In situ SST Quality Monitor (*i*Quam)

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

SST Quality Monitor (SQUAM)

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

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NOAA STAR; CSU CIRA; GST Inc.
*(*Formerly with NOAA and GST Inc.)*

Supported by JPSS, GOES-R, & NOAA ORS Programs

*i*Quam

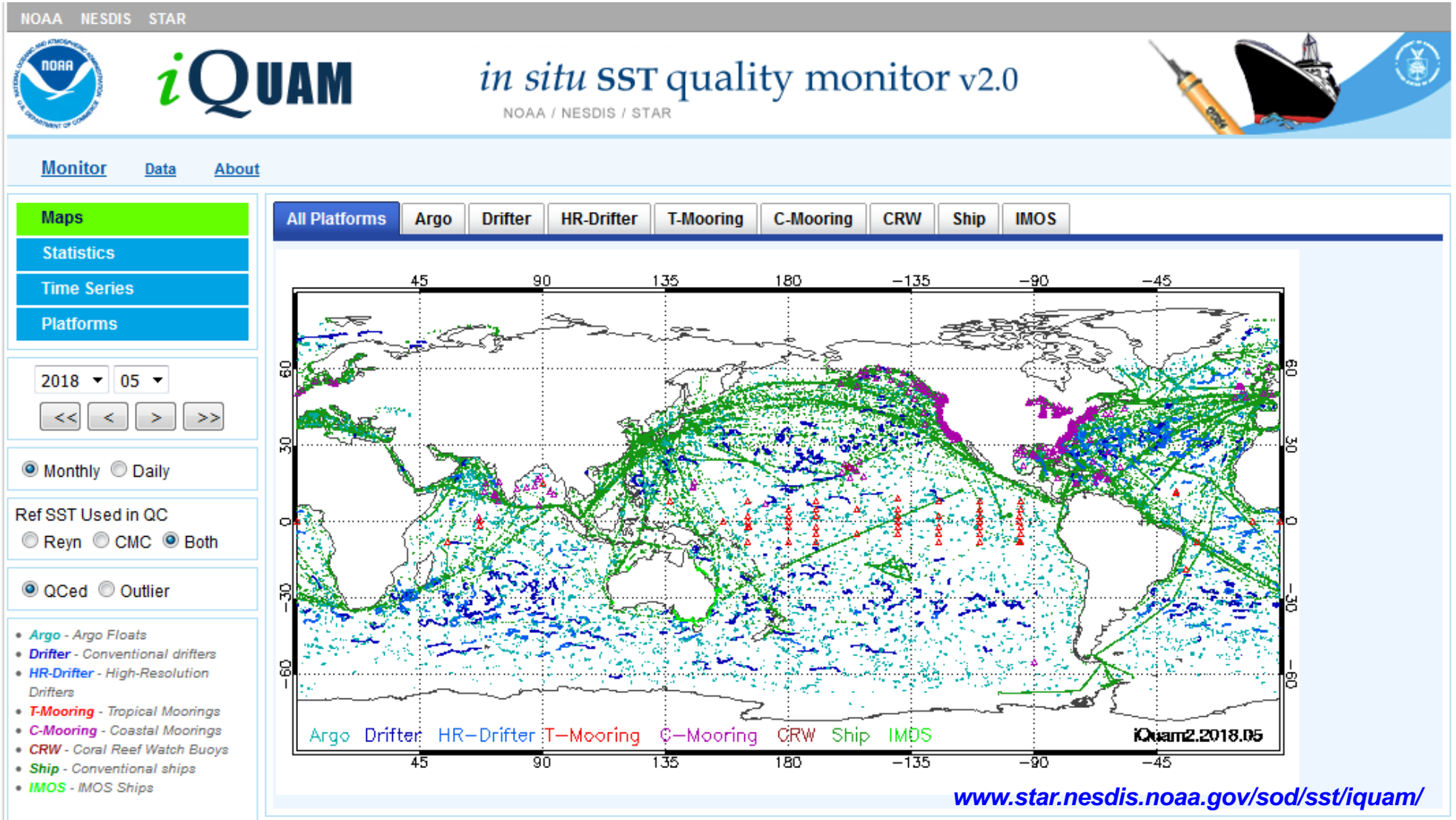
www.star.nesdis.noaa.gov/sod/sst/iquam/

*i*Quam Basics & Users

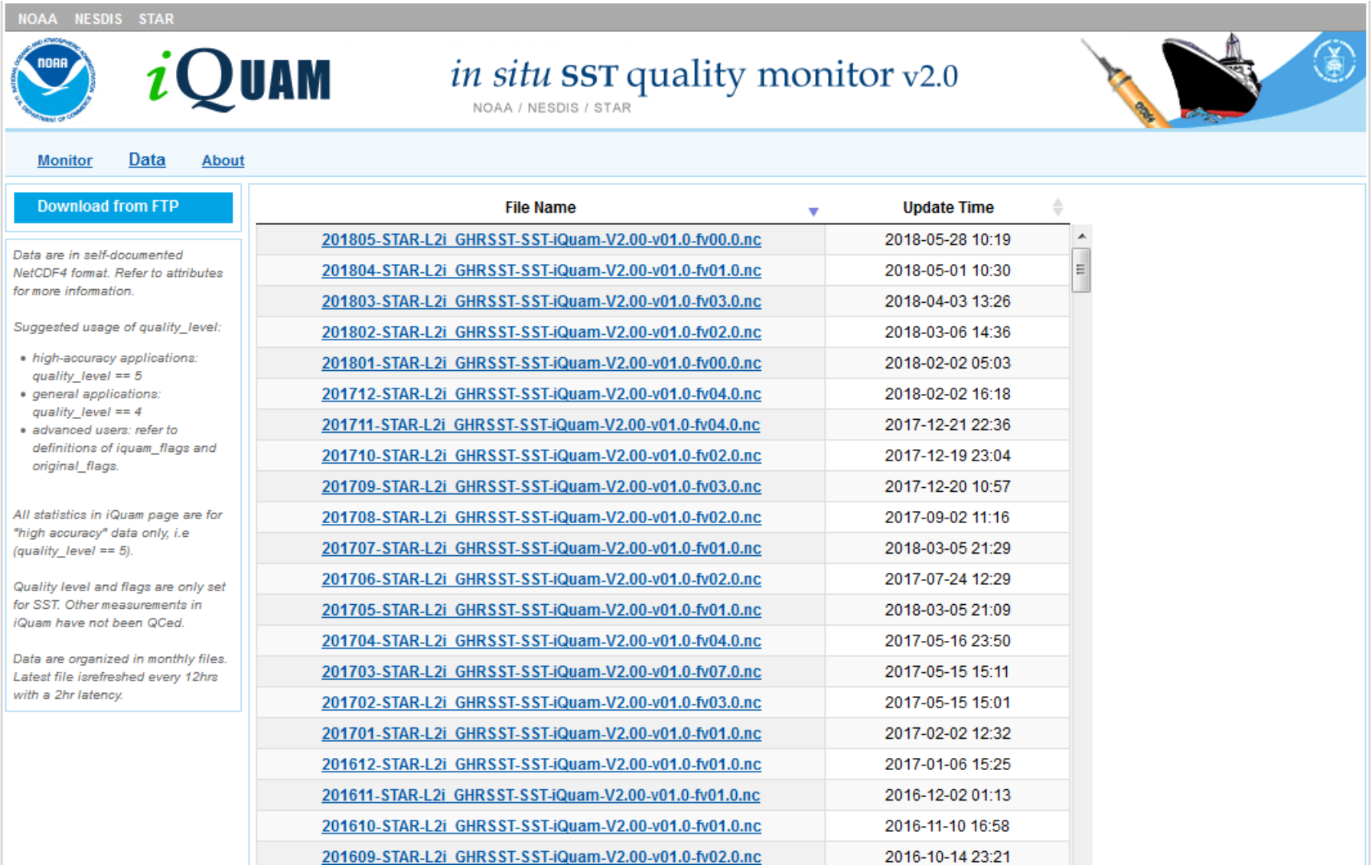
Development started in 2009 (Xu and Ignatov, 2010). V1 implemented in 2010 *(Xu and Ignatov, 2014)*, to mainly support NOAA needs. Today, *i*Quam is a GHRSST Resource

- **Collect *in situ* data for satellite era (1981-pr)** [from multiple sources]
- **Perform uniform & accurate QC**
- **Monitor online** statistical summaries of *in situ* minus reference L4 SST, (1) by platform type (e.g., drifters/ships/moorings/Argo etc); and (2) by individual platform IDs.
- **Update QC'ed data twice daily & Serve to Users (NOAA & External)**
  - NOAA ACSPO & SQUAM (JPSS, GOES-R, Himawari, AVHRR) (US) – A. Ignatov & ACSPO Team
  - NOAA Heritage GOES L2P, Geo-Polar Blended L4 (US) – P. Koner, J. Mittaz, A. Harris, E. Maturi
  - U. Miami (US) – K. Kilpatrick, P. Minnett, L. Williams, etc.
  - NASA GMAO (US) – S. Akella, R. Toddling, M. Suarez
  - JPL MUR (US) – M. Chin
  - NOAA NCEI (US) – K. Saha
  - BoM, U. Melbourne (Australia) – H. Beggs, C. Griffin, P. Govekar, H. Zhang, A. Babanin
  - Ocean Univ., CMA, SOA, IRSDE (China) – L. Guan, S. Wang, Q. Tu, Z. Liao, Q. Dong
  - JAXA/JMA (Japan) – Y. Kurihara, M. Kachi, M. Hori, H. Murakami
  - ISRO (India) – G. Tyagi, K. Babu, A. Mathur, H. Solanki
  - EUMETSAT, Felyx, CMS (Europe) – P. Dash, A. O'Carroll, J.-F. Piollé, A. Marsouin

*i*Quam2 replaced *i*Quam1 in Mar 2018



Data in *i*Quam2



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201804-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2018-05-01 10:30
201803-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv03.0.nc	2018-04-03 13:26
201802-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv02.0.nc	2018-03-06 14:36
201801-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv00.0.nc	2018-02-02 05:03
201712-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv04.0.nc	2018-02-02 16:18
201711-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv04.0.nc	2017-12-21 22:36
201710-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv02.0.nc	2017-12-19 23:04
201709-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv03.0.nc	2017-12-20 10:57
201708-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv02.0.nc	2017-09-02 11:16
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201706-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv02.0.nc	2017-07-24 12:29
201705-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv01.0.nc	2018-03-05 21:09
201704-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv04.0.nc	2017-05-16 23:50
201703-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv07.0.nc	2017-05-15 15:11
201702-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv03.0.nc	2017-05-15 15:01
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201609-STAR-L2i_GHRSST-SST-iQuam-V2.00-v01.0-fv02.0.nc	2016-10-14 23:21

