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Atmospheric Chemistry and Physics Discussions

Interactive comment on "North African dust transport toward the western Mediterranean basin: Atmospheric controls on dust source activation and transport pathways during June–July 2013" *by* Kerstin Schepanski et al.

Anonymous Referee #2

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General remarks:

The present manuscript search to aim for an assessment on atmospheric circulation patterns that determine dust source activation and dust transport toward the western Mediterranean basin with regard to the ChArMEx/ADRIMED special observation period in June and July 2013. EOF analysis is used to identify different modes of variance of dust simulations using the atmosphere-dust model COSMO-MUSCAT.

While the results of the study are interesting to be published, their presentation and discussion are not yet sufficient to be published at Atmospheric Chemistry and Physics

in the current form. The present manuscript is focusing on the meteorological synoptic patterns that determine the dust transport towards the western Mediterranean basin by means a regional dust model, the COSMO-MUSCAT. The main problem is that the authors do not clearly provide evidence of the performance of the meteorological-dust model for the study period to provide support for the conclusions. ChArMEx project proposes a multi-scale model-observation integrated strategy with satellite and field observations. During the Charmex short observation periods (SOP) detailed process studies are performed during intensive campaigns (for summer 2012 and 2013); studies include continental plume transport and aging and chemical and optical closures in the column. In this sense, I would suggest a comparison with satellite aerosol products observations (as MODIS or SEVIRI/AERUS) or ground-based lidar stations (such as EARLINET) in addition to reanalysis (such as MACC reanalysis and ERA-Interim) to demonstrate the ability of the COSMO-MUSCAT model to reproduce the dust transport during summer 2013 over the Mediterranean.

Finally, I would suggest to include in the discussion of the results some recent references as the following:

- Cuevas, E., Gómez-Peláez, Á. J., Rodríguez, S., Terradellas, E., Basart, S., García, R. D., García, O. E., and Alonso-Pérez, S.: Pivotal role of the North African Dipole Intensity (NAFDI) on alternate Saharan dust export over the North Atlantic and the Mediterranean, and relationship with the Saharan Heat Low and mid-latitude Rossby waves, Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-287, 2016. In this manuscript it is revised the index that quantifies the North African Dipole Intensity (NAFDI), and explain its relationship with the Saharan Heat Low (SHL) and mid-latitude Rossby waves. If you check the results of this work, you will see similar results to your negative phase associated of the dust transport and meteorological patterns associated with the negative NAFDI phase.

- Menut, L., Rea, G., Mailler, S., Khvorostyanov, D., and Turquety, S.: Aerosol forecast over the Mediterranean area during July 2013 (ADRIMED/CHARMEX), Atmos.

Chem. Phys., 15, 7897-7911, doi:10.5194/acp-15-7897-2015, 2015. This work is also covering the same study period using the CHIMERE model and it would desirable to compare your results with those included in this analysis.

Minor errors:

Page 2 Line 28. You could include the following reference: Gkikas, A., Basart, S., Hatzianastassiou, N., Marinou, E., Amiridis, V., Kazadzis, S., Pey, J., Querol, X., Jorba, O., Gassó, S., and Baldasano, J. M.: Mediterranean intense desert dust outbreaks and their vertical structure based on remote sensing data, Atmos. Chem. Phys., 16, 8609-8642, doi:10.5194/acp-16-8609-2016, 2016.

Page 2 Line 33. If you check Ginoux et al. (2012) you will see that there are some desert dust anthropogenic sources that affects the Mediterranean.

- Ginoux, P., Prospero, J. M., Gill, T. E., Hsu, N. C., & Zhao, M. (2012). GlobalâĂŘscale attribution of anthropogenic and natural dust sources and their emission rates based on MODIS Deep Blue aerosol products. Reviews of Geophysics, 50(3).

Page 3 Line 14. You could add Gkikas et al. (2016).

Page 3 Line 26. Could you give any detail about the radiative module implemented in the model?

Page 4 Line 32. Does the model include any soil moisture or drag partition correction in the calculation of the threshold friction velocity?

Page 5 Line 26. You could add Gkikas et al. (2016).

Page 6 Line 8. Could you include any other information about the model configuration used in the present study? As the meteorological initial and boundary conditions, and the dust initial conditions (does the model include data assimilation?)

Page 6 Line 17. For the coarse-mode AOD comparison with AERONET, are you are taking the coarse fraction of the simulated dust fields (i.e. r > 1microm)?

Page 7 Line 16. You could add the work of Rodríguez, S., Querol, X., Alastuey, A., Kallos, G., and Kakaliagou, O.: Saharan dust contributions to PM10 and TSP levels in Southern and Eastern Spain, Atmos. Environ., 35, 29 2433–2447, 2001.

Page 8 Line 2. You could add the work of Basart, S., Pérez, C., Cuevas, E., Baldasano, J. M., and Gobbi, G. P.: Aerosol characterization in Northern Africa, Northeastern Atlantic, Mediterranean Basin and Middle East from direct-sun AERONET observations, Atmos. Chem. Phys., 9, 8265-8282, doi:10.5194/acp-9-8265-2009, 2009. Page 8 Line 10. For the Eastern Mediterranean region, you should consider the Middle East desert dust sources particularly in spring.

Page 8 Line 16. Could you quantify “significantly stronger”?

Page 9 Line 13. You should indicated that they are the dust sources predicted by the model.

Section 5.1. In addition to AERONET comparison, you should include the spatial comparison of your model results using other aerosol observational datasets as MODIS, SEVIRI/AERUS and EARLINET.

Figure 1. Include the locations of Sirtra and Biscaia Gulf.

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