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SOUW Presentation

Never Stand Still | Physical Oceanography

Investigating SST Diurnal Variation over the Tropical Warm Pool Using IMOS-GHRSST Products

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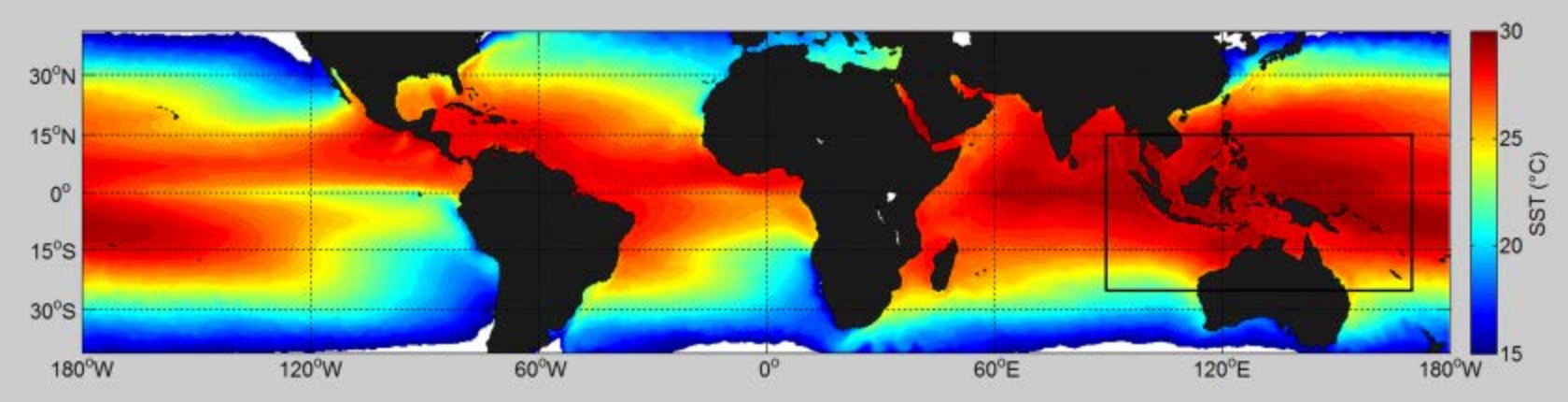
- Why the SST Diurnal Variation (DV) events over the Tropical Warm Pool (TWP, defined as 90E – 170E, 25S – 15N) region?

1. TWP region plays a key role in climate system due to its high annual average SST feature.



2. Clayson and Bogdanoff (2013) have found that significant portions of the tropical oceans experience flux differences as high as 10 Wm-2 on a yearly average when the SST DV effects are taken into consideration.

Outlines

1. Data Sets
2. Statistical Analysis
3. DV/WS/SSI Relationship
4. Seasonal Patterns
5

- Two SST Data sets:

  - Four months (Jan to Apr 2010) *geostationary* MTSAT-1R V3 data over the TWP region, produced by the Bureau and IMOS especially for the TWP+ project, obtained from the Bureau's TWP+ Data Set;

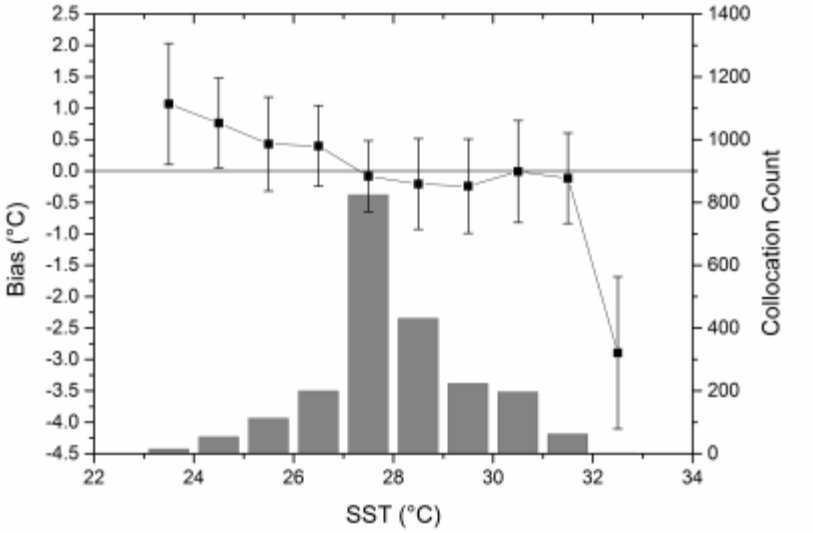
  - Five years (2010 – 2014) *polar – orbit* IMOS HRPT AVHRR SST Data set (sensor 19) over the TWP region, produced by the Bureau and IMOS, obtained from the Bureau.

