Which SST Product Should I Use?

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Spoilt for choice?

- http://podaac.jpl.nasa.gov/datasetlist?search=GHRSST
- 25 GHRSST L2P single sensor swath products
- 4 GHRSST global L3C single sensor, multiple swath, gridded products (5 km to 25 km resolution)
- 15 GHRSST L4 gap-free, multiple sensor analysis products (1 km to 25 km resolution)

Useful sites for selecting and downloading GHRSST products

- https://www.ghrsst.org/quick-start/
- http://podaac.jpl.nasa.gov/datasetlist?ids=Collections&values=GHRSST&view=list
- http://podaac.jpl.nasa.gov/datasetlist?view=table&ids=Collections&values=GHRSST
- http://www.nodc.noaa.gov/SatelliteData/ghrsst/accessdata.html
- http://data.nodc.noaa.gov/geoportal/rest/find/document?searchText=title:GHRSST&start=1&max=100&contentOption=intersecting&f=searchPage&expandResults=True
- Validation/Inter-comparison: http://www.star.nesdis.noaa.gov/sod/sst/squam
- IMOS SST: http://imos.org.au/sstproducts.html

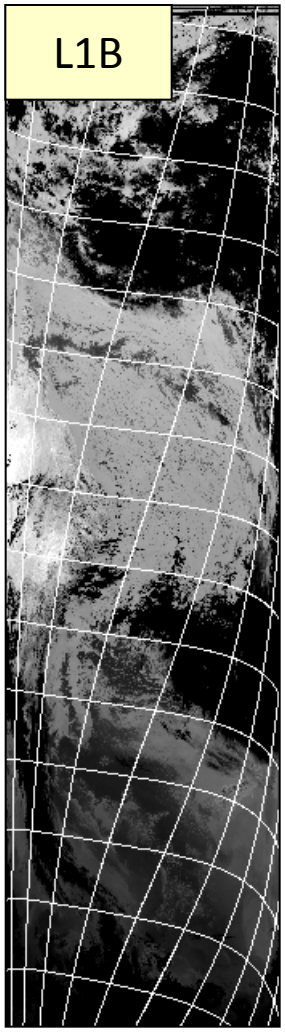
Range of IMOS-GHRSST products

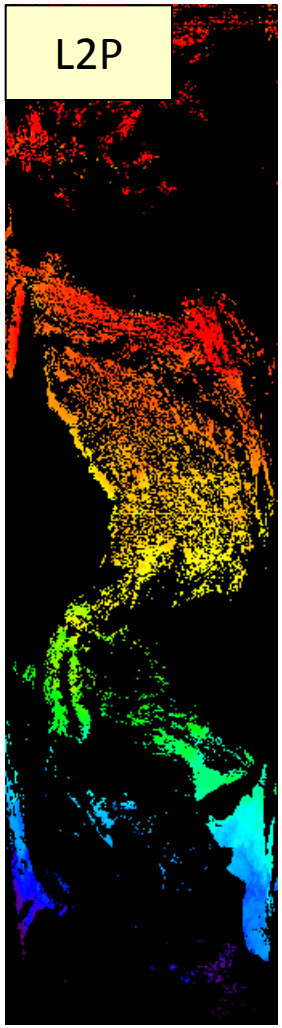
Swath BT

Swath SST

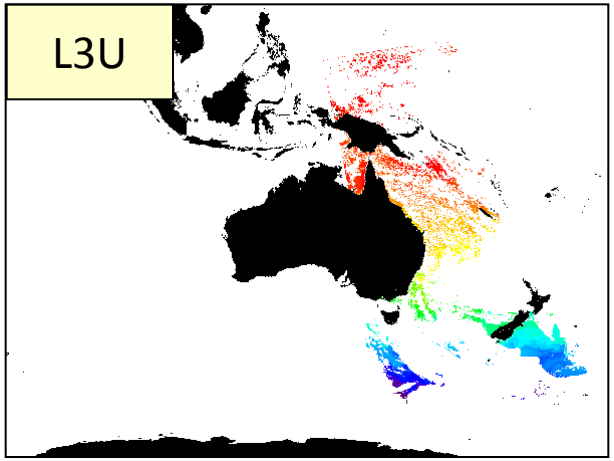
single swath

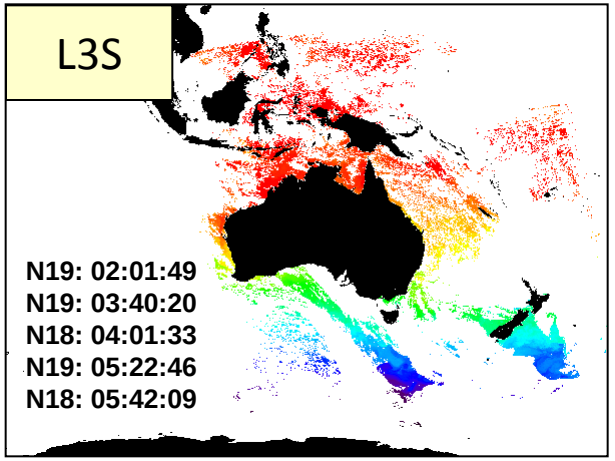
multi-swath, multi-sensor, (1-day)

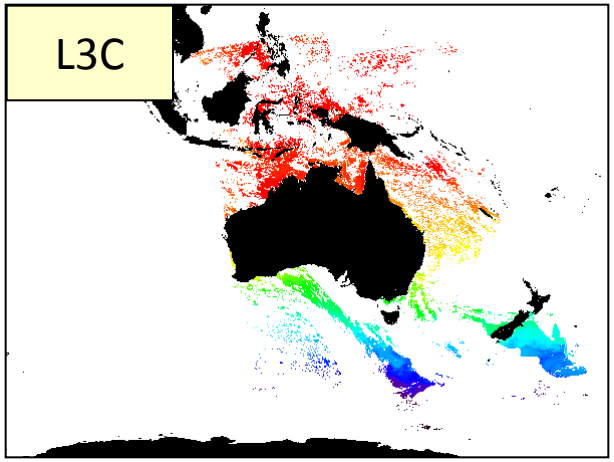




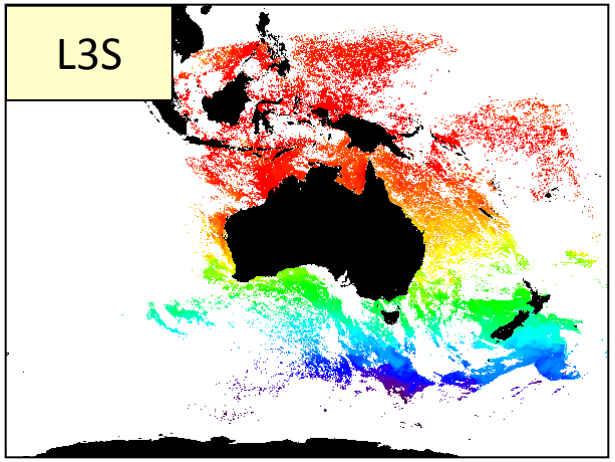
N18: 2011-04-30 04:01:33







multi-swath, single sensor

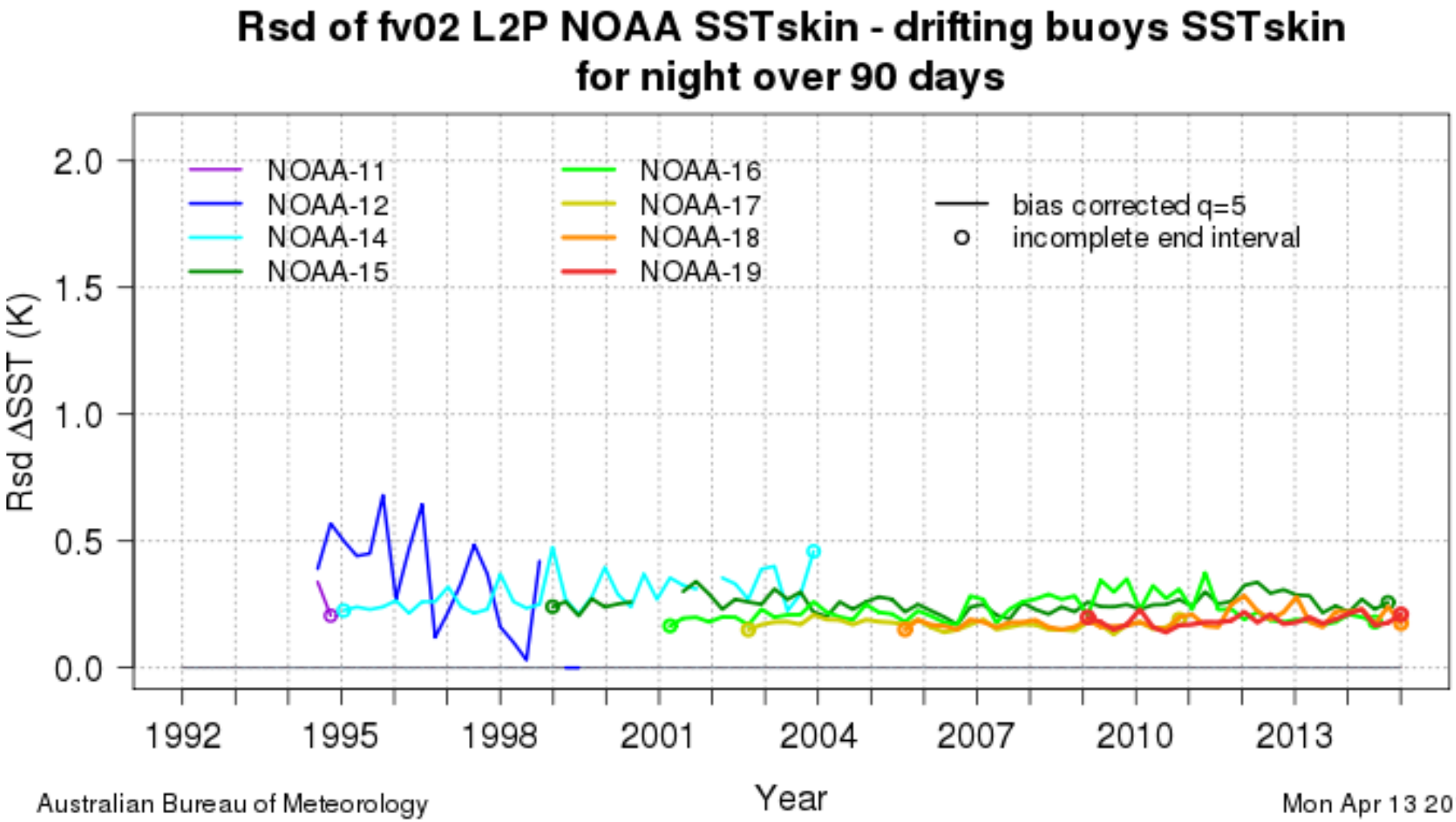


multi-swath, multi-sensor, multi-day (3-day)

