New IMOS Himawari-8 and Multi-sensor Sea Surface Temperature products

Pallavi Govekar[1], Jonathan Mittaz[2], Christopher Griffin[1] and Helen Beggs[1]

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AOMSUC-12 virtual conference, 11-18 November 2022.

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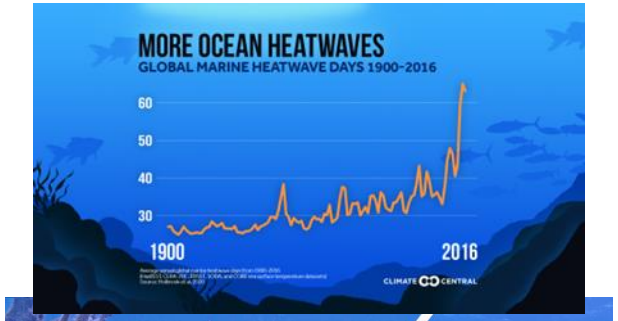

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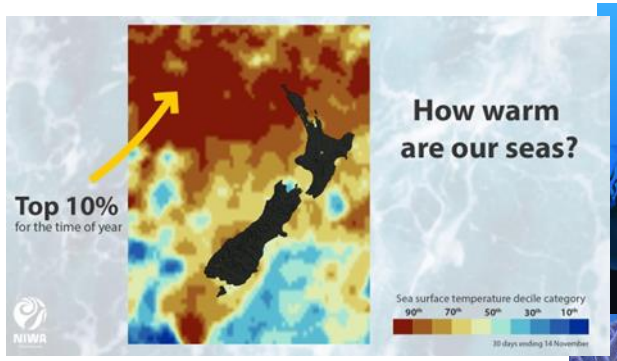

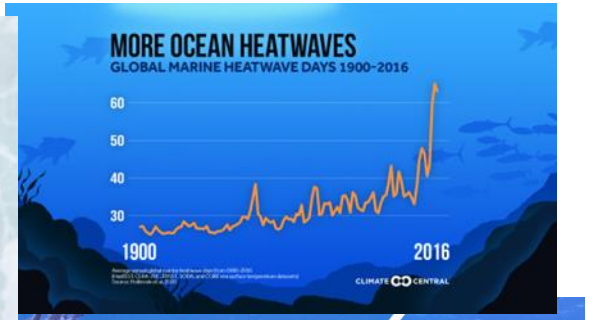

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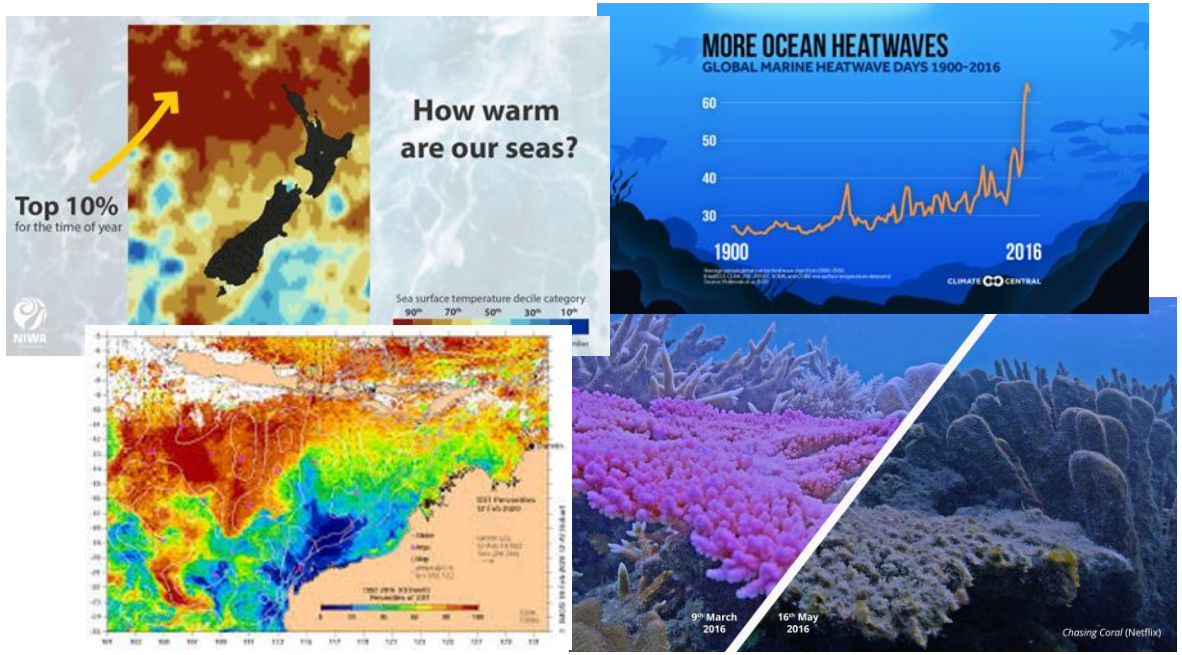


Overview of Satellites

Meteorological satellites provide continuous observations of the Earth surface. They provide useful environmental information such as temperature, wind, clouds, fires, dust storms, snow cover etc.