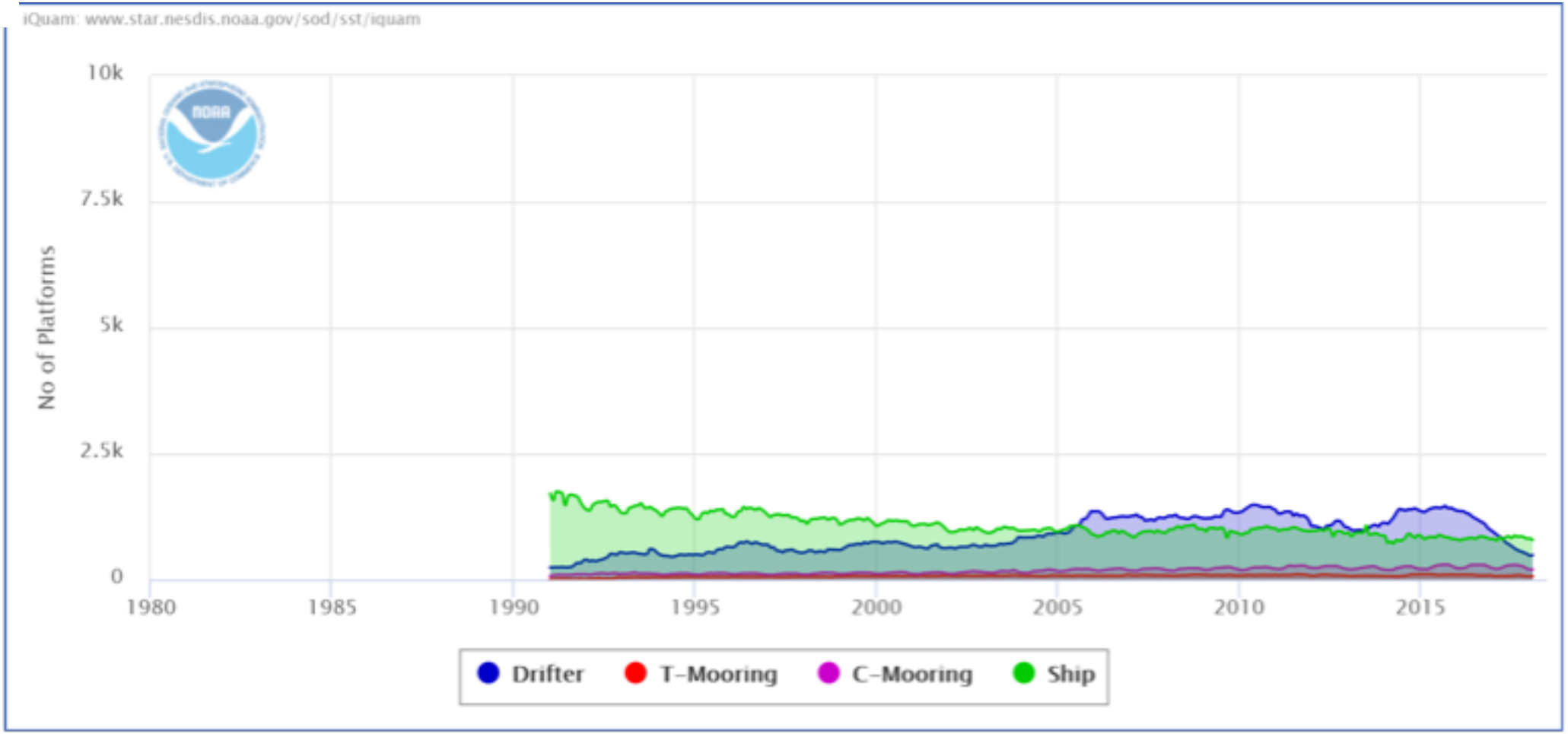
*i*Quam2 vs. *i*Quam1

- **Extended *i*Quam period to 1981 (*i*Quam1: 1991) using ICOADS R2.50**
- **Improved QC**
  - Added 2nd reference SST – CMC (*i*Quam1 only used Reynolds SST)
  - Added CMS black list, and individual QFs from data producers
  - Added "performance history" check (*i*Quam version of CMS/UKMO "black lists)
- **Added 4 new *in situ* data types (to ships, drifters, tropical/coastal moorings)**
  - ARGO Floats (in 2 modes: NRT and post-processing)
  - Hi-Res GHRSST Drifters
  - IMOS Ships (BoM/Helen Beggs)
  - Coral Reef Watch buoys
- **Improved Functionality, Robustness and Web interface**
  - Added daily statistics (previously, only monthly were available)
  - Enhanced web graphics (interactive display; print/save capability)
  - Redesigned and optimized the code
- **Changed output format to NetCDF4 "GDS2i" (from hdf4 in *i*Quam1)**

