

## **New IMOS Multi-Sensor Sea Surface Temperature Composites provide better coverage and accuracy**

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IMOS has produced a 27-year suite of satellite-based sea surface temperature (SST) composites on a  $0.02^\circ \times 0.02^\circ$  grid (IMOS, 2018; Griffin et al., 2017), using locally received, 1.1 km resolution at nadir, brightness temperature data from Advanced Very High Resolution Radiometer (AVHRR) sensors aboard the series of NOAA Polar-Orbiting Environmental Satellites (NPOES). From 2018, NOAA officially replaced the AVHRR sensor program with the Visible Infrared Imaging Radiometer Suite (VIIRS) sensor program, after a long trial which began with the first VIIRS sensor launched in 2012 aboard the Suomi National Polar-Orbiting Partnership (NPP) platform. The VIIRS sensor provides higher spatial resolution (0.75 km at nadir) and lower noise than AVHRR, and has better orbital stability, with daily global SST coverage in cloud-free conditions at around 01:20 and 13:20 local time. The NOAA Office of Satellite and Product Operations (OSPO) produce real-time VIIRS "L3U" SST on the IMOS  $0.02^\circ \times 0.02^\circ$  grid (NOAA CoastWatch, 2018). The Bureau of Meteorology (BoM) have composited the OSPO VIIRS L3U data, following the method in Griffin et al. (2017), to produce daily day/night "L3C" composites of VIIRS data on the IMOS grid and domain. The NPP VIIRS L3U data are composited based on quality and uncertainty estimates with AVHRR SST data from NOAA-18 and NOAA-19 to construct the new IMOS "Multi-sensor L3S" product suite (Griffin et al., 2017), resulting in improvements to overall quality, accuracy and coverage. This new product, produced operationally at BoM since 16<sup>th</sup> November 2018, is intended to be a drop-in replacement for the existing AVHRR-only L3S product set, with similar file format. Figure 1 demonstrates the improvements in spatial coverage expected. Validation of the night-time 1-day Multi-sensor L3S SST against *in situ* SST indicates incorporating VIIRS data significantly reduces the standard deviation of the 30-day differences from typically 0.4-0.7°C to 0.2-0.5°C for highest quality level L3S SSTs (BoM, 2019).

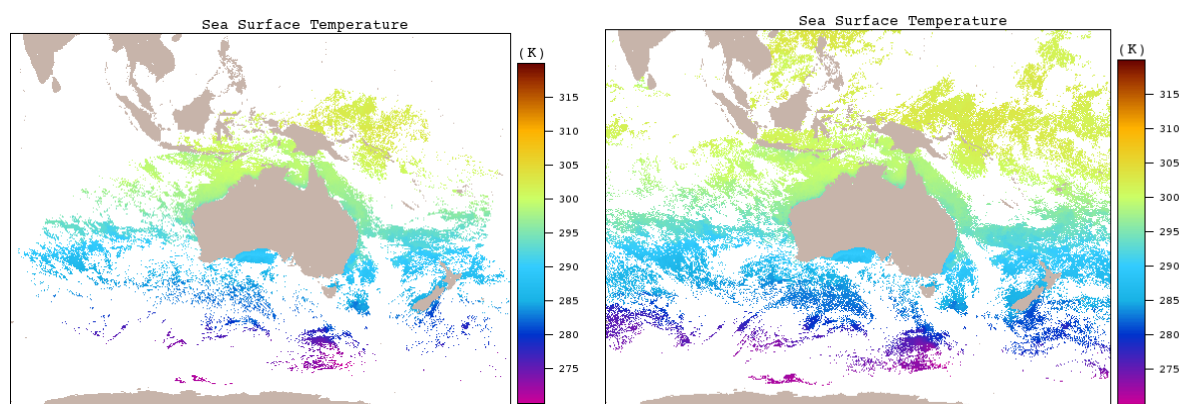


Fig 1. 2 km resolution skin SSTs with quality level 4 and 5 from (left) AVHRR-only 1-day night-only L3S and (right) Multi-sensor 1-day night-only L3S files for 29<sup>th</sup> July 2018 over the IMOS Australian domain

(70°E to 190°E, 70°S to 20°N). For this date, the AVHRR-only L3S was formed using data from NOAA-18 and NOAA-19, and the Multi-Sensor L3S included additional data from NPP.

