Airborne Water Vapor Reporting – WVSS-2

- **WVSS (Water Vapor Sensing System)**

"Cargo-Door" View WVSSII
WVSSII Located on Forward-Port Side of UPS B-757

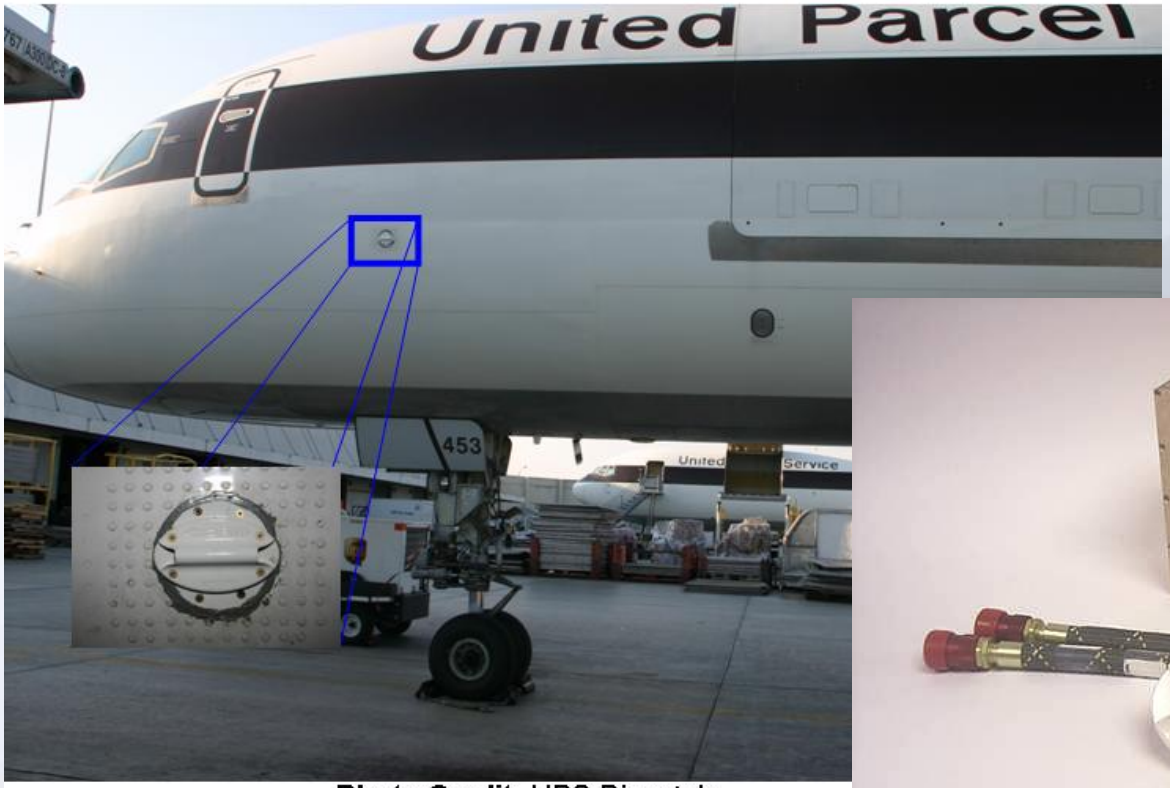
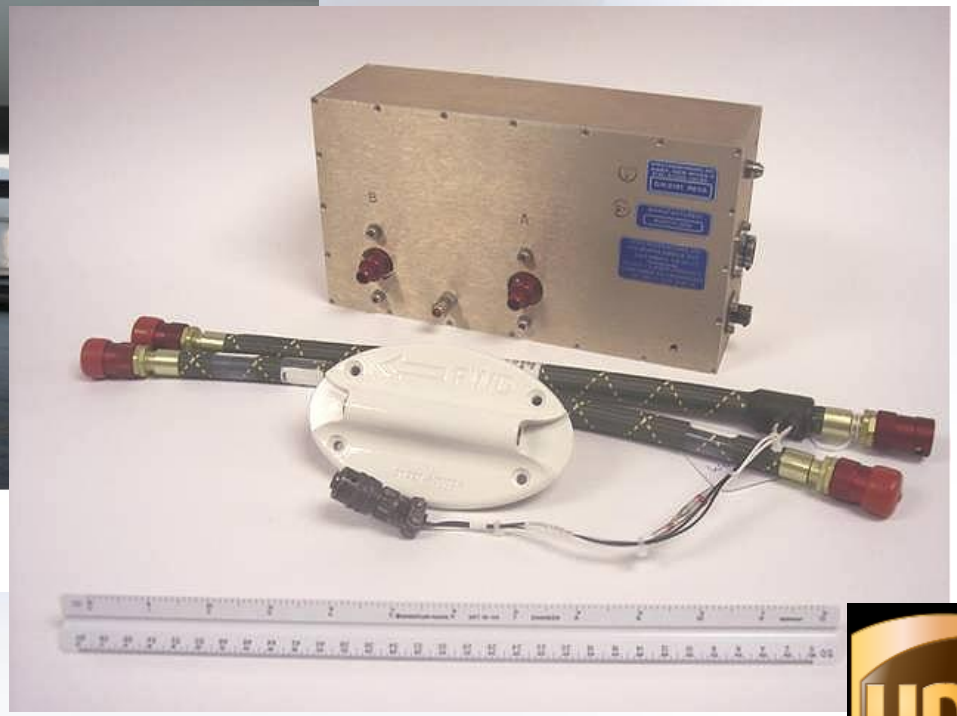


Photo Credit: UPS Dispatch
Contact for Usage: Randy Baker/UPS; Email: air1rtb@ups.com



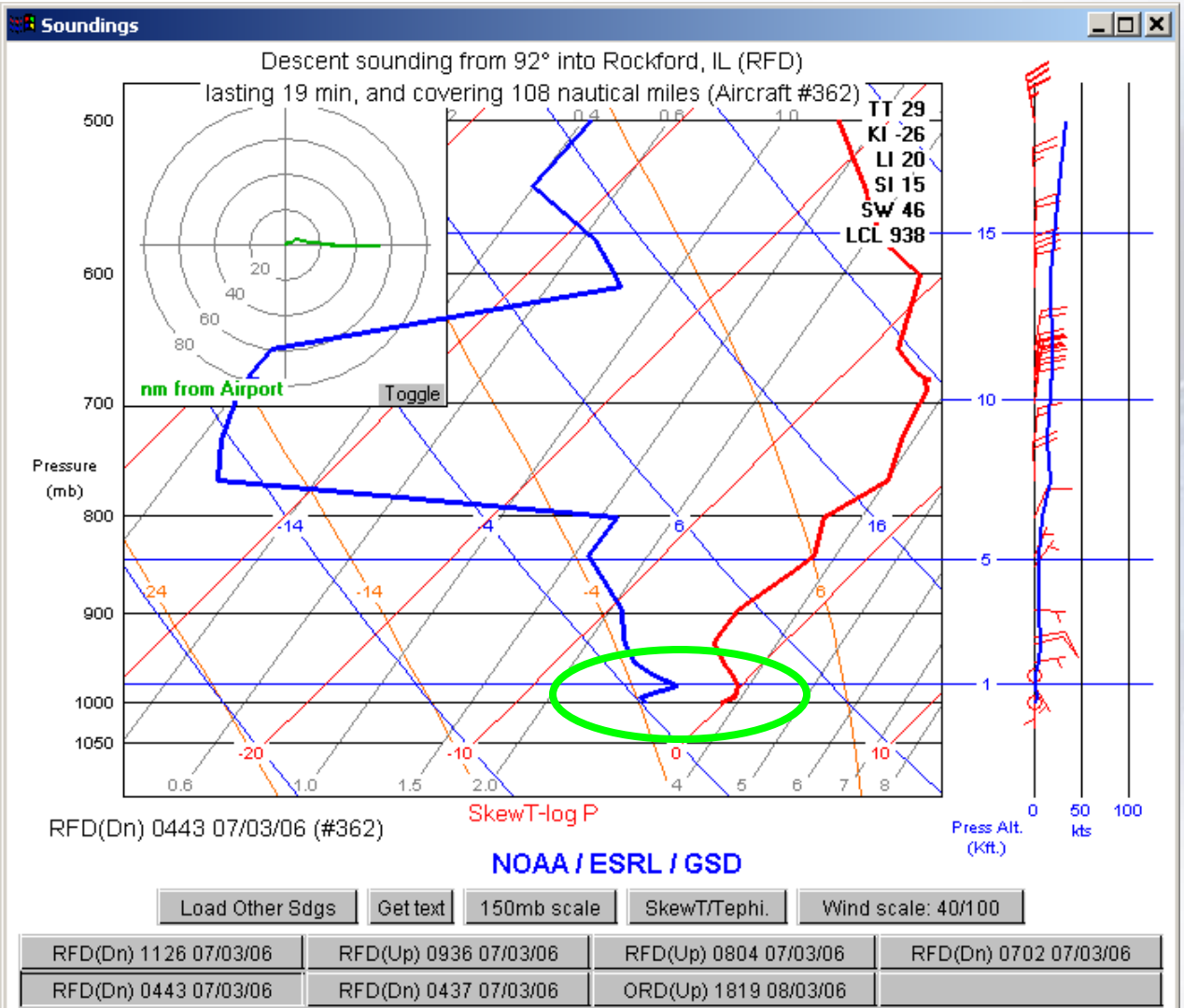
WVSS History

- 1st Generation 1996, measured RH
- WVSS-2 installed 2005, measured mixing ratio
- Re-engineering 2009. Primarily improved sensitivity to temperature and pressure changes