There are two types of meteorological satellites:

1. **Geostationary:**
    - Remain stationary with respect to the Earth
    - View the same region at all times
    - Resolution at nadir 2-5 km

2. **Polar-orbiters:**
    - Circle the Earth in north-south direction
    - View the entire Earth
    - Resolution at nadir 0.7-4 km

Polar orbiting weather satellite NOAA-20 was launched on 18 November 2017, Image credit : NASA

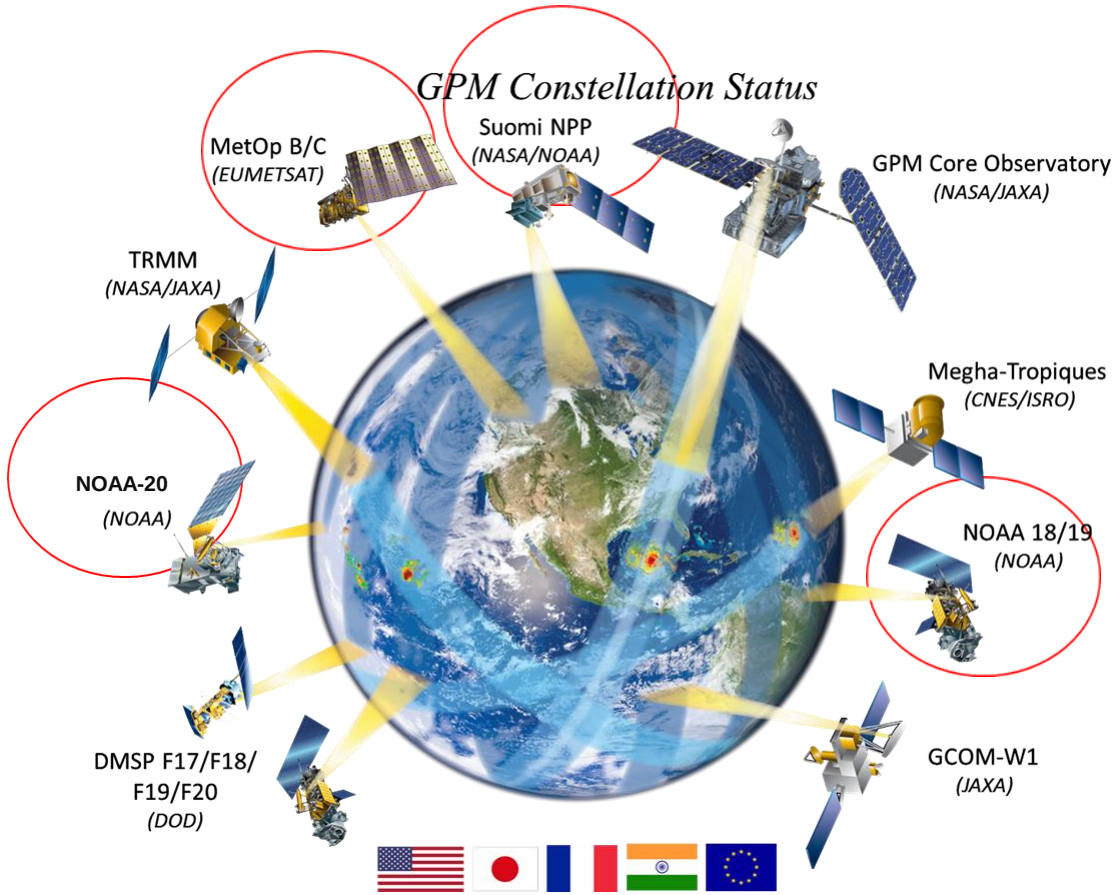
Which satellites does the Bureau use for SST?

At the Bureau, we currently produce real-time SST products
using infrared data from:

