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IMOS Integrated Marine Observing System

A Quick introduction to the methods and features of the IMOS HRPT AVHRR SST dataset produced by the Australian Bureau of Meteorology

http://imos.org.au/sstproducts.html

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Ideas and features for users

- AVHRR from NOAA Polar orbiting satellites – currently NOAA-11 through NOAA-19
- Australian reception stations. Multiple Satellites.
- Wide swath. Long “stitched” swaths from all reception stations.
- Gridded 0.02 degree resolution (or better for ungridded data).
- Multiple pass / Multiple instrument composites.
- Real time available (typically within two hours of the pass).
- Archival data comes later (typically within 48 hours).
- Long time period dataset (from 1992 April to present)
- **GHRRST** 2.0r4 compliant netCDF. (bias / standard error statistics)

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Group for High Resolution Sea Surface Temperature

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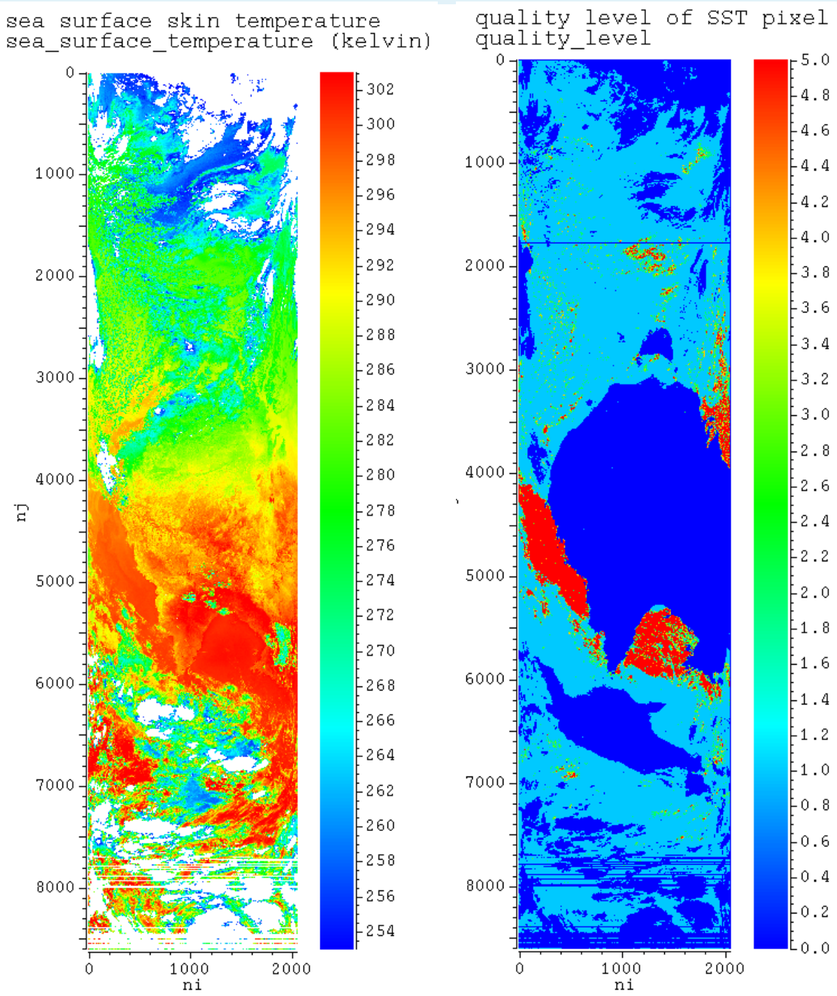
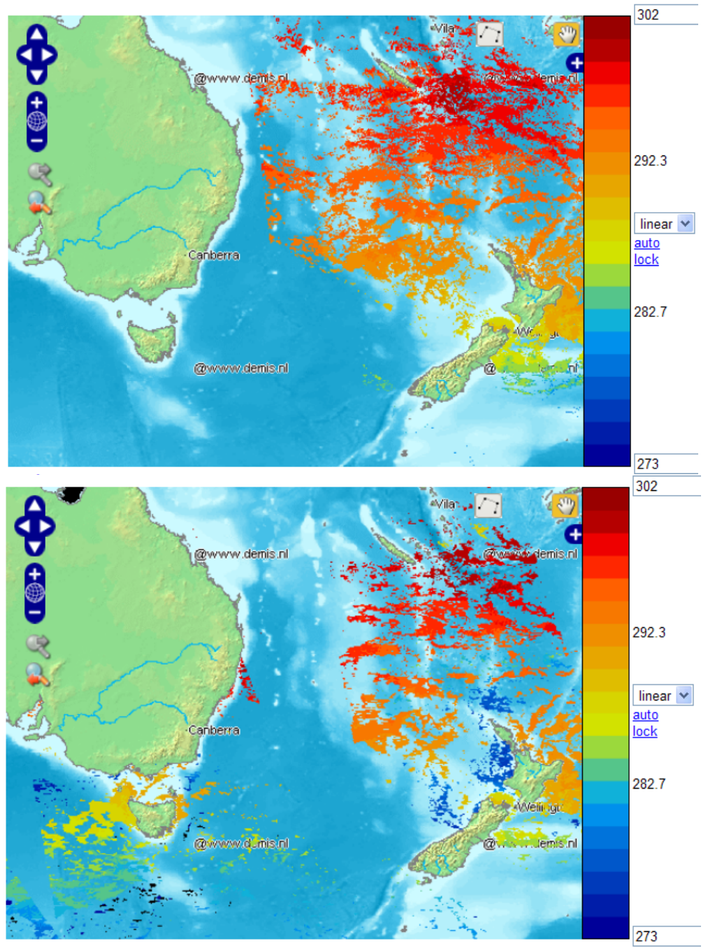
Swaths wide and long



Our dataset

NOA11, 1992 April 1st
BOM L3U vs pathfinder L3C

Pathfinder



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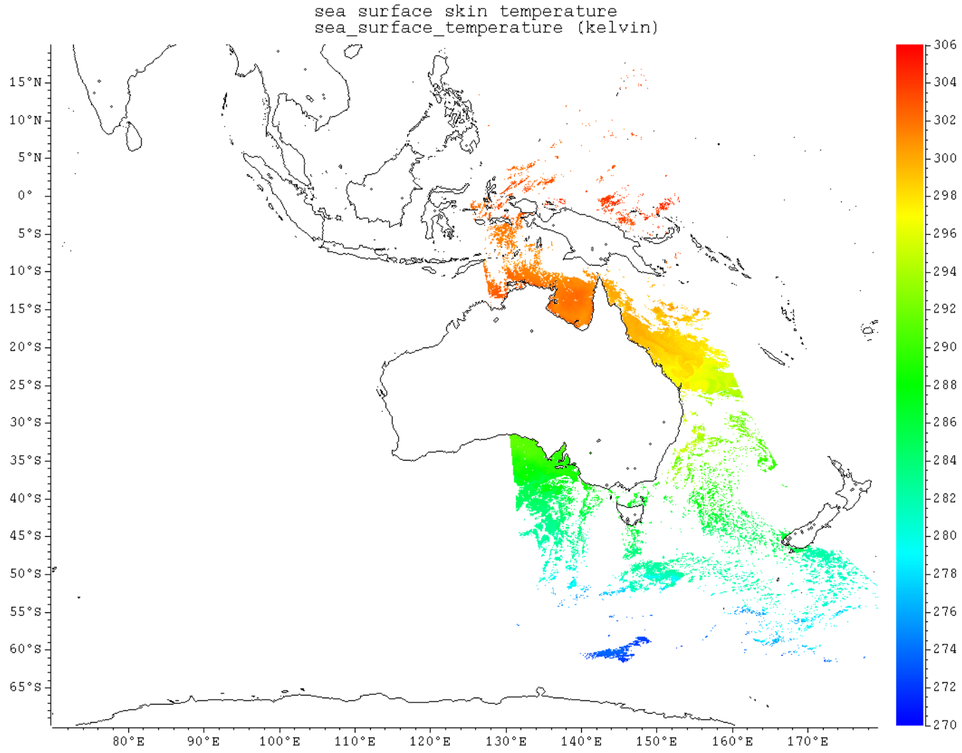
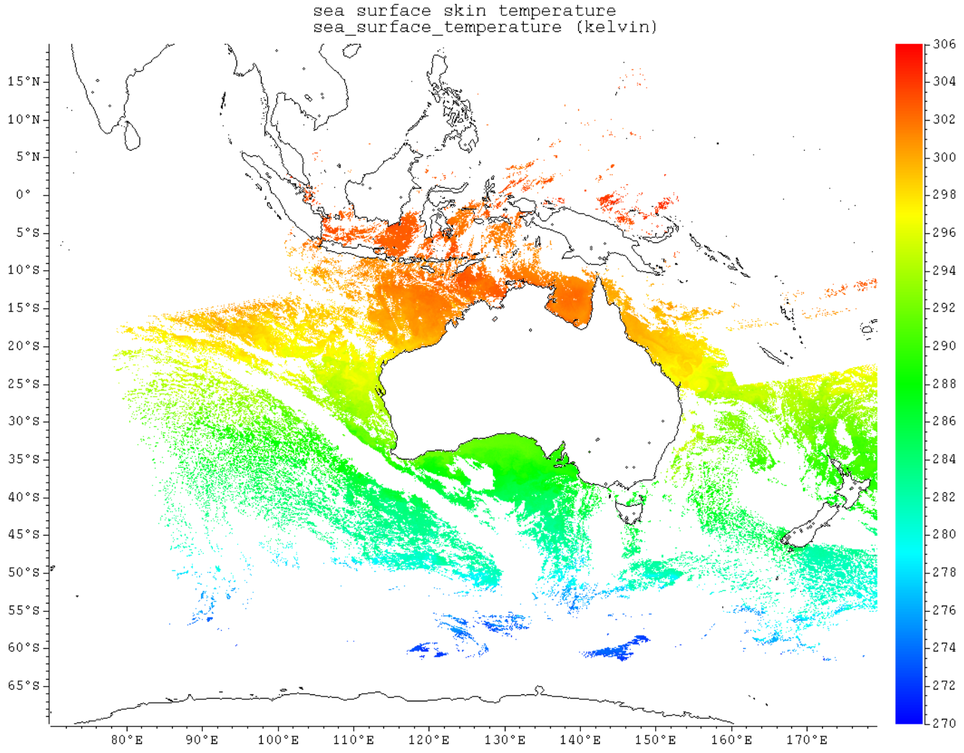
Gridded, single, multiple composites



