Aura meeting, 11 September 2006

Validations using the Cryogenic Frostpoint Hygrometer (CFH)

Holger Vömel

Cooperative Institute for Research in Environmental Sciences

University of Colorado

Acknowledgements

Henry Selkirk, NASA Ames Research Center

Jéssica Valverde Canossa, Universidad Nacional
Juan Valdés, Universidad Nacional
Students of the Universidad Nacional and Universidad de Costa Rica

Werner Stolz, Instituto Meteorológico Nacional
Grace Peng, Aerospace Corporation
J. Andrés Diaz, Centro Nacional de Alta Tecnología

Fumio Hasebe, Hokkaido University
Masatomo Fujiwara, Hokkaido University
Masato Shiotani, Kyoto University

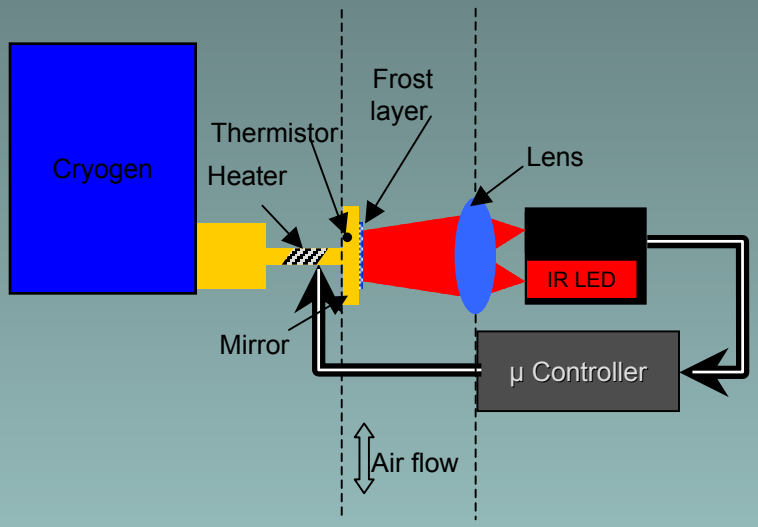
Cornelius Schiller, FZ Jülich

Overview

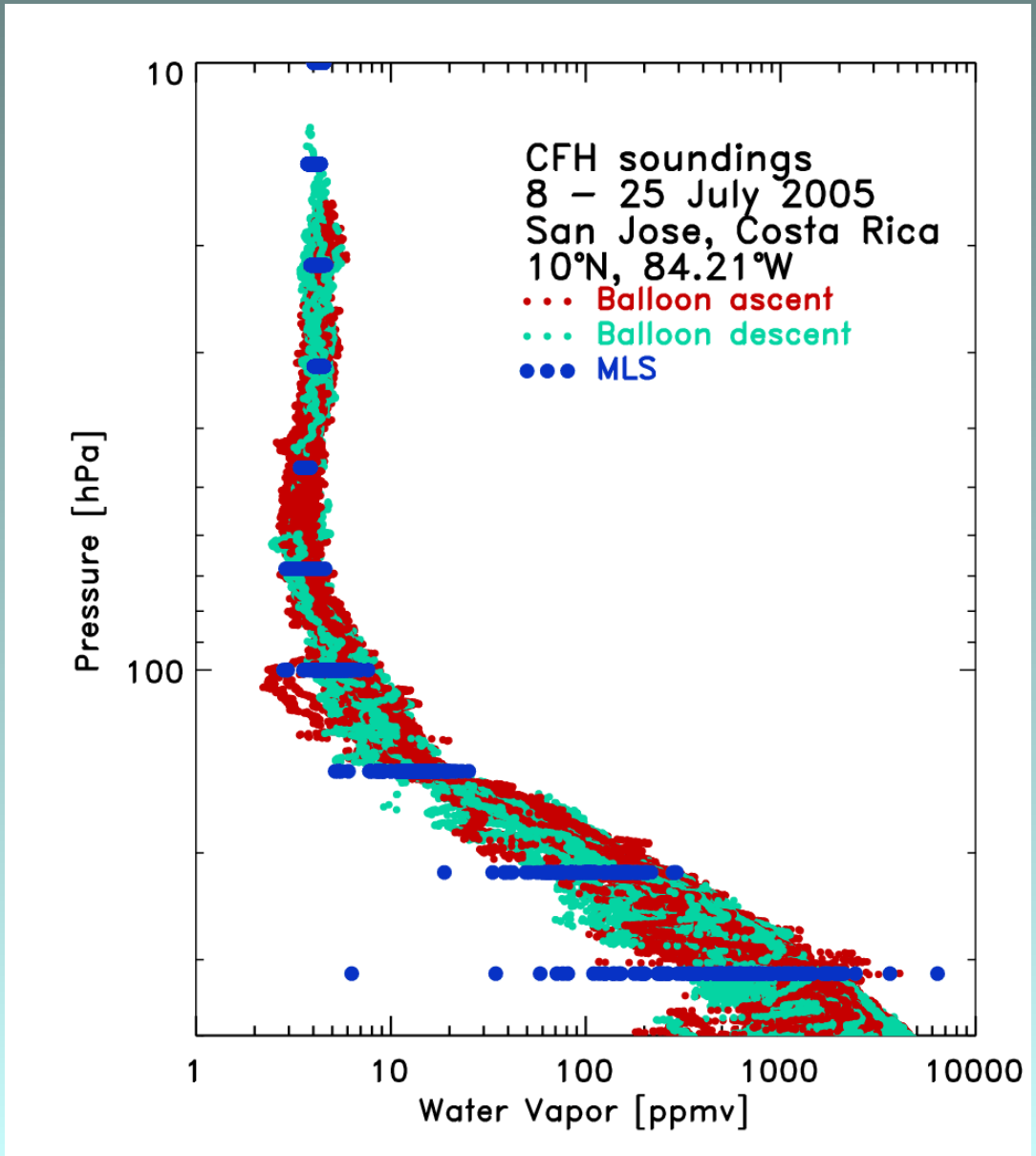
- Update on MLS water vapor validation with version 1.5
- Quicklook at MLS water vapor test version 2.1
- Comparison of Hygrometers
- Vaisala RS92 update

Cryogenic Frostpoint Hygrometer (CFH)

- Absolute measurement
- Vertical Range: surface to ~28 km
  (surface to ~25 km on ascent)
- Uncertainty: troposphere: > 4% MR
  stratosphere: ~ 9 %
- Microprocessor control
- Phase sensitive detector:
  electronic sunlight filter
- Weight: ~ 400 gr
- Payloads carry ECC ozone sonde and Vaisala RS80
- ~170 soundings so far

