Validated Stage 3 SST Maturity Review

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Canadian Met Centre

Outline

- JPSS SST Team & Acknowledgements
- Product Requirements & VAL Maturity Stages
- Evaluate SST performance to spec requirements
  - VIIRS SST Products: **IDPS**, **ACSPO**, **NAVO**
  - JPSS SST – ACSPO; Processing Environment – NDE
  - VIIRS SST Performance
    1. One day analysis
    2. Time Series Jan 2012 – present
    3. Annual statistics (1 Jun 2013 – 30 May 2014)
    4. Examples VIIRS SST Imagery
- Documentation
- Users & Feedback
- Conclusion & Path Forward

JPSS SST Team

Name	Affiliation	% Funding	Tasks
Ignatov	STAR	NOAA	Lead, JPSS Algorithm & Cal/Val
Stroup, Kihai, Dash, Liang, Petrenko, Xu, Bouali, Zhou, Gladkova, Mikelsons	STAR/CIRA STAR/STG STAR/GST STAR/GST	JPO, NOAA ORS, GOES-R, NASA	Quality Monitoring of VIIRS SSTs (SQUAM), Radiances (MICROS), and in Situ SSTs (*i*Quam) Data support; IDPS SST code, Match up, Cloud Mask, SST retrievals; Destriping L1b & SST
May, Cayula, McKenzie, Willis	NAVO	Navy, NJO	NAVO SEATEMP SST & Cal/Val VIIRS Cloud Mask evaluation
Minnett Kilpatrick	U. Miami	JPO, U. Miami	Uncertainty & instrument analyses; RTM; VAL vs. drifters & radiometers; skin to sub-skin conversion
Arnone Fargion	USM/NRL UCSD	NJO, USM	SST Algorithm Analyses, SST improvements at slant view zenith angles/swath edge
LeBorgne Roquet	Meteo France	EUMETSAT	Processing VIIRS and Cal/Val using O&SI SAF heritage; Comparisons with AVHRR/SEVIRI

Acknowledgements

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- NOAA NDE Team – Tom Schott, Dylan Powell, Bonnie Reed
- JPSS DPA – Eric Gottshall, Janna Feeley, Bruce Gunther
- VIIRS SDR & GSICS – Changyong Cao, Fuzhong Weng, Mark Liu, Frank DeLuccia, Jack Xiong
- NOAA STAR JPSS Team – Lihang Zhou, Paul DiGiacomo, Ivan Csiszar, many others
- NOAA CRTM Team – Yong Chen, Mark Liu, Yong Han
- U. Wisconsin – Liam Gumley, Steve Dutcher, Jim Davies

JPSS Skin SST Requirements

EDR Attribute	Threshold	Objective
a. Horizontal Cell Size (Res)	1.6km[1]	0.25km
b. Mapping Uncertainty, 3σ	2km[1]	0.1km
c. Measurement Range	271 K to 313 K	271 K to 318 K
d. Measurement Accuracy[2]	0.2K	0.05K
e. Measurement Precision[2]	0.6K	0.2K (<55° VZA)
f. Refresh Rate	12 hrs	3 hrs
g. Latency	90 min	15 min
h. Geographic coverage	Global cloud and ice-free ocean; excluding lakes and rivers	Global cloud and ice-free ocean, plus large lakes and wide rivers

[1] Worst case scenarios corresponding to swath edge; both numbers are ~1km at nadir

[2] Represent global mean BIAS and STDV validation statistics against QCed drifting buoys (for day & night, and in full VIIRS swath & range of atmospheric conditions). Uncertainty = Square root of Accuracy squared plus Precision squared. Better performance is expected against ship radiometers.

SNPP Validation Maturity Stages & SST Schedule

Validated Stage 1 (Jul'2014):

Using a limited set of samples, the algorithm output is shown to meet the threshold performance attributes identified in the JPSS Level 1 Requirements Supplement with the exception of the S-NPP Performance Exclusions

Validated Stage 2 (Oct'2014):

Using a moderate set of samples, the algorithm output is shown to meet the threshold performance attributes identified in the JPSS Level 1 Requirements Supplement with the exception of the S-NPP Performance Exclusions

Validated Stage 3 (Apr'2015):

Using a large set of samples representing global conditions over four seasons, the algorithm output is shown to meet the threshold performance attributes identified in the JPSS Level 1 Requirements Supplement with the exception of the S-NPP Performance Exclusions

SST Team recommends to declare JPSS SST "Validated Stage 3". We are ahead of schedule due to the use of mature ACSPO product

JPSS-1 Product Maturity Definition

JPSS/GOES-R Data Product Validation Maturity Stages – COMMON DEFINITIONS (Nominal Mission)

1. Beta

- Product is minimally validated, and may still contain significant identified and unidentified errors.
- Information/data from validation efforts can be used to make initial qualitative or very limited quantitative assessments regarding product fitness-for-purpose.
- Documentation of product performance and identified product performance anomalies, including recommended remediation strategies, exists.

2. Provisional

- Product performance has been demonstrated through analysis of a large, but still limited (i.e., not necessarily globally or seasonally representative) number of independent measurements obtained from selected locations, time periods, or field campaign efforts.
- Product analyses are sufficient for qualitative, and limited quantitative, determination of product fitness-for-purpose.
- Documentation of product performance, testing involving product fixes, identified product performance anomalies, including recommended remediation strategies, exists.
- Product is recommended for operational use (user decision) and in scientific publications.

3. Validated

- Product performance has been demonstrated over a large and wide range of representative conditions (i.e., global, seasonal).
- Comprehensive documentation of product performance exists that includes all known product anomalies and their recommended remediation strategies for a full range of retrieval conditions and severity level.
- Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose.
- Product is ready for operational use based on documented validation findings and user feedback.
- Product validation, quality assurance, and algorithm stewardship continue through the lifetime of the instrument.

VIIRS SST Products

IDPS – NOAA Interface Data Processing Segment (IDPS)

- ✓ Official NPOESS SST EDR, Ownership transferred to NOAA JPSS PO
- ✓ Developed by NGAS; Operational at Raytheon; Archived at NOAA CLASS
- ✓ As of this review, meets specs at night, but not during the daytime
- ✓ **Jan 2014: JPO recommends "discontinue IDPS EDR support, concentrate on ACSPO"**
- ✓ IDPS SST EDR to phase out as soon as ACSPO SST is archived at JPL/NODC

ACSPO – NOAA Advanced Clear-Sky Processor for Ocean (ACSPO)

- ✓ **Jul 2014: JPO approves reallocation of SST Requirements to NDE ACSPO**
- ✓ NOAA heritage SST system (building on AVHRR GAC and FRAC)
- ✓ Terra/Aqua MODIS experimentally processed at STAR since Jan 2012
- ✓ NDE ACSPO: Operational (Mar 2014); GDS2 archived at JPL/NODC (May 2014)
  ftp://podaac-ftp.jpl.nasa.gov/allData/ghrsst/data/GDS2/L2P/VIIRS_NPP/OSPO/
- ✓ Meet/exceed APU specs, provides complete global coverage

NAVO – SEATEMP

- ✓ Builds on NOAA (pre-ACSPO) / NAVO AVHRR heritage
- ✓ VIIRS operational (Mar 2013); GDS2 archived at JPL/NODC (May 2013)
- ✓ Meet/exceed APU specs. Coverage is ~3 smaller compared to ACSPO

Evaluation of VIIRS SST Products

1. One day global analysis – 23 April 2014

All Products Are Continuously Monitored Online

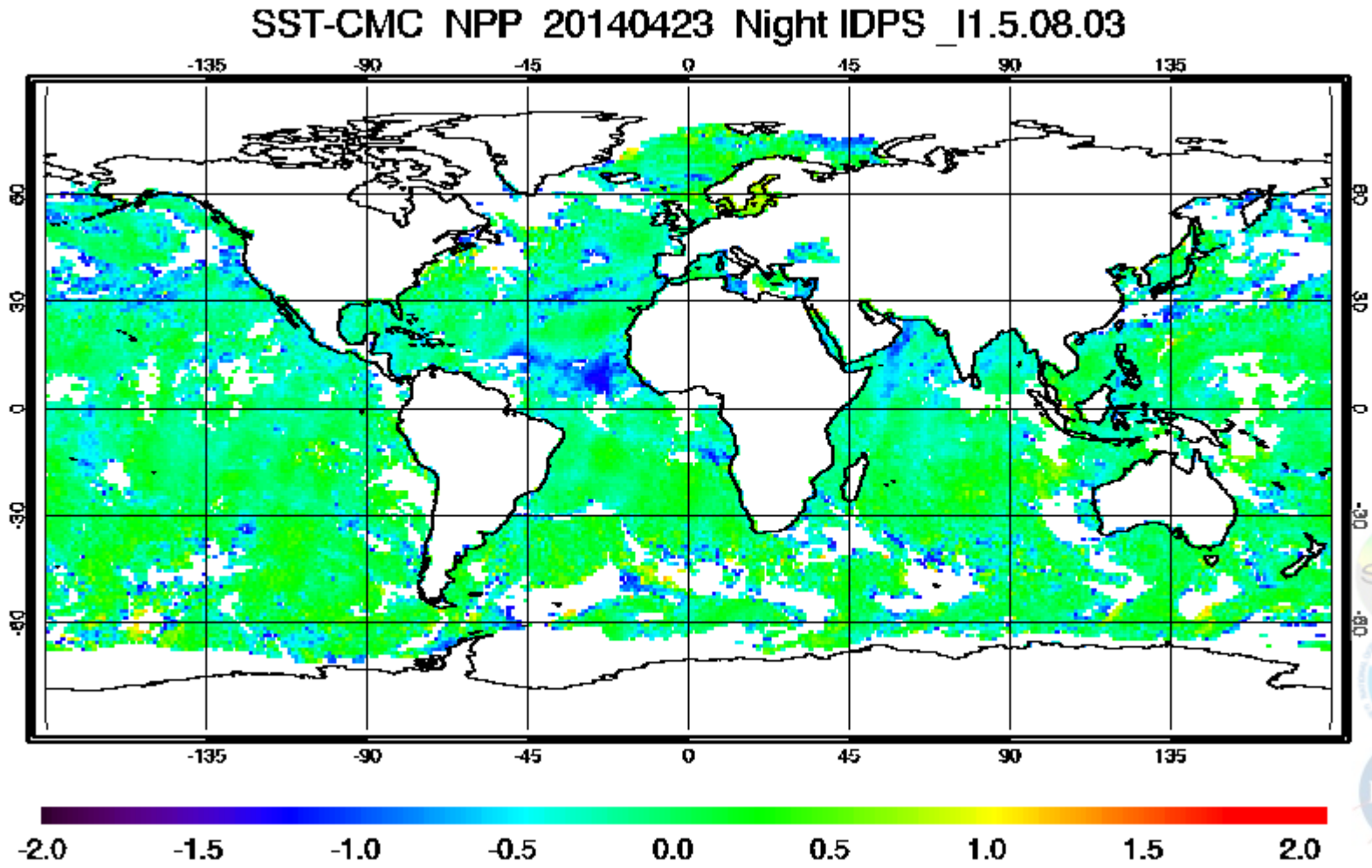
We first compare SST Domain & Performance in **IDPS**, **ACSPO**, **NAVO** against two global reference SSTs

- L4 SST – Canadian Met Centre CMC0.2 Analysis.
- *In situ* SST – QCed drifting buoys in iQuam *www.star.nesdis.noaa.gov/sod/sst/iquam/*

using one day of globally representative data – 23 April 2014 – in SST Quality Monitor (SQUAM) *www.star.nesdis.noaa.gov/sod/sst/squam/*

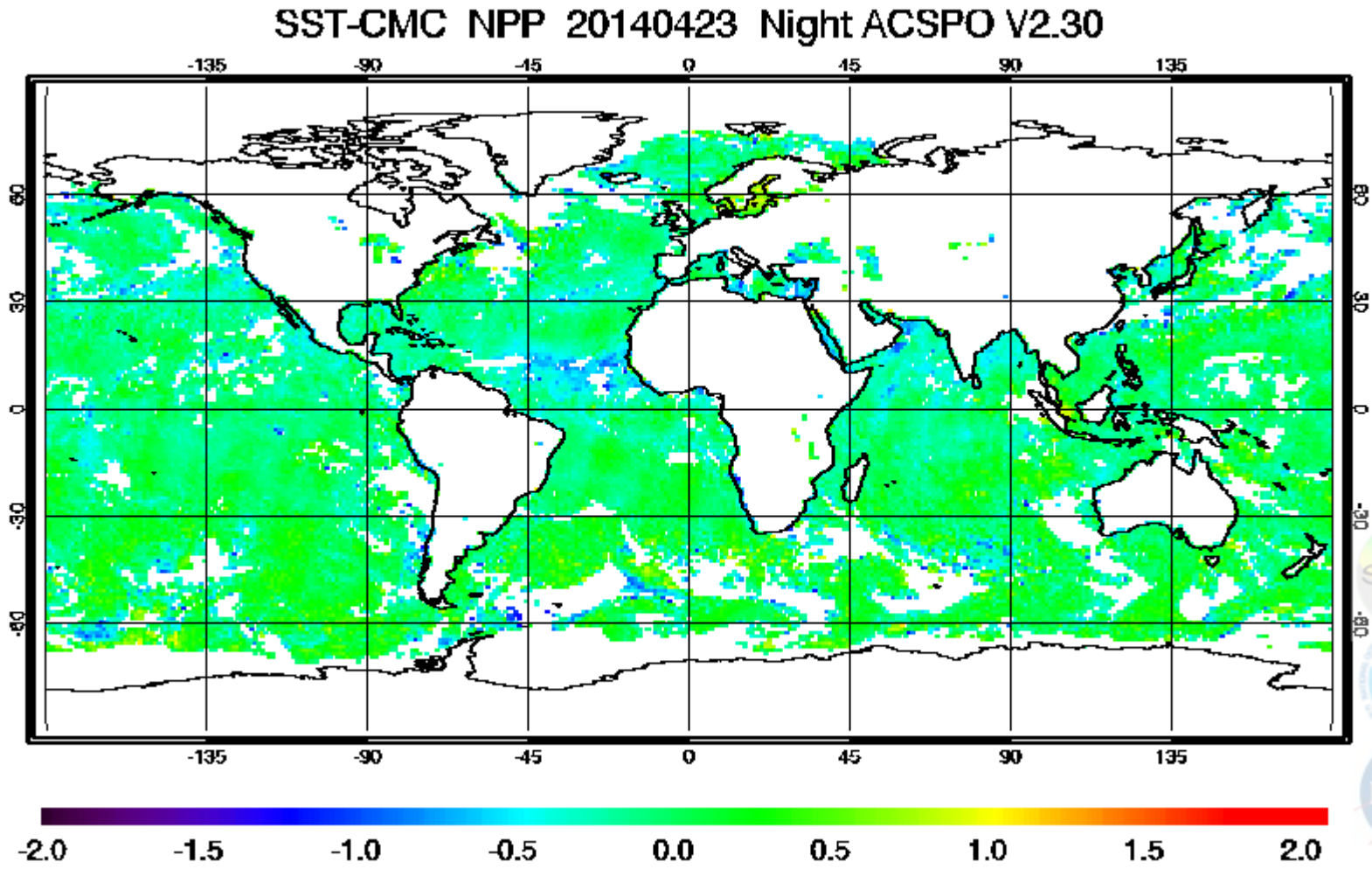
And then discuss corresponding time series

NIGHT: IDPS L2 minus CMC L4
23 April 2014



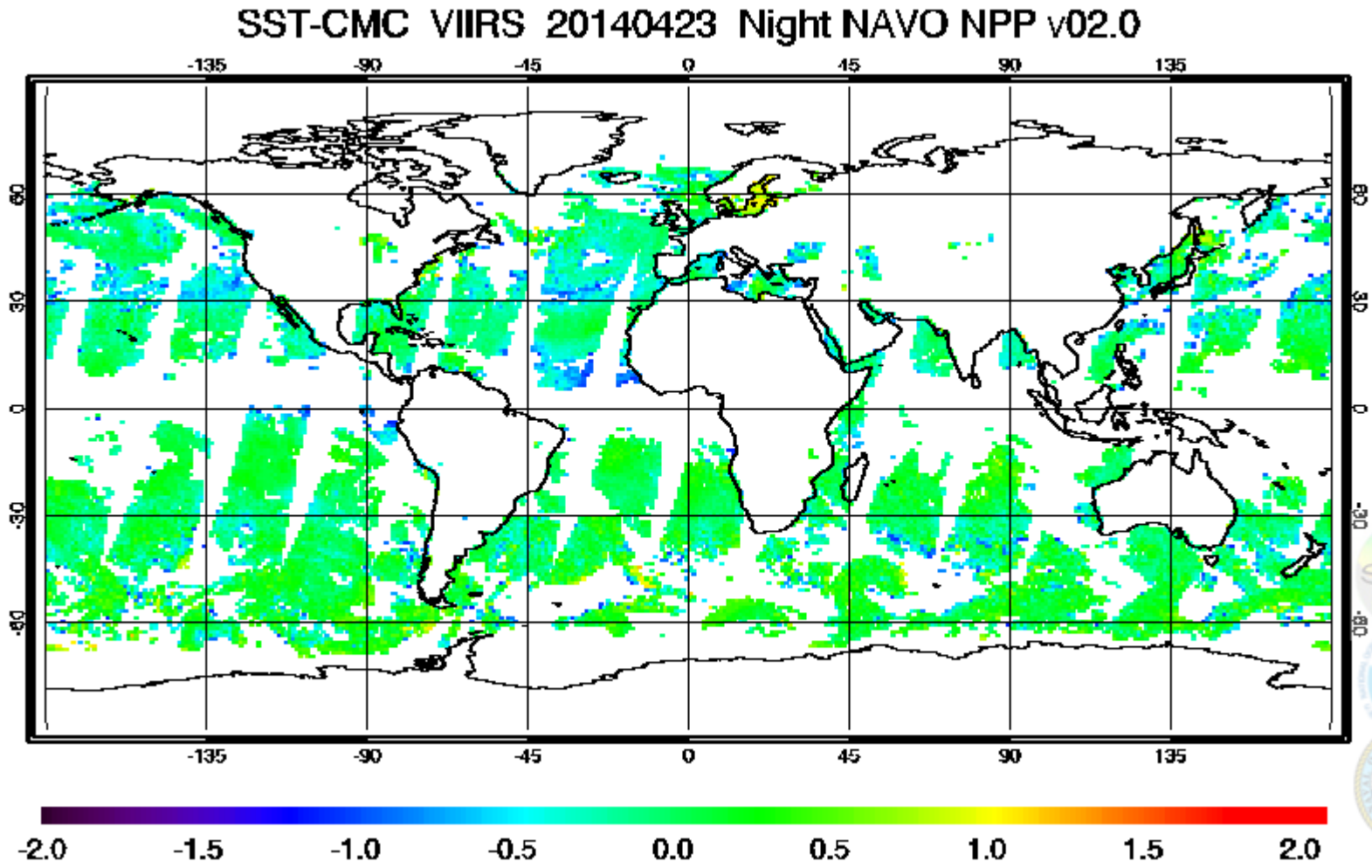
- ***Impressive global coverage***
- ***Delta close to zero as expected***
- ***Cold spots – Residual Cloud/Aerosol leakages***

NIGHT: ACSPO L2 minus CMC L4
23 April 2014



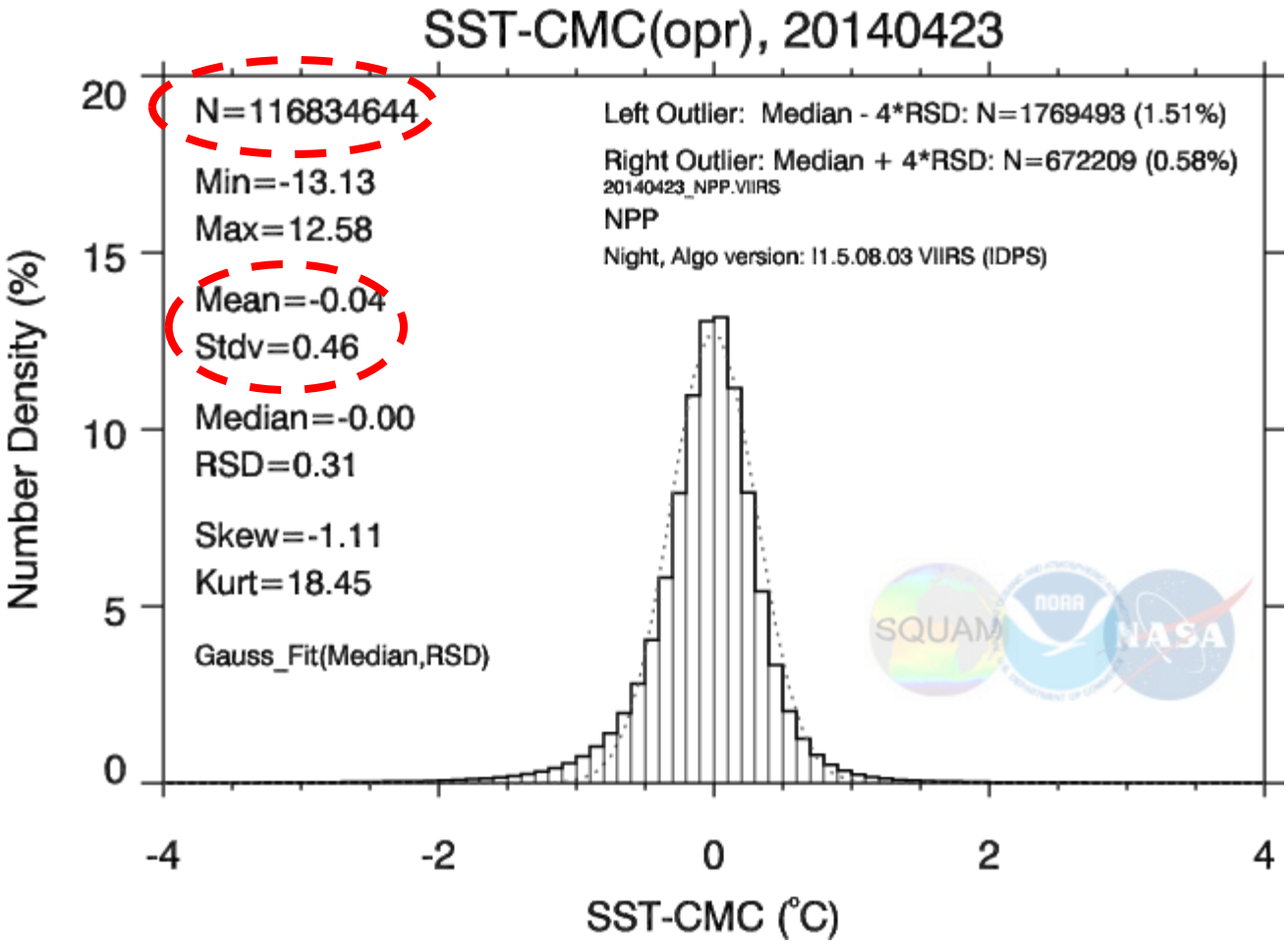
- ***ACSPO coverage comparable with IDPS***
- ***Delta on average closer to zero***
- ***Fewer Cold spots (Cloud/Aerosol leakages)***

