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The Project PerduS: Improvements in photovoltaic power forecasts during Saharan dust episodes over Europe

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The importance of photovoltaic (PV) power in Germany's energy mix is constantly increasing. Currently, an installed capacity of 40 GW can even supply up to 50% of Germany's instantaneous electricity demand during sunny days 1).
In order to incorporate PV energy efficiently, accurate forecasts of the expected PV power production, and therefore of the underlying numerical weather prediction (NWP) models, are indispensable. However, during some Saharan dust outbreaks substantial forecast errors arise, because mineral dust particles are not explicitly considered in today's weather forecast models. The research project PerduS, which is a collaboration of the German Weather Service (DWD), the Karlsruhe Institute of Technology (KIT) and meteocontrol GmbH, focuses on this problem. Both, weather and PV power forecasts shall be improved during Saharan dust outbreaks for the target region Germany. In PerduS, the model system ICON-ART forms the base for the intended improvements in forecast quality. It combines the non-hydrostatic global NWP model ICON and the ART modules for the treatment of Aerosols and Reactive Trace gases in the atmosphere in an online-coupled system. Within the project PerduS the mineral dust forecast is validated and further improvements shall be placed in the modelling system ICON-ART. In order to achieve this goal, high quality observations are acquired and prepared. The simulated mineral dust emission and transport processes, its optical properties as also the wet deposition, i.e. the washout of aerosols are examined. Furthermore, the pollution of PV panels by deposited mineral dust and their subsequent cleaning due to precipitation will be parameterized. The ultimate goal of PerduS consists of a quasi-operational application of ICON-ART in the weather prediction mode, including the interactions between mineral dust and the atmosphere, in particular, with the radiation. Therefore, technical aspects are also addressed and a long term application of the modelling system is tested.
The submitted contribution outlines the project PerduS. Furthermore, different case studies concerning Saharan dust outbreaks are presented. Amongst these, the challenge of introducing of a new evapotranspiration scheme in the NWP system ICON and its influence on the dust emission in ICON-ART will be shown. The new scheme led to reduced soil moisture in the Saharan region and concurrently to better simulations of mineral dust concentrations. Improvements will be demonstrated not only in classical metrics of NWP, but also by successive PV power predictions.

1) Source: www.pv-fakten.de Aktuelle Fakten zur Photovoltaik in Deutschland, Fraunhofer ISE