+ 6-day, 14-day, 1-month L3S

fv02 L2P SST on-line routine verification

http://opendap.bom.gov.au:8080/thredds/fileServer/abom_imos_ghrsst_archive/v02.0fv02/Validation/web/index.html

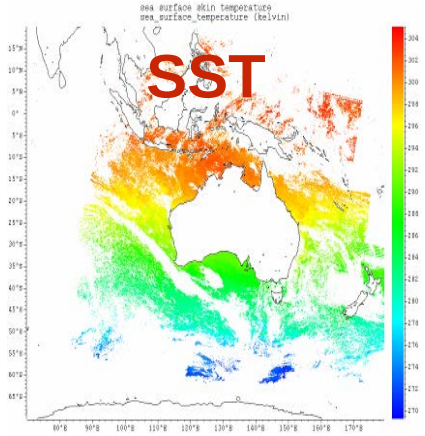


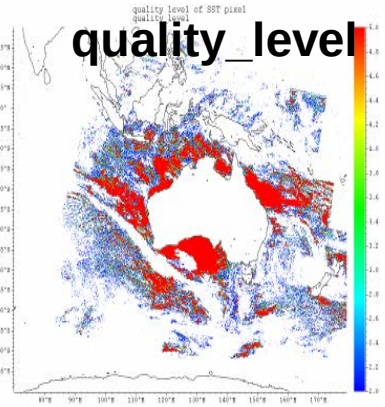
Bureau of Meteorology GHRSST products

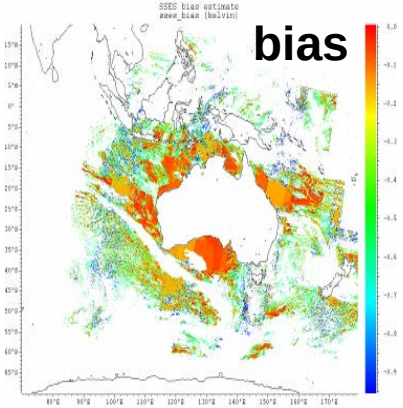
Designed for different applications…

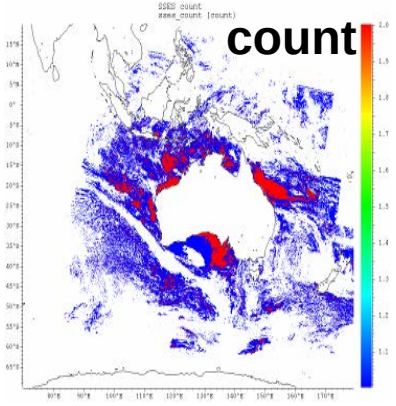
- 1 km IMOS AVHRR L2P SSTskin *(SST Analyses – Tue)*
- 2 km IMOS AVHRR L3U SSTskin *(OceanCurrent – Tue)*
- 2 km 1/3-day IMOS AVHRR L3C SSTskin *(X. Zhu, H. Zhang – Tue)*
- 2 km 1/3/6/14-day and 1-month IMOS AVHRR L3S SSTskin/SSTfnd *(ReefTemp – Mon; OceanCurrent – Tue)*
- 2 km 10-min Himawari-8 L2P SSTskin *(Chris Griffin – Mon)*
- 5 km hourly IMOS MTSAT-1R L3U SSTskin *(Haifeng Zhang – Tue)*
- 9 km Daily Regional L4 SSTfnd *(Lixin Qi – Tue)*
- 25 km Daily Global L4 SSTfnd *(Lixin Qi – Tue)*
- 100 km Weekly/Monthly Global L4 SSTdepth *(Lixin Qi – Tue)*

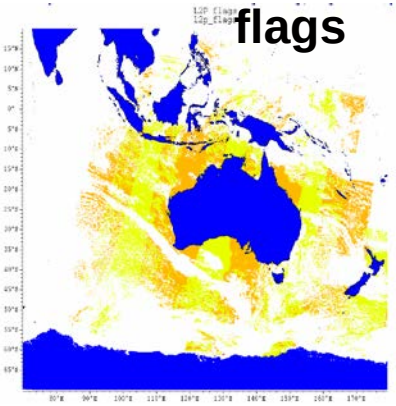
Useful pixel-by-pixel information (following GHRSST 2.0 format)

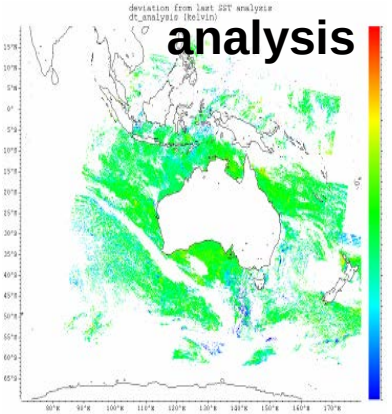


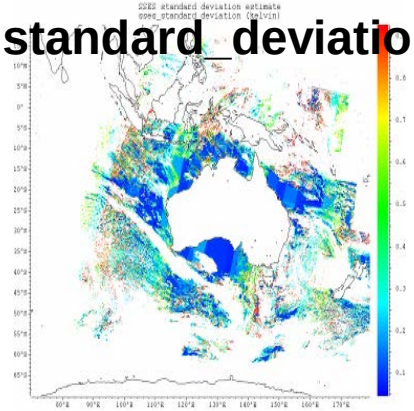












+ wind speed

+ aerosol

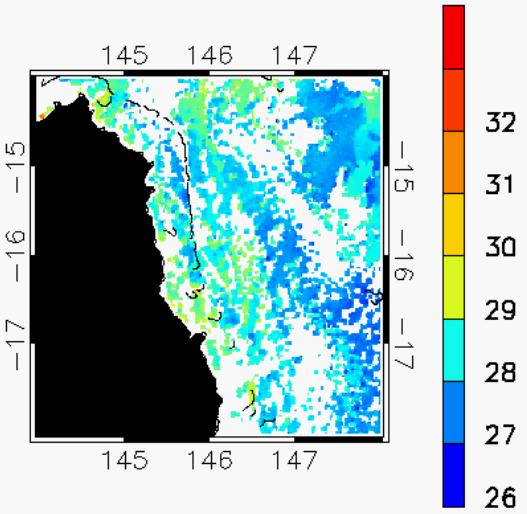
+ sea ice fraction

20131007 night composite from multiple satellites "L3S"

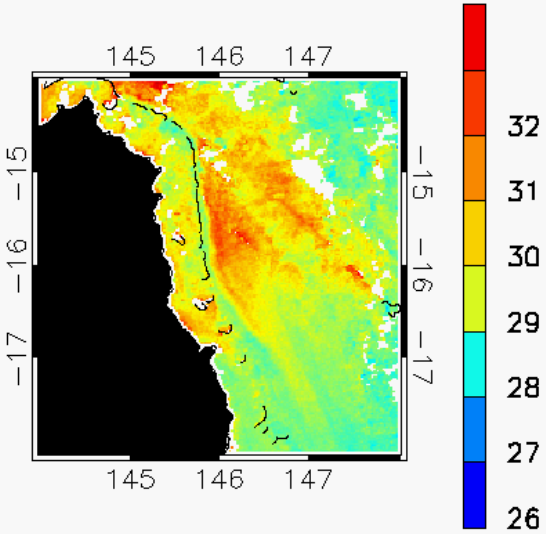
Why day-only, night-only and day+night L3S products?

1 Jan 2014

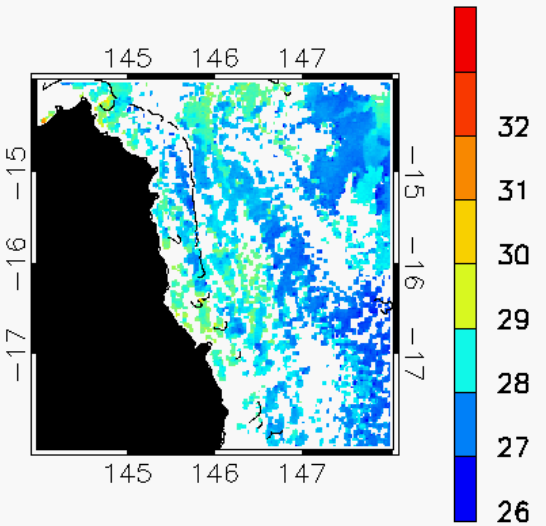
2 km IMOS day+night L3S



2 km IMOS day L3S



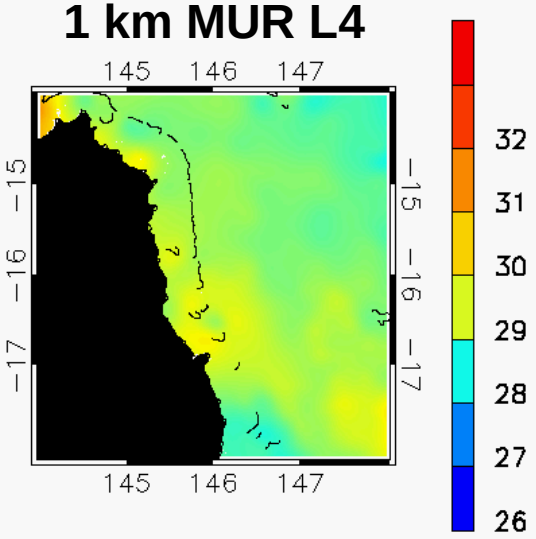
2 km IMOS night L3S



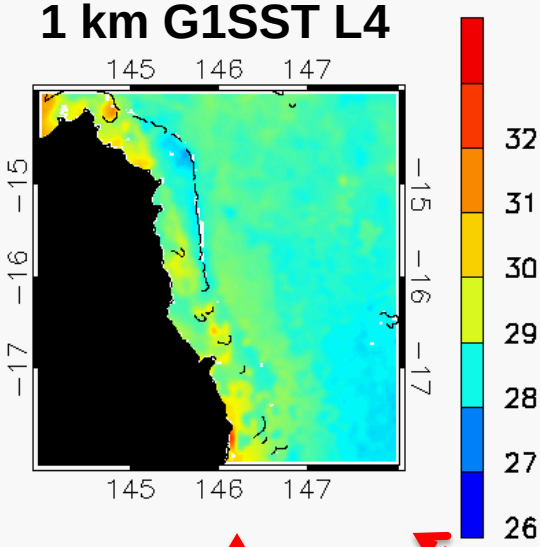
L4 interpolated SST vs L3S composite SST

L4 grid resolution ≠ Feature resolution!