NIGHT: NAVO L2 minus OSTIA L4
23 April 2014



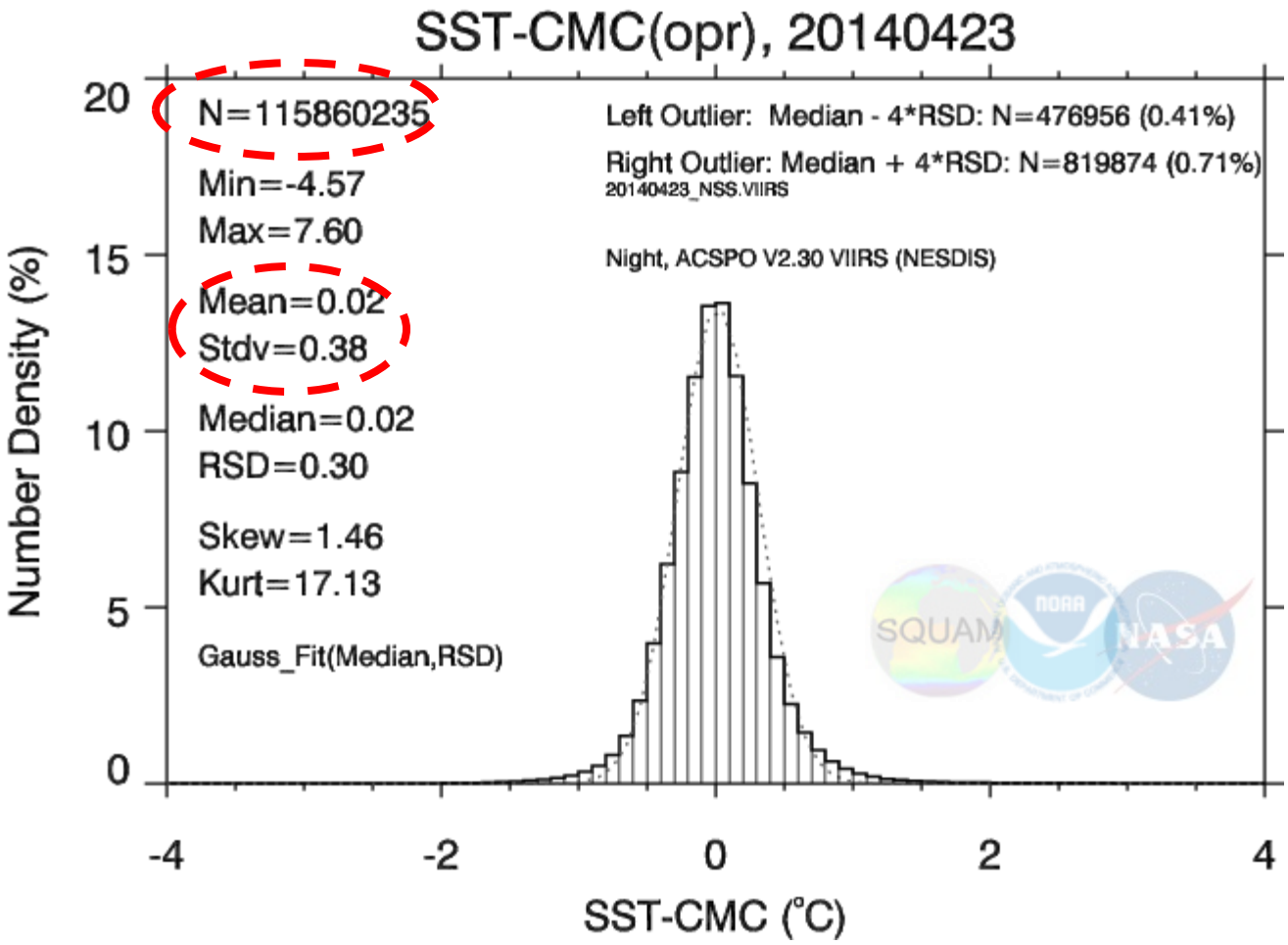
- ***Retrievals limited to VZA<54°***
- ***Fewer data in the Tropics and at high latitudes***

NIGHT: IDPS L2 minus CMC L4
23 April 2014



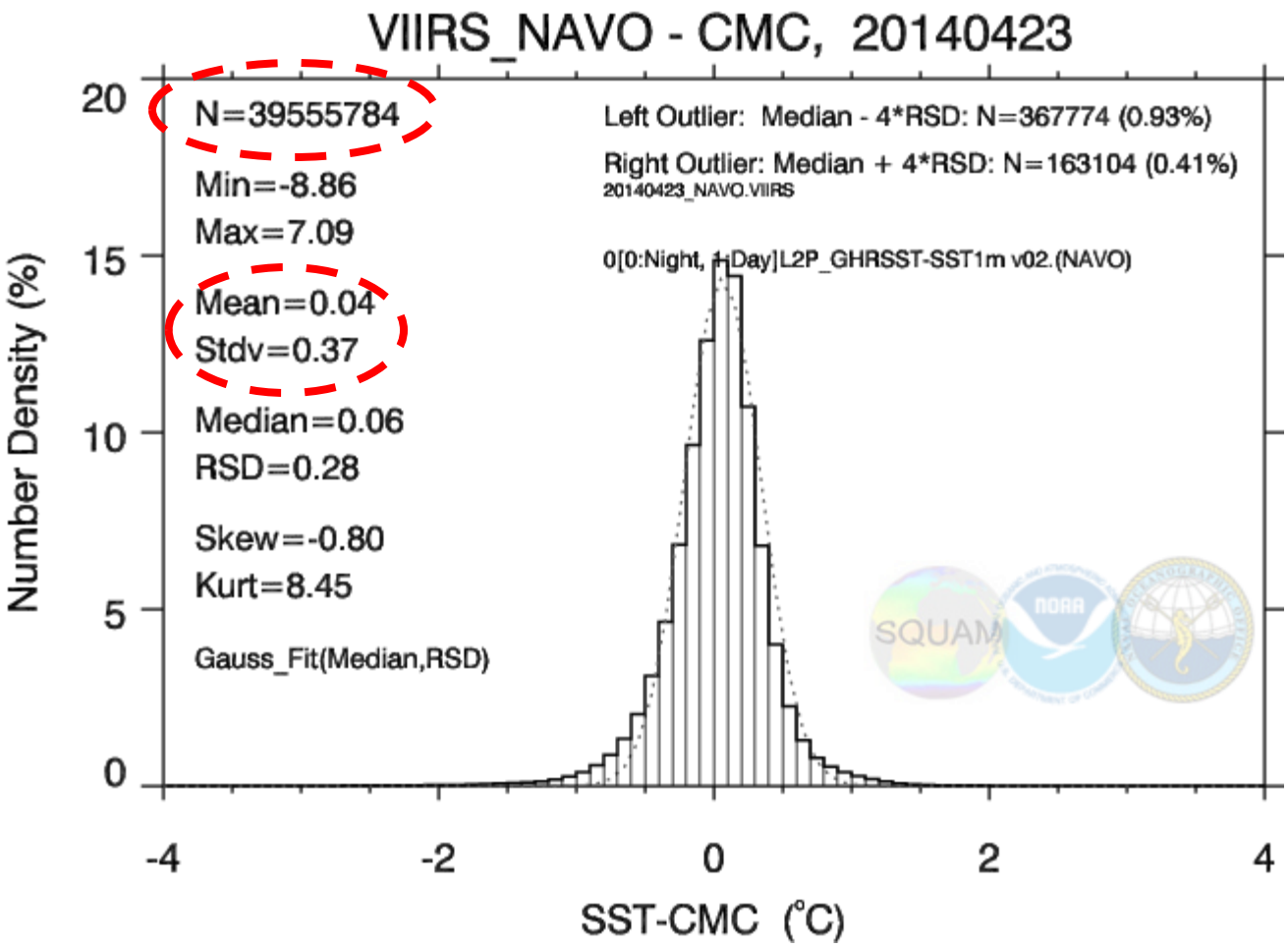
- ***Shape close to Gaussian***
- ***Long tail on the left: Residual Cloud/Aerosol***

NIGHT: ACSPO L2 minus CMC L4
23 April 2014



- ***ACSPO: Shape closer to Gaussian than IDPS***
- ***Tail on the left smaller: Less Cloud/Aerosol***

NIGHT: NAVO L2 minus CMC L4
23 April 2014



- ***Shape close to Gaussian***
- ***Domain smaller, but STD slightly better***

QCed in situ data come from *i*Quam system

NOAA NESDIS STAR

iQUAM *in situ* SST quality monitor v2.0

NOAA / NESDIS / STAR

Monitor Data About

Current Validation standard are drifting buoys
ARGO Floats and Tropical Moorings are being evaluated

- Maps
- Statistics
- Time Series
- Platforms

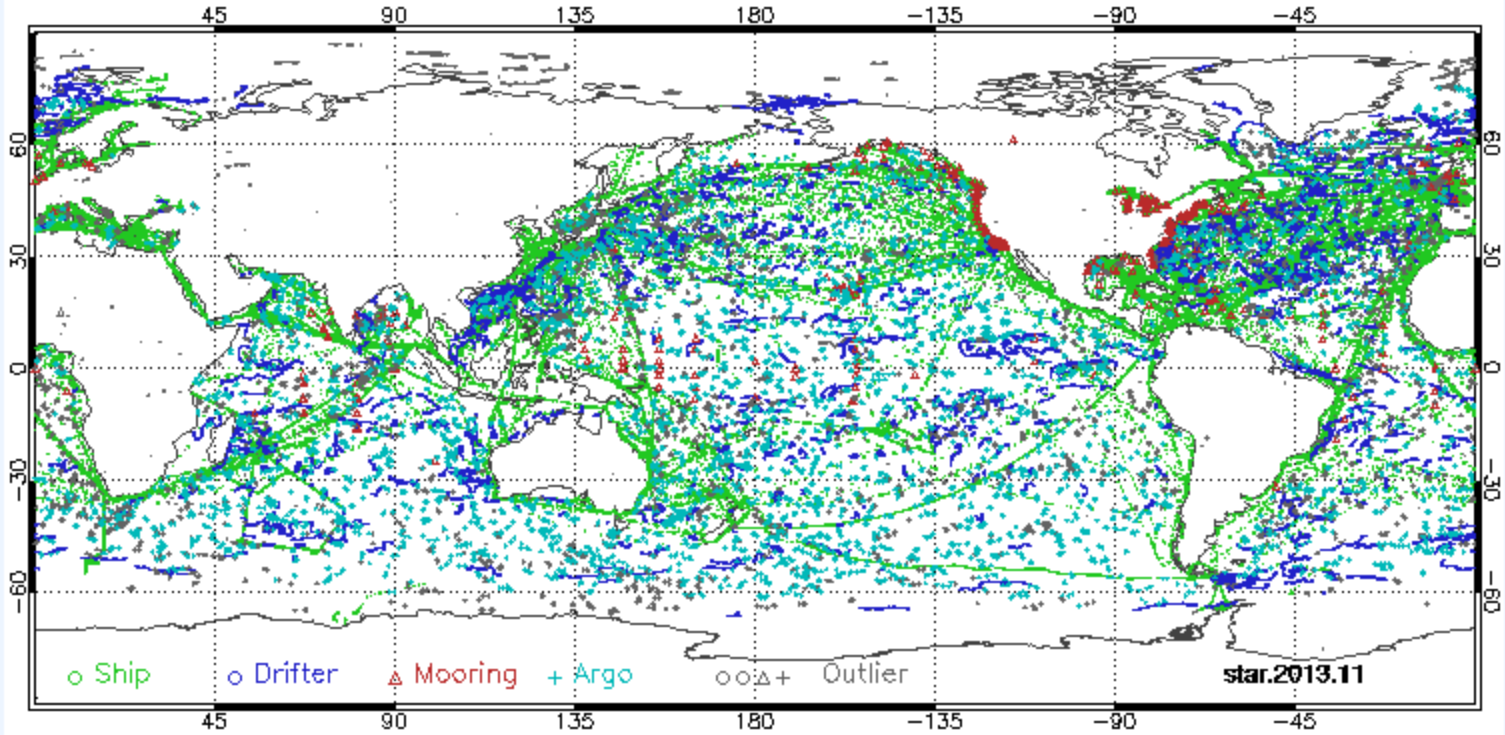
< 11 2013 >

Different platform types are shown in different colors, with obs detected by QC shown in gray. Each symbol stands for one observation.

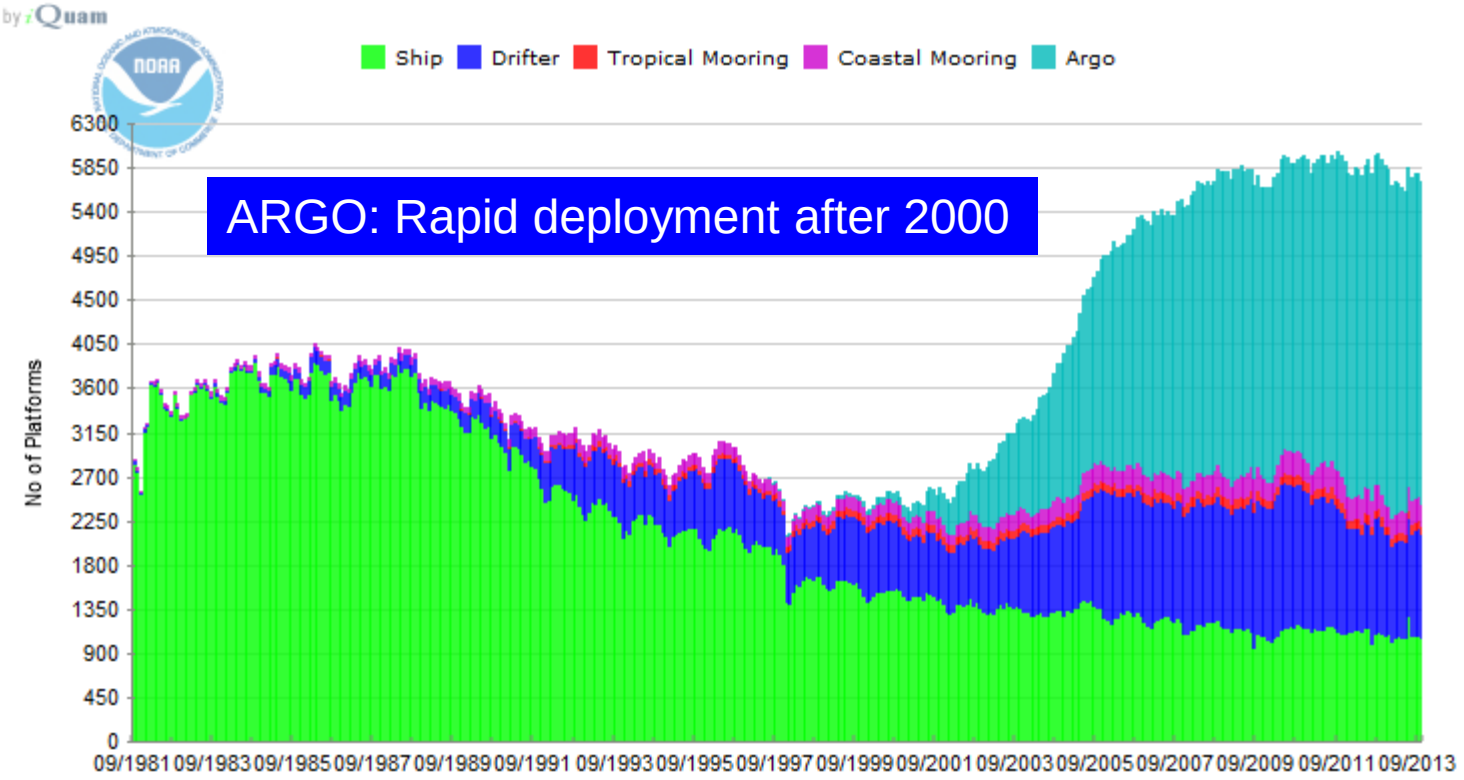
Tropical moorings include TAO/TRITON, PIRATA, RAMA etc. Coastal moorings are all other moorings.

Argo floats data are from USGODAE GDAC ftp site. The shallowest good measurement in 3-8dbar depth range is extracted from each profile.

Global map of measurements

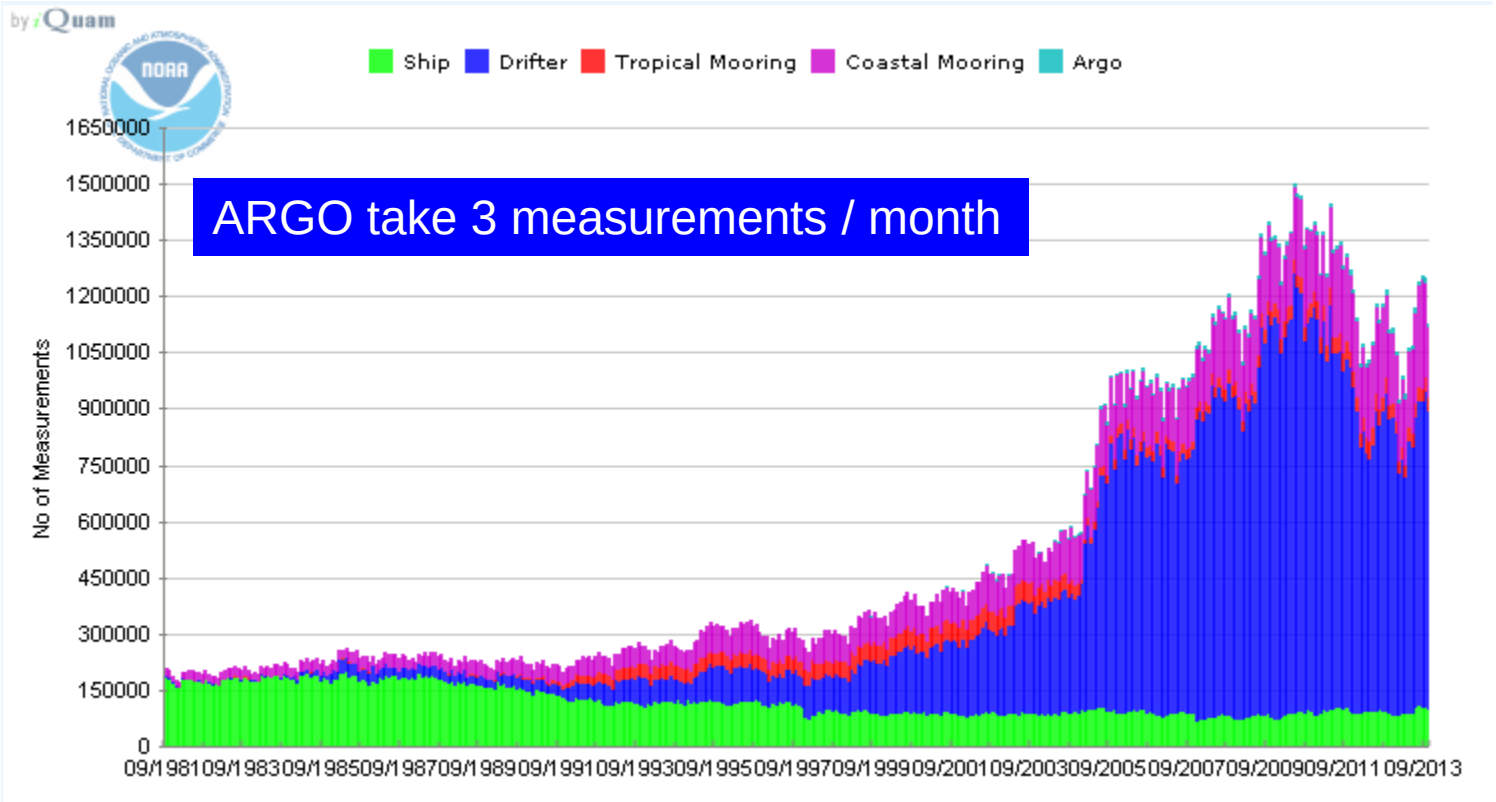


Number of unique IDs



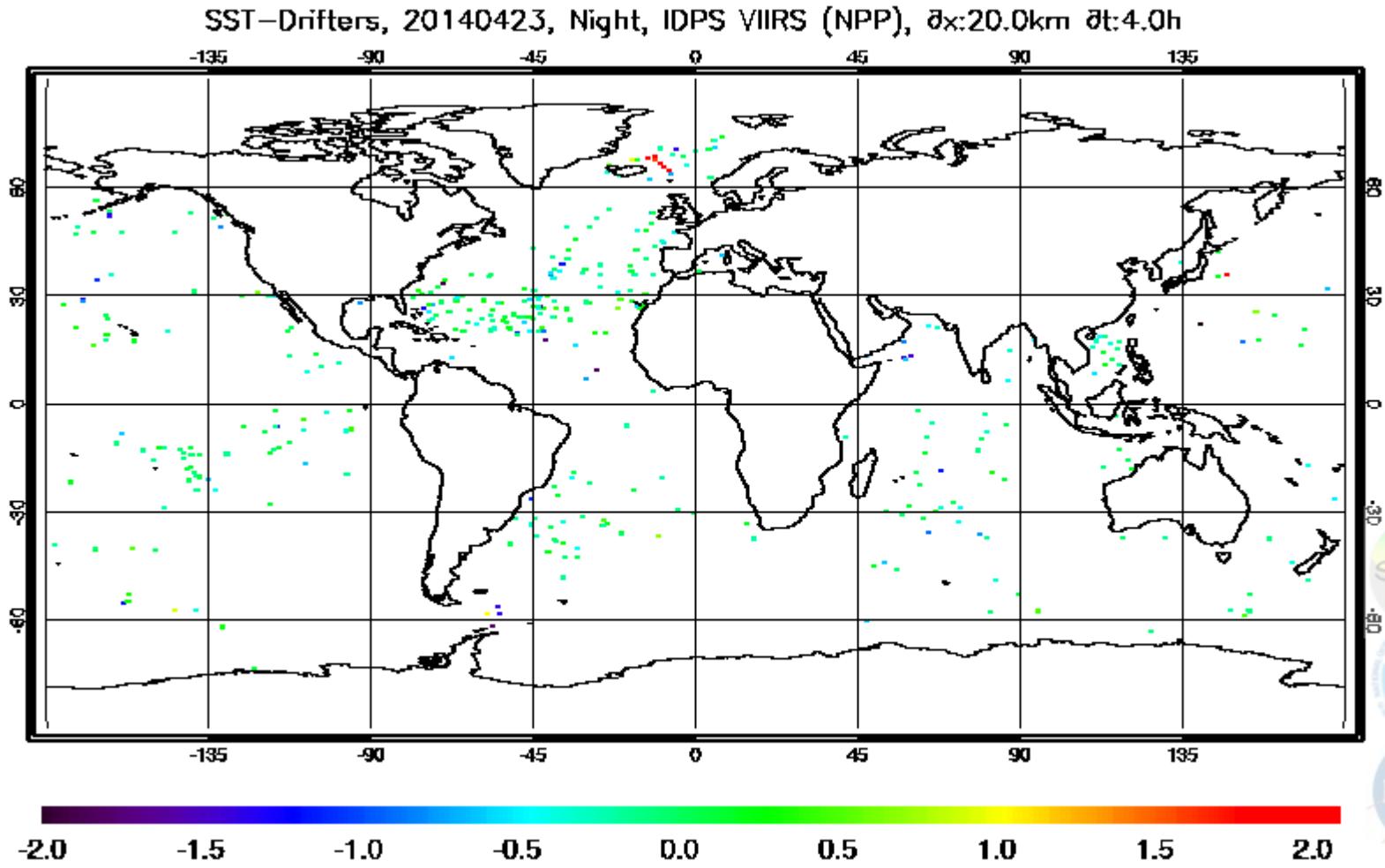
- Current JPSS in situ validation standard are drifting buoys
- ARGO Floats and Tropical Moorings are being evaluated