Operational Use of Data

- Operational Forecast Decisions
  - Fog
  - Winter Precipitation Types
  - Thunderstorms
- Initialize Forecast Models
  - RFD Raob Intercomparison Results

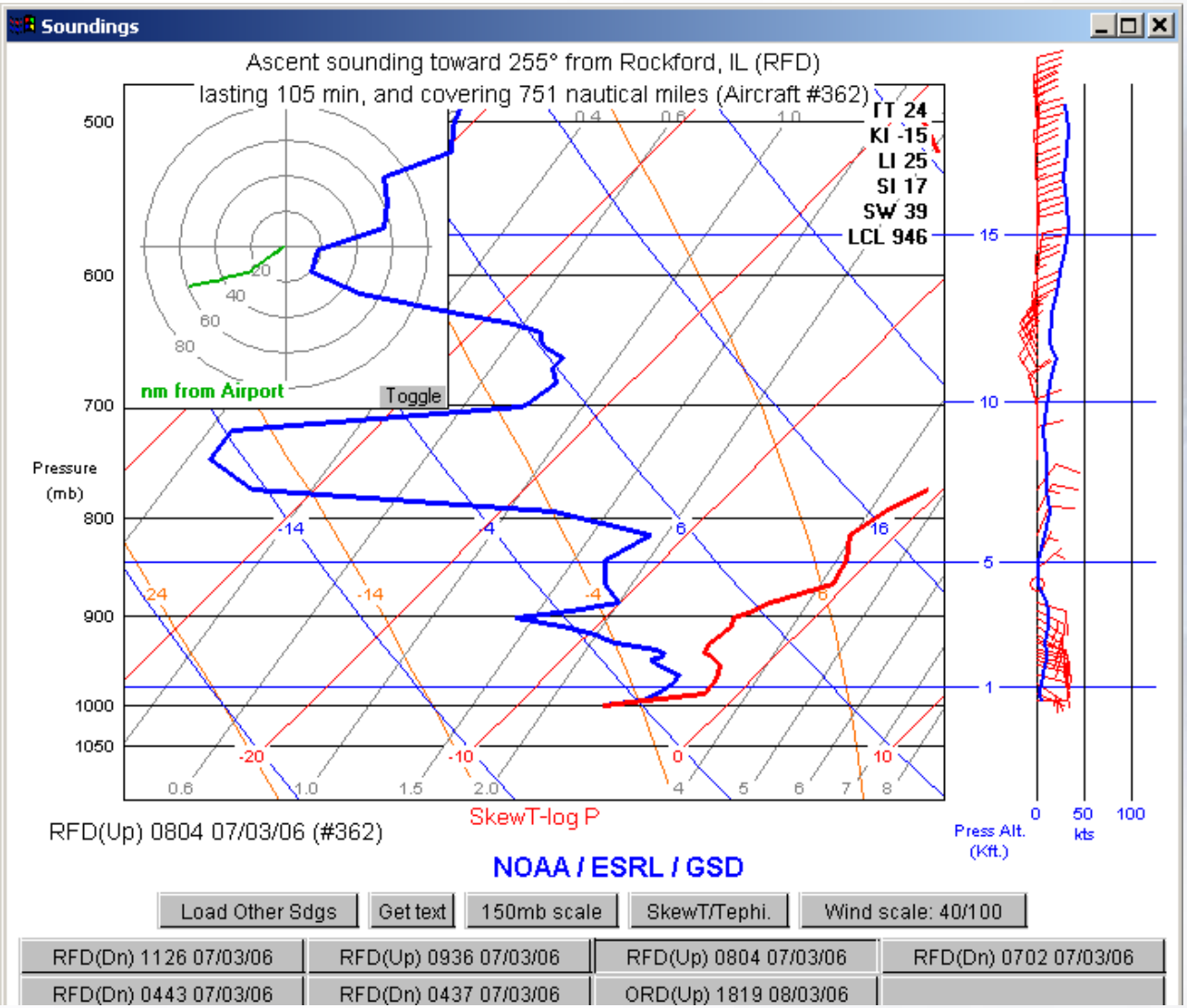
Fog Forecasting



-Moisture Increasing with Height

-Inversion/Light Winds

Fog Forecasting

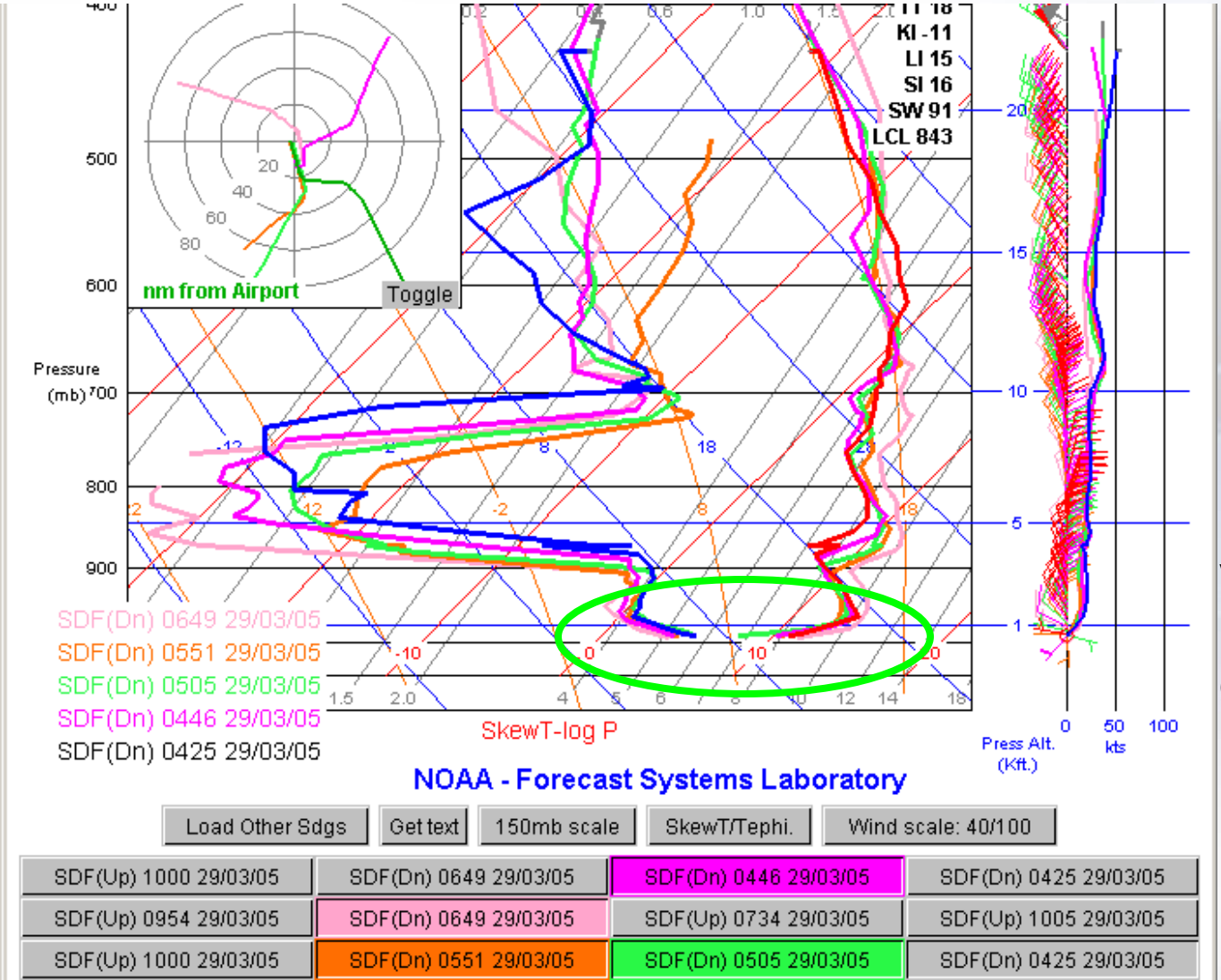


3 hours later...