❑ Polar orbiters:
- NOAA-18 AVHRR
- MetOp-B
- Suomi-NPP VIIRS
- NOAA-20 VIIRS

❑ Geostationary satellite:
- Himawari-8 AHI

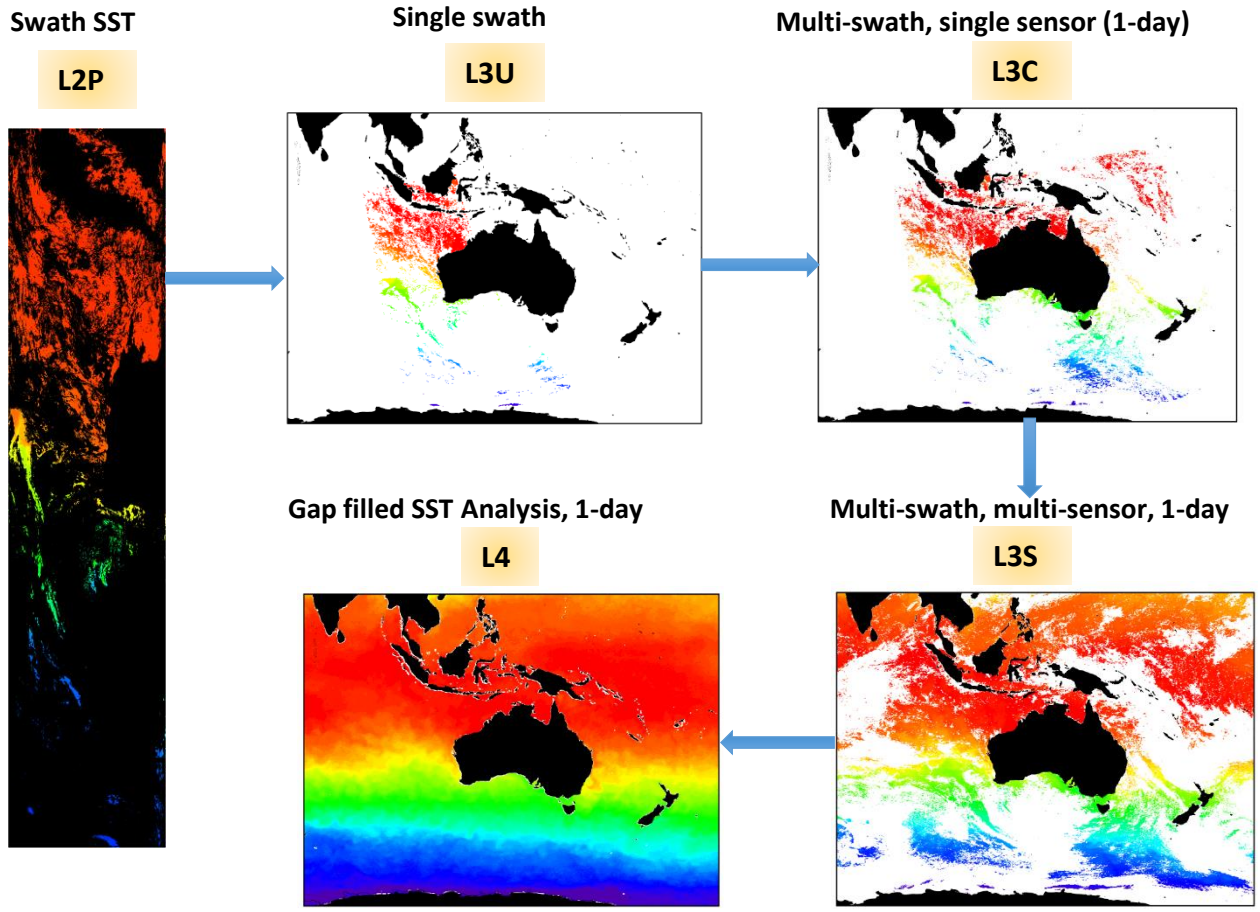
Constellation of polar-orbiting satellites (image credit: NASA)



Different SST products

Through IMOS Project, the following SST products for each of the available satellite sensors are available:

- L2P (geolocated, native resolution of sensor)
- L3U (swath, gridded)
- L3C (multiple swath, gridded)
- L3S (multiple sensor, gridded)



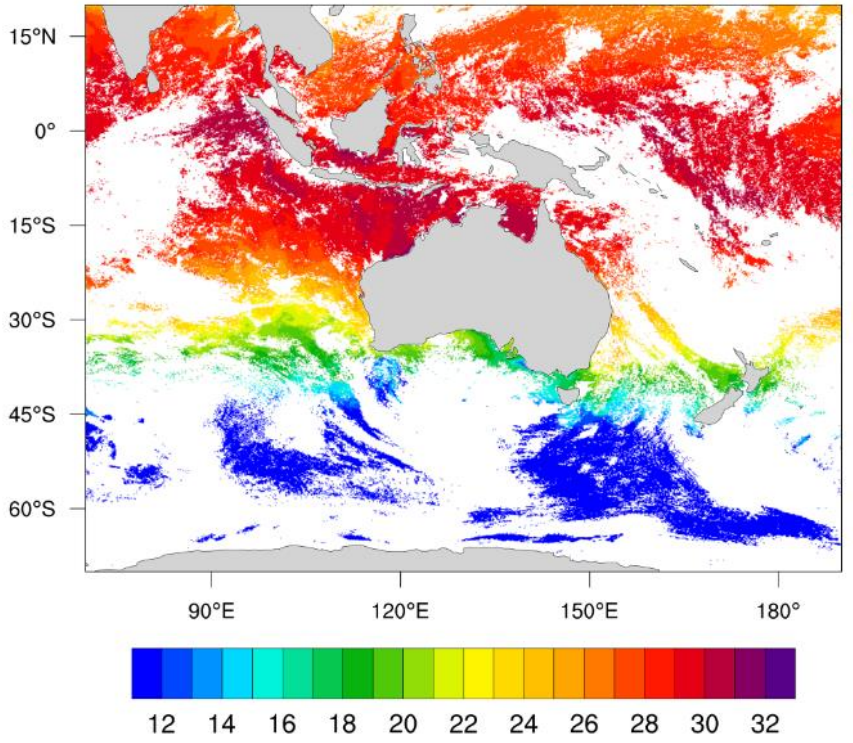
Operational Multi-Sensor L3S products

Composites of SST data from AVHRR sensors on NOAA-18 and MetOp-B, and VIIRS sensors on Suomi-NPP and NOAA-20

Resolution: 0.02º x 0.02º; 1, 3, 6 days and 1 month

Available: 2012 to present from http://portal.aodn.org.au and https://opus.nci.org.au/

