中国内モンゴル草原における地表面状況と人間活動のダストに与える影響
Influences of land surface conditions and human activities on dust events in Inner Mongolian grasslands, China

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Aeolian processes in temperate grasslands (TGs) are unique in that the plant growth–decay cycle, soil moisture, and land-use interactivity affect seasonal and interannual variations of dust events. When compared with Mongolian TGs, Inner Mongolian TGs are characterized by unique land-uses (settle grazing and grass mowing). Since 2003, to prevent desertification and dust storms, land-uses have been controlled by the grassland protection law. We used process-based ecosystem (DAYCENT) and statistical models as well as dust event observations during March–June 1981–2015 to (1) identify critical land surface factors that control dust emission (soil moisture and vegetation components; live grasses, standing dead grasses and litter) in Inner Mongolian steppe and desert steppe sites, and (2) estimate the impacts of the controlled land-use law on dust events. The DAYCENT model realistically simulated dynamics of the vegetation components and soil moisture that were captured by observations (2005–2015). Results showed that at both sites, the spring dust events had a similar amplitude of significant correlation with wind speed and a combination of all the surface factors that retained anomalies (memory) of the preceding year. Among the surface factors, vegetation was a critical dust suppressing factor in Inner Mongolian TGs, similar to Mongolian TGs. Importantly, in the desert steppe, the standing dead grasses had the strongest memory and simultaneous significant correlation with the dust events, while no significant correlations were found in the steppe. This suggests that in the steppe, intensive grazing and mowing resulted in smaller dead grasses and a negligible effect on dust events. Moreover, simulations of dust events under controlled land-use (light grazing) and uncontrolled conditions (heavy grazing) showed that since 2003, the grassland protection law resulted in reduced dust events by 25% and 40% in the steppe and desert steppe, respectively.

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