SST Quality Monitor Version 2 (SQUAM2)

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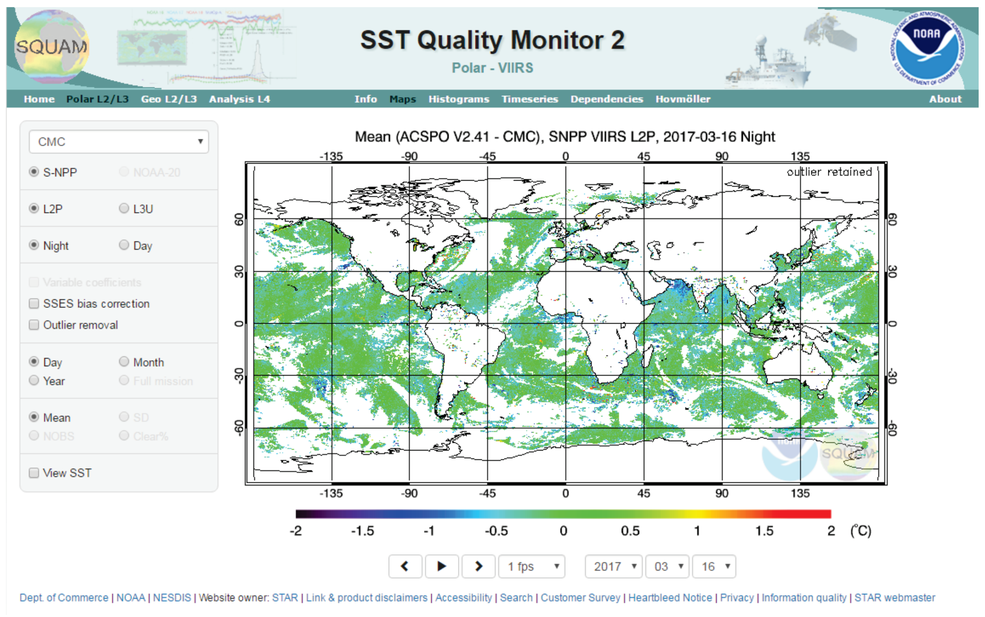


SQUAM2: *https://www.star.nesdis.noaa.gov/sod/sst/squam2/ (temporary url)*

SQUAM Background

- Development started in 2007. V1.0 was released in 2009
- Today, SQUAM is a GHRSST resource for near real-time monitoring and validation of major global satellite & blended SST products produced by the SST community
- SQUAM analyzes bias of global satellite L2/L3 SSTs w.r.t. 2 types of reference SSTs
  - (1) *in situ* (from the NOAA *i*Quam system) ; and (2) global gap-free L4 SST analyses.
  - L4 analyses offer global coverage ("instantaneous look") and greater uniformity in space & time
  - The global distributions of the *ΔTs* are expected to be centered at ~0 and close to Gaussian
- Plots: Maps, Histograms, Time Series, Dependencies, and Hovmöller Diagrams

Motivation for Redesign

- Need to downsize list of products, due to data volumes / computing resources
  - Focus on NOAA & NOAA partners SST products (can add other products by data users/producers request)
  - New gen hi-res polar: VIIRS (SNPP/J1-J4); AVHRR FRAC (Metop-A/B/C); MODIS (Terra/Aqua)
  - New gen hi-res geo: ABI (G16 /GOES-S/T/U); AHI (Himawari-8/9)
  - Reanalyses (RAN): Current (AVHRR GAC, VIIRS) and future (AVHRR FRAC, MODIS, ABI, AHI)
  - The list of L4 products is now reduced (NOAA partners; most informative for SQUAM analyses)
- Need to add new functionalities
  - SSES bias correction
  - Variable regression coefficients (for ACSPO RAN SSTs)
  - SQUAM processing improvements: time aggregation, match-up, etc
- Need to update the 8-year-old web interface

