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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Assimilation of lidar signals: application to aerosol forecasting in the Mediterranean Basin" *by* Y. Wang et al.

Anonymous Referee #1

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General

The paper presents the main results of a study dealing with lidar data assimilation into an atmospheric transport model to forecast aerosol conditions. However, only the most simple or basic lidar data are used (calibrated range-corrected signals = attenuated backscatter). It is not clear to me why and how this simple and partly misleading lidar information leads to forecast improvements. More explanations are required.

Details

Page 13066, lines 20-22: The model is able to interpret attenuated backscatter, i.e., this complex mixture of backscattering and extinction? Otherwise, if the model interprets attenuated backscatter as backscatter then the use of the lidar data can lead to very

bad results, i.e., when ignoring the extinction effect on the range-corrected lidar signals. We need more details how the lidar data are used! Reference to Wang et al. (2013) is not sufficient.

Page 13067, line 19: The modelling domain covers western and part of eastern Europe, only!! This is strange (sorry for this emotion, but I was a bit upset)! How can you provide high-quality aerosol forecasting in the Mediterranean Basin if the Mediterranean is not totally covered by the model? The most interesting and highly polluted area (and thus source of aerosols even in the central and western Mediterranean) is the Eastern Mediteranean! Why is this part excluded? Please give detailed information.

Observation section:

Page 13069, line 20 to page 13070, line 25: Even as a modeller, please do not ignore the reality! So, please provide an improved Table 1 and Figure 1! The list of participating stations in Table 1 is incomplete. CUT, Limassol, Cyprus measured this 9-12 July episode in the framework of the project as well. I asked them by e-mail! Even if not included in this paper and model study, the reality (full list of network stations) should be reflected in Table 1. CUT, by the way, is also one of the stations with 1640nm photometer channel, thus one of the modern AERONET stations. Please provide a better Figure 1, showing the full Mediterranean and then insert, may be, a box with the modelling domain. To be clear here, I will not accept this paper, if Table 1 and Figure 1 are not improved according to my suggestions!

Again, does the model explicitely use the backscatter AND extinction information, or is the attenuated backscatter just interpreted as backscatter? Please state that clearly!

Page 13070, line 23: The lidar color plots are rather poor, contain almost no information. Almost nothing is seen in these figures, some plumes, mostly decreasing signals, no PBL tops. Why are the lidar data so poor? Are the lidars so bad? I am really surprized that such low quality observations can lead to improvements of aerosol fortecasts.

Page 13071, line 12: Why do you use 355 nm AOD? The AOD at 340 nm (used to get the 355 nm AOD) is not just free of uncertainties, because strongly controlled by Rayleigh extinction (and correction of this effect). Why not using 500 or 532 nm AOD? Please explain! May be the reason is, ... as it is often found in measurement-model inercomparisons... , the modelled AOD matches much better the measurements at short wavelengths than at 500, 532, or 550 nm AOD? Please explain, why you use this a bit complicated wavelength (even the Angstroem exponent is uncertain at these short wavelengths).

Again, Cyprus (CUT, AERONET/EARLINET station) belongs to AERONET too. Again, Figure 1 is really bad, even Crete (in the center of the Mediterranean) is almost not on the map. As mentioned, please improve Figure 1 significantly.

Page 13072, line 3: Now you switch to 550 nm AOD, and you show the full Mediterranean! This is great!

Page 13073: How can lidar data in terms of attenuated backscatter with all the problems introduced by overlap problems in the near field (in the lowest 500-1500 m above ground) improve ground-based PM2.5 and PM10 forecasts? Please explain. I have no idea, how this is possible.

Page 13076: line 5-28: What is now the most important lidar information when using attenuated backscatter? Please state! Is it the observed aerosol layering (geometrical properties) or the optical properties of aerosols which may be used to estimate volume and mass concentrations of the particles? Please provide more details on this! And again, how did you overcome the large uncertainties in the lidar data in the lowest tropospheric heights?

Pages 13077 and 13078: There are no explanations why the forecasts improve, all the results do not help. The reader will almost learn nothing without further information.

Figure 7: What is the truth? (what is the true curve or the curve most close to the

reality)? May be I missed the point?

Figures 10 and 11: Again, what are the true curve?

Figures 12 and 13: I do not see any improvement when using these attenuated backscatter data from lidar!

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 13059, 2014.