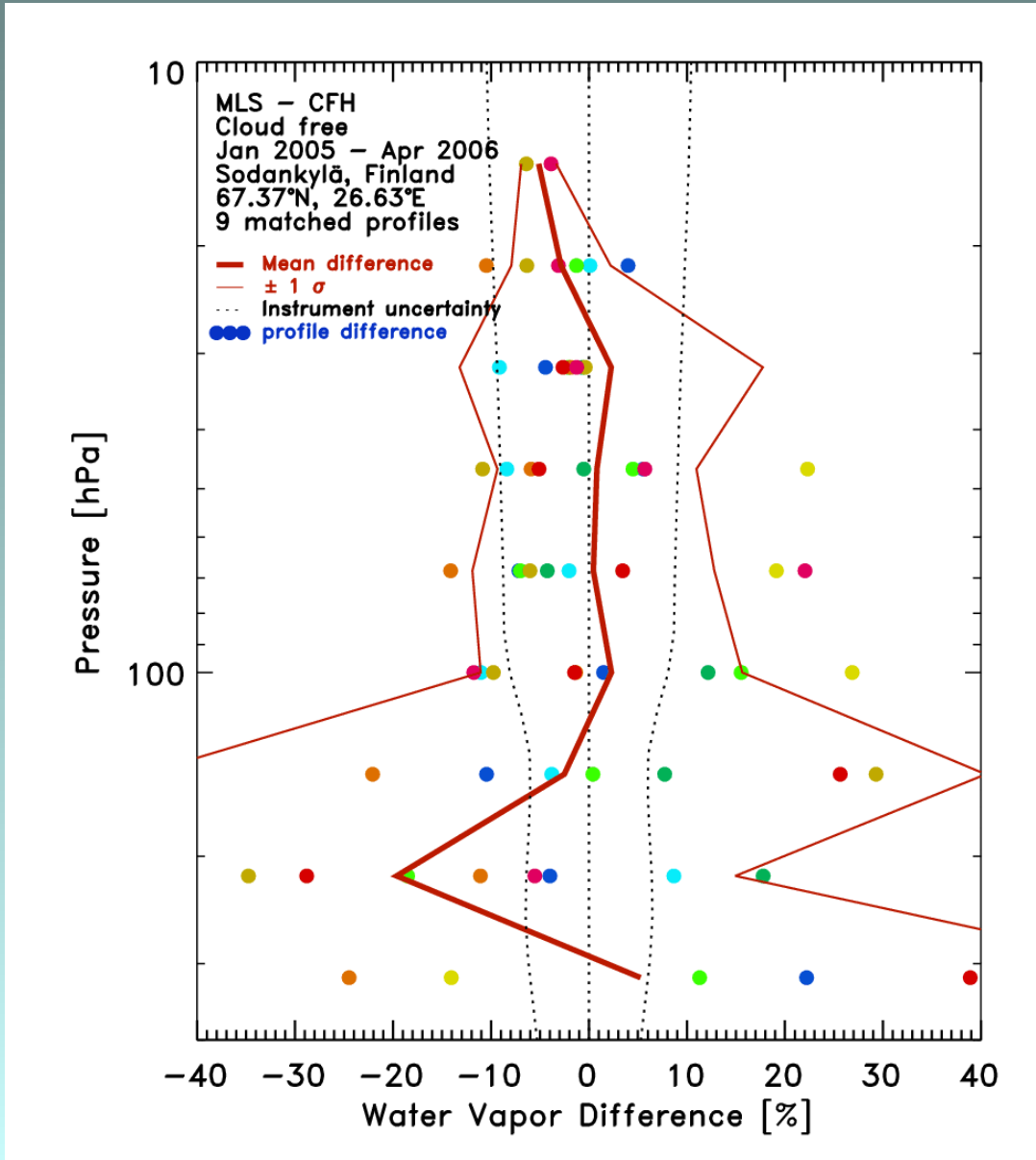


Satellite comparison

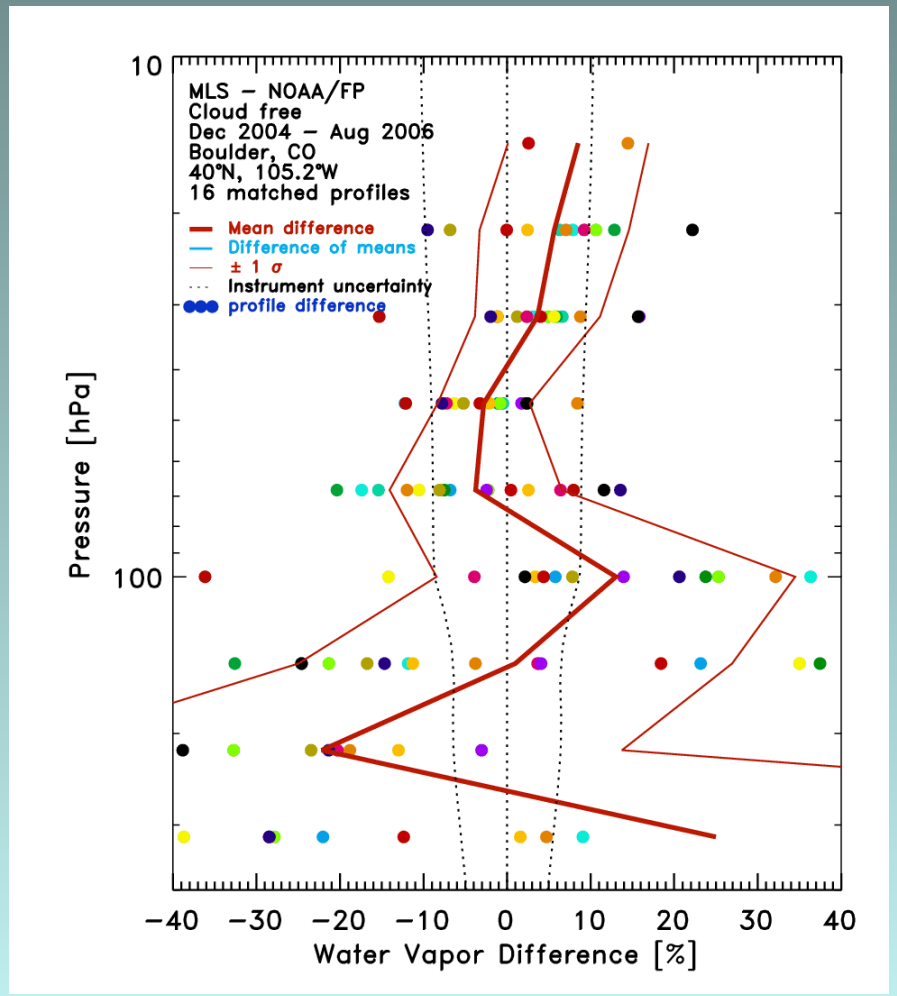


Validation of MLS version 1.5 water vapor

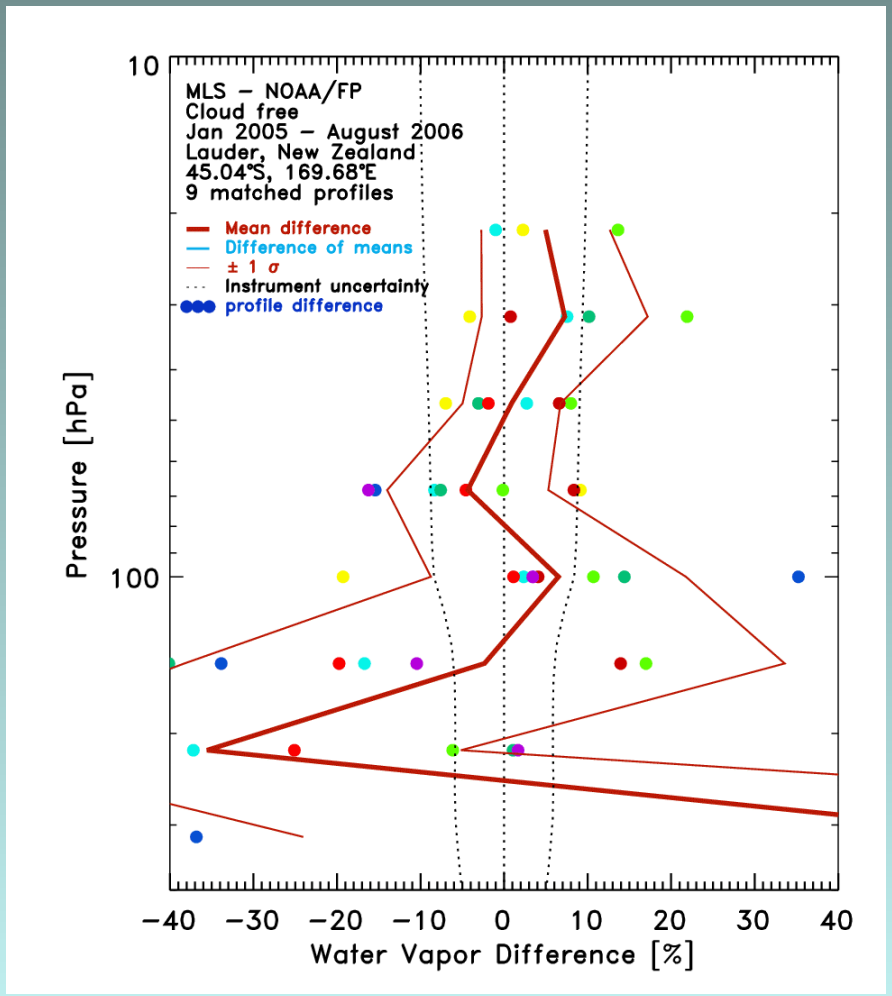
MLS Comparison: Arctic winter



MLS Comparison: Mid latitudes



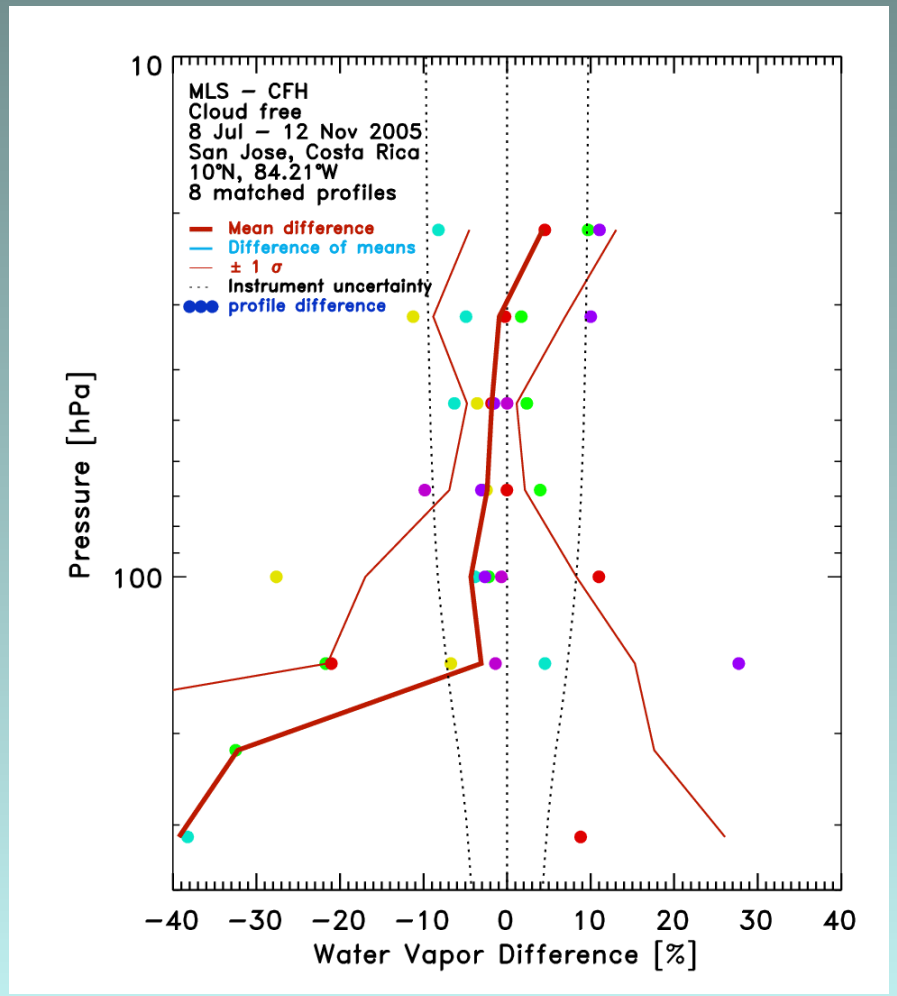
Boulder, CO

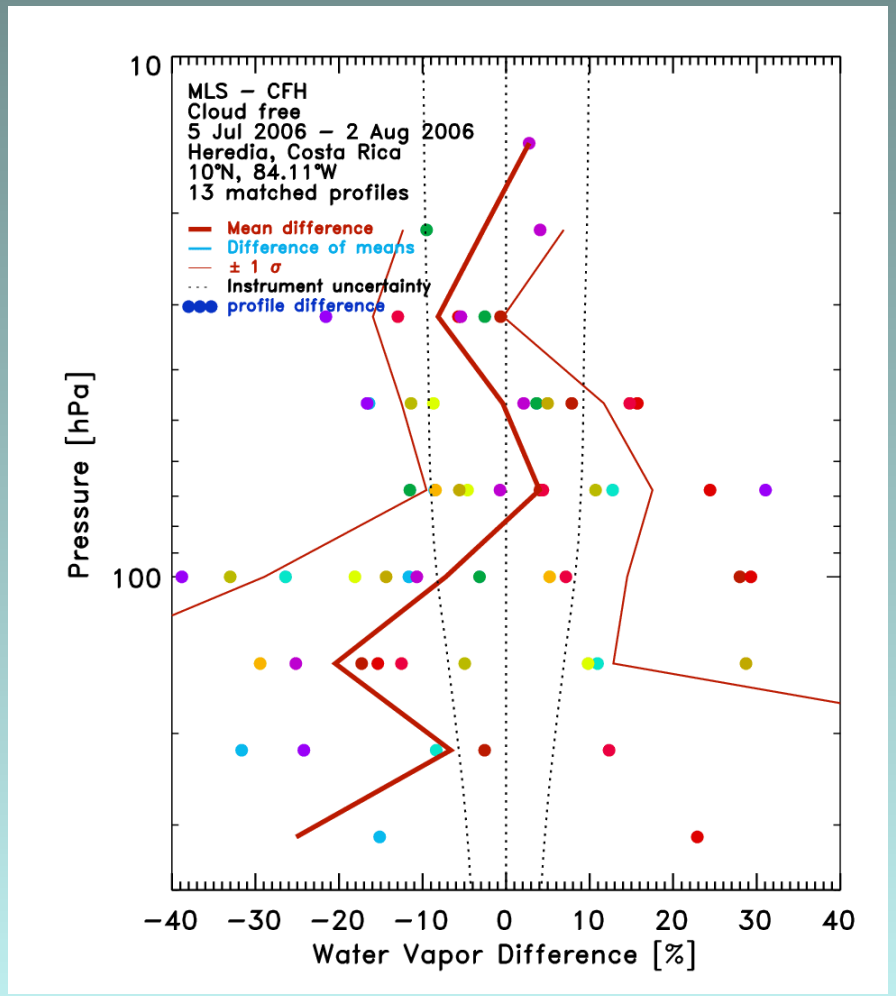


Lauder, NZ

MLS Comparison: Tropics

Costa Rica : July



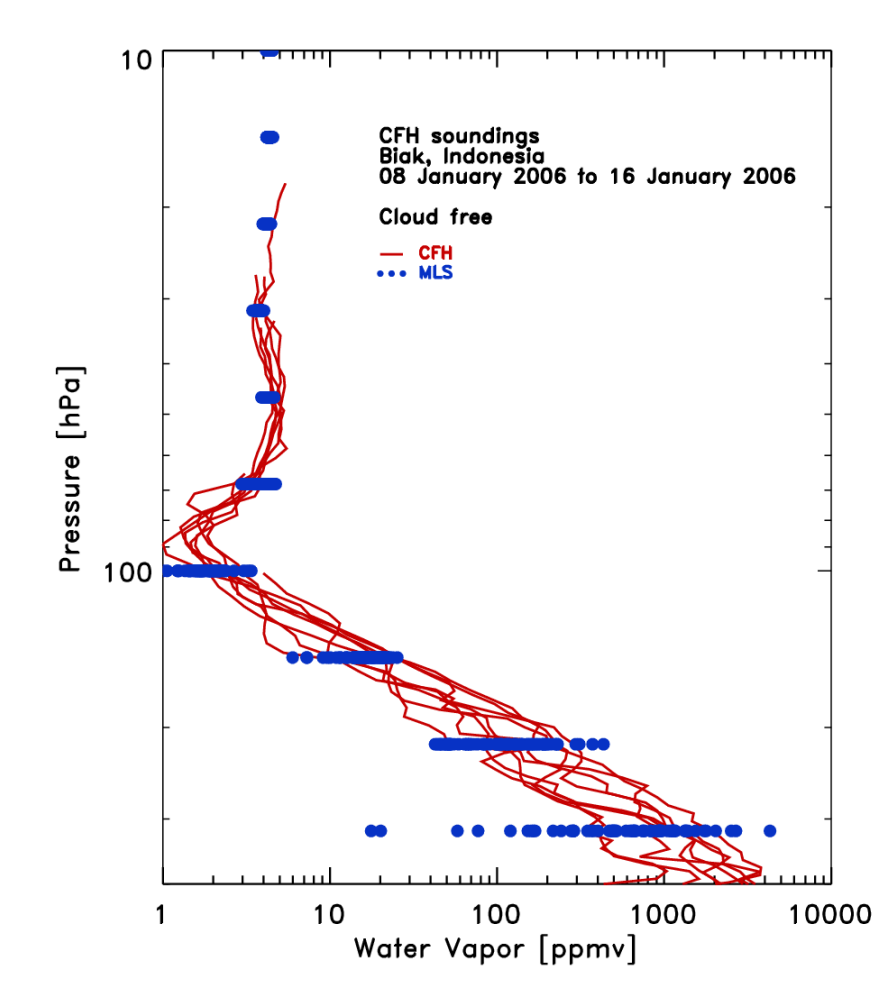


