CLH Overview

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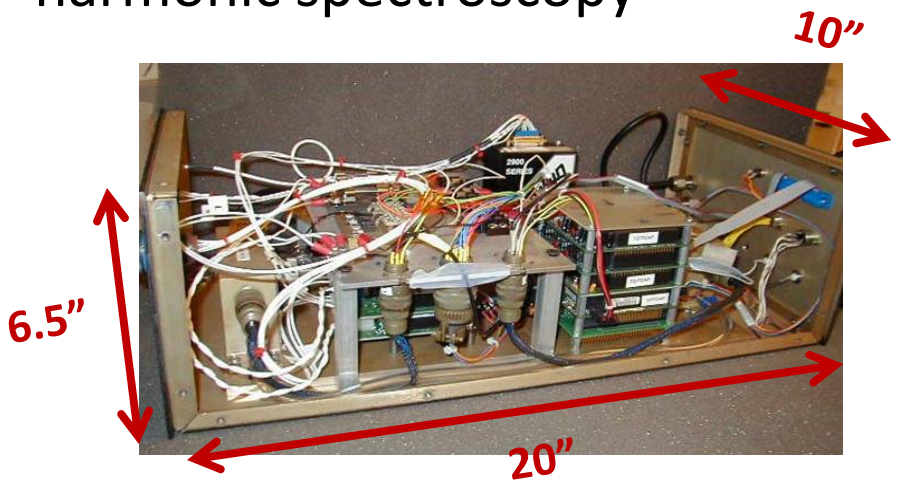
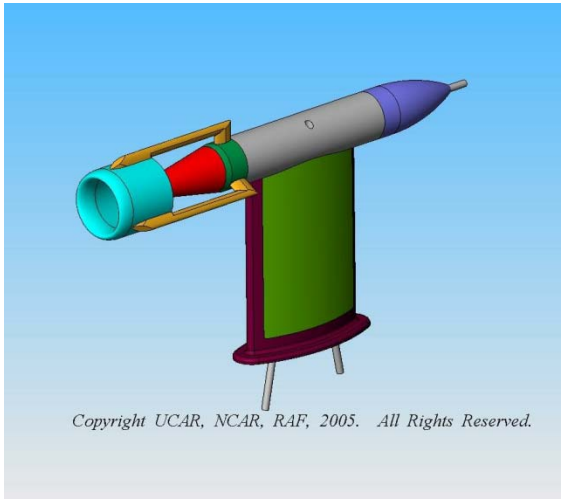
CLH Overview

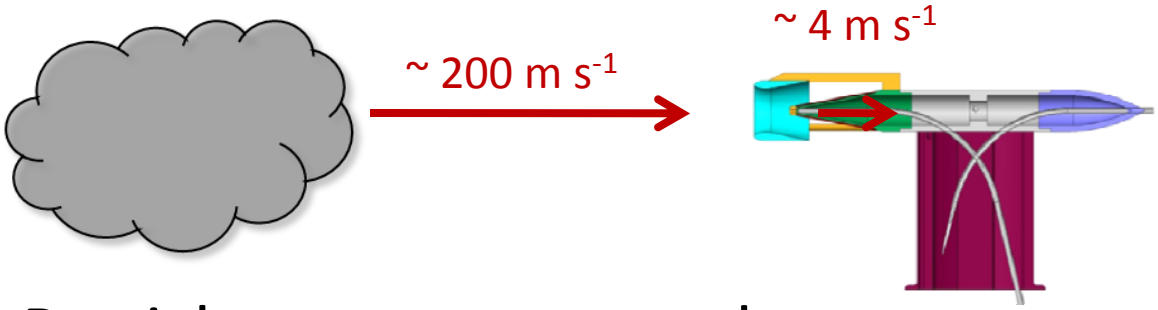
- CLH = Closed-path tunable diode Laser Hygrometer
- **Measures:** Water Vapor / "Enhanced" Total Water → CWC
- **Laser:** 1.38 μm MayComm TDL
- **Measurement Principle:** Direct/2nd harmonic spectroscopy
- **Instrument Specs:**
  - Power/Weight : ~250 W / 35 lb
  - Path length: 27 cm
- **Sampling:** Subisokinetic inlet