NOAA 16 – 20131007T113647Z



NOAA 16 – 20131007 – night only

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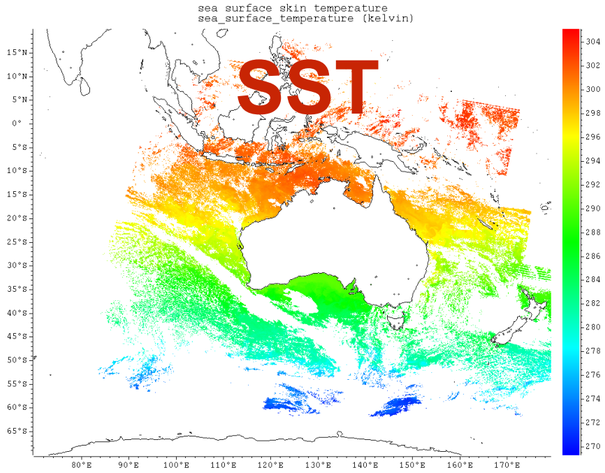
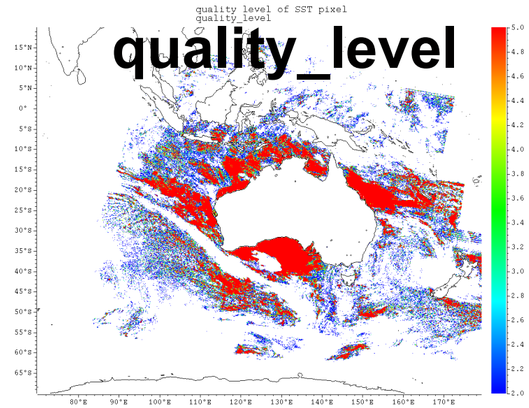
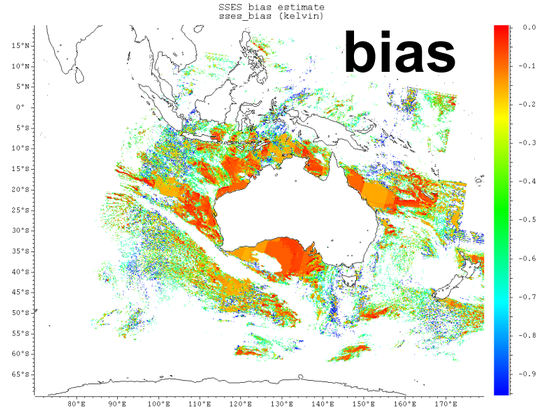
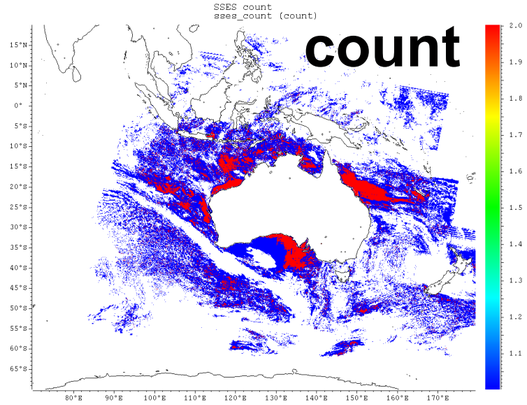
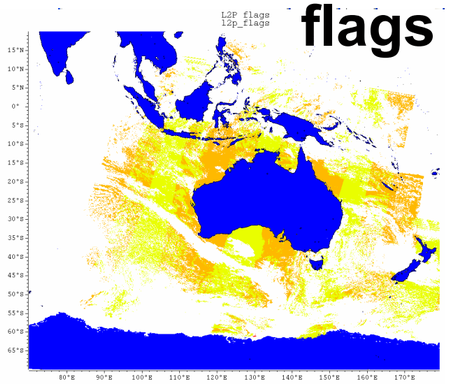
GHRSST 2.0 r4 compliant netCDF

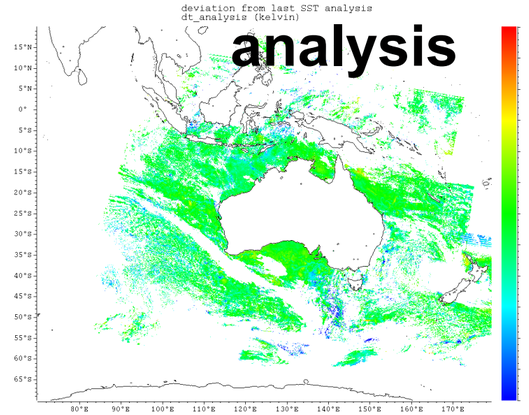


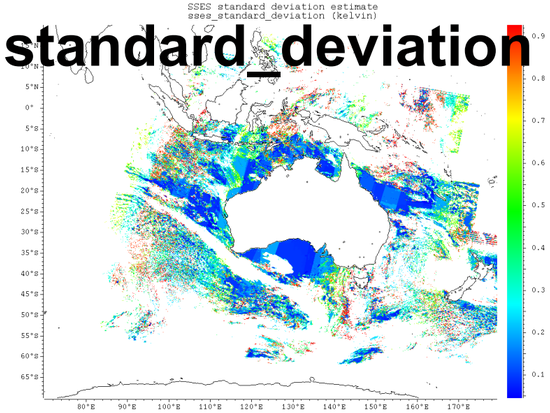












+ wind speed

+ aerosol

+ sea ice fraction

20131007 night composite

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“Philosophical” ideas and features

- “open loop” retrievals.
  No SST analysis in retrieval.
- Calibrated against *in situ* measurements (floating buoys).
  Adaptively managed.
- Estimates of bias and standard deviations (floating buoys).
  Adaptively managed.
- Keep the “best representative” SST.
  Include bias compensation in composition.
- Includes “3 channel” day and night algorithm.

