

SST Quality Monitor (SQUAM)

www.star.nesdis.noaa.gov/sod/sst/squam/

In situ SST Quality Monitor (iQuam)

www.star.nesdis.noaa.gov/sod/sst/iquam/

Sasha Ignatov, Prasanjit Dash, Xinjia Zhou, Feng Xu

Thanks to: NOAA and GHRSSST Colleagues

SST Quality Monitor (SQUAM)

www.star.nesdis.noaa.gov/sod/sst/squam/

Dash, et al: SST Quality Monitor (SQUAM). JTech, 2010.

SST Monitoring in SQUAM

Keywords

- Google “SQUAM SST” or “NOAA SQUAM”
- Validation (vs. *in situ*); Consistency Checks (vs. L4s)
- Automated, Near-Real Time, Global, Online system

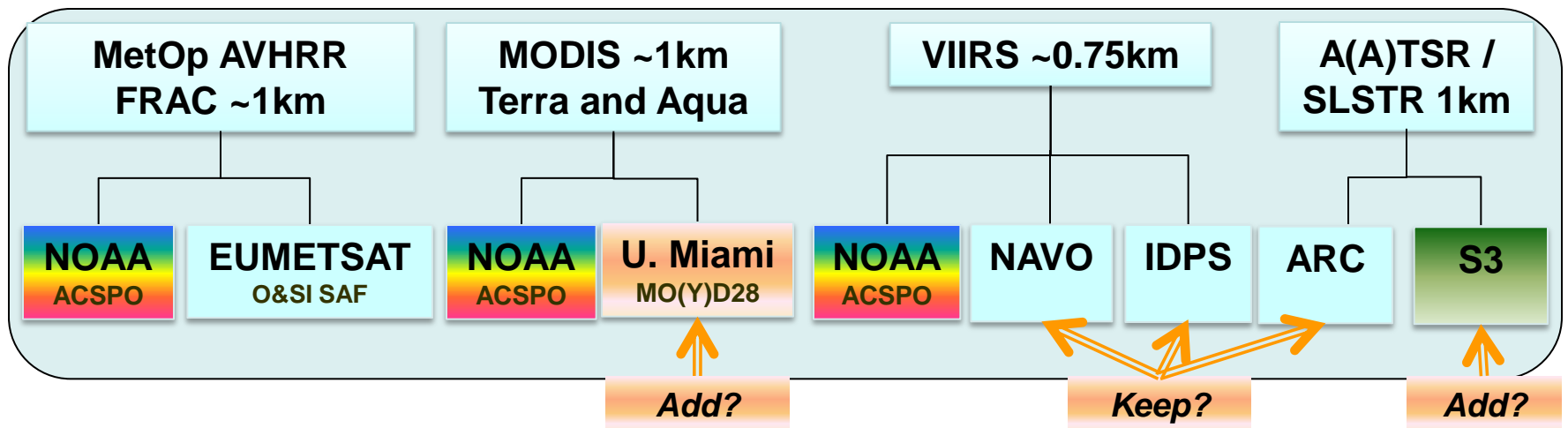
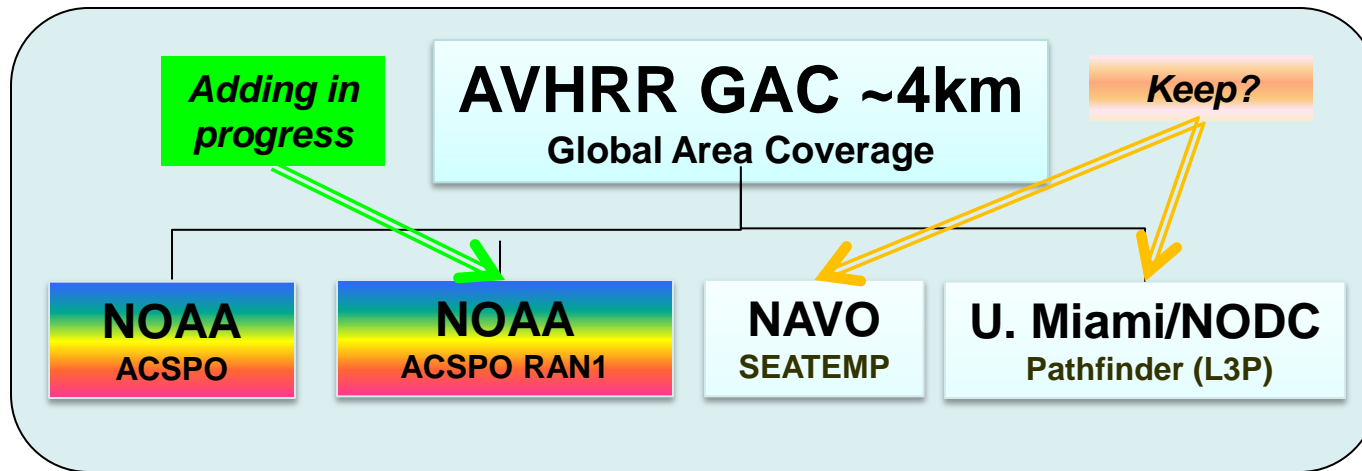
SST products in SQUAM

- Swath (L2) + Gridded (L3) + Analysis (L4) = 3 SQUAM modules
- Initially created as a NOAA system, but now additionally monitors many community products – hence GRSST resource

Analyzed are deviations from reference SSTs, $\Delta T_s = T_s - T_{REF}$

- Gaussian? Centered at ~ 0 ? Narrow? No outliers?
- Two types of T_{REF}
 1. ***iQuam in situ (“Validation”).*** Data may be: Non-uniform in accuracy and precision (even after QC); Have sparse coverage, and geographical biases; Not always available in real-time
 2. ***Global L4 analyses (“Consistency Checks”).*** More complete global coverage and uniform data accuracy and precision; Much larger “match-up data sets” (3-4 orders of magnitude); Available in real-time

