APEC Climate Symposium 2011

A Long, Consistent

Marine Surface Wind Dataset

for Climate Change Analysis

– Application over **Tropical Indo-Pacific** –

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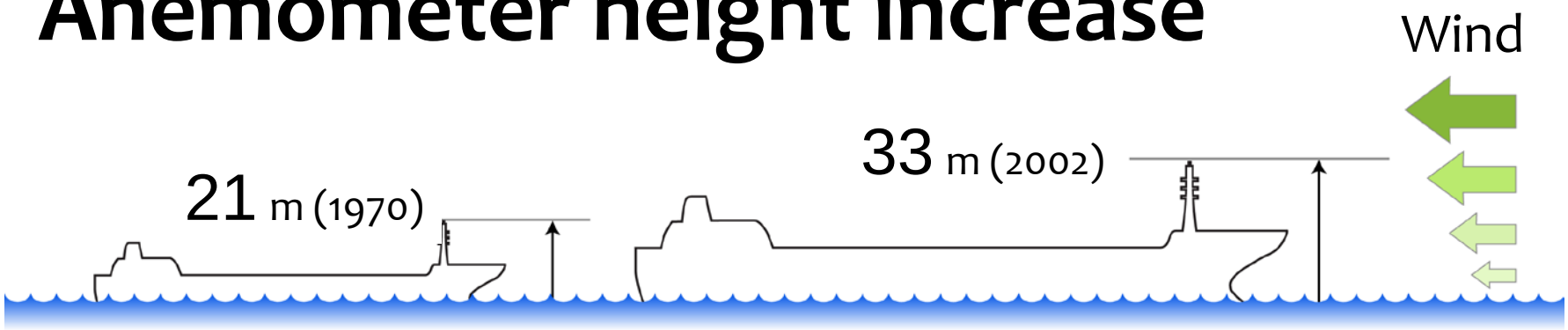
Marine Surface Wind

- Sea surface temperature
- Ocean circulation
- Sea level height
- Atmospheric convection… etc.

Long-term wind changes are still not clear…

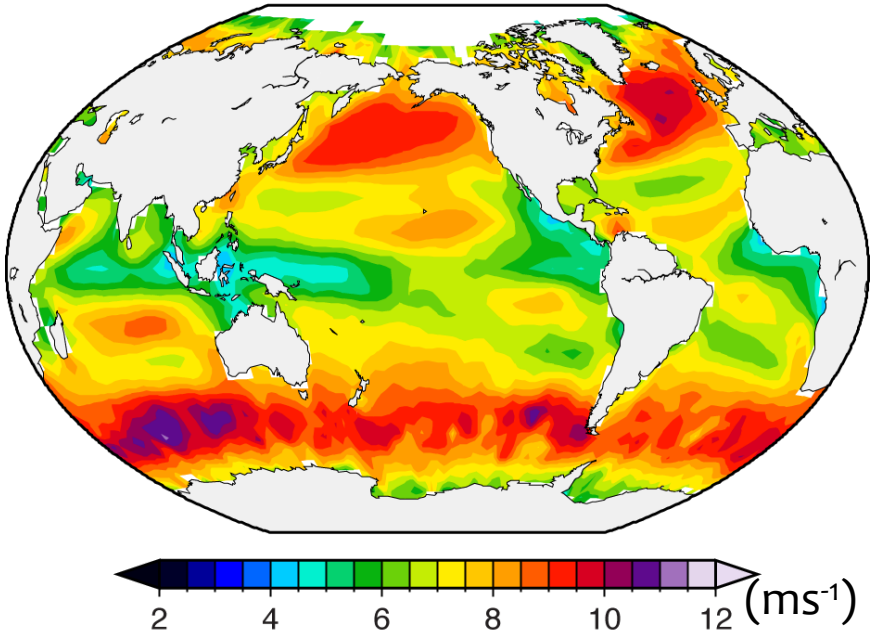
Wind bias due to Anemometer height increase



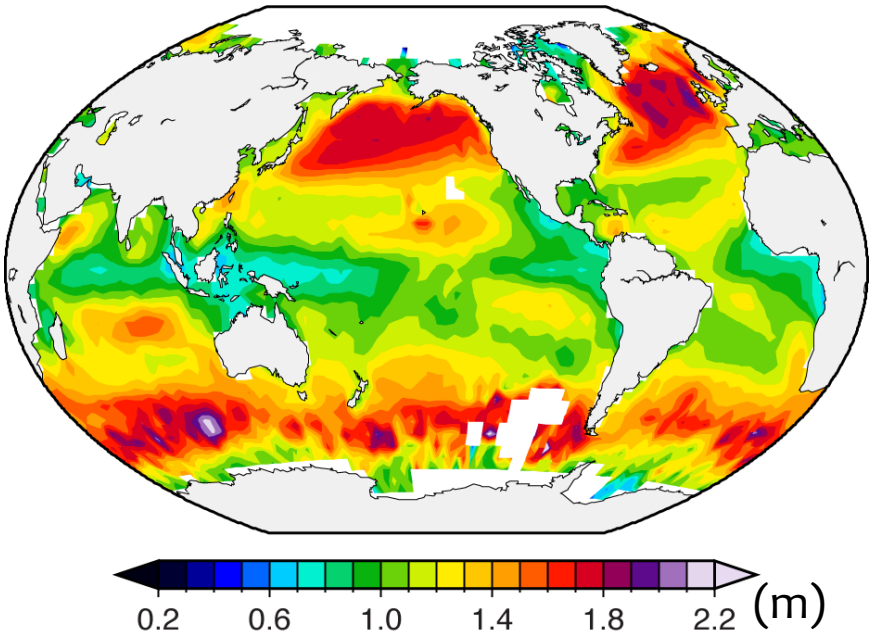
Increase in ship size

Wind estimate from wind-wave height

Scalar wind



Wind-wave height



$$(10\text{m wind speed}) = a \bullet (\text{Wind-wave height})^{b} + c$$

$$b \sim 0.5$$

WASWind **W**ave and **A**nemometer-based **S**ea-surface **Wind**

- 4° x 4° longitude-latitude grid
- Monthly means for 1950 – 2009
- Scalar & vector winds
- Wind stress

Tokinaga, H. & S.-P. Xie 2011:

