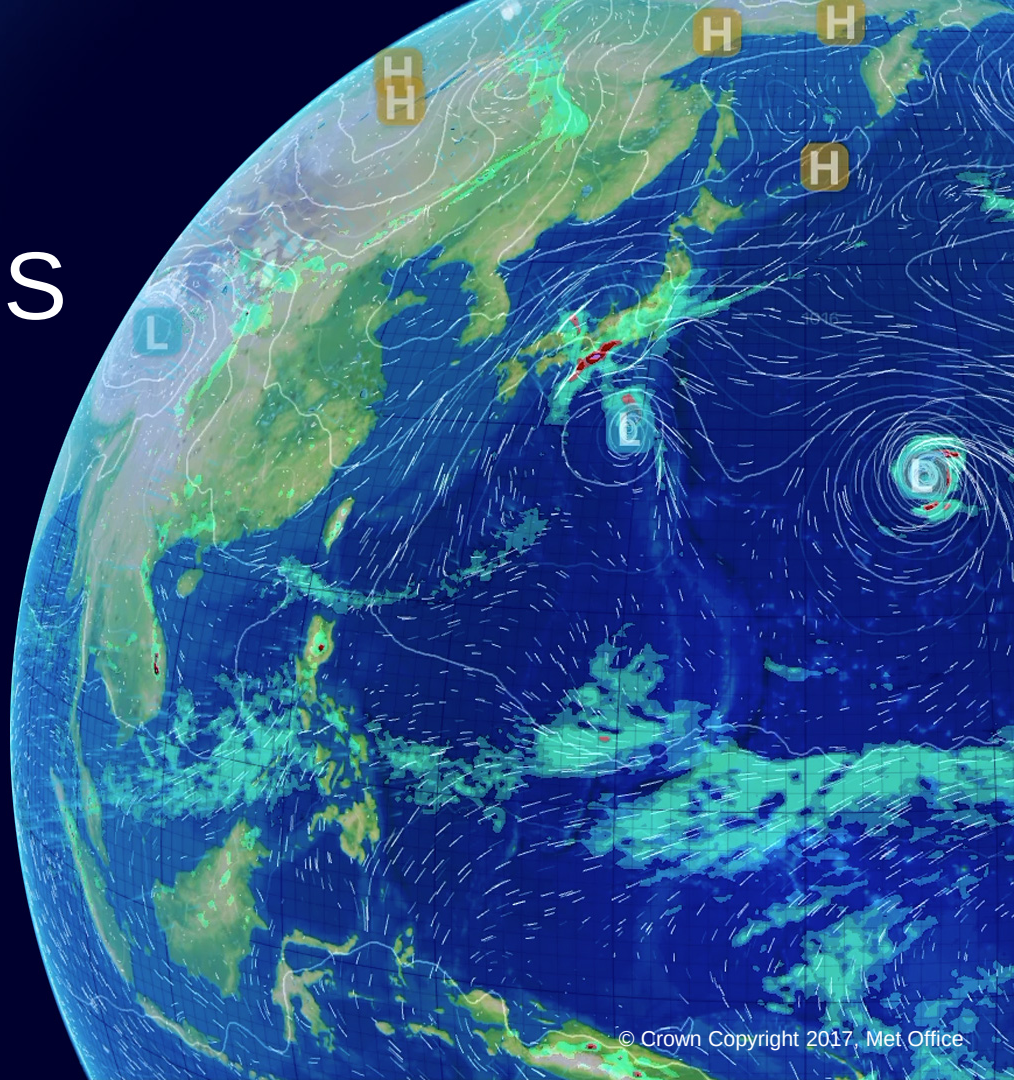
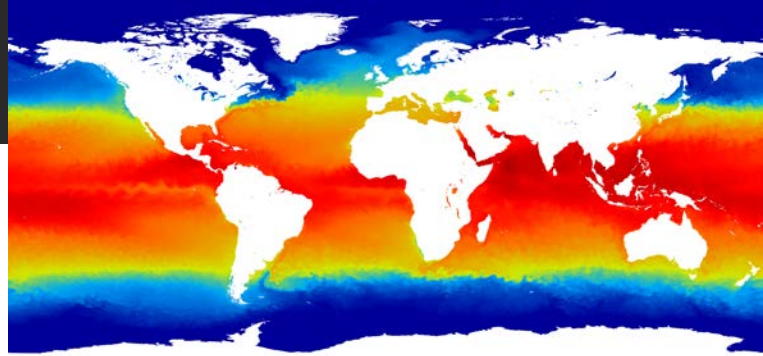
Use of ACSPO VIIRS L3U SST in the OSTIA system

