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Operational Numerical Prediction of Dust Storms in China

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Wind erosion is a serious environmental problem in arid and semi-arid regions of China and in many other parts of the world. Strong wind erosion events, such as severe dust storms, may threaten human lives and cause substantial economic damage. The Northwestern China region is one part of the central Asia dust storm area. The spring time dust events are driven by front system associated with an upper-atmospheric trough located over Siberia and northeastern part of China, generating large dust storms. Recently, the dust storm occurred frequently in spring in China, which arise widely attention of the public and the governments.

To predict continental scale dust storm activities, it is necessary to develop an integrated wind erosion modeling system coupling various dynamic models and a geographic information database. In this study, An integrated modeling system is further developed by incorporating the new wind erosion scheme of Shao (2001).

In spring of 2002, 2003 and 2004, we used the integrated wind erosion modeling system developed by Shao et al. (1999,2000), land surface data and GIS data to make real time forecast of dust storm occurred in China from March to May. The simulation area is (30E, 5N) to (180E, 65N) with a spatial resolution 0f 50km. The area of data analysis is (72E, 5N) to (148E, 53N). The atmospheric data required for model initialization and boundary conditions are derived from the T213-GCM of the China Meteorological Administration. During these periods, NMC provide numerical forecasts products on dust weather every day. It is the first real time forecast of dust weather in the world.

The integrated prediction system not only forecast the emission sources, temporal and spatial structure distribution of dust but also can be used to operational dust weather forecast every day. The simulated evolution of dust storms is in qualitative agreement with the observations. Quantitative agreement is not verified for lack of observational data. In CMA (China Meteorological Administration) , the forecast of dust weather has been carried out and also made great success. In the simulation of dust storm events, the reliability of the atmospheric forcing data and the availability of land-surface parameters are two additional constrains imposed upon wind erosion modeling. Wind erosion events are often associated with the development of certain synoptic and sub-synoptic severe weather events, and these type weather events are often the most difficult to describe and predict using atmospheric models. We require high-resolution land–surface parameters for soil texture, soil hydraulic properties, vegetation characteristics and surface aerodynamic properties. It is therefore hopeful that as various aspects of the modeling system improve, the simulation and prediction of dust weather will become satisfactory.