



Satellite Sounding product Characteristic performance and Impact of satellite overpass time

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09/25/2017

NASA/AIRS Sounder Science Team Meeting
Oct 24-26, 2017
Greenbelt, Maryland



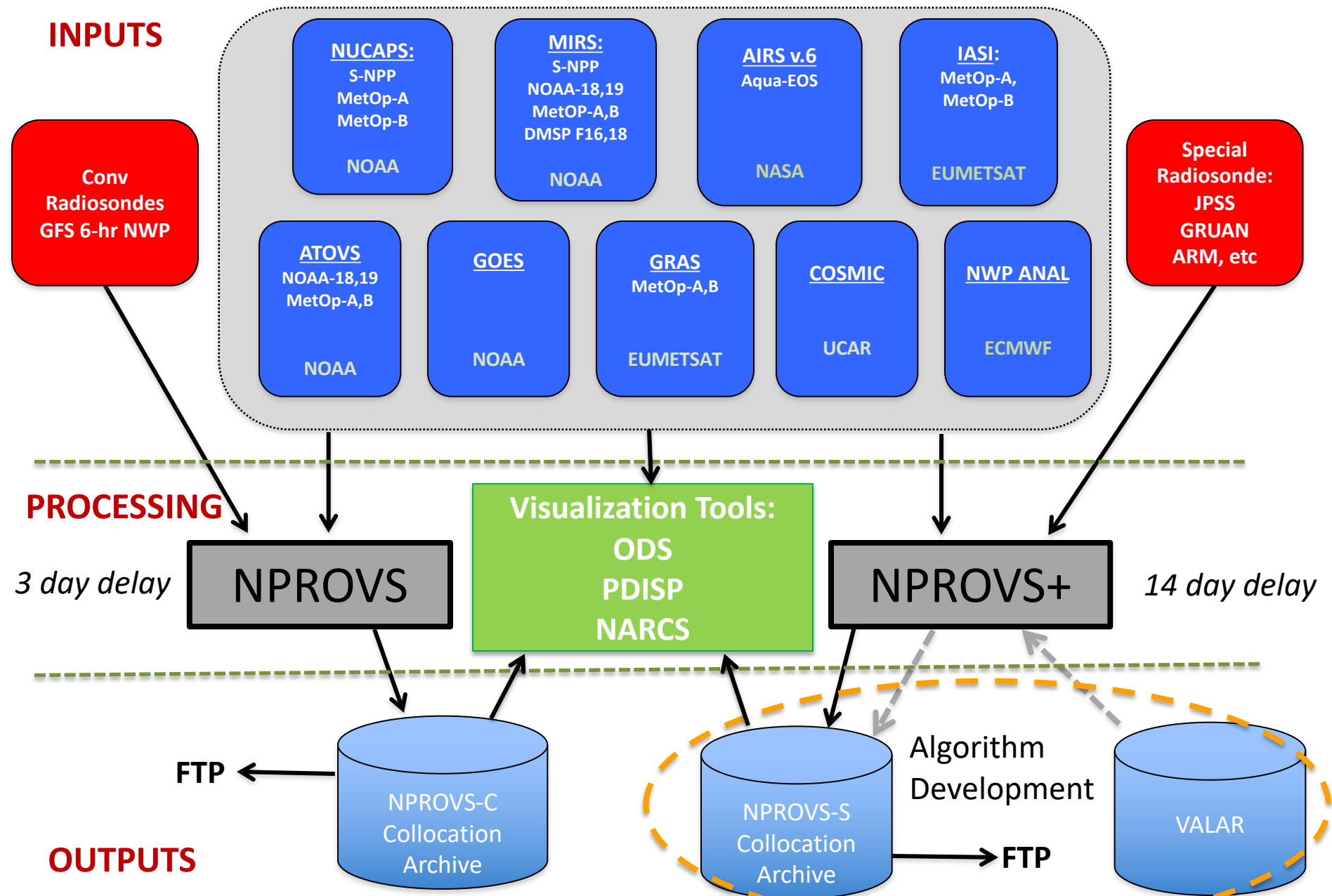
OUTLINE

- **NPROVS collocations of satellite and radiosondes provide an “enterprise” validation approach for atmospheric soundings**
- **Strategy demonstrated to assess impact of local satellite overpass combined with synoptic radiosondes on perceived systematic differences in respective product performance**
- **Results shown using short term (10-day) global collocation datasets (PDISP) including terrain and time window stratification**
- **Results shown using long-term global collocation datasets (NARCS) including seasonal effects**
- **Summary**

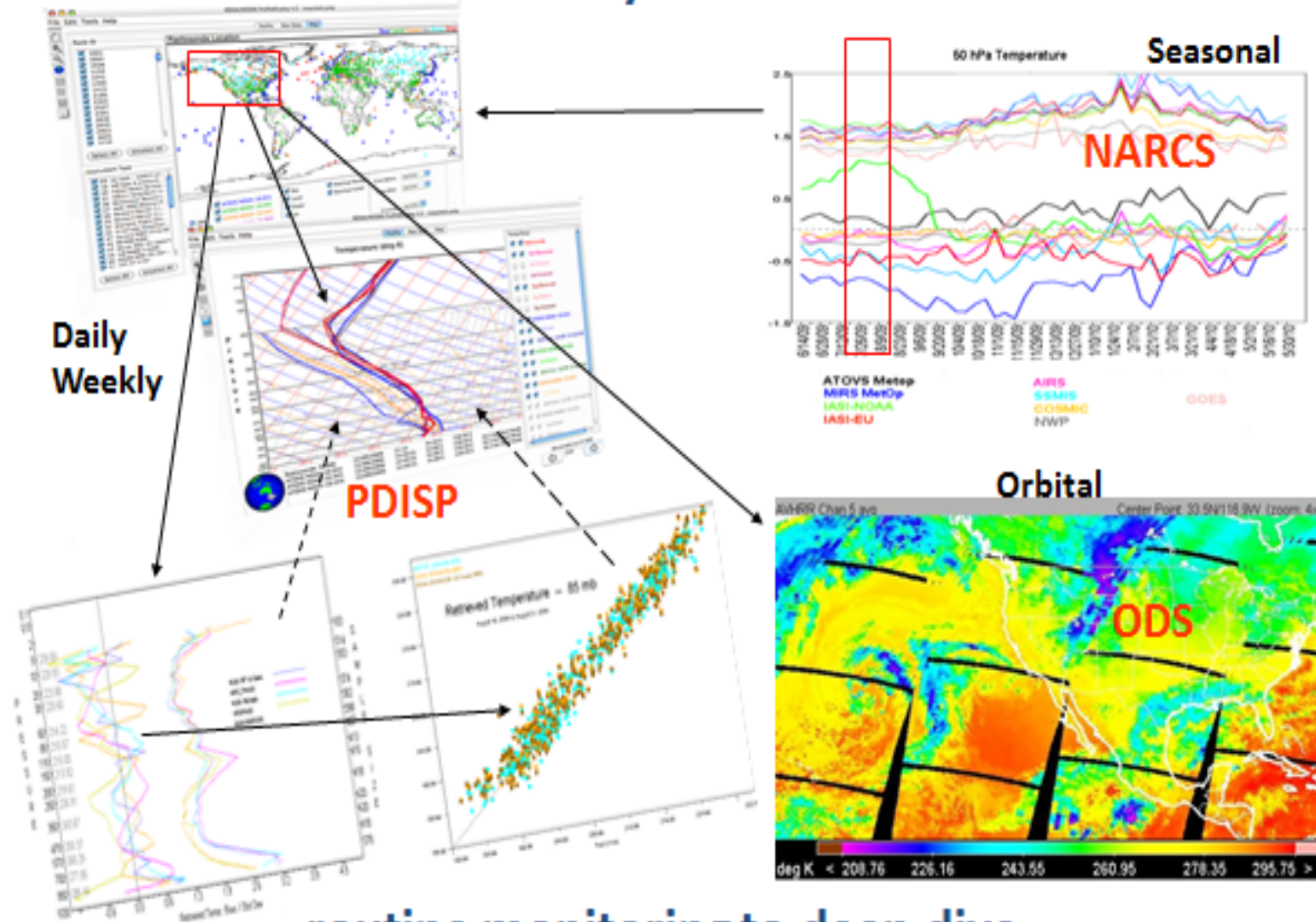
NPROVS/NPROVS+ Schematic

E
N
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Analytical Interface



... routine monitoring to deep dive



Coast

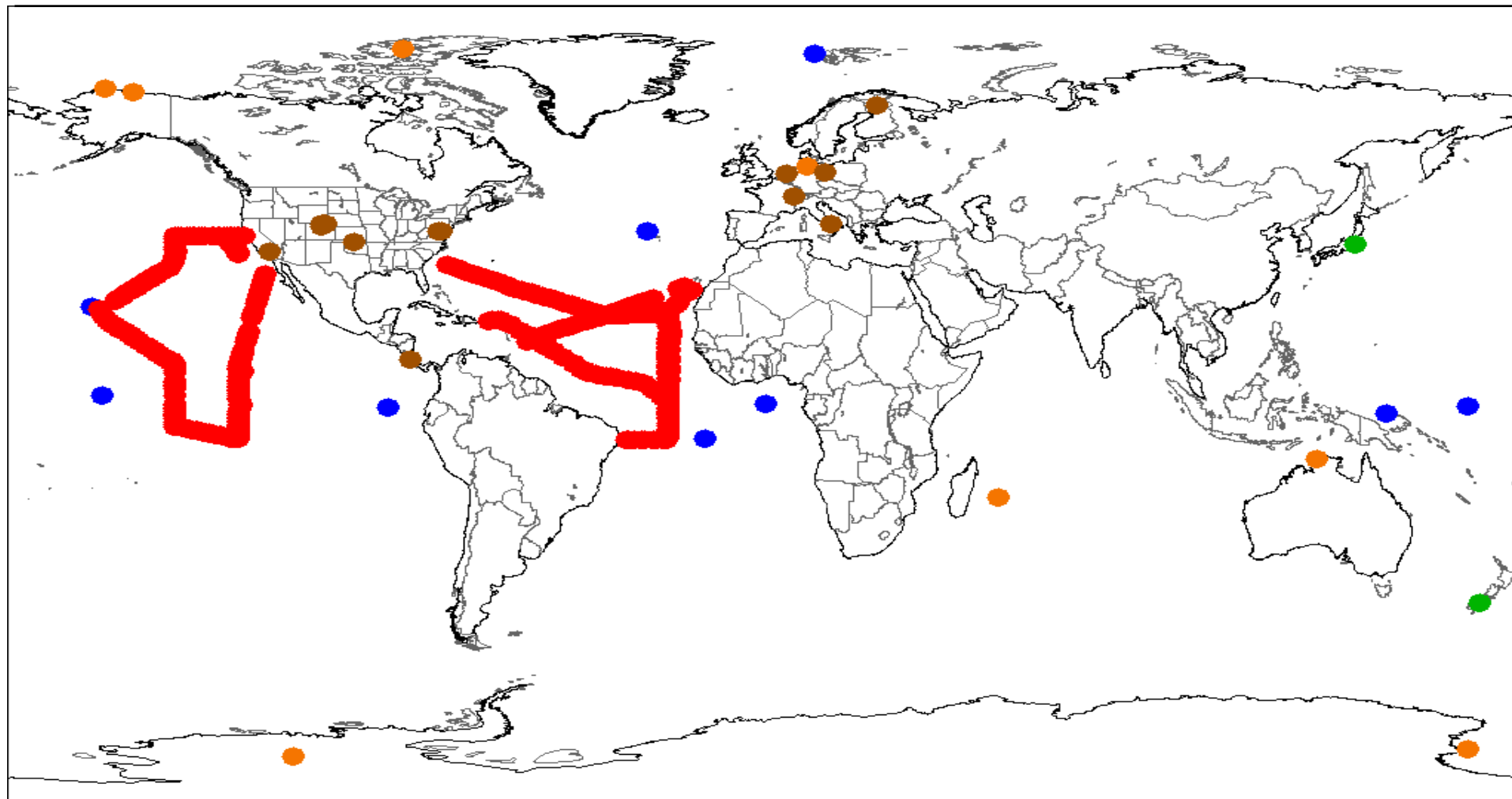
Land

Island (Coast)

Island (Inland)

Ship

Dropsonde



Number of collocations: 32,633 (42 unique locations)

2013 to 2017

NPROVS+ (Special) ... see talk Thursday afternoon



Coast

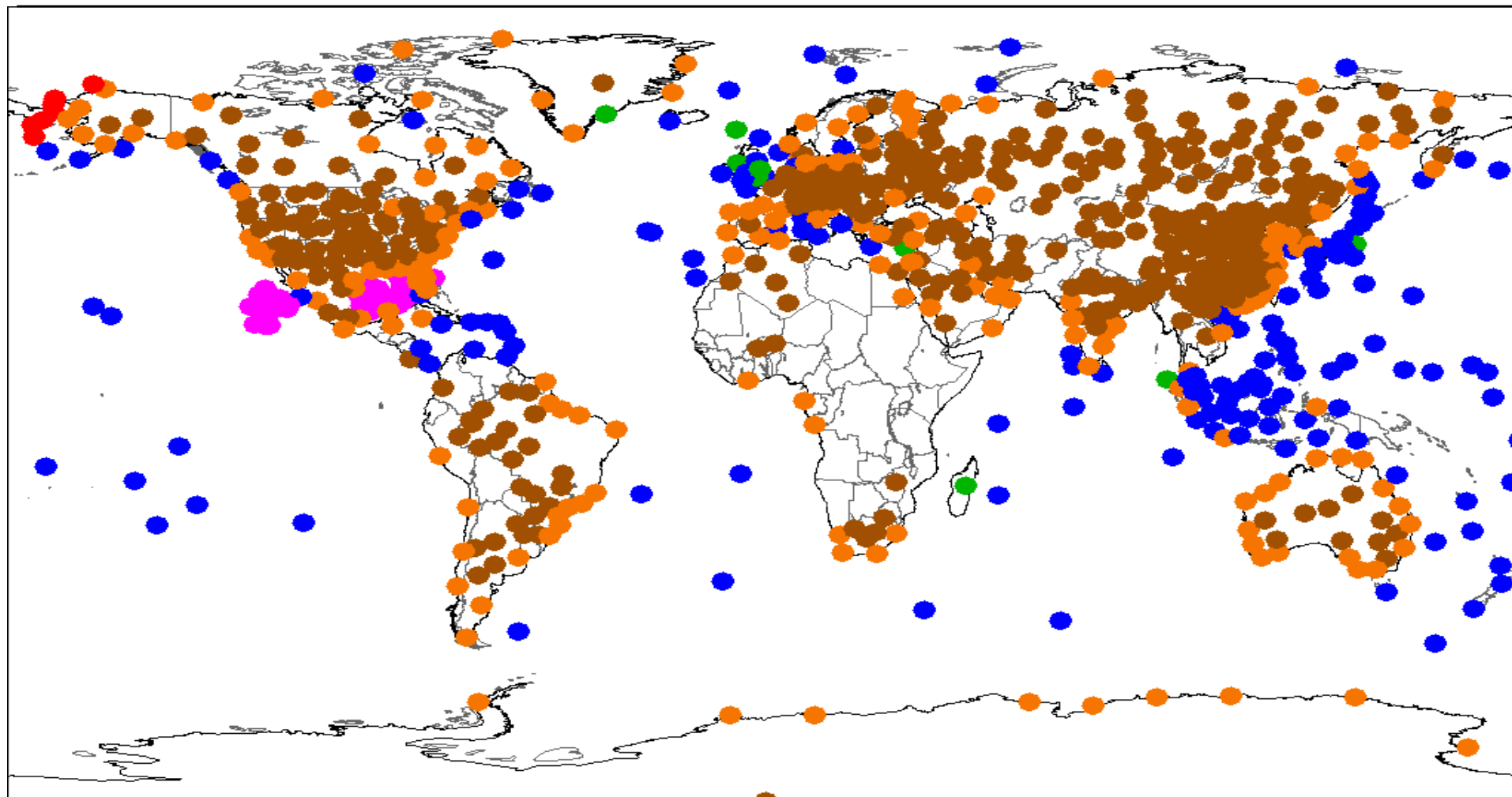
Land

Island (Coast)

Island (Inland)

Ship

Dropsonde



Number of collocations: 5538 (768 unique locations)

August 21, 2017 (8z) to August 31, 2017 (23z)