***J. Climate*, 24, 267-285 (January issue)**

http://iprc.soest.hawaii.edu/users/tokinaga/waswind.html

Application for

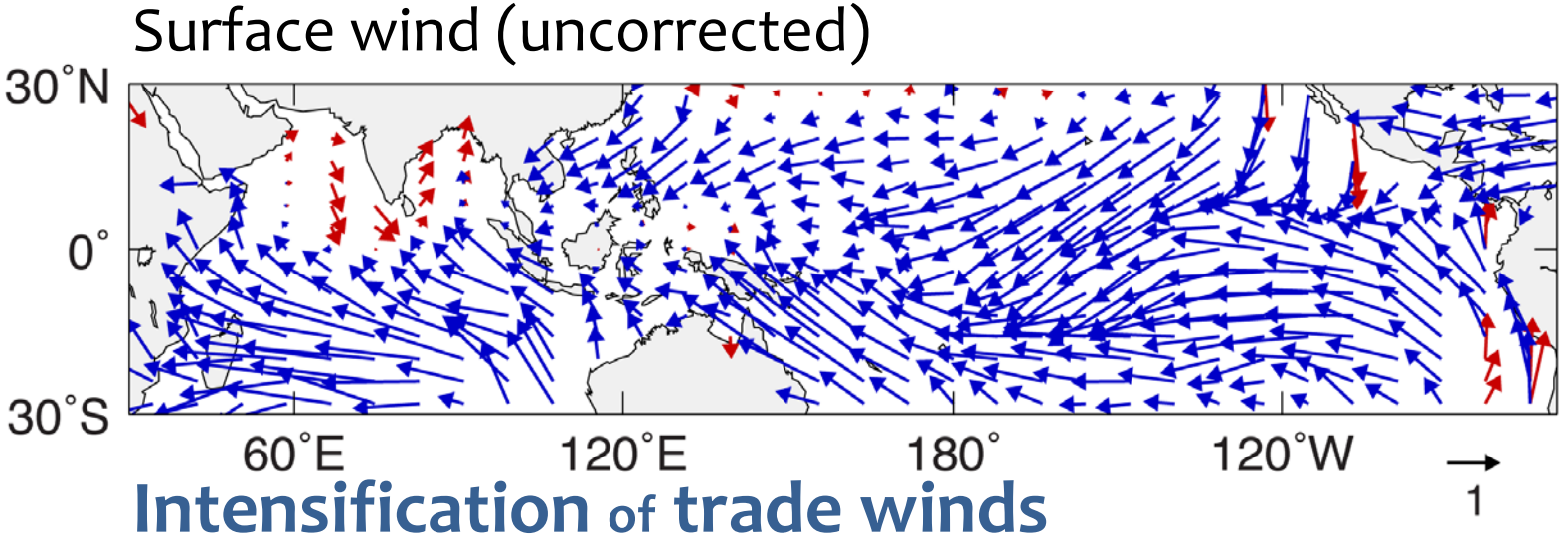
Tropical Indo-Pacific Climate Change

over the last 60 years

- **Surface wind changes** associated with Walker Circulation change
- Physical consistency with changes in **total cloudiness, SLP, precipitation, ocean subsurface temperature**
- In-situ observations from **ships** & **land stations**

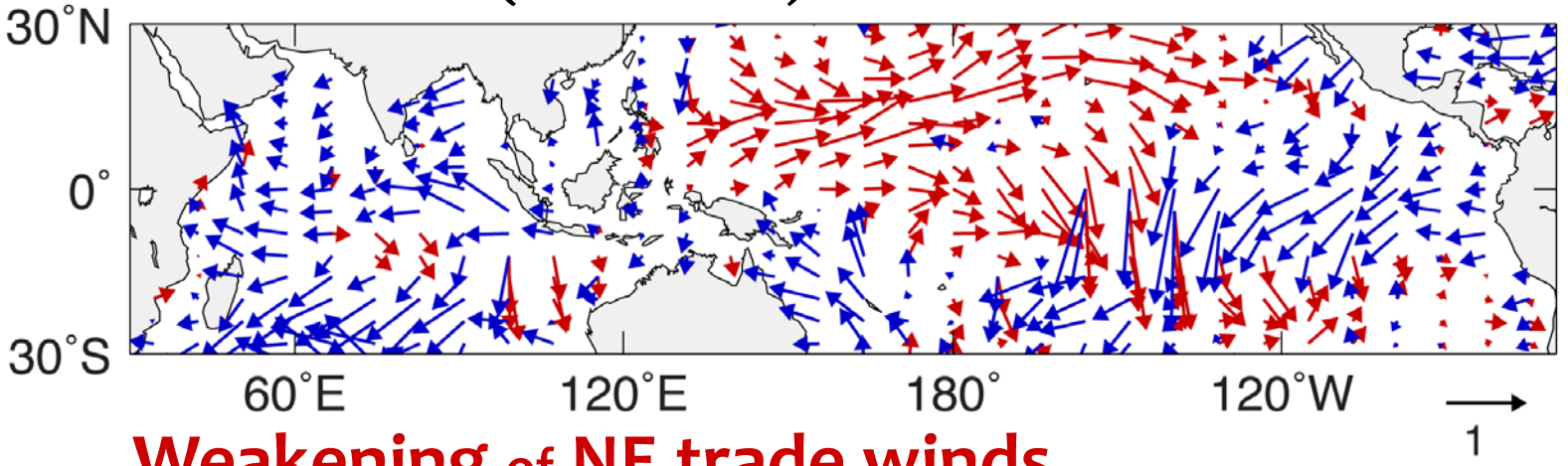
Tokinaga, H., S.-P. Xie, A. Timmermann, S. McGregor, T. Ogata, H. Kubota, & Y. M. Okumura, 2011: ***J. Climate,*** in press

Annual mean trend (1950–2009)



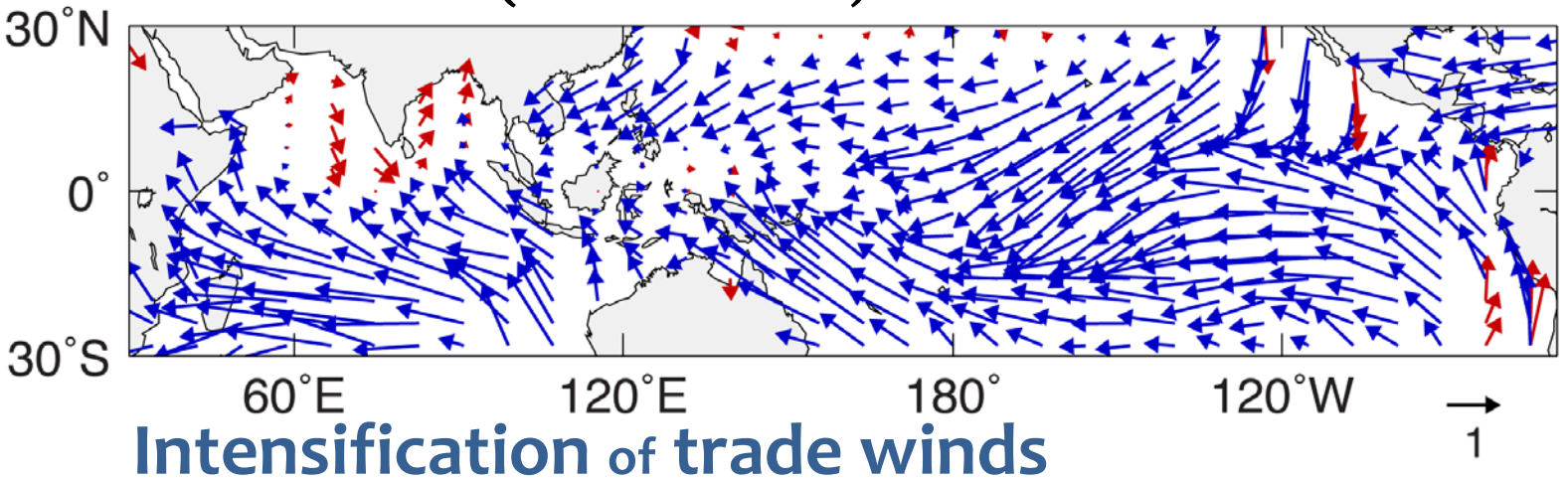
Annual mean trend (1950–2009)

Surface wind (WASWind)



