EMS Annual Meeting Abstracts
Vol. 14, EMS2017-155, 2017

Satellite-based DNI nowcasting based on a sectoral atmospheric motion approach

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Within European Commission's FP7 DNICast project a nowcasting scheme based on Meteosat Second Generation cloud imagery and cloud movement tracking was developed. It uses a sectoral approach and answers the question at which time any cloud structure will affect the solar power plant. It distinguishes between thin cirrus clouds and other clouds, which typically occur in different heights in the atmosphere and move in different directions. The algorithm [1] has undergone a major revision resulting now in the nowcasting of DNI percentiles. Those originate from cloud optical depth (COD) percentiles being derived from the pixel to pixel variability in the upcoming cloud system. These percentiles are of high interest for the dispatch optimization, the plant operation and the combination of the nowcasts with other nowcasting methods. Both the jumpiness from each nowcast to the next nowcast and the percentile range in each individual nowcast turn out to be a promising indicator of the real 1 min variability.
In parallel, the DNICast project also worked on a cloud motion vector approach using optical flow methods [2]. Both methods show a similar small mean bias error over the whole nowcast horizon at the Plataforma Solar de Almeria site. The mean absolute error (MAE) is similar until 40 minutes and afterwards the optical flow performs better with respect to the MAE. With respect to the root mean square error (RMSE), the sectoral receptor model performs better until 40 minutes. Afterwards the RMSE is slightly larger compared to the optical flow method. Similar RMSE are reached for both approaches from 220 minutes forecast lead time onwards.
This paper will especially look into the verification of this scheme with respect to various cloud conditions. Scattered, broken/overcast, cirrus, and clear situations are separated in the verification as previously used in [3] are evaluated.

References

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