IASI L2PCORE SEA SURFACE TEMPERATURE

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ABSTRACT

IASI L2Pcore skin sea surface temperatures have been produced at EUMETSAT since March 2011. The SSTs are those available since April 2008 from the IASI L2 Product Processing Facility (PPF) at EUMETSAT. Metop-A IASI SSTs have previously been validated to have a cool bias of 0.4K and standard deviation of 0.4K against AATSR [1], and more recently, globally against drifting buoys to have a cool bias of 0.32K, standard deviation 0.32K [2], showing that the IASI SSTs are of good quality. Since the first validations shown in [1], the IASI PPF was upgraded in September 2010, including improvements to the cloud detection tests [3]. The latest comparisons have shown Metop-A IASI SSTs to have a global cool bias of 0.29K and standard deviation of 0.34K, with the highest quality results having a cool bias of 0.17K. Three-way collocations, using the methodology from [4], have shown Metop-A IASI SSTs to have a global accuracy of 0.26K. Validation results for Metop-B have shown the SSTs to have a similar bias and standard deviation again *in situ* to Metop-A.

1. Introduction

This paper presents validation results comparing IASI SSTs to collocated AVHRR and drifting buoy SSTs obtained from the EUMETSAT OSI-SAF matchup dataset [5]. In addition, results from the validation of Metop-B IASI SSTs are shown. Validation using ship borne radiometric SST observations has been performed by W. Wimmer and reported in [7].

The IASI L2Pcore SSTs are produced following the Group for High Resolution Sea Surface Temperature (GHRSST) Data Specification 2.0 [6] format, and contain skin SSTs, Sensor Specific Error Statistics, quality levels, flags and collocated model surface winds. They are provided in swath format with the IASI observations having an IFOV of 12km at nadir. The IASI L2Pcore product is available via ftp access from the EUMETSAT Data Centre and FTP server, with registration possible through the EUMETSAT EO Portal. The Metop-A AVHRR matchup dataset (mdb1 full version) from the EUMETSAT OSI-SAF was used for validation purposes.

2. Metop-A IASI SST versus drifting buoys

IASI L2Pcore SSTs have been collocated to the AVHRR and drifting buoy observations in the OSI-SAF MDB. Table 1 shows statistics of the comparisons between observations over the period July 2012 to July 2013, for night-time only observations, where IASI SSTs have been converted from skin to sub-skin SST using a 0.17K offset.

SST difference	Mean	Standard deviation	Number of matchups
IASI - buoy	-0.29 K	0.34 K	276
AVHRR - IASI	0.26 K	0.29 K	276
Buoy - AVHRR	0.03 K	0.26 K	276

Table 1. Statistics of SST differences over the period July 2012 to July 2013.

As previous years comparisons have shown, Metop-A IASI SSTs have a slight cool bias compared to drifting buoy and AVHRR sea surface temperatures of around 0.2-0.3K. This is thought to be due to the retrieval process. Figure 1 shows histograms of the differences for IASI minus buoy, AVHRR minus IASI, and buoy minus AVHRR differences. The plot of the differences against latitude in figure 2, show that there is a latitudinal variation in the biases, likely due to the atmospheric conditions affecting the retrieval of surface temperature. For this reason the methodology to define the L2P Specific Sensor Error Statistics (SSES) is based on the use of IASI water vapour. The global map of differences in figure 3 indicates the largest differences occur in regions of high spatial variability e.g. Gulf Stream due to the difficulty of collocating observations with different spatial sizes.

The plots of SST minus buoy difference versus the standard deviation of 21x21 AVHRR observations to cover an approximate IASI grid in figure 4, show a fairly constant 0.2K IASI cool bias

at the lower AVHRR standard deviations (below σ 0.3K). The SSES scheme is based on a methodology stratifying the bias against water vapour information from the IASI L2 dataset. The highest quality data (5) gives a IASI SST bias of -0.17K, σ 0.27K. Figure 5 shows histograms of the IASI minus buoy differences for each of the quality levels 2 (worst) to 5 (best).

