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## Daily global aerosol forecasts with ICON-ART to reduce forecast errors for photovoltaic power generation caused by high loadings of aerosols

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The shift towards renewable energy sources such as wind and solar poses major challenges for the entire energy sector. In order to ensure a secure energy supply in the future, accurate weather forecasts are becoming increasingly important. The majority of the operational numerical weather prediction models do not consider prognostic aerosol and aerosol-cloud radiation interaction. This repeatedly leads to erroneous weather forecasts during special weather conditions that involve aerosols, such as strong Saharan dust episodes or biomass burning events.

The project PermaStrom (May 2020 – April 2024), namely “Photovoltaic power prediction to better manage the influence of the atmospheric aerosol on the electricity grids in Germany and Europe” (translation from the German title), follows up on the developments of the predecessor project PerduS (March 2016 – February 2020), where global and refined regional forecasts of dust aerosol were established in a pre-operational version at DWD. Within PermaStrom, the model system is extended with more aerosol species (soot from biomass burning and sea salt) to further improve photovoltaic yield forecasts. Additionally, the treatment and parameterization of aerosol-cloud interactions are studied in a high-resolution LAM (limited area mode) setup along with ICON-ART ensemble predictions. The model developments are continuously validated against various ground- and satellite-based measurements of aerosol concentration and distribution, clouds and solar radiation. The dust forecasts are planned to become operational at DWD in its own data assimilation cycle in winter 2023/2024 with a global 26 km grid and a two-way 13 km nest covering Europe, North Africa and the North Atlantic.

This contribution will provide an overview of the research and model development activities within the PermaStrom project. Additionally, we will show validation results for several aerosol events with direct attention to photovoltaic power production in Germany.