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Introduction

OSTIA is the Met Office Operational SST and Ice Analysis system

- L4 (global, gap-free analysis), produced daily at 1/20^{o} grid resolution
- Foundation SST (uses all nighttime observations and daytime observations only when wind speed >6 m s^{-1} to remove diurnal warming effects)
- Validates well against other analyses (compared to independent near-surface Argo observations)
- Available from http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=SST_GLO_SST_L4_NRT_OBSERVATIONS_010_001

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SST data used in OSTIA

- ACSPO VIIRS
- AMSR2 (from Remote Sensing Systems)
- NOAA-18 and -19 AVHRR (from NAVO)
- MetOp AVHRR (from OSI SAF)
- SEVIRI (from OSI SAF)
- GOES-E (from OSI SAF)
- In situ (ships, drifters, moored buoys) (from GTS)

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Change in the last year

OSTIA performs a bias-correction of satellite data to a reference dataset of all in situ data and high-quality satellite data

- Prior to November 9, 2016, the reference satellite data was a subset of MetOp-A AVHRR (nighttime, max satellite zenith angle 48 degrees, QL4+)
- From November 9, 2016 onwards the reference satellite data was ACSPO VIIRS nighttime data

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Prior testing of the impact of the change

Before proceeding with the change, testing was carried out. Two runs were conducted for the period 09 Dec 2015 – 11 Jan 2016:

- Control: MetOp-A AVHRR (nighttime, max satellite zenith angle 48 degrees, Q4+) used as the reference dataset
- VIIRSG_ref: Nighttime VIIRS QL5 data used as the reference dataset

Validation used Argo observations (shallowest observations between 3-5 m depth have been shown to be representative of foundation temperature and they are not used in the analysis) from the Met Office Hadley Centre EN4 database (www.metoffice.gov.uk/hadobs)

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Near-surface Argo minus OSTIA analysis statistics for a test period of 9 Dec 2015 – 11 Jan 2016

Region (CMEMS definitions)	Mean diff to Argo (K)		RMS diff to Argo (K)	
	control	VIIRSG_ref	control	VIIRSG_ref
Global	0.12	0.06	0.45	0.40
North Atlantic	0.22	0.05	0.48	0.42
Tropical Atlantic	0.17	0.11	0.28	0.24
South Atlantic	0.08	0.08	0.46	0.44
North Pacific	0.20	0.09	0.51	0.45
Tropical Pacific	0.08	0.07	0.26	0.22
South Pacific	0.03	0.07	0.32	0.30
Indian Ocean	0.03	0.09	0.29	0.28
Southern Ocean	0.07	0.04	0.45	0.42

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Results from prior testing

- Sizable improvement of 0.05 K global RMS difference to Argo using VIIRS as a reference and improvements in RMS consistent across all regions
- Similar results were seen for a second test period of 01 to 31 May 2016
- Improvements of mean difference to Argo in most ocean regions
  - Largest magnitude decrease of 0.16 K in North Atlantic
  - Smallest magnitude decrease of 0.01 K in Tropical Pacific
  - Detriments to mean difference seen in South Pacific (0.04 K) and Indian Ocean (0.06 K)

