A Long, Consistent
Marine Surface Wind Dataset
for Climate Change Analysis
– Application over **Tropical Indo-Pacific** –

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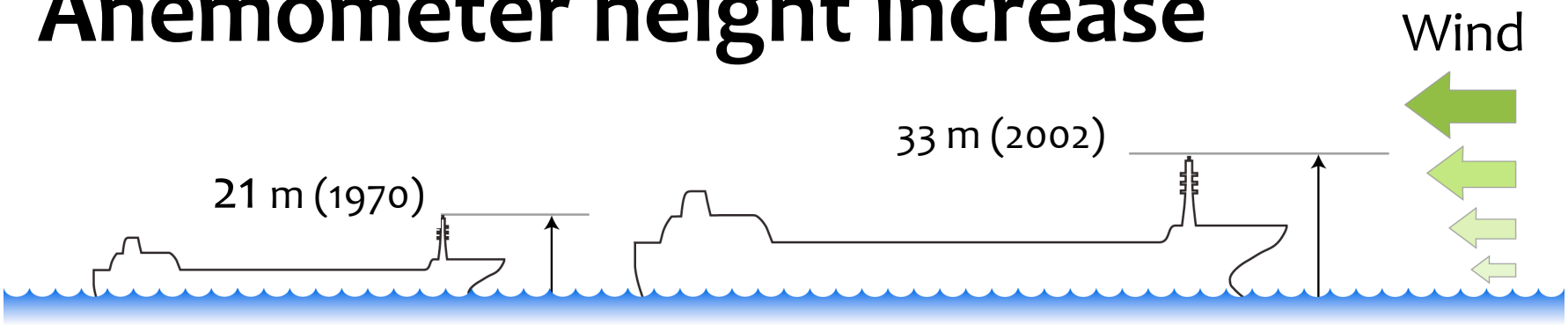
Marine Surface Wind

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

Long-term wind changes are important. But…
Surface wind datasets for climate change research are lacking…

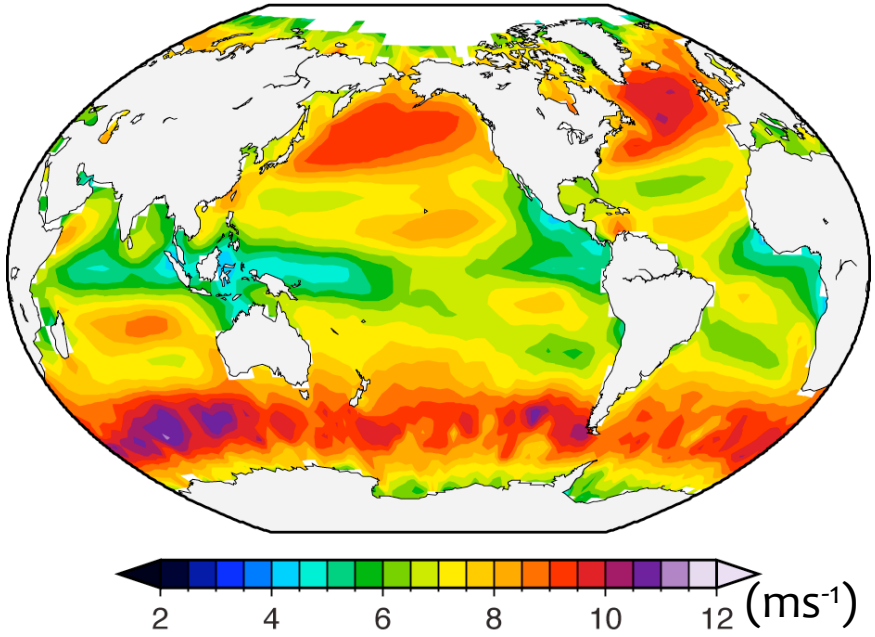
Wind bias due to Anemometer height increase



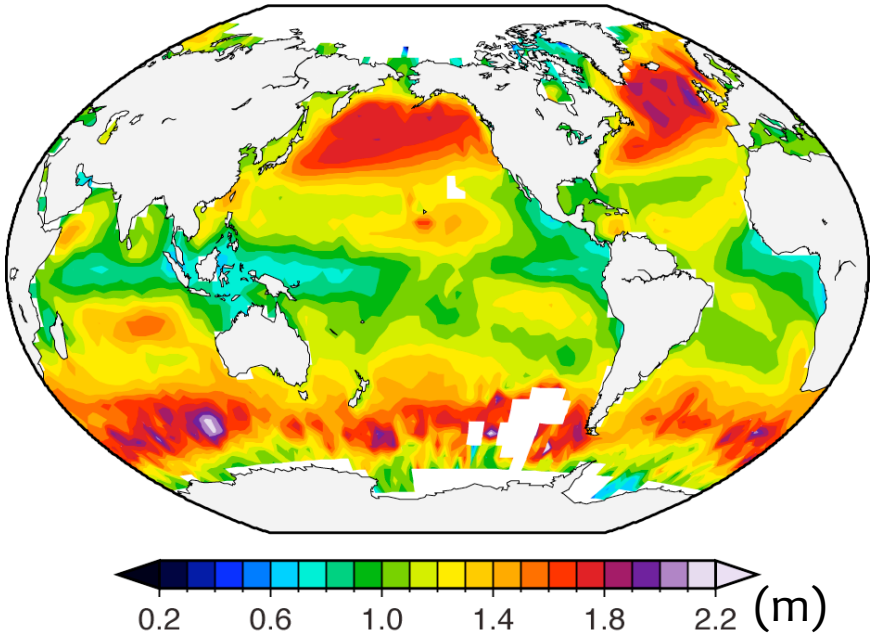
Increase in ship size

Wind estimate from wind-wave height

Scalar wind



Wind-wave height



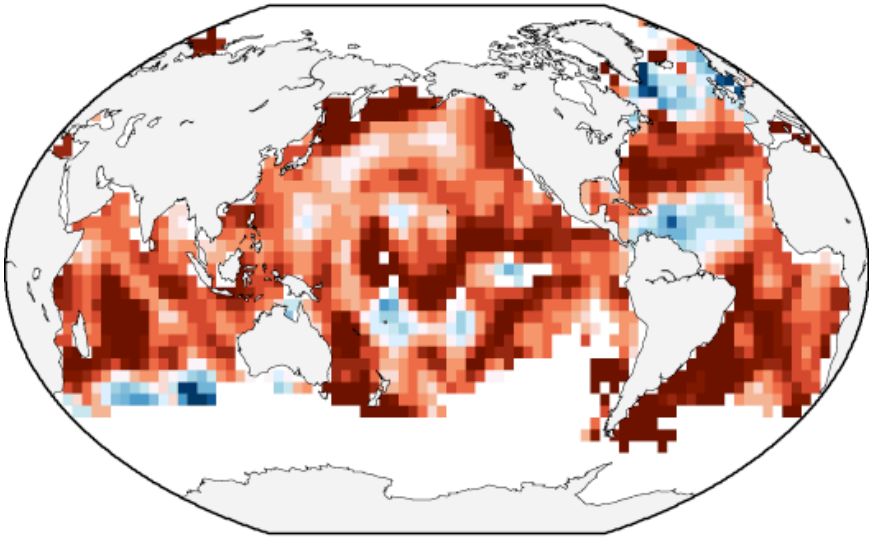
$$(10\text{m wind speed}) = a \bullet (\text{Wind-wave height})^{b} + c$$

