



## ECMWF's global and direct normal irradiance forecasts – an accuracy assessment taking the new MACC aerosol forecasts into account

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Solar surface irradiance forecasting is of major importance for the management of the solar energy capacities providing larger shares of our electricity supply due to the energy system transition process. Especially, applications from the grid management sector require intra-day and day-ahead irradiance forecasts in hourly resolution. Any operation strategies for electricity grids and the electricity trading will take such forecasting into account in future. European's 7th Framework project Orpheus deals with the management of hybrid energy grids and the development of business models for the future energy system and its stakeholders. Within Orpheus, we evaluate the leading irradiance forecasts provided by the European Centre for Medium-Range Weather Forecasts (ECMWF) with respect to scattered cloud situations and strong aerosol load conditions being most relevant for forecasting of large solar shares in the grid.

Photovoltaics and non-concentrating solar thermal technologies require mainly global horizontal irradiance (GHI) forecasts but also together with good knowledge on the direct/diffuse irradiance split for the calculation of irradiance on tilted surfaces. Nowadays numerical weather prediction schemes typically provide global irradiances only, but mostly no direct normal irradiance (DNI) forecasts. The ECMWF has recently changed its output variable selection in order to include direct irradiances. Additionally, the European Copernicus program MACC project's near-real time services provide daily analysis and forecasts of various parameters based e.g. on new aerosol properties. The operational ECMWF/IFS forecast system will profit on the medium term from the MACC aerosol forecasts.

This evaluation is done at the Plataforma Solar de Almeria (PSA) and twelve BSRN stations within the Meteosat Second Generation satellite's field of view. The availability of satellite data allows the discrimination of scattered cloud cases from overcast cloud cases and cloud free situations in the evaluation. It was found that the inclusion of the new aerosol climatology in October 2003 improved both the GHI and DNI forecasts remarkably, while the change towards a new radiation scheme in 2007 had only minor and partly unfavourable impacts on the performance indicators. For GHI, larger RMSE values are found for broken/overcast conditions than for scattered cloud fields. For DNI, the findings are opposite with larger RMSE values for scattered clouds compared to overcast/broken cloud situations.