Weakening of NE trade winds

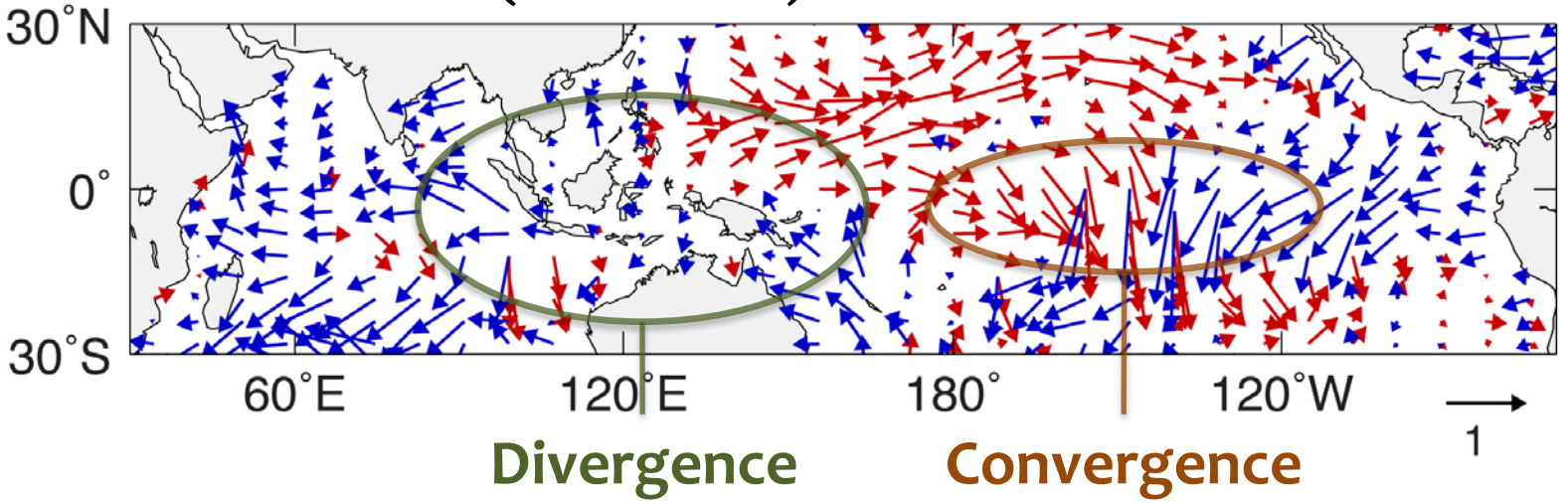
Surface wind (uncorrected)



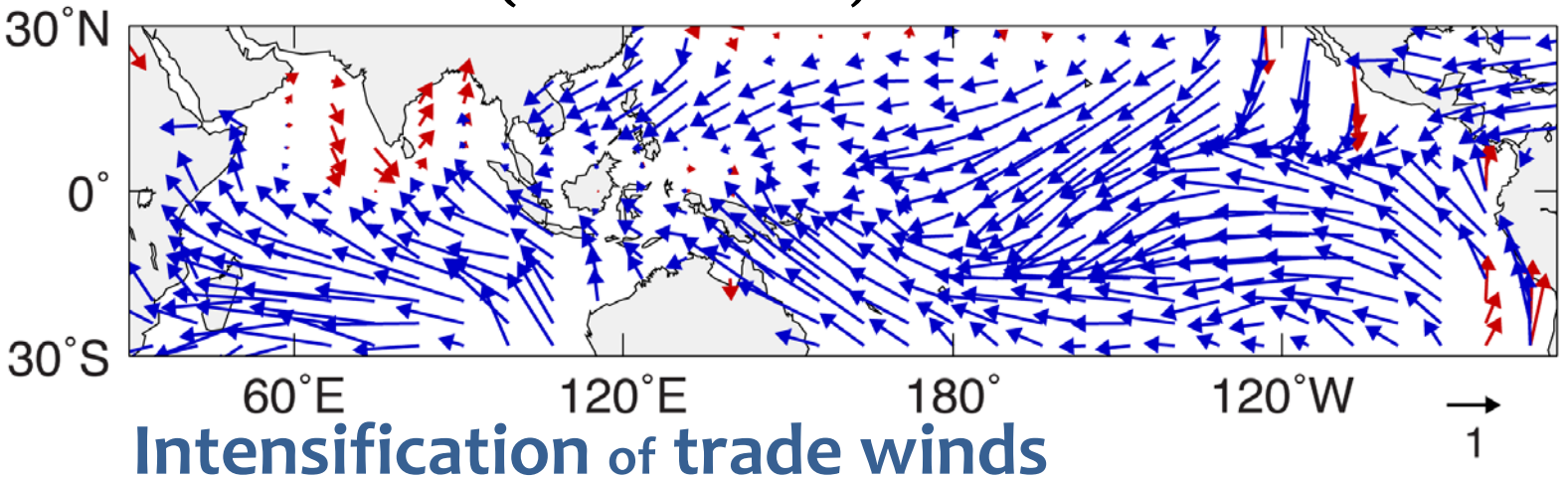
Intensification of trade winds

Annual mean trend (1950–2009)

Surface wind (WASWind)



Surface wind (uncorrected)



Intensification of trade winds

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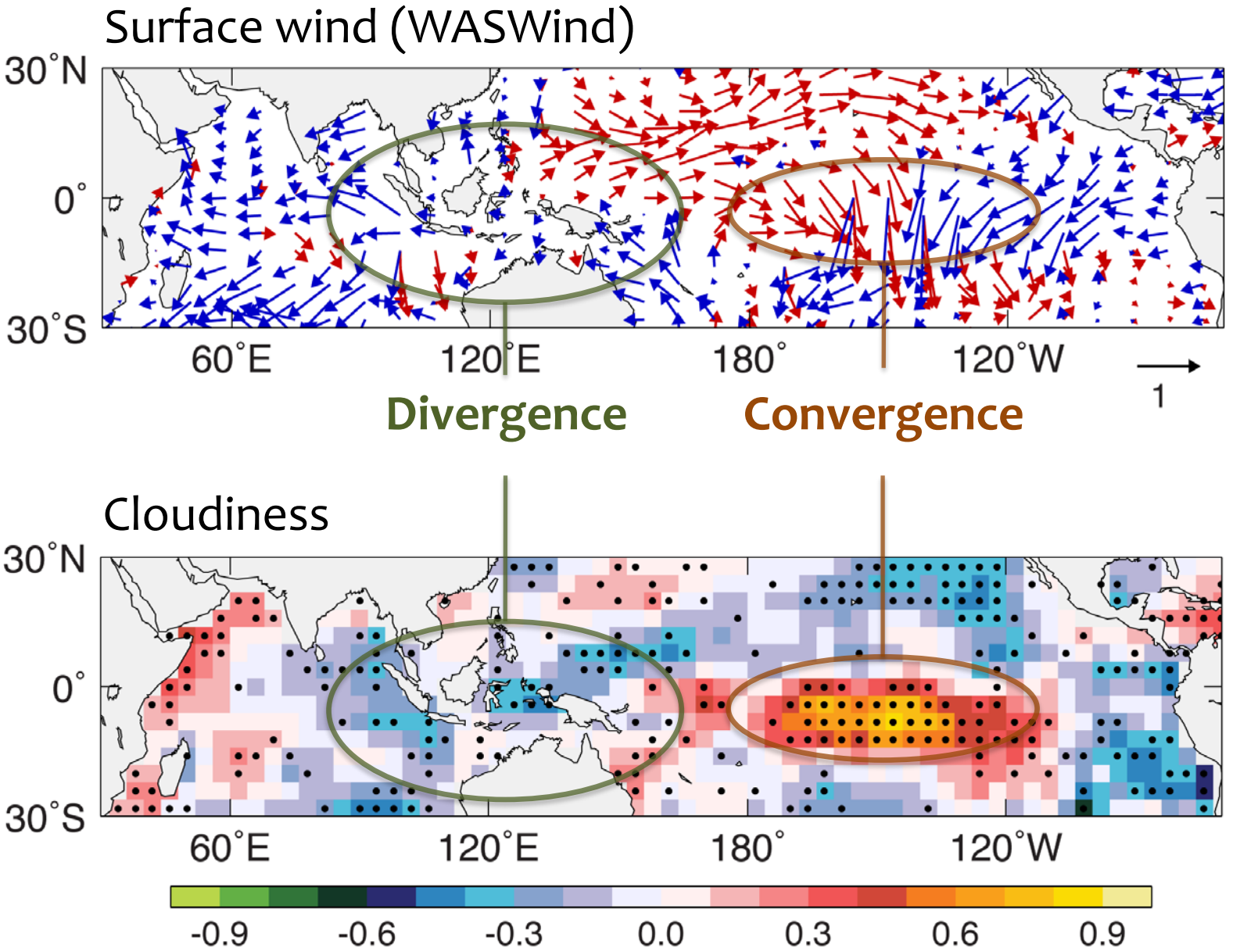

