



## 20<sup>th</sup> GHRSSST Science Team Meeting

3-7 June 2019, Frascati, Italy



### ***In situ* SST Quality Monitor (*iQuam*)**

[www.star.nesdis.noaa.gov/sod/sst/iquam/](http://www.star.nesdis.noaa.gov/sod/sst/iquam/)

### **SST Quality Monitor (SQUAM)**

[www.star.nesdis.noaa.gov/sod/sst/squam/](http://www.star.nesdis.noaa.gov/sod/sst/squam/)

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NOAA STAR; GST Inc.

*Supported by JPSS and GOES-R Programs*

*Thanks to Xinjia Zhou (formerly CSU/CIRA) for initial help with iQuam2.1*



# *iQuam*

[\*www.star.nesdis.noaa.gov/sod/sst/iquam/\*](http://www.star.nesdis.noaa.gov/sod/sst/iquam/)



# *i*Quam: *in situ* SST data for satellite Cal/Val and blended analyses

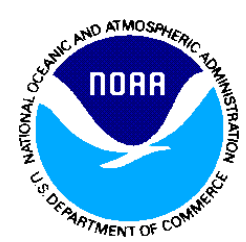
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*Introduced in 2010 for NOAA Cal/Val needs (Xu and Ignatov, JTECH, 2014).*

*Today is a GHRSSST Community Resource, with two dozen of US/international users*


What *i*Quam does


- Collect *in situ* data from various sources (with QC, if available)
- Perform uniform QC, add *i*Quam QFs
- Serve data online (in monthly “GDS*i*” netCDF files, updated daily)
- Monitor *in situ* data online



# iQuam v2.0 was upgraded to v2.1 in Nov 2018

NOAA NESDIS STAR

 **iQUAM2** *in situ SST Quality Monitor v2.10*  
NOAA / NESDIS / STAR



[Monitor](#) [Data](#) [About](#) [www.star.nesdis.noaa.gov/sod/sst/iquam2/](http://www.star.nesdis.noaa.gov/sod/sst/iquam2/) ← Temporary URL – use this one for now!

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

2019 05 28  
[Navigation icons]  
 Show hour 0

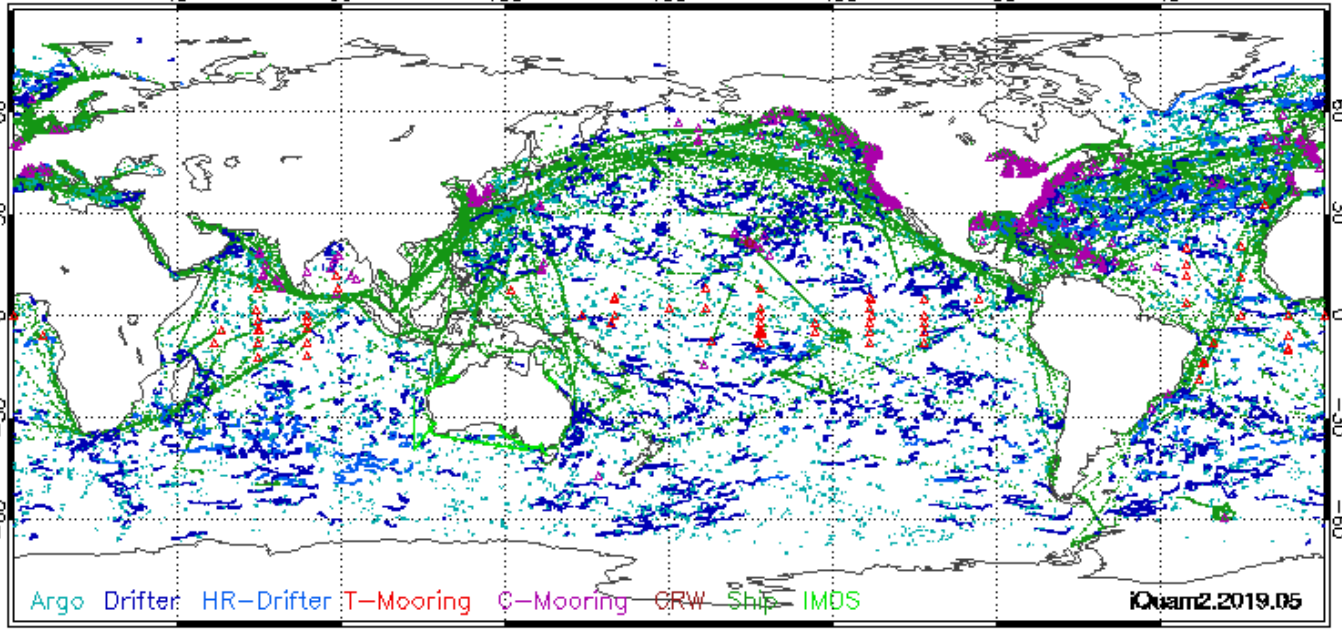
Month  Day

Ref SST used in QC  
 Reyn  CMC

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

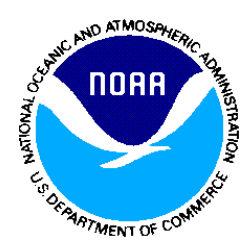
Symbol = one observation.



