Australian Government
Bureau of Meteorology

A consistent day/night SST regression algorithm based on 3-channel AVHRR

Christopher Griffin[1,2], Helen Beggs[2], Leon Majewski[1],

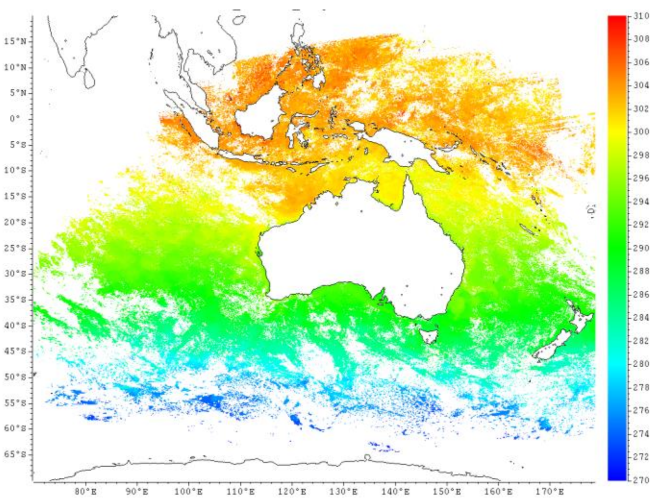
[1]Observations & Engineering Branch, Bureau of Meteorology, Australia

[2]CAWCR, Bureau of Meteorology, Australia

EARWiG Breakout Session, 14th GHRSST Science Team Meeting, Woods Hole, 17-21 June 2013

Australian Government
Bureau of Meteorology

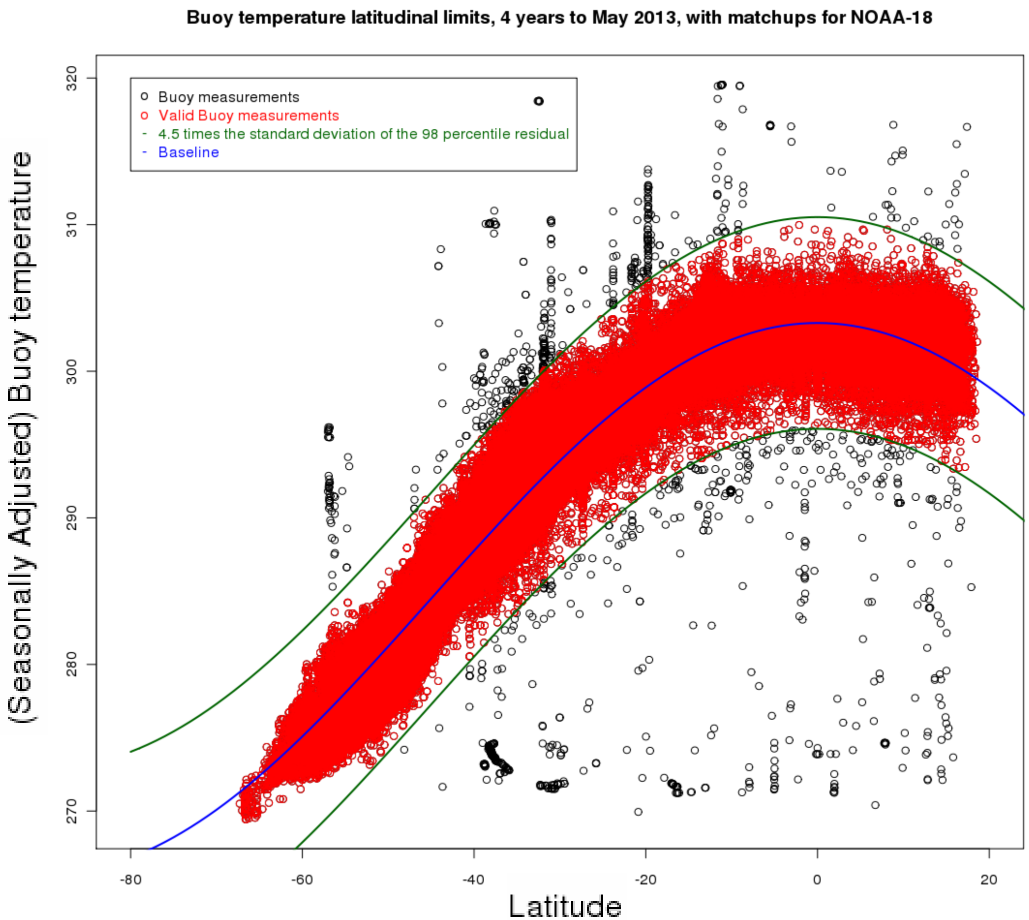
Scale Tuning (Climatology)



