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Modeling on the effect of an overshooting convection from middle latitude on the humidity in the lower stratosphere

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A deep convection in Lingbi area of Anhui was simulated by using Weather Research and Forecasting (WRF) mesoscale model coupled with the Morrison's double-parameter microphysical solution and other three microphysical schemes, the vertical transportation of water vapor by deep convection and its influence on humidity of LS (Lower Stratosphere) was analyzed in this study. These results are very helpful for us to understand the influence of the vertical transportation by deep convection on the atmosphere in the LS. The simulated characteristics of the storm by WRF model revealed a good agreement to observations in the following: the location of convection and precipitation, the height of cloud.

The results with Morrison scheme showed the most prominent effect on moistening in LS by deep convection among that with any other microphysical schemes, the moistening lasted for more than 8 hours. The moistening area 10% higher than ever covered at least 2.1 latitudes and 3.3 longitudes at the height of 18.054 km. The results showed that the water vapor transported by deep convection was the primary reason of moistening in LS but the sublimation of hydrometeor moistened this layer weakly. The stratosphere water vapor content is sensitive to cloud microphysical schemes. Specifically, the duration time of overshooting was about 4.5 to 8 hours in different schemes and the averaged water vapor mixing ratio was about 7 times difference among results with these schemes. The moistening area 10% higher than ever at the height of 18.054 km which was also sensitive to cloud microphysical parameterization schemes. The maximum area was about 1.5 latitudes and longitudes lager than the minimum.