$b \sim 0.5$

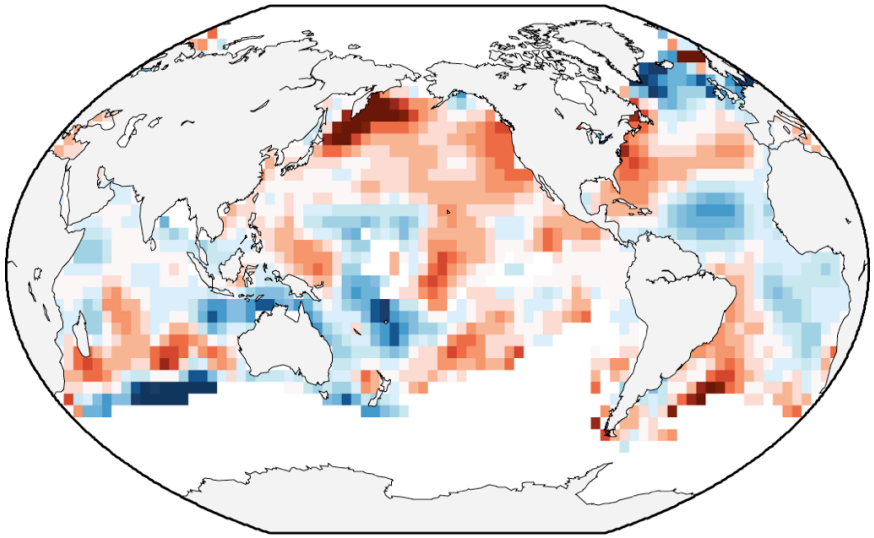
Comparison of wind trend patterns

for recent 20 years

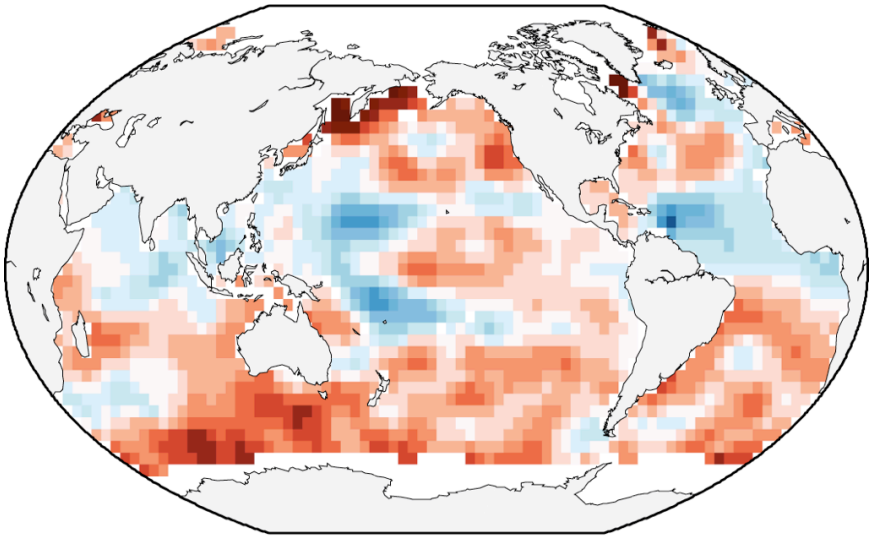
Ship (Uncorrected)



WASWind



Satellite (SSM/I)



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

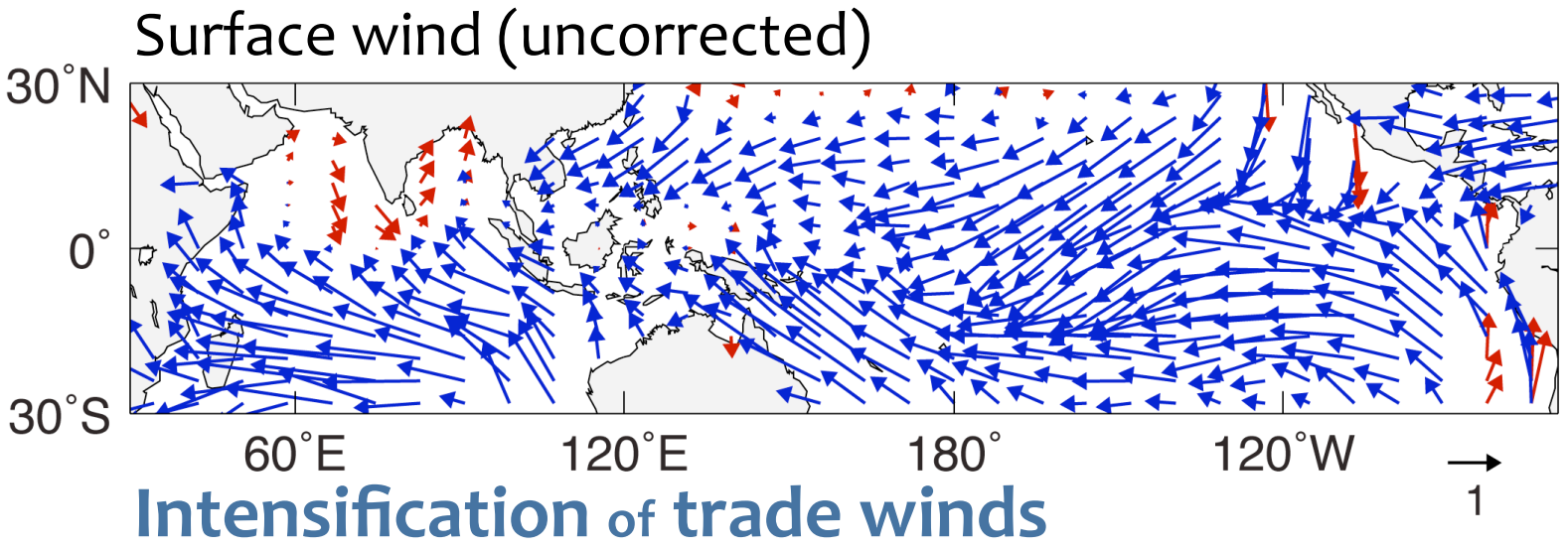
Tropical Indo-Pacific Climate Change

over the past 60 years

- **Surface wind changes** associated with Walker Circulation change
- Physical consistency with changes in **SLP, total cloudiness, 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