Ongoing Work Towards *i*Quam2.1

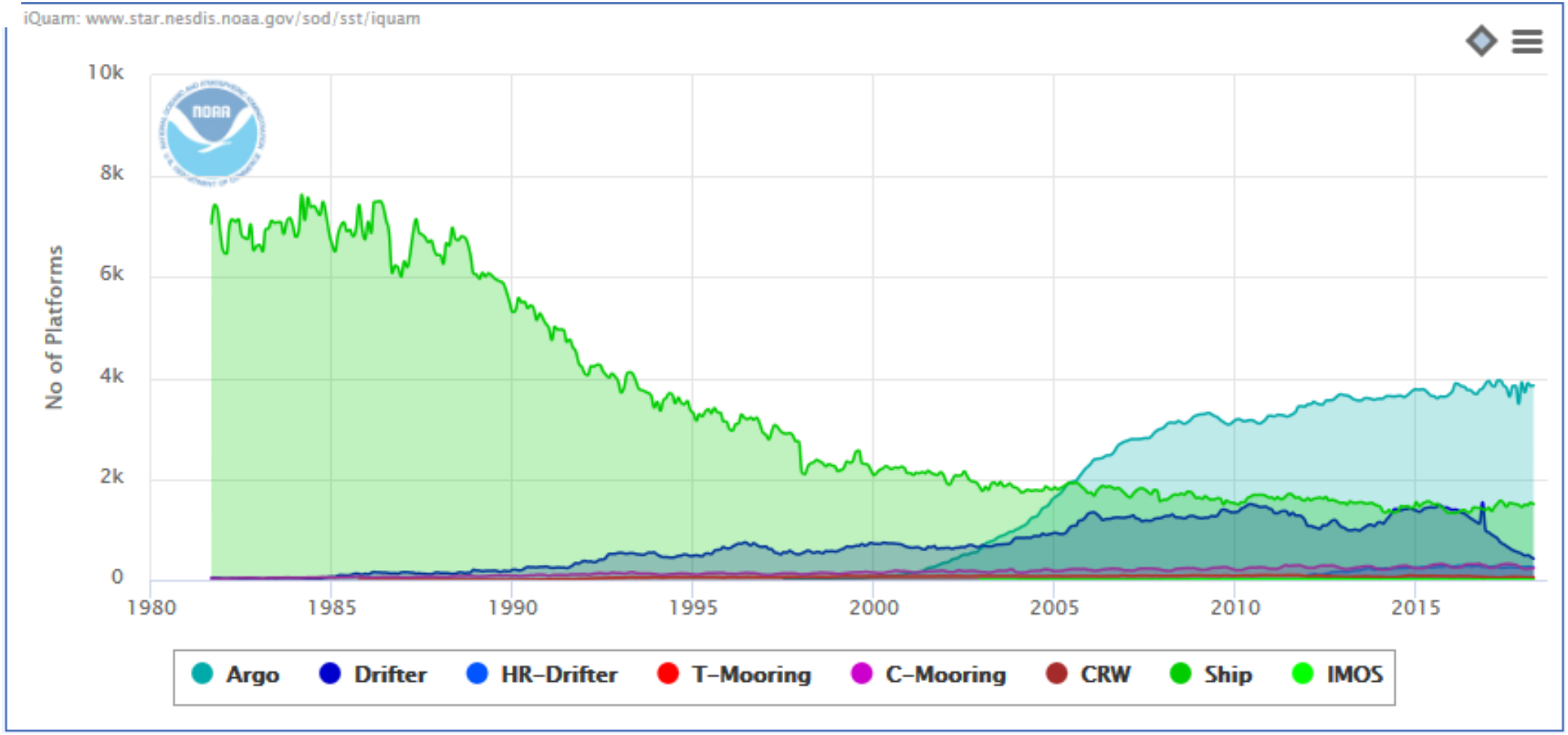
- **Merge RT GTS data from NCEP, FNMOC, ICOADS**
  - To improve data stability
  - To address the 5 to 7 digit ID WMO transition (still not addressed in NCEP GTS)
- **Add Argo floats from 2 more sources (in addition to IFREMER)**
  - USGODAE
  - NOAA NODC
- **Replace ICOADS R2.5 with 3.0**
  - Also NetCDF data are used instead of IMMA1
- **Interactive/extended plots for individual platforms**
  - Added time series of mean, SD and NOBS for individual platforms
  - All time series are now interactive
- **Hourly maps added**
  - Useful to analyze & fill data gaps
- **Permalink feature is being explored**

Number of IDs in *i*Quam1



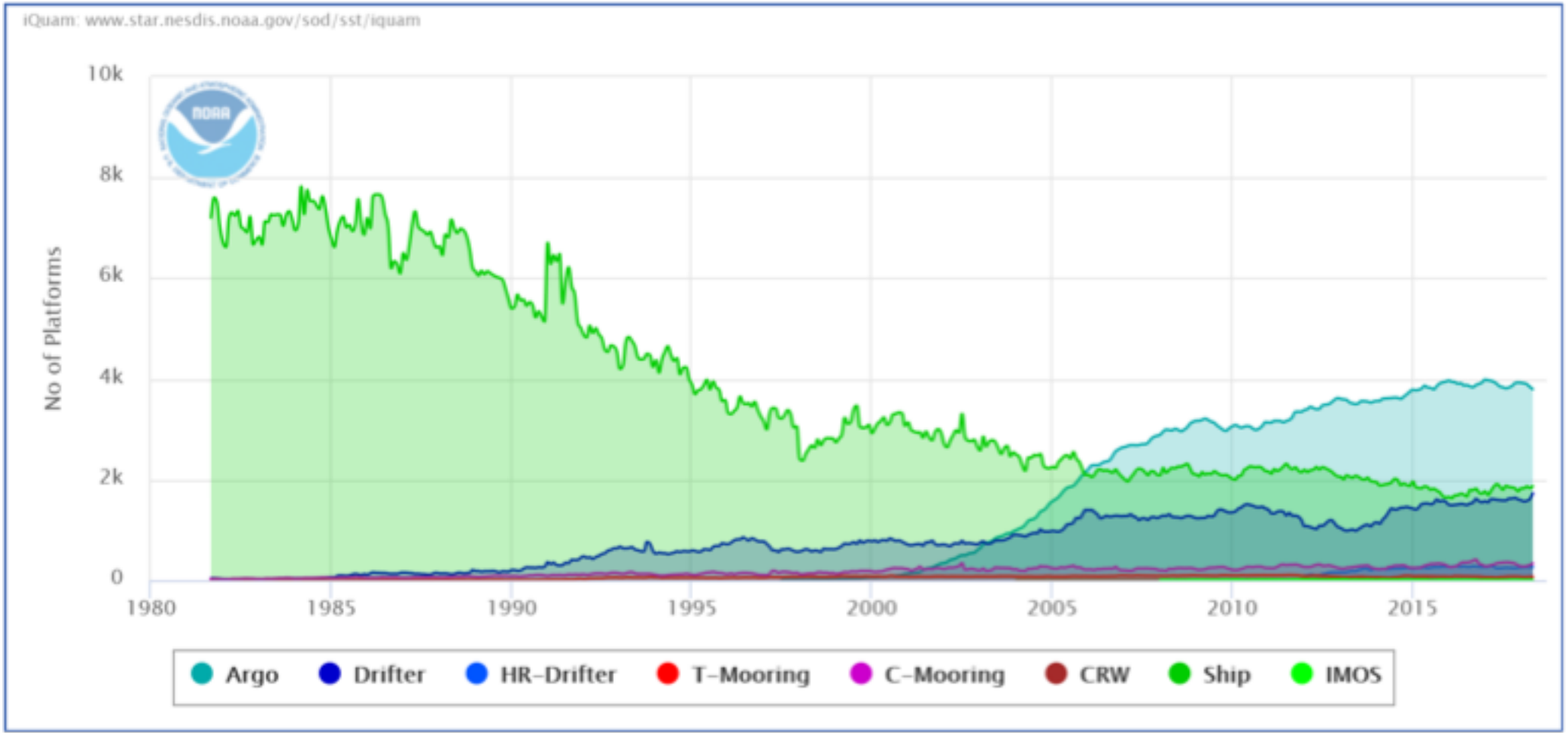
***i*Quam1 ingested only NCEP GTS (1991-on) which included 4 platform types**