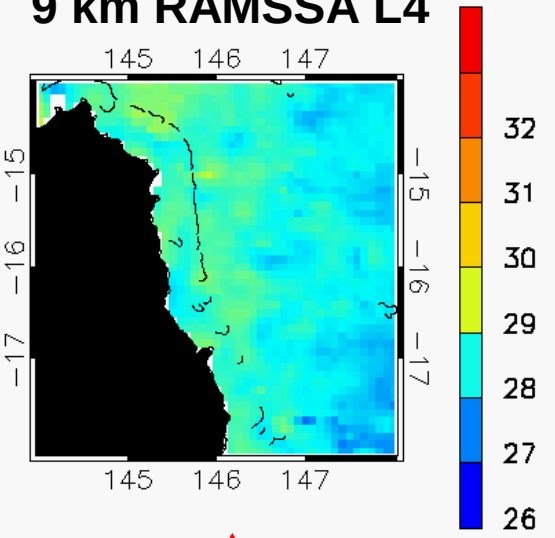
1 km MUR L4



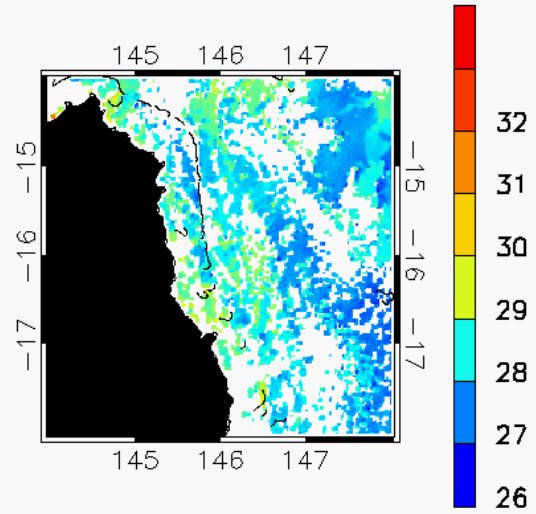
1 km G1SST L4



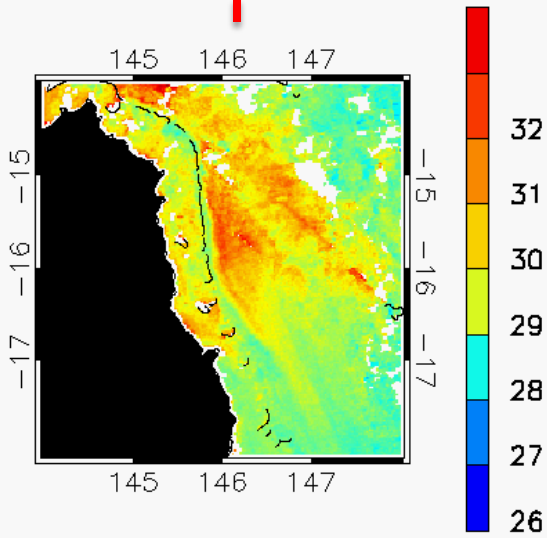
9 km RAMSSA L4



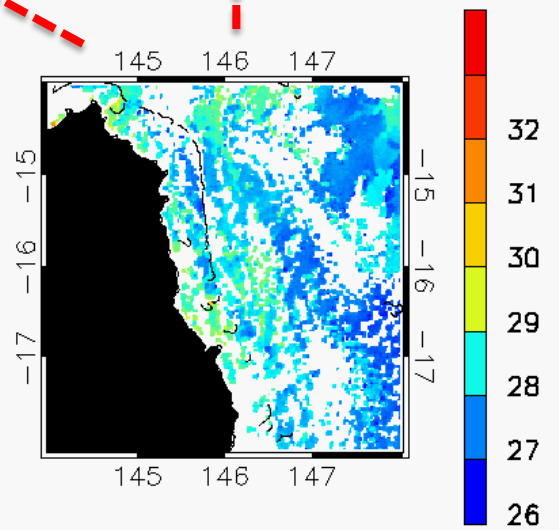
2 km IMOS day+night L3S



2 km IMOS day L3S



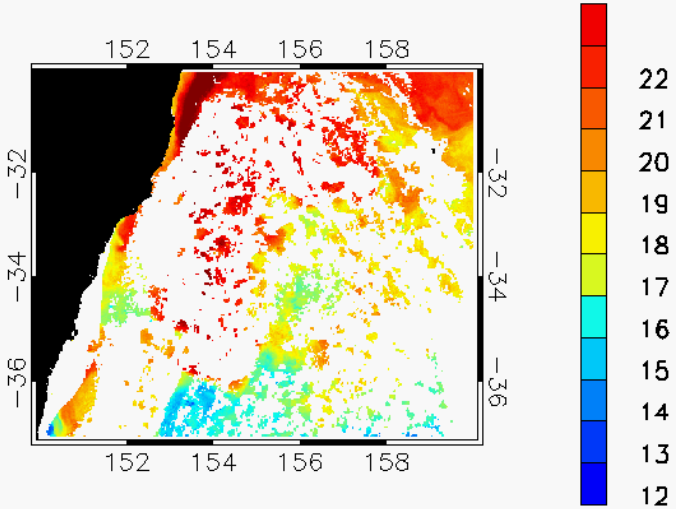
2 km IMOS night L3S



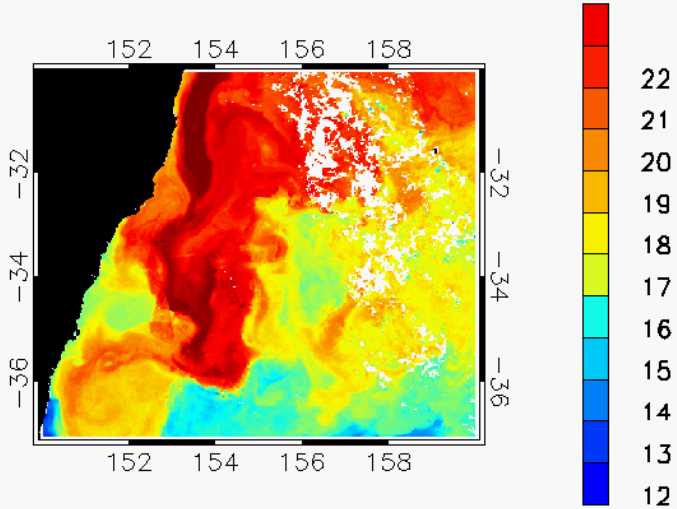
Temporal Averaging vs Spatial Interpolation

