EMS Annual Meeting Abstracts
Vol. 15, EMS2018-59, 2018

Comparison between thermal and dynamic tropopause in severe weather events

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The tropopause dynamics is involved in the most severe weather events. The tropopause, thin layer between the troposphere and the stratosphere, can be defined in a number of ways, but the most frequent description in meteorology is made using the thermal vertical gradient (thermal tropopause) and the potential vorticity (dynamical tropopause). The aim of this study is to compare the two tropopauses, in respect with severe weather events, in order to choose the most useful one for the operational meteorological forecast. The analysis was focused on a few weather severe cases in 2017 year. The selected events manifested in south-eastern Europe, including Romania, were characterized by large amounts of precipitation, generally higher than 50 mm in 24 hours and/or wind gusts more than 55 km/h. In addition, the cases were selected if they were associated with a high positive potential vorticity anomaly. ERA-Interim data were used for this study. It was investigated the influence and interaction between the two tropopause types, analyzing especially the heights of the dynamic tropopause (considering the surface of potential vorticity PV = 2 PVU), and the heights of the thermal tropopause, calculated using the World Meteorological Organization (WMO) definition. The time variations of their phase and amplitude were analyzed and compared. In almost all cases the decreasing rate of dynamical tropopause is higher than that of thermal tropopause. This result makes dynamical tropopause more suitable for prediction than thermal tropopause. Another important result is that for the most severe events, the deeper fall in the both thermal and dynamical tropopause has to take into account.

Key words: dynamic tropopause, thermal tropopause, potential vorticity