

# Sea Surface Temperature from IASI: OSI SAF L2P and recent results



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## Introduction

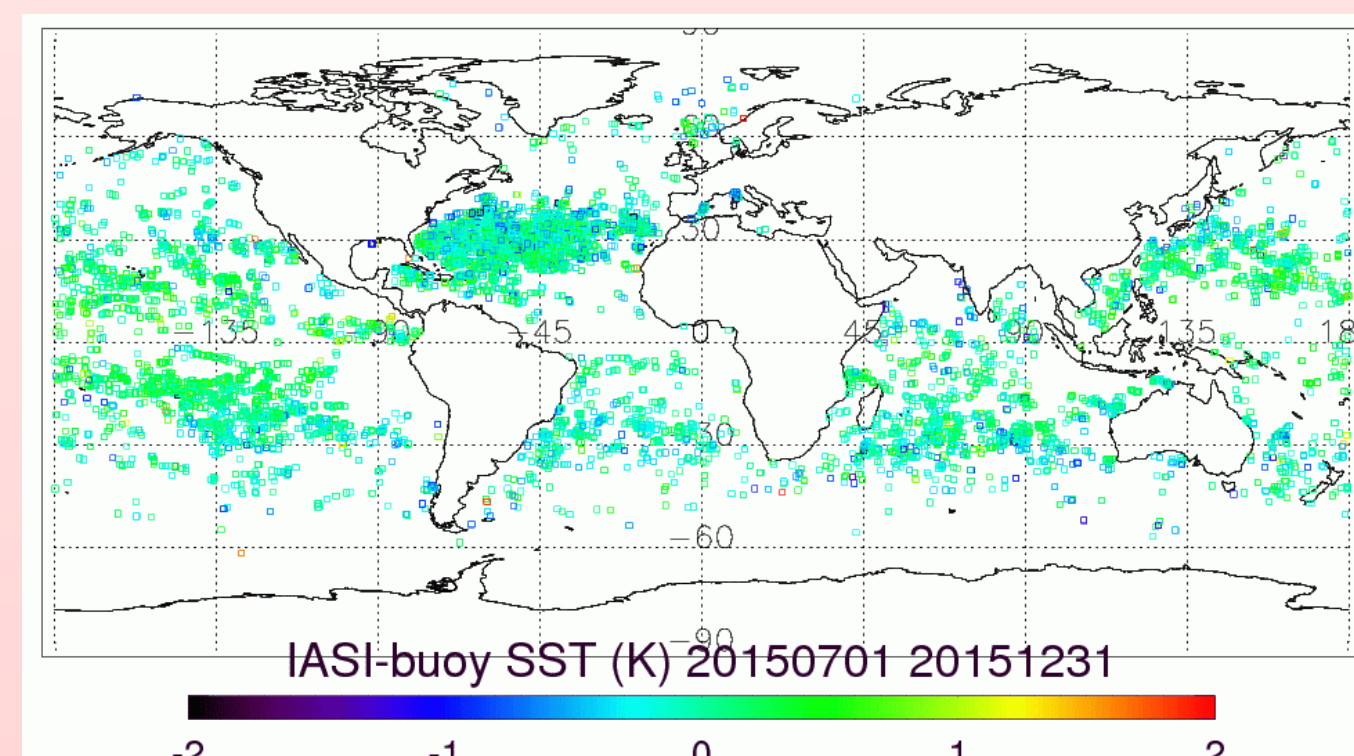
IASI SSTs have been available since April 2008 from EUMETSAT, contained within the IASI Level 2 product suite. These data are available via EUMETCast, together with vertical temperature and humidity profiles in the BUFR product IASI L2 TWT (August *et al*, 2012).

The Metop IASI L2Pcore SST product follows the format specification of the Group for High Resolution Sea Surface Temperature (GHR SST) and has been available via ftp from the Data Centre since March 2011, with Metop-B available since January 2014. The IASI SST L2Pcore contains skin SSTs from the IASI PPF, flags, quality information and SSES, plus an auxiliary wind-speed field, but no further auxiliary data required for the complete GHR SST specification.

Within the Continuous Development and Operations Phase 2 (CDOP-2) of the EUMETSAT Ocean and Sea-Ice Satellite Application Facility (OSI SAF) a full GHR SST specified Metop-A IASI L2P SST is produced based on the Metop-A IASI L2Pcore SST from the central facilities (O'Carroll *et al*, 2012) and is named OSI-208, operational since May 2015.

