NPROVS feedback on GRUAN uncertainty (RS92 vs RS41) and RIVAL

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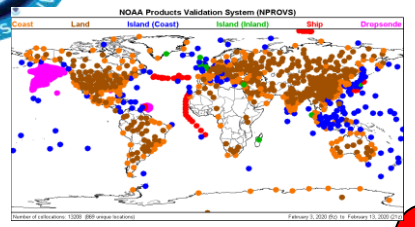
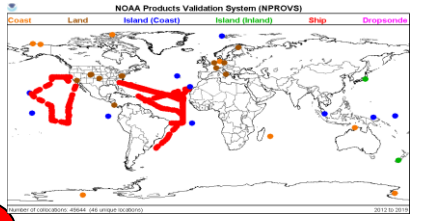
GRUAN ICM-12
16-20 November 2020

NOAA Products Validation System (NPROVS)





INPUTS

Conventional Radiosonde
GFS 6-hr
CFSR

Special Radiosonde:
JPSS
DOE / ARM
GRUAN
NWS …

Geophysical Profiles

NUCAPS	MIRS	AIRS v.6	IASI-L2
NOAA20 S-NPP MetOp-A,B,C NOAA	S-NPP NOAA20 NOAA-18,19 MetOp-A,B,C NOAA	Aqua-EOS NASA	MetOp-A, B, C EUMETSAT

ATOVS	GOES	GRAS	COSMIC	NWP
NOAA-19 MetOp-B NOAA	? NOAA	MetOp-A,B,C EUMETSAT	UCAR KOMPSAT Korea	(Analysis) NOAA ECMWF

Parallel Test Systems
All

Collocation Processing (daily)

NPROVS-C

VisualizationTools
ODS
PDISP
NARCS

NPROVS-S

OUTPUT (Collocated Radiosonde and Satellite Observations)

Conventional
NPROVS Collocation Archive

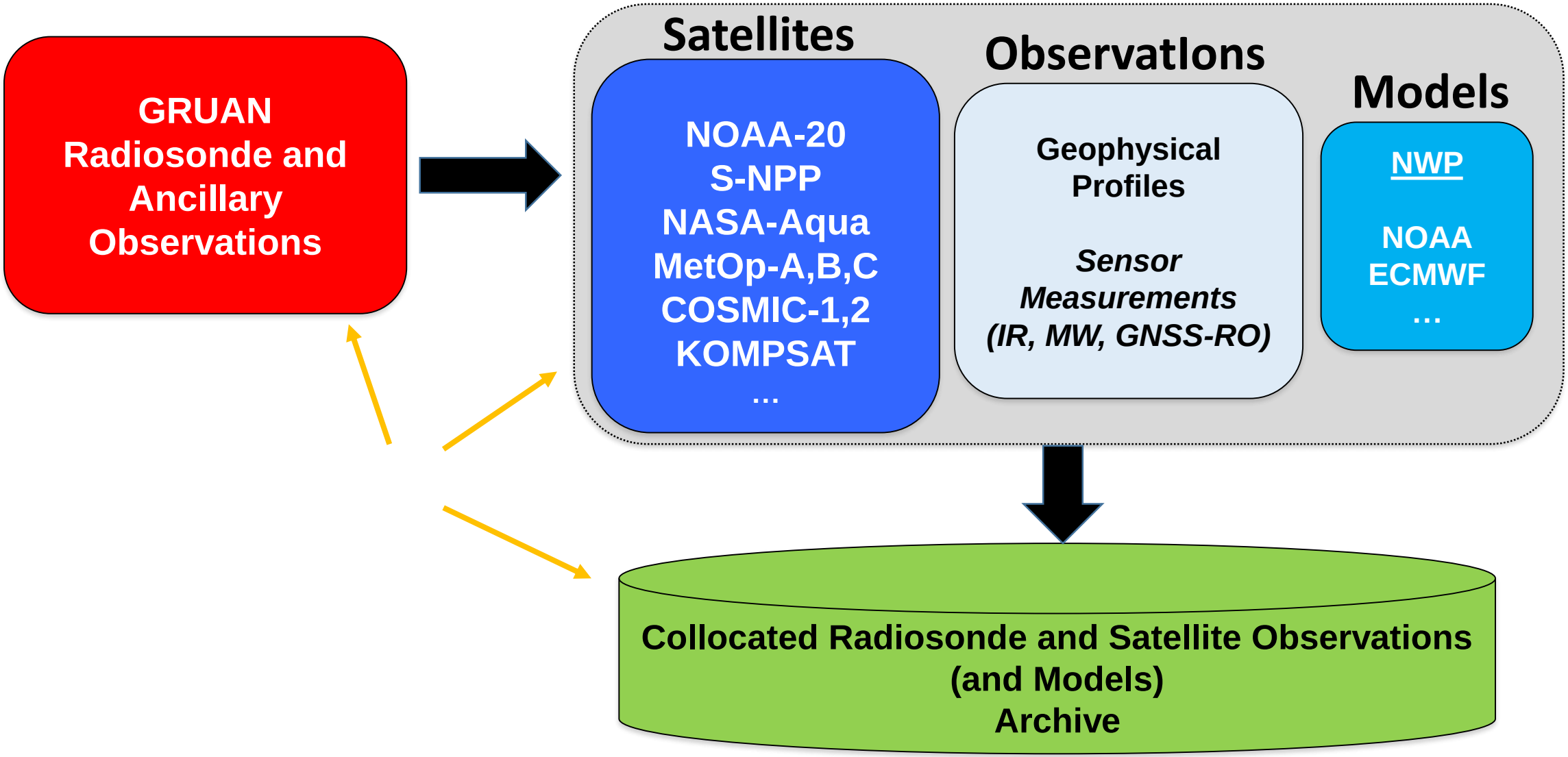
Special
NPROVS-S Collocation Archive

Algorithm Development

SDR
VALAR
(Sensor)

FTP

NOAA Products Validation System (NPROVS)



Daily collocated radiosonde and satellite observations supporting JPSS Cal/Val and Dedicated Radiosonde programs

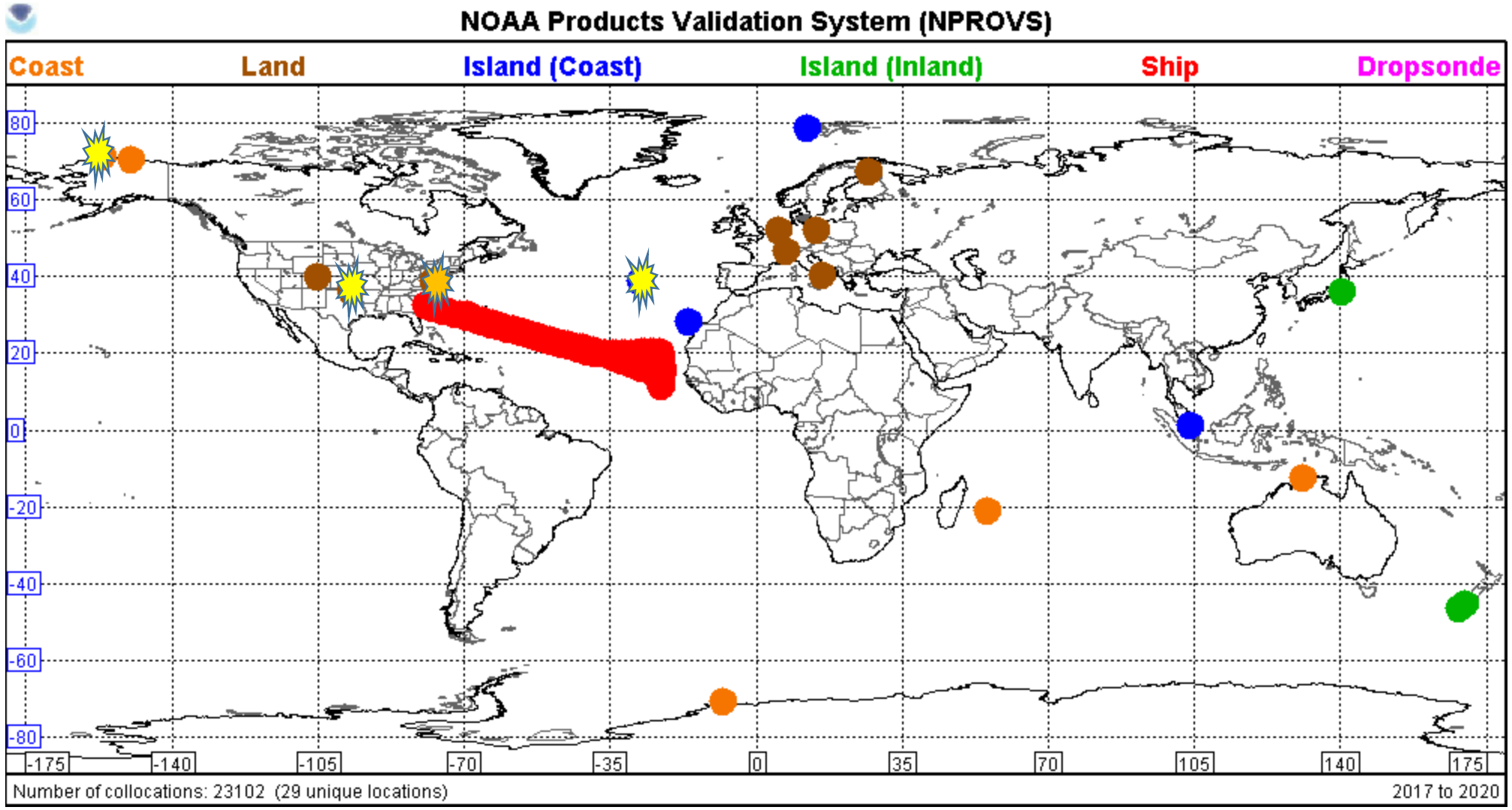
RIVAL

Radiosonde Intercomparison and VALidation (RIVAL) program was a 2-year program to launch dual Vaisala RS41/92 radiosondes synchronized with NOAA-20 polar satellite obsevtaions

Coordinated among GRUAN, DOE-ARM and the NOAA JPSS dedicated radiosonde program

PI: **Lori Borg (SSEC)**

Radiosonde Intercomparison and VALidation (RIVAL)
Feb 2018 to Feb 2020



RIVAL sites (ARM); NSA, SGP, ENA

Beltsville also provides dual launch during RIVAL Campaign

Example RIVAL Spread-sheet for SGP

	A	B	C	D	E	F	G	H	I
1	Date	RS41 (C1)	RS41 (S01)	RS92 (S02)	RS92 (S03)	Radiosonde Received	In NPROVS (NRT)	Collocated with N20	SDR Available
66	7/11/2018	8:25				Yes	Yes	Yes	
67			7:40			Yes	Yes	Yes	
68					7:40	Yes	Yes	Yes	
69	7/11/2018		19:36			Yes	Yes	Yes	
70					18:56	Yes	Yes	Yes	
71	7/23/2018	19:15				Yes	Yes	No	
72			18:35			Yes	Yes	No	
73	7/27/2018	19:39				Yes	Yes	Yes	
74			19:01			Yes	Yes	Yes	
75					19:01	Yes	Yes	Yes	
76	7/29/2018	19:02				Yes	Yes	Yes	
77			18:23			Yes	Yes	Yes	
78	8/2/2018	8:18				Yes	Yes	Yes	
79			7:29			Yes	Yes	Yes	
80					7:29	Yes	Yes	Yes	
81	8/2/2018	19:28				Yes	Yes	No	
82			18:51			Yes	Yes	No	
83					18:51	Yes	Yes	No	
84	8/8/2018	7:54				Yes	Yes	Yes	
85			7:15			Yes	Yes	Yes	
86					7:15	Yes	Yes	Yes	

