

*Howard University
Beltsville Research Campus*

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Acknowledgment:

Howard: *Drs. W. Low, D. Venable, E. Joseph, M. Adam at Howard University;*

NASA : *Drs. D. Whiteman, T. McGee, B. Gentry, F. Schmidlin*

NCAS: *All the graduate students who worked at Beltsville*

NWS: *J. Facundo; J. Fitzigbins, C. Bower, J. Ashby, R Ryan, and all others*

PSU (A. Thompson); **NCAR** (L. Miloshevich); **NOAA** (H. Vomel); **UMBC** (Hoff, Delgado)

All the once I have forgotten - apologies

Outline

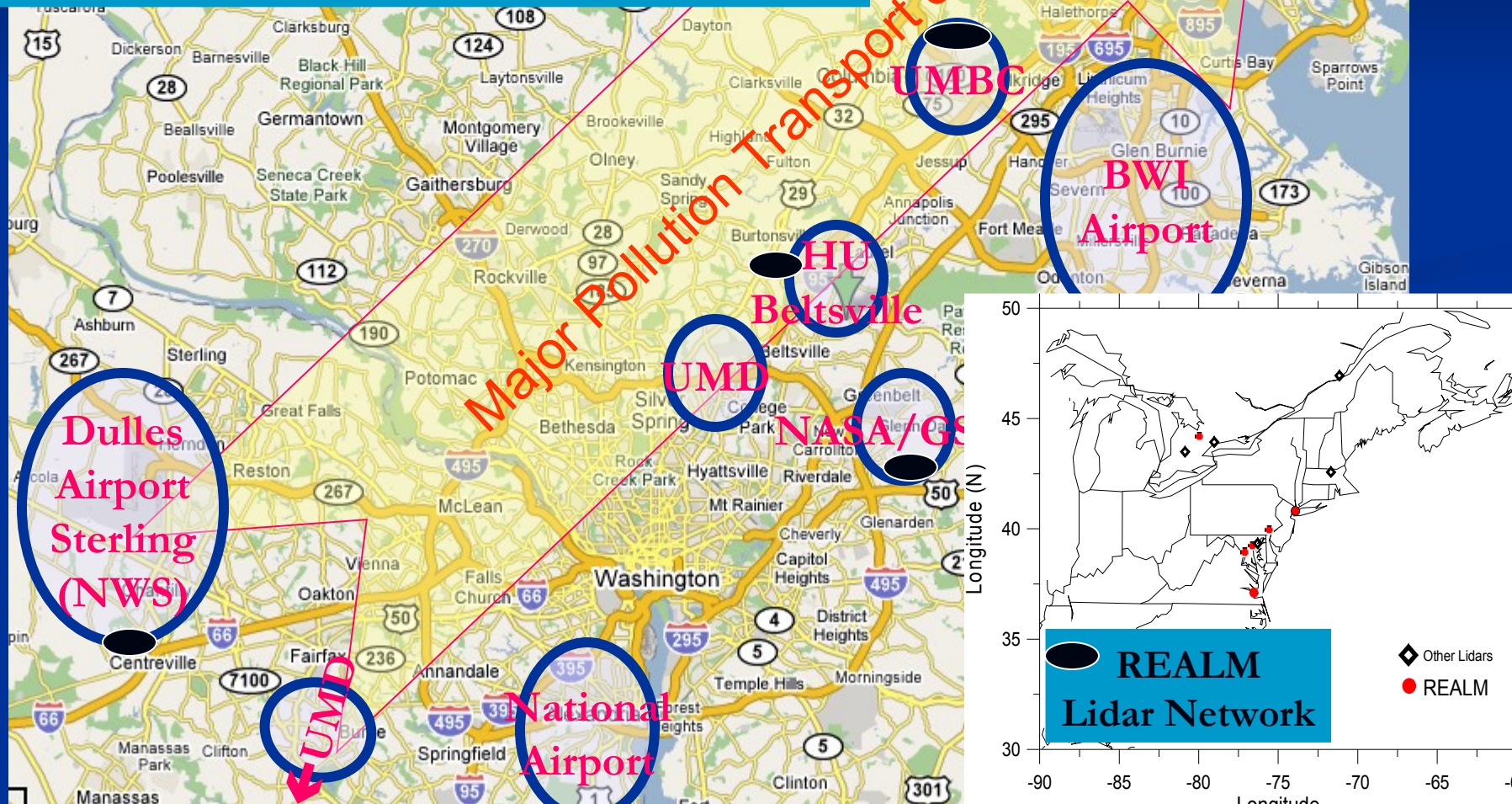
- **HU-Beltsville Research Campus (HUBRC):**
 - *HUBRC: Broad goals that we operate under*
 - *HUBRC: Location and Instrumentation*
- **Examples of research at HU-BRC:**
 - *HUBRC: Major collaborations*
 - *HUBRC: As a reference site and technology test bed*
 - (Examples of work in progress)*
 - *Operational radiosonde technology testing (NWS)*
 - *Sond-to-sonde comparisons tests (NWS, NASA)*
 - *Radiosonde-satellite comparison (NASA)*
 - *Satellite-satellite-Sonde comparisons (NASA)*
 - *Towards a “Consensus referencing” methods - redundancy*
- **Summary: HUBRC potential as a GRUAN site**

Broad Goals of Beltsville Field Site

- Enhance the capacity of HU to conduct research
- Contribute to national and international climate and environmental monitoring activities
- Facility for hands-on student training in instrumentation and atmospheric observation

HUBRC: location, Uniqueness of Site

- Semi-urban site (not “pristine”)
- Major Pollution corridor
- Integrate Science and Education
- Extensive instrumentation
- Great place for collaboration



