Satellite Products Cal/val and Climate Research Support using GRUAN

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Outline

- TT5 tasks addressed in this PPT
- NPROVS to GPROVS
- GPROVS objectives including proposal for Ancillary profiles concurrent with RAOBs in air and satellite overpass … SASBE
- Examples of GRUAN monitoring and utility to monitor other platforms using GRUAN 2011 RAOBS … LIN vs TWP
- K profile uncertainty analysis … LIN vs TWP
- Review of past work using NPROVS for Climate

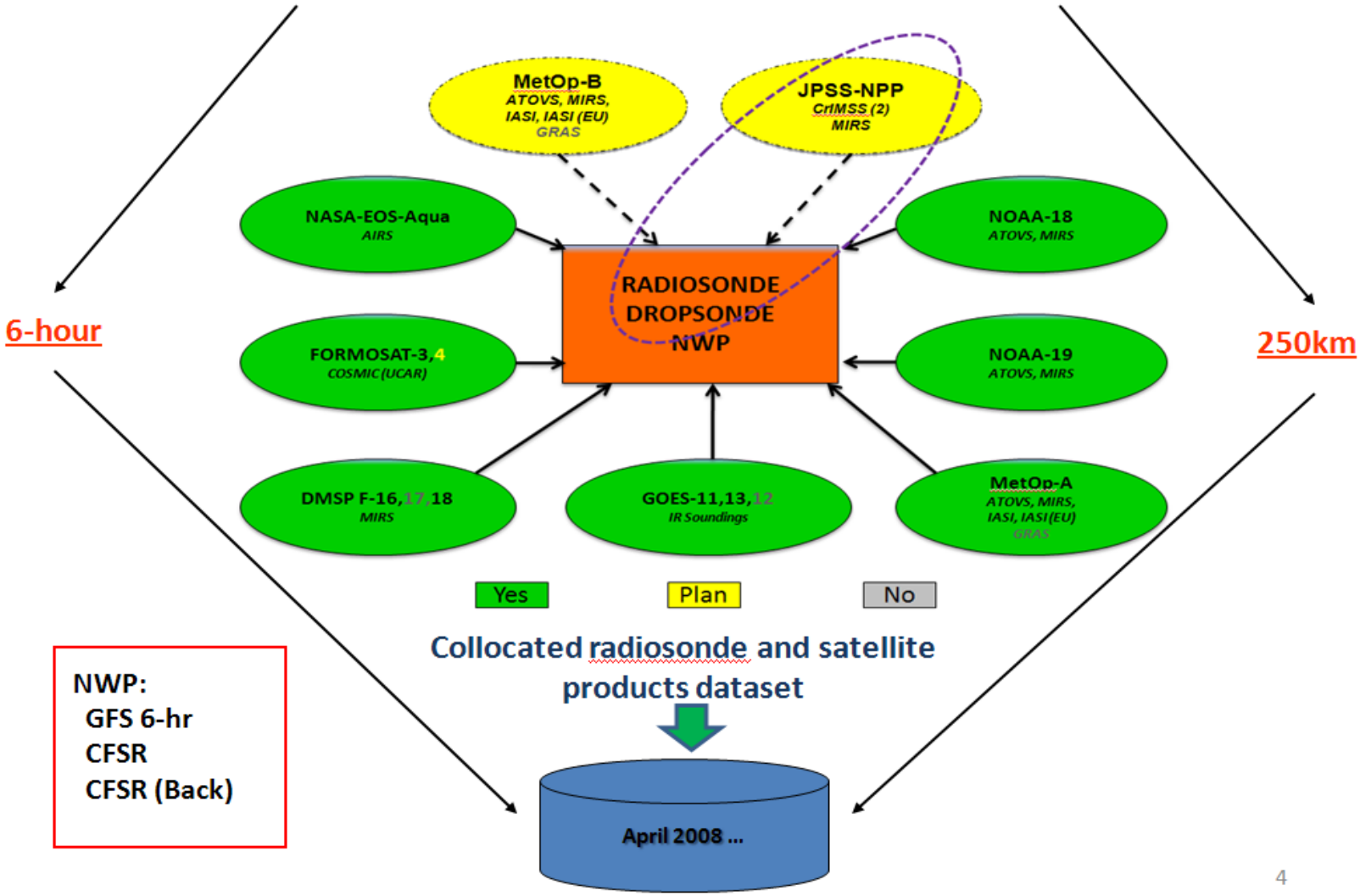
Task 1: Inventories of Retrievals and Products from satellites
Main Contact: Reale/Schroder **Due Date:** ICM-x **Status:** Ongoing
Milestone: TBA
Progress: Available legacy real-time derived satellite products have been identified for atmospheric temperature and moisture profiling suitable for validation exercises at GRUAN sites including those from newly deployed Suomi-NPP. Associated meta-data and climate oriented legacy products still being pursued
Issues: None

Task 2: Validation Strategies and Results (Satellite): Coordination with JPSS Cal/val team
Main Contact: T. Reale **Due Date:** ICM-x **Status:** Ongoing
Milestone: January 2013, NOAA/JPSS Suomi-NPP Products Compliance Review Report
Progress: Concurred with Suomi NPP cal/val team members to pursue opportunities for routine validation of NPP Environmental Data Record (EDR) for atmospheric temperature and moisture soundings at GRUAN sites as cal/val program component to determine product adherence to specifications
Issues: None

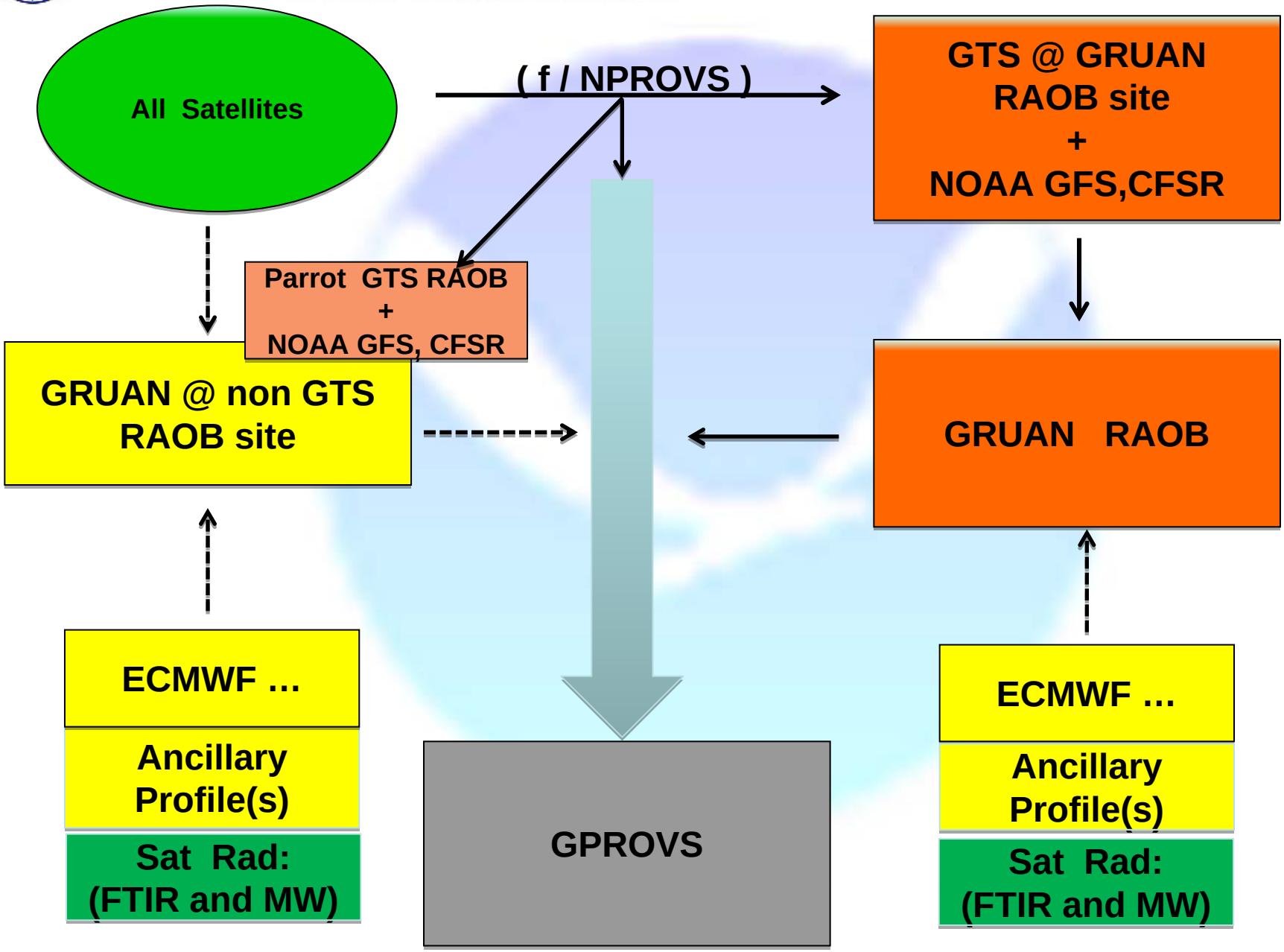
Task 3: Validation Strategies and Results (Satellite): GRUAN Products Validation (GPROVS)
Main Contact: Tony Reale **Due Date:** ICM-X **Status:** Ongoing
Milestone: TBA
Progress: Successful access/compilation of GRUAN RAOB data from NCDC and LC for 2011 and 2012, collocated with conventional sonde and satellite observations and completed analysis comparing RAOB and satellite profiles including preliminary "K" profiles based on GRUAN uncertainty estimates
Issues: Access to ECMWF (NWP) and GRUAN Ancillary Profiles collocated to sondes and Suomi-NPP satellite overpass

Task 18: Suitability of Deployed Equipment: Site Atmospheric State Best Estimate (SASBE)
Main Contact: Tobin/Reale **Due Date:** TBA **Status:** Ongoing
Milestone: January 2013, NOAA/JPSS Suomi-NPP Products Compliance Review Report
Progress: D. Tobin with SUOMI-NPP cal/val team (and J Dykema) compiling/ processing ARM (and Beltsville) dedicated observations at Suomi-NPP overpass to serve as basis to develop "recipe(s)" of GRUAN ancillary and sonde measurements to calculate SASBE with focus on atmospheric temperature and moisture for NPP satellite FTIR/MW products validation; preliminary results expected by early summer 2013
Issues: NPP dedicated ARM Observations do not contain GRUAN sanctioned uncertainty estimates

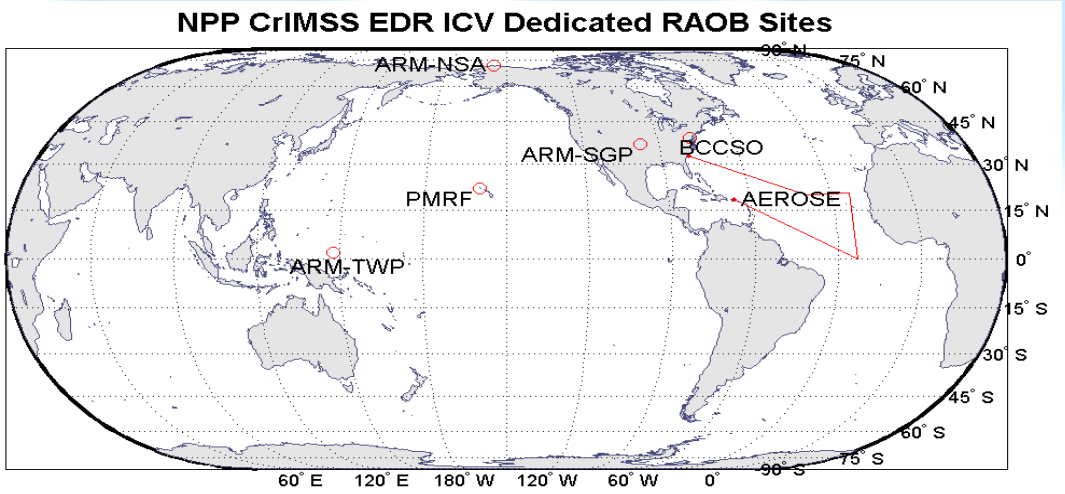
Centralized Radiosonde and Collocation Processing



NOAA Products Validation System (NPROVS)


All Satellites
(f / NPROVS)
GTS @ GRUAN RAOB site + NOAA GFS,CFSR
Parrot GTS RAOB + NOAA GFS, CFSR
GRUAN @ non GTS RAOB site
GRUAN RAOB
ECMWF …
Ancillary Profile(s)
Sat Rad: (FTIR and MW)
GPROVS
ECMWF …
Ancillary Profile(s)
Sat Rad: (FTIR and MW)

	ARM-TWP	ARM-SGP	ARM-NSA		ARM-TWP	ARM-SGP	ARM-NSA	PMRF	BCCSO	NOAA AEROSE
Location	Manus Island, Papua New Guinea	Ponca City, Oklahoma, USA	Barrow, Alaska, USA	Location	Manus Island, Papua New Guinea	Ponca City, Oklahoma, USA	Barrow, Alaska, USA	Kauai, Hawaii, USA	Beltsville, Maryland, USA	Tropical North Atlantic Ocean
Regime	Tropical Pacific Warm Pool, Island	Midlatitude Continent, Rural	Polar Continent	Regime	Tropical Pacific Warm Pool, Island	Midlatitude Continent, Rural	Polar Continent	Tropical Pacific, Island	Midlatitude Continent, Urban	Tropical Atlantic, Ship
Planned N	90	180	180	Planned N	90	180	180	40	—	≈ 60–120
Launched n_1	**42**	**92**	**93**	Launched n_1	**42**	**92**	**93**	**40**	**23**	**2**
Launched n_2	—	**88**	**90**	Launched n_2	—	**88**	**90**	—	—	**0**
Time Frame	Aug–present	Jul–present	Jul–present	Time Frame	Aug–present	Jul–present	Jul–present	May, Sep	Jun–Jul, Sep–present	Jan–Feb 2013



Additional "reference" from ongoing JPSS Suomi-NPP cal/val program

GPROVS Scope

- Monitor GRUAN profiles from NCDC (w/ Michael S)
- GRUAN profiles help determine Satellite product adherence to specification
  - coordination within Suomi-NPP cal/val team (Tobin … Belay)
  - process dedicated RS92 (also CFH…) at ARM and other (slide 6) with GRUAN software
- Develop uncertainty applications (K profiles…)
- Integrate Ancillary and RAOB profiles f/GRUAN sites (w/uncertainty…)
  - schedule ancillary profiles with RAOB and sat overpass (NPP + COSMIC), respectively
  - append sat radiances (FTIR and MW) to vertical column
  - append ECMWF
  - utilize available satellite synchronized launches (see launch schedule tables)