NPROVS+ (Conventional)



PDISP

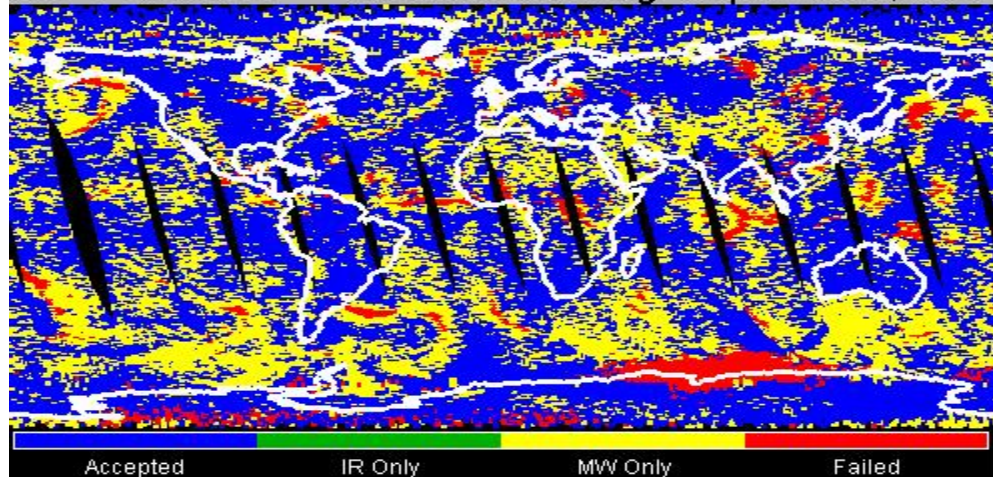
Vertical Statistics (Vstats)

Satellite-minus-Radiosonde (conventional)

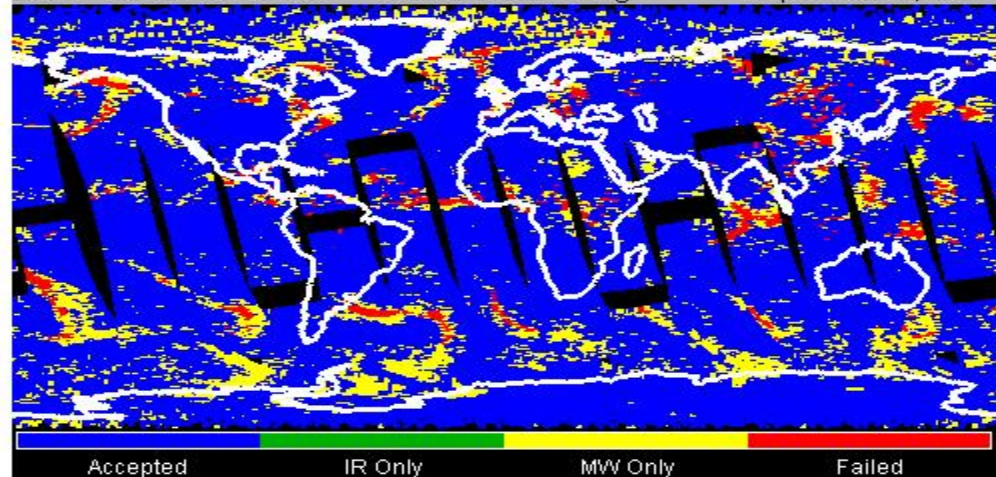
Selected 10-day periods

(IR Pass QC)

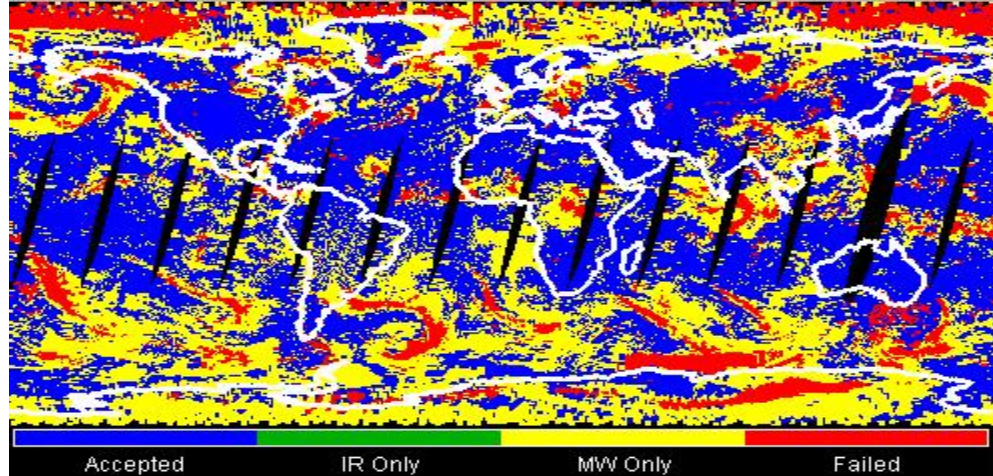
SNPP NUCAPS Converted QC Flag September 3, 2017



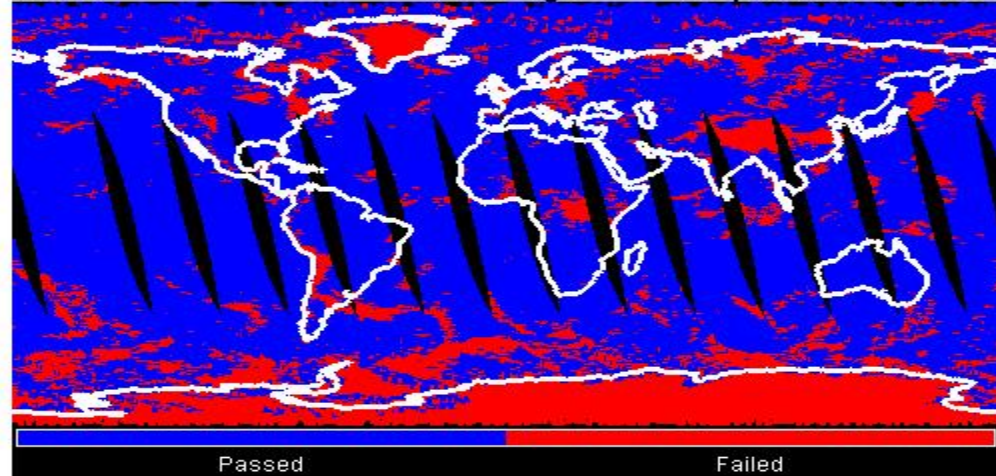
SNPP NUCAPS Parallel Converted QC Flag September 3, 2017



IASI MetOp-B Converted QC Flag September 3, 2017



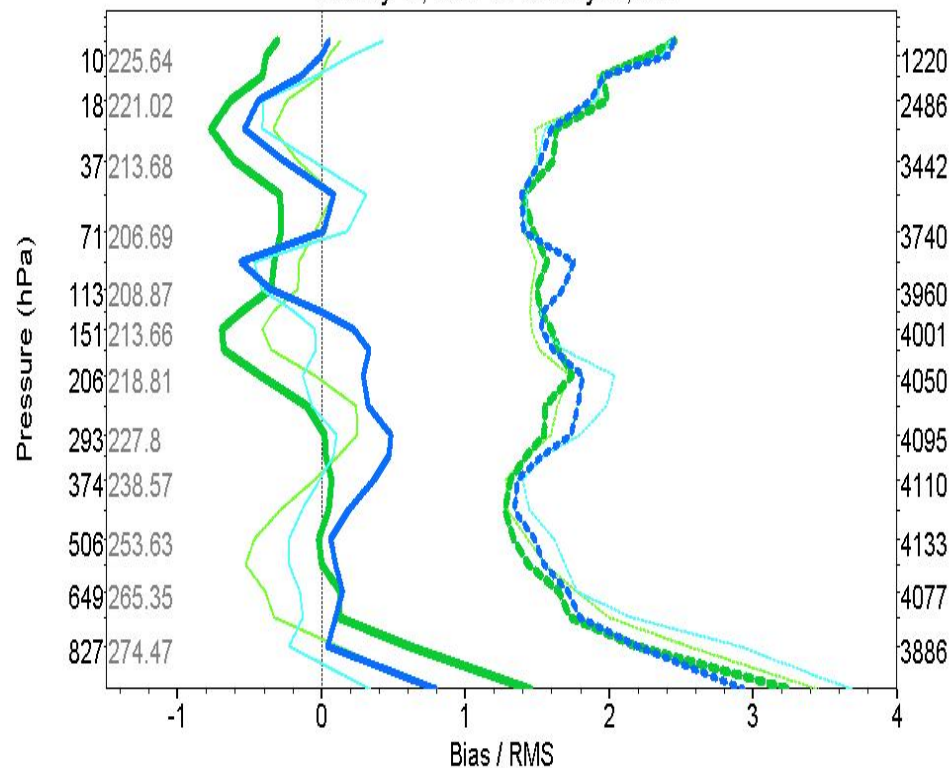
AIRS QC Flags September 3, 2017



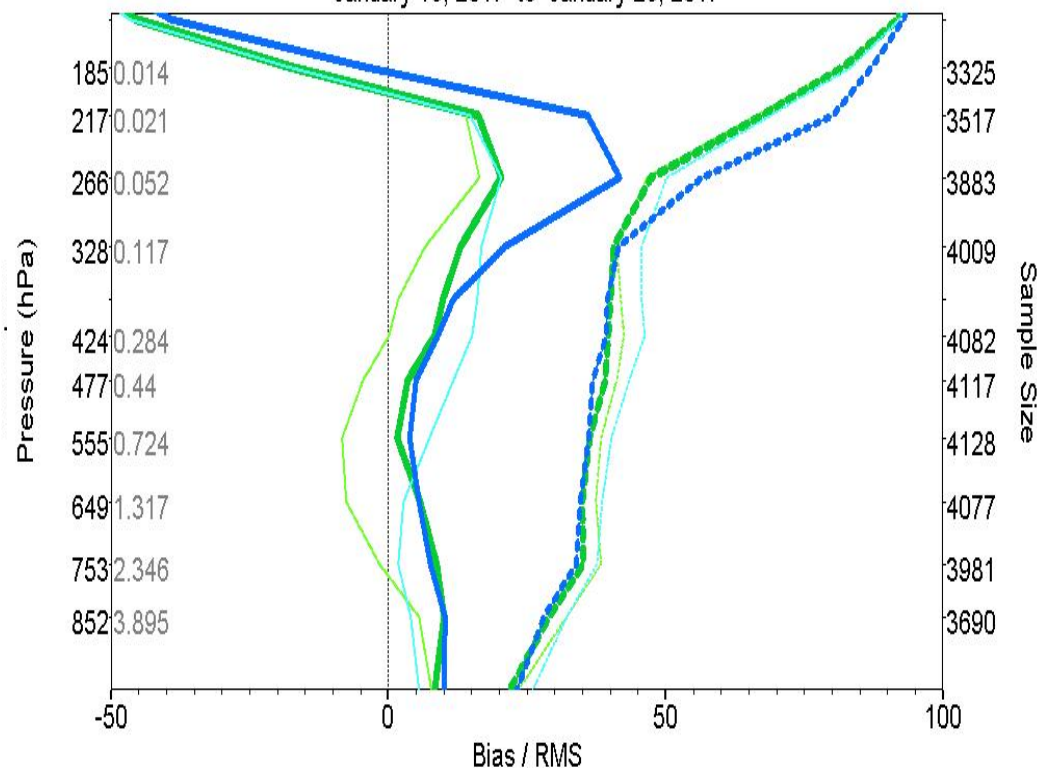
IR Pass QC are “blue”



Temperature (sat - baseline) deg K
January 16, 2017 to January 26, 2017



Water Vapor (sat - baseline) % error
January 16, 2017 to January 26, 2017



TPW -40 -30 -20 -10 0 10 20 30 40 4134

Baseline: SONDE

Baseline: SONDE

NOAA IASI MetOp-B
NUCAPS NPP First Guess

NOAA IASI MetOp-B First Guess

NUCAPS NPP

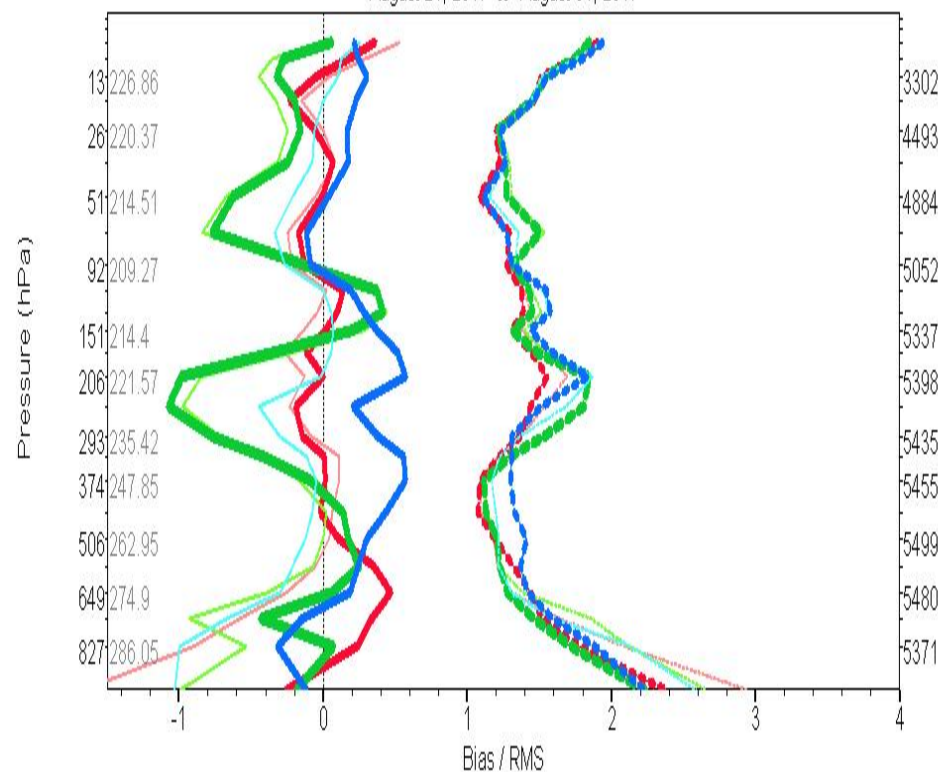
NOAA IASI MetOp-B
NUCAPS NPP First Guess