Aerial View of Site

Latitude: +39° 03' 15.117"
Longitude: -76° 52' 39.448"
Elevation: 53.2 m

Office/Shops/Labs



C-Band Radar



Profiler

MDE



Full Air Quality

Rad. (~BSRN)

GPS (X2)
Ceilometer
MWR
All Sky



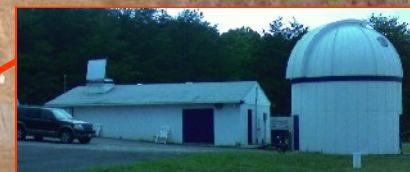
8-levels T/RH
Flux, Net rad
Soil Moisture
Chemistry

PDB
RSOS
CORS



HURL
ALVIS
AT/STROZ
GLOW
Ceilometer

Lidar Laboratory



31 Met Tower

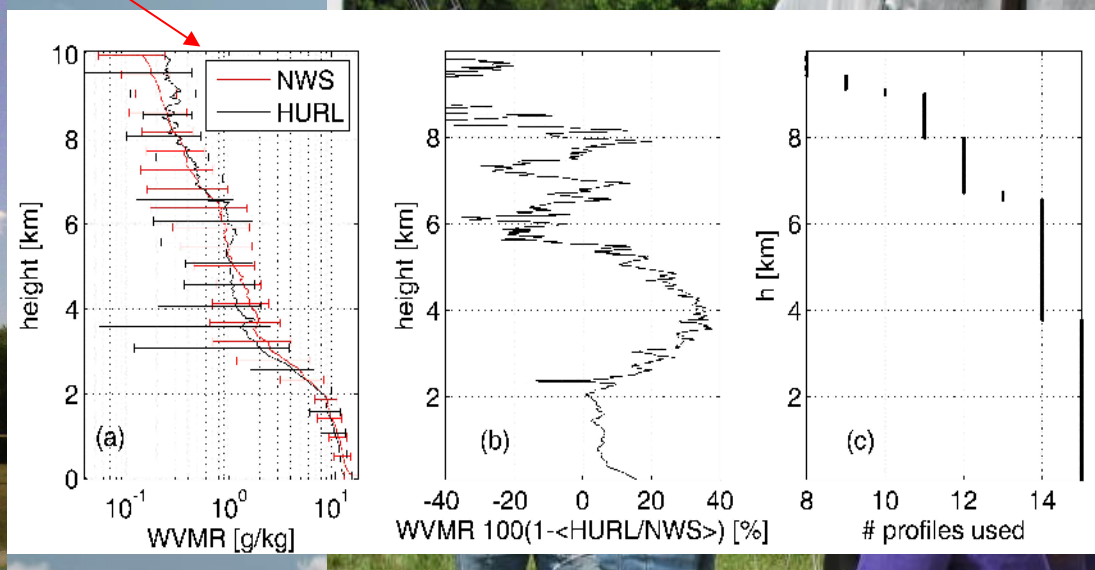
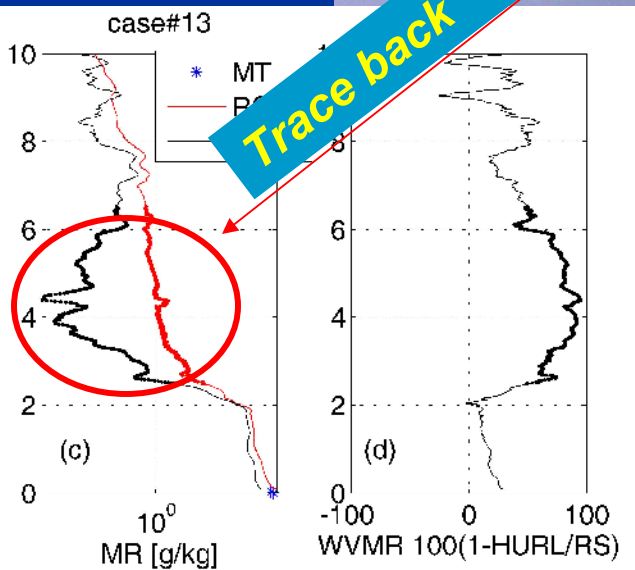
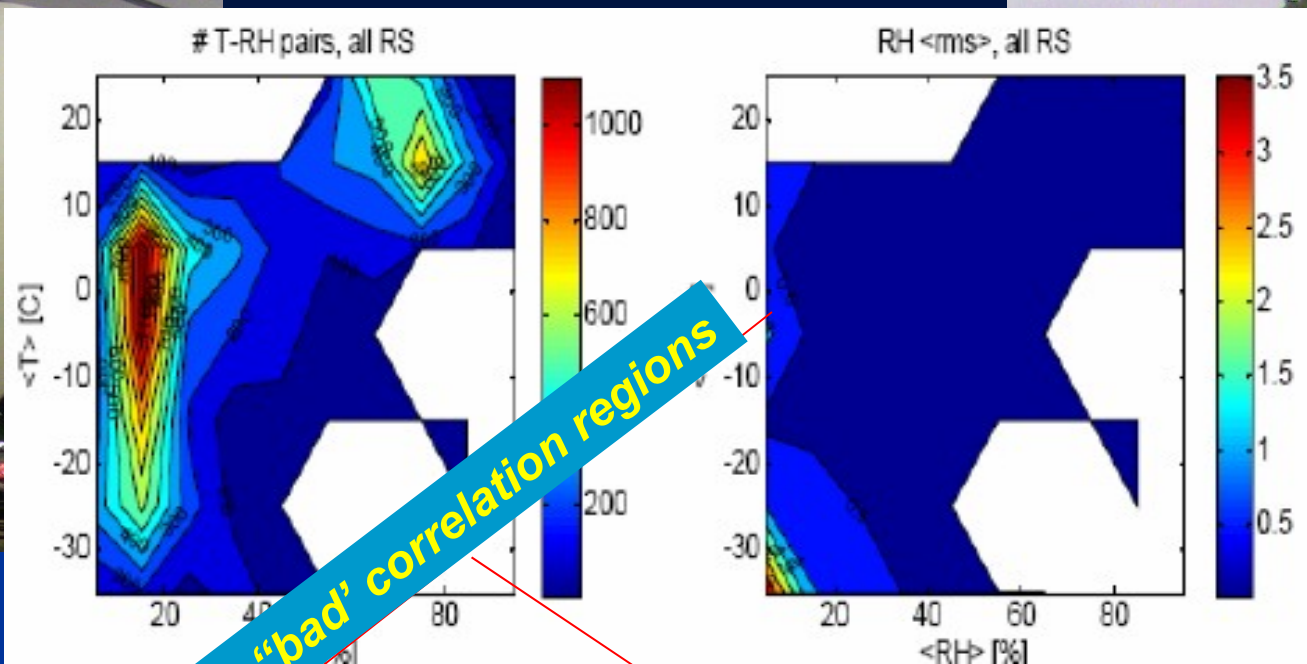