Number of IDs in *i*Quam2



***i*Quam2: iQuam1 + ICOADS R2.5 + HR Drifters + Ifremer Argo + BoM IMOS + CRW**

Number of IDs in *i*Quam2.1



***i*Quam2.1: iQuam2 + FNMOC + ICOADS R3.0 (+RT GTS) + USGODAE/NODC Argo**

SQUAM

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

SQUAM Basics

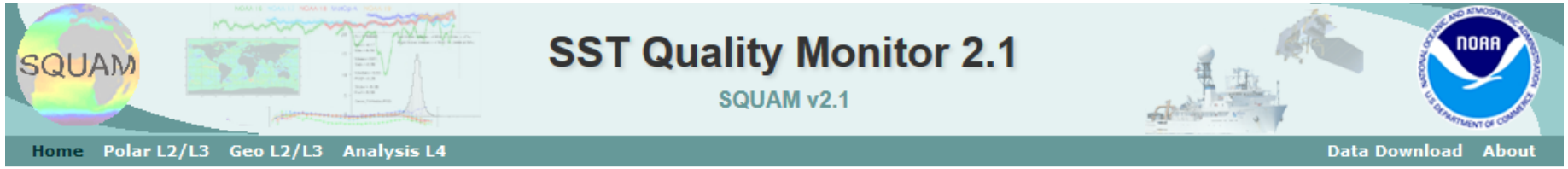
Development started in 2007. V1 released in 2009, to support NOAA Cal/Val (Dash et al, 2010). Today, SQUAM is a GHRSST resource

- **Monitor satellite L2/3/4 SSTs using ΔSST=SAT–Ref**
  - *In situ* SST (from *i*Quam) – standard validation
  - Gap-free L4 SST – global QC
- **Check if global distributions of ΔSST are near-Gaussian**
  - Centered at (approximately) zero
  - Global SD is a measure of noise in the SAT and Ref
- **Plot global**
  - Maps
  - Histograms
  - Time Series
  - Dependencies
  - Hovmoller Diagrams

SQUAM 2.0 and 2.1

- **In 2017, SQUAM was updated to V2**
- **Focus of V2 is on NOAA & Partners' Products**
  - Data volume from NOAA new-generation polar (SNPP/N20 VIIRS) and GEO (GOES-16/17 ABI, and H08/9 AHI) satellites is very large
  - We can try and work with individual users offline, if needed – let us know
- **New Functionality/Interface**
  - Interactive/User-controlled graphics; Permalink feature added
  - Monthly and yearly aggregations added (to the prior daily only)
  - Geo page newly created (UTC vs Local Time, etc)
  - SSES Bias correction On/Off button added
- **In 2018, SQUAM updated to V2.1**
  - Provisioned are N20 VIIRS; G17 ABI; & Full line of ACSPO L3Us
  - All developmental products moved to internal pages