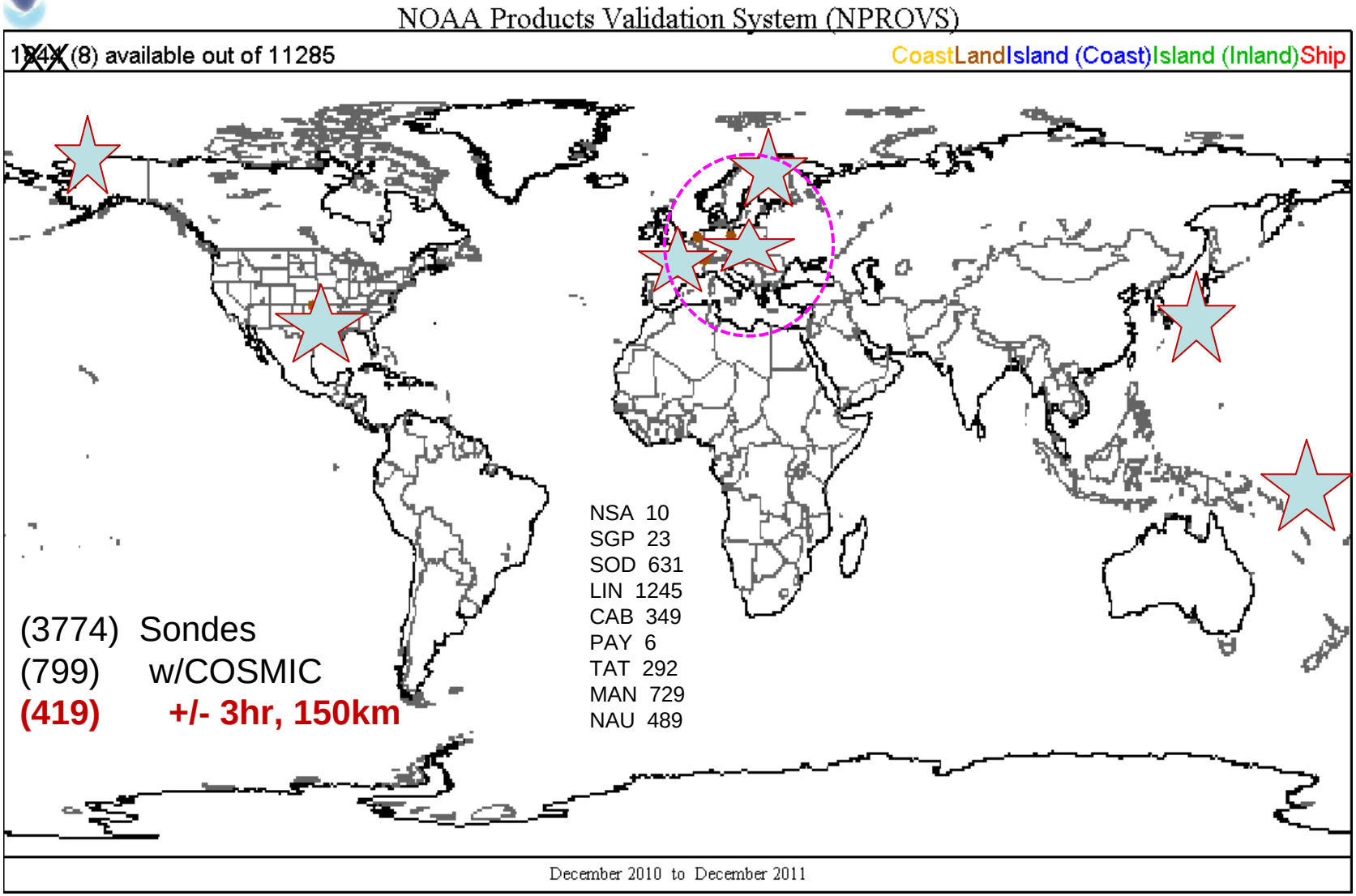
GPROVS Objective (cont)

- SASBE with associated impact studies (Dave Tobin, John D …)

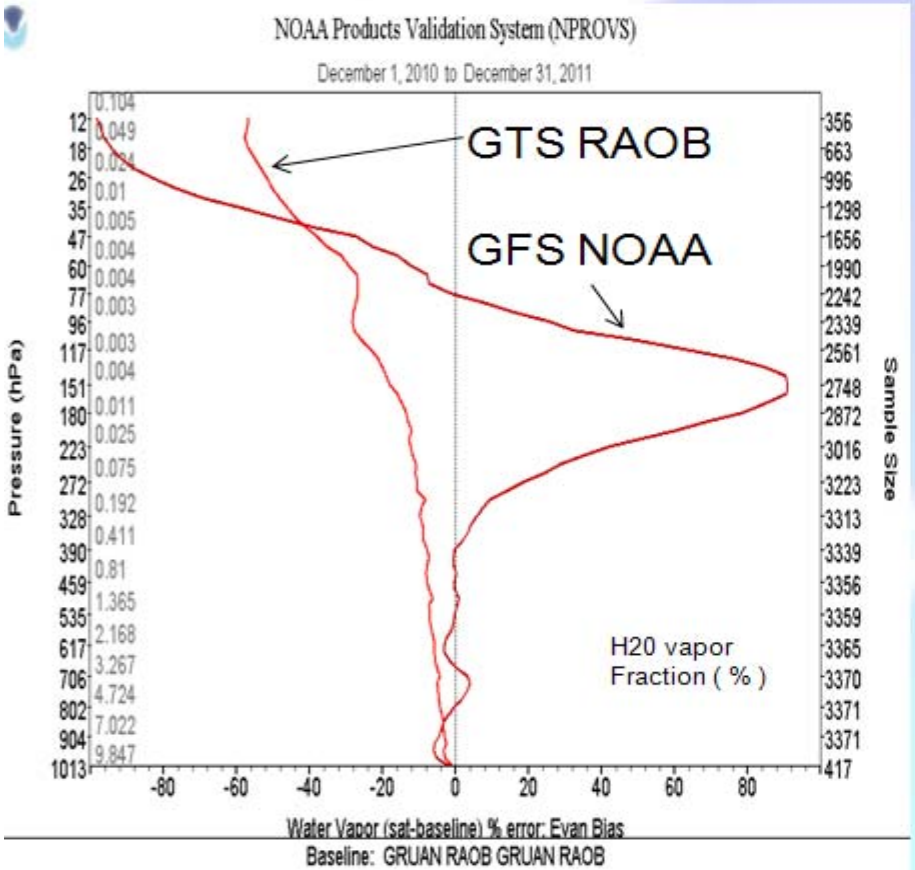
- Maintain long term collocation datasets (+NPROVS)
  - GATNDOR interaction
  - Climate support
  - Publications on spatial/temporal mismatch impact

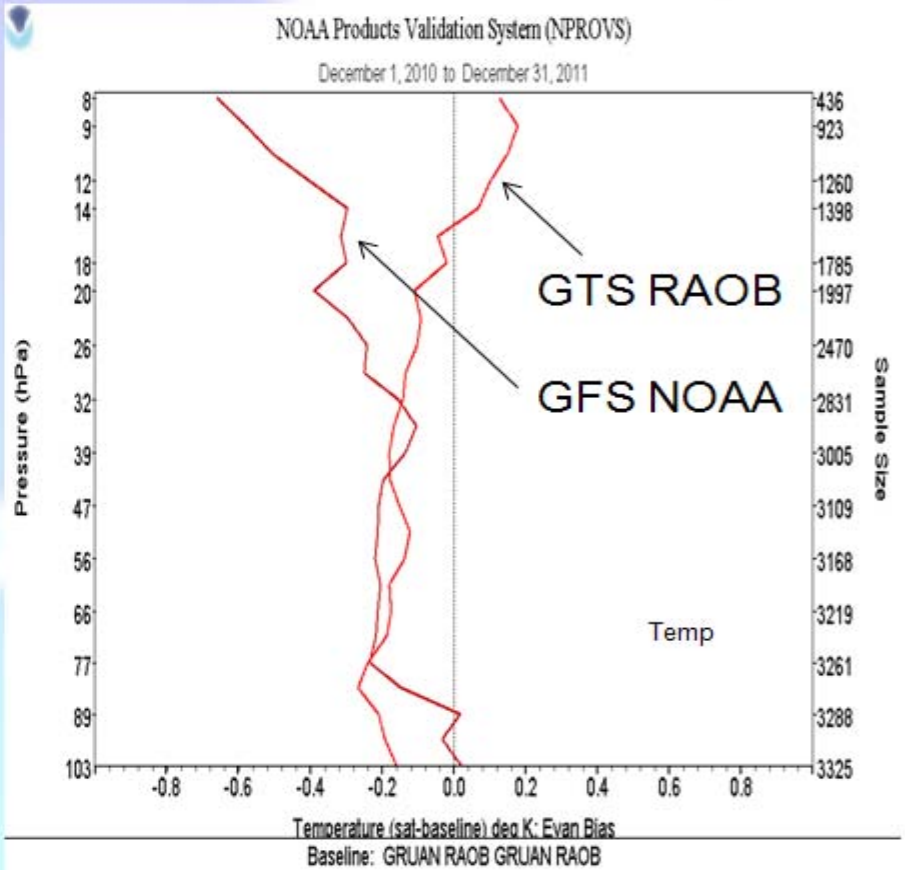
- Demonstrate / Utility of COSMIC as stratosphere T reference (and tropopause)
  - compare in stratosphere to FTIR and MW from satellite
  - develop COSMIC anchored collocations (currently RAOB anchored)
  - publications on radiation correction anomalies

Results from preliminary GPROVS using
GRUAN 2011 RAOBS
integrated into NPROVS

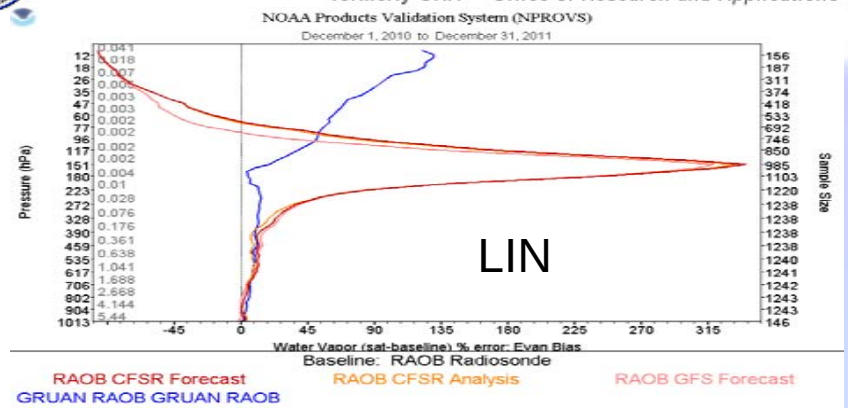


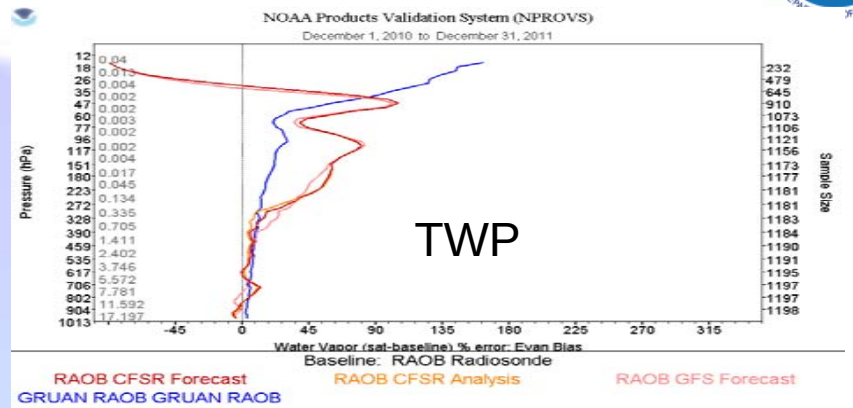
Collocations of GRUAN Sonde, GTS Sonde and COSMIC; 2011

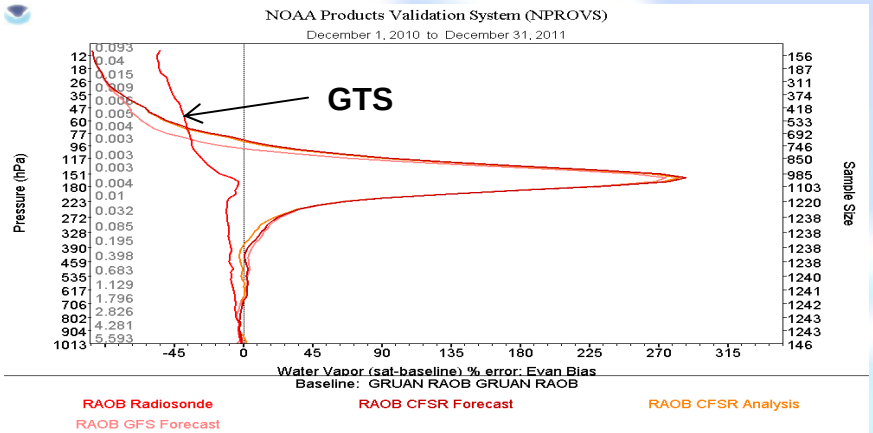


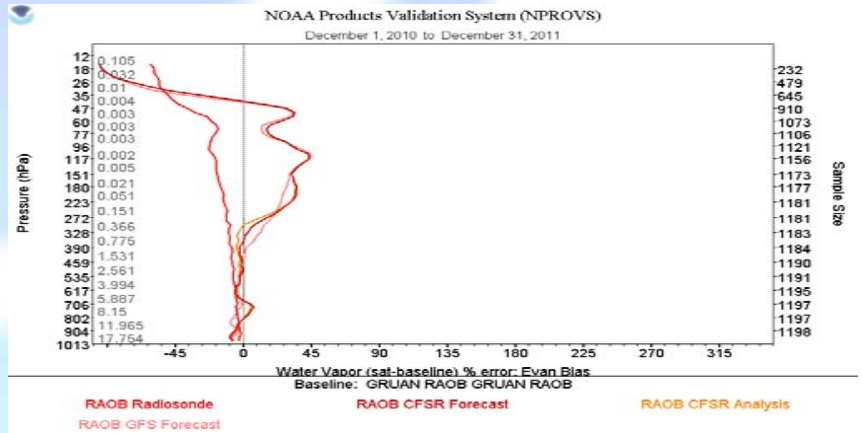


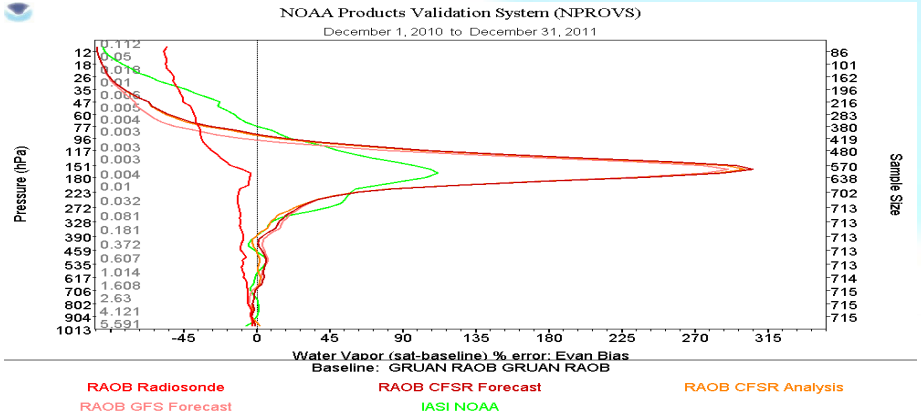
Differences vs GRUAN RAOB


NOAA Products Validation System (NPROVS)
December 1, 2010 to December 31, 2011
LIN
Pressure (hPa)
Sample Size
Water Vapor (sat-baseline) % error: Evan Bias
Baseline: RAOB Radiosonde
RAOB CFSR Forecast
RAOB CFSR Analysis
RAOB GFS Forecast
GRUAN RAOB GRUAN RAOB


NOAA Products Validation System (NPROVS)
December 1, 2010 to December 31, 2011
TWP
Pressure (hPa)
Sample Size
Water Vapor (sat-baseline) % error: Evan Bias
Baseline: RAOB Radiosonde
RAOB CFSR Forecast
RAOB CFSR Analysis
RAOB GFS Forecast
GRUAN RAOB GRUAN RAOB