6 day composite (NOAA 18/19), 1 June 2013

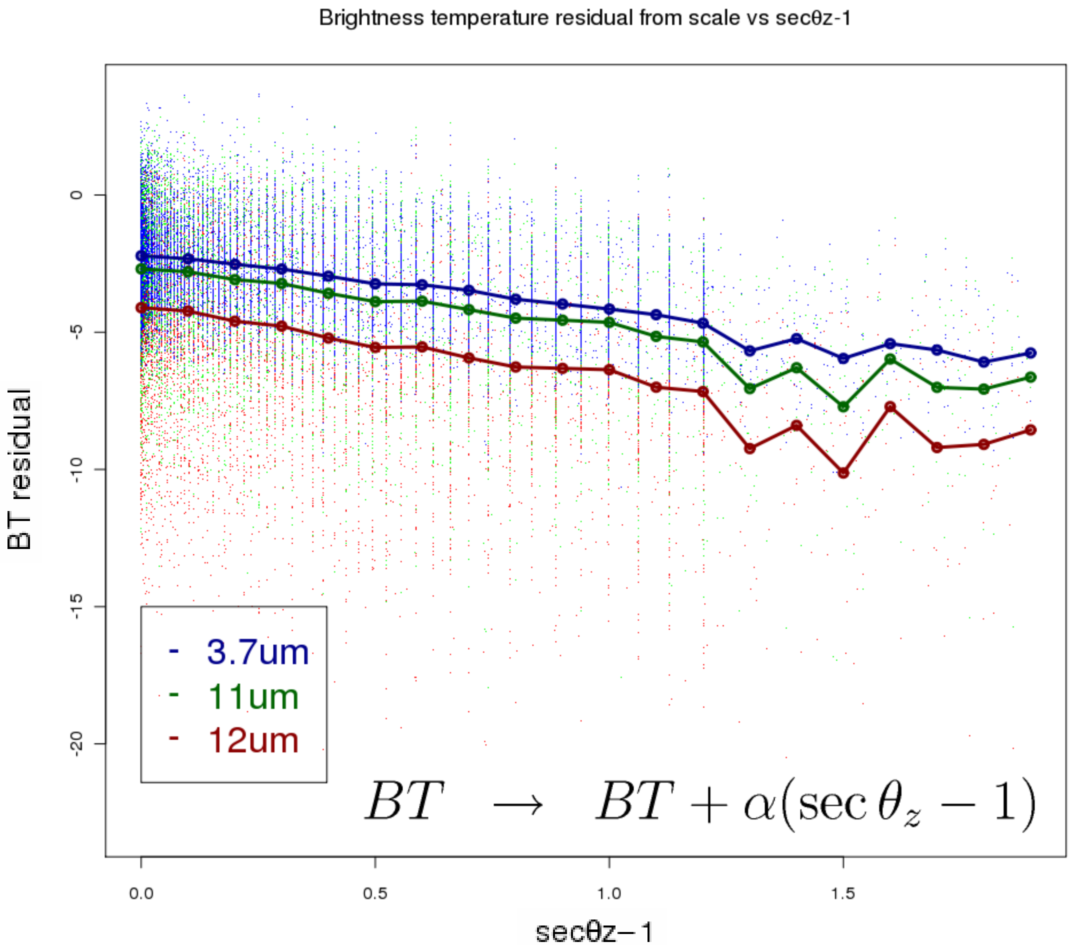
$$T = T_0 + \kappa_l \sin^2(\text{lat}) + \kappa_s \sin(2\pi\tau + \phi)$$

