NOAA Satellites and Information

National Environmental Satellite, Data, and Information Service

STAR – Center for Satellite Applications and Research

formerly ORA – Office of Research Applications

Noaa PROduct (integrated) Validation System (NPROVS)

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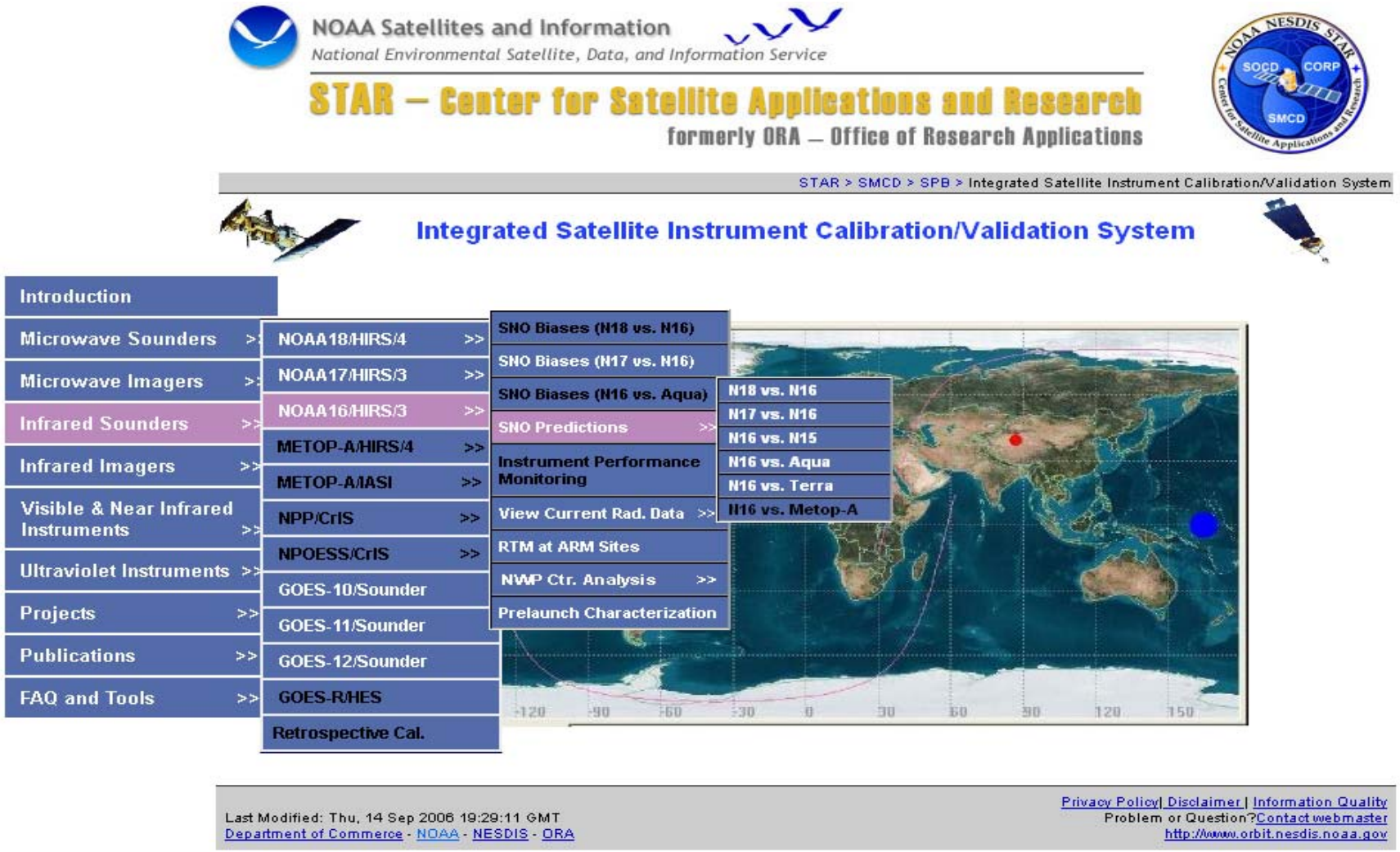
International A-TOVS Study Conference 16

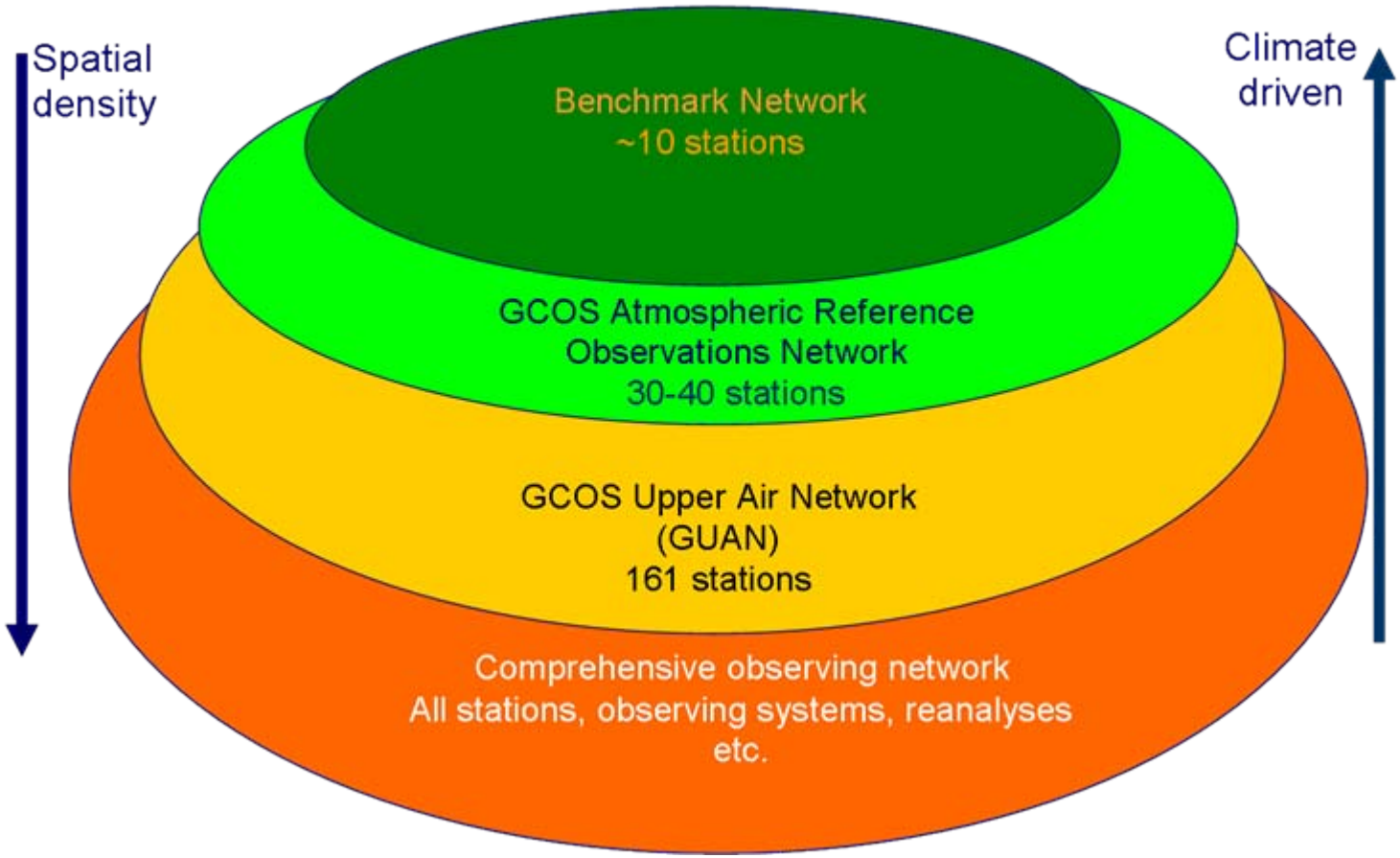
May 2008

Integrated Cal/Val System

(Weng, Cao … Goldberg)



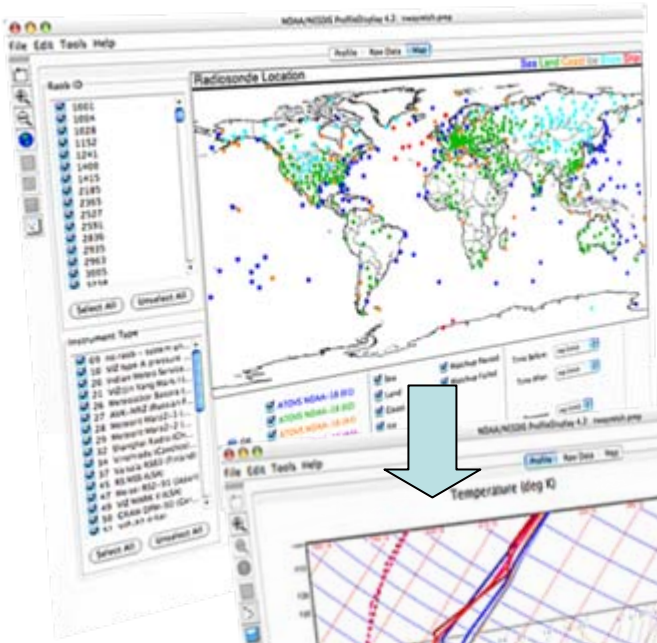
http://www.orbit.nesdis.noaa.gov/smcd/spb/calibration/icvs/

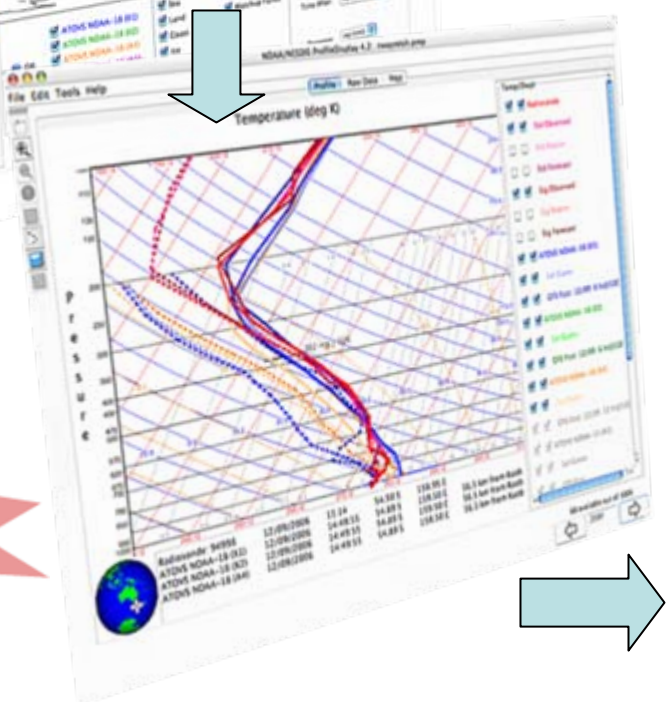


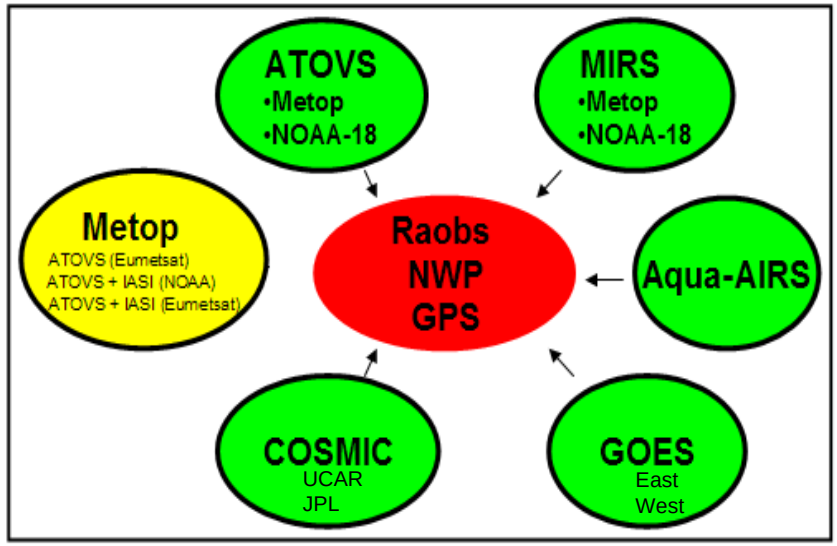
... *procedures and strategies relevant to "evolving" GCOS Atmospheric Reference Observations Network*

NOAA Product Integrated Validation System (NPROVS)

… streamlining the processing of data, calibration, and validation from satellites and ground stations.







Critical in development of MetOp and NPOESS

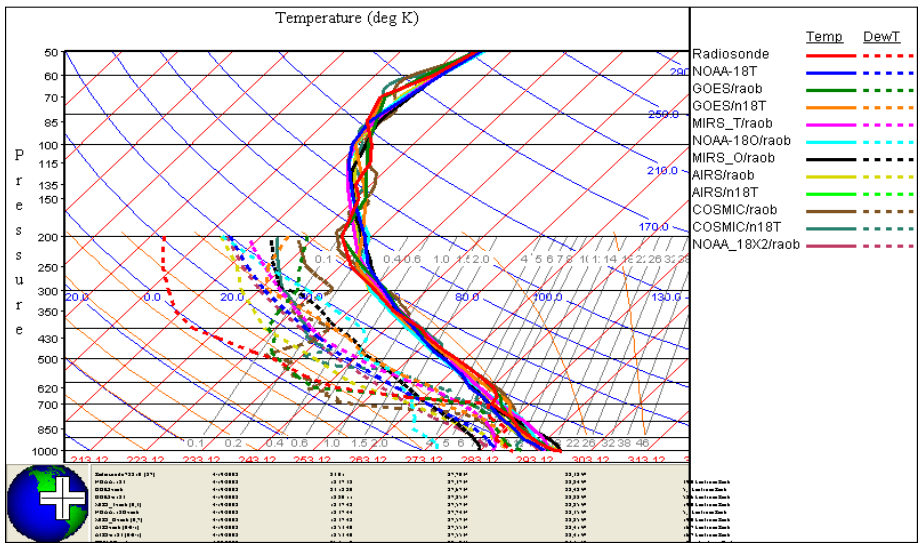
Environmental Data Graphic and Evaluation System *(EDGE)*

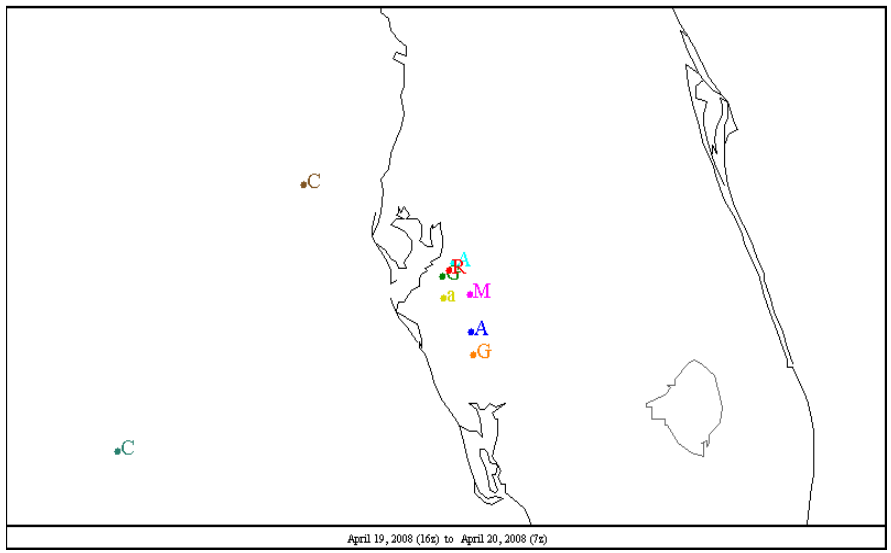
- Collocated multiple platforms of ground truth vs satellite observations.
- Displays radiosonde and satellite profiles.
- Displays a geographic distribution of collocations
- Displays statistics that shows the vertical accuracy between a radiosonde and one or more satellite soundings.

