Dear Editor,

Thank you for agreeing to consider a revision of our manuscript "Particle size distribution and PM concentrations during synoptic and convective dust events in West Texas". We modified and revised the manuscript to address the reviewers' comments as well as to clarify points that they found confusing or unclear.

We would like to thank the two anonymous reviewers for their helpful comments and suggestions, and many thanks to you for your time and efforts with this revision. In line with the comments and suggestions, we revised the manuscript and made the requested additions and changes. Below are all the comments (in bold) followed by the replies. The parts that are in italic are corrections that are included in the revised version of the paper:

Sincerely,
Karin Ardon-Dryer

Anonymous Referee #1
The authors present an interesting study on the properties of dust particles during convective-driven and synoptic-driven dust storms. The study is based on in-situ measurements of mass and number concentrations of dust particles and also size distributions at high temporal resolution. It is well written with justified results and provides important evidence of dust properties inside the dust storms. Overall I recommend publication in ACP.

We would like to thank the reviewer for the suggestions, corrections, and comments.

Minor considerations are:
1. Move the Grimm results (Figure S3) from the supplement to the main text and elaborate more on the results shown in this plot. These are important measurements of coarse dust particles (>10um) directly inside the density currents that are not often available in the literature.

We would like to thank the reviewer for the suggestions, we kept the original figure as a supplement as it represents daily value comparison to show the comparison between the two instruments. But per the review suggestion we added a new figure to the revised manuscript, as part of Fig 4. The new figure compares the size distribution during the peak of the dust and right before it to during the two convective dust events to emphasis on increase of larger particles (up to 35.15 μm). The new figure and additional information on this comparison were added to the revised manuscript:

Next an examination of the size distribution of coarse particles of the two convective events, using Grimm 11-D which track particles up to 35.15 µm was performed (Fig. 4E). It should be noted that the unit was not operated during synoptic dust event). Observation of particle size distribution of particles larger than 10 µm (Fig. 4E) shows that some of the coarse particle sizes concentration increased by more than two orders of magnitude compared to the time before the dust event. In additions an increase in particle concentration was observed for both convective dust events in the larger size bin (35.15 µm).

Comparison of total number concentration for coarse particle size, as measured by Grimm 11-D, was also performed for the two convective dust events. During the June 5 dust event (based on a 10-minutes average at the peak of the dust) the total number concentration for particles 5 to 35.15 µm was 4.6 ± 2.9 cm^{-1} while for particles in the size range of 10 to 35.15 µm the total number concentration was 1.3 ± 0.9 cm^{-1}. The increase in total number concentration was more than 350 to 675 times higher than the total number concentration right before the dust reach the station for particles > 5 and > 10 µm, respectively. The total number concentration during the June 21 convective dust event (based on a 10-minutes average at the peak of the dust) was slightly lower than those measured on June 5 with 2.3 ± 0.7 cm^{-1} and 0.5 ± 0.3 cm^{-1} for particles range of 5 to 35.15 µm and 10 to 35.15 µm, respectively. The increase in total number concentration was more than 141 to 318 times higher than the total number concentration right before the dust reach the station for particles > 5 and > 10 µm, respectively.

This study provides measurements for particle size distribution and total number concentrations of particles > 5 µm during the three different dust events (of different types) and for particles > 10 µm for the two convective events showing that the concentration of these coarse particles may increase by more than two orders of magnitude during dust events. These findings are in line with recent studies that found coarse particles during dust events near the source (Ryder et al., 2019; O'Sullivan et al., 2020), and even thousands of kilometers from the sources (Weinzierl et al., 2017; van der Does et al., 2018). Moreover, recently it has been stated that the atmosphere contains four times more coarse dust particles than what is currently simulated in climate models, which ends in a substantial underestimation of the impact coarse dust particles may have on the Earth system (Adebiyi and Kok, 2020). Therefore, Mahowald et al. (2014) suggested that models should improve their ability to capture the evolution of dust size distribution which should be based on additional cross-comparison of differing observational methods. Such effort has taken place in recent years, yet many of these studies indicate that models still cannot capture some of the super coarse particles due to their deposition process which is still unclear (Drakai et al., 2022; Meng et al., 2022). In addition, some of the differences between measurements and models might be impacted by the proximity of the measurement location to the dust source (closer to the source meaning more coarse particles) as well as to the meteorological conditions that generated the dust event.

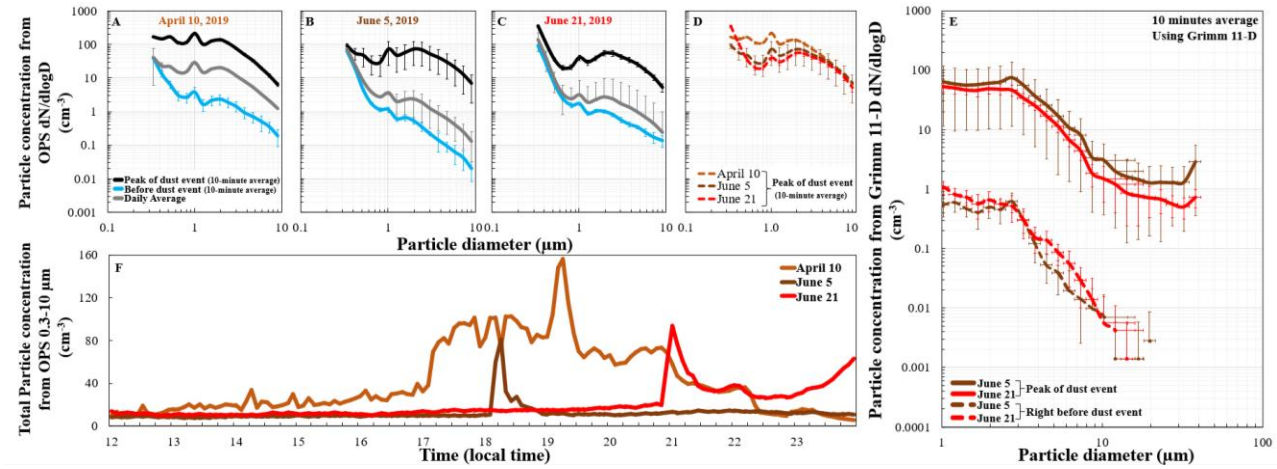

Figure 4. Changes in particle size distribution based on optical particle diameter, as measured by OPS, during the three dust events, April 10 (A), June 5 (B), and June 21 (C). The peak of the dust (10-minutes average for time with the highest concentration (black), a time before dust reached the station (10-minutes average in dark light blue), and daily average (gray). Comparison of the three size distributions at peak of the dust (10-minutes average for time with the highest concentration) in D. Comparison of 10 minutes average size distribution from June 5 (dark brown) and June 21 (red) as measured, with Grimm 11-D, at the peak of the dust event (straight line) and right before the dust event (in dashed line) in E. The particle's total number concentration (0.3 to 10 µm) from OPS for each of the dust events (F) for April 10 (light brown), June 5 (dark brown), and June 21 (red).

2. Line 281, a typo, Coarse

Changes were made according to the reviewer's suggestion.

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