Campaign features combinations of sequential and dual launches (yellow) synchronized with NOAA-20 overpass leveraging JPSS dedicated radiosonde program (white)

RIVAL Campaign Observations Summary

Site	Start	End	Launch	Received	EDR Collocated (N20)	SDR CrIS/ATMS (250km)
NSA	4/26/18	10/20/19	19	19	18	*18*
SGP	2/13/18	1/6/20	78	78	60	*60*
ENA	4/26/18	10/18/19	54	54	48	*48*
**Belt*	*1/10/18*	*1/6/20*	*112*	*112*	*70*	*70*

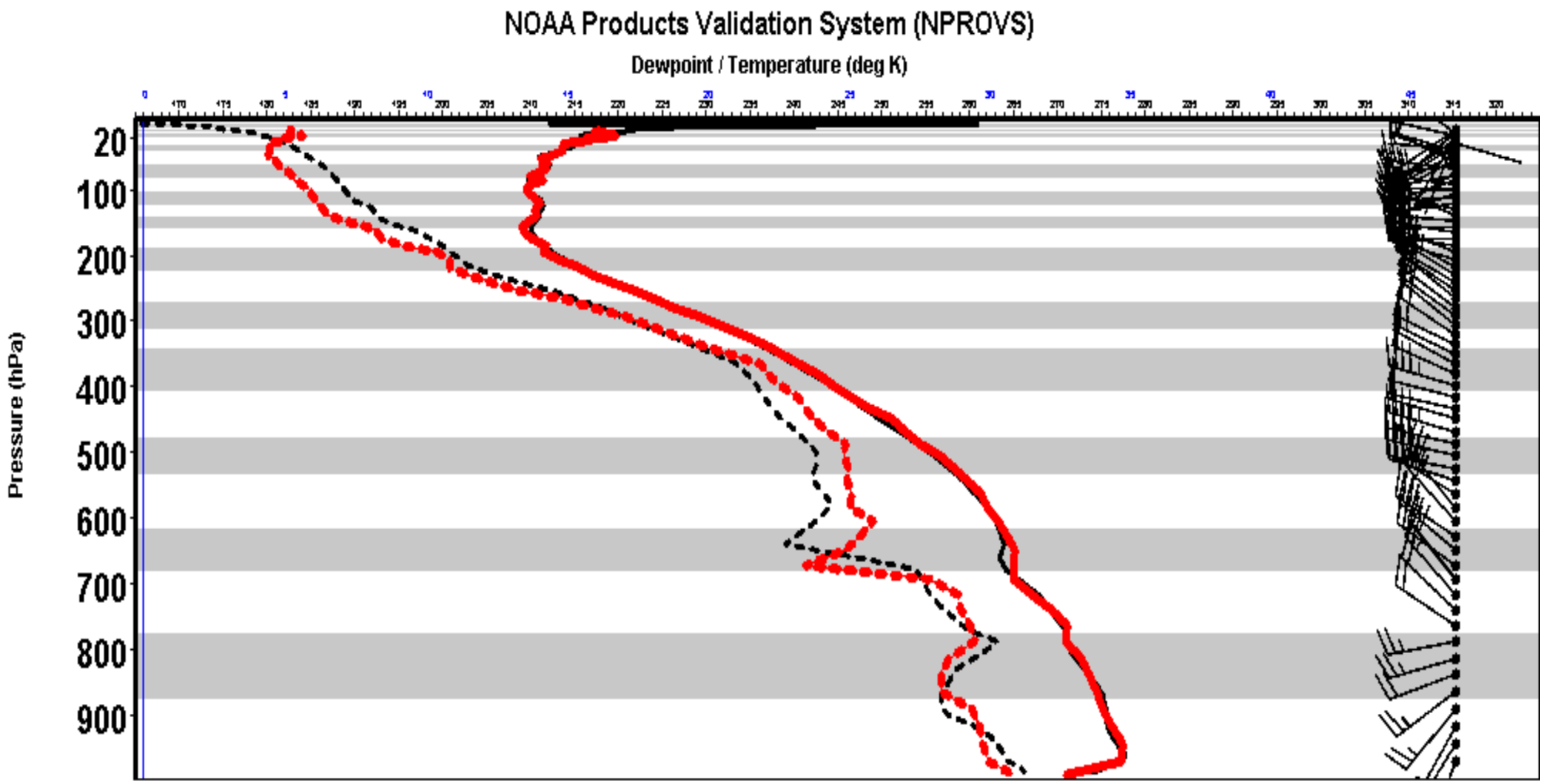
* Can also be simultaneous with (RS41 or RS92 (30) from Sterling Field Support Center (SFSC)

Vaisala RS92 are the GRUAN Data Product (GDP)

Vaisala RS41 are currently the Vendor processed data product

Activity underway to replace the RS41 Vendor with RS41 GDP (Beta)

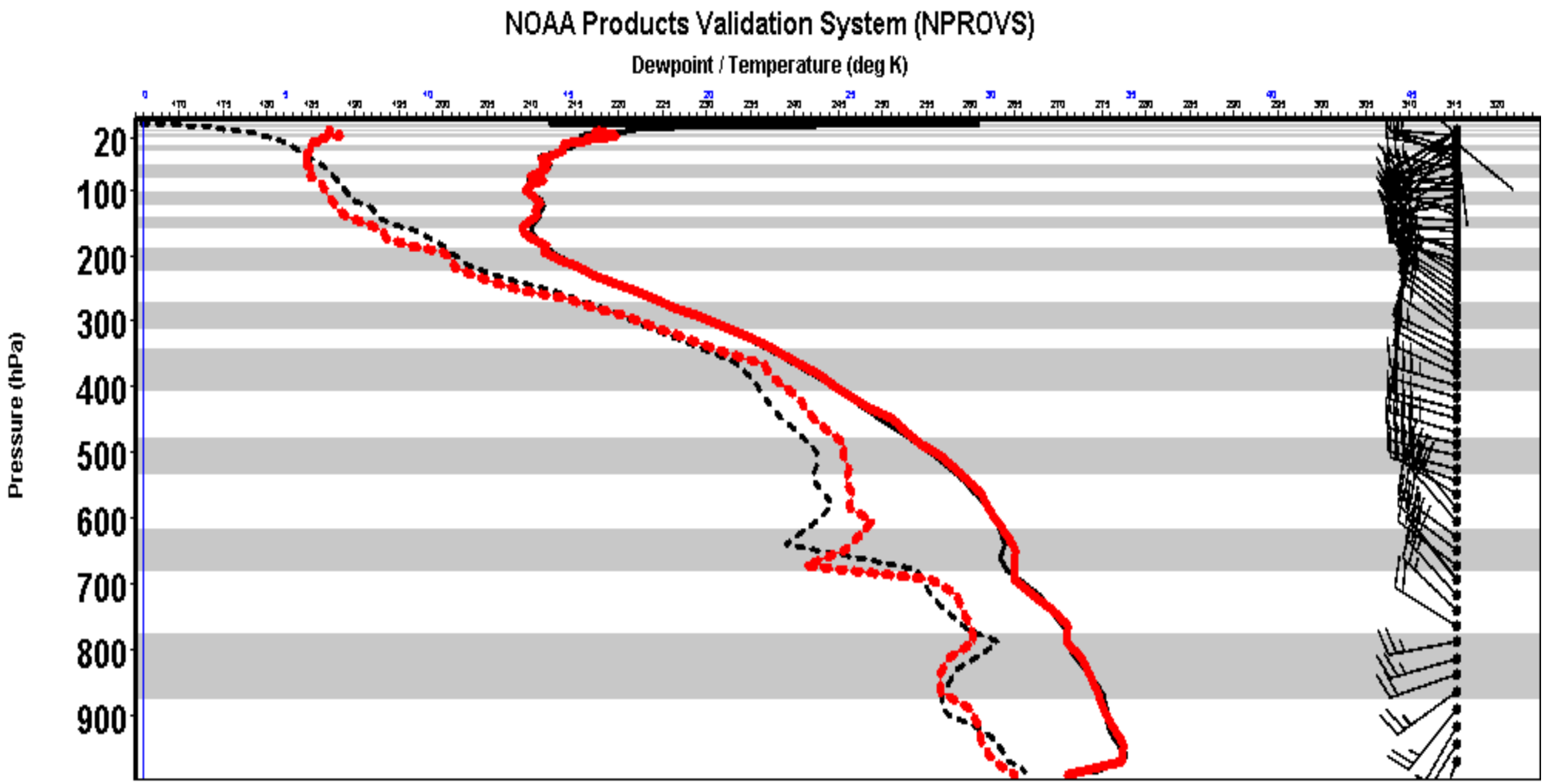
Among the areas of interest for RIVAL are comparing (*and utilizing for satellite product cal/val*) the respective “Uncertainties” for the dual RS41 and RS92 GDP’s



Radiosonde 74646 (141) Radiosonde 12/11/2019 7:33:00Z 36.6 N / 97.5 W

ECMWF 12/11/2019 6:00:00Z (-1.5 hours) 36.5 N / 97.5 W (12.2 km)

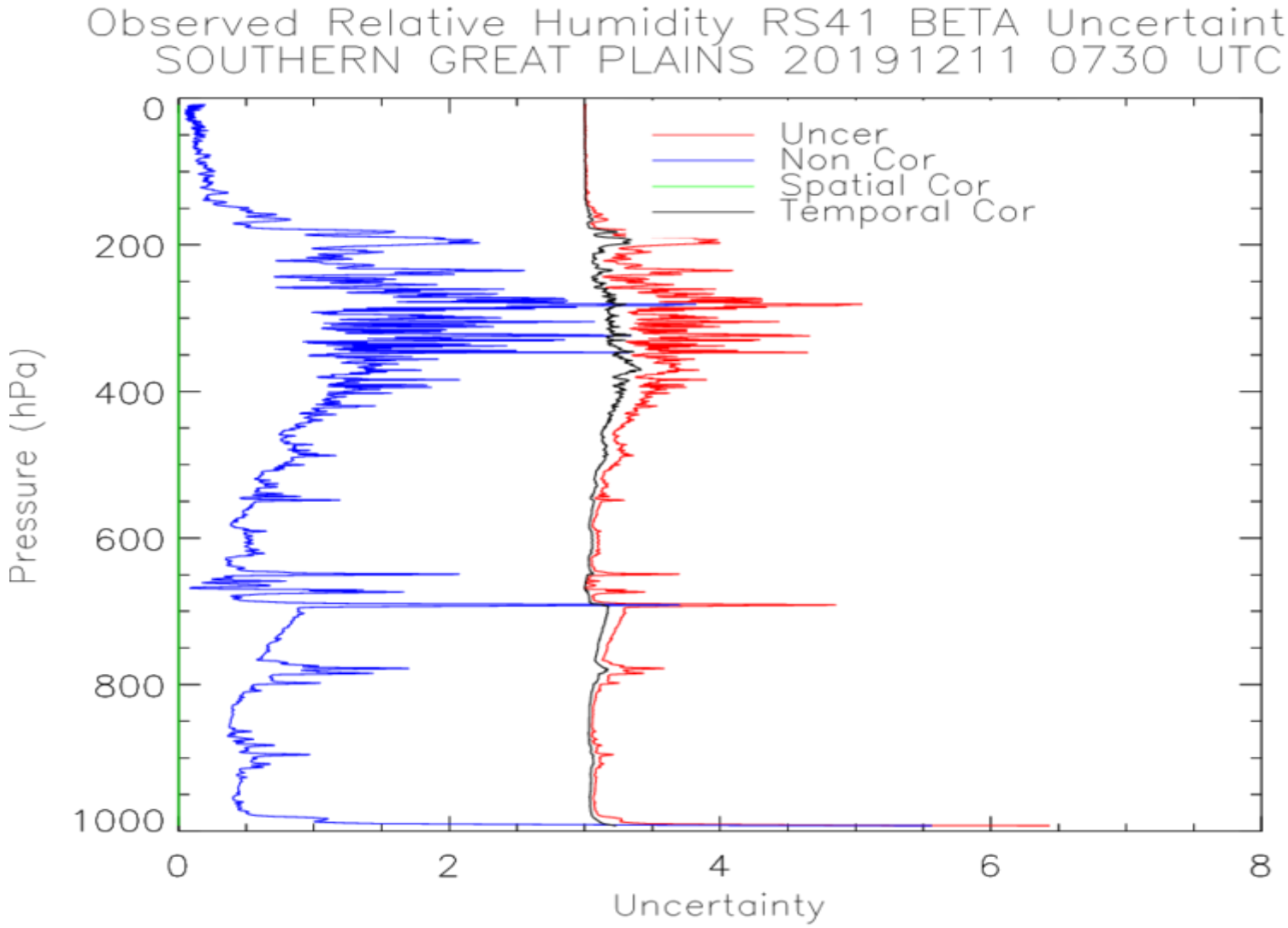
Example of RIVAL Dual Radiosonde … RS41 Beta GDP



