Comparisons between Tropospheric Emission Spectrometer (TES) observations and isotope enabled GCMs

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Abstract

Water vapor isotopes are widely used for understanding the global hydrological cycle because they are tracers of evaporation or condensation processes and also can identify moisture sources. New observations of water vapor isotope from the Tropospheric Emission Spectrometer (TES) on NASA's Aura spacecraft in the middle troposphere have been used to identity tropospheric moisture sources, their transport pathways and efficiencies in which vapor is converted to precipitation and back again. Here, we compare the TES observations of water vapor isotopes to the simulated results from Community Atmospheric Model (CAM) with water isotope enabled. Our objective is to examine the moisture transport characteristics within the CAM model, and to use this insight to help studies of global water cycle, paleoclimate, and the response of precipitation to climate change.

TES data utilized in this study are from December 2005 to August 2007. Two seasonal data are created from data retrievals from December to February (DJF) and June to August (JJA) dates, respectively. The global distribution of the TES water vapor isotope is consistent with the CAM results. Both water vapor isotope results show the expected spatial distribution ("latitude effect") and a hemispheric symmetry (larger variations over northern hemisphere than over southern hemisphere during JJA and vice versa during DJF). This agreement indicates that the large-scale transport of moisture from the equator and sub tropics to polar regions is well explained by the CAM results. However, significant differences exist in the mid-latitude Pacific Ocean and over regions of strong convection, such as summer time Africa, India, and Asia. These differences point towards improving our understanding of advective and convective moisture transport into the troposphere over Asia and the warm pool and the Pacific.