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“open loop” retrieval

- No Analysis fields in calibration
  No Radiative Transfer Model
  No Background SST
  In situ measurements pre-selected
  Non-linear Retrieval (MCSST, NLSST like)

Night: $$SSTskin = a_0 T_4 + a_1 T_3 (T_3 - T_5) + a_2 (\sec\theta - 1) + a_3$$

Day: $$SSTskin = b_0 T_4 + b_1 T_4 (T_4 - T_5) + b_2 (T_4 - T_5)(\sec\theta - 1) + b_3$$

- Monitor:
  Performance compared with Analysis
  Residual error from fit
  Sensitivity (use *in situ* measurements)
  Propagation of sensor errors
  per **GHRSST** specifications

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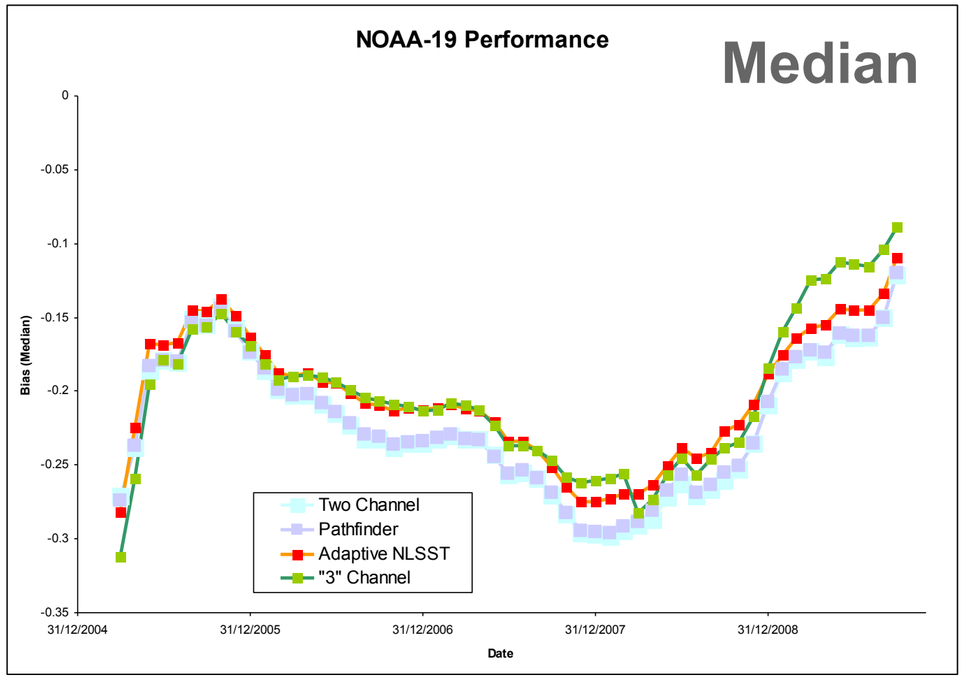
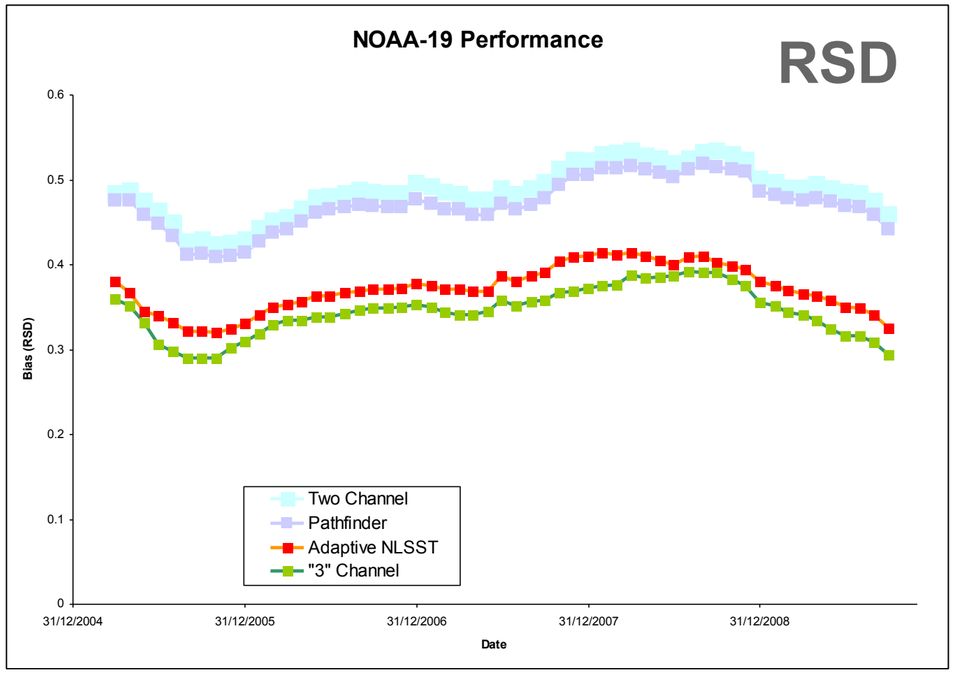
Adaptive Calibration





- Tuned on the best data (high quality, mid range winds, low deviation from “fitted norm”)
- Performance measured on an expanded dataset (lower quality allowed, relaxed bounds on other parameters)
- Running 1 year calibration window, adjusted monthly

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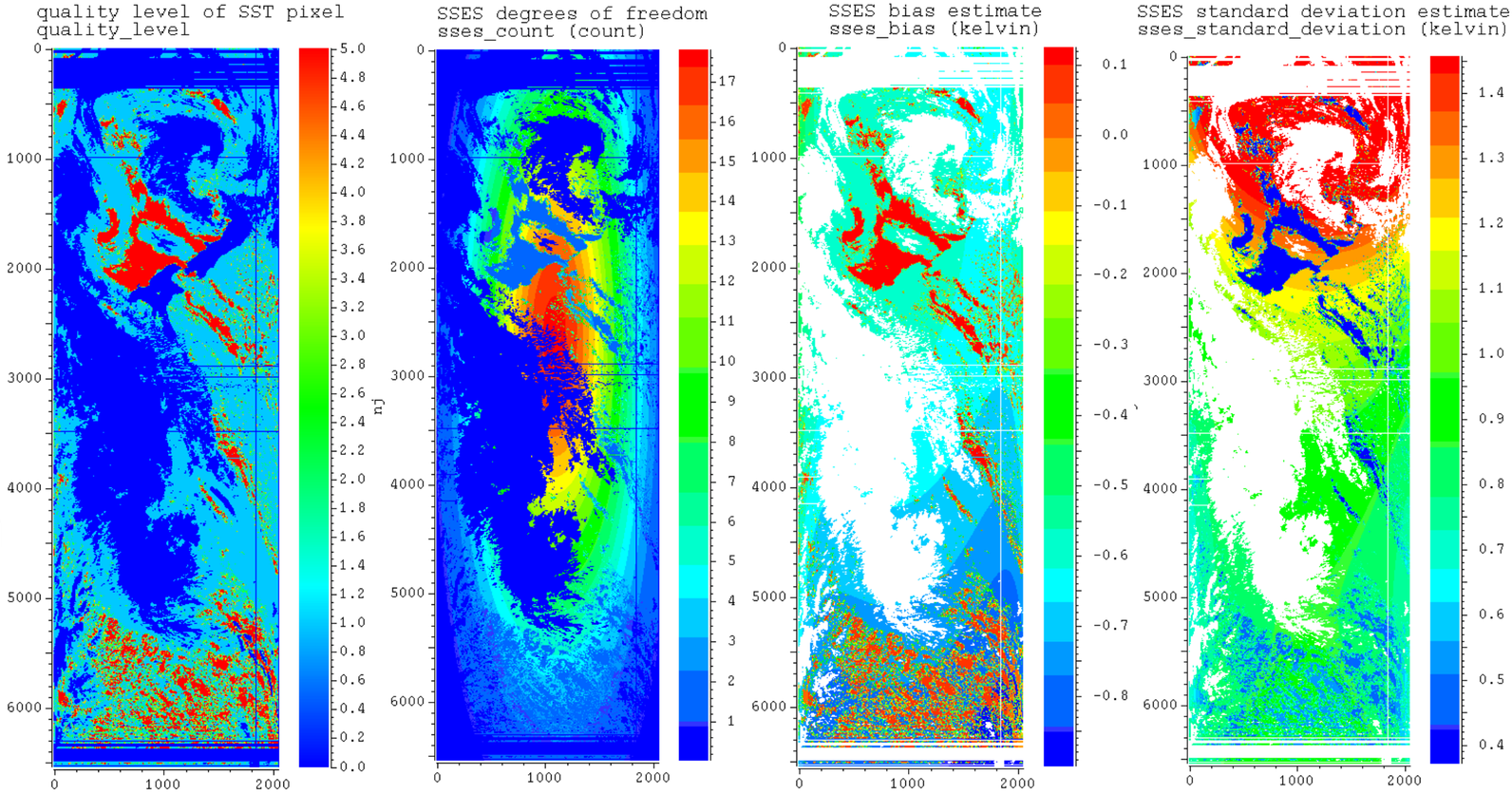
Adaptive Error Statistics

- Rolling 1 year window adjusted daily
- Measurements are weighted by time (120 day time constant)
- 5-d model based on time of day, satellite zenith angle, quality level, latitude and age
- Per pixel
- Continuously varying



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Composition which respects bias

Composition of different sensors

- Consider all sources of measurement weighted by the count
- Biases are adjusted before measurements are combined.
- The combined count is recorded.