NOAA Products Validation System (NPROVS)
December 1, 2010 to December 31, 2011
GTS
Pressure (hPa)
Sample Size
Water Vapor (sat-baseline) % error: Evan Bias
Baseline: GRUAN RAOB GRUAN RAOB
RAOB Radiosonde
RAOB CFSR Forecast
RAOB CFSR Analysis
RAOB GFS Forecast


NOAA Products Validation System (NPROVS)
December 1, 2010 to December 31, 2011
Pressure (hPa)
Sample Size
Water Vapor (sat-baseline) % error: Evan Bias
Baseline: GRUAN RAOB GRUAN RAOB
RAOB Radiosonde
RAOB CFSR Forecast
RAOB CFSR Analysis
RAOB GFS Forecast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Baseline: GRUAN RAOB GRUAN RAOB
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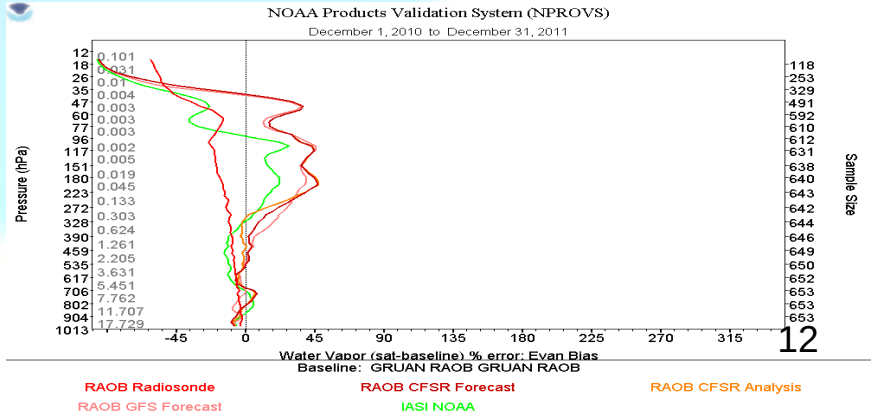
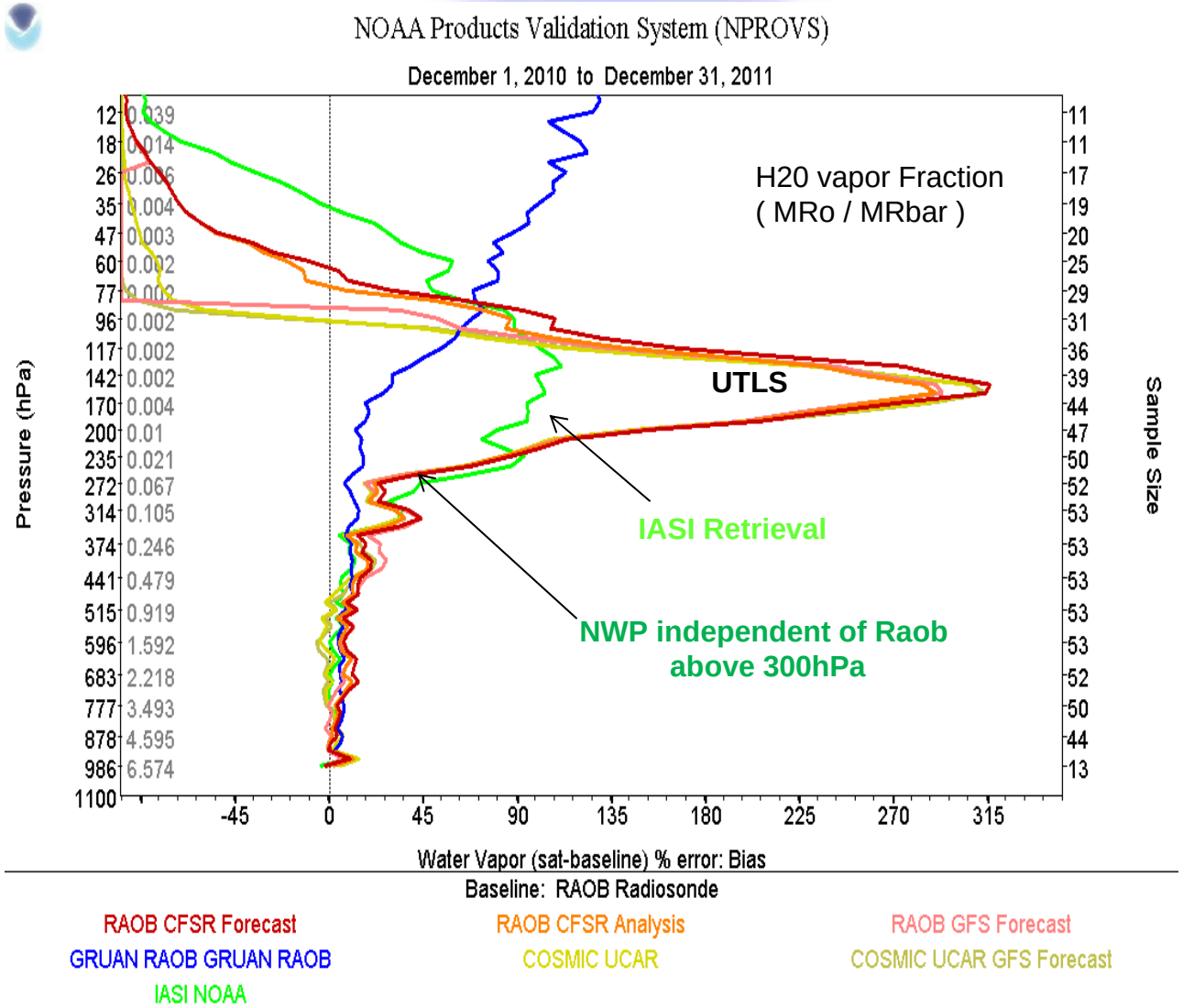
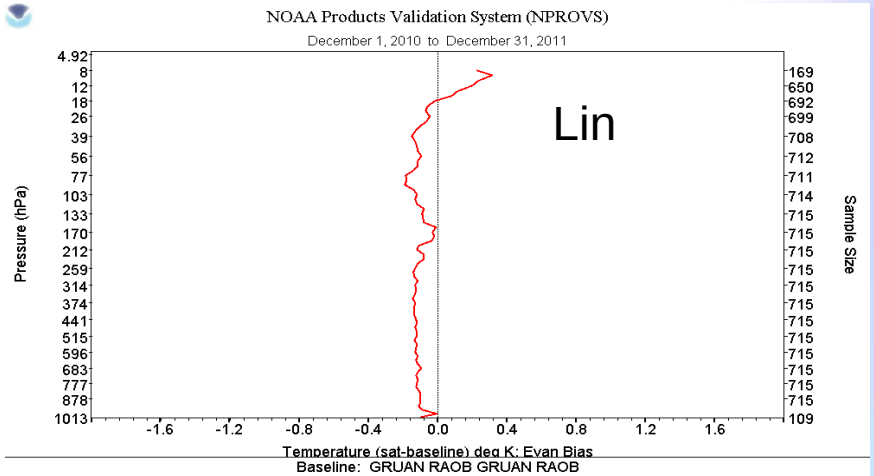
RAOB GFS Forecast
IASI NOAA


NOAA Products Validation System (NPROVS)
December 1, 2010 to December 31, 2011
Pressure (hPa)
Sample Size
Water Vapor (sat-baseline) % error: Evan Bias
Baseline: GRUAN RAOB GRUAN RAOB
RAOB Radiosonde
RAOB CFSR Forecast
RAOB CFSR Analysis
RAOB GFS Forecast
IASI NOAA

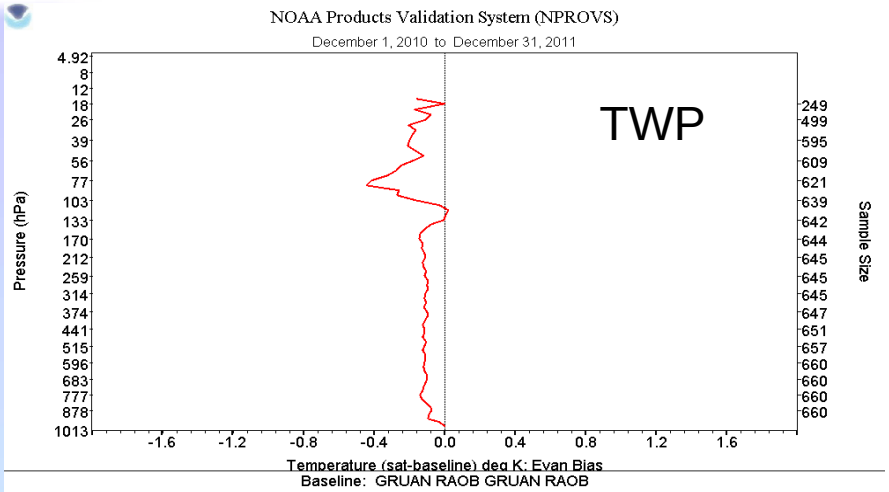
Mainly Vicinity of Lindenberg, Germany



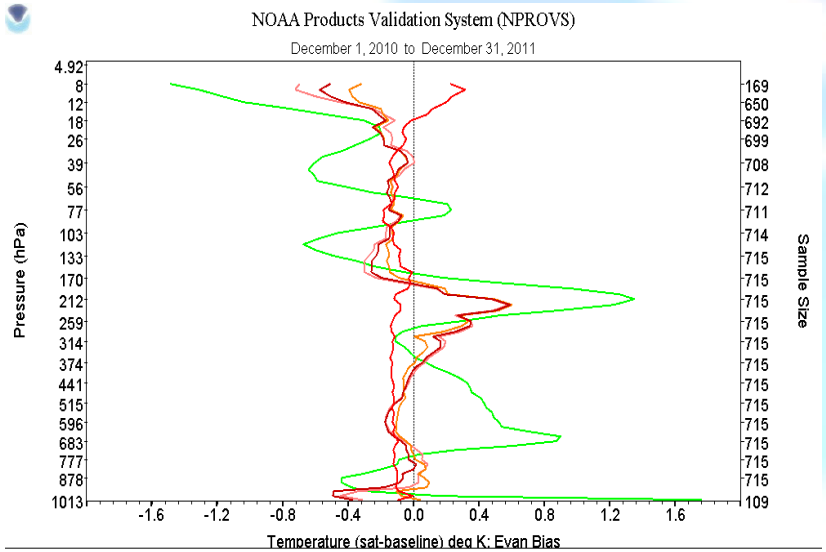
GRUAN Sonde, NWP and COSMIC, respectively, -minus-GTS Sonde



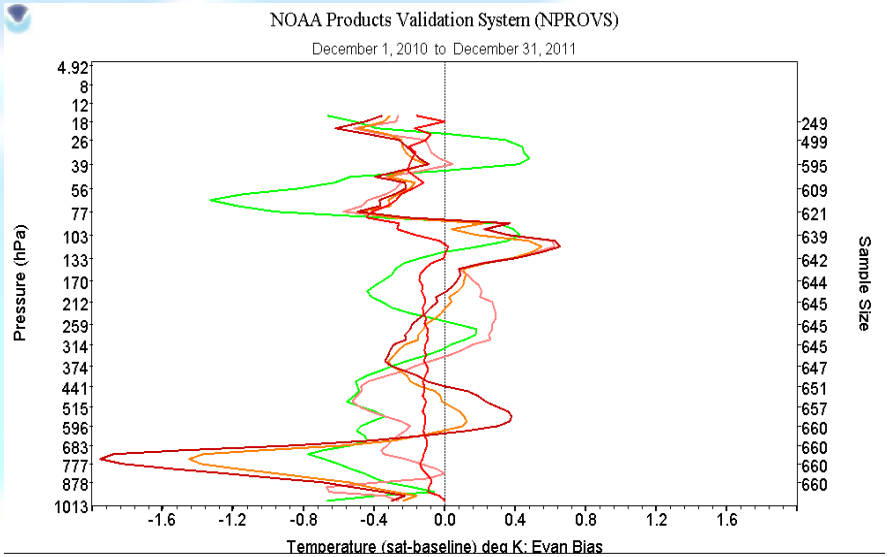
RAOB Radiosonde



RAOB Radiosonde



RAOB Radiosonde RAOB CFSR Forecast RAOB CFSR Analysis
RAOB GFS Forecast IASI NOAA



RAOB Radiosonde RAOB CFSR Forecast RAOB CFSR Analysis
RAOB GFS Forecast IASI NOAA

Introducing new “K” profiles analysis into GPROVS

Consistency in a finite atmospheric region

Co-location / co-incidence:

Determine the variability (σ) of a variable (m) in time and space from measurement or model

Two observations on different platforms are consistent if

$$|m_1 - m_2| < k\sqrt{\sigma^2 + u_1^2 + u_2^2}$$

✓ This test is only meaningful, i.e. observations are co-located or co-incident if:

$$\sigma < \sqrt{u_1^2 + u_2^2}$$

… **GATNDOR Toolbox** to routinely compute u and sigma

Validation: Redundancy and Consistency

- GRUAN stations should provide *redundant* measurements

$$|m_1 - m_2| < k\sqrt{u_1^2 + u_2^2}$$

- Redundant measurements should be consistent:
  - ✓ No meaningful consistency analysis possible without uncertainties
  - ✓ if m_2 has no uncertainties use $u_2 = 0$ ("agreement within errorbars")

$\lvert m_1 - m_2\rvert < k\sqrt{u_1^2+u_2^2}$	TRUE	FALSE	significance level
k=1	consistent	suspicious	32%
k=2	in agreement	significantly different	4.5%
k=3	-	inconsistent	0.27%

GATNDOR Toolbox …

K = (X – GRUAN) / GRUAN Uncertainty

1) Temperature

2) Water Vapor Mix Ratio … MRo /MRs …. RH

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K

137	Level	Pressure	GRUAN	Uncertainty	RAOB		GFS		CFSR		COSMIC		IASI	
138	1	1.08											232.52	
139	2	2.75									226.58		225.19	
140	3	4.13									222.23		217.72	
141	4	5.40									219.70		213.18	
142	5	6.42									216.31		211.44	
143	6	8.23									212.56		209.97	
144	7	10.26									211.51		209.38	
145	8	13.70	210.10	0.41	209.87	0.57	211.13	2.50	211.39	3.12	211.49	3.38	210.13	0.08
146	9	18.65	211.65	0.38	211.47	0.48	211.19	1.21	211.39	0.69	211.00	1.70	211.48	0.45
147	10	26.55	211.91	0.34	211.82	0.27	211.85	0.17	211.87	0.14	210.95	2.83	211.87	0.14
148	11	37.65	213.57	0.30	213.42	0.52	212.79	2.62	213.30	0.92	212.42	3.86	211.75	6.09
149	12	52.00	213.97	0.27	213.89	0.29	212.91	3.97	213.47	1.86	212.66	4.92	212.14	6.87
150	13	72.05	213.24	0.24	212.87	1.56	213.41	0.71	213.54	1.23	213.37	0.51	213.75	2.13
151	14	93.10	214.51	0.22	214.35	0.73	213.95	2.59	213.98	2.45	214.13	1.77	215.72	5.55
152	15	114.30	215.62	0.20	214.93	3.48	215.59	0.16	215.53	0.49	215.79	0.85	218.06	12.31
153	16	133.95	219.38	0.19	219.20	0.95	219.45	0.37	219.15	1.21	219.54	0.80	220.29	4.69
154	17	151.35	222.97	0.18	222.94	0.13	223.18	1.15	222.71	1.39	221.60	7.45	221.77	6.51
155	18	175.35	224.94	0.17	224.90	0.22	224.29	3.77	224.43	2.95	222.86	12.09	223.01	11.22
156	19	206.85	224.41	0.16	223.97	2.65	224.37	0.24	224.49	0.51	223.59	4.96	222.78	9.87
157	20	248.15	222.75	0.15	222.32	2.88	222.22	3.55	222.73	0.16	219.25	23.55	220.55	14.82
158	21	293.50	223.04	0.14	222.67	2.63	221.42	11.57	222.49	3.90	219.45	25.69	221.14	13.62
159	22	328.85	222.67	0.14	222.51	1.22	223.63	7.06	223.86	8.81	223.18	3.78	224.19	11.21
160	23	375.50	226.45	0.13	226.29	1.18	227.95	11.09	227.08	4.63	229.00	18.87	228.94	18.43
161	24	442.65	234.39	0.13	234.32	0.56	234.69	2.23	234.08	2.36	237.08	20.39	235.87	11.19
162	25	506.55	241.48	0.13	241.33	1.18	241.57	0.74	241.36	0.90	244.58	24.23	242.08	4.69
163	26	576.35	248.55	0.13	248.27	2.18	248.44	0.80	248.27	2.16	250.20	12.79	248.09	3.57
164	27	650.55	255.14	0.12	254.70	3.63	254.69	3.72	254.55	4.88	256.21	8.84	253.71	11.84
165	28	730.65	257.18	0.12	256.96	1.86	257.80	5.30	257.47	2.49	261.80	39.15	257.74	4.77
166	29	828.15	259.62	0.13	259.46	1.31	260.18	4.38	260.14	4.05	261.92	18.11	262.49	22.58
167	30	989.30	267.51	0.13	267.40	0.82	267.85	2.56	267.92	3.15	268.07	4.21	270.39	21.67
168														