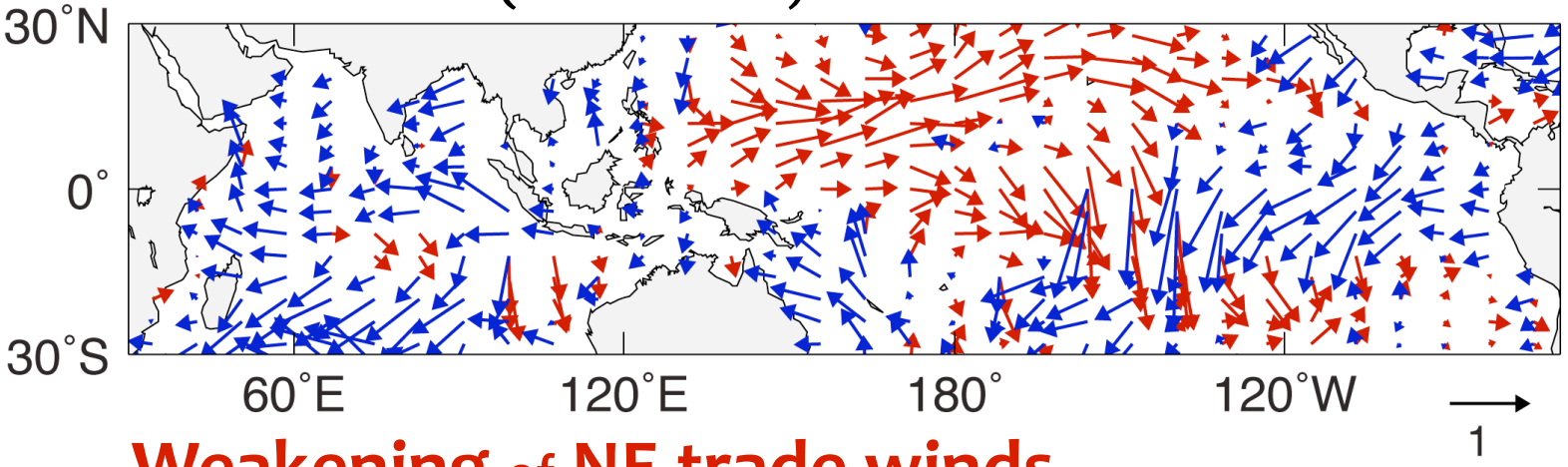
Annual mean trend (1950–2009)



Results

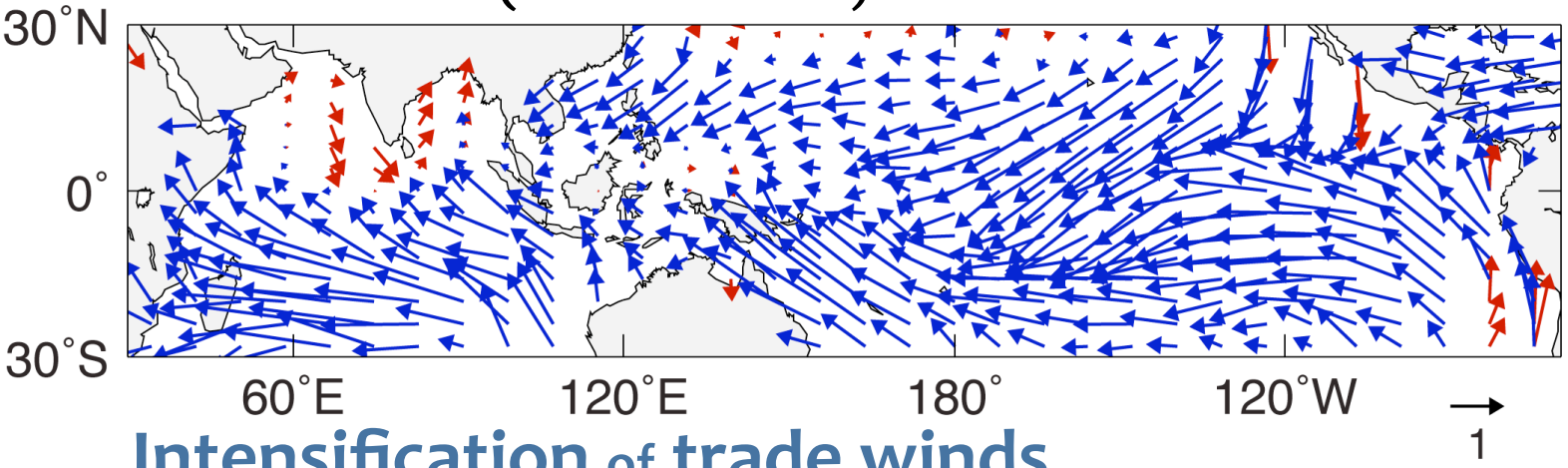
Annual mean trend (1950–2009)

Surface wind (WASWind)



Weakening of NE trade winds

Surface wind (uncorrected)

