

The Mechanism of the Stepwise Decrease of Stratospheric Water Around the Year 2000

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The stepwise drop in the stratospheric water vapor (SWV) at around the year 2000 (e.g., Randel et al., 2006; Rosenlof and Reid, 2008; Fueglistaler, 2012) has been a special interest in middle atmosphere science due to the importance of SWV on global climate (Solomon et al., 2010). By referring to the entry value of water to the stratosphere (Fueglistaler et al., 2005; $[\text{H}_2\text{O}]_e$) together with some Lagrangian diagnostics of dehydration in the Tropical Tropopause Layer (TTL), the mechanism of the drop, being identified to have taken place in September 2000, is discussed. The processes responsible for the drop will be as follows: the TTL trajectories circulating the Tibetan high in northern summer show eastward expansion due possibly to the influence of the eastward expansion of the equatorial warm water to the central Pacific in 2000. The reduction of the water transport borne by the air parcels taking the Lagrangian cold point over the Bay of Bengal and the western tropical Pacific is the direct cause of the drop in $[\text{H}_2\text{O}]_e$. The modulated sea surface temperature distribution, having been maintained at least till 2005, may be responsible also for the reduction of $[\text{H}_2\text{O}]_e$ in the successive northern winter. The interaction of the thermal forcing at the bottom boundary could thus play an important role in the variabilities of SWV.

Key words: stratospheric water vapor, TTL dehydration, Lagrangian diagnostics, climate change

References

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