0812z RVR 1000-2800

1254z RVR 600-1000

Fog Forecasting – SDF 29 Mar 05

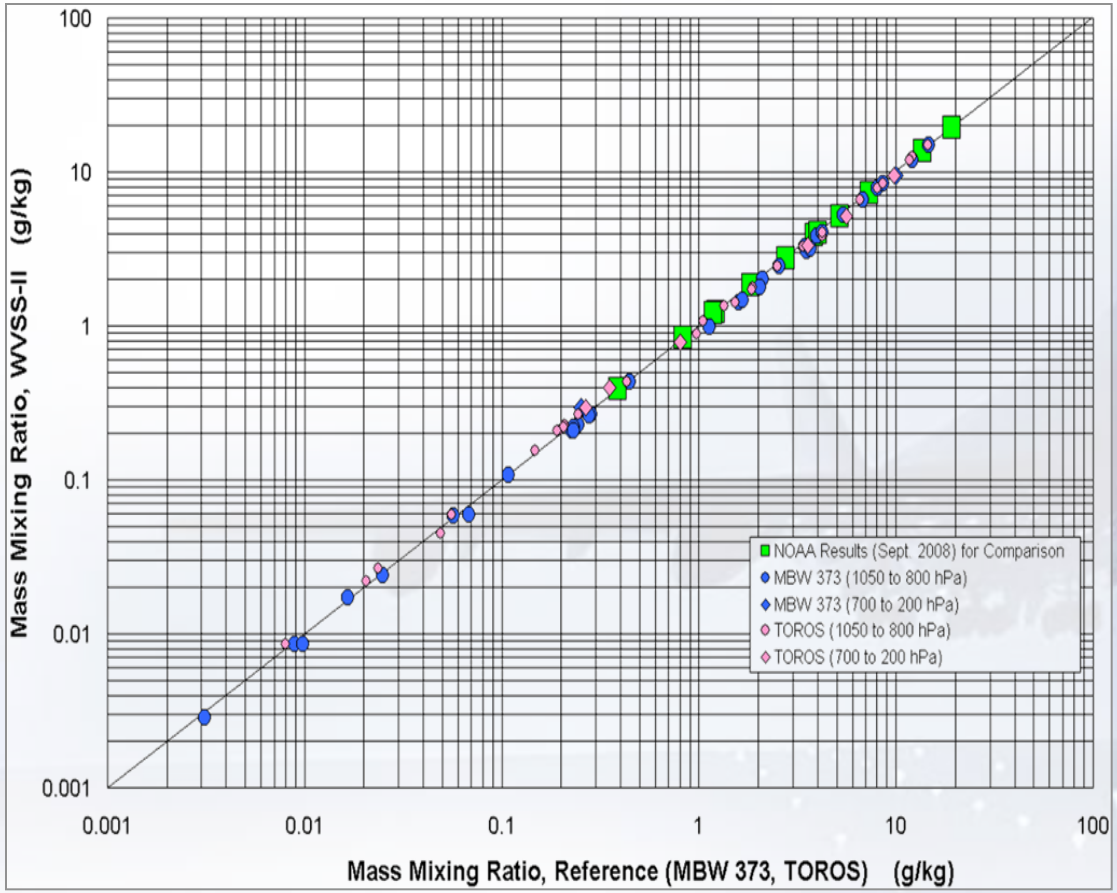


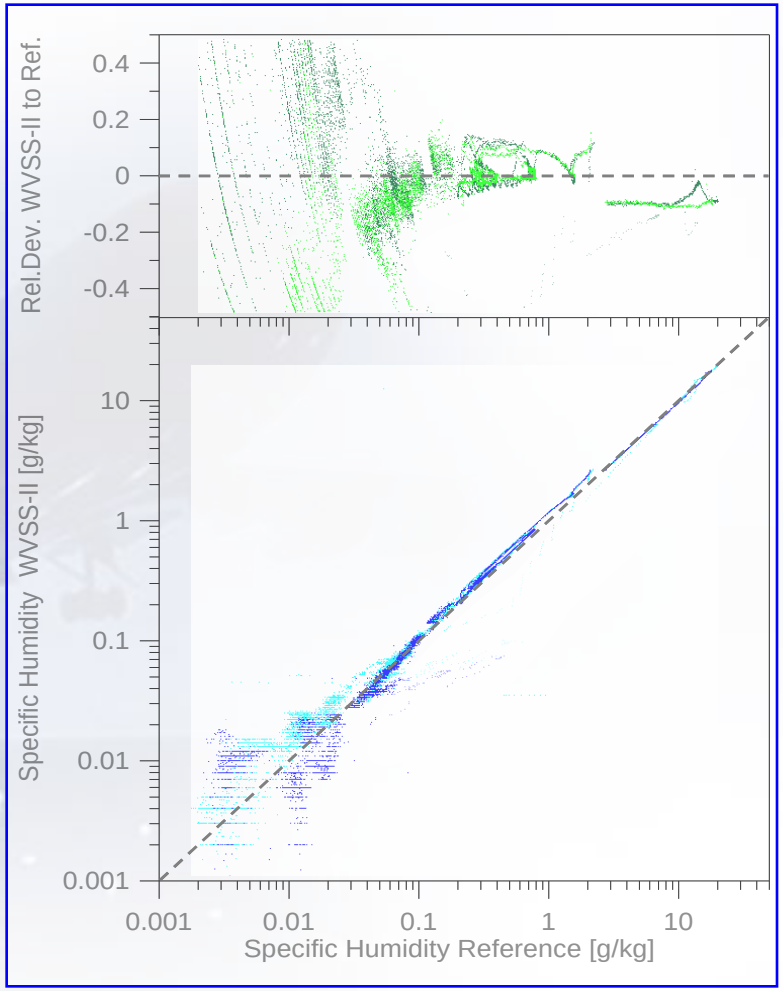
Moisture decreasing with height

Favors shallow ground fog

WVSS Validation

Chamber Experiments by NOAA and DWD were Very Positive



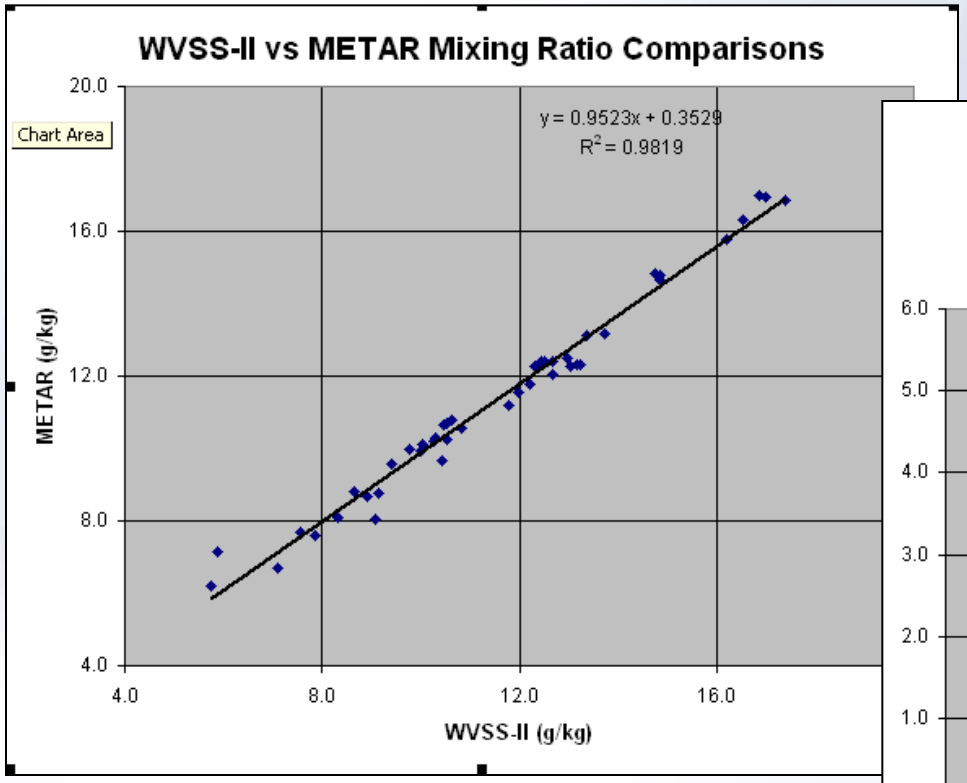


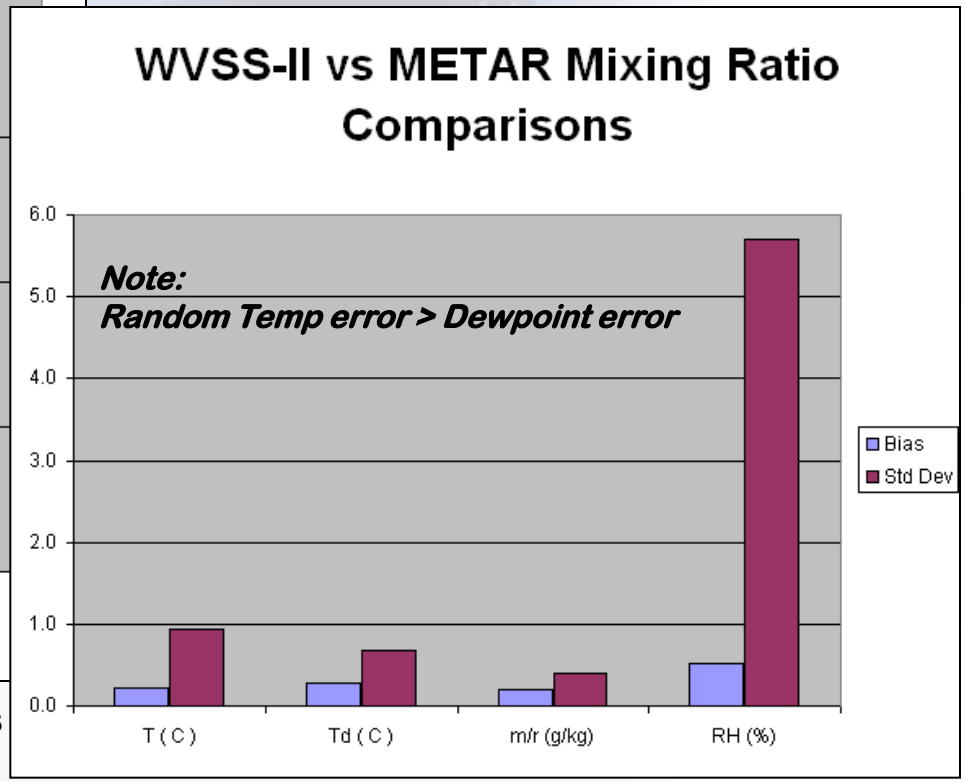
Only substantial differences appear for Specific Humidity below ~0.03 g/kg

Initial Comparisons of re-engineered WVSS-II with co-located surface (METAR) reports

