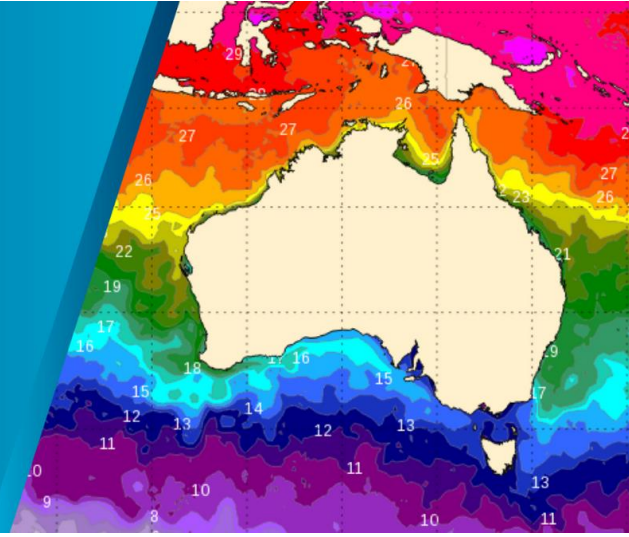
Australian Government
Bureau of Meteorology

Gridded Sea Surface Temperature Observations



Through the Integrated Marine Observing System (IMOS), the Bureau of Meteorology now offers real-time and historical gridded sea surface temperature (SST) observations, covering Australia and the Southern Ocean, every 10 minutes, hour, 4-hours, day, 3-days, 6-days, and month.

Overview

There is increasing demand from Australian users for sea surface temperature (SST) products within a few kilometers of coasts that can resolve fine-scale features, such as ocean upwelling, fronts, and coastal Marine Heatwaves. With support from IMOS (www.imos.org.au), the Bureau of Meteorology (Bureau), in collaboration with CSIRO and University of Reading, produces a range of high spatial and temporal resolution SST products from polar-orbiting and geostationary satellites, designed to suit different applications. The satellite sensors currently used are AHI on Himawari-8, AVHRR on NOAA-18 and MetOp-B, VIIRS on Suomi-NPP and NOAA-20, and AMSR2 on GCOM-W.

Real-time and Reprocessed Products

IMOS satellite SST products are provided in three product levels (2, 3 and 4) to suit different applications (see Table). All data are formatted following the International Group for High Resolution SST (www.ghrsst.org) data specification, including time varying error estimates and quality level flags for each SST value. The level 3 records form a 30-year data set, from 1992 to present, of quality-assured SST data from single or multiple infra-red radiometers (AVHRR, VIIRS and AHI). These are provided on a 0.02° x 0.02° grid over two domains – Australia (70°E - 190°E, 70°S - 20°N) and the Southern Ocean (2.5°E - 202.5°E, 77.5°S - 27.5°S).

Since infra-red radiometers cannot measure SST under cloud, to improve spatial coverage "L3S" composites are formed by combining single sensor "L3C" composites from multiple platforms (Figure 1(c)). The "Multi-sensor L3S" product formed from AVHRR and VIIRS data (Govekar et al., 2022) is widely used, including as inputs to IMOS OceanCurrent and the Bureau's coral bleaching risk monitoring service (ReefTemp Next Generation).

Level	Description	Applications
L2P	SST at native resolution from single swath or scene	SST analyses, ocean models, air-sea coupled models, fisheries
L3U	Gridded SST from single swath or scene	Ocean models, SST analyses, fisheries
L3C	Gridded SST from single sensor over multiple swaths/scenes (hourly, 4-hourly, daily)	Research (e.g., diurnal warming, coastal upwelling) Ingestion into daily operational SST analyses
L3S	Gridded SST from multiple sensors (daily, 3-days, 6-days, monthly)	Monitoring marine environment (e.g., coral, heatwaves), climatology, climate monitoring, validating ocean models, research
L4	Gridded gap-free SST from multiple sensors and in-situ platforms (daily, weekly, monthly)	Numerical weather and seasonal prediction, climate monitoring, research

In 2022, to reduce data gaps due to cloud, but retain feature resolution, the Bureau composited Himawari-8 AHI 10-minute 2 km SST data with data from VIIRS and AVHRR sensors installed on polar-orbiting satellites to construct new "Geo-Polar Multi-sensor L3S" products on the IMOS grid (Figure 1(d)) for 2015 to 2020. Hourly, 4-hourly, and daily Himawari-8 L3C SST products have also been produced (Figures 1(a) and (b)).