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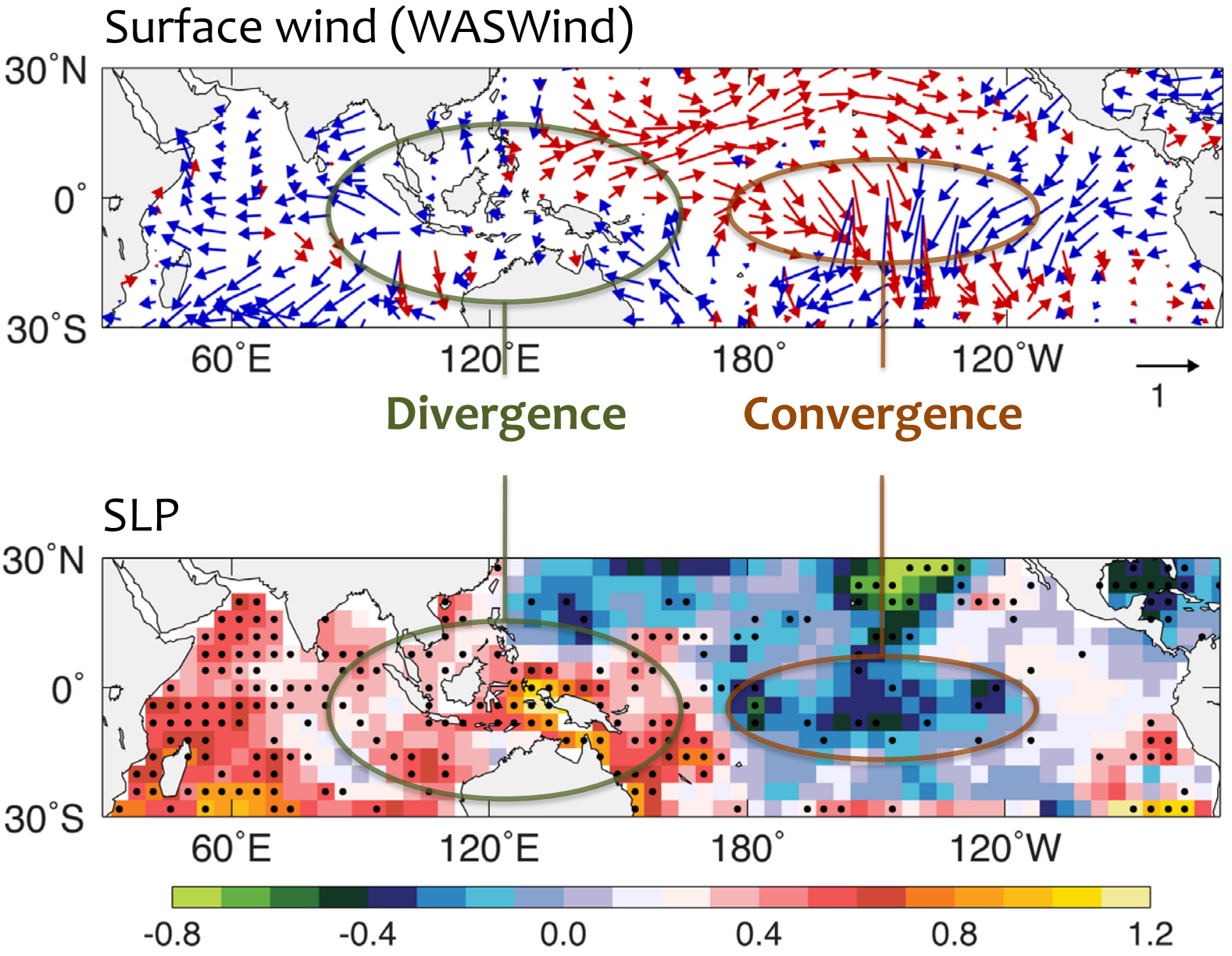
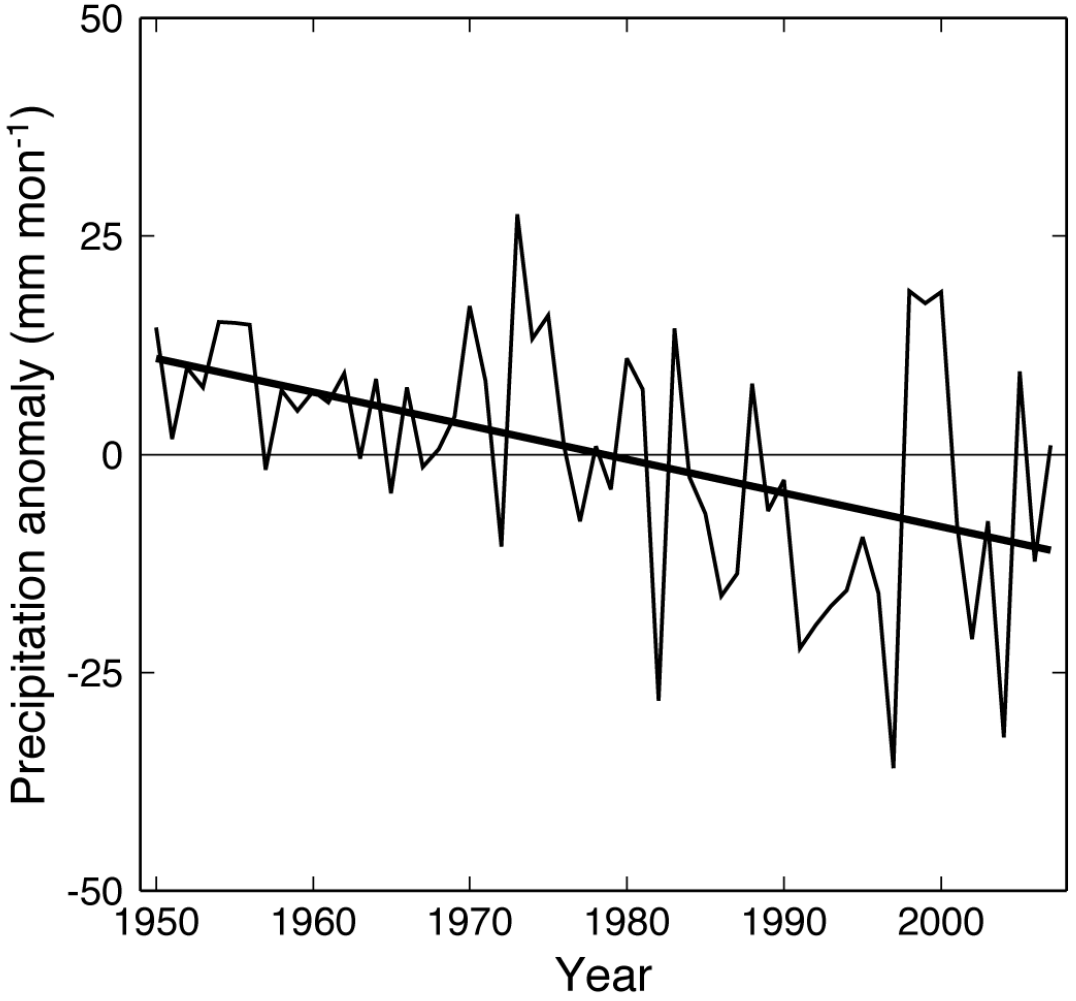
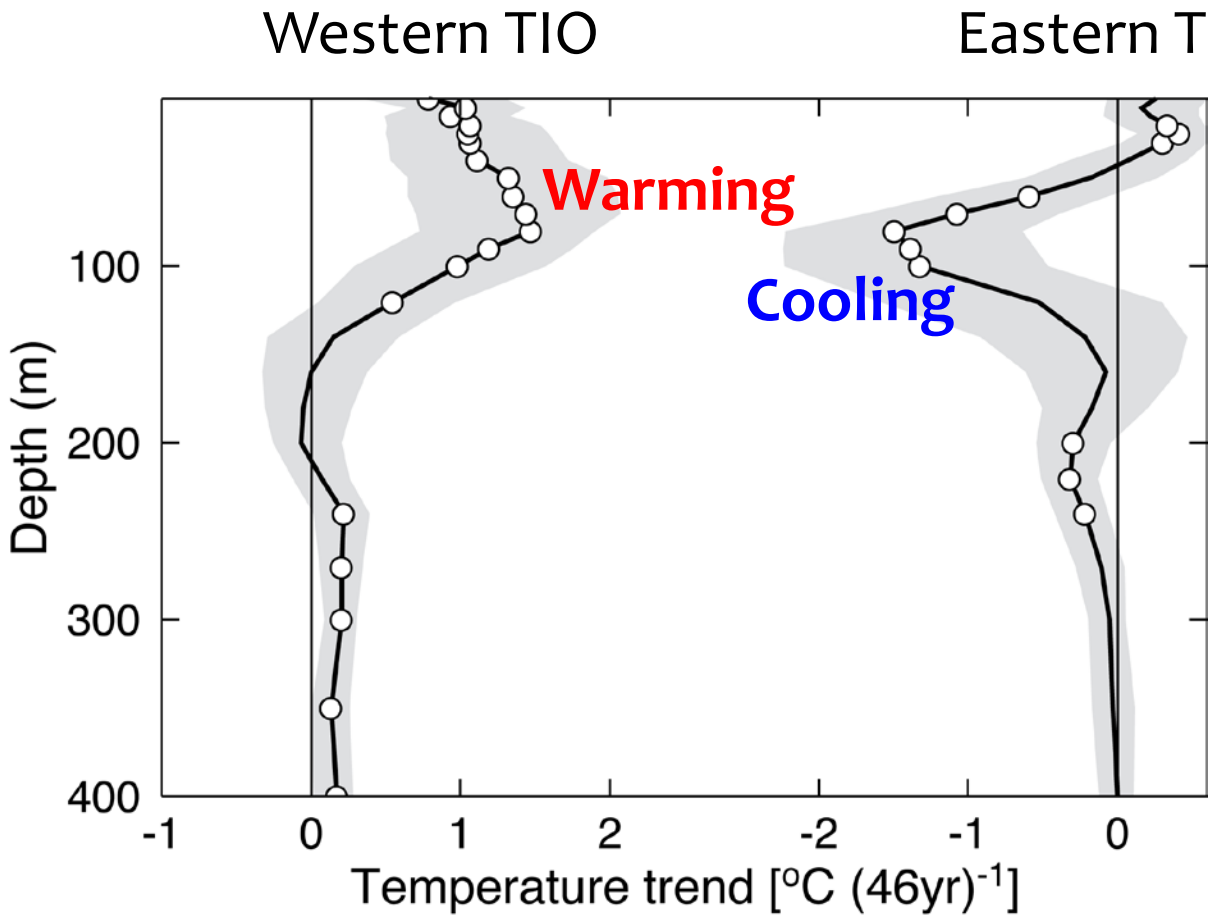


