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Environmental production factors in solar energy forecasting

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Accurate estimation of solar energy output is a priority when optimizing a large scale combined electricity production system, where solar energy production is playing a significant role. As the prevailing weather conditions are the largest unknown variable in determining the solar energy production efficiency at each point in space and time, it is important to study the magnitude and interaction relationship between all of these production factors.

In addition to the production factors which temporal variability is known, such as the temporal cycle of shadows, this study focuses on the main meteorological factors, such as air temperature, wind speed, and cloud cover, and on their impact on the forecasting skill of a Numerical Weather Prediction (NWP) model based solar energy forecast. The difference in choosing a particular NWP model for estimating energy production in specific weather situations is also estimated.

The study will be carried out by implementing an independent solar energy calculation module on top of different operational NWP models. The calculation module produces the momentary solar panel efficiency and production output estimate for each location and point in time, by first acquiring solar radiation, air temperature and wind speed information from each NWP model, and by then calculating the site specific inclined solar radiation component, and integrating other meteorological and solar panel system specific information to the calculation.

The comparison will be implemented by comparing the production outputs of various solar panel installations to site specific energy forecasts in the area of Finland. The utilized NWP models are a regional (HARMONIE) and a global model (ECMWF).