110	7	10.26									240.28		241.77	
111	8	13.70	239.90	0.08	239.65	3.09	240.45	6.88	240.41	6.45	239.15	9.49	239.13	9.75
112	9	18.65	237.94	0.09	237.52	4.91	237.05	10.39	237.18	8.82	237.82	1.42	234.88	35.45
113	10	26.55	231.30	0.09	231.76	5.33	230.50	9.33	230.70	7.04	229.63	19.40	230.03	14.80
114	11	37.65	224.23	0.08	224.28	0.55	224.62	4.66	224.58	4.26	223.73	6.07	225.78	18.72
115	12	52.00	221.49	0.08	221.53	0.44	221.45	0.58	221.46	0.37	221.13	4.40	222.30	9.76
116	13	72.05	219.25	0.08	218.56	8.34	219.29	0.42	219.33	0.91	218.91	4.06	218.66	7.10
117	14	93.10	219.35	0.08	219.06	3.58	219.11	3.01	219.18	2.12	218.89	5.64	218.90	5.50
118	15	114.30	221.04	0.08	220.66	4.81	220.54	6.23	220.55	6.17	220.00	12.97	221.11	0.87
119	16	133.95	222.52	0.08	222.17	4.42	222.42	1.33	222.30	2.78	221.22	16.47	222.72	2.50
120	17	151.35	223.27	0.08	223.21	0.78	223.67	4.96	223.47	2.47	222.02	15.74	224.01	9.28
121	18	175.35	223.71	0.08	223.89	2.17	224.28	7.10	224.03	3.93	223.70	0.11	225.60	23.68
122	19	206.85	224.42	0.08	224.63	2.59	224.64	2.68	224.51	1.12	222.88	18.92	225.24	10.17
123	20	248.15	224.18	0.08	224.27	1.02	224.08	1.25	224.53	4.30	222.12	25.58	223.02	14.43
124	21	293.50	222.95	0.08	222.76	2.38	223.08	1.56	223.36	5.16	221.07	23.64	220.81	26.97
125	22	328.85	223.10	0.08	222.71	4.93	223.13	0.46	223.41	3.99	222.15	12.13	221.03	26.30
126	23	375.50	224.03	0.08	223.97	0.80	223.78	3.09	223.95	1.00	225.36	16.31	224.05	0.25
127	24	442.65	228.88	0.09	228.89	0.15	228.78	1.09	228.70	2.06	231.24	26.18	230.66	19.70
128	25	506.55	235.95	0.09	235.83	1.24	236.07	1.38	235.97	0.27	239.13	35.35	237.94	22.16
129	26	576.35	243.29	0.10	243.12	1.87	243.56	2.74	243.46	1.69	245.29	20.91	245.25	20.50
130	27	650.55	250.95	0.09	250.97	0.23	250.98	0.39	250.95	0.03	252.88	21.08	251.23	3.10
131	28	730.65	257.41	0.09	257.33	0.89	257.72	3.55	257.75	3.97	259.31	21.98	256.16	14.42
132	29	828.15	263.66	0.09	263.45	2.28	263.96	3.31	264.20	5.90	268.37	51.31	262.91	8.11
133	30	989.30	272.03	0.09	272.07	0.52	271.34	7.71	271.93	1.13			270.37	18.55
134														

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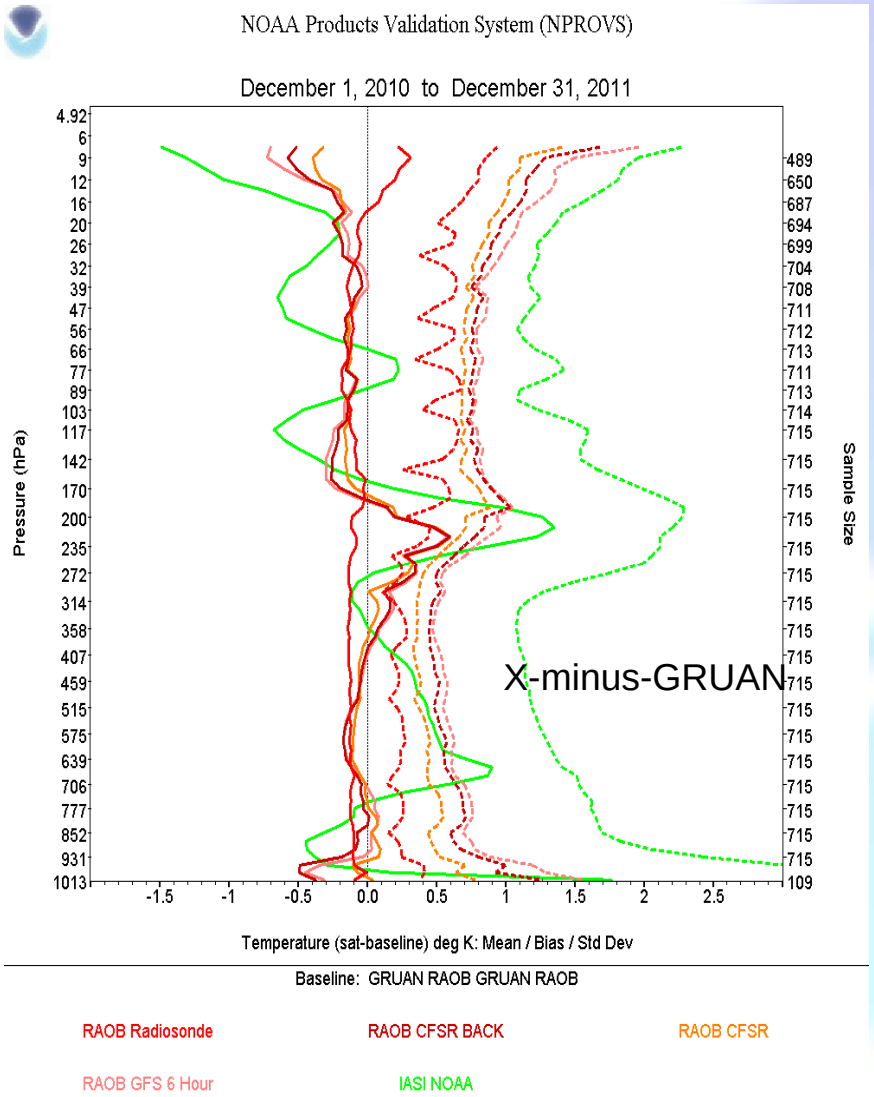
TWP day

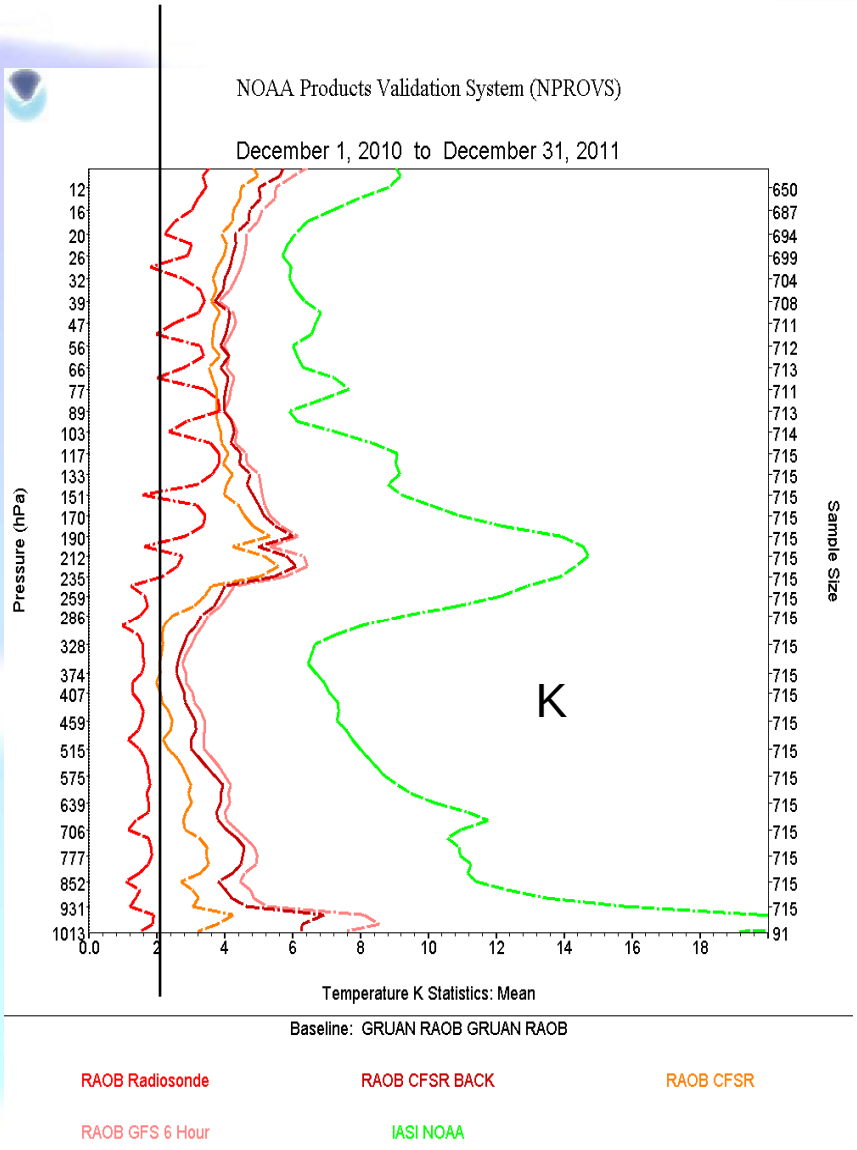
K

1	Level	Pressure	GRUAN	Uncertainty	RAOB		GFS		CFSR		COSMIC		IASI	
2	1	1.08											242.24	
3	2	2.75											249.70	
4	3	4.13									238.26		239.96	
5	4	5.40									230.58		232.58	
6	5	6.42									225.91		228.70	
7	6	8.23									226.93		224.69	
8	7	10.26									226.85		222.09	
9	8	13.70									223.66		220.65	
10	9	18.65									218.17		219.12	
11	10	26.55	214.70	0.42	214.82	0.28	213.20	3.55	213.92	1.85	214.33	0.87	216.11	3.33
12	11	37.65	212.37	0.38	212.02	0.93	211.91	1.22	212.13	0.62	210.87	3.95	211.97	1.05
13	12	52.00	204.97	0.33	205.19	0.66	205.72	2.26	205.44	1.42	204.97	0.00	206.08	3.34
14	13	72.05	197.11	0.30	197.30	0.63	197.64	1.79	197.38	0.90	195.95	3.89	197.12	0.05
15	14	93.10	188.21	0.26	188.18	0.11	188.21	0.02	188.43	0.85	188.92	2.70	190.23	7.67
16	15	114.30	194.80	0.24	194.53	1.13	193.77	4.27	193.81	4.09	193.82	4.03	192.02	11.48
17	16	133.95	200.91	0.23	200.73	0.79	199.83	4.71	199.91	4.35	198.64	9.92	197.78	13.65
18	17	151.35	204.66	0.22	204.47	0.86	204.85	0.87	204.86	0.94	204.48	0.81	203.68	4.44
19	18	175.35	212.17	0.21	212.14	0.16	212.59	2.03	212.55	1.83	213.04	4.17	211.79	1.83
20	19	206.85	221.90	0.20	221.81	0.46	222.14	1.22	222.04	0.73	222.81	4.61	221.76	0.71
21	20	248.15	231.35	0.19	231.47	0.63	232.33	5.23	232.20	4.53	230.68	3.62	232.34	5.32
22	21	293.50	241.12	0.17	241.04	0.43	241.33	1.22	241.21	0.53	241.01	0.64	241.75	3.62
23	22	328.85	247.22	0.18	247.13	0.52	247.56	1.93	247.48	1.49	247.93	4.02	247.94	4.08
24	23	375.50	255.55	0.16	255.36	1.13	254.93	3.75	254.97	3.51	255.29	1.60	254.80	4.53
25	24	442.65	263.24	0.15	263.35	0.77	263.26	0.16	263.30	0.40	263.63	2.61	262.99	1.61
26	25	506.55	270.01	0.14	269.94	0.48	269.52	3.44	269.61	2.78	268.42	11.11	269.16	5.96
27	26	576.35	276.43	0.13	276.63	1.56	276.14	2.22	276.31	0.95	274.62	14.14	274.61	14.25
28	27	650.55	280.01	0.12	280.03	0.22	280.00	0.04	280.04	0.30	279.07	7.69	279.80	1.68
29	28	730.65	284.90	0.12	284.86	0.34	283.32	13.22	283.59	10.89	285.10	1.71	284.73	1.37
30	29	828.15	289.71	0.12	289.56	1.28	288.83	7.70	289.12	5.14	290.25	4.66	289.92	1.78
31	30	989.30	296.19	0.11	296.06	1.14	296.15	0.30	296.21	0.18	296.07	1.02	296.53	2.99
32														