First new WVSS-II unit on UPS aircraft agrees very closely with time/space co-located night-time surface observations from September 2009:

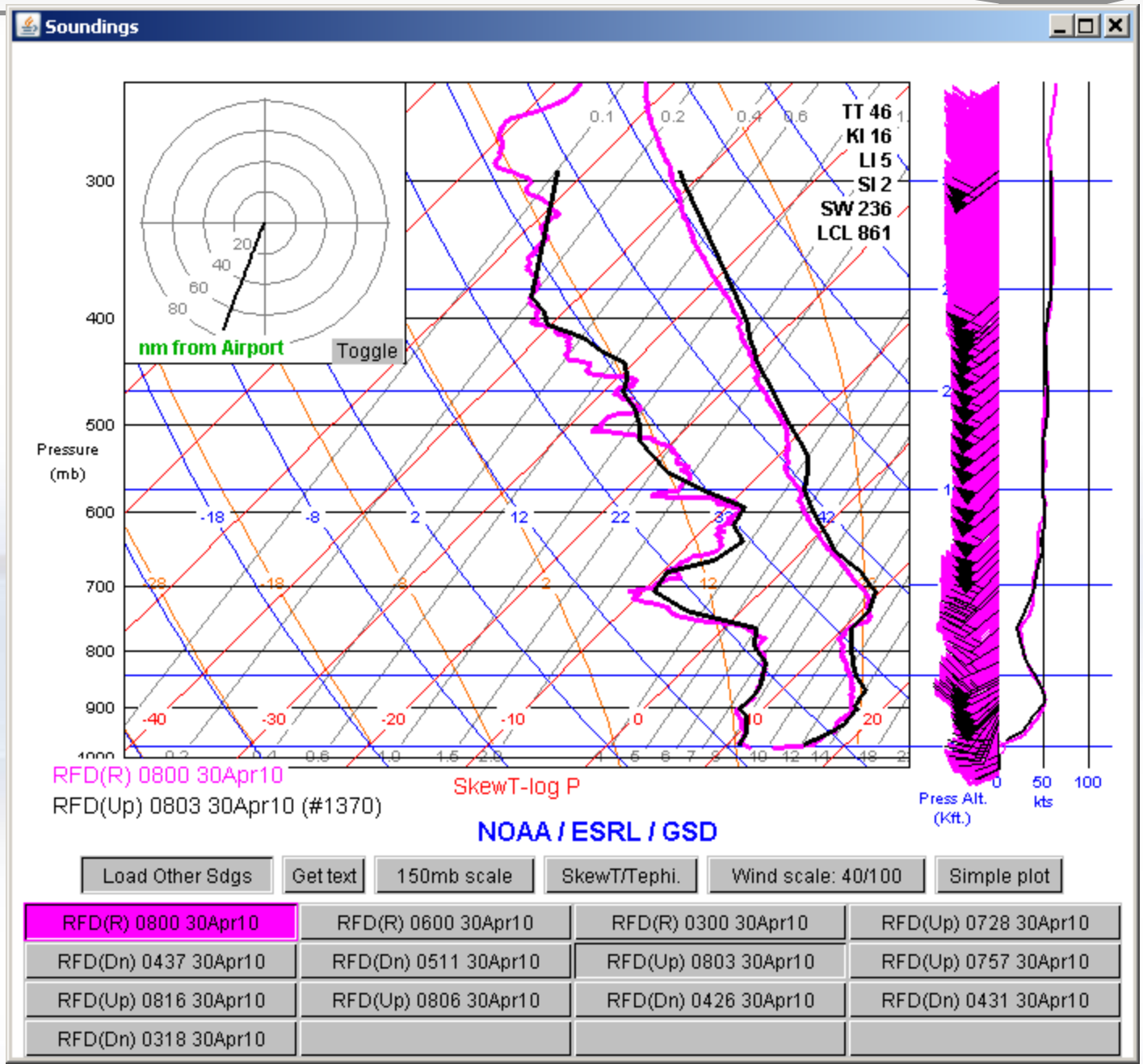
Mixing Ratio Bias ~ 0.2 g/kg
Mixing Ratio Standard Deviation ~ 0.4 g/kg





Data provided by Randy Baker, UPS

RFD Raob Comparison



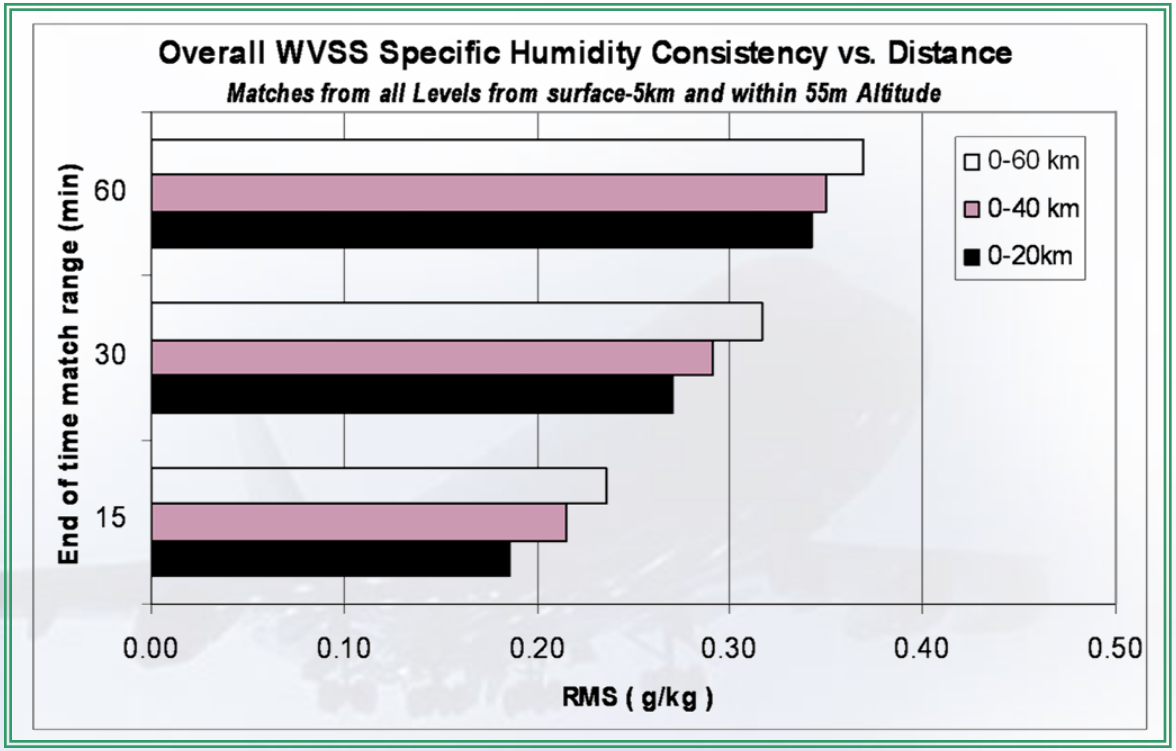
2009-2010 Validation Results

Specific Humidity Variability amongst WVSS-II Observations

RMS calculated for:

Time ranges of 0-15, 0-30 and 0-60 minutes

Distance ranges of 0-20, 0-40 and 0-60 minutes



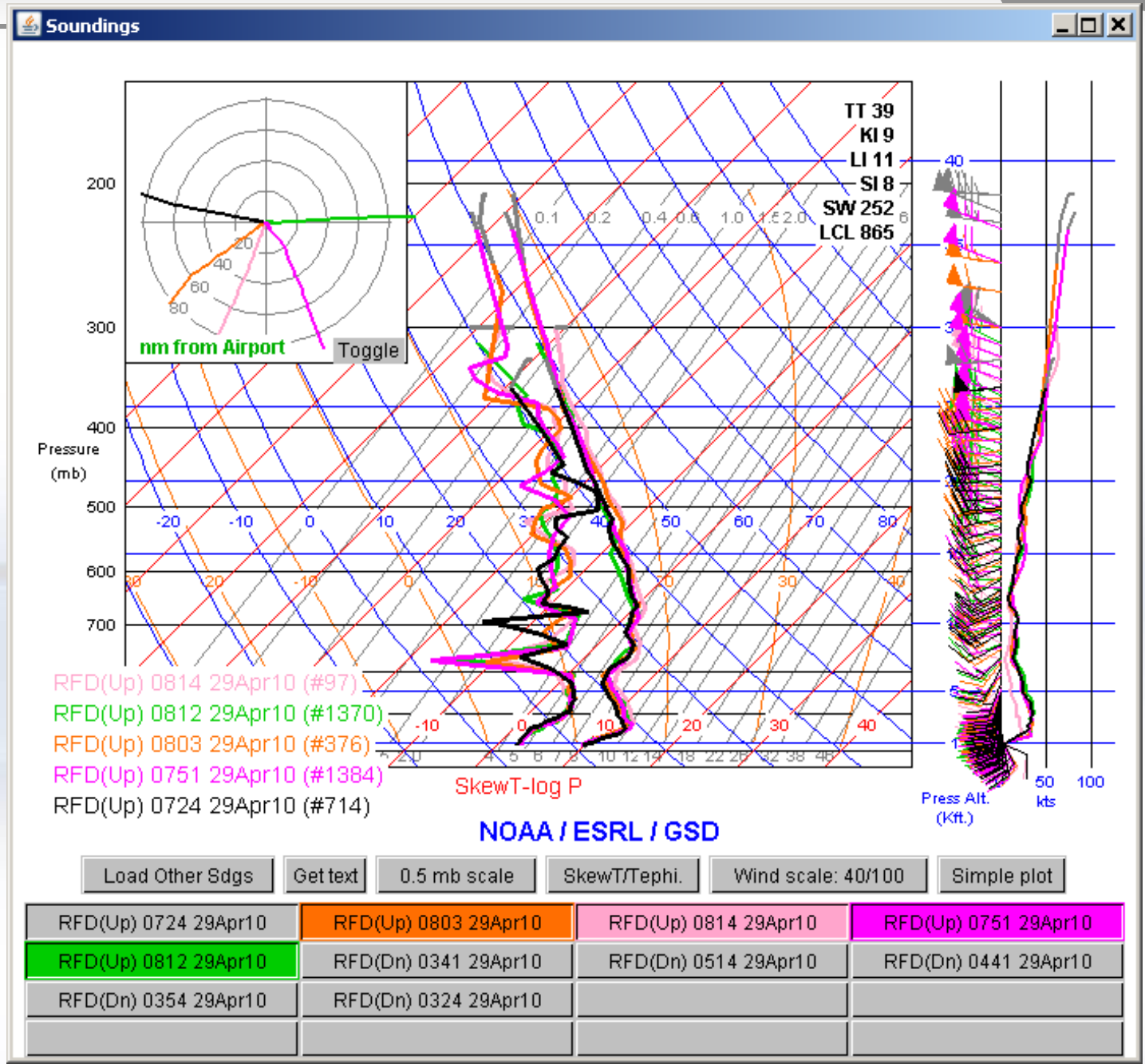
RMS Differences show (Including Dry/Moist Environments):

