



## **Spatial and temporal evolution of natural and anthropogenic dust events over northern China**

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Mineral dust interacts with radiation and cloud microphysics in East Asia can affect local and regional climate. In this study, we found that the occurrences of dust storms, blowing dust, and floating dust over northern China has decreased 76.7%, 68.5%, and 64.5% considerably since the beginning of this century. Based on a multi-dimensional ensemble empirical mode decomposition (MEEMD) method, a steady decrease in zonal maximum wind speed (up to -0.95 m/s) in the Northern Hemisphere was largely responsible for this recent decline in dust event occurrences. Then, a new detection technique that combines multi-satellite datasets with surface observations of dust events is developed to estimate the contribution of anthropogenic dust column burden from disturbed soils to the observed total dust. It is found that the percentage of the anthropogenic dust column burdens to total mineral dust is up to 76.8% by human activities during 2007-2014 in eastern China, but only less than 9.2% near desert source regions in northwestern China. However, we note that the anthropogenic effects on the dust loading for both regions are non-negligible.