Structure

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

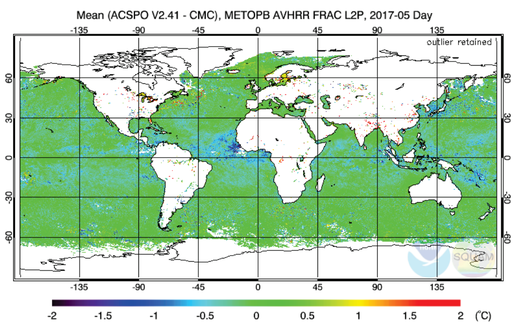
SQUAM2: Polar

Use **AVHRR FRAC** as an example

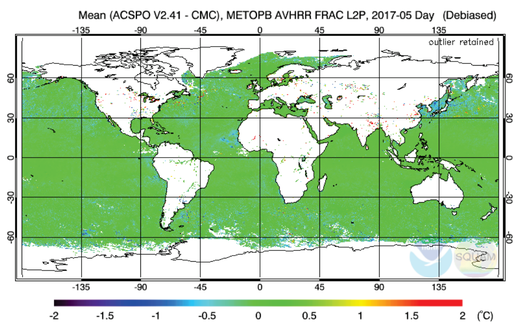
- ACSPO L2P & L3U, OSISAF L2P
  - Metop-A & B
- Reference SSTs:
  - L4: CMC, OSTIA, Reynolds
  - *In situ* (*i*Quam2): drifters + tropical moorings, ARGO floats
- Stratified by Day/Night
- SSES bias correction
- Outlier removal (>±4RSD)
- Various time aggregation intervals: day, month, year, full mission (future)

SSES Bias Correction

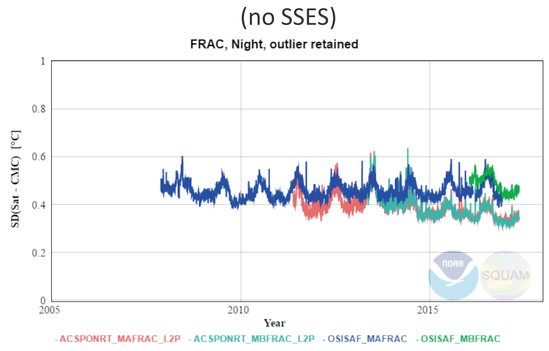
ACSPO Metop-B L2P 2017-05 (daytime)
bias=-0.01K, SD=0.43K (no SSES)



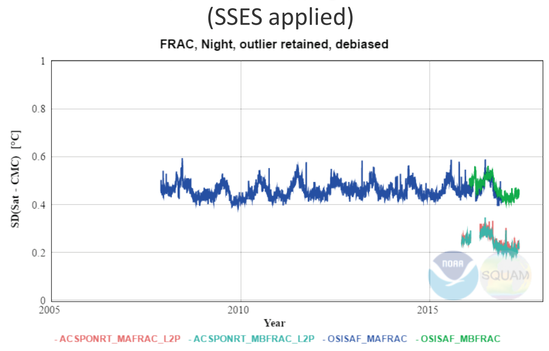
ACSPO Metop-B L2P 2017-05 (daytime)
bias=0.05K, SD=0.24K (SSES applied)



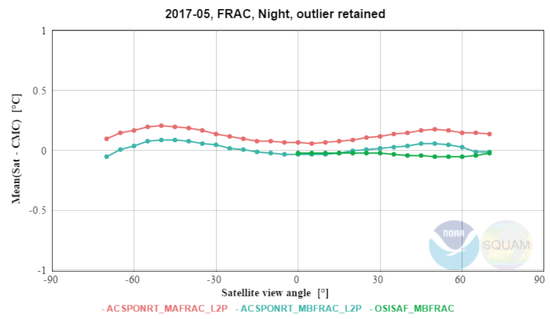
SD(FRAC-CMC) (night time)
(no SSES)



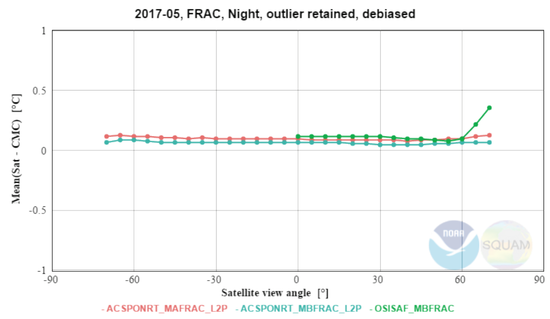
SD(FRAC-CMC) (night time)
(SSES applied)