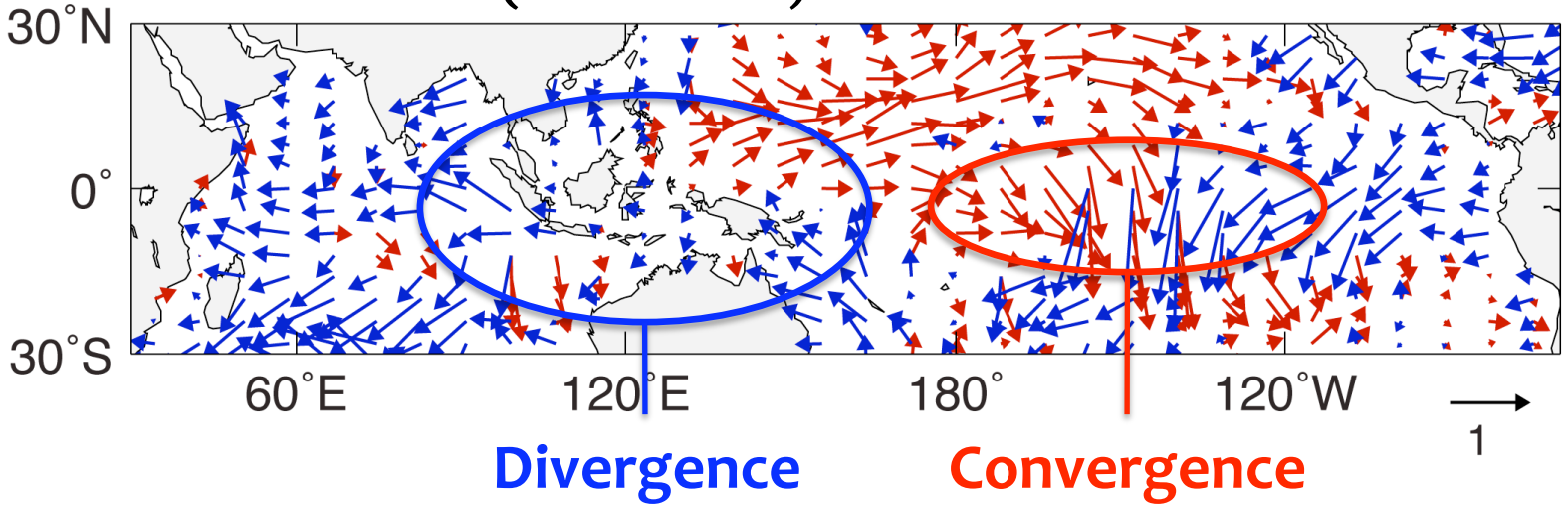


Intensification of trade winds

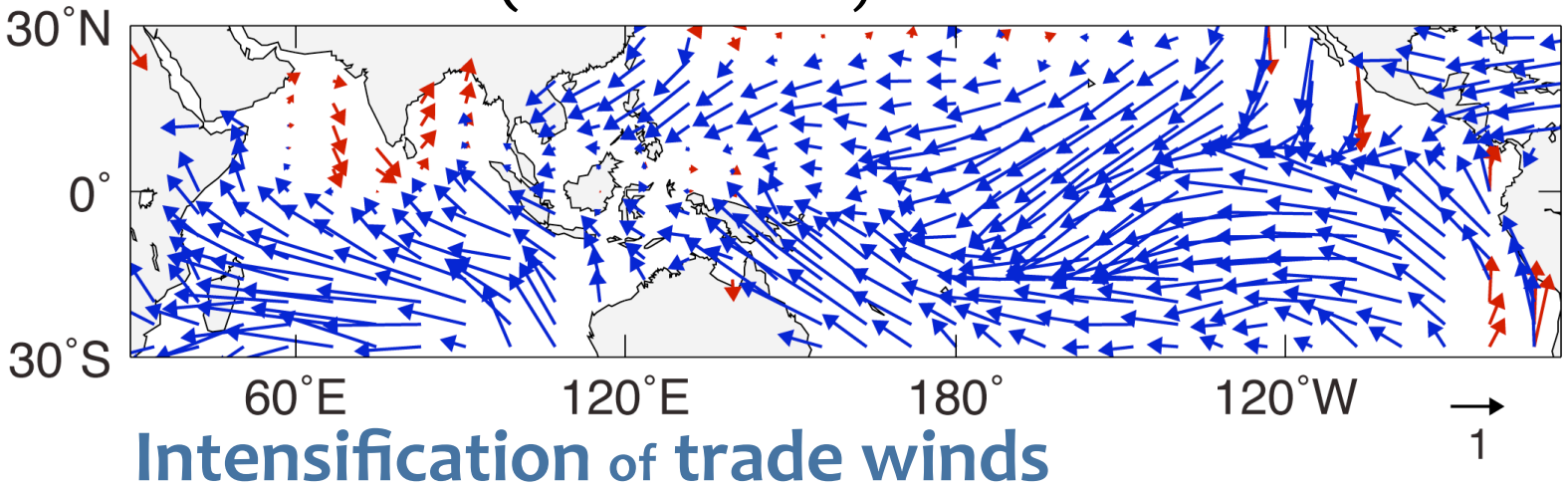
Results

Annual mean trend (1950–2009)

Surface wind (WASWind)



Surface wind (uncorrected)



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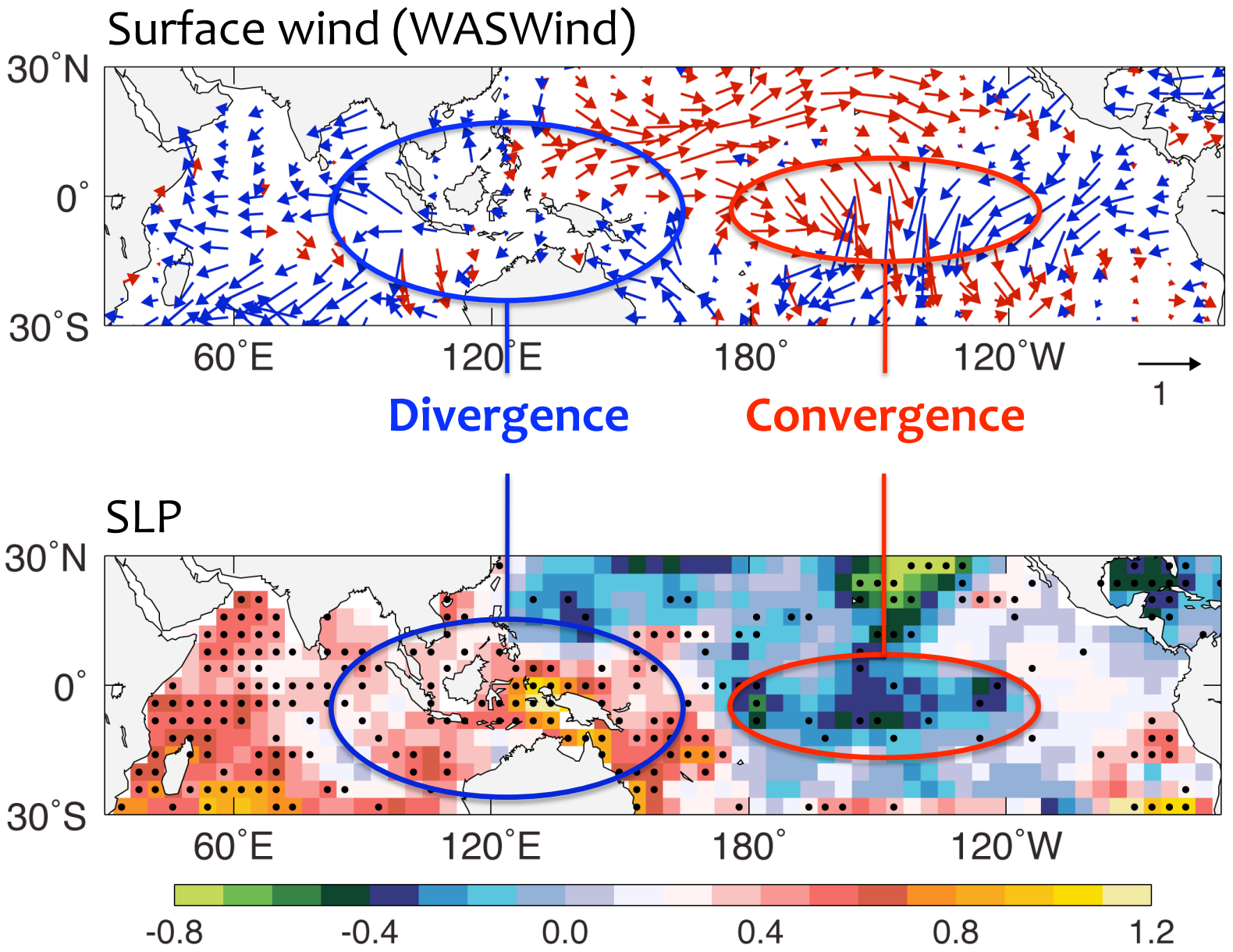