Composition from the same sensor

- When combining, consider all sources of measurement weighted by $\left(\frac{n}{\sigma^2}\right)$
- Biases are estimated by weighting.
- The combined count is recorded.

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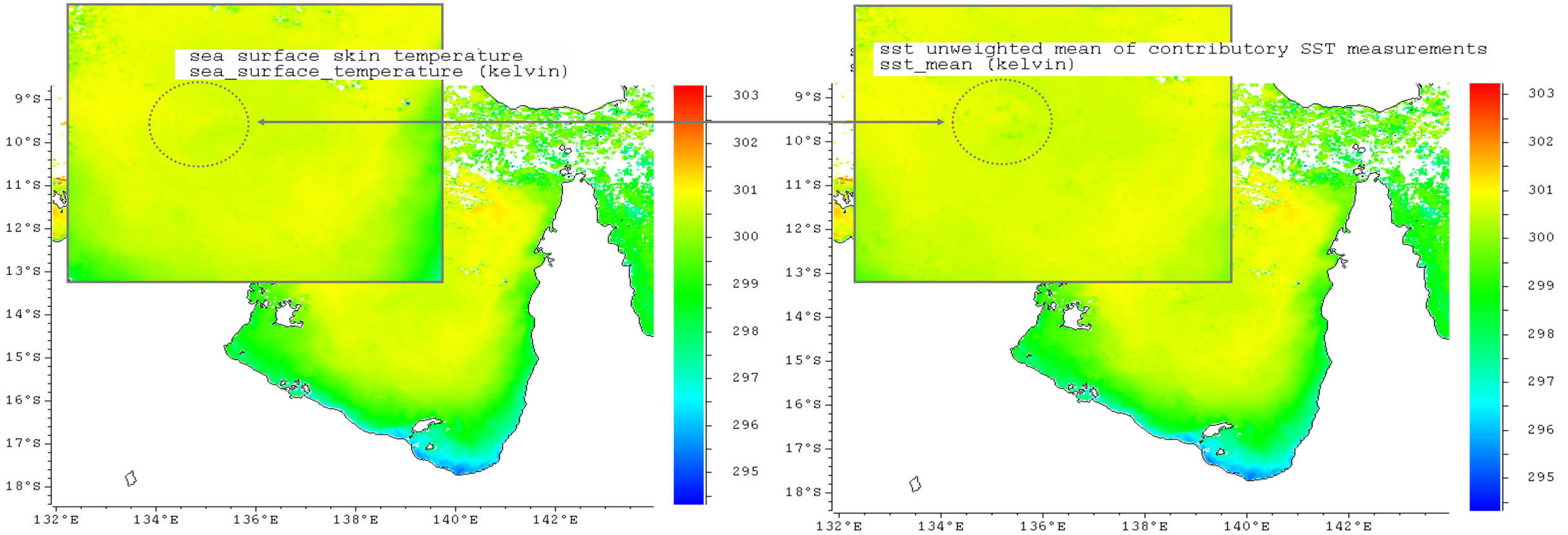
“best” representative SST

Using standard deviation and degrees of freedom fields.



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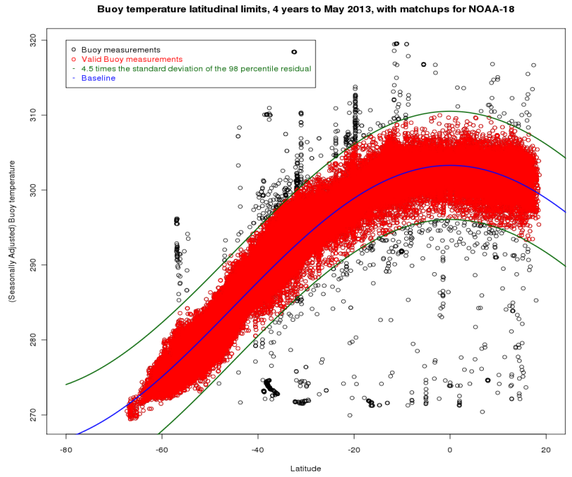
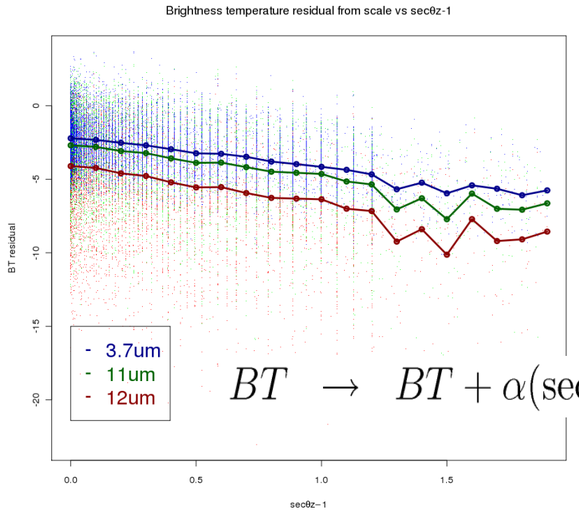
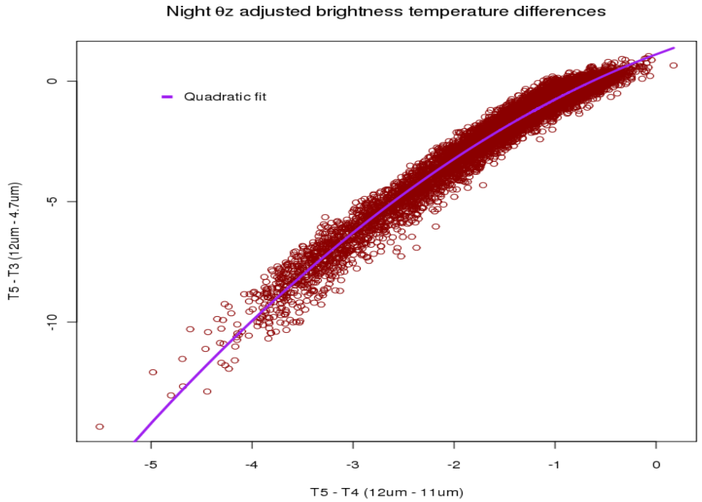
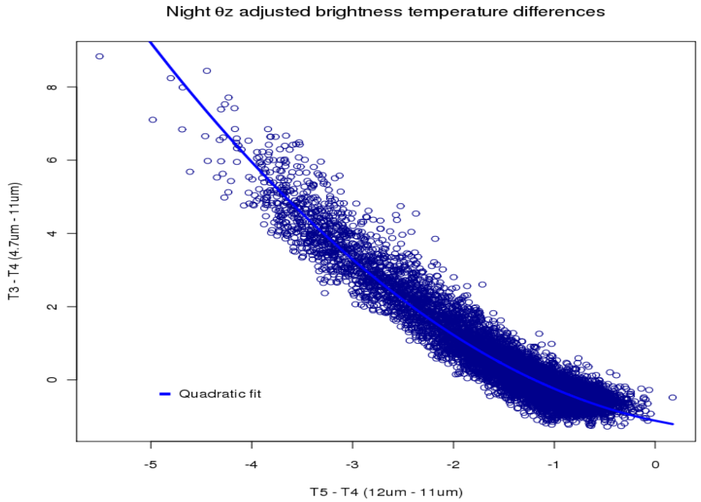
“3” Channel Day/Night Algorithm

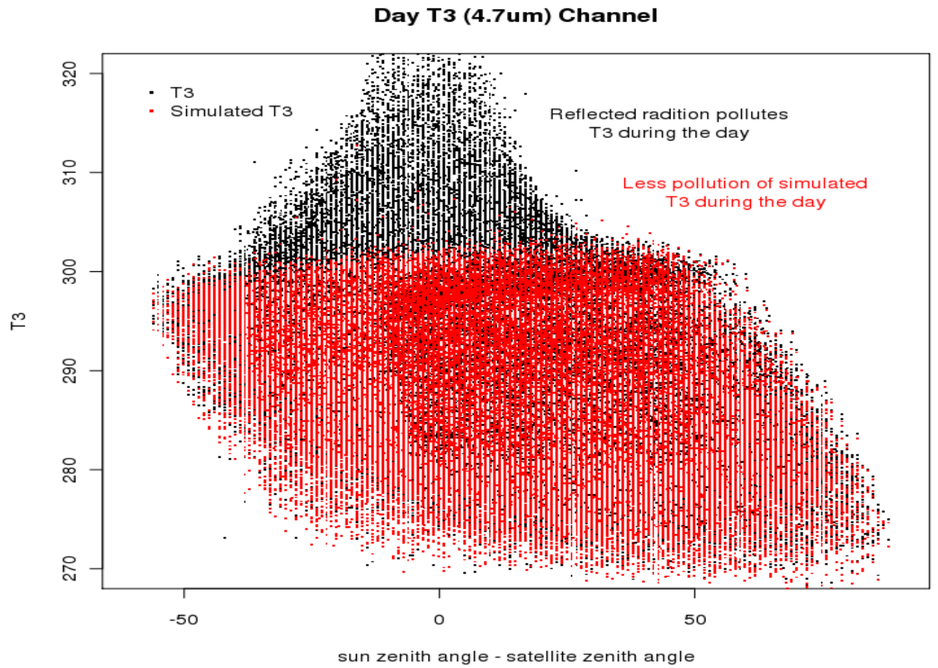




$$BT \rightarrow BT + \alpha(\sec\theta_z - 1)$$







$$T = aT_4 + b(T_3 - T_5) + c(T_5 - T_4)$$

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“3” channel Day/Night performance

