



Ensemble Data Assimilation of Photovoltaic Power Information in the Convection-permitting High-Resolution Model COSMO-DE

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Determining the amount of weather dependent renewable energy is a demanding task for transmission system operators (TSOs) and wind and photovoltaic (PV) prediction errors require the use of reserve power, which generate costs and can - in extreme cases - endanger the security of supply. In the project EWeLiNE funded by the German government, the German Weather Service and the Fraunhofer Institute on Wind Energy and Energy System Technology develop innovative weather- and power forecasting models and tools for grid integration of weather dependent renewable energy.

The key part in energy prediction process chains is the numerical weather prediction (NWP) system. Irradiation forecasts from NWP systems are however subject to several sources of error.

For PV power prediction, weaknesses of the NWP model to correctly forecast i.e. low stratus, absorption of condensed water or aerosol optical depths are the main sources of errors. Inaccurate radiation schemes (i.e. the two-stream parametrization) are also known as a deficit of NWP systems with regard to irradiation forecast. To mitigate errors like these, latest observations can be used in a pre-processing technique called data assimilation (DA). In DA, not only the initial fields are provided, but the model is also synchronized with reality – the observations – and hence forecast errors are reduced. Besides conventional observation networks like radiosondes, synoptic observations or air reports of wind, pressure and humidity, the number of observations measuring meteorological information indirectly by means of remote sensing such as satellite radiances, radar reflectivities or GPS slant delays strongly increases.

Numerous PV plants installed in Germany potentially represent a dense meteorological network assessing irradiation through their power measurements. Forecast accuracy may thus be enhanced by extending the observations in the assimilation by this new source of information. PV power plants can provide information on clouds, aerosol optical depth or low stratus in terms of remote sensing: the power output is strongly dependent on perturbations along the slant between sun position and PV panel. Since these data are not limited to the vertical column above or below the detector, it may thus complement satellite data and compensate weaknesses in the radiation scheme.

In this contribution, the used DA technique (Local Ensemble Transform Kalman Filter, LETKF) is shortly sketched. Furthermore, the computation of the model power equivalents is described and first results are presented and discussed.