Radiosonde 74646 (272) Radiosonde 12/11/2019 7:33:00Z 36.6 N / 97.5 W

ECMWF 12/11/2019 6:00:00Z (-1.5 hours) 36.5 N / 97.5 W (12.2 km)

Example of RIVAL Dual Radiosonde … RS92 GDP



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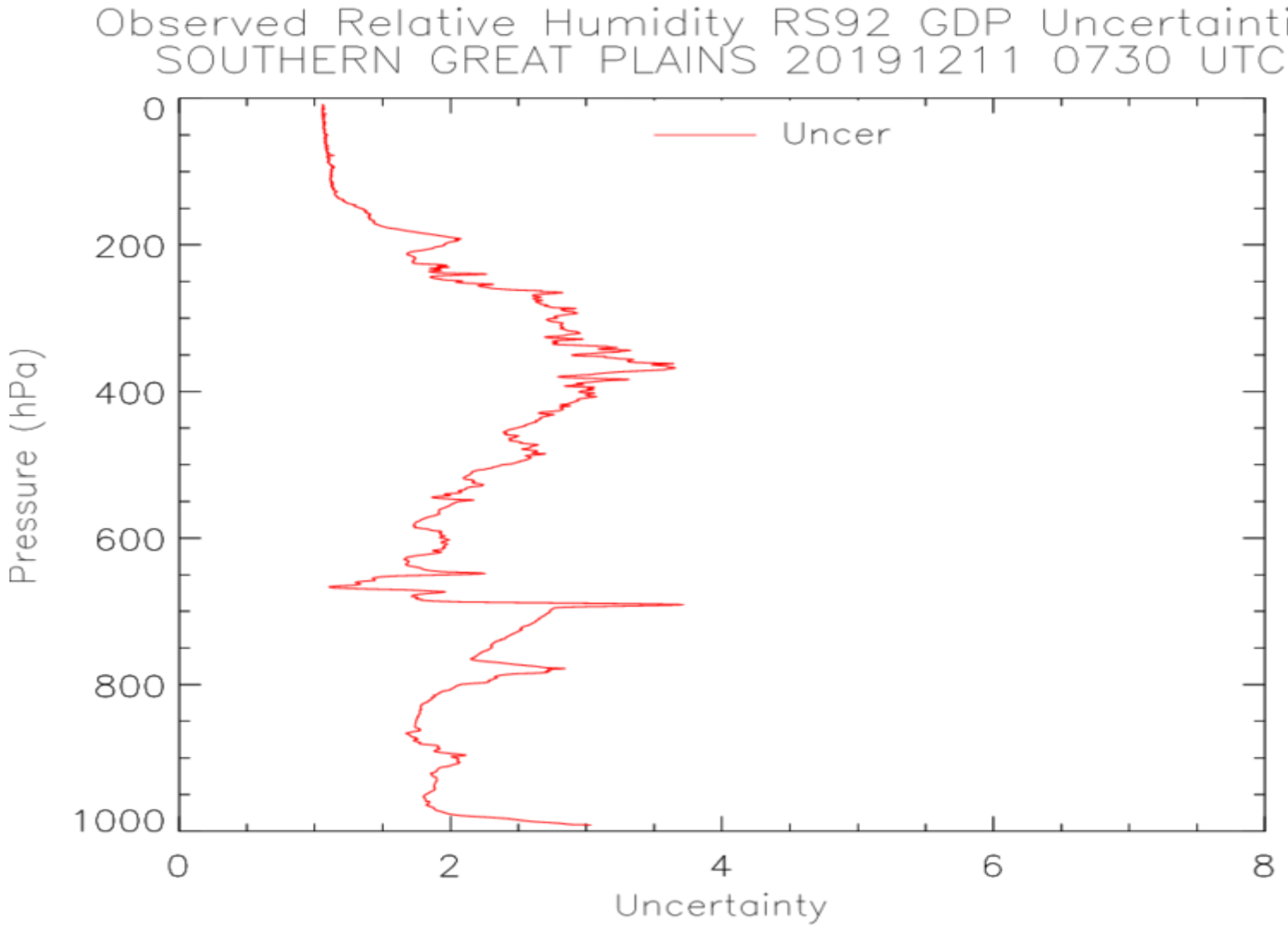
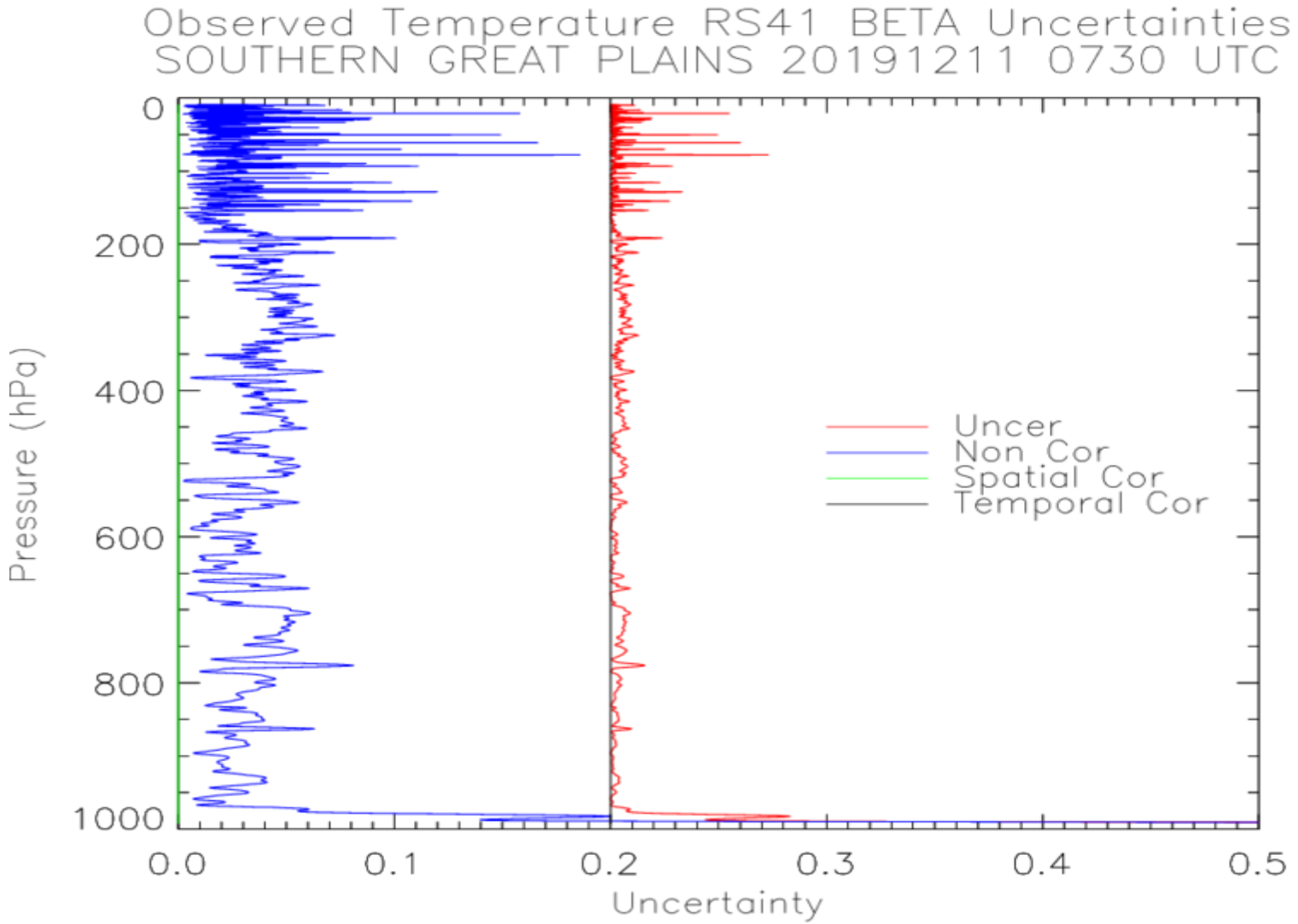
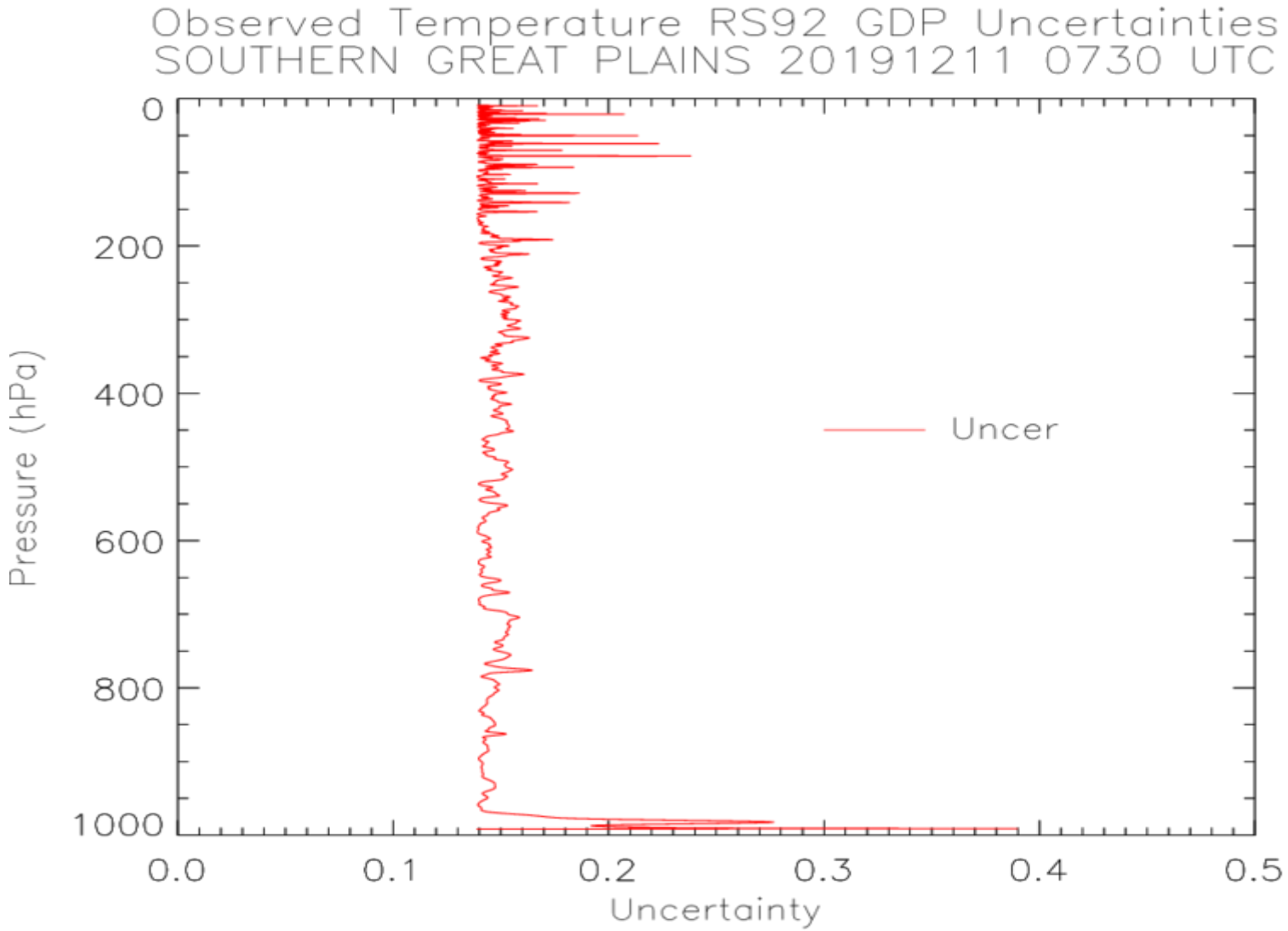