E.g. Multi-satellite day+night SSTfnd for 15 Aug 2013

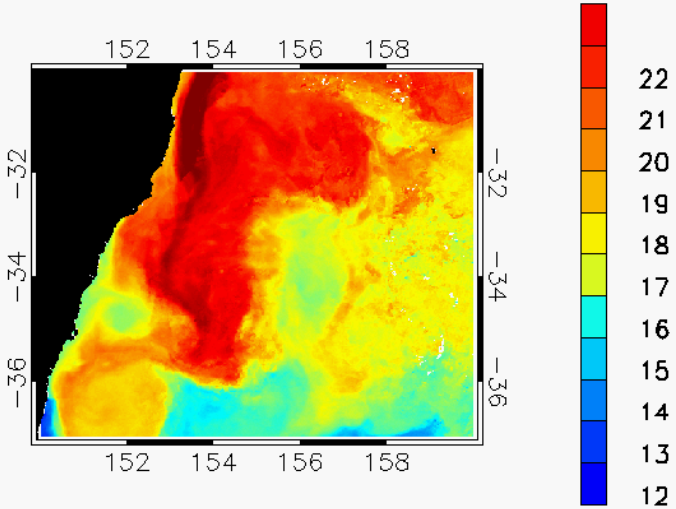
1-day 2 km L3S



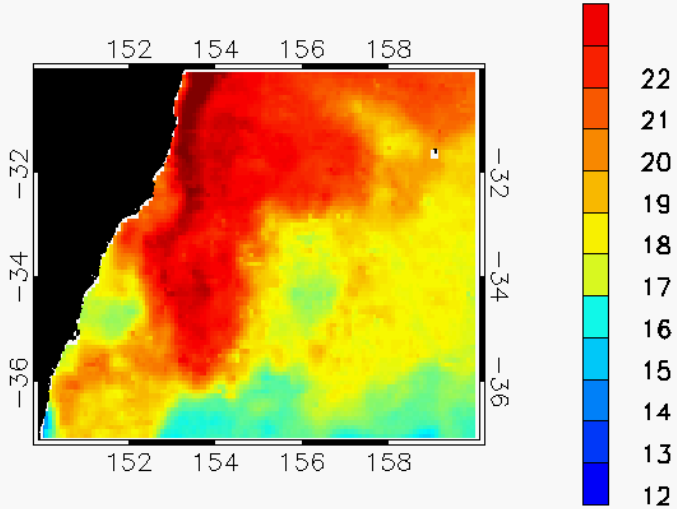
3-day 2 km L3S



6-day 2 km L3S



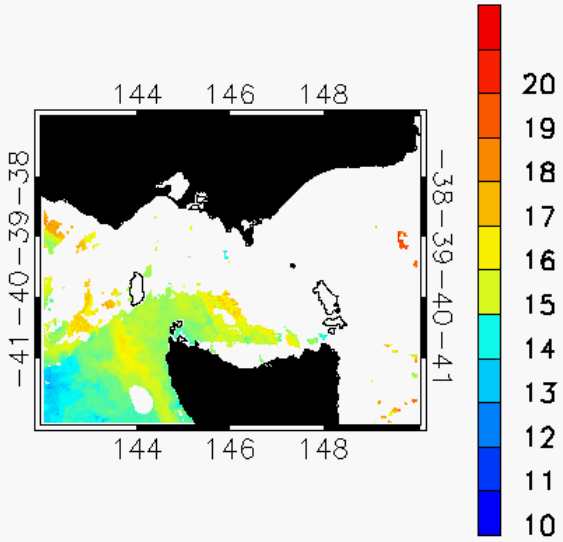
Daily 9 km RAMSSA L4



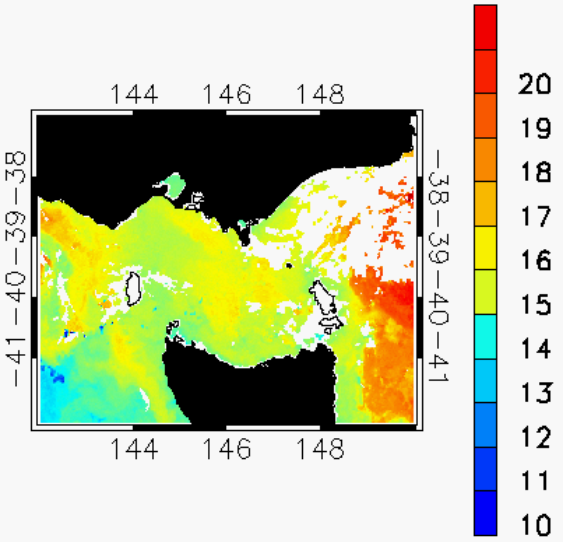
Temporal Averaging vs Spatial Interpolation

E.g. Multi-satellite day+night SSTfnd for 2 Jun 2014

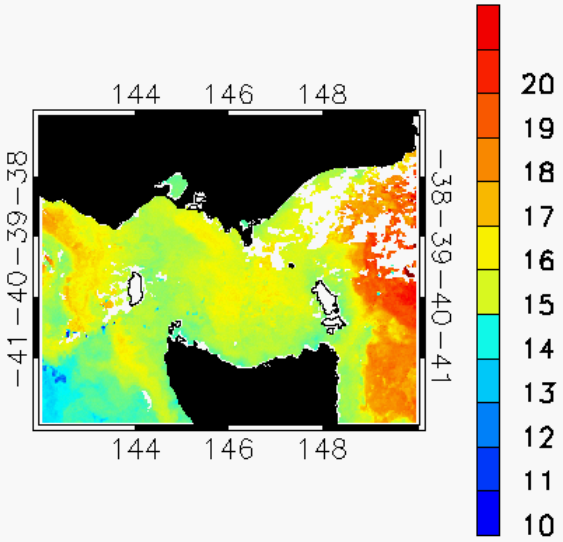
1-day 2 km L3S



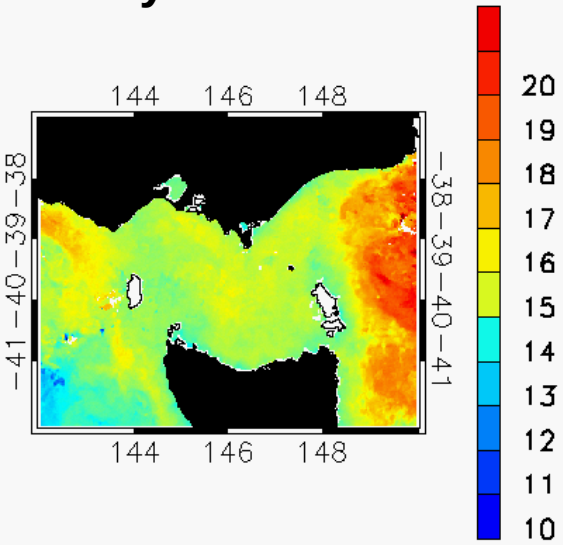
3-day 2 km L3S



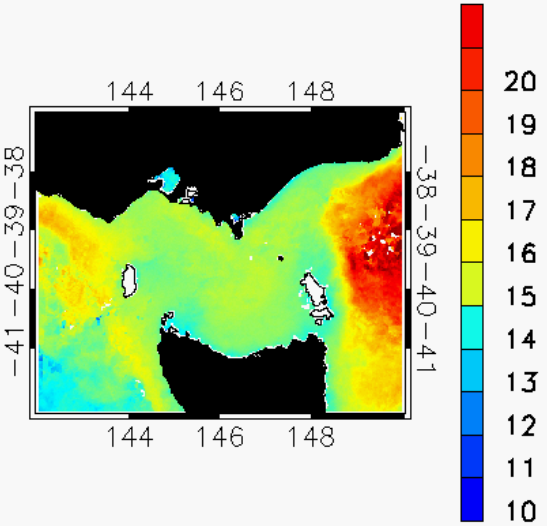
6-day 2 km L3S



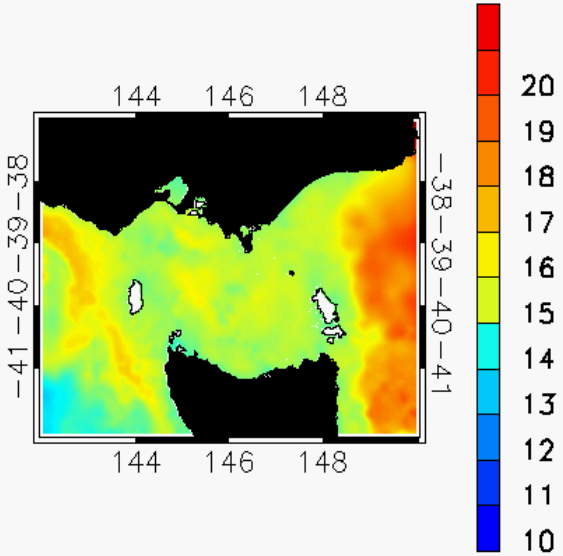
14-day 2 km L3S



1-month 2 km L3S



Daily 1 km MUR L4



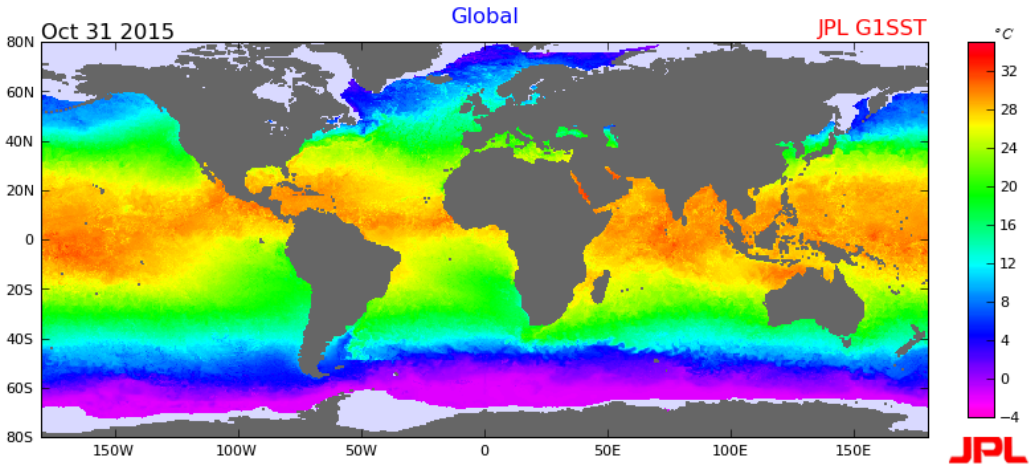
Different IMOS-GHRSST Products suit different applications

- **L2P (geolocated swath)**

- Input into “L4” SST analyses (e.g. Bureau's daily SST analyses – RAMSSA and GAMSSA, JPL Ourocean G1SST 1 km Global analysis)

- Future input into coastal ocean models (e.g. 4 km eReefs)

