Dear Editor and reviewers,

Thanks for the valuable comments, which help to improve significantly the quality of the paper. In this revision, we addressed the majority of the reviewer comments especially in terms of the study objective, figure clarity and sentence grammars rephrased by a colleague living in an English-speaking country. The detailed replies are listed below point by point in red.

Best regards,

Lu She on behalf of all authors

Interactive comment on "Investigation of severe dust storms over the Pan-Eurasian area using multi-satellite observations and ground-based measurements" by Lu She et al.

Anonymous Referee #3

Received and published: 5 July 2018

General comments

The Study presented in this manuscript analyze in details large-scale heavy dust storm during May 2017 over Asia. Airborne dust originated from Gobi desert dispersed in several dust plumes, which propagated for several days in different directions. The authors used diverse sources of observations to generate the knowledge on origin, timing and spatial coverage of the dust storm, overcoming setbacks of one observational system with other sources of measurements, leaving no room for uncertainties in created hypothesis on this event. Scientific significance, scientific and presentation quality are good. Presented subject is of great significance because of the popularity of the topic, large impact of dust on climate system, but still not well understood and poorly represented in numerical models. Case study described here may be well used in further numerical models development and verification, since it is hard to correctly capture and describe fully any dust storm. This reviewer recommends this manuscript for publishing, after consideration of the following comments.

Specific comments

1) The title mentions in plural "dust storms", but in the manuscript is analyzed one dust storm that dispersed in several dust plumes. In the text is also mixture in mentioning dust storm as single event and dust storms as plural. To avoid confusion the authors should decide to define this event as one dust storm that has divided in several dust

plumes or to define this event as severe airborne dust transport, which consists of several dust storms with the same origin. This reviewer suggests defining described event as severe dust storm that has complex multi-plume propagation. Whatever the authors decide, title and the mentioning in the text of the manuscript should be changed accordingly. In the title should be the date of the event, to outstand that the study covers specific study case.

Response: The title has changed to be "Towards a comprehensive view of dust event from multiple satellite and ground measurements: exemplified by the East Asia May 2017 dust storm" in response to this and also to the Reviewer #1 and 2's concerns on the paper objective.

We have referred to the event as one dust storm that has divided in several dust plumes.

2) In the manuscript there is no analysis of meteorological parameters to be able to understand the atmospheric conditions that produced this severe large-scale dust storm.

It is very important, to fully understand the event, to provide information about synoptic situation. To simplify this request it is enough to add the information on surface wind velocity and direction in the source region at the time of dust emission (or surface wind field), and to provide wind fields at representative height and/of geopotential heights (for example 500mb level) in representative times for later days. This would additionally explain the atmospheric circulation that carried dust particles. Data can be used from reanalysis fields.

Response: We have added the spatial distribution of wind velocity and direction, and geopotential height fields (Fig.3). Related analysis has also been added.

3) Add information about source of input data for HYSPLIT model that produced backward trajectories.

Response: Information about the input data for HYSPLIT mode have been added the revised version in section 2.7.

4) It would be very useful to add an image that presents hypothesis about dust storm propagation in different directions (or mark with arrows in Fig. 1), which is proved using many observations. It is hard to follow in case the geography of the region is not well known.

Response: This has been improved. See Fig.1.

Technical corrections

1) line 26: change "10 mm" in "10 _m"

   Response: This typo has been corrected.

2) line 55: change "10 mm" in "10 _m"

Response: This typo has been corrected.

3) line 59: change “Many studies have been carried out to study different aspects of dust plumes from deserts using...” in “Many studies have been carried out to study different aspects of airborne dust transport from deserts using...”

   Response: This sentence has been rephrased as “Many literatures have studied desert dust from different perspectives using different satellite data, ground-based observations and model simulations (Badarinath et al., 2010; Wang et al., 2013; Teixeira et al., 2016)”.

4) line 120: change “that can used to...” in “that can be used to...”

   Response: This has been corrected.

5) line 123: change “It has been suggested that...” in “It has been evaluated that..."

   Response: This has been corrected.

6) line 136/137: change “The inversion products includes both microphysical parameters ...“ in “The inversion products include both, microphysical parameters ...”

   Response: This has been corrected.

7) line 146: change in “... during both, day-time and night-time.”

   Response: This has been corrected.

8) line 149/150: change in “...were collected to evaluate the dust-affected areas and to further analyse the transport of the dust plume.”

   Response: This has been corrected.

9) line 172: is it correct to have easterly wind in “... swept through the North China plain on 4 May 2017 due to a strong easterly wind,...”? It is not likely to have east wind, maybe west wind, which means that circulation was eastward?

   Response: This has been corrected. It should be west wind, and we have also added the information about wind direction, see Fig. 3

10) line 215: exclude “The” at the beginning of “The This result is ...”

    Response: This has been corrected.

11) line 254: In the following sentence “Fig. 8 depicts the PM10 concentration distribution...” add an information about PM data values, are they hourly average of what? how many stations are considered?

    Response: More information about PM data has been added in the revised version. The PM values are hourly average, and all the valid observations from 1350 stations located in mainland China were used. The PM values are real-time measurement, the air stations make the measurements every hour.

12) Letters in some Figures are too small, and require large zoom to be readable, especially Fig. 2, Fig. 4 and Fig. 9. If possible, use different rearrangement of plots and landscape mode.

Response: This has been corrected. The letters in figures were enlarged, and the figures have been rearranged in the revised version.