Precipitation trend over the Maritime Continent



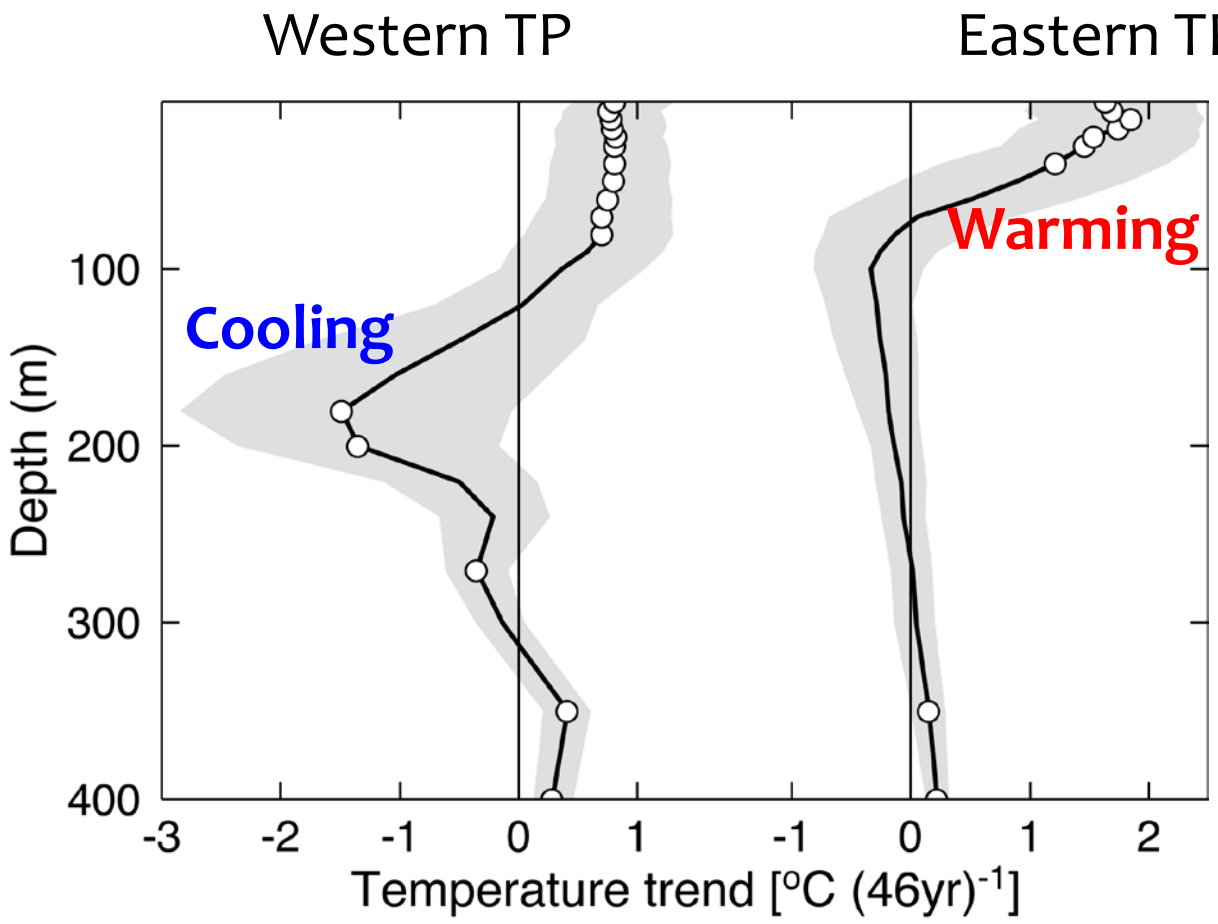
Subsurface ocean temp. trend

~**Tropical Indian Ocean**: Bias-corrected XBT, 1963–2009~



Subsurface ocean temp. trend

~**Tropical Pacific**: Bias-corrected XBT, 1963–2009~

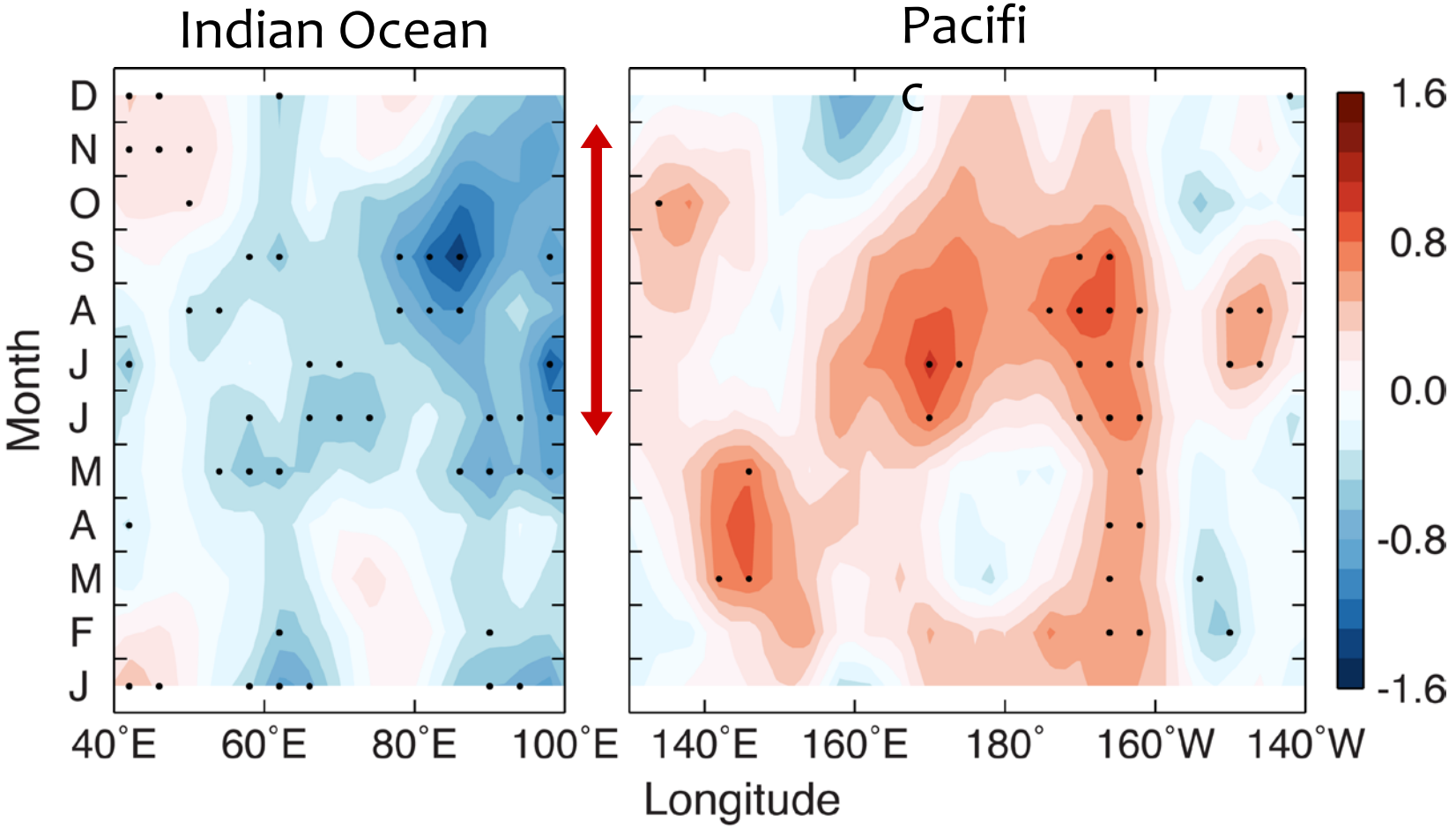


Summary

- A new surface wind product, **WASWind**, was constructed for climate change analysis
