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Statistical calibration of weather parameters essential to renewable energy production.

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Abstract

Finnish Meteorological Institute - FMI is participating in VaGe project. Goal of this project is to investigate how much the weather forecasts can improve the decision making on energy system operations. Renewable energy production is weather dependent: wind, photovoltaic (PV) and hydro power reservoirs are all highly affected by prevailing weather conditions. Due to Finland's Northern location also demand of heating (or cooling) and thus energy consumption is largely weather dependent. The optimization of the weather and power forecast system is expected to have an economic impact.

We have studied the ability of medium-range weather forecasts to provide useful forecast and uncertainty information for renewable energy production process. We have used global ensemble predictions from ECMWF (IFS-ENS) with 50 + 1 members up to 15 days ahead. Longest lead times are necessary for the estimation of possible energy reservoirs like hydro power. The study area covers the domain of Nord Pool Spot (Nordic countries, Eastern Baltic countries and UK). All the forecasts have been verified and calibrated. The statistical calibration methods have been jointly developed with Hirlam-Aladin consortium.. In addition to traditional weather forecast parameters (T2m, S10m), weather parameters essential for wind and solar energy production have been investigated. Lidar measurements and Radar winds have been used for the verification and calibration of wind speeds at 100m height. Likewise surface solar radiation have been verified and calibrated against 30 solar radiation stations in Finland.

The results indicate that the medium-range probabilistic weather forecasts are under dispersive in general, and thus the calibration is needed. Calibration has increased the probabilistic skill and accuracy of the forecasts on average but locally they are not perfect. Like for the 100m winds the positive outcomes of the calibration are: 1.) Calibration increases the Spread. 2.) RMSE is reduced. 3.) Predictability is increased by 1 - 2 days. The calibration tools still need to be further developed to capture of the local details of error.

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