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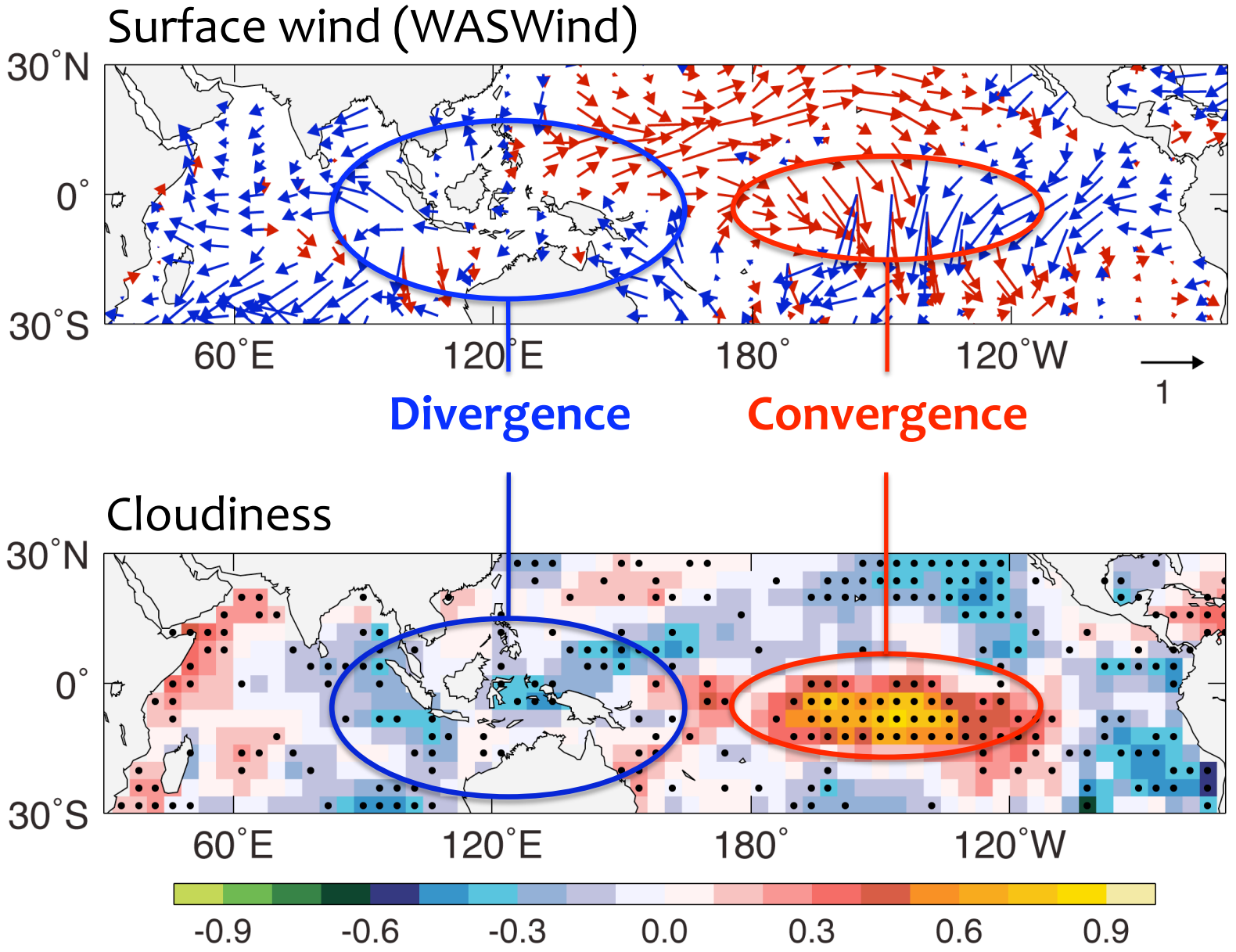