		2 channel linear	2/3 channel linear	2/3 channel NLSST	“3” channel
Model complexity		3 terms Includes θ_z	Day / Night 2 equations	Day / Night 2 equations	“3” terms
μ	Day	0.09 K	**0 K**	**0 K**	0.10 K
	Night	-0.07 K	**0 K**	**0 K**	-0.08 K
	Both	0 K	0 K	0 K	0 K
σ	Day	0.56 K	0.56 K	0.56 K	0.54 K
	Night	**0.58 K**	0.44 K	0.42 K	0.43 K
	Both	**0.58 K**	0.50 K	0.48 K	0.49 K
median	Day	0.05 K	-0.05 K	-0.05 K	0.06 K
	Night	-0.11 K	**-0.05 K**	**-0.05 K**	-0.14 K
	Both	-0.04 K	-0.05 K	-0.05 K	-0.07 K
rsd	Day	0.30 K	0.30 K	0.29 K	0.28 K
	Night	**0.30 K**	0.21 K	0.20 K	0.20 K
	Both	**0.31 K**	0.24 K	0.23 K	0.25 K

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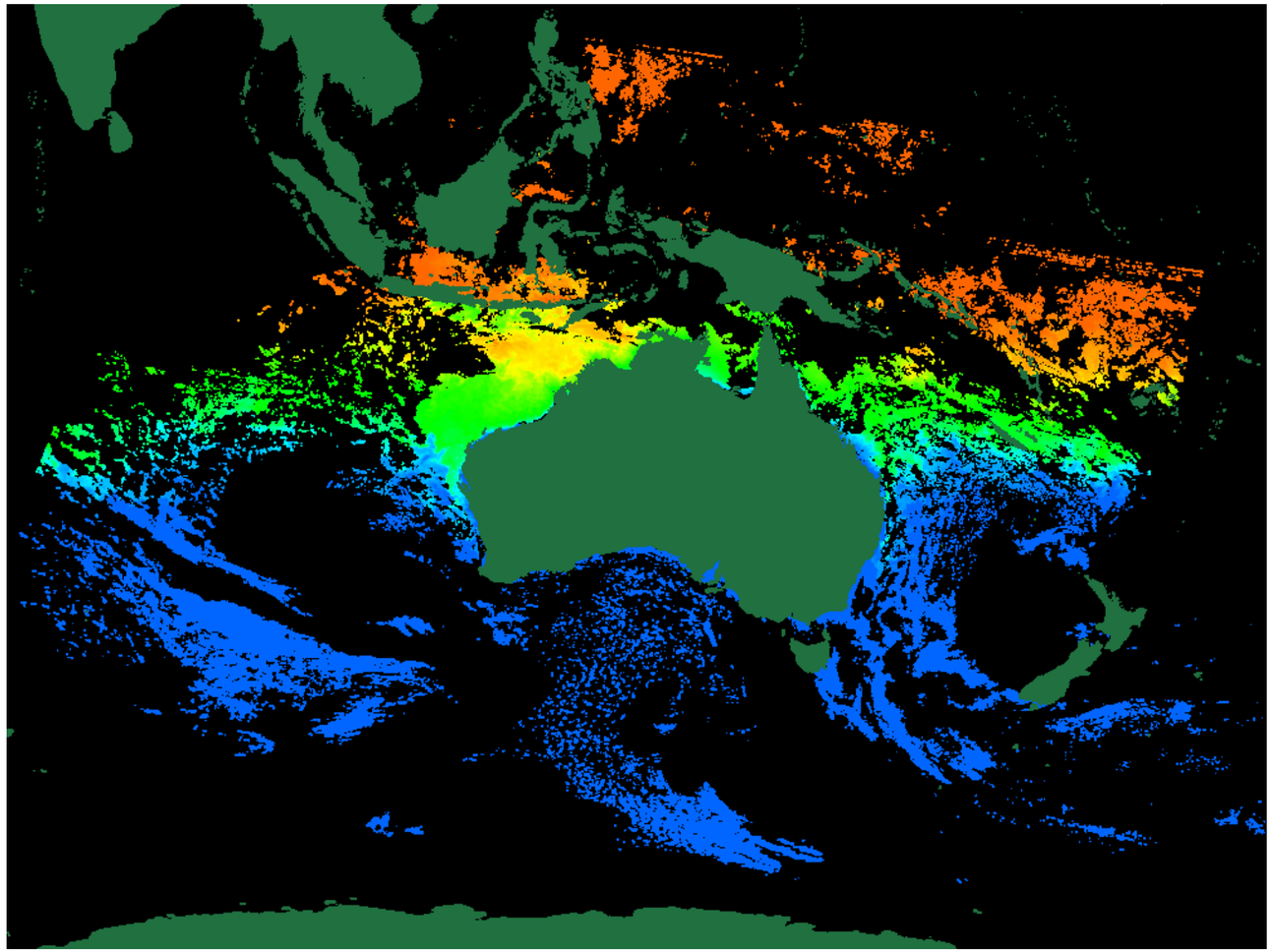
Coverage – 1 day composite

- L3S – 1 day
- Currently 2 satellites (NOAA-18 & NOAA-19)
- 0.02 x 0.02 degree
- Trade off coverage with time scale