For applications requiring a gap-free, Level 4 (L4) SST analysis, such as constraining weather prediction models, the Bureau produces regional 1/12° and global 0.25° L4 SST analyses ("RAMSSA" and "GAMSSA"), formed by optimally interpolating observations from in-situ platforms and infrared and microwave satellite sensors. An example of SST from RAMSSA is shown in Figure 1(e).

Which SST product should I use?

As illustrated in the table, no one SST product will suit every application. Unlike an L2P, L3U, L3C or L3S SST product, the feature resolution (i.e., ability to resolve surface ocean features such as fronts, eddies, coastal upwelling) of an L4 SST product does not equate to the grid resolution (Figure 1). One may also need a high temporal resolution SST product to capture sub-daily variability, such as diurnal warming of the ocean surface. For guidance on how to select satellite SST products for your application, see Beggs (2021).

More information and data access

NCI (2022a) briefly describes the Bureau's IMOS satellite SST products and NCI (2022b) lists their pros and cons and data access via the National Computational Infrastructure (NCI) or Australian Ocean Data Network (AODN).

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References

Beggs, Helen (2021). Temperature. Ch 14 in Earth Observation: Data, Processing and Applications. Volume 3B—Surface Waters. CRCSI, Melbourne. pp. 245–279. ISBN 978-0-6482278-5-4.

https://www.eoa.org.au/earth-observation-textbooks

Govekar, P.D., C. Griffin, H. Beggs (2022) Multi-sensor Sea Surface Temperature products from the Australian Bureau of Meteorology, *Remote Sensing*, 2022, **14**, 3785. https://doi.org/10.3390/rs14153785

NCI (2022a). https://opus.nci.org.au/ - Search for "Bureau of Meteorology Satellite SST Products"

NCI (2022b). https://opus.nci.org.au/ - Search for "Products Summary (qm43)"

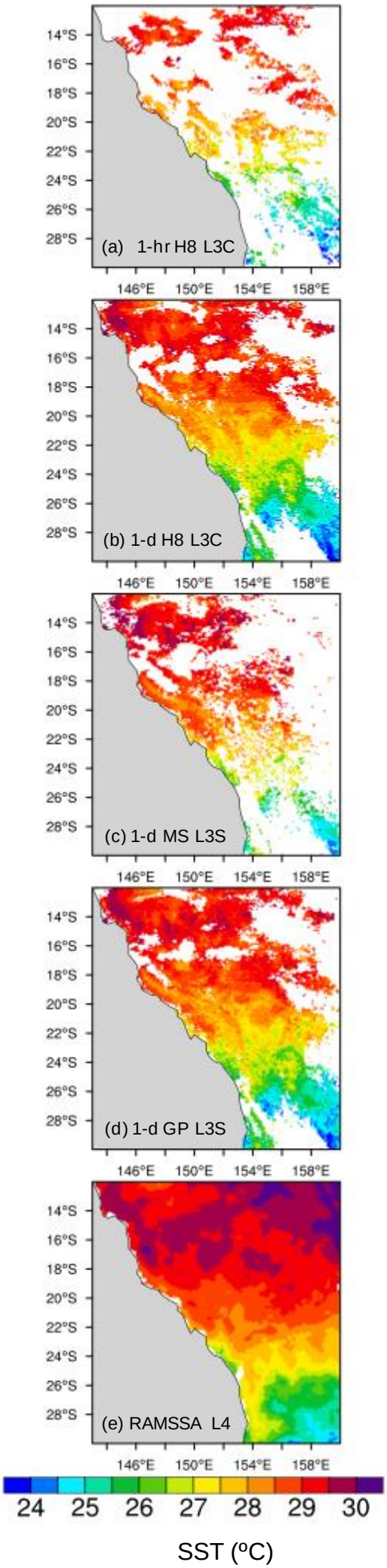

Figure 1: SST from (a) 1-hour Himawari-8 L3C, (b) 1-day night Himawari-8 L3C, (c) 1-day night Multi-sensor (AVHRR, VIIRS) L3S, (d) 1-day night Geo-Polar Multi-sensor (H-08, AVHRR, VIIRS) L3S and (e) RAMSSA (AVHRR, VIIRS, AMSR2) daily L4 for 15th March 2020.