Polar L2/L3 SST Products in SQUAM

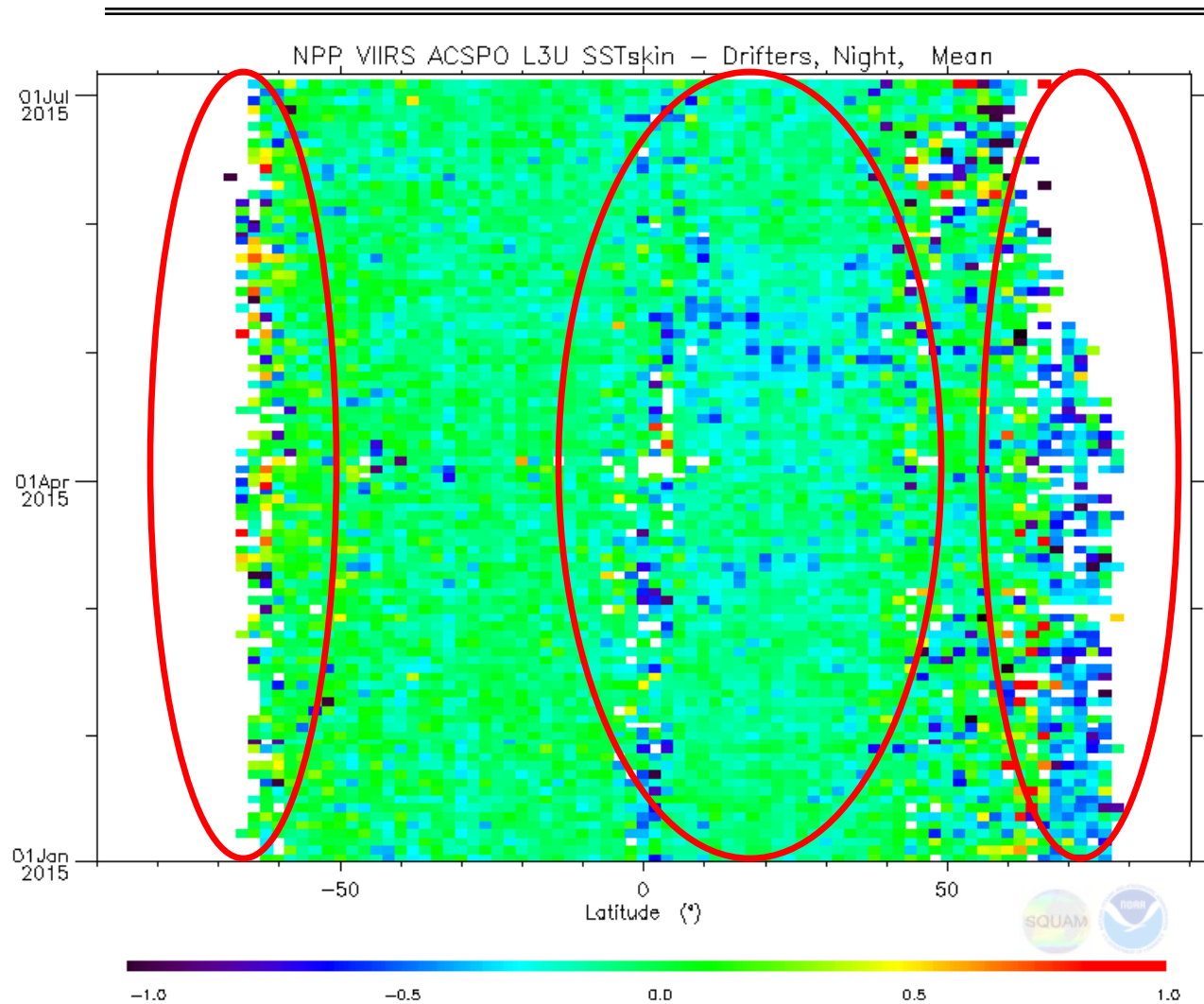


- In addition to NOAA SSTs, SQUAM monitors several community products
- Feedback from data producers/users is appreciated on what to keep/drop/add

SQUAM progress since G-XV

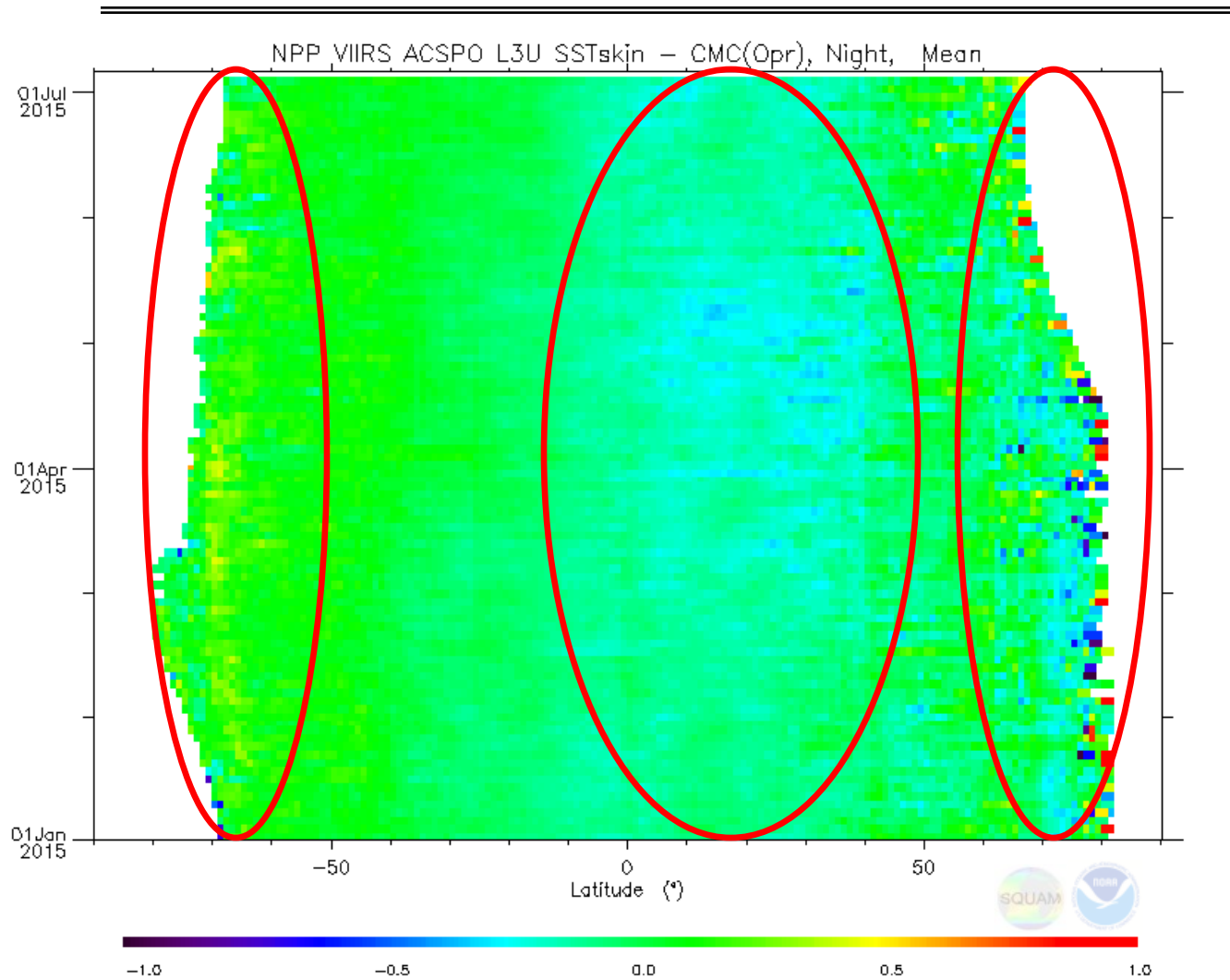
- **Two previously tested partners' products implemented**
 - NAVO VIIRS and ARC
- **New products under testing**
 - Polar: ACSPO 0.02° L3U (Thanks to ABoM Helen Beggs' group for help with L3 code)
 - Geo: ACSPO H8 (NOAA ACSPO) and H7 (heritage NOAA product)
- **New/Improved functionality**
 - Gridding code optimized (CPU time reduced by ~30%)
 - Handling of outliers improved (Maps/Histograms now available “with/without”)
 - *In situ* validation uniformly (re)generated for all products; Monthly statistics added
 - CMC L4 replaced previously used RTG SST (due to improved diagnostic skill)
- **Coming year**
 - Complete geo functionality (add ABoM and JAXA H8 SSTs)
 - Implement ACSPO VIIRS RAN1 and L3 monitoring
 - Redesign AVHRR GAC module; Implement ACSPO AVHRR GAC RAN1
 - Implement VAL against iQuam2 (including ARGO floats, IMOS ships)
 - Consider discontinuing products with no feedback (from producers or users)

