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Comparison of two different dust emission mechanisms over the Horqin Sandy Land area: aerosols contribution and size distributions

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Dust aerosols emission fluxes due to convective turbulent dust emissions (CTDE) and saltation-bombardment and/or aggregation-disintegration dust emissions (SADE) events were comparatively studied using the data obtained from the Naiman station over the Horqin Sandy Land area in Inner Mongolia, China from 2011 to 2015. The annual cumulative dust fluxes released by CTDE events was about one third of that by SADE events. The particle size distributions (PSDs) with diameter between 0.1 and 20 μm during CTDE and SADE events over the Horqin Sandy Land area were simulated based on the fragmentation theory, respectively. The results indicated that an improved equation based on fragmentation theory could be applied to describe the PSD over the Horqin site and that was more applicable to SADE which may be because the scale-invariant fragmentation theory mainly explains the size distributions of free dust particles on the surface, which differs from the size distributions of suspend airborne dust. The number-related mean aerosol diameters barely varied under different friction velocity for SADE events, while the volume-related mean aerosol diameters changed distinctly with the change of friction velocity. For CTDE events, the number-related and volume-related mean aerosol diameters had no obvious relationship with the change of friction velocity because the dominating influence factor during CTDE event was thermal convection rather than friction velocity. The mass-related PSDs usually exhibited a peak between 0.45 and 0.70 μm during SADE events, while for CTDE events there was a wide peak in the range of 0.10 and 0.70 μm . The results suggest that number-related mean aerosol diameters should not be recommended as an individual parameter to describe the PSDs. The mass-related PSDs can effectively distinguish the SADE and CTDE events.