- WASWind indicates an **eastward shift** of the **Walker Circulation**.
- Patterns of surface wind change are **consistent** with those of **cloudiness**, **SLP**, **precipitation** and **subsurface ocean temperature**.
- It is still challenging to obtain realistic SST trend patterns due to observational biases.

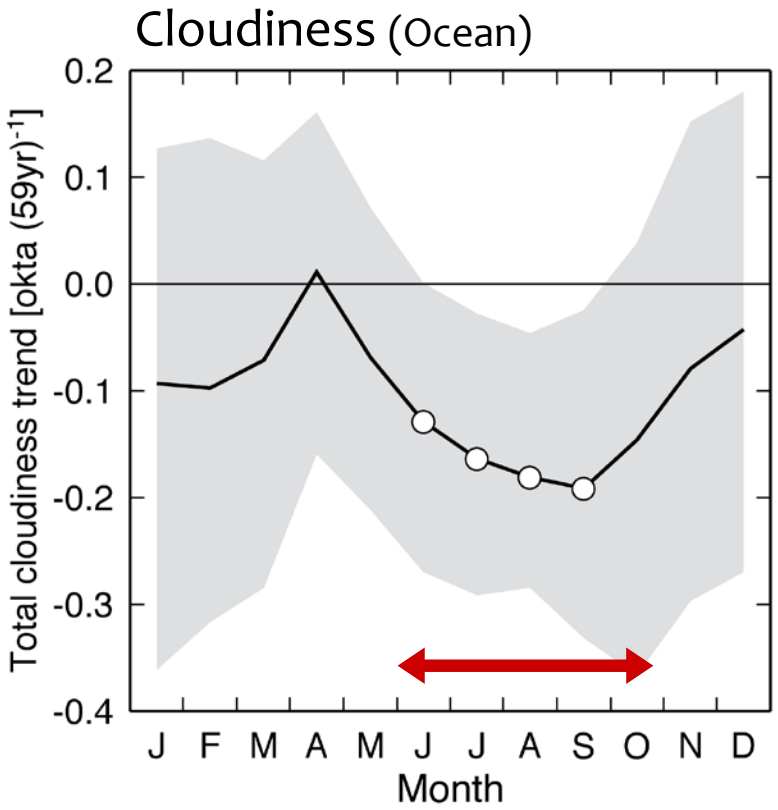
Equatorial zonal wind trend

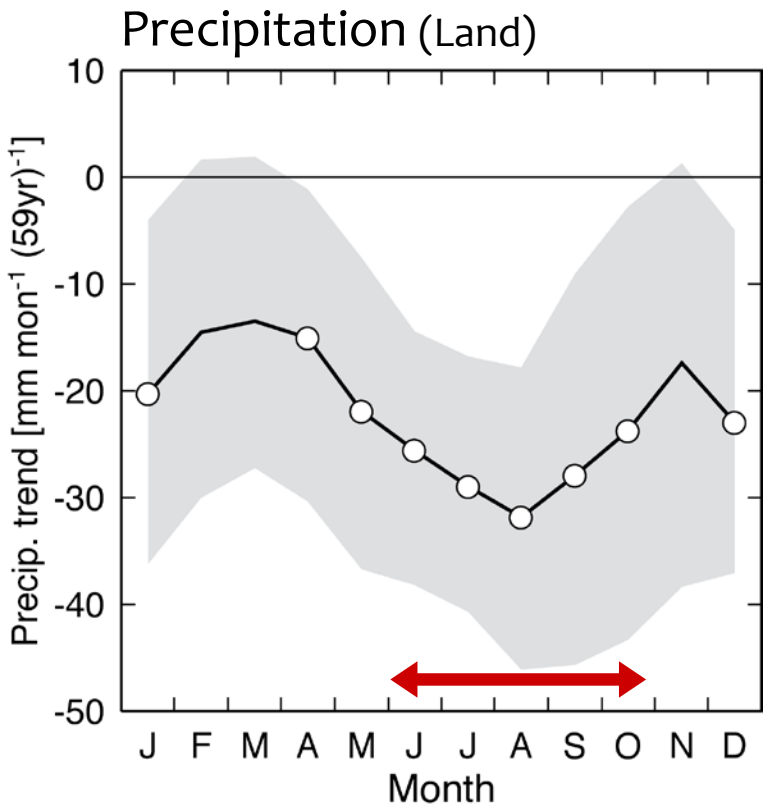
(4°S–4°N, 1950–2009)



