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Benefits of an ultra large and multiresolution ensemble for estimating available wind power

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In this study we investigate the benefits of an ultra large ensemble with up to 1000 members including multiple nesting with a target horizontal resolution of 1 km. The ensemble shall be used as a basis to detect events of extreme errors in wind power forecasting. Forecast value is the wind vector at wind turbine hub height ($\sim$ 100 m) in the short range (1 to 24 hour).
Current wind power forecast systems rest already on NWP ensemble models. However, only calibrated ensembles from meteorological institutions serve as input so far, with limited spatial resolution ($\sim 10 - 80$ km) and member number ($\sim$ 50). Perturbations related to the specific merits of wind power production are yet missing. Thus, single extreme error events which are not detected by such ensemble power forecasts occur infrequently.
The numerical forecast model used in this study is the Weather Research and Forecasting Model (WRF). Model uncertainties are represented by stochastic parametrization of sub-grid processes via stochastically perturbed parametrization tendencies and in conjunction via the complementary stochastic kinetic-energy backscatter scheme already provided by WRF. We perform continuous ensemble updates by comparing each ensemble member with available observations using a sequential importance resampling filter to improve the model accuracy while maintaining ensemble spread. Additionally, we use different ensemble systems from global models (ECMWF and GFS) as input and boundary conditions to capture different synoptic conditions. Critical weather situations which are connected to extreme error events are located and corresponding perturbation techniques are applied.
The demanding computational effort is overcome by utilising the supercomputer JUQUEEN at the Forschungszentrum Juelich.