CLH Measurement

1. Decelerated air produces particle enhancement



2. Particles are evaporated
3. "Enhanced" Total Water is measured:

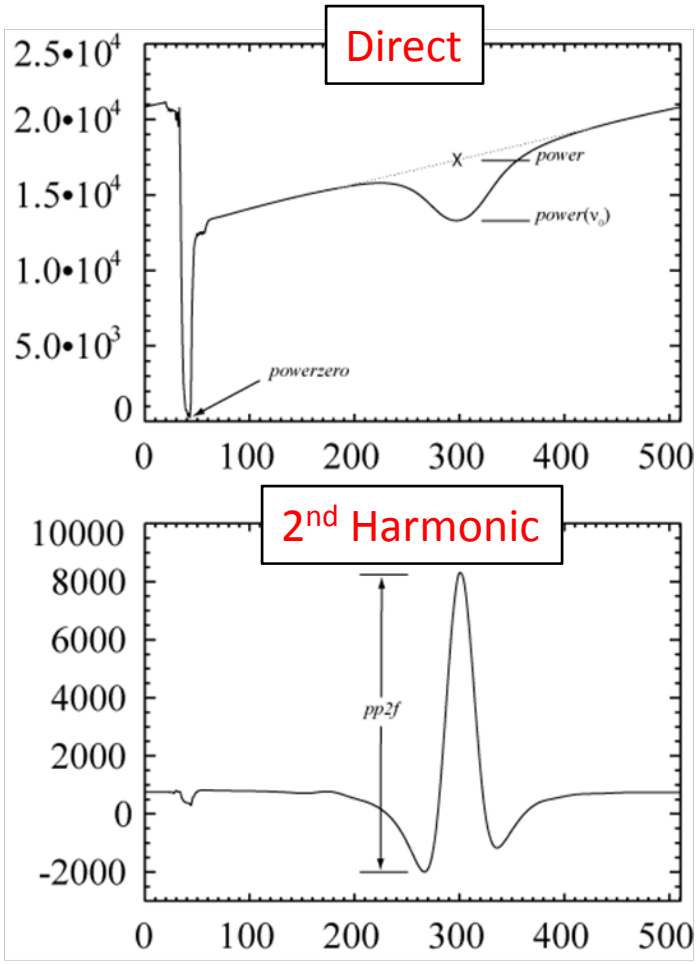
$$eTW = IWC*EF + WV$$

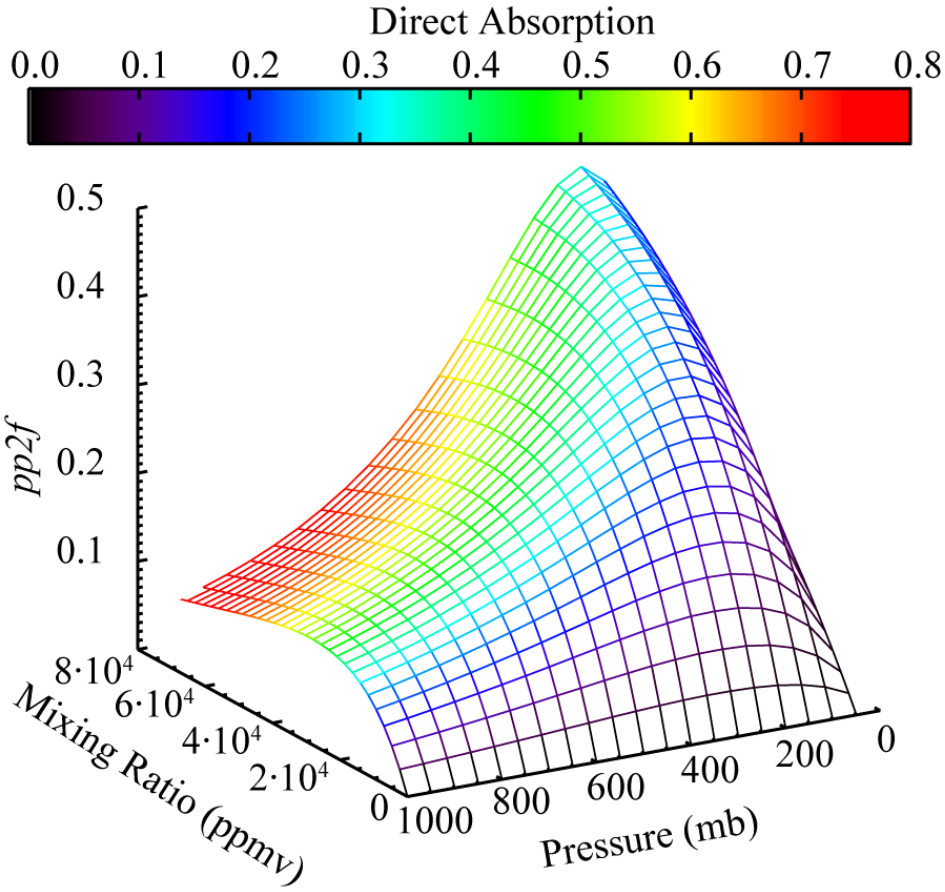
4. IWC is calculated using auxiliary measurements