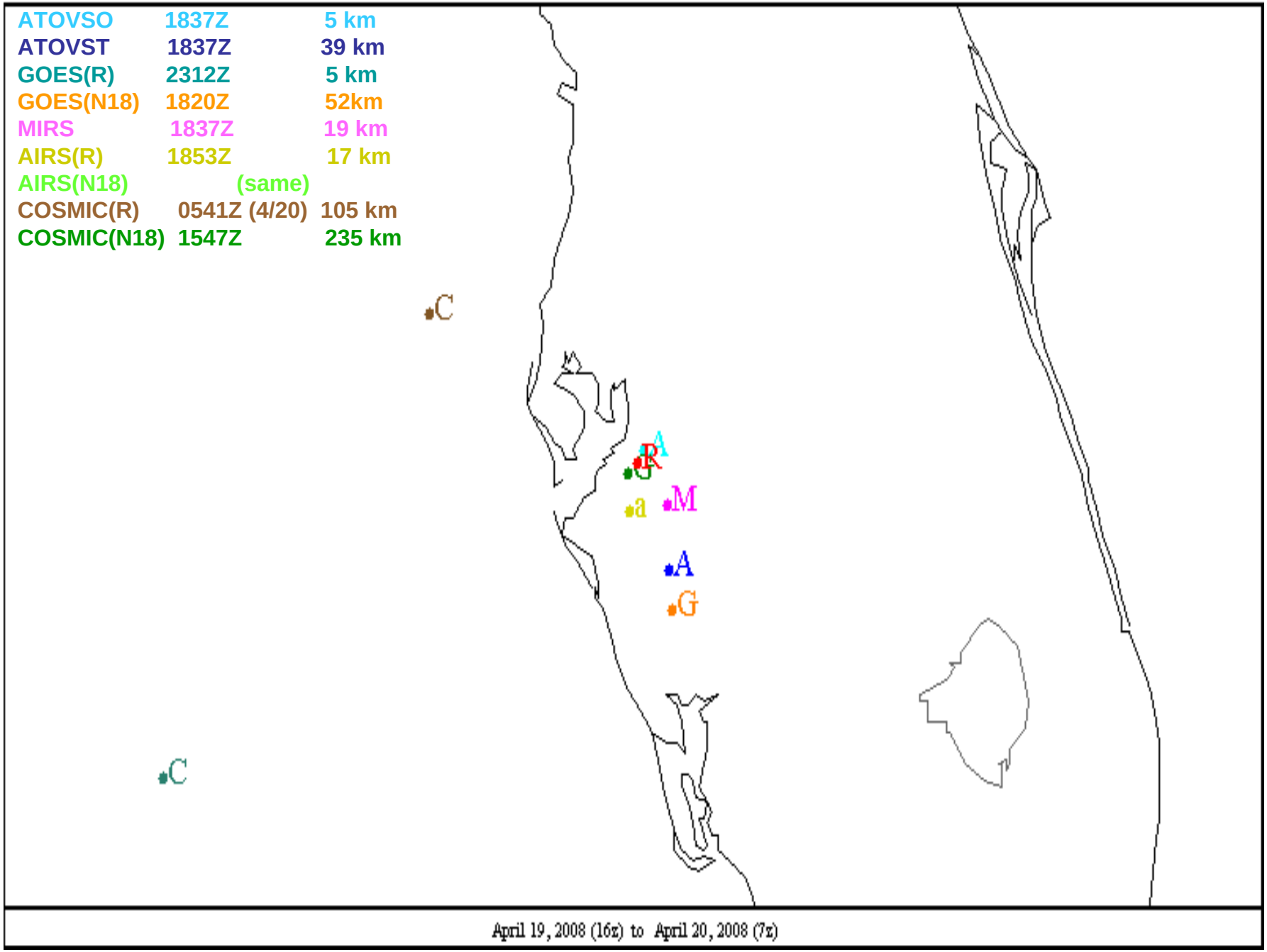
NPROVS Provides Consistent Validation Across NOAA Product Landscape

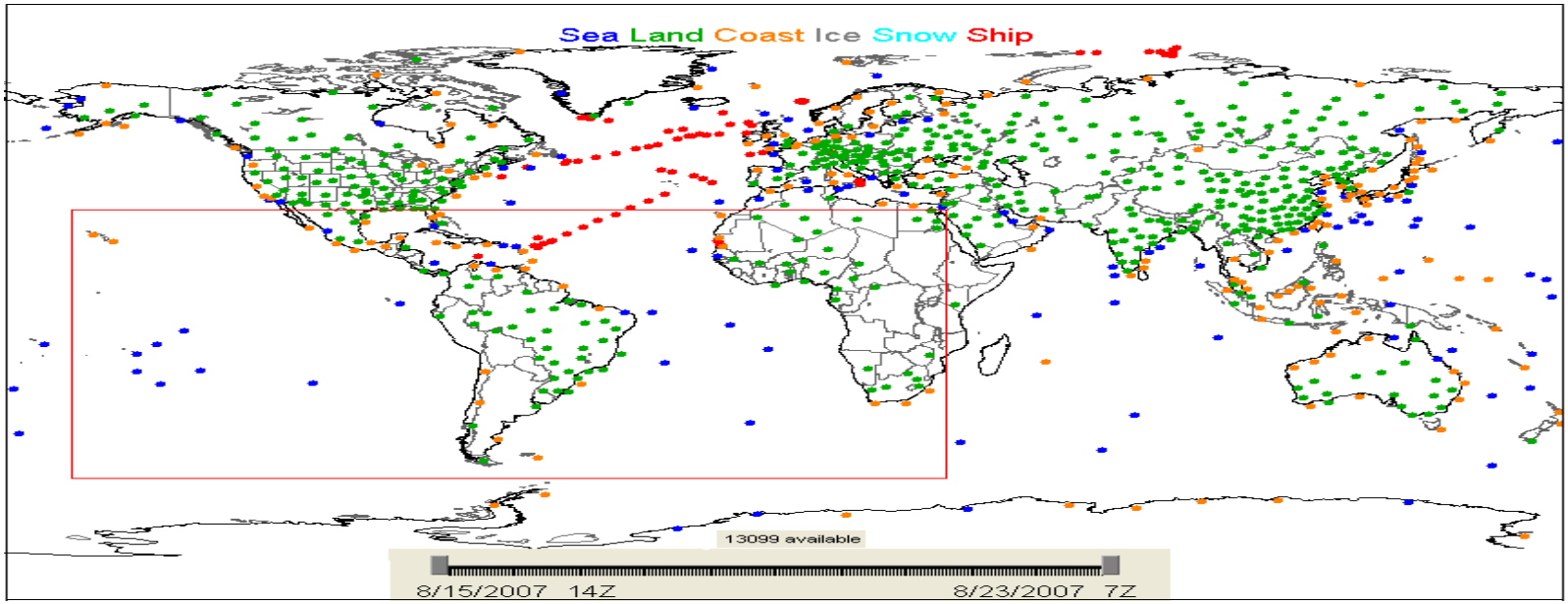
Centralized Function

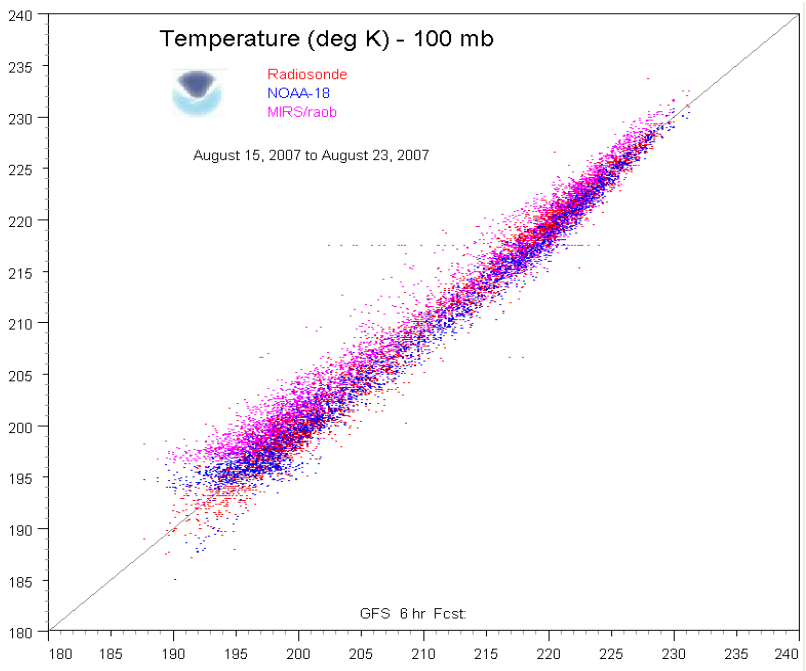
- Routine Access of satellite (GOES, POES, COSMIC), ground truth (Raob, … GPS, Dropsonde) and *NWP observations*
  - NWP 6-hr guess collocated to raob *(… plan to append Analysis during wait time)*
  - NWP 3-hr or 6-hr guess collocated to respective satellites
- *"Consistent strategy"* for collocating respective satellite and ground truth platforms
  - 6-hours; 200km
  - Single "closest" collocation
  - Accounts for respective platform spatial and temporal characteristics
- Screening / qc protocols per respective platform
- Display and analysis (EDGE…)

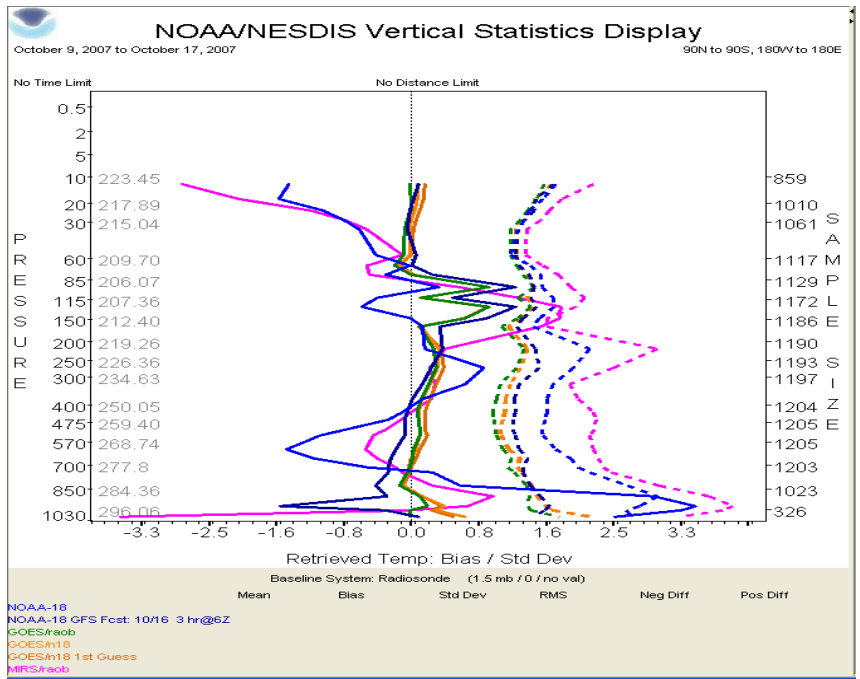


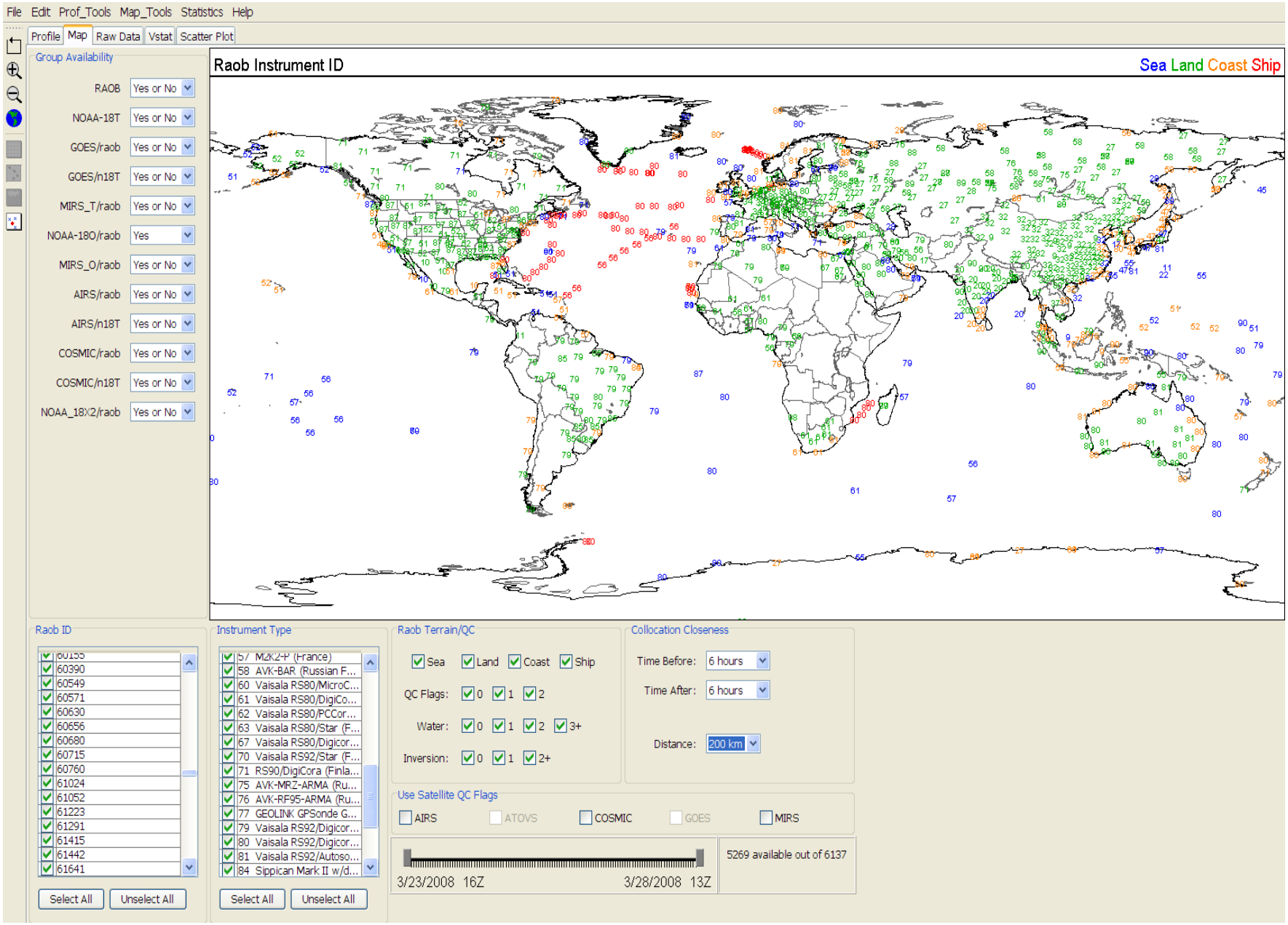



ATOVSO 1837Z 5 km
ATOVST 1837Z 39 km
GOES(R) 2312Z 5 km
GOES(N18) 1820Z 52km
MIRS 1837Z 19 km
AIRS(R) 1853Z 17 km
AIRS(N18) (same)
COSMIC(R) 0541Z (4/20) 105 km
COSMIC(N18) 1547Z 235 km
C
A
R
G
a
M
A
G
C
April 19, 2008 (16z) to April 20, 2008 (7z)

