

## 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° grid resolution
- Foundation SST (uses all nighttime observations and daytime observations only when wind speed >6 m s<sup>-1</sup> 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



## 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)



## 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



## 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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Argo minus

**OSTIA** analysis

statistics for a

test period of 9

Dec 2015 - 11

Jan 2016

Region (CMEMS	Mean diff to Argo (K)		RMS diff to Argo (K)	
definitions)	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
<b>Tropical Atlantic</b>	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
<b>Tropical Pacific</b>	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



## 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)

#### **Met Office**

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<sup>-1</sup>, and SSES biases have been removed







## 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

## 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 <a href="http://ghrsst-pp.metoffice.com/pages/latest\_analysis/sst\_monitor/argo/">http://ghrsst-pp.metoffice.com/pages/latest\_analysis/sst\_monitor/argo/</a>
- GMPE data are available from <a href="http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com\_csw&view=details&product\_id=SST\_GLO\_SST\_L4\_NRT\_OBSERVATI\_ONS\_010\_005">http://marine.copernicus.eu/services-portfolio/access-to-products/?option=com\_csw&view=details&product\_id=SST\_GLO\_SST\_L4\_NRT\_OBSERVATI\_ONS\_010\_005</a>



## 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!