Data Monitored in SQUAM 2.1



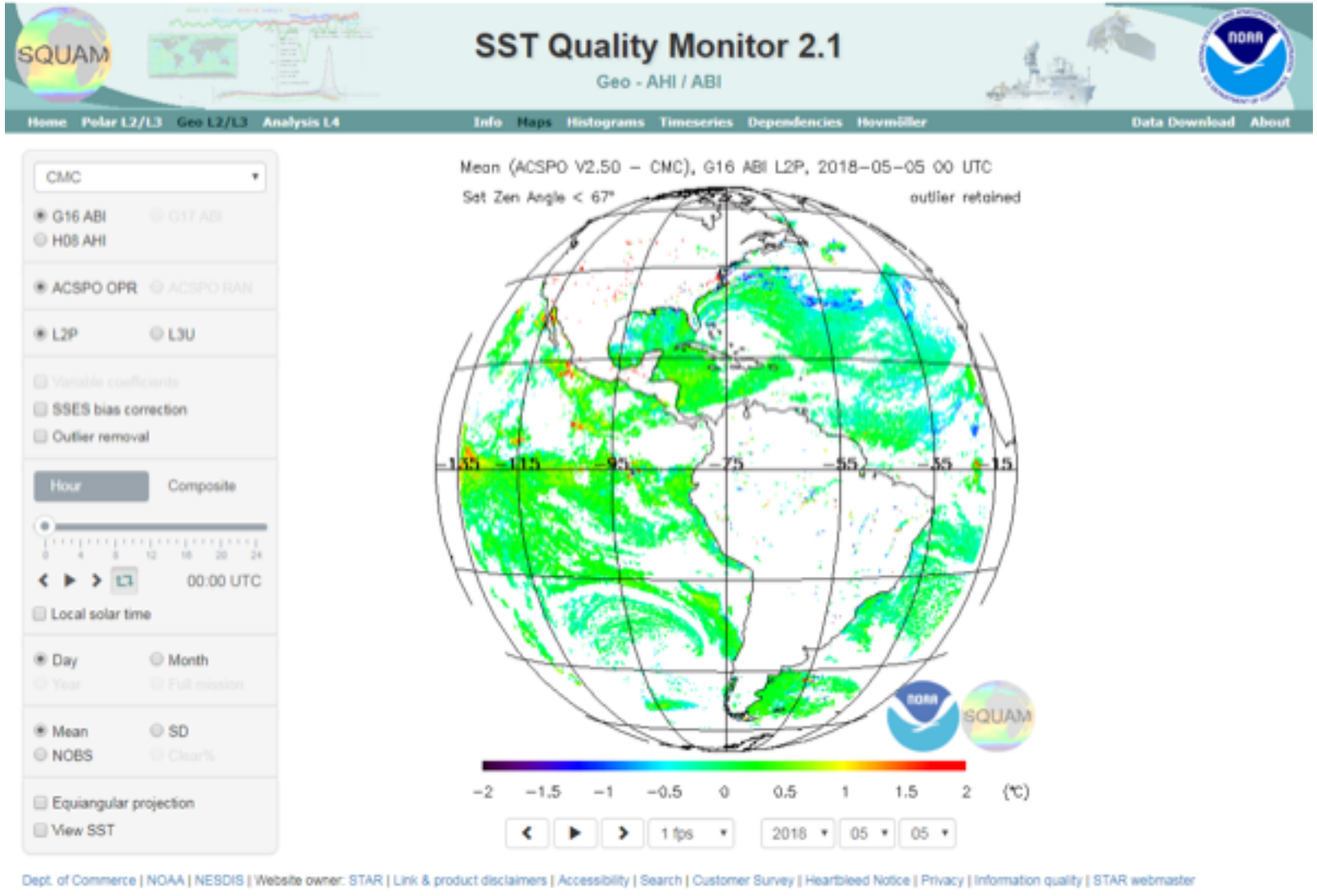
SST products monitored in SQUAM R2

	Polar L2/L3	Geo L2/L3	Analysis L4
High Res	**VIIRS** ACSPO L2P/L3U **AVHRR FRAC** ACSPO L2P OSISAF L2P	**Himawari-8 AHI** ACSPO L2P/L3U **GOES-16 ABI** ACSPO L2P/L3U	MUR (JPL)
Low Res	**AVHRR GAC** ACSPO L2P/L3U		CMC (Environment Canada) OSTIA (Met Office) OSTIA RAN (Met Office) GMPE (Met Office) Geo Polar Blended (NOAA) Reynolds (NOAA) GAMSSA (BoM)