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


iQuam2.2019.05

*iQuam and SQUAM*



# Data in *i*Quam2.1

NOAA NESDIS STAR

 **iQUAM** *in situ* SST Quality Monitor v2.10  
NOAA / NESDIS / STAR

[Monitor](#) [Data](#) [About](#) [www.star.nesdis.noaa.gov/sod/sst/iquam2/](http://www.star.nesdis.noaa.gov/sod/sst/iquam2/) ← Temporary URL – use this one for now!

**Download from FTP**

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 iquam\_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.

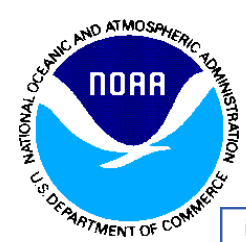
File Name	Update Time
<a href="#">201905-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv00.0.nc</a>	2019-05-29 00:05
<a href="#">201904-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv00.0.nc</a>	2019-05-28 20:06
<a href="#">201903-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv01.0.nc</a>	2019-05-28 00:30
<a href="#">201902-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv02.0.nc</a>	2019-05-28 15:36
<a href="#">201901-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv03.0.nc</a>	2019-05-27 04:10
<a href="#">201812-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv04.0.nc</a>	2019-05-27 04:01
<a href="#">201811-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv05.0.nc</a>	2019-05-27 03:56
<a href="#">201810-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv06.0.nc</a>	2019-05-27 03:53
<a href="#">201809-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv07.0.nc</a>	2019-05-27 01:38
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<a href="#">201806-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv09.0.nc</a>	2019-05-26 20:09
<a href="#">201805-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv10.0.nc</a>	2019-05-27 20:09
<a href="#">201804-STAR-L2i_GHRSSST-SST-iQuam-V2.10-v01.0-fv11.0.nc</a>	2019-05-28 22:27
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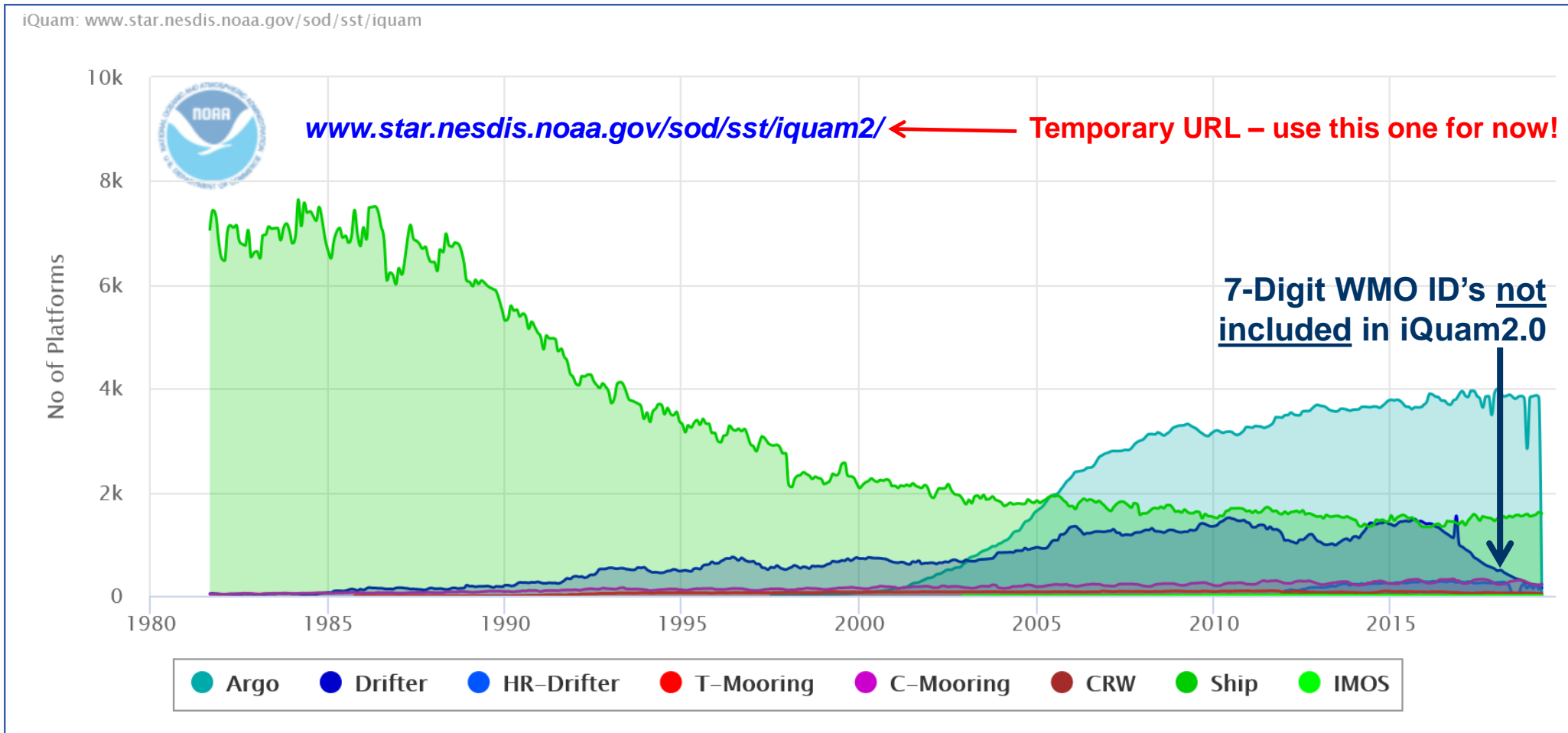
# Major Updates in *iQuam2.1* (still being tested before official release)