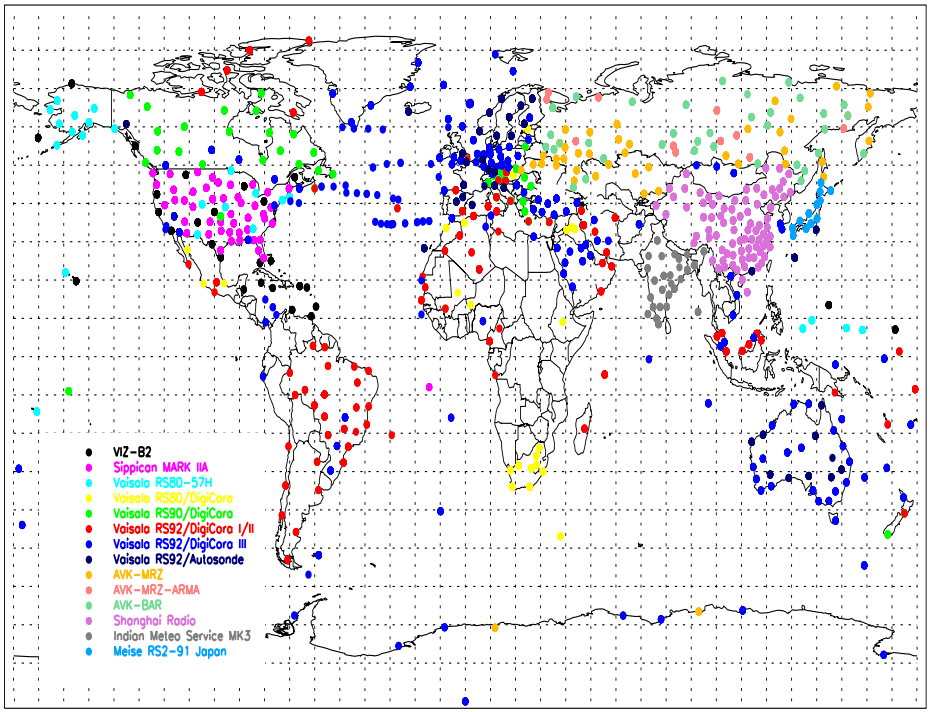

Sea Land Coast Ice Snow Ship
13099 available
8/15/2007 14Z
8/23/2007 7Z


Temperature (deg K) - 100 mb
Radiosonde
NOAA-18
MIRS/raob
August 15, 2007 to August 23, 2007
GFS 6 hr Fcst
240
235
230
225
220
215
210
205
200
195
190
185
180
180 185 190 195 200 205 210 215 220 225 230 235 240

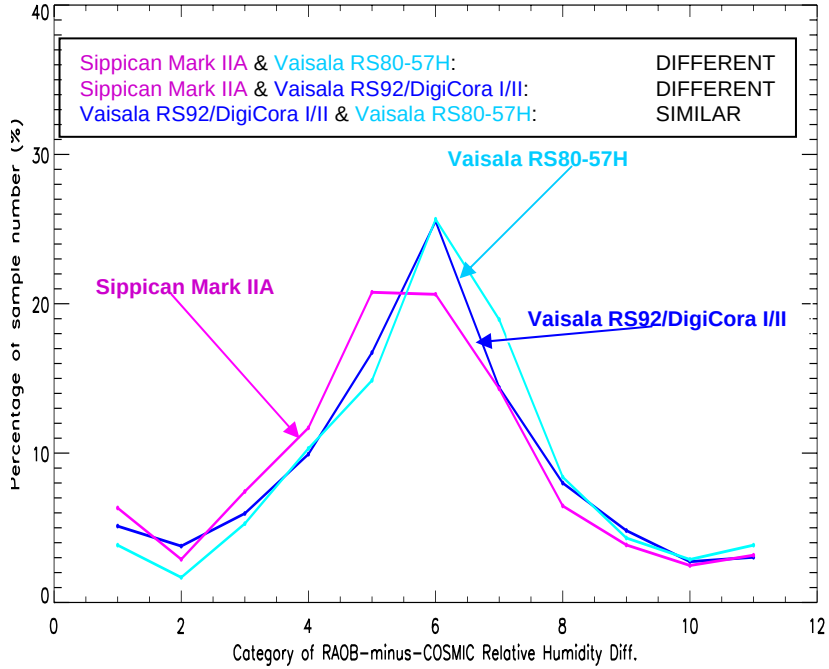

NOAA/NESDIS Vertical Statistics Display
October 9, 2007 to October 17, 2007
90N to 90S, 180W to 180E
No Time Limit
No Distance Limit
PRESSURE
SAMPLE SIZE
0.5
2
5
10 223.45 859
20 217.89 1010
30 215.04 1061
60 209.70 1117
85 206.07 1129
115 207.36 1172
150 212.40 1186
200 219.26 1190
250 226.36 1193
300 234.63 1197
400 250.05 1204
475 259.40 1205
570 268.74 1205
700 277.8 1203
850 284.36 1023
1030 296.06 326
-3.3 -2.5 -1.6 -0.8 0.0 0.8 1.6 2.5 3.3
Retrieved Temp: Bias / Std Dev
Baseline System: Radiosonde (1.5 mb / 0 / no val)
Mean Bias Std Dev RMS Neg Diff Pos Diff
NOAA-18
NOAA-18 GFS Fcst: 10/16 3 hr@6Z
GOES/raob
GOES/n18
GOES/n18 1st Guess
MIRS/raob


File Edit Prof_Tools Map_Tools Statistics Help
Profile Map Raw Data Vstat Scatter Plot
Group Availability
RAOB Yes or No
NOAA-18T Yes or No
GOES/raob Yes or No
GOES/n18T Yes or No
MIRS_T/raob Yes or No
NOAA-18O/raob Yes
MIRS_O/raob Yes or No
AIRS/raob Yes or No
AIRS/n18T Yes or No
COSMIC/raob Yes or No
COSMIC/n18T Yes or No
NOAA_18X2/raob Yes or No
Raob Instrument ID
Sea Land Coast Ship
Raob ID
60155
60390
60549
60571
60630
60656
60680
60715
60760
61024
61052
61223
61291
61415
61442
61641
Select All
Unselect All
Instrument Type
57 M2K2-P (France)
58 AVK-BAR (Russian F...
60 Vaisala RS80/MicroC...
61 Vaisala RS80/DigiCo...
62 Vaisala RS80/PCCor...
63 Vaisala RS80/Star (F...
67 Vaisala RS80/Digicor...
70 Vaisala RS92/Star (F...
71 RS90/DigiCora (Finla...
75 AVK-MRZ-ARMA (Ru...
76 AVK-RF95-ARMA (Ru...
77 GEOLINK GPSonde G...
79 Vaisala RS92/Digicor...
80 Vaisala RS92/Digicor...
81 Vaisala RS92/Autoso...
84 Sippican Mark II w/d...
Select All
Unselect All
Raob Terrain/QC
Sea Land Coast Ship
QC Flags: 0 1 2
Water: 0 1 2 3+
Inversion: 0 1 2+
Collocation Closeness
Time Before: 6 hours
Time After: 6 hours
Distance: 200 km
Use Satellite QC Flags
AIRS ATOVS COSMIC GOES MIRS
3/23/2008 16Z
3/28/2008 13Z
5269 available out of 6137

Use of NPROVS to Evaluate Radiosonde Instrument Type Performance



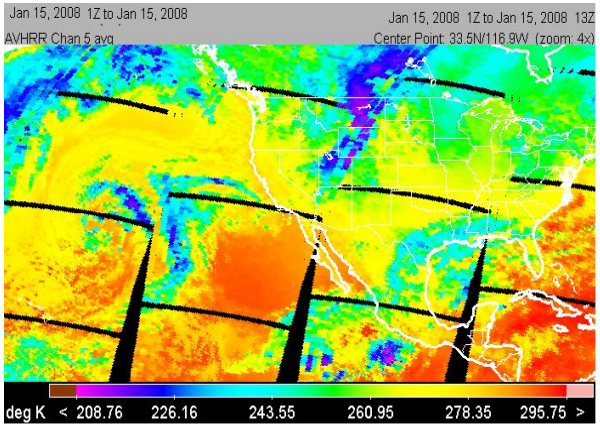
Global distribution of major radiosonde instrument types that are routinely collocated with multiple satellite data platforms contained in NPROVS

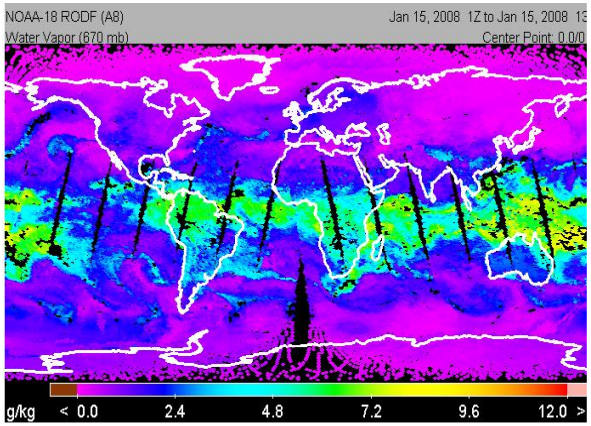


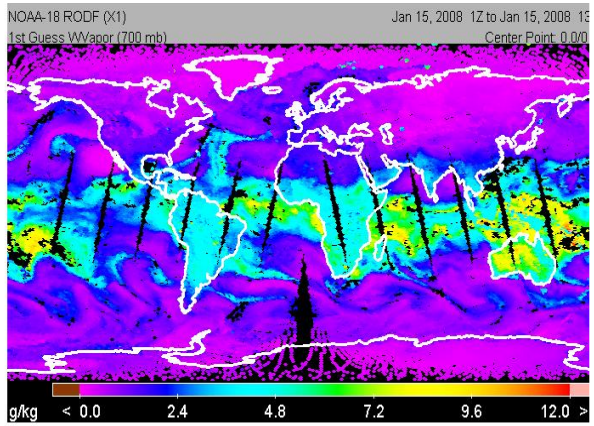
Example of statistical tests which compare the measurement characteristics of different radiosonde instrument types.

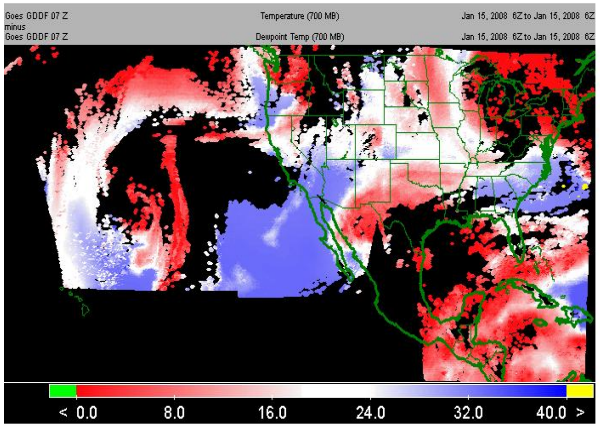
** also sites routinely launching different sondes …*

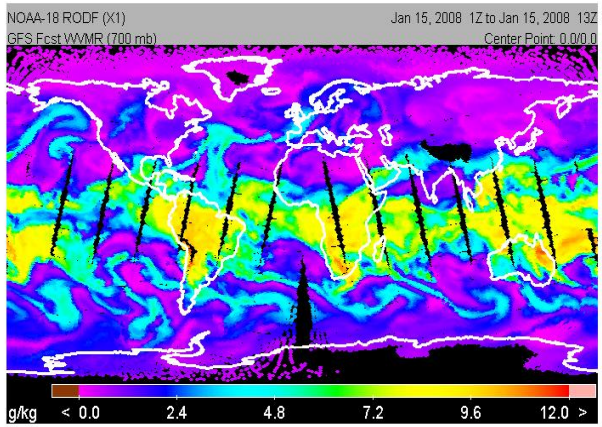
Significance: **Knowledge of respective radiosonde instrument type performance will improve their utility in satellite sounding product validation, retrieval algorithm tuning, numerical weather prediction and the construction of long-term upper-air records for climate.**

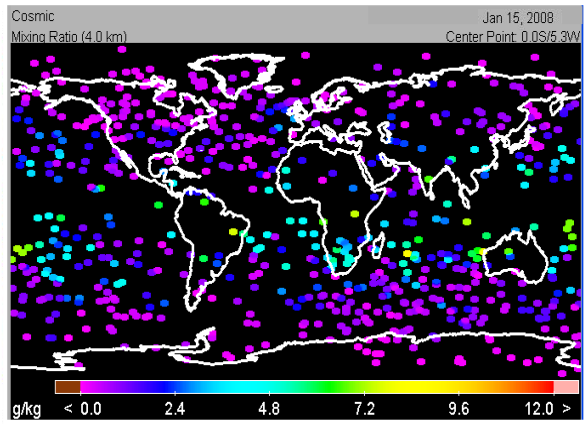

Jan 15, 2008 1Z to Jan 15, 2008
Jan 15, 2008 1Z to Jan 15, 2008 13Z
AVHRR Chan 5 avg
Center Point: 33.5N/116.9W (zoom: 4x)
deg K < 208.76 226.16 243.55 260.95 278.35 295.75 >

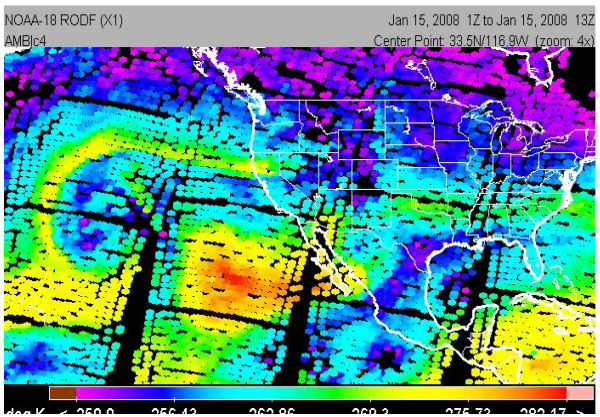

NOAA-18 RODF (A8)
Jan 15, 2008 1Z to Jan 15, 2008 13
Water Vapor (670 mb)
Center Point: 0.0/0
g/kg < 0.0 2.4 4.8 7.2 9.6 12.0 >

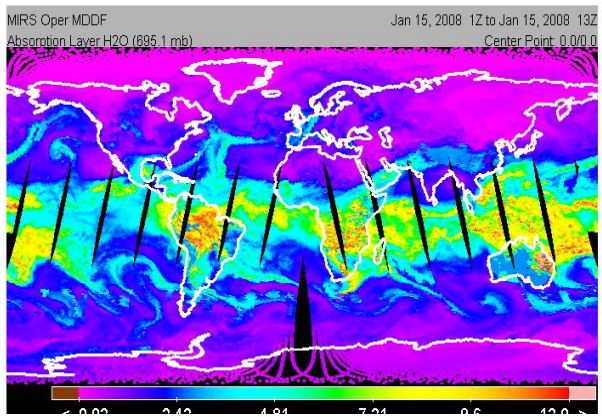

NOAA-18 RODF (X1)
Jan 15, 2008 1Z to Jan 15, 2008 13
1st Guess WVapor (700 mb)
Center Point: 0.0/0
g/kg < 0.0 2.4 4.8 7.2 9.6 12.0 >