τ time of year
ϕ seasonal phase shift



4 Year Buoy measurements in view of NOAA-18, 9 May 2013

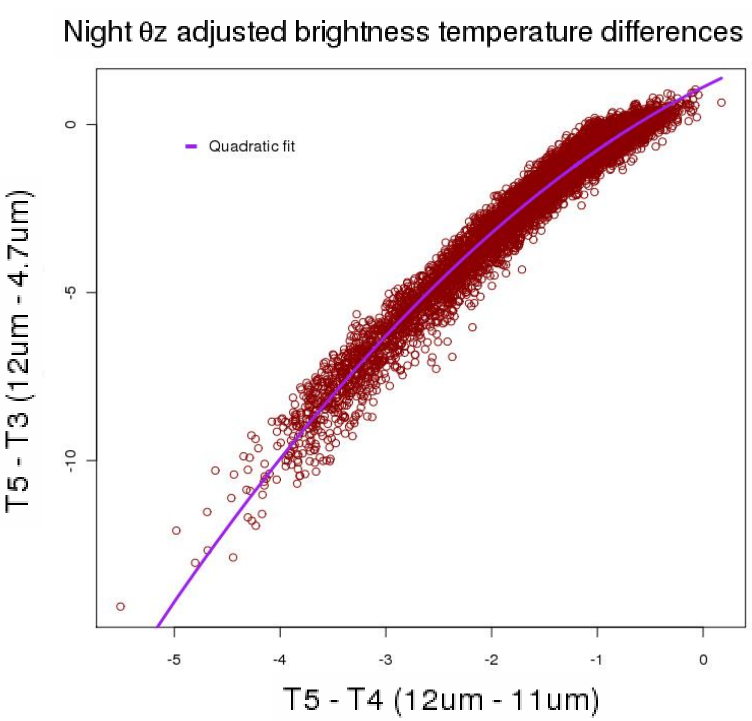
Compensating for θ_z

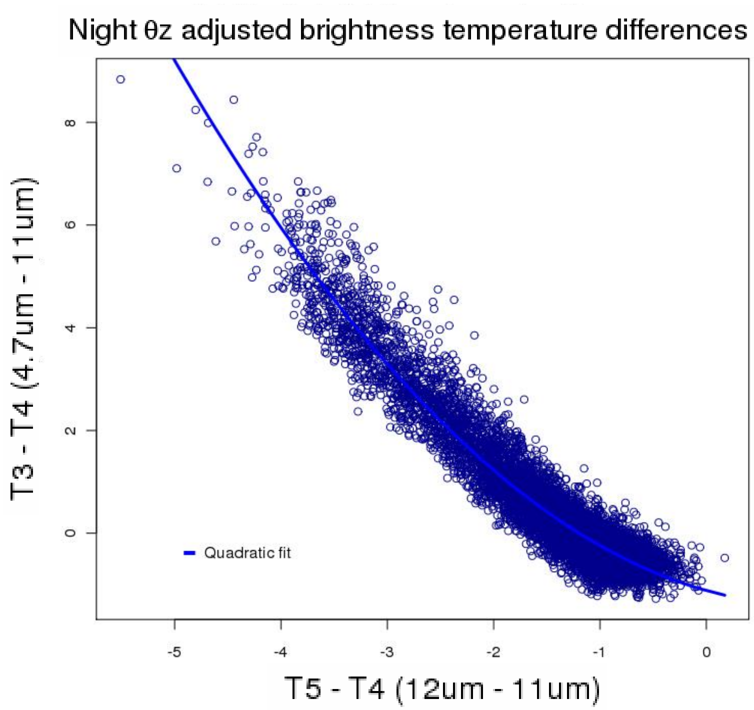


View angle dependence:

- is a geometrical artefact
- is linear in sec θ_z to first order and does not scale with the brightness temperature
- applies to each brightness temperature, since it is geometrical in nature
- Use the deviation from the Scale Tuning (Climatology)
- "does not / should not" require matching *in situ* measurements to correct for

