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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Assessment of the radiative effects of aerosols in an on-line coupled model over the Iberian Peninsula" *by* Laura Palacios-Peña et al.

Anonymous Referee #2

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The objective of this paper is to quantify the aerosol radiative feedback for the Iberian Peninsula for some pollution episodes. A coupled meteorology-chemistry model WRF-Chem was used to simulate gas/aerosol chemistry, aerosol-radiation-cloud interactions for two case studies. These cases were focused on a Saharan dust break and a wildfire episodes. The model results were evaluated using various remote sensing datasets. The subject of this study is relevant for publication in ACP. It is crucial to accurately estimate feedback of aerosols from different sources to radiation budget over the region.

In my opinion authors need to improve the quality of presentation of the modeling framework, the model results and evaluations in the paper before it is accepted to ACP.

The section 2.1 provides limited information about the WRF-Chem model setup used

in the study. Which gas chemistry, microphysics etc. options were used in the model?

Why did the authors choose the SORGAM module? It's well known that the SORGAM drastically underestimates secondary organic aerosol (SOA) concentrations, consequently total aerosol concentrations. There are versions of the MADE aerosol scheme coupled to new SOA schemes in WRF-Chem (e.g. Tuccella et al., 2015).

The authors need to provide more details on how the aerosol-radiation and aerosol-cloud interactions are parameterized in their version of WRF-Chem. These details could help to better interpret the model-observation discrepancies.

The model was run on 23km resolution. This is a relatively coarse model grid. It doesn't allow simulating land-sea breeze and other mesoscale circulations. Moreover, in such resolution there are more parameterized (by cumulus parameterization) clouds in the model. Since the model doesn't treat aerosol-cloud feedback in cumulus parameterization, the overall ACI effect can't be captured by these model settings.

Another uncertainty stems from using ECMWF analysis fields for the meteorological initial and boundary conditions in the regional WRF-Chem modeling. The ECMWF model assimilates met. observations, which might be already affected by those dust and fire aerosols. Hence, the base WRF-Chem model case implicitly may already include some of the aerosol feedback. I understand that it's hard to set up a "perfect" regional modeling framework to study the aerosol-meteorology interactions, however this issue needs to be mentioned in the paper.

I don't see much discussions of the simulated ACI effect in the paper. For clarity it'd better to show three model cases - w/o any aerosol feedback, with aerosol feedback on radiation and with aerosol feedback on radiation+clouds, and discuss them more thoroughly.

Another missing piece in this paper is lack of evaluations of the simulated aerosol concentrations. Thus, it's hard to interpret AOD comparisons given the lack of information

about the model's skill to simulate aerosol mass concentrations in dust and smoke plumes.

Minor comments: Authors use many abbreviations in the text. I suggest adding a table showing all of them in one place.

page 9: correct "values shows"

page 11: correct "fires particles"

References section: The paper by Iacono et al. is entered twice.

REFERENCES: Tuccella, P., G. Curci, G. A. Grell, G. Visconti, S. Crumeyrolle, A. Schwarzenboeck and A. A. Mensah (2015). "A new chemistry option in WRF-Chem v. 3.4 for the simulation of direct and indirect aerosol effects using VBS: evaluation against IMPACT-EUCAARI data." Geoscientific Model Development 8(9): 2749-2776.

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