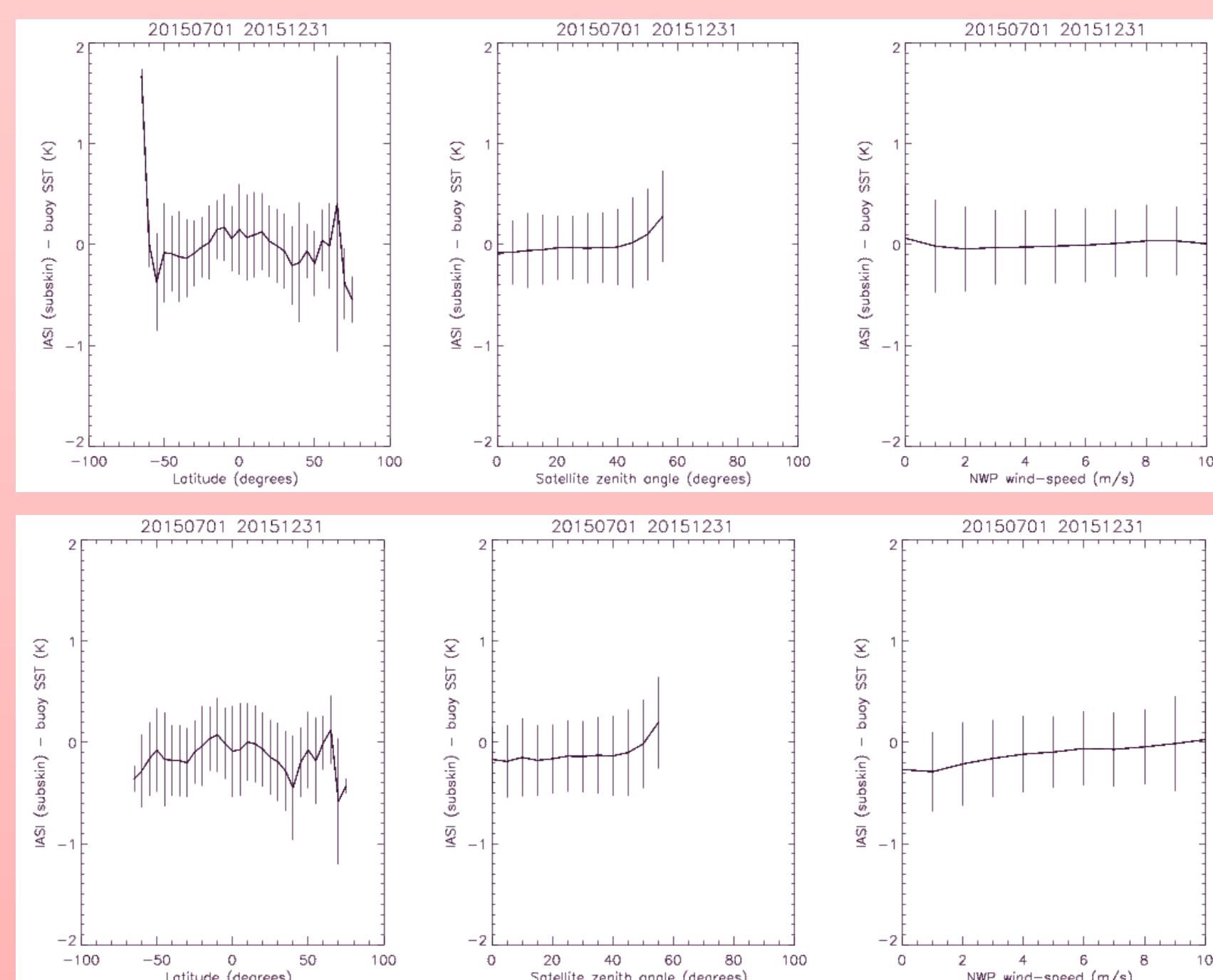
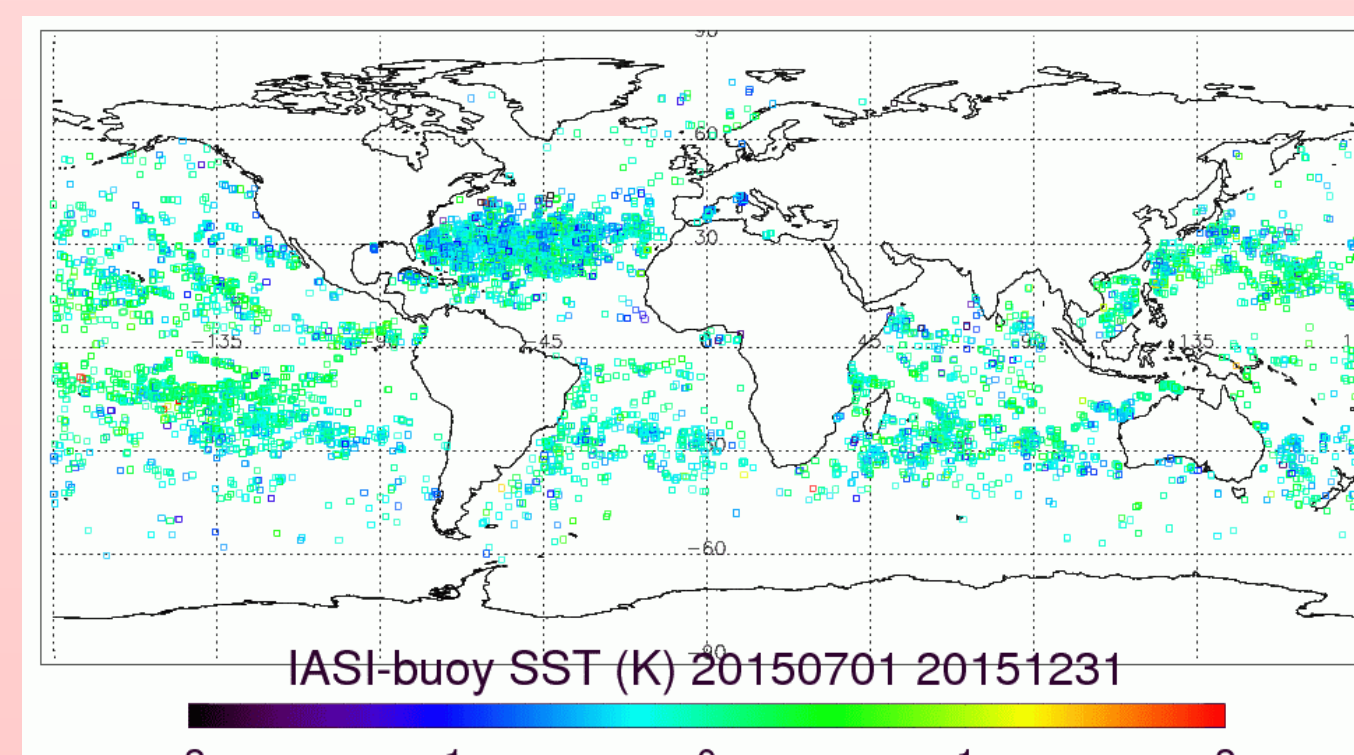
The OSI-208 has been available via EUMETcast since 8 January 2015. OSI-208 switched to use Metop-B on 23<sup>rd</sup> February 2016. OSI-208 is also available from [ftp://efftp.ifremer.fr/cersat-rt/project/osi-saf/data/sst/l2p/iasi\\_metop\\_a/](http://efftp.ifremer.fr/cersat-rt/project/osi-saf/data/sst/l2p/iasi_metop_a/). Further information can be found from <http://www.osi-saf.org>.