NOAA IASI MetOp-B First Guess

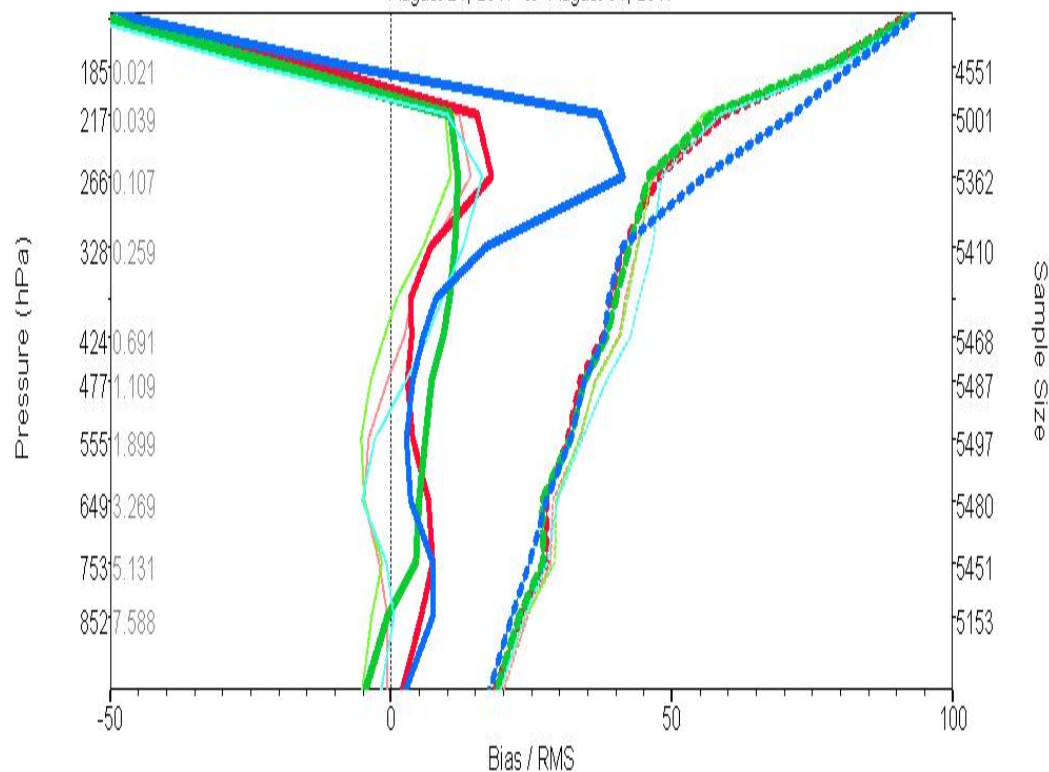
NUCAPS NPP



Temperature (sat - baseline) deg K
August 21, 2017 to August 31, 2017



Water Vapor (sat - baseline) % error
August 21, 2017 to August 31, 2017



TPW -40 -30 -20 -10 0 10 20 30 40 5499

NOAA IASI MetOp-B
NUCAPS NPP First Guess

Baseline: SONDE
NOAA IASI MetOp-B First Guess
NUCAPS NPP TEST

NUCAPS NPP
NUCAPS NPP TEST First Guess

NOAA IASI MetOp-B
NUCAPS NPP First Guess

Baseline: SONDE
NOAA IASI MetOp-B First Guess
NUCAPS NPP TEST

NUCAPS NPP
NUCAPS NPP TEST First Guess



Coast

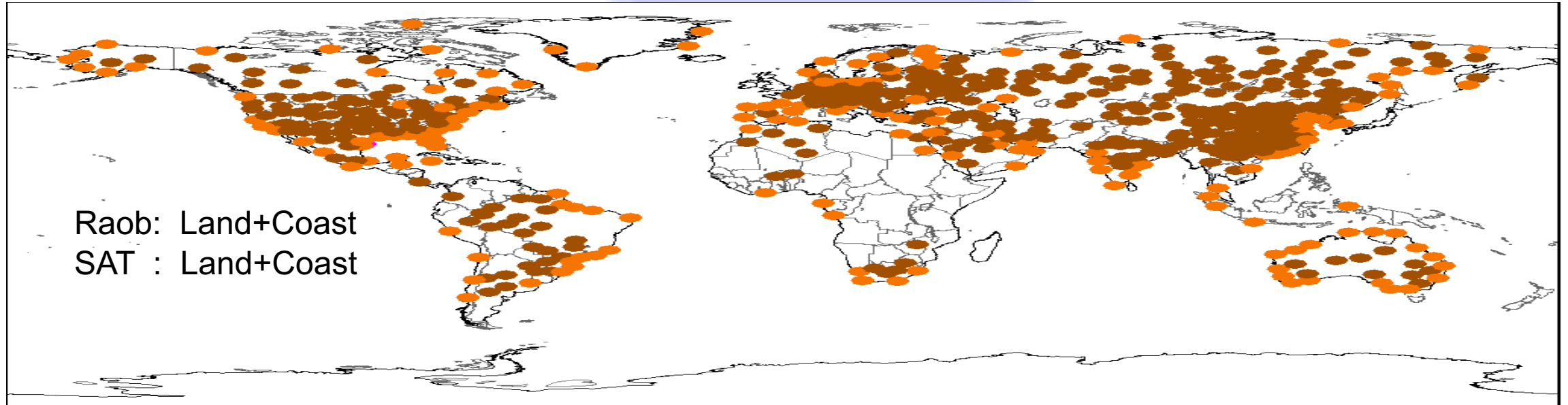
Land

Island (Coast)

Island (Inland)

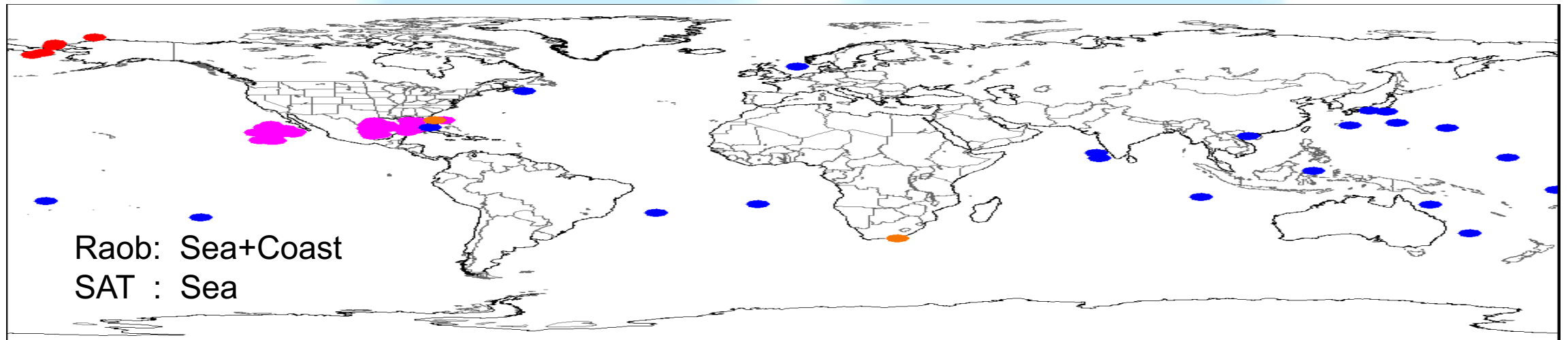
Ship

Dropsonde



Number of collocations: 4248 (548 unique locations)

August 21, 2017 (8z) to July 31, 2017 (23z)

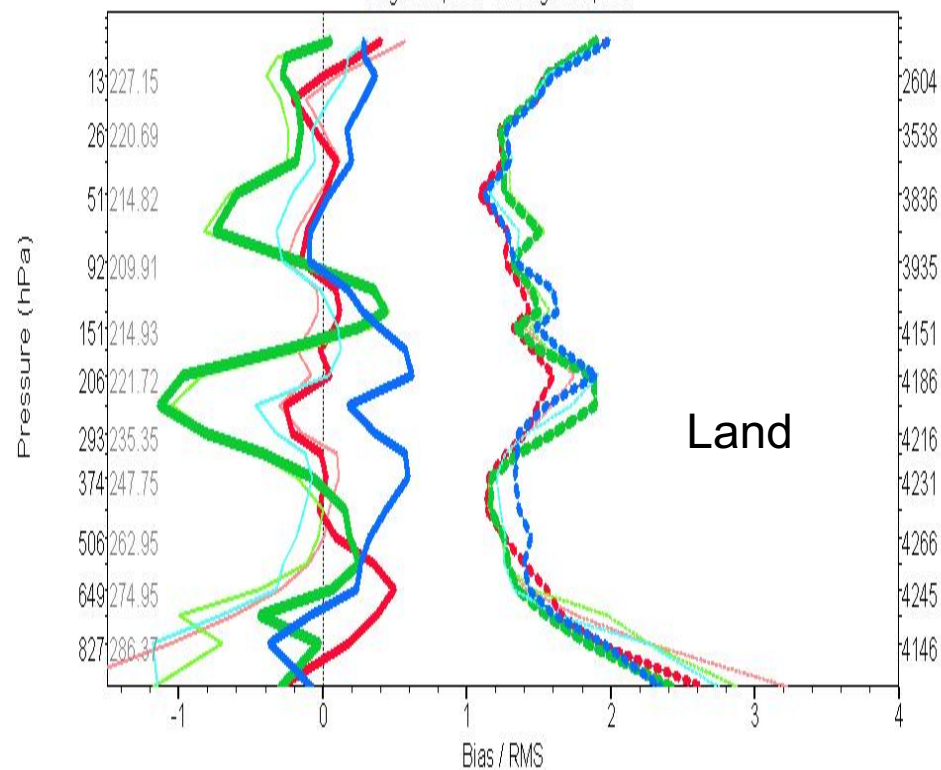


Number of collocations: 106 (66 unique locations)

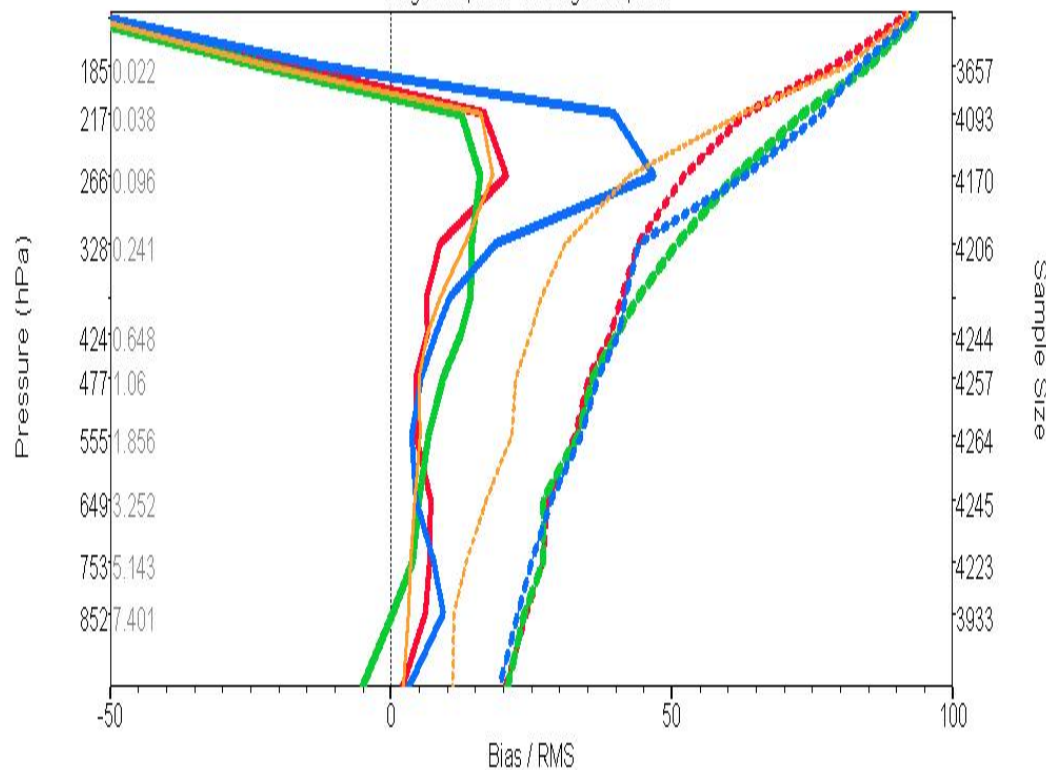
August 21, 2017 (8z) to July 31, 2017 (23z)



