Real-time and historical gridded IMOS Sea Surface Temperature (SST) products are derived from observations captured by infrared radiometers aboard a range of polar-orbiting and geostationary satellites. These data are formatted and flagged according to the International Group for High Resolution SST (GHRSST) Data Specification (GDS) 2.0 revision 5 (r5) format specification (GHRSST Science Team, 2012), including time varying error estimates and quality level flags for each SST value, calculated using matchups with drifting buoy SST data and proximity to cloud, respectively. The records form a unique 33-year data set that supplies quality-assured SST values, both at native resolution (level 2 Products, L2P) and 0.02° gridded Level 3 uncollated (L3U), Collated (L3C) and suspercollated (L3S) SST products over two domains – Australia (70oE to 190oE, 70oS to 20oN) and the Southern Ocean (2.5oE to 202.5oE, 77.5oS to 27.5oS). (Govekar et al., 2022).

The highest spatial resolution (1.1 km x 1.1 km) data from Advanced Very High Resolution Radiometer (AVHRR) sensors on NOAA Polar-orbiting Operational Environmental Satellites (POES) was obtained through receiving direct broadcast High Resolution Picture Transmission (HRPT) data from the satellite. The Bureau of Meteorology (Bureau), in collaboration with CSIRO Oceans and Atmosphere Flagship, combined raw HRPT data from reception stations located in Australia and Antarctica and produced real-time, level 2 (geolocated, swath) and level 3 (gridded, composite) files containing either “skin” (~ 10 micron depth) or “foundation” (~ 10 m depth) SSTs.

NOAA decommissioned last of POES satellite NOAA-18 on 6th June 2025 that Bureau was processing in real time. The IMOS SST processing system provided a consistent, accurate record of SST over 1992- 6th June 2025 period using data received from AVHRR sensors on all operational NOAA POES satellites from NOAA-11 to NOAA-19. The SST values in these “AVHRR only” products were derived by regressing the brightness temperature observations from the satellite sensor against collocated drifting buoy SST observations. The system smoothly and automatically corrected for changes in each sensor’s bias using a running one year calibration window, adjusted monthly (Govekar et al., 2022, Griffin et al., 2017). The 1-day night-only AVHRR L3S products were used to form the SSTAARS 1992 to 2016 daily 0.02 deg SST(0.2m) climatology (Wijffels et al., 2018).

The Visible Infrared Imaging Radiometer Suite (VIIRS) on Suomi-NPP, NOAA-20, and NOAA-21 has replaced AVHRR sensors on POES satellites, offering higher spatial resolution (750 m vs. 1.1 km), additional spectral bands, and improved radiometric accuracy. NOAA generates real-time VIIRS L3U SST data on a grid aligned with the IMOS 0.02° grid, which Bureau further processes to create IMOS VIIRS L3U, L3C, and Multi-sensor L3S products following process described in Govekar et al. (2022).

NOAA-18 and NOAA-19 were the last operational POES satellites to carry AVHRR sensors, though AVHRR remains on ESA’s MetOp series (A, B, C). EUMETSAT provides FRAC AVHRR L2P SST products for MetOp satellites, which Bureau processes into IMOS MetOp AVHRR L3U, L3C, and Multi-sensor L3S products.

As AVHRR platforms degrade, BoM has integrated SST data from advanced sensors into Multi-sensor L3S composites, covering the same and Southern Ocean domains as legacy AVHRR composites. The VIIRS L3U data are composited, based on quality and uncertainty estimates, with AVHRR SST data to construct the IMOS “Multi-sensor L3S” product suite. This has resulted in improvements to overall quality, accuracy and coverage of IMOS L3S composites (Govekar et al., 2022). These are publicly available in real-time and delayed mode from March 2012, replacing AVHRR-only L3S products. Currently, VIIRS L3U data from SNPP and NOAA-20 are composited with AVHRR SST data from MetOpB and MetOpC to create IMOS Multi-sensor L3S products in real time.

Infrared sensors on geostationary satellites have provided accurate SSTs at high temporal resolution over the Australian region since 2006, from the Japanese Meteorological Agency’s (JMA’s) Himawari series of satellites - with 10 minute, 2 km observations from the currently operational Himawari-9 (Govekar et al., 2024), which when composited over a number of hours enables filling in gaps due to transient cloud. Currently Bureau produces 10-min L2P, hourly, 4-hourly and night L3C for Himawari-9 in real time (Govekar et al., 2024)

If users require a coarser spatial resolution, but gap-free, Level 4 (L4) SST analysis over the Australian or global domain then it is suggested that they use regional and global L4 SST analyses (“RAMSSA” and “GAMSSA (Beggs, 2021). Note that 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.

All IMOS SST products follow the latest International Group for High Resolution Sea Surface Temperature (GHRSST) “GDS 2” file formats. To best use these IMOS L3C and Multi-sensor L3S products it is recommended that users select data with quality level 4 or higher and subtract sses_bias.