Number of Observations



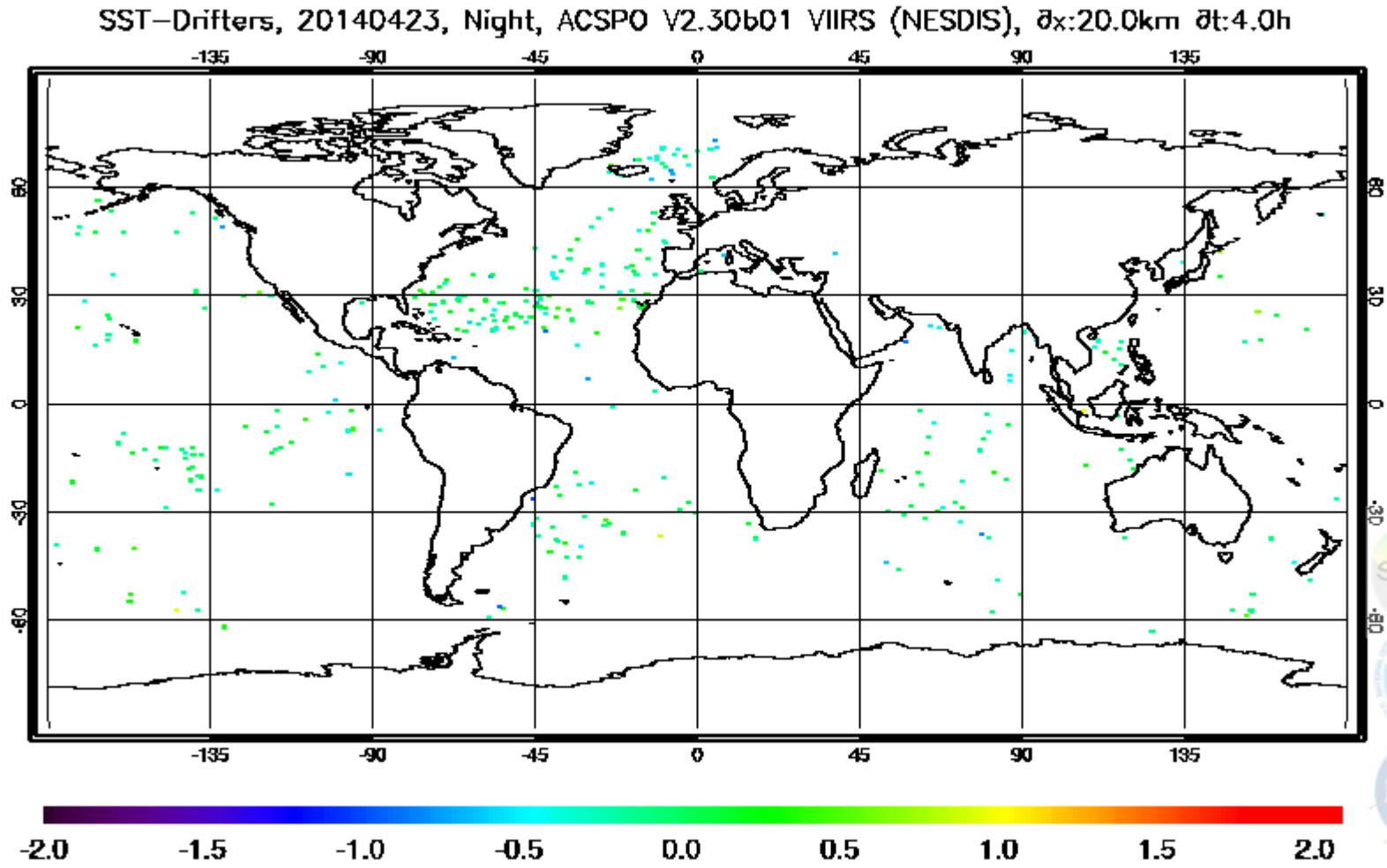
- ARGO Floats take relatively infrequent measurements
- However, they are high quality and provide most uniform global coverage
- Overall, they very well complement data from drifters

NIGHT: IDPS L2 minus *in situ drifter* SST
23 April 2014



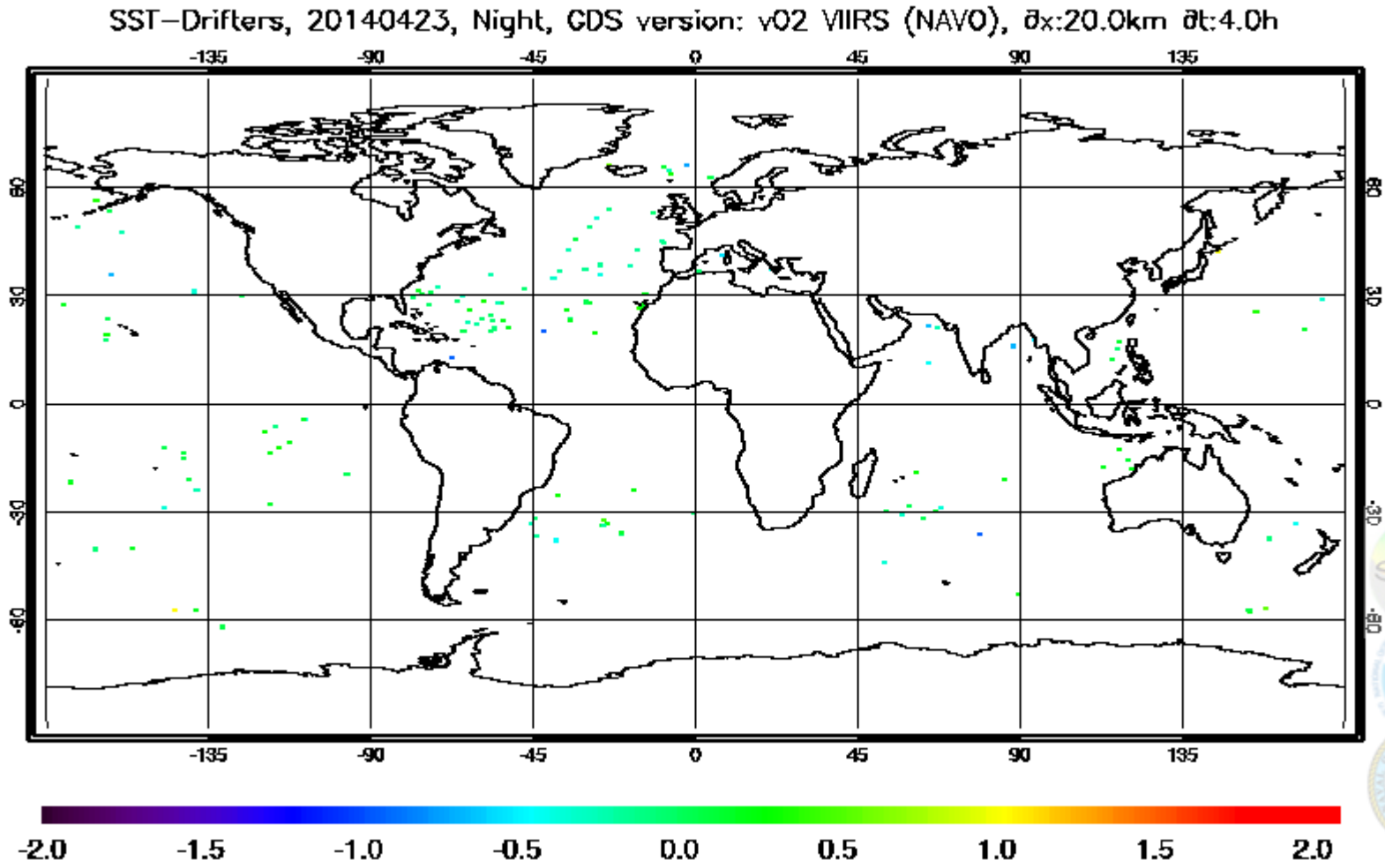
- ***Much sparser coverage than against L4***
- ***Not fully representative of global ocean***

NIGHT: ACSPO L2 minus *in situ drifter* SST
23 April 2014



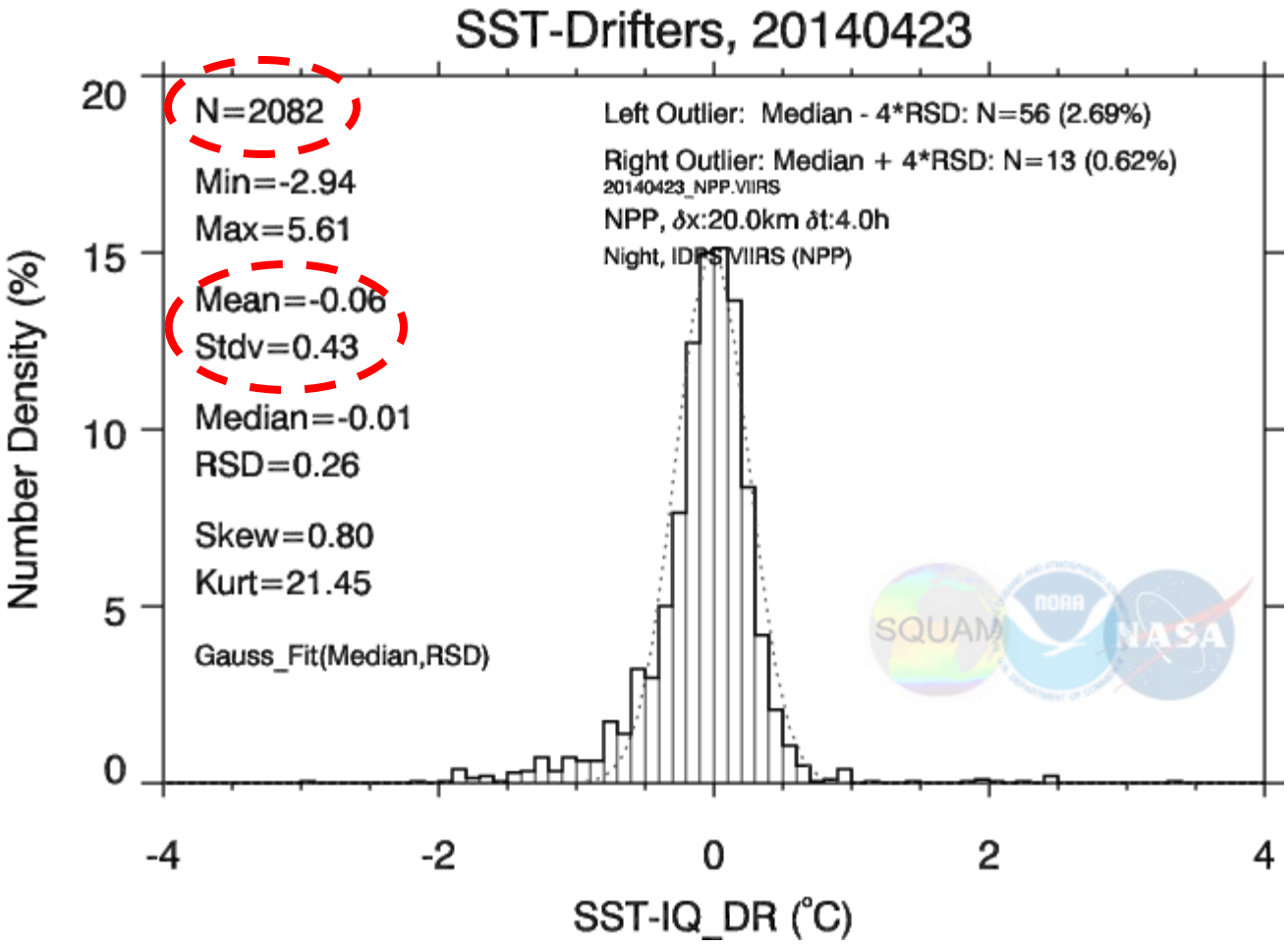
- ***ACSPO match-ups: Comparable with IDPS***
- ***Fewer cold ΔSSTs than in IDPS***

NIGHT: NAVO L2 minus *in situ drifter* SST
23 April 2014



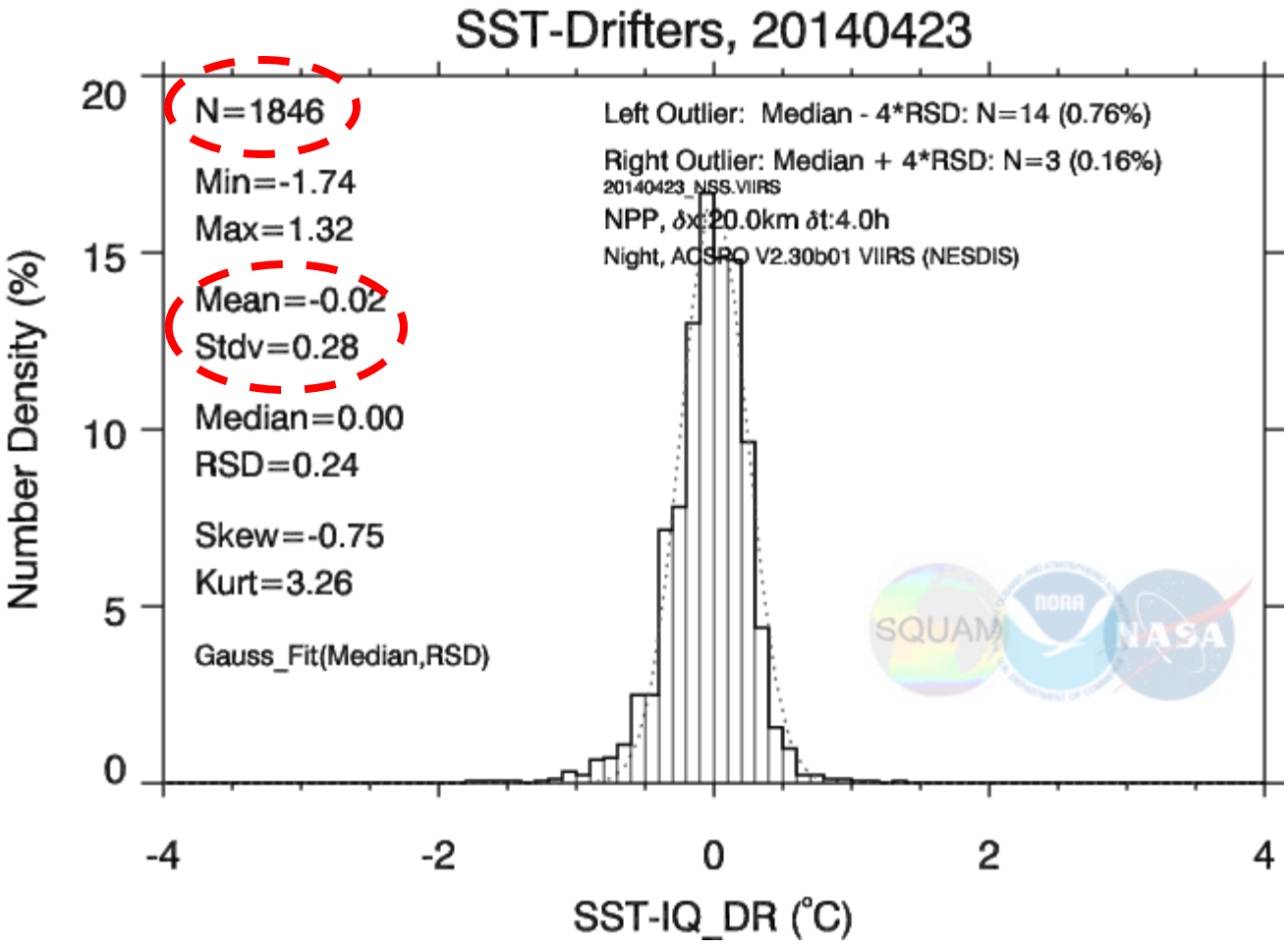
- ***NAVO match-ups much sparser than IDPS/ACSPO***
- ***Similarly to ACSPO, very few cold outliers***

NIGHT: IDPS L2 minus *in situ* SST
23 April 2014



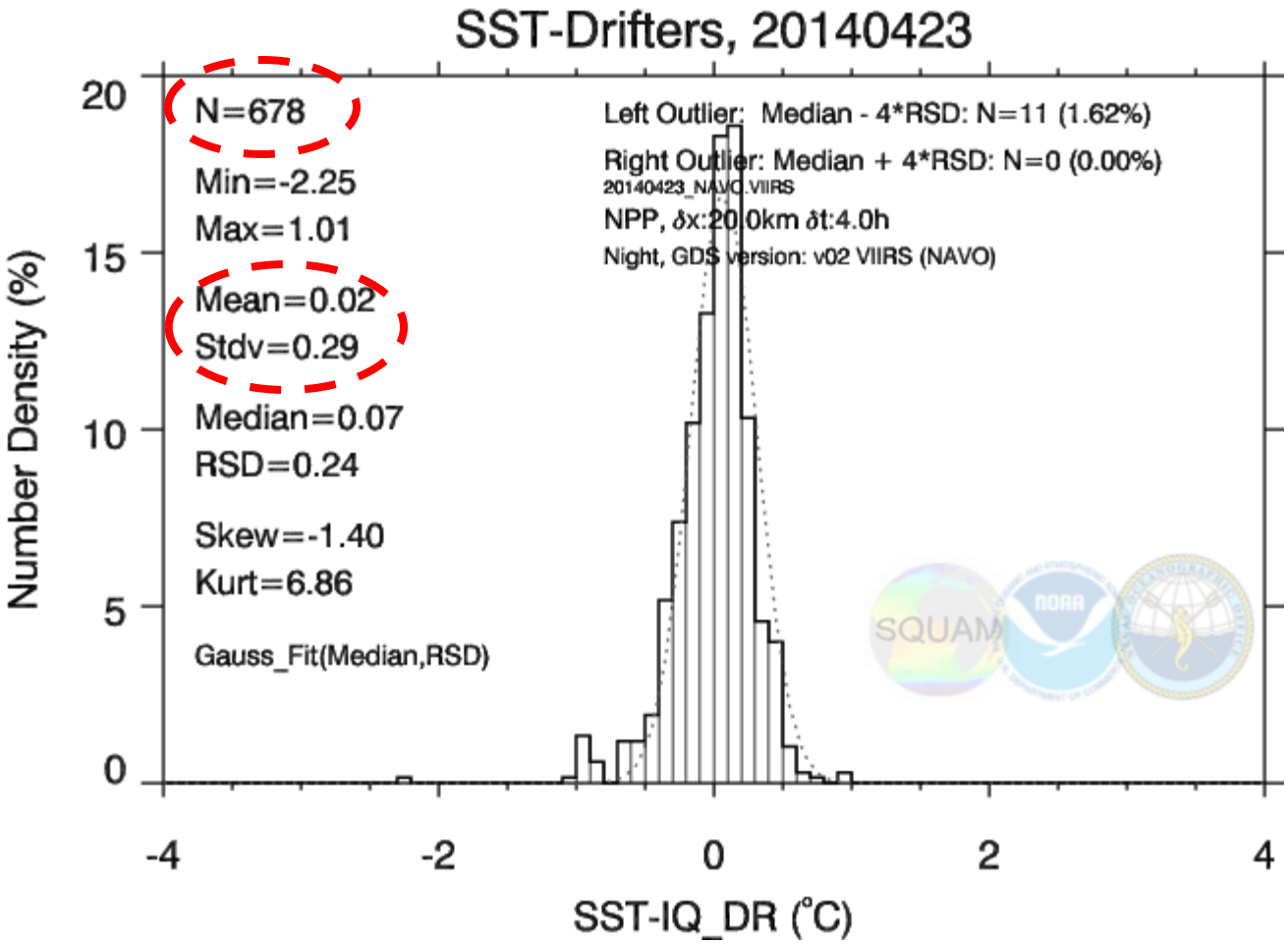
- ***Shape close to Gaussian – except cold tail & positive outliers***
- ***Performance Stats within specs (Bias<0.2K, STD<0.6K)***

NIGHT: ACSPO L2 minus *in situ* SST
23 April 2014



- ***ACSPO: Shape closer to Gaussian than IDPS***
- ***Performance Stats well within specs (Bias<0.2K, STD<0.6K)***

NIGHT: NAVO L2 minus *in situ* SST
23 April 2014



- ***NAVO: Shape close to Gaussian, Performance Stats within specs***
- ***~2.5 fewer matchups compared to ACSPO/IDPS***

NIGHT 23 Apr 2014 – Summary

Vs. L4

ΔT = "VIIRS minus CMC" SST (expected ~0)

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD
IDPS	116.8M (101%)	-13.1/+12.6	-0.04/0.46	-0.00/0.31
ACSPO	115.9M (100%)	- 4.6/+7.6	-0.02/0.38	-0.02/0.30
NAVO	39.5M (34%)	- 8.9/+7.1	+0.04/0.37	+0.06/0.28

- *IDPS: SST domain is +1% larger than ACSPO, All stats degraded*
- *NAVO: SST domain is factor of ×3 smaller than ACSPO, stats improved*

Vs. in situ

ΔT = "VIIRS minus in situ" SST (expected ~0)

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD
IDPS	2,082 (113%)	-2.9/+5.6	-0.06/0.43	-0.01/0.26
ACSPO	1,846 (100%)	-1.7/+1.3	-0.02/0.28	-0.00/0.24
NAVO	678 (37%)	-2.3/+1.0	+0.02/0.29	+0.07/0.24

- *IDPS: SST domain is +13% larger than ACSPO, All stats degraded*
- *NAVO: SST domain is factor of ×3 smaller than ACSPO, stats comparable*

DAY 23 Apr 2014 – Summary

Vs. L4

ΔT = "VIIRS minus CMC" SST (expected ~>0)

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD
IDPS	120.4M (100%)	- 28.7/+10.4	+0.20/0.77	+0.24/0.45
ACSPO	121.0M (100%)	- 5.4/+ 9.2	+0.29/0.59	+0.21/0.41
NAVO	41.3M (34%)	- 8.2/+ 7.5	+0.28/0.56	+0.22/0.40

