EGU21-7218
https://doi.org/10.5194/egusphere-egu21-7218
EGU General Assembly 2021

Assessment of a newly developed short-term forecasting system (nextSENSE) of Downwelling Surface Solar Irradiance (DSSI) and validation with ground-based measurements

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Monitoring and forecasting cloud coverage is crucial for nowcasting and forecasting of solar irradiance reaching the earth surface, and it's a powerful tool for solar energy exploitation systems.

In this study, we focused on the assessment of a newly developed short-term (up to 3h) forecasting system of Downwelling Surface Solar Irradiation (DSSI) in a large spatial scale (Europe and North Africa). This system forecasts the future cloud position by calculating Cloud Motion Vectors (CMV) using Cloud Optical Thickness (COT) data derived from multispectral images from the Spinning Enhanced Visible and Infrared Imager (SEVIRI) onboard the Meteosat Second Generation (MSG) satellite and an optical flow motion estimation technique from the computer vision community. Using as input consecutive COT images, CMVs are calculated and cloud propagation is performed by applying them to the latest COT image. Using the predicted COT images, forecasted DSSI is calculated using Fast Radiative Transfer Models (FRTM) in high spatial (5 km over nadir) and temporal resolution (15 min time intervals intervals).

A first evaluation of predicted COT has been conducted, by comparing the predicted cloud parameter of COT with real observed values derived by the MSG/SEVIRI. Here, the DSSI is validated against ground-based measurements from three Baseline Surface Radiation Network (BSRN) stations, for the year 2017. Also, a sensitivity analysis of the effect on DSSI for different cloud and aerosol conditions is performed, to ensure reliability under different sky and climatological conditions.

The DSSI short-term forecasting system proposed, complements the existing short-term forecasting techniques and it is suitable for operational deployment of solar energy related systems

Acknowledgements

This study was funded by the EuroGEO e-shape (grant agreement No 820852).