HUBC – *Major Federal/State collaborations*

- NASA/GSFC: focus is satellite.
 - *Wind, water vapor, Ozone, Temperature (and soon Precipitation)*
 - *ATM sondes (Accurate Temp. Measurement, F. Schmidlin): $\Delta T=0.2^{\circ}\text{C}$*
- NWS – Sterling/Silver Spring: upper air instrumentation tested
 - *Assess different sonde package performance*
 - *Assess ceilometer performance (cloud boundaries)*
 - *Development of the consensus reference concept and student mentoring*
- NOAA/EPA: will forecast aerosol/Ozone.
 - *Model PBL/Flux verification*
- *Maryland Department of Environment*
 - *Collaborative pollution and state variable monitoring*
 - *Summer Ozone sonde launches*

HURBC: Extensive lidar/sonde capability

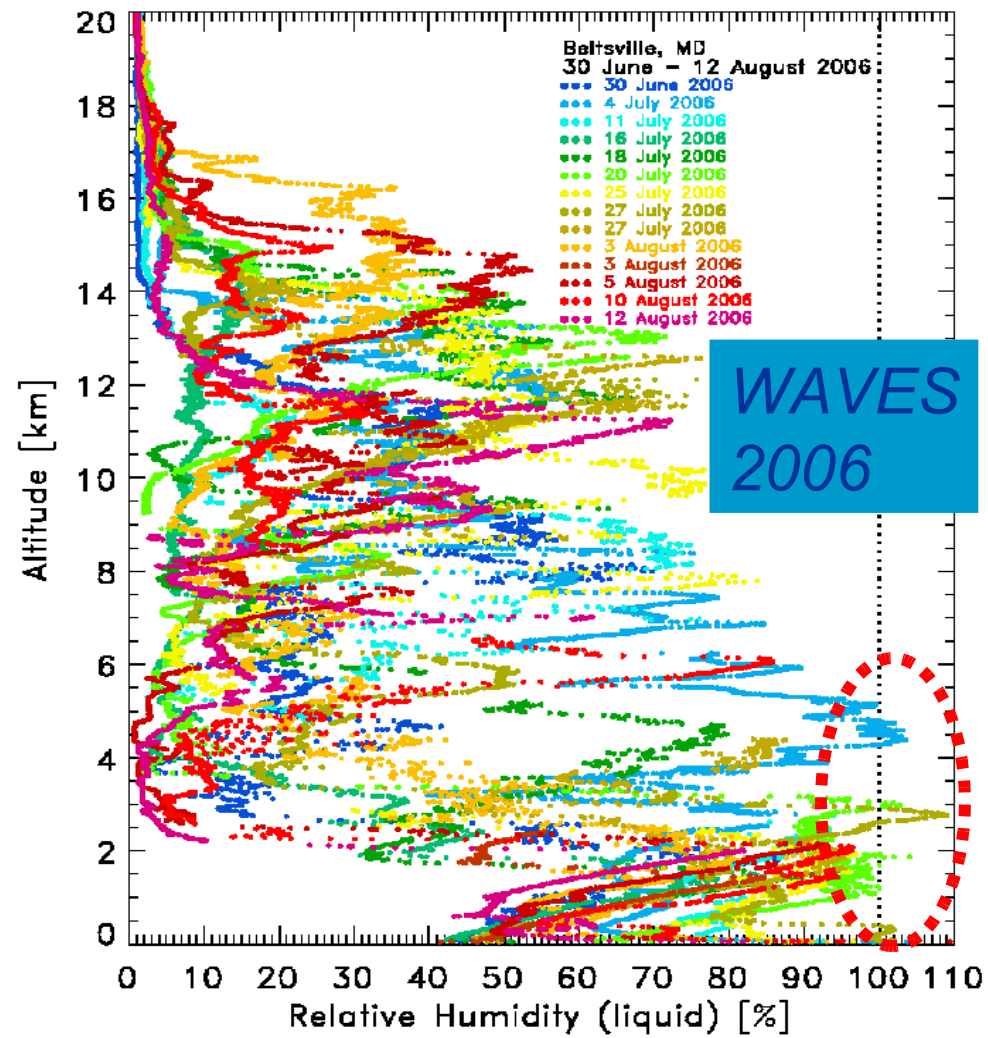
Payloads flown



HUBRC: Preferred or “reference” sensor.