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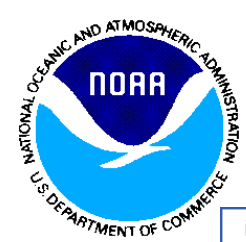
- **Merged RT GTS data from NCEP, FNMOC, ICOADS**
  - To improve data stability
  - To address the 5-to-7 digit ID WMO transition (still not addressed in NCEP GTS)
- **Added Argo floats from 2 more sources (in addition to IFREMER)**
  - USGODAE & NOAA NODC
- **Replaced ICOADS R2.5 with R3.0**
  - Also NetCDF data are used instead of IMMA1
- **Added Interactive/extended plots for individual platforms**
  - Added time series of mean/SD/NOBS for individual platforms (All time series are now interactive)
- **Added hourly maps**
  - Useful to analyze & fill data gaps
- **Added permalink feature**
  - Useful to share the page content with partners
- **Files are updated once daily (vs. twice daily before)**
  - Increased data volumes started creating job run conflicts



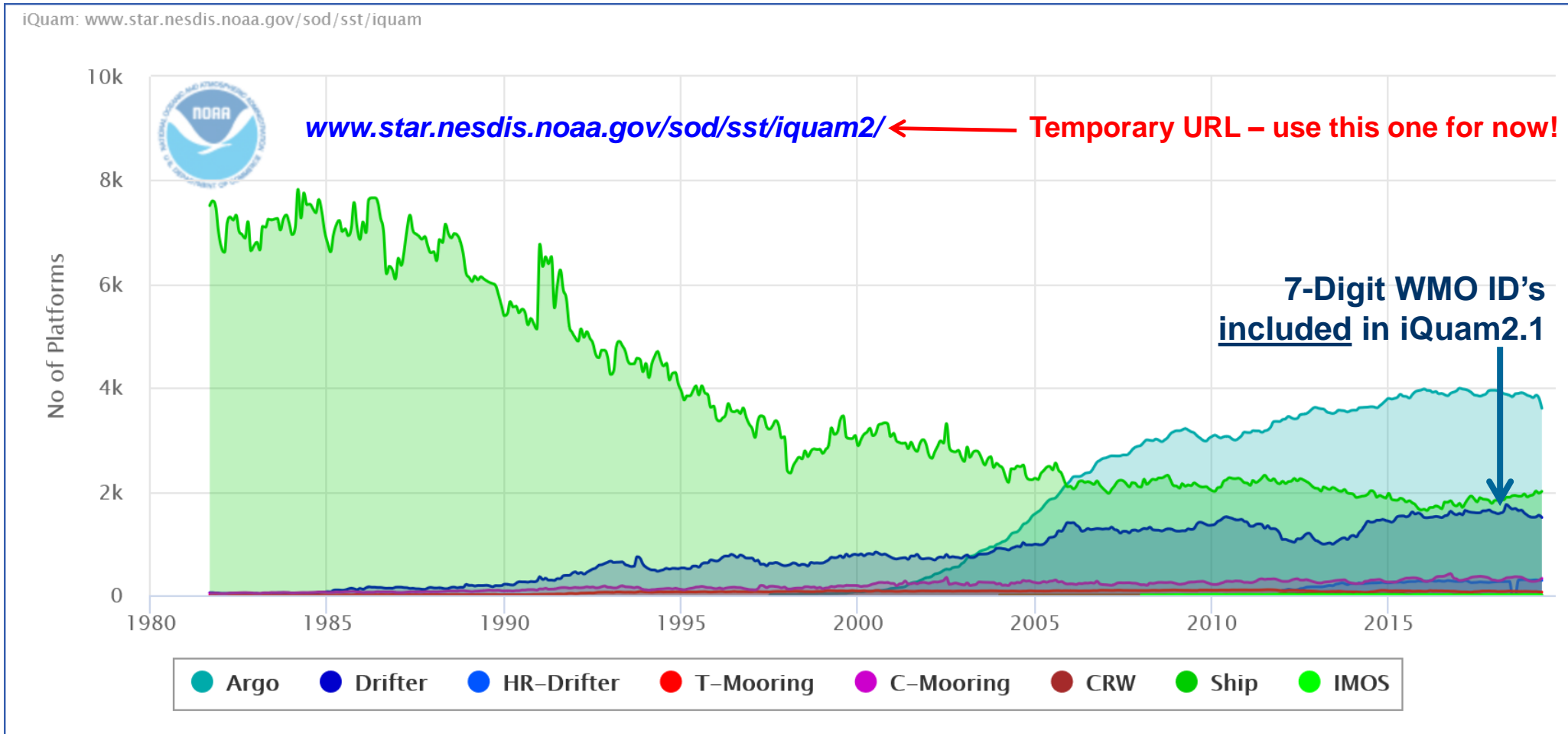
# Number of IDs in *i*Quam2.0



***i*Quam2.0: *i*Quam1 + ICOADS R2.5 + HR