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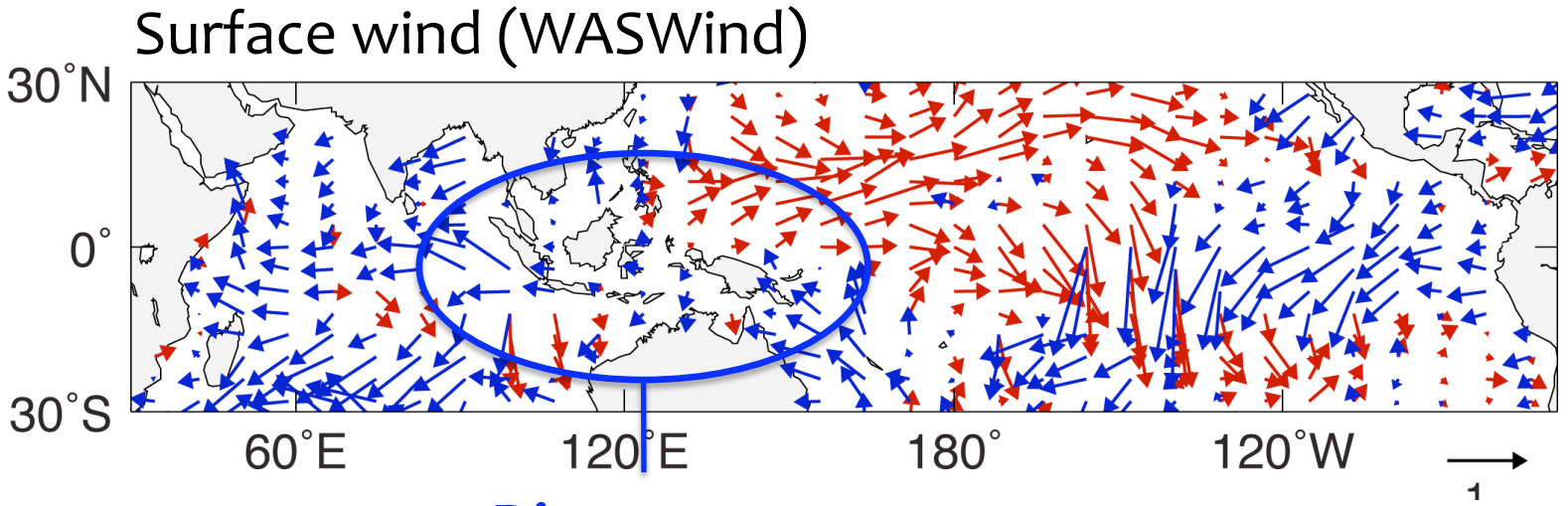
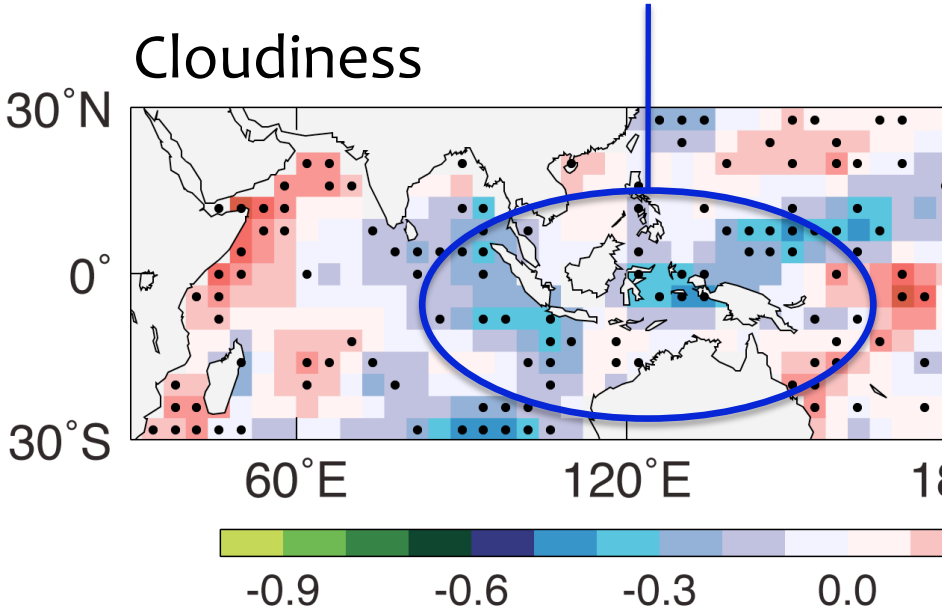
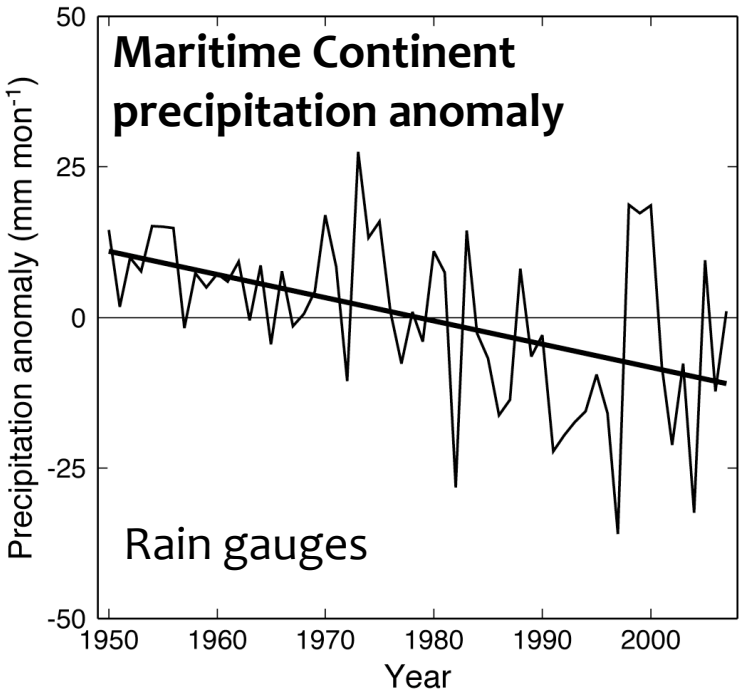


