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Tropopause Folding Turbulence Prediction and its Application in Mid-latitude Weather Analysis and Forecasting

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Tropopause folding is an important mid-latitude atmosphere phenomenon within the upper troposphere and lower stratosphere which is always found to be corresponded to the cyclogenesis, rainstorm and convection generation and precipitation enhancement. Since the atmosphere environment for any of these above-mentioned weathers is terribly complicated, those preexisting popular schemes taking no account for water vapor may not suitable for detecting tropopause folding that dealt with these weathers. With regard of the merits and demerits of the pattern recognition scheme on basis of satellite and numerical data, a dynamic new scheme based on FY2E geostationary weather satellite data is presented to detect tropopause folding related to rainstorm. The core idea of this scheme is based on the statistical relationship between tropopause folding and the water vapor at high level troposphere, the general moist potential vorticity, ozone and upper-level jet with considering the auxiliary effect of the height of dynamic tropopause simultaneously. After accuracy verification using the total amount of ozone and ozone profile operational products retrieved by FY3A and FY3B and the potential vorticity calculated by ECMWF Interim data, this scheme is applied to analyze two typical middle-latitude weather processes. One is the famous Beijing extreme rainfall of 21 July 2012 and the other is South China rainstorm during May 14-17, 2013. A good application effect of both cases suggests that our new method for tropopause folding detection is feasible and can be helpful in middle-latitude disastrous weather monitoring and forecasting.