

## ***Interactive comment on “February 2017 extreme Saharan dust outbreak in the Iberian Peninsula: from lidar-derived optical properties to evaluation of forecast models” by Alfonso J. Fernández et al.***

### **Anonymous Referee #1**

Received and published: 25 June 2018

The paper describes a dust episode with high value of optical depths over Spain and Portugal. It mainly focuses on optical measurements obtained from AERONET photometers and EARLINET lidars. Additionally, these measurements are used to assess dust forecasts made with two models. The paper is well written and organized. It is however just another paper reporting on optical properties of a dust episode that occurred over the Iberian Peninsula. It is claimed that this episode is an extreme event. But nothing sustains this claim. Many other aspects, as those described below, should be addressed before the paper may be acceptable for publication in ACP.

### **Major comments**

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**Extreme event.** There is no definition of extreme events in the paper. The extreme nature of the event should be addressed explicitly. How this episode is extreme? For example, what is the frequency of such events over the Iberian Peninsula? Note also that AOD values of 2 and larger are not uncommon over Africa. See for example the papers on the Fennec field campaign.

**Introduction.** The introduction is lengthy. It details many general aspects on dust and its impacts (cloud condensation nuclei (no ice nuclei?), radiative forcing, aircraft operation, health issues, ...) that are not addressed in the paper. I suggest to either shorten these parts or to address these issues for the dust episode under study. The latter option would make the paper much more interesting than it is actually.

**Origin of dust.** The paper does not discuss the origin of dust. This must be done with the objective to better document the episode, by using backtrajectories for example. This would also help to discuss the successes or failures of the forecasts.

**Sharav cyclone.** The low over Morocco looks like a Sharav cyclone. There is quite a number of papers discussing such cyclones and their role in dust emission. References to this literature seems more than welcome for documenting this particular February 2017 dust event in a broader context.

**Performance of dust models.** The paper shows an assessment of the dust forecasts against lidar measurements, but it is very limited in the possible causes of the model deficiencies. A more thorough discussion on such causes must be provided. Furthermore, the quality of the forecasts should not be limited to the assessment of the vertical profile of dust extinction. It would of a larger interest to discuss the model performance in terms of radiative fluxes (because the importance of aerosol radiative forcing as stated in the introduction), sensitive weather variables (temperature and humidity at 2 m, wind at 10 m) and horizontal winds (because it is a potential cause of model discrepancies as written line 742).

**Calibration issues.** In Fig. 5, the RCS signal presents a large change at 1200 UTC

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21 February. So does the signal at 8-km altitude shown on 23 February in Fig. 8. These changes suggest a strong issue on the lidar calibration. Please comment these changes and the data reliability.

### Minor comments

Figure 1 shows the mean sea level pressure, with many small-scale features due to orography. In order to describe the synoptic circulation, I suggest to plot the geopotential at 500 hPa, or at 850 hPa.

Page 14, lines 299 and 300. Figures 2b and 2c do not show easterly and southeasterly winds.

Page 18, line 356. The acronym RCS must be defined here, not afterwards (line 511)

Page 19, line 365 typo on "especial"

Page 27, line 503. Remove "extraordinary" unless you explain the "extraordinary" character of the event

Figures 5, 8, 10. Please add the days on the time label and use a larger font for all the labels.

Figures 14 and 5 and Table 5. Please specify in the caption for which variable the correlation coefficient and the fractional bias are computed. This remark applies to the text as well.

Page 38, line "649". Please avoid the adjective "nervousness" for qualifying a meteorological model

Page 39, lines 682-686. Remove the discussion on the troposphere-stratosphere exchanges as the dust plume is not concerned by this process (or "very unlikely" as you wrote).

Page 43, line 779. Remove "extraordinary" unless you explain the "extraordinary" char-

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acter of the event

Page 44, line 800. Remove "perfectly"

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