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State-of-the-Art Climate Predictions for Energy Climate Services

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Climate predictions tailored to the energy sector represent the cutting edge in climate sciences to forecast wind power generation. At seasonal time scales, current energy practices use a deterministic approach based on retrospective climatology, but climate predictions have recently been shown to provide additional value. For this reason, probabilistic climate predictions of near surface winds can allow end users to take calculated, precautionary action with a potential cost savings to their operations.

As every variable predicted in a coupled model forecast system, the prediction of wind speed is affected by biases. To overcome this, two different techniques for the post-processing of ensemble forecasts are considered: a simple bias correction and a calibration method. The former is based on the assumption that the reference and predicted distributions are well approximated by a normal distribution. The latter is a calibration technique which inflates the model variance, and the inflation of the ensemble is required in order to obtain a reliable outcome. Both methods use the "one-year out" cross-validated mode, and they provide corrected forecasts with improved statistical properties.

The impact of these bias corrections on the quality of the ECMWF S4 predictions of near surface wind speed during winter is explored. To offer a comprehensive picture of the post-processing effect on the forecast quality of the system, it is necessary to use several scoring measures: rank histograms, reliability diagrams and skill maps. These tools are essential to assess different aspects of the forecasts, and to observe changes in their properties when the two methods are applied.

This study reveals that the different techniques to correct the predictions produce a statistically consistent ensemble. However, the operations performed on the forecasts decrease their skill which correspond to an increase in the uncertainty. Therefore, even though the bias correction is fundamental for climate services, this comes at a price in terms of forecast quality.