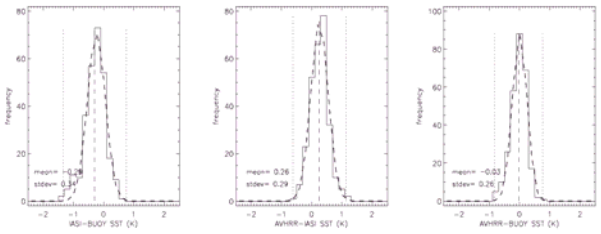

Figure 1. Histograms of IASI-buoy, AVHRR-IASI and buoy-AVHRR differences over the period July 2012 to July 2013.

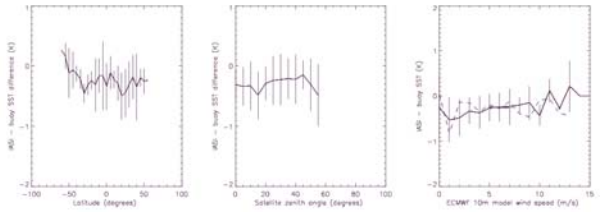

Figure 2. Binned plots of IASI minus buoy differences versus latitude, satellite zenith angle and ECMWF wind-speed over the period July 2012 to July 2013.

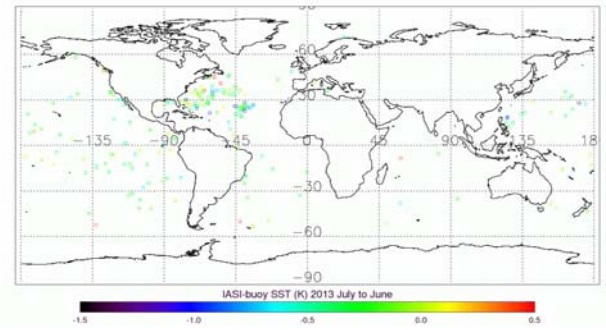

Figure 3. Global map of IASI minus buoy differences over the period July 2012 to July 2013.

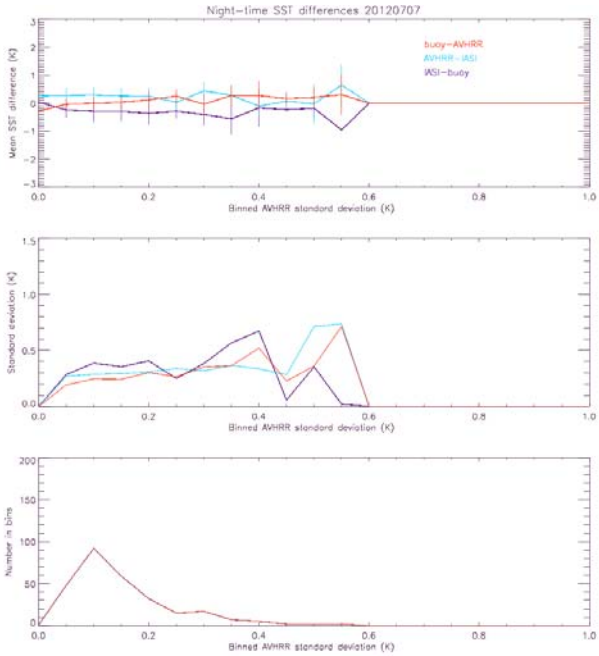

Figure 4. IASI minus buoy SST versus standard deviation of 21x21 AVHRR observations over the period July 2012 to July 2013.

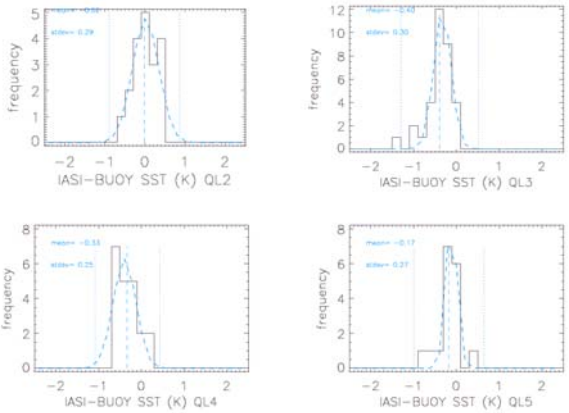

Figure 5. Histograms of IASI minus buoy differences for quality levels 2 to 5 over the period July 2012 to July 2013.