Night: ACSPO VIIRS L3U – *i*Quam drifters (Jan – Jul, 2015)



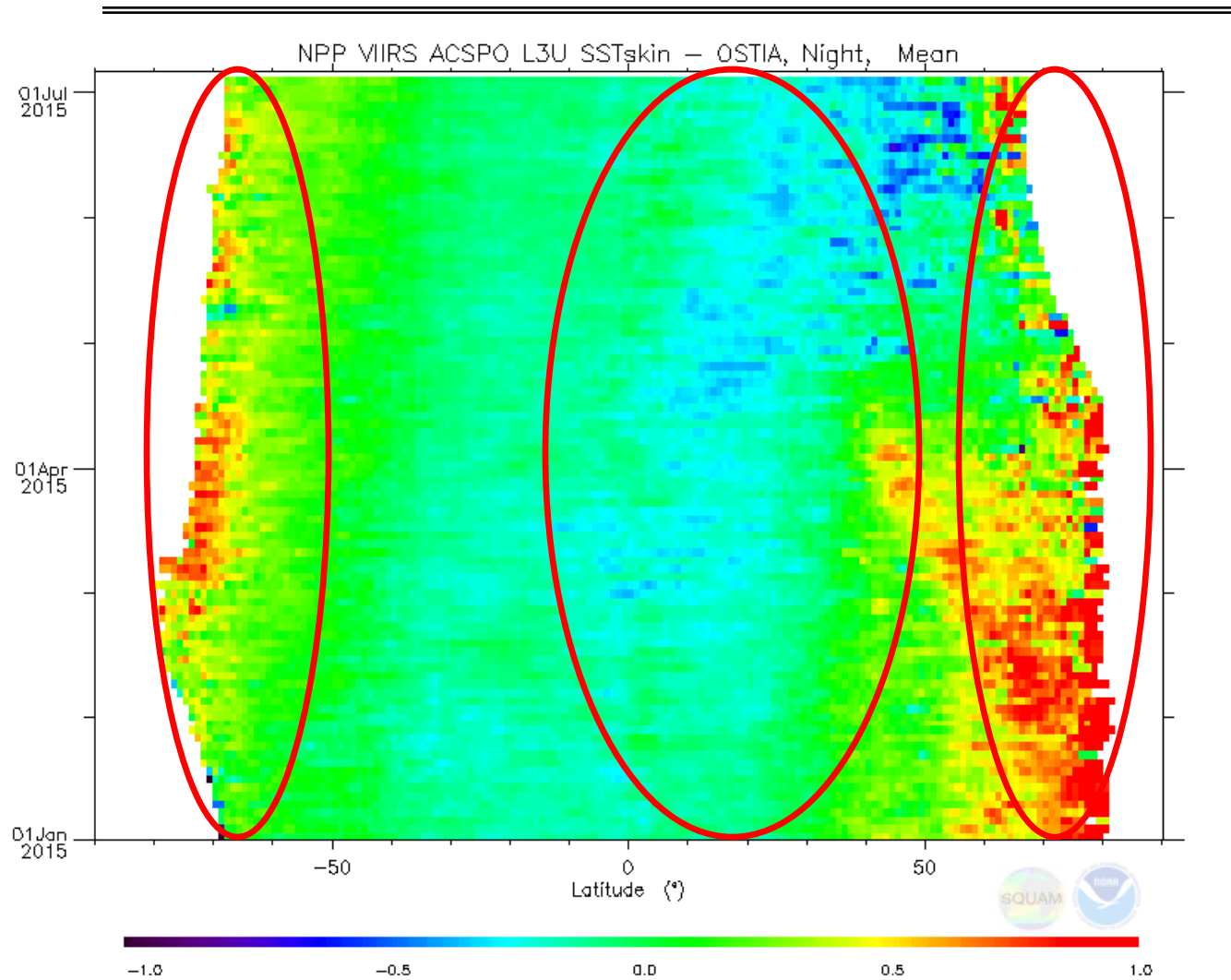
Overall good agreement except in the high and low-to-mid latitudes

Night: ACSPO VIIRS L3U – CMC L4 (Jan – Jul, 2015)