- *IDPS: SST domain is comparable with ACSPO, All stats degraded*
- *NAVO: SST domain is factor of ×3 smaller than ACSPO, stats comparable*

Vs. in situ

ΔT = "VIIRS minus in situ" SST (expected ~>0)

	NOBS (%ACSPO)	Min/ Max	Mean/ STD	Med/ RSD
IDPS	1,758 (105%)	-5.3/+2.7	-0.06/0.77	+0.10/0.48
ACSPO	1,680 (100%)	-1.4/+2.8	+0.07/0.42	+0.06/0.37
NAVO	510 (30%)	-1.2/+2.1	+0.12/0.35	+0.07/0.35

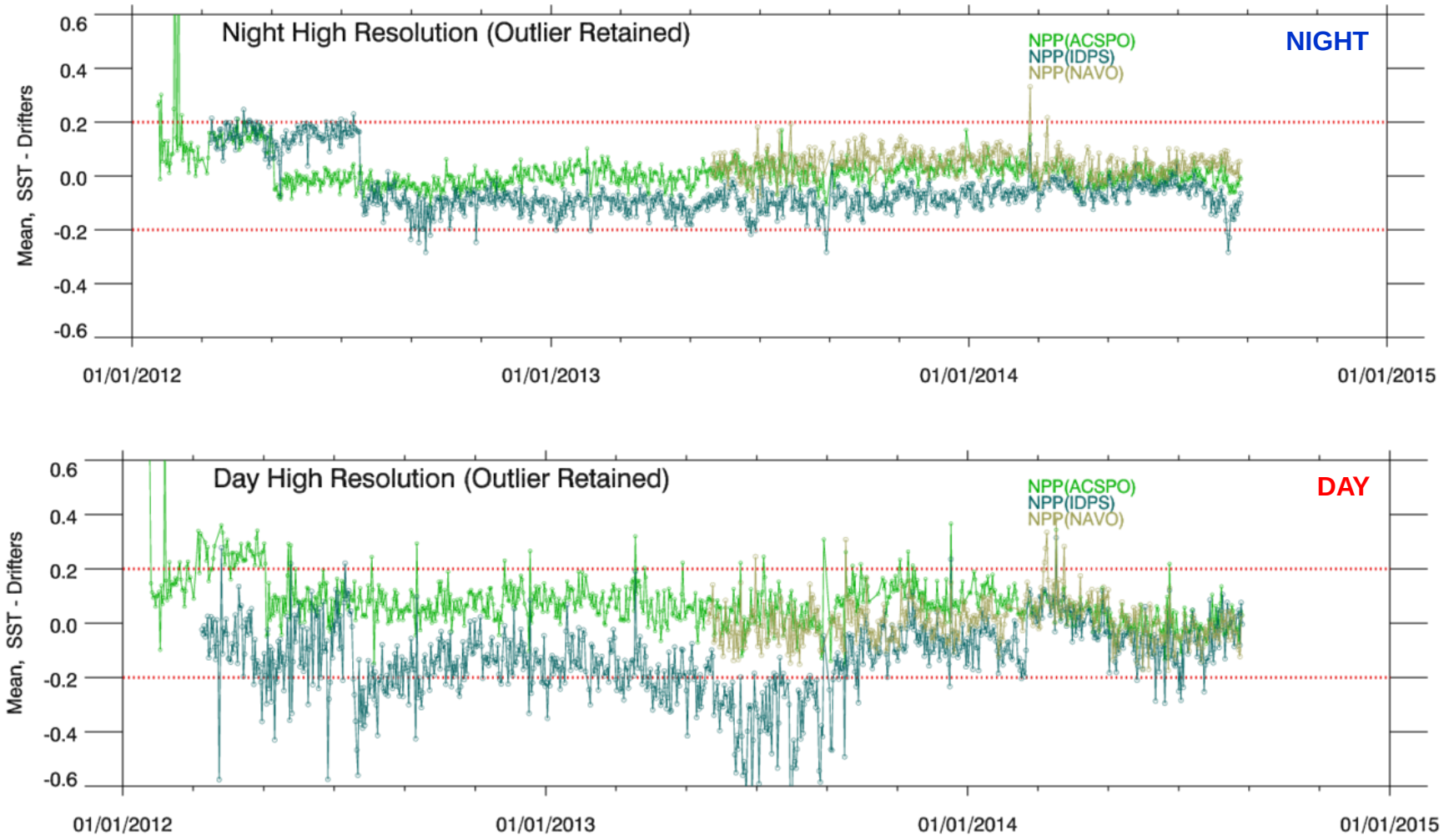
- *IDPS: SST domain is +5% larger than ACSPO, All stats degraded*
- *NAVO: SST domain is factor of ×3 smaller than ACSPO, stats improved*

Evaluation of VIIRS SST Products

2. Time Series of Daily Statistics Jan 2012 - Present

NPP SST Daily Validation: *Mean "VIIRS minus Drifters" SST*

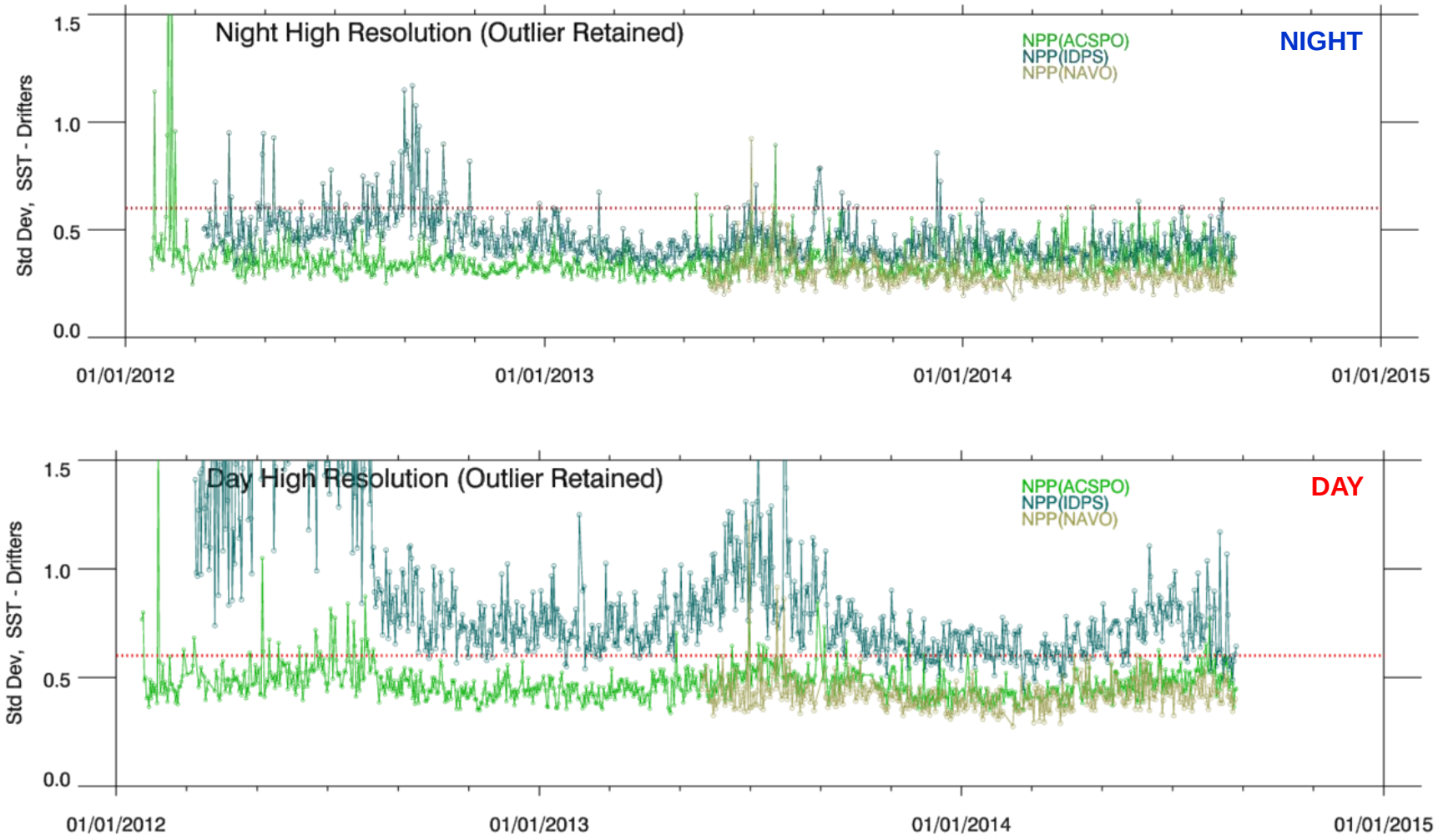
Maps | Histograms | **Time-series** | Dependencies | Hovmöller



- ***ACSPO SST (adjusted by +0.14K for skin-bulk difference) meets accuracy specs ±0.2K***
- ***Bias is closer to 0K at night, and slightly positive during daytime***
- ***This is expected (satellite skin SST more subject to diurnal warming than in situ bulk SST)***

NPP SST Daily Validation: *Std Dev "VIIRS minus Drifters" SST*

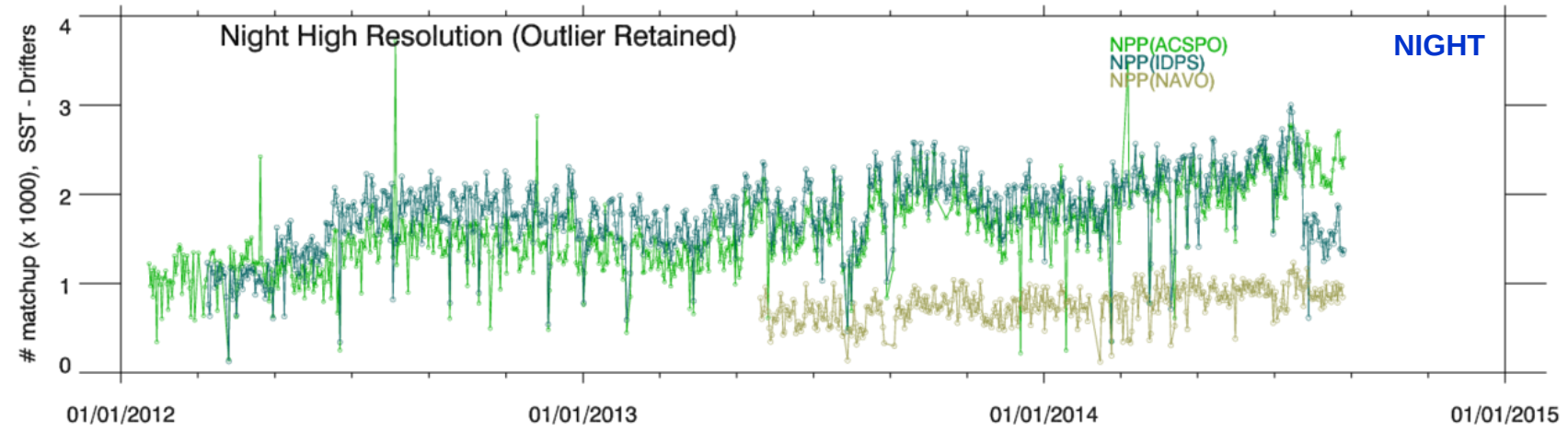
Maps | Histograms | **Time-series** | Dependencies | Hovmöller

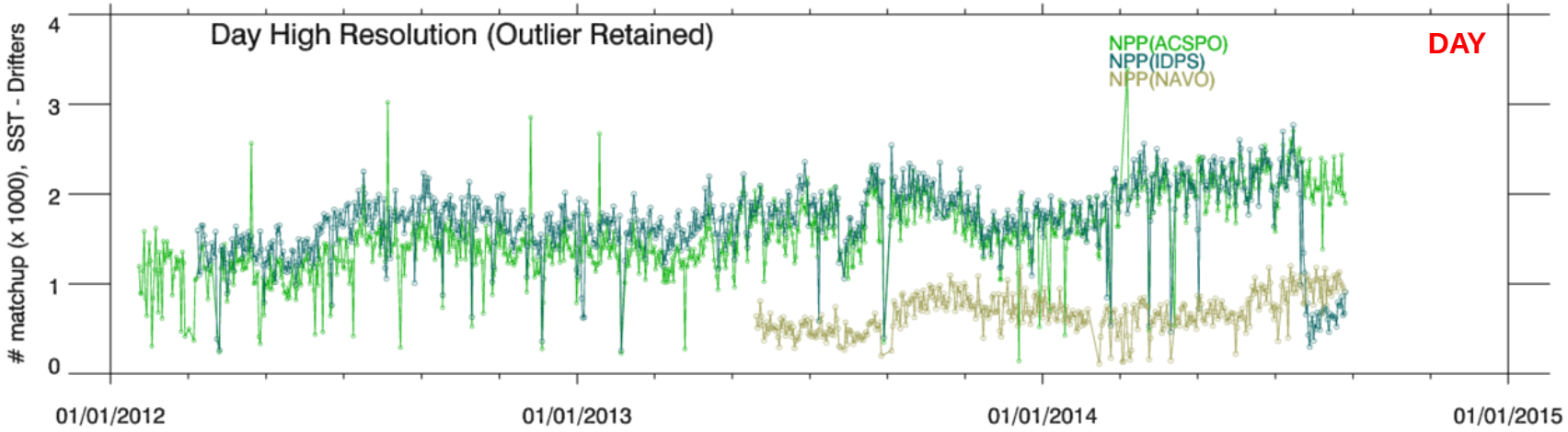


- ***ACSPO SST meets precision specs 0.6K. STD smaller at night, larger during daytime. This is expected because in situ SST is bulk and retrieved SST is skin***
- ***In fact, nighttime STD is deemed to better represent performance of daytime SST***

NPP SST Daily Validation: *# of matchups with Drifters*

Maps | Histograms | **Time-series** | Dependencies | Hovmöller

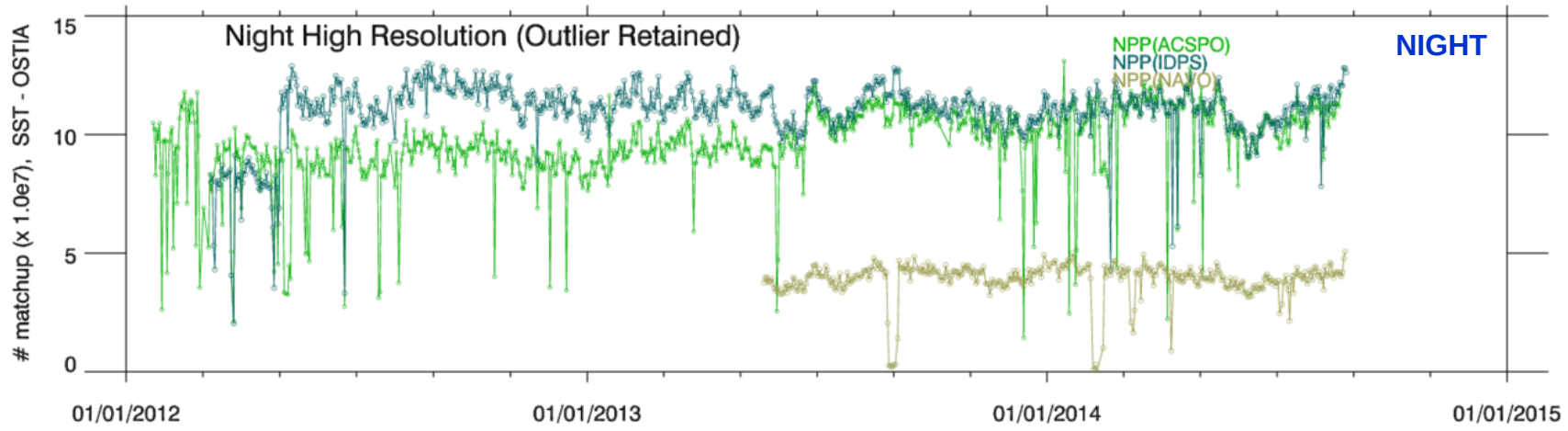


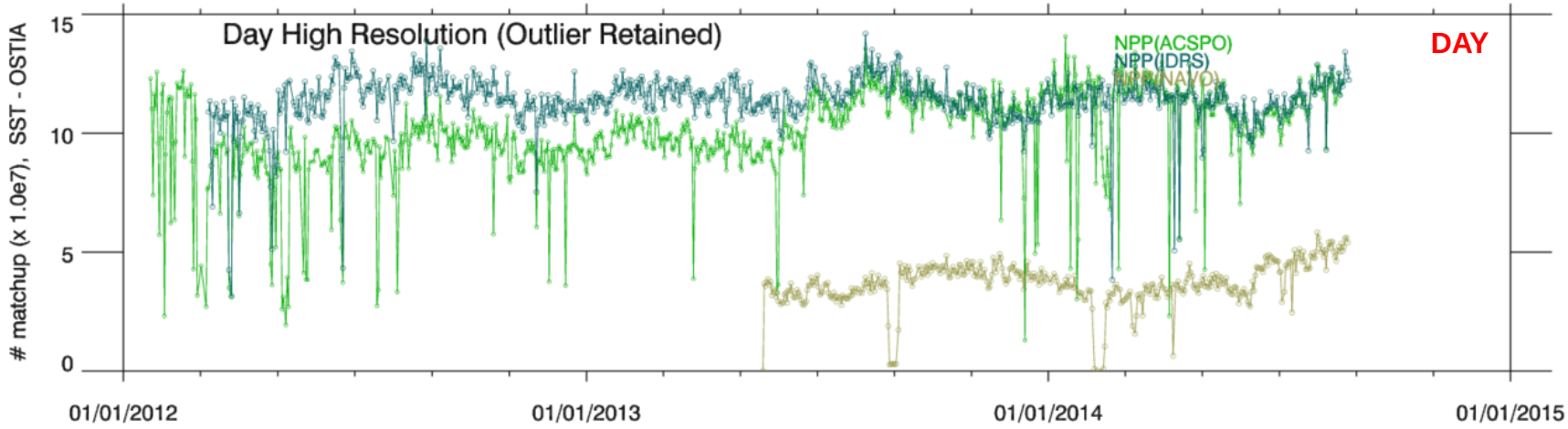


- ***Number of matchups with in situ SST is ~2,000/day and ~2,000/night for ACSPO & IDPS***
- ***For NAVO, number of matchups is ~3 smaller***
- ***Daily number of matchups is sufficient for daily VAL, but residual day-to-day noise remains***

NPP SST Daily Validation: # *of matchups with OSTIA*

Maps | Histograms | **Time-series** | Dependencies | Hovmöller





- ***Number of VIIRS SST retrievals is >100M/day and >100M/night for ACSPO & IDPS***
- ***For NAVO, number of SST retrievals is ~3 smaller***
- ***Drop-outs in # Obs is due to VIIRS outages & processing at STAR (improved in NDE)***

