Météo-France's convective-scale ensemble. It has been demonstrated that forecasts should be interpreted in light of previous runs, as their reliability appears to depend on forecast consistency. It was also found that the traditional use of basic probabilities and quantiles seems limited when it comes to predicting heavy precipitation and needs to be refined. Finally, an alternative visualisation method for quickly extracting ensemble information has been tested and found promising.

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