

## ***Interactive comment on “Recent divergences in stratospheric water vapor measurements by frost point hygrometers and the Aura Microwave Limb Sounder” by Dale F. Hurst et al.***

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### **1 Overview**

This paper considers two very different sets of measurements of water vapour in the lower stratosphere. One set of measurements is made with a satellite instrument, MLS, the other is made with frost-point hygrometers carried on balloons.

The paper notes that there are statistically significant differences between these two sets of data and that those differences have changed over time. This result needs to be reported in order to prevent over-interpretation either of the two datasets, so the paper

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should be accepted for publication, subject to some minor revisions. There are a few technical corrections to be made, but they are small; the paper is very clearly written and the figures are, for the most part, clear and easy to interpret.

Where the paper is lacking is in any explanation of the reported differences. Now, I recognise that:

- The authors can not produce an explanation out of thin air.
- The publication of the observation should not be held up while we wait for an explanation to be forthcoming.
- It is not valuable for the paper to include a lot of baseless speculation as a substitute for an explanation.

It would nevertheless be an improvement on the paper if it were possible to make any further factual statements on the possible causes of the differences. Were there any secular changes in temperature over the measurement period, for example? If so, how clearly decoupled are the two water vapour measurements from the temperature? Is it possible to eliminate temperature changes as a potential cause of the differences observed in water vapour? It would be nice if the authors were able to address this kind of question rather than leaving it hanging. But if there is nothing to be said, then the paper should be left as it is.

A point which is worth my making here, and which should arguably be noted briefly in the paper, is that the ACE-FTS instrument provides a third set of data covering the same period. There are currently no ACE-FTS data available for dates after March 2013, but I am reliably informed that this is not because the instrument has ceased working. Rather, it is due to a software issue which has every prospect of being solved. The paper reviewed here does not need to wait for the updated ACE-FTS

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data. However, we may hope that the ACE-FTS data might allow a future paper to provide answers to some of the questions posed by the paper reviewed here.

## 2 Minor revision

The *conclusions* section should contain some conclusions on the rest of the paper. Currently, it contains only the point that both sets of measurements will come to an end soon and there are no firm plans in place to replace them. This point is extremely important and is not restricted to water vapour; measurements of many other chemical species in the upper troposphere and the middle atmosphere will come to an end with the forthcoming demises of the Aura and SciSat-1 (ACE) missions. However, the conclusions section of the paper should sum up the results of the paper as briefly as possible as well as making this point.

## 3 Technical corrections

In figures 3 and 4, the blue and green colours in the left-hand panel are rather hard for the eye to separate, especially on a paper copy read in artificial light.

In figure 5 I am not entirely convinced by the use of letters as data points. Well-designed data points have an obvious centre which a plotting program will place at the right point. Letters do not have an obvious centre. The authors should at least consider replacing S, C, and E with something along the lines of a filled circle, an open circle and a square.

In a number of places (Page 3 line 30, Page 4 line 32, Page 5 line 11) the word *likely* has been used as an adverb. The word *likely*, despite ending in the letters 'ly', is an adjective and is synonymous with *probable*. If you want the equivalent adverb, you

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have to use *probably*. The use of *likely* as an adverb is a common colloquialism but has, in my personal opinion, no place in good written English. (I accept that this is an issue on which I am fighting a lone, losing, rearguard action.)

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