Water vapor

- **RS-90** and **RS-92** showed nearly identical behavior but need correction (*Miloshevich et al. 2006*)
- **SnowWhite** shows good mean agreement with **CFH** up to tropopause
 - Occasional electronic instability
 - Low RH (<~5%) floor
- **Intermet**, **Sippican** have significant problems
- **CFH** preferred but occasional overshoot (>100%)

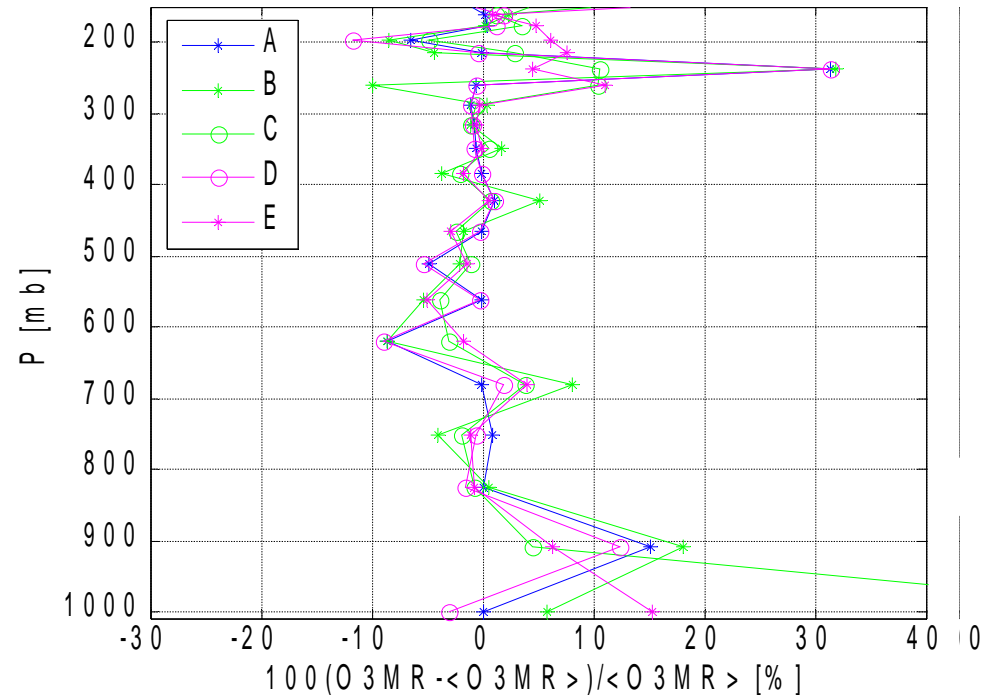
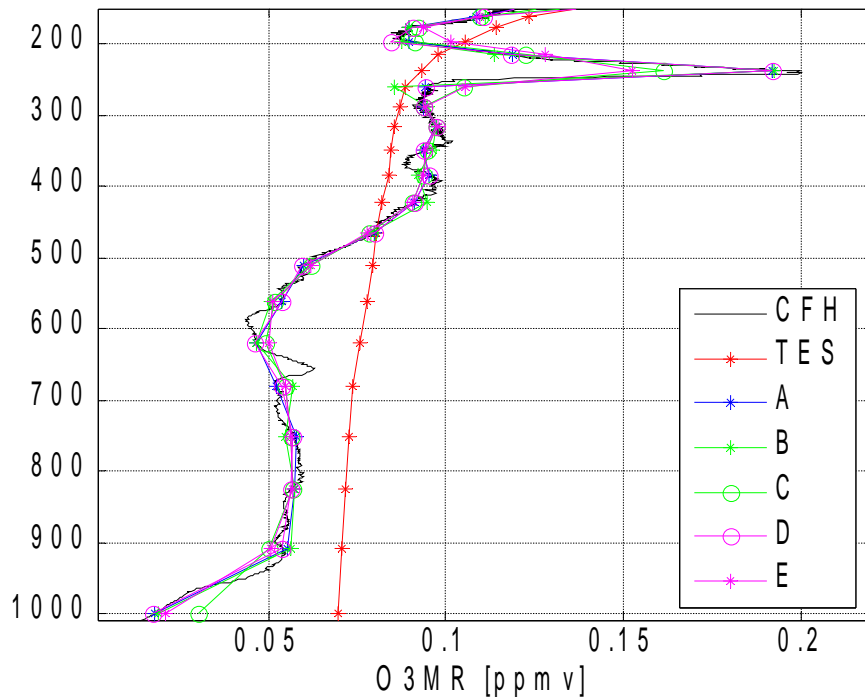


→ **Periodic inter-comparison!**

HUBRC: WAVES Satellite Intercomparison Study

- Initial comparison of Sonde with satellite (AIRS and TES) retrievals performed by different people, did not necessarily lead to same conclusions
 - Sub-group formed (HU, NOAA, JPL, AER, GSFC) to arrive at common agreement on how to intercompare AIRS and TES with validation data (either sonde or lidar)

Temperature: ~ 1 K differences are frequently seen only from data handling.
Water Vapor: ~ 25% deviations exhibited in places in all, at times more.
Ozone: ~ Results are within +/-10%.