1-day night-time Multi-Sensor L3S SST



Govekar et al., 2022, Remote Sensing

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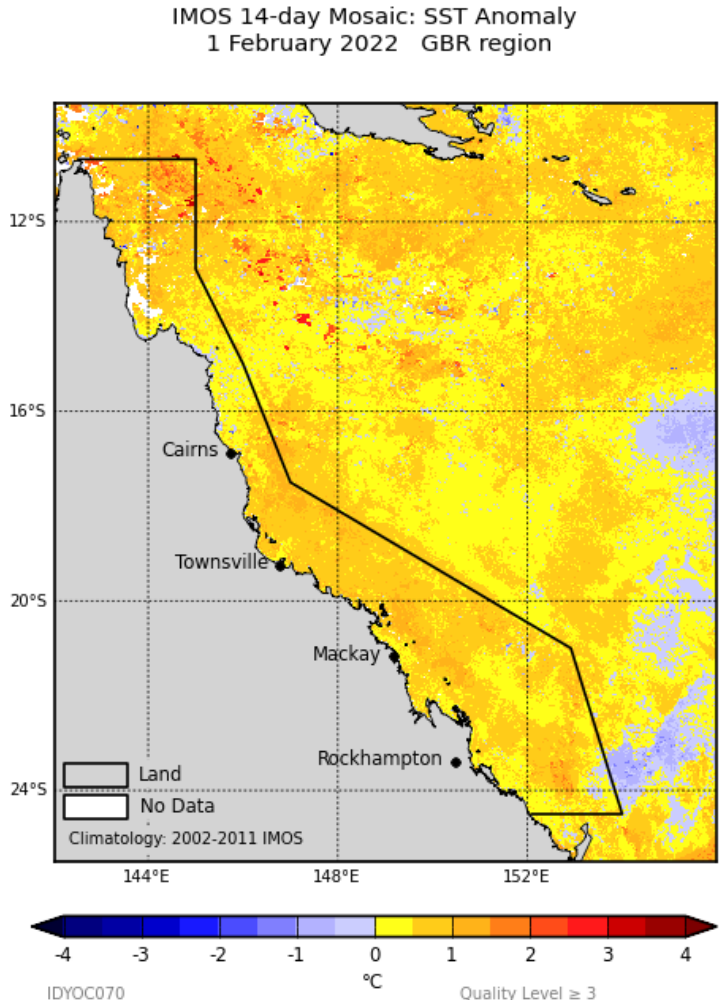
Uses:

- BoM ReefTemp NextGen Coral Bleaching Risk Monitoring http://www.bom.gov.au/environment/activities/reeftemp/reeftemp.shtml

ReefTemp SST Anomaly Map from 1-day Multi-Sensor L3S



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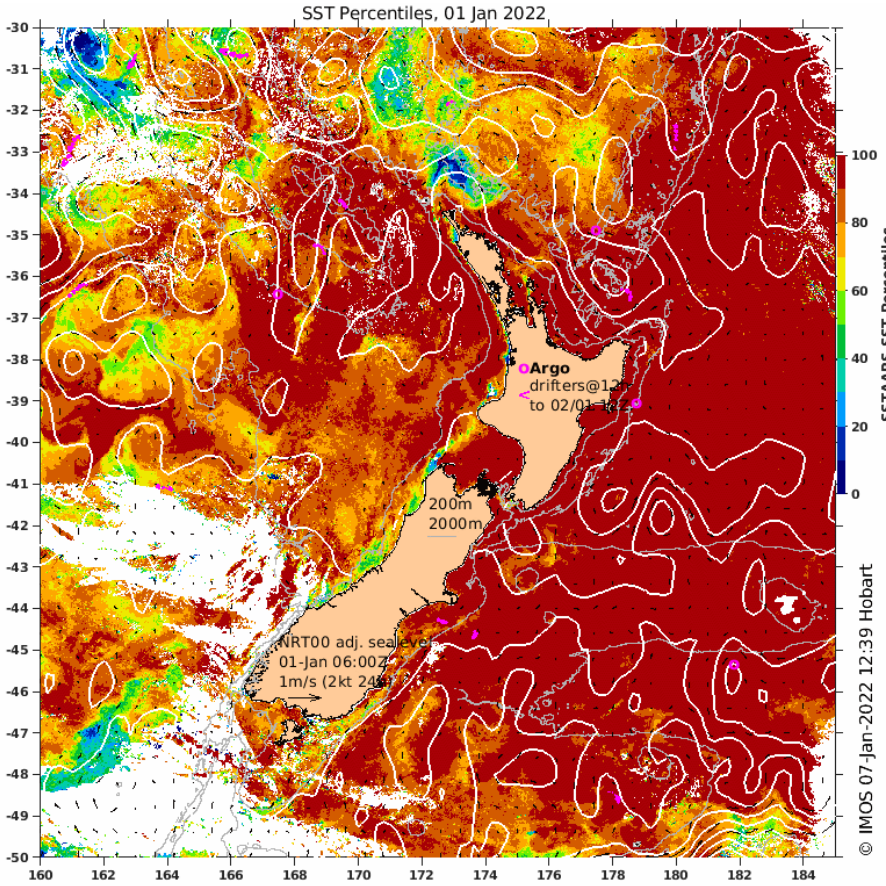
- BoM ReefTemp NextGen Coral Bleaching Risk Monitoring http://www.bom.gov.au/environment/activities/reeftemp/reeftemp.shtml
- IMOS OceanCurrent SST and Percentile Maps http://oceancurrent.imos.org.au

SST Percentiles from 6-day Multi-Sensor L3S – 1 Jan 2022



GeoPolar Himawari-8 L2P SST Product

Method:

Radiative Transfer Model (RTTOV12.3) and Bayesian cloud clearing method based on the ESA CCI SST code developed at the Uni of Reading.

SSES model developed at BoM is then applied to L2P files.

