

Interactive comment on “An update on the uncertainties of water vapor measurements using Cryogenic Frostpoint Hygrometers” by H. Vömel et al.

Anonymous Referee #1

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An update on the uncertainties of water vapor measurements using Cryogenic Frostpoint Hygrometers

by Vömel et al.

This paper discusses the uncertainty factors and budget of the Cryogenic Frostpoint Hygrometer (CFH) measurements. The CFH is now widely used in both research and operational purposes for tropospheric and lower stratospheric water vapor. It is also one of the key instruments for validation of various other water vapor instruments (i.e., balloon-borne and aircraft in situ instruments, and ground-based and satellite-borne remote sensing instruments). Thus, this is a very useful paper for the CFH operators and CFH data users. The paper is well written, and I have only a few minor comments.

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Introduction. It is useful to show the formula of volume mixing ratio and relative humidity from dewpoint/frostpoint temperature. With these formula, it is understood that radiosonde pressure and temperature measurements and the choice of actual expression of the Clausius-Clapeyron equation are also the important sources of uncertainties. It would be useful to show the way how to evaluate the total uncertainty of volume mixing ratio and relative humidity with additional uncertainty from pressure and temperature measurements. These discussions might be placed in a later section.

Pages 4-5. Discussion on the time lag. It is pointed out here that Hasebe et al. (2013) previously discussed the time lag of CFH to be 4-10 sec in the upper troposphere to the stratosphere, being larger at higher altitudes. The results here are broadly consistent with the Hasebe paper.

Hasebe, F., Inai, Y., Shiotani, M., Fujiwara, M., Vömel, H., Nishi, N., Ogino, S.-Y., Shibata, T., Iwasaki, S., Komala, N., Peter, T., and Oltmans, S. J.: Cold trap dehydration in the Tropical Tropopause Layer characterised by SOWER chilled-mirror hygrometer network data in the Tropical Pacific, *Atmos. Chem. Phys.*, 13, 4393-4411, doi:10.5194/acp-13-4393-2013, 2013.

Page 10, lines 4-6. It would be useful to describe the recommended (and unrecommended) way of mirror cleaning prior to launch.

Page 10, lines 17-18. It would be useful to describe the criteria for contamination.

Page 12, line 3. A photograph showing the ground check system as an example would be useful.

Page 12, line 20. "section 0"

Summary. It would be useful to show typical uncertainty values also in ppmv and %RH, by assuming typical uncertainty values of pressure and temperature measurements from recent radiosonde models.

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