

Moist phase in the SH extratropical lower stratosphere: a view of transport from the tropics

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Stratospheric water vapor in the Southern Hemisphere (SH) presents a “wet phase” of the annual cycle during September to December, right after the Northern Hemispheric (NH) monsoon season. The variability of this “wet phase” is dominated by stratospheric water vapor variations over three regions – Western Pacific, South American and African regions. In this study, we use Aura MLS measurements during 2004-2014 to examine the sub-seasonal and interannual variability of water vapor in those regions and characterize their relationships to deep convection, large-scale temperatures and circulation. Results show that the interannual variations are mainly dominated by QBO and ENSO. The subseasonal variations are controlled by the cold-point temperatures over those three regions, with warmer temperatures lead to less dehydration and more water vapor entering the stratosphere, and vice versa. The transport of water vapor from those regions to the SH extratropics is further identified by a domain-filling forward trajectory model. Trajectory results show that water vapor parcels in the SH are from the above three regions in the tropics and get finally dehydrated by the cold-point temperatures, after which, parcels transport southward along with the general circulation. These results demonstrate that the moist phase in the SH is mainly due to the transport from the tropics rather than from the NH summer monsoon regions, and the water vapor variations are primarily controlled by temperatures and large-scale circulation.