Geophysical Research Abstracts,
Vol. 11, EGU2009-2259, 2009
EGU General Assembly 2009

Cross tropopause transport of water substance by deep convective storms in tropics and extratropics

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Deep convective storms are capable of transporting substantial amount of water substance from the troposphere into the stratosphere with their strong updrafts and therefore should be an important link in the global water cycle. But the dynamical mechanism that is responsible for this transport is only becoming clear in the last few years. It turns out that storm top instability and gravity waves play a central role in this process. W have performed numerical model studies of this transport process relevant to both tropical and extratropical conditions to show that such a transport can occur in different fashion in these two regions due to different storm top wind shear conditions. Model results will be shown to match aircraft and satellite observations in these cases. Some recent aircraft and satellite measurements of HDO/H2O ratio can be explained by this deep convective transport process. Implications to future observations and large scale modeling will be discussed.