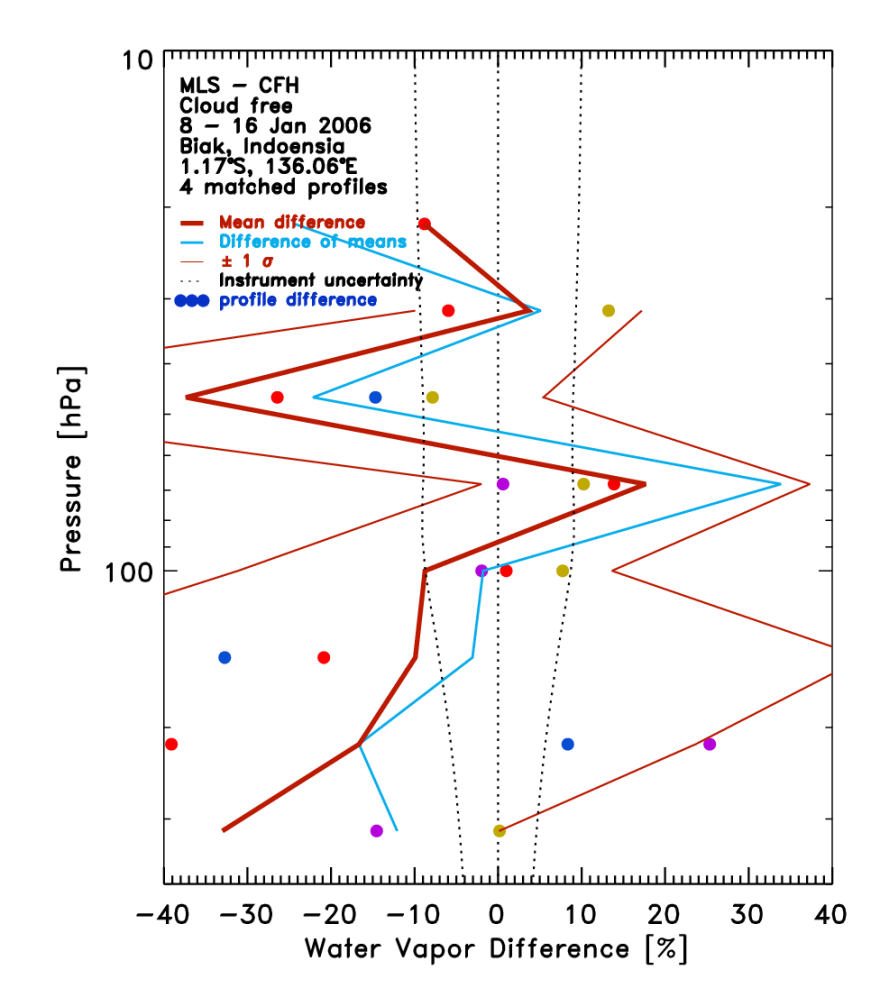
July 2005

July 2006

MLS Comparison: Tropics

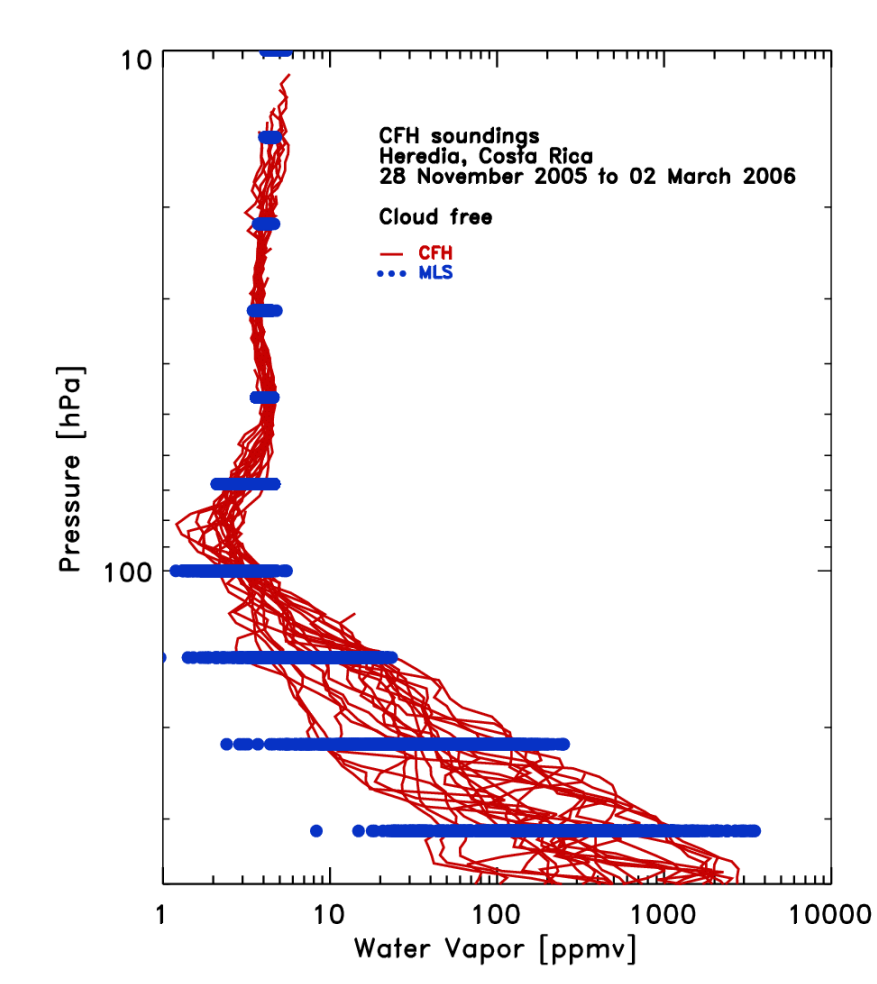
Biak Indonesia: Jan 2006

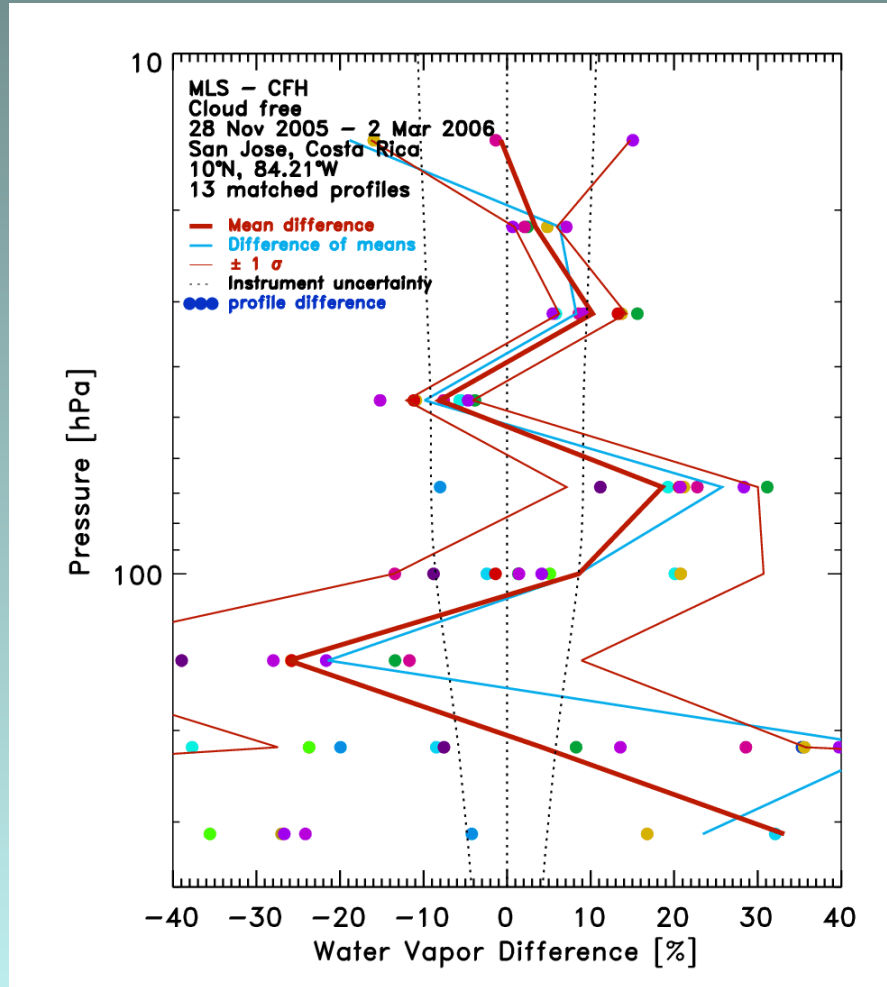




MLS Comparison: Tropics

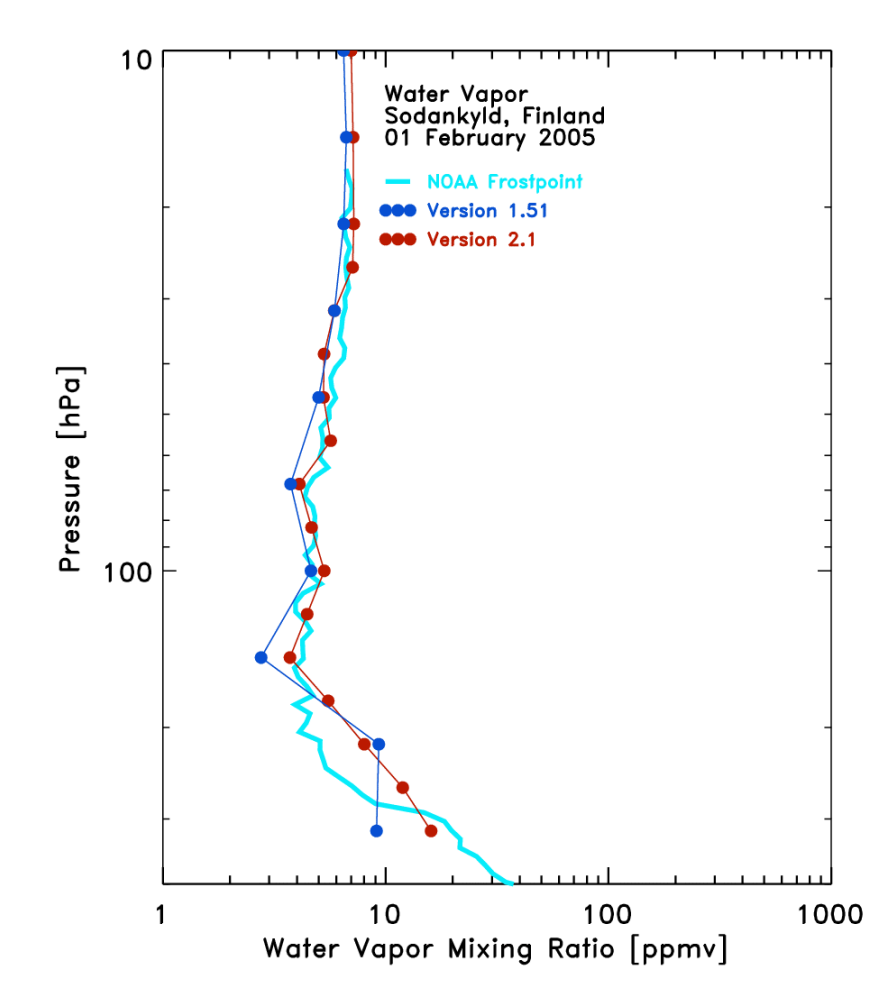
Costa Rica AVE Jan/Feb 2006

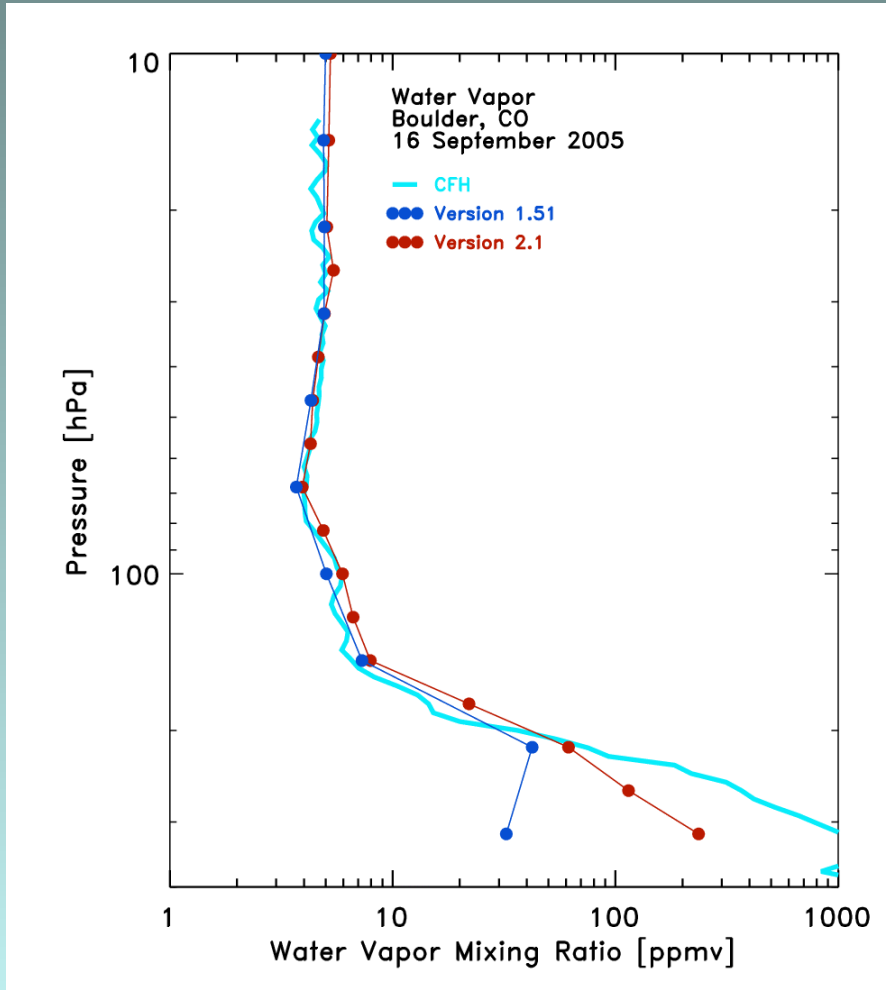




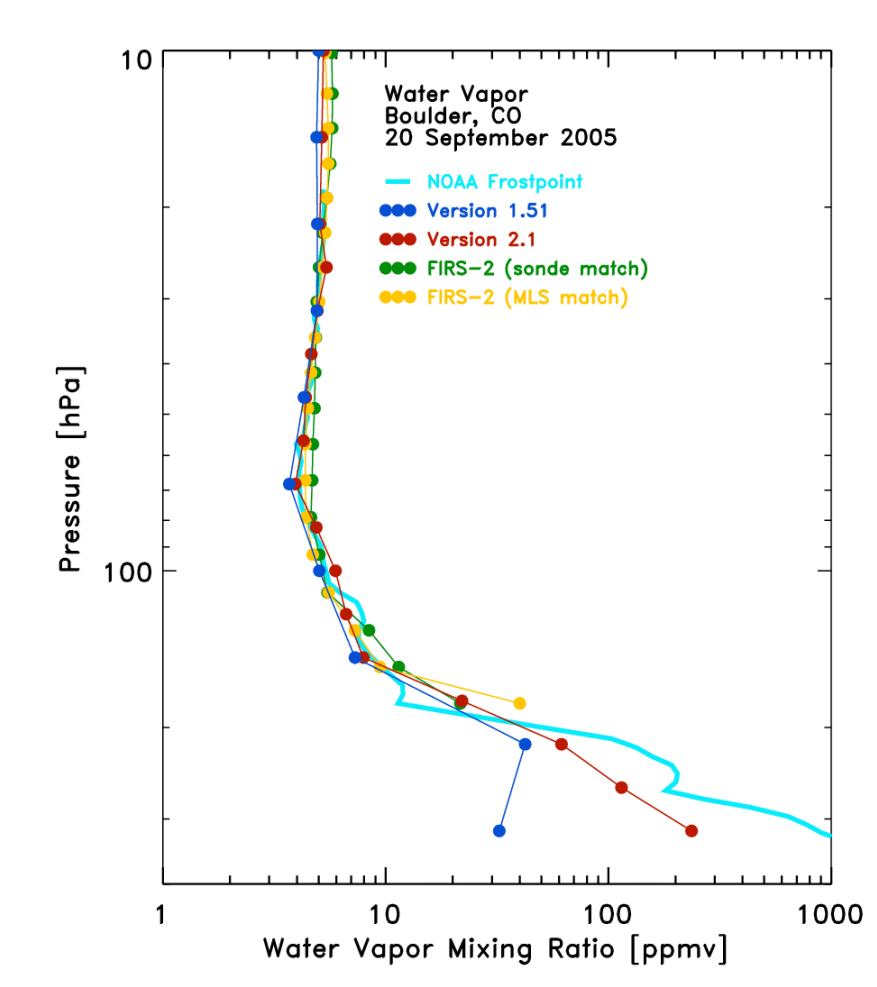
Comparison of versions 1.5 and 2.1