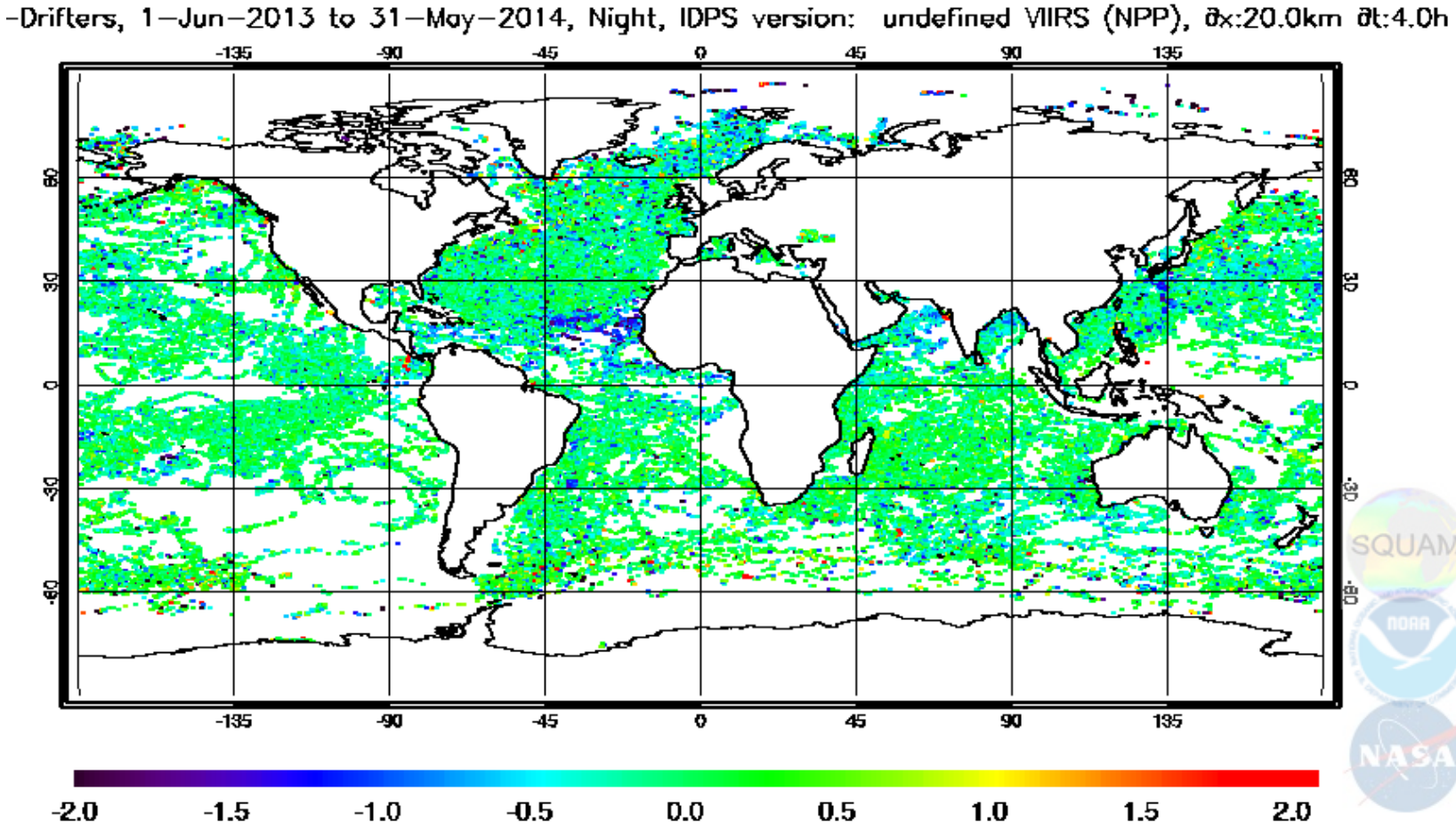
Evaluation of VIIRS SST Products

3. Yearly Statistics
1 June 2013 – 31 May 2014

NPP SST Annual Validation: Night IDPS

Maps | Histograms | Time-series | Dependencies | Hovmöller

IDPS VIIRS *minus* Drifters, 1-Jun-2013 to 31-May-2014

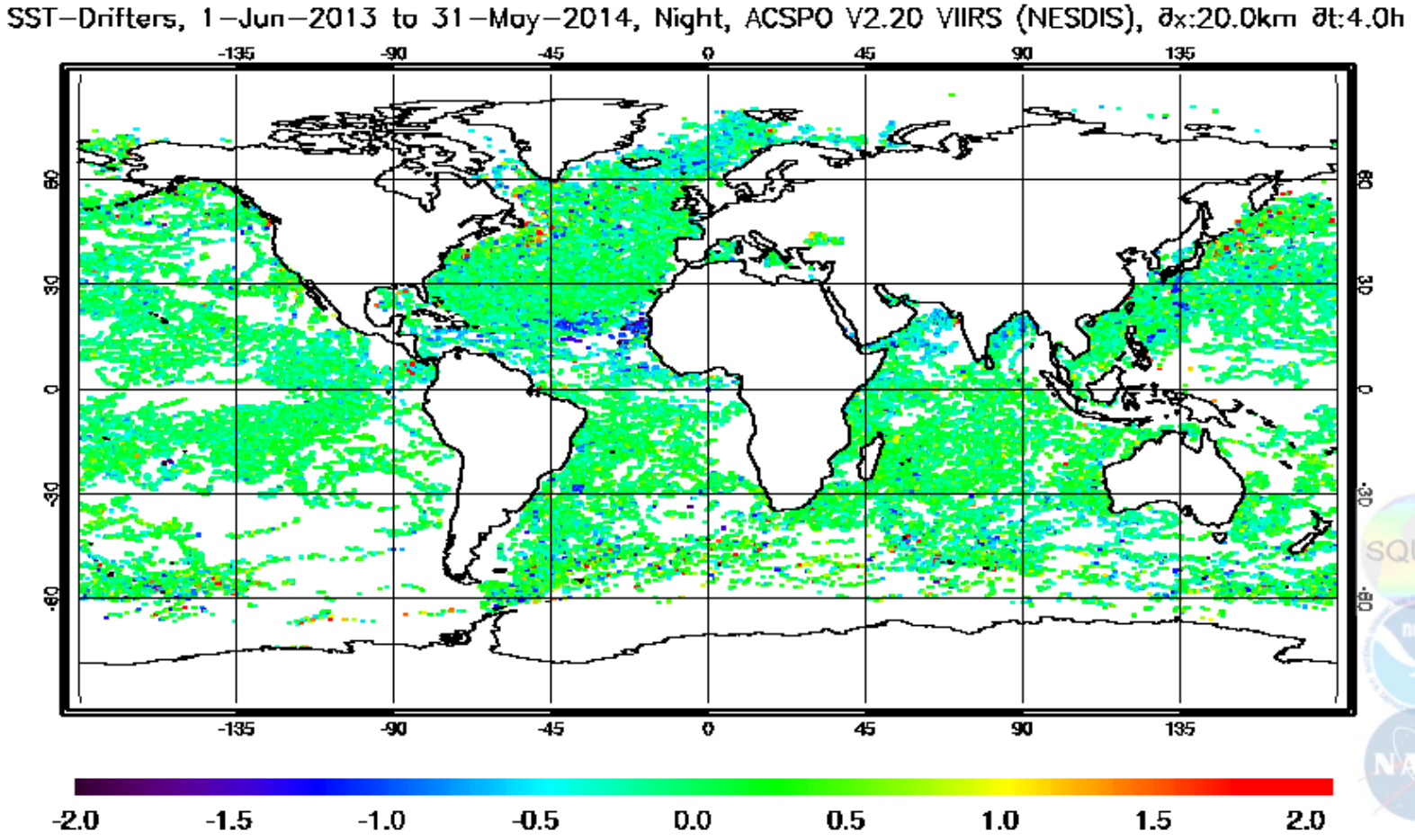


- IDPS match-ups cover most global ocean, except a few “white spots”
- Cold speckles, suppression off Africa: Due to residual Cloud/Aerosols

NPP SST Annual Validation: Night ACSPO

Maps | Histograms | Time-series | Dependencies | Hovmöller

ACSPO VIIRS *minus* Drifters, 1-Jun-2013 to 31-May-2014

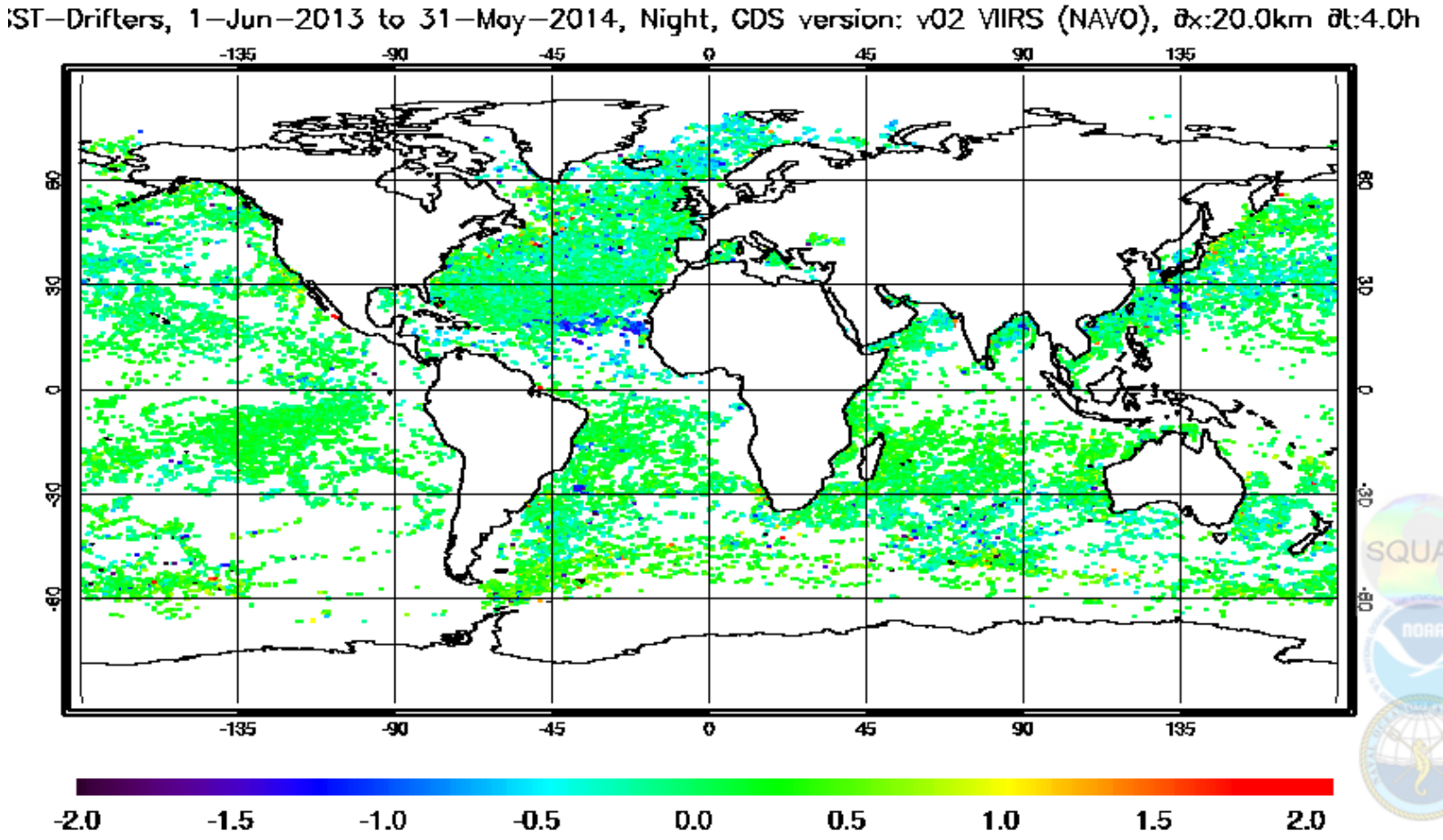


- ACSPO: Similar coverage to IDPS
- Fewer speckles, less suppression: Less residual Cloud/Aerosols

NPP SST Annual Validation: Night NAVO

Maps | Histograms | Time-series | Dependencies | Hovmöller

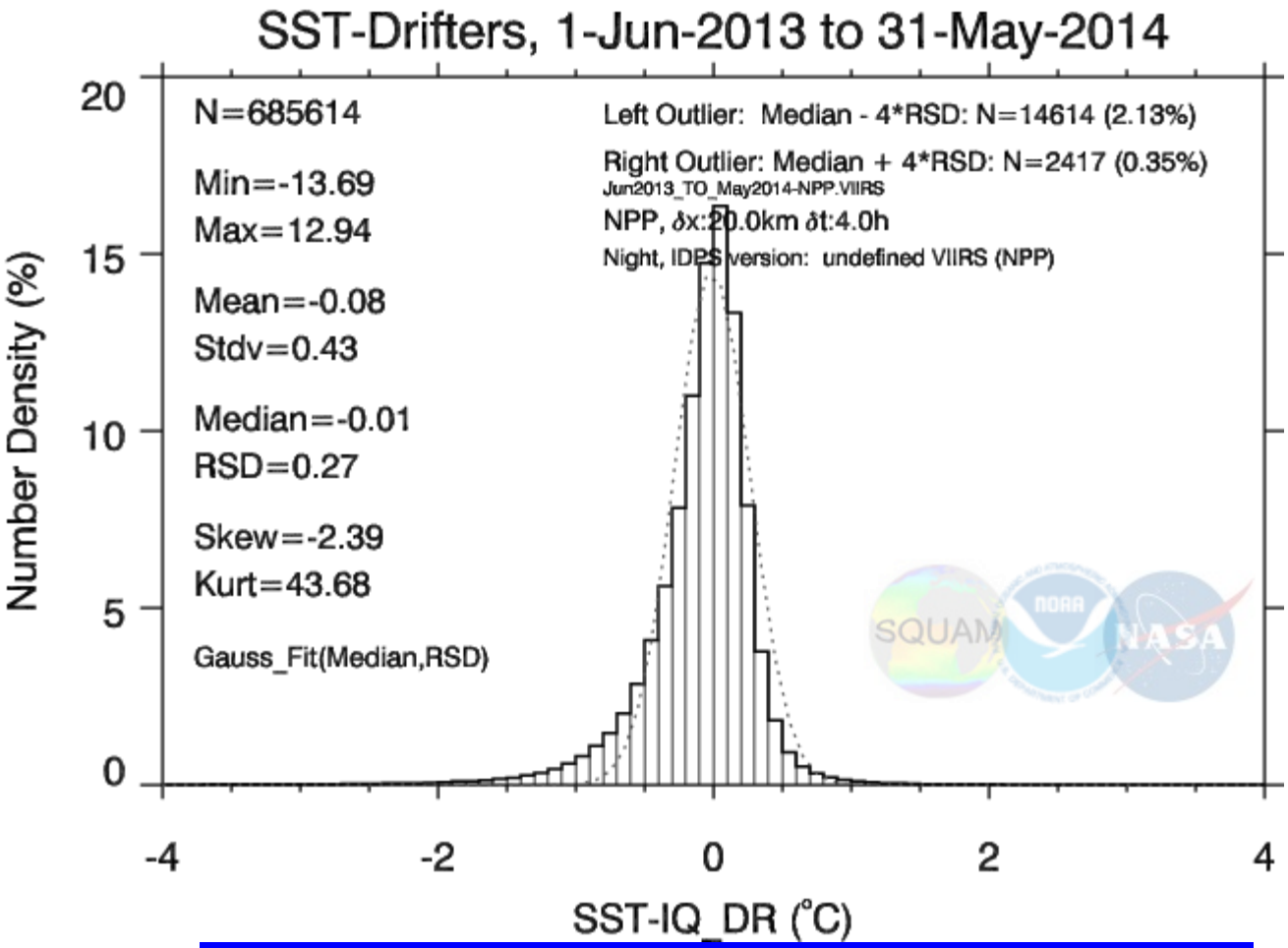
NAVO VIIRS *minus* Drifters, 1-Jun-2013 to 31-May-2014



- NAVO coverage sparser than IDPS/ACSPO
- Fewer speckles, less suppression: Less residual Cloud/Aerosols

NPP SST Annual Validation: Night IDPS

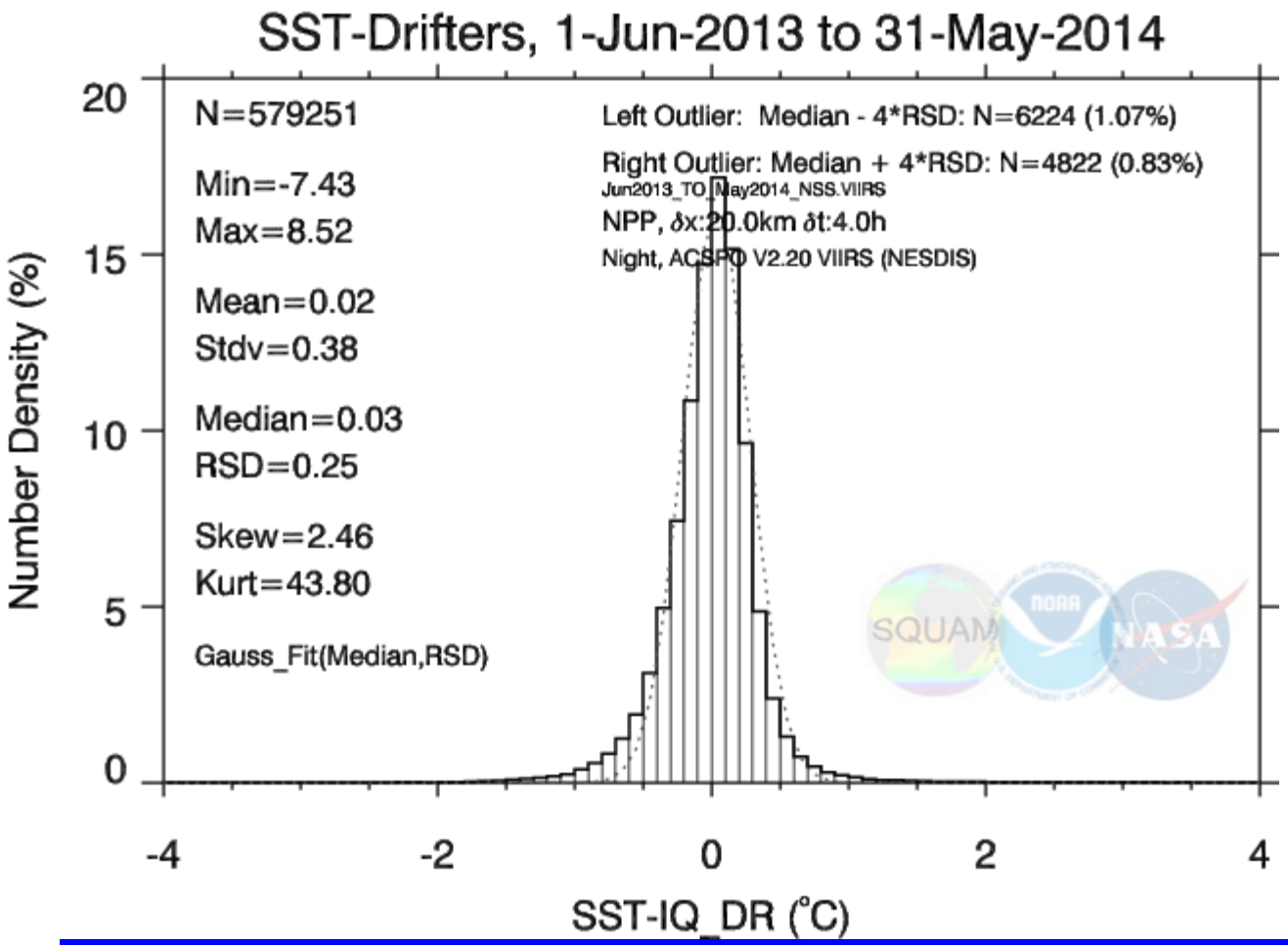
Maps | Histograms | Time-series | Dependencies | Hovmöller



- IDPS histogram: Biased & Skewed negatively
- IDPS product meets specs at night

NPP SST Annual Validation: Night ACSPO

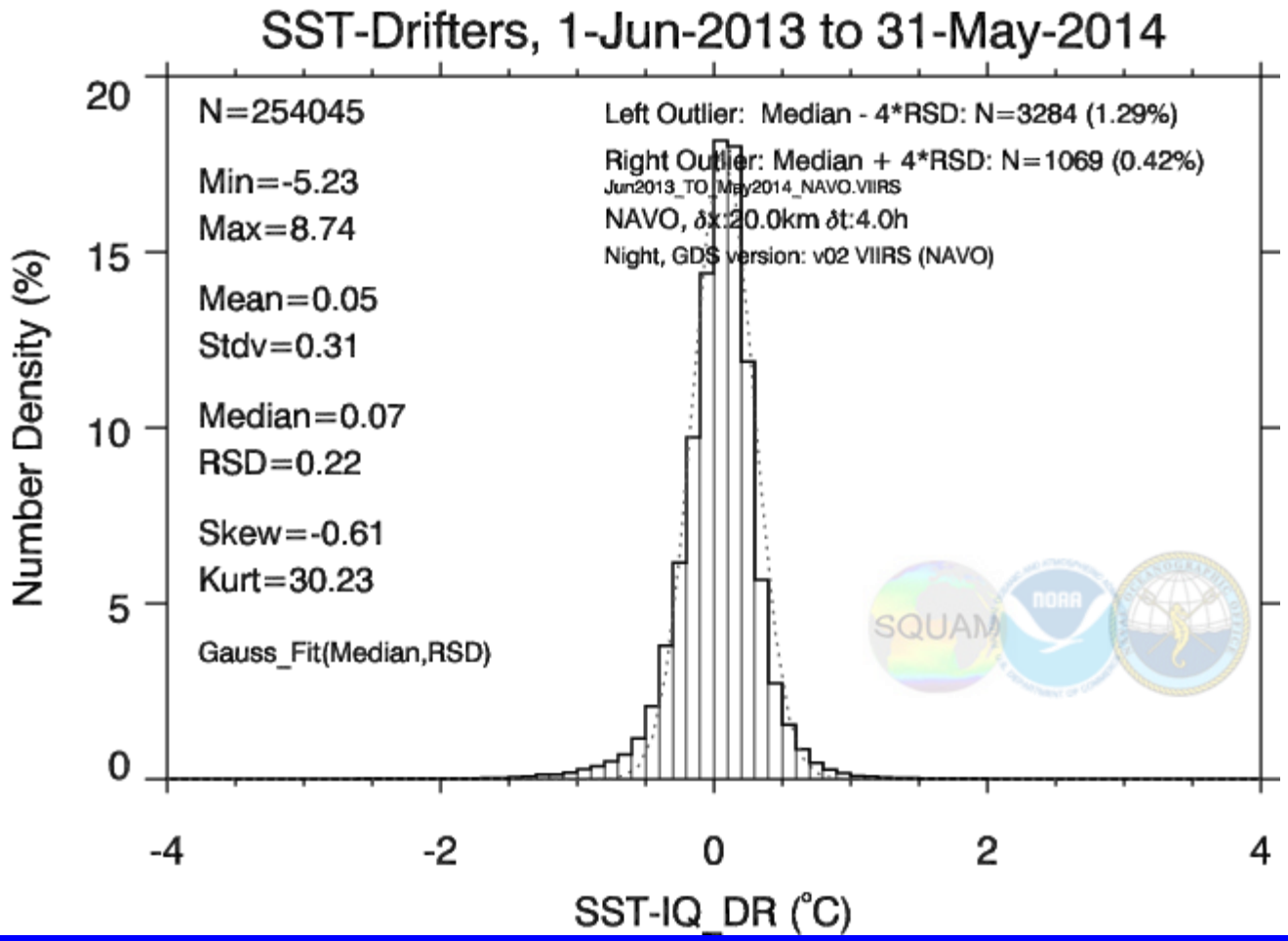
Maps | Histograms | Time-series | Dependencies | Hovmöller



- ACSPO: Fewer matchups, Reduced Bias / Skew / STD
- Meets specs by a wider margin than IDPS

NPP SST Annual Validation: Night NAVO

Maps | Histograms | Time-series | Dependencies | Hovmöller

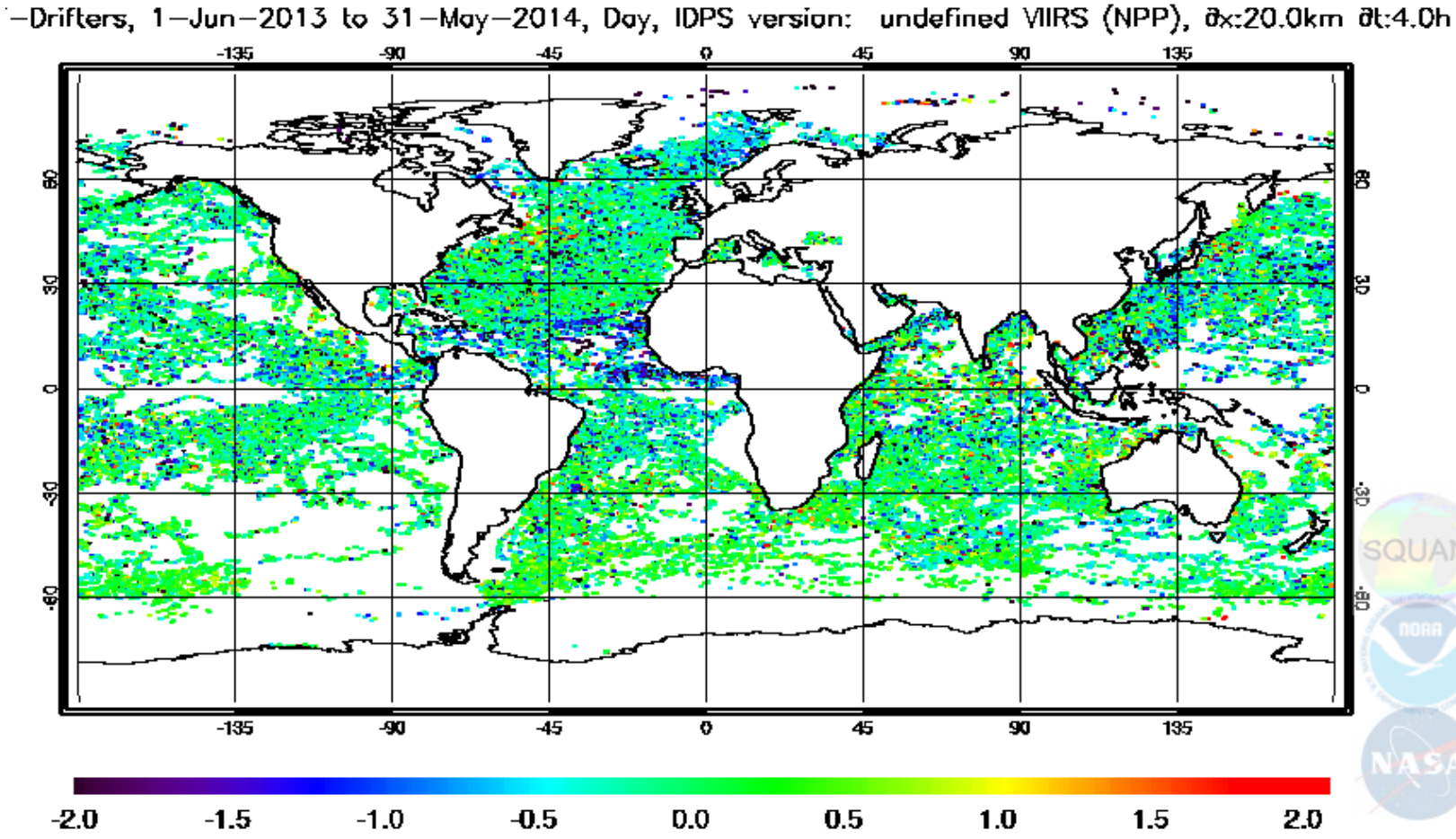


- NAVO: fewer matchups, reduced Bias / Skew / STD
- Meets specs by even wider margin, but in a ~2.5 smaller sample