Temperature (sat - baseline) deg K
August 21, 2017 to August 31, 2017



Water Vapor (sat - baseline) % error
August 21, 2017 to August 31, 2017



NOAA IASI MetOp-B
NUCAPS NPP First Guess

Baseline: SONDE
NOAA IASI MetOp-B First Guess
NUCAPS NPP TEST

NUCAPS NPP
NUCAPS NPP TEST First Guess

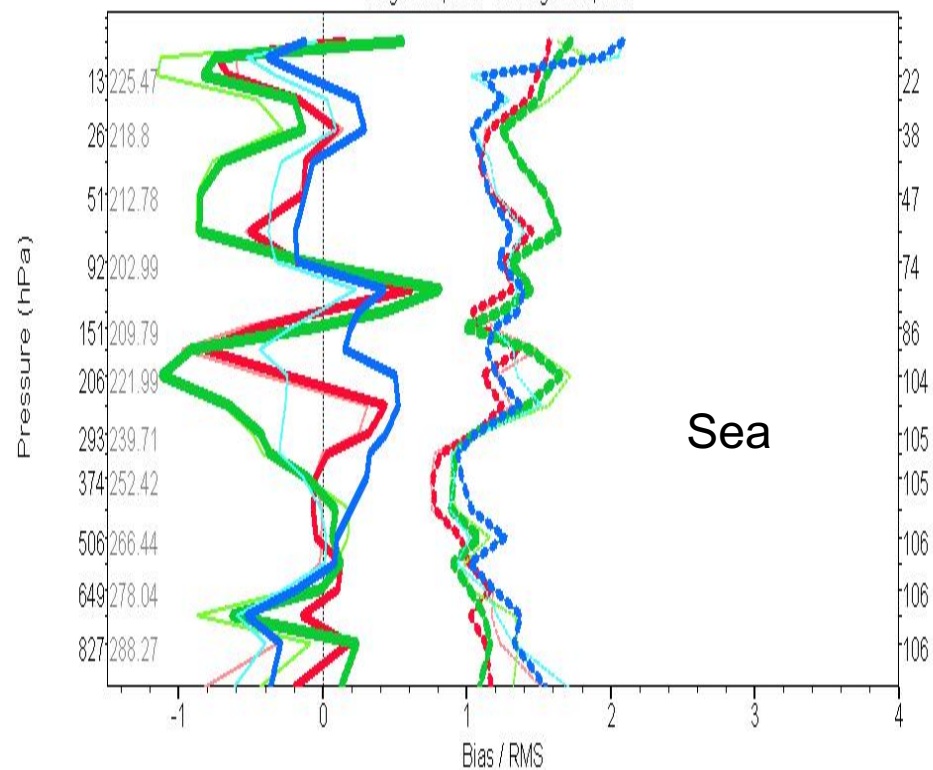
ECMWF
NUCAPS NPP TEST

Baseline: SONDE
NOAA IASI MetOp-B

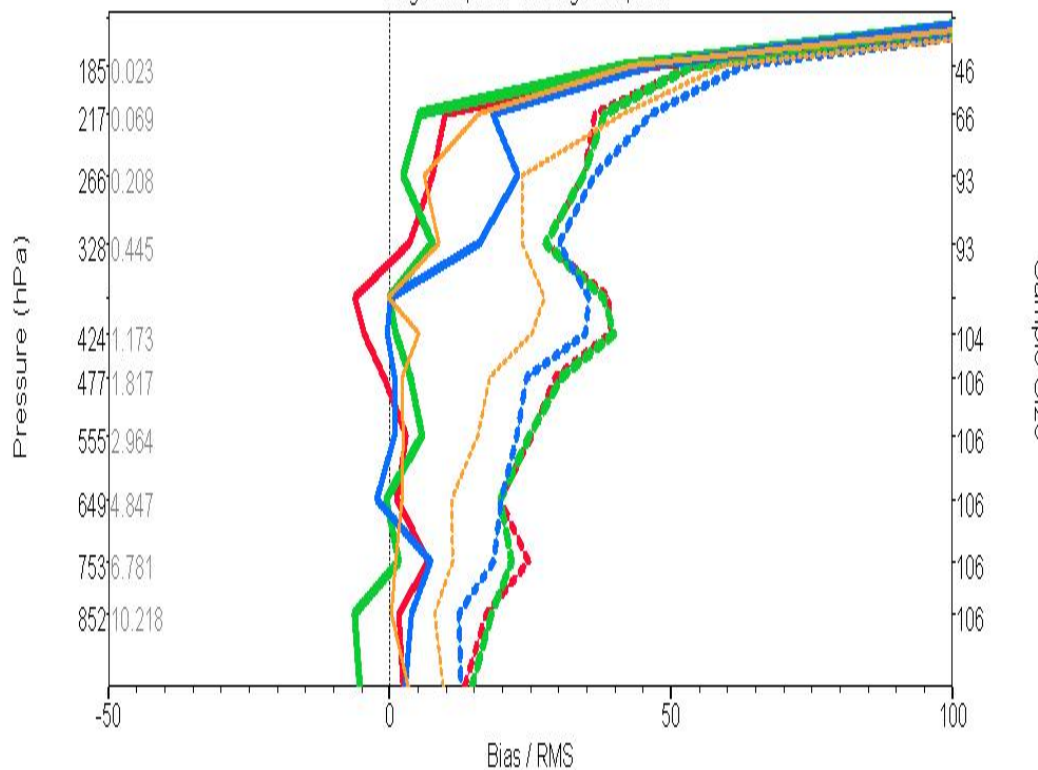
NUCAPS NPP



Temperature (sat - baseline) deg K
August 21, 2017 to August 31, 2017



Water Vapor (sat - baseline) % error
August 21, 2017 to August 31, 2017



NOAA IASI MetOp-B
NUCAPS NPP First Guess

Baseline: SONDE
NOAA IASI MetOp-B First Guess
NUCAPS NPP TEST

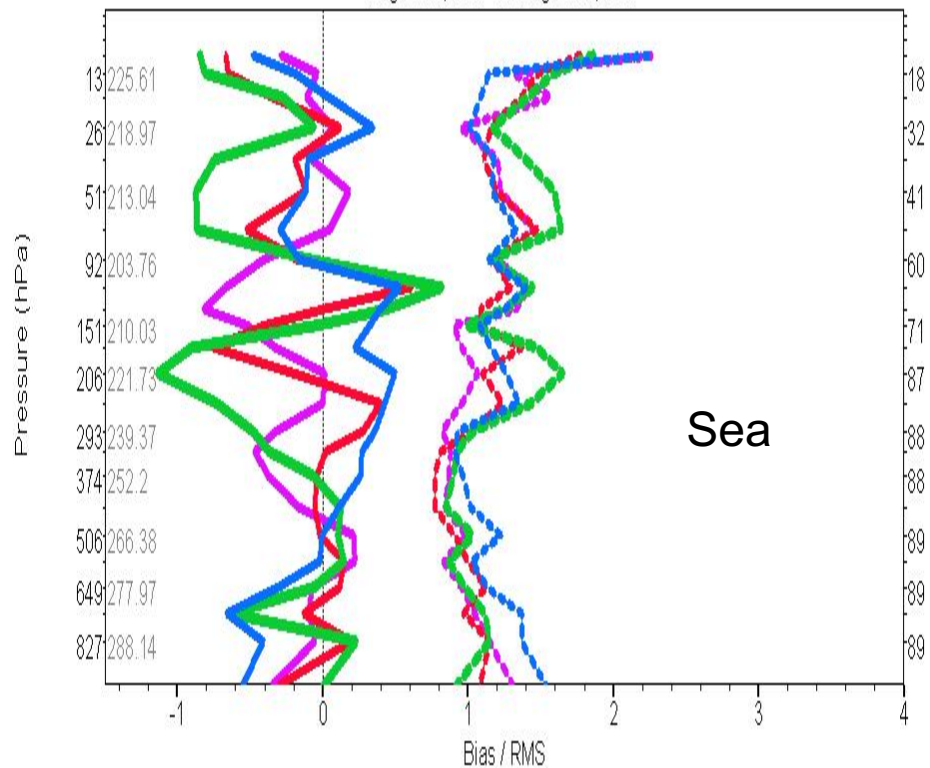
NUCAPS NPP
NUCAPS NPP TEST First Guess

ECMWF
NUCAPS NPP TEST

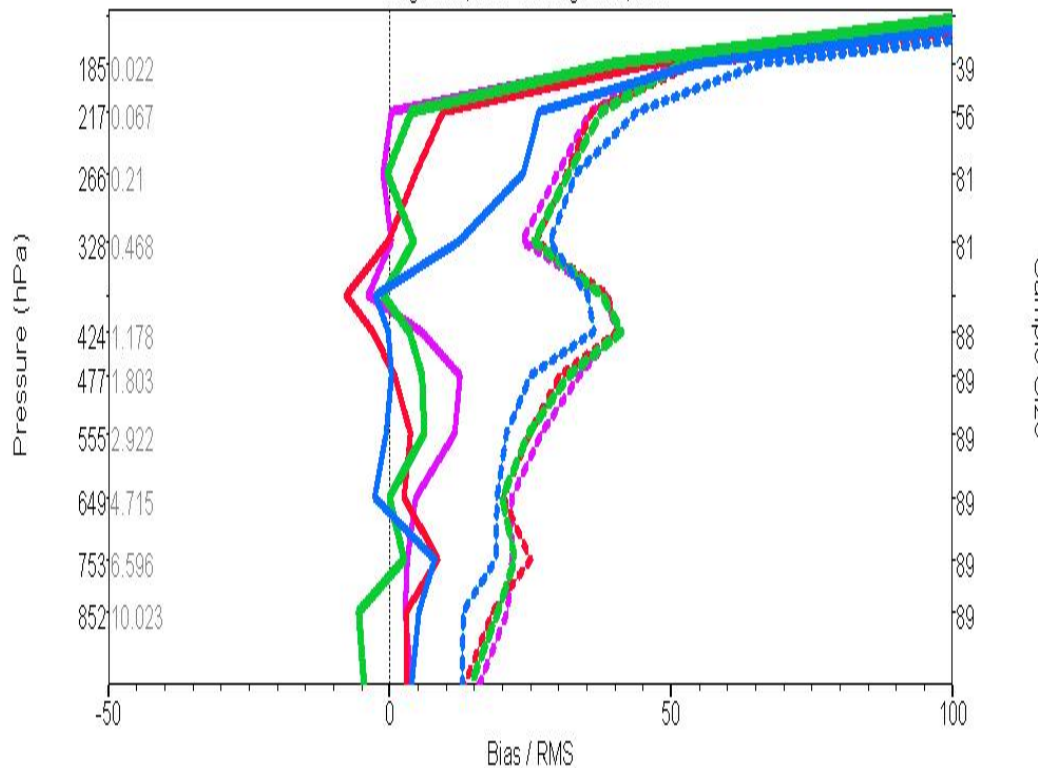
Baseline: SONDE
NOAA IASI MetOp-B
NUCAPS NPP



Temperature (sat - baseline) deg K
August 21, 2017 to August 31, 2017



Water Vapor (sat - baseline) % error
August 21, 2017 to August 31, 2017



Baseline: SONDE

NOAA IASI MetOp-B
AIRS AQUA

NUCAPS NPP

NUCAPS NPP TEST

Baseline: SONDE

NOAA IASI MetOp-B
AIRS AQUA

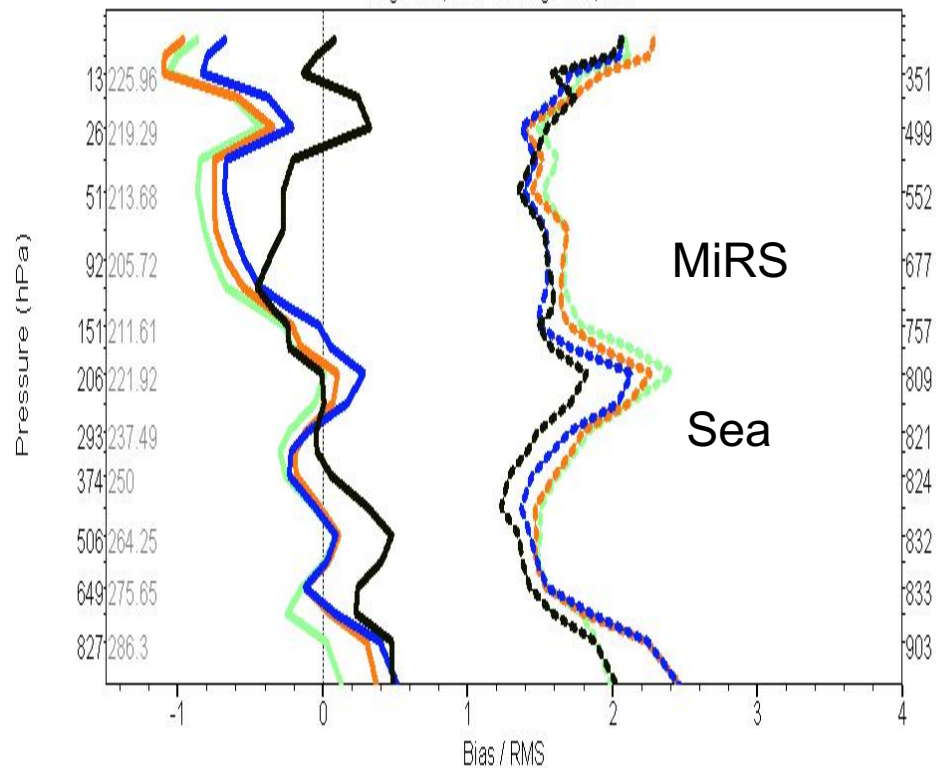
NUCAPS NPP

NUCAPS NPP TEST



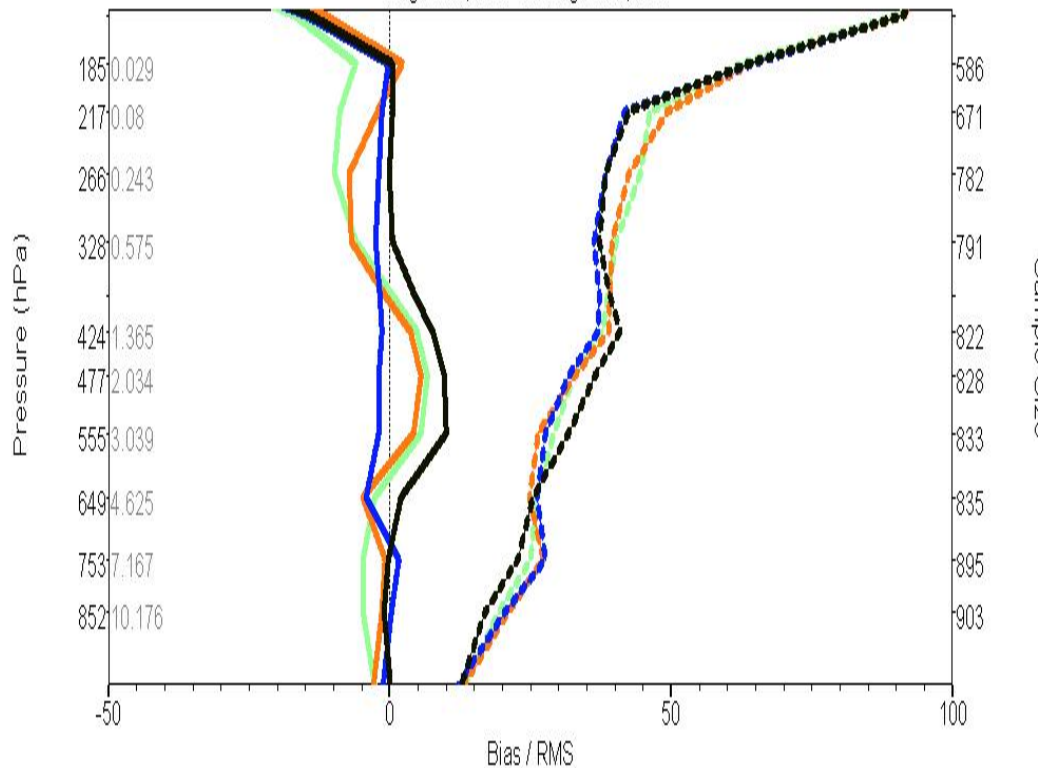
Temperature (sat - baseline) deg K

August 21, 2017 to August 31, 2017



Water Vapor (sat - baseline) % error

August 21, 2017 to August 31, 2017



Baseline: SONDE

MIRS NPP v11

MIRS MetOp-B

MIRS NOAA-18

MIRS NOAA-19

Baseline: SONDE

MIRS NPP v11

MIRS MetOp-B

MIRS NOAA-18

MIRS NOAA-19

NOAA Products Validation System (NPROVS)

Coast

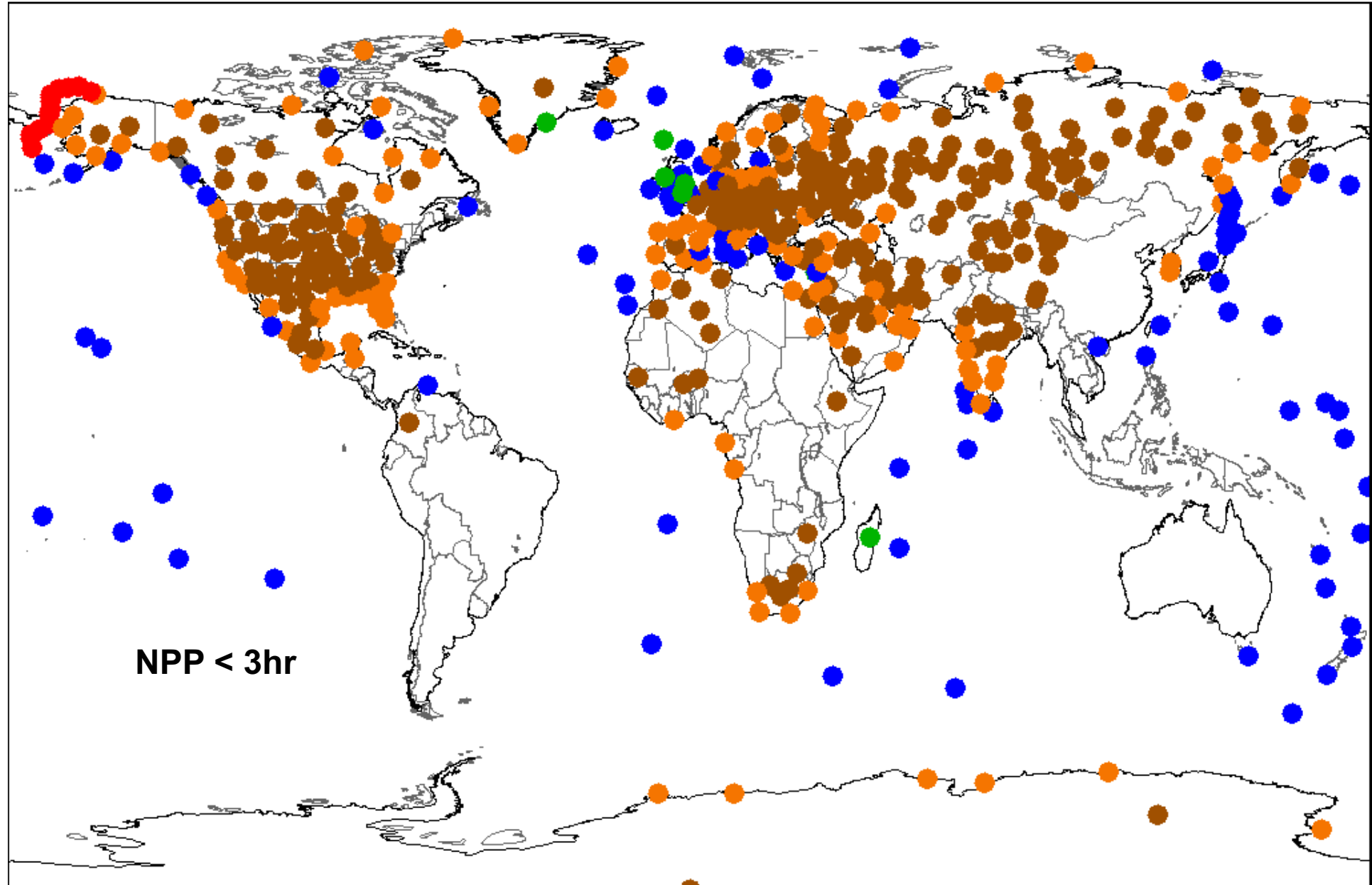
Land

Island (Coast)

Island (Inland)

Ship

Dropsonde



Number of collocations: 4907 (461 unique locations)

August 21, 2017 (8z) to July 31, 2017 (23z)

NOAA Products Validation System (NPROVS)