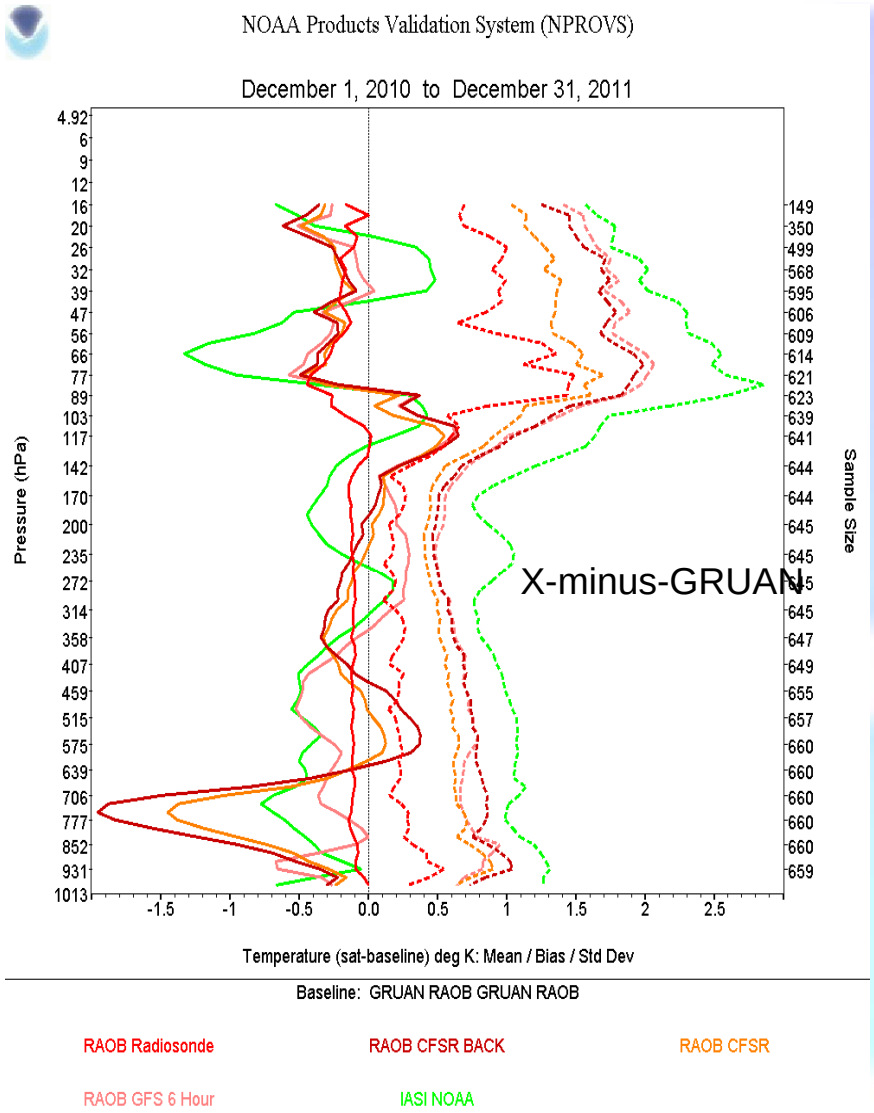
77	8	13.70									224.26		222.06	
78	9	18.65									223.38		222.01	
79	10	26.55	215.85	0.08	215.29	6.77	215.60	3.06	215.65	2.41	216.98	13.64	218.17	28.01
80	11	37.65	212.66	0.09	212.51	1.76	212.44	2.58	212.70	0.38	209.63	34.68	212.72	0.59
81	12	52.00	205.88	0.10	205.61	2.61	205.43	4.38	205.72	1.54	205.71	1.70	204.88	9.81
82	13	72.05	195.02	0.11	195.38	3.44	194.80	2.03	194.70	3.00	197.06	19.41	194.10	8.72
83	14	93.10	187.08	0.10	189.86	28.80	189.69	27.07	189.49	25.05	188.52	15.00	189.25	22.56
84	15	114.30	195.34	0.09	195.58	2.75	194.76	6.71	194.67	7.70	194.85	5.61	193.23	24.30
85	16	133.95	201.89	0.08	202.01	1.43	201.66	2.72	201.62	3.18	201.39	5.99	199.59	27.34
86	17	151.35	206.08	0.09	206.02	0.64	206.34	2.92	206.26	2.05	205.36	8.17	205.72	4.06
87	18	175.35	213.82	0.09	213.63	2.21	213.34	5.56	213.35	5.38	212.52	14.87	213.83	0.05
88	19	206.85	222.03	0.09	221.93	1.20	222.07	0.40	222.17	1.45	221.46	6.35	223.01	10.68
89	20	248.15	232.89	0.09	232.88	0.11	232.56	3.67	232.73	1.81	232.52	4.06	233.05	1.78
90	21	293.50	242.48	0.09	242.36	1.38	242.48	0.04	242.68	2.27	242.56	0.94	243.26	8.98
91	22	328.85	249.52	0.08	248.98	6.33	248.51	11.84	248.71	9.48	249.26	3.08	249.58	0.69
92	23	375.50	256.34	0.08	256.20	1.80	255.19	14.12	255.38	11.89	256.18	2.05	255.77	7.11
93	24	442.65	262.13	0.09	261.89	2.71	262.99	9.89	262.77	7.36	262.77	7.44	262.92	9.14
94	25	506.55	267.96	0.09	267.71	2.82	268.47	5.89	268.19	2.67	267.41	6.30	268.51	6.41
95	26	576.35	275.06	0.08	274.86	2.46	274.66	4.93	274.65	4.94	274.09	11.93	274.28	9.51
96	27	650.55	281.02	0.08	280.99	0.42	280.59	5.29	280.57	5.48	280.98	0.57	280.09	11.31
97	28	730.65	285.74	0.08	285.55	2.48	284.81	11.59	284.74	12.47	286.25	6.32	285.43	3.97
98	29	828.15	292.32	0.08	292.23	1.15	290.11	26.54	290.50	21.86	292.17	1.79	290.74	19.00
99	30	989.30	296.57	0.09	296.57	0.06	297.33	8.75	297.27	8.04			295.66	10.56
100														

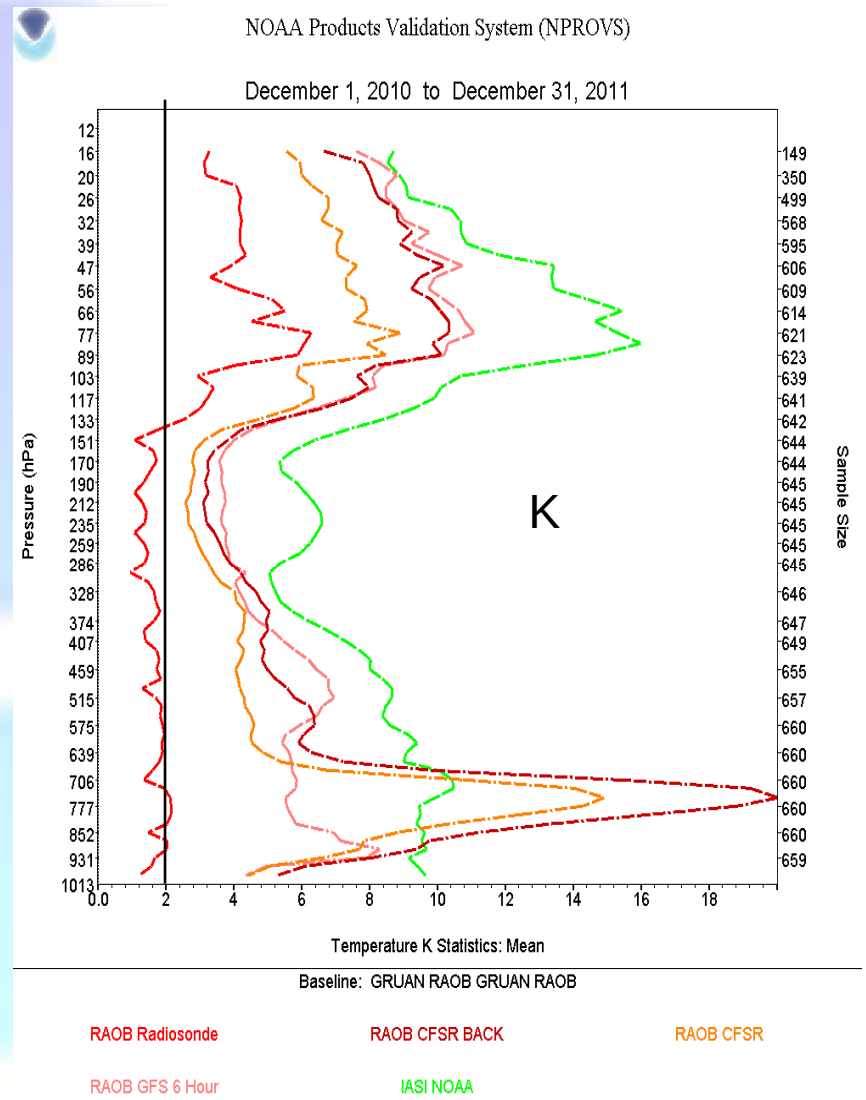
TWP nite





Lindenberg 2011 Temperature





TWP 2011 Temperature

Climate Research Support Using Collocation Datasets (2008 to present …)

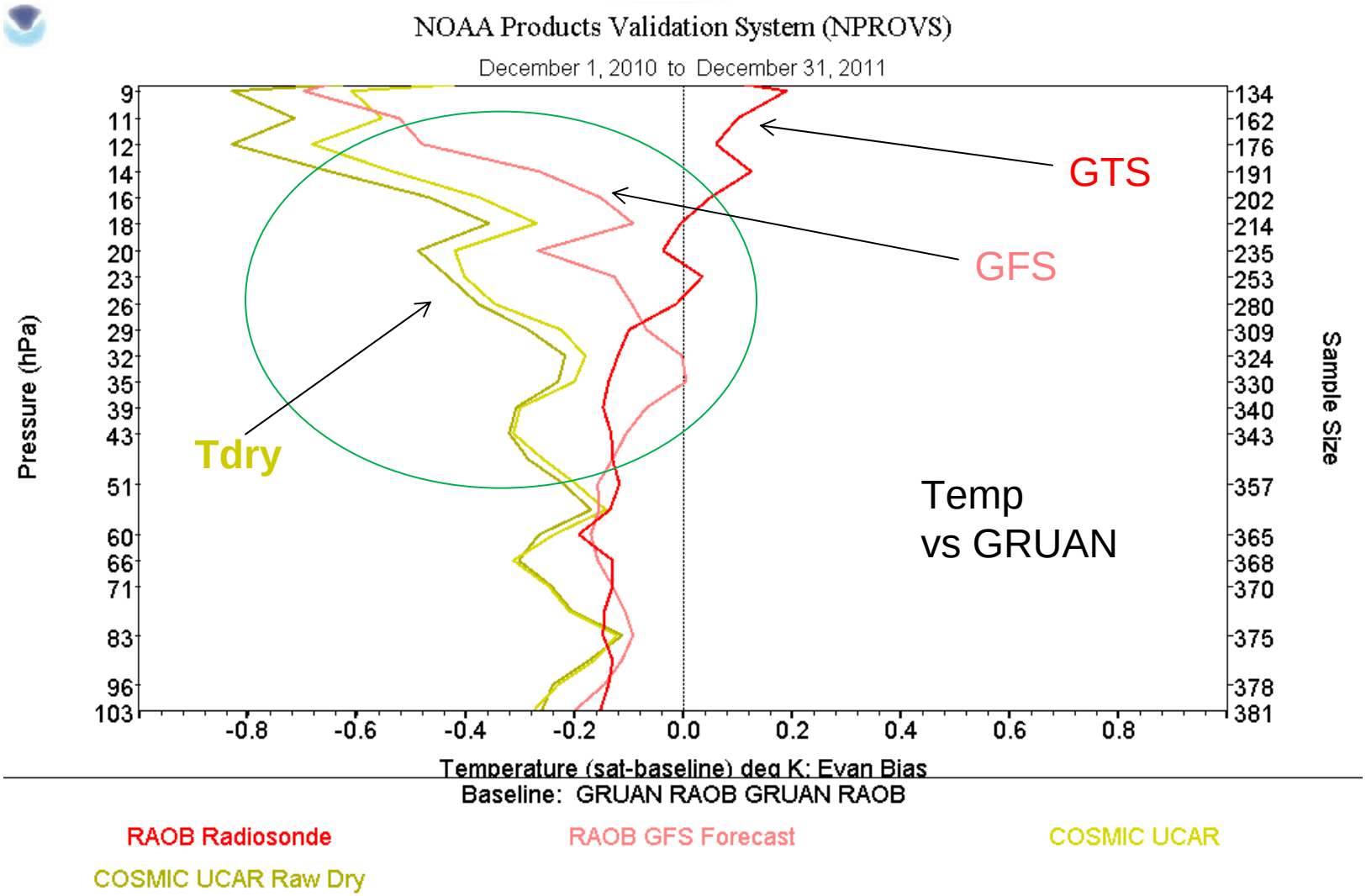
1) Sun, B., A. Reale, D. J. Seidel, and D. C. Hunt (2010), Comparing radiosonde and COSMIC atmospheric profile data
to quantify differences among radiosonde types and the effects of imperfect collocation on comparison statistics, J. Geophys. Res., 115, D23104, doi:10.1029/2010JD014457.

2) Reale, A., B. Sun, F. Tilley, and M. Pettey (2012), NOAA Products validation System (NPROVS) *J. Atmos. Oceanic. Tech., 29, 629-645.*

3) Towards improved corrections for radiation-induced biases in radiosonde temperature observations

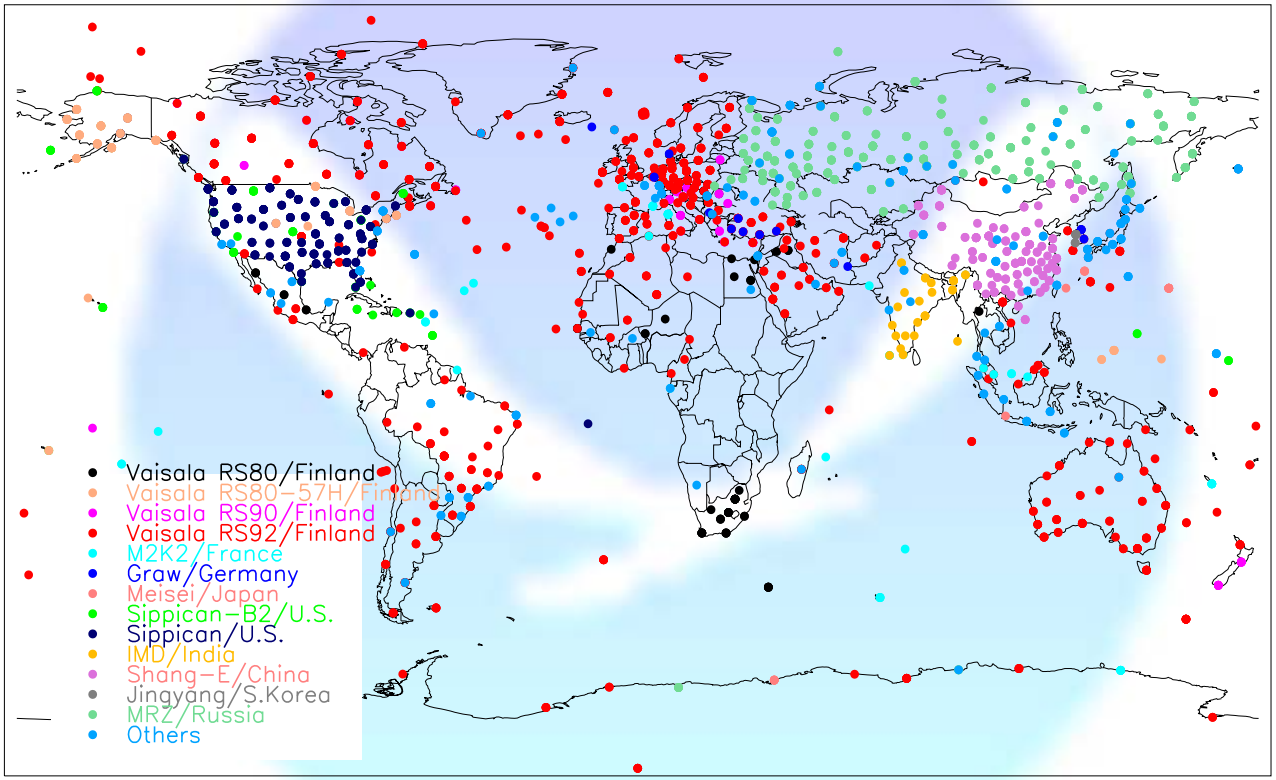
Bomin Sun 1, Tony Reale 2, Steven Schroeder 3, Dian J. Seidel 4, and Bradley Ballish 5
1. I.M. Systems Group, Rockville, MD
2. NOAA NESDIS Center for Satellite Applications and Research, Md
3. Texas A & M University, College Station, TX
4. NOAA Air Resources Laboratory, College Park, MD
5. NOAA NCEP Central Operations, College Park, MD