night



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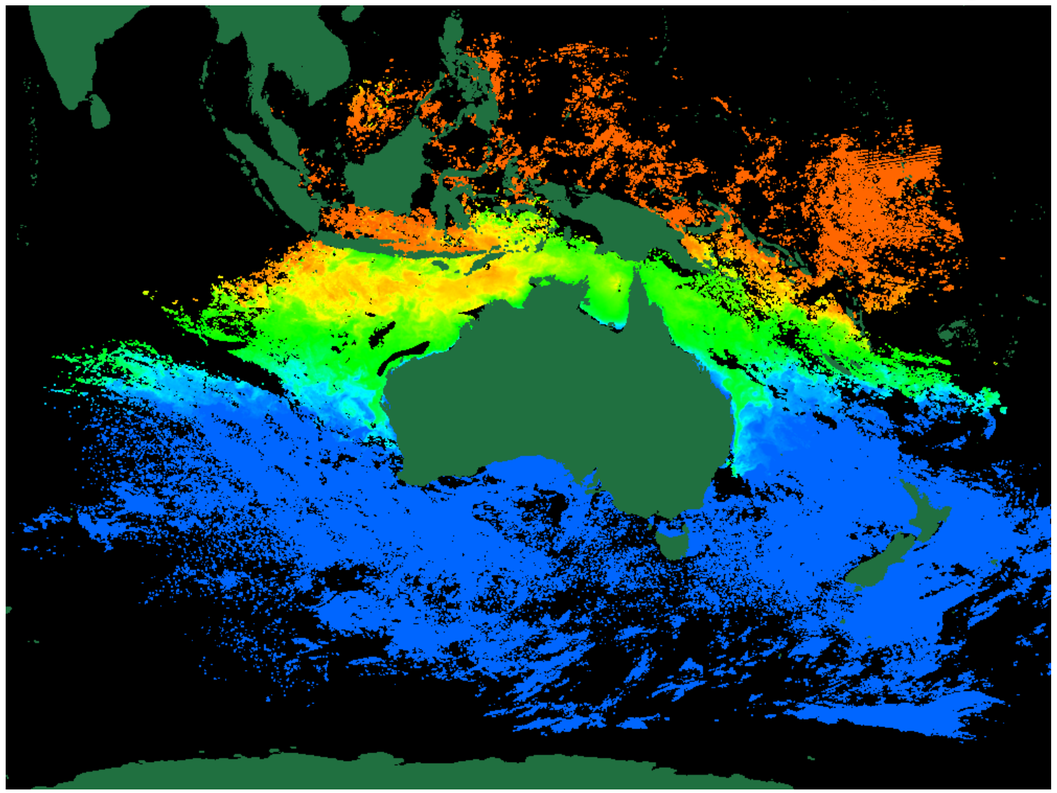
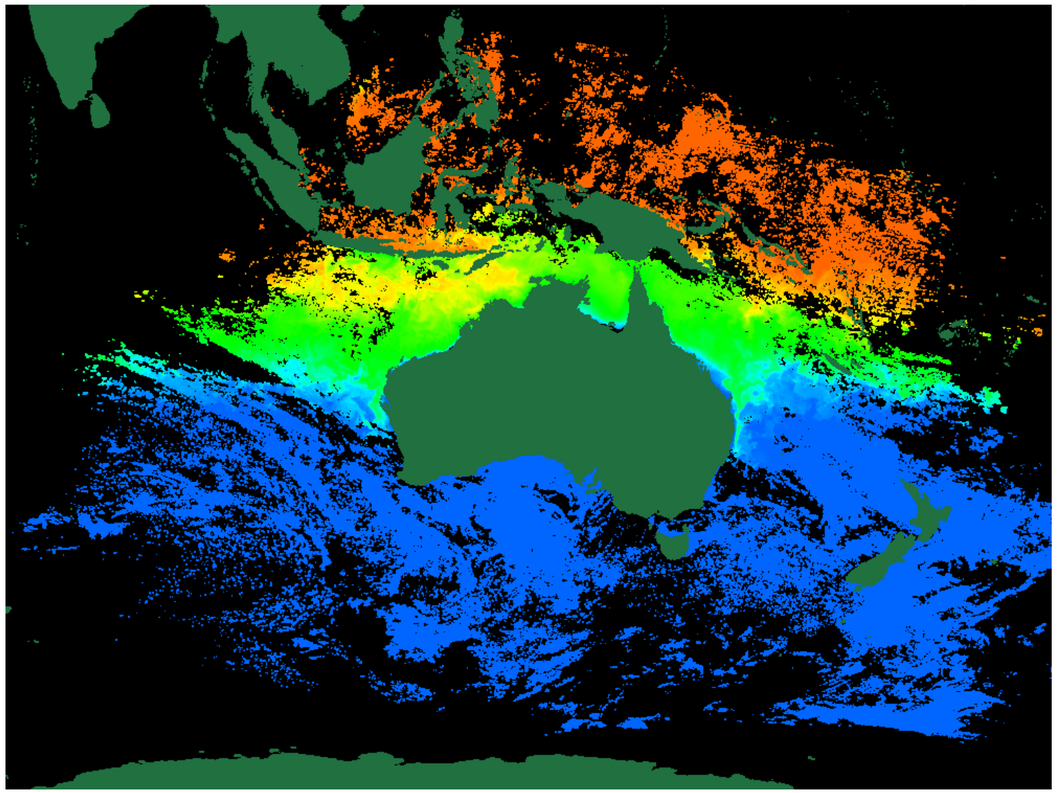
Coverage – 3 day composite

- L3S – 3 day

day/night



night



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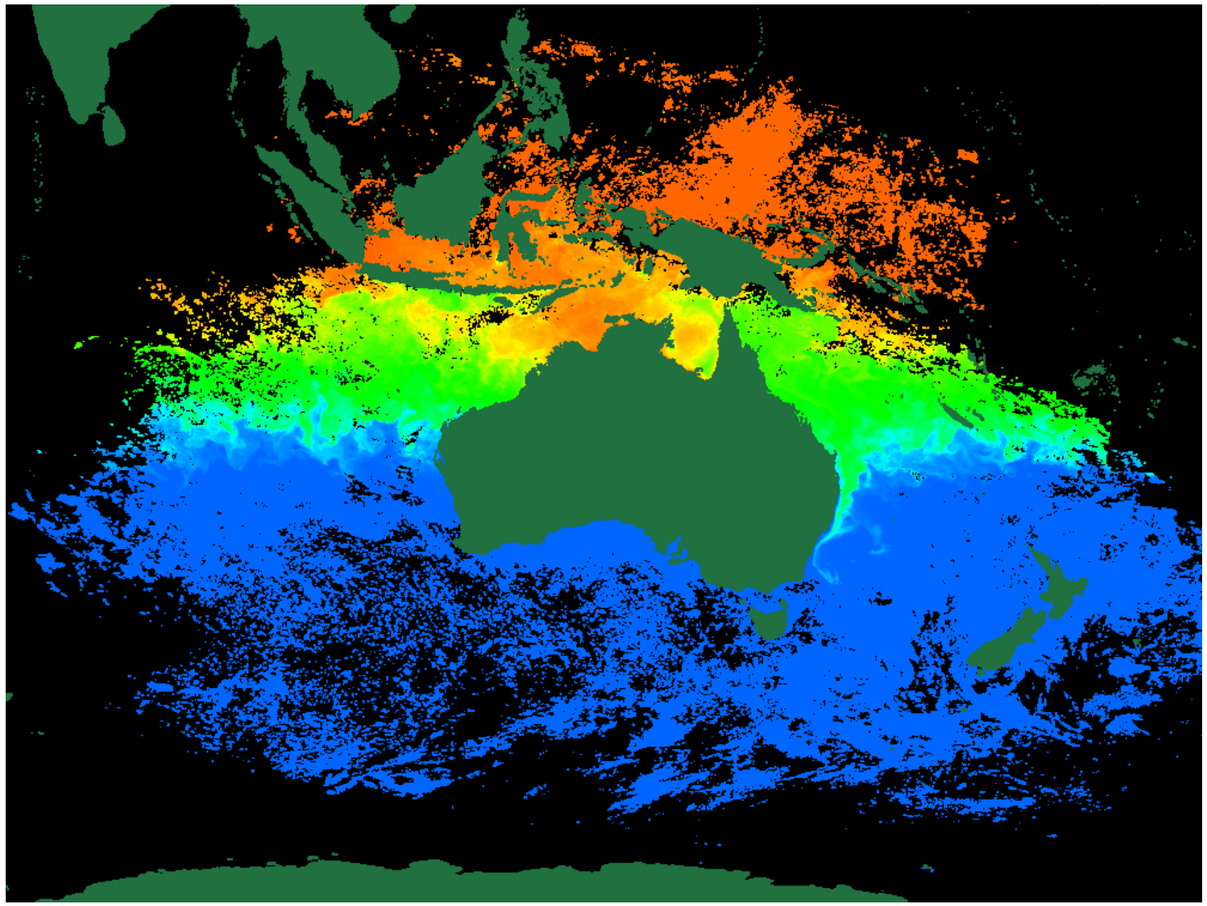
Coverage – 6 day composite



