

Preliminary Analysis of the Causes of "811" Strong Tornado weather

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Using the conventional meteorological observation data, 5-minute surface observation data, radar and NCEP/NCAR reanalysis data, the strong tornado weather in the northwest of Chifeng city on August 11, 2017 is analyzed. The results show that:

(1) The occurrence of the "811" strong tornado weather is the result of interactions among the synoptic scales, mesoscale and small-scale convective storm systems, which occurred in the background of Mongolian cold vortex and had the characteristics of typical Supercell Storm with long life cycle. The unstable potential stratification and strong vertical wind shear from 0 to 1km provide favorable environmental conditions for the development of supercell organization. In addition, surface cyclone convergence, afternoon surface humidification and the formation of a significant pressure-reduction zone on the ground for three hours are also important factors in inducing tornadoes.

(2) There are the following significant changes in surface meteorological elements during the occurrence of strong tornadoes: the surface wind speed increases sharply and the wind direction shows a significant deflection. In terms of the temperature change, the temperature of the first tornado was slightly reduced, and it quickly rose back to the temperature before the tornado occurred. However, when the second tornado attacked, the ground temperature dropped sharply, and the temperature dropped more severe even than the transit line. The dramatic drop of the surface air temperature is an important feature of the strong storm cold pool outflow. When there is a clear outflow of the cold pool, even if the convective storm echo strength is still maintained at 55dBZ, but because the strong cold pool destroyed the vertical structure of the tornado supercell wind field, the possibility of another tornado attack in this area is greatly reduced

(3) There are the following significant changes before the occurrence of the tornado: the pseudo-equivalent temperature reduction rate increased significantly. The vertical circulation of supercell which rose in front and sank in back was formed over the tornado, which was helpful to form strong convection when the upper cold air sank to the lower level which was the high energy and humidity environment. As the storm moves eastwards, strong updrafts in its front cause the supercell to hold up for a long time.

(4) The long-life supercell of "811" strong tornado originated from the middle troposphere, and the convection development was very vigorous in most time periods of its life cycle. In the process, the extension height of strong echo above 55dBZ can reach 9 to 11km. When the two tornados grounded, the radar echo shows the characteristics of classic supercell storm, there are obvious hook echoes, weak echo regions and corresponding V-notch on the front in the lower layer, accompanied by a medium-strength medium cyclone.

(5) In the "811" strong tornado process, after the first tornado, the southeast jet inflow in the lower layer is the main reason that the convective storm can continue to strengthen and develop into supercell storm, which causes the second tornado occurrence. It can not

only lead to the formation of a V-notch in the lower layer in front of the storm, but also, it is conducive to maintaining and strengthening the updraft and vertical wind shear in the storm. Thus the storm developed into the supercell storm.

Key words: Strong tornado, environmental conditions, Supercell, analysis of causes