NPP SST Validation: Day IDPS

Maps | Histograms | Time-series | Dependencies | Hovmöller

IDPS VIIRS *minus* Drifters, 1-Jun-2013 to 31-May-2014

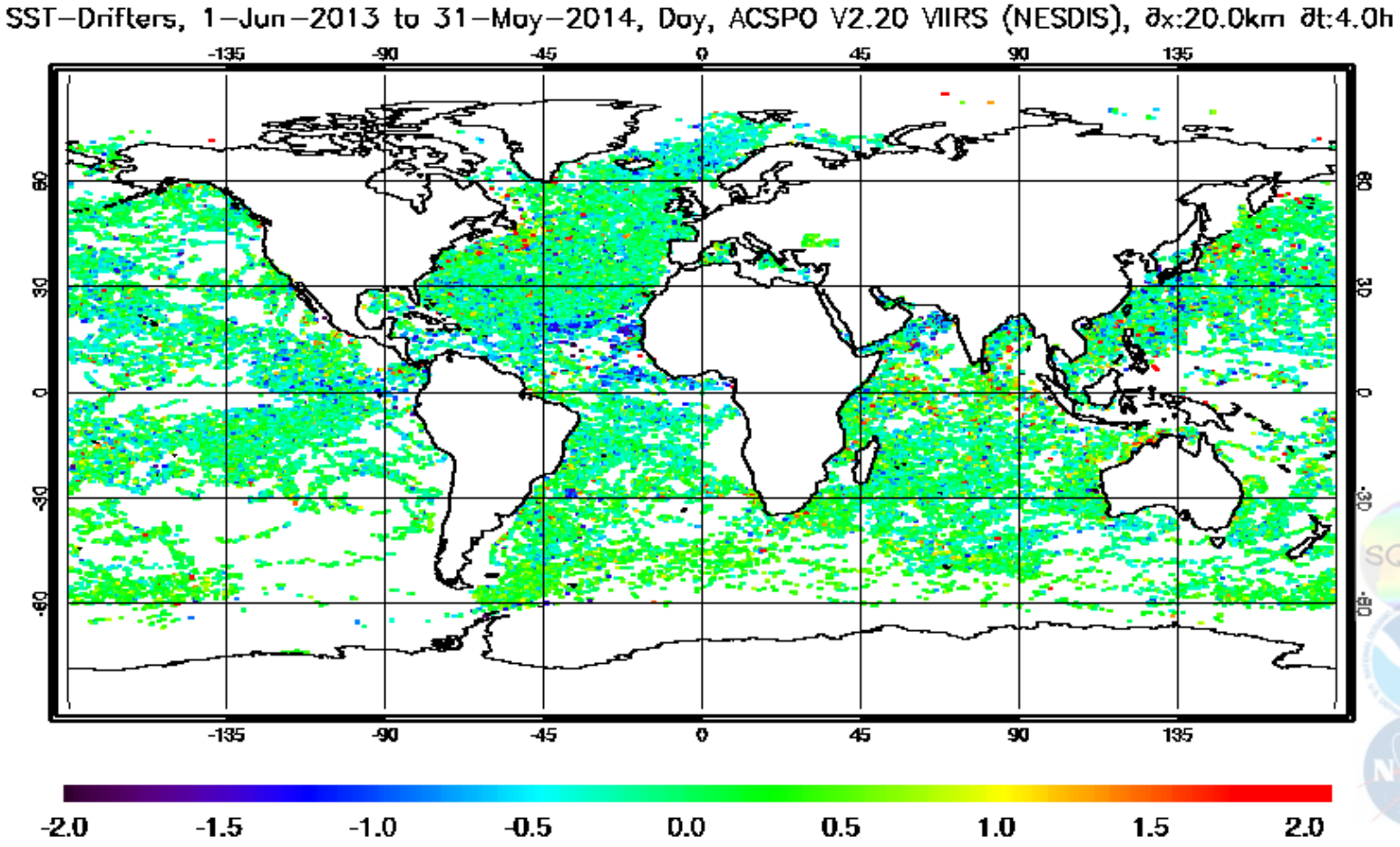


- IDPS match-ups cover most global ocean, except a few “white spots”
- Cold speckles, suppression off Africa: Due to residual Cloud/Aerosols

NPP SST Validation: Day ACSPO

Maps | Histograms | Time-series | Dependencies | Hovmöller

ACSPO VIIRS *minus* Drifters, 1-Jun-2013 to 31-May-2014

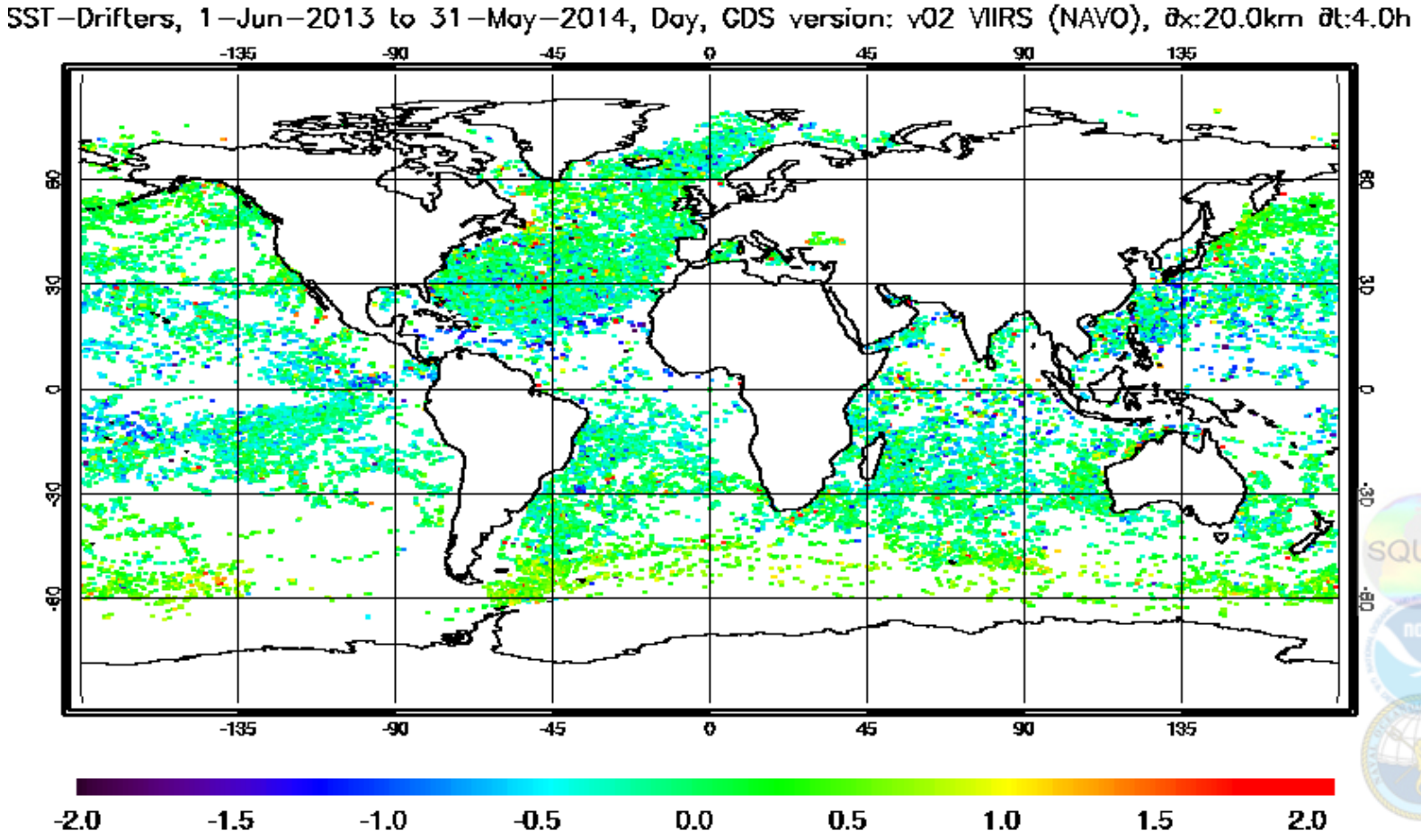


- ACSPO coverage: Similar to IDPS
- Fewer speckles, less suppression: Less residual Cloud/Aerosols

NPP SST Validation: Day NAVO

Maps | Histograms | Time-series | Dependencies | Hovmöller

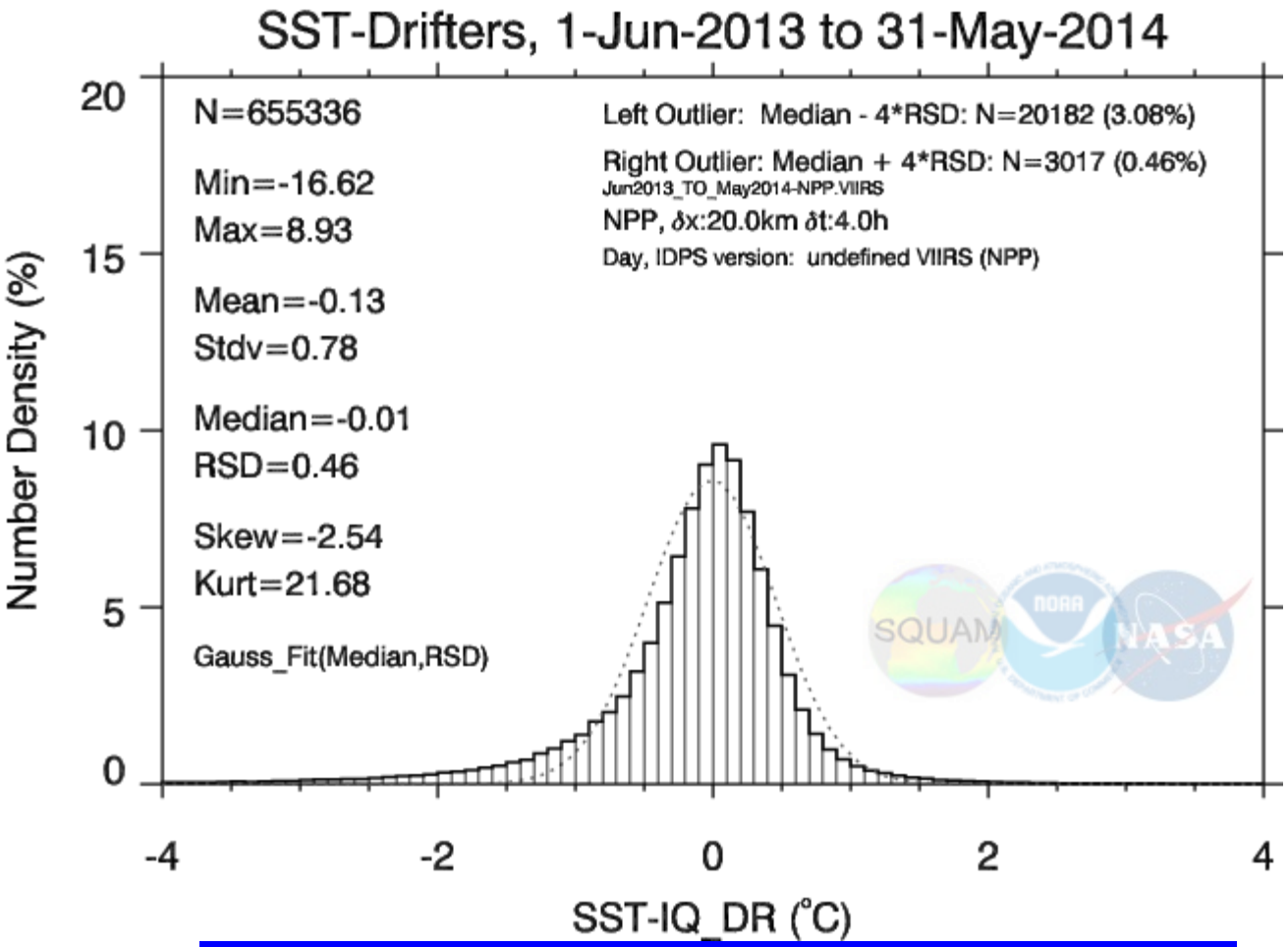
NAVO VIIRS *minus* Drifters, 1-Jun-2013 to 31-May-2014



- NAVO coverage sparser than IDPS/ACSPO, warm bias at Hi-Lat
- Fewer speckles, less suppression: Less residual Cloud/Aerosols

NPP SST Validation: Day IDPS

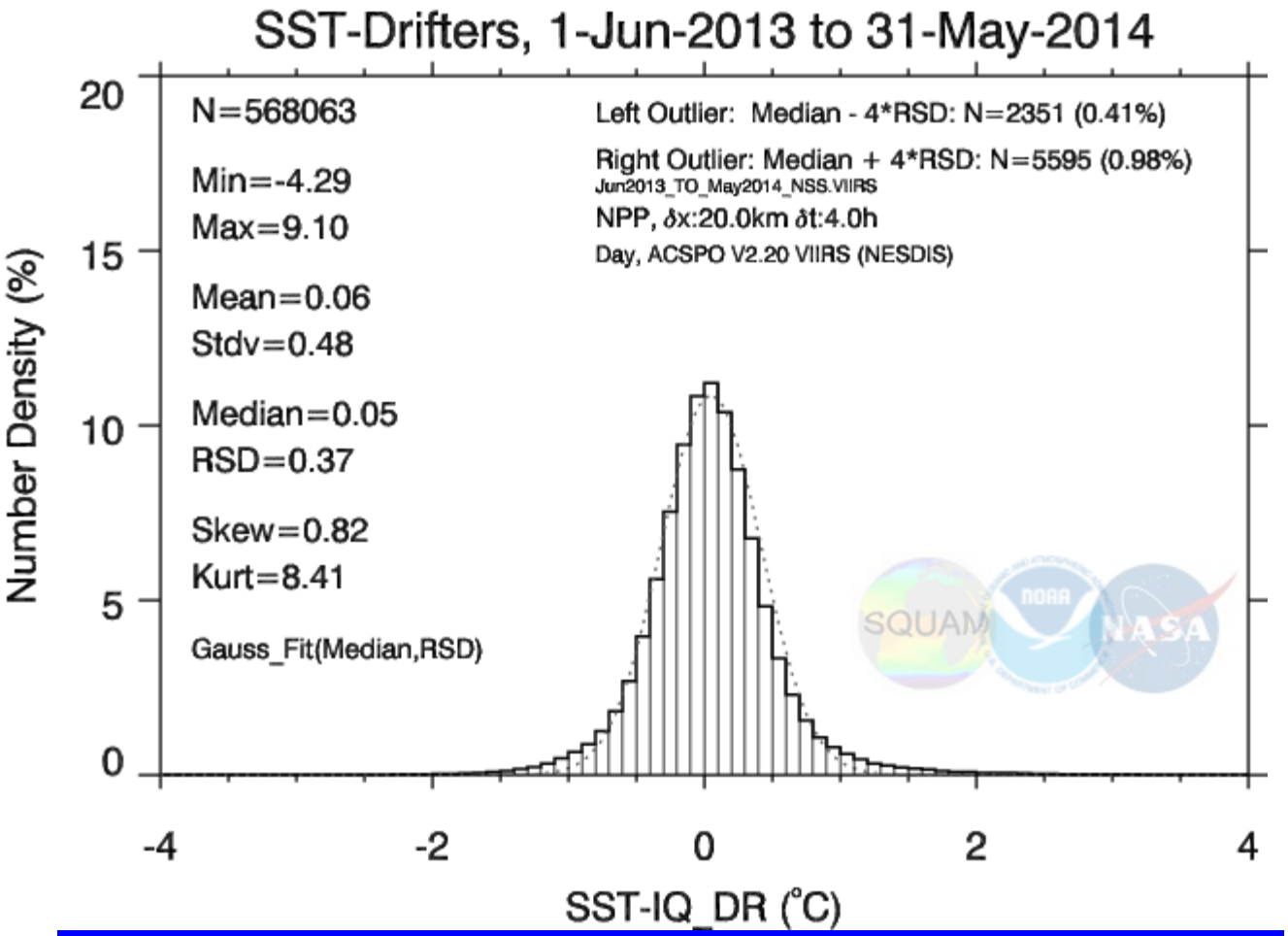
Maps | Histograms | Time-series | Dependencies | Hovmöller



- IDPS histogram: Biased/skewed negatively
- STD~0.78K: IDPS product out of spec

NPP SST Validation: Day ACSPO

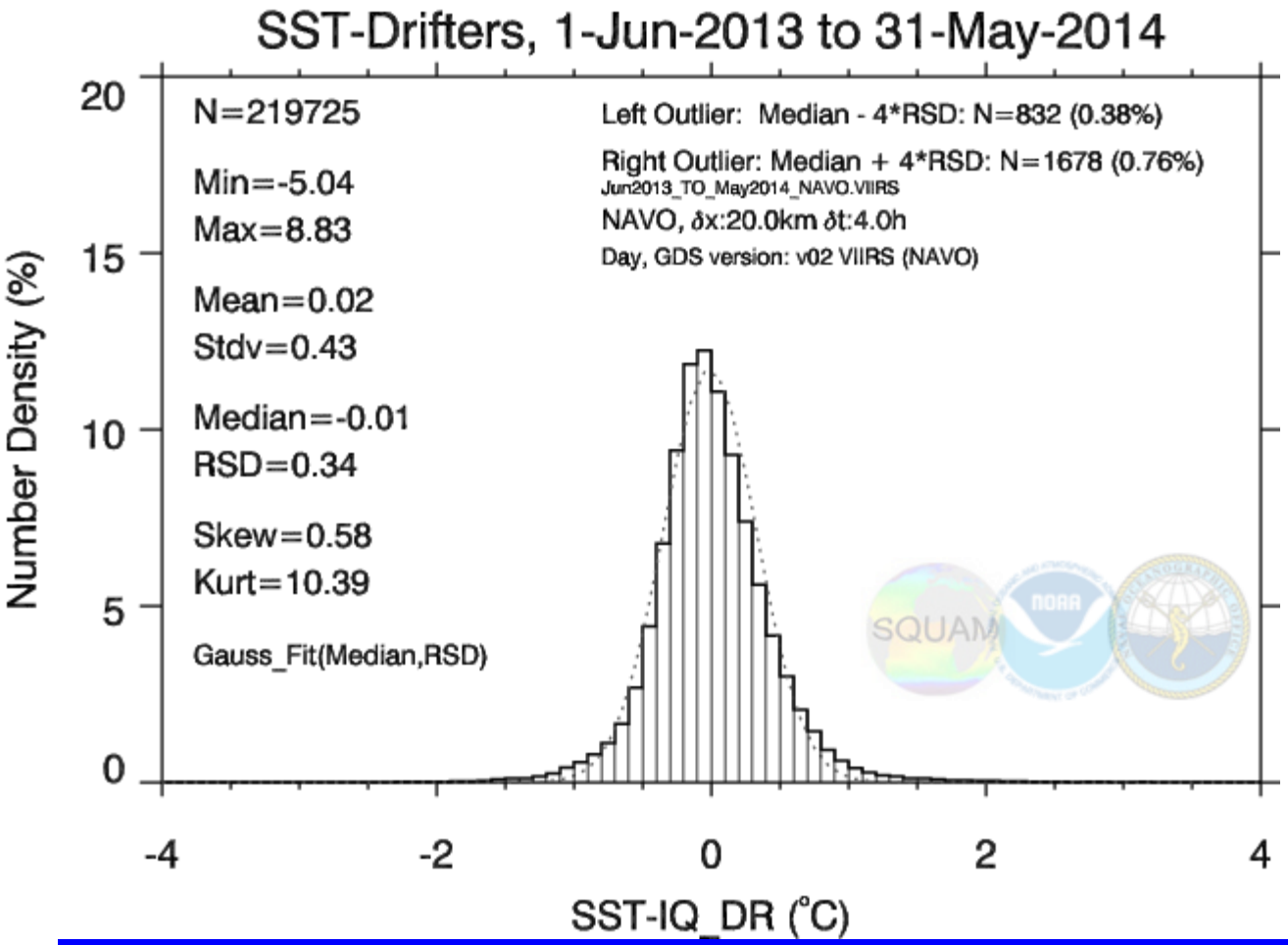
Maps | Histograms | Time-series | Dependencies | Hovmöller



- ACSPO: fewer matchups, reduced Bias / Skew / STD
- Meets JPSS specs, by a wide margin

NPP SST Validation: Day NAVO

Maps | Histograms | Time-series | Dependencies | Hovmöller



- NAVO: ~2.5 fewer matchups, reduced Bias / Skew / STD
- Meets specs by even wider margin, nut in a smaller domain

Annual Validation statistics against drifters

summary for "01-JUN-2013 to 31-MAY-2014"

Night

Processor	NOBS (%ACSPO)	Min / Max	Mean / STD	Med / RSD
IDPS	685,614 (118%)	-13.69 / +12.94	-0.08 / 0.43	-0.01 / 0.27
ACSPO	578,851 (100%)	- 7.43 / +8.52	+0.01 / 0.36	+0.03 / 0.25
NAVO	254,045 (44%)	- 5.23 / +8.74	+0.05 / 0.31	+0.07 / 0.22