## Validation using drifting buoy SSTs



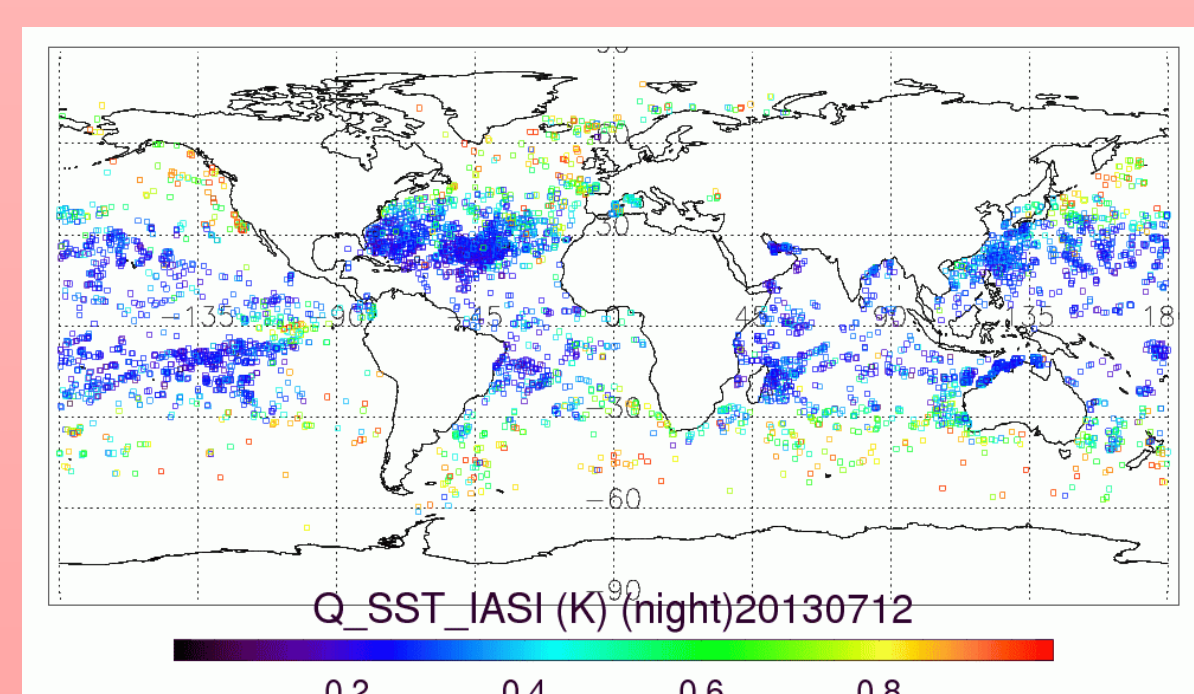
Validation has been performed using a matchup dataset which is compiled at the OSI SAF and contains AVHRR, drifting buoy, and IASI SST observations. Overall a slight global cool bias with respect to drifting buoys is observed at around -0.12K for night-time Metop-A IASI SST observations, with standard deviations of 0.39K, over the period July to December 2015.

