Atmos. Chem. Phys. Discuss., 14, C8436–C8440, 2014
www.atmos-chem-phys-discuss.net/14/C8436/2014/

Atmospheric Chemistry and Physics Discussions

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 #1

Received and published: 23 October 2014

Review of paper: Title: Dust aerosol radiative effects during summer 2012 simulated with a coupled regional aerosol-atmosphere-ocean model over the Mediterranean Author(s): P. Nabat et al. MS No.: acp-2014-527

General comments:

This paper aims at characterizing the dust aerosol radiative effects over the Mediterranean. The focus is done over a specific period, the summer 2012, in which in-situ measurements were made as part of the campaign TRAQA/CHARMEX. This paper

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

addresses several different questions: (i) the ability of a model dust emissions scheme to produce realistic fluxes and then aerosols concentrations, (ii) the impact of these dust concentrations on the daily radiation variability, (iii) the impact of the use of a deterministic scheme in place of a climatology, (iv) climatological differences between 'dusty' or not days, (v) a comparions between several AOD satellite products.

This leads to a very long paper, mixing several concepts: climate and a specific studied case, model sensitivity tests, model comparisons (with MACC), data comparisons, impact of aerosols on radiation, comparisons between model outputs and measurements. The result is sometimes not very clear and several issues has to be corrected before publications. Removing unnecessary parts could make the article more clear and precise.

Regardless of long or unnecessary parts, there is critical issues:

1. the paper is presented as a study of 'aerosol-climate' interactions. There is a confusion between meteorology and climatology. And this is all along the paper. The aerosols hourly interact with the meteorological variables, leading, after a long time, to a climate change. But you can not claim that, with a study of three months, you are able to characterize the 'aerosol-climate' interactions over a region.

2. The comparison between an aerosol climatology and a deterministic calculation of dust emissions has no sense in the framework of a case study. Knowing the large variability of daily emissions, it is obvious that a climatology of aerosols is not adaptated. This part of the paper should be removed because the confusion between hourly meteorology and climate does not highlight the entire study.

3. the modelled domain is not adaptated to the studied problem. For a study about mineral dust long-range transport, this is surprising to make simulations with a large part of missing African dust emissions potential sources: the lowest latitude of the domain is 8N (domain is not explained in the text and figures are small), when a latitude of 0 is a minimum to be sure to catch all possible events.

ACPD
14, C8436–C8440, 2014

4. The use of MACC outputs does not provide significant added value to the article and should be removed.

5. The criterion used to select the 'dusty' days seems to be inappropriate. The use of a number (10%) of dusty days to select them as well as the use of AOD in place of Angstrom coefficient to select dust periods make results difficult to understand.

———————————————————————————————- Specific comments:

1. Introduction:

- the term 'interactive dust scheme' is not clear. Do you mean 'dust production scheme'? - Dust particles are not from 'desert sources' but from 'arid areas'

2.2 The aerosol scheme

p. 25359 l.2: The dust emission scheme is a keypoint for this study, the results being directly compared to a climatology. But the scheme itself appear to be an old scheme, not up to date compared to the model development on dust emissions these last ten years. Mainly: the Marticorena and Bergametti uses constant values to estimate the vertical dust flux from the horizontal one. But these constant values were primarily fitted over the Sahara and sahel region. p. 25359 l. 7 and 17: Finally, these fluxes are integrated in 3 bins (whereas others aerosols are over 12 bins?). For hourly regional studies, 3 bins are not sufficient, leading to errors in transport, sedimentation and deposition. If the model is limited in computer resources, it is better to use lognormal modes for dust. p. 25359 l. 21: The aerosol scheme is not complete and certainly useful for some climate studies. But is it really adaptated for this specific study, focussing on a real event during three months? What about the nitrate?

Some references discussing these points: - Mahowald, N., et al. The size distribution of desert dust aerosols and its impact on the Earth system. Aeolian Research 2013), 10.1016/j.aeolia.2013.09.002 - Knippertz and Todd, 2012, Mineral dust aerosols over the Sahara: meteorological controls on emission and transport and implications for

ACPD

14, C8436–C8440, 2014

modeling, Reviews of Geophysics, 50, RG1007. - Simpson et al, The EMEP MSC-W chemical transport model - technical descriptions, Atmos. Chem. Phys., 12, 7825-7865, 2012. - Shao et al., 2011, Dust cycle: An emerging core theme in Earth system science, Aeolian Research, 181-204.

3. Evaluation of the simulated aerosols.

p. 25364-25365: This section is dedicated to the model scores. For that, AOD are compared to AERONET measurements. In fact there is also a comparison between several satellite products. This reduces the understanding of the section. The conclusion is the model is better than the satellites compared to aeronet stations: but in this section, the comparisons is done between very different products: sun-photometers high-frequency time resolution, two models, and satellite known to be time-averaged to give realistic aerosols patterns. Thus, the comparisons are really between tomatoes and potatoes and the conclusion that the model is better than the satellite is erroneous. I suggest to remove the comparison to MACC, not useful, and to discuss separately the comparison with the satellites products and the models outputs by adaptating the time average to the products.

4. Aerosol radiative effect: Apart to prove that a climatology of aerosols is not adaptated to this kind of study, the interest to have the PROG-M simulation is not useful and should be remove. This is the same than for NO simulation. To study aerosols variablity, the use of no aerosols or climatological aerosols is not suitable and it is just obvious. This leads here to a very long section, given numerous quantification of detailed scores, but based on tools not adaptated to the scientific question.

5. Composite analysis: In this section, a threshold in AOD is estimated to select between 'dusty' days or not. The following sentences is not clear to me: p.25374 l.16: 'A threshold in AOD has been chosen for each stations in order to have 10% of dusty days'. This means that a 'dusty' days is not defined considering the AOD absolute values, for the 10% of the highest recorded values for one site? What is the physical

ACPD
14, C8436–C8440, 2014

meaning of this choice? In addition, high AOD are not only due to long-range transport of dust but may be the effect of local intense particulate matter resuspension, long-range transport of other sources (fires for example). To select 'dusty' days, the use of the ratio between fine and coarse mode, angstrom coefficient over the aeronet stations would give more realistic results. After this selection using the data, the study could quantify the ability of the model to retrieve the same type of scores. But, to have different treshold between stations, using AOD only (in place of Angstrom coefficient) can not give physical answers to the question. This part has to be redone and rewritten taken into account these remarks.

———————————————————————————————- Technical corrections:

- sulphate (not sulfate) - Enlarge the legends figures, sometimes very small and difficult to read. - Many informations on the figures, with text often superimposed and thus unreadable (Fig. 5) or symbols too small (Fig. 4) or colors difficult to distinguish (fig.7). Please correct.

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