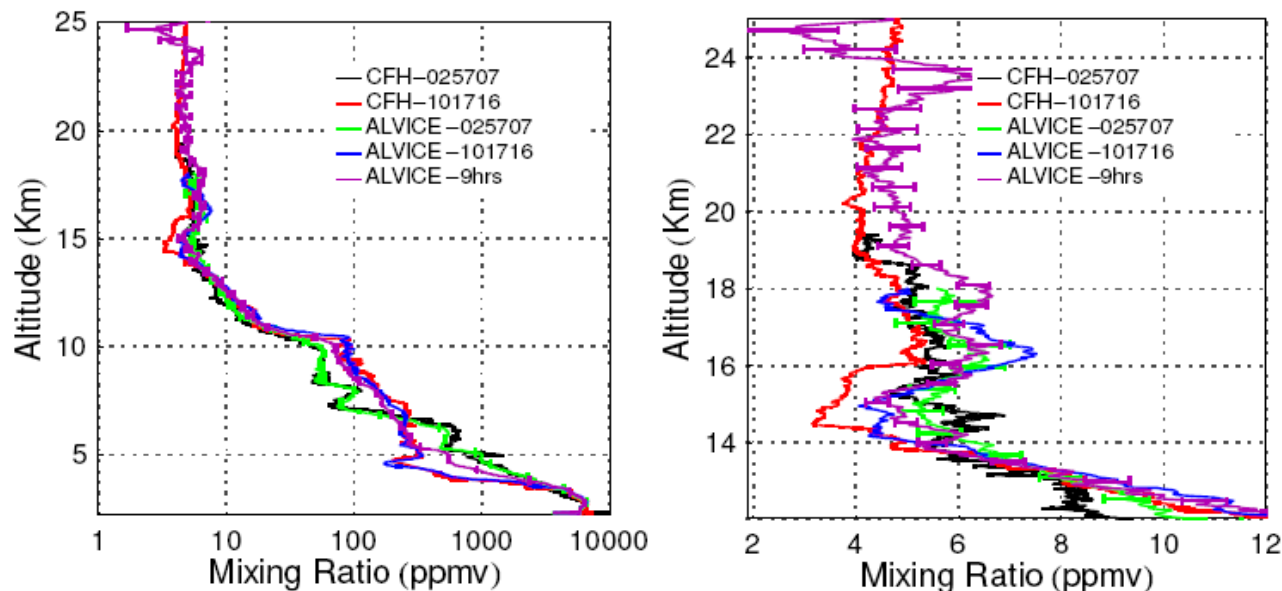


ALVICE: - Atmospheric lidar for Validation, Interagency Collaboration and Education

- HU-GSFC collaboration
- Measures water vapor, Temperature (planned)
- Mobile, but will be based at HUBRC
- Can be Operated from aircraft (King Air)

ALVICE measurements Oct 14, 2007 vs CFH

- Two one hour summations of lidar data coordinated with sonde launch time and 9 hr all night sum



Measurements acquired during the MOHAVE – II field campaign at Table Mountain Facility (elevation 2.285 km)

Extensive Monitoring of Ozone, trace gases, and aerosols

- Developed through leveraged support from MDE, NOAA and NASA
- PSU/IONs (A. Thompson) Collaboration
- Starting to building extensive climatology (2004 – 2008: 200+ ECCs)
- Satellite AURA/AIRS validation and NCEP/EMC evaluation of quality forecasts (NAQFS)
- Designed to compliment surface monitoring for regional air quality.