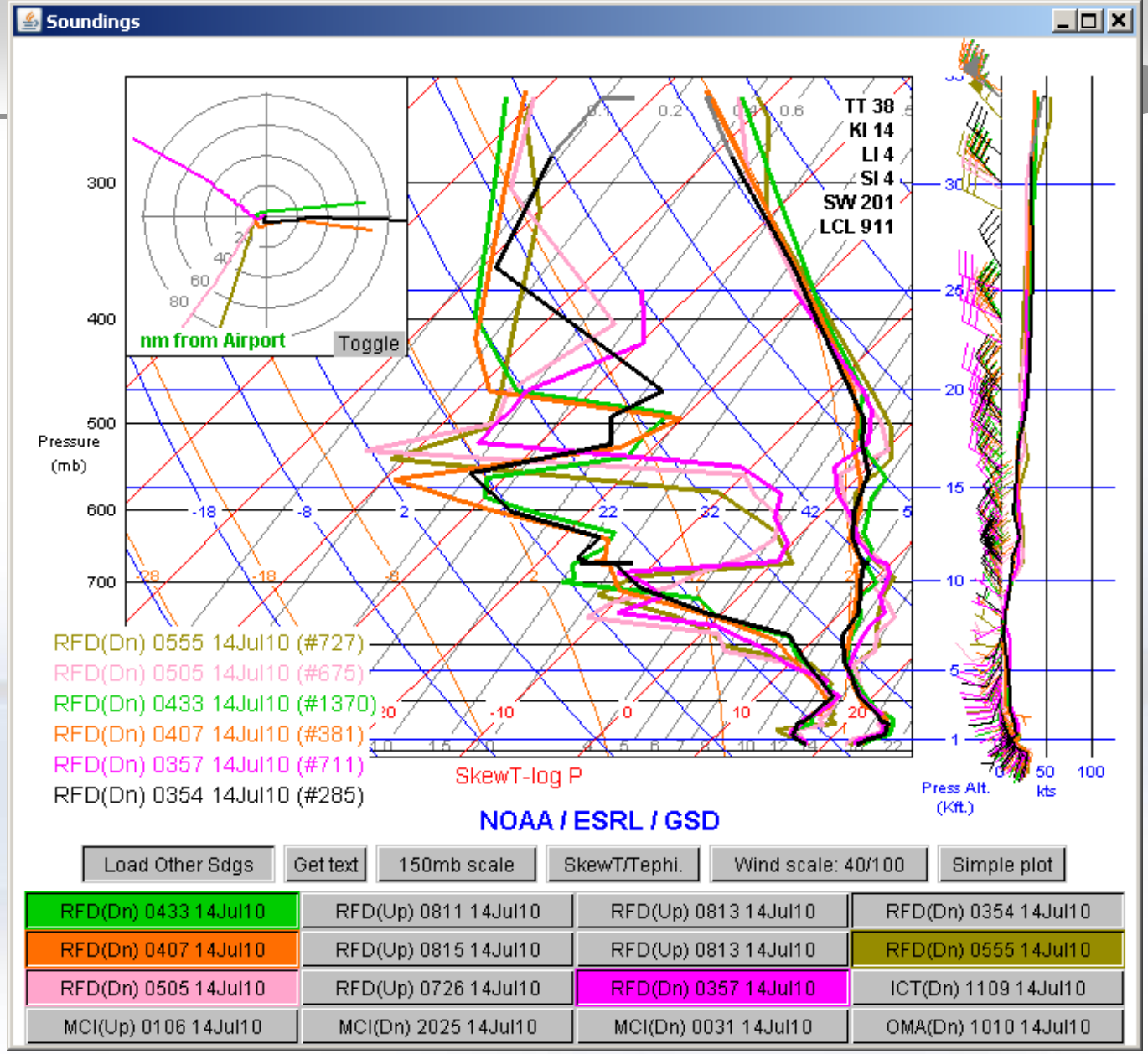
WVSS-II observations agree extremely well with one another

☑ ***WVSS-II data Meet WMO requirements for mesoscale observations***

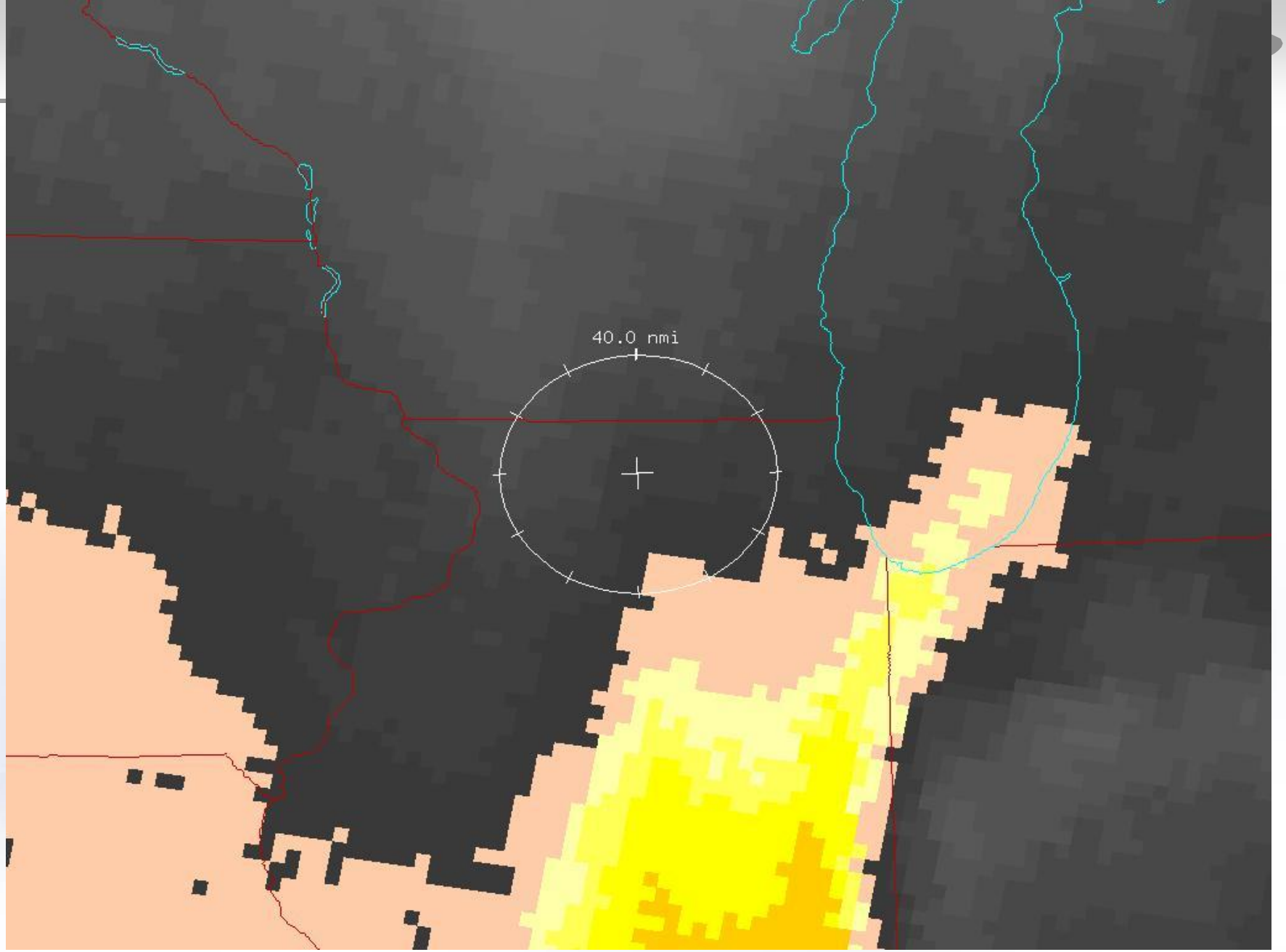
For exact co-locations, operational WVSS-II instrument errors should be ~0.1 g/kg

