Idealized simulations of HDO profiles in the TTL

M. Bolot, E. J. Moyer, B. Legras

We investigate key factors controlling the isotopic composition of water vapor in the TTL. We derive a model for the averaged tropical budget of HDO by introducing an implementation of isotopologue physics in a corresponding model for the tropical budget of vapor. This model considers both convective and large-scale transport with sources and sinks due to evaporation and condensation. Our approach is then to assimilate tropical averaged analyses of circulation, temperature, moisture and radiative heating rates from Era Interim to reconstruct profiles of isotopic composition in the TTL. This approach allows us to focus on that part of the physics which is relevant for isotopologues while our moisture budget is constrained by Era Interim analyses. We first present a simple interpretation of equilibrium profiles under stationary forcing. We assess the sensitivity of such profiles to ice isotopic composition and ice evaporation at various levels in the TTL. We then present some simulations of the seasonal cycle of the isotopic composition in the TTL. We test our results against observations from the CR-AVE and TC4 missions and see what we can learn from them.