Submitted to Journal of Geophysical Research-Atmospheres 13
October 24, 2012 14 , Revised: February 21, 2013



COSMIC as Reference … Tdry … 0.1 K accuracy is stratosphere …

Sonde types flown in global operational network (2008-2011)

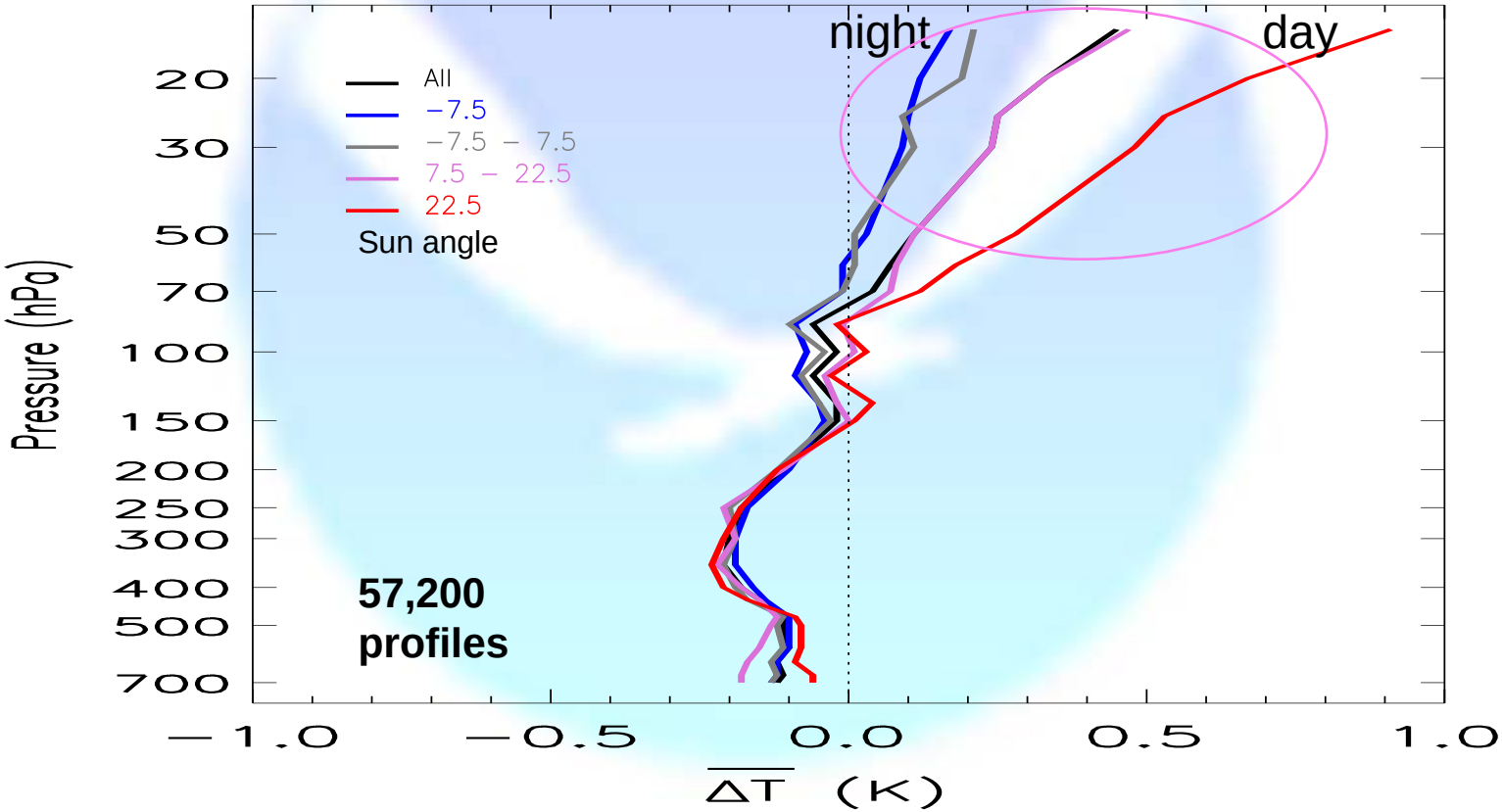


Operational raobs are used for the analysis. Data for most of the sonde types already experienced radiation corrections at the field sites using schemes provided by manufactures, etc. …. Sun, 2010

Vaisala RS92

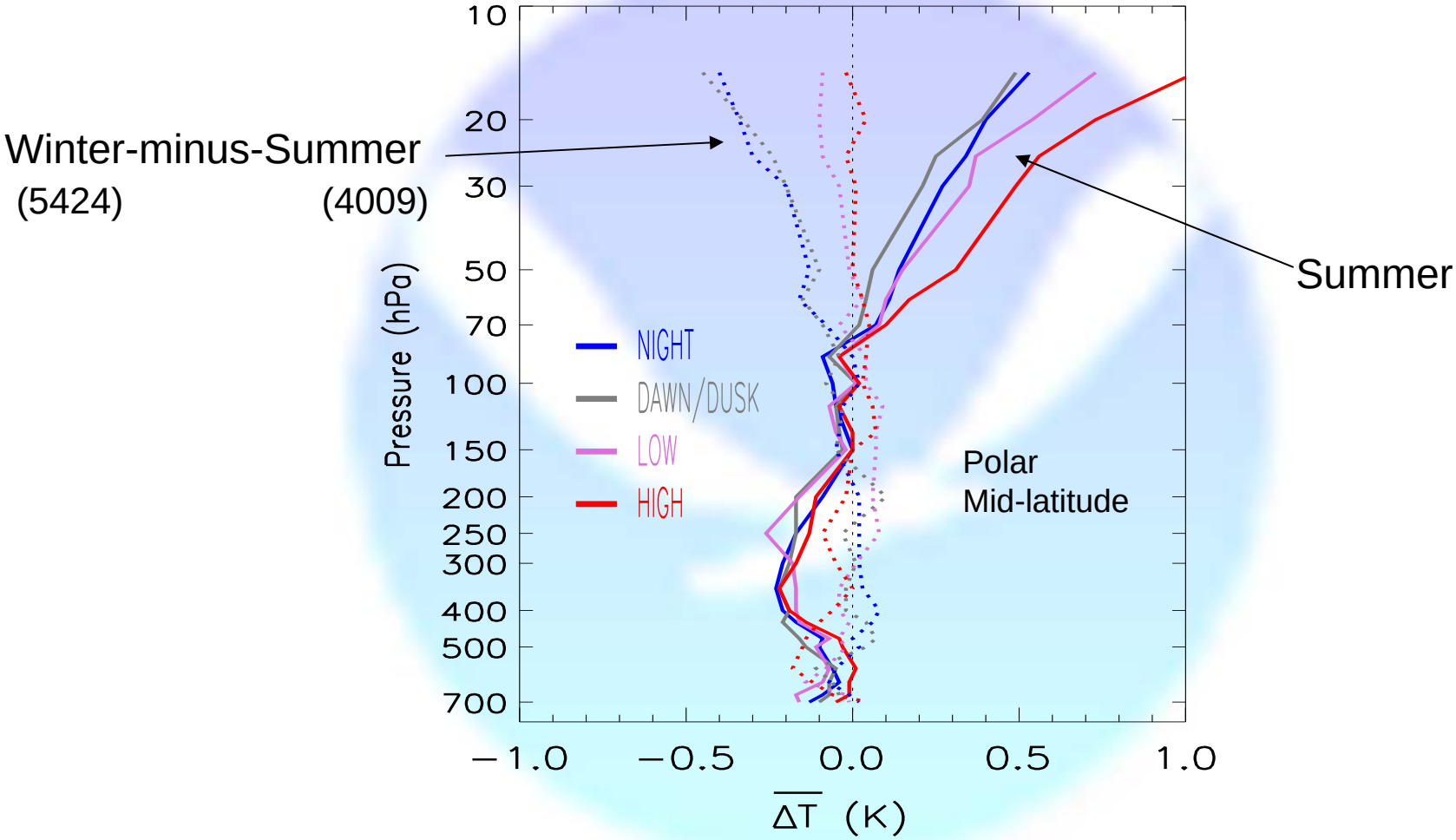
difference from COSMIC T

All sample



Raob-minus-COSMIC Sun, 2011

Seasonal Variation in Raob-minus-COSMIC for Vaisala RS92

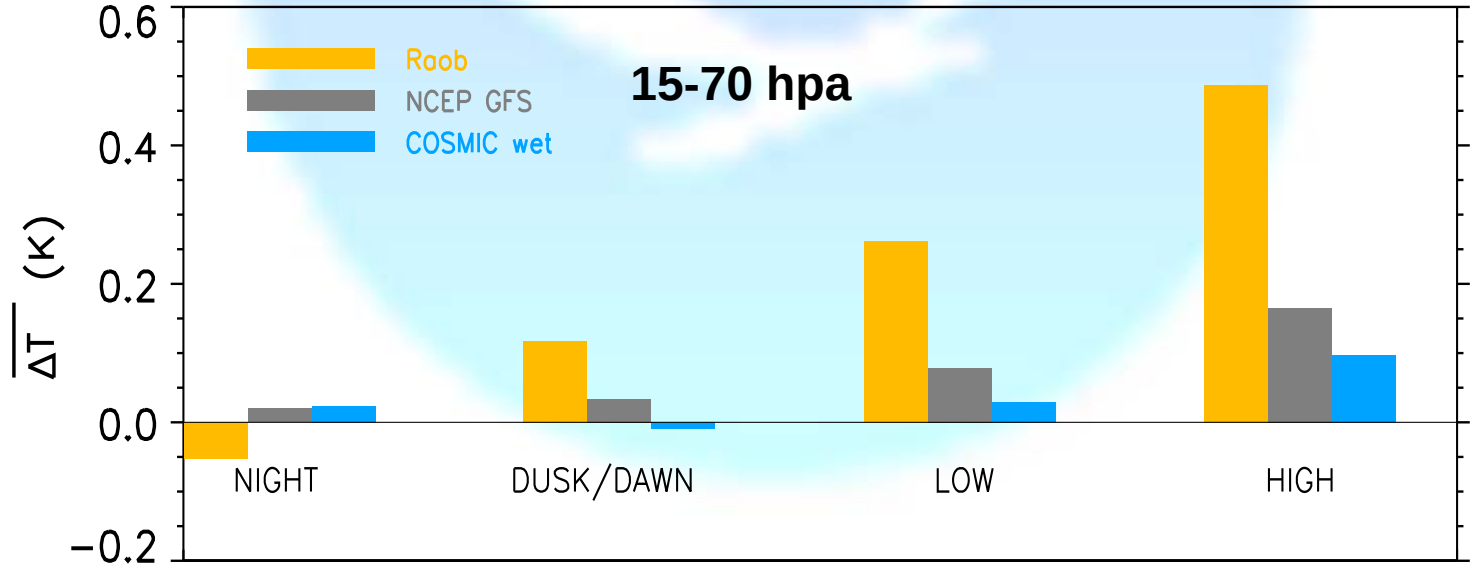


Seasonal variation in bias is bigger at nighttime:
Summer relatively warm, no bias night winter ?!
GRUAN interest … Sun 2011

MOTIVATION

- Better use of operational RAOBS in:
  - NWP assimilation and forecasting
  - Upper air climate change detection
  - Satellite calibration/validation

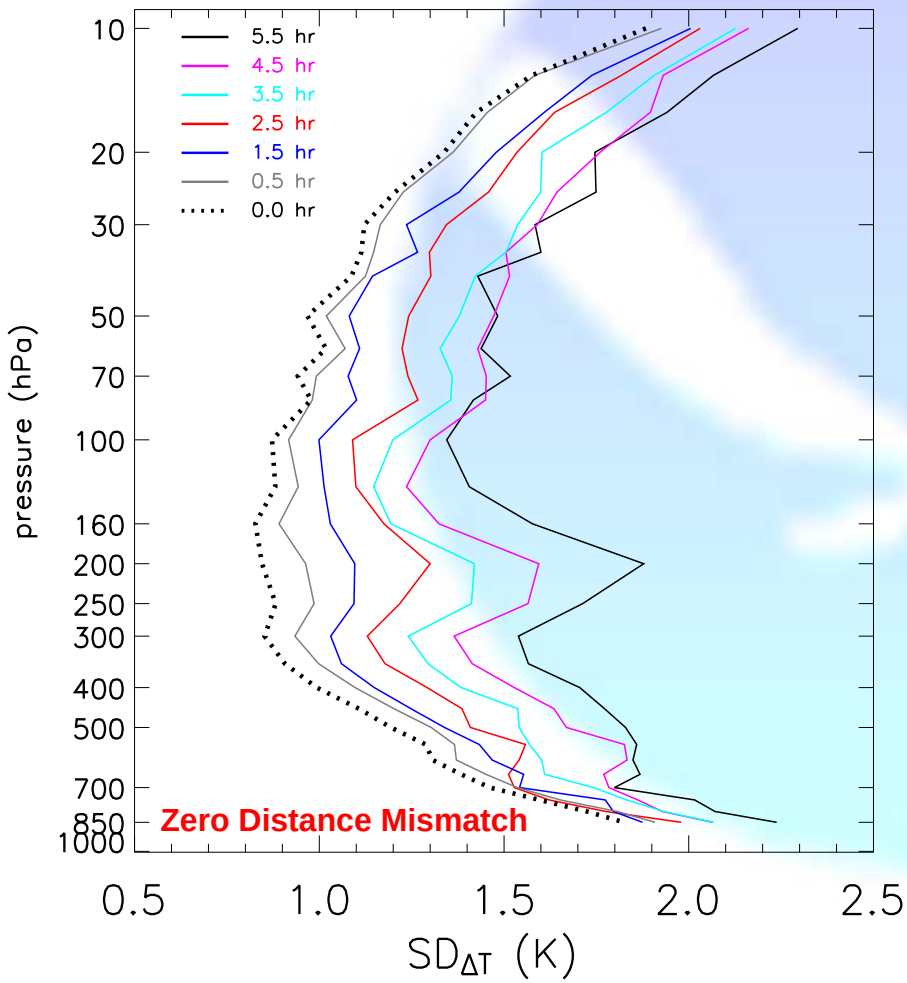
Raob T biases propagate: → **to forecast *via* data assimilation**
→ **to sat product via forecast**