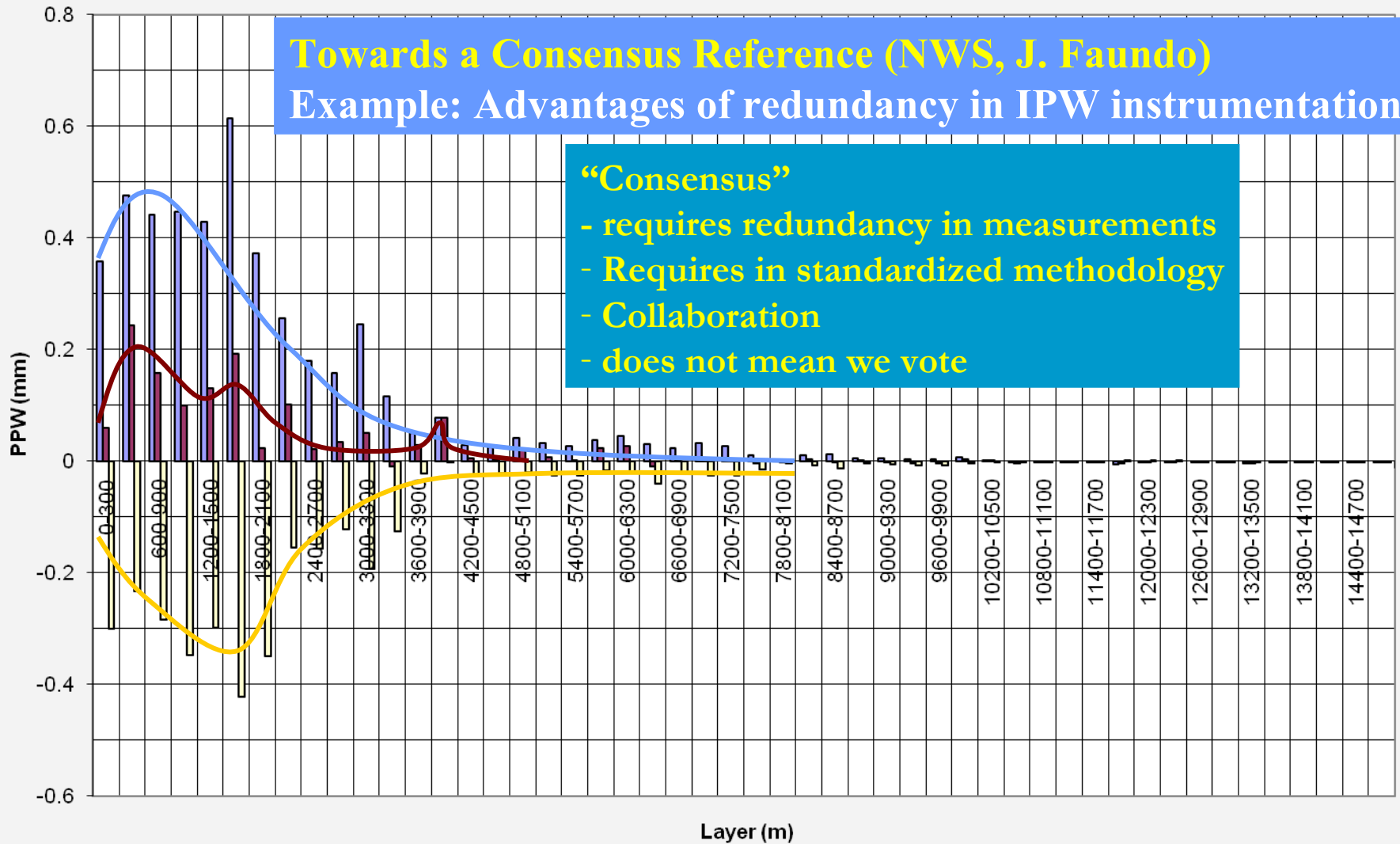
Regional Air Quality

(MDE, PSU, UMCP, NOAA, HU)

- **Surface Gases (MDE 2004-)**
 - O₃, NO_x, CO
 - 56 VOCs via canister samplers and Gas Chromatograph / Flame Ionization Detection
 - 7 Carbonyls via tube samplers and Liquid Chromatograph
 - 42 Toxic Compounds via canister samplers and Gas Chromatograph / Mass Selective Detector
- **Surface Particles (MDE 2004-)**
 - PM_{2.5} from FRM (Daily), TEOM (Hourly), & BAM (Hourly) PM_{2.5} Speciation (filters analyzed in laboratory)
- **HU Research Measurements**
 - QCM (impactor): Mass fractionated sampling
 - Climet (laser particle counter): Size-fractionated number densities from 0.3 to 25 μm in seven size bins

Difference Between Different Partial Precipitable Water (PPW) Values of a Raman Lidar 31 Minute Average, LMS-6 and RS-29 Radiosondes in 300m Layers at the Howard University Atmospheric Observatory in Beltsville, MD on August 2, 2007 at 04:10:50 UTC

Towards a Consensus Reference (NWS, J. Faundo)
Example: Advantages of redundancy in IPW instrumentation



■ HURL minus LMS-6
 ■ HURL minus RS-92
 ■ LMS-6 minus RS-92

HUBRC – *Excellent potential as a GRUAN site*

Priority 1:

- ✓ Pressure, temperature, RH, Wind
- ✓ Balloon-Based measurements
- ✓ GPS – IPW (both Suominet/NOAA)
- ✓ Reference GPS planned (NOAA-CORS)
- ✓ Redundancy in measurements

Priority 2:

- ✓ Surface radiation (similar to BSRN)
 - ✓ MWR
 - ✓ Raman Lidar
 - ✓ Surface trace gases
 - ✓ Column AOD (not a photometers)
- ↔ AERI (planned)

Extended Instrumentation

- REALM – lidar network
- Near 2 MPL network stations
- Near 3 AERONET Sunphotometer
- AERI: @ UMBC (~ 20 km)
- Extensive lidar work
Wind, Temp, Water vapor, clouds

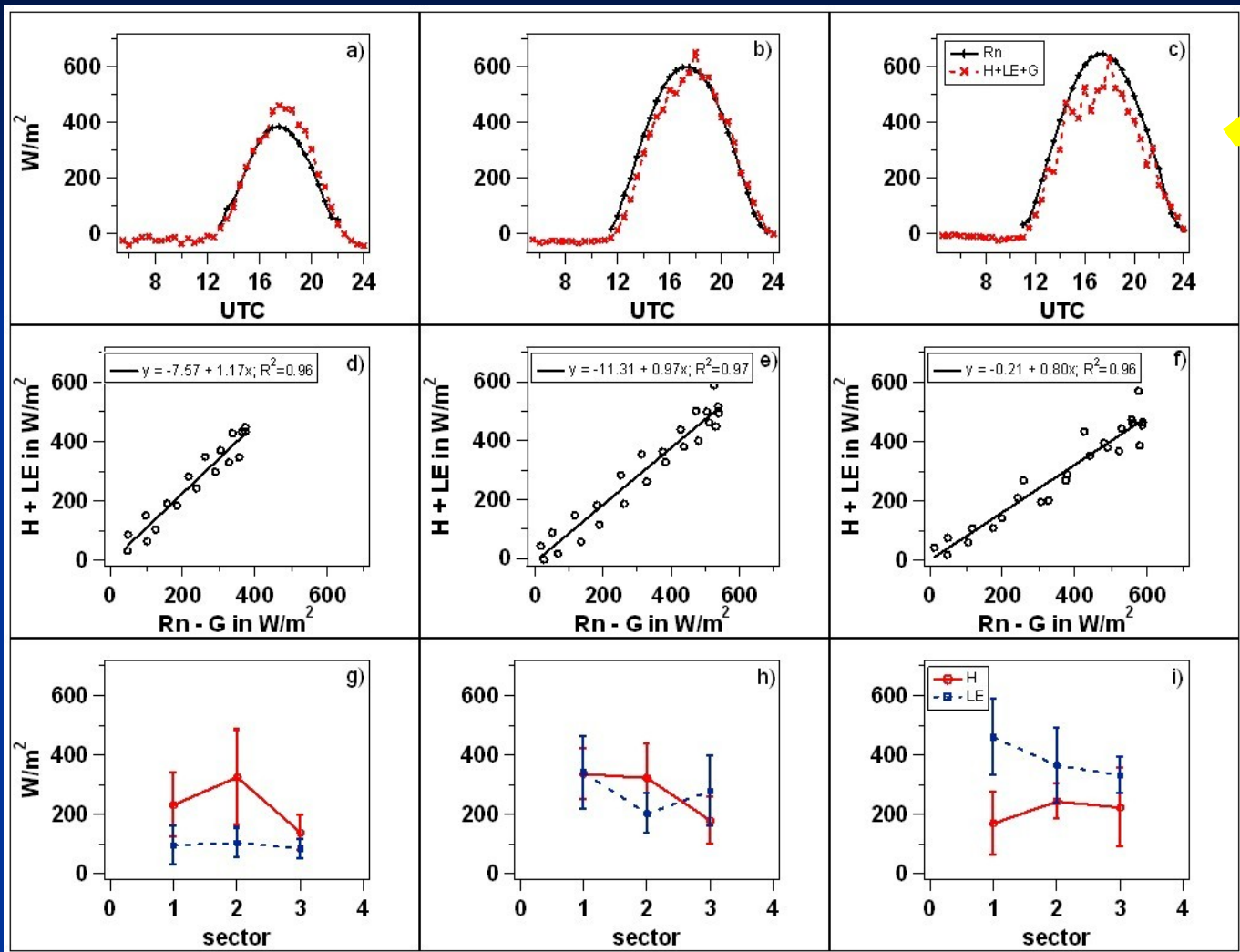
Issues ...