Mean (FRAC-CMC) vs VZA, 2017-05
(night time) (no SSES)



Mean (FRAC – CMC) vs VZA, 2017-05
(night time) (SSES applied)



SQUAM 2: Geo

Use **H8 AHI** as an example

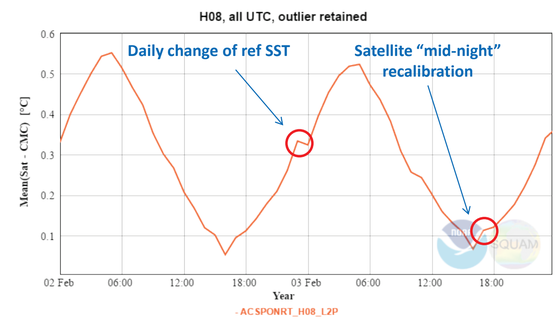
- ACSPO L2P
- Reference SSTs:
  - L4: CMC, OSTIA
  - *In situ* (*i*Quam2): drifters + tropical moorings, ARGO floats
- SSES bias correction
- Outlier removal (>±4RSD)
- Time aggregation: Day, Month, Year
- Hourly + composite analyses
  - Hour: specify hour of day (HOD)
  - Composite: daytime/nighttime
- Analyses vs. UTC or Local Solar Time

For hourly analyses, SQUAM picks the 1st full disk image in a 1-hour interval (sensor data available as 10 min intervals).

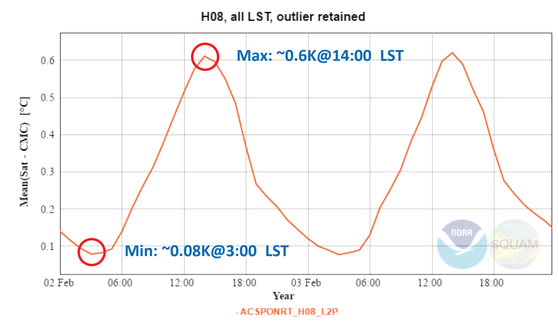
The analyses are done based on

- **UTC**
  For monitoring sensor performance
- **Local solar time (LST)**
  For scientific analysis, since physics are based on local time, e.g. diurnal cycle

Mean(AHI-CMC), UTC
2017-02-02 to 2017-02-03



Mean(AHI-CMC), LST
2017-02-02 to 2017-02-03



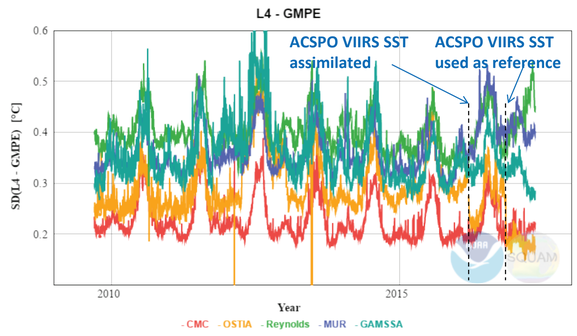
SQUAM2: L4 Analyses

L4 SSTs: CMC, OSTIA, GMPE, Reynolds, GAMSSA, MUR

In situ SSTs (*i*Quam2): Drifters + Tropical Moorings, ARGO floats

OSTIA Example

- OSTIA has made two changes in 2016
  - Mar 2016, SD(OSTIA – GMPE) decreased from ~0.3K to ~0.23K (OSTIA started to assimilate ACSPO VIIRS SST)
  - Nov 2016, SD dropped from ~0.27K to ~0.20K (OSTIA started using ACSPO VIIRS as reference)
- OSTIA SD wrt. GMPE is comparable with CMC (which has been assimilating ACSPO VIIRS SST since May 2014)
- Other L4 products shown do not assimilate ACSPO VIIRS SST yet



Summary

- SQUAM is being redesigned and upgraded to v2, to
  - Meet challenging demands of data volumes and computing resources, due to new hi-res data
  - Stay more NOAA partners' products - centric
  - Provide new features (SSES, etc.)
  - Improve processing efficiency
  - Enhance web interface and functionality
- Ongoing development and improvements are based on user needs and feedback

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- The views, opinions, and findings in this report are those of the authors and should not be construed as an official NOAA or U.S. government position or policy

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