An Overview of GMD's Water Vapor Research

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Atmospheric water vapor is a strong infrared absorber and a potent greenhouse gas. It is also part of an ominous climate feedback loop: as the Earth's surface warms, the atmospheric burden of water vapor also increases, further warming the surface that responds by evaporating more water vapor into the atmosphere. ESRL/GMD's water vapor monitoring efforts focus on the upper troposphere and stratosphere, where even small abundance perturbations can drive significant changes in surface temperatures. ESRL/GMD's pioneering role in the monitoring of upper atmospheric water vapor with balloon-borne frost point hygrometers began in Boulder in 1980 and continues today at Boulder, Colorado; Hilo, Hawaii; and Lauder, New Zealand. Despite today's prevalence of satellite-based water vapor sensors with near-global coverage, ESRL/GMD's *in situ* measurements, with high vertical resolution and stable accuracy, prove extremely valuable for the analysis of seasonal and longer-term variability in upper atmospheric water vapor, and for ongoing evaluations of bias and drift in the measurement records of satellite-based water vapor sensors.

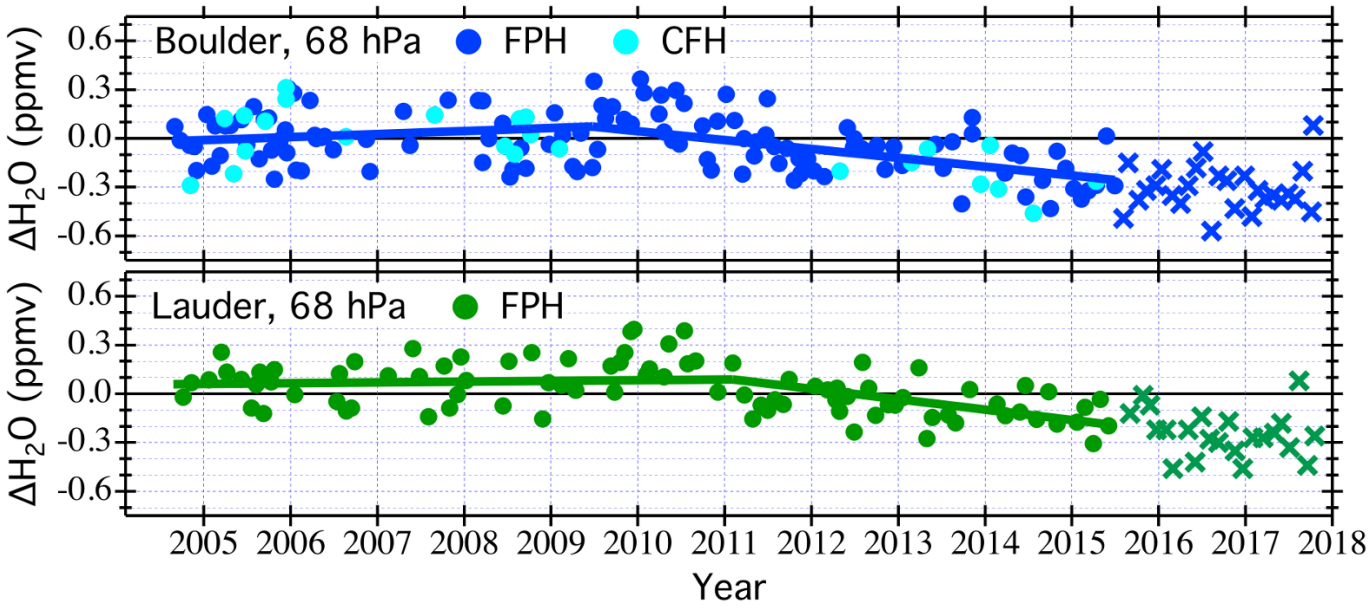

Figure 1. Trends in the differences between stratospheric water vapor measurements by frost point hygrometers and the Aura Microwave Limb Sounder (MLS) over Boulder, Colorado, and Lauder, New Zealand. Trend changes beginning in 2009-2011 indicate significant drifts in the MLS retrievals that persisted through 2017.