**Fig 2. Metop-A IASI SST minus drifting buoy SST, July to December 2015, Top: day, Bottom: night**



The stability of the IASI SST comparisons to *in situ* SST is also beneficial for multi-mission satellite validation

**Fig 3. Binned Metop-A IASI SST minus drifting buoy SST, July to December 2015, versus latitude, satellite zenith angle and ECMWF wind-speed, Top: day, Bottom: night**



**Fig 4. Night-time SST retrieval uncertainty**

For Version 6, a new SSES scheme has been derived, using the information contained in Q\_SST\_IASI (from 1D-Var). The GHR SST Quality Levels are defined as followed: QL2: Q\_SST\_IASI greater than 0.7K; QL3: Q\_SST\_IASI between 0.5 to 0.7K; QL4: Q\_SST\_IASI between 0.3 to 0.5K; QL5: Q\_SST\_IASI less than 0.3K

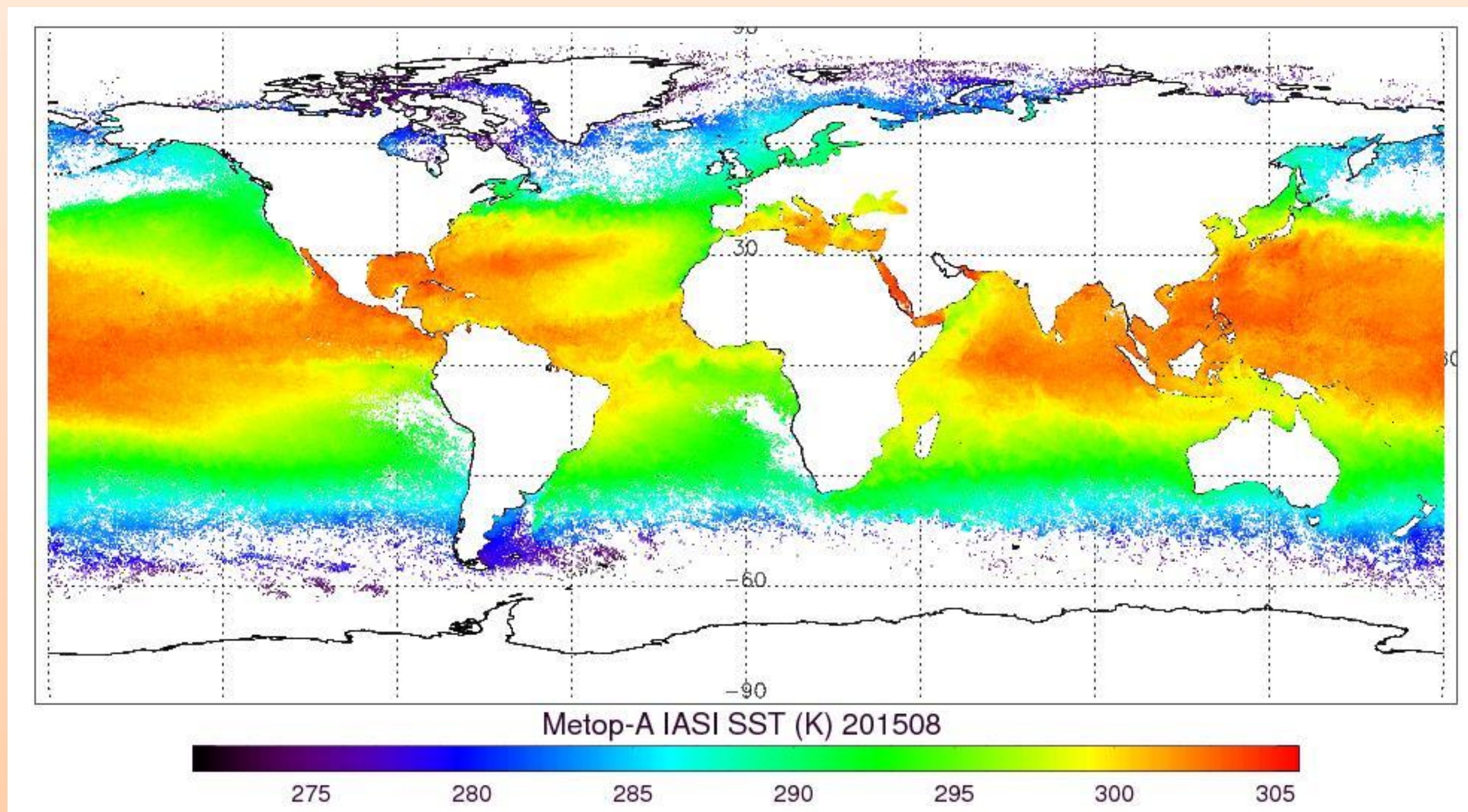
## Future plans

Activities are on-going to assess a new SST retrieval to allow a greater number of observations, particularly at high latitudes, to pass the quality level criteria.

A recent study with the University of Leicester on IASI and AATSR collocated datasets aims to specify and acquire representative collocated datasets of IASI measurements and AATSR SST and aerosol products over oceans, towards possible aerosol flagging and correction of IASI SST.

A EUMETSAT study will soon begin on Ice Surface Temperature for Metop IASI to compile an inventory and assessment of *in situ* datasets relevant for the validation of Ice Surface Temperature with a primary focus in the Arctic.

