Title: Convective storms and lower stratospheric moisture

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Abstract:

The primary focus of this thesis is to diagnose contributions to upper tropospheric and lower stratospheric (UTLS) water vapor from convective storms. The first parts of this work introduces two approaches used for a detection of lower stratospheric water vapor above convective storm tops - brightness temperature difference (BTD) technique and EOS MLS measurements. The BTD technique is based on brightness temperature difference between the water vapor absorption and infrared window bands, assuming a thermal inversion above the cloud top level. The most frequently offered explanation of positive BTD values above convective storms is presence of warmer water vapor in the lower stratosphere. Furthermore, so called BTD anomalies were described and it was proposed an algorithm for objective detection of such BTD anomalies. Characteristics of parameters describing BTD, BTD anomaly, infrared window brightness temperature were investigated during storms evolution on dataset of 320 storms from the area of Europe. The analysis of these characteristics proved highly probable conection between positive BTD values and lower stratospheric water vapor. BTD anomalies may be attributed to a local source of water vapor, which are transported into the lower stratosphere. The next part is dedicated to interannual and annual variability of water vapor in the UTLS region and also to case study, which show how the presence of storms can influence the water vapor concentration in UTLS.

Keywords: convective storms, water vapor, upper troposphere lower stratosphere, brightnes temperature difference technique, tropopause