Drifters + Ifremer Argo + BoM IMOS + CRW**



# Number of IDs in *i*Quam2.1

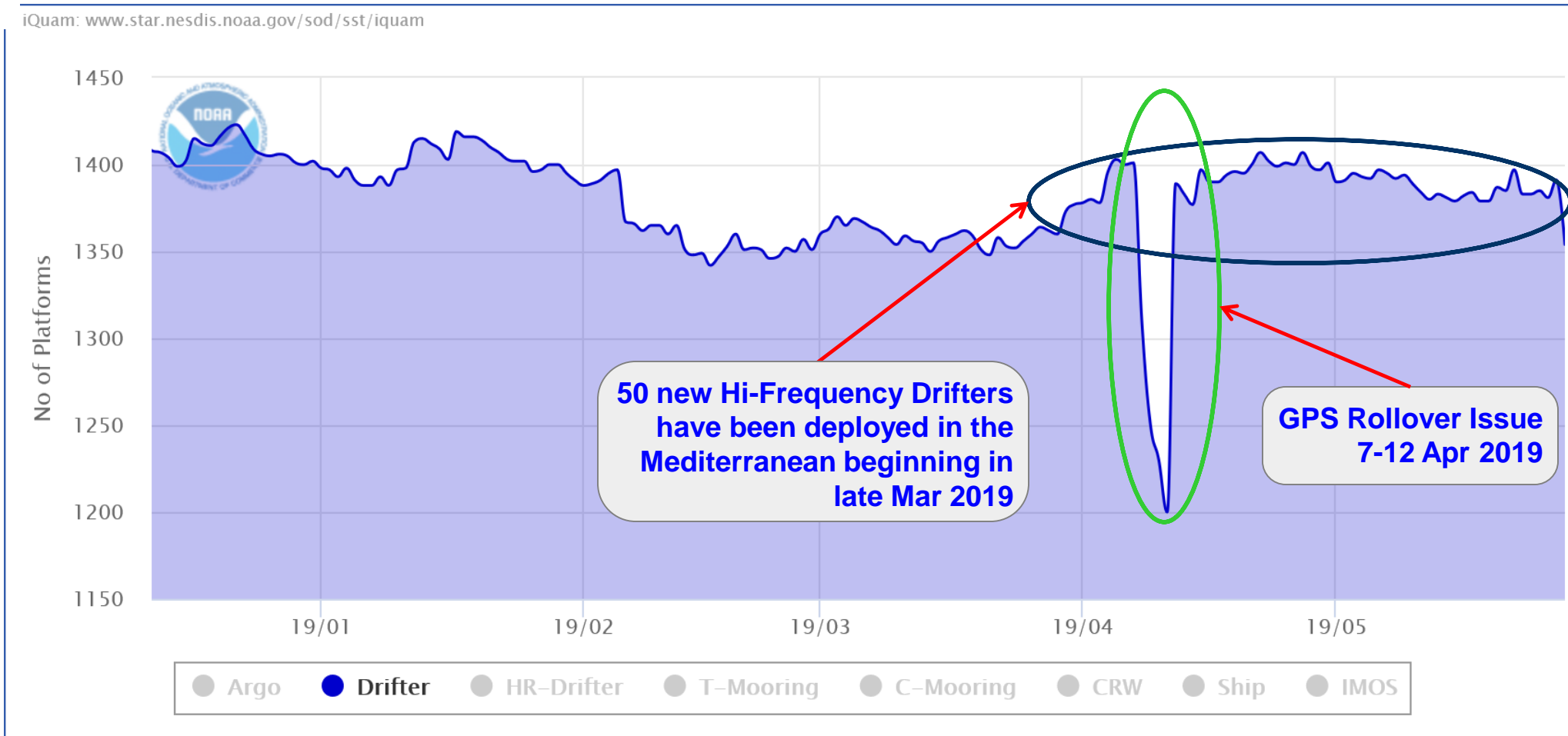


***i*Quam2.1: *i*Quam2 + FNMOC + ICOADS R3.0 (+RT GTS) + USGODAE/NODC Argo**

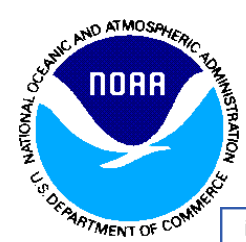




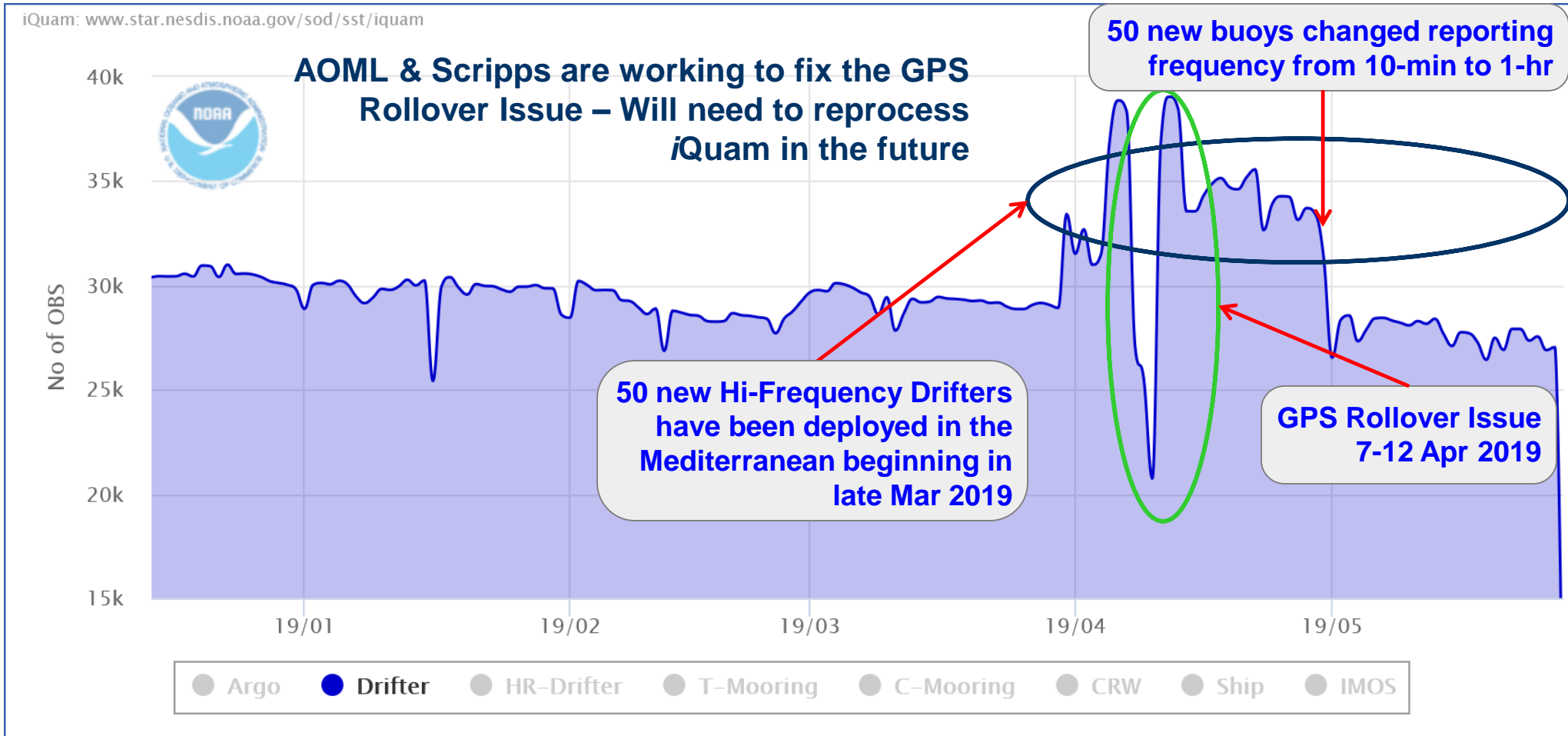
# Apr 2019 “Anomaly”: +50 new Hi-Freq Drifters & GPS Clock Issue On Some Drifters: Number of IDs



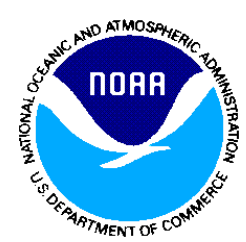
Number of IDs increased by +50 – dropped by -200 – increased..



