

## ***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 #3**

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This manuscript entitled "On the radiative impact of aerosols on photolysis rates: comparison of simulations and observations in the Lampedusa island during the ChArMEx/ADRIMED campaign" presents a very interesting work dealing with the impact of aerosols on photolysis rates and ozone concentration during summer 2013 in Lampedusa. The authors have carried out simulations with a chemistry-transport model (CHIMERE) and compared them to different observations from the field campaign to show that aerosols have reduced the photolysis rates and modified the ozone concentrations. Therefore I suggest to accept this article for a publication in ACP, after

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the correction of the following points.

Main comments:

- I do not understand why the authors have chosen to use the WRF model at a resolution of 60km to carry out a study using observations in Lampedusa island, that cannot be represented in the model at such a coarse resolution. Figure 1 clearly shows that the diurnal cycle of surface temperature is not correctly simulated because of the absence of land surface. The authors should justify their choice, and explain if results would be changed with an explicit representation of the island. Moreover, it would be interesting to know if this impact of the island on temperature can be seen at higher altitudes.

- I find that the authors are too optimistic with regards to the performance of the CHIMERE model to reproduce AOD and ozone variations. For ozone, it would be better to justify why the smaller variability in the model compared to observations can be attributed to the use of a climatological value for the stratospheric ozone column. For AOD, Figure 3 and 5 show that CHIMERE has some deficiencies that should be better pointed out. For example, during the dust peak from 21 to 24 June in Lampedusa mentioned page 7601 (line 14), the overestimation by the model is about 40%.

Specific comments: - Page 7587, line 22: Please define  $J(O_1D)$  and  $J(NO_2)$ . - Page 7587, line 58: the whole simulation domain - Page 7588, line 17: the effects of aerosols on meteorology and climate should be mentioned, in addition to their effects on the radiative budget. - Page 7589, line 24: could the authors give more details about this climatology for stratospheric ozone (how has it been built, evaluation, etc.) ? - Page 7590, line 8: occurred (...) 1 June to - Page 7891, line 8: what is the resolution used for NCEP/GFS ? I suppose that it is not very different from the 60 km used in the WRF simulation. Has a nudging method inside the domain been used ? - Page 7891, line 9: in Fig. 3 - Page 7592, line 3: Is it really necessary to use a climatology (I suppose that it is a monthly climatology) for dust aerosols in the boundary conditions ? The domain

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seems to be large enough to include all the dust sources that affect the Lampedusa island. It could even mitigate the performance of the model if climatological dust plumes come from remote places. - Page 7593, line 12: Are these values of radiative indices specific to Saharan dust ? - Page 7594, line 15: for the whole simulation period - Page 7595, line 18: The first sentence seems to be useless. - Page 7599, line 16: how could these missing dust emissions be explained ? is it due to a poor representation of the soil characteristics in some regions ? is the soil humidity taken into account in the calculation of dust emission ? - Page 7600, line 10: is it 600 nm ? - Page 7600, line 22: To evaluate more precisely this plume of strong AOD, it would be nice to have AERONET stations in northern France or in the British Isles. Because in Fig 3, only the points where MODIS data are available are taken into account, so that this plume of strong AOD is not evaluated. - Page 7601, line 27: For the peak in Oujda between 12 and 17 June, it seems that CHIMERE simulates a second peak after the first one which is not the case in observations. - Page 7601, line 10: Could the meteorological conditions explain that CHIMERE has missed this peak between 25 and 30 June ? - Page 7603, line 9: from 2 to 4 July - Page 7604, line 29: I don't agree that the overestimation of the wind during periods of weak winds can explain the excessive background SSA concentration, as even when wind is not overestimated, SSA concentration is overestimated (for example on 8 June). - Page 7607, line 25: as the presence of clouds is discussed in this paragraph, it would be interesting to add an estimation of cloud cover simulated by the model in Fig 1 in addition to temperature and wind - Page 7612, line 4: no cloud is present

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

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