Coast

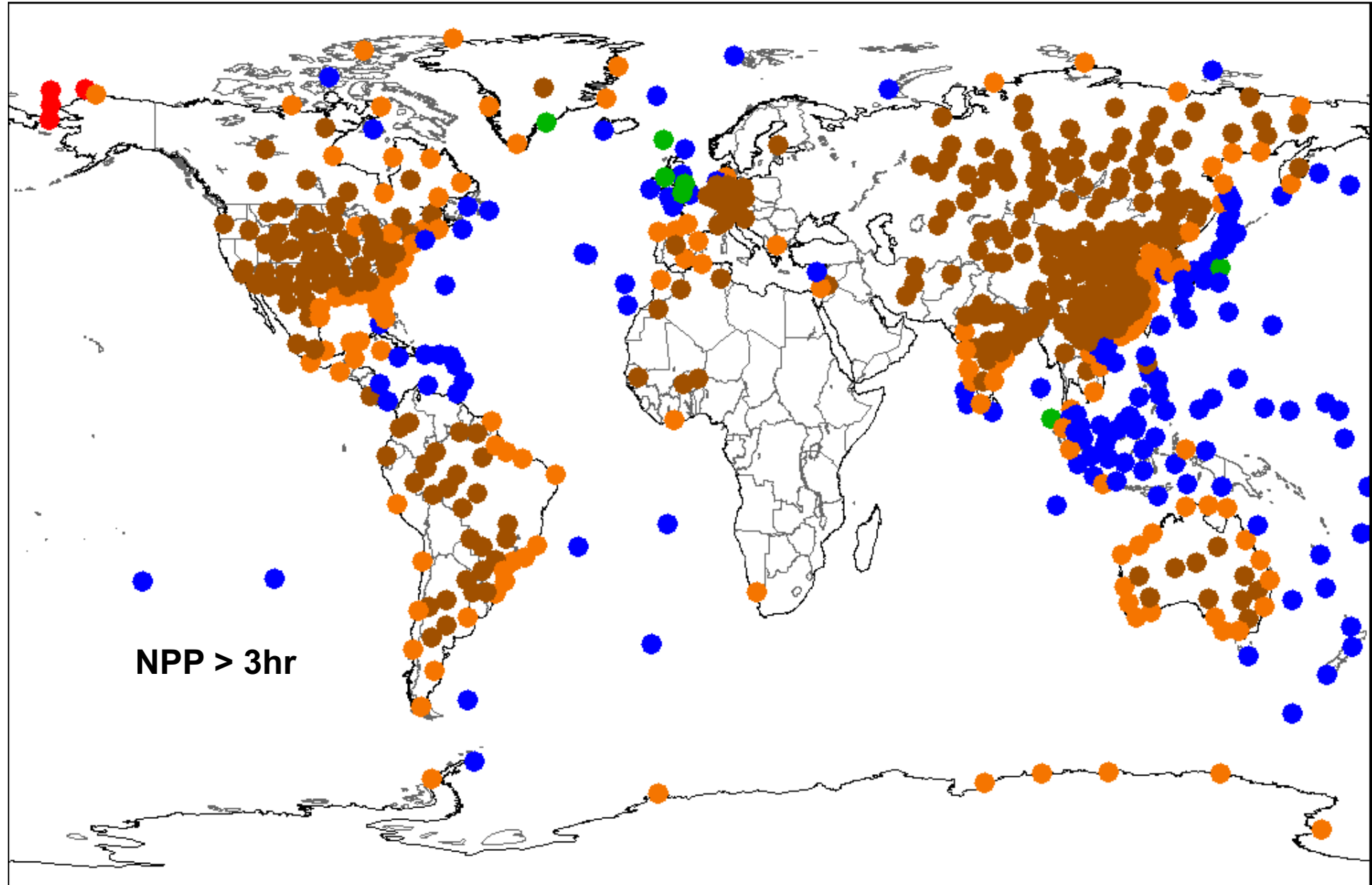
Land

Island (Coast)

Island (Inland)

Ship

Dropsonde



Number of collocations: 6812 (570 unique locations)

August 21, 2017 (8z) to July 31, 2017 (23z)

NOAA Products Validation System (NPROVS)

Coast

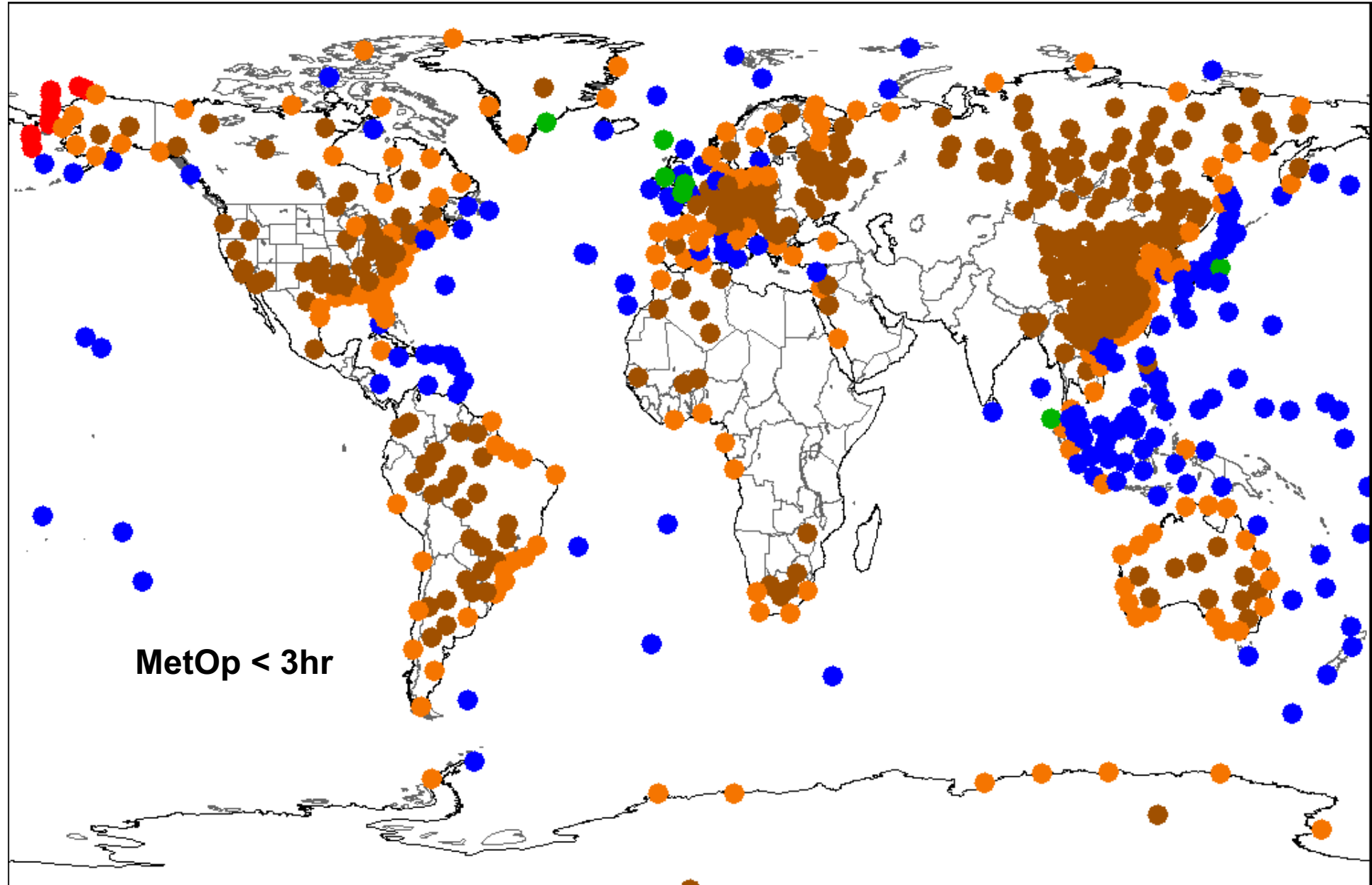
Land

Island (Coast)

Island (Inland)

Ship

Dropsonde



Number of collocations: 6512 (584 unique locations)

August 21, 2017 (8z) to July 31, 2017 (23z)

NOAA Products Validation System (NPROVS)

Coast

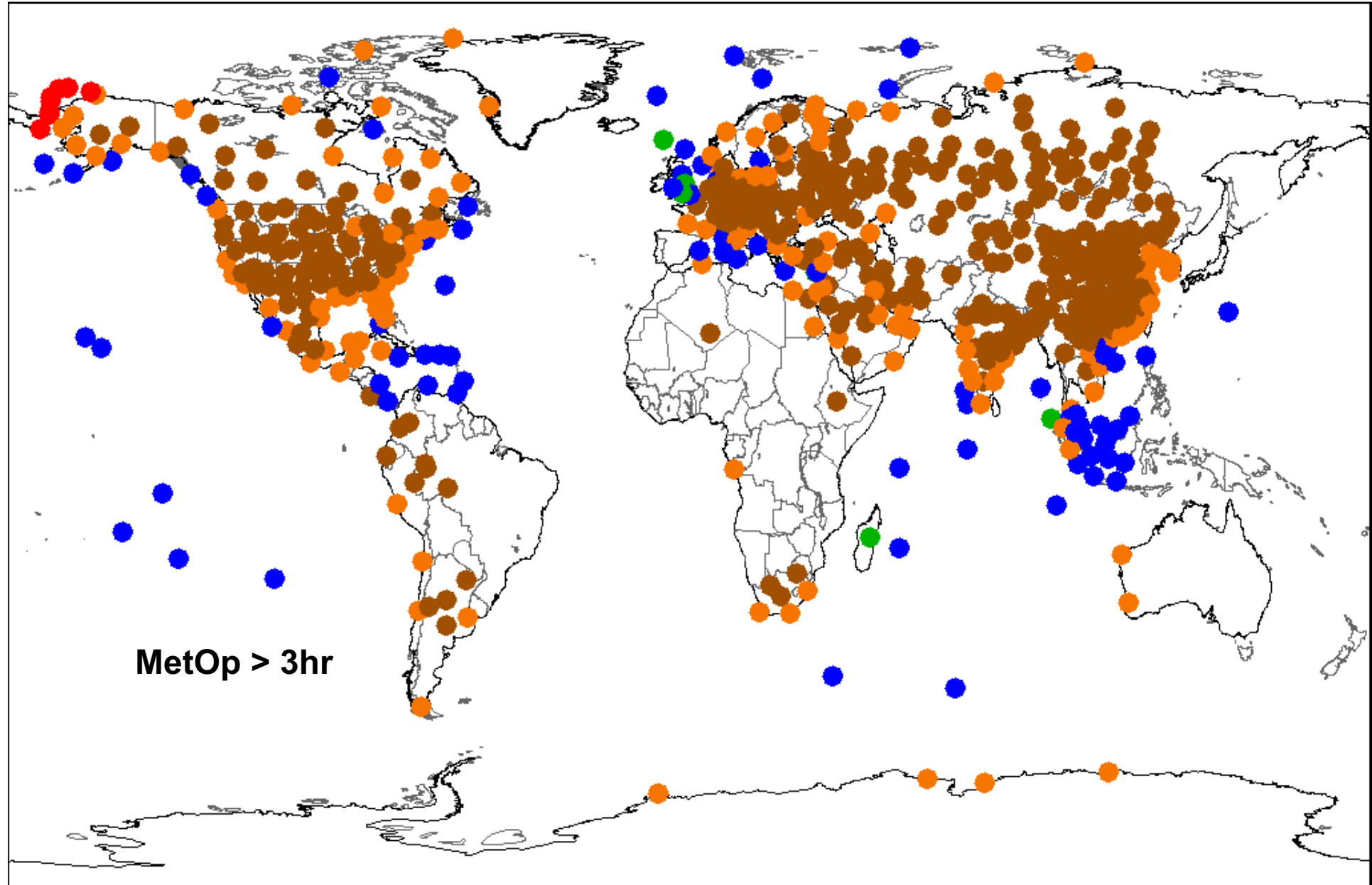
Land

Island (Coast)

Island (Inland)

Ship

Dropsonde



Number of collocations: 5428 (549 unique locations)

August 21, 2017 (8z) to July 31, 2017 (23z)

NOAA Products Validation System (NPROVS)

Coast

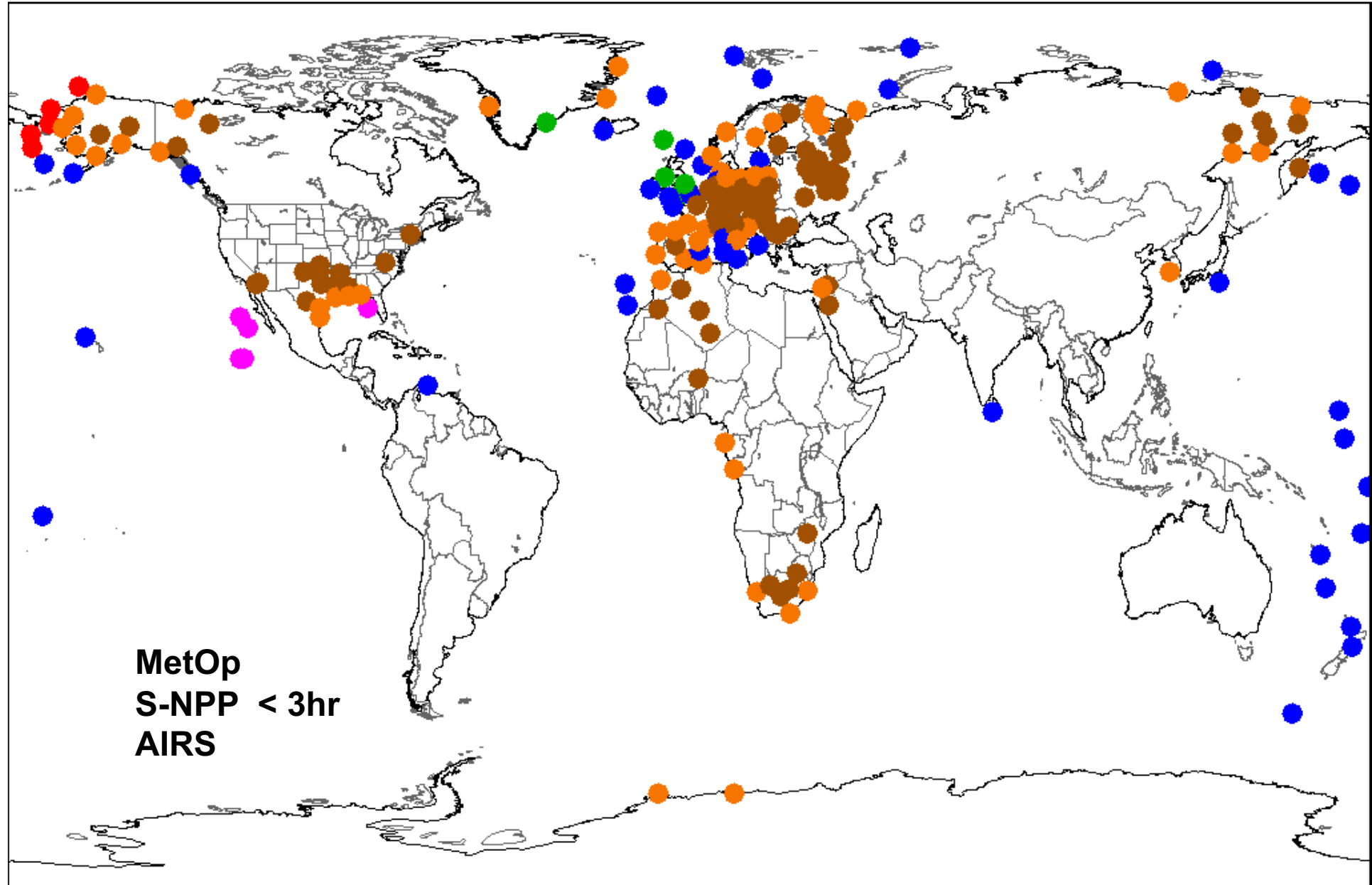
Land

Island (Coast)

Island (Inland)

Ship

Dropsonde



Number of collocations: 828 (185 unique locations)

August 21, 2017 (8z) to July 31, 2017 (23z)

NOAA Products Validation System (NPROVS)

