Use of ACSPO VIIRS L3U SST in the Australian Bureau of Meteorology

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Background

- ABoM currently uses NAVOCEANO’s 9 km x 4 km global AVHRR SST data from NOAA-18/19 and METOP-A/B in operational SST analyses and ocean models.

- ABoM produces GHRSSST L2P, L3U, L3C and L3S products from HRPT AVHRR SST data from NOAA satellites for IMOS Project and operational ABoM systems.

- Need Suomi-NPP VIIRS SSTs for above systems as a follow-on to NOAA-19 AVHRR SST.

- Unable to access VIIRS L2P SST via FTP in real-time due to high volumes so requested ACSPO produce lower resolution VIIRS L3U files.

- NOAA/NESDIS/STAR produces ACSPO VIIRS 0.02° L3U product with grid aligned with IMOS 0.02° L3U product.

- ABoM testing these products for operational systems.
• ABoM and CSIRO have raw 1 km HRPT AVHRR data from NOAA-11 to NOAA-19 from groundstations in Australia and Antarctica

• As part of IMOS, ABoM has produced GHRSSST products (L2P and 0.02° gridded L3U, L3C, L3S) over two domains (Australia and Southern Ocean) from 1992 to present

• Could ACSPO VIIRS 0.02° L3U SST help improve the IMOS L3S spatial coverage?
IMOS NOAA-19 fv01 L3C SSTskin vs bias-corrected VIIRS L3U SSTsubskin
Queensland Coast: 17 Aug 2015 Night

IMOS L3C (1520 UT)

VIIRS L3U (1540 UT)

VIIRS L3U (1550 UT)

QL ≥ 3

QL = 5

QL = 5
IMOS NOAA-19 fv01 L3C SSTskin vs bias-corrected VIIRS L3U SSTsubskin
Queensland Coast: 17 Aug 2015 Day

IMOS L3C (0320 UT)

VIIRS L3U (0240 UT)

VIIRS L3U (0420 UT)

QL ≥ 3

QL = 5

QL = 5
Does VIIRS L3U help coverage?
Compare "Harmonised Quality Level" (q_s)
VIIRS increases spatial coverage of good quality SSTs on a single pass

Compositing single swath SSTs from 4 satellites for $q_s \geq 2$
Initial Findings

- VIIRS L3U SSTs (filtered for QL = 5) have slightly greater spatial coverage to IMOS fv01 NOAA-19 L3C SSTs (filtered for QL ≥ 3)
- Adding VIIRS L3U SST to IMOS L3C SSTs from NOAA-15/18/19 increases spatial coverage and overall quality from a single pass
  - VIIRS had ~ 1.5 to 2 times more QL=5 SSTs than IMOS NOAA-19 (within same area)
  - After bias correction using sses_bias, matchups with drifting + tropical moored buoys showed similar biases and ACSPO SDs significantly less (~0.2 K) than IMOS SDs (Note: IMOS L3U SSTskin converted to SSTsubskin by adding 0.17 K)

<table>
<thead>
<tr>
<th>L3U Product</th>
<th>Day Matchups</th>
<th>Day Bias (K)</th>
<th>Day SD (K)</th>
<th>Night Matchups</th>
<th>Night Bias (K)</th>
<th>Night SD (K)</th>
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</thead>
<tbody>
<tr>
<td>IMOS</td>
<td>847</td>
<td>0.00</td>
<td>0.55</td>
<td>956</td>
<td>-0.02</td>
<td>0.47</td>
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<tr>
<td>ACSPO</td>
<td>4908</td>
<td>0.09</td>
<td>0.34</td>
<td>5540</td>
<td>-0.03</td>
<td>0.30</td>
</tr>
</tbody>
</table>
Using Chris Griffin's "harmonised quality level" ($q_s$) method (presented at GHRSSST-XVII) one expects to be able to take the best quality measurements from IMOS AVHRR L3U and merge with ACSPO VIIRS L3U SSTs to form multi-sensor L3S products with greater spatial coverage but no worse accuracy.

Currently modifying ACSPO VIIRS L3U files to have some same ancillary fields to IMOS L3U files (e.g. l2p_flags, sea ice, winds, dt_analysis) but retain ACSPO SSES and quality_level fields, prior to merging with IMOS L3U files to produce IMOS VIIRS L3C and IMOS VIIRS+AVHRR L3S products.
Over coming 12 months VIIRS L3U SST is a high priority data stream to add to satellite data ingested into:

- IMOS 0.02° VIIRS L3C and 0.02° VIIRS+AVHRR L3S products
  - input into ABoM operational ReefTemp NextGen coral bleaching nowcasting system over Great Barrier Reef
- RAMSSA/GAMSSA L4 analyses*
- OceanMAPS3 Global 0.1° Ocean Model*
- eReefs Great Barrier Reef ~ 4 km Ocean Model*

* Delayed until late 2016/early 2017 due to system porting to new supercomputer
Thankyou!

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EXTRA SLIDES FOR DISCUSSION
Regional Australian Multi-Sensor SST Analysis

Depth: Foundation (pre-dawn SST)

Resolution: Daily, 1/12°

Domain: 60ºE - 170ºW, 20ºN - 70ºS

Data Inputs:
- 1 km IMOS HRPT AVHRR (NOAA-18,-19) L2P
- 9 km NAVOCEANO GAC AVHRR (NOAA-18, NOAA-19, METOP-A, METOP-B) L2P
- 25 km JAXA AMSR-2 (GCOM-W) L2P
- Buoy, ship, Argo, CTD, XBT obs (GTS)
- 1/12° NCEP ice concentration analyses
- BGF: Combination of previous day’s RAMSSA SST and Reynolds climatology

Uses: Boundary condition for ABoM operational regional NWP models
Global Australian Multi-Sensor SST Analysis

Depth: Foundation (pre-dawn SST)

Resolution: Daily, 1/4°

Domain: Global

Data Inputs:
- 1 km IMOS HRPT AVHRR (NOAA-18,-19) **L2P**
- 9 km NAVOCEANO GAC AVHRR (NOAA-18, NOAA-19, METOP-A, METOP-B) **L2P**
- 25 km JAXA AMSR-2 (GCOM-W) **L2P**
- Buoy, ship, CTD, XBT obs (GTS)
- 1/12° NCEP ice concentration analyses
- BGF: Combination of previous day’s GAMSSA SST and Reynolds climatology

Uses: Boundary condition for ABoM operational global NWP models; Initialises ABoM seasonal prediction model; Contributes to GMPE.