Example for RIVAL Dual Radiosonde … RS92 GDP



Example for RIVAL Dual Radiosonde … RS41 Beta GDP



Example for RIVAL Dual Radiosonde … RS92 GDP

We have observed much variations in looking at uncertainty (and components) for RS41Beta. For example:

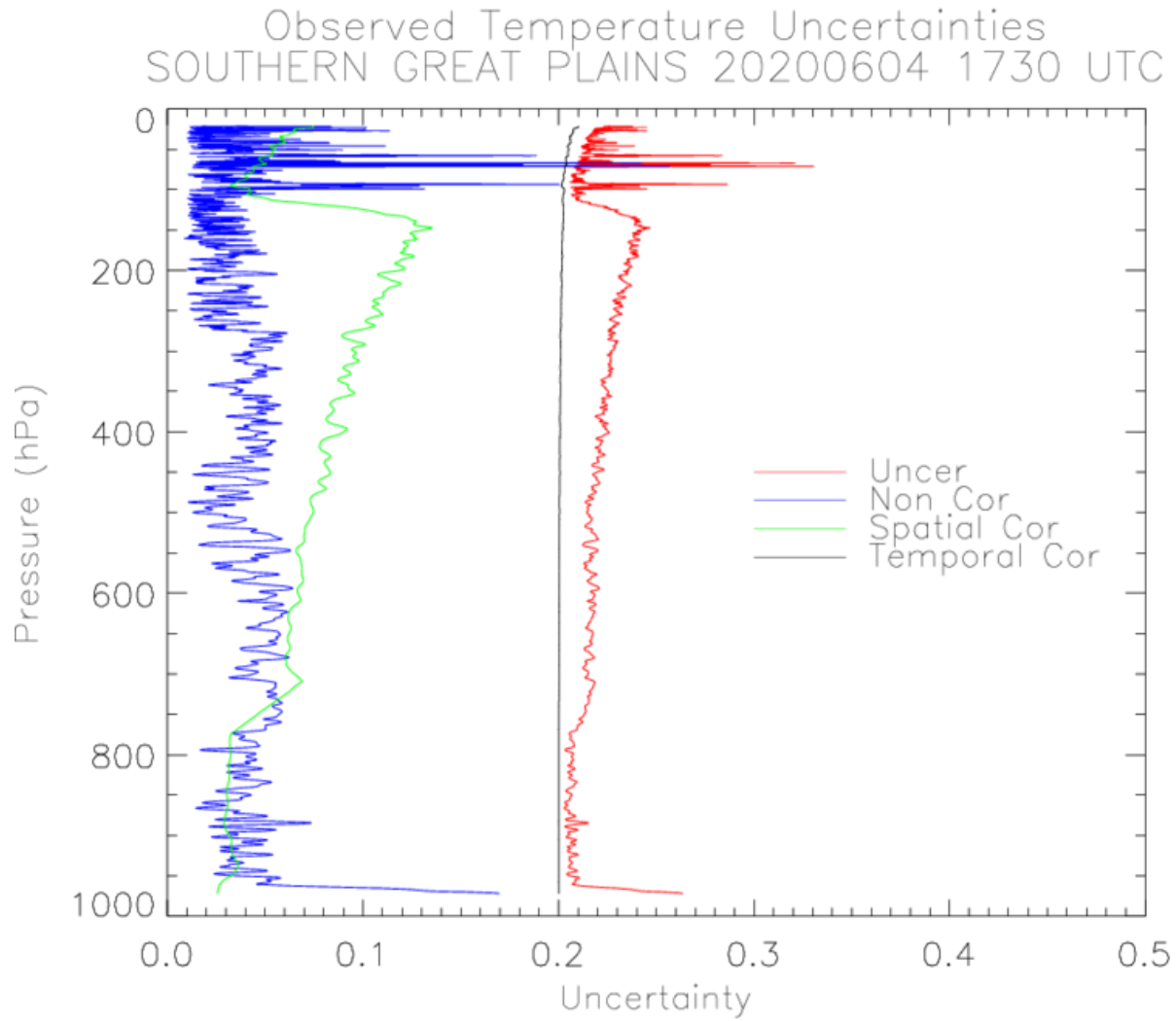
the spatial cor uncertainty always appear to be 0 at night

the temporal cor uncertainty is often relatively fixed for a given profile and often the largest uncertainty component

the non correlated unc typically is most related to the shape of the final (total) uncertainty

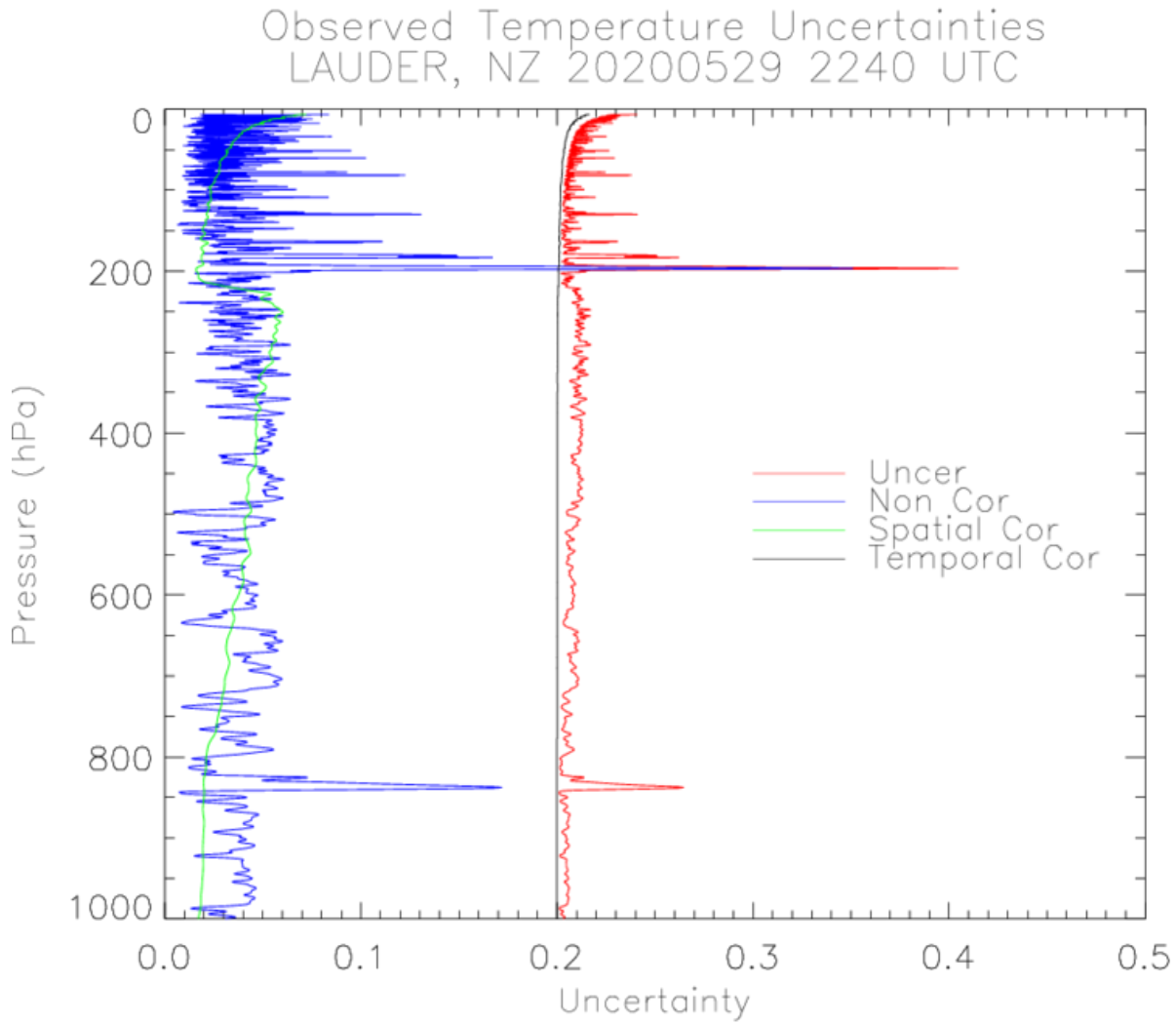
Also there are cases where the uncertainties show large variations across specific vertical layers which are perhaps associated T and RH profiles features … some hints of this apparent in 12/11/19 cases