  - For both satellite data sets, uncertainty information has been used.

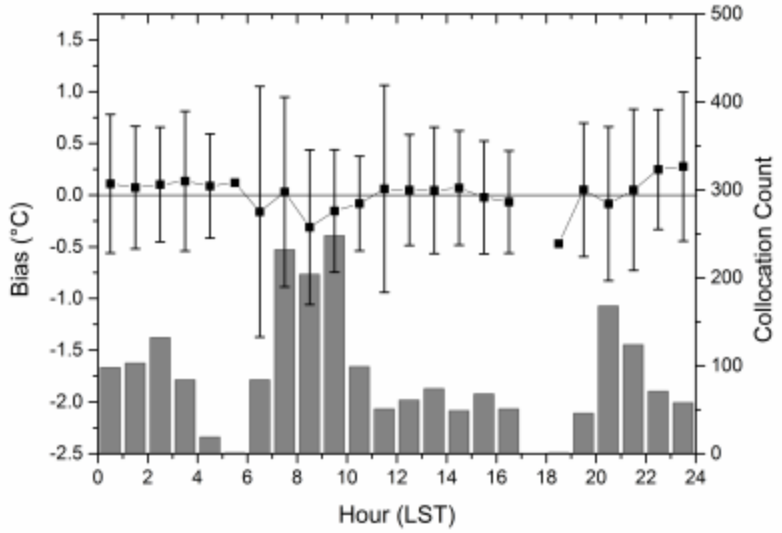
  - Other meteorological variables, like the wind speed and solar shortwave insolation (SSI), four years (2010 to 2013) data are from the ACCESS-R model outputs provided by the Bureau.

Validation – *MTSAT-1R* against drifting buoy SST data

Collocations against SST ranges



Collocations against local hours



		Num	Bias (ºC)	STD (ºC)	SI	R
Day		1138	-0.064	0.712	0.026	0.845
Night		988	0.080	0.737	0.026	0.902
All		2126	0.003	0.727	0.026	0.883

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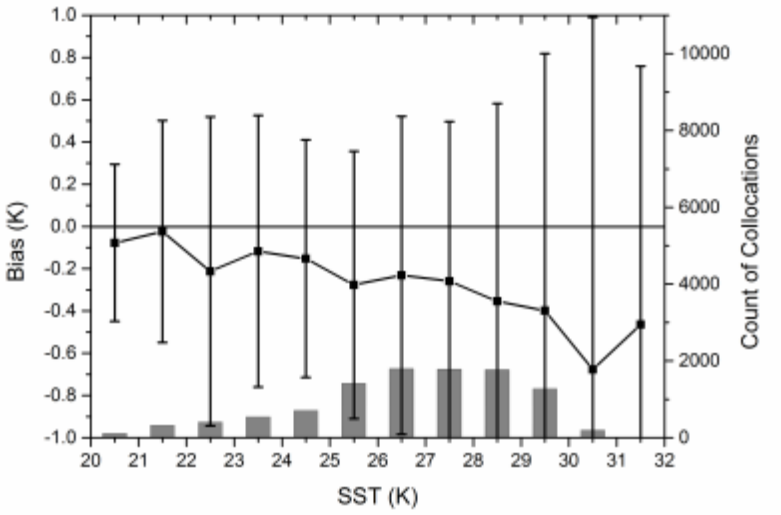
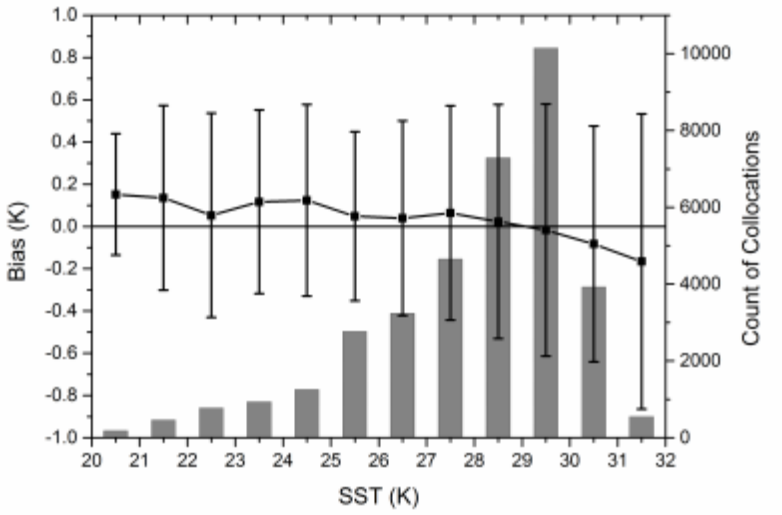
Validation – *AVHRR* against drifting buoy SST data