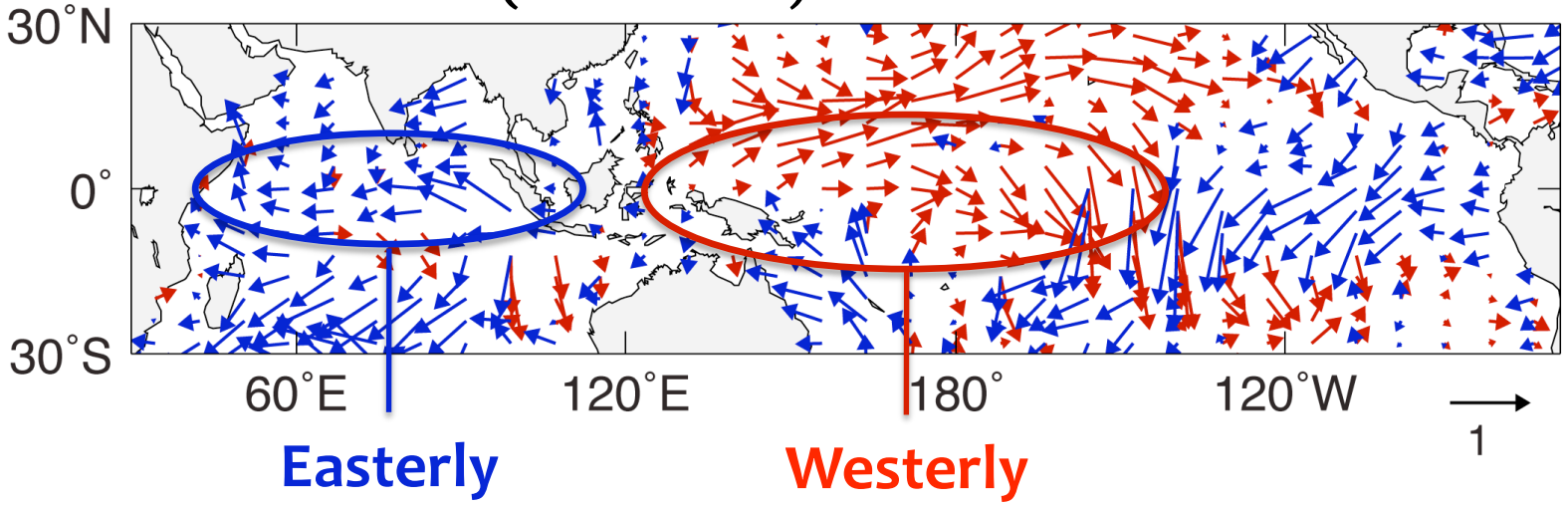
Divergence



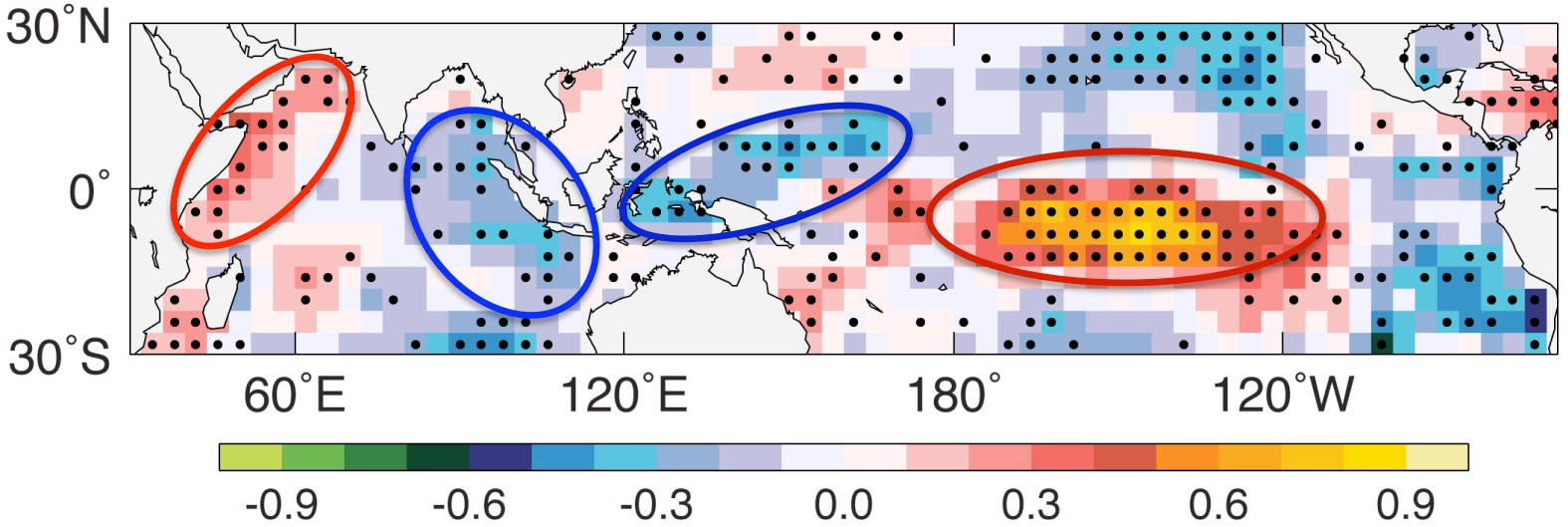


Annual mean trend (1950–2009)

Surface wind (WASWind)



Cloudiness



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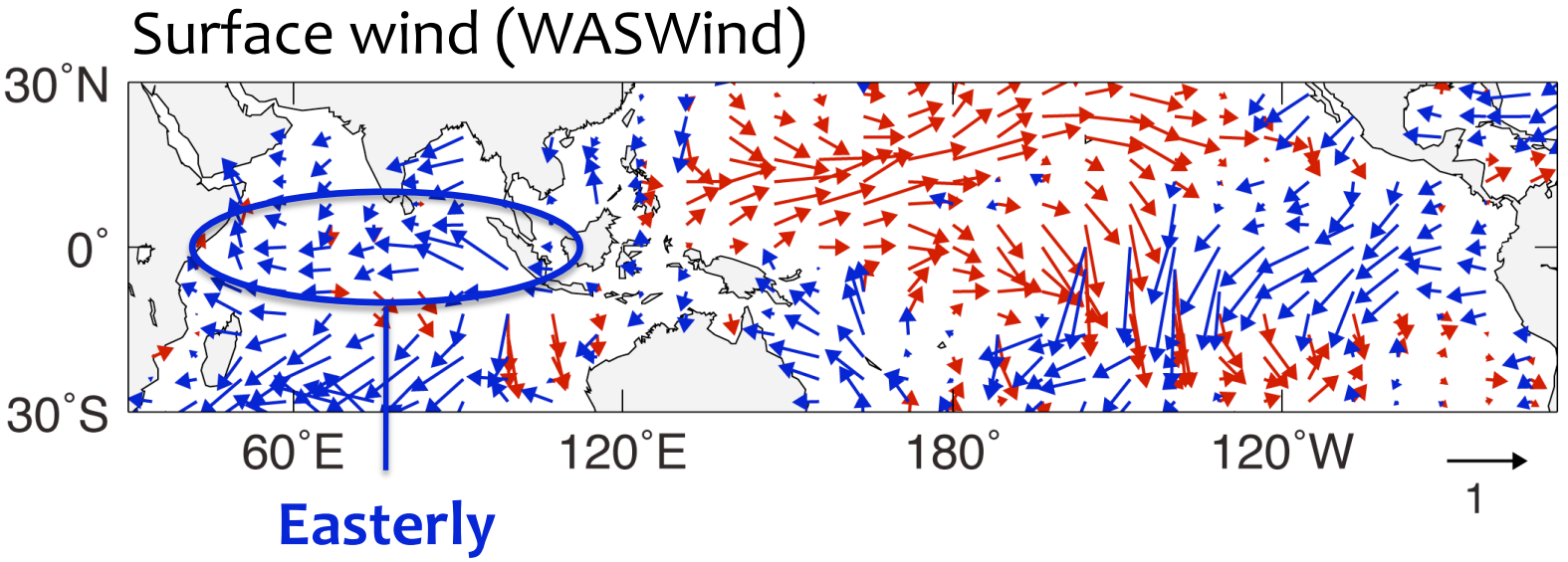
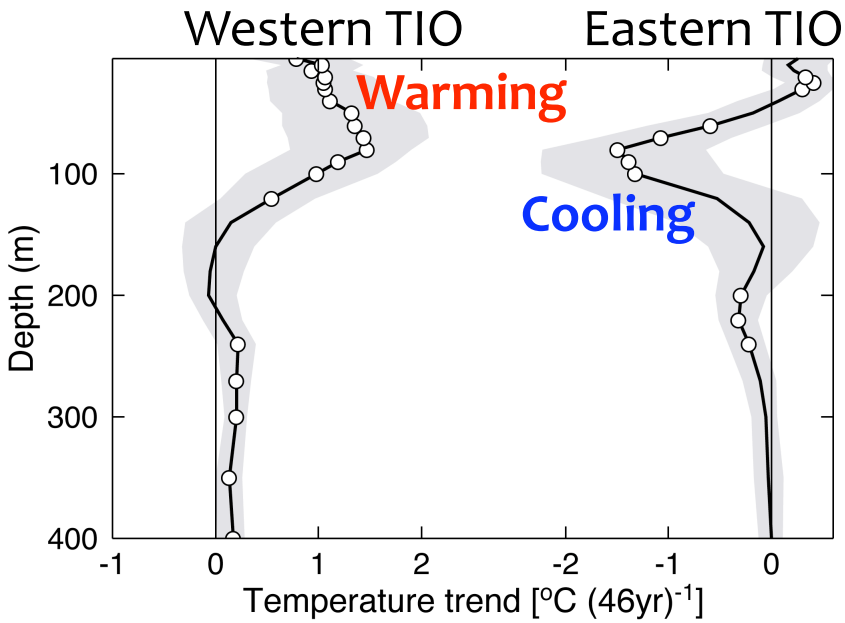