3. Monthly validation 2010 to 2013

The time-series in figure 6 shows the global (night-time) standard deviation of error, calculated on a monthly basis from March 2010 for a 3 year period, with the corresponding IASI minus buoy mean differences and standard deviations shown in figure 7. The uncertainty of AVHRR SST is consistently the lowest, followed by drifting buoys and then IASI SSTs. The uncertainties have decreased through the 3 year period, with the uncertainty of IASI SSTs being generally between 0.2 and 0.3K.

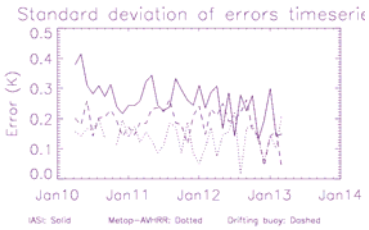

Figure 6. Monthly time-series of global uncertainties for IASI, drifting buoy and AVHRR SSTs.

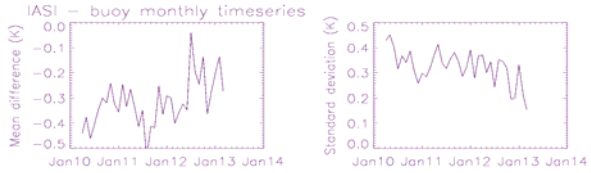

Figure 7. Monthly time-series of IASI minus buoy mean differences and standard deviations.

4. Metop-B

Metop-B was launched on 17th September 2012, and includes the IASI instrument. Metop-B Cal/Val activities to decide on the validation status of the products are currently underway. However, initial IASI-B validation results (over the period February to June 2013) give similar results to IASI-A, both in terms of bias and standard deviation. Figure 8 show histograms for Metop-B (top), with Metop-A below. Metop-B replaced Metop-A as EUMETSAT's prime operational polar-orbiting satellite following the end of its commissioning period on 24th April 2013, ensuring long term continuity of vital polar-orbiting weather and climate data.

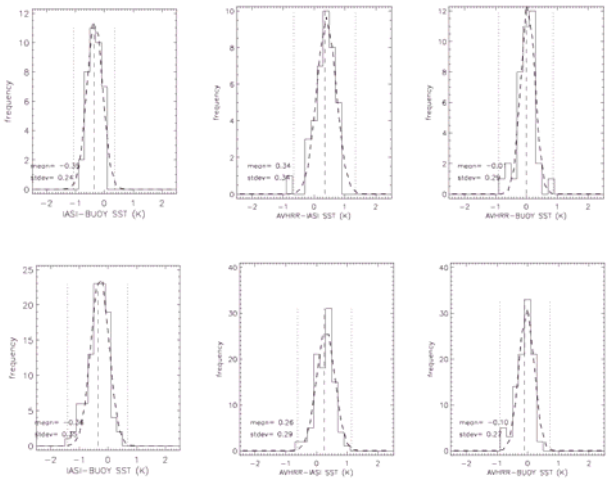

Figure 8. Histograms of IASI minus buoy, AVHRR minus IASI, and AVHRR minus buoy differences, for Metop-B (top) and Metop-A (bottom) over the period July 2012 to July 2013.

Metop-A is continuing operations in parallel, with two sets of data providing added value to users by improving forecast models, products and data resolution. The current goal is to operate Metop-A including product dissemination in parallel with Metop-B until the end-of-commissioning of Metop-C currently envisaged for 2018.

5. Future plans

The next L2 PPF upgrade, version 6, is planned for later in 2013 to include a new optimal estimation retrieval, a new cloud detection scheme and L2 product quality flagging. Further information on version 6 can be found in [8].

The SSES will be re-evaluated based on the new cloud flags available. Other issues to be considered soon include: improvements to address the slight angular dependency; the inclusion of band 3 (shorter wavelengths) in the retrieval at night-time; and the detection of dust layers for flagging and possibly correction.

Within the Continuous Development and Operations Phase 2 of the EUMETSAT Ocean and Sea-Ice Satellite Application Facility (OSI-SAF) a full IASI L2P SST will be produced based on the IASI L2Pcore SST produced at EUMETSAT central facilities and the addition of the extra auxiliary data needed (e.g. aerosol, ice).

6. Acknowledgements

Thank you to the OSI-SAF for the Metop-AVHRR in-situ database.

7. References

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