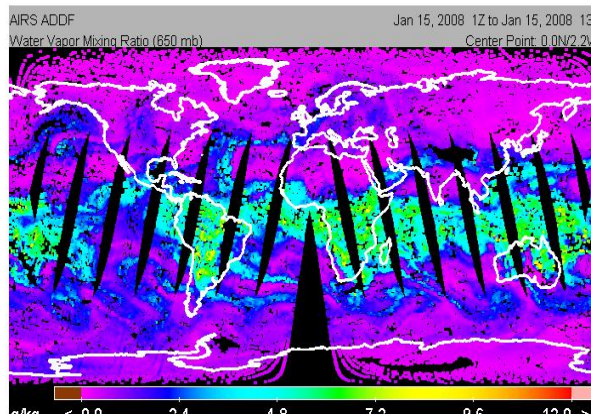

Goes GDDF 07 Z
minus
Goes GDDF 07 Z
Temperature (700 MB)
Jan 15, 2008 6Z to Jan 15, 2008 6Z
Dewpoint Temp (700 MB)
Jan 15, 2008 6Z to Jan 15, 2008 6Z
< 0.0 8.0 16.0 24.0 32.0 40.0 >

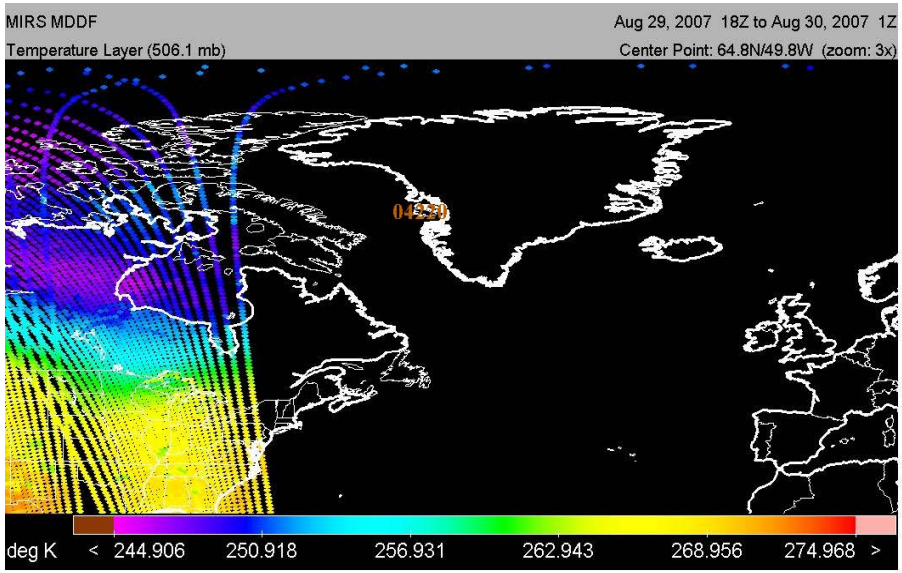

NOAA-18 RODF (X1)
Jan 15, 2008 1Z to Jan 15, 2008 13Z
GFS Fcst WVMR (700 mb)
Center Point: 0.0/0.0
g/kg < 0.0 2.4 4.8 7.2 9.6 12.0 >

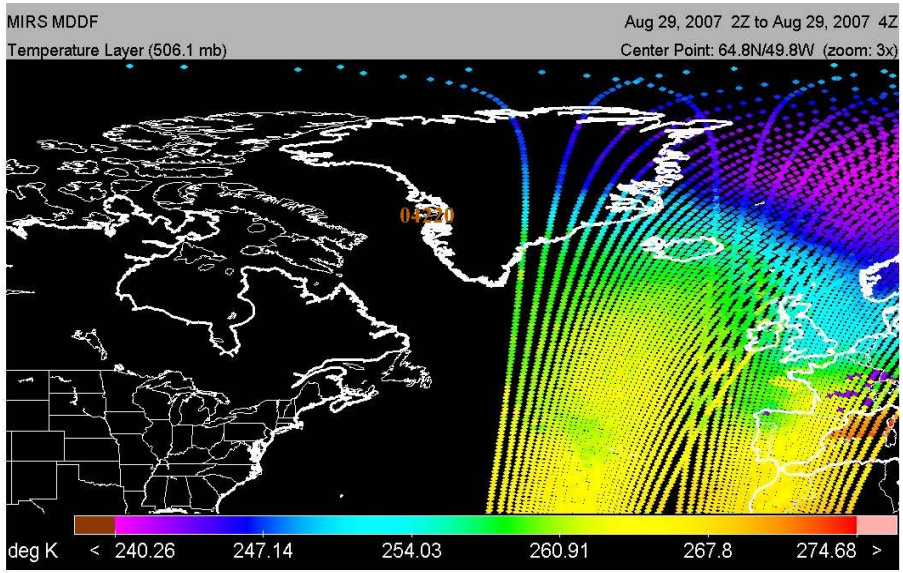

Cosmic
Jan 15, 2008
Mixing Ratio (4.0 km)
Center Point: 0.0S/5.3W
g/kg < 0.0 2.4 4.8 7.2 9.6 12.0 >

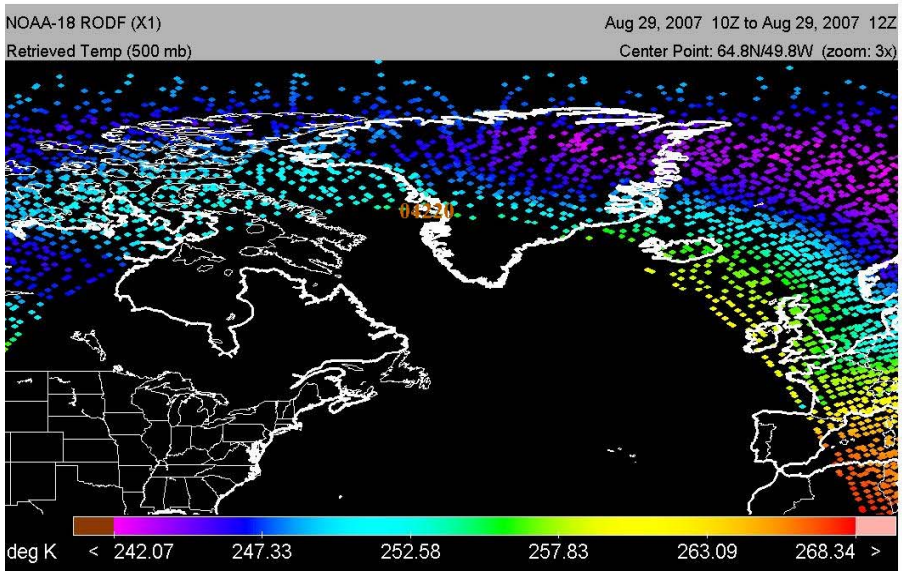

NOAA-18 RODF (X1)
Jan 15, 2008 1Z to Jan 15, 2008 13Z
AMBlc4
Center Point: 33.5N/116.9W (zoom: 4x)

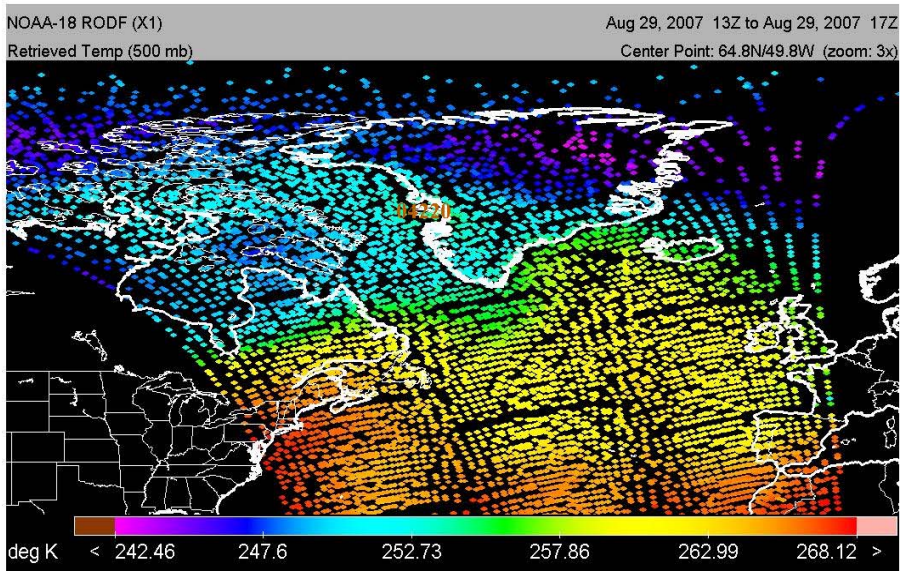

MIRS Oper MDDF
Jan 15, 2008 1Z to Jan 15, 2008 13Z
Absorption Layer H2O (695.1 mb)
Center Point: 0.0/0.0


AIRS ADDF
Jan 15, 2008 1Z to Jan 15, 2008 13
Water Vapor Mixing Ratio (650 mb)
Center Point: 0.0N/2.2









Selective sampling at 70N (site 04220)
00Z (18Z to 04Z; upper) versus 12Z (10Z to 17Z; lower)

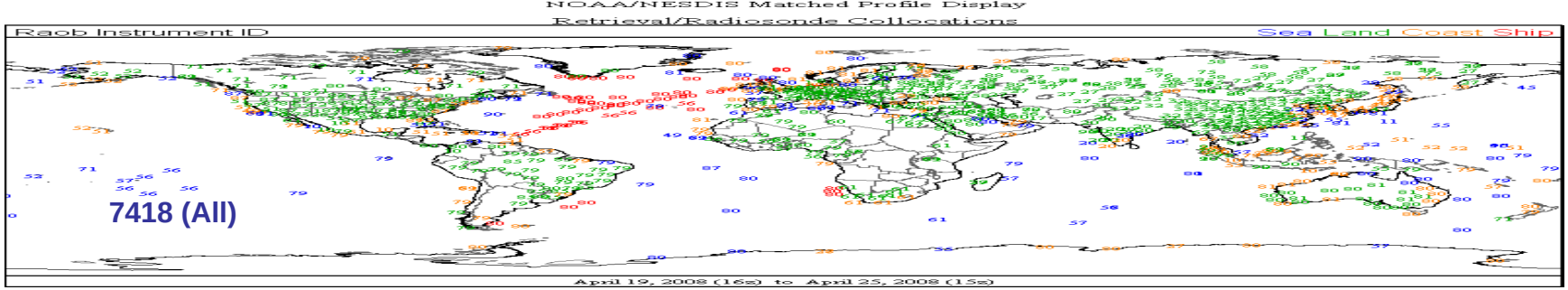
Analysis with Environmental Data Graphical Evaluation (EDGE)

Profile Display

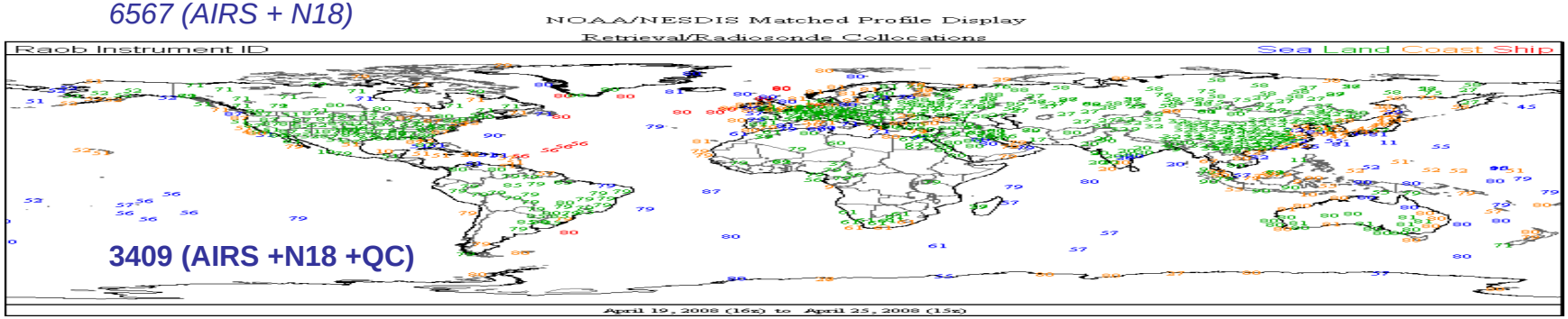
Horizontal Imagery

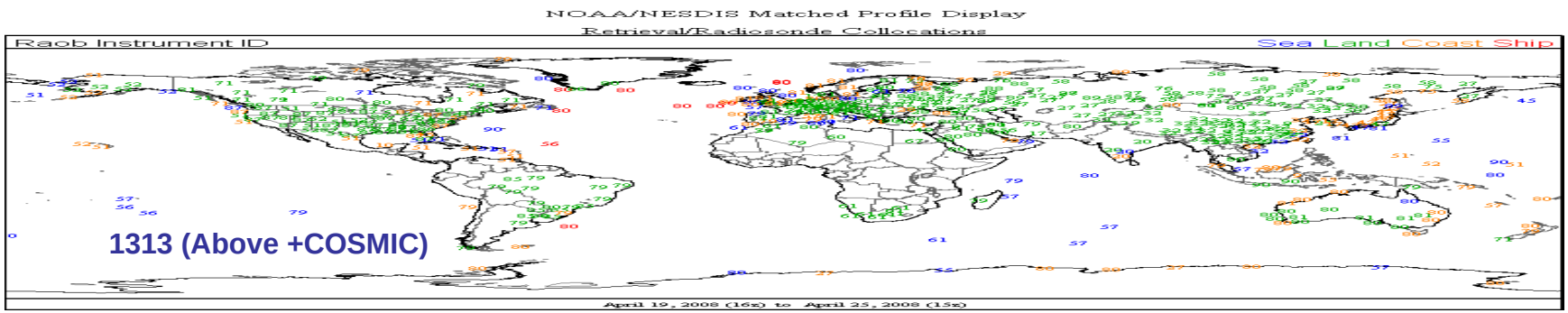
Longer Term Statistics (vertical, trend …)

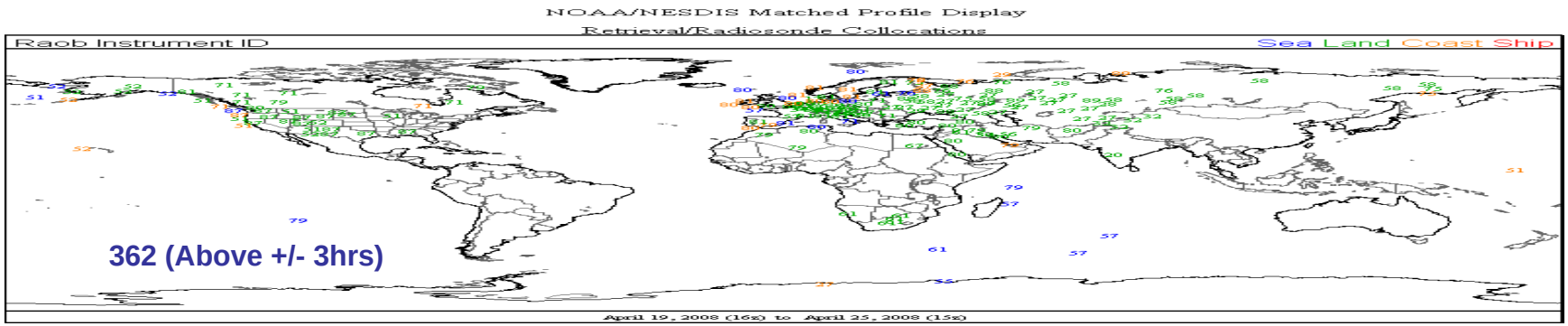
(visit SSSP Web site)