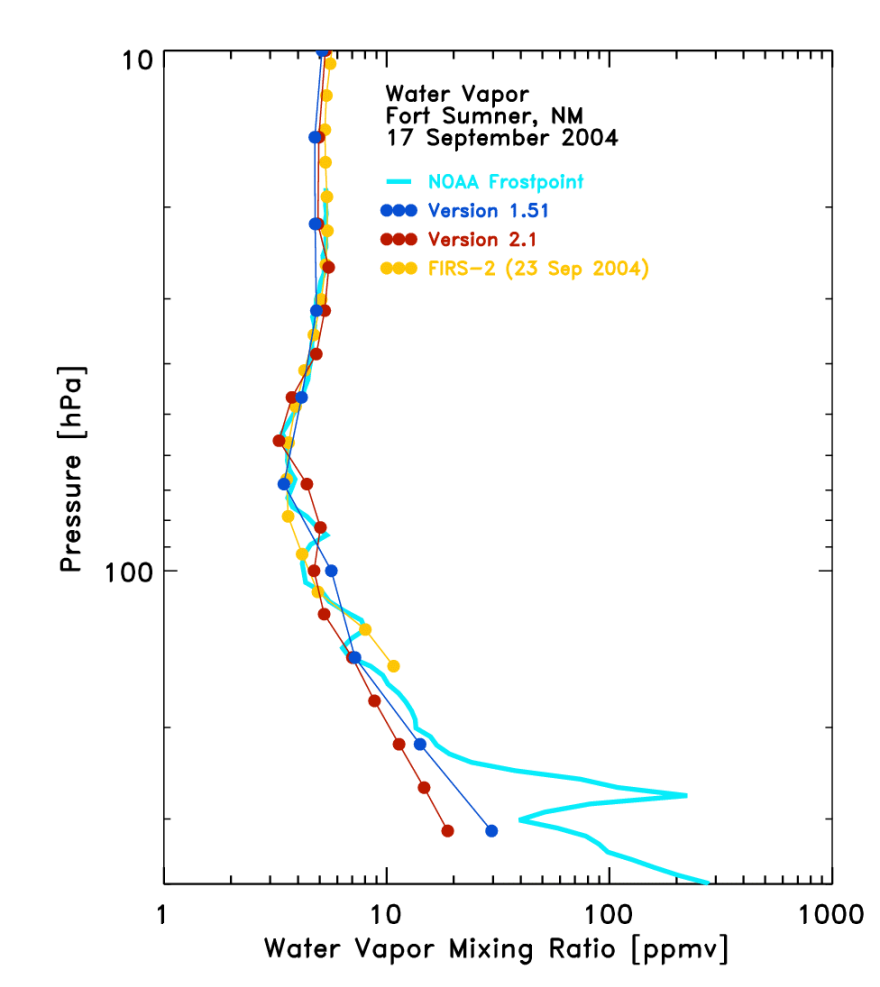
Sondakylä & Boulder example



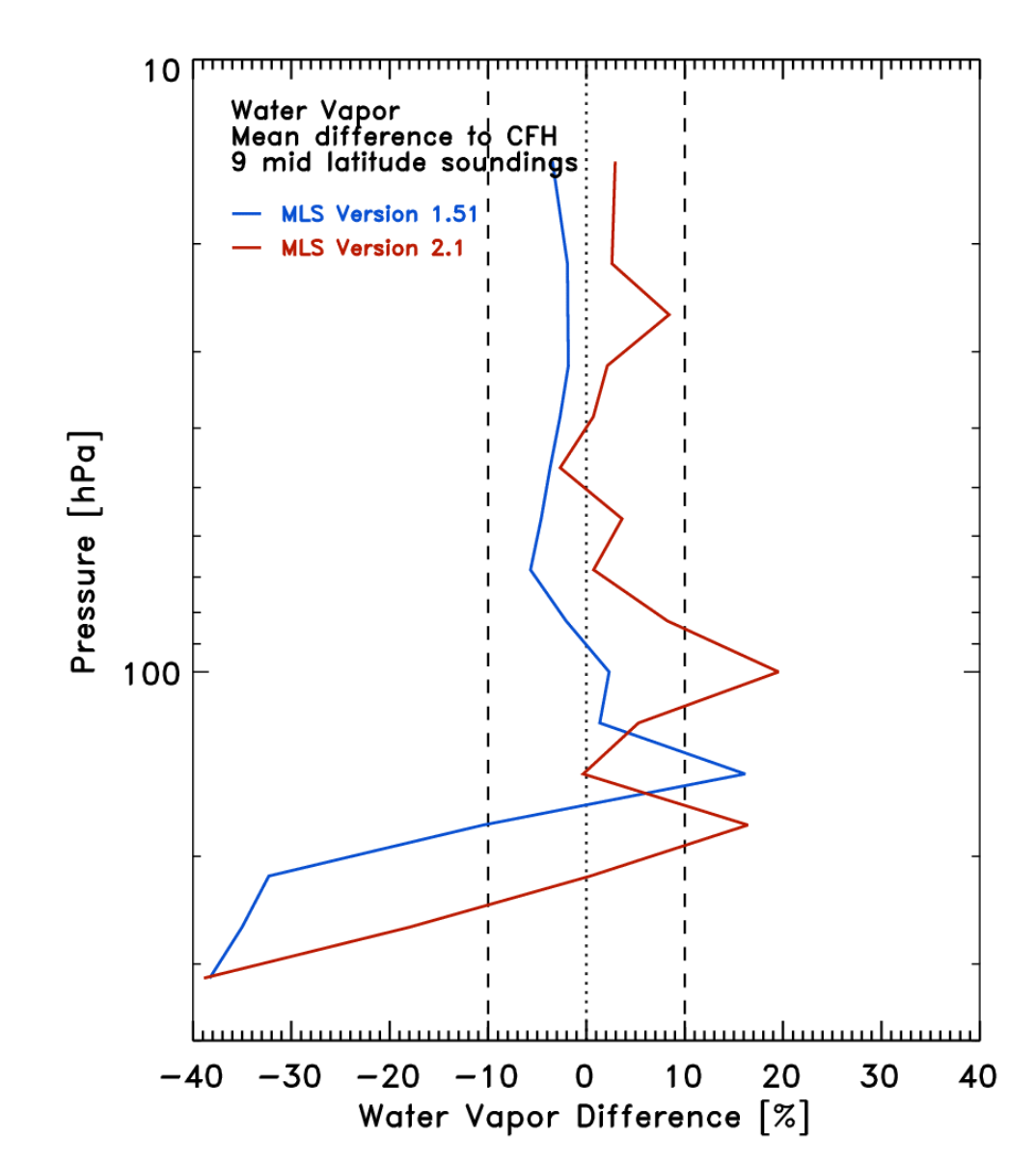


Comparison with FIRS-2





Average difference from CFH: version 1.5 & 2.1

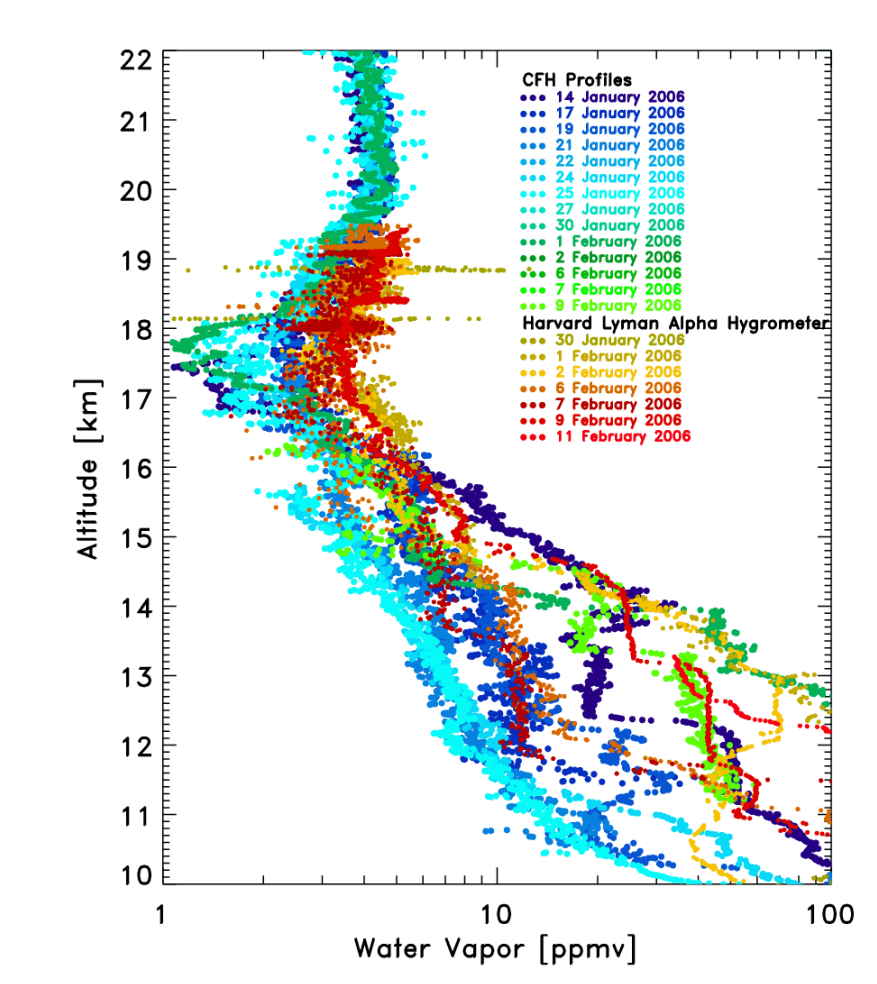


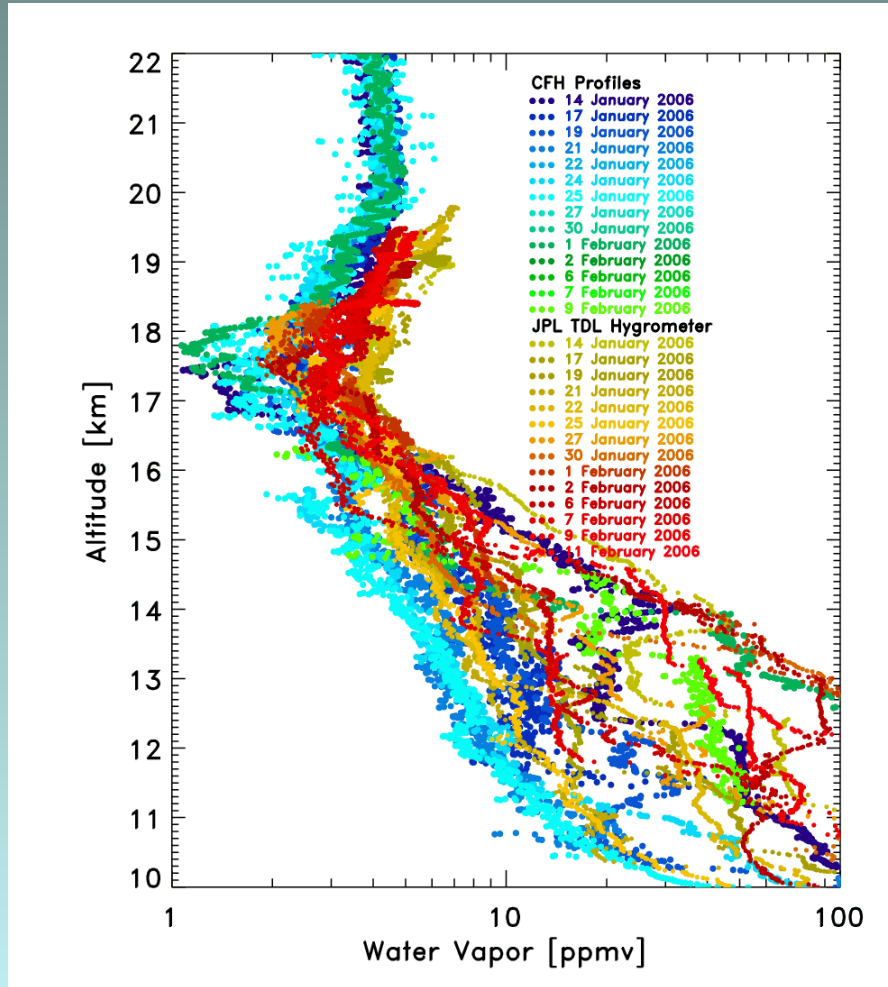
Mid and high latitudes only

Comparison between CFH and aircraft

January/February 2006

WB57 and CFH profiles

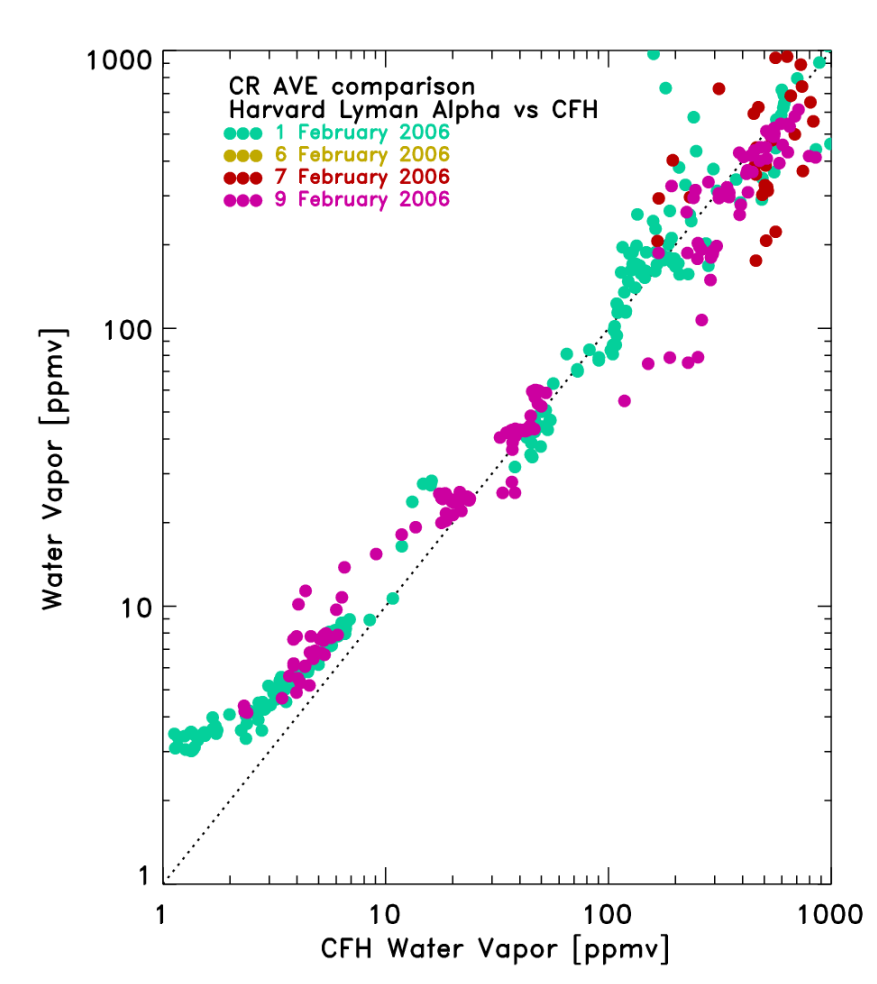


