

Interactive comment on “Temporal evolution of stable water isotopologues in cloud droplets during HCCT-2010” by J. K. Spiegel et al.

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The authors gathered valuable data on the isotopic composition of droplets in fog/clouds, which will help better understand the formation of the isotopic composition of atmospheric water. The samples were collected at a station close to the summit of Schmücke (Thüringer forest) at an altitude of 937 m.a.s.l. The selected sampling period September/October 2010 is within the autumn season, in which in that region often fog develops, so called “Herbstnebel” (autumn fog). The authors consider this fog as orographic cap cloud. To define the source of the moisture forming the clouds, backward trajectories were calculated. This concept of backward trajectories is known to be useful in case of clouds moving above the Planetary Boundary Layer. In case of fog or clouds forming and moving near the ground (including orographic cap clouds), the

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potential of such calculated back trajectories in identifying the moisture source needs to be discussed.

In this context, it should be noted that the sampling station Schmücke is located rather close to a relatively extended upland moor (“Schneekopfmoor” about 500 m north of Schmücke station and “Beerbergmoor” about 2000 m north-north-west from it). Therefore, it can be expected that a certain part of the air moisture (and thus also of the droplets) in the fog/clouds consists of moisture recycled by evaporation of soil water from the ground near the sampling site. Also the orographic cap clouds that develop by adiabatic ascent to the summit of the forest, may entrain moisture evaporated from the forest ground. The effect of recycling of evaporated moisture from regions near the sampling station certainly depends on how fast the clouds move. Nevertheless, it has been shown (Froehlich et al., 2008) that even a relative small contribution in the order of a few percent of such recycled moisture increases remarkably the deuterium excess. For a discussion of these aspects, the authors may also consult a paper, which is not included in their list of references: Jun Cui, Shuqing An, Zhongsheng Wang, Changming Fang, Yuhong Liu, Haibo Yang, Zhen Xu, Shirong Liu (2009) Using deuterium excess to determine the sources of high-altitude precipitation: Implications in hydrological relations between sub-alpine forests and alpine meadows. *Journal of Hydrology* 373 (2009) 24–33.

All in all, the observed changes in d-excess should be seen as a phenomenon caused by recycling of evaporated moisture from the ground. In this study, recycling from regions close to the sampling station should be given due consideration. The original isotopic composition of the evaporating water in the ground represents the isotopic composition of precipitation fallen prior to the observation period. Therefore, looking at the isotopic composition of precipitation and its sources is also of interest, at least in connection with the explanation of the observed changes of the δ values in the cloud droplets.

A considerable part of the paper is devoted to the description and application of the

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model developed by the authors to understand the temporal change of the isotopic composition of the water vapor and the droplets in the cloud. However, the description of the model appears to be rather obscure and difficult to verify. It remains to be shown that the model calculations really contributed to a better understanding of the observations. Unfortunately, the authors missed the unique opportunity, to measure the isotopic composition of both the droplets and the water vapor in the clouds (see also last sentence of the paper, page 15163, line 7-11).

In conclusion, the paper should be re-written taking the above comments into account. The main goal of the revised version should be a presentation of the measured data together with a description of the sampling and measuring procedures and the measured ambient parameters. The discussion and interpretation of the data should be more succinct as in the present version and conclusions should be avoided which hardly can be verified by available data and observations. Since a major revision (re-writing) of the paper is recommended, no specific comments on the writing clarity of the present version will be given.

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