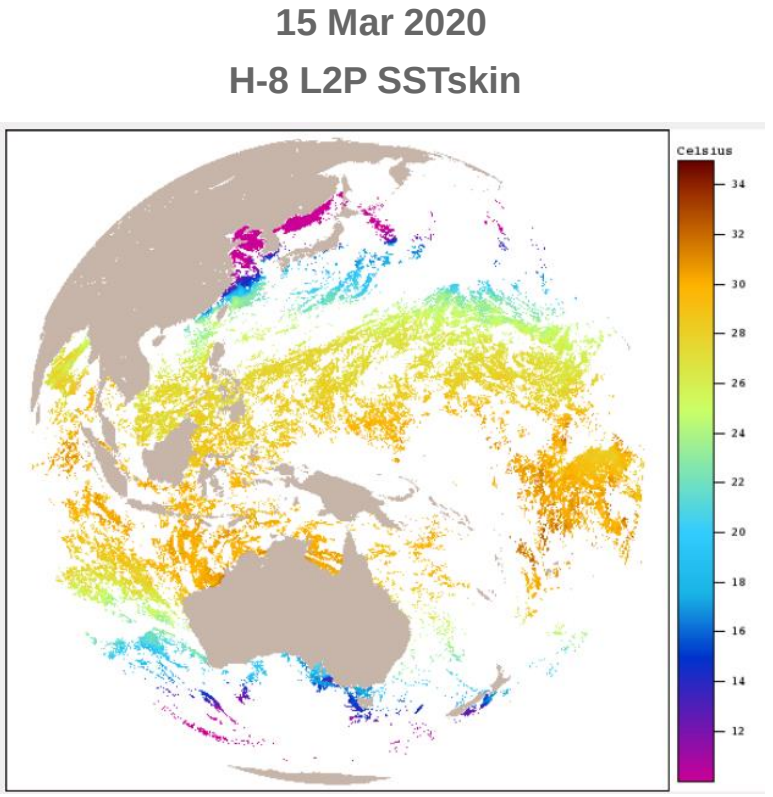
Quality level is reassessed using SSES.

Inputs: ~2 km 10 min radiances from AHI radiometer on JMA's geostationary Himawari-8 satellite

Resolution: 10 min^{-1}, 2 km^2 at nadir, full disk

Available: Reprocessed data over full disk on H-8 GEO projection from July 2015 – December 2020.

Access: NCI and OPeNDAP (Contact ghrsst@bom.gov.au)



GeoPolar Himawari-8 L3C SST Products

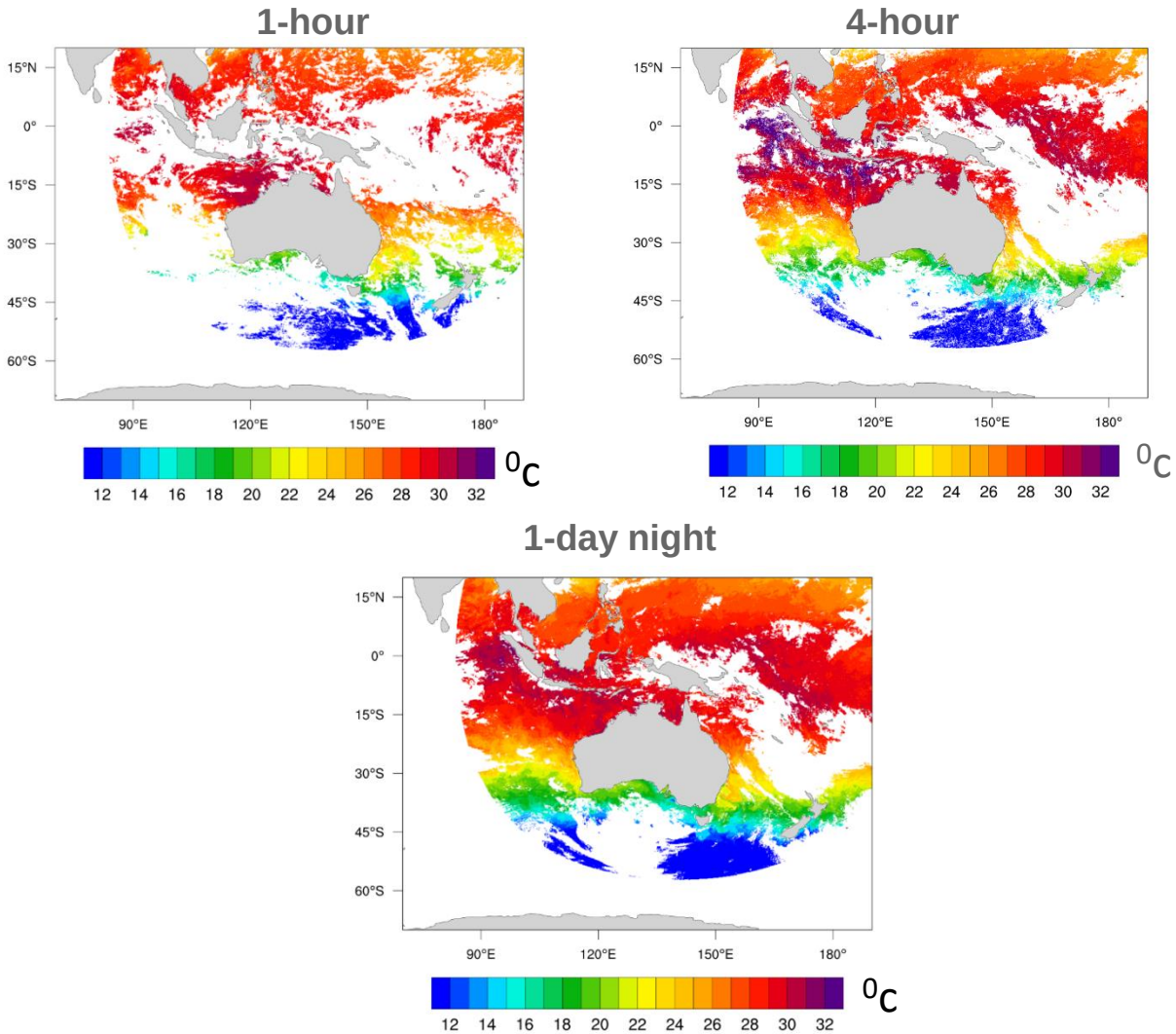
Method:. Night L3C is determined by choosing the latest SST after local sunset that has the best quality.

