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Interactive comment on "Dust aerosol radiative effects during summer 2012 simulated with a coupled regional aerosol–atmosphere–ocean model over the Mediterranean" *by* P. Nabat et al.

Anonymous Referee #2

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Dust aerosol radiative effects during summer 2012 simulated with a coupled regional aerosol–atmosphere–ocean model over the Mediterranean by Nabat et al.

General comments:

According to the tittle the manuscript deals with the simulation of dust aerosol and its radiative effects by means of a coupled regional aerosol-atmosphere-model. In order to test the success of the modeling scheme the authors apply it to the Mediterranean basin during summer 2012. The model results are tested against experimental data on aerosol optical depth, total solar irradiance and temperature at surface level. In fact

the selected study case corresponds to the whole summer with intensive measurements of some variables during short periods. The study is interesting and the results obtained are relevant in the framework of atmospheric aerosol studies and their role in the Earth energy balance and through this on the evaluation of the aerosol climate effect. Nevertheless, the manuscript includes some errors that the author must correct before the manuscript will be publishable in ACP. Mainly there is some confusion on terminology concerning the climate and meteorology scales. Especially the abstract is confusing using terms like "Mediterranean climate daily variability". In fact, although the results of the study are relevant for climate studies the study in itself only tests the modeling scheme against a study case, although the study case covers in fact a period of a whole summer. The success of the modeling is tested using different time scales, since the daily scale at particular stations to the summer average at the regional level. Due to the broad cover of the paper sometimes these facts are not clearly stated.

Particular comments:

The abstract must be rewording taking in mind the comment on the confusion about meteorology and climate previously mentioned. Also the introduction requires a depth review in order to avoid expressions like: "A particularly intense dust event has been measured at the end of June with different observation means (balloons, aircraft, surface and remote-sensing measurements), and consequently represents a documented case to evaluate the ability of climate models to reproduce this kind of events and their effects on climate". As I said before you can test the capability of the coupled regional aerosol–atmosphere–ocean model to reproduce a particular event but you can't evaluate the effect on climate of a particular event, is a matter of scales. Since the beginning the purpose of running the simulations SN-PROG, SN-PROG-M and SN-NO must be clearly stated. The utility of SN-NO to capture the variability in the analyzed fields due to other elements different of the aerosol is interesting, must be clearly formulated since the beginning. The utility of SN-PROG-M is not so clear to me and must be justified. It is obvious that using monthly values for the aerosol field will not capture effect of the

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daily variability of this component so likely this part of the study can be excluded. Concerning the presentation of results it is necessary to include the uncertainties associate to both the experimental values and the model outputs. This is especially interesting for the daily comparison and for the particular cases like the aerosol extinction coefficient profiles. The uncertainties on the retrieval of the extinction coefficient from elastic lidar using the Klett algorithm would lead to large uncertainties in spite of using the AERONET aerosol optical depth as a constrain that must be included. Concerning the capability of the modeling scheme to simulate the aerosol profile, the authors are really optimistic in their comment on the success of this simulation, specially looking at the results over Barcelona. Anyway the use of only two profiles is too poor to extract conclusions on the effectivity of the modeling scheme to reproduce the aerosol vertical structure. Looking at figure 1 it seems that some AERONET stations in southern Iberian Peninsula are missing, there is any reason for this?

All the discussions on numeric results require including the uncertainties associated to modeling and experimental measurements and in addition due to the approach used, checking summer averages of regional fields or daily averages of the atmospheric variables in a particular site, an indication of data spreading through standard deviation values is required.

The quality of figures must be improved, especially concerning the size of labels and scales. Any axis must include the appropriate units used that in some cases are missed, see for example Figure 6.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 25351, 2014.