6567 (AIRS + N18)

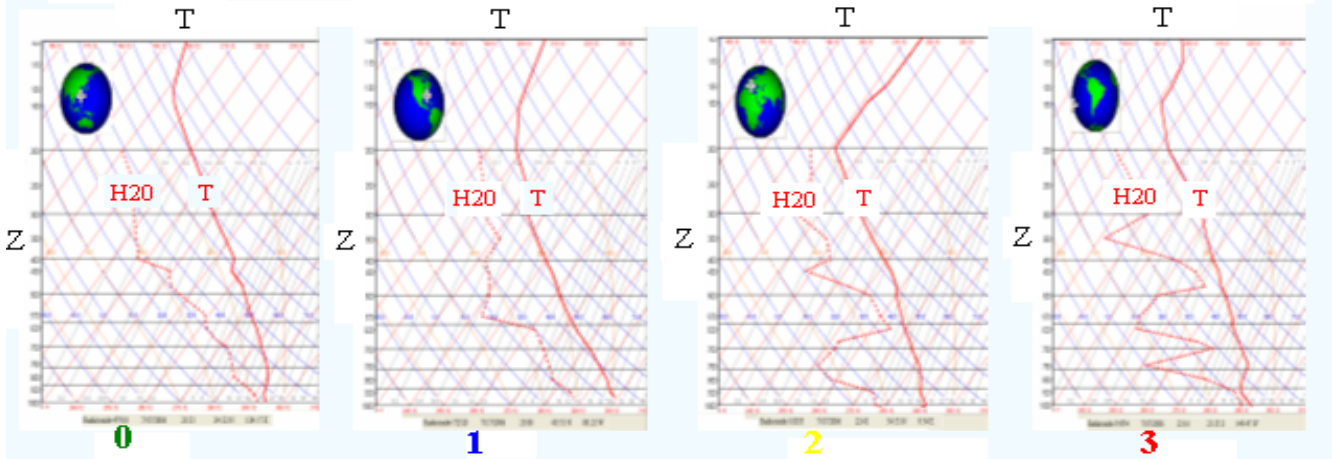




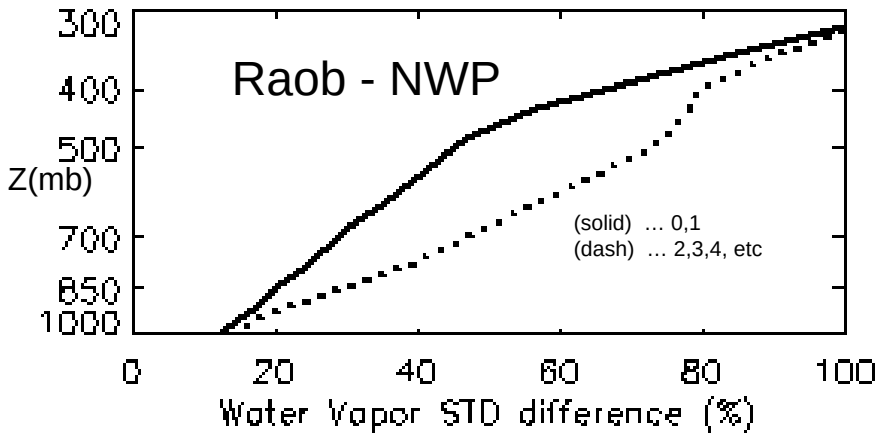


NOAA Products Integrated Validation System

... new moisture screening approach

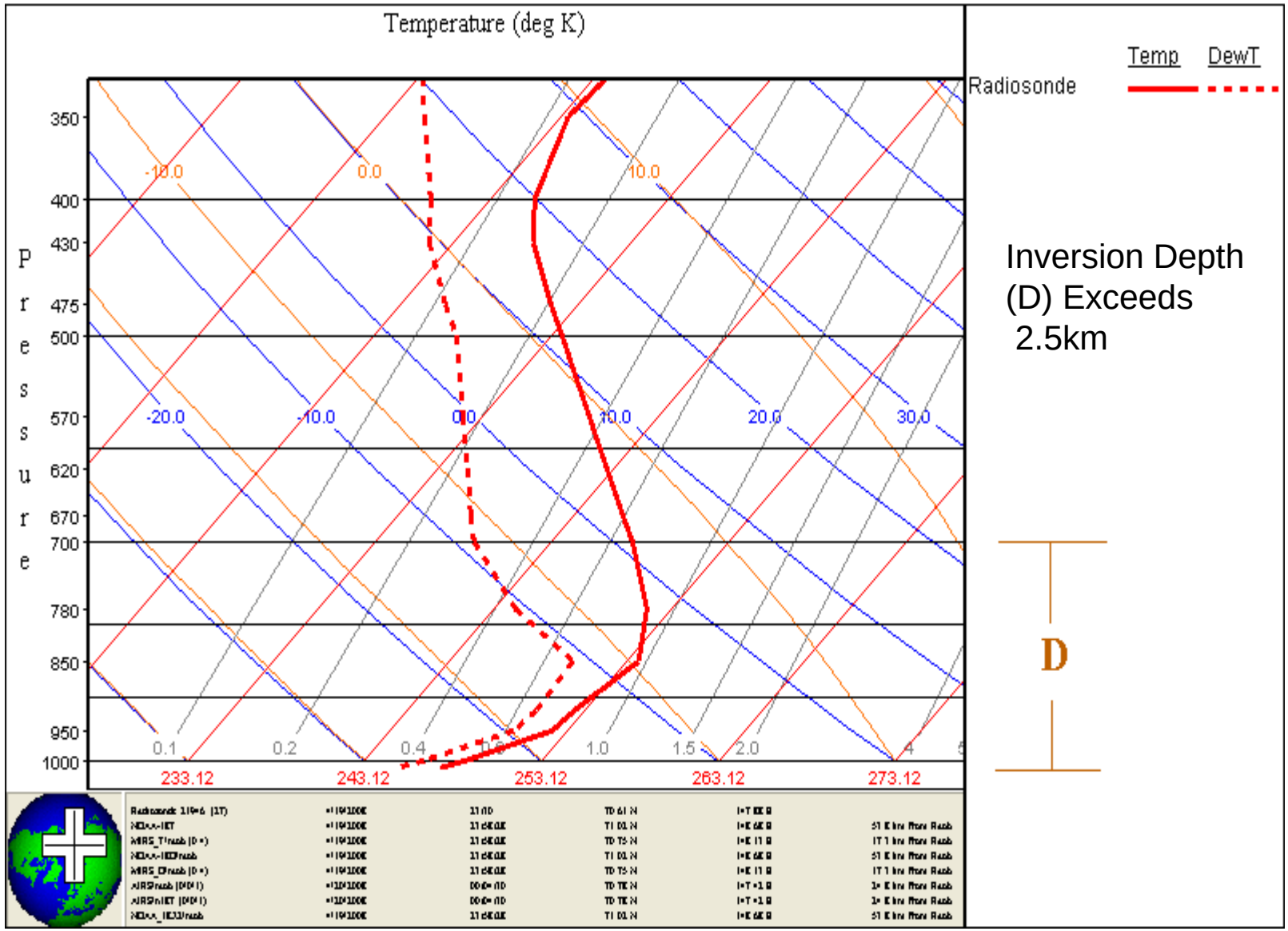


- Analyzes for abrupt changes in moisture profiles
- Scores each profile (0, 1, 2, 3 or more)

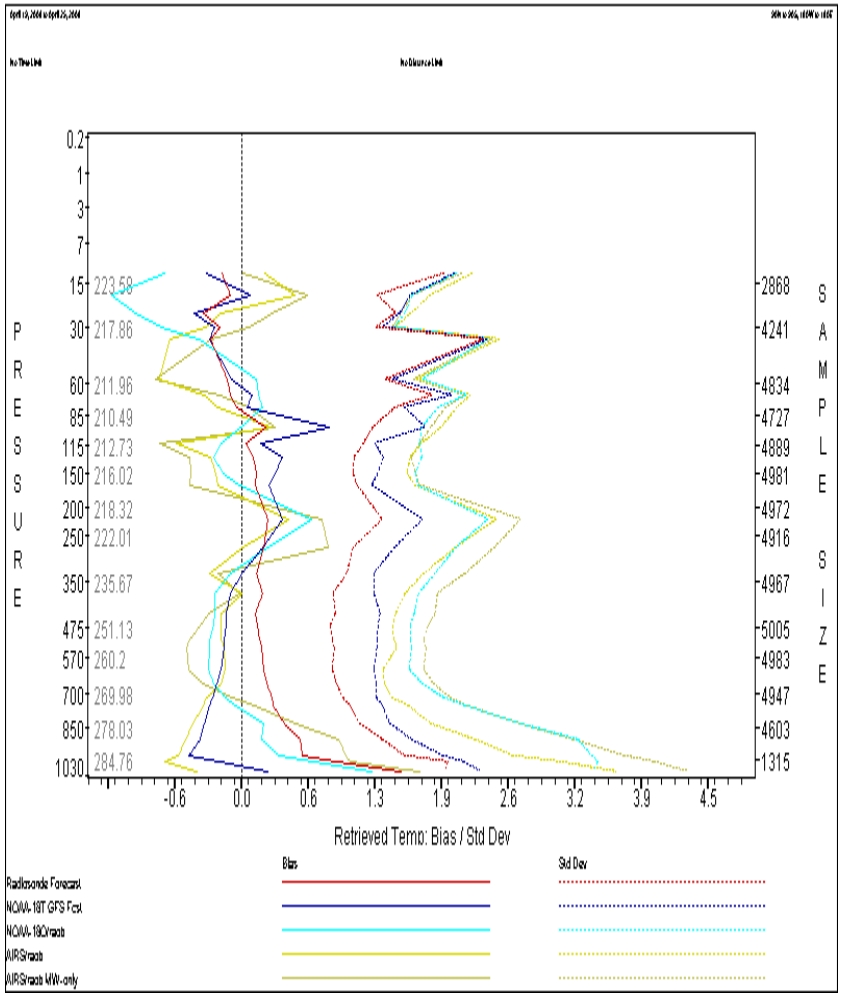


- **Agreement between Raob and NWP H20 vapor improves up to 40% using (0,1) reports**
- **Reale, Tilley Preliminary Report on Radiosonde Screening 9available on request)**

