Response to Dipesh Rupakheti Referee comments for the manuscript "Exceptional high AOD over Svalbard in Summer 2019: A multi-instrumental approach" by Sara Herrero-Anta et al. in AMT

AC: First of all, we would like to thank the time and effort of the referee for their review of the manuscript. Reviewer comments (RC) are in bold font and author comments (AC) in italic font.

RC: This manuscript attracted my attention as I have investigated the columnar aerosol properties utilizing AERONET datasets over another important region (South and Central Asia). I have provided some suggestions to consider while revising this work:

RC: L19: 'than the globe' reads awkward; revise.

AC: This phrase is literally the title of the known article 'The Arctic has warmed nearly four times faster than the globe since 1979' by Rantanen et al. (2022).

We have changed it to 'nearly four times faster than the rest of the globe' in the new version of the manuscript.

RC: L23: reword 'present'.

AC: This has been changed to 'show' in the new version of the manuscript.

RC: Quantitative information based on relevant earlier studies (already cited) must be included in the Introduction section.

AC: Thank you for the remark. Due to the variability of the methodology of studies conducted in the Arctic where, well designed actions have rarely been conducted, we decided it was better to give a qualitative information in the introduction. However we do give quantitative and relevant information for our study about the results obtained in the MOSAIC campaign and Pulimeno et al. (2024) studies. Relevant information is also given during the analysis of FLEXPART results, but again, due to the variability of the methods we preferred to give the qualitative information.

RC: Figure 1: What do different colors indicate? Please elaborate on the abbreviations in the figure caption.

AC: This figure caption in the new version of the manuscript indicates the following:

"Topographic map of the vicinity of Ny-Alesund and its location on Svalbard. The main stations used for the study have been located in the map: Zeppelin Observatory (ZEP), Gruvebadet Atmospheric Laboratory (GAL), AWIPEV and Sverdrup. The colors indicate

the altitude; blue indicates water surface. Map created using the dataset by Moholdt et al. (2019).”

RC: L91: State the relationship between AE value and particle size.

AC: The relationship between AE and particle size distribution is not straightforward and nor is the focus of this study. One may refer to specific literature to consult this relationship. We have included a citation for that in the new version of the manuscript (Kokhanovsky, 2008):

“AE is related to the aerosol particle size (Kokhanovsky, 2008). A mean value of AE equal to 1.3 is observed for the average continental aerosol (Ångström, 1929), while values close to 0 indicate coarse particles.”

RC: L111: Which data level was used for AOD and AE retrieved from the AERONET website? This is very important regarding QA/QC.

AC: We use the same data level for AOD and AE as for inversion products. This might not be clear in the old version of the manuscript. For the new version we have changed it:

“All AERONET data used correspond to level 1.5 products (version 3).”

RC: Figure 2 caption: shaded box color is not red (at least to me).

AC: Thank you for the remark. This has been corrected in the new version of the manuscript:

“The time periods highlighted in dark red, pink and red shaded areas correspond to the three events identified as aerosol events in the column, respectively: 6-10 July (C1), 25-28 July (C2) and 6-17 August (C3).”

RC: L247: rephrase ‘collects’.

AC: This has been exchanged by ‘summarizes’.

RC: L259: cite reference for longer transport time in August.

AC: This is only a hypothesis for the reason of the different size distributions in July and August, not a general behaviour for the times of transport to the Arctic. In order to make this more clear we have slightly modified the sentence: ‘might had been longer in August compared to July’.

RC: Figure 3: My suggestion is to plot event-average values here and move the detail figure to supplementary, as the present figure looks crowded with hard-to-decipher information.

AC: We understand it might be a bit crowded. However, we believe it is more useful to look at the individual retrievals, since we might lose information when conducting the average. We already give the averaged values of all the available aerosol properties from the sun-photometer in Table 2.

RC: L297: Those lower values refer to instantaneous values?

AC: Yes, this has updated in the new version: For event CS1 the mean SSA_{530} was 0.95 ±0.01 with lowest instantaneous values equal to 0.92.

RC: L303: With respect to GAL?

AC: This was changed to 'Regarding GAL observations' in the new version of the manuscript.

RC: Figure 12: In the x-axis, correct the spelling for August.

AC: Thank you for the remark, this has been corrected in the new version.

RC: L458: As a result…. This sentence could be removed.

AC: Thank you for the remark, this sentence has been removed in the new version of the manuscript.

RC: L462: I don't think such detailed information on the aerosol event occurrence date is required, at least here.

AC: Thank you for the remark. As we are referring to the different aerosol events, we believe it is helpful to state the dates, instead of only saying CS1, C2…

RC: Conclusion section: The current version reads like a simple summary of each subsection, which needs revision.

AC: The conclusions section has been updated in the new version of the manuscript according to the comments received from the different reviewers.