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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of the 4 April 2014 Saharan dust outbreak on the photovoltaic power generation in Germany" *by* Daniel Rieger et al.

Anonymous Referee #1

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This paper aims at characterizing the impact of the mineral dust events on the incoming solar radiation variability in Numerical Weather Prediction Models. The focus is done for Germany and a specific event, observed at 4 April 2014.

The fact to explicitely diagnose mineral dust emissions and transport is not new, but it seems this was not the case in the German weather forecast model. This is thus a large improvement even if it is not a new scientific research. Many models are calculating all aerosols able to modify the radiation properties, including in forecast, as, for example, for the COPERNICUS CAMS daily forecast. Please improve the bibliography about forecast in Europe. For analysis or regional forecast, some of them are already online to account for the direct and indirect effects of aerosols (see papers by A.Baklanov in ACP, among others).

This model improvement is applied for a specific application, the photovoltaic power production. This aspect is more new and more related to the ACP topics.

The study present two different topic: the improvement of the model and the impact of the improved mineral dust calculations on PV production. But there is no validation of the improved model, on the specific test case (only one day). However, many measurements exist and could give a larger confidence on the quantification of the impact. Finally, the paper is clear and well written. It can be published after some corrections (mainly the addition of the test case validation using available measurements).

General comments:

- The section 2 is very complete about the model description. Many details are provided, but, if this is not new for this paper, some references would be enough.

- 2.2 Radiation: We agree that the complex refractive index is probably one of the sensitivie parameter for this kind of study. Please provide more precisely the values used (a figure for example). Did you already made sensitivity tests to have the range of uncertainty of your results?

- 4 Model set-up: the two possible ways are explained: 1. Compare the NWP with the climatology and the really resolved dust emissions. 2. Use only the really resolved model to quantify the impact of dust on PV production, The authors stated that only the 2nd approach is useful for their study. Why not the two? The approach #1 will provide the benefit to have a better methodology for dust and to quantify the confidence is the future results about PV. The #2 will provide the impact on PV. The two are complementary. Specifically, because there is no real validation of the test case with measurements in the paper. Before to quantify the impact of dust on PV, it is necessary to prove that your simulation has correct order of magnitude and variability of AOD and surface PM2.5 and PM10. A lot of measurements exist in Europe and could be used for that (AERONET, EMEP).

- 5.1 Simulated mineral dust distribution: The Figure 5 presents comparisons between the model and measurements. It is necessary to done the same with the Figure 4 for AOD, by using AERONET stations for example. If you consider there is no enough stations in your nested domain, you can present, at least, a comparison with the largest one. As you are studying only one day, this would be also interesting to see model validation for the days before, in order to better understand if the mineral dust plume is well transported or not.

- What about local resuspension? The problem with mineral dust is not only the plume above the PV unit but also the deposition. The deposition is not only dry or wet, but there is also mainly very local emissions, due to resuspension and directly on the PV units.

Some typos to check and correct (not all, just examples): p.2, l25: its influcence p.6, l.6: kinetic energye

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