SGP Daytime Temperature



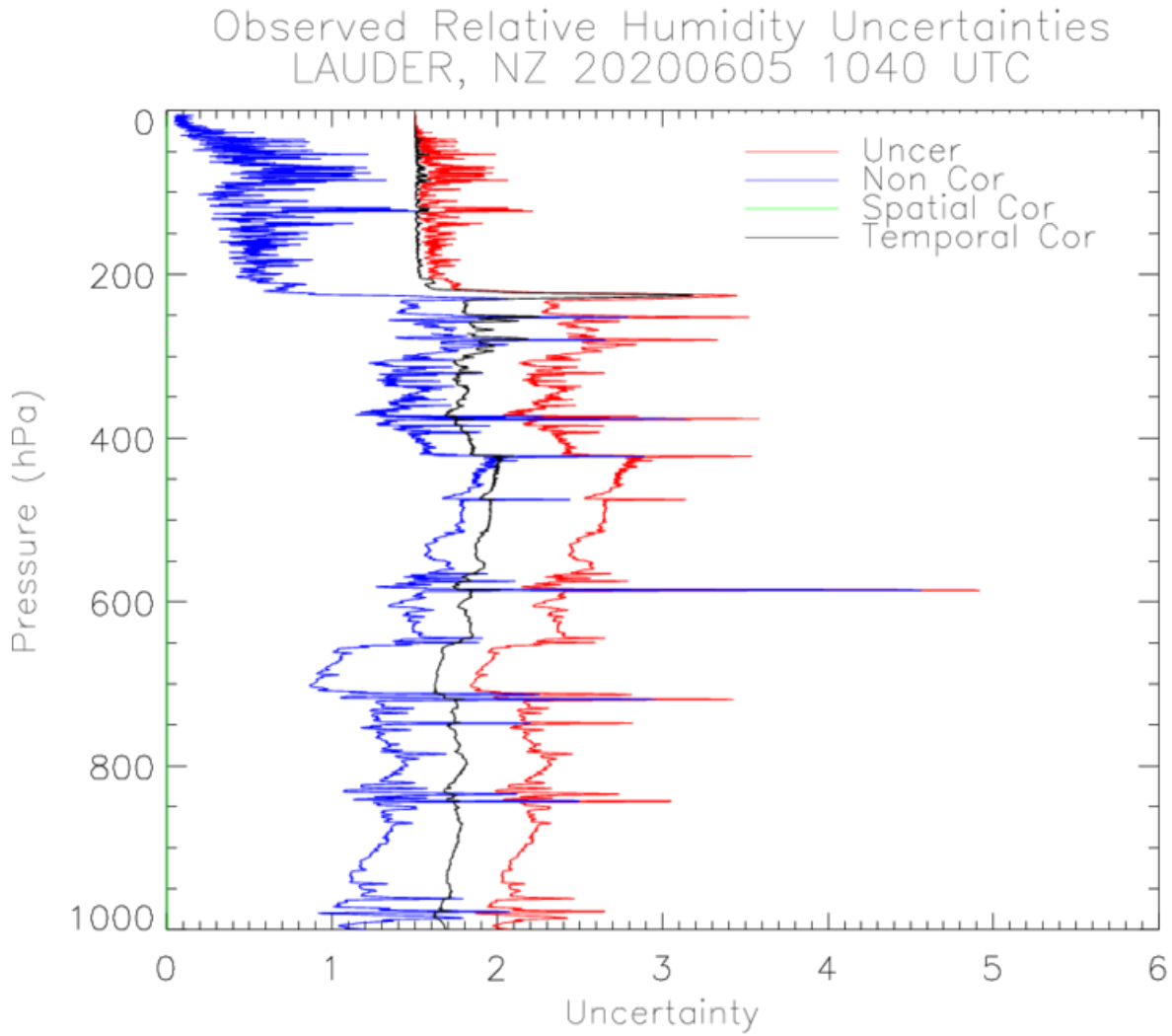
RS41 Beta GDP

LAU Daytime Temperature



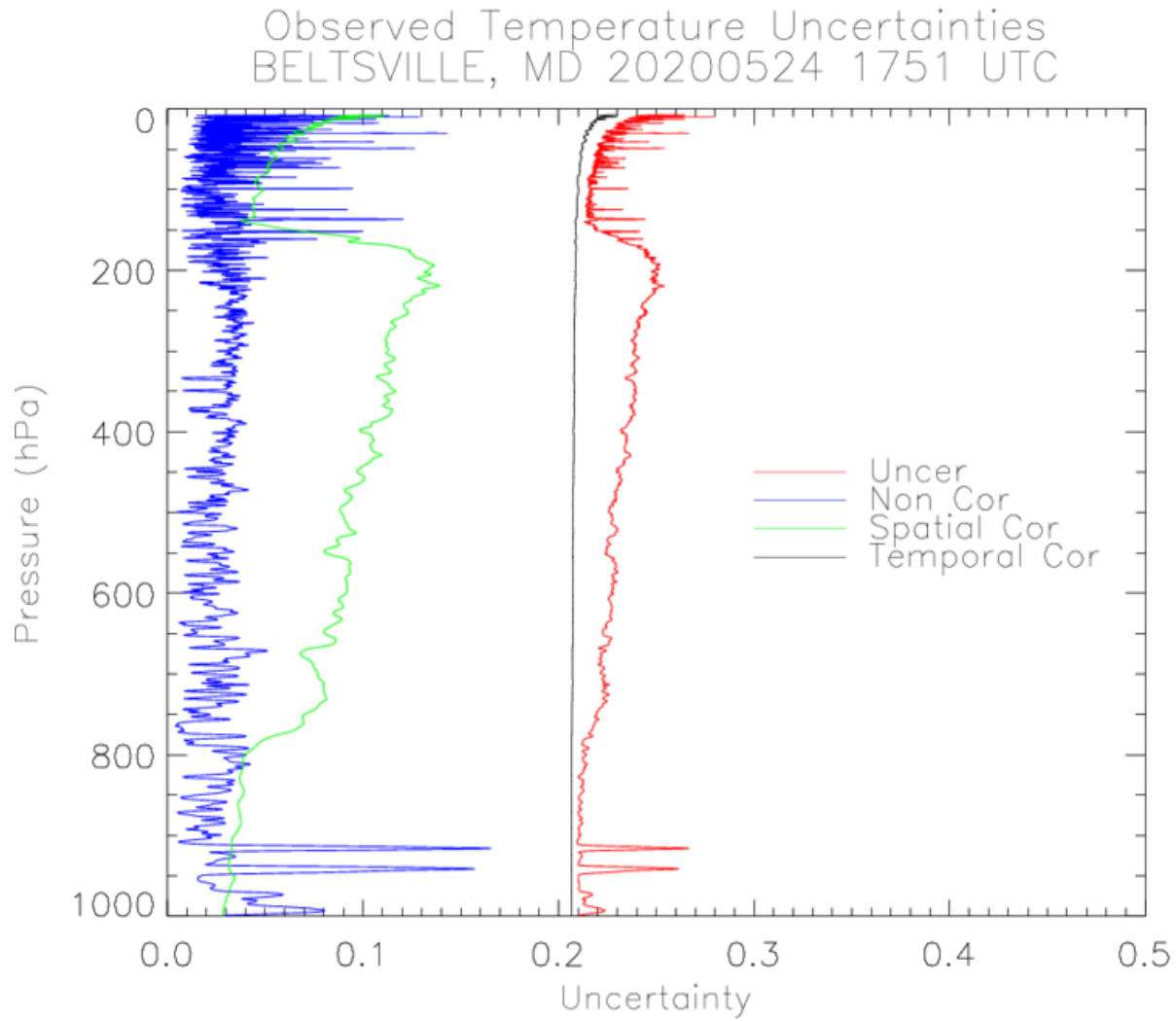
RS41 Beta GDP

LAU Nighttime RH



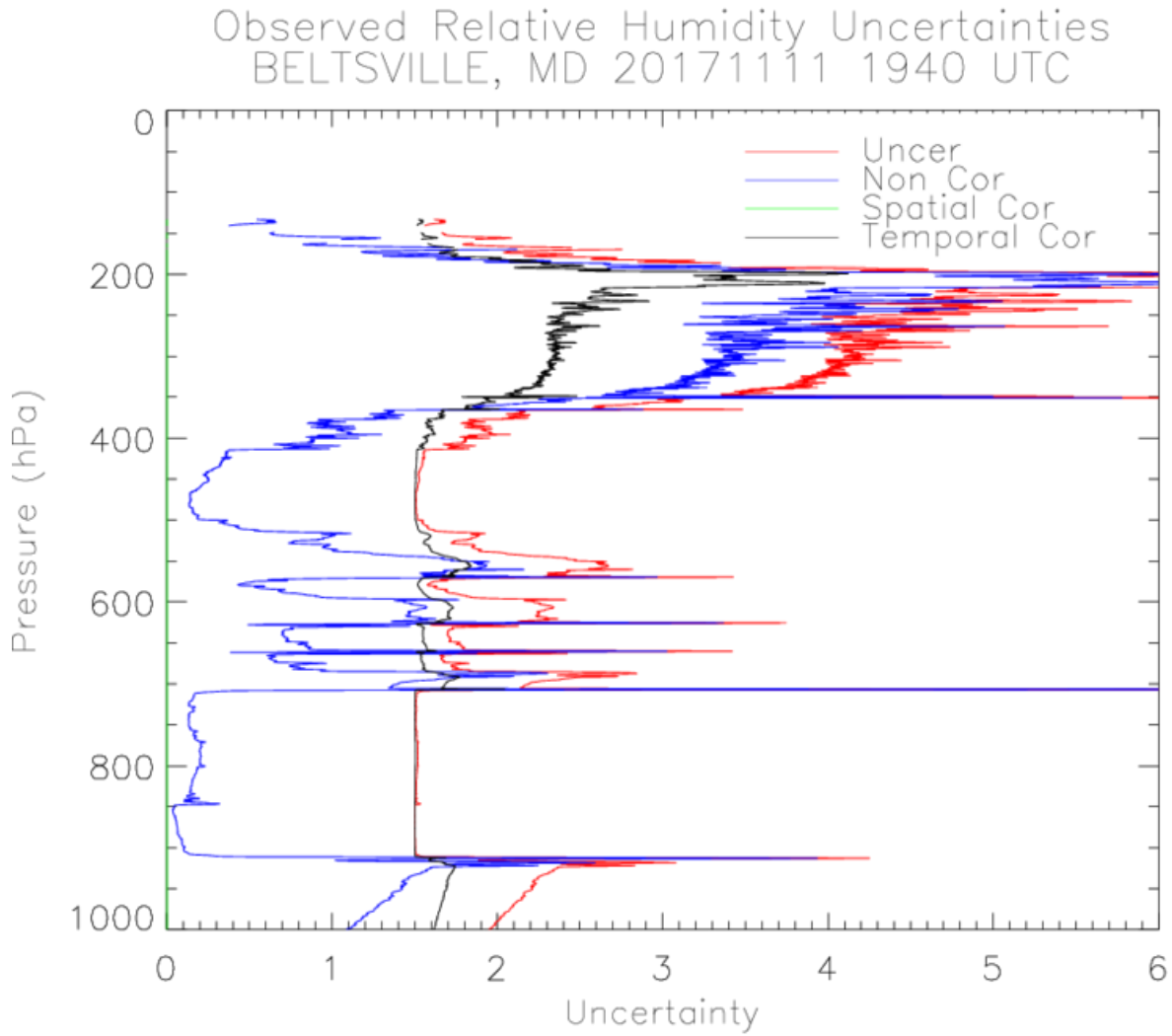
RS41 Beta GDP

BEL Daytime Temperature



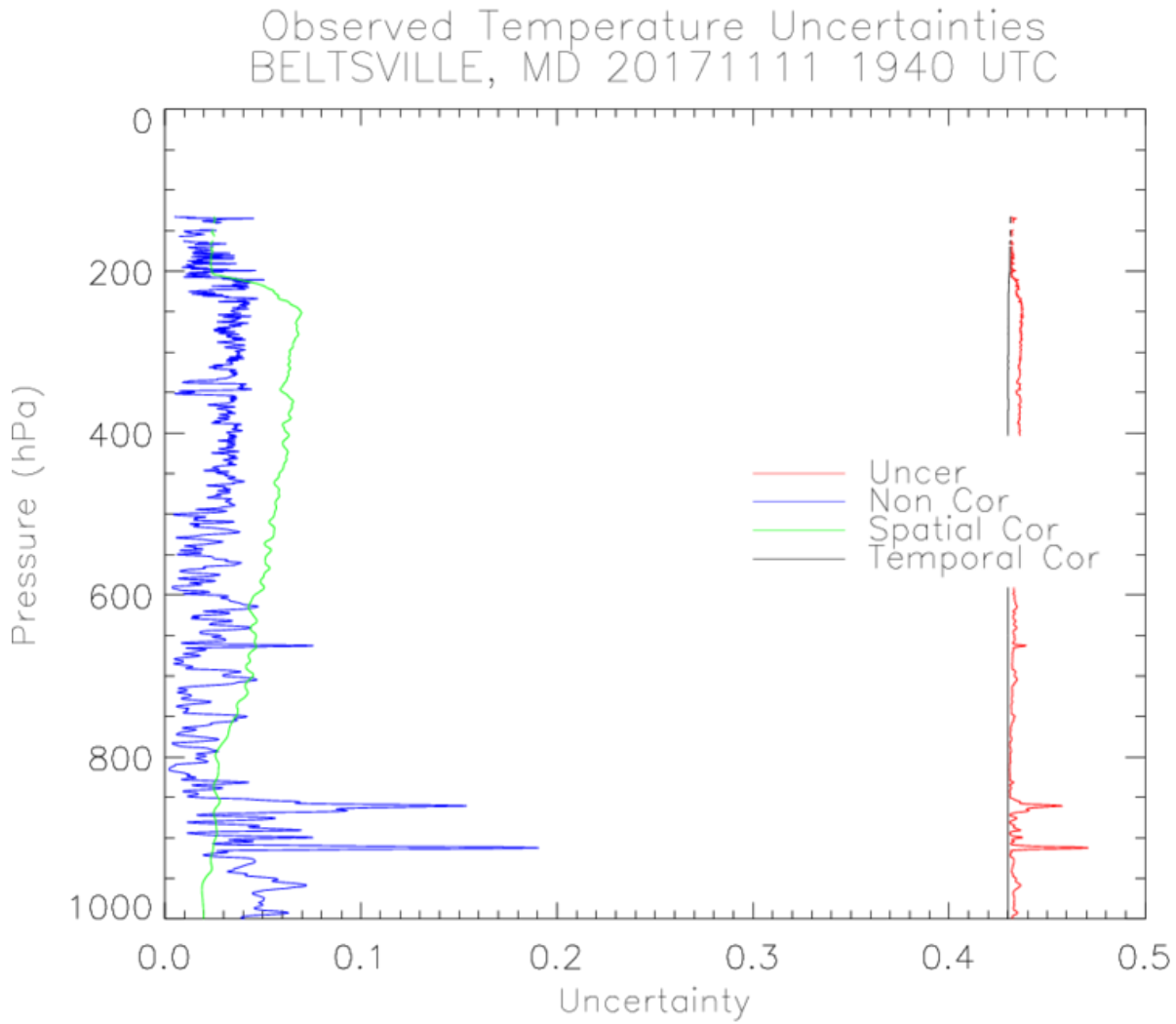
RS41 Beta GDP

BEL Daytime RH



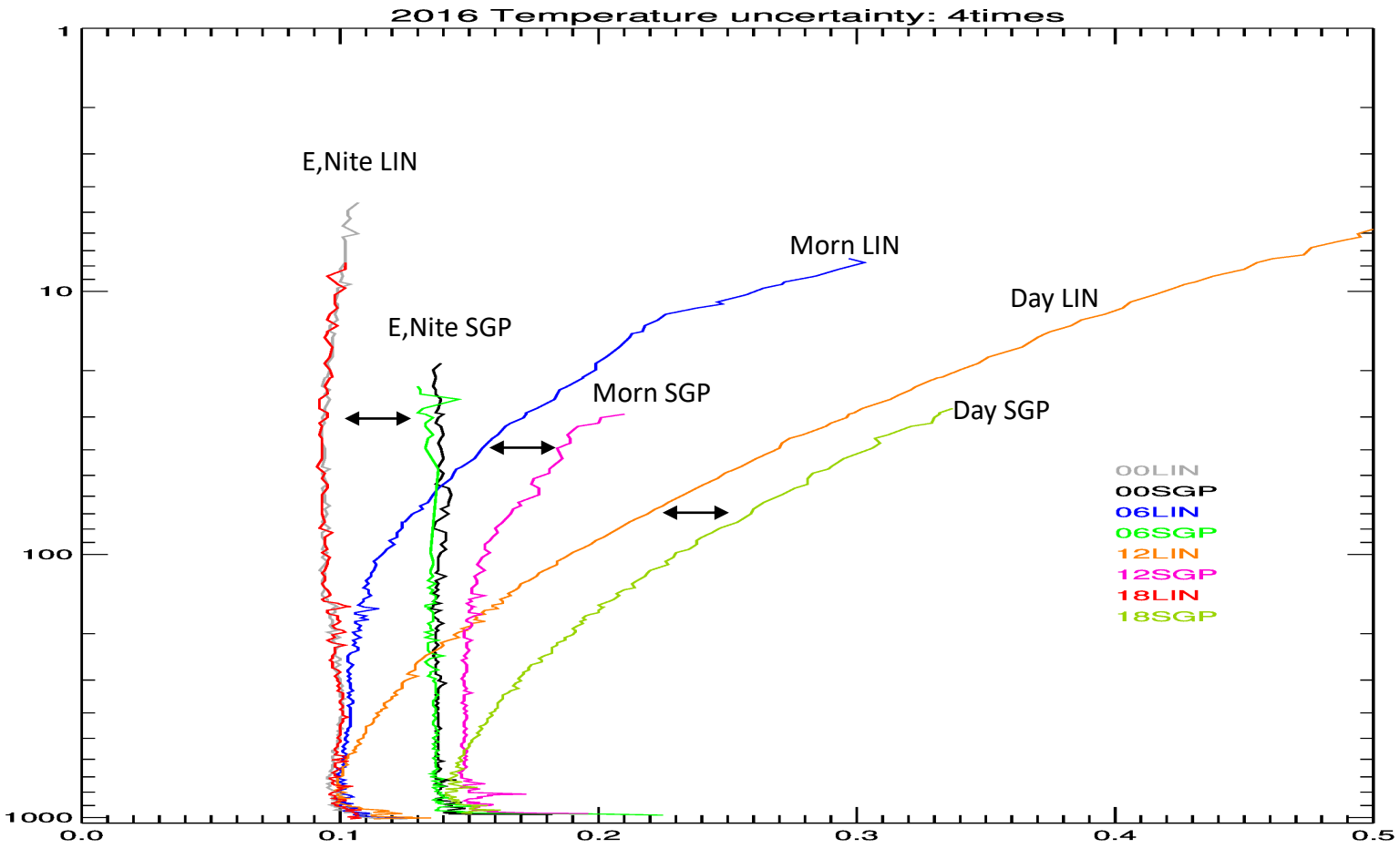
RS41 Beta GDP

BEL Daytime Temperature

