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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the radiative impact of aerosols on photolysis rates: comparison of simulations and observations in the Lampedusa island during the ChArMEx/ADRIMED campaign" *by* S. Mailler et al.

Anonymous Referee #2

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This paper presents an interesting quantification of aerosol impact on photolysis rates and ozone concentrations. The study is supported by measurements operated at the Lampedusa island, satellite observations and simulations made with the CHIMERE CTM coupled to FAST J-X radiative transfer scheme. I think the study deserves publication in ACP / ChArMEX special issue. Before that, I would have some suggestions that call for minor revisions since no additional simulations are a priori required.

Section 2 :

Rather than only based on the Lampedusa site (not resolved by the model), the "validation" of surface temperature and wind could be made on larger/ regional scale e.g. by comparison with reanalysis products. Here you want to convince us that the WRF simulation does a reasonable job in reproducing average dynamic over the period of study (which we expect since there is some nudging applied).

Chemical boundary conditions. Lateral boundary conditions: I understand they are relaxed towards LMDZ INCA-climatology. Upper chemical boundary conditions: I understand that the radiative transfer code uses its own climatology for the unresolved stratosphere. But what is the boundary condition for the chemical tracer (especially ozone) at top of the model ? In this regards, could the underestimation of the total ozone column come from an ozone underestimation by CHIMERE in the upper levels of the model (400-300) hpa perhaps to be checked on vertical profiles) ?

From the text, I understand that aerosol can perturb radiative transfer at 5 specific wavelengths. What happen to radiative energy carried at intermediate wavelengths? does it see any aerosol ? Maybe you should also recall how are calculated the actinic flux and photolysis coeff in the model (e.g. which wavelengths are important ..).

Section 3:

Comparison of AOD : Maybe a specific focus (with appropriate color scale) should be made on the Mediterranean region to better illustrates the gradients in model and observations.

P7600L27-29: Sentence a bit confusing

Section 3.1.

Overestimation of PM10 in the B.L : Beside deposition and numerical diffusion, there could be issues linked to the dynamic of marine B.L. as simulated by wrf or the uncertainty on emission size distribution which could play an important role. Do we have an idea of typical dust size distribution observed at Lampedusa ? How would that compare

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to the model ?

The Lidar fig 6c gives a strong signal in the first atmospheric levels. Is it significant ?

As in many modeling studies we see some discrepancies arising from different model-measurement comparisons: -AOD is very well simulated (only slightly overestimated sometime). -Simulated surface concentrations are overestimated, while concentration vertical profile gradients seem consistent with b.s. obserations but show an overestimation of aerosol vertical extension. From this two last results we would expect a priori an overestimated AOD, if optical properties were perfect. So there might be different error compensation operating here, that should be acknowledged in the manuscript. It would be helpful to have the same time axis on the time series in figure 5-6-7

P7602L 3. There is a discrepancy between the total overestimation and the different aerosol contributions

Section 3.3 Impact on ozone concentration It would be good to have some regional estimations of the impact (e.g over the full domain, or over the Mediterranean domain. Also how are affected the vertical profiles ? for climate study, there could be an interest to evaluate the impact on mid-tropospheric ozone (with a vertical profile).

Also since you are using a limited area model and chemical boundary conditions that affect concentrations, it would be useful to have an illustration of the impact of aerosol on the net chemical production of ozone within the domain (in addition to final concentrations). This could also help the discussion between the role of jNO2 vs JO1D.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 7585, 2015.