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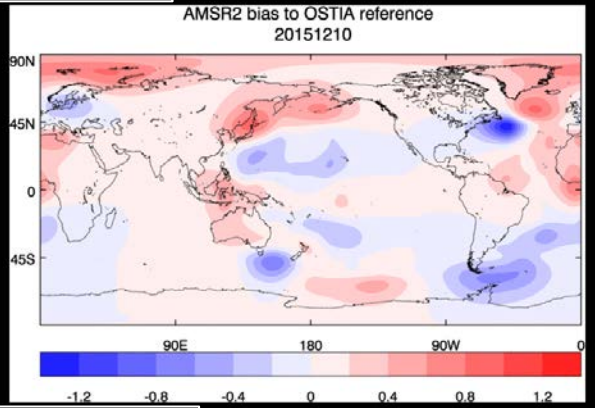
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Animations of daily bias fields:

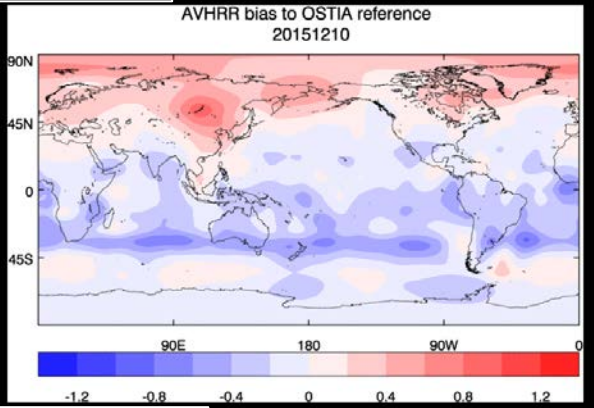
REMSS AMSR2 and NOAA -18 and -19 AVHRR minus the two reference datasets, control (MetOp-A AVHRR) and VIIRS

Observations have already been filtered to remove daytime measurements where wind speed < 6 m s^{-1}, and SSES biases have been removed

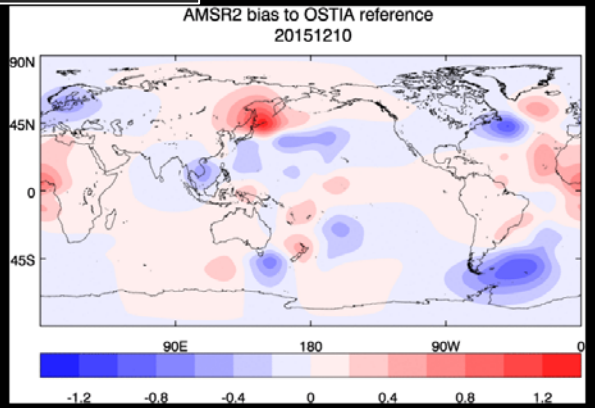
Control



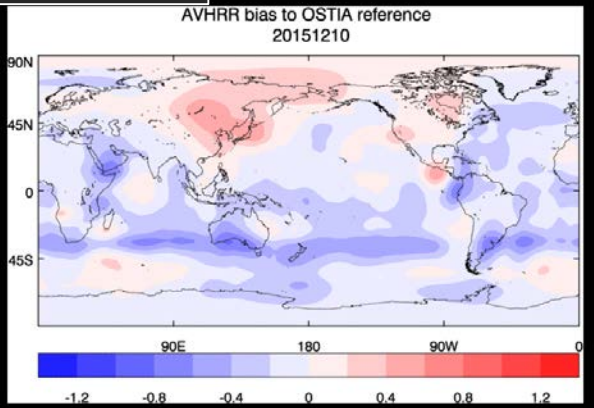
Control



VIIRS_ref



VIIRS_ref



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Results from prior testing

- The bias fields show the magnitude of the correction removed from the observations by the OSTIA system
- The run using VIIRS as a reference has eliminated the warm bias seen in the Arctic, so this “correction” is no longer being applied to the data
- The magnitude of the biases is generally smaller for the run using VIIRS as a reference, meaning the observations are in closer agreement with the reference data
- Note the unusual band of cold bias for combined NAVO AVHRR-18 and -19 along 30-40S compared to both reference datasets