Cloud & Precip. trends over Maritime Continent

(80°-150°E, 20°S-20°N, 1950–2009)



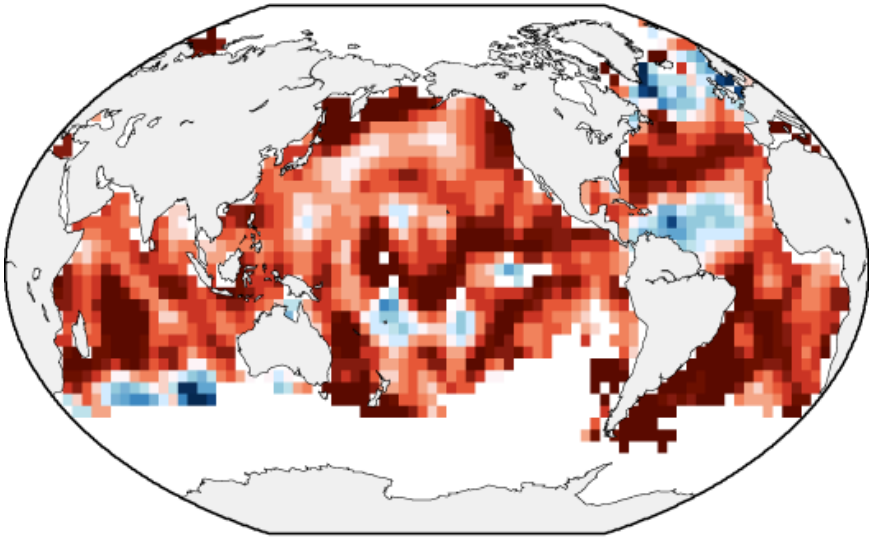


Consistent with **surface divergence trend**

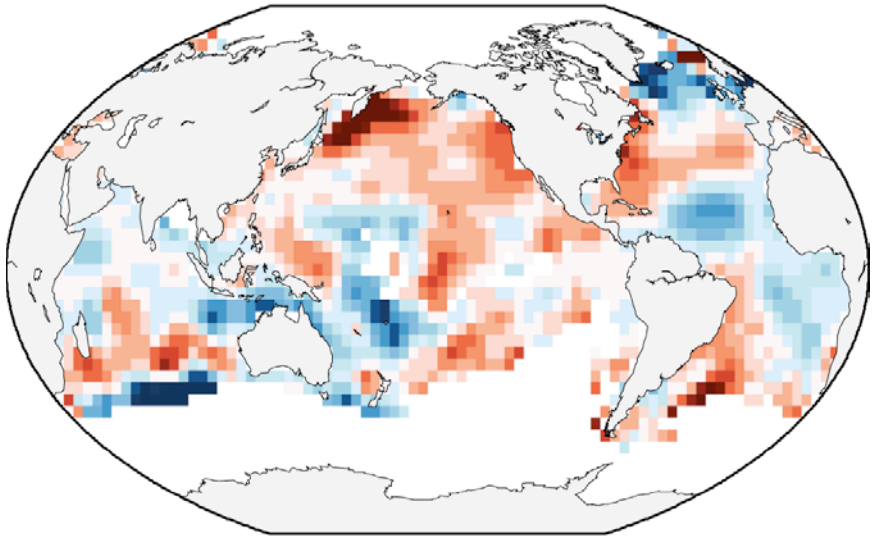
Comparison of wind trend patterns

for recent 20 years

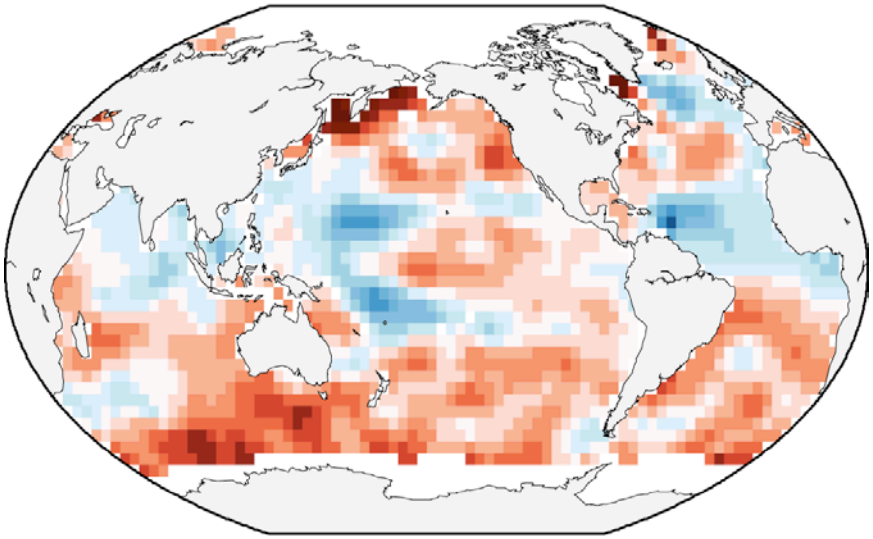
Uncorrected ship



WASWind



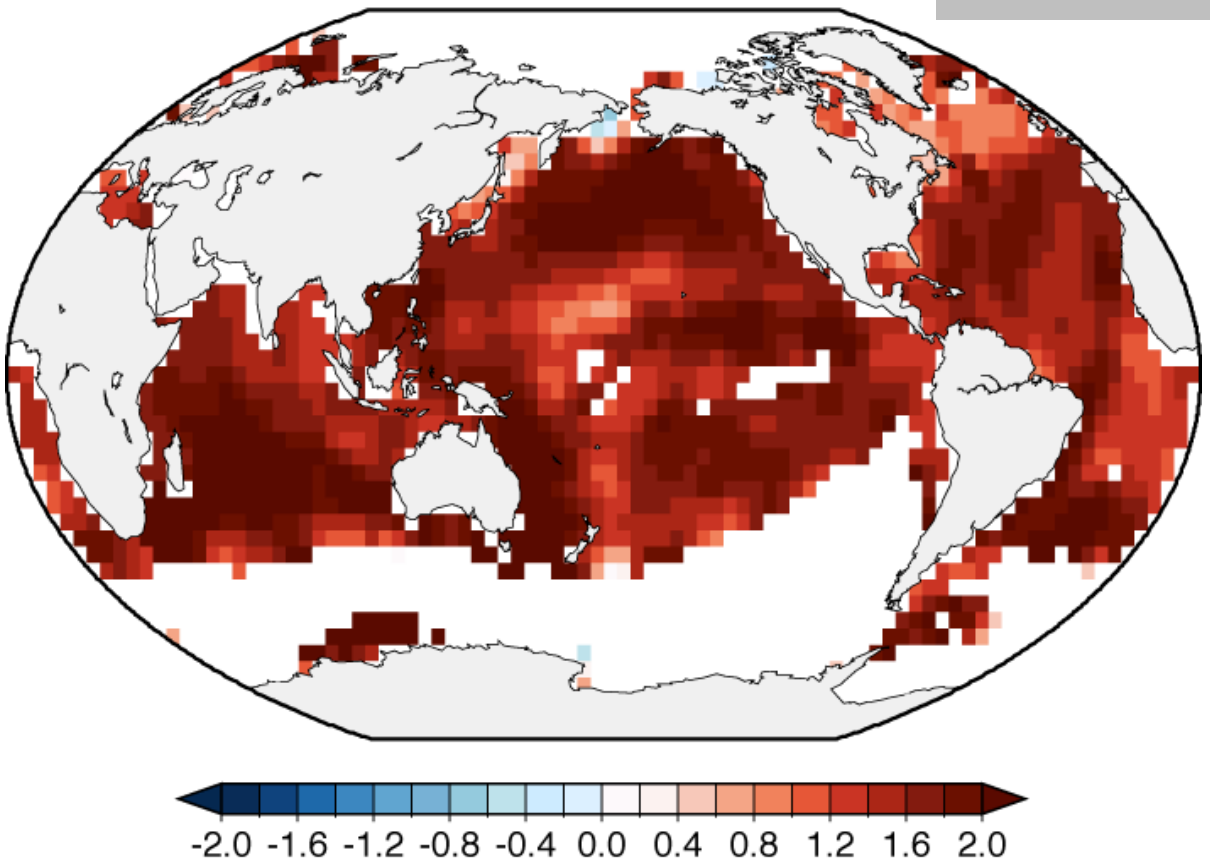
SSM/I satellite



Upward wind trends?

Scalar wind trend
