(25-220414-A) **The Efficacy of Long-term in Situ Measurement Programs in the Evaluation and Amelioration of Satellite Measurement Records: Stratospheric Water Vapor**

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The NOAA Global Monitoring Laboratory's upper atmospheric water vapor monitoring program started in 1980 with monthly balloon-borne launches of the NOAA Frost Point Hygrometer (FPH). Additional water vapor sounding sites were added in 2004 at Lauder, New Zealand, and in 2010 at Hilo, Hawaii. These 42-, 17- and 11-year records not only document the interannual variability and longer-term net changes in stratospheric water vapor (SWV), but are also capable of revealing relative changes in the multiple-year measurement records produced by satellite sensors like the *Aura* Microwave Limb Sounder (MLS).

MLS produced very stable and reliable SWV records since its launch in 2004, with recurring refinements to its retrieval algorithms over time. The agreement with frost point hygrometer records was routinely assessed over time, with small biases indicated at some retrieval pressures. In 2016 it was revealed that MLS timeseries of SWV retrievals at many retrieval pressures over multiple sites had a positive (wet) drift relative to FPH measurements for the last 5-7 years [*Hurst et al.,* 2016]. The MLS team initially responded by looking for ways the FPH measurements might be drifting negatively (dry), but a similar finding of positive drift in the MLS records by a study not using FPH data [*Randel and Park*, 2019] prompted a closer look at the health of the MLS instrument and the robustness of its version 4 (v4) retrievals.

Livesey et al. [2021] describes in detail the MLS problems that were identified and the new version 5 retrievals for SWV and other trace gases that were developed to ameliorate drifts. The v5 data reduce but don't entirely eliminate the positive drift in MLS relative to FPH records.

**References:**

Hurst, D.F., *et al*., *Atmos. Meas. Tech., 9,* 4447–4457, doi:10.5194/amt-9-4447-2016, 2016.

Livesey, N.J., *et al*., *Atmos. Chem. Phys., 21*, 15409-15430, doi:10.5194/acp-21-15409-2021, 2021.

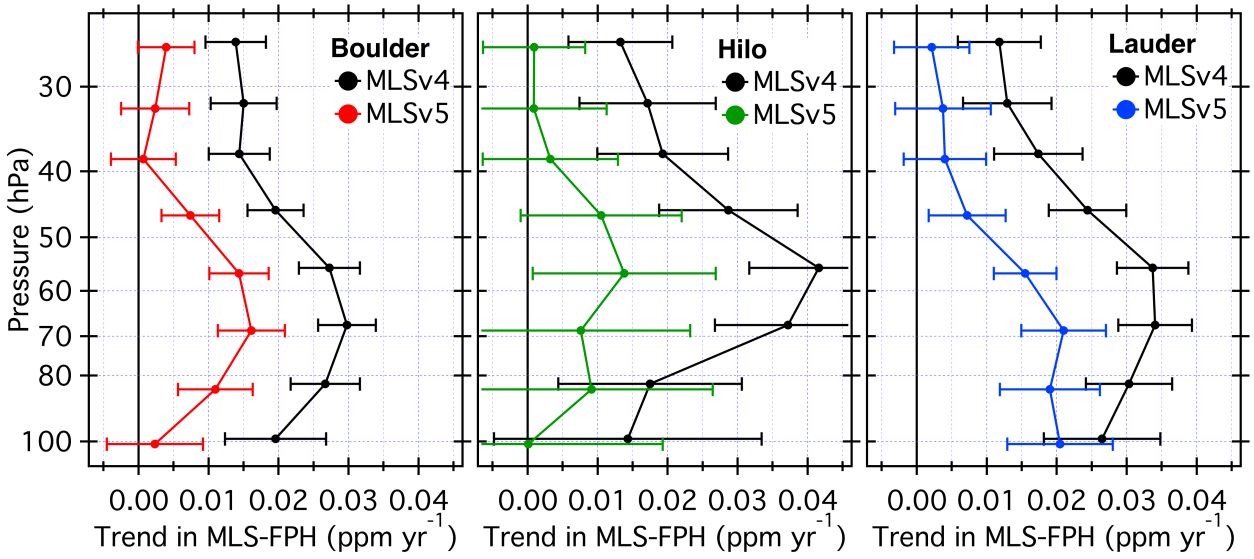


**Figure 1.** Linear trends for the full records of MLS–FPH differences over Boulder, Hilo and Lauder. Error bars depict the 95% confidence intervals of the trends. Trends in v5 differences are 65 ± 20% weaker than for v4 differences, but are still significant at 10 of 24 retrieval pressures.