## Sea Surface Temperature from IASI



**Fig 1. Sea Surface Temperature from Metop-A IASI for August 2015**

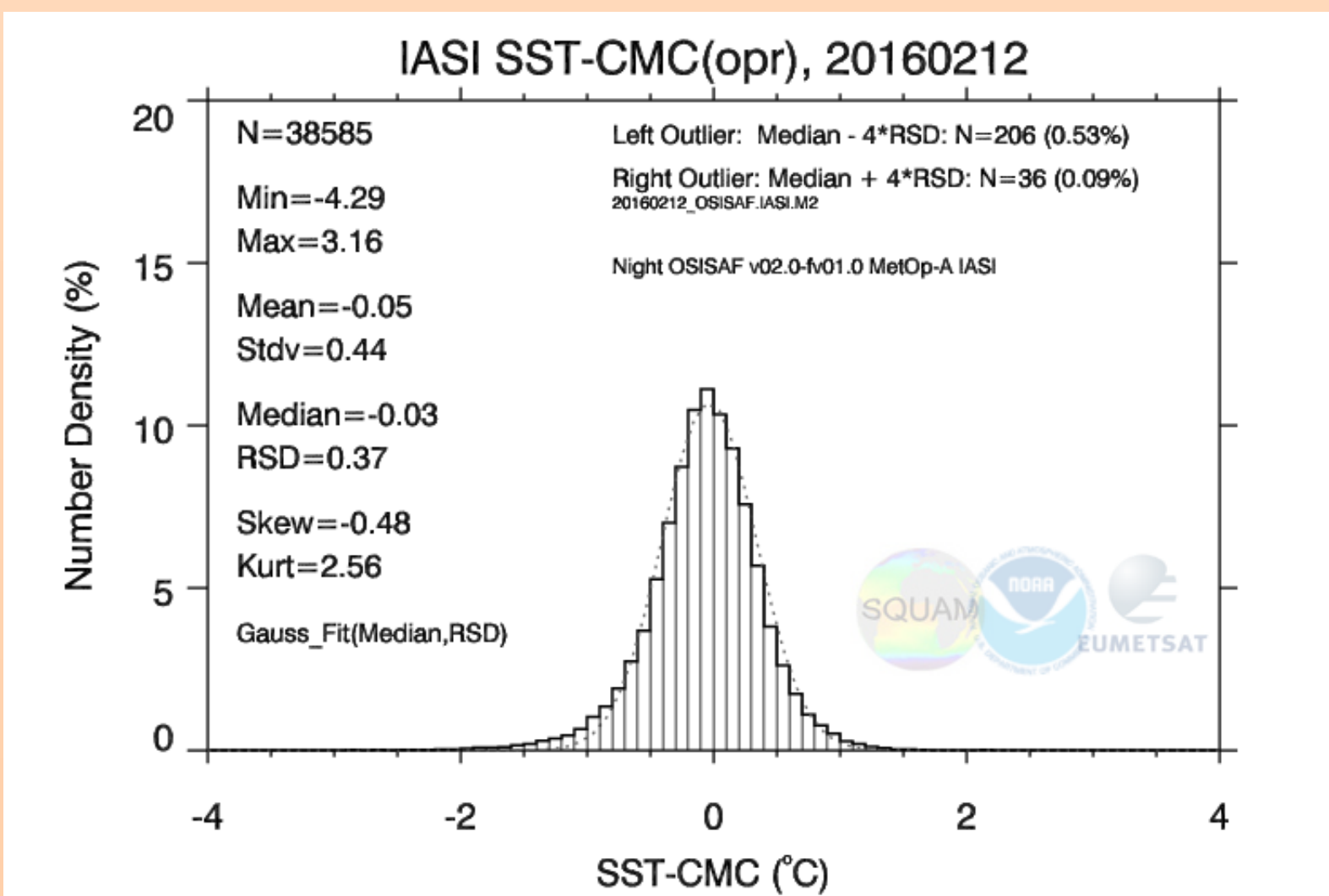
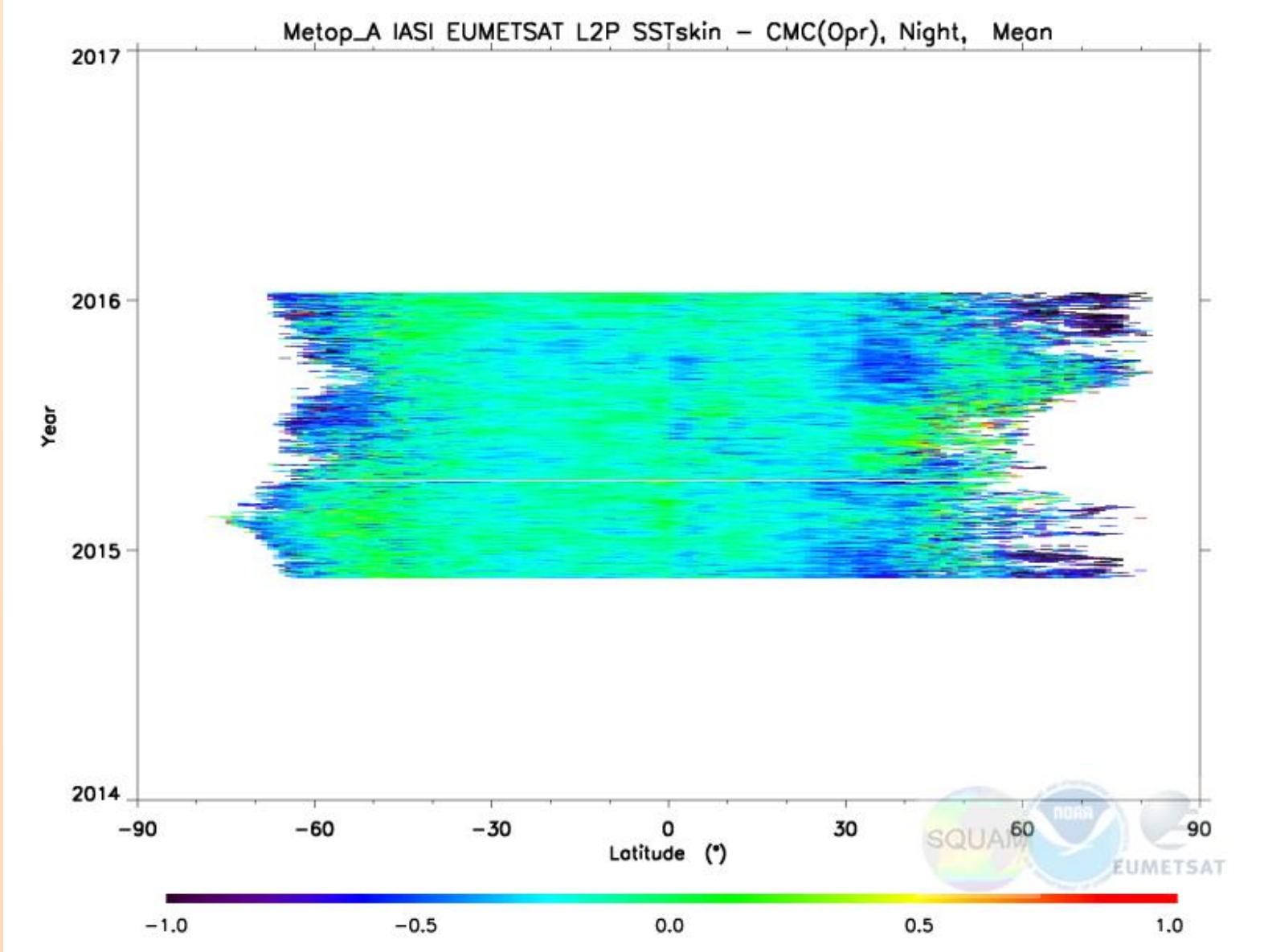
The OSI SAF L2P product contains extra auxiliary data such as sea-ice fraction and aerosol information, which is necessary to fulfil the complete GHR SST specification. The SST retrieval from IASI is based on the 1D-VAR Optimal Estimation Method, recently updated with the Version 6 of the IASI Level-2 Product Processing Facility (PPF).