Day

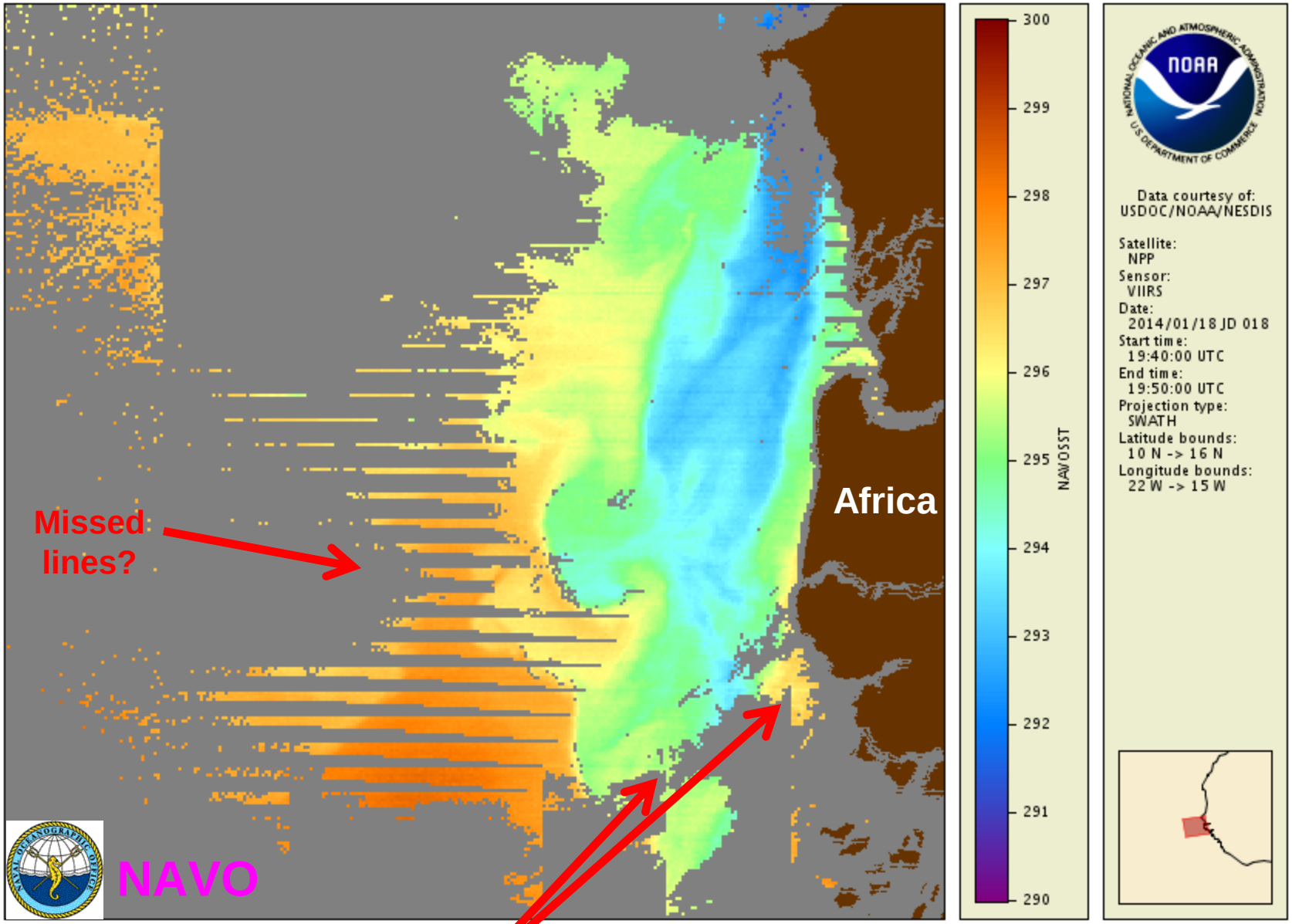
Processor	NOBS (%ACSPO)	Min / Max	Mean / STD	Med / RSD
IDPS	655,336 (115%)	-16.62 /+8.93	-0.13 / 0.78	-0.01 / 0.46
ACSPO	568,610 (100%)	- 4.29 / +9.10	+0.06 / 0.48	+0.05 / 0.37
NAVO	219,725 (39%)	- 5.04 / +8.83	+0.02 / 0.43	-0.01 / 0.34

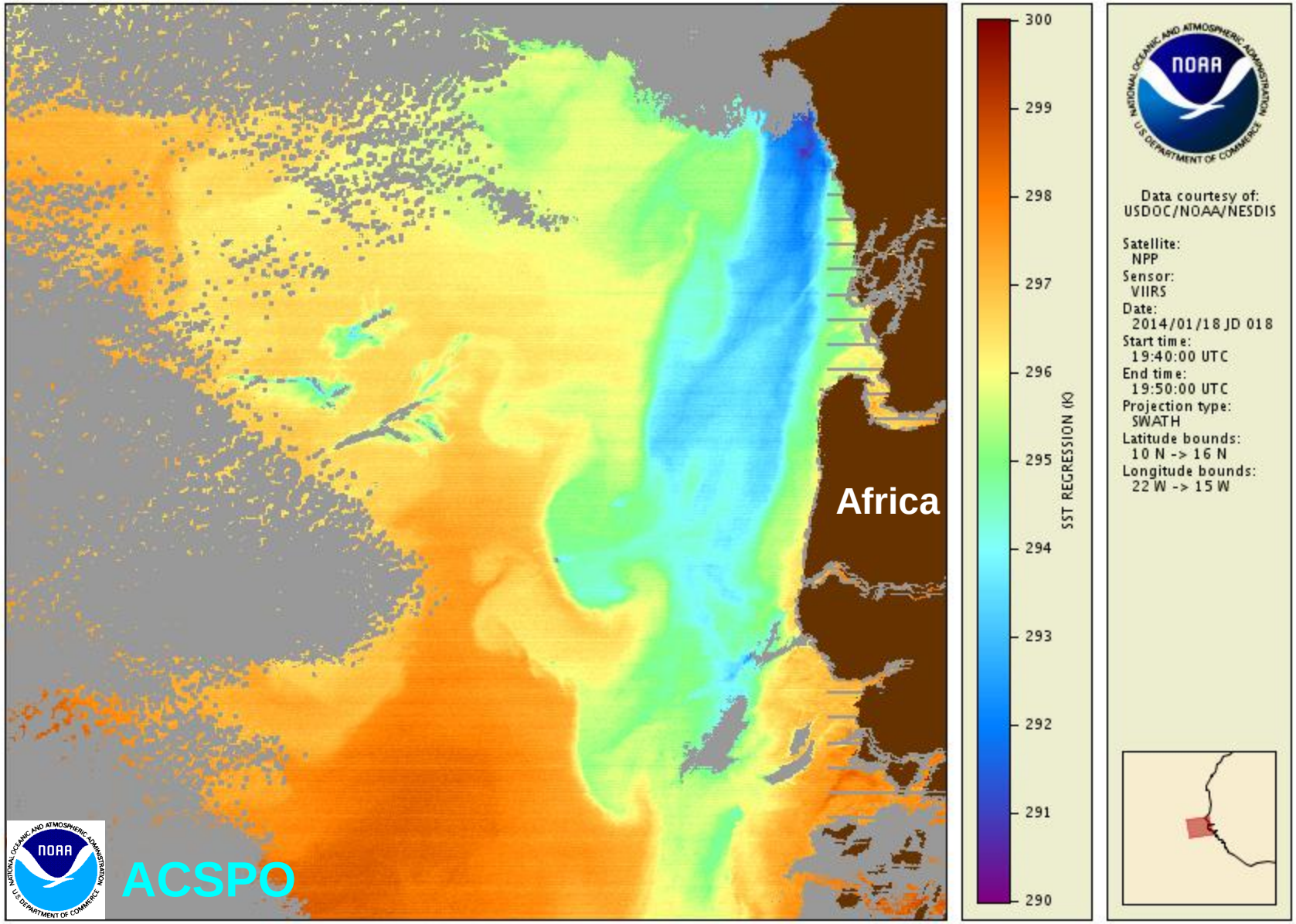
Evaluation of VIIRS SST Products

4. Examples SST Imagery

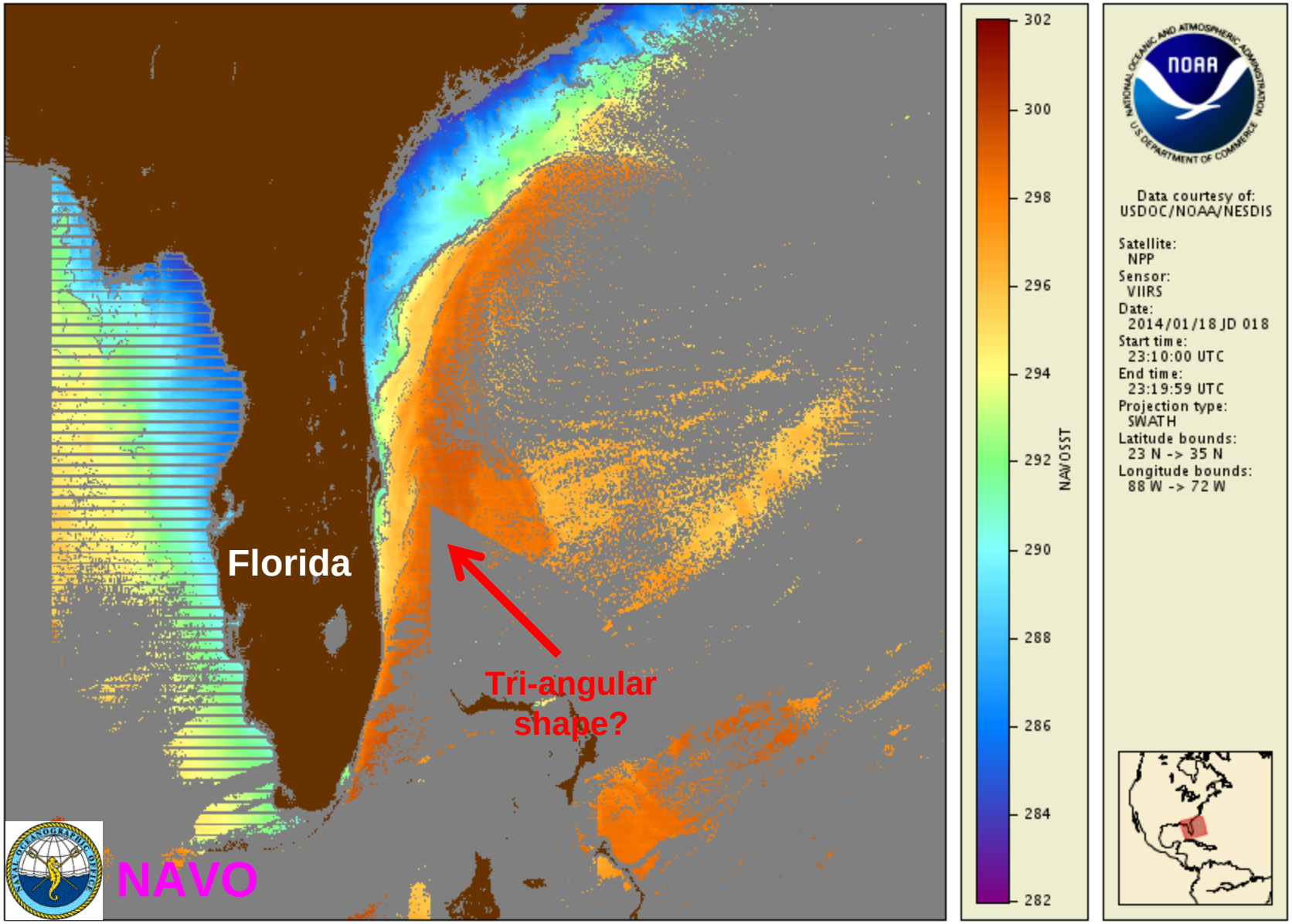
NAVO images shown below are from the then-operational product. Following STAR feedback, NAVO has fixed imagery artifacts.

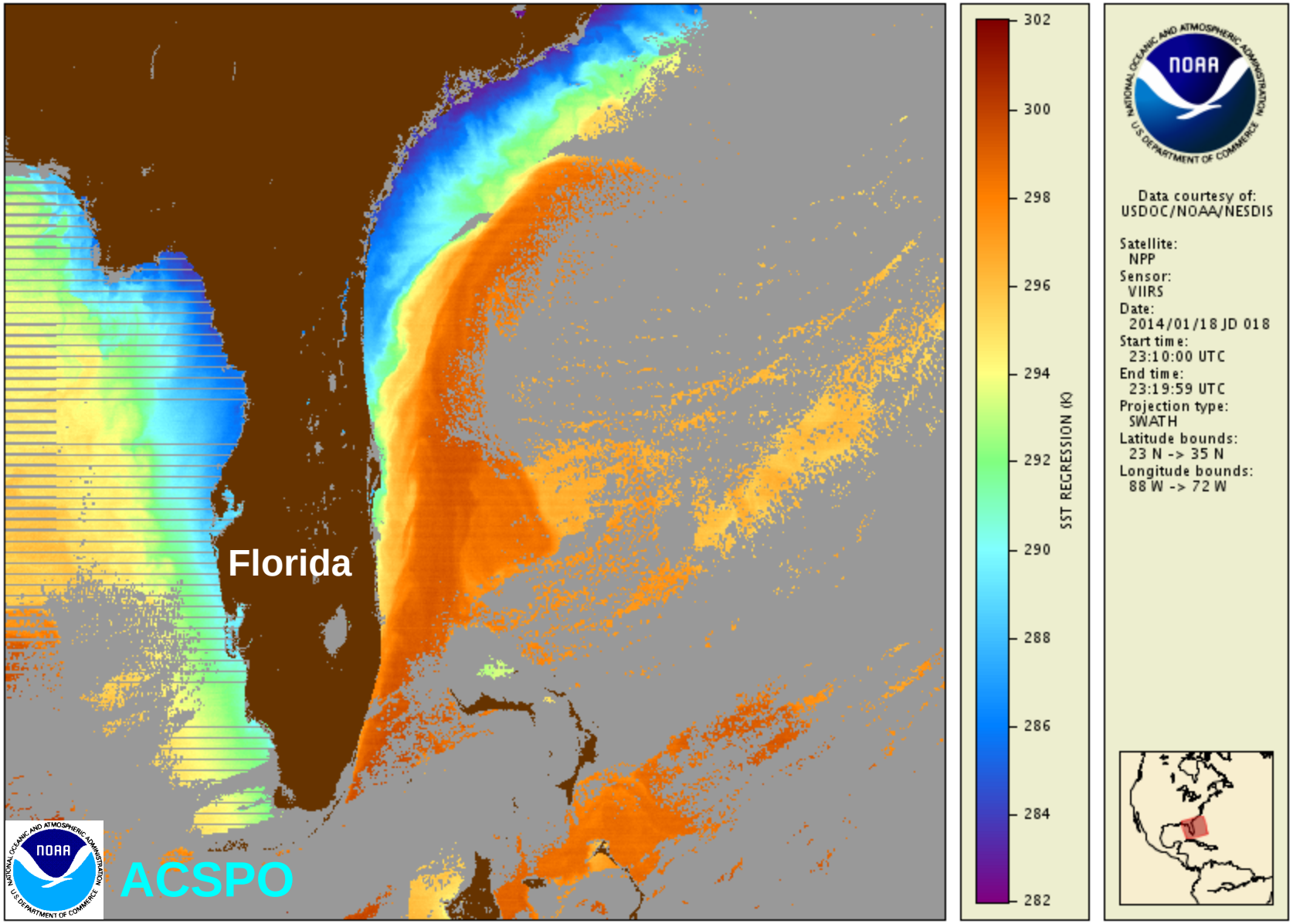
ACSPO_V2.30b01_NPP_VIIRS_2014-01-18_1440-1450_20140314.174252_NAVO



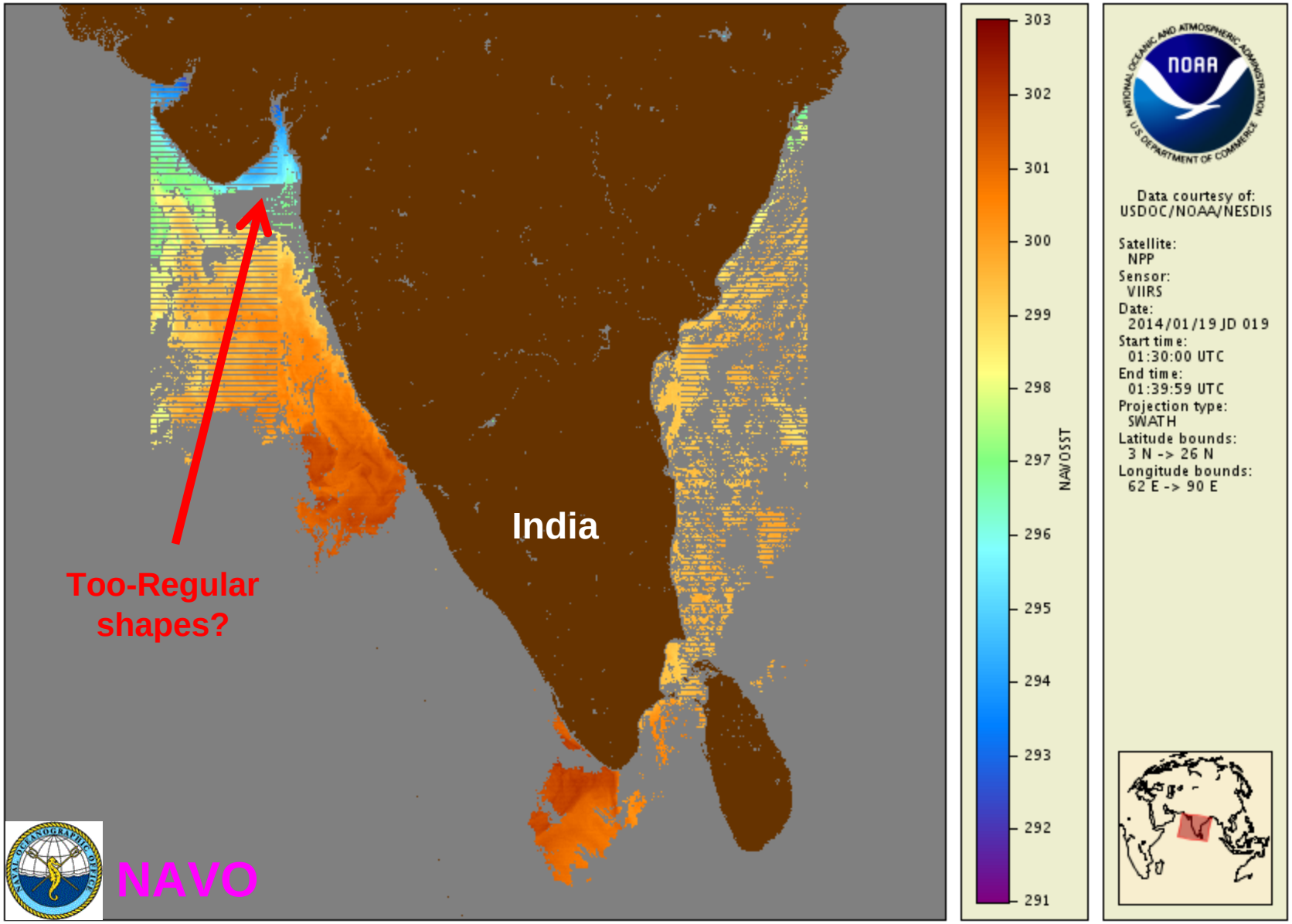

Africa
ACSPO
300
299
298
297
296
295
294
293
292
291
290
SST REGRESSION (K)
Data courtesy of:
USDOC/NOAA/NESDIS
Satellite:
NPP
Sensor:
VIIRS
Date:
2014/01/18 JD 018
Start time:
19:40:00 UTC
End time:
19:50:00 UTC
Projection type:
SWATH
Latitude bounds:
10 N -> 16 N
Longitude bounds:
22 W -> 15 W

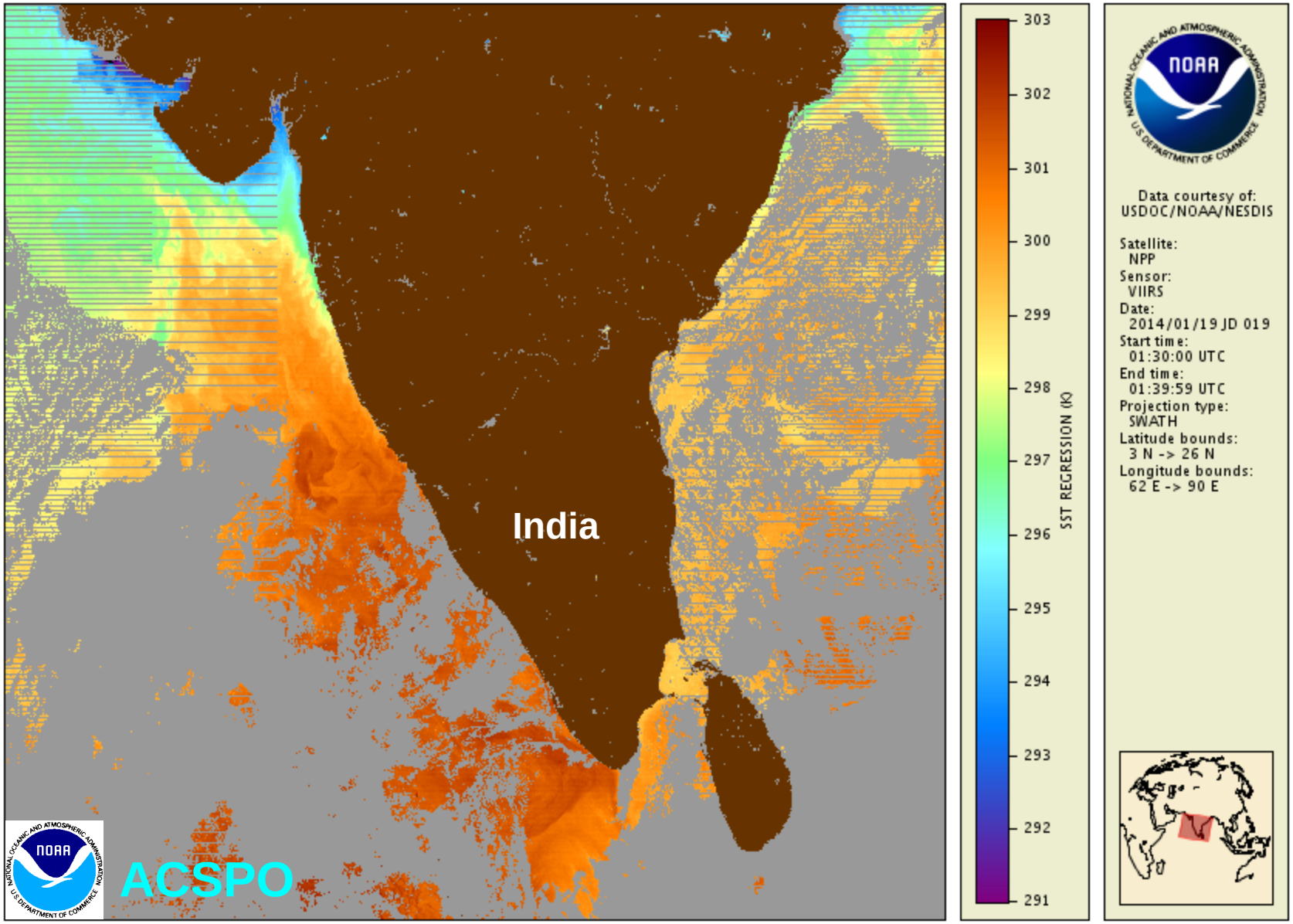
ACSPO_V2.30b01_NPP_VIIRS_2014-01-18_1810-1819_20140314.184153_NAVO