night

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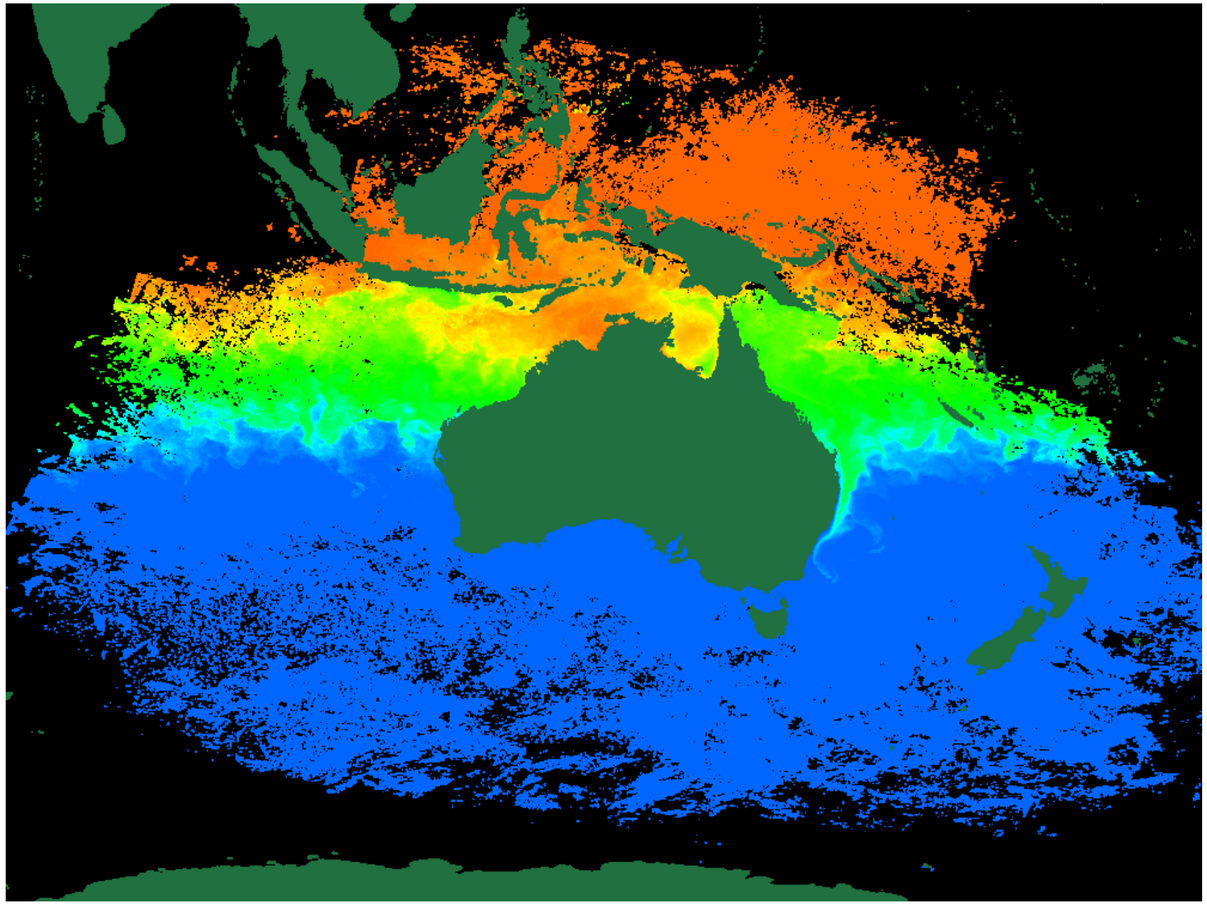
Coverage – 14 day composite

- like legacy product



night

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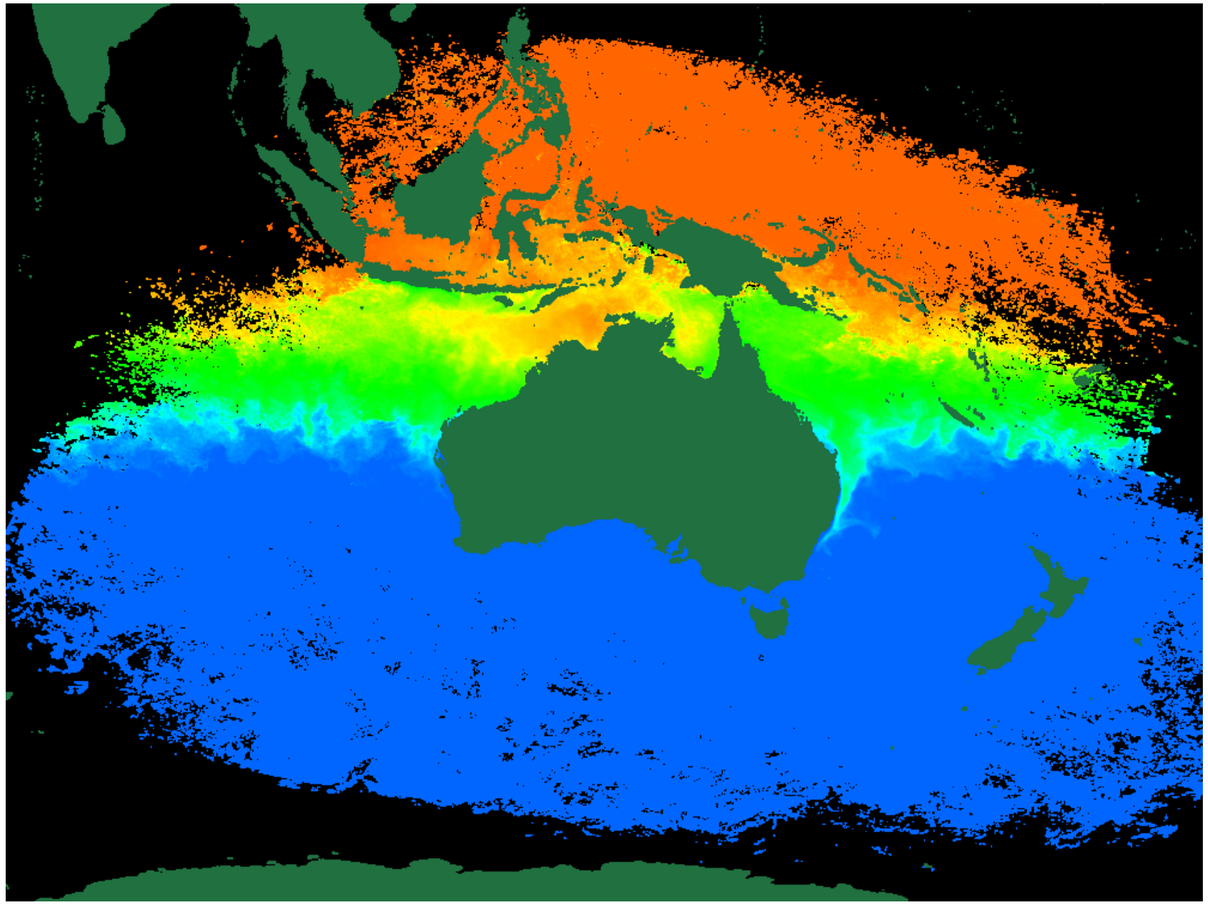
Coverage – 1 month composite



night

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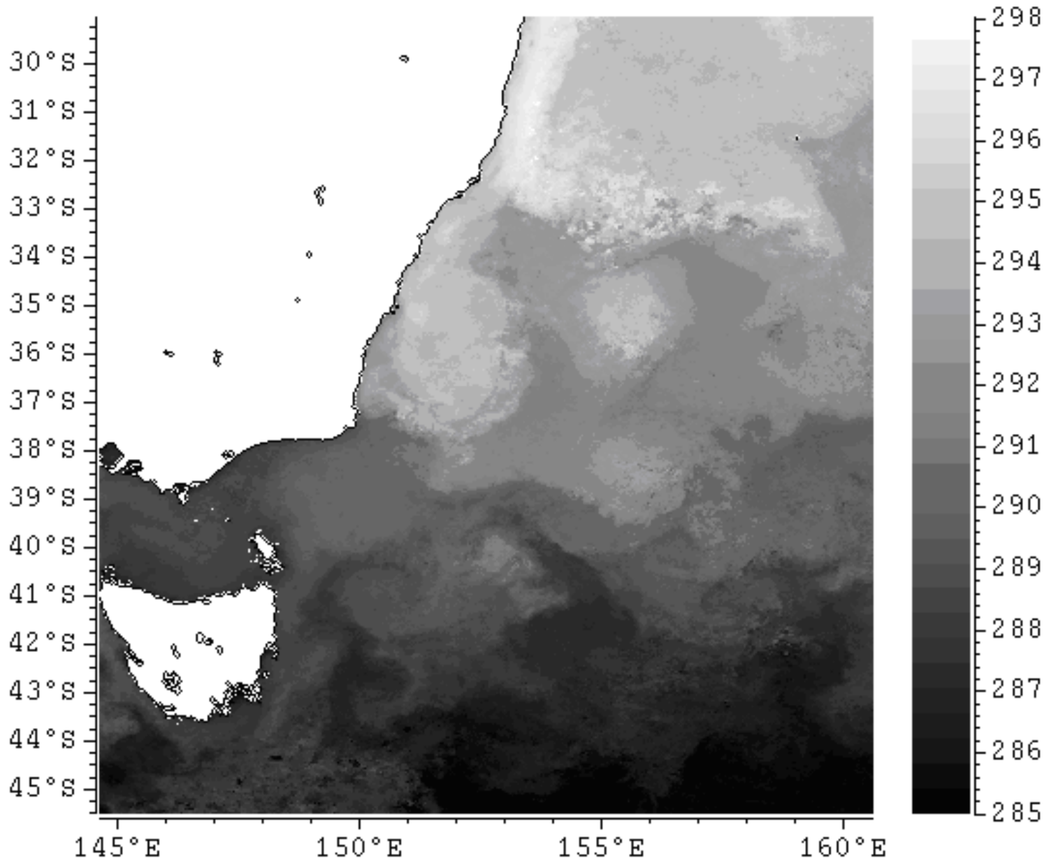
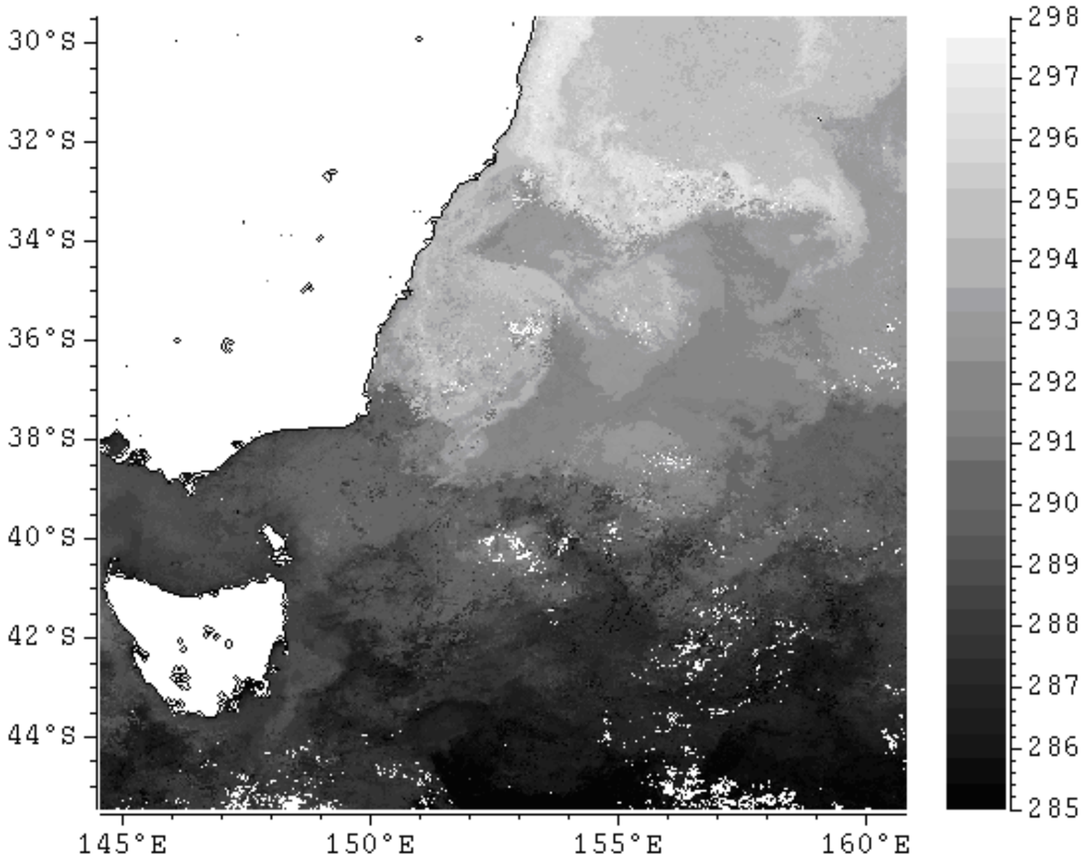
Comparison with legacy product



