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The origin of exceptional water vapor mixing ratios at the 100hPa level over Europe in the year 2017

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Water vapor is one of the strongest greenhouse gases of the atmosphere. Its driving role in the upper troposphere / lower stratosphere region (UTLS) for the radiation budget was shown by Riese et al., (2012). Despite its low abundance of 4 - 6 ppmv in the stratosphere, even small changes in its mixing ratio can leed to a positive feedback to global warming. To better understand changes and variability of the water vapor in the lower stratosphere, we focus on exchange processes from the moist troposphere to the dry stratosphere.
The Microwave Limb Sounder (MLS) aboard the AURA satellite, globally measures water vapor on multiple height levels. It shows clearly the seasonal variations with about 3 ppmv in winter and around 6 ppmv in summer in the lower stratosphere (at the 100hPa level) over Europe. Additionally, in nearly every year since 2004, in late August, singular events with high mixing ratios were observed reaching up to 7 ppmv. Exceptional, in comparison to the average, was the year 2017 when from August to October, 69 events over Europe were found reaching up to 15 ppmv. Smith at al., (2017) reports of similar values measured in multiple in situ measurements over the North American continent and found troposphere-penetrating convection to be the origin of the events. Hence, the origin of the events over Europe in 2017 is suggested to be also overshooting convection and will be discussed in this poster using a combination of MLS observations, ECMWF ERA-5 meteorological data and a trajectory analysis. A possible reason for this enhanced entry of water vapor into the mid-latitude lower stratosphere the increasing number of severe weather events will be considered.