Daytime Collocations



Nighttime Collocations



	Num	Bias (ºC)	STD (ºC)	R
Day	10349	-0.272	0.850	0.928
Night	36204	0.012	0.540	0.969
All	46553	0.051	0.659	0.960

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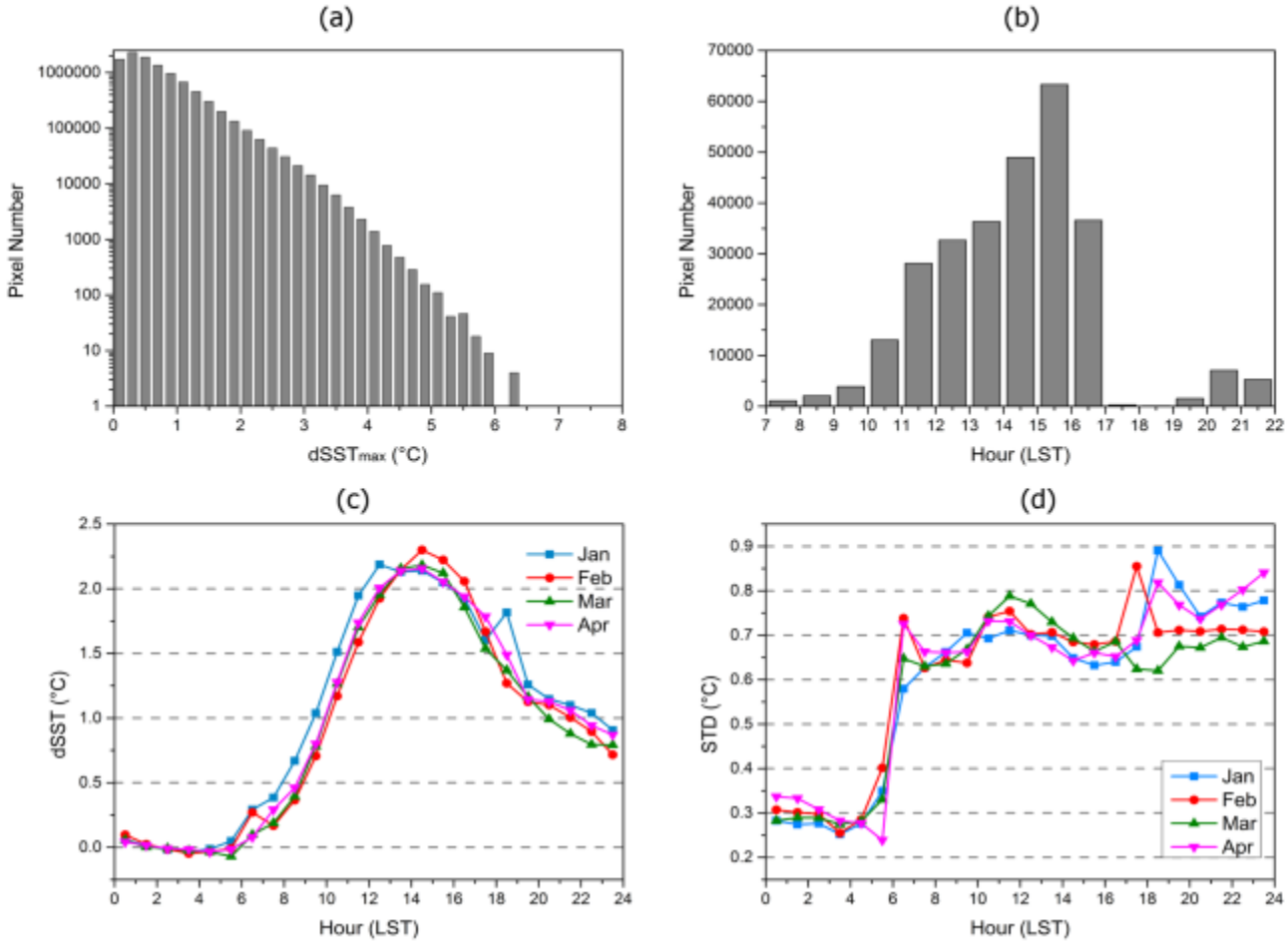
Statistics – *MTSAT-1R*