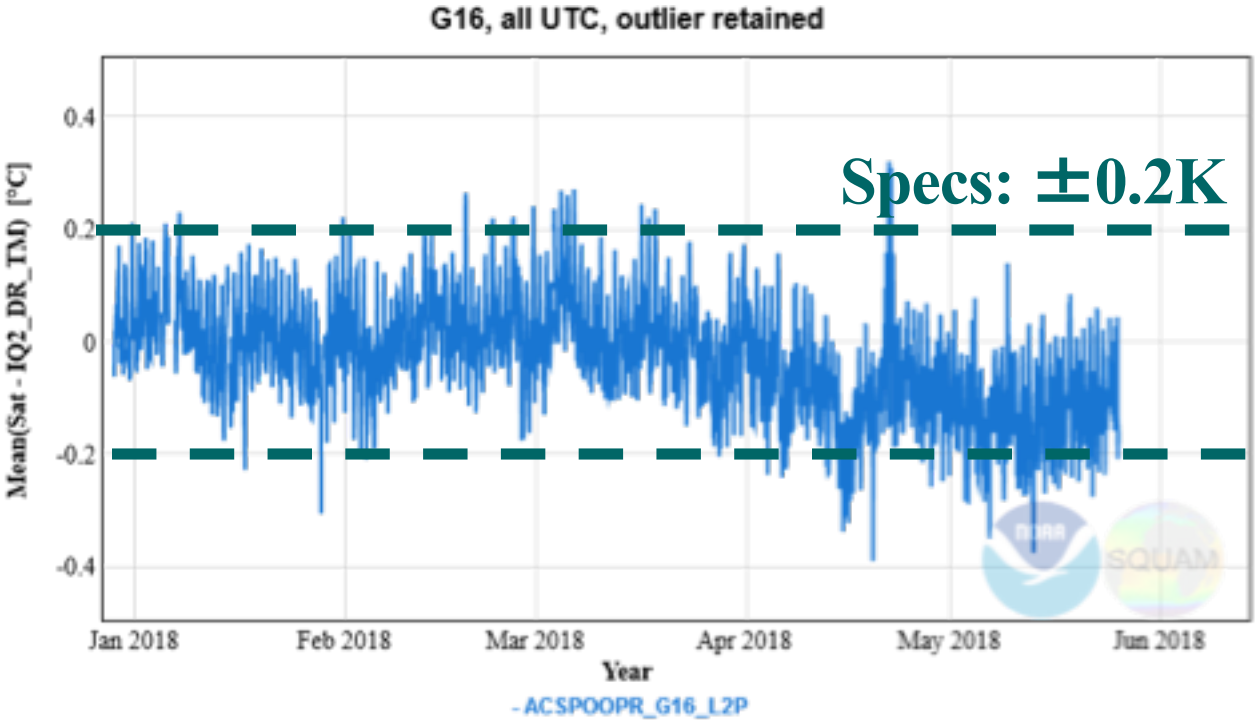
SST data providers

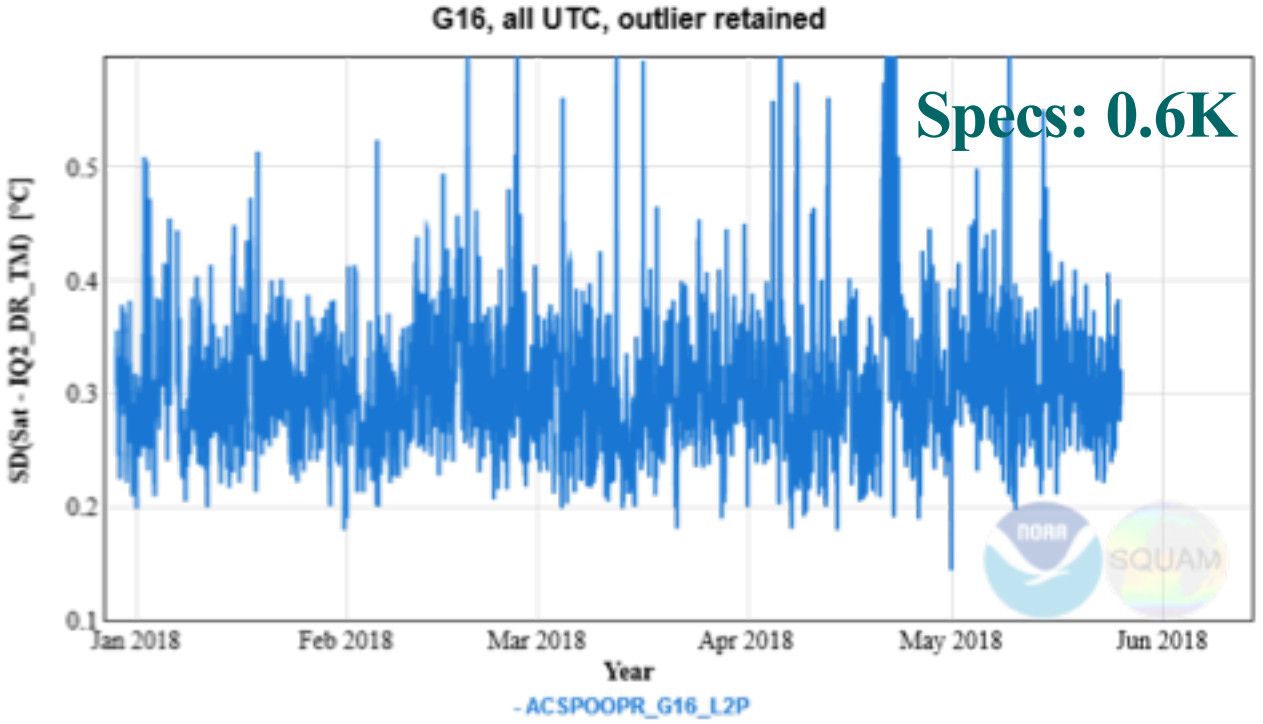
Satellite missions

New SQUAM2 GEO Page



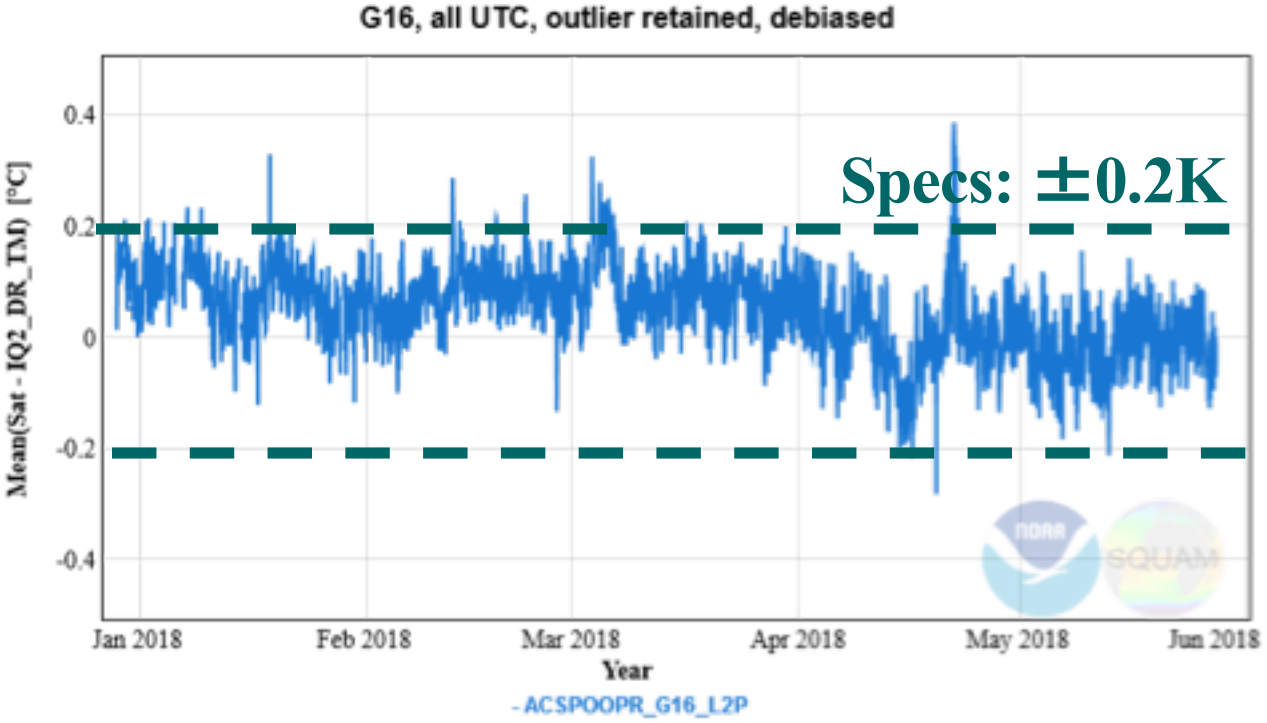
G16 "Sub-Skin" SST: Mean Bias & Std. Dev wrt. *in situ*