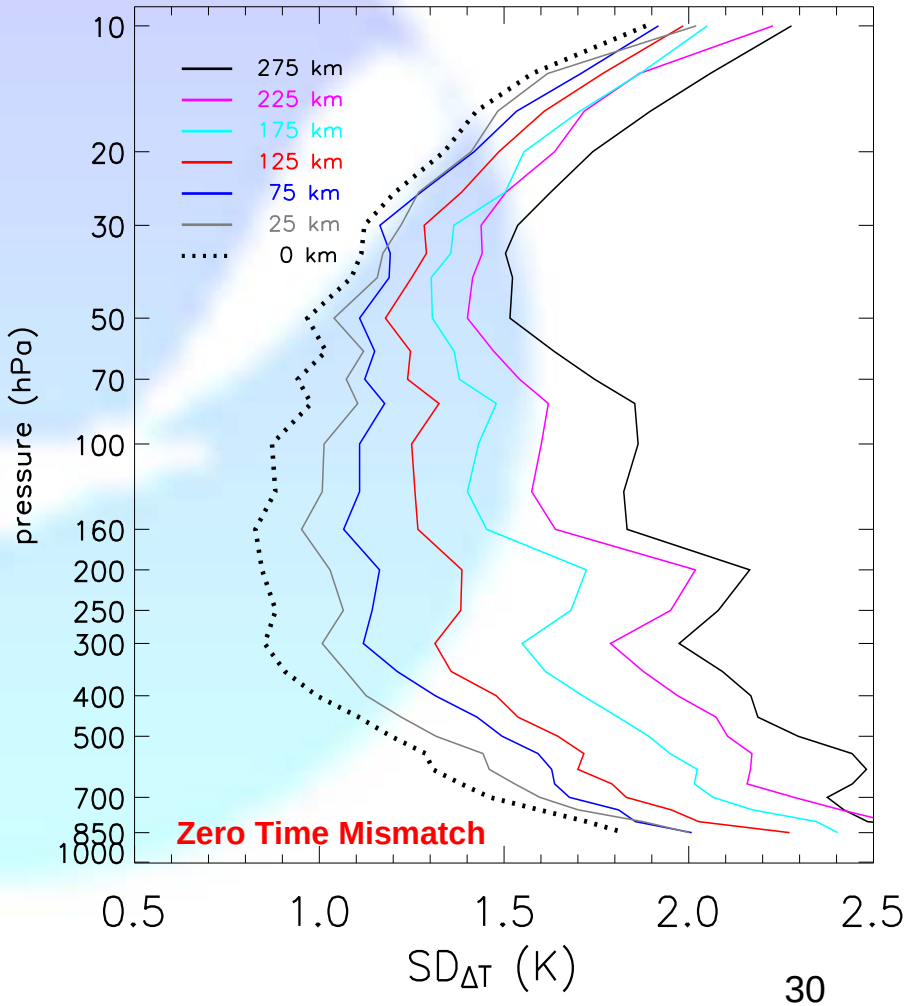
Differences vs Tdry … Sun 2011

Collocation Mismatch Impact: Temperature Profile

Time Mismatch Impact



Distance Mismatch Impact



Sun, 2010

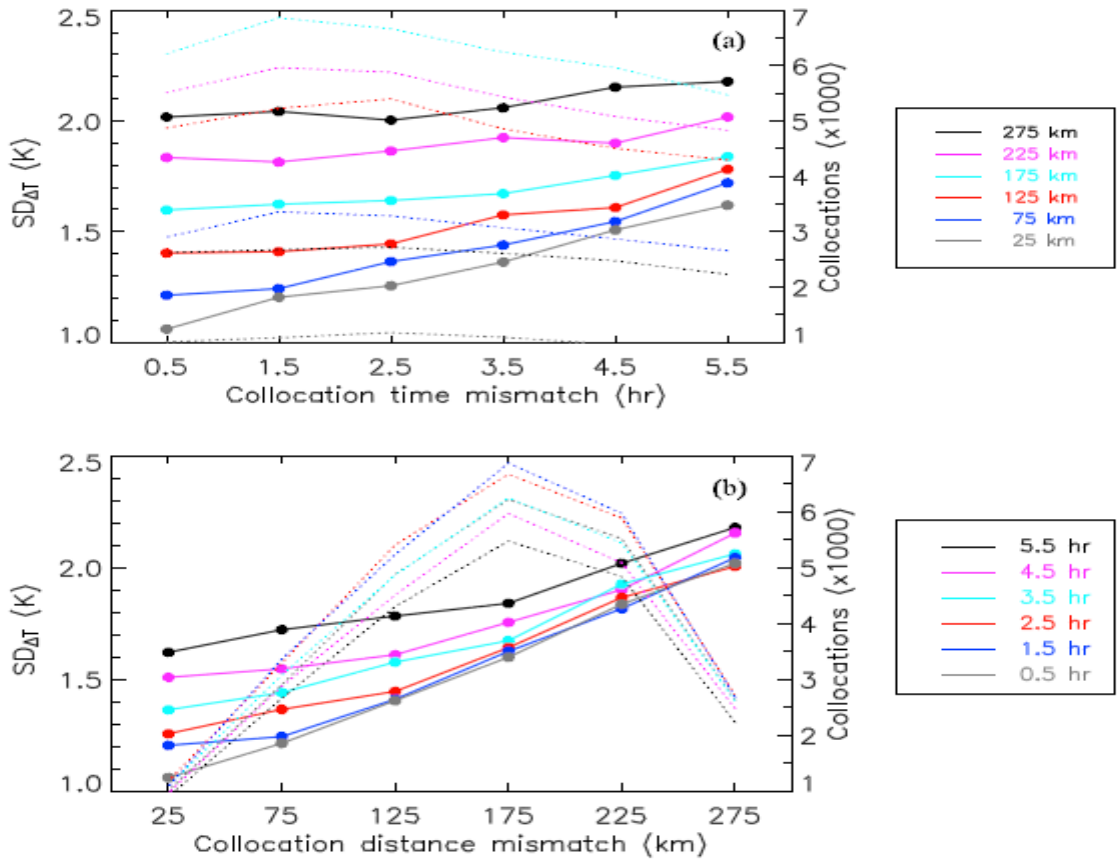


Figure 8. Dependence of 300 hPa standard deviation of raob-minus-COSMIC temperature difference on collocation mismatch for (a) time mismatch and (b) distance mismatch. Solid curves represent $SD_{\Delta T}$, and dotted curves denote the number of collocations used to compute $SD_{\Delta T}$.

Sun, 2011

	NIGHT	DUSK/DAWN	LOW	HIGH	ALL
Clear	0.03 (1.81, 9745)	0.33 (1.93, 2304)	0.41 (1.90, 1895)	0.64 (1.77, 3050)	0.22 (1.85, 16994)
Cloudy	-0.02 (1.89, 15433)	0.23 (1.88, 9898)	0.34 (1.88, 9862)	0.46 (1.73, 17902)	0.25 (1.84, 53095)

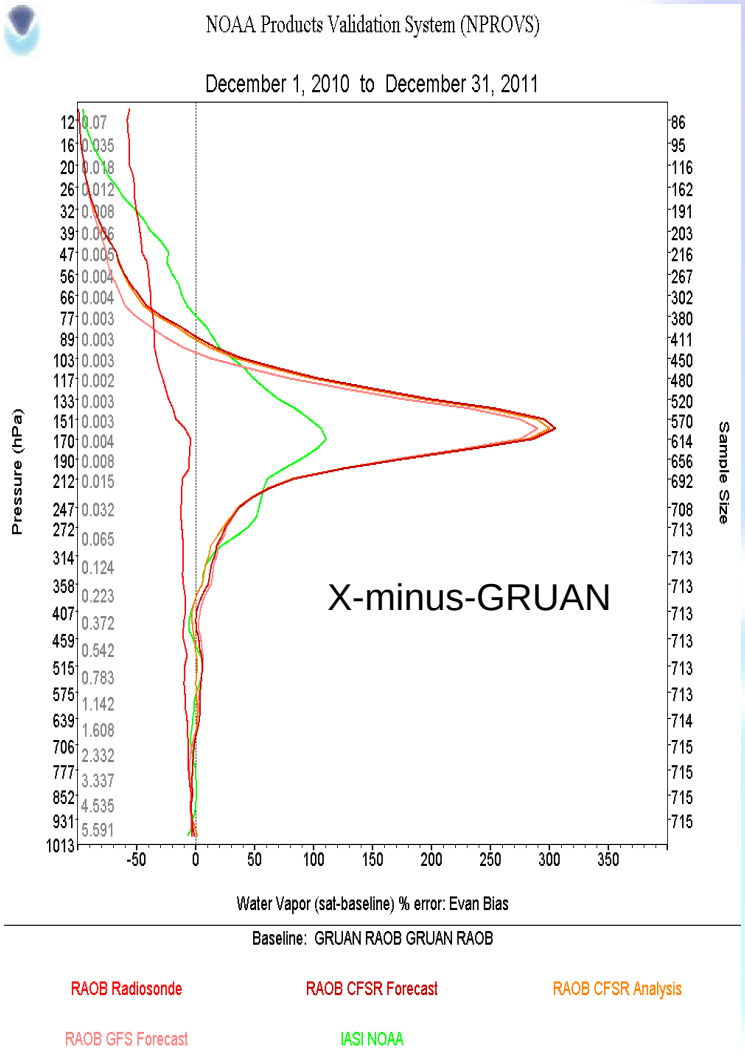
Table 2c. RAOB-minus-COSMIC mean biases (K) and standard deviations (K) for different cloud sky conditions and solar elevation angles averaged over 15-70 1 hPa. The statistics were computed from countries/regions where cloud information is included in radiosonde reports (see text for detail). Values in parenthesis are 2 standard deviation and sample size

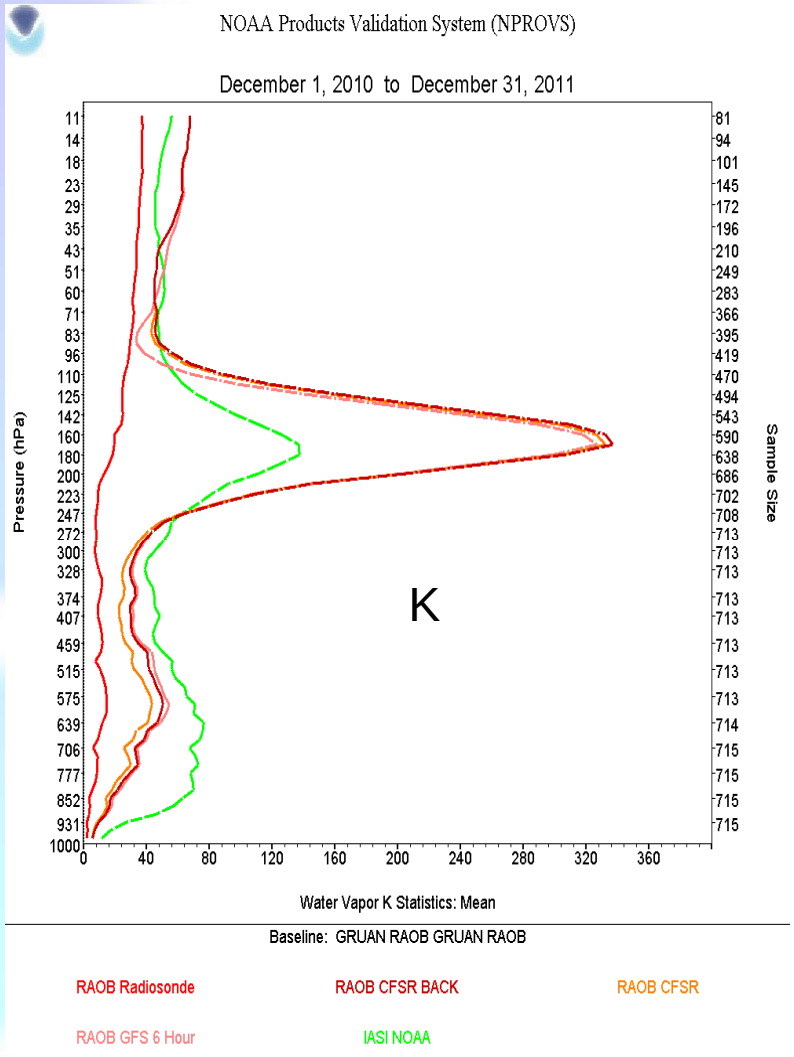
Sun et al, 2013 … revised Feb 2013 .. still under review

Summary

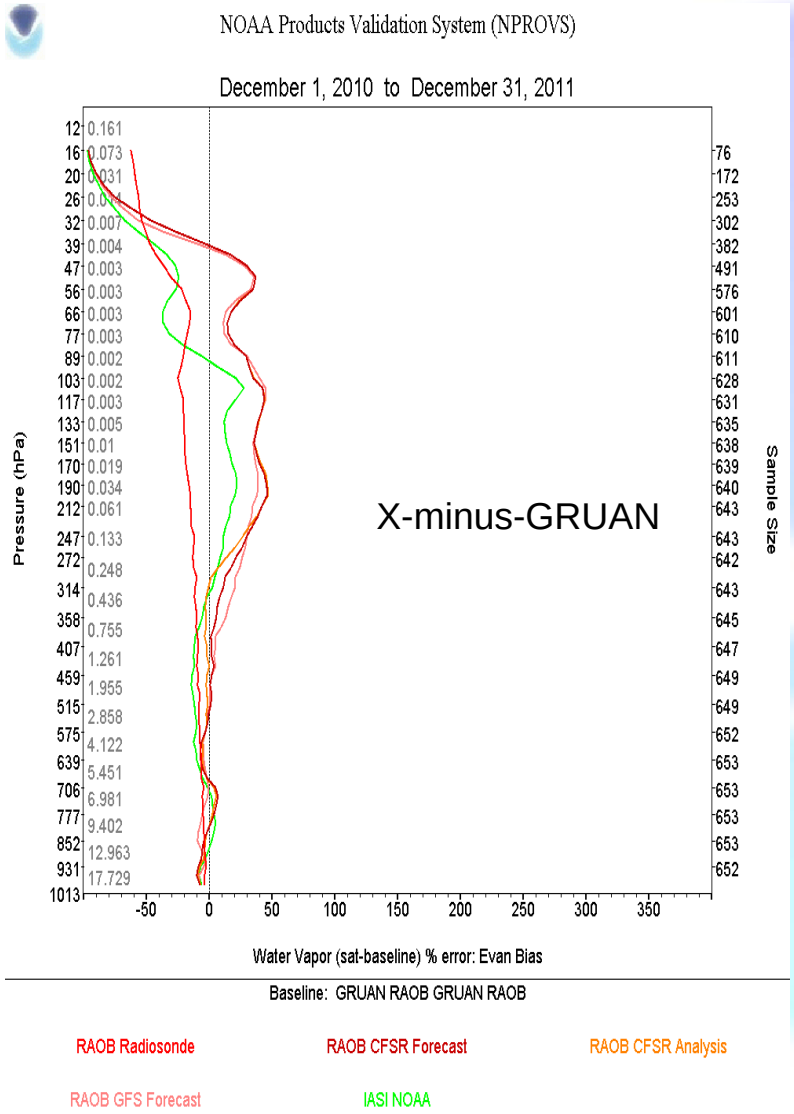
- GPROVS Interface for radiosonde (RS92)
- Site (+ship) expansion via Suomi-NPP cal/val program to validate product adherence to spec … *process dedicated RS92 using GRUAN*
- GRUAN to provide "Ancillary" at times of raob and/or satellite (+COSMIC) overpass (include appending Sat MW and FTIR…) (TTAM, Scheduling, GATNDOR)
- Append ECMWF at GRUAN at time of assimilation (similar to NOAA GFS)
- SASBE, K profiles ….
- Archive of Collocation data records useful for climate