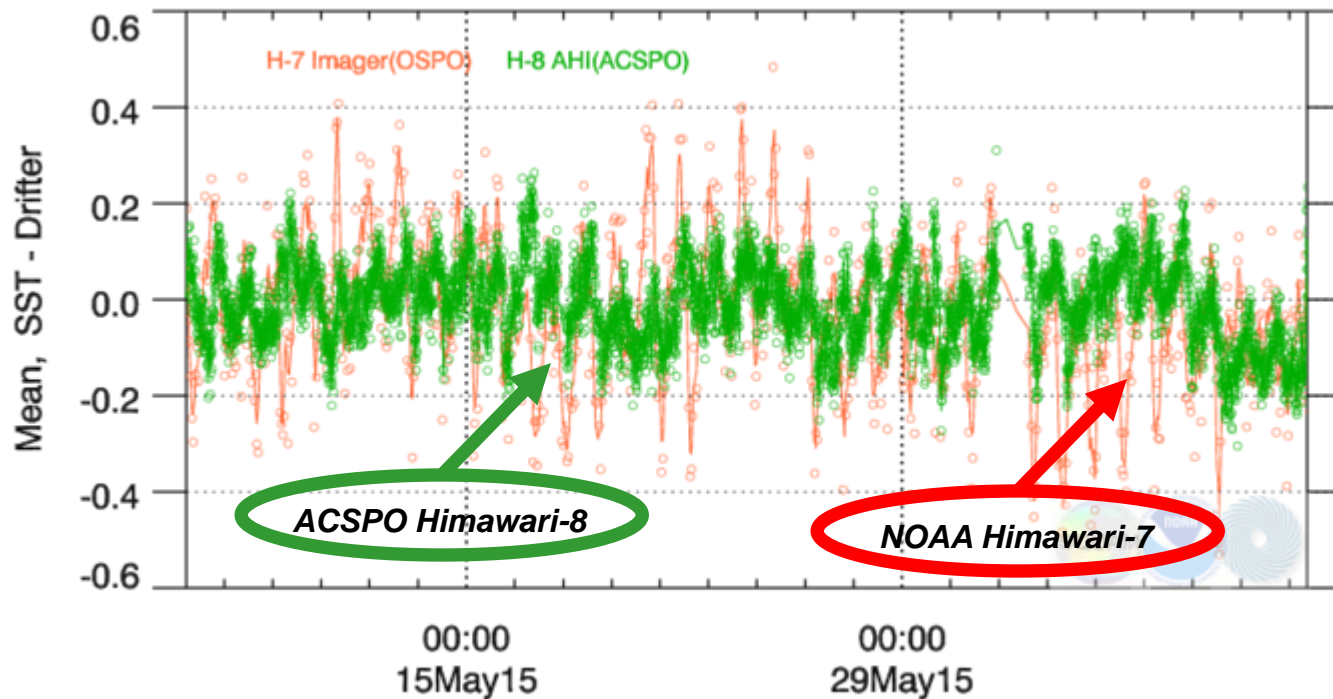
Overall good agreement except at high and in the low-to-mid latitudes

Night: ACSPO VIIRS L3U – OSTIA L4 (Jan – Jul, 2015)



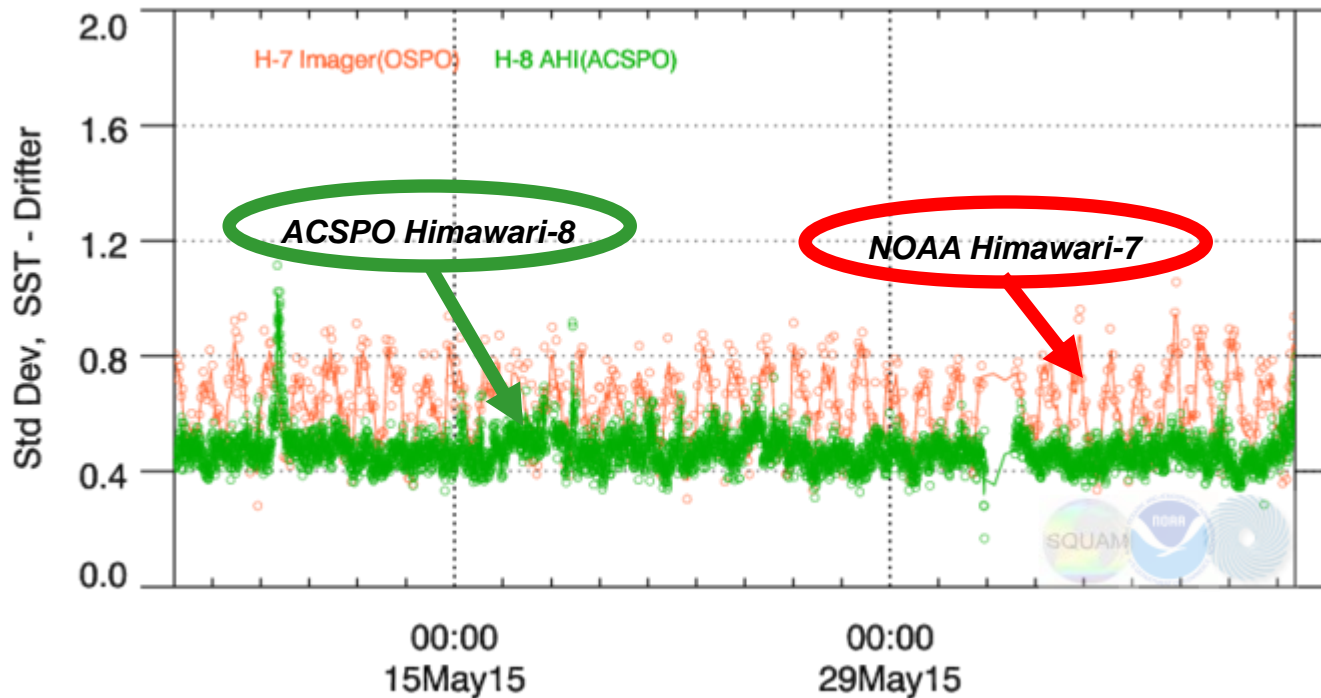
Large (+) differences in the high and recently (-) in the mid latitudes

Mean Bias wrt. *in situ* drifters: ACSP0 H8 vs. NOAA heritage H7 SST



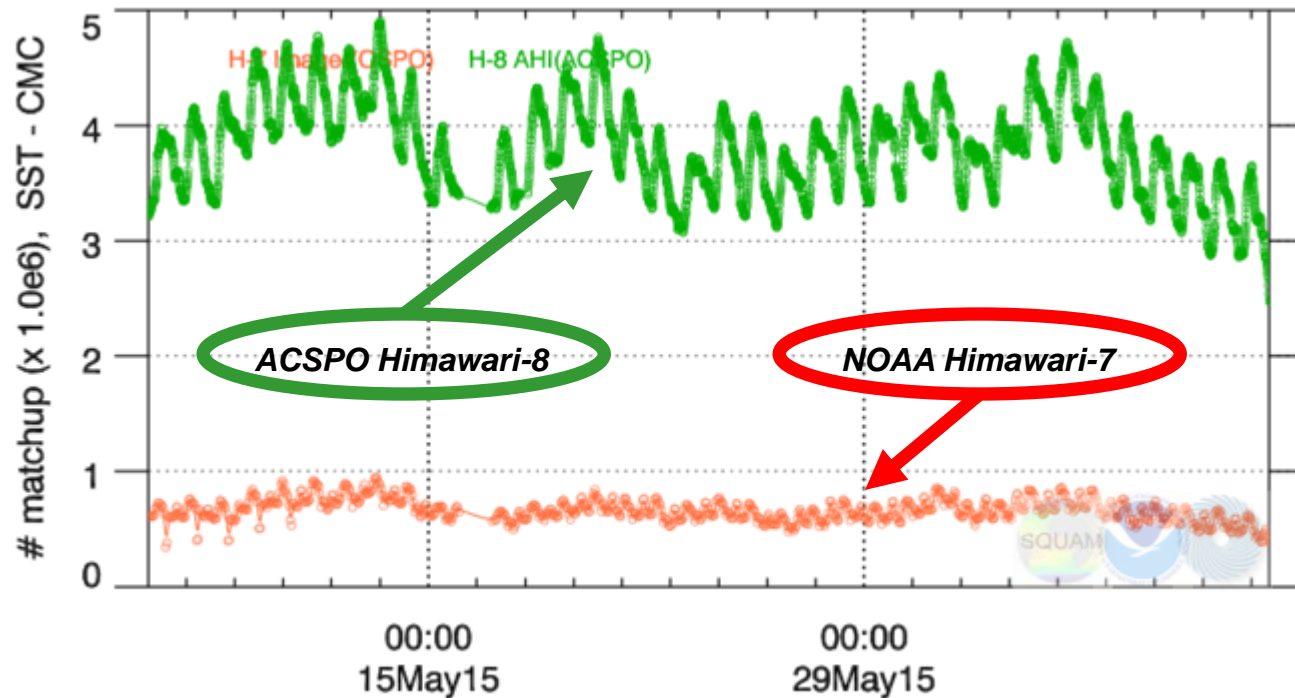
- ACSP0 H8 SST is within ± 0.2 K of drifters (vs. ± 0.4 K for heritage H7 SST)
- Some instabilities on order of 0.1 K in H8 SST may be due to sensor