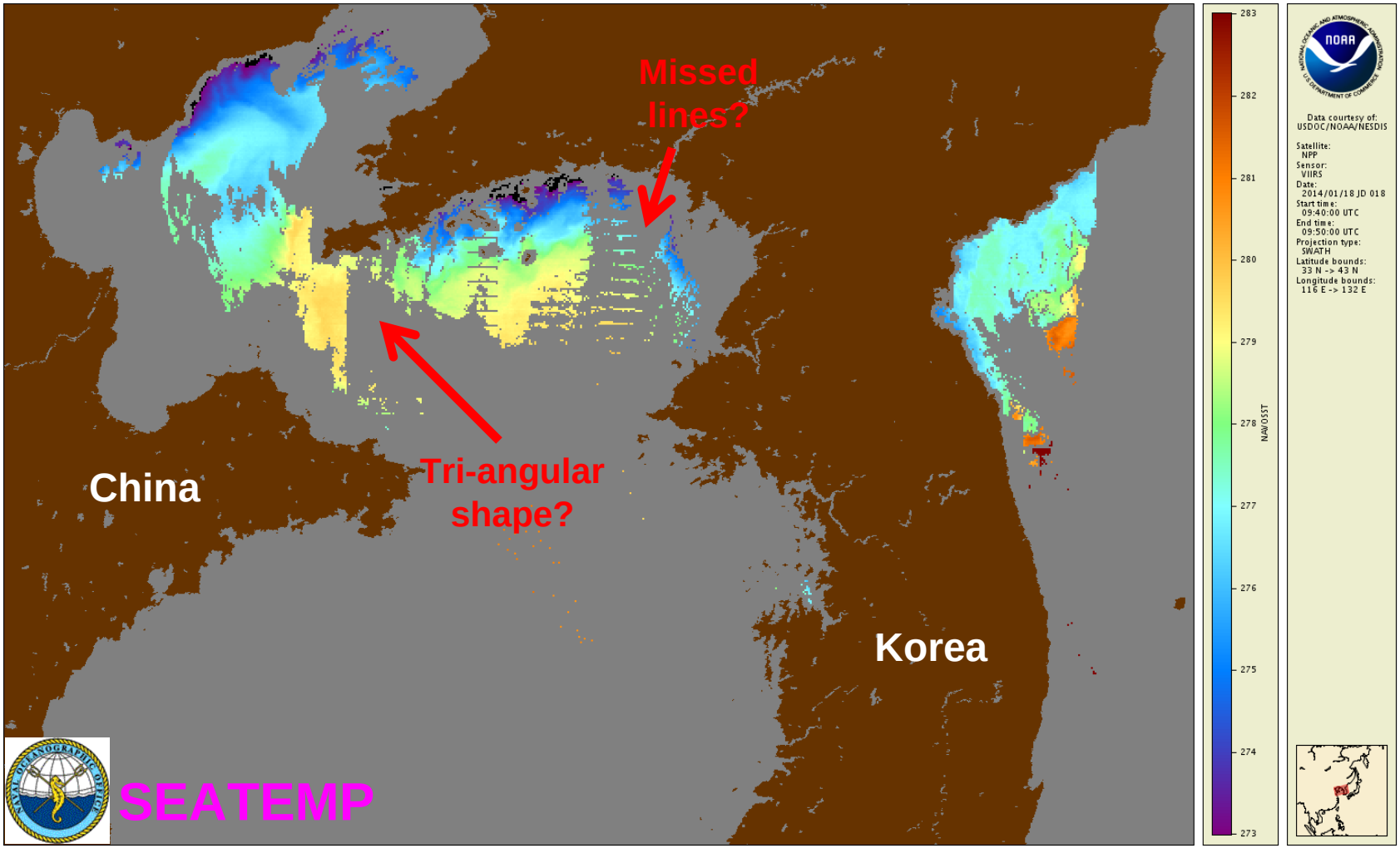

Florida
ACSPO
302
300
298
296
294
292
290
288
286
284
282
SST REGRESSION (K)
Data courtesy of:
USDOC/NOAA/NESDIS
Satellite:
NPP
Sensor:
VIIRS
Date:
2014/01/18 JD 018
Start time:
23:10:00 UTC
End time:
23:19:59 UTC
Projection type:
SWATH
Latitude bounds:
23 N -> 35 N
Longitude bounds:
88 W -> 72 W

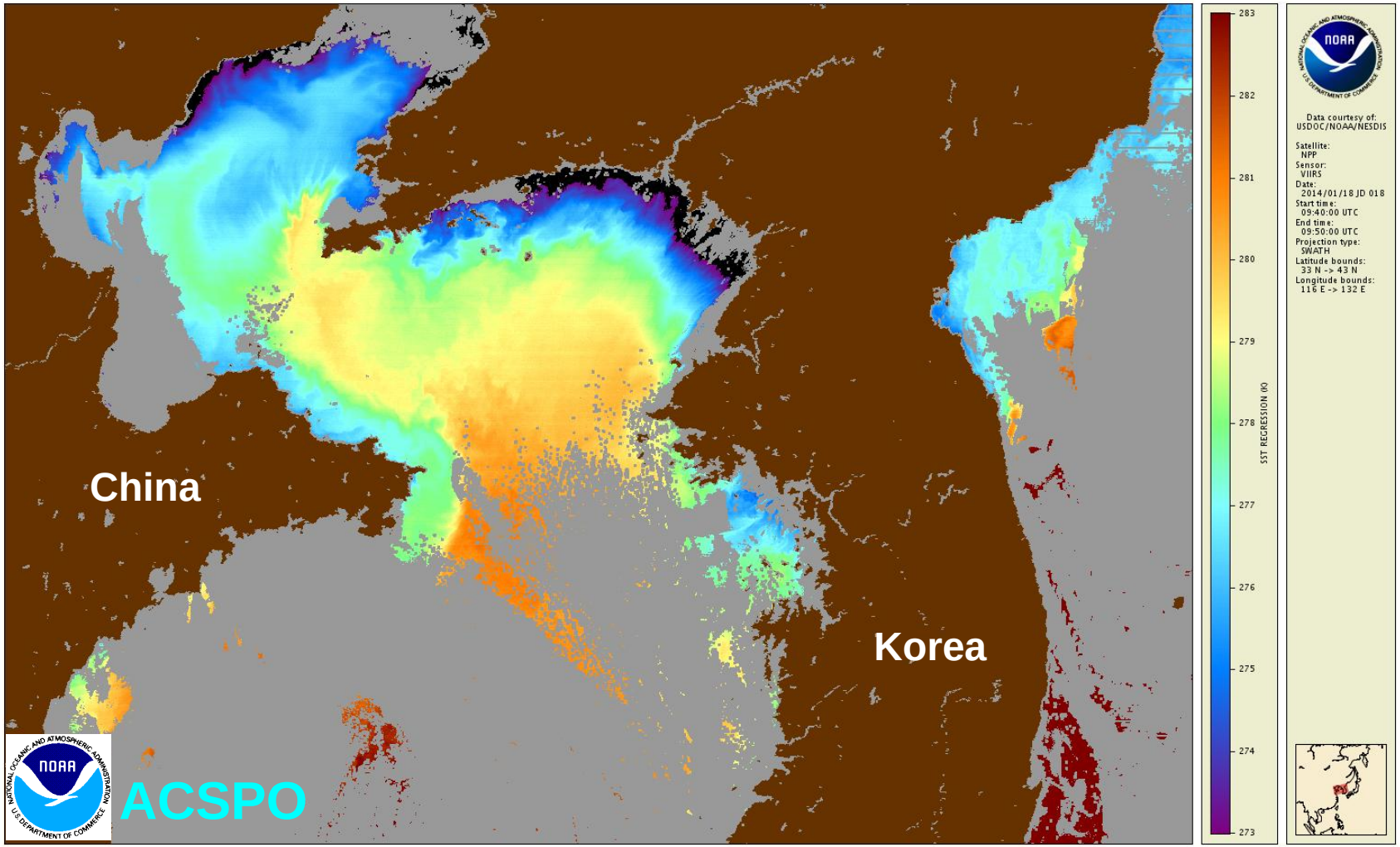
ACSPO_V2.30b01_NPP_VIIRS_2014-01-18_2030-2039_20140314.192134_NAVO




India
ACSPO
303
302
301
300
299
298
297
296
295
294
293
292
291
SST REGRESSION (K)
Data courtesy of:
USDOC/NOAA/NESDIS
Satellite:
NPP
Sensor:
VIIRS
Date:
2014/01/19 JD 019
Start time:
01:30:00 UTC
End time:
01:39:59 UTC
Projection type:
SWATH
Latitude bounds:
3 N -> 26 N
Longitude bounds:
62 E -> 90 E

ACSPO_V2.30b01_NPP_VIIRS_2014-01-18_0440-0450_20140314.145310_NAVO




China
Korea
ACSPO
283
282
281
280
279
278
277
276
275
274
273
SST REGRESSION (K)
Data courtesy of:
USDOC/NOAA/NESDIS
Satellite:
NPP
Sensor:
VIIRS
Date:
2014/01/18 JD 018
Start time:
09:40:00 UTC
End time:
09:50:00 UTC
Projection type:
SWATH
Latitude bounds:
33 N -> 43 N
Longitude bounds:
116 E -> 132 E

Documentation

JPSS SST Documentation

- Liang, X., and A. Ignatov, 2013: AVHRR, MODIS and VIIRS Radiometric Stability and Consistency in SST Bands. *JGR*, 118, 6, 3161-3171, doi:10.1002/jgrc.20205.
- Bouali, M., A. Ignatov, 2014: Adaptive Reduction of Striping for improved SST Imagery from S-NPP VIIRS. *JTech*, **31**, 150-163, doi:10.1175/JTECH-D-13-00035.1
- Xu, F., A. Ignatov, 2014: In situ SST Quality Monitor (iQuam). *JTech*, **31**, 164-180, doi:10.1175/JTECH-D-13-00121.1
- Petrenko, B., A. Ignatov, Y. Kihai, J. Stroup, P. Dash, 2014: Evaluation and Selection of SST Regression Algorithms for JPSS VIIRS. *JGR*, **119**, *8*, 4580-4599, doi:10.1002/2013JD020637.
- Liu, Q., A. Ignatov, F. Weng, and X. Liang, 2014: Removing Solar Radiative Effect from the VIIRS M12 Band at 3.7 μm for daytime SST Retrievals. *JTech*, in press, doi:10.1175/JTECH-D-14-00051.1
- Gladkova, I., Y. Kihai, A. Ignatov, F. Shahriar, and B. Petrenko, 2014: SST Pattern Test in ACSPO Clear-Sky Mask for VIIRS. *RSE*, in review.
- ACSPO SST ATBD, ACSPO SST External Users Manual (NDE)

ACSPO VIIRS SST Users

NASA and NOAA JPSS SST Users

Current and/or Interested Users

- **NOAA STAR (GEO/POLAR Blended L4) – Eileen Maturi**
- NOAA STAR (Coral Reef Watch) – Mark Eakin
- NOS (Chesapeake Bay Ecosystem analysis) – Chris Brown
- NCDC (Reynolds SST L4) – Viva Banzon
- NASA JPL (JPL MUR L4) – Mike Chin

Work also underway with

- NCEP/CPC/OPC – Bob Grumbine, Avichal Mehra; Joe Sienkiewicz
- NASA GMAO (MERRA) – Ricardo Todling
- Coast Watch – John Sapper
- NMFS – Cara Wilson/John Sapper
- URI – Peter Cornillon

International JPSS SST Users

Current and/or Interested Users

- **Canadian Met Centre (CMC L4) – Bruce Brasnett**
- Australian Bureau of Meteorology (GAMSSA L4) – Helen Beggs
- UK Met Office (OSTIA L4) – Emma Fiedler
- Japanese Met Agency (MGD L4) – Shiro Ishizaki
- DMI, Denmark (DMI L4) – Jacob L. Høyer
- EUMETSAT (EUMETCAST) – Simon Elliott
- JPL/PO DAAC (Archive) – Ed Armstrong
- IFREMER, France (Odyssea L4) – Jean-François Piolle, Emmanuelle Autret

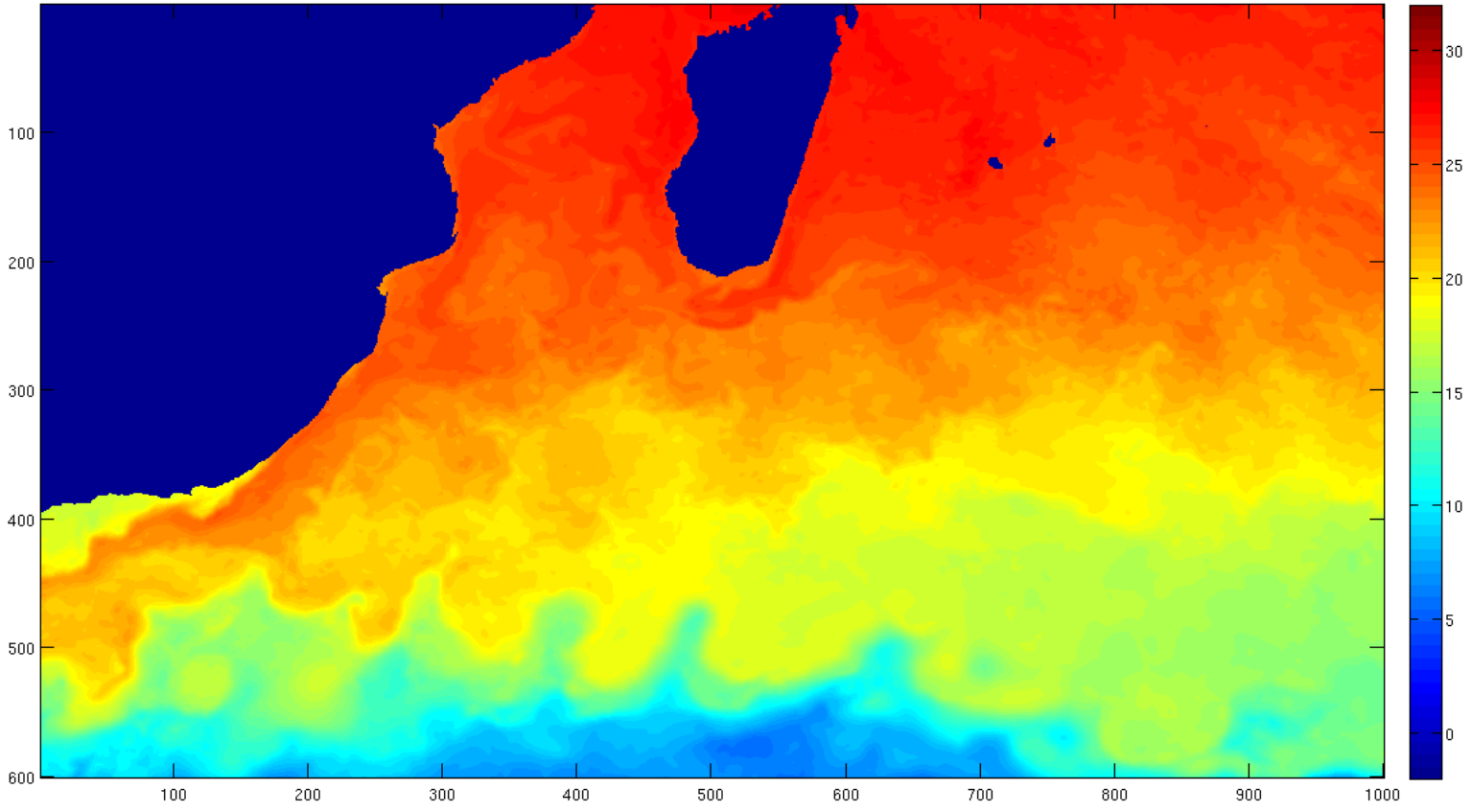
To be polled

- Other users to be polled at GHRSST Meeting, June 2014, Cape Town

Users' Feedback

Harris – NOAA Geo-Polar Blended L4 SST

- VIIRS successfully incorporated into Geo-Polar Blended 5-km global SST analysis



Super-cool SST in GAC data

Environment Canada Environnement Canada

Canada

Results of Assimilating ACSPO VIIRS L2P Datasets

Bruce Brasnett

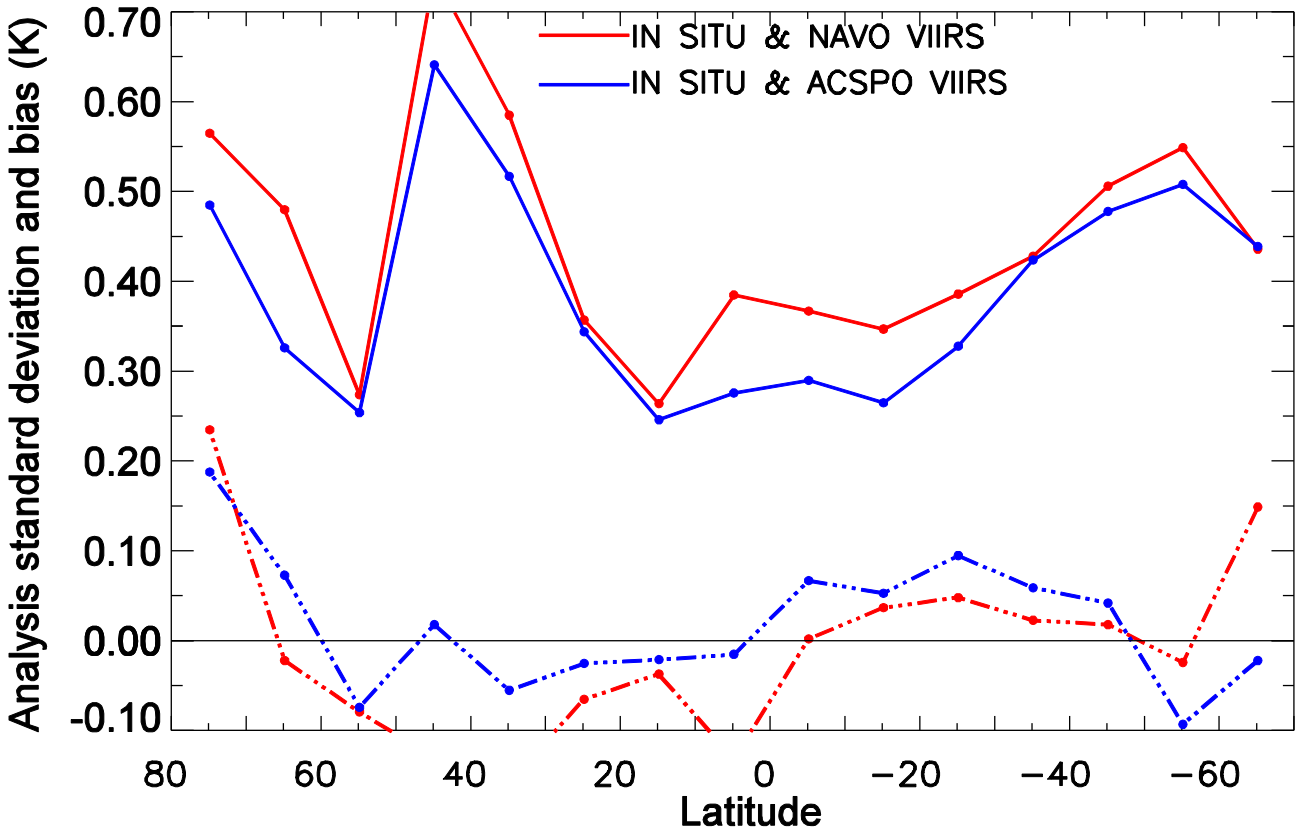
Canadian Meteorological Centre

May, 2014

ACSPO VIIRS L2P Datasets

- Received courtesy of colleagues at STAR
- Two periods: 1 Jan – 31 Mar 2014 & 15 Aug – 9 Sep 2013
- Daily coverage is excellent with this product
- Experiments carried out assimilating VIIRS data only and VIIRS data in combination with other satellite products
- Rely on independent data from Argo floats to verify results
- Argo floats do not sample coastal regions or marginal seas

Assessing relative value of 2 VIIRS datasets: NAVO vs. ACSPO



Using ACSPO instead of NAVO improves CMC assimilation

CMC Summary

- ACSPO VIIRS L2P is an excellent product
- Based on the Jan – Mar 2014 sample, VIIRS contains more information than either NAVO VIIRS, OSI-SAF Metop-A or the RSS AMSR2 datasets
- L2P ancillary information: quality level flags and wind speeds are useful
- CMC started assimilating ACSPO VIIRS L2P dataset on 29 May 2014

CMC Feedback – Bruce Brasnett

- 7 July 2014, “We are now running with ACSPO VIIRS and are very happy with the results. You and your team have done an outstanding job with the VIIRS product. Any idea when the backfilled data to Jan. 2012 will be available?”
- 28 July 2014, “For years, we at CMC have wanted more retrievals of lake temperatures. Unfortunately, all we were getting from NAVO was retrievals for the largest lakes... nothing for medium and small lakes. This is one reason why we are excited about the ACSPO VIIRS product (many other reasons to be excited about the ACSPO product, by the way)”
- 19 August 2014, “We have been assimilating ACSPO VIIRS data (downloaded from JPL) for a couple of months now and I am very happy with the results. Excellent global coverage and good performance at high latitudes.”

Summary

JPSS ACSPO SST Product

- ✓ Has been validated online in NRT, globally and continuously since opening VIIRS cryoradiator doors on 18 Jan 2012. It meets JPSS L1RD specs and validated 3 stage requirements
- ✓ IDPS SST domain is comparable with ACSPO. At night, IDPS VAL stats are degraded compared to ACSPO but meet specs. During the daytime, IDPS SST does not meet specs
- ✓ NAVO SST meets L1RD specs, by a slightly wider margin than ACSPO. However, the retrieval domain is ~2.5 smaller
- ✓ ACSPO SST is assimilated into two global L4 analyses: NOAA geo-polar blended and Canadian Met Centre CMC02. Positive feedback received on excellent global coverage, and in particular, coverage in high latitudes and over internal waters

SST Team recommends to declare SNPP SST Validated stage 3

Near-Term ACSPO Priorities & Plans

Priority of SST Team is to focus on ACSPO users: Work individually, customize product, ensure meeting their needs

- ✓ Continue monitoring ACSPO SST in SQUAM, cross-evaluate against IDPS and NAVO, and validate all against *i*Quam
- ✓ Generate Level 3 SST product (multiple users requests)
- ✓ Establish VIIRS SST reprocessing capability (in conjunction with UW). Back-fill ACSPO L2/L3 SSTs to Jan'2012
- ✓ Archive ACSPO L2/3 at JPL/NODC, discontinue IDPS
- ✓ Focus on dynamic, coastal and high-latitude areas
- ✓ Enhance ACSPO clear-sky and ice masks, using pattern recognition approach and day-night band
- ✓ Improve Single Scanner Error Statistics (SSES; part of GDS2)
- ✓ Implement destriping operationally
- ✓ Explore optional VIIRS bands for aerosol correction/flagging