Comparison of short-term (hour-ahead) solar irradiance forecasts from all-sky imager, satellite images and numerical weather prediction models

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The all-sky imager (ASI) network Eye2Sky has been used for short-term solar irradiance forecasting in the of the city of Oldenburg, in northwest Germany. Eye2Sky is a network of ASIs and meteorological measurement instruments operated by DLR. This network is the basis for very short-term, high-resolution and accurate predictions of solar irradiance in the upcoming minutes (nowcast). A high density of ASIs with low spatial distances between cameras in the urban area allows an almost full coverage of the city (about 10x12 km). On the other hand, ASI-based solar irradiance nowcasts lack long forecast horizons due to their limited field of view (typically 15 minutes for single cameras). With a network of ASIs not only the coverage is increased but also the forecast horizon.

Forecasting methods based on satellite images or numerical weather prediction (NWP) models are used as the standard for solar power forecasts. They provide larger spatial coverages and longer forecast horizons compared to ASI forecasts. On the contrary, due to their limited resolution and update rate the accuracy for small forecast lead times and single sites is reduced.

Here, we demonstrate the value of a network of ASIs inside an urban environment for the spatial coverage and forecast horizon available from ASI. Moreover, we show a comparison of forecast accuracy between the ASI nowcasts and the reference forecasts from satellite and a NWP model for a short-term forecast lead time of up to 30 minutes.

These studies are the basis for a seamless forecasting strategy covering always finer spatial and temporal scales for intra-day applications. The main objective is to provide the highest available accuracy based on the hybridization of multiple data sources.

We are looking for an intensive exchange with research and industry on the application of short-term solar forecasting in modern renewable energy driven energy systems, e.g. the use of short-term forecasts in the operation of large PV plants. Any feedback from stakeholders on their needs and requirements will support us to adapt nowcasting strategies to specific applications.