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Exploring alternatives for the improvement of the CIADCast short-term solar radiation hybrid forecasting method

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Accurate short-term, i.e. up to 6 hours ahead, solar radiation forecasts are important for the solar energy integration and solar power plant management.
The Cloud Index Advection and Diffusion (CIADCast) is a hybrid method for short-term solar radiation forecasting developed at the MATRAS research group. The method is based on the advection and diffusion of Meteosat Second Generation (MSG) cloud index estimates using the Weather Research and Forecasting (WRF) numerical weather prediction (NWP) model. The forecasted cloud index is transformed in GHI and DNI forecasts by means of the Heliosat-2 method. In this way, GHI and DNI are forecasted every 15 minutes up to 6 hours ahead with a time resolution of 15 minutes. Here we explore different alternatives to insert the cloud index maps in the WRF model. Particularly, we evaluate the use of 1) a fixed height, 2) the cloud height provided by a ceilometer, 3) the EUMETSAT cloud top height product and 4) the height provided by the WRF-Solar model. In addition, the CIADcast forecasts were benchmarked using three other models: smart persistence, a CMV-based approach and the WRF-Solar suite of the WRF model. Radiometric data collected at three stations (Seville, Jaen and Almería) located in southern Spain were used for the evaluation. Data correspond to a set of 25 days specifically selected in order to account for characteristic sky conditions. Results showed that the CIADcast method provide improved forecasts for the DNI and certain types of sky conditions. The performance of the different alternatives for the cloud height greatly varies among sky conditions.