Connecting the Three Channels

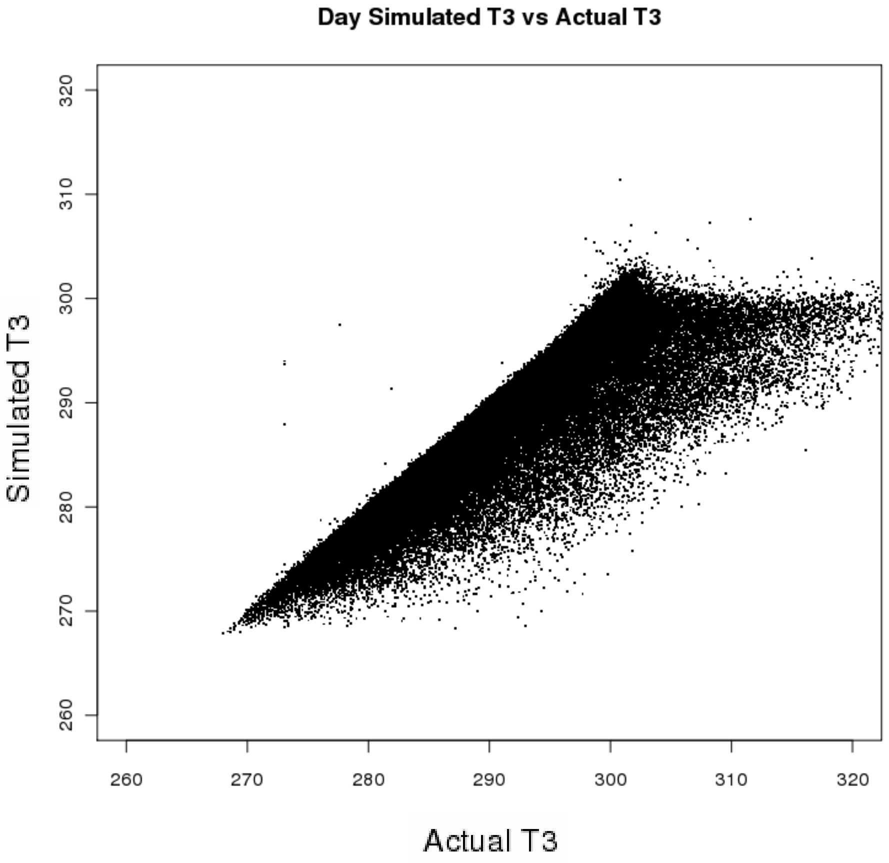




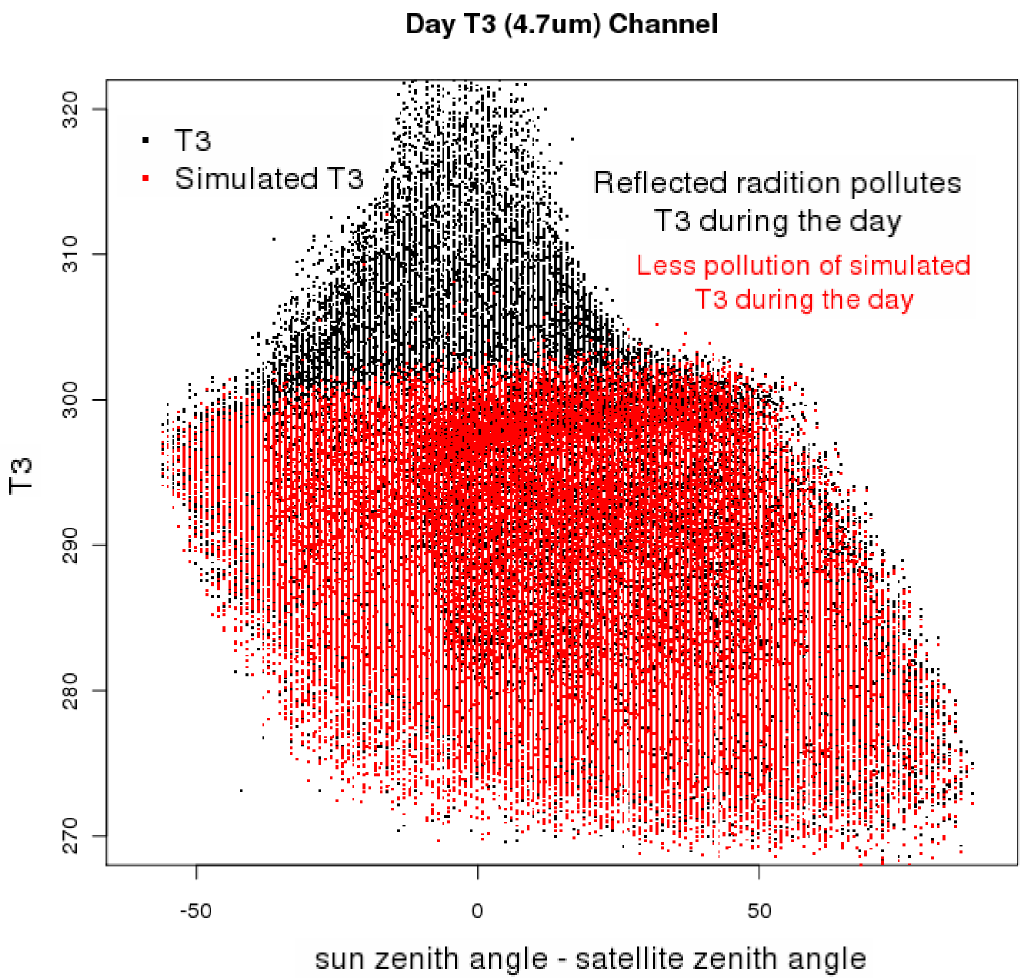
- Differences between brightness temperatures characterise and correct for atmospheric conditions.
- There is a single largest “primary factor” (atmospheric water). This will result in a pair-wise non-linear correlation between the temperature differences.

