Atmos. Chem. Phys. Discuss., 12, C11624–C11625, 2013
www.atmos-chem-phys-discuss.net/12/C11624/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modelling and intepreting the isotopic composition of water vapour in convective updrafts" *by* M. Bolot et al.

Anonymous Referee #3

Received and published: 16 January 2013

This paper presents detailed investigation of the isotopic variability in response to the cloud microphysics and thermodynamics in the convective updraft. The authors simulate water isotope profiles with a detailed cloud physics model and highlighted a role of the content of supercooled water, the degree of supersaturation over ice, and the route to cloud glaciation (WBF process vs. freezing of droplets). Their conclusion is critically important to the isotope modelers because these microphysics schemes have not explicitly incorporated into state of the art GCMs, and may encourage further model development. In particular, it may be helpful to reduce the observation-model difference in water isotopologues in the upper troposphere. Although this seems to be a textbook rather than an article, this manuscript is well written and structured. Specific comments and suggestions are listed in below.

Introduction: To draw attention to the difference from the recent modeling work, it is better to briefly explain how water isotopes are incorporated into state of art GCMs. The most of convective scheme in the GCM do not take into account mixed phase zone, so that, as mentioned in the text, the degree of supersaturation is parameterized as a function of temperature. In addition, the appropriate parameter is often chosen to reproduce the observed isotope behavior in the cold region (e.g., Hoffmann et al., 1998). The authors should add these problems in the introduction.

P22461 L.24: Does Fig?? mean FigB1?

P22464 L12: "total water be conserved" ->"total water must be conserved"

P22474 L7: The word of "generalised" is correct? I think this is "generalized"...

P22490 L21: "This works also suggests" ->"This work also suggests"

Section 6: To conclude that the cloud parameters can retrieve from isotopic values obtained from both cloud base and cloud top, the uncertainty arising from the adiabatic assumption should be discussed in this section. Undiluted updraft is an ideal case, and convective entrainment can't be disregarded in the real convective systems.

In addition, the authors must mention how to obtain the isotope data of updrafted air. We can obtain spatially averaged isotopic values from satellite or aircraft observation, but cannot partition between updraft and downdraft region. I think that the discussion in this section is too ideal to apply to the real world.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 22451, 2012.

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12, C11624–C11625, 2013