Inputs: IMOS Himawari-8 L2P SSTskin

Resolution: Hourly, 4-hourly and Daily night-time, 0.02º x 0.02º

Access: NCI and OPeNDAP (Contact ghrsst@bom.gov.au)

15 Mar 2020 H-8 L3C SSTskin for QL ≥ 3

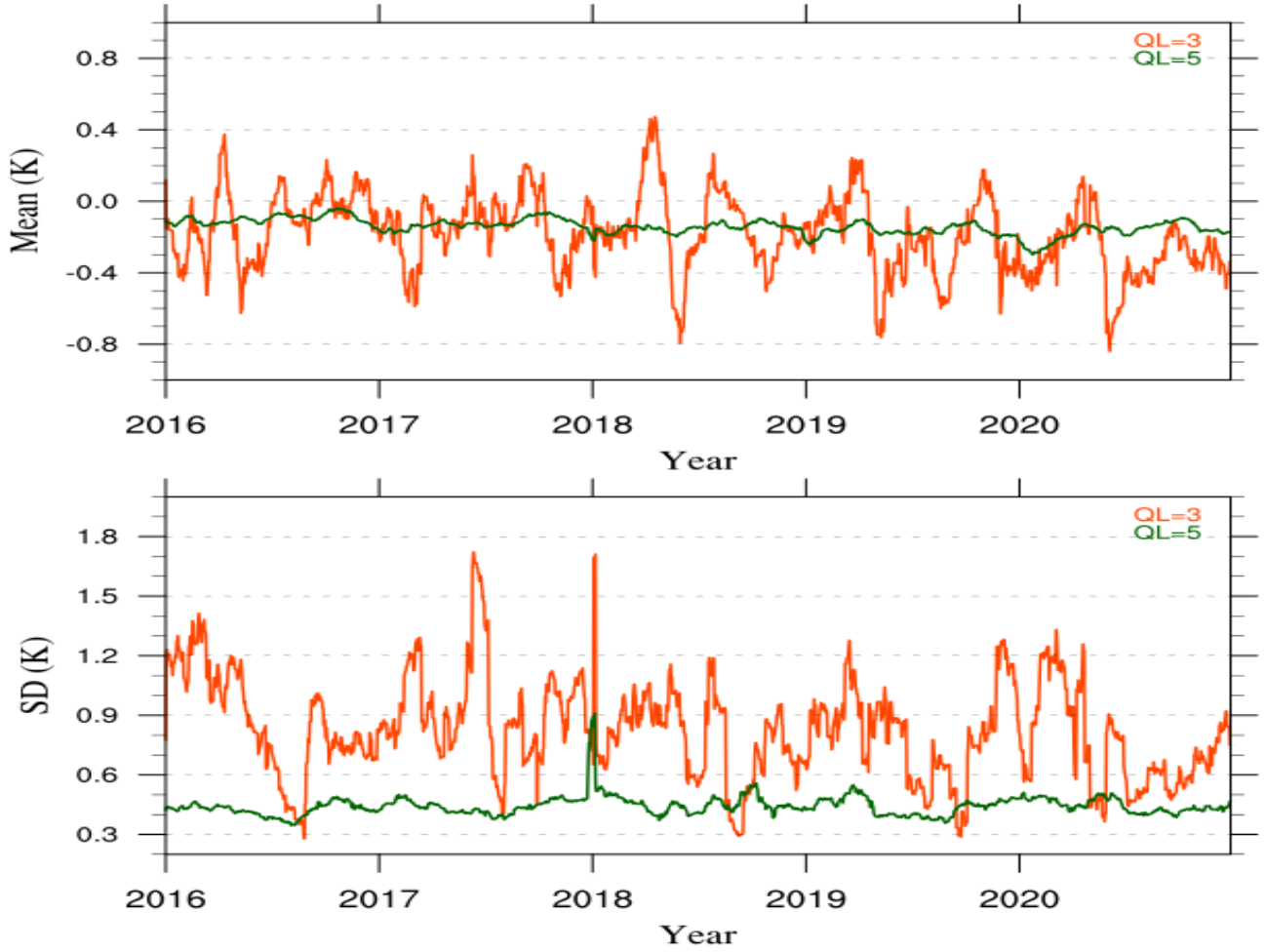


Himawari-8 SST Validation against buoy SST

L3C-01day, night only, monthly statistics, Jan 2016 - Dec 2020

Note: Mean bias = SST - in situ SST + 0.17 (in Kelvin),

Match-ups thresholds: < 10 km distance and +- 6 hours time.



