Using a neural network approach to correct for systematic biases in seasonal wind power electricity generation forecasting

Johann Baumgartner, Johannes Schmidt, and Katharina Gruber
University of Natural Resources and Life Sciences, Institute for Sustainable Economic Development, Department of Economics and Social Sciences, Vienna, Austria (johann.baumgartner@boku.ac.at)

Neural networks are widely applicable for different modelling purposes in the energy sector such as predictions of electricity generation from wind and solar resources as well as electricity demand and prices. However, neural network approaches heavily rely on the availability of sound climate and actual generation data for model training. Sufficiently long and accurate time series of climate data needed for model training and seasonal climate forecasts for the prediction process are often not available from a data source based on the same climate model for the corresponding study area. Most likely data sources based on different climate models also feature different bias and consequently using one data source for model training and using another one for model prediction will produce systematically biased results that need correction.

Therefore, we assess here if a neural network approach can be successfully applied as a means to correct for systematic biases when a neural network is trained on wind power electricity generation while using a different climate data source for the prediction process.

We apply neural networks on climate assimilation data from climate modelling and train the neural network on actual generation from wind power. The trained neural networks are then used with an ensemble of climate input variables from seasonal forecasts to seasonally predict electricity generation from wind power. As the neural network is trained on a different data source, the modelled generation values are systematically biased. A subsequent neural network is applied to reduce this bias and to gain insight into how the bias between the two data sources differs via an analysis of the networks weights as well as a sensitivity analysis.

The neural network's ability to correct for systematic biases is assessed based on whether the quality of the modelled distributions in terms of their seasonal characteristics and extreme event frequencies is improved compared to not using this bias correcting neural network. Initial model results show that a neural network can in fact be used to correct for systematic biases introduced by using different data sources in model training and prediction to help generate results of improved quality versus not using a bias correcting neural network.

How to cite: Baumgartner, J., Schmidt, J., and Gruber, K.: Using a neural network approach to correct for systematic biases in seasonal wind power electricity generation forecasting, EGU