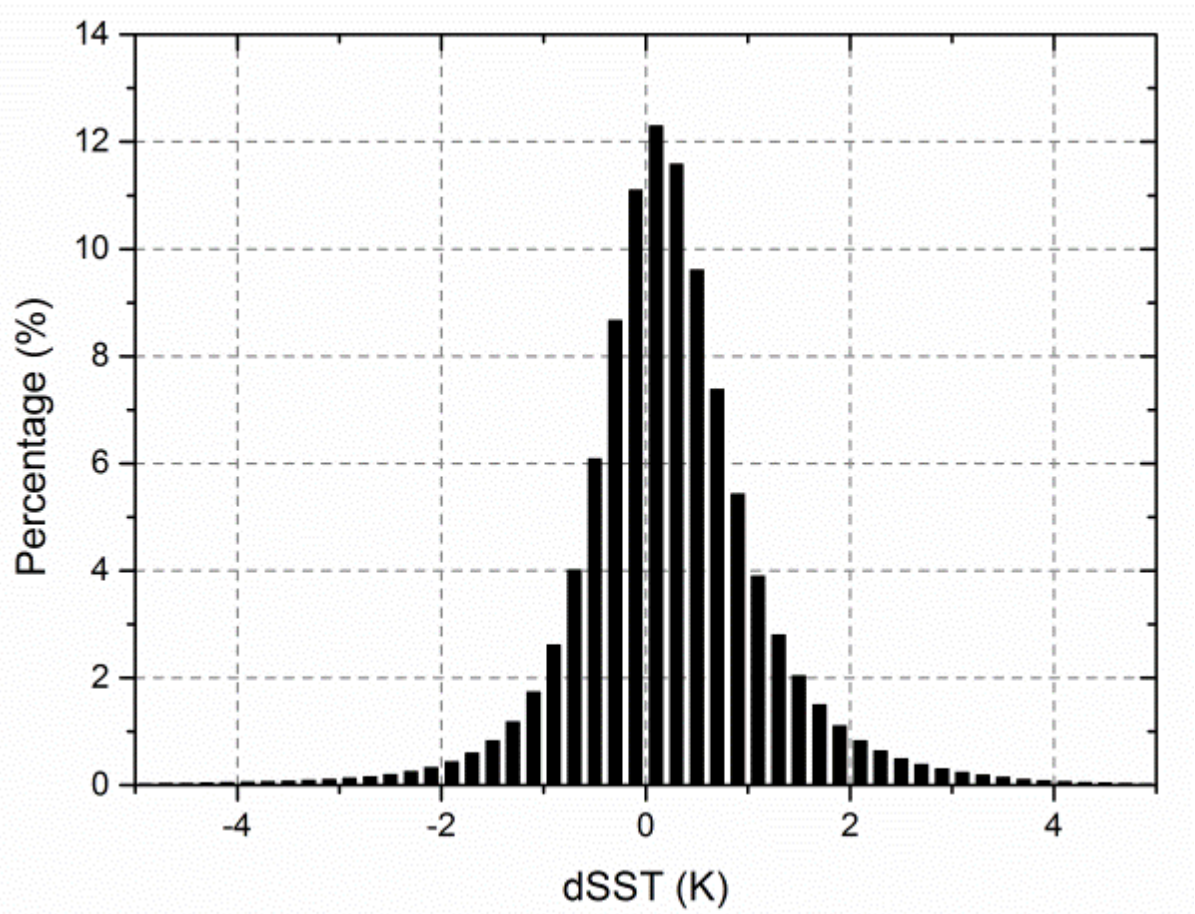
(a) DV amplitudes distribution;

(b) DV local peak times;

(c) Diurnal cycles for each month;

(d) STDs for each cycle.