GeoPolar Multi-Sensor L3S products

Method: L3C data are composited to L3S using an equal area weighted averaging method based on quality level, SSES bias and SSES standard deviation.

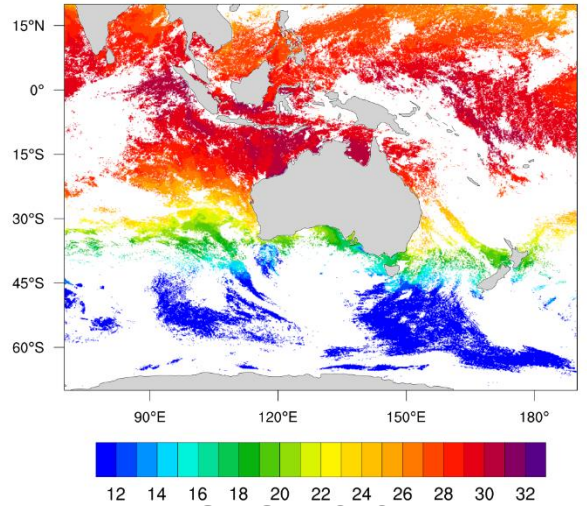
Inputs: L3C SSTs from NOAA-18, MetOpB, Suomi-NPP, NOAA-20 and Himawari-8

Available: Sept 2015 - Dec 2020

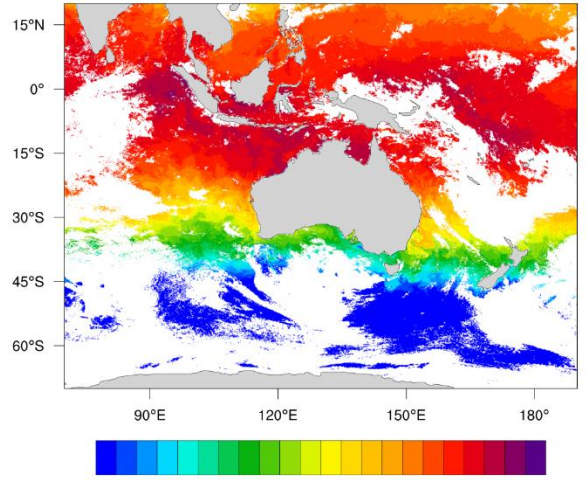
Access: NCI and OPeNDAP (Contact ghrsst@bom.gov.au)