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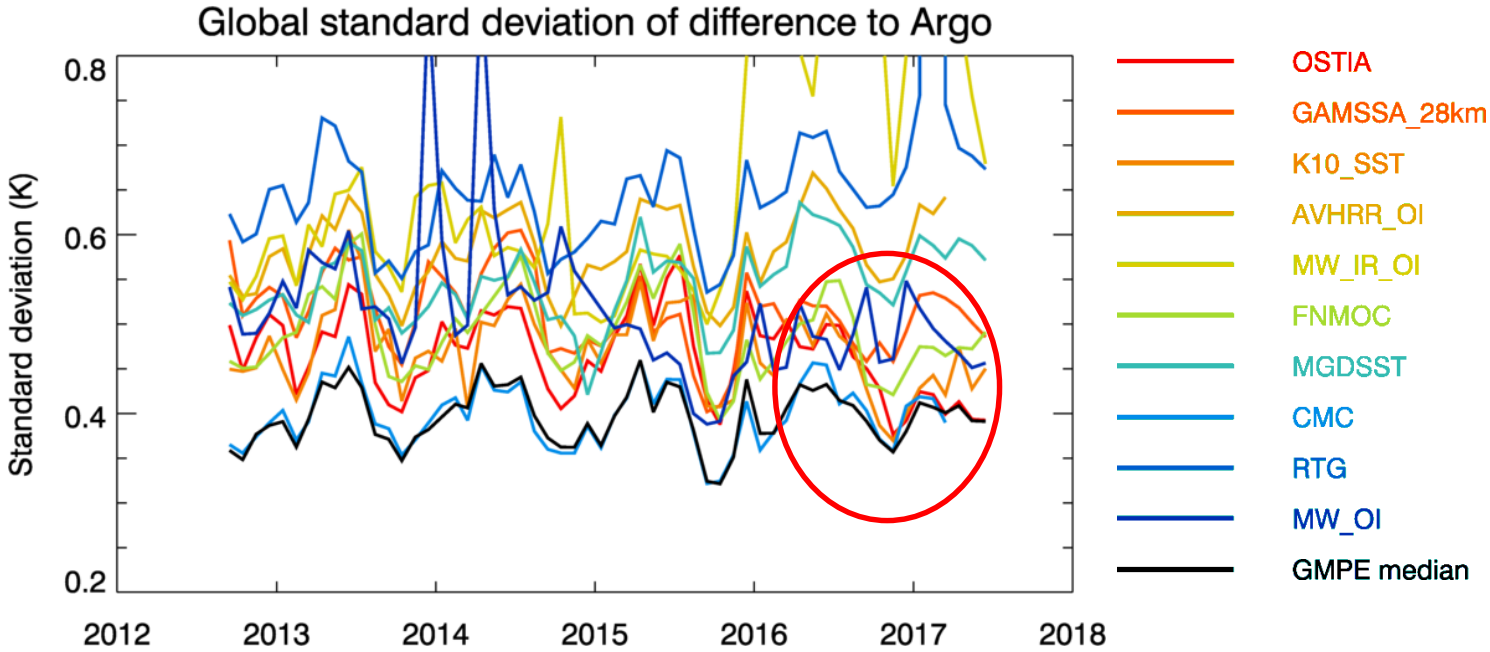
Impact on the operational system - GMPE

- Near-surface temperature observations from Argo profiling floats are used to validate various global SST analyses and their daily ensemble median, known as the GMPE (GHRSST Multi-Product Ensemble) median product
- These statistics are updated on the first of the month for the previous-but-one month using Argo data from the Met Office Hadley Centre EN4 database
- Plots can be seen at http://ghrsst-pp.metoffice.com/pages/latest_analysis/sst_monitor/argo/
- GMPE data are available from http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com_csw&view=details&product_id=SST_GLO_SST_L4_NRT_OBSERVATIONS_010_005