- A new start: 3 - 4 years only
- Funded through proposals
- “No single PI controls” the instr.
- A co-laboratory: *active participation by NWS, NASA, State of MD, Univ.,*
- Training/education and Networking

Thank You!

HURBC: Towards multi-year history of net radiation

Daily Clear Sky Mean for 3-seasons, 2006.



Measured net Rad.
Vs
Heat, latent, soil fluxes

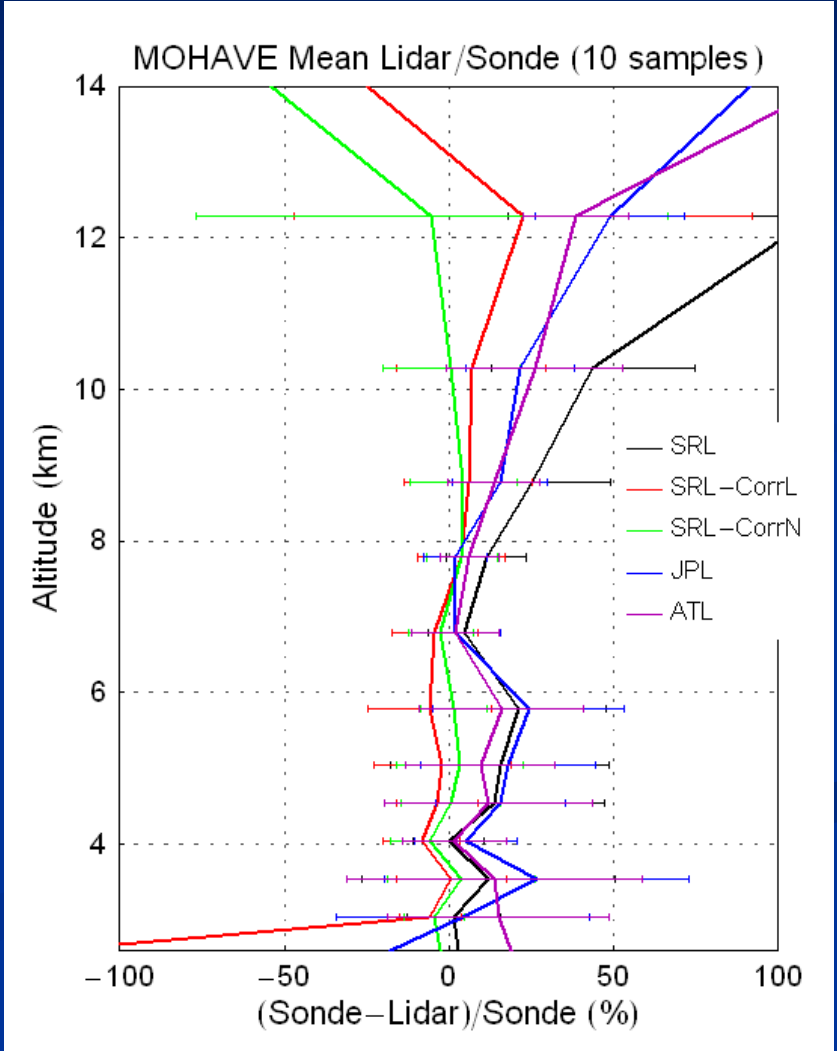
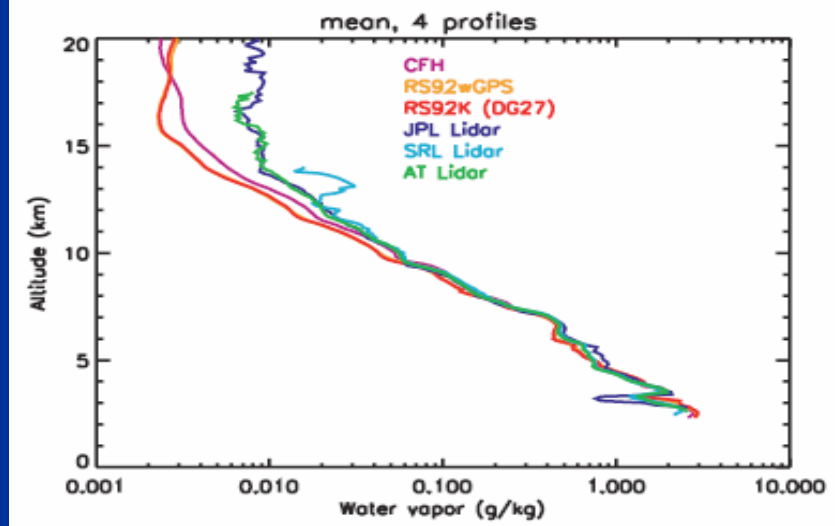
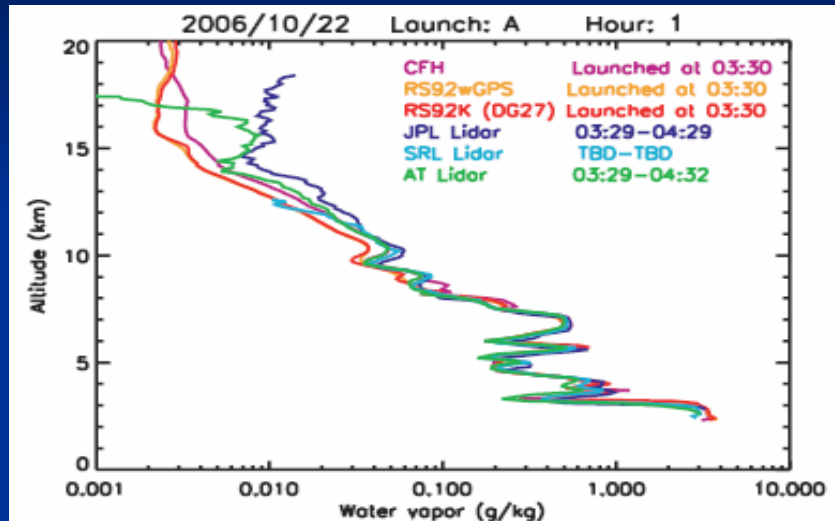
Surface energy closure