$$IWC = \frac{eTW - WV}{EF}$$

Water Vapor Measurement

HITRAN Database → Voigt Profile → Synthetic Spectra

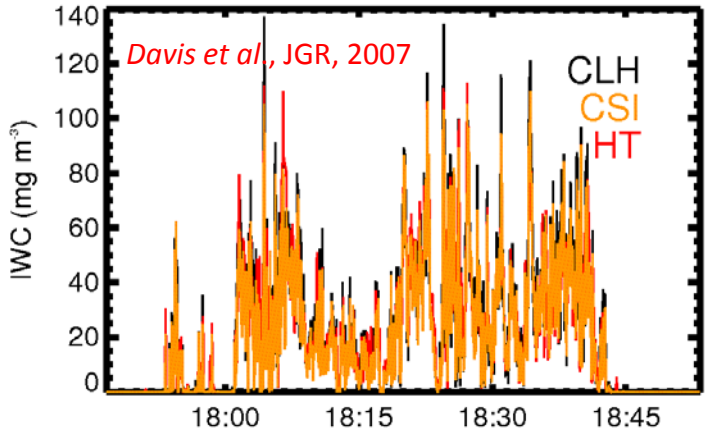




Davis et al., JTECH, 2007

CLH Measurement

- **Sampling Frequency:** 8 Hz
- **Detection Limit:**
  - WV: ~10 ppm
  - IWC: ~0.2 ppm (0.02 mg m^{-3})
- **Precision (@ 1 Hz):**
  - WV: ~1 ppm
  - IWC: ~0.02 ppm (0.002 mg m^{-3})
- **Accuracy (2σ):**
  - ~10 % (water vapor)
  - ~25% (IWC)



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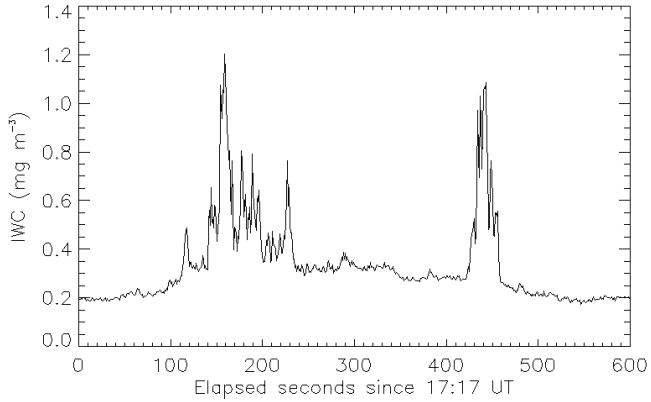

- **References:**

Davis, S.M., Hallar, A.G., Avallone, L.M., and W. Englom, Measurements of Total Water Content with a Tunable Diode Laser Hygrometer: Inlet Analysis, Calibration Procedure, and Ice Water Content Determination, J. Atmos. Ocean Tech.,24, 3, 463-475, 2007.

Davis, S.M., Avallone, L.M., Weinstock, E.M., Twohy, C.H., Smith, J.B., Kok, G.L., Comparisons of in situ measurements of cirrus cloud ice water content, *J. Geophys. Res., 112, doi:10.1029/2006JD008214,* 2007.