Coast

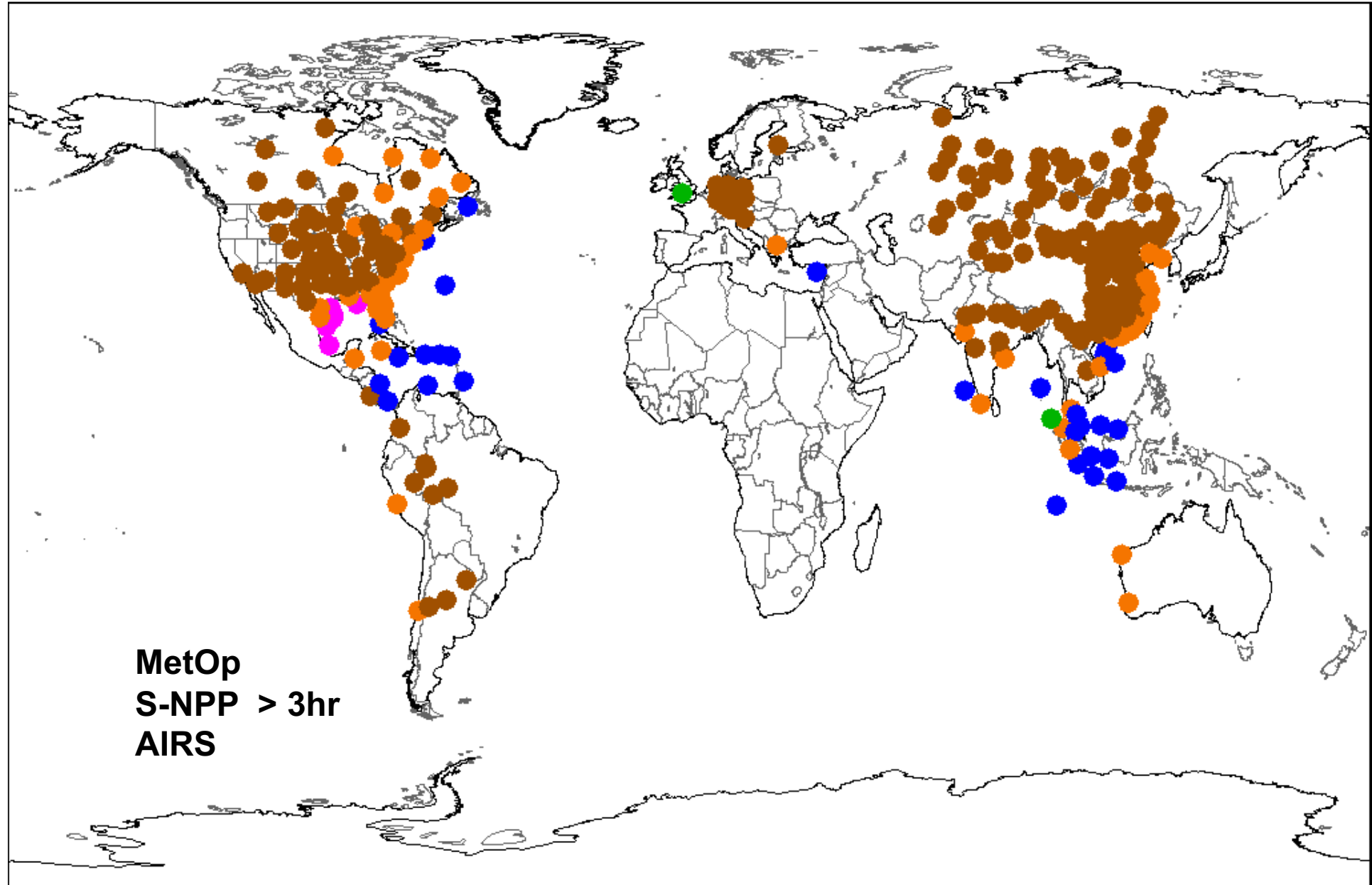
Land

Island (Coast)

Island (Inland)

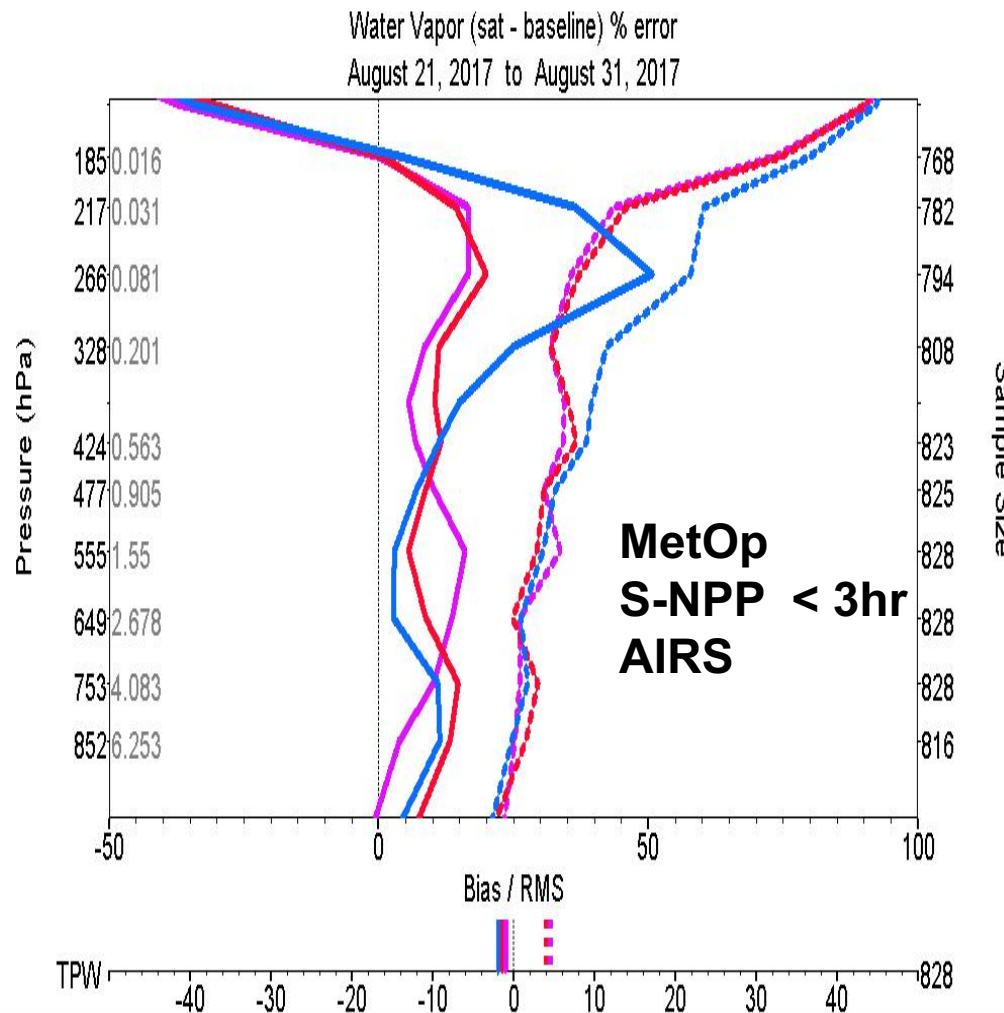
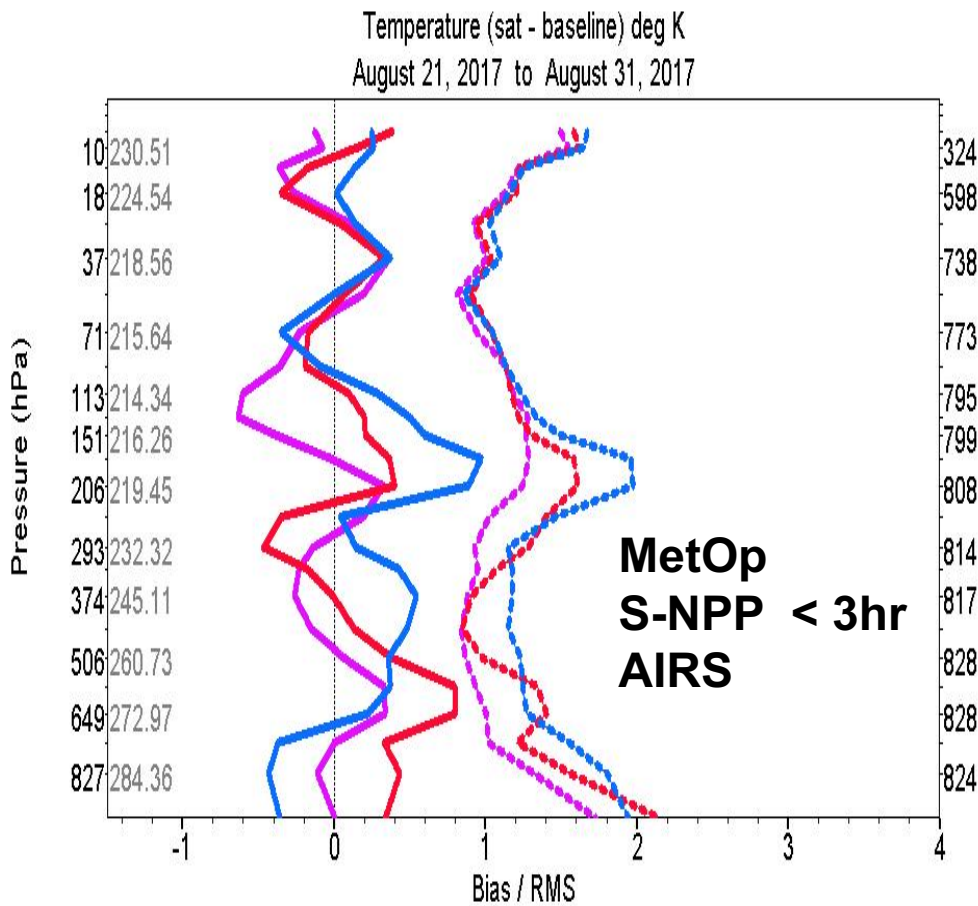
Ship

Dropsonde



Number of collocations: 844 (265 unique locations)

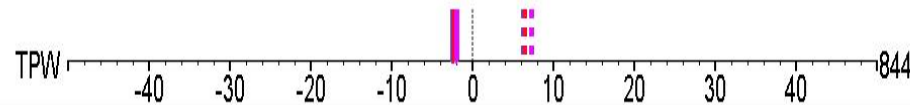
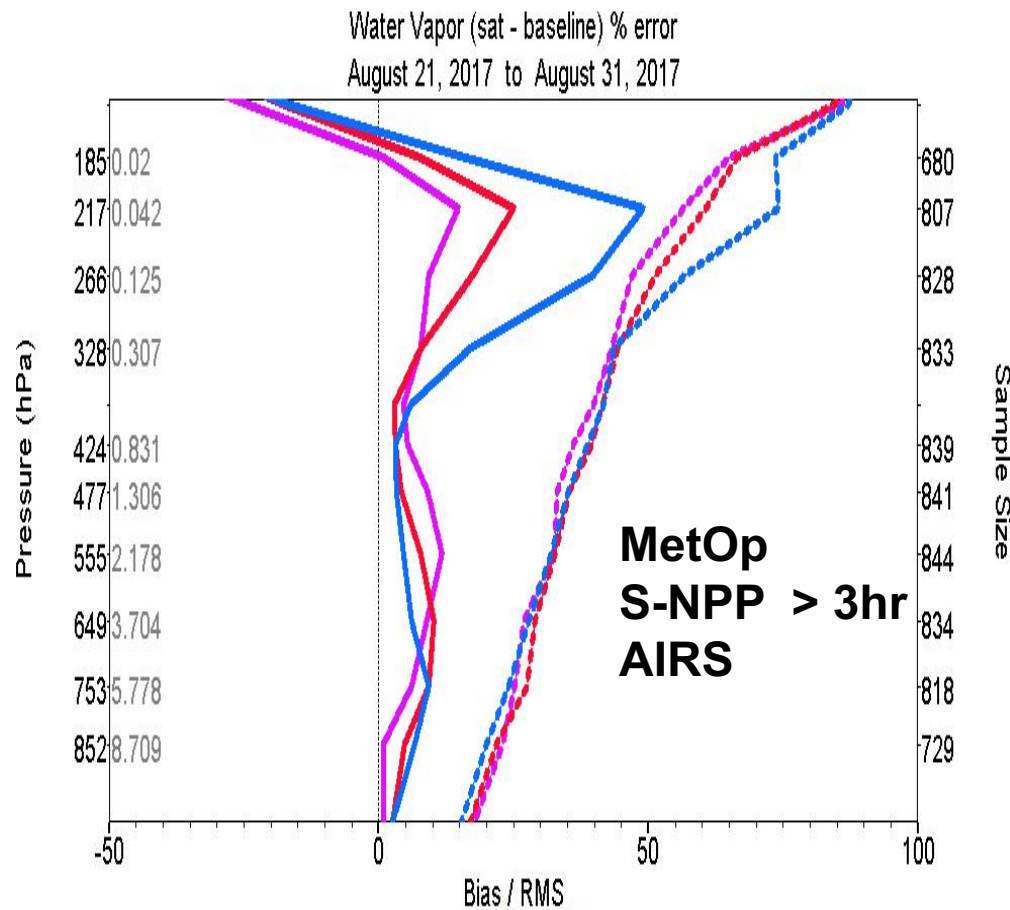
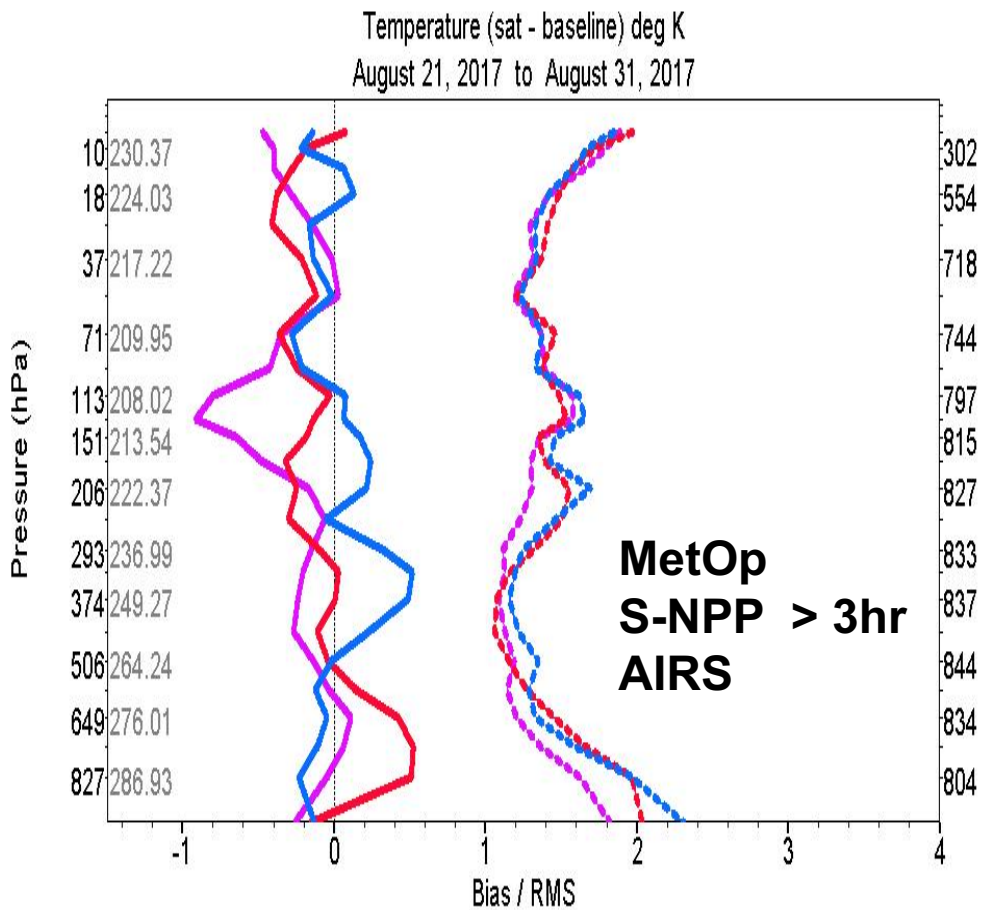
August 21, 2017 (8z) to July 31, 2017 (23z)