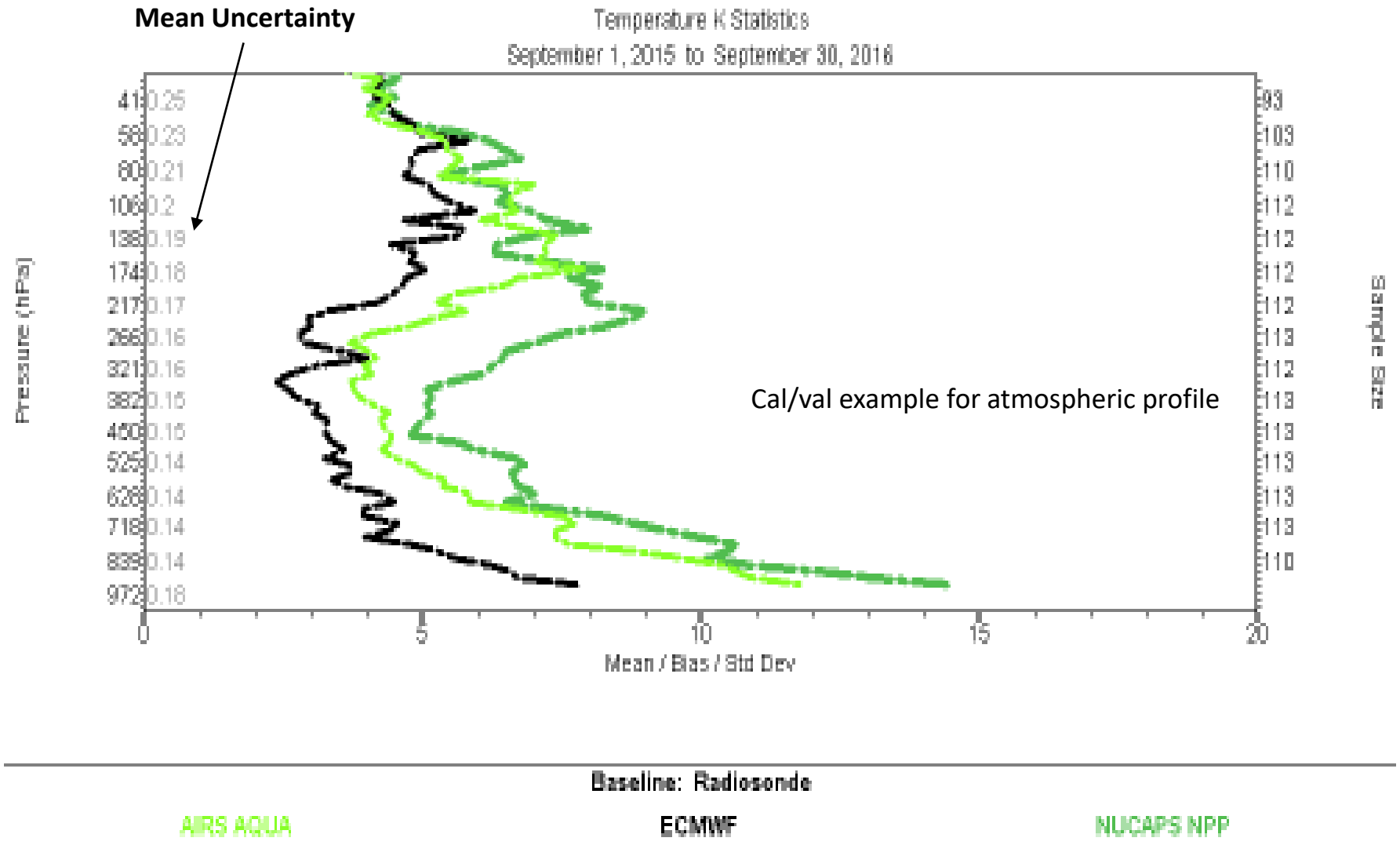


RS41 Beta GDP

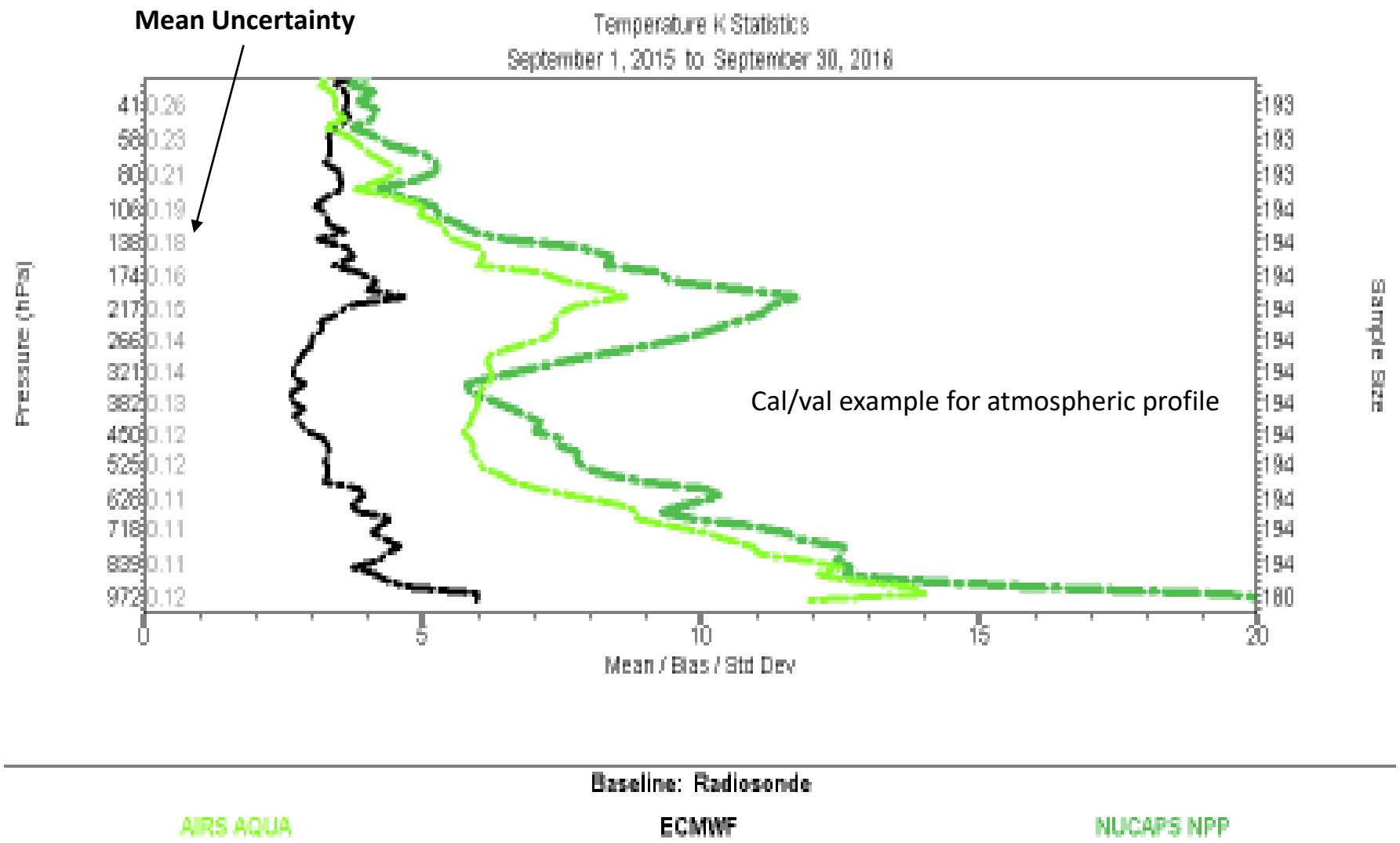
SGP Uncertainty about 30% higher than at LIN …



Courtesy Bruce Ingleby


Mean Uncertainty
Temperature K Statistics
September 1, 2015 to September 30, 2016
Pressure (hPa)
Sample Size
Mean / Bias / Std Dev
Cal/val example for atmospheric profile
Baseline: Radiosonde
AIRS AQUA
ECMWF
NUCAPS NPP

SGP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Cal/val example for atmospheric profile
