

**Reply to the RC2's comments on "Development and evolution of an anomalous Asian dust event across Europe in March 2020" by Tositti L. et al.**

Manuscript Ref: acp-2021-429

We thank the reviewer for his/her useful comments. Below are the reviewers' comments in italic followed by our replies in blue text.

**RC2**

*This study presents an interesting dust event that originated from Central Asia and was evident in parts of Southern Europe, with a specific focus in Italy. The event is discussed mainly by means of particle number densities and particle size distributions, derived from optical particle counters located at three different sites, namely Bologna, Trieste and Mt. Cimone. While the paper is overall well written, some parts of it need revisions and the syntax could be improved.*

We thank the reviewer for his/her overall appreciation of our work and for the useful comments provided improving its quality. In the following we reply specifically to each of the comments raised.

*Specific comments:*

- *Section 2.1: Since the instrumentation is not uniform for all three sampling sites, I would recommend summing up all the relevant information in a table.*

We added a Table (Table 1) in Section 2.1 with the relevant information for the three OPC

- *Section 2.2 would fit better in the end of Section 2.*

We moved old section 2.2 after the OPC-section (now it is section 2.3). Our original idea was to put the descriptions of the methods and of the results in the same order of the description of the results, but we agree with the reviewer that the "synoptic conditions" paragraph does not fit between the "sampling sites" and the "OPC" sections.

- *The authors should explain their choice of using the total, fine and coarse mode AOD at the 500 nm wavelength.*

We have inserted a reference to the work of O'Neill et al. (2003) explaining in detail the spectral deconvolution algorithm applied to retrieve total, fine and coarse mode AOD at the standard reference wavelength of 500 nm. Now the sentence in Section 2.5 reads: "Total mode, fine mode, and coarse mode AOD at 500 nm (standard reference wavelength) were computed using a best-fit second-order polynomial according to the spectral deconvolution algorithm (SDA) by O'Neill et al. (2003). "

- *Section 3.1 needs to be rewritten given more focus to the synoptic conditions above Central Asia. In addition, Fig. 1 needs to be revised and include the dust source region.*

We deeply modified Section 3.1 and Figure 1 with more emphasis on the synoptic conditions above central Asia. We also enlarged the number and type of maps reported the old Figure 1, and we included now a second Figure (Figure 2) to make the results clearer.

- *Both sections 3.3.2 and 3.3.3 would benefit from a more in depth analysis.*

We added a more in-depth description of the chemical data (Section 3.3.3). However, both LIDAR and chemical data were not recorded by us and are not the main focus of the paper, which are the synoptic and OPC analyses. These sections, indeed, are reported as “ancillary analyses” and are used only to give a more general description of the event. Therefore we decided not to further deepen this part of the discussion.

- *A.2(a): The backtrajectories ending at 1.7 km and 2.7 km altitude originate from the Sahara region. In line 330 the authors state that the air mass “it did not give origin to visible peaks in the OPC time-series”. Please elaborate more on that statement. Perhaps a peak would be visible for other fractions.*

Figure A4 (A3 in the previous version) shows all the fractions registered by the OPCs, and in the case of Mt. Cimone no peak in all fractions was observed on March 27, the day for which those back-trajectories were calculated. We added a reference to Fig. A4 in that paragraph and a more deepen explanation has been added in Section 3.2.1: it is likely that no peak was observed in March 27 because a strong north-easterly wind flowed over Mt. Cimone, making impossible for the OPC to register a particle increase.

*Minor comments:*

- *Please make sure that all acronyms have been defined properly in the manuscript (e.g., EUSAAR in line 129).*

All acronyms are now defined.

- *Lines 345-346: A reference for the statement would be useful.*

A reference for the statement was inserted.

- *Figures 5 and 9 are difficult to read.*

The figures quality have been improved.