Baseline: SONDE
NOAA IASI MetOp-B
NUCAPS NPP TEST

AIRS AQUA
NOAA IASI MetOp-B

Baseline: SONDE
NUCAPS NPP TEST
AIRS AQUA



Baseline: SONDE
NOAA IASI MetOp-B
NUCAPS NPP TEST

AIRS AQUA

Baseline: SONDE
NOAA IASI MetOp-B
NUCAPS NPP TEST

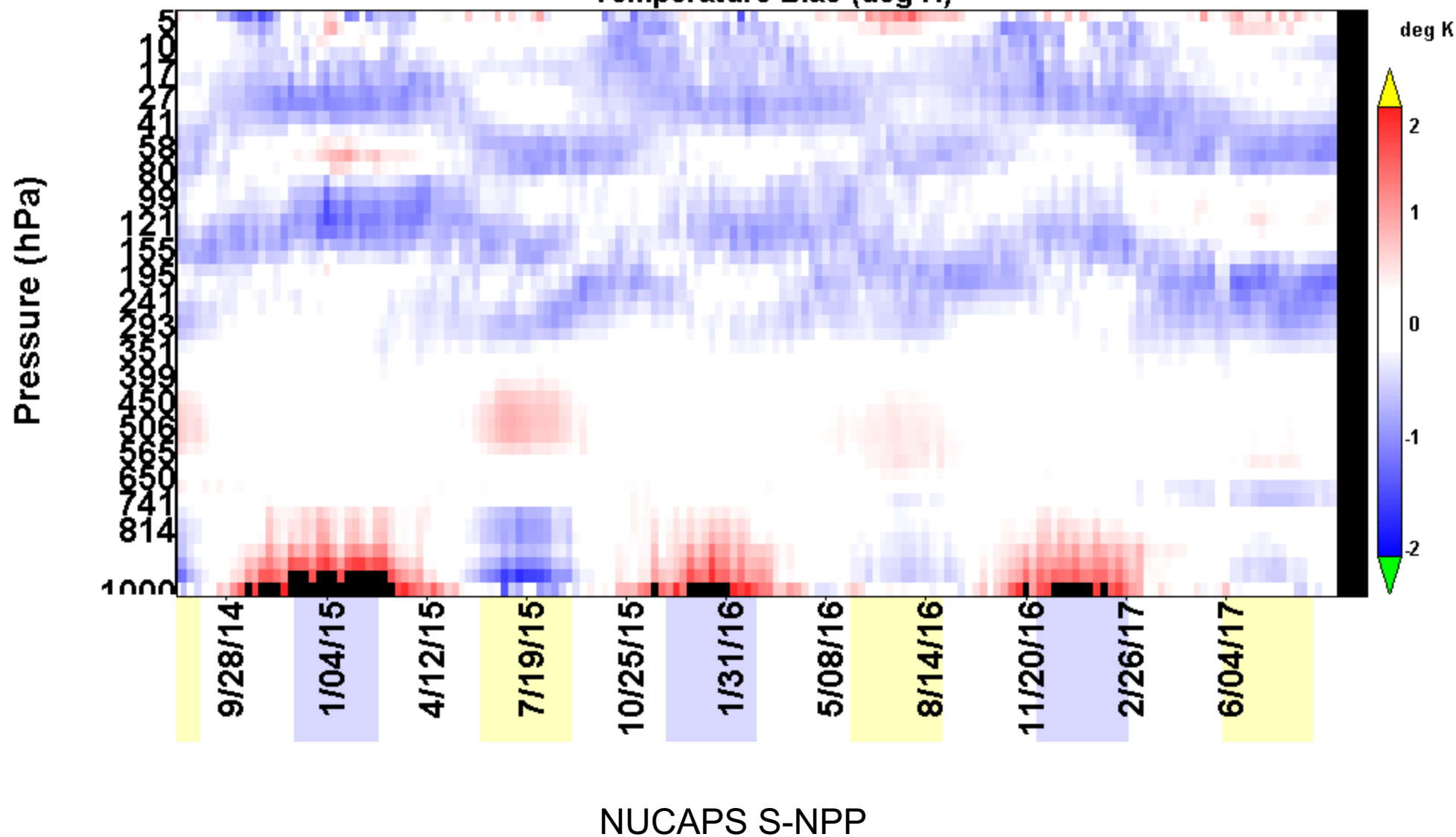
AIRS AQUA



**NARCS “Atmosphere” analysis of
long-term satellite-minus radiosonde (conventional)
Differences (bias)**

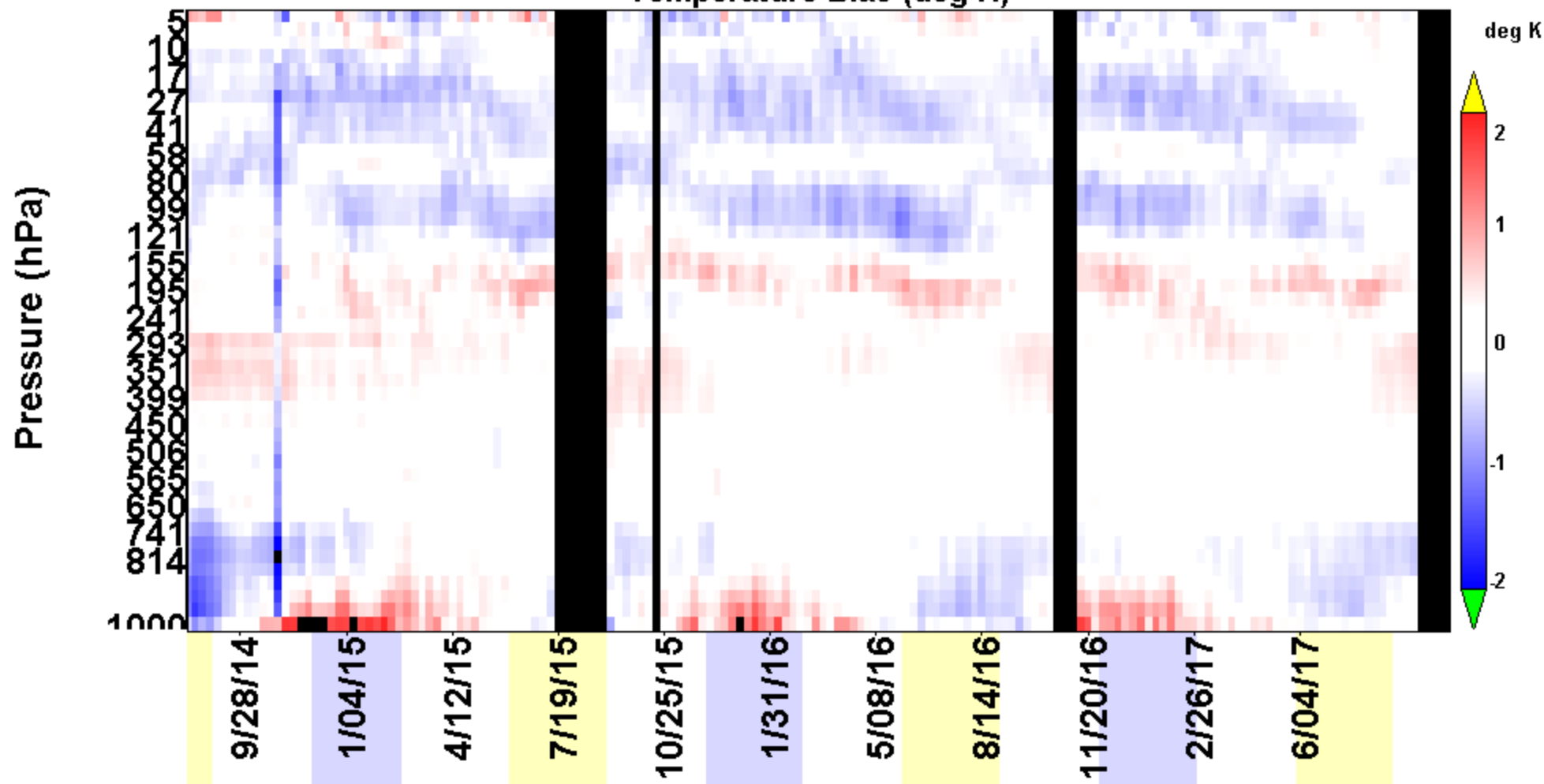


**SNPP NUCAPS IR + MW All Terrain(Passed) - Sonde All Terrain
 Temperature Bias (deg K)**





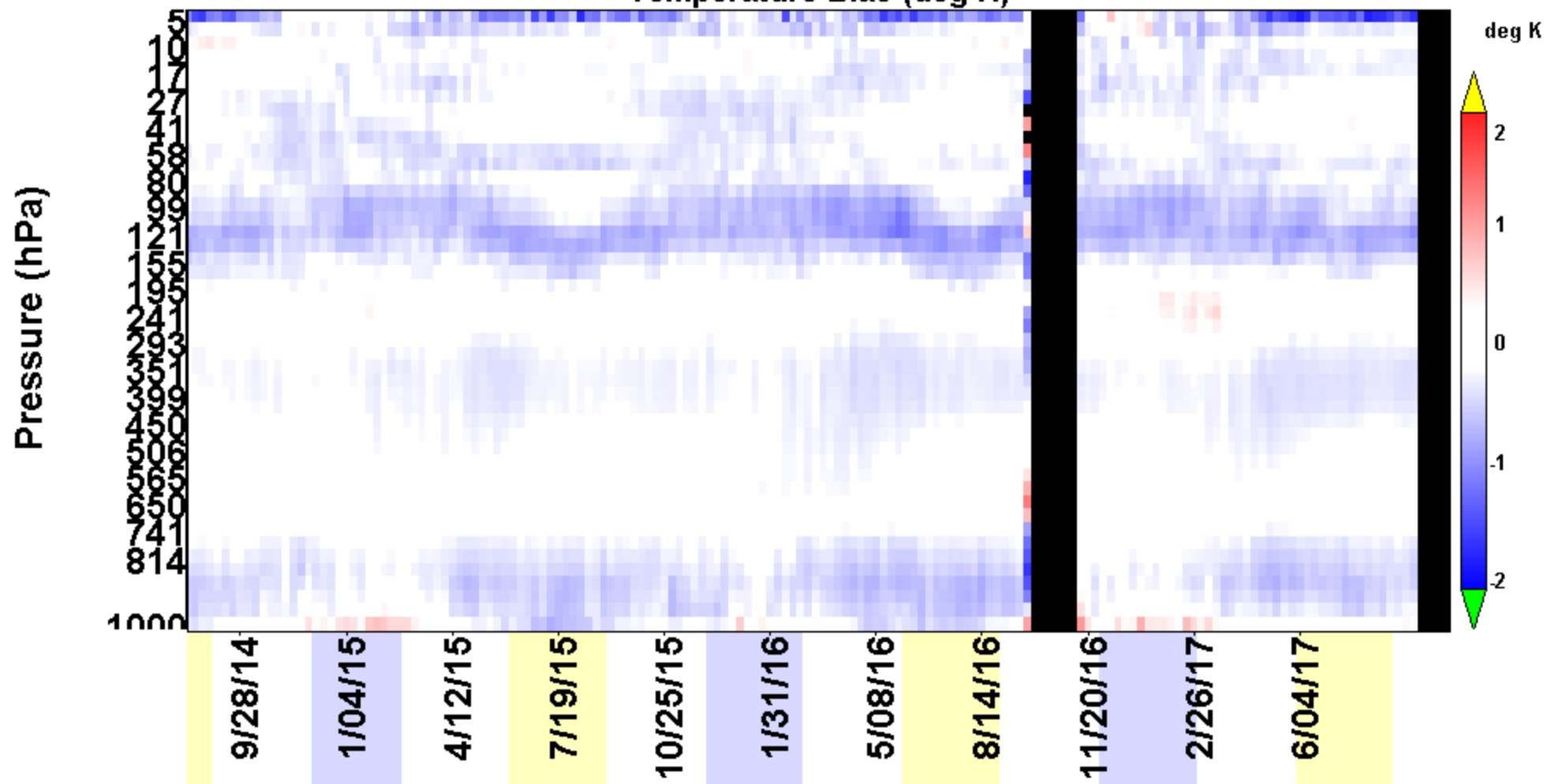
**NOAA IASI MetOp-B IR + MW All Terrain(Passed) - Sonde All Terrain
 Temperature Bias (deg K)**



NUCAPS MetOp-B

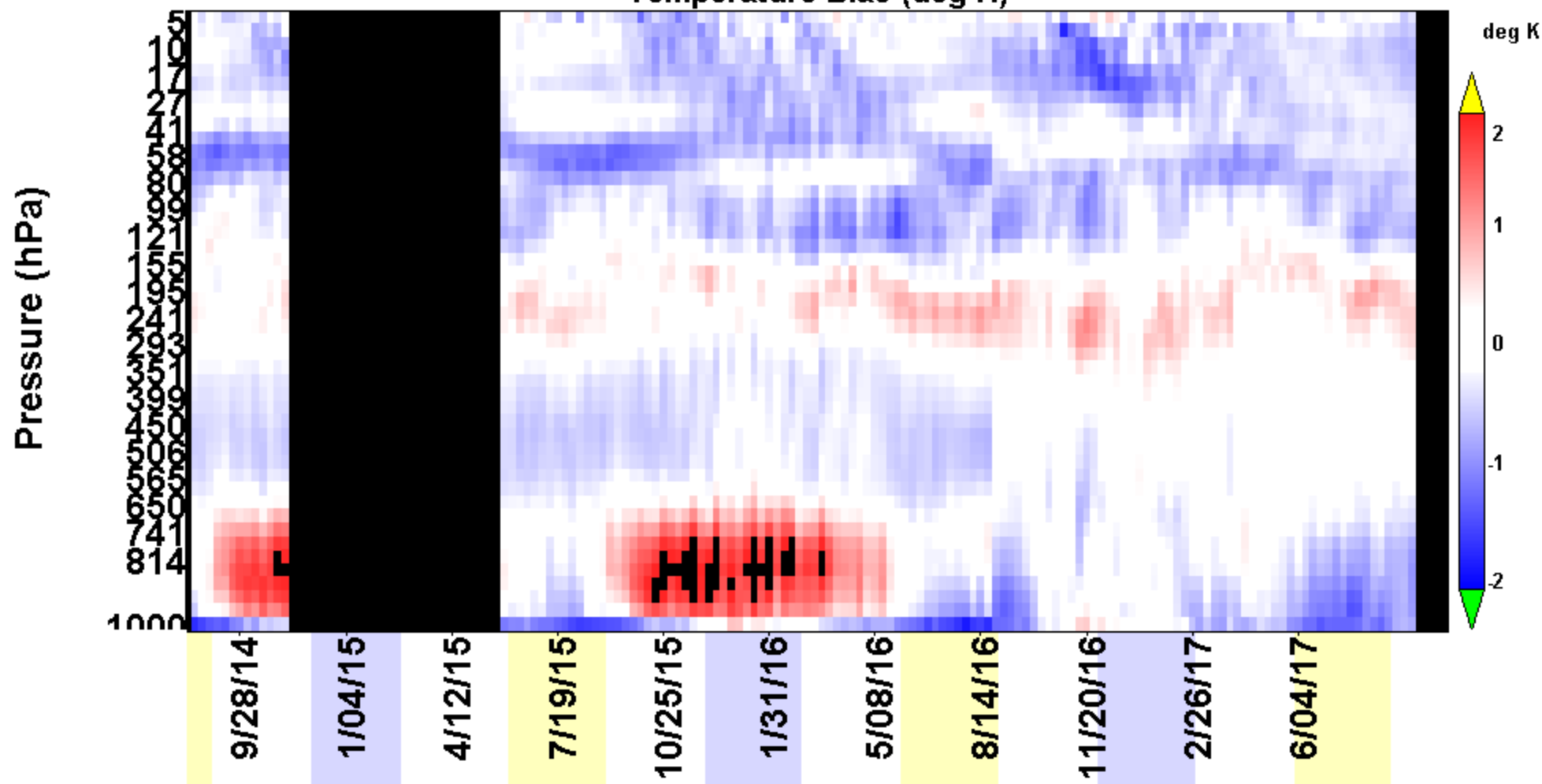


**AIRS AQUA IR + MW All Terrain(Passed) - Sonde All Terrain
 Temperature Bias (deg K)**



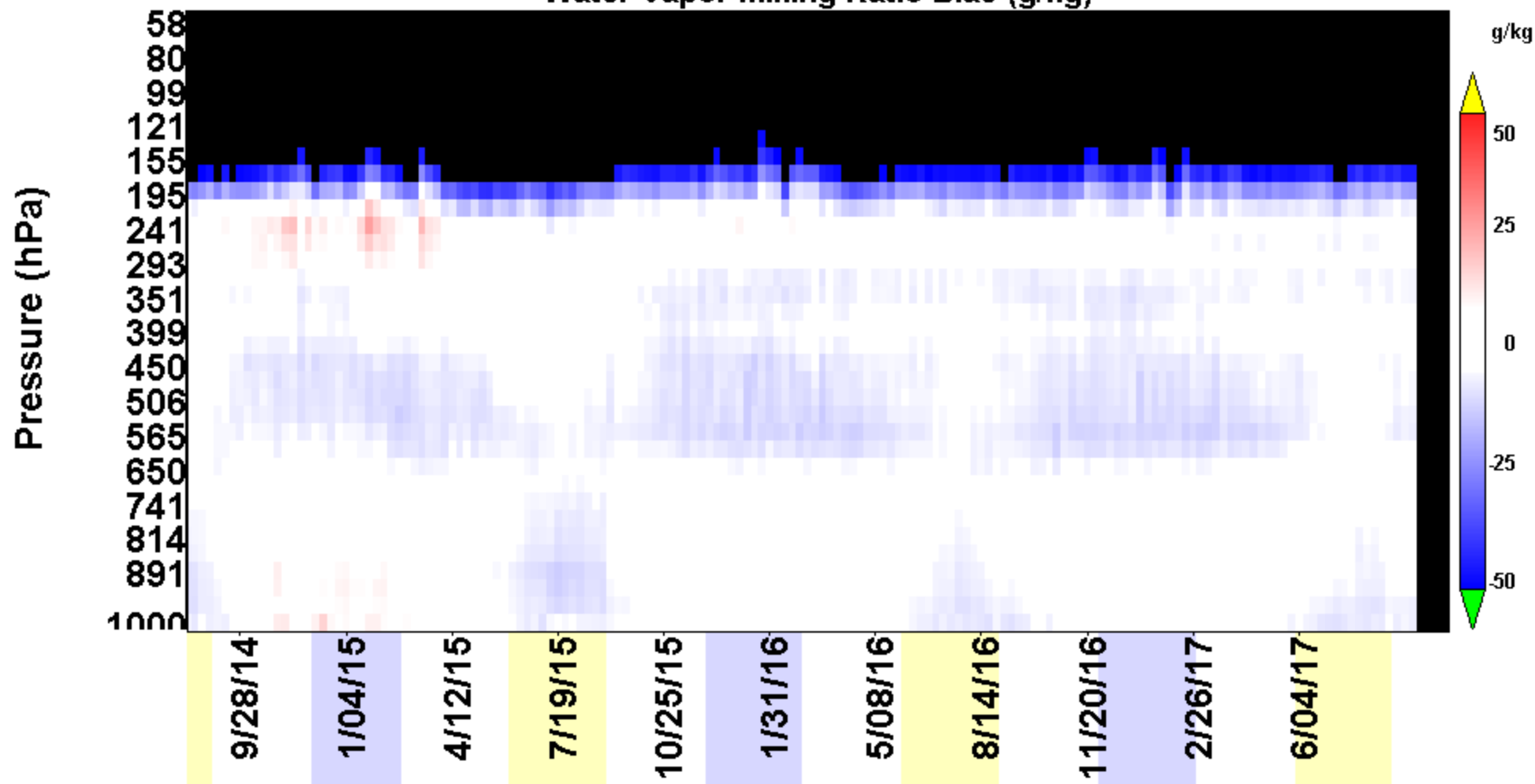


MIRS Test MetOp-B MW All Terrain(Passed) - Sonde All Terrain
Temperature Bias (deg K)