Statistics – *AVHRR*



DV amplitudes distribution

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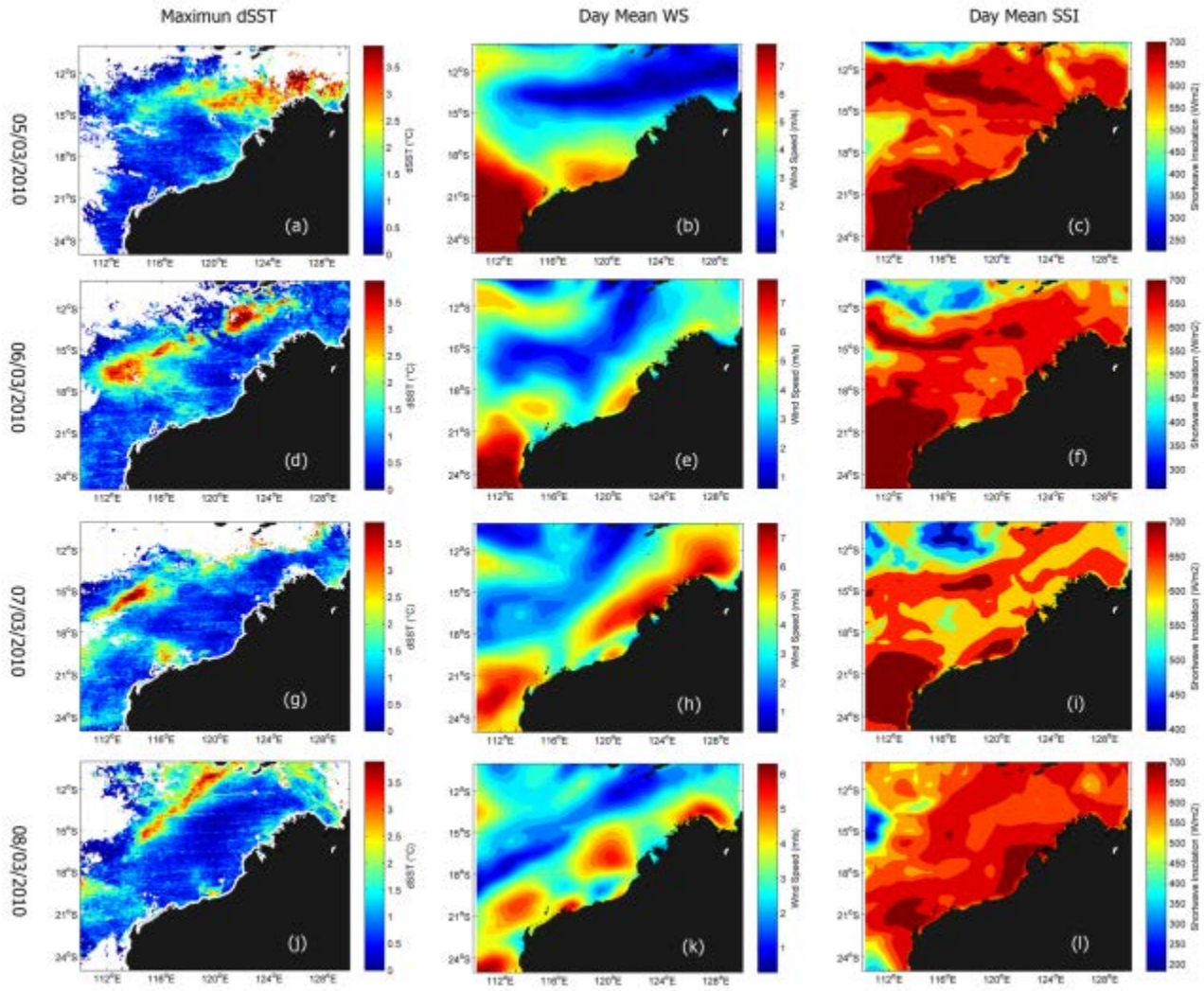
Case study – *MTSAT-1R*



Case study from 5th to 8th in March 2010. Left column: maximum DV amplitudes; Middle column: daily mean wind speed; Right column: daily mean solar shortwave insolation (SSI).