# Apr 2019 “Anomaly”: +50 new Hi-Freq Drifters & GPS Clock Issue On Some Drifters: Number of OBS

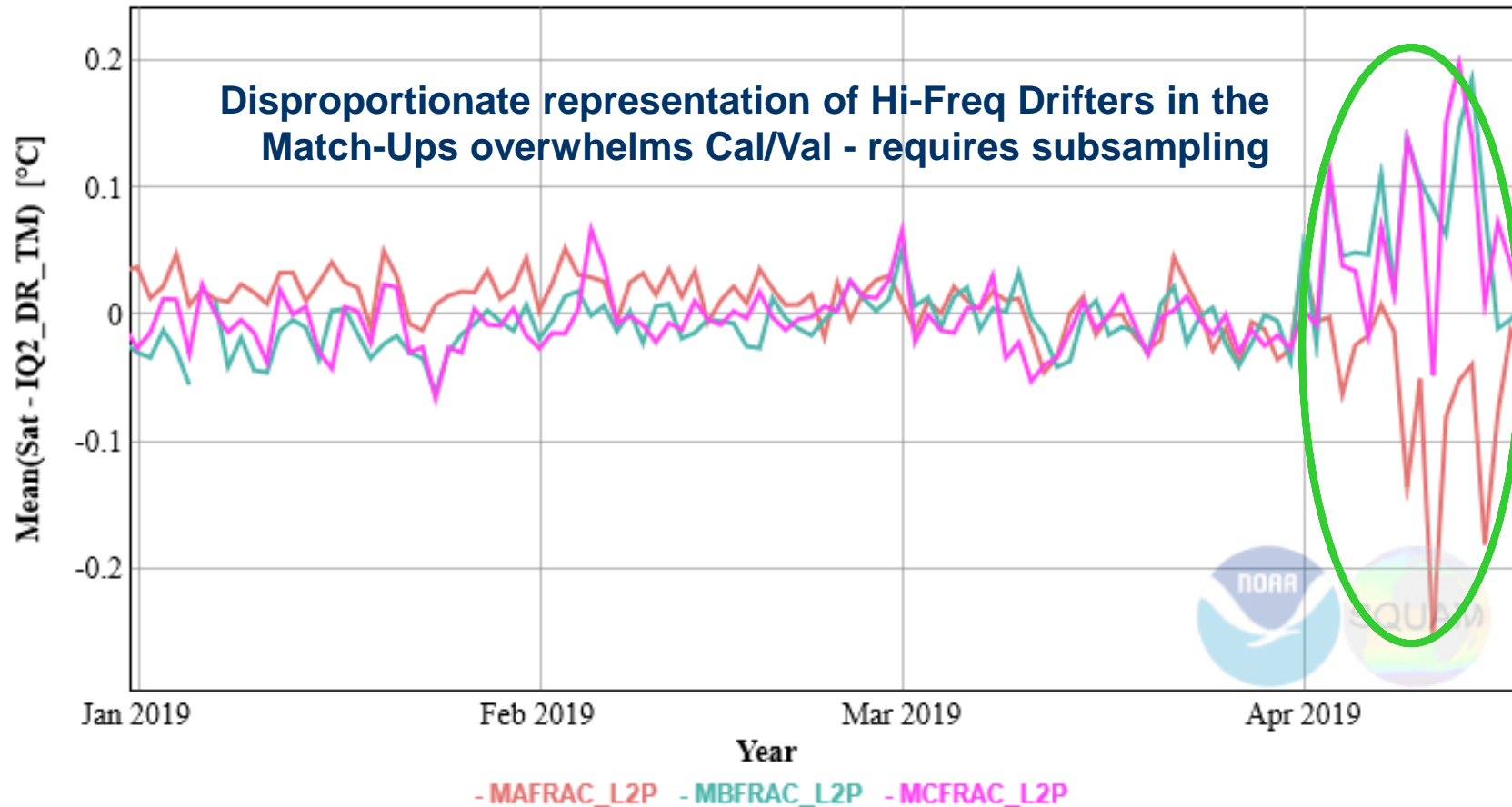


Number of OBS increased by +30% – dropped by -30% – increased..