Std Dev wrt. *in situ* drifters: ACSP0 H8 vs. NOAA heritage H7 SST



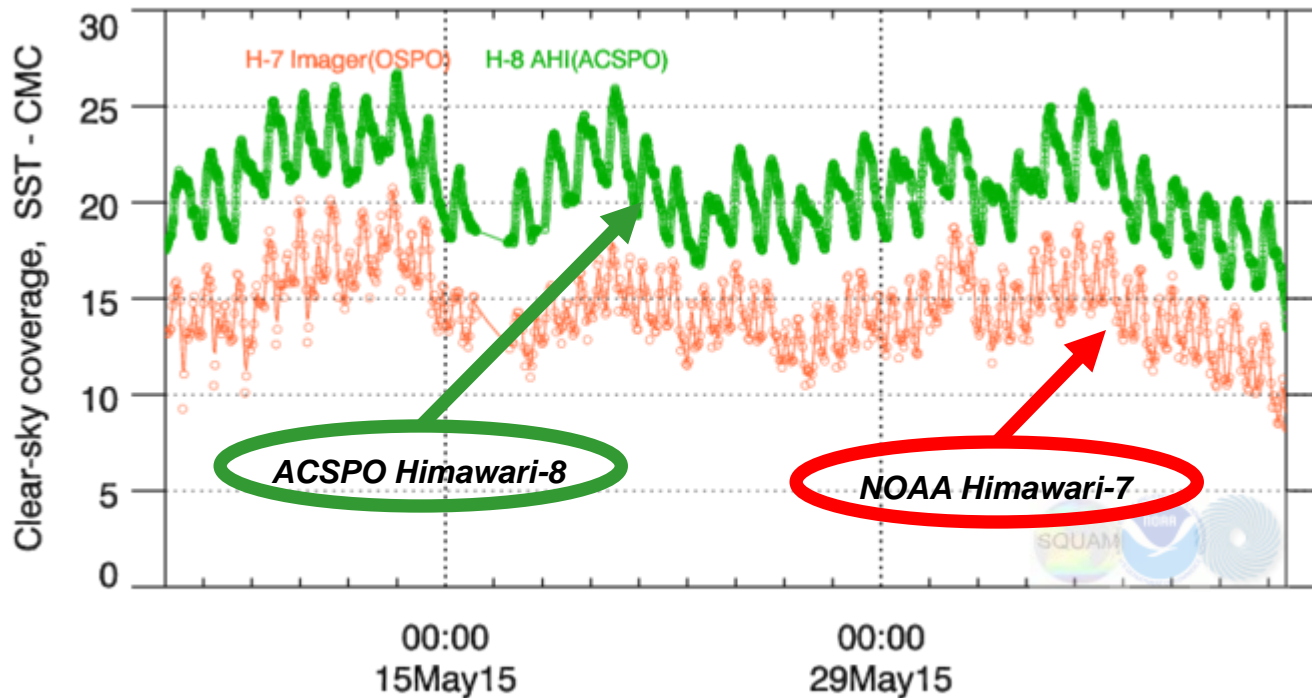
- ACSP0 H8 SST compares w/drifters to within $\pm 0.4-0.6$ K RMS (cf. 0.5-1.0 K for heritage H7 SST)
- Improved H8 performance is expected due to better AHI spatial resolution and radiometric performance

of SST retrievals: ACSP0 H8 vs. NOAA heritage H7



- Factor of $\times 5$ more SST retrievals in ACSP0 H8 than in heritage H7
- More ocean and more clear-sky pixels is expected due to superior H8 spatial resolution (2km vs. 5km at nadir)

Fraction of Clear-Sky Ocean Pixels: ACSP0 H8 vs. NOAA heritage H7



- % of clear sky pixels is 18-27% in ACSP0 H8 (compared to 12-20% in H7)
- Improved coverage is expected due to higher resolution of H8 (2km vs. 5km at nadir)

In situ SST QC & Monitoring in *i*Quam

www.star.nesdis.noaa.gov/sod/sst/iquam/

Xu, Ignatov: In situ SST Quality Monitor (*i*Quam). JTech, 2014.

iQuam Objectives

Perform the following functions in near-real time

- ❑ **Collect in situ data for satellite Cal/Val:** from various sources, covering full satellite era from 1981 – pr
- ❑ **Perform QC:** Uniform, accurate, flexible, consistent with wider Meteorological and Oceanographic communities
- ❑ **Monitor online:** Statistical summaries of *in situ* minus reference L4 SST, stratified by platform type (drifters, ships, tropical & coastal moored, ARGO, ..; and individual platforms)
- ❑ **Serve to users:**
 - NOAA: L2/3/4 matchups w/iQuam are monitored in SQUAM
 - Felyx: Matchups and cal/val
 - JPL: Assimilation in L4 MUR
 - U. Miami: Cal/Val of satellite SST retrievals

***i*Quam2 (2015) additions to *i*Quam1 (2009)**

- **Extend *i*Quam period back to 1981 (using ICOADS data)**
- **Improve QC**
 - Add 2nd reference SST – CMC (*i*Quam1 only used Reynolds SST)
 - Add CMS black list, and individual QFs from data producers
 - Add “performance history” check (*i*Quam version of CMS/UKMO “black lists
- **Add 4 new *in situ* data types (in addition to the 4 available in *i*Quam1 – ships, drifters, tropical moorings, and coastal moorings)**
 - ARGO Floats (in 2 modes: NRT and post-processing)
 - High-Resolution GHRSSST Drifters
 - IMOS Ships (ABoM/Helen Beggs)
 - Coral Reef Watch buoys
- **Improve Web interface**
 - Add daily statistics
 - Enhance web graphics (interactive display; print/save capability)
 - Redesign and optimize the code
- **Change output format to NetCDF4 “GDS2i”**

iQuam2 interface

NOAA NESDIS STAR



iQUAM

in situ SST quality monitor v2.0

NOAA / NESDIS / STAR



[Monitor](#) [Data](#) [About](#)