Legacy 14d composite



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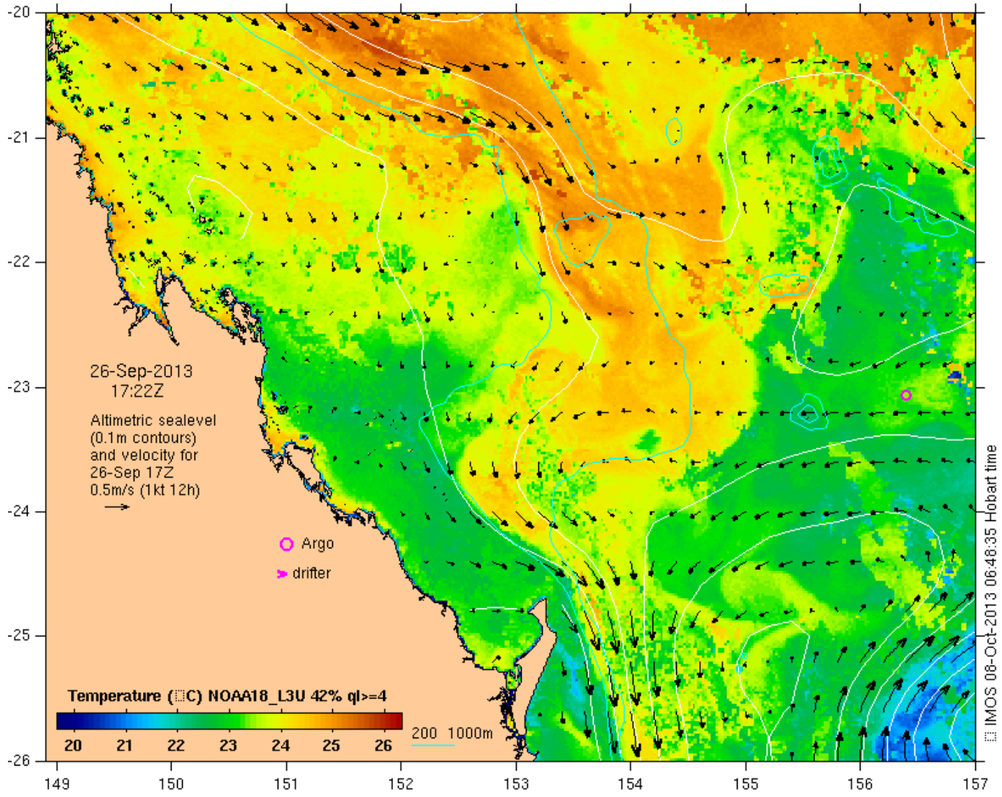
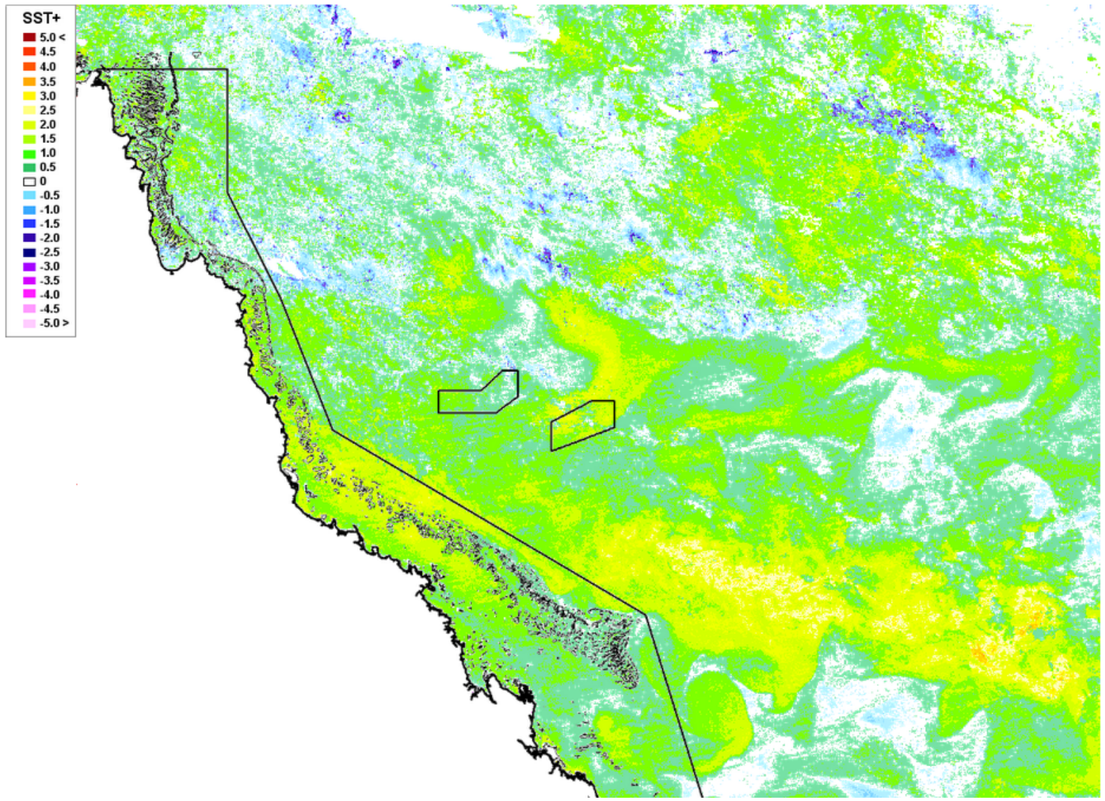
“Early” adopters

CSIRO

http://oceancurrent.imos.org.au/



http://www.cmar.csiro.au/remotesensing/reeftemp/web/ReefTemp.htm



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ReefTemp

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Questions ?

Thank you for listening…

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