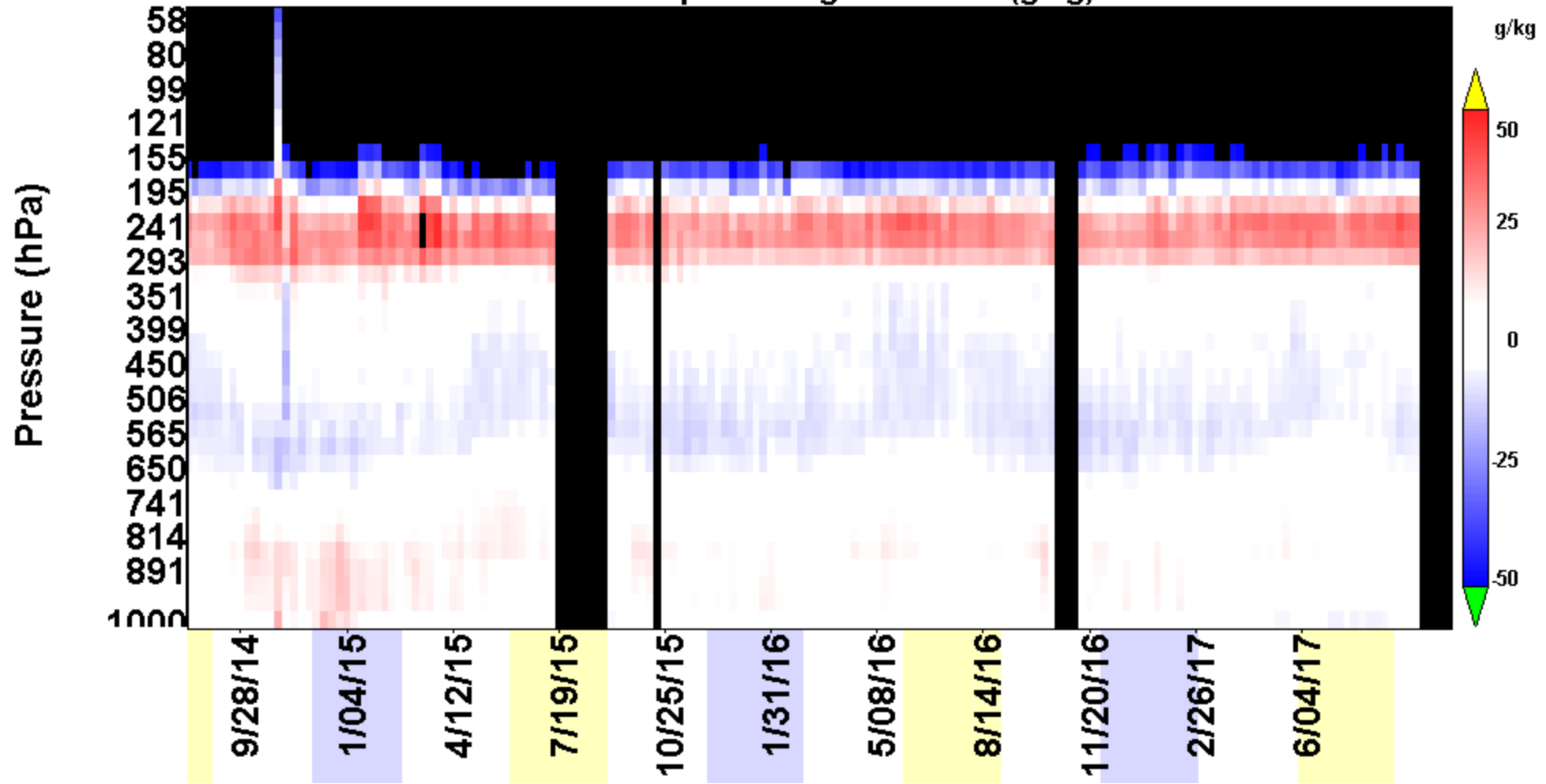
SNPP NUCAPS IR + MW All Terrain(Passed) - Sonde All Terrain
Water Vapor Mixing Ratio Bias (g/kg)



NUCAPS S-NPP

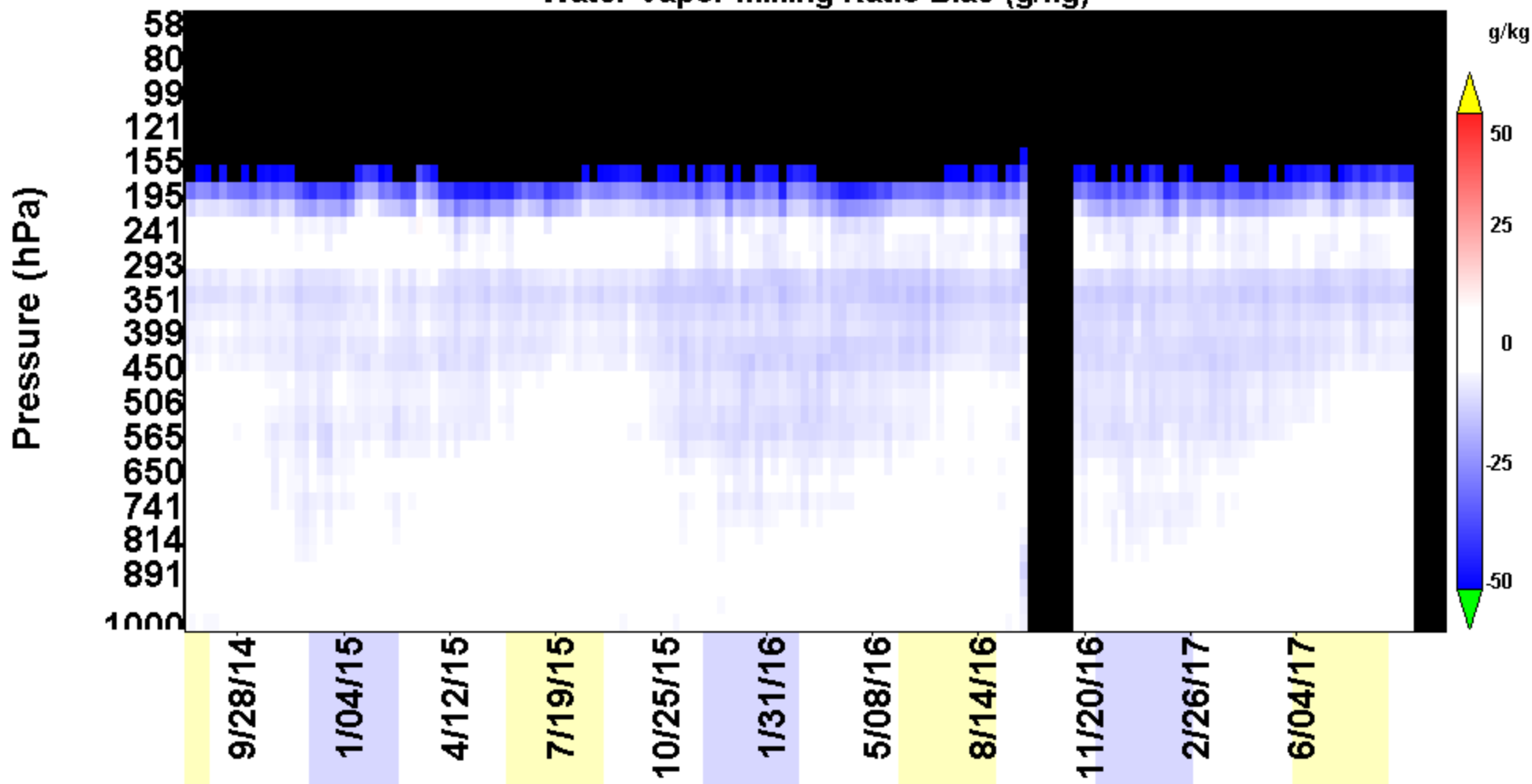


**NOAA IASI MetOp-B IR + MW All Terrain(Passed) - Sonde All Terrain
 Water Vapor Mixing Ratio Bias (g/kg)**



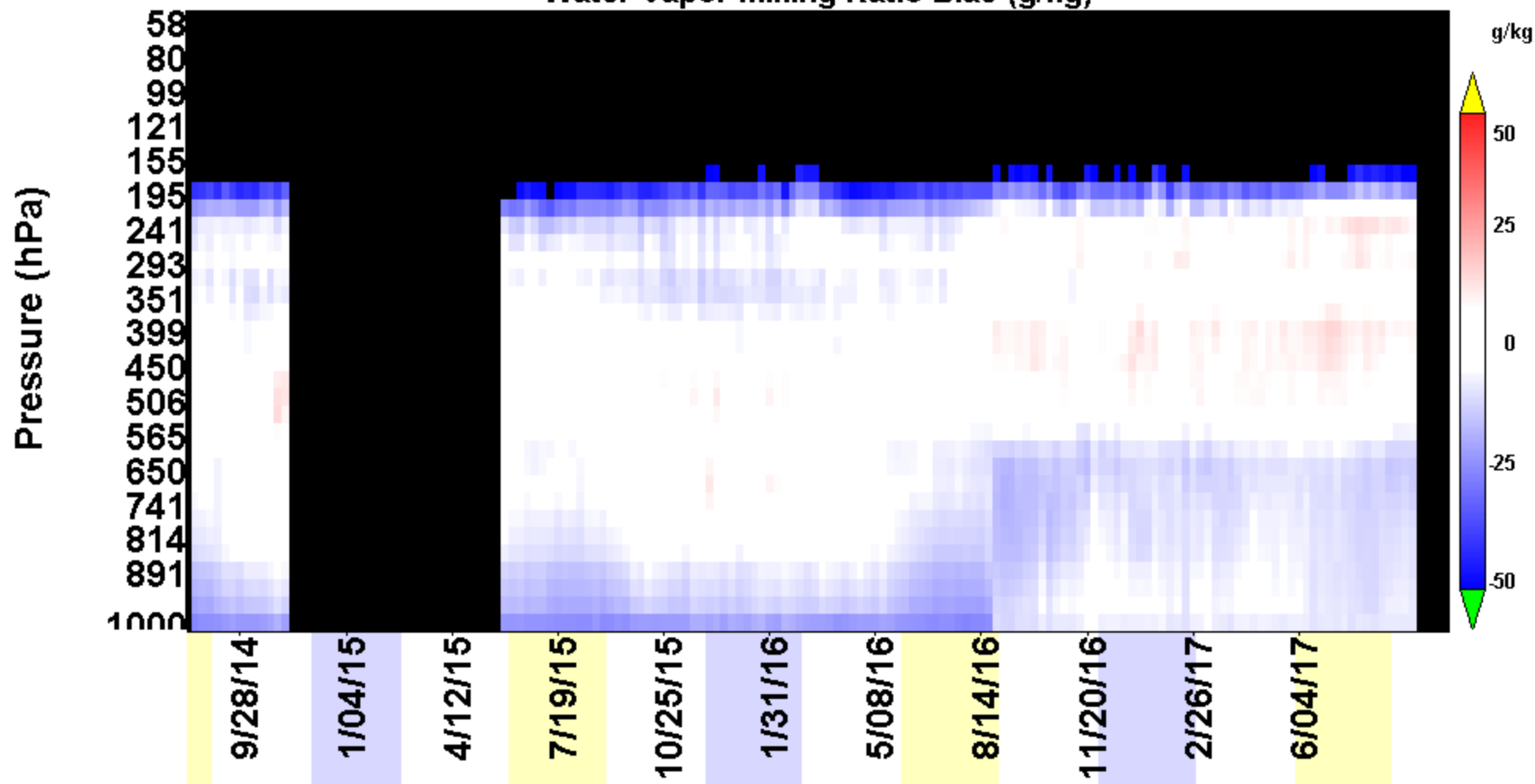


AIRS AQUA IR + MW All Terrain(Passed) - Sonde All Terrain
Water Vapor Mixing Ratio Bias (g/kg)





**MIRS Test MetOp-B MW All Terrain(Passed) - Sonde All Terrain
 Water Vapor Mixing Ratio Bias (g/kg)**





Summary

- ❖ NPROVS provides “enterprise” assessment for satellite derived atmospheric sounding products
- ❖ Strategy and results on sounding product characteristic performance and possible impacts based on local satellite overpass time are presented
- ❖ Vertical statistics indicate systematic differences among NUCAPS S-NPP, Metop-B and AIRS products at various levels for temperature and moisture; *differences appear reduced for NUCAPS v2.1.2 (FSR) versus old v1.5*
- ❖ Differences are observed across mutually exclusive sets of collocations over sea, non-sea and at different time windows (regions)
- ❖ Differences mainly manifested in bias can exceed 1K
- ❖ Impacts of such differences on users (i.e., AWIPS-2 users of NUCAPS for S-NPP and MetOp) is unclear
- ❖ *Recommend a requirement for “consistency” among operational satellite product suites be considered*



NPROVS Assessment of NUCAPS

Time-line for NUCAPS “FSR” Staged Upgrades in Parallel Test:

v1.9.3	up to March 3	
ATMS Block 1-2: March 8		
v2.0.1	March 3-13	<i>all-sky for MIT</i>
v2.0.2	March 13-17	<i>all-sky for MIT</i>
v2.0.4	March 17-30	IR+MW
v2.0.4.1	March 30	IR-only
v2.0.4	April 21	IR+MW
v2.0.5	May 18	IR+MW new RTA tuning !!
v2.0.5.4	June 22 16Z	IR+WW Block 2 tuning
V2.0.5.4	July 14 19Z	IR-only
	July 28	Offline
v2.1.1DB	Aug 8	IR+MW (7FOV)
v2.1.1	Aug 11	IR+MW (previously 2.0.5.4)
v2.1.1DB	Aug 21	IR+MW (7FOV)
v2.1.2	Aug 22	IR+MW + new CCR ... final for AK
v2.1.2	Sep 18 (19Z)	IR-only (new CCR)
v2.1.2	Oct 3 (15Z)	IR+MW (new CCR) ... final for AK