JPL G1SST daily SSTdepth



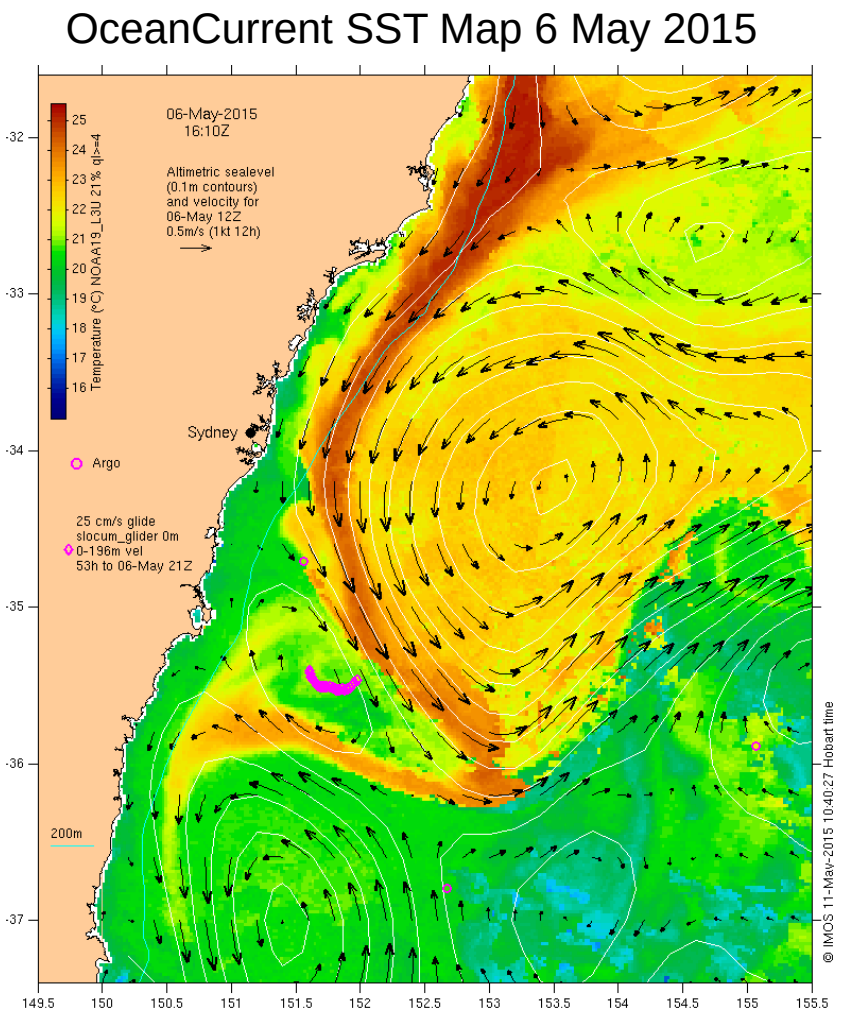
Different IMOS-GHRSST Products suit different applications

- **L3U (2 km gridded, single swath)**

- Real-time SST maps

- www.fishtrack.com

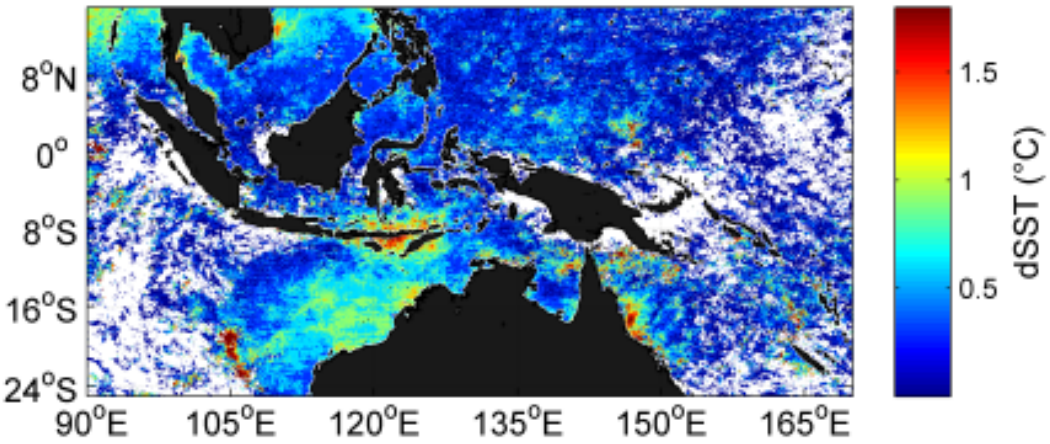
- IMOS OceanCurrent (http://oceancurrent.imos.org.au/sst.php) – Tue pm



Different IMOS-GHRSST Products suit different applications

- **MTSAT-1R L3U (Hourly, 5 km gridded, single scene)**

Mean Mar 2010 MTSAT-1R ΔSST



- Research into diurnal warming
- Evaluation of dSST (0.5m) in GC2 coupled NWP experiments (José Rodriguez, UK Met Office)
- Great Barrier Reef (Xiaofang Zhu, PhD Uni of Miami) – Tue am
- Tropical Warm Pool (Haifeng Zhang, PhD UNSW@ADFA) – Tue am

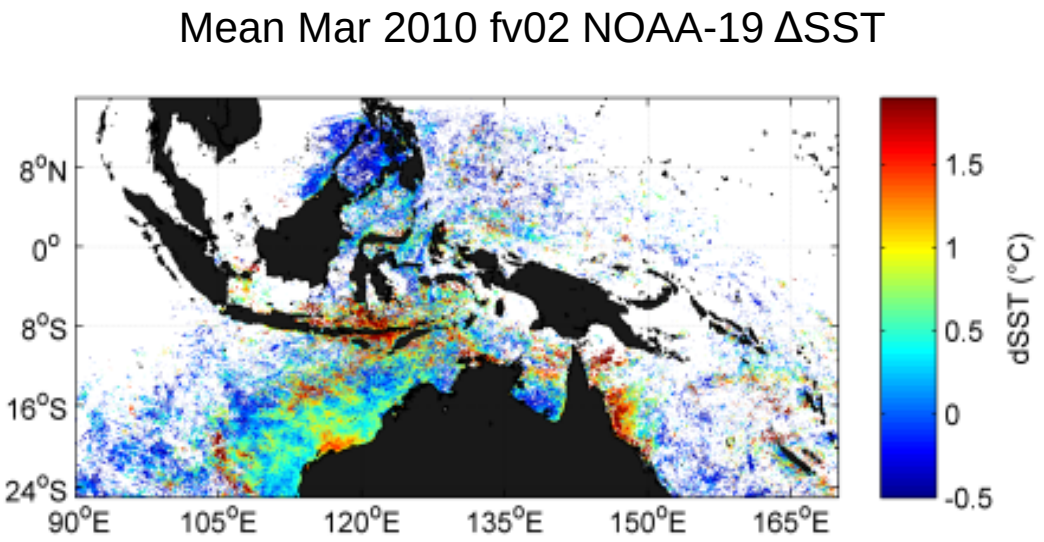
Different IMOS-GHRSST Products suit different applications

- **L3C (2 km gridded, multiple swath, night-only, day-only)**

- Research into diurnal warming

- Great Barrier Reef (Xiaofang Zhu, PhD Uni of Miami) – Tue am

- Tropical Warm Pool (Haifeng Zhang, PhD UNSW@ADFA) – Tue am



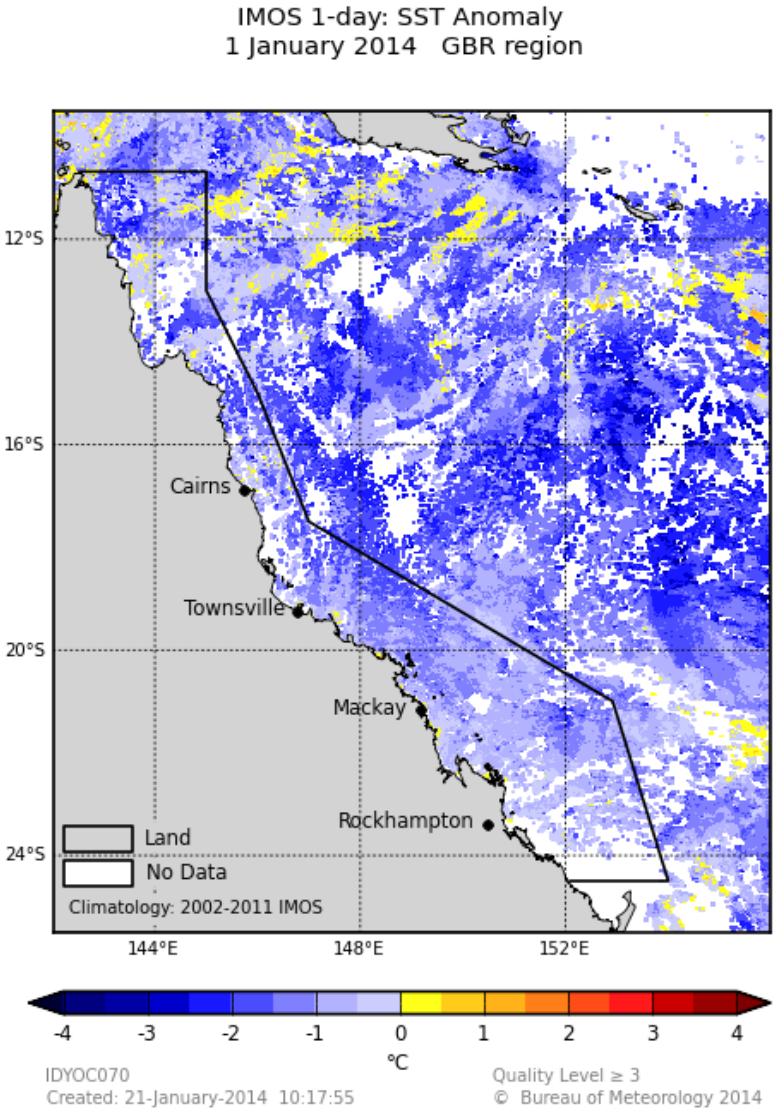
Different IMOS-GHRSST Products suit different applications

- **L3S (gridded, multiple sensor)**

- Nowcasting of coral bleaching
  - ReefTemp NextGen uses night-only 1-day L3S http://www.bom.gov.au/marinewaterquality

- Near RT maps of SST
- IMOS *OceanCurrent* uses day-only, night-only 3-day/6-day L3S and night-only 1-month L3S – Tue pm

- Validation of high res ocean models



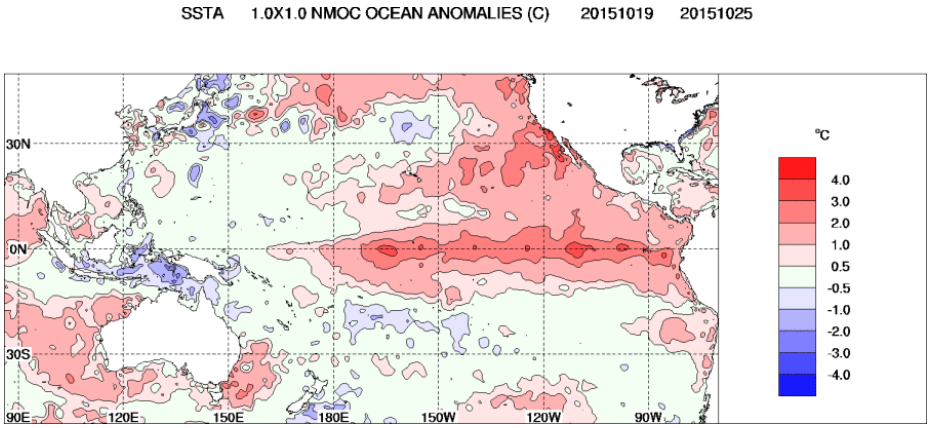
Different BoM-GHRSST Products suit different applications

- **L4 (gridded, multiple sensor, interpolated)**

- Daily:
  - Boundary condition for NWP models
  - Initialising Seasonal Prediction Model (POAMA)
  - Validating ocean forecasts

- Weekly/Monthly:
  - Bureau's NINO indices and Climate Outlooks (www.bom.gov.au/climate/enso).