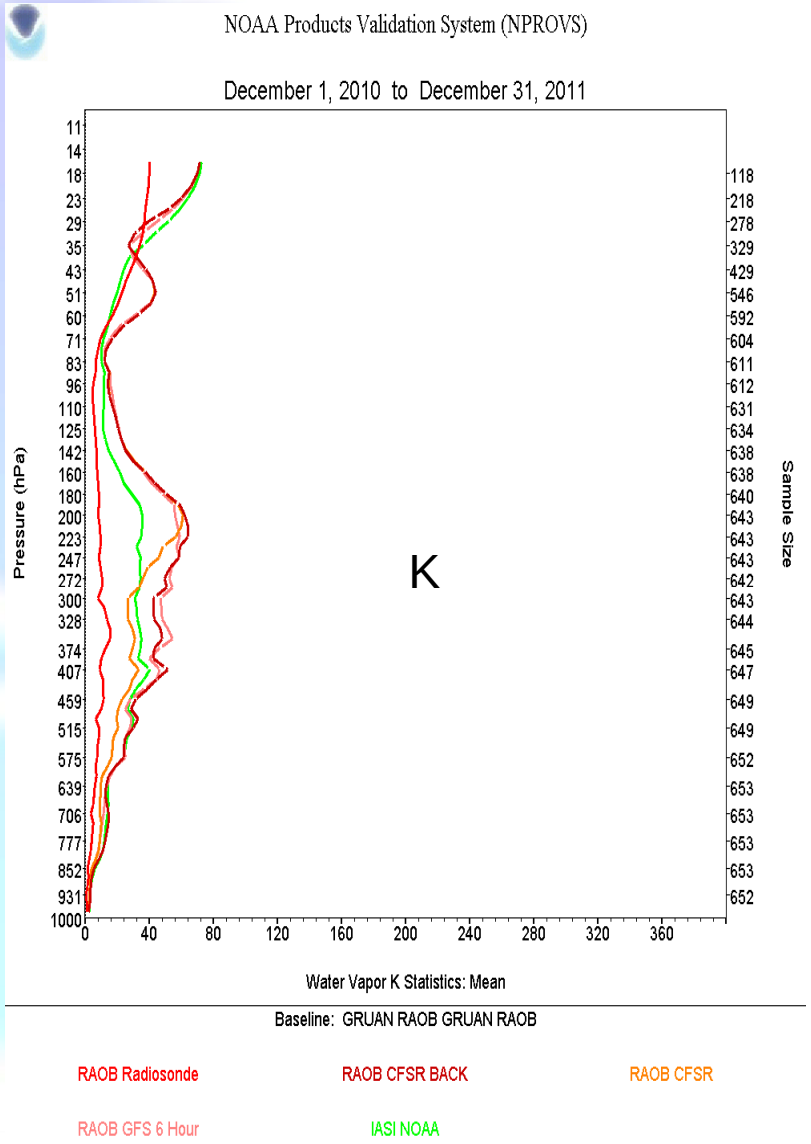
Extras



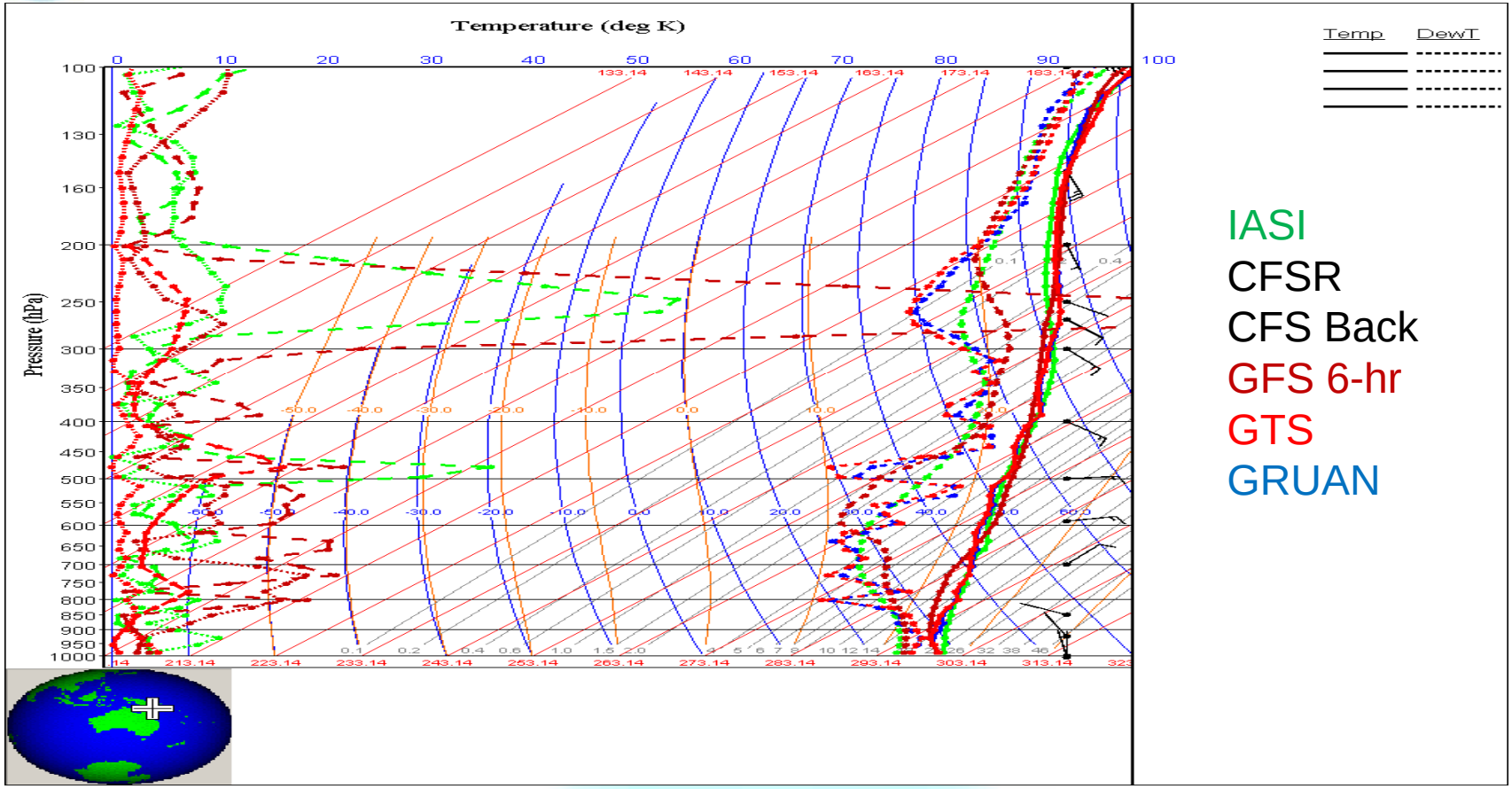


H20 Mix Ratio


NOAA Products Validation System (NPROVS)
December 1, 2010 to December 31, 2011
X-minus-GRUAN
Pressure (hPa)
Sample Size
Water Vapor (sat-baseline) % error: Evan Bias
Baseline: GRUAN RAOB GRUAN RAOB
RAOB Radiosonde
RAOB CFSR Forecast
RAOB CFSR Analysis
RAOB GFS Forecast
IASI NOAA

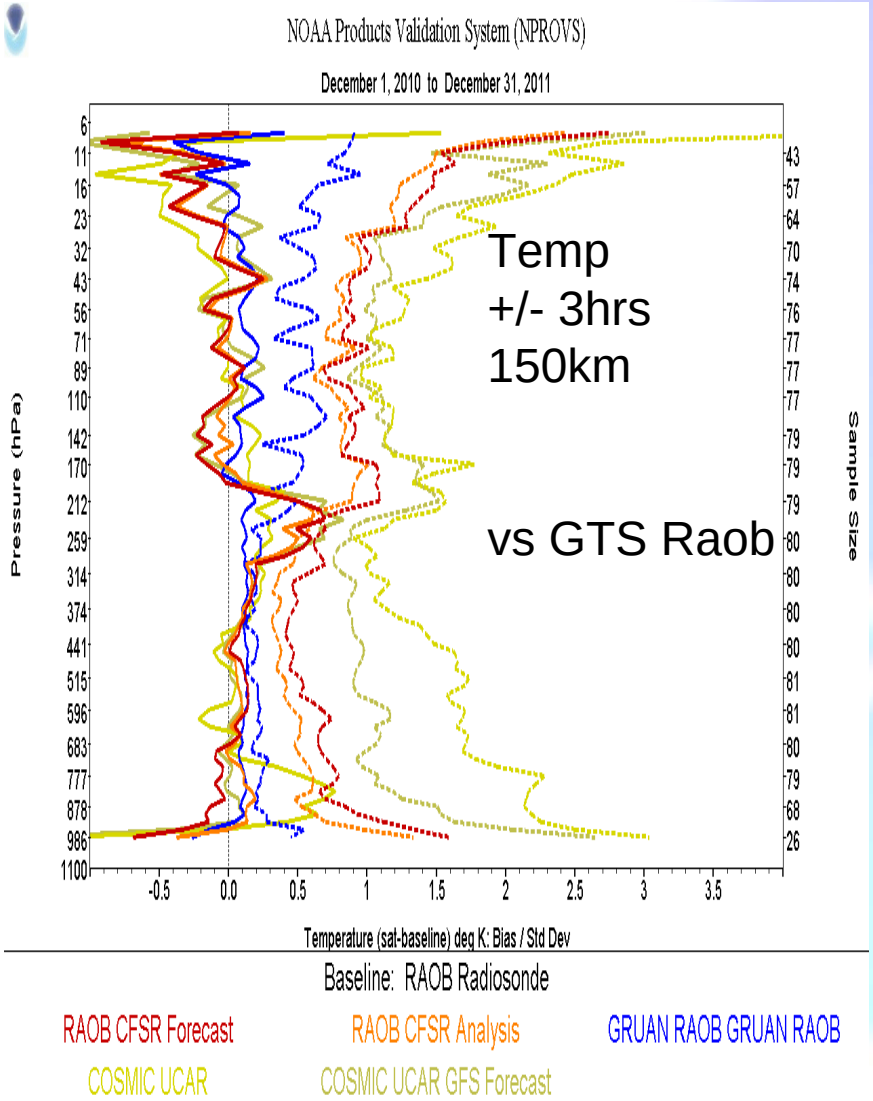

NOAA Products Validation System (NPROVS)
December 1, 2010 to December 31, 2011
K
Pressure (hPa)
Sample Size
Water Vapor K Statistics: Mean
Baseline: GRUAN RAOB GRUAN RAOB
RAOB Radiosonde
RAOB CFSR BACK
RAOB CFSR
RAOB GFS 6 Hour
IASI NOAA

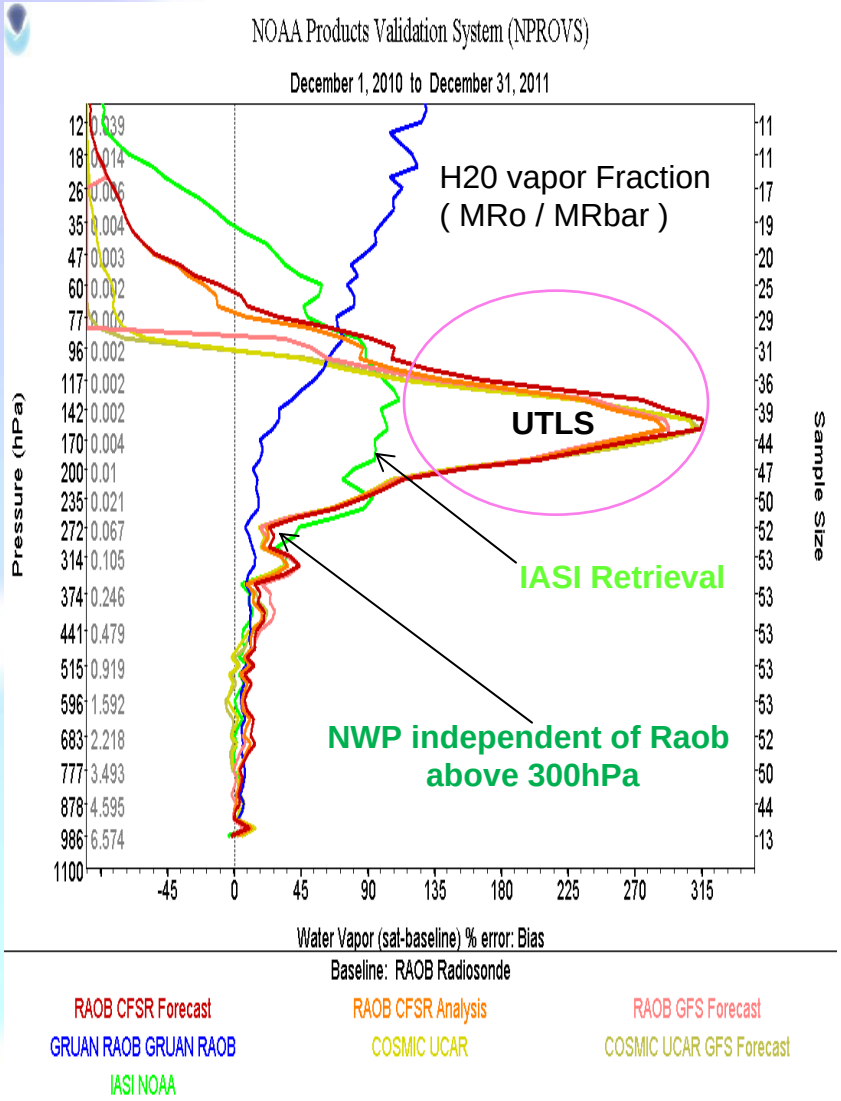
NOAA Products Validation System (NPROVS)



K values for T (solid) and H20 (dash) on extreme left using upper scale

Mainly Vicinity of Lindenberg, Germany





GRUAN Sonde, NWP and COSMIC, resepectively, -minus-GTS Sonde

CriMSS Performance Specification

Atmospheric Vertical Temperature Profile (AVTP) Measurement Uncertainty – Layer Average Temperature Error	
PARAMETER	**THRESHOLD**
AVTP Clear, surface to 300 mb	**1.6 K / 1-km layer**
AVTP Clear, 300 to 30 mb	1.5 K / 3-km layer
AVTP Clear, 30 mb to 1 mb	1.5 K / 5-km layer
AVTP Clear, 1 mb to 0.5 mb	3.5 K / 5-km layer
AVTP Cloudy , surface to 700 mb	**2.5 K / 1-km layer**
AVTP Cloudy, 700 mb to 300 mb	1.5 K / 1-km layer
AVTP Cloudy, 300 mb to 30 mb	1.5 K / 3-km layer
AVTP Cloudy, 30 mb to 1 mb	1.5 K / 5-km layer
AVTP Cloudy, 1 mb to 0.5 mb	3.5 K/ 5-km layer

Atmospheric Vertical Moisture Profile (AVMP) Measurement Uncertainty – 2-km Layer Average Mixing Ratio % Error	
PARAMETER	**THRESHOLD**
AVMP Clear, surface to 600 mb	**Greater of 20% or 0.2 g/kg / 2-km layer**
AVMP Clear, 600 to 300 mb	Greater of 35% or 0.1 g/kg / 2-km layer
AVMP Clear, 300 to 100 mb	Greater of 35% or 0.1 g/kg / 2-km layer
AVMP Cloudy, surface to 600 mb	**Greater of 20% of 0.2 g/kg / 2-km layer**
AVMP Cloudy, 600 mb to 400 mb	Greater of 40% or 0.1 g/kg / 2-km layer
AVMP Cloudy, 400 mb to 100 mb	Greater of 40% or 0.1 g/kg / 2-km layer

(courtesy Nick Nalli)