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Impact on the operational system - GMPE

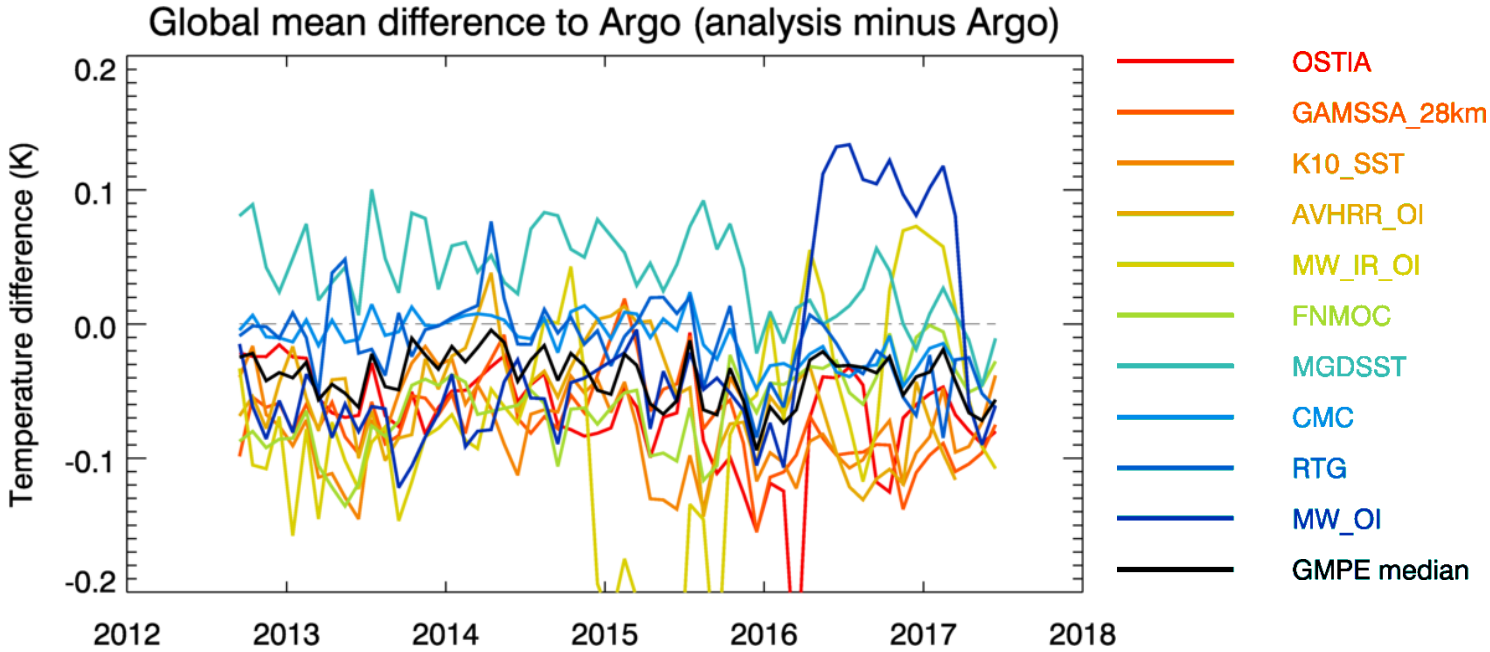
There is a clear improvement in standard deviation of differences from the time of the upgrade



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Impact on the operational system - GMPE

However, global mean differences are variable and do not show a clear change



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Summary

- OSTIA is a near real time, operational SST analysis run daily at the Met Office
- In November, the system was upgraded to use nighttime ACSPO VIIRS data as the reference used to correct for biases in other satellite data
- Prior testing indicated that this change should improve mean and standard deviation of differences to reference Argo data
- Monitoring since the upgrade has shown a clear improvement to standard deviation of differences; however this is not clear in mean differences

- Thanks for making your excellent data available!

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