Weekly SST anomalies Tropical Pacific

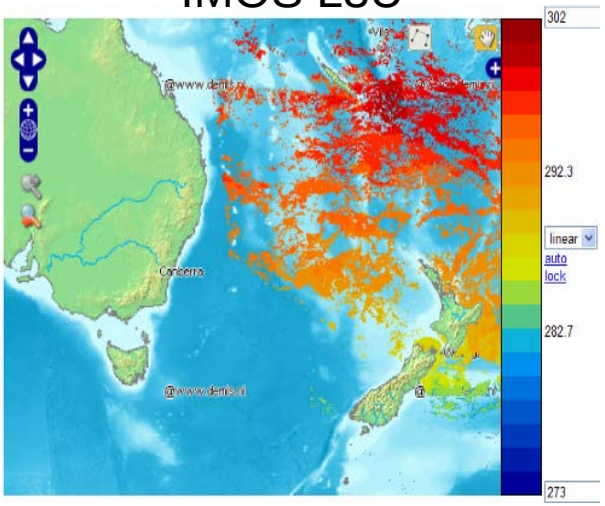


Index	Previous	Current	Temperature change (2 weeks)
NINO3	+2.3	+2.2	0.1 °C cooler
NINO3.4	+2.1	+2.2	0.1 °C warmer
NINO4	+1.1	+1.3	0.2 °C warmer

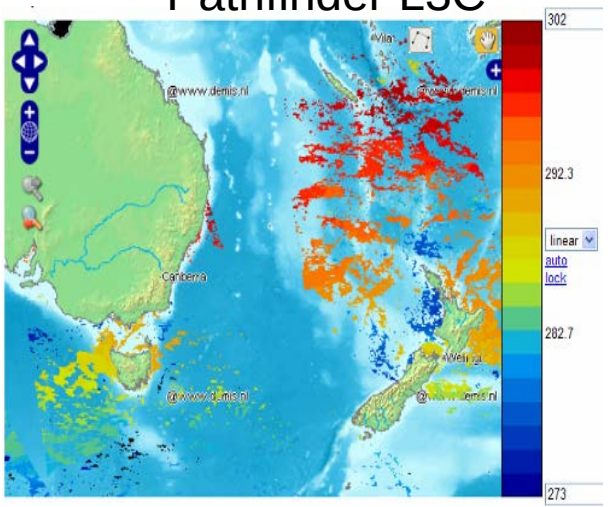
How does IMOS fv02 AVHRR L3C differ from Pathfinder AVHRR L3C SST?

- **Wider swath width**
- **Higher spatial resolution** - 1.1 km x 1.1 km cf 4.4 km x 1.1 km resolution at nadir
- **More ancillary fields** - IMOS product has error estimates per pixel to comply with GHRSST spec
- **More satellites** - IMOS uses all available NOAA satellites, Pathfinder only one at a time
- IMOS back to 1992, Pathfinder back to 1981
- **IMOS real-time**, Pathfinder > 1 year behind
- IMOS uses "adaptive calibration" and "adaptive error statistics" to "tune" AVHRR SSTs using regional in situ data to minimise error

IMOS L3U



Pathfinder L3C



Key tips for choosing an SST product

- Different SST products suit different applications…
- Be clear what SST depth you need
- Weigh up spatial coverage vs accuracy
- L4 grid resolution ≠ ocean feature resolution
  - L3 will be more sensitive than L4 but has gaps
- Match the product temporal resolution to the process resolution
  - E.g. day ↔ 1 km, week ↔ 7 km, month ↔ 25 km, year ↔ 2000 km, decade ↔ 4000 km

Things to consider when choosing an SST product…

Depth

Horizontal Resolution

Temporal Resolution

Level 3 vs Level 4

Sensitivity

Stability

Accuracy

Non-gridded vs gridded

Specified Uncertainties

Date Span

Latency

"Operational"?

Metadata

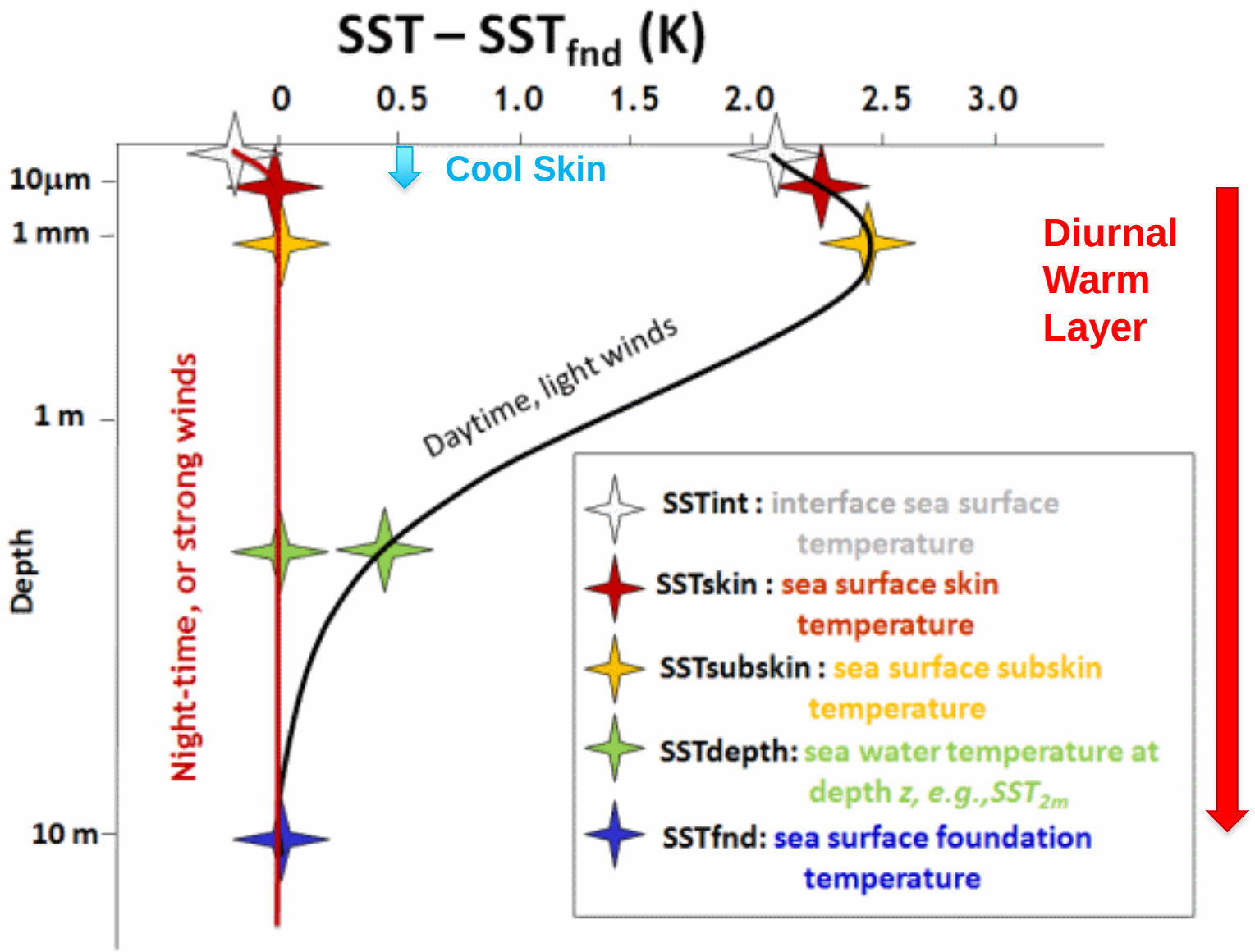
Format

Availability

One SST product cannot best suit every application!

Why SST depth is important

www.ghrsst.org



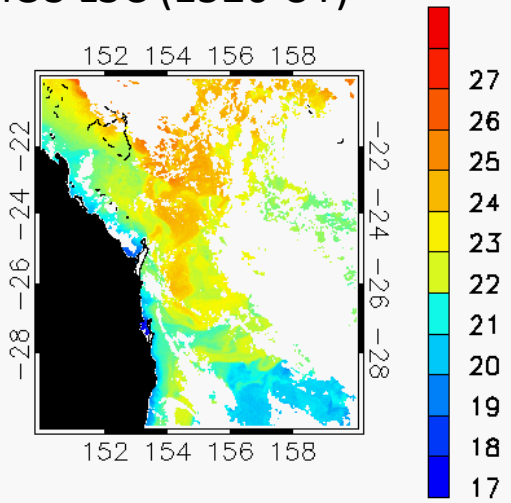
New higher resolution SST products

- 0.75 km VIIRS SST from Suomi-NPP
- 2 km 10-min AHI SST from Himawari-8

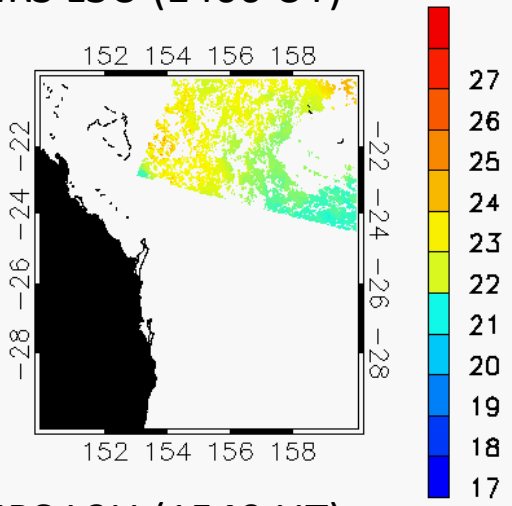
IMOS NOAA-19 fv01 L3C SSTskin vs bias-corrected VIIRS L3U SSTsubskin

