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Production of a multi-model, convective-scale superensemble over western Europe as part of the SESAR project

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Ensemble forecasting has emerged as a key tool in numerical weather prediction (NWP) to account for forecast uncertainty due to errors in model parameterisation, boundary conditions, and initialization due to gaps in observation datasets. Methods such as the introduction of randomized perturbations into model physics and/or the analysis forecast field, and differing the choice of model parameterisation have proven to introduce sufficient ensemble spread, providing a number of ways to account for deterministic forecast error. However, with increasing model resolution and interest in high-risk, convective-scale phenomena, certain limitations arise. Specifically, the computational cost inherent in the production of high-resolution model members necessary to account for all types of forecast error becomes a concern. In addition to restrictions on the number of forecast members, and therefore the inflation of ensemble spread, model domain size is another constraint due to computational limitations. As a result, current operational, convective-scale ensemble forecast models within Europe have been restricted to the size of specific countries.
In an effort to produce a larger, high-resolution domain, output from the ensemble modeling systems produced by forecast centers in France, Germany, and the United Kingdom are being combined to produce a “superensemble” dataset, providing seamless, probabilistic forecasts across most of northwest Europe. Within the context of the SESAR project, forecasts providing the probability of fields related to convective-scale hazardous weather, such as simulated reflectivity, vertically integrated liquid, and echotop, will be generated in anticipation of a future operational product for the aviation community. Other forecast fields will follow in the future, as well as verification techniques using the national radar network within France. The superensemble presented represents a novel approach toward solving problems related to computational limitation inherent to ensemble probabilistic forecasts, as well as a promising avenue toward fostering international collaboration within the ensemble modeling community.