Activities continue at both EUMETSAT and OSI SAF (Meteo-France) in a collaboration towards the GHR SST specified IASI SST product. The IASI SST retrieval is performed at EUMETSAT and the full GHR SST specification and distribution of OSI-208 is completed at the OSI SAF. Validation activities are a collaboration between EUMETSAT and the OSI SAF at Meteo-France.

## Inter-comparisons using SQUAM

Synergies and collaboration between NOAA and EUMETSAT satellite based SST validation were progressed as part of a visiting scientist (VS) activity. P. Dash visited EUMETSAT in Autumn 2015 to work on SST monitoring and validation, including Metop-A IASI SST in NOAA's SST Quality Monitor (SQUAM); Dash *et al*, 2010:

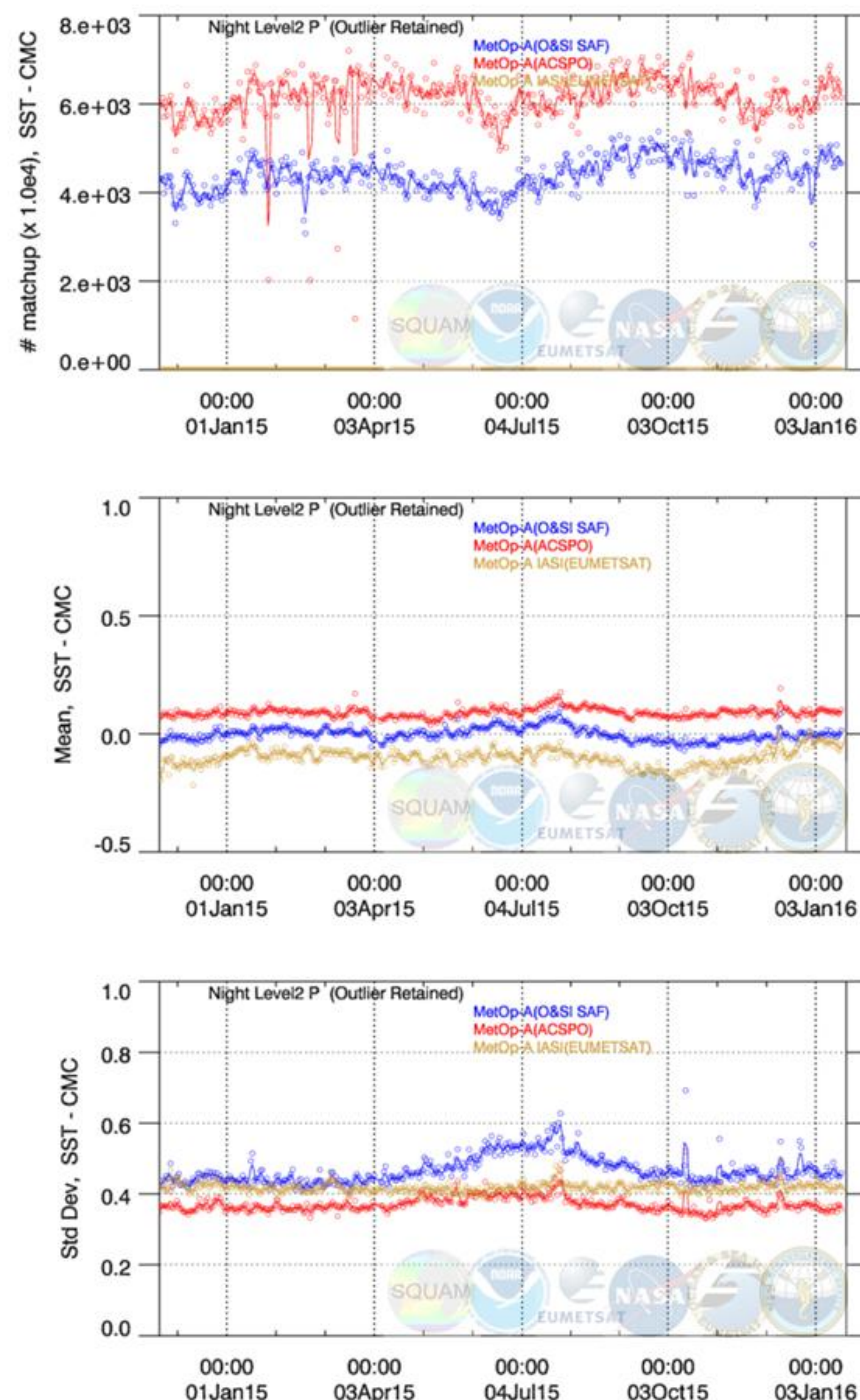
[http://www.star.nesdis.noaa.gov/sod/sst/squam/H/index\\_eum.html](http://www.star.nesdis.noaa.gov/sod/sst/squam/H/index_eum.html).