Site Sector analysis

Winter

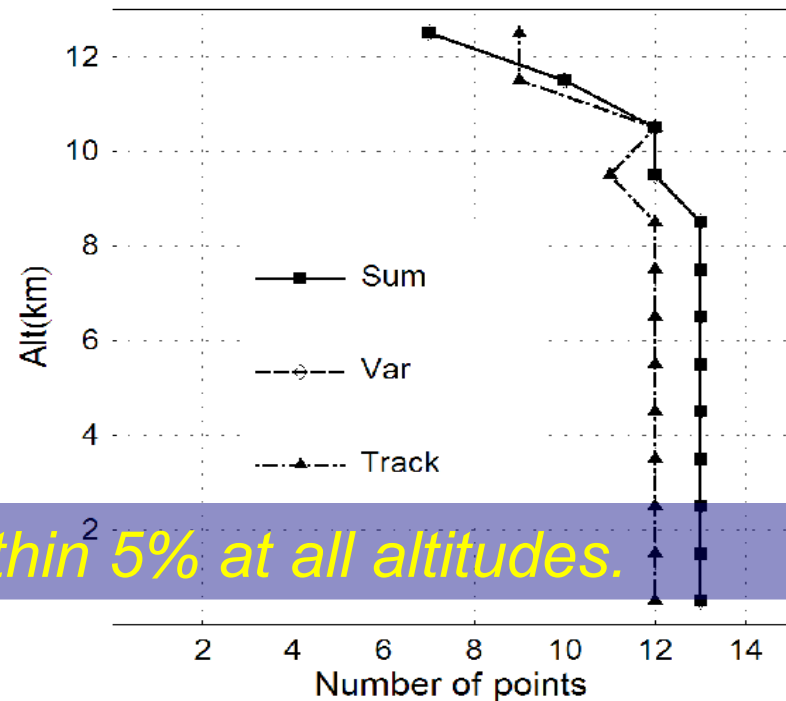
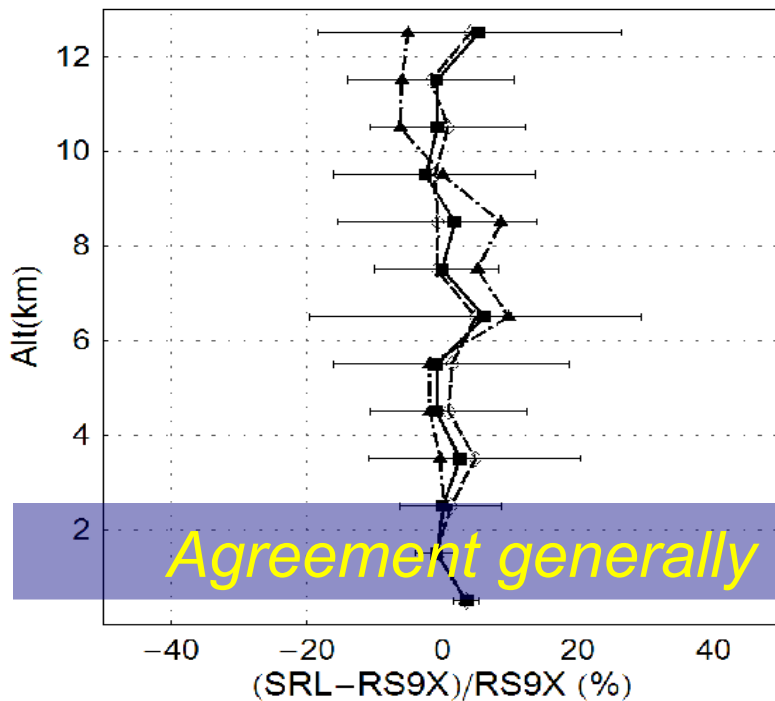
Spring

Summer



HUBC – *As a validation site*

Lidar (SRL) and Radio sonde (RS9X)



Summer 2006 (NASA funded):

- A “repeat” experiment at HUBC.
- HU, UMBC, GSFC, NCAR
- NWS will be invited to participate.

GOAL is to Study:

- Water vapor variability
- AURA – validation
- Study sonde-technologies