Atmos. Chem. Phys. Discuss., 13, C1219–C1223, 2013
www.atmos-chem-phys-discuss.net/13/C1219/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Size distributions of mineral aerosols and dust emission flux observed over Horqin Sandy Land area in northern China" *by* X. Li and H. S. Zhang

X. Li and H. S. Zhang

leexlpku@gmail.com

Received and published: 12 April 2013

Response to comments: Thank you very much for your comments. I have summarized them into several questions, as the following:

1. Whether the method can be used to accurately compute size-resolved dust emission fluxes or not? Response: The accurate calculation of size-resolved dust emission fluxes F(Ddi) requires two devices at least to measure dust mass/number concentrations of different sizes at various heights based on the relationship of flux-gradient. If only the bulk dust emission flux F is known, it is usually to roughly estimated size-resolved dust emission fluxes F(Ddi) by assumming that the dust particle size distribu-

tion (PSD) is known at first (Shao et al. 2011); this scheme has been used in some dust models (Westphal et al., 1988). In this study, we make an assumption that the PSD will not change with height in the atmospheric surface layer, hence, the values of F(Ddi) can be obtained from p(d) is the particle size distribution and is obtained from the QCM impactor at 3 m height. Considering the observation data we have at present, the assumption is necessary in spite of too ideal. 2. How to explain the peak in the submicronic particles measured in Horqin Sandy Land area? Response: According to the soil classification designed by the United States Department of Agriculture (USDA), the surface soil around the station belongs to loamy sand soil, containing 87.80% sand ($63 < d \leq 2000$ μm), 7.39% silt ($4 < d \leq 63$ μm) and 4.81% clay ($d \leq 4$ μm), measured by a laser particle analyzer (Mastersize 2000, Malvern Instruments). The peak in the submicronic particles should be related to the surface soil components; soil particles with diameters less 1 μm occupied 26.7% of the total PM20 particles. We have added this information in the revision. 3. The correlation between PM10 mass concentration measured from QCM impactor and those measured by beta guage is not so good in Fig. 2, how to explain it? Response: The correlation is not very good (with correlation coefficient $R2 < 0.60$) between PM10 mass concentration measured from QCM impactor and those measured by beta guage; QCM observations were mostly lower than the beta gauge values, especially under very low ($\sim$ 1 μg m-3) and very high concentration conditions ($\sim$ 1,000 μg m-3). However, the proportion of dust concentration among various stages is thought to be reliable, hence we only use the ratio of dusts of sizes c(Ddi)/c measured by QCM impactor for further analysis. 4. The height of Sensit Sensor is set as 0.75 m, is it too high for saltation observation? Response: We have mentioned that in the revision, "It should be noted that the saltation intensity of sand particles is sensitive to observation height: the higher the observation height, the weaker the saltation behavior was observed. Although the observation height (0.75 m) is relatively higher in this study than the lowest observation height in most previous studies, e.g. the Sensit Sensors were equipped at height of 5, 10, 20, 50 and 100 cm in Gillette et al. (2008), the response number is still able to reflect the change trends of saltation process, as shown in Fig. 4b." 5. The precisely discussed should be added in the revision. Response: We have added more discussion in the revision, such as make comparison with previous studies, "Such similar feature has also been observed by Fratini et al. (2007), which found that while in low turbulent conditions the contribution of finer particles (0.26 $\leq$d $\leq$ 0.90 μm) to the total mass is comparable to that of coarser particles (0.90 $\leq$d $\leq$ 7.0 μm), a larger increase in the coarser mode occurs during the dust events" , and "Sow et al. (2009) indicated that the size distribution of dust released by wind erosion depends on the aerodynamic conditions prevailing during its generation, and they observed that the dust emission flux of fine (< 2 μm) particles in strongly convective event is about 10 factors of that in Monsoon event. Hence it is necessary to divide dust events into different types according to their aerodynamic conditions for investigating the features of size distributions of dust concentration and dust emission flux. Additionally, besides the parameter friction velocity u*, the thermal effects of turbulence on size distribution of dust emission flux is worth to be paid attention to. However, due to the limitation of our observation at present, we hope to accomplish it the future study." 6. Does wind direction have impact on the determination of z0? Response: The value of z0 was estimated to be about 0.147 m in this study, via plotting κU/u* against the stability factor z/L under stable (z/L>0) and unstable (z/L<0) conditions using turbulence measurements (Chen et al., 1997). The values of z0 are insensitive to wind direction at the station site, as shown in the following two figures, (a) for northern wind and (b) for southern wind (d) in the study period. Reference: Chen, J., Wang, J., and Yasushi, M.:An independent method to determine the surface roughness length, Scientia Atmospherica Sinica, 17(1), 21-26, 1993.

Minor revision: a) All of the conventional meteorological and dust parameters were recorded automatically and continuously with a sample interval of 10 min. The 10-min data were dealt with a 30-min moving average, but still reserve the time interval of 10 min. The turbulence measurements were recorded with a frequency response of 10 Hz. The hourly mean turbulence data are only used to calculate z0 in this study. b) The location of Horqin station has been corrected in Fig.1a, and the PM10 concentration

measured at 18 m height during 9:00-11:00 LT has been deleted for self-test of beta gauge.

Xiaolan Li Peking University 12 April 2013

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 2671, 2013.

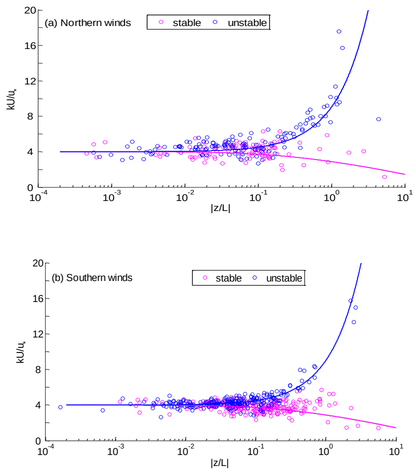

Fig.1 The plotting $\kappa U/u_*$ against the stability factor z/L under stable ($z/L>0$) and unstable ($z/L<0$) conditions using turbulence measurements, (a) for northern winds, and (b) for southern winds.

Fig. 1. The z0 values under different wind direction