**Fig 5. Metop-A IASI nighttime SST minus Level-4 CMC. Top: Hovmöller diagram versus latitude, Bottom: Histograms of differences for 12<sup>th</sup> February 2016**

IASI (skin) SSTs are slightly cooler as expected than the CMC [<https://podaac.jpl.nasa.gov/dataset/CMC0.2deg-CMC-L4-GLOB-v2.0>] (foundation) SST and Metop-A AVHRR (sub-skin) SST. The IASI SSTs are observed to have a good stability and this is particularly observed in the Northern Hemisphere summer where AVHRR SSTs show increases in global standard deviations (from high-latitude observations). The VS work included focus on sensitivity studies to analyse quality level and observational uncertainties (Sensor Specific Error Statistics, SSES).

| QL  |       | SSES Bias not applied |           |              | SSES Bias applied |           |              |
|-----|-------|-----------------------|-----------|--------------|-------------------|-----------|--------------|
|     |       | # of Obs              | Mean (°C) | Std Dev (°C) | # of Obs          | Mean (°C) | Std Dev (°C) |
| ≥ 3 | Night | 35,757                | -0.32     | 0.42         | 35,757            | -0.19     | 0.42         |
|     | Day   | 44,161                | -0.23     | 0.40         | 44,161            | -0.11     | 0.40         |
| ≥ 4 | Night | 32,554                | -0.31     | 0.41         | 32,554            | -0.19     | 0.41         |
|     | Day   | 40,575                | -0.22     | 0.40         | 40,575            | -0.11     | 0.40         |
| = 5 | Night | 20,803                | -0.26     | 0.37         | 20,803            | -0.17     | 0.37         |
|     | Day   | 31,889                | -0.20     | 0.38         | 31,889            | -0.11     | 0.38         |



**Fig 6. Metop-A (AVHRR and IASI) nighttime SST minus Level-4 CMC. Top: number of valid cloud-free observations, Middle: Mean difference, Bottom: Std Dev. Three colors represent three different products: ACSPO AVHRR (red), OSI SAF AVHRR (blue) and IASI (light brown). [Daytime time series are available from NOAA SQUAM webpage].**

**Table 1. Sensitivity of Metop-A IASI vs. CMC comparison on choice of quality levels and SSES bias for data on 20-Nov-2014.**

The results support that the use of Quality levels 3 to 5 give similar results in terms of standard deviations. The SSES bias term provided in the product should be applied to make the IASI skin SST comparable to CMC foundation SST during night time (considering a ~0.17K skin effect).

## References

August, T., *et al*, IASI on Metop-A: Operational Level 2 retrievals after five years in orbit, J. Quant Spectrosc Radiat Transfer (2012), doi:10.1016/j.jqsrt.2012.02.028  
O'Carroll, A.G., *et al*, The accuracy of SST retrievals from Metop-A IASI and AVHRR using the EUMETSAT OSI-SAF matchup dataset, RSE, 126 (2012), 184-194  
Dash, P., *et al*, The SST Quality Monitor, JTech (Oceans), 27 (2010), 1899-1917  
The recommended GHR SST Data Specification Revision 2.0, [www.ghrsst.org/modules/documents/documents/](http://www.ghrsst.org/modules/documents/documents/)