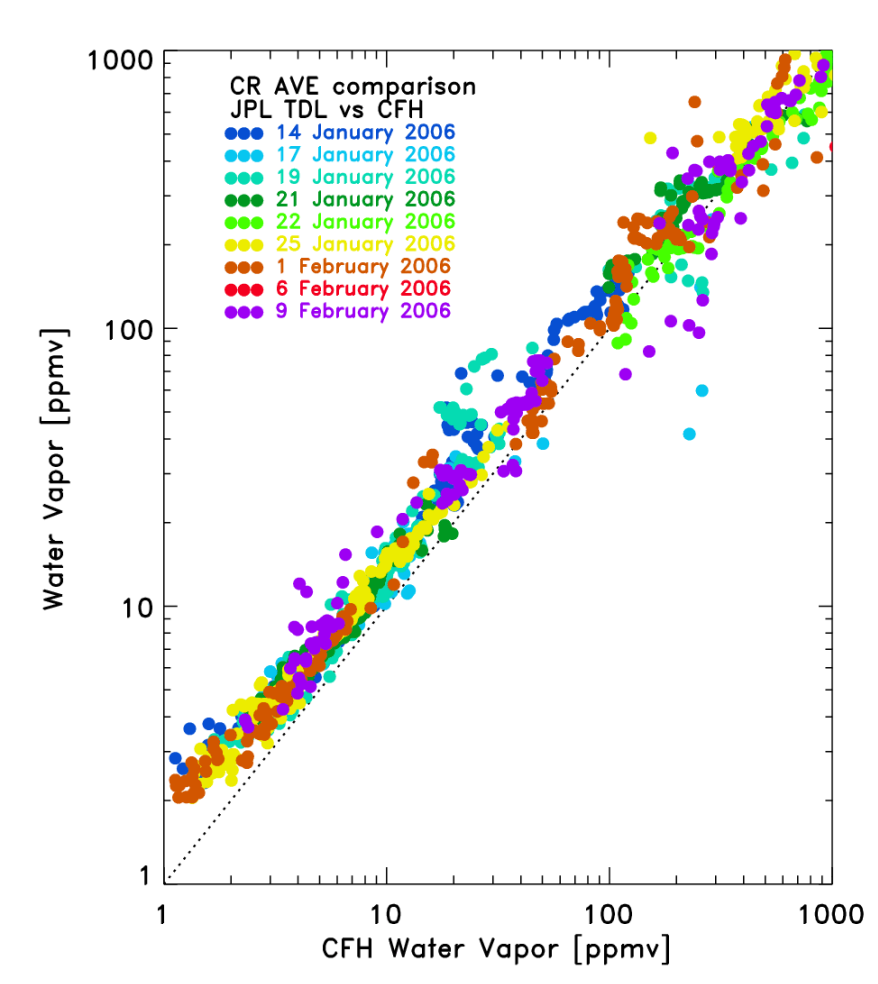


Harvard Ly-alpha

JPL TDL

CFH Correlations

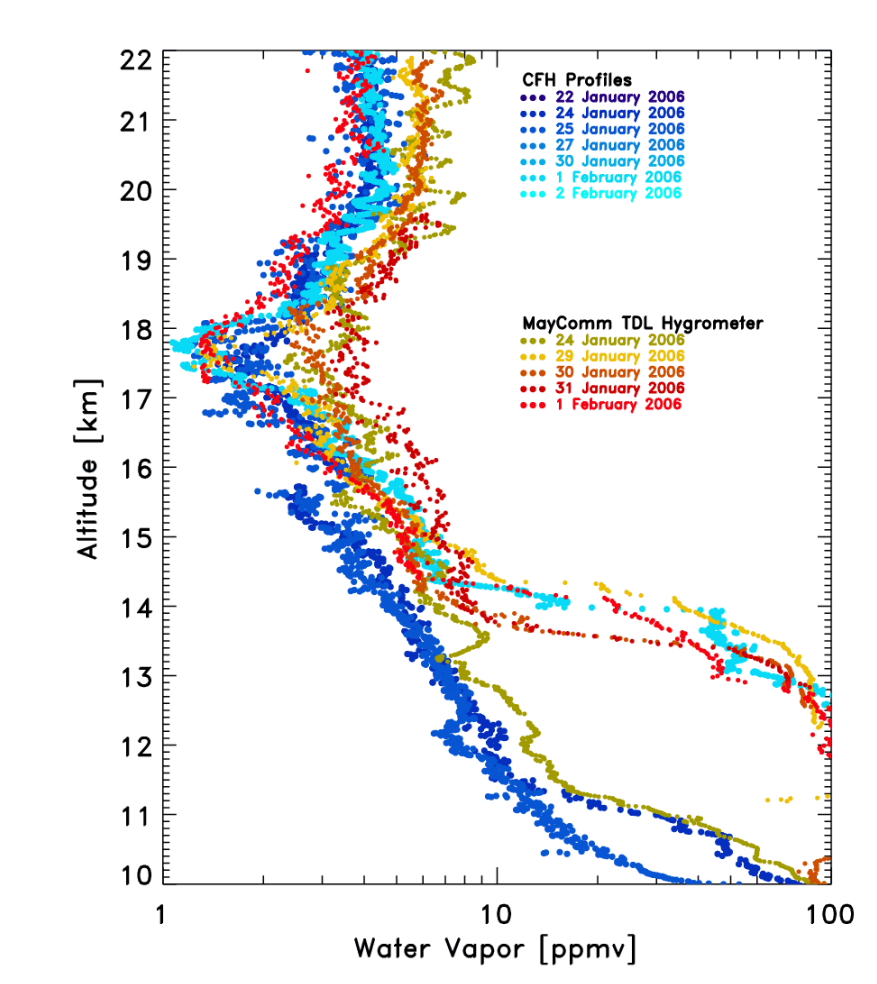


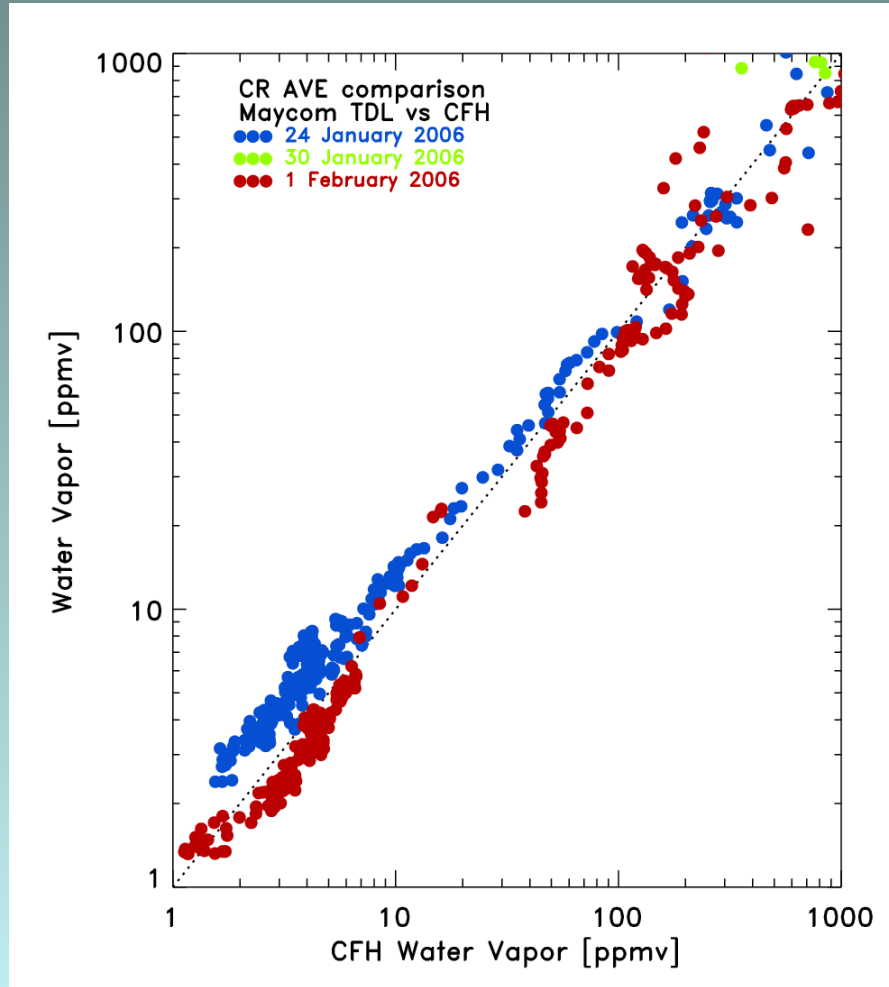


Harvard Ly-alpha

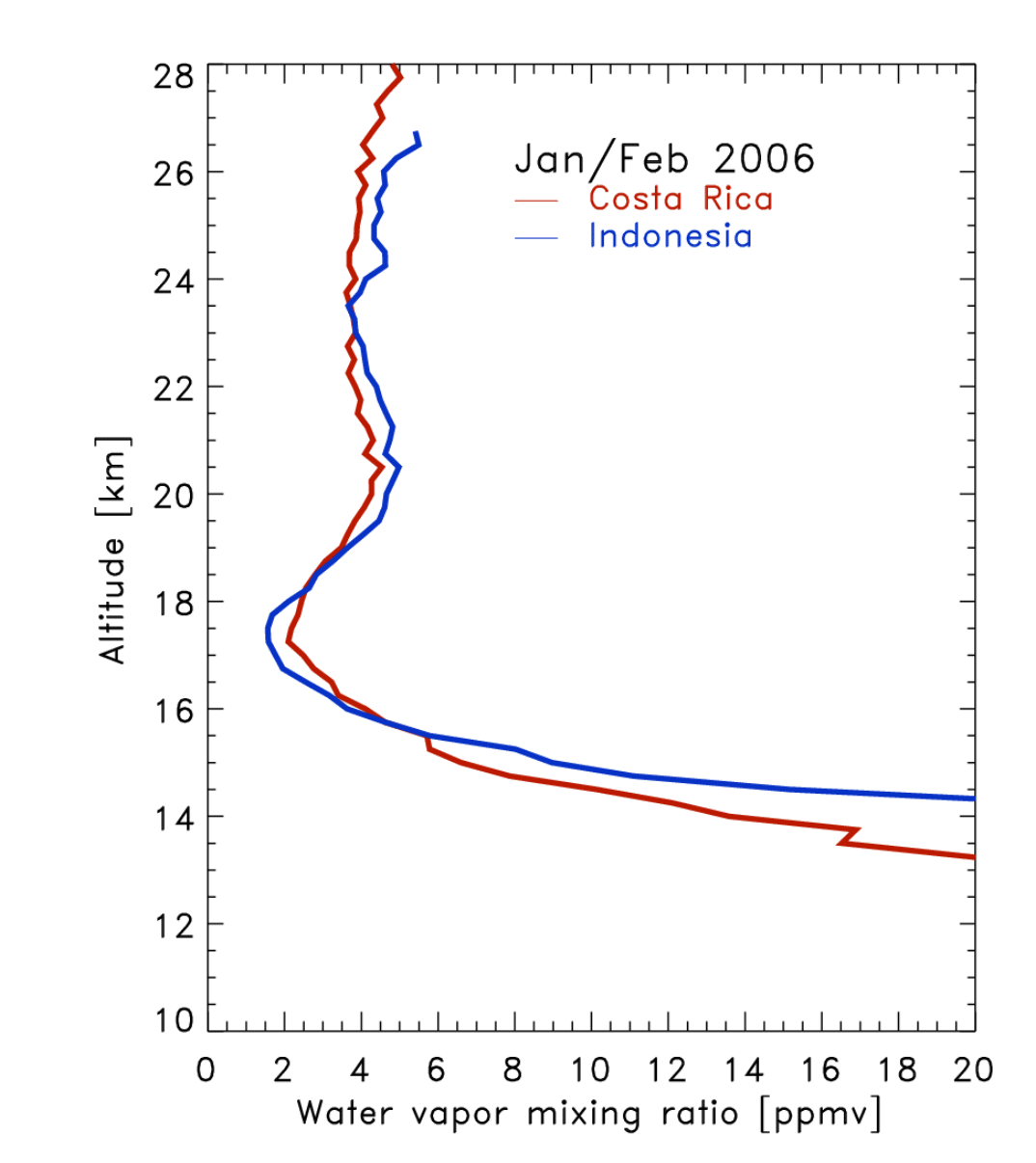
JPL TDL

CFH Correlation MayComm balloon borne TDL





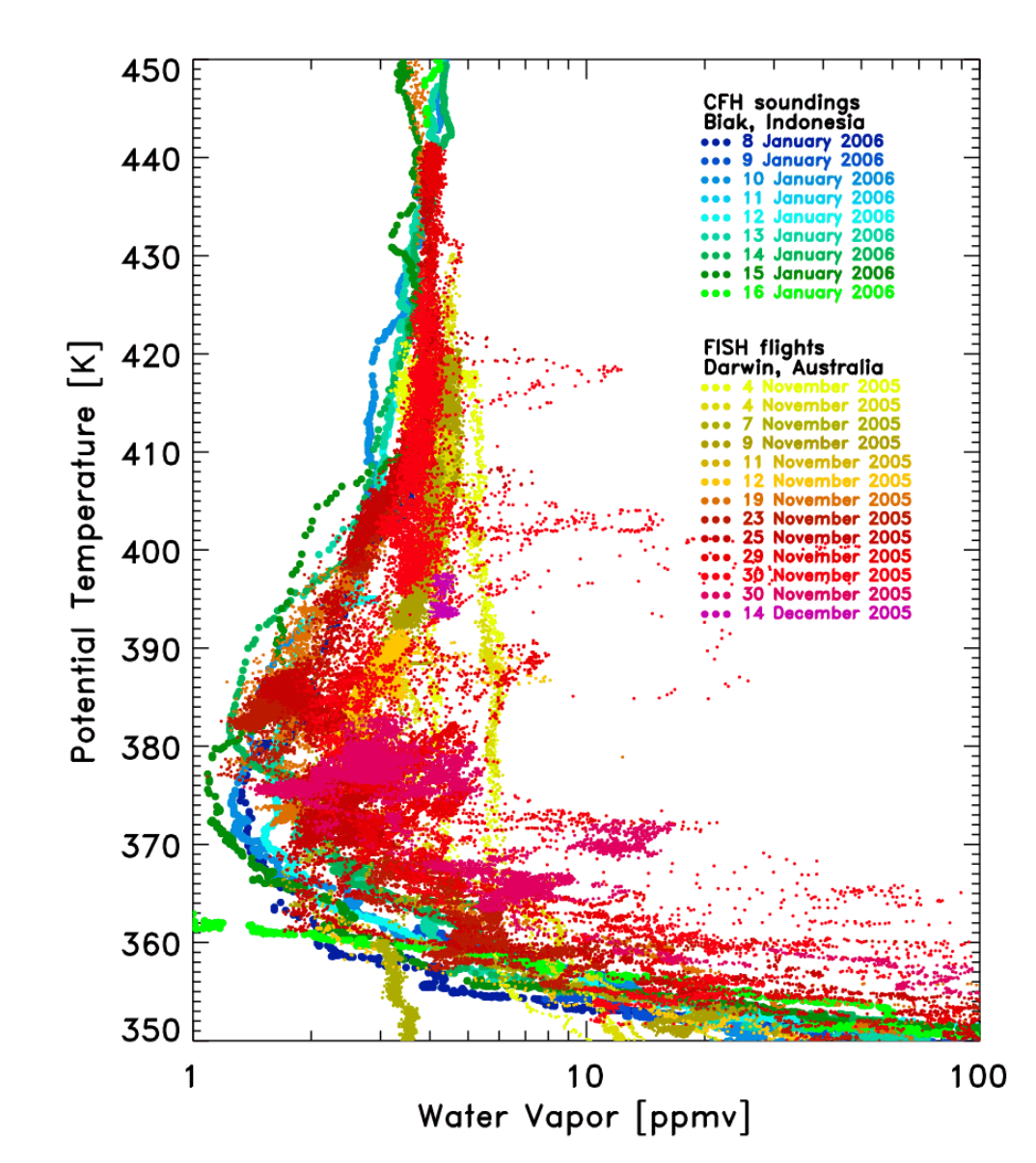
CR-AVE and SOWER/Biak comparison



Average CFH profile at Costa Rica 10.0°N, 84.1°W 4 Jan – 4 Mar 2006