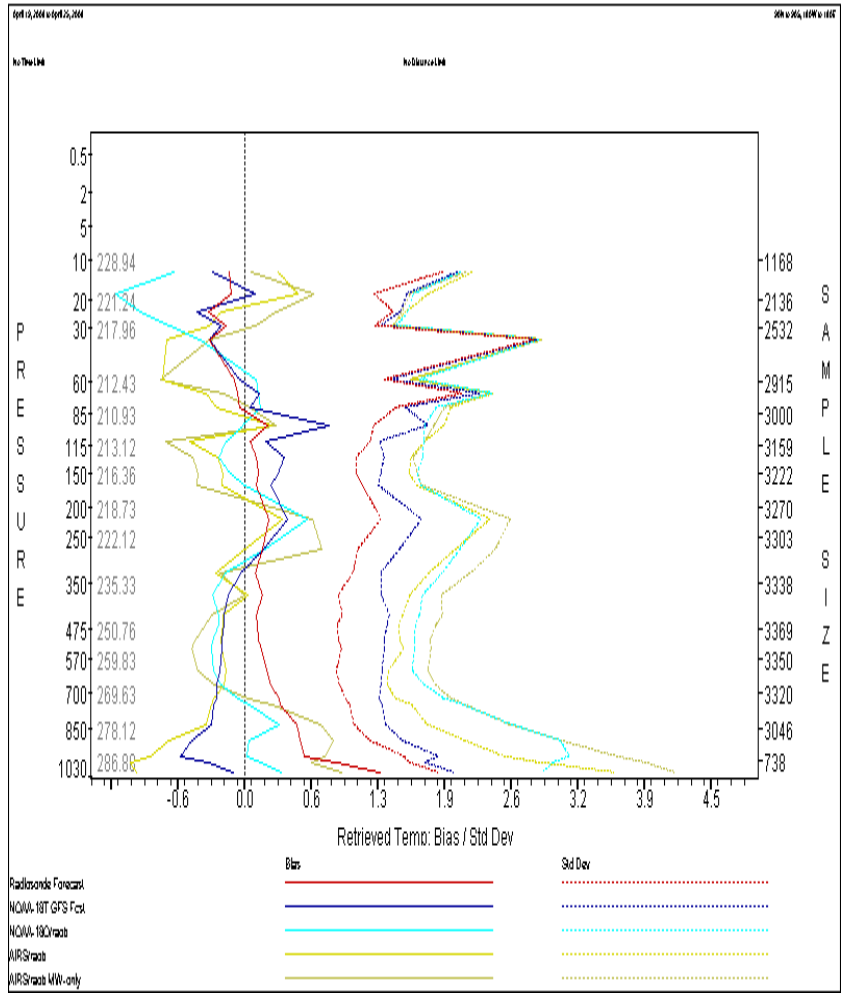
NOAA/NESDIS Matched Profile Display



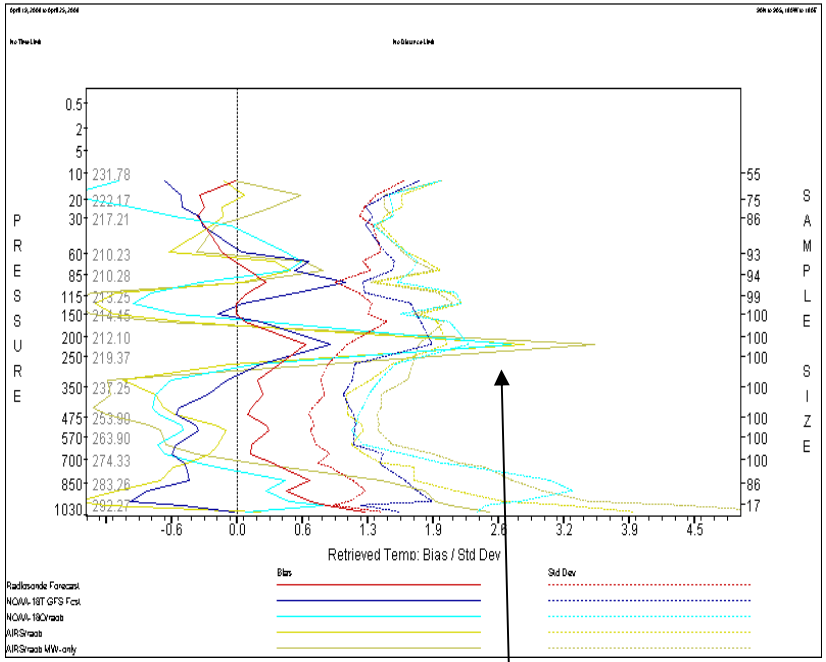
NOAA/NESDIS Matched Profile Display



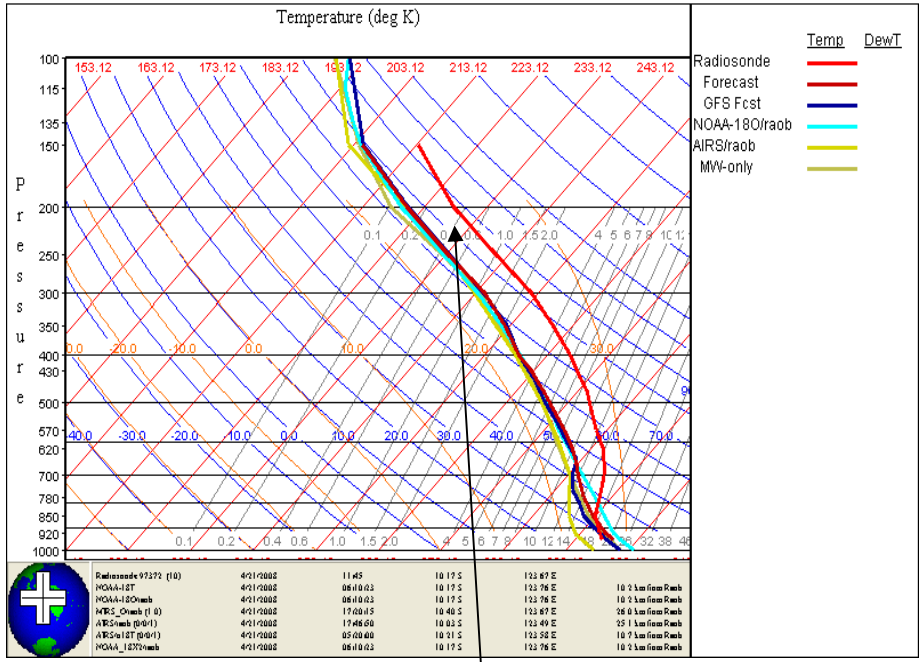
NOAA/NESDIS Matched Profile Display



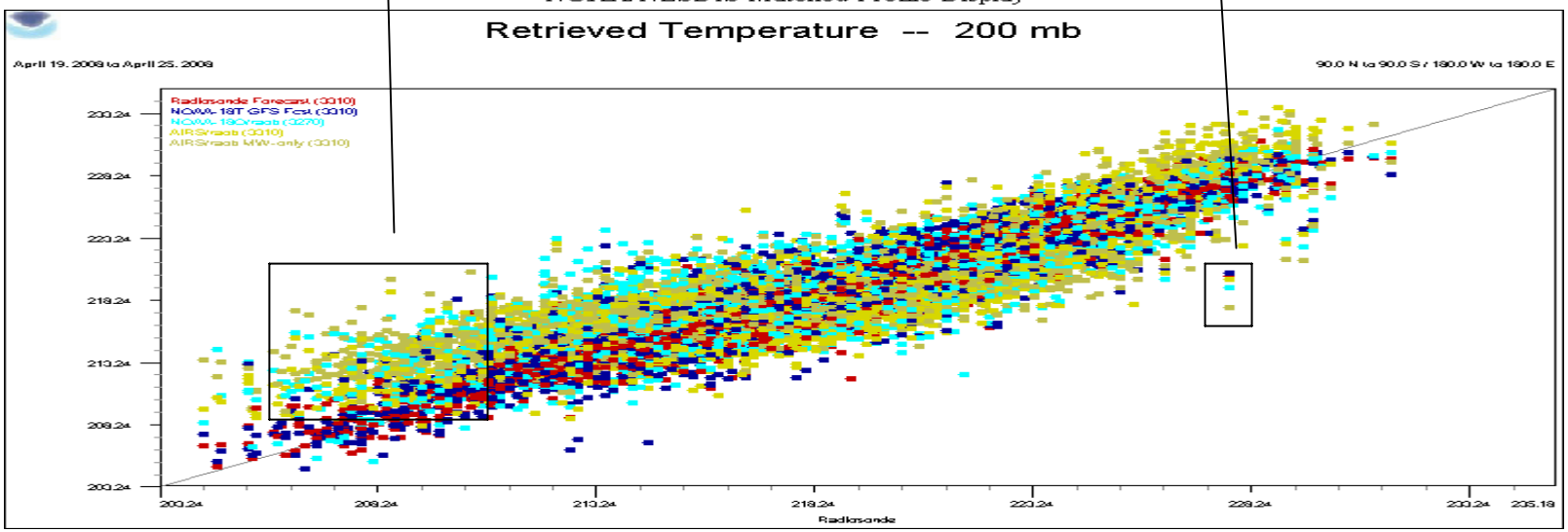
NOAA/NESDIS Matched Profile Display



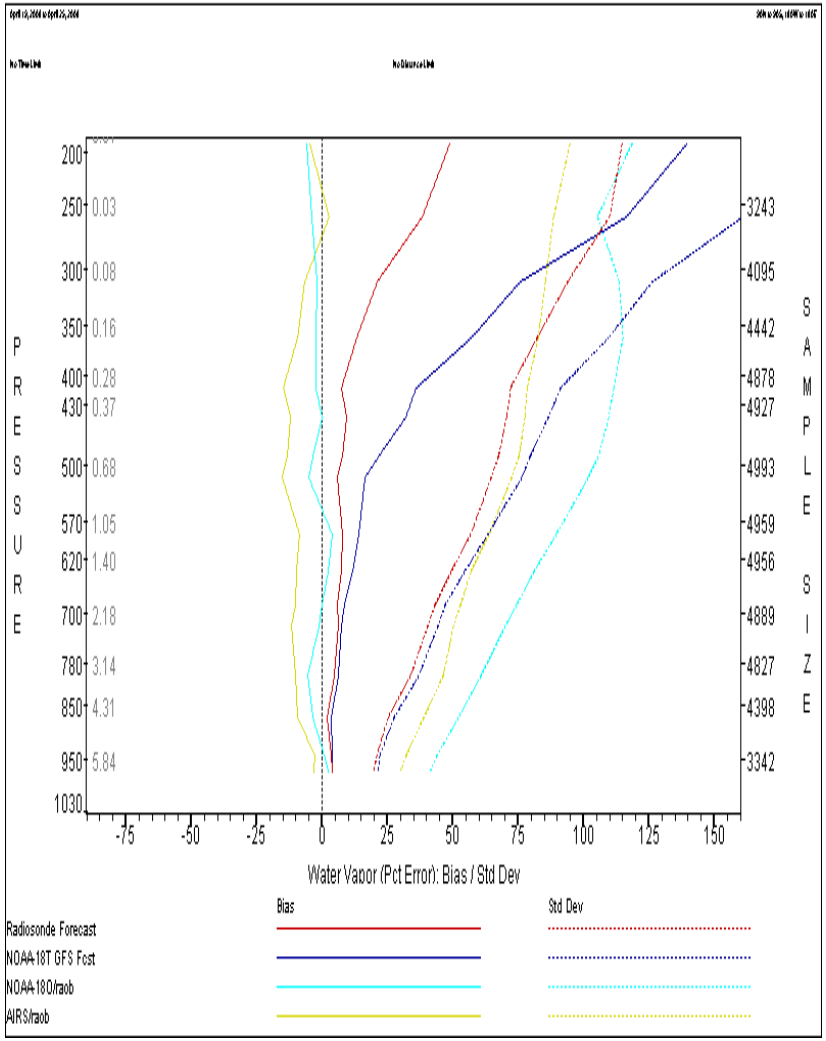
NOAA/NESDIS Matched Profile Display



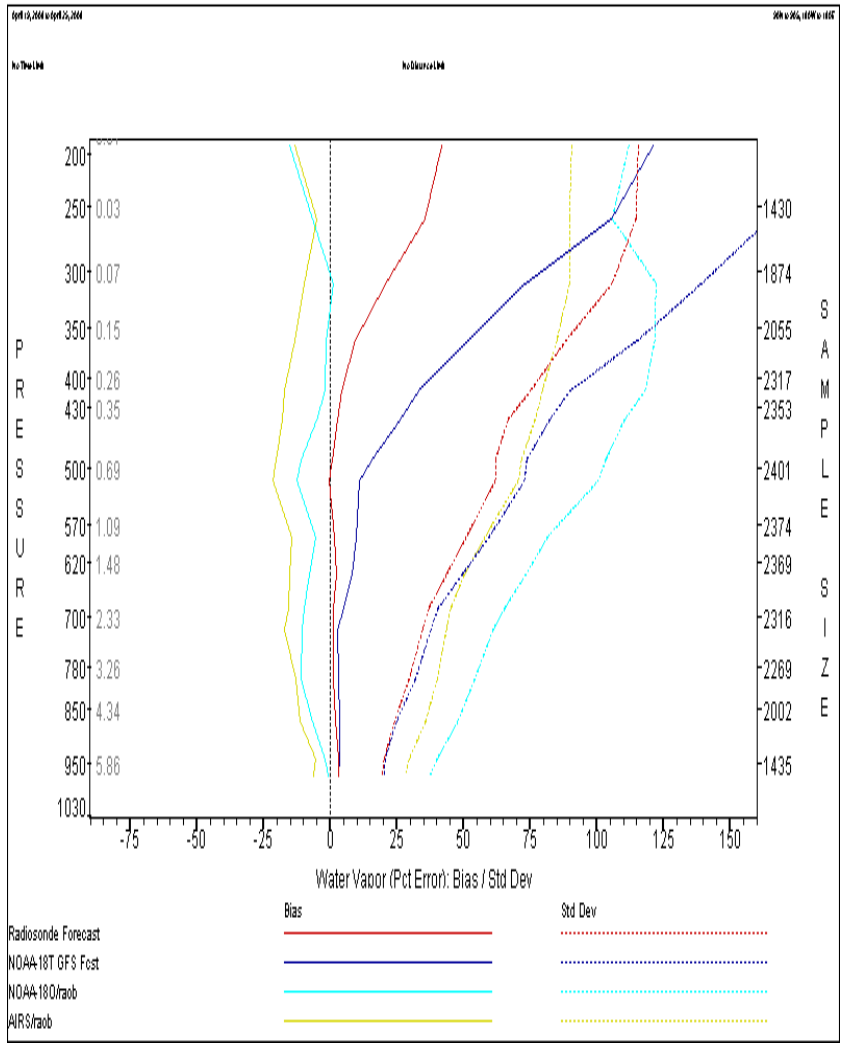
NOAA/NESDIS Matched Profile Display



NOAA/NESDIS Matched Profile Display



NOAA/NESDIS Matched Profile Display



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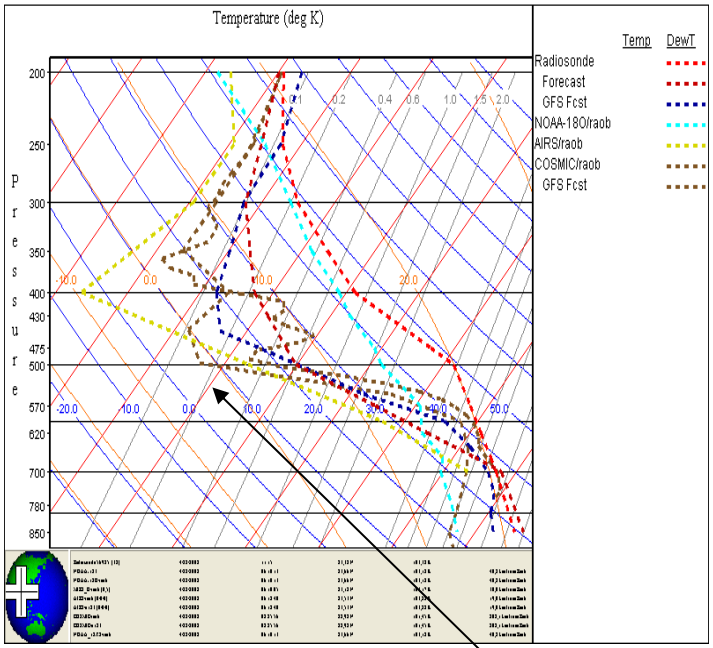

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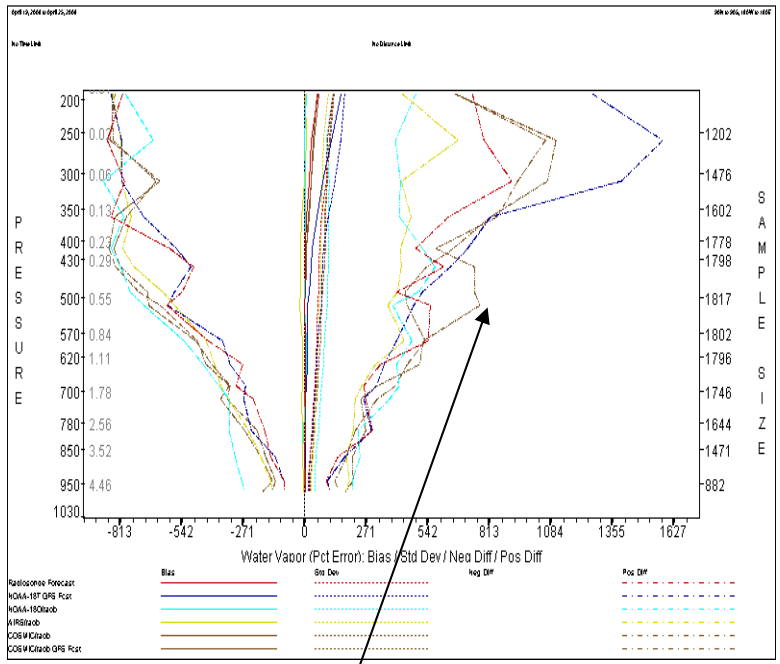