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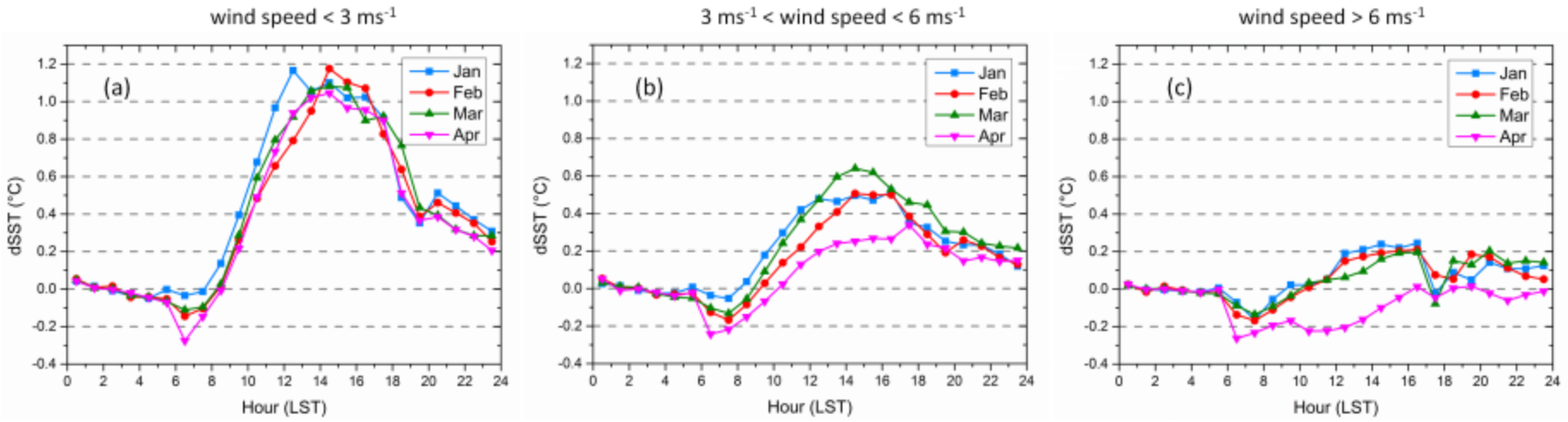
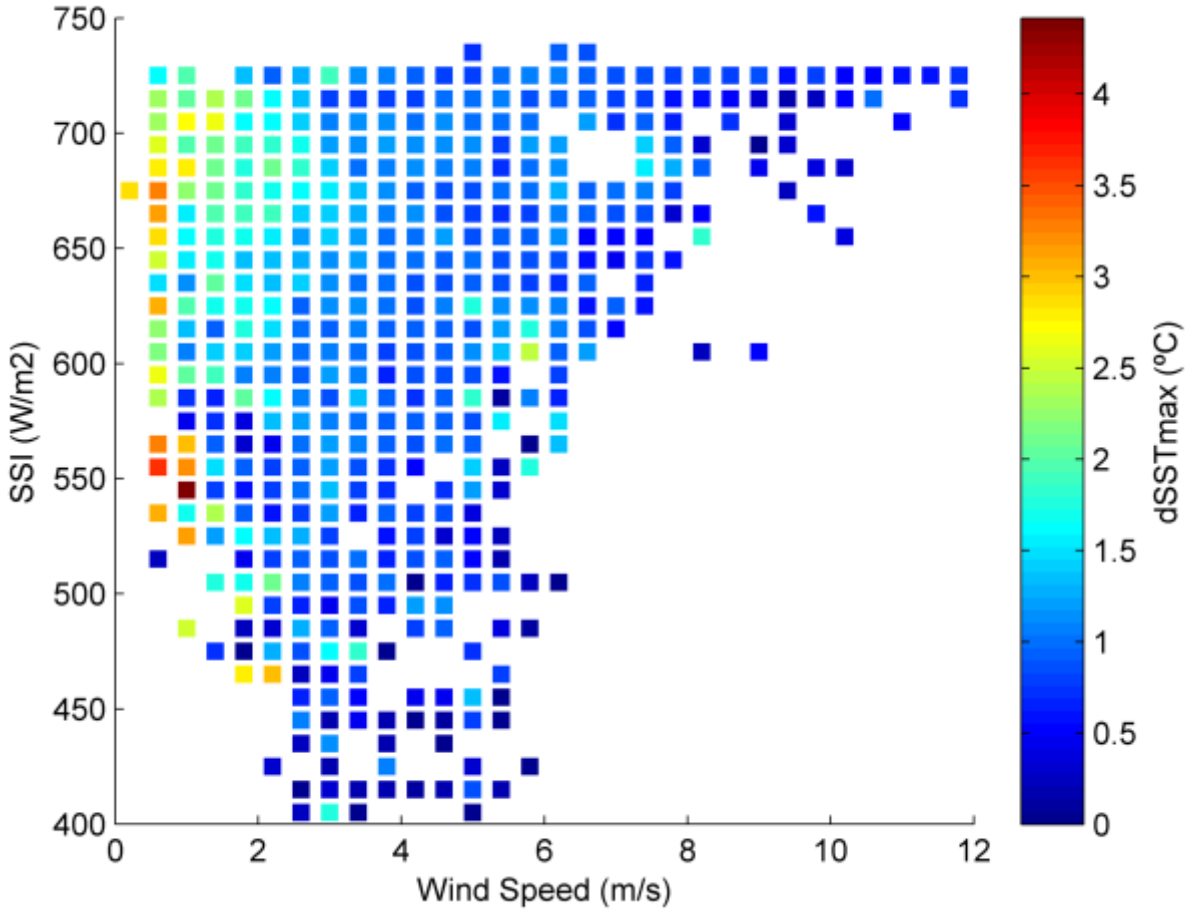
❑ Relationship between DV amplitudes and Wind Speed – *MTSAT-1R*



Monthly shape of the diurnal cycles against different wind speed conditions:
(left) wind speed < 3 ms-1;
(middle) wind speed between 3 and 6 ms-1;
(right) wind speed > 6 ms-1.

- Relationship between DV/Wind Speed/SSI – *MTSAT-1R*



Relationship between the DV amplitudes with wind speed and solar shortwave insolation (SSI)

