

Responses to “Interactive comment on “Polarization properties of aerosol particles over western Japan: classification, seasonal variation, and implications for air quality” by Anonymous Referee #2

The authors greatly appreciate anonymous reviewer for evaluating our manuscript and providing many insight comments on the manuscript. We revised the manuscript according to each comments/suggestions. In order to better understanding the variability of polarization properties of aerosol particles at the urban site in the western Japan and its applications for air quality, the study period was extended from Jan. 2014 to Dec 2015. and the comparison between POPC observation and ground-based lidar results was added in the analysis (as shown in Figure 3 in the manuscript). The specific response to the reviewer’s comments are as followings:

Technical - Important information of the observation duration is not described obviously in the Measurements section. At line 13 in page 3, limited information of "beginning in October 2013" appears.

Reply: In the revised manuscript, the studying period covers two years, and POPC data are from January 1, 2014 – December 31, 2015.

- Line 31 in page 3: "at Kyushu University (Longitude: . . ." -> "at Kyushu University, Fukuoka (Longitude: . . .")?

Reply: To avoid confusion, the site information at Line 12, Page3 will be removed. The Longitude and Latitude only appear in the “measurements” section Line 31, Page 3.

- Line 19 in page 4: "at Fukuoka University (Longitude: . . ." -> "at Fukuoka University (Longitude: . . .")?

Reply: Kobayashi et al.,’s study was performed at Fukuoka University, about 10 kilometer northwest to the observation site at Kyushu university. To avoid confusion, the geographical information will be deleted.

- Line 26 in page 4: ". . . method, after the addition . . ." -> ". . . method, respectively, the latter being with the addition . . .")?

Reply: We will correct the expression according to reviewer’s suggestion.

- Lines 22 in page 5: "spring (MAM)" would be better "spring (MAM: May, April and May) "? The same for summer, fall and winter in the manuscript for the first appearance.

Reply: The exact months were added for abbreviation of MAM, JJA, SON and DJF.

- Lines 7-8 in page 6: The argument sounds better when reference literature is added.

Reply: The relevant references are added.

- Lines 32-34 in page 6: "a DR-Dp-volume plot" does not exactly match with labels of Figure 5. The vertical label is "Mode DR", however, the above sentence means quite different. In my understanding the label should be "DR" or "Depolarization ratio (DR)". Is this correct? If not, all "DR" should be expressed as "MDR" in the text. This should be applied to the term appearing at the first line in page 7 and so on.

Reply: I agreed with the reviewer's opinion, and all the labels in the context and figures will be changed to DR. In Line 32, Page 6, the sentences will be changed to "To better identify the polarization characteristics of different aerosol types, the variations of depolarization ratio as a function of particles size were plotted (Figure 6), and the color represents the volume concentration during specific periods. Hereafter, such plot was referred to as DR-Dp-Volume plot.

- Line 34 in page 6: "areas" should be in line with the term in Figures ("regions")? Please clarify "regions" or "the Regions" afterwards.

Reply: The word "Area" is changed to "Sub-region" for conformity in the context.

- Line 2 in page 8: Please add literature.

Reply: The missing literatures are added.

- Line 5 in page 8: "the winter" -> "winter"? This is depending on if "the winter" means "2014 winter" or not.

Reply: In the revised manuscript, two years data (2014 and 2015) were analyzed. We found that in the winter of 2014, mixing type aerosols featured about 20%-60% substandard days in Fukuoka. However, in the winter of 2015, pollution type was dominant (~60%) and the contribution of mixing type decreased slightly, depending on winter monsoon intensity and the dust-storm activities in the dust source regions. We added more discussions in the section 4.2.

- Line 12 in page 8: Please insert "geographical" in "different origins".

Reply: The word "geographical" will added.

- Line 13 in page 8: Please add "(Figure 7)" after ". . . trajectory analysis".

Reply: (Figure 8) will be added after "trajectory analysis"

- Line 22 in page 8: "fine mode" -> "coarse mode"??

Reply: To avoid confusion, the sentence "This suggested that spherical particles (e.g., sea salt) in the fine mode comprised most of the aerosol." was changed to "The small polarization degree of aerosol particles in the fine mode indicated that the aerosol particles tend to be spherical."

- Line 24 in page 8: "North China" -> "northern China"?

Reply: “North China” is changed to “northern China”

- Line 32 in page 8: "Region I" -> "the Region I"? There are many similar ones hereafter.

Reply: The definite article “the” is added in the front of “Region” in the context.

- Line 34 in page 10: "LRT" should be spelled out.

Reply: Abbreviation “LRT” is changed to “long-range transport”

- Caption of Figure 1: "Spring (MAM)" -> "spring (MAM)" or "spring (March, April and May)".

Reply: The abbreviations are spelled out in the Figures.

- All labels and notations in Figure 2 should start from capital (uppercase letter).

Reply: We corrected the labels and notations in Figure2

- Legend of Figure 3: ". . . mixed type dominated cases" -> ". . . mixed type dominated cases, respectively". Also, the observation duration should be written obviously in figure caption.

Reply: The word “respectively” and observation duration is added in the caption.

- The above mentioned points should be applied to Figure 4.

Reply: The caption is corrected as suggested.

- Caption and labels of Figure 5: Please check "MDR" or "DR". "size" -> "size (Dp)"?

Reply: To avoid confusion, the abbreviation “DR” and “Dp” is used uniformly in the context and Figures.

- Figure 7: Number of the trajectories analyzed should be described obviously.

Reply: The Number of trajectories is added in the context.

- Caption of Figure 7: "Air mass originating" -> "Air mass arrived at Fukuoka, Japan, which originating"?

Reply: The sentences will be corrected as reviewer suggested.

- Caption of Figure 9: "NH4+" "4" should be lowercase letter. - Figures 6, 7 and 8 are in low resolution.

Reply: The mis-spelling is corrected.