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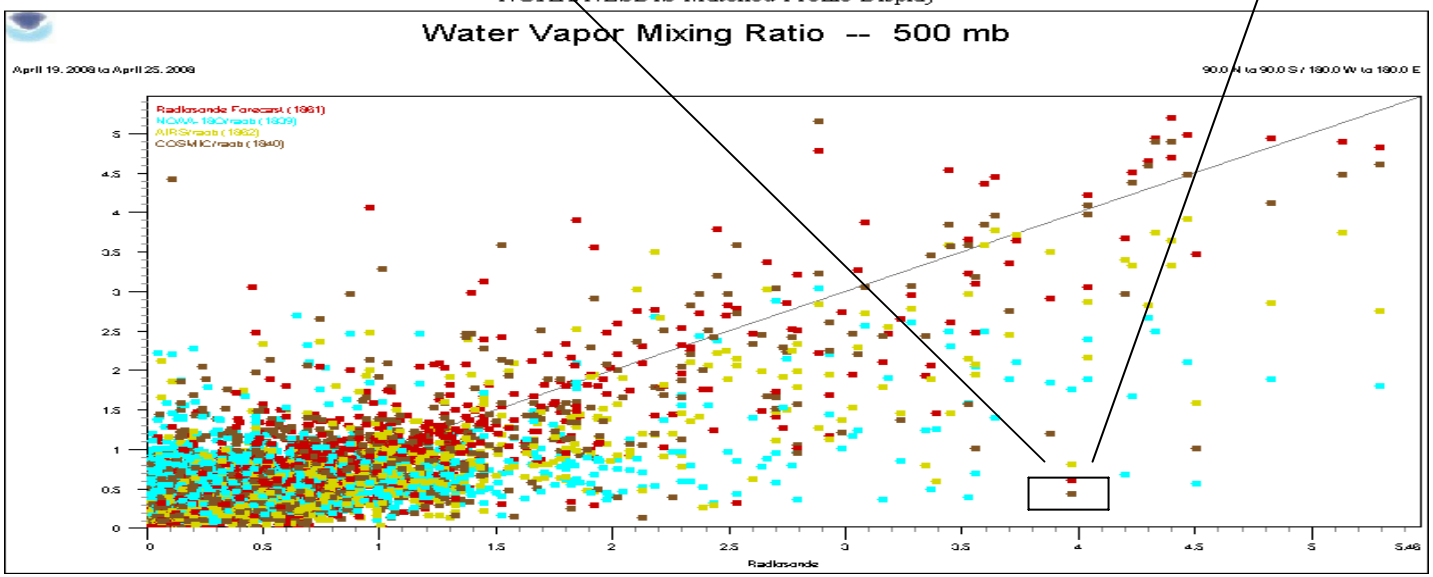
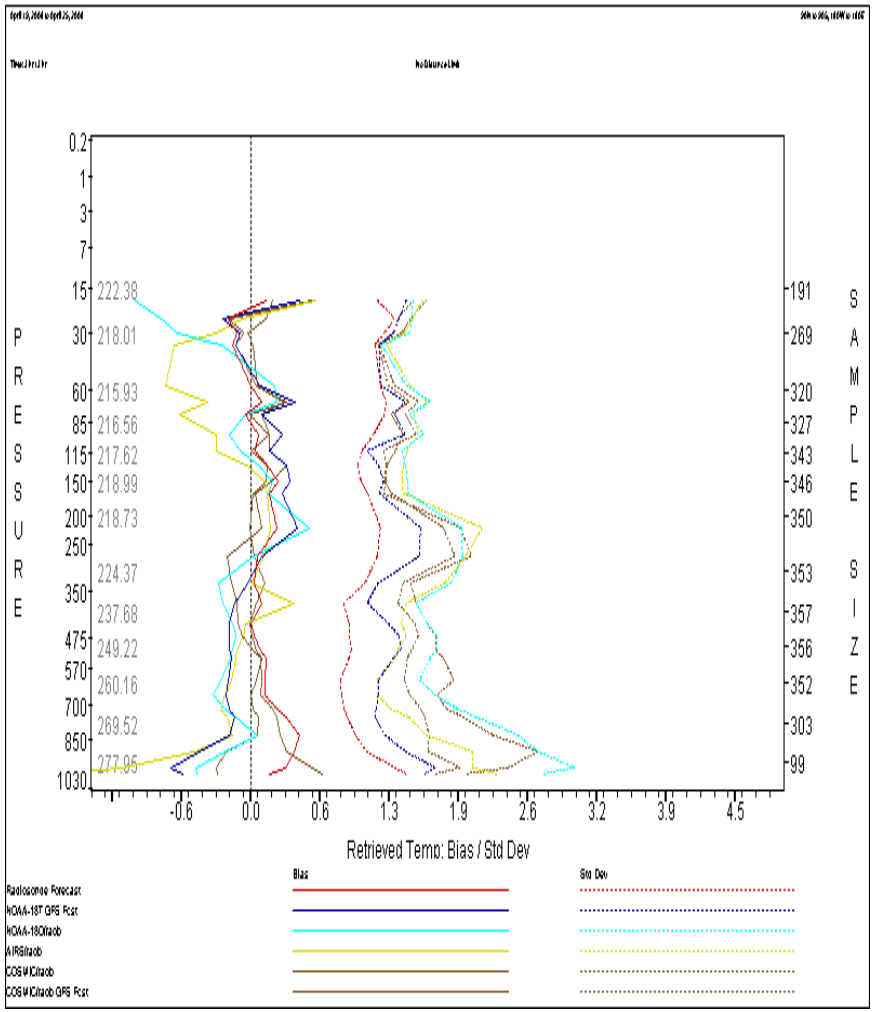
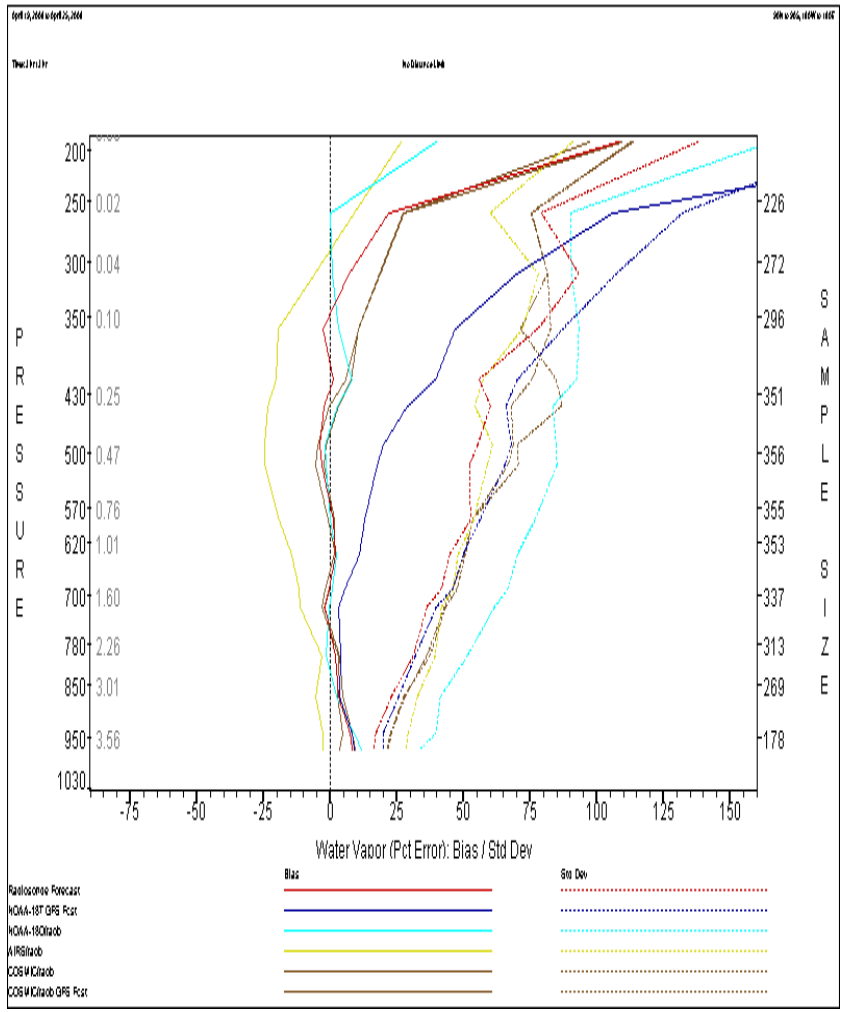


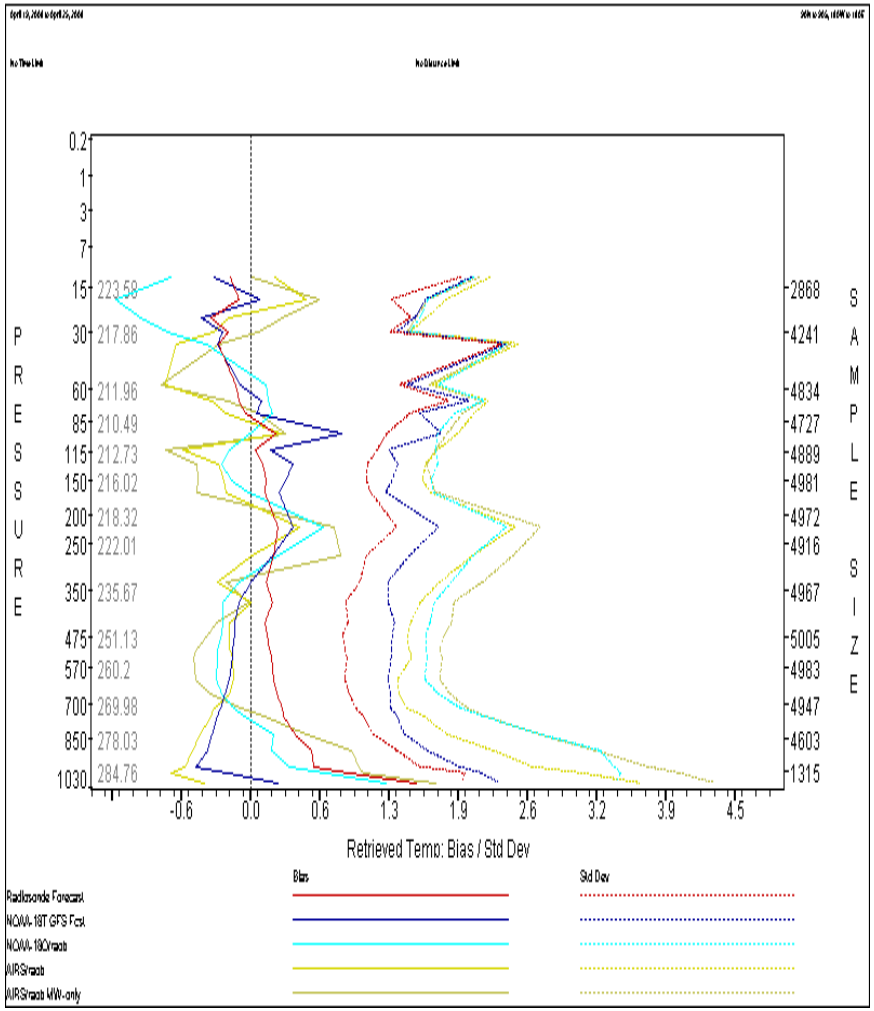
NOAA/NESDIS Matched Profile Display



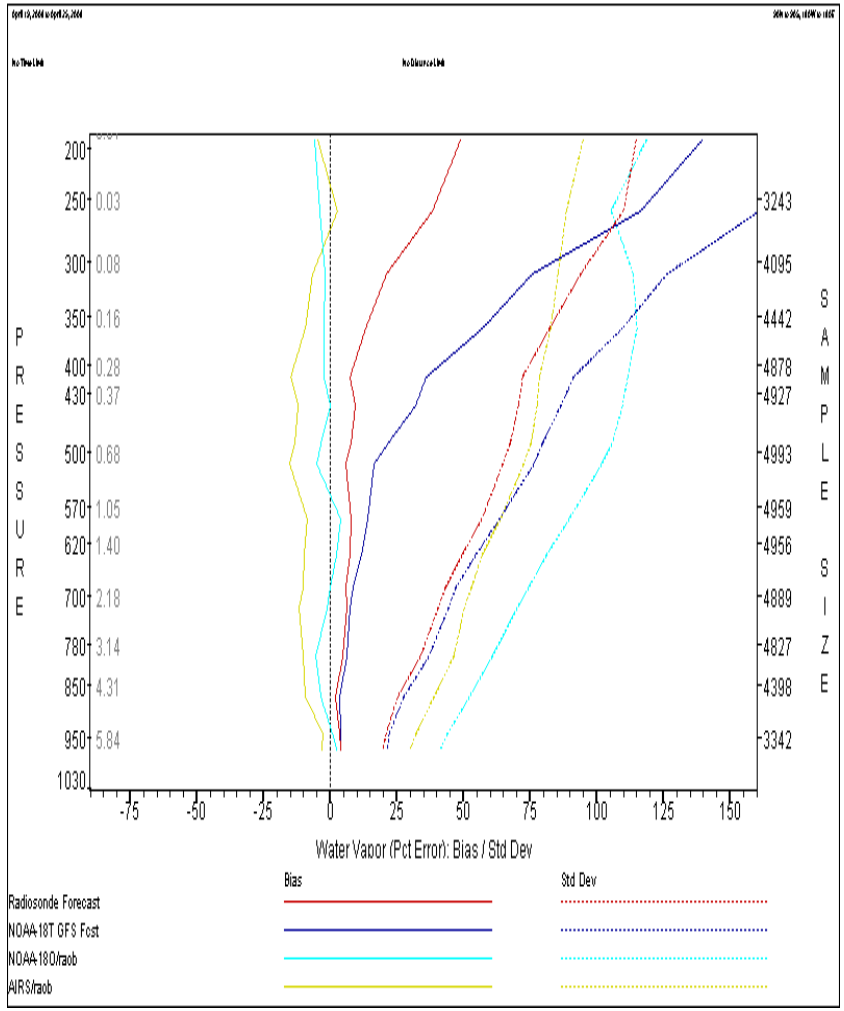
NOAA/NESDIS Matched Profile Display



NOAA/NESDIS Matched Profile Display



NOAA/NESDIS Matched Profile Display



Other Issues

- NPROVS Based Papers
  - Radiosonde Instrument type performance for Temperature and Humidity (*GRL*)
  - COSMIC radio occultation sounding assessment (*JGR*)
    - Temp, H20, tropopause, stratosphere …
  - Assessment of first guess approaches for satellite derived products (*IJRS*)

- Emerging NOAA Derived product Systems
  - MIRS / ATOVS merged products tuned with NPROVS
  - IASI Products (tuned with NPROVS)
  - NOAA vs EUMETSAT Product Comparison (April25-29)

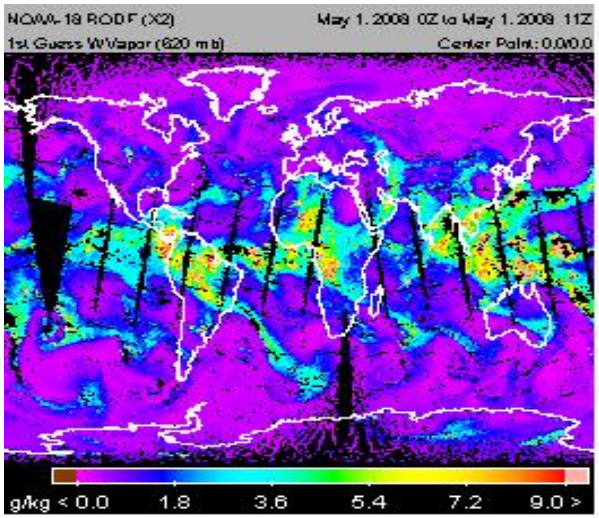
- NWS Severe Storms Prediction Center request (preference) for polar satellite "cloudy" soundings to supplement radiosonde, NWP profiles, etc
  - Case study August 19 2007… hurricane Erin re-develops over Oklahoma northward
  - *regionally tuned local direct readout processing system (AAPP, IMAPP…)*

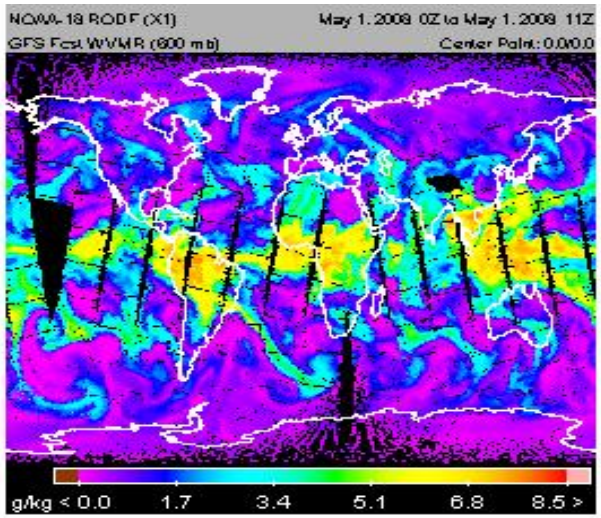
- Historical TOVS collocation database on STAR Data Storage Facility
  - NPROVS sensor oriented collocation "database" (Phase-2)