(Ships, 1950-2008)

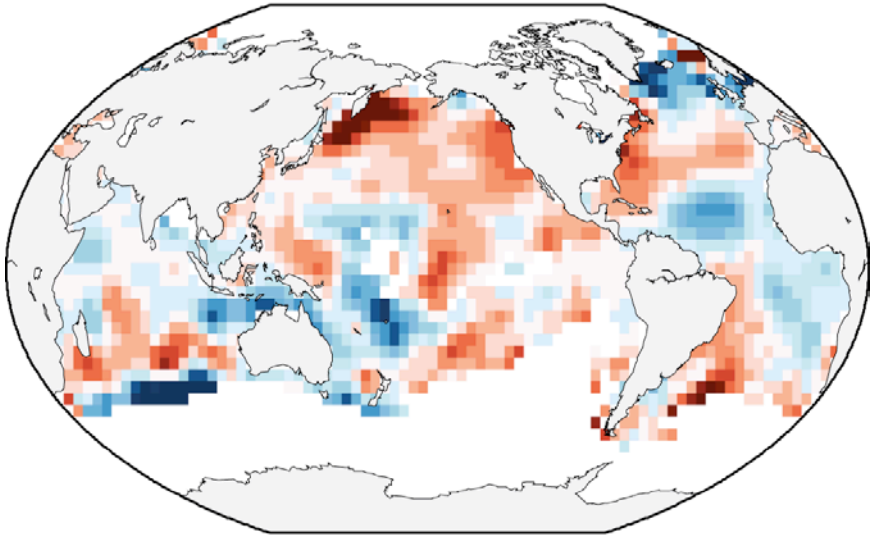
+1.8 ms^{-1}/ 59yr



WASWind

Wave and **A**nemometer-based **S**ea-surface **Wind**

WASWind



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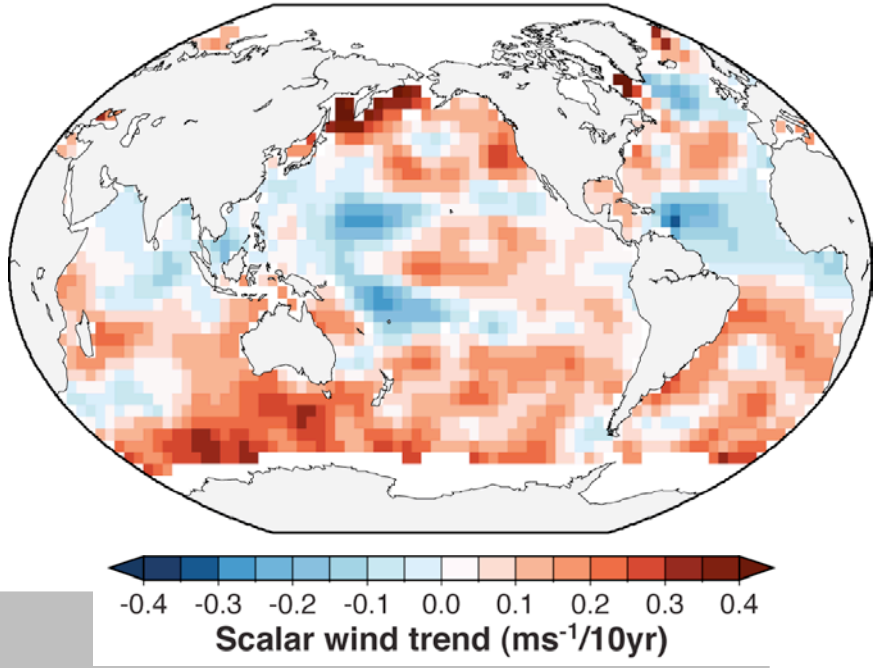

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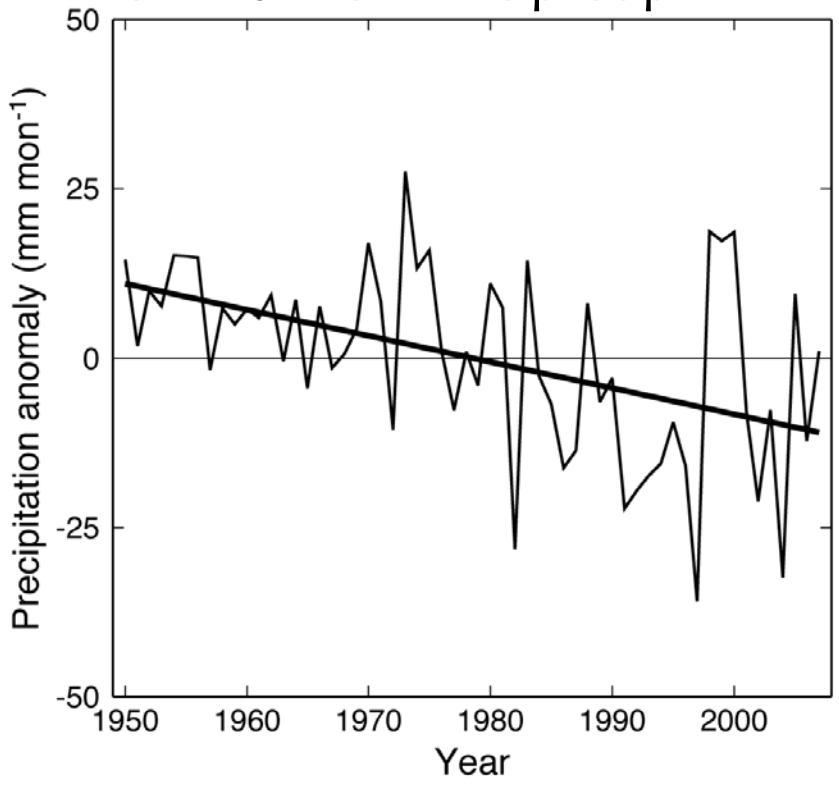
Precipitation trend over the Maritime Continent

Univ. of Delaware precip.



ASEAN rain-gauge