Queensland Coast: 17 Aug 2015 Night

IMOS L3C (1520 UT)



VIIRS L3U (1400 UT)



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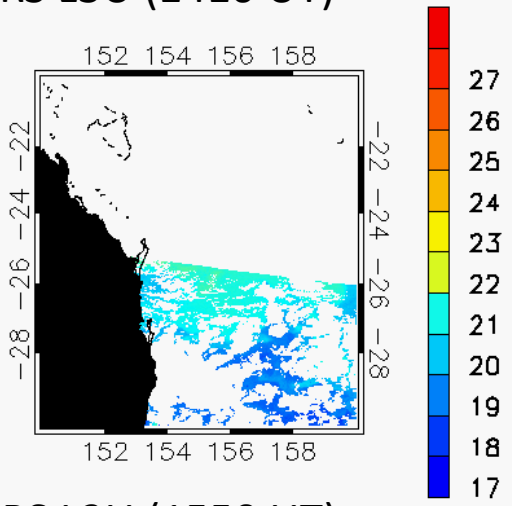

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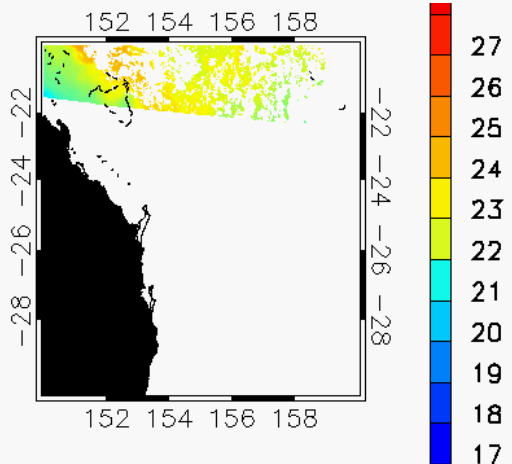

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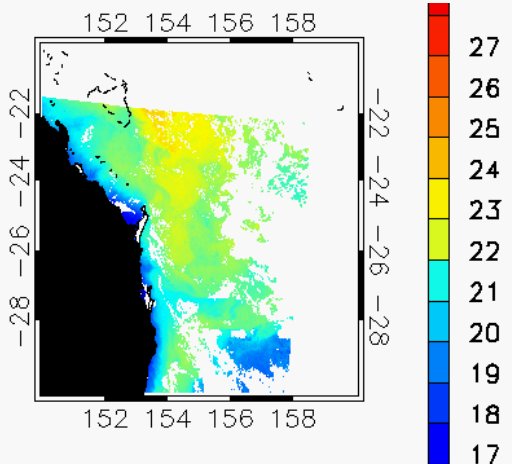
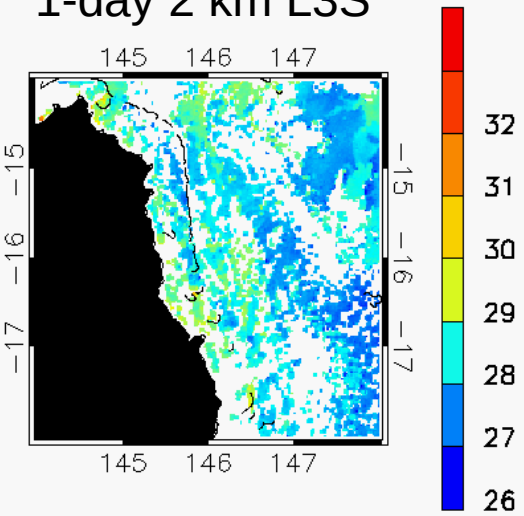


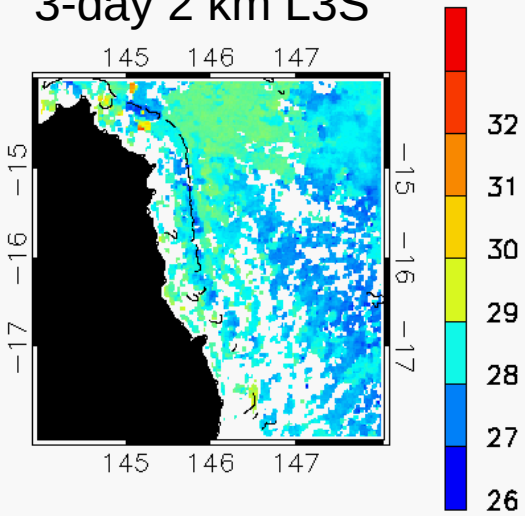
Temporal Averaging vs Spatial Interpolation

Eg. North Queensland, 1 Jan 2014 mean SSTfnd products

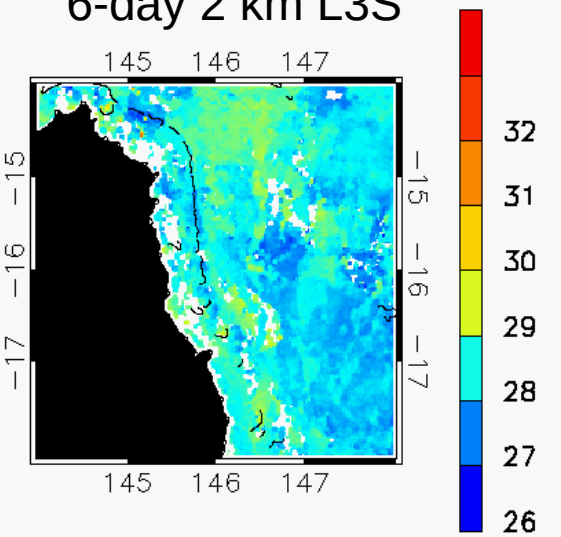
1-day 2 km L3S



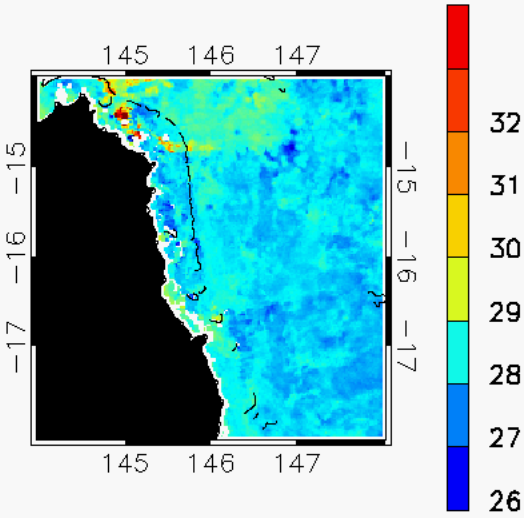
3-day 2 km L3S



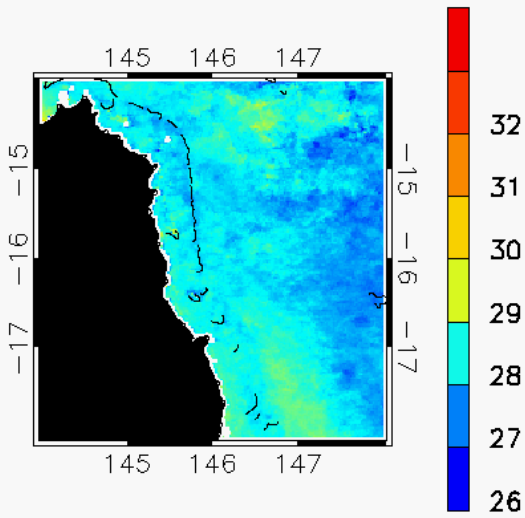
6-day 2 km L3S



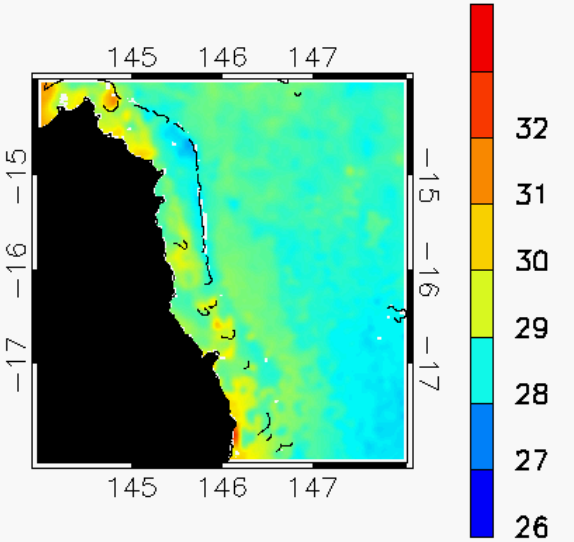
14-day 2 km L3S



1-month 2 km L3S



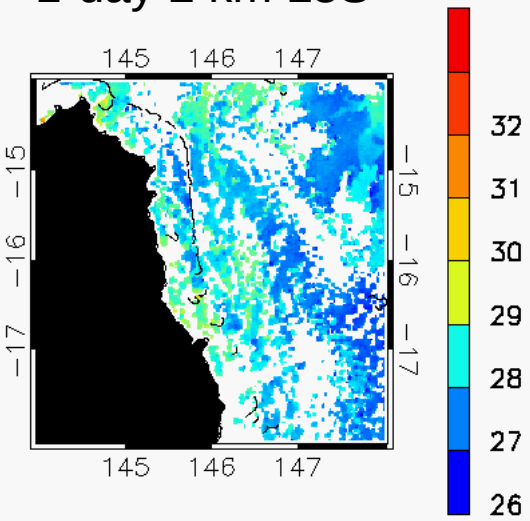
Daily 1 km G1SST L4



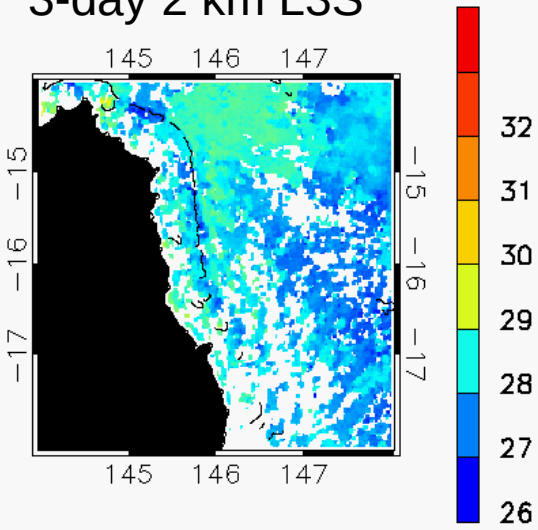
Temporal Averaging vs Spatial Interpolation