Moist Profile

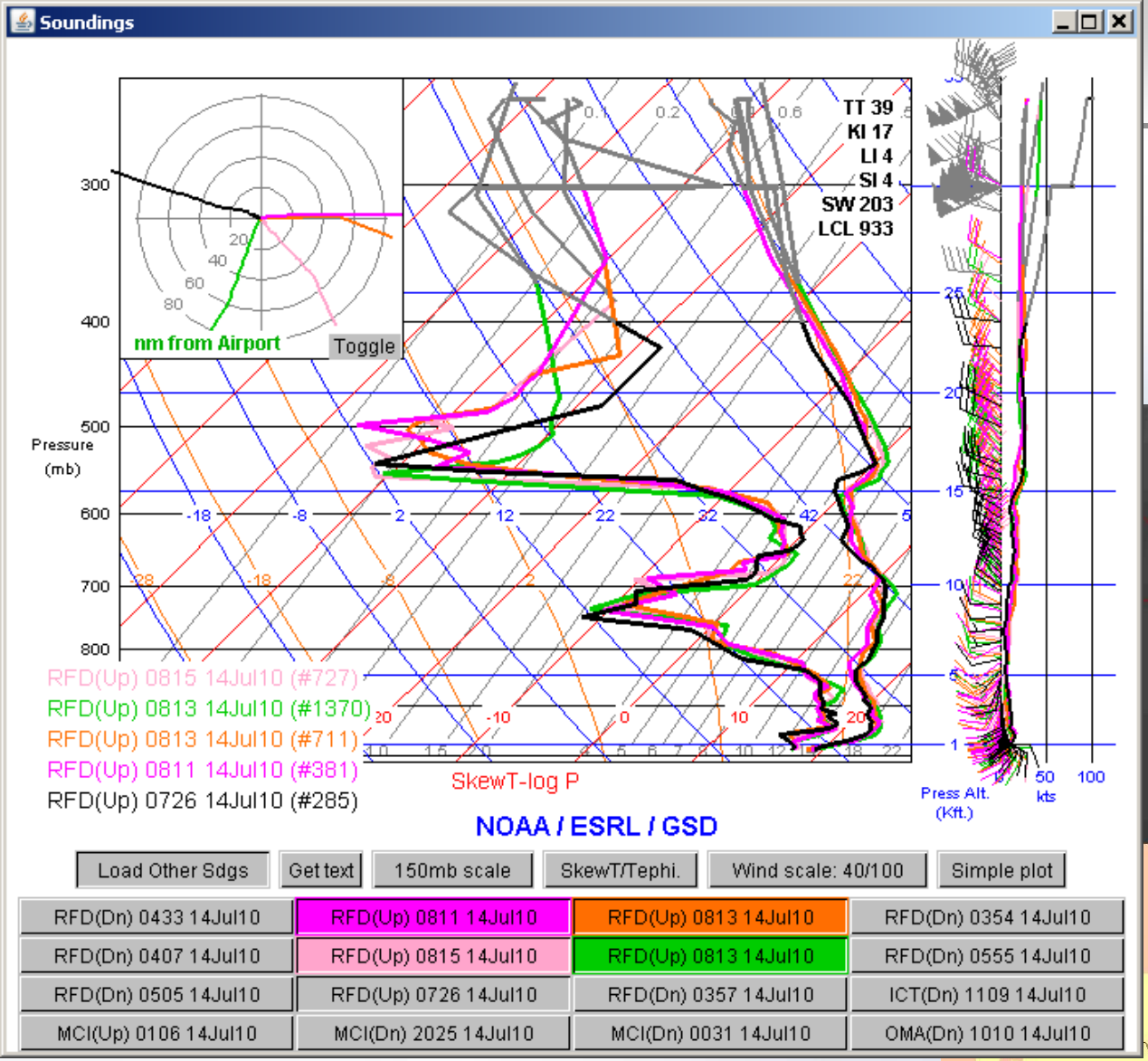


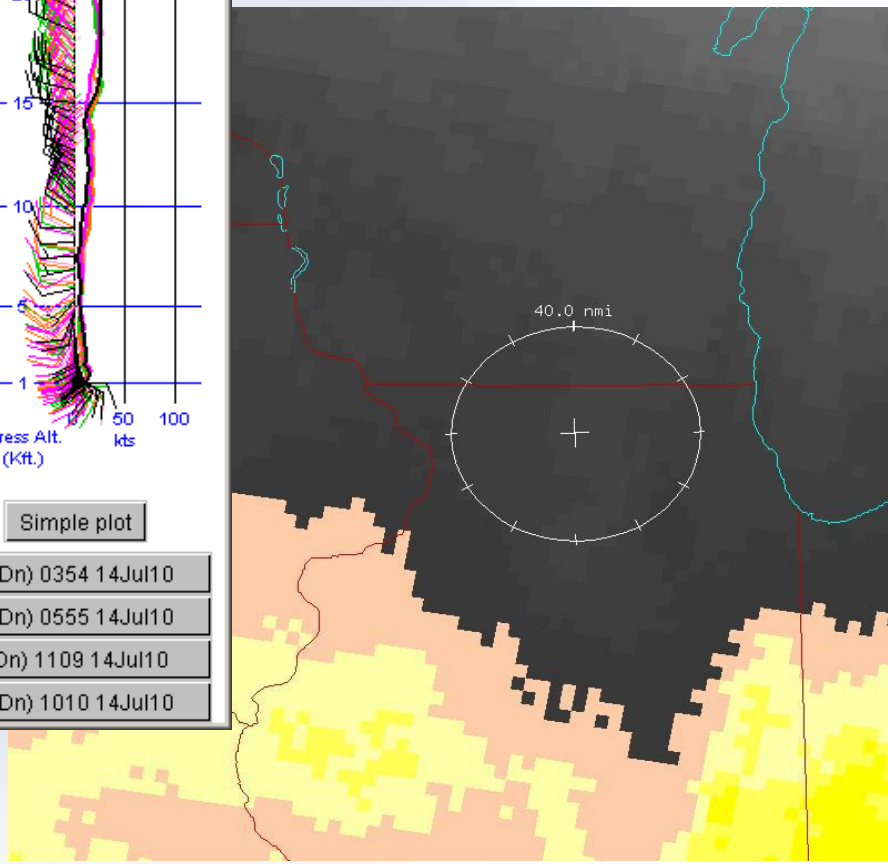


RFD arrivals 14JUL2010. Interesting difference at 11,000-15,000 feet between aircraft arriving from the west and those from the east. Aircraft at that altitude were about 40nm out. Skies were clear of clouds at the time.