Average CFH profile at Biak Indonesia 1.2°S, 136.1°E 8-16 Jan 2006

Geophysica and CFH profiles



CFH profiles at

Biak Indonesia

1.2°S, 136.1°E

8-16 Jan 2006

FISH total water

profiles at

Darwin, Australia

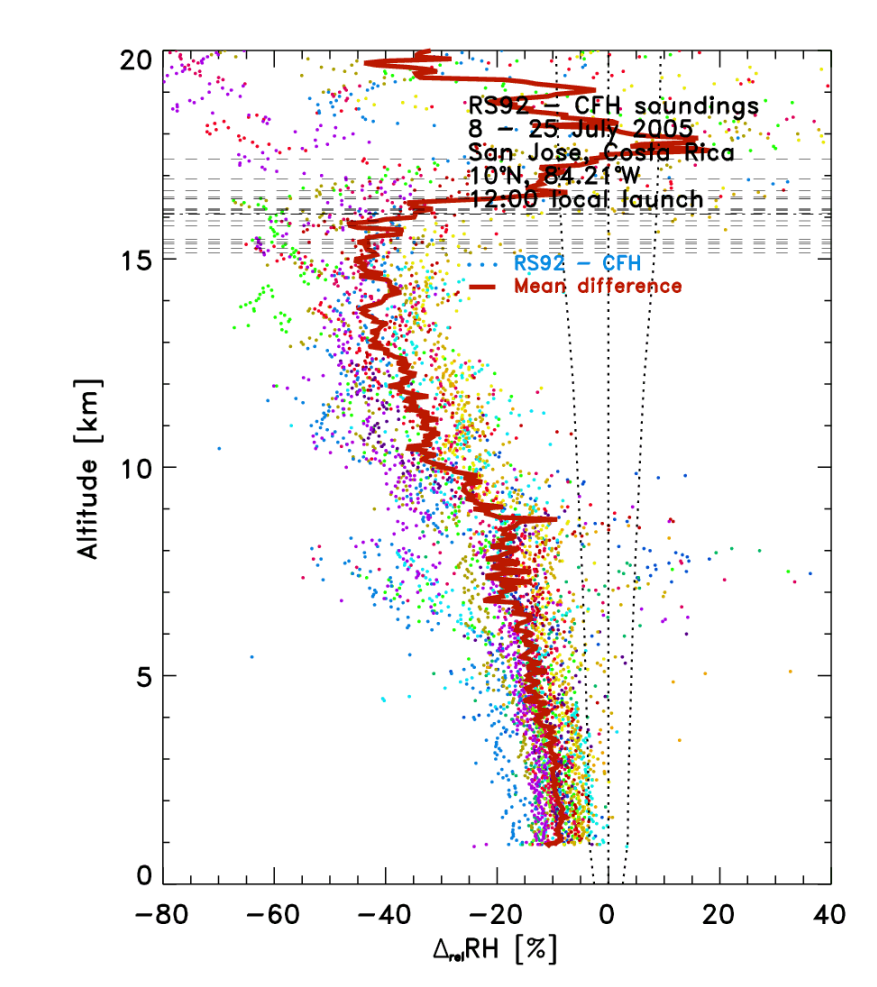
12°S, 131°E

4 Nov – 14 Dec 2005

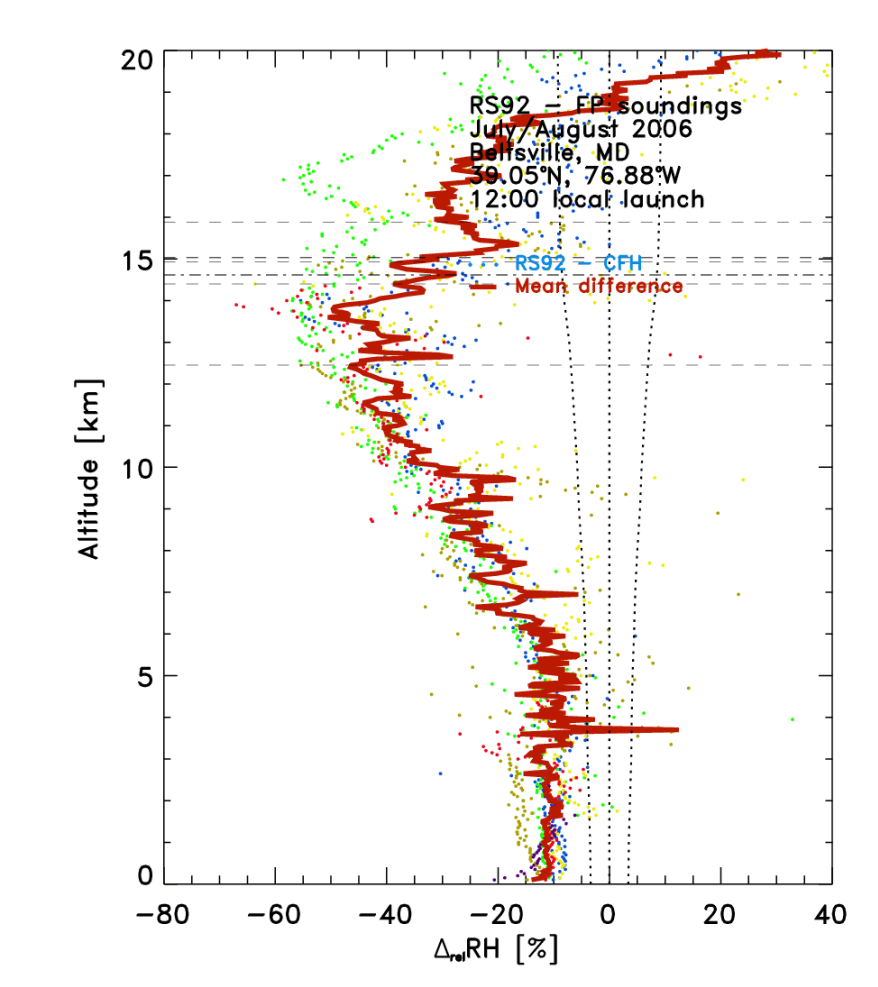
Data courtesy C. Schiller

Daytime comparisons between CFH and Vaisala RS92

Relative RH difference RS92 - CFH



Costa Rica Jul 2005



Beltsville, MD Jul 2006

Summary

- Stratospheric MLS water vapor:
  Agreement within measurement uncertainty for both version 1.5 and 2.1
- Except for tropical tape recorder during boreal winter

- Tropospheric MLS water vapor:
  Version 2.1 improves general shape in UT,
  but still very dry and highly variable

- WB57 instruments are too wet compared to CFH;
  no serious disagreements between CFH and other balloon or Geophysica instruments

- Vaisala RS92 relative humidity during daytime still up to 50% too dry (same as last year)

Aura meeting, 11 September 2006

Validation of AURA/MLS water vapor observations using the Cryogenic Frostpoint Hygrometer (CFH) and comparisons with aircraft water vapor instruments and Vaisala RS92

Holger Vömel

Cooperative Institute for Research in Environmental Sciences

University of Colorado