

Recent Divergences in Stratospheric Water Vapor Measurements by Aura MLS and Frost Point Hygrometers

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Almost every day since August 2004 the Aura Microwave Limb Sounder (MLS) has provided approximately 3500 near-global vertical profile measurements of water vapor from the upper troposphere to well past the stratopause. Long-term agreement between the MLS and balloon-borne frost point hygrometers (FPs) has been excellent until recently. Now there is compelling evidence of divergences in spatiotemporally coincident stratospheric water vapor measurements by MLS and FPs. Time series of FP-MLS differences at 8 stratospheric pressure levels (100-26 hPa) over 5 different FP sites were analyzed (Figure 1). Statistically significant changepoints were detected in many of the time series of FP-MLS differences, so trends were evaluated using piecewise continuous linear regression. The analysis reveals statistically significant (95% confidence) downward trends in FP-MLS differences during the last 4-6 years. By mid-2015 the stratospheric FP-MLS differences had changed by -0.3 to -0.4 ppm (-7 to -9%) and half of the endpoint differences exceeded the combined accuracy estimates for FPs and MLS. These recent divergences are attributed to increasing wet (high) biases in MLS retrievals, primarily because it is highly unlikely that two different types of FPs (FPH and CFH), independently manufactured and calibrated, are drifting at similar rates at several FP sounding sites.

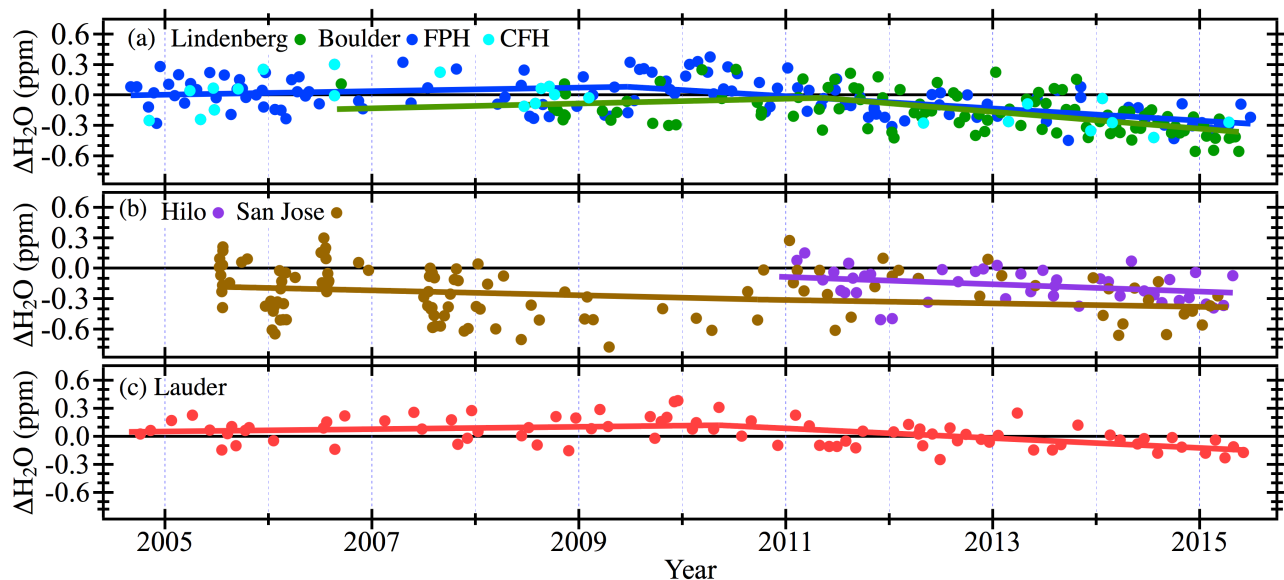


Figure 1. Differences in coincident stratospheric water vapor measurements by frost point hygrometers (FPs) and the MLS at 68 hPa over five FP sites. Trends were determined using piecewise continuous linear regression because statistically significant changepoints were detected.