The authors are grateful to the referee for your interest and quick comments on our work. We noticed that the referee seemed a little confused regarding the novelty of our work. Therefore, below we will provide a quick response to these confusing questions from the referee.

It is important to clarify that the strong SDS events that occurred in northern China in March 2021 (especially the "3.15" event) attracted widespread concern due to their historical level of intensity and the huge impact on people's lives and the environment. Therefore, such a significant extreme weather event is bound to attract a large number of researchers to conduct in-depth studies on it through different approaches and perspectives. It is for this reason that the referee felt that the main subject of the presented study may overlap with some of the currently published work, and in this way considered our work to be uninnovative. We would like to say that we cannot fully agree with these points of the referee. Firstly, the major difference between this study and other studies (including but not limited to the three works mentioned by the referee) is that we focus on both the "3.15" and "3.27" events, while most of the other studies focus on the "3.15" event. Although the intensity of the "3.27" event was low compared to that of "3.15" event, it was still of historical magnitude, as our study found the maximum daily mean PM_{10} concentration of 2670 μg m^{-3}). In our work, we focused on the similarities and differences in the dust transport processes, meteorological causes and impacts between these two SDS events. Secondly, there are no studies to confirm the historical ranking of these two SDS events (are they the strongest in the last 10 years or 20 years as claimed by most studies and reports or not?) by long-term dust aerosol loading observations. To quantify the historical intensity of the contemporaneous dust aerosol loading during March and even during these two SDS event periods, we retrieved a high-resolution DOD dataset from 2000 to the present using MODIS Level 2 products for both Terra and Aqua satellites, which gives us the opportunity to place the intensity of these two SDSs, with DOD as an indicator, in the context of the last two decades to assess their historical ranking, which is one of the greatest highlights of the study. But unfortunately our efforts here were overlooked by the referee. Thirdly, as for the referee's reference to some overlap between this study and three other published papers, we would say that these efforts share some of the similarities but also differ in many regards that are grossly summarized as follows:

"As Section 3.3 of this study, the atmospheric circulation conditions, that triggered the exceptional 3.15 SDS (the strong Mongolian cyclone including its day-by-day movement) are in detail explained in Filonchyk (2022) (their Section 3.1 using ERA5 data)). "

Response: Firstly, the biggest difference is the different periods they investigated: "3.15" event (Filonchyk (2022)) and the combined "3.15" and "3.27" events (our study). Secondly, there is the difference in the meteorological elements of concern. In Filonchyk (2022), they focus on the day-by-day evolution of geopotential height at 850hpa and the 10m wind field during the "3.15" event, but do not present the joint influence of temperature and sea-level pressure field, and also do not show the hour-by-hour evolution of the sea level pressure field at the beginning of the "3.15" event (14 March). These meteorological factors are key to driving dust emissions, transport and deposition. In addition, Filonchyk (2022) does not seem to cover the dynamic changes of dust aerosols with the meteorological field during the southward movement of dust plumes, but mainly focuses on the analysis of large-scale synoptic conditions. This may ignore some details of the dynamic evolution of dust aerosols under the influence of meteorological conditions during the dust transport process. For example, Lines 193-194 in our study: *"On March 17, under the influence of southeasterly winds blowing from the Yellow Sea, the dust plume stopped continuing southwards and began to reflux and gradually deposit, and the intensity of its influence weakened significantly compared with the previous two days."*

2. Also, like the presented Section 3.1, the spatiotemporal evolution of the SDS using ground-based along with satellite-based measurements is covered by Filonchyk (2022) (their Section 3.2 and 3.3) and Liang et al. (2022) (their Figure S3, using ERA5 data).

Response: Once again, our study time period differs from these two published studies mentioned by the referee. Specifically, Filonchyk (2022) presents the temporal evolution of surface PM_{10} concentrations at several sites from northwest to north China, but misses the impact of dust aerosol transport on northeast China during the "3.27" event (especially on March 28). In Liang (2022), they present the spatial distribution of PM_{10} for 4 specific hours in 2 days, but the dynamic results of the later period of the "3.15" SDS event are not shown, especially the dust backflow phenomenon during the southward movement of the dust plumes on March 16-17. Regarding the satellite observations, Filonchyk (2022) presents the dynamic evolution of the MAIAC AOD, while we present the evolution of the DOD inferred from the MODIS L2 AOD product. DOD, as one of the key parameters for characterizing the optical properties of dust aerosols, describing the columnar optical depth due to the extinction by mineral dust particles. In our study, the use of DOD enables a more realistic characterization of the evolution of dust aerosol loading, whereas AOD cannot distinguish between the contributions of anthropogenic aerosols and dust aerosols, especially those transported over long distances from dust source areas to typical anthropogenic aerosol polluted areas (e.g., the North China Plain).