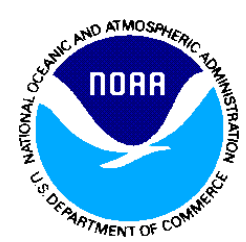


# Impact on SQUAM Validation Statistics: Global Mean Bias w.r.t. *i*Quam Drifters + Trop. Moorings

FRAC, ACSPONRT, Night, outlier retained

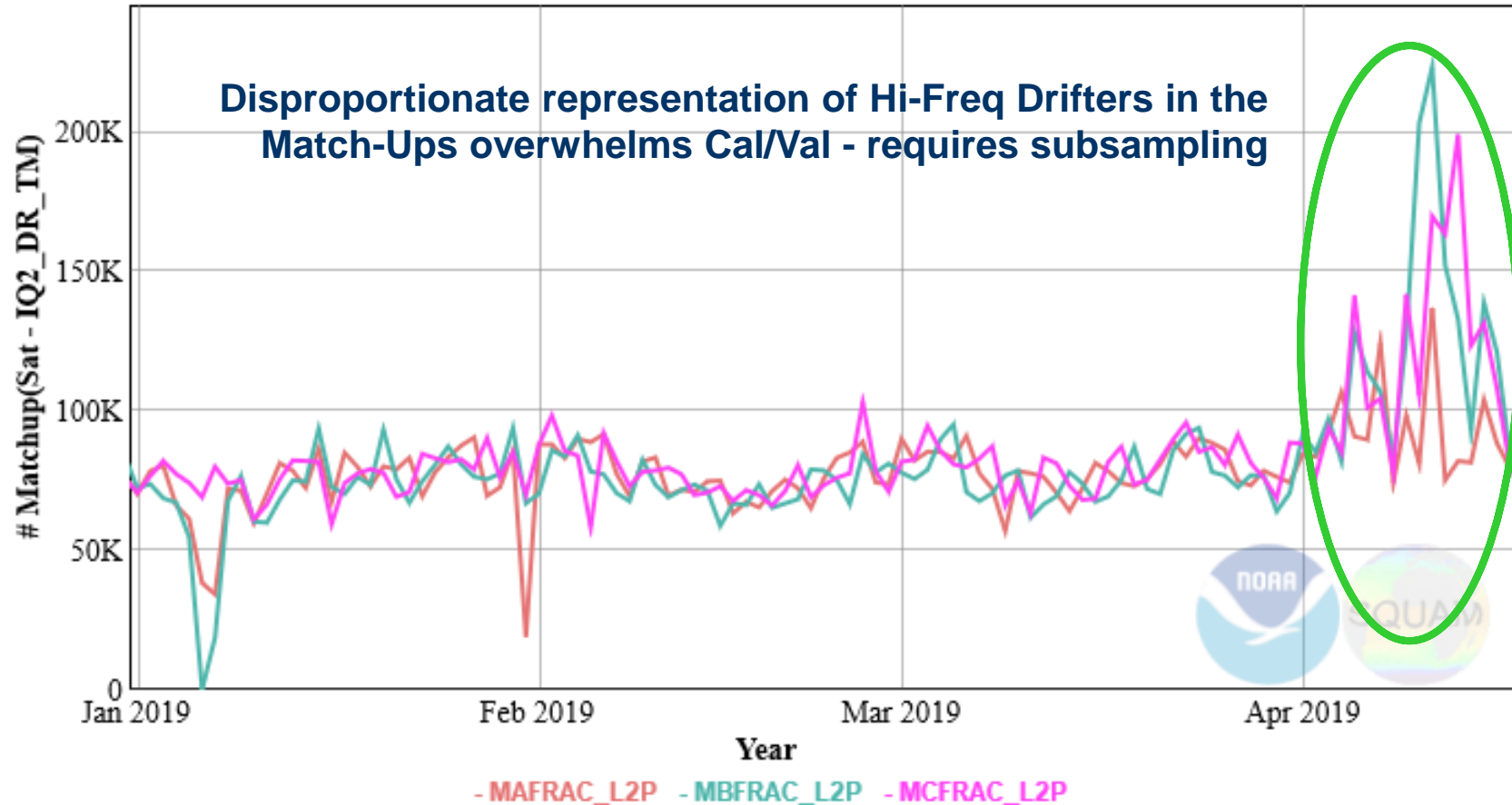


Changes in *in situ* data seriously affected our validation statistics



# Impact on SQUAM Validation Statistics: Number of Match-ups with *i*Quam Drifters + Trop. Moorings

FRAC, ACSPONRT, Night, outlier retained

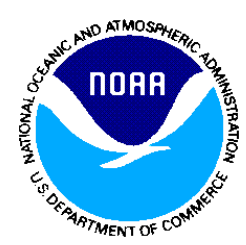


Changes in *in situ* data seriously affected number of match-ups



# SQUAM

[www.star.nesdis.noaa.gov/sod/sst/squam/](http://www.star.nesdis.noaa.gov/sod/sst/squam/)



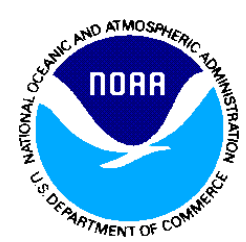
# SQUAM Basics

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*V1 released in 2009, to support NOAA Cal/Val (Dash et al., 2010).*

*Today, SQUAM is a GHRSSST resource*

- **Monitor satellite L2/3/4 SSTs w.r.t “Ref”:**  $\Delta\text{SST}=\text{SAT}-\text{Ref}$ 
  - *In situ* SST (from *iQuam*) – “validation”
  - Gap-free L4 SST – “global QC”
- **Check if global distributions of  $\Delta\text{SST}$  are near-Gaussian**
  - Centered at (approximately) zero
  - Width as a measure of noise in the SAT and Ref
- **Plot global**
  - Maps
  - Histograms
  - Time Series
  - Dependencies
  - Hovmoller Plots



# Data Monitored in SQUAM 2.1

**SST Quality Monitor 2.1**  
SQUAM v2.1

## SST products monitored in SQUAM R2

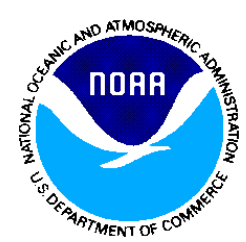
	Polar L2/L3	Geo L2/L3	Analysis L4
<b>High Res</b>	<b>VIIRS</b> ACSP0 L2P/L3U  <b>AVHRR FRAC</b> ACSP0 L2P OSISAF L2P	<b>Himawari-8 AHI</b> ACSP0 L2P/L3U  <b>GOES-16 ABI</b> ACSP0 L2P/L3U	MUR (JPL)
<b>Low Res</b>	<b>AVHRR GAC</b> ACSP0 L2P/L3U		CMC (Environment Canada) OSTIA (Met Office) OSTIA RAN (Met Office) GMPE (Met Office) Geo Polar Blended (NOAA) Reynolds (NOAA) GAMSSA (BoM)