Forming a 3rd Day Channel

- Assume that the same “primary factor” is dominant during the day.
- $T_3 - T_4$ and $T_5 - T_3$ can be estimated from $T_5 - T_4$
- These in turn can provide a simulated T_3 during day time.
- At night, continue to use the measured T_3



Correcting / Detecting Reflected Contamination



Tuning with a Tri-linear Rule

- We Scale Tuned without satellites
- We Compensated for θ_z without *in situ* measurements (almost)
- We Guessed T_3 during the Day without *in situ*
- We have no analysis SST in our equation
- Now we can Tune for SST

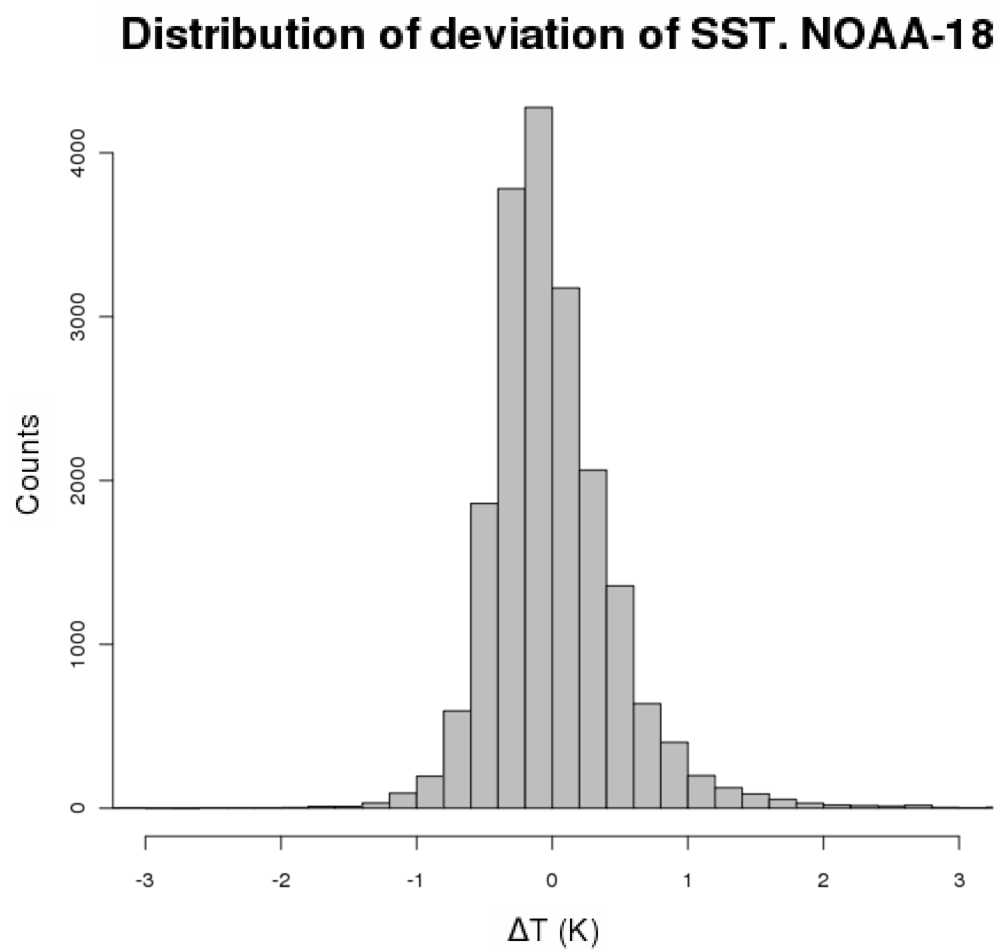
$$T = aT_4 + b(T_3 - T_5) + c(T_5 - T_4)$$

Day and Night can have the same parameters !

