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Duststorm Generation in Mongolia and China

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Duststrom consisted with a great amounts of dust, soil and small size of rock, which were generated by strong wind was investigated from March 19 through 31and April 17 through 25, 2001. First concern was given to the dynamic of duststorm generation in Mongolia and northern China such as the relationship of baroclinic potential vorticity (PV) to the generation of duststom, using three-dimensional nonhydrostatic model-MM5. Outside area of the maximum negative geopotential height tendency ($\partial\Phi/\partial t$) at the 500 mb level, the area of maximum negative vorticity which induces the strong upward motion of air coincides the area of the duststorm generation in the inner Mongolia of the northern China under relative humidity less than 30 % and wind speed over 8 m/s and the dust transportation always follows the negative vorticty area in the downwind side [1] [2]. The second concern was given to the atmospheric boundary layer forcing to the dustorm generation and its transport The region of duststorm generation (maximum negative vorticity area) is the same region of the unstable atmospheric layer (negative PV layer) near the ground surface in the vertical distribution of baroclinic PV, which is a function of diabatic heating and frictional terms with respect to time.

Air parcels (dust) for day are uplifted to about 700 mb level (about 3 km), where potential temperature gradient with pressure ($\partial\theta/\partial p$) is zero and above 700 mb level, stable upper atmosphere influenced by the stratosphere exists (Fig. 1). Convective boundary layer (CBL; negative PV value) exists in less or more than 1 km and initially dust particle floats from the ground surface to the mixed layer (ML) of about 1.5 km above the CBL and it remains inside the ML. Westerly wind drives the particles to the downwind side. At night, a shallow stable boundary layer near the surface (inversion layer; big positive PV) is developed and the particles inside the stable layer merge to the ground surface and move downwind side. The dust particles in the ML still move downwind side and their dry deposition from the top of stable layer into the surface occurred. Stable layer near surface also forms for day and the dust particles merge into the stable layer and transport and high concentration in the local area.

Keywords: Duststorm, Vorticity, Potential vorticity, Convective boundary layer

References

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