Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2017-165-AC2, 2017

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurement of scattering and absorption properties of dust aerosol in a Gobi farmland region of northwest China – a potential anthropogenic influence" *by* Jianrong Bi et al.

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Received and published: 19 May 2017

Response to Referee-2:

We appreciate the Editor and Referee-2's valuable and constructive comments for this manuscript, which greatly assist in improving the quality of the original manuscript! We have carefully checked and revised the whole manuscript according to Referee-2's comments. Please find a point-by-point reply to the issues as follows. And we have also uploaded the file of 'acp-2017-165-supplement.pdf'.

General comments:

This manuscript presents the measurement of scattering and absorption properties of dust aerosol from a comprehensive field campaign in a Gobi farmland region of northwest China during spring 2012. Overall, the manuscript could make a good contribution to the scientific research by providing useful scientific knowledge on the interaction among dust aerosol, atmospheric chemistry, and climate change in desert source region. However, I believe that the manuscript needs the following minor revisions before it is accepted for publication by ACP.

Response: Thank you very much for the Referee's insightful suggestions and constructive comments on this manuscript. We have carefully checked and revised the whole manuscript according to Referee2's comments. Please find a point-by-point reply to the issues as follows.

Minor comments:

1. Lines 22–24: Please present the more results and discussions on the statement in the text about the statement in the abstract that "The anthropogenic dust produced by agricultural cultivations (e.g., land planning, plowing, and disking) exerted a significant superimposed effect on high dust concentrations in Dunhuang farmland prior to the growing season (i.e., from 1 April to May)."

Response: We have presented visual photos of a variety of agricultural cultivations in Dunhuang farmland (nearby SACOL's Mobile Facility) prior to the growing season (i.e. from 1 April to 10 May, 2012), as shown in Figure S1. Diverse agricultural operations (e.g., land planning, plowing, disking and laying plastic mulch) were carried out in loose and bare Dunhuang farmland from 1 April to 10 May, 2012, which produced massive soil dust into the atmosphere, especially under strong surface winds (see Figure S1a-c). Therefore, the mass concentrations of particulate matter (PM10) in the source and adjacent downwind regions (including SACOL's Mobile Facility) were significantly elevated by these human activities. In contrast, the crops in Dunhuang farmland gradually become green since 10 May, 2012, indicating the coming of growth season (Figure

S1f).

We also added more discussions about this in the context (Page 10, Lines 272–278). Please check our revised manuscript in detailed.

2. Lines 25–27: It is a misleading conclusion that “Strong south valley wind and vertical mixing in daytime scavenged the pollution and weak northeast mountain wind and stable inversion layer at night favorably accumulated the air pollutants near the surface.” Please follow the diurnal changes of winds and PM10 in Figs. 4 and 6.

Response: Thank you very much for your suggestions! The conclusion here corresponds to the diurnal changes of winds and PM10 in Figs. 4 and 6, which can be interpreted by classical mountain-valley wind circulation. Please refer to more detailed explanations in Pages 12–13, Lines 336–359.

3. It could be unnecessary to present the wind fields at 500 hPa and 850 hPa levels from the MERRA reanalysis products in Fig. 7, because the dust aerosols in a Gobi farmland region of northwest China are mostly the local emissions and a short-distance transport to the measurement site within the boundary layer.

Response: Thank you very much for your good comments! We mainly intend to elucidate two points using Fig. 7. Firstly, the selected three heavy dust events (i.e. 30 April, 1 May, and 10 June) were triggered by different synoptic cyclones. East Asian region was governed by the powerful and stable westerlies at 500 hPa height on 30 April and 1 May 2012, whereas strong Mongolian cyclones at 500 hPa upper atmosphere hovered about the southern Mongolia on 10 June 2012. Secondly, the ground-based measured strong northeast and east winds (> 10 ms-1) under three dust events were completely consistent with the wind fields at 850 hPa levels from the MERRA reanalysis products, which indicated the studied dust events were regional scales instead of local scales.

4. Line 532: “mesoscale cyclones” should be “synoptic cyclones”.

Response: We have changed “mesoscale cyclones” to “synoptic cyclones” in Line 532.

5. Lines 570–577: It is an interesting result that Figure 10d displays that “the DLW values under dusty cases were always greater than that in clear-sky cases, with the total average differences of +40 +60 Wm-2”. However, the interpretation is unconvinced. From Fig. 10d, it could be seen that the warming dust layer could enhance that surface DLW with a large (+40 +60 Wm-2: not a few percentages!) contribution to the increased DLW. It is unreasonable that the potential greenhouse gases in the atmosphere could substantially affect the DLW differences between dusty and clear-sky cases (Fig. 10d). Also, please present the measured cloud cover or RH on April 9 to support the statement that “it is partly attributable to the higher RH values on 9 June than that in other days.”

Response: Thank you very much for your insightful and valuable comments! Indeed, the warming dust layer could enhance that surface DLW with a large contribution to the increased DLW (+40 +60 Wm-2: not a few percentages!). Hence, we have changed “contribute a few percentages to the increased DLW” to “contribute a large percentages to the increased DLW” in Line 576.

“the potential greenhouse gases in the atmosphere could substantially affect the DLW variations.”: “the greenhouse gases” in the manuscript represent the presence of water vapor or clouds in the atmosphere, which causes confusion. Therefore, we have changed “This is because the potential greenhouse gases in the atmosphere could substantially affect the DLW variations.” to “This is because the potential water vapor in the atmosphere could substantially affect the DLW variations.” in Lines 573-575. Meanwhile, we have presented the diurnal variations of 10-second average relative humidity (RH,

6. Please improve the quality of all the Figs., with clarifying the figure captions, such as horizontal wind vector in Figs. 4, near surface wind in Figs. 6 and 8, and the same color curves for all the Figs. 10a, 10b, 10c and 10d.

Response: Thank you very much for your valuable comments for improving the quality

of this manuscript! We have improved the quality of all the Figs. in the context and corrected the same color curves for all the Figs. 10a, 10b, 10c, and 10d. Please refer to the revised manuscript in detail.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/acp-2017-165/acp-2017-165-AC2-supplement.pdf

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