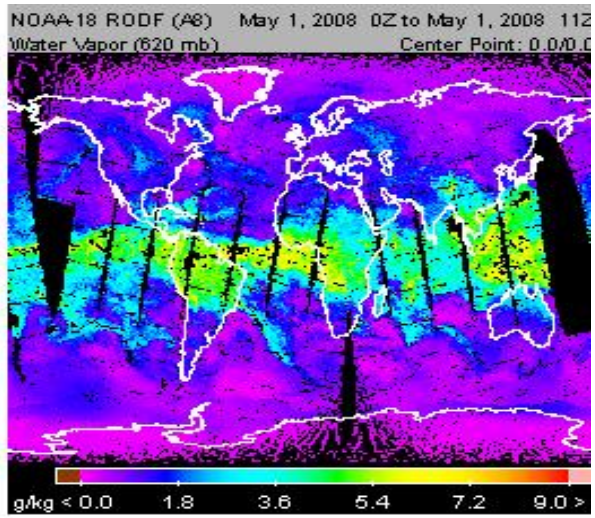
First Guess Regression Using NPROVS

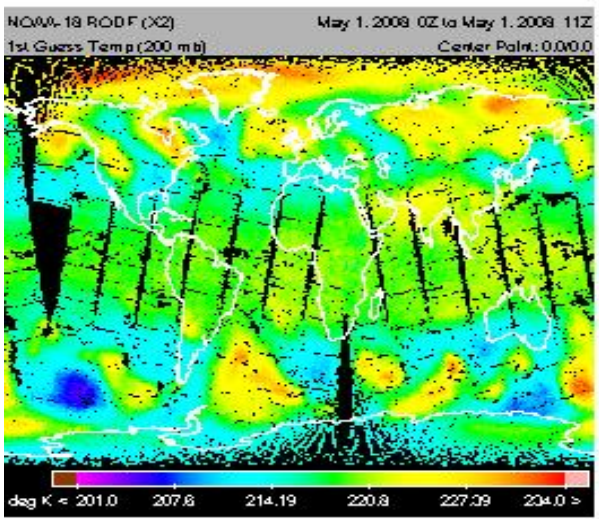
NWP

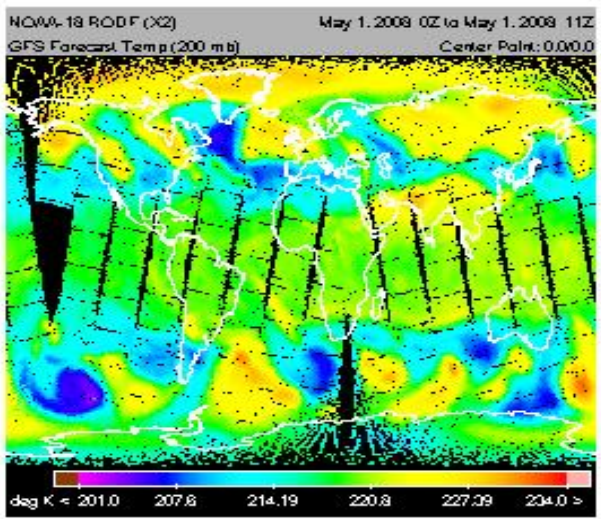
ATOVS Operation

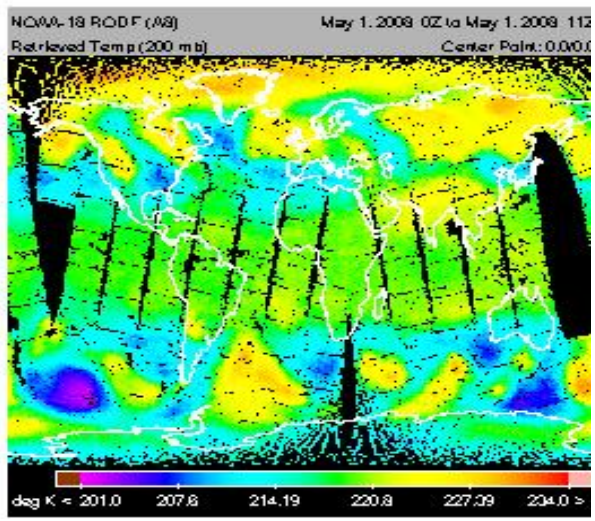






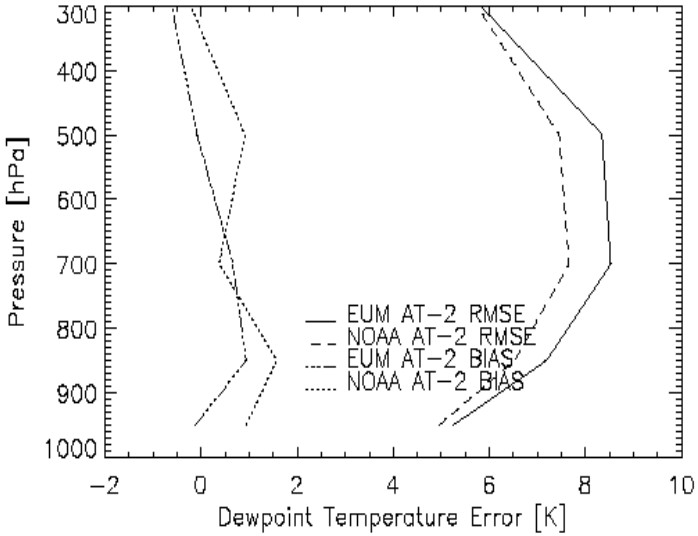


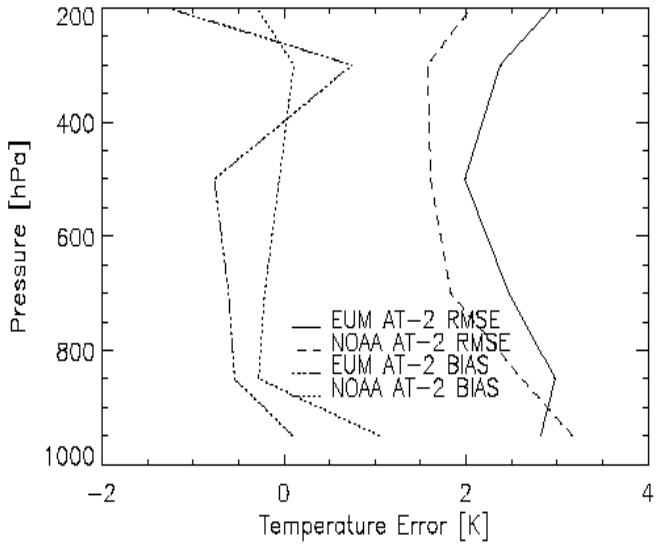


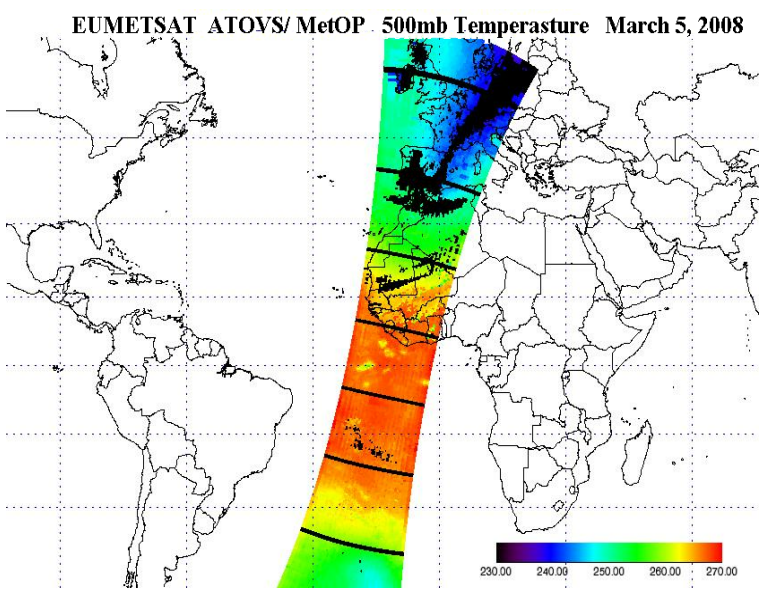


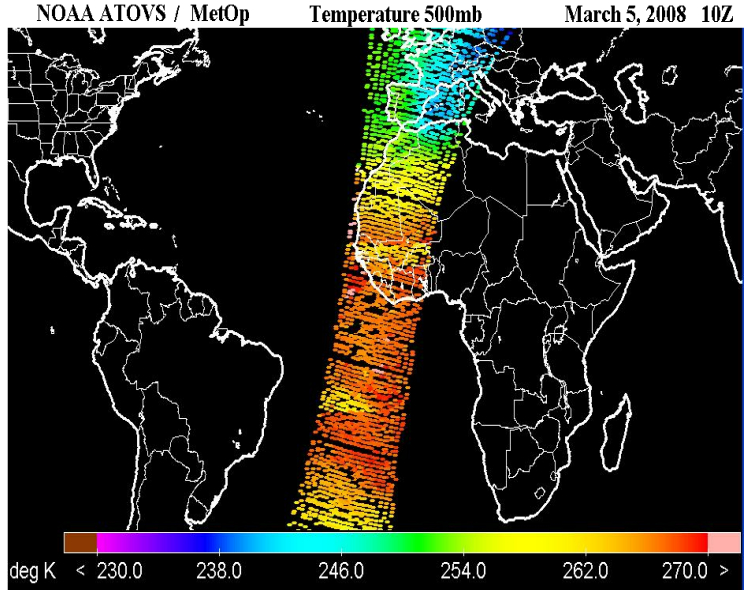
NOAA / EUMETSAT MetOp Products Exchange

(Eamonn McKernan, Tony Reale)

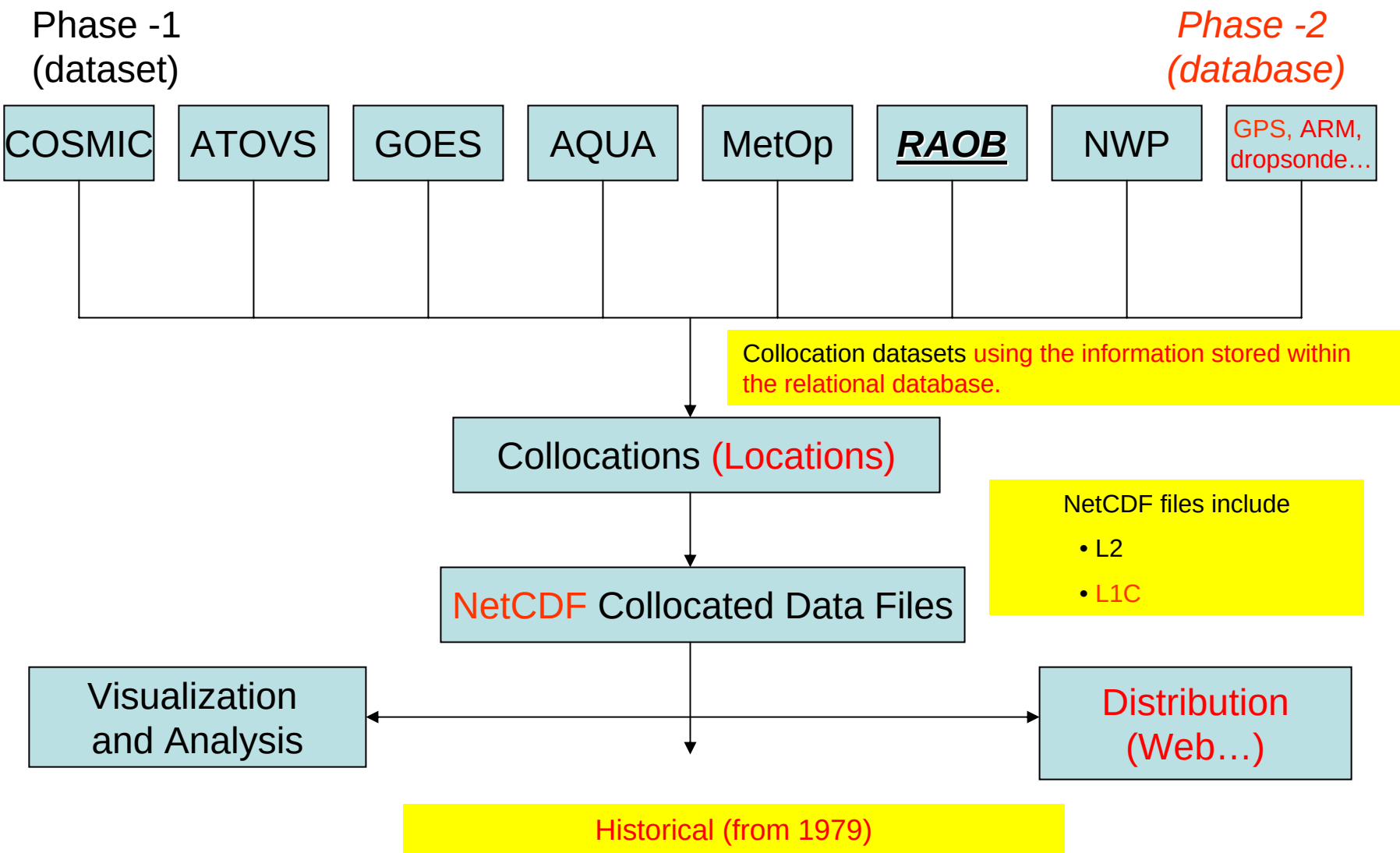








Integrated Product Validation System
System Flowchart



HISTORICAL TOVS AND COLLOCATED RADIOSONDES (1979-2001)

The purpose of this project is to compile a historical dataset of collocated radiosondes and TOVS (HIRS and MSU 1b) observations.

This project was initially supported by NOAA-SEARCH (2004 to 2007)

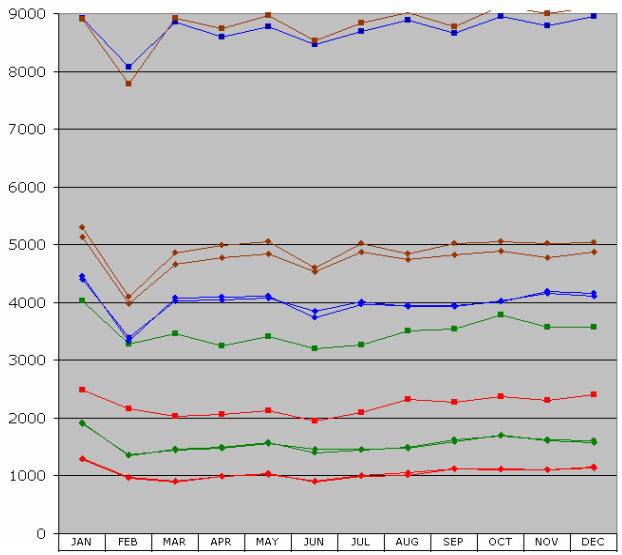
NOAA Study of Environmental Arctic Change (SEARCH)

NOAA is one of eight federal agencies participating in the implementation of SEARCH. With a mission to understand and predict changes in the Earth's environment, and conserve and manage coastal and marine resources to meet the Nation's economic, social and environmental needs, NOAA has a particularly important role to play in SEARCH.

with continued support under NOAA-STAR to complete and expand the database

www.orbit.nesdis.noaa.gov/smcd/opdb/poes/TOVScollocation

NOAA-10 1988



- **Radiosondes at 0Z (dark red), 12Z (blue), 6Z (green) and 18Z (red) and corresponding collocations with respective MSU and HIRS (lower curves)**
- **Over 300,000 radiosondes and 200,000 collocations with NOAA-10 HIRS and MSU for satellite year (1988)**
- **"Database on STAR Computer Facility contains over 50 satellite years spanning NOAA 6 to 14 with over 10 million collocations"**
- **Planned expansions to append SSU, TOVS soundings, DMSP …**
- **Baseline for merging with Noaa PROducts (integrated) Validation System (NPROV) … Phase-2**
- **Resulting long term record (TOVS, ATOVS, MetOp … NPOESS) consistent with GEOSS goals**

Summary

- NPROVS (Phase-1) provides centralized NOAA function for validation of multiple satellite and ground data platforms
  - NOAA, Metop, GOES, COSMIC, AIRS, COSMIC, NWP, Raob…
- Data management, validation and analytical strategies presented (relevant to GCOS reference networks)
- NPROVS leveraging for NPP/NPOESS Level 2 QC …
  - Dataset archive (format) and longer term statistics
- Phase-2 expansion to sensor oriented "*database*" (existing TOVS Collocation database as baseline)
- **SSSP web site access**