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Seasonal and inter-annual variabilities of tropical upper tropospheric humidity from the Microwave Limb Sounder (MLS) and Atmospheric Infrared Sounder (AIRS)

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We analyze seasonal and inter-annual variabilities of tropical upper tropospheric humidity from the Microwave Limb Sounder (MLS) instrument on the Aura satellite, and the Atmospheric Infrared Sounder (AIRS) instrument on the Aqua satellite for the period of August 2004 to March 2009.

Annual variation is seen at most southern hemisphere (SH) tropical latitudes (1.5 - 22.5S) with maximum water vapor mixing ratio during SH summer and minimum at NH winter. Similar annual variation with opposite phase exists at the northmen hemisphere (NH) tropical latitudes of 5.5 - 22.5N with maximum at NH summer and minimum at NH winter whereas semi-annual variation is observed at latitudes of 0.5S-4.5N. These seasonal variations are mainly explained by the temporal and spatial migration of the inter-tropical convergence zone (ITCZ) and by the fact that ITCZ is not centered exactly on the Equator rather than a few degrees north. The seasonal variations observed by the two instruments are similar in both hemispheres, but have different magnitudes. The reason for these discrepancies are analyzed in detail.

MLS and AIRS humidity observations of inter-annual variability show distinct spatial patterns up to about 200hPa, whereas above up to the tropopause the variations are very homogeneous. Correlations among the humidity observations at different pressure levels within one instrument and correlations between the two instruments are calculated to show the feasibility of the combined data set for the study of the upper tropical tropospheric humidity.