Maps

Statistics

Time Series

Platforms

2015 06



Monthly Daily

Ref SST Used in QC

Reyn CMC Both

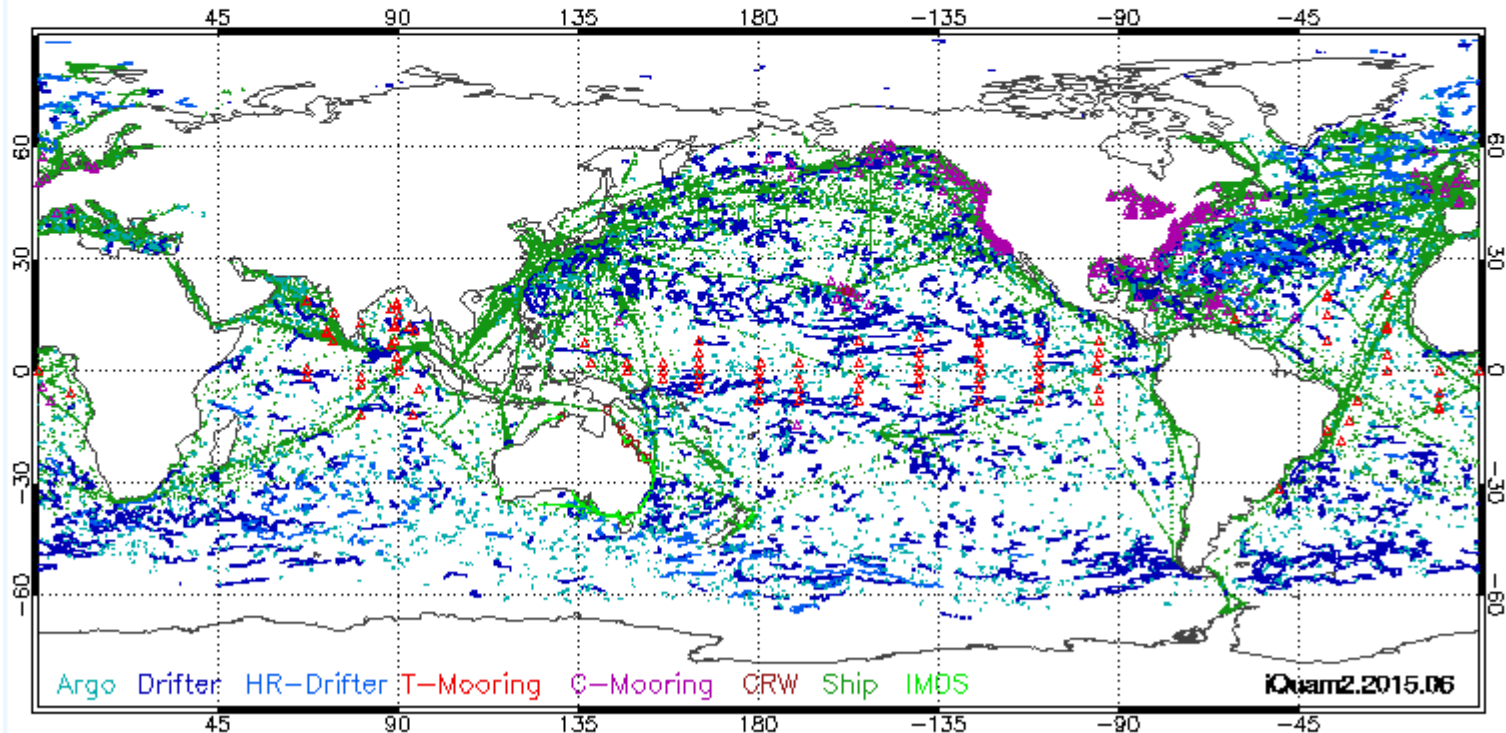
QCed Outlier

- Argo - Argo Floats
- Drifter - Conventional drifters
- HR-Drifter - High-Resolution Drifters
- T-Mooring - Tropical Moorings
- C-Mooring - Coastal Moorings
- CRW - Coral Reef Watch Buoys
- Ship - Conventional ships
- IMOS - IMOS Ships

20 July 2015

Symbol = one observation.

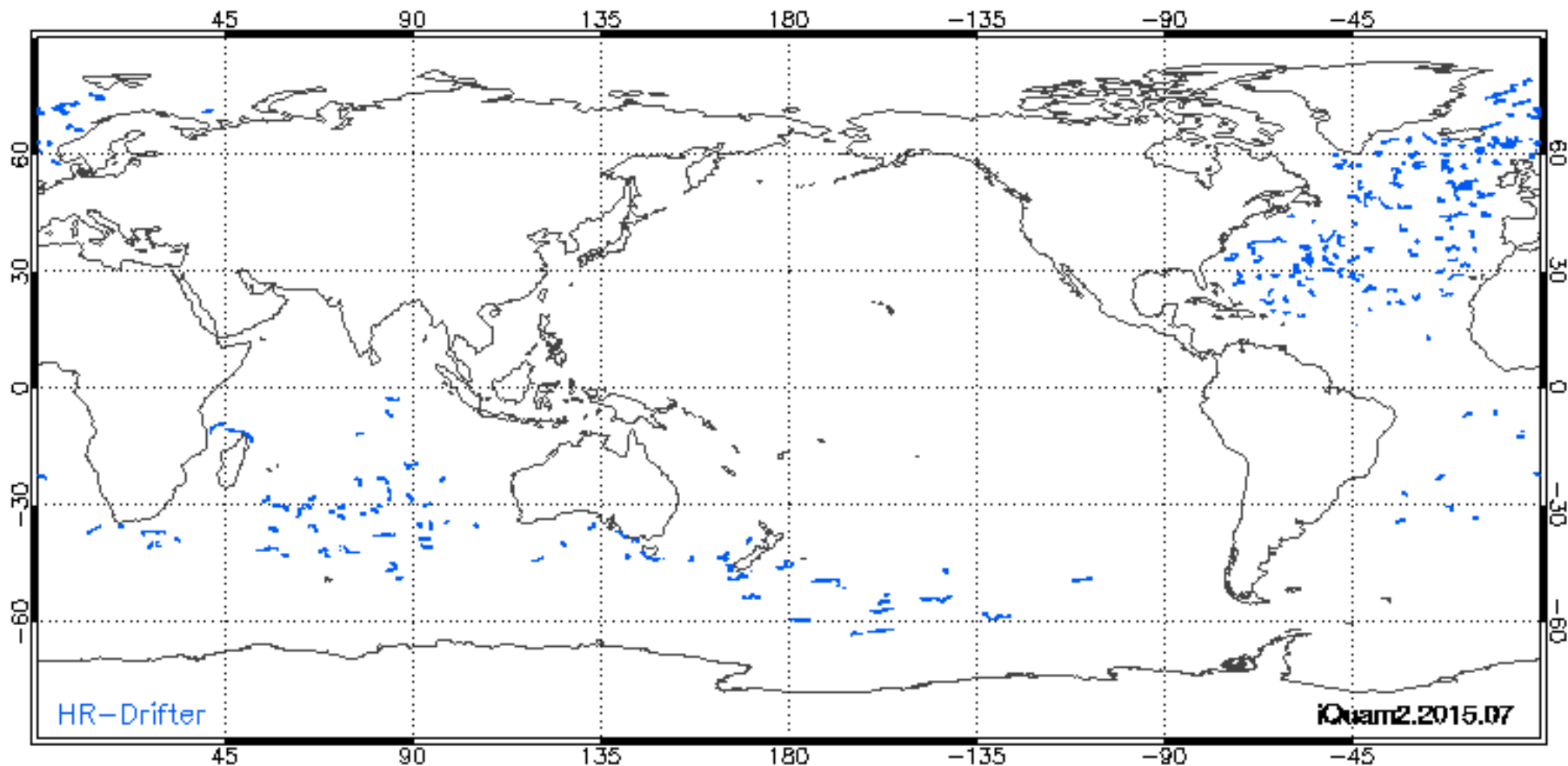
All Platforms Argo Drifter HR-Drifter T-Mooring C-Mooring CRW Ship IMOS



