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Assessment of the forecast quality of different seasonal climate prediction systems for the wind energy sector

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Wind power will play an increasingly important role in providing a substantial share of renewable energy supply in the future. The ability to reliably and accurately anticipate and respond to changes in wind energy supply and demand is essential to stabilize and secure the entire electricity network. Previous works have dealt with the sensitivity of the energy system to the variability at either short or long-time scales, such as with the use of weather forecasts or climate change projections. Instead, there are few examples of the use of climate predictions (sub-seasonal and seasonal) due to general perception on their low forecast quality.
We focus in this contribution on the enhancement of the efficiency of different aspects of the wind energy sector by employing the multi-model seasonal climate predictions. We have assessed the ability of several seasonal climate prediction systems to simulate a series of observed phenomena (surface wind speed and temperature) relevant to the sector and evaluated the forecast quality using a range of measures for deterministic and probabilistic predictions.
The climate forecast systems used are the ECMWF's System 4 and Meteo-France's Systems 3 and 4. The assessment has been performed at the global scale using the ERA-Interim and JRA-55 reanalyses as reference. The temporal correlation, root mean square error (RMSE), spatial pattern correlation, Brier skill score and continuous ranked probability skill score (CRPSS) have been estimated over the retrospective forecast periods. The uncertainty in the skill difference of two competing forecast systems has also been quantified to identify genuine improvements. In addition, the relative merit of post-processing methods (bias correction and calibration) has been evaluated in their ability to improve aspects of the forecast quality. The advantages of using a multi-model ensemble based on the combination of independent different forecast systems have been illustrated for the first time for wind energy forecasts. The results of this study suggest that the wind-energy sector has good opportunities to reduce the uncertainty of future energy estimates.