15 Mar 2020

1-day night Multi-Sensor L3S SST



1-day night GeoPolar Multi-Sensor L3S SST

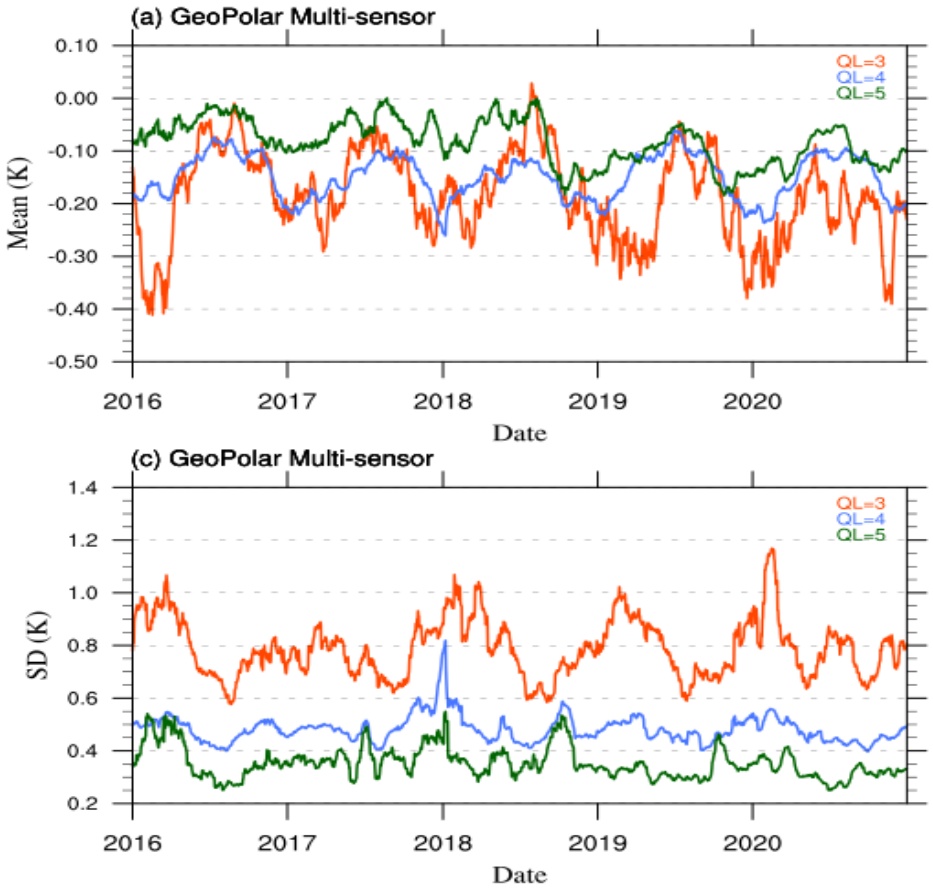


Multi-sensor L3S SST Validation against buoy SST

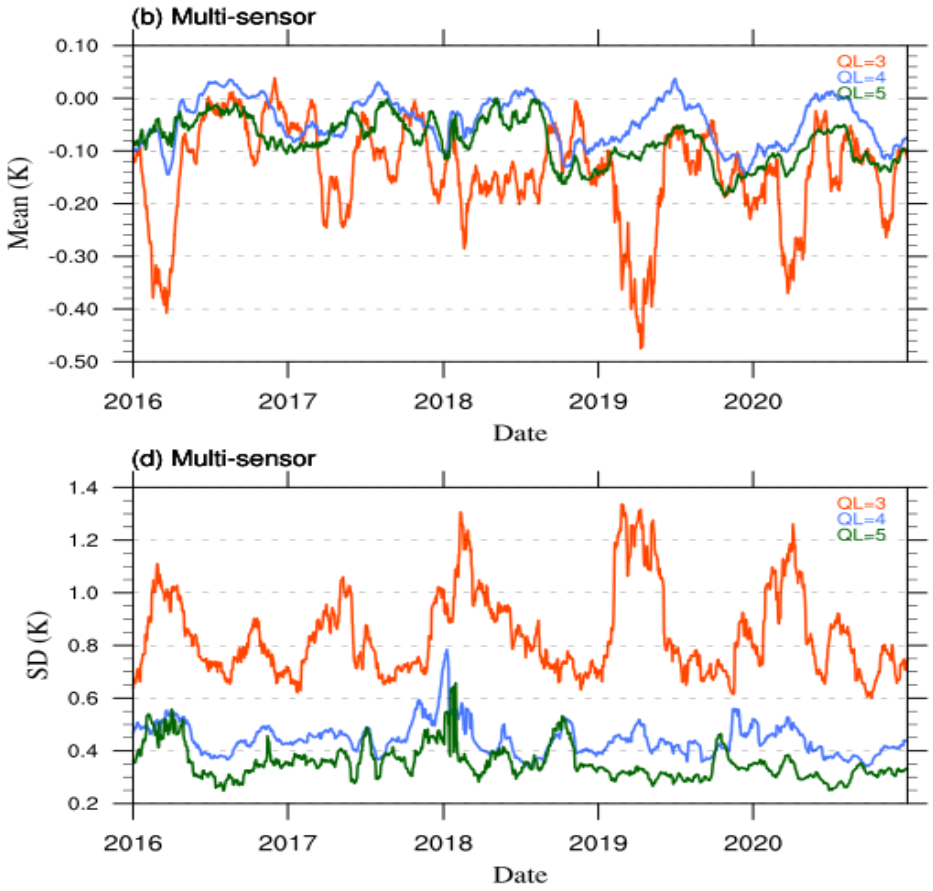
L3S-01day, night only, monthly statistics, Jan 2016 - Dec 2020

Note: Mean bias = SST - in situ SST + 0.17 (in Kelvin),
Match-ups thresholds: < 10 km distance and ± 6 hours time.

GeoPolar Multi-Sensor L3S

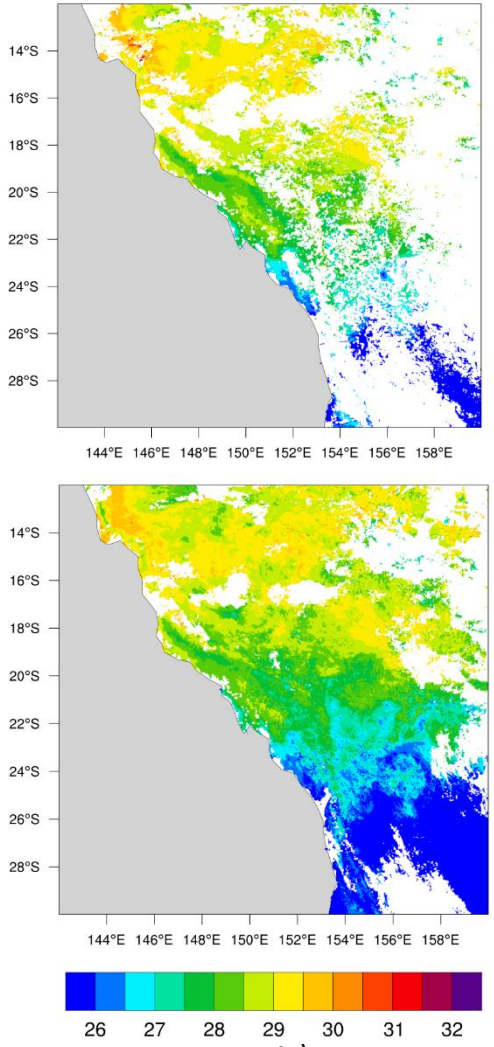


Multi-sensor L3S



Summary

- Different satellite SST products suit different applications…
- The Bureau, through IMOS, produces several high-resolution, regional satellite SST products useful for monitoring Marine Heat Waves, coastal upwelling, diurnal warming and climate trends over Australasian waters
- Available via http://portal.aodn.org.au (search for "SRS SST") and https://opus.nci.org.au/ (search for "Bureau of Meteorology Satellite SST Products")
- In collaboration with Uni of Reading, we are developing more accurate Himawari-8 SST products which enable us to produce new SST products with enhanced temporal resolution (hourly, 4-hourly) and improved spatial coverage (Multi-sensor L3S including Himawari-8)



Addition of Himawari-8 data to AVHRR+VIIRS L3S SST significantly improves data coverage over Great Barrier Reef region for 15th March 2020.

The Bureau of Meteorology

Thank You!

Contact: pallavi.govekar@bom.gov.au