SQUAM and iQuam

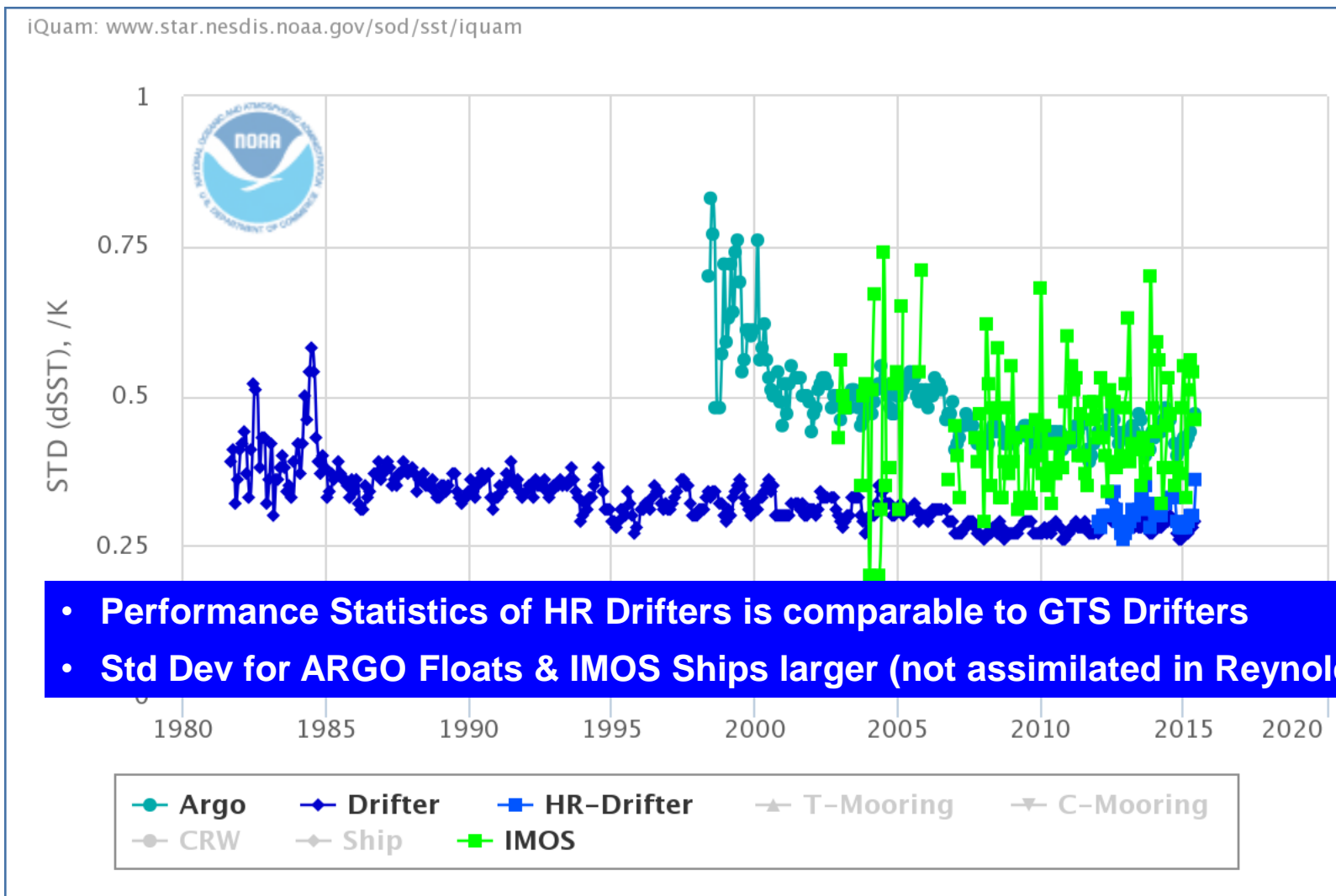
16

High Resolution Drifters July 2015

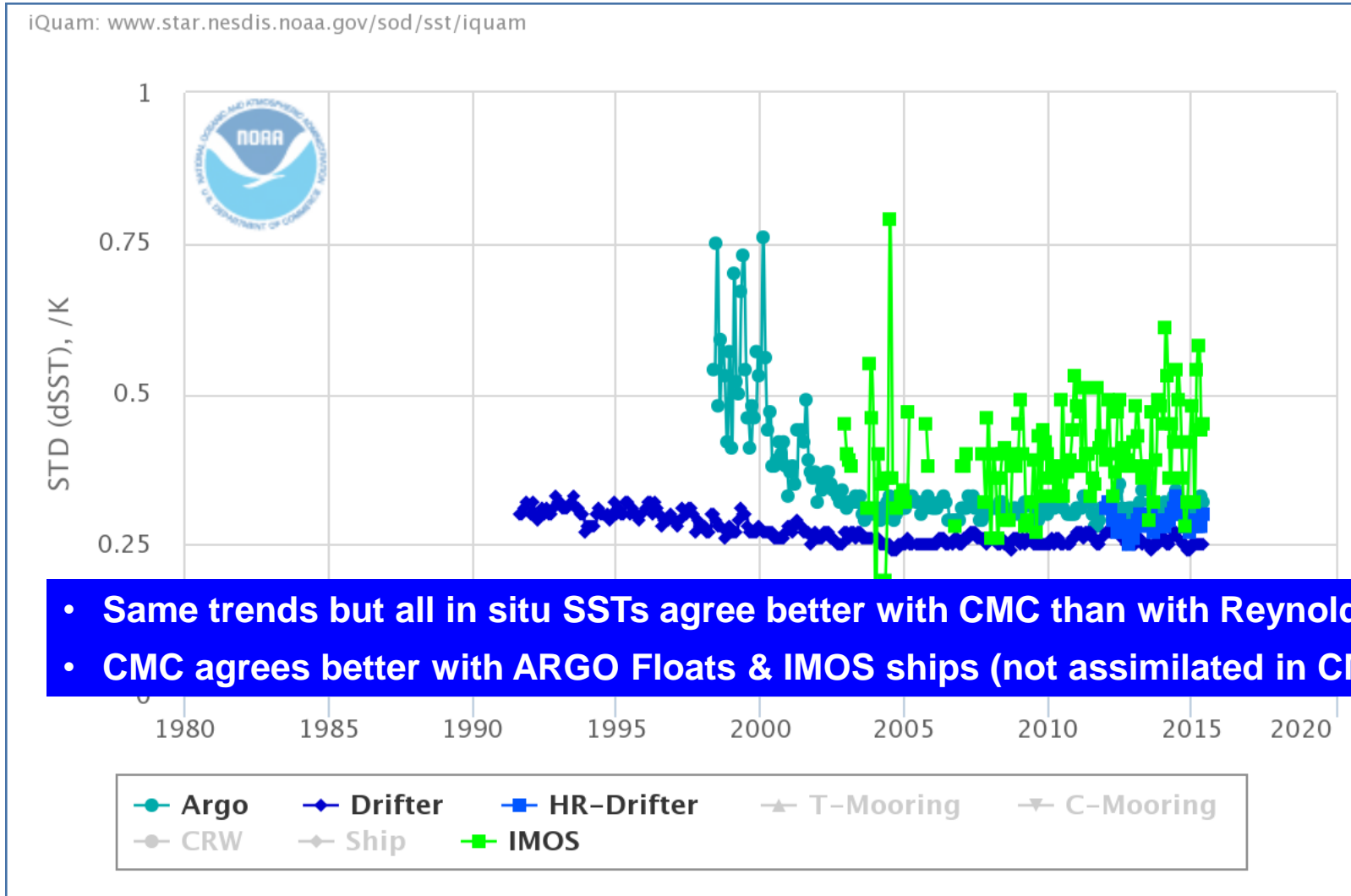


High Resolution drifters are mostly found in the N. Atlantic and S. Indian/Pacific

Std Dev wrt. Reynolds L4



Std Dev wrt. CMC L4



Data for Download

NOAA NESDIS STAR



iQUAM

in situ SST quality monitor v2.0

NOAA / NESDIS / STAR



[Monitor](#) [Data](#) [About](#)

NetCDF with Quality Flags

Data Log

Data are in self-documented NetCDF4 format. Refer to attributes for more information.

Suggested usage of quality_level:

- high-accuracy applications: quality_level == 5
- general applications: quality_level == 4
- advanced users: refer to definitions of iqum_flags and original_flags.

All statistics in iQuam page are for "high accuracy" data only, i.e. (quality_level == 5).

Quality level and flags are only set for SST. Other measurements in iQuam have not been QCed.

Data are organized in monthly files. Latest file is refreshed every 12hrs with a 2hr latency.

All data are available via [ftp](#).

File Name	Last Update Time	Data Source
201507-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv00.0.nc	2015-07-14 08:02	GTS; ARGO_rt; HR; IMOS; CRW.
201506-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 13:09	GTS; ARGO; HR; IMOS; CRW.
201505-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:15	GTS; ARGO; HR; IMOS; CRW.
201504-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:19	GTS; ARGO; HR; IMOS; CRW.
201503-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:15	GTS; ARGO; HR; IMOS; CRW.
201502-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-08 08:13	GTS; ARGO; HR; IMOS; CRW.
201501-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:25	GTS; ARGO; HR; IMOS; CRW.
201412-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:17	GTS; ARGO; HR; IMOS; CRW.
201411-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:23	GTS; ICOADS; ARGO; HR; IMOS; CRW.
201410-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:28	GTS; ICOADS; ARGO; HR; IMOS; CRW.