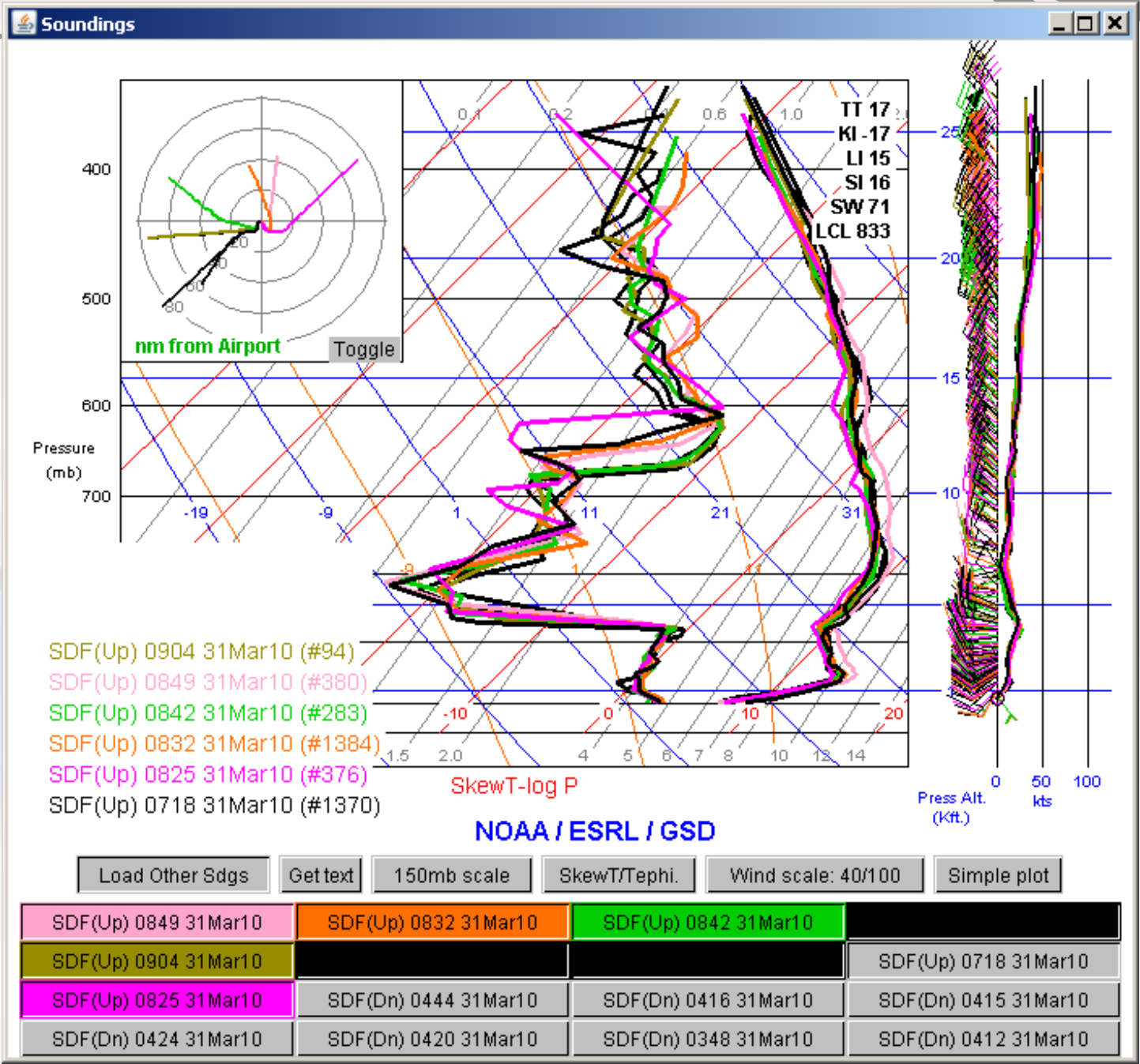


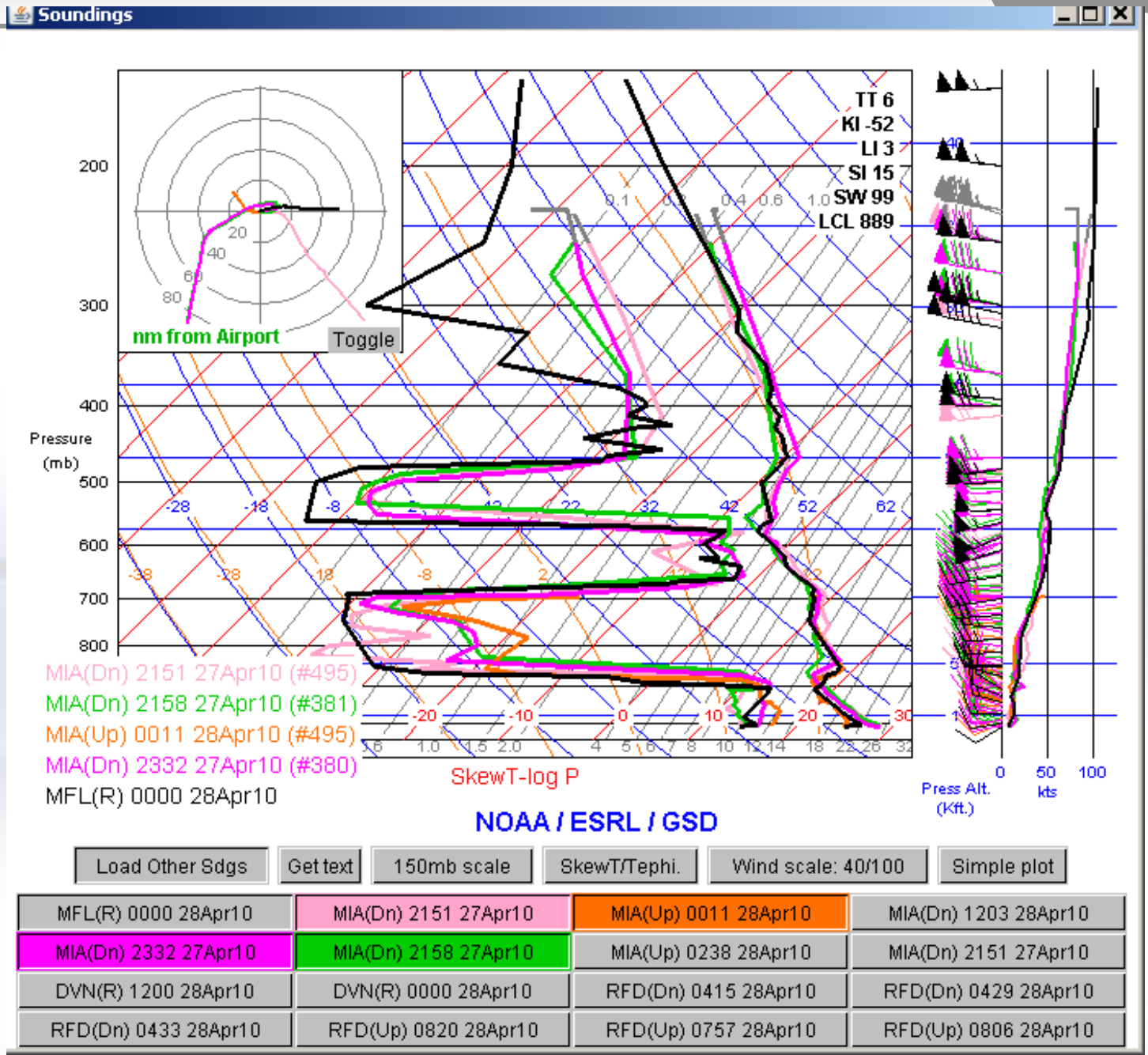
04z Moisture Channel, showing drier air to the southeast, and higher moisture to the west.



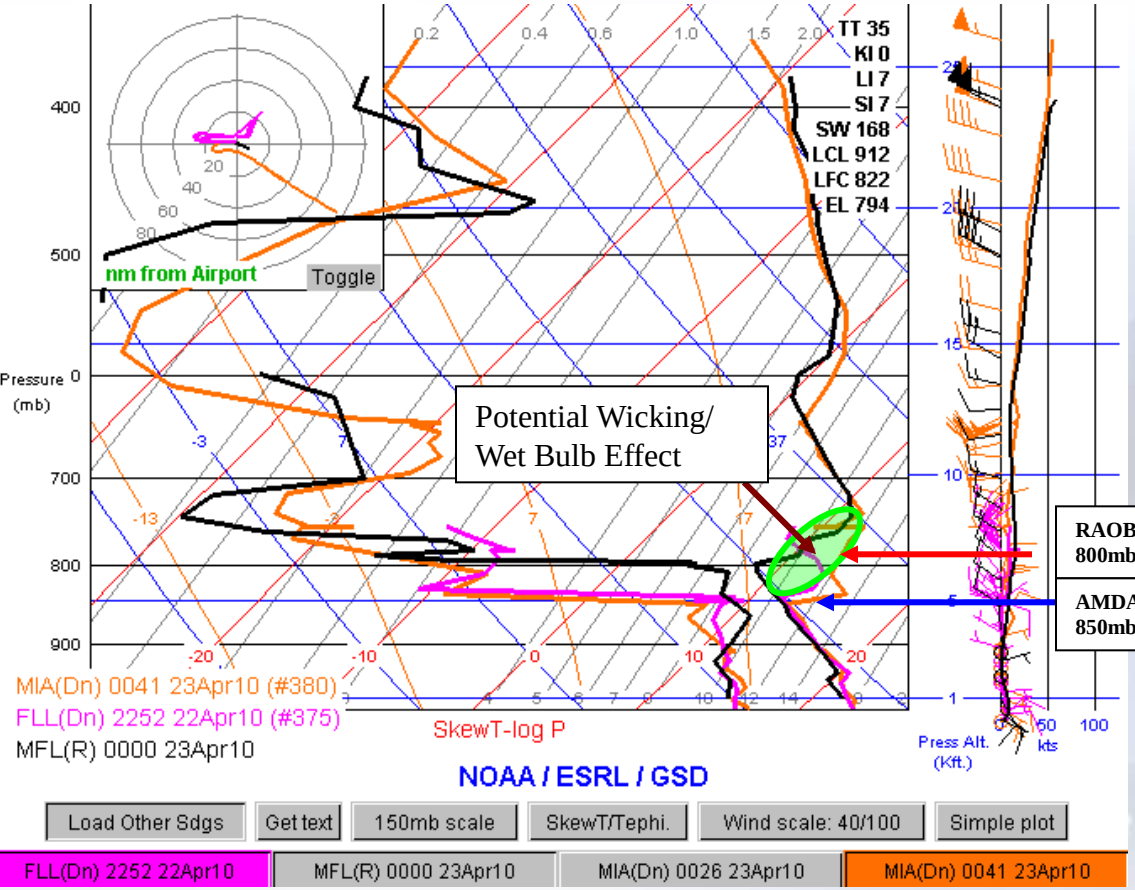


08z Moisture Channel


Soundings
TT 17
KI -17
LI 15
SI 16
SW 71
LCL 833
nm from Airport
Toggle
Pressure (mb)
400
500
600
700
SDF(Up) 0904 31Mar10 (#94)
SDF(Up) 0849 31Mar10 (#380)
SDF(Up) 0842 31Mar10 (#283)
SDF(Up) 0832 31Mar10 (#1384)
SDF(Up) 0825 31Mar10 (#376)
SDF(Up) 0718 31Mar10 (#1370)
SkewT-log P
Press Alt. (Kft.)
kts
NOAA / ESRL / GSD
Load Other Sdgs
Get text
150mb scale
SkewT/Tephi.
Wind scale: 40/100
Simple plot
SDF(Up) 0849 31Mar10
SDF(Up) 0832 31Mar10
SDF(Up) 0842 31Mar10
SDF(Up) 0904 31Mar10
SDF(Up) 0718 31Mar10
SDF(Up) 0825 31Mar10
SDF(Dn) 0444 31Mar10
SDF(Dn) 0416 31Mar10
SDF(Dn) 0415 31Mar10
SDF(Dn) 0424 31Mar10
SDF(Dn) 0420 31Mar10
SDF(Dn) 0348 31Mar10
SDF(Dn) 0412 31Mar10


Soundings
TT 6
KI -52
LI 3
SI 15
SW 99
LCL 889
nm from Airport
Toggle
Pressure (mb)
MIA(Dn) 2151 27Apr10 (#495)
MIA(Dn) 2158 27Apr10 (#381)
MIA(Up) 0011 28Apr10 (#495)
MIA(Dn) 2332 27Apr10 (#380)
MFL(R) 0000 28Apr10
SkewT-log P
Press Alt. (Kft.)
kts
NOAA / ESRL / GSD
Load Other Sdgs
Get text
150mb scale
SkewT/Tephi.
Wind scale: 40/100
Simple plot
MFL(R) 0000 28Apr10
MIA(Dn) 2151 27Apr10
MIA(Up) 0011 28Apr10
MIA(Dn) 1203 28Apr10
MIA(Dn) 2332 27Apr10
MIA(Dn) 2158 27Apr10
MIA(Up) 0238 28Apr10
MIA(Dn) 2151 27Apr10
DVN(R) 1200 28Apr10
DVN(R) 0000 28Apr10
RFD(Dn) 0415 28Apr10
RFD(Dn) 0429 28Apr10
RFD(Dn) 0433 28Apr10
RFD(Up) 0820 28Apr10
RFD(Up) 0757 28Apr10
RFD(Up) 0806 28Apr10

WVSS More Accurate Than Raob?

