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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The stable isotopic composition of molecular hydrogen in the tropopause region probed by the CARIBIC aircraft" *by* A. M. Batenburg et al.

M. S. Johnson (Referee)

msj@kiku.dk

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This is an important and comprehensive study which greatly extends our knowledge of the in situ chemistry of hydrogen in the upper troposphere and lower stratosphere. A key element of the study is the determination of the deuterium enrichment. This is quite useful for hydrogen; as the authors write the photochemical production of loss of hydrogen approximately balance resulting in relatively constant hydrogen mixing ratio. However, at the same time, the kinetic and photolytic deuterium isotope effects combine to give increased δD(H_2) in processed air. The results shown in (Fig 4a,b) give good insight into this phenomenon. The CARIBIC project has resulted in a rich

dataset which forms the basis of this study. The parameterization given in eq. 2 can be used directly in atmospheric models to parameterize the δD of H_2 mixed in from the stratosphere. This paper is characterized by a high degree of professionalism and craftsmanship and should be published after minor revision.

Scientific comments. 592, 10: As the authors note, many studies have been done concerning the isotope effects in the in situ production of hydrogen. Especially for the UT/LS, it is important to note that the photolytic deuterium fractionation in going from formaldehyde to molecular hydrogen is pressure dependent. Please see:

E. J. K. Nilsson, V. F. Andersen, H. Skov and M. S. Johnson, Pressure dependence of the deuterium isotope effect in the photolysis of formaldehyde by ultraviolet light, Atmospheric Chemistry and Physics, 10, 3455 - 3463, 2010.

In addition there is a pronounced isotope effect in the abstraction of hydrogen from the methoxy radical:

E. J. K. Nilsson, M. S. Johnson, F. Taketani, Y. Matsumi, M. D. Hurley and T. J. Wallington, Atmospheric Deuterium Fractionation: HCHO and HCDO Yields in the CH2DO + O2 Reaction, Atmospheric Chemistry and Physics, 7, 5873 – 5881, 2007.

Technical comments. The accepted convention is that the symbol *m* is reserved for mass thus the authors use of this symbol to mean 'mixing ratio' is very confusing, and it is nonstandard. Mixing ratios/mole fractions should use the symbol *x* or *y*. See the IUPAC 'Green Book'.International Union of Pure and Applied Chemistry (IUPAC) Quantities, Units and Symbols in Physical Chemistry, 3rd Ed., RSC Publishing, Cambridge 2007. Change throughout.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 589, 2012.