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Baseline: Radiosonde
AIRS AQUA
ECMWF
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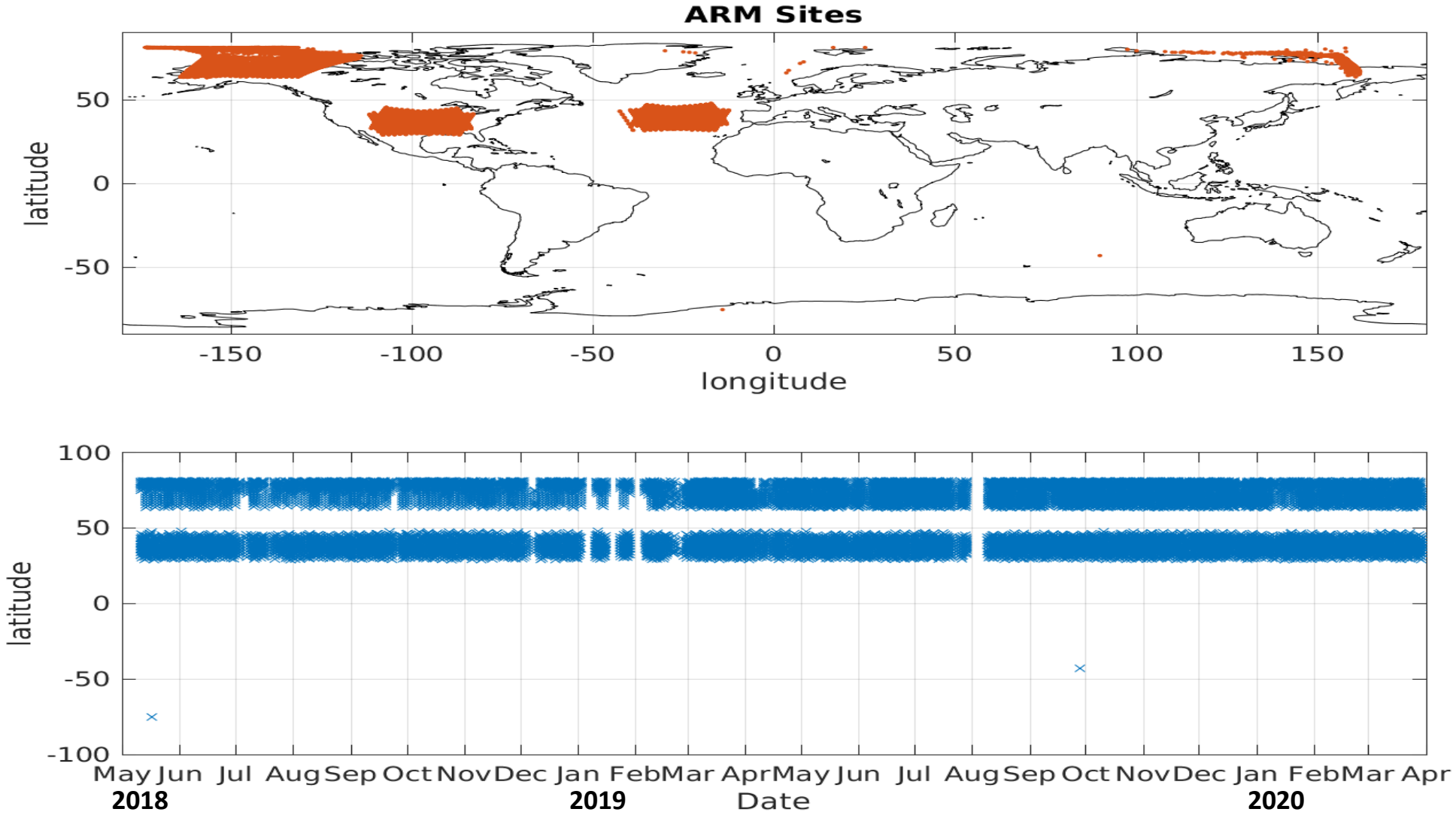
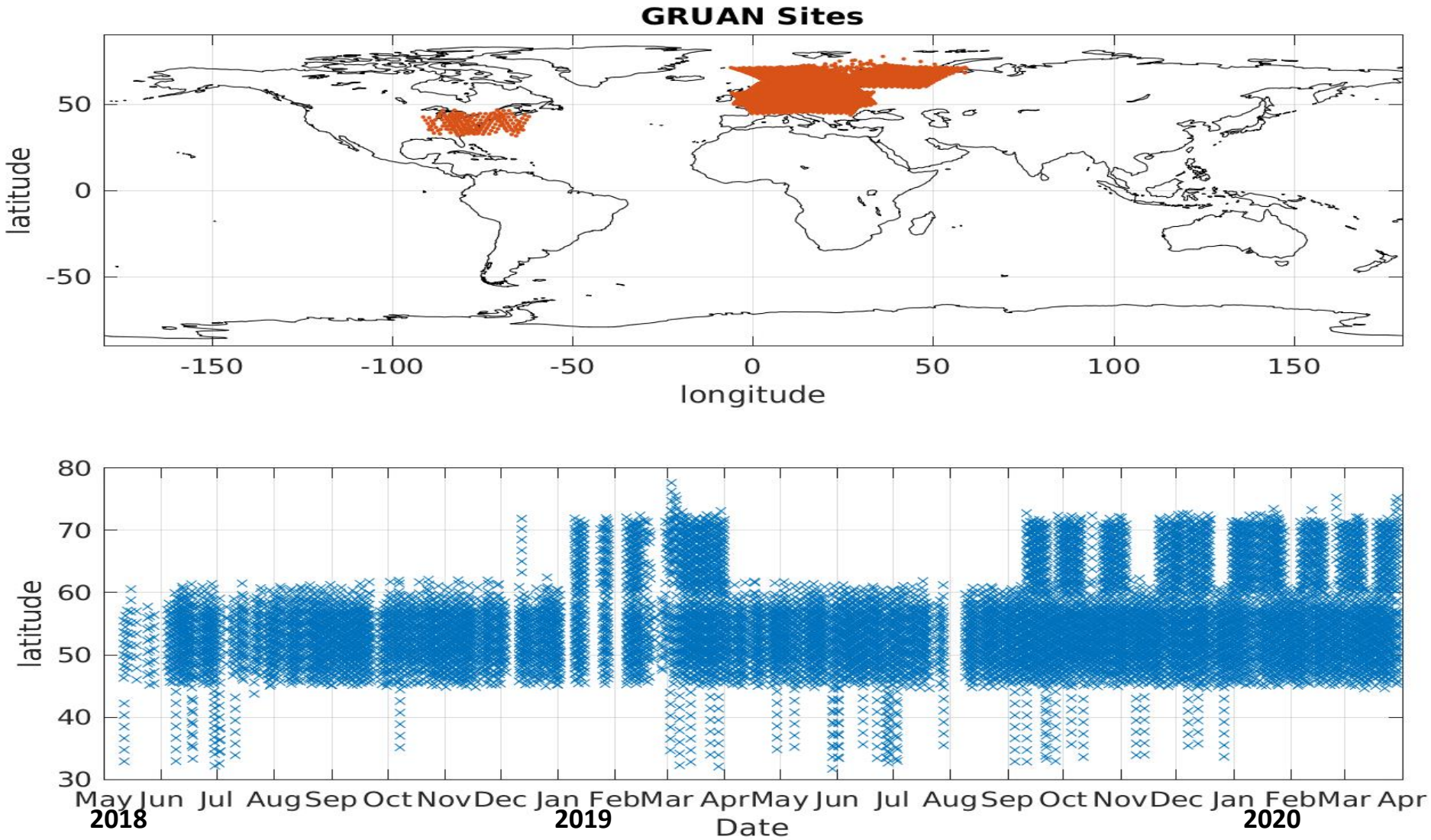
LIN

RIVAL opened door for a NOAA-wide program to also store satellite Sensor Data Records (SDR) synchronized with ARM radiosonde in support of **Satellite Sensor Monitoring**