3. The sources of the dust aeolian aerosols have also been demonstrated using model simulations (Filonchyk (2022)) and HYSPLIT backward trajectories (Liang et al. (2022)).

Response: In Filonchyk (2022), they used the BSC-DREAM8b model to study the transport and settlement of desert dust. However, we note that in their study, only the predicted day-by-day spatial distribution of dust concentrations is presented (their Fig. 7), but the evolution of daily emissions of dust aerosols is not characterized, so this makes it difficult to determine the source location of the dust. In addition, we noted that their study only analyzed the model predictions, and the accuracy of model predictions decreases over time. In contrast, aerosol reanalysis (here MERRA-2) can provide a more reasonable and accurate product of dust emissions due to the assimilation of a large number of real-time observations (e.g. MODIS). By comparing with satellite and ground-based observations, Yao et al., (2020) demonstrated the ability of MERRA-2 in characterizing the three-dimensional evolution of dust aerosols during an extreme SDS event in East Asia.

Although backward trajectory analysis can be one of the effective methods to identify dust aerosol sources, it does not clarify the specific location of dust source areas, much less quantitatively assess dust aerosol emissions. In our study, the analysis of MERRA-2 dust emissions, wind fields, and the results of satellite observations (including DOD and AAI) can provide a more accurate identification of the specific locations of dust source areas.

Yao, W., Che, H., Gui, K., Wang, Y. and Zhang, X.: Can MERRA-2 Reanalysis Data Reproduce the Three-Dimensional Evolution Characteristics of a Typical Dust Process in East Asia? A Case Study of the Dust Event in May 2017, Remote Sens., doi:10.3390/rs12060902, 2020.

4. In addition, as here, the vertical distribution of dust aerosols has also been investigated by CALIPSO retrievals in both Filonchyk (2022), and Liang et al. (2022) works.

Response: We used a completely different CALIOP data product to explore the aerosol vertical distribution characteristics. In Filonchyk (2022) and Liang et al. (2022), the CALIOP VFM product was used, while the aerosol profile data product (05kmAPro, V4.21) was used in our study. In these two studies, they aimed to identify dust aerosols from the aerosol type classification products (i.e., VFM), while our study focused on studying the intensity of dust aerosol extinction. The aerosol extinction coefficient can be used as one of the indicators to quantify the dust concentration, and it can provide some observational constraints for the subsequent modeling studies. To summarize, although we all used products from CALIOP, there was a clear difference in focus. In addition, CALIOP has a long revisit period and a fixed transit orbit, which limits its ability to obtain time-continuous vertical measurements. Therefore, to track the dynamic effects of long-range transport of dust aerosols to downstream regions, we additionally introduced ground-based Lidar observations. These observations are not currently covered by other studies during these two strong SDS events, and this should not be overlooked by the referee.

5. Furthermore, like the presented Section 3.5, the climate conditions and anomalies across the study area that could trigger the 3.15 SDS (and not only) event have also been investigated by Zhicong et al. (2021).

Response: We would like to say that the periods studied are completely different. Specifically, in our study, we examine the period 2000-2021, which overlaps with MODIS observations, and we specifically focus on the anomalies of four key meteorological factors (Tem, SD, PPT, VSM) in the two weeks preceding these two strong SDS events. Our aim is to characterize the anomalies of four local meteorological factors that are closely related to dust emissions to explain the enhanced dust emissions. In contrast, Yin (2021) focuses on a longer time span (1 December to 31 March) on a longer time scale (1979-2021) or a shorter time scales (2011-2020). In their study, they aimed to emphasize the sub-seasonal variability of the dust source area and to further reveal the joint forces from preceding climate factors, such as sea ice, Nino3.4 index, SST. Although the time periods of the two studies were different, the conclusions obtained were supported by each other.

Finally, we would like to thank the referee once again for their careful comments, and we will highlight the innovative points of this study by clarifying as much as possible the differences between this study and these published studies in the subsequent revised version.

In addition, we will also include an analysis of the effect of dust aerosols on the incoming solar radiation in the revised version, as suggested by the referee. We will also respond to the specific comments mentioned by the referee in a subsequent response.