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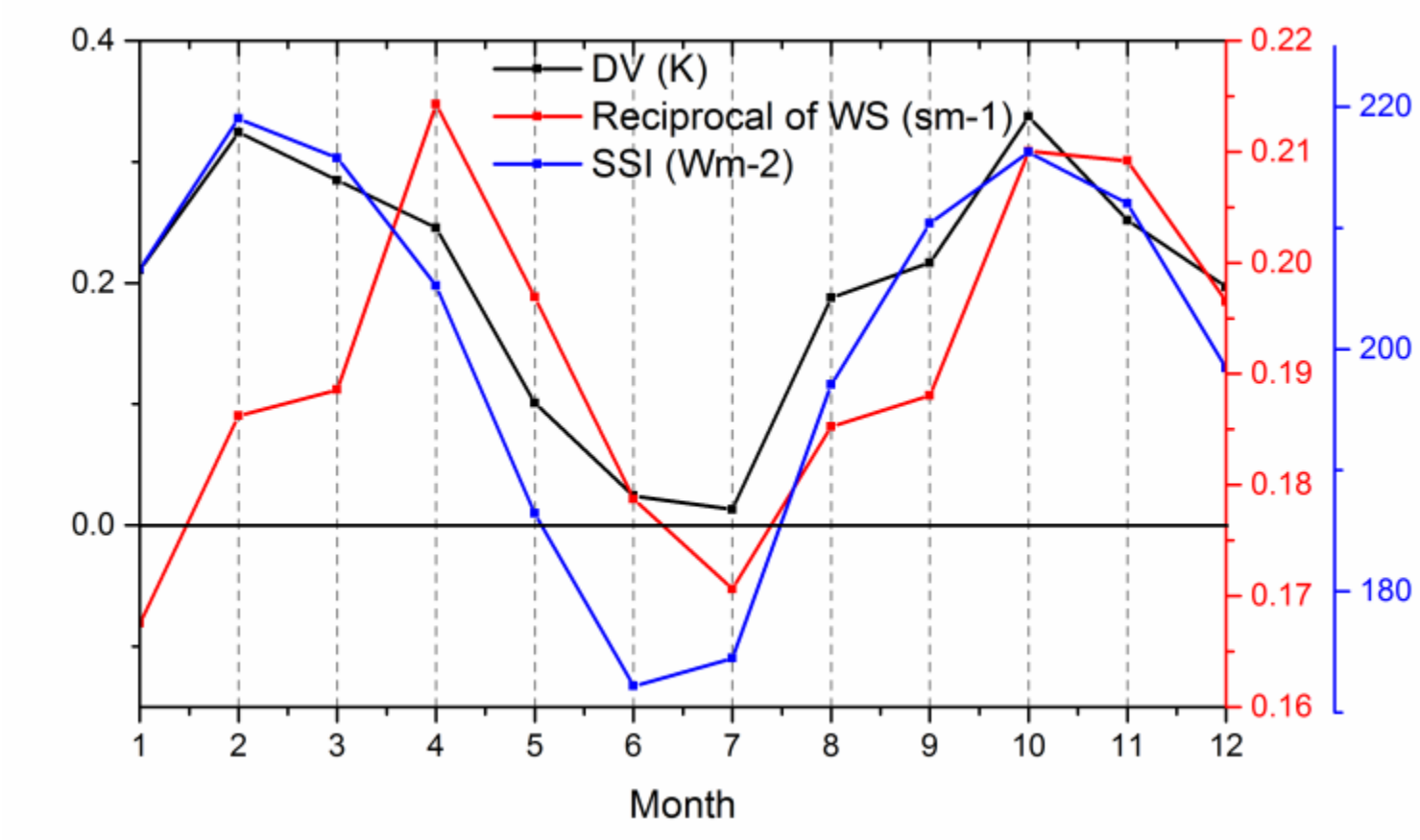
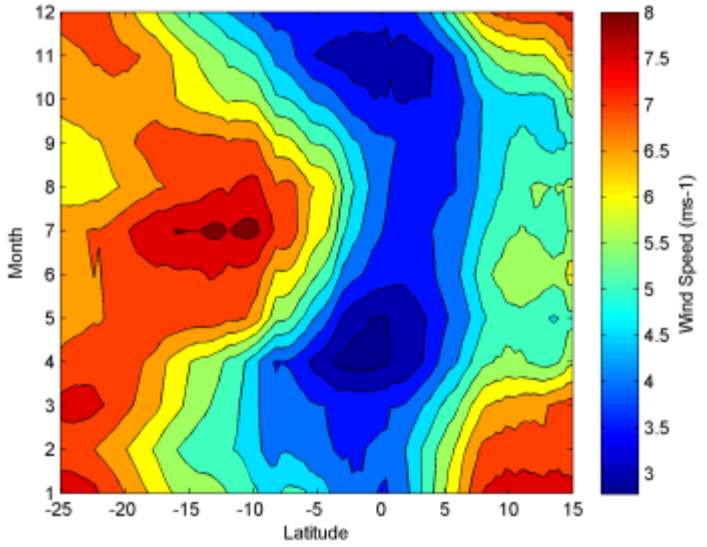
- Seasonal patterns of DV/Wind Speed/SSI – *AVHRR*



