Geophysical Research Abstracts
Vol. 12, EGU2010-12277-1, 2010
EGU General Assembly 2010

Deep convection over the Tibetan Plateau and global stratospheric water vapor

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Global stratospheric water vapor has important radiative and chemical implications. It has previously been shown that deep convection over the Tibetan Plateau and the south slope of the Himalayas provides a seasonal source of water vapor to the local lower stratosphere. Here we examine whether this convective transport also exerts an influence on water vapor concentrations entering the global stratospheric Brewer-Dobson circulation. Diabatic back trajectories are initiated during October, November, and December at Microwave Limb Sounder observations of moist air at 68 hPa in the tropics, and are integrated using output from two independent meteorological reanalysis projects. Although the quantitative results differ according to the reanalysis dataset used, the qualitative conclusion is robust: deep convection over the Tibetan Plateau region during boreal summer is an important source of moist air to the global stratosphere. In particular, the moistest air parcels at 68 hPa can often be traced back to deep convection over the Tibetan Plateau region (70°E to 100°E and 27°N to 35°N). The importance of this region relative to the Asian monsoon region (70°E to 100°E and 10°N to 15°N) and global tropics (15°S to 15°N) appears to result from several factors, including the frequent occurrence of afternoon deep convection over the Tibetan Plateau and the south slope of the Himalayas, a warmer tropopause at lower altitude, and systematically warmer cold point temperatures during transport between convective detrainment and the base of the Brewer-Dobson circulation. The statistics of transport between convective detrainment and 68 hPa are presented and interannual variability is discussed.