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Occurrence frequency of overshooting analyzed by use of A-train

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We show characteristics of a tropical deep convection observed in an experiment employing the A-train constellation, the space-borne imager MODIS, the sounder AIRS-AMSU, the cloud radar CloudSat, and the lidar CALIOP for understanding amount of water vapor transported from troposphere into the stratosphere, since stratospheric water vapor plays an important role in chemical and radiative effects such as ozone depletion, stratospheric temperature, and surface climate. The deep convection, measured at 4.75 S, 178.9 E at 1345 UT on 12 January, of which cloud top height is 840 m higher than that of 380 K potential temperature is analyzed by use of the radar/lidar method; the deep convection has a potential to hydrate the stratosphere with about 100 t of water vapor. CloudSat and AIRS-AMSU data from September 2006 to August 2007 are analyzed to estimate the occurrence number of deep convections above a height of 380 K. Since shapes of most clouds measured by use of CALIOP are too complicated to carry out the radar/lidar method, we do not use CALIOP data for the statistical analysis. The global map of deep convections above a height of 380 K shows the occurrence frequency of the deep convections is greater over land and warm water pool. This is consistent of Fig. 2 of Alcala and Dessler (2002, JGR). We then estimate a occurrence frequency of deep convections above a height of 380 K between 20 N and 20 S, and it is 10 num/min. That of deep convections whose cloud top is 0.8 km higher than a height of 380 K, the same or greater convection than the case study's, is about 1 num/min. Thus, deep convections could hydrate global stratosphere 0.3 ppmv in a year.

Keywords: Overshooting, A-train, hydration, stratosphere