Geophysical Research Abstracts
Vol. 16, EGU2014-6762, 2014
EGU General Assembly 2014

Using HDO/H_2O dynamics to constrain GCM convective processes during the MJO

Obbe Tuinenburg (1), Camille Risi (1), Jean-Lionel Lacour (2), and Matthias Schneider ()

(1) Laboratoire Meteorologie Dynamique, Jussieu, Paris, France, (2) Universite Libre de Bruxelles, Bruxelles, Belgium, (3) KIT, Karlsruhe, Germany

This research aims to improve the convective processes during the MJO and other modes of intra-seasonal variability in the LMDZ atmospheric models, by making use of joint HDO and H_2O (vapor) measurements.

The joint use of HDO/H_2O yields additional information compared to sole humidity measurements. In addition to atmospheric drying and wetting derived from the humidity measurements, the HDO measurements provide enrichment and depletion information. This information is used to distinguish between different moistening and drying processes. For example, a separation can be made between atmospheric moistening due to ocean surface evaporation and due to rain re-evaporation, as the re-evaporating moisture is more depleted in HDO than the surface evaporation.

We use IASI and TES satellite HDO and H_2O measurements and determine their evolution in the troposphere (700 to 400 hPa) during the MJO. Moreover, these evolutions are compared to the isotope enabled LMDZ GCM, which is forced with reanalysis wind fields. In this nudged mode, sensitivity tests of key parameters (cold pool representation, entrainment rate, precipitation efficiency, droplet size and fall speed, etc.) in the convection scheme are performed and compared with the measurements.

Initial results suggest that over the Indian ocean, there is a difference between the lower- and mid-tropospheric HDO-H_2O dynamics for MJO events. In the lower troposphere (at 700 hPa), the dynamics of HDO and H_2O are exactly out of phase, following a curve which indicates surface moistening by surface evaporation throughout the MJO event. At 500 hPa, the measurements indicate the main moisture source is surface evaporation before the MJO peak and rain re-evaporation during the 10 days after the MJO peak. Over the maritime continent, the dynamics are the same in the lower and mid-troposphere. The predominant source is surface evaporation before the event, and re-evaporation during the 10 days after the event.

The model captures the HDO/H_2O dynamics of the MJO reasonably well. However, over the Indian ocean in the lower troposphere, the modeled atmosphere is more depleted than the measurements after the MJO event, which suggests an over-estimation of re-evaporation. The comparison of the measured HDO/H_2O dynamics with the results of sensitivity tests will be presented, together with the usefulness of joint measurements of HDO and H_2O to constrain the GCM processes.