Real-time, operational, Multi-Sensor L3S netCDF files containing average SSTs over periods of 1, 3, 6 days and 1 month are available from 1<sup>st</sup> January 2018 from the AODN Thredds server at <http://thredds.aodn.org.au/thredds/catalog/IMOS/SRS/SST/ghrsst/catalog.html> in the L3SM-1d, L3SM-3d, L3SM-6d and L3SM-1m sub-directories.

They will shortly also be available from the AODN portal (<http://portal.aodn.org.au>). Maps of these Multi-sensor composite SSTs are available for various Australian regions from IMOS OceanCurrent (<http://oceancurrent.imos.org.au/index.php>) back to 1<sup>st</sup> January 2018. Since 21<sup>st</sup> November 2018, the IMOS Multi-sensor 1-day nighttime L3S SSTs have been ingested into the Bureau of Meteorology's ReefTemp NextGen coral bleaching nowcasting system (<http://www.bom.gov.au/environment/activities/reeftemp/reeftemp.shtml>).

NOAA-18 and NOAA-19 are the last in the series of operational NPOES satellites to carry AVHRR sensors, starting with NOAA-6 in 1981, although they are still carried on the European Space Agency (ESA) MetOp series of polar-orbiters, MetOp-A, B and C. Orbital decay of NOAA-18 and NOAA-19 during recent years has affected the accuracy of the real-time IMOS AVHRR SST products during some months (BoM, 2019). The AVHRR sensor on NOAA-19 was adversely affected by passing for the first time into a fully sunlit orbit on 13<sup>th</sup> September 2018 (NOAA NESDIS, 2019), and from 29<sup>th</sup> September 2018 SSTs from this satellite have not contributed to the IMOS AVHRR L3S products (described in Griffin et al., 2017 and Wijffels et al., 2018). NOAA-18 is expected to pass into a similar full-sun orbit in late February 2019 (NOAA NESDIS, 2019). It is therefore recommended that users requiring accurate 2 km SST composites over the Australian region consider using the new IMOS Multi-sensor L3S in place of the AVHRR L3S.

In 2019, BoM plans to include Ifremer's 1.1 km resolution AVHRR SSTs from MetOp-B, OSPO's new VIIRS L3U SSTs from NOAA-20 and BoM's Himawari-8 SST in the IMOS Multi-sensor L3S suite, and reprocess the historical archive back to 2012 (launch of the first VIIRS sensor on NPP).

For further information and early access to reprocessed Multi-Sensor data please contact [ghrsst@bom.gov.au](mailto:ghrsst@bom.gov.au).

## References

BoM (2019), BoM IMOS near real-time fv01 SST Validation Web Page:

[http://opendap.bom.gov.au:8080/thredds/fileServer/abom\\_imos\\_ghrsst\\_archive-1/staticweb/sst-rt-batch/index01.html](http://opendap.bom.gov.au:8080/thredds/fileServer/abom_imos_ghrsst_archive-1/staticweb/sst-rt-batch/index01.html)

Griffin, C., H. Beggs and L. Majewski (2017), GHRSSST compliant AVHRR SST products over the Australian region – Version 1, *Technical Report, Bureau of Meteorology, Melbourne, Australia, 151 pp.* [http://imos.org.au/fileadmin/user\\_upload/shared/SRS/SST/GHRSSST-DOC-basic-v1.0r1.pdf](http://imos.org.au/fileadmin/user_upload/shared/SRS/SST/GHRSSST-DOC-basic-v1.0r1.pdf)

IMOS (2018), IMOS Satellite Remote Sensing SST Data Web Page:

<http://imos.org.au/facilities/srs/sstproducts/sstdata0/>

NOAA CoastWatch (2018), ACSPO Global SST from VIIRS Web Page:

<https://coastwatch.noaa.gov/cw/satellite-data-products/sea-surface-temperature/acsपो-viirs.html>

NOAA NESDIS (2019), National Oceanographic and Atmospheric Administration NESDIS 3S Sensor Stability for SST web site, showing night duration plots for NPOES and METOP satellites, see "N Dur" tab at <https://www.star.nesdis.noaa.gov/sod/sst/3s/>

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