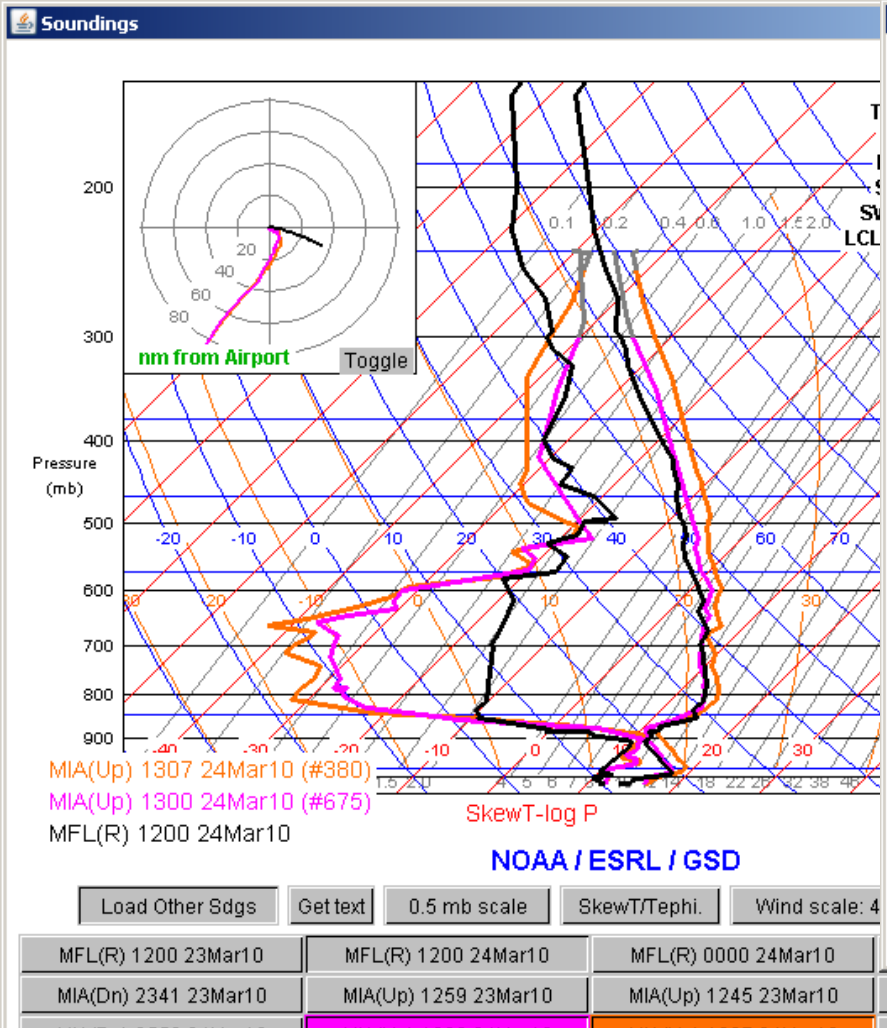


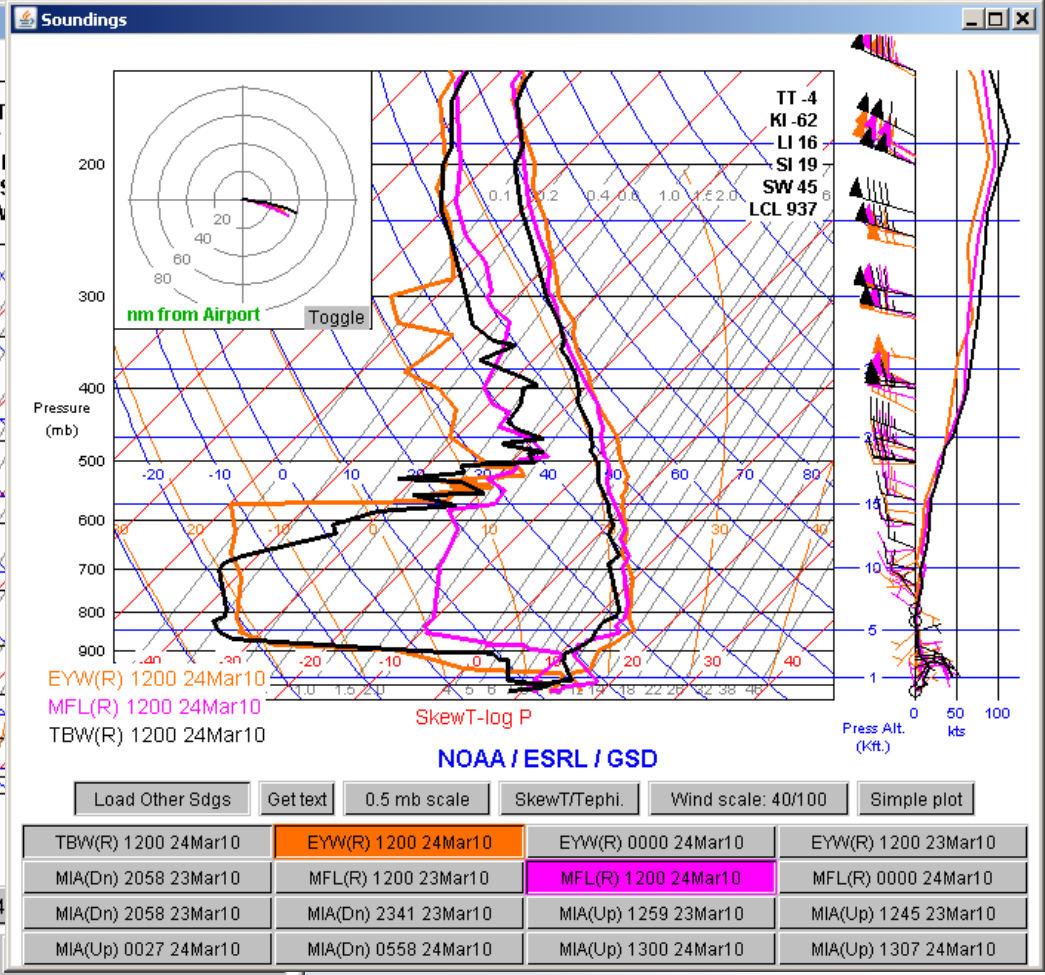
Possible Wicking Event
Miami, Florida Radiosonde
April 23, 2010 @ 00:00 UTC

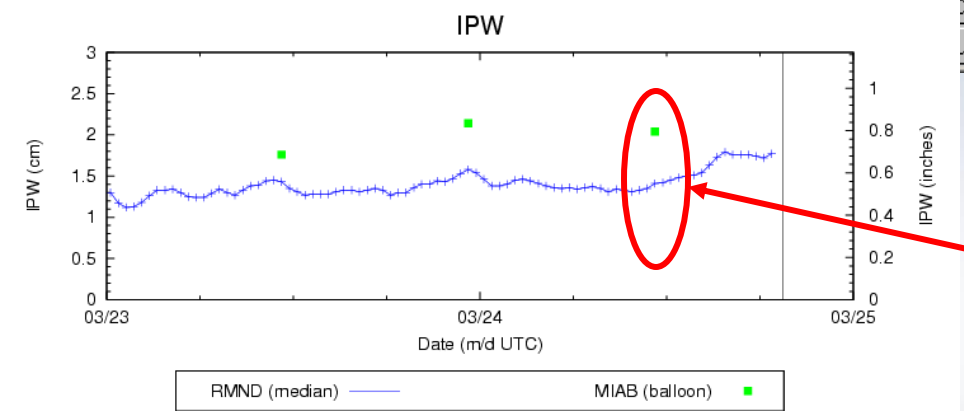
RAOB BL Height= 800mb/2.0 km/6.5kft

AMDAR BL Height= 850mb/1.5km/4.8kft

KMIA 230053Z 14005KT 10SM FEW050 BKN250
24/18 A2996 RMK AO2 SLP144 T02440178







MFL RAOB vs. GPS-Met Integrated Precipitable Water (IPW) shows WVSS was more accurate!

WVSS-2 Data Ready for Models

- Currently used to initialize RUC-Backup at GSD
- Next step: evaluation of WVSS for operational models