201409-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-08 08:24	GTS; ARGO; HR; IMOS; CRW.
201408-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:17	GTS; ARGO; HR; IMOS; CRW.
201407-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:22	GTS; ARGO; HR; IMOS; CRW.
201406-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:27	GTS; ARGO; HR; IMOS; CRW.
201405-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:32	GTS; ARGO; HR; IMOS; CRW.
201404-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-07 10:01	GTS; ICOADS; ARGO; HR; IMOS; CRW.
201403-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:22	GTS; ICOADS; ARGO; HR; IMOS; CRW.
201402-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:26	GTS; ICOADS; ARGO; HR; IMOS; CRW.
201401-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:32	GTS; ICOADS; ARGO; HR; IMOS; CRW.
201312-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:21	GTS; ICOADS; ARGO; HR; IMOS; CRW.
201311-STAR-L2i_GHRSSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2015-07-06 10:26	GTS; ARGO; HR; IMOS; CRW.

Topics to discuss at G-XVI

SQUAM

- ✓ Discuss with Yukio Kurihara, Masakazu Higaki, Helen Beggs monitoring of JAXA/JMA and ABoM H8 products in SQUAM
- ✓ Collect feedback on what products to keep/include. Product on which there is no feedback may be phased out. We are interested in more focused/targeted use of SQUAM resources

iQuam2

- ✓ NOAA plan to switch to iQuam2 in Sep 2015 – any show stoppers? Feedback from current iQuam users
- ✓ GHRSSST Guidance/Consensus on in situ data format. Currently, iQuam2 uses the “GDS2i” described in draft document by Tim Nightingale – is it OK?
- ✓ Should we archive with GHRSSST? Data volume is current <40GB, with 1GB/yr increment

More SQUAM/iQuam Resources at G-XVI

- Monday, 20 July @16-18 – Poster Session
 - Prasanjit Dash, SQUAM: Poster and Demo
 - Xinjia Zhou, *iQuam2*: Poster and Demo

- Thursday, 23 July @11:30-13:30
 - Discussion on data standard for in situ data (including *iQuam2*)

Thank You!