EMS Annual Meeting Abstracts
Vol. 16, EMS2019-553, 2019

Surface solar radiation forecasts by advecting cloud physical properties derived from Meteosat Second Generation observations

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A surface solar radiation forecast algorithm is developed using cloud physical properties from the Spinning Enhanced Visible and Infrared Imager (SEVIRI) on board of the Meteosat Second Generation (MSG) geostationary satellite. The novelty of the algorithm is the derivation of cloud motion vectors using cloud physical properties. The solar radiation forecast products include global horizontal irradiance (GHI) and direct normal irradiance (DNI). The forecast horizon is 0-4 hours at a 15 minute temporal resolution. The forecast is currently tested for the Netherlands at a spatial resolution of about 4 km x 6 km. Compared to measurements of the Baseline Surface Radiation Network (BSRN) site of Cabauw, the root mean square error (RMSE) is about 31-44% for GHI and 59–100% for DNI at a forecast horizon of 2 hours. For a forecast horizon of 15 minutes, the RMSE is 22-24% for GHI and 43-61% for DNI. The correlation coefficients between the forecasts and BSRN measurements are similar for GHI and DNI, and decrease from about 0.8-0.9 at 15 minutes to 0.45-0.75 at 2 hours. The SEVIRI forecast outperforms the HARMONIE numerical weather prediction model forecast in the first 2-3 hours. The quality of the forecast depends on the sky conditions: for clear-sky indices larger than 0.7, the SEVIRI GHI forecast is better than both smart persistence and the HARMONIE forecast in the first 4 hours.
In the presentation we will explain the cloud advection algorithm, show the solar radiation forecast products and the comparison with ground-based solar radiation measurements.