Australian Government
Bureau of Meteorology

Performance against *in situ*

μ	Day	0.10 K
	Night	-0.08 K
	Both	0 K
σ	Day	0.54 K
	Night	0.43 K
	Both	0.49 K
median	Day	0.05 K
	Night	-0.13 K
	Both	-0.07 K
rsd	Day	0.28 K
	Night	0.20 K
	Both	0.25 K



Australian Government
Bureau of Meteorology

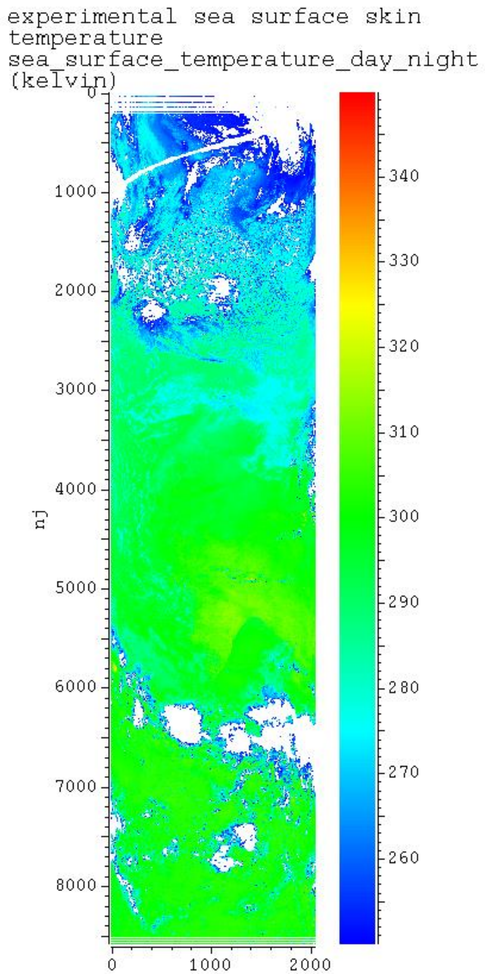
Comparison

No SST analysis used in any of these algorithms

		2 channel linear	BOM 2011	2/3 channel linear	2/3 channel NLSST	Tri-linear
Model complexity		3 terms Includes θ_z	9 terms	Day / Night 2 equations	Day / Night 2 equations	“3” terms
μ	Day	0.09 K	0.08 K	**0 K**	**0 K**	0.10 K
	Night	-0.07 K	-0.06 K	**0 K**	**0 K**	-0.08 K
	Both	0 K	0 K	0 K	0 K	0 K
σ	Day	0.56 K	**0.48 K**	0.56 K	0.56 K	0.54 K
	Night	**0.58 K**	**0.49 K**	0.44 K	0.42 K	0.43 K
	Both	**0.58 K**	0.49 K	0.50 K	0.48 K	0.49 K
median	Day	0.05 K	0.03 K	-0.05 K	-0.05 K	0.06 K
	Night	-0.11 K	**-0.09 K**	**-0.05 K**	**-0.05 K**	-0.14 K
	Both	-0.04 K	-0.03 K	-0.05 K	-0.05 K	-0.07 K
rsd	Day	0.30 K	**0.22 K**	0.30 K	0.29 K	0.28 K
	Night	**0.30 K**	0.23 K	0.21 K	0.20 K	0.20 K
	Both	**0.31 K**	0.23 K	0.24 K	0.23 K	0.25 K