## SST data providers



## Satellite missions





# 2019 Focus: Back End Redesign

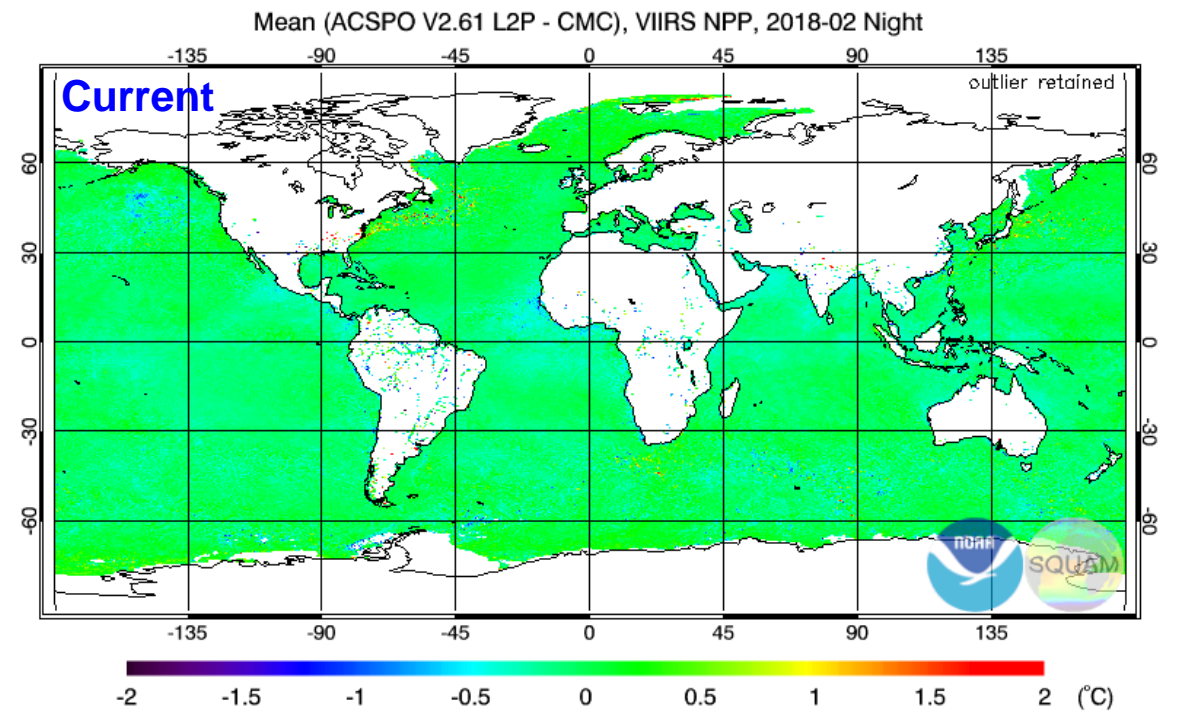
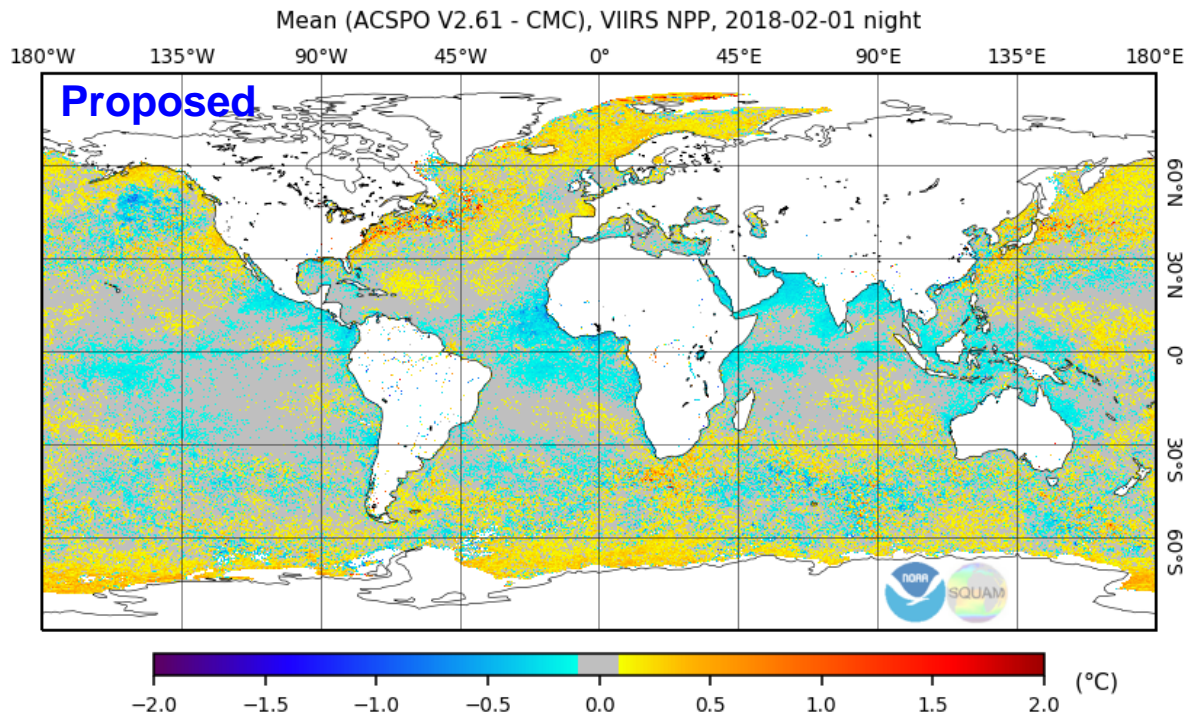
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- **2017: SQUAM updated to V2**
  - Focus on NOAA's and Partners' products, due to prohibitive data volumes
  - Added Interactive/User-controlled graphics & Permalink feature
  - Added radio button with SSES Bias correction On/Off
  - Added Monthly/Yearly aggregations
  - Newly created geo page
- **2018: SQUAM updated to V2.1**
  - Provisioned for N20, G17, Metop-C, & Full line of ACSPO L3Us
  - Moved all developmental/external products to internal pages
- **2019: Back End Redesign**
  - Back end was initially designed for much smaller data volumes (e.g., AVHRR only)
  - Now process multiple ACSPO (VIIRS/FRAC/GAC/MODIS/ABI/AHI) + external products
  - Old backend (combination of IDL + bash scripts) can not keep up
  - A more scalable redesign based on python, C++ and SQL database underway



# 2019 Focus: Front End Tweaks

- **2019: Data representation improvements**
  - Example monthly (Feb 2018) aggregated night time bias map (NPP VIIRS - CMC L4) shows that new color scheme better reveals subtle regional/seasonal biases in the -0.5 to 0.5 K range
  - Similar color scale will be considered for Hovmoller plots





# ***i*Quam & SQUAM Priorities (Resources Permitting)**

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## ● ***i*Quam**

- Redesign back end, to improve stability and efficiency
- Test v2.1, promote to the *i*Quam main URL, document
- Find more *in situ* SSTs in early 1980s, to support AVHRR GAC RAN

## ● **SQUAM**

- Redesign back end, to improve stability and efficiency
- Tweak front end, to facilitate data quality control
- Add G17 & new Reanalyses (AVHRR, ABI, AHI, MODIS RANs)



# Issues to be raised at G-XX

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## ● *iQuam*

- Users pointed out that *iQuam* QC may over-screen diurnal events
- This is due to the use of the reference check based on Reynolds & CMC L4s
- Both do not resolve diurnal cycle & not fully accurate (e.g., Reynolds)
- We will take a look when get a chance, what and how can be improved

## ● **SQUAM**

- The proposed color scheme for SST deltas in Maps/Hovmoller – OK?