

NOAA FPH Vs APicT During the AquaVIT-2 Water Vapor Intercomparison

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While discrepancies in upper troposphere and lower stratosphere (UTLS) water vapor observations between aircraft, balloon-borne, satellite, and ground based instrumentation have decreased in recent years, some significant differences still remain. In an effort to better understand uncertainties between various instruments used to measure UTLS water vapor on different platforms, a two week long intercomparison was performed in the aerosol and cloud simulation chamber (AIDA) in April 2013 called AquaVIT-2. The Karlsruhe Institute of Technology (KIT) operates a large volume (84 m³) aerosol and cloud simulation chamber which was used in AquaVIT-2 with the ability to vary pressure, temperature, and water vapor mixing ratio in a highly controlled fashion.

The experiment conducted in AquaVIT-2 built off an initial intercomparison (AquaVIT-1) done with the AIDA chamber in October 2007. Each day the chamber was held at one specific temperature unlike the pressure and water vapor mixing ratio which varied throughout the day. The daily temperatures did change between 190 K and 233 K over the ten days of experiments. The water vapor mixing ratios changed between ~ 0.15 and 1000 ppmv while the pressure in the chamber started each day around 80 hPa and increased stepwise to 1000 hPa before stepping back down to 80 hPa at the end of each day. Typically there were 6 distinct pressure steps throughout the day, which were used to intercompare the participating instruments during quasi-static conditions.

Three of the ten days of experiments were blind. This work will focus on comparing the non-blind days between the NOAA Frostpoint Hygrometer (FPH) and the two, calibration-free open-path, in-cloud direct tunable diode laser spectrometers (TDLAS) called MC-APicT-14 and SP-APicT evaluated by the German national meteorology institute (PTB).

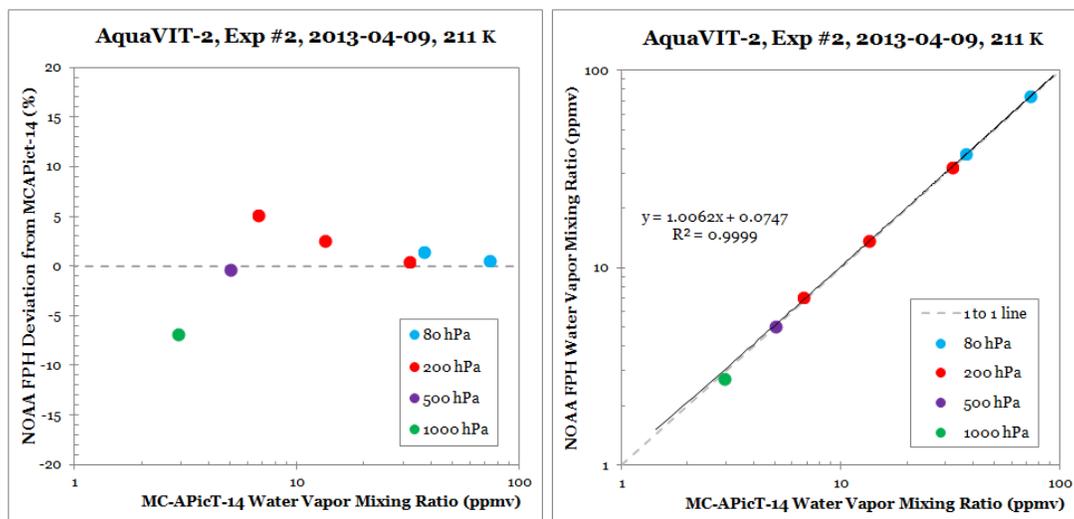


Figure 1. The left panel shows the relative deviation of the NOAA FPH from the open-path tunable diode laser spectrometer MC-APicT-14 during experiment #2 on April 9, 2013. The right panel has a scatter plot with a linear regression showing good agreement between 3 and 80 ppmv. The individual data points are color coded by pressure level.