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Interactive comment on "Dust–air pollution dynamics over the Eastern Mediterranean" *by* M. Abdelkader et al.

Anonymous Referee #1

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General

The paper deals with a very important and modern research topic: mineral dust transport, mixing of dust with pollution, chemical aging of dust. An atmospheric chemistry-climate model is applied to the region around Cyprus in the eastern Mediterranean. Two case studies of pollution-dust transport are analyzed to discuss the potential of the model. Extended comparisons with observations are presented and discussed. This is a strong point of the paper.

But, I believe, we need a comparison with the lidar at Cyprus. Therefore, I recommend: major revisions.

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Discussion Paper

Because I am familiar with EARLINET and AERONET techniques and observations, my questions deal with the respective comparisons.

Section 3.2.1, AOD: Since the EMAC model distinguishes dust particles (mainly coarse mode) and anthropogenic particles (mainly fine mode), why not showing the AERONET comparisons in more detail? AERONET provides also coarse-mode and fine-mode AOD! Because the focus later on is on CUT-TEPAK comparisons, one could do these specific comparisons at least for the Cyprus AERONET station.

I know that regional dust transport models have their difficulties with correct dust uptake (emissions) by the atmosphere, and I would like to know what the result is here (EMAC), when using a global model with even coarser resolution than these regional models have.

Section 3.3.1, Vertical profiling: Lidar provides the potential to distinguish dust and fine-mode particles, too. There is an EARLINET polarization lidar at Limassol, and I found in AMT a paper (Mamouri et al., 2014) dealing with the same time period as shown here (27-29 September 2011). Why do you not include these observations in this paper in the frame of a thorough comparison?

I have long experience with lidar/model comparisons in the case of dust and know that these comparisons usually show large discrepancies between lidar and modeled dust profiles. I assume (speculate) that this is similar here, and I further speculate that this is the reason for ignoring the lidar observations. Nevertheless, progress in science arises from discrepancies! So, please show these comparisons, at least for the published strong dust outbreak (28-29 September).

Let me start with Figure 6: The satellite images indicate a lot of dust over Cyprus on 28 September as well as on 29 September.

Figure 7: Why did you calculate trajectories for Limassol (22 Sep) and then for the northeastern peak of Cyprus (28 Sep, evening)? Why not again Limassol? This is

strange and seems to be arbitrarily selected. In the evening of 28 Sep there was probably dust everywhere over Cyprus according to the images in Figure 6. So, please show the trajectories for Limassol, only!

Figures 8, 9 show very nice model results covering the two outbreak situations. Height-longitude plots of dust distribution are shown. You emphasize the CUT-TEPAK station, so these dust cross sections are for 34.5 North? Right? Please state that clearly! What does 'zonal dust' then mean in this context? A dust value at 700 hPa, for 30E and 34.5N describes just one value for the given location, not for a zonal belt?

Now, a comparison between the Limassol lidar versus EMAC dust profile (dust extinction, overall aerosol extinction profiles) is required. Maybe the best time for comparison is the morning of 29 September (according to the images in Figure 6).

I realize from Figure 9 that there are strong horizontal dust inhomogeneities (in the model results), especially close to Limassol, so the lidar comparison may reflect that by strong deviations between observation and modelling. This must be discussed. But at least the geometrical structures (base and top heights of the dust layer) should match, I speculate.

Finally, Figure 10: I appreciate very much that CALIPSO data are included in the comparison. This is not just an easy task! CALIPSO provides backscatter coefficients. How did you get the extinction values? What lidar ratios were applied? Probably 40sr for pure dust and 60sr for polluted dust, and 20sr for marine!

And what I know from the Kanitz paper (AMT 2014?) the jumps (in color) in the extinction values are artefacts and due to the jumps in the extinction values when you go from laser foot prints over the Mediterranean Sea (lidar ratio 20) to land surfaces (lidar ratio of 40/60) and back to sea surfaces (20) again. These strong aretfacts should be mentioned.

But all in all, the comparisons are convincing. . .., but should include discussion of com-

parisons with the ground-based lidar observations.

Figure 10: I cannot see (or distinguish) brown and black isolines. . . ?

In summary, the work is a valuable addition to the literature, especially because of the extended comparisons with observations. Only the further comparison with ground-based lidar at Limssol is left as an open issue.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 7493, 2015.