Australian Government
Bureau of Meteorology

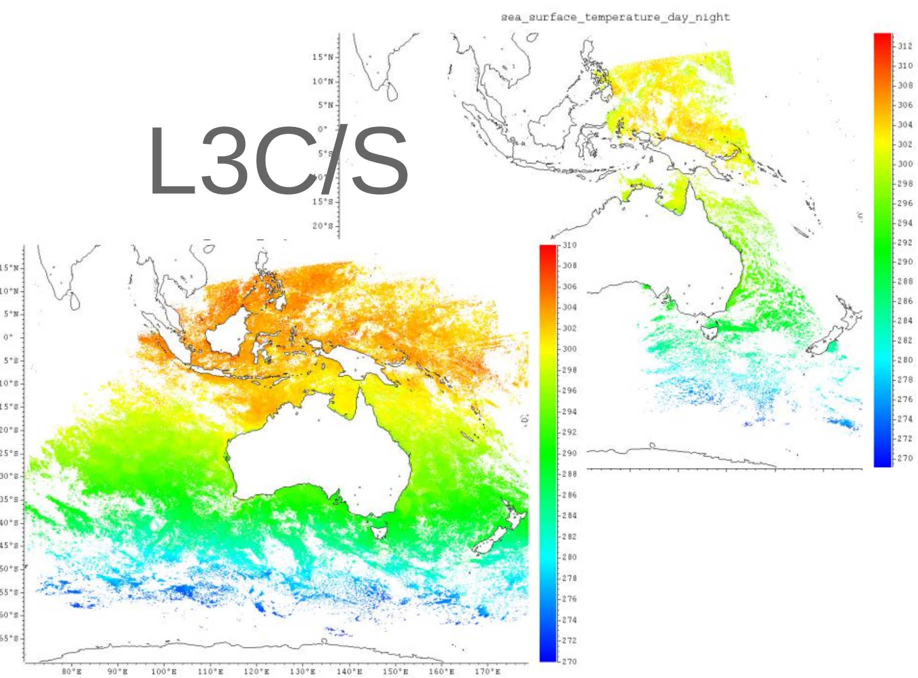
Availability
(from July 2013)



L2P

- ABOM GHRSST SST products
- Experimental field

L3U

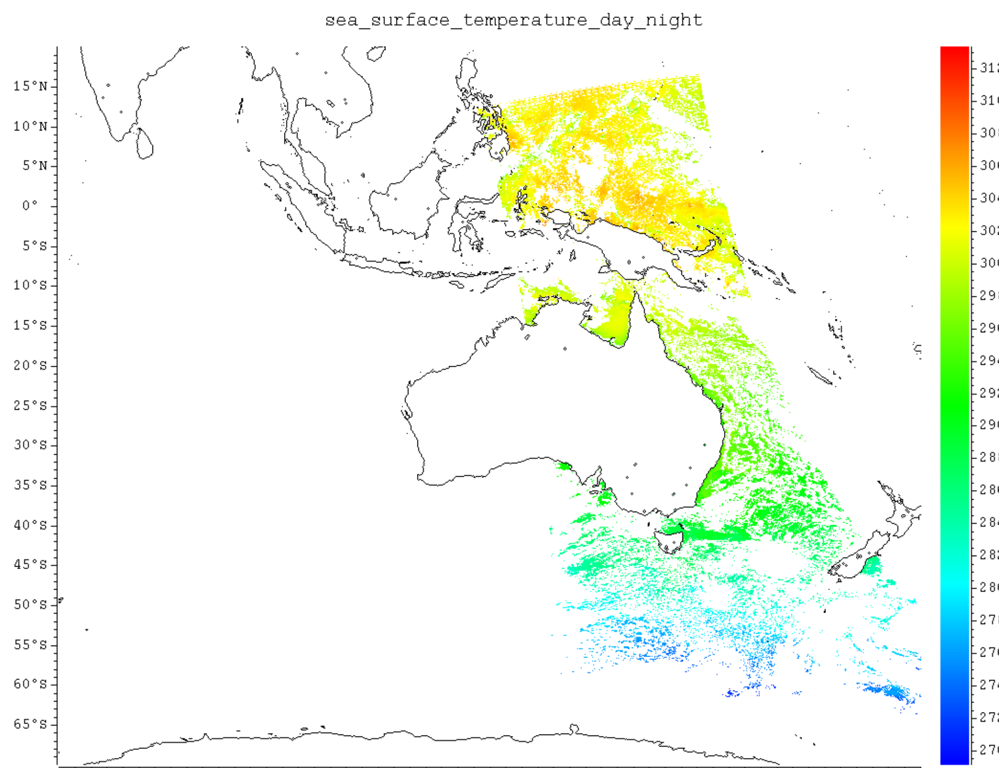


L3C/S

sea_surface_temperature_day_night

Further work

- Compensation of Θ_z decoupled from buoy measurements – we have shown that this is possible, but definitely some room for improvement.
- Allows anomalous T_3 to be detected independent of *in situ* measurements.
- It may be possible to generalize to 2nd Dominant factor characterization - independent of *in situ* measurements, perhaps using spatial correlations.
- Tuning to *in situ* involves a small number of parameters and is thus less sensitive to noise, and instabilities in fitting. Same parameters used for day and night
- Greater stability allows the tuning to be effectively performed on a rolling time window.



Australian Government
Bureau of Meteorology

Thank you…

Christopher Griffin

C.Griffin@bom.gov.au