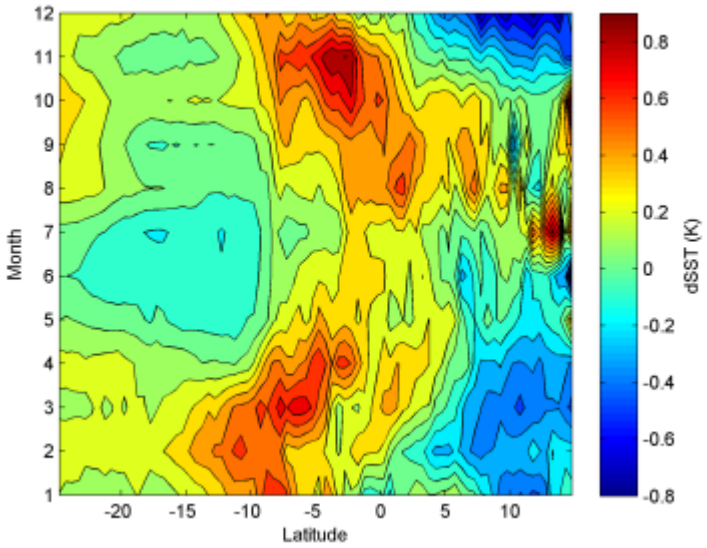
Monthly mean DV amplitudes / wind speed / solar shortwave insolation (SSI) values over the five / four years.

Seasonal patterns of DV/Wind Speed/SSI – *AVHRR*

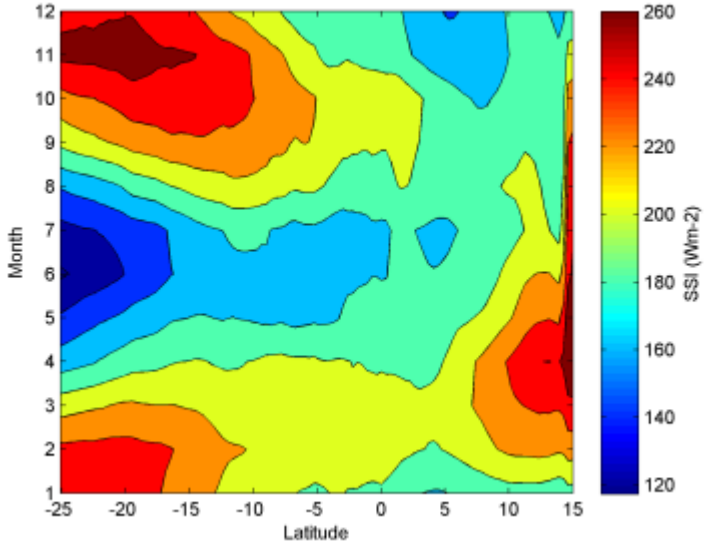
Wind speed against month/lat



DV amplitudes against month/lat



SSI against month/lat



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- Summary:

  - Both MTSAT-1R V3 and AVHRR data sets are of fine quality and are suitable to conduct DV studies over the TWP region;

  - The combination of low wind speed and high solar shortwave insolation conditions leads to the largest possible DV events, though wind speed seems to be dominant over SSI;

  - Most prominent DV events happen between 10S – 5N belt from February to April and from September to November, due to the relatively weak wind; June and July have seen the least frequent and small amplitude DV events.

Key references:

1. Beggs, H., Majewski, L., Kruger, G., Verein, R., Oke, P., Sakov, P., Tingwell, C., Barras, V., Sandery, P., & Griffin, C. (2012a), Report to GHRSST13 from Australia - Bluelink and IMOS, *In: Proceedings of the GHRSST XIII Science Team Meeting*, Tokyo, 4 – 8 June 2012, p. 149-163. https://www.ghrsst.org/files/download.php?m=documents&f=121207144549-GHRSSTXIIIProceedingsIssue1Rev0.pdf
2. Beggs H, Majewski, L., Griffin, C., Verein, R., Sakov, P., Huang, X., Garde, L., & Tingwell, C. (2013). Report to GHRSST14 from Australia - Bluelink and IMOS, *In: Proceedings of the GHRSST XIV Science Team Meeting*, Woods Hole, USA, 17 - 21 June 2013, p. 104-121. https://www.ghrsst.org/documents/q/category/ghrsst-science-team-meetings/ghrsst-xiv-woods-hole-ma-usa/
3. Clayson, C. A., & Bogdanoff, A. S. (2013). The Effect of Diurnal Sea Surface Temperature Warming on Climatological Air–Sea Fluxes. *Journal of Climate*, 26(8), 2546-2556. doi: 10.1175/jcli-d-12-00062.1
4. Karagali, I., & Høyer, J. L. (2014). Characterisation and quantification of regional diurnal SST cycles from SEVIRI. *Ocean Science Discussions*, 11(2), 1093-1128. doi: 10.5194/osd-11-1093-2014
5. Zhang, H., Beggs, H., Majewski, L., Wang, H., & Kiss. A. (2015), Investigating Sea Surface Temperature Diurnal Variation over the Tropical Warm Pool Using MTSAT-1R Data. *Remote Sensing of Environment* (*submitted*)

Thank you!

Question?