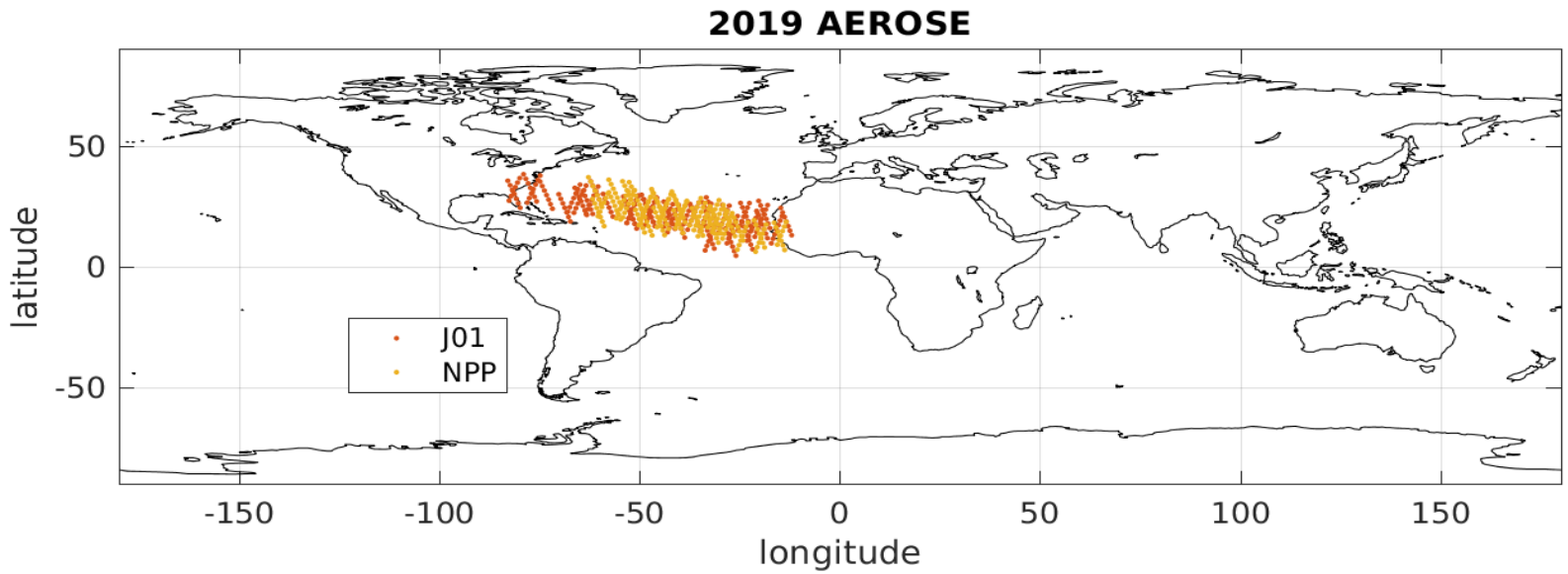


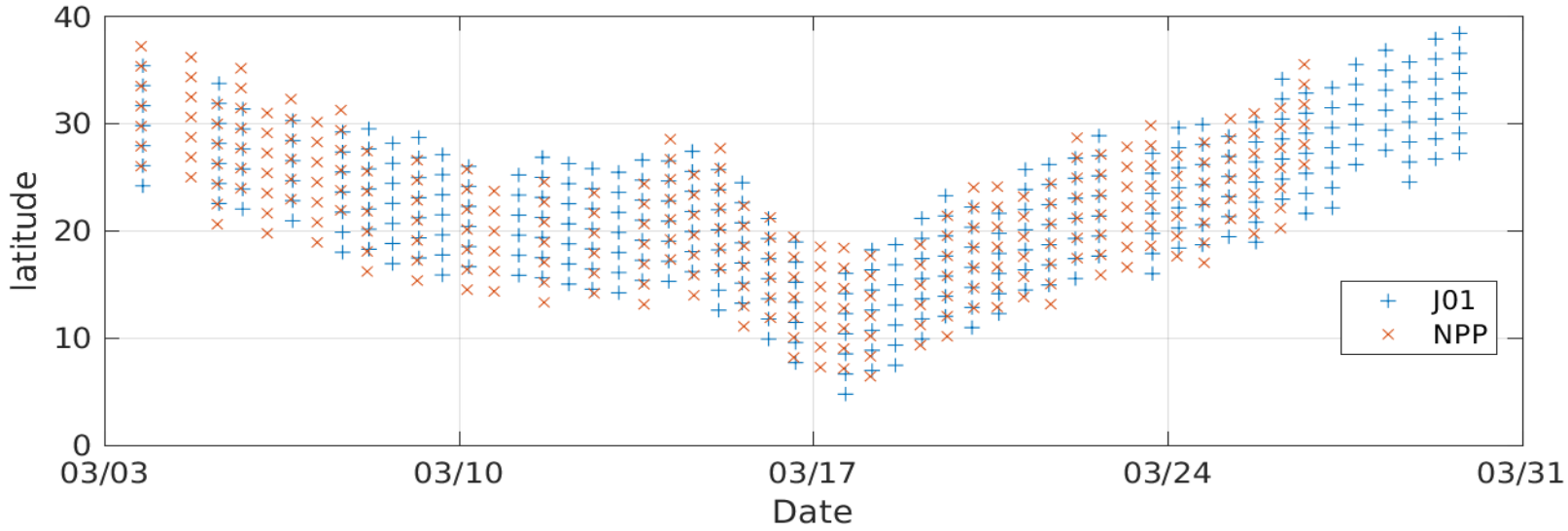
Leveraging NOAA JPSS dedicated radiosonde program with added benefit (from GRUAN to NOAA) of a reference radiosonde for use in satellite products Cal/Val

RIVAL opened door for a NOAA-wide program to also store satellite radiance data records (SDR) synchronized with any GRUAN radiosonde in support of satellite sensor monitoring



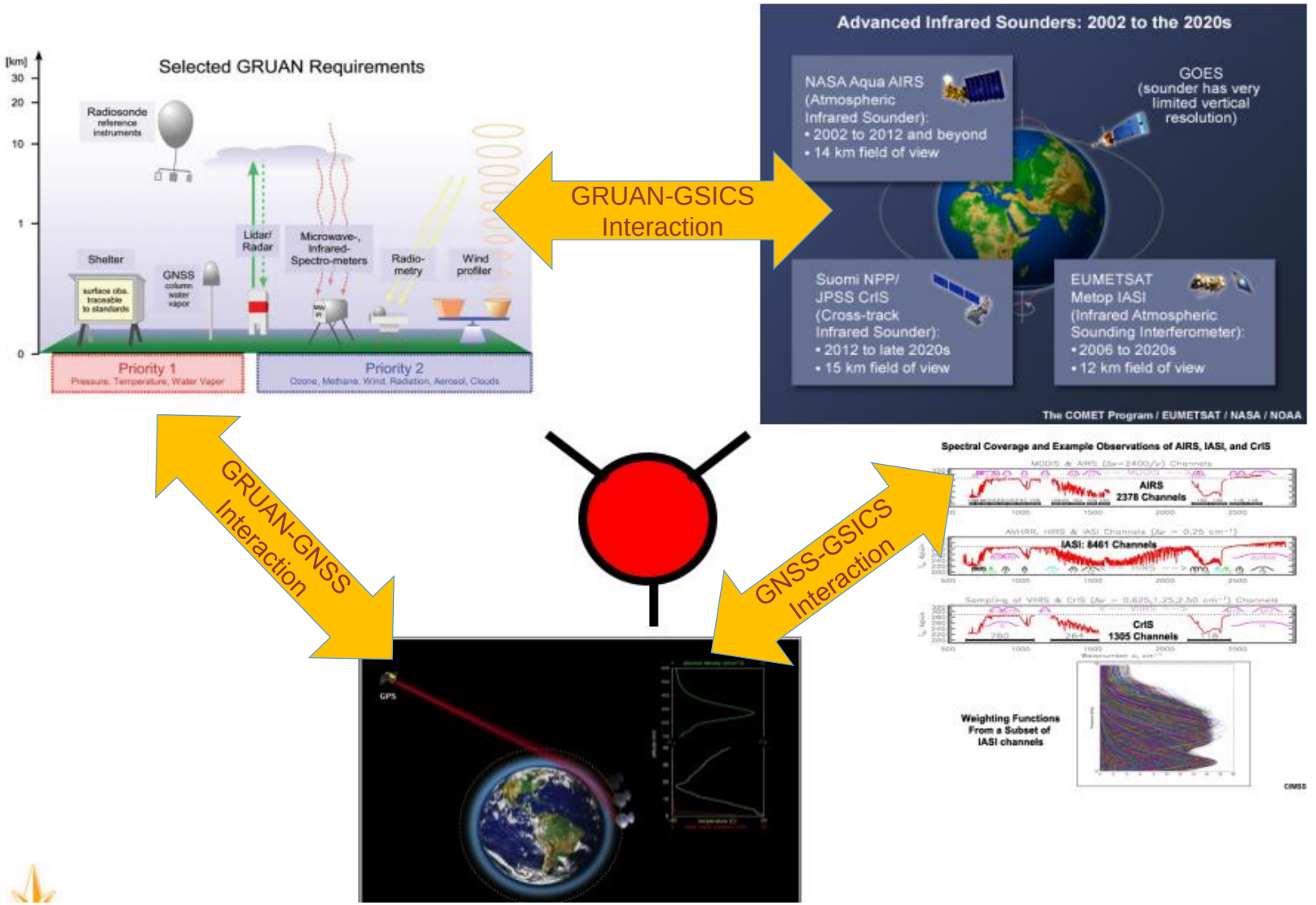
Leveraging NOAA JPSS dedicated radiosonde program (Beltsville) with added benefit of a reference radiosonde for use in satellite products cal/val





Leveraging NOAA JPSS dedicated radiosonde program (AEROSE … tropical ocean) with added benefit of a reference radiosonde for use in satellite products cal/val

Global Space-based Inter-Calibration System (GSICS)
GNSS and GRUAN (3G) Framework



Satellite

Sensor

Monitoring

entering radiance space … RT model and sensor monitoring

GRUAN Ascent Heights Jan 2018 to March 2020 (RIVAL Period)

	Launches	reach 20 hPa	reach 10 hPa	reach 5hPa
All	23102	14542 (63%)	7565 (33%)	420 (2%)
All Polar (90-60)	7107	3681 (52%)	1559 (22%)	60 (1%)
All Mid-Lat (60-30)	10961	6975 (64%)	3769 (34%)	294 (3%)
All Tropic	3332	2758 (82%)	1460 (44%)	66 (2%)
Winter Polar	1169	489 (42%)	296 (25%)	18 (2%)
Winter Mid-Lat	1968	1125 (57%)	716 (36%)	93 (5%)
Summer Polar	1337	757 (57%)	126 (9%)	2 (<1%)
Summer Mid-Lat	2262	1542 (68%)	700 (31%)	36 (2%)
All NZ	1680	1111 (66%)	766 (46%)	0
Summer NZ	322	303 (94%)	222 (69%)	0
Winter NZ	327	304 (92%)	214 (65%)	0

Winter: Oct 2018 to March 2019 Summer: April 2019 to Sept 2019

*NZ: after 10/1/2018, *Invercargill switch from 350g to 700g; Lauder 1500g … R. Querel*

… push radiosonde to achieve 50% at 20 hPa

A Plan:

Continue the process initiated with RIVAL to routinely compile collocated GRUAN radiosonde and satellite observations that target polar satellites and GNSS; 3G.

Push these radiosondes to attain heights of 10 hPa or higher.

These datasets would be compiled in a nrt environment (saving costs) and include associated SDR within a 100km radius of the radiosonde site.

Data management and distribution need to be addressed.

Arrangement are currently underway at NOAA to insure adequate computer disc space to maintain this process and the continuation of dedicated radiosonde programs (with NOAA and GNSS satellites (COSMIC-2)

EUMETSAT is encouraged to follow suit wrt MetOp satellites.