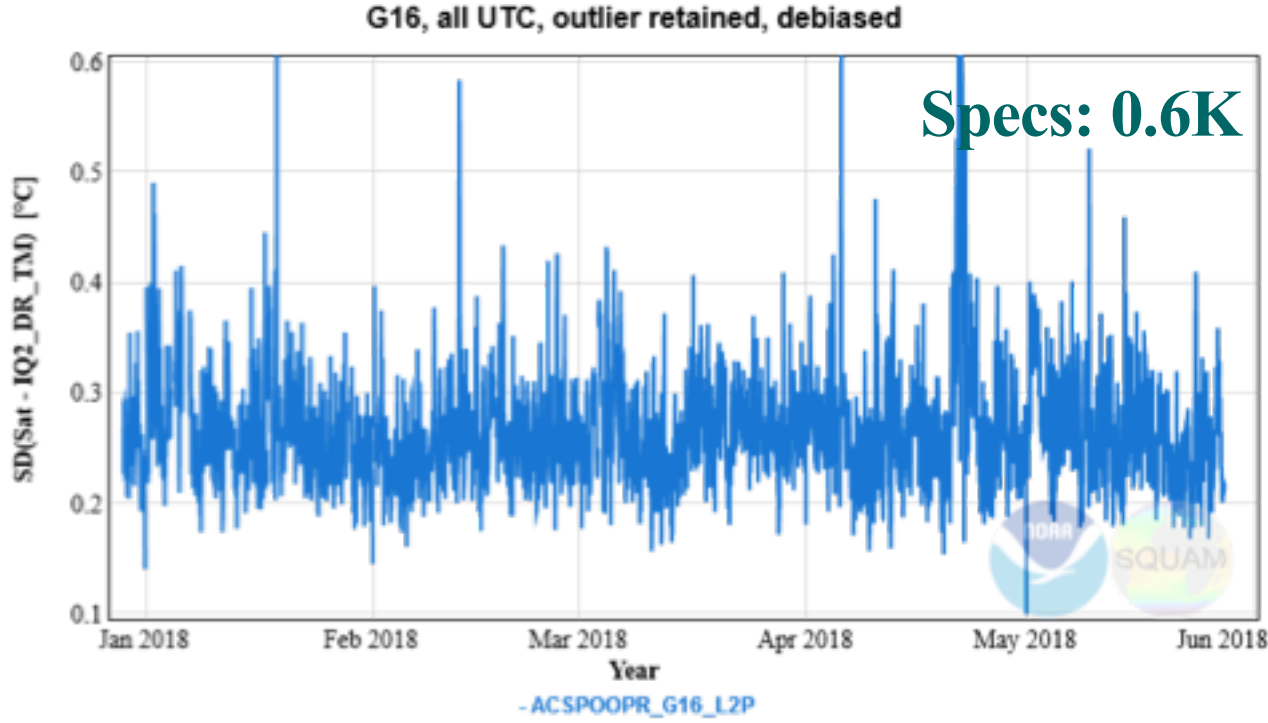




- ACSPO 2.50 real-time "Sub-Skin SST" is largely within NOAA SST Specs
- ACSPO 2.60 will employ superior collated algorithm (Gladkova et al @ Thu)
- Full ABI Record Jan 2018-on will be uniformly reprocessed & archival @ PO.DAAC

G16 "Depth" SST ("Sub-Skin – SSES Bias"): Mean Bias & Std. Dev wrt. *in situ*





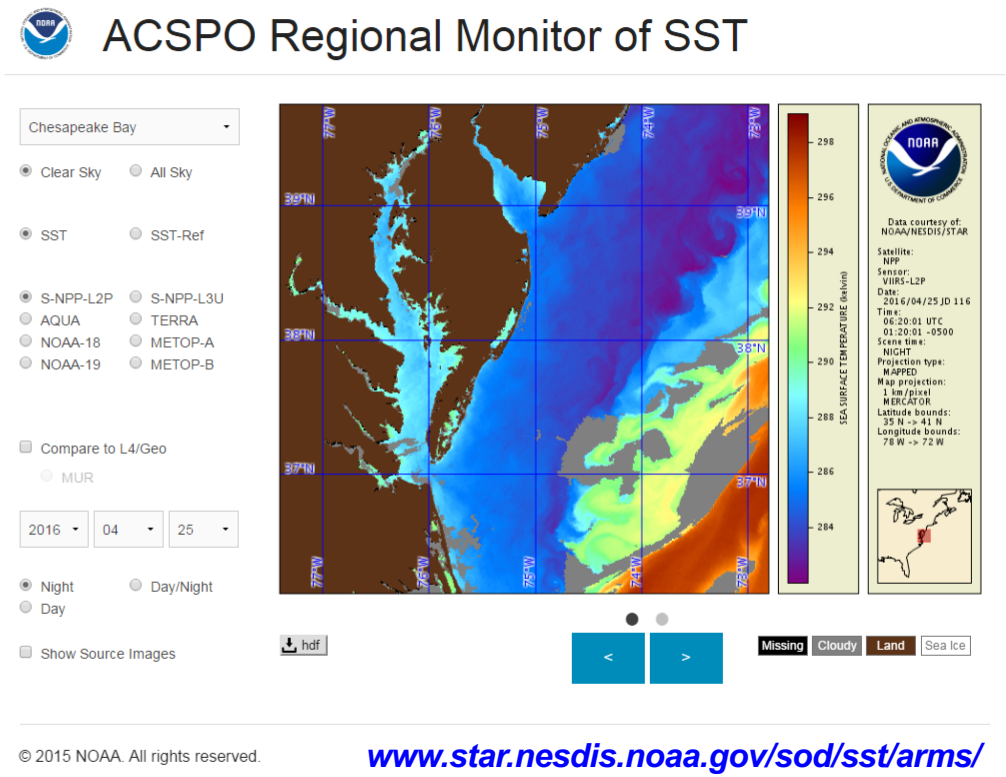
- ACSPO 2.50 real-time "Depth SST" is largely within NOAA SST Specs
- ACSPO 2.60 will employ superior collated algorithm (Gladkova et al @ Thu)
- Full ABI Record Jan 2018-on will be uniformly reprocessed & archival @ PO.DAAC

Ongoing *i*Quam and SQUAM Work

- ***i*Quam**
  - Complete v2.1, promote to the *i*Quam main slot
  - Work on early years of satellite era, Identify best *in situ* SSTs for Cal/Val of ACSPO AVHRR GAC RANs
  - Document *i*Quam2.0/2.1 enhancements
- **SQUAM**
  - Operational: Add N20/VIIRS & G17/ABI SSTs
  - Reanalyses: Add VIIRS & AVHRR GAC RAN2s; ABI/AHI RAN1
  - New Products: Add all L3U/C products from various sensors

More SST Monitoring Resources at GRSST-XIX

- ✓ Xinjia Zhou – *i*Quam (presented by Ignatov)
- ✓ Kai He – SQUAM (presented by Pennybacker)



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

Ignatov – ACSPO Regional Monitor for SST (ARMS).
7 Jun (Thu) @AM

Thank You!