Eg. North Queensland, 1 Jan 2014 night-only L3S products

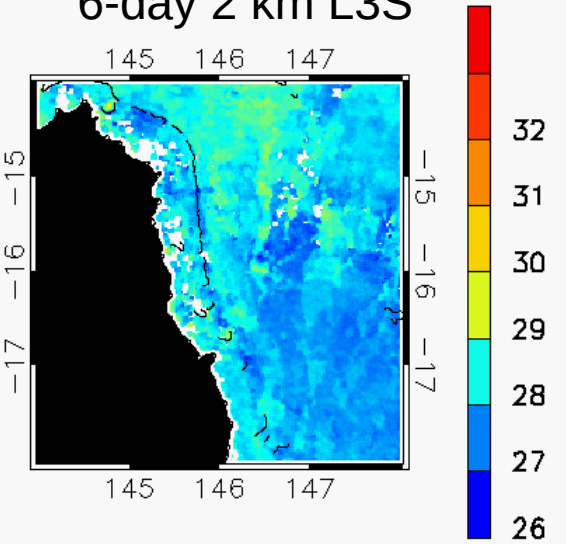
1-day 2 km L3S



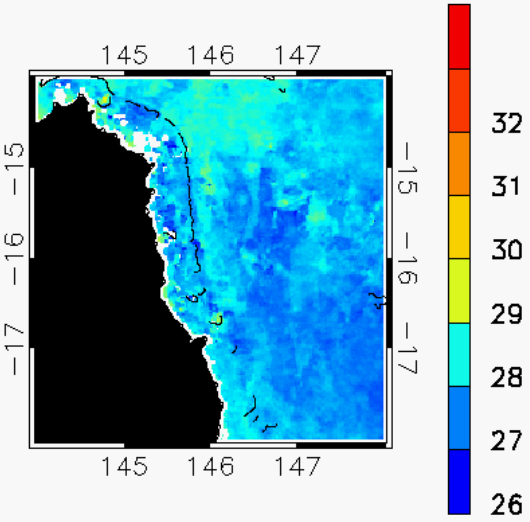
3-day 2 km L3S



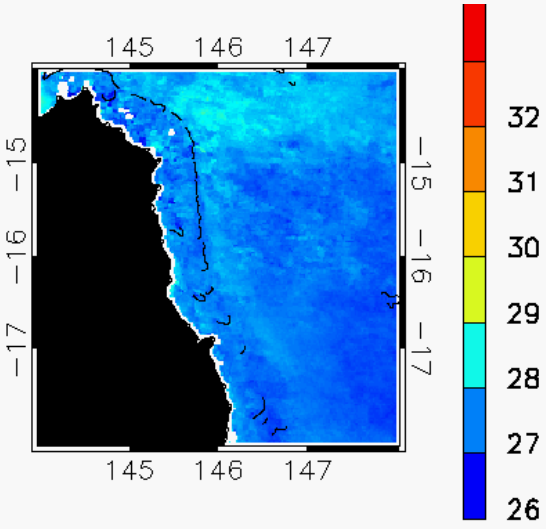
6-day 2 km L3S



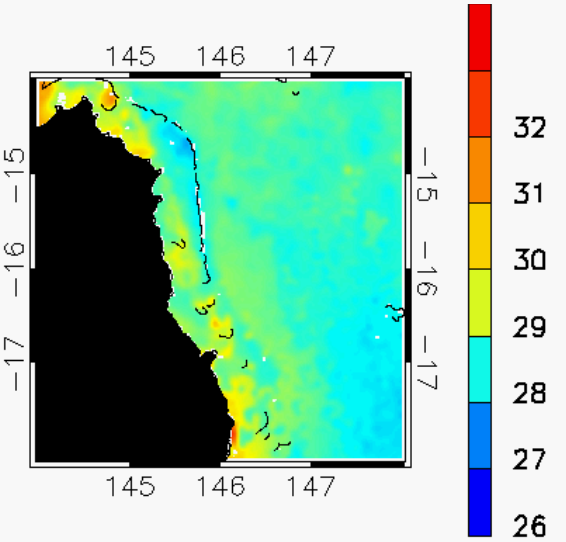
14-day 2 km L3S



1-month 2 km L3S



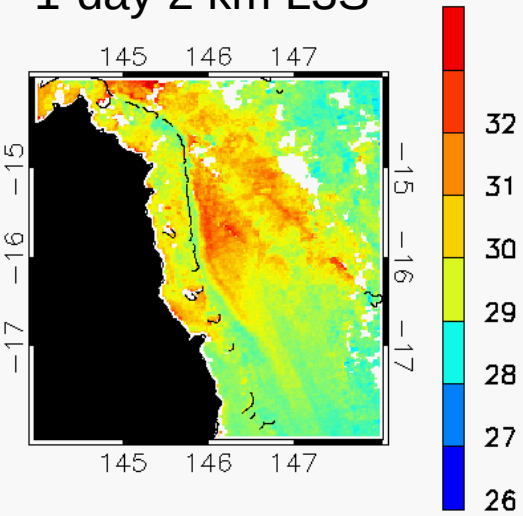
Daily 1 km G1SST L4



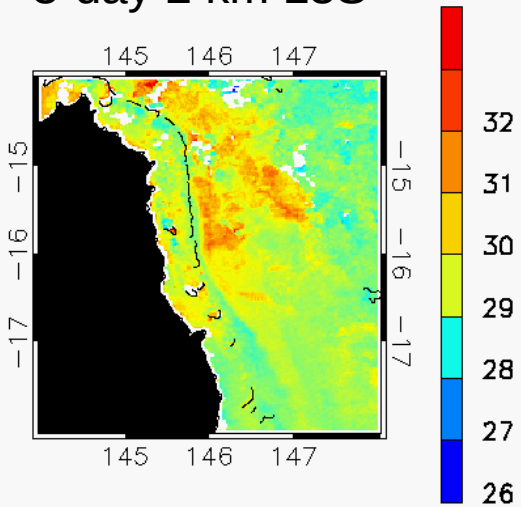
Temporal Averaging vs Spatial Interpolation

Eg. North Queensland, 1 Jan 2014 day-only L3S products

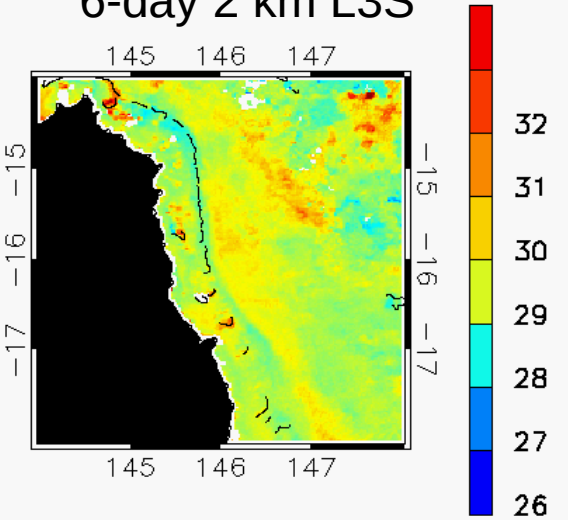
1-day 2 km L3S



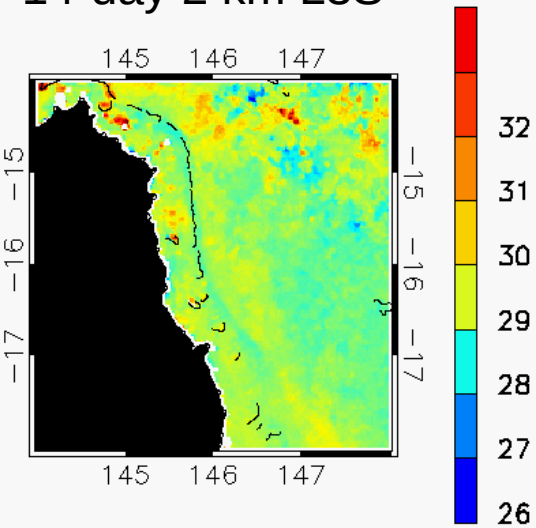
3-day 2 km L3S



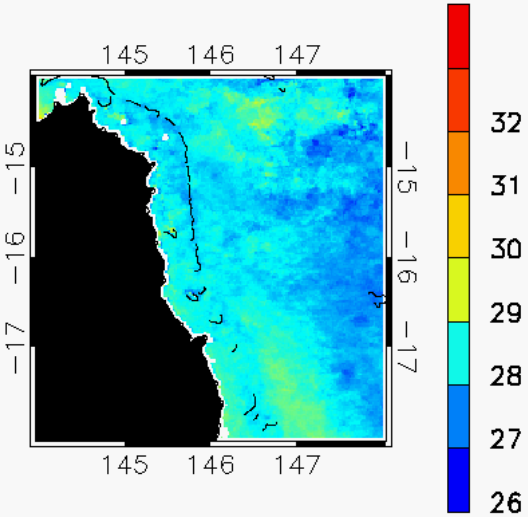
6-day 2 km L3S



14-day 2 km L3S



1-month 2 km L3S



Daily 1 km G1SST L4