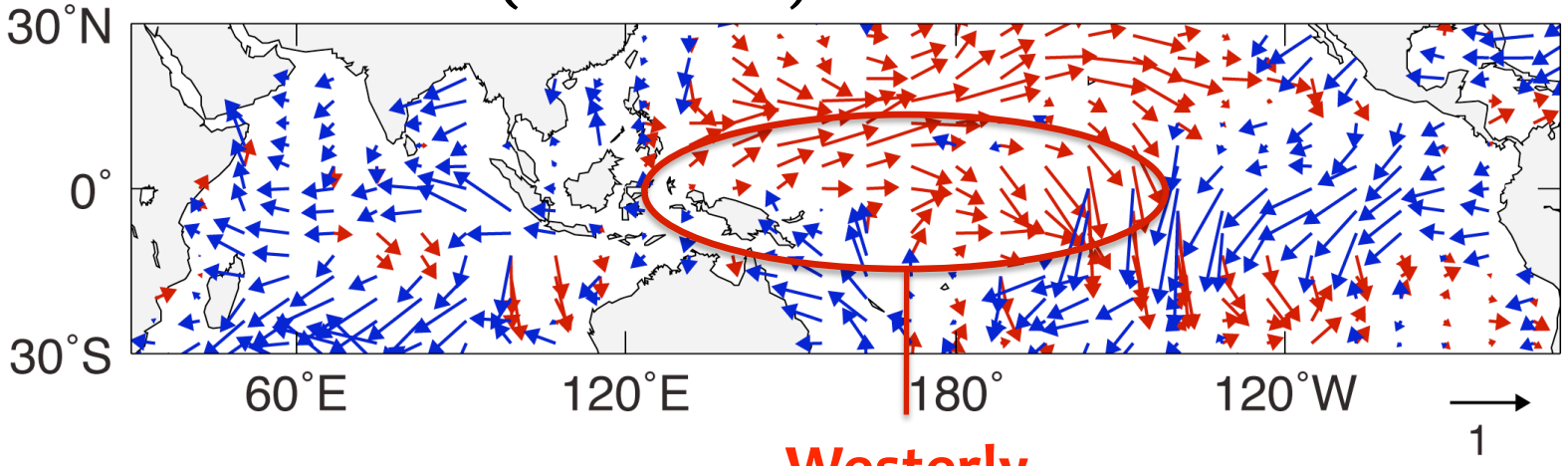


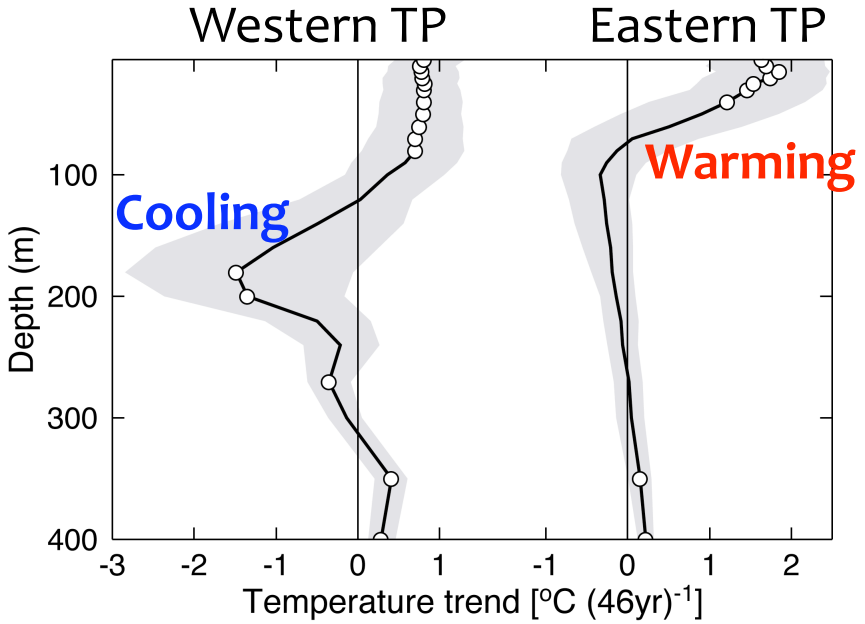
Subsurface temp. trend
in the **tropical Indian Ocean**
(Bias-corrected XBT, 1963–2009)

Results

Annual mean trend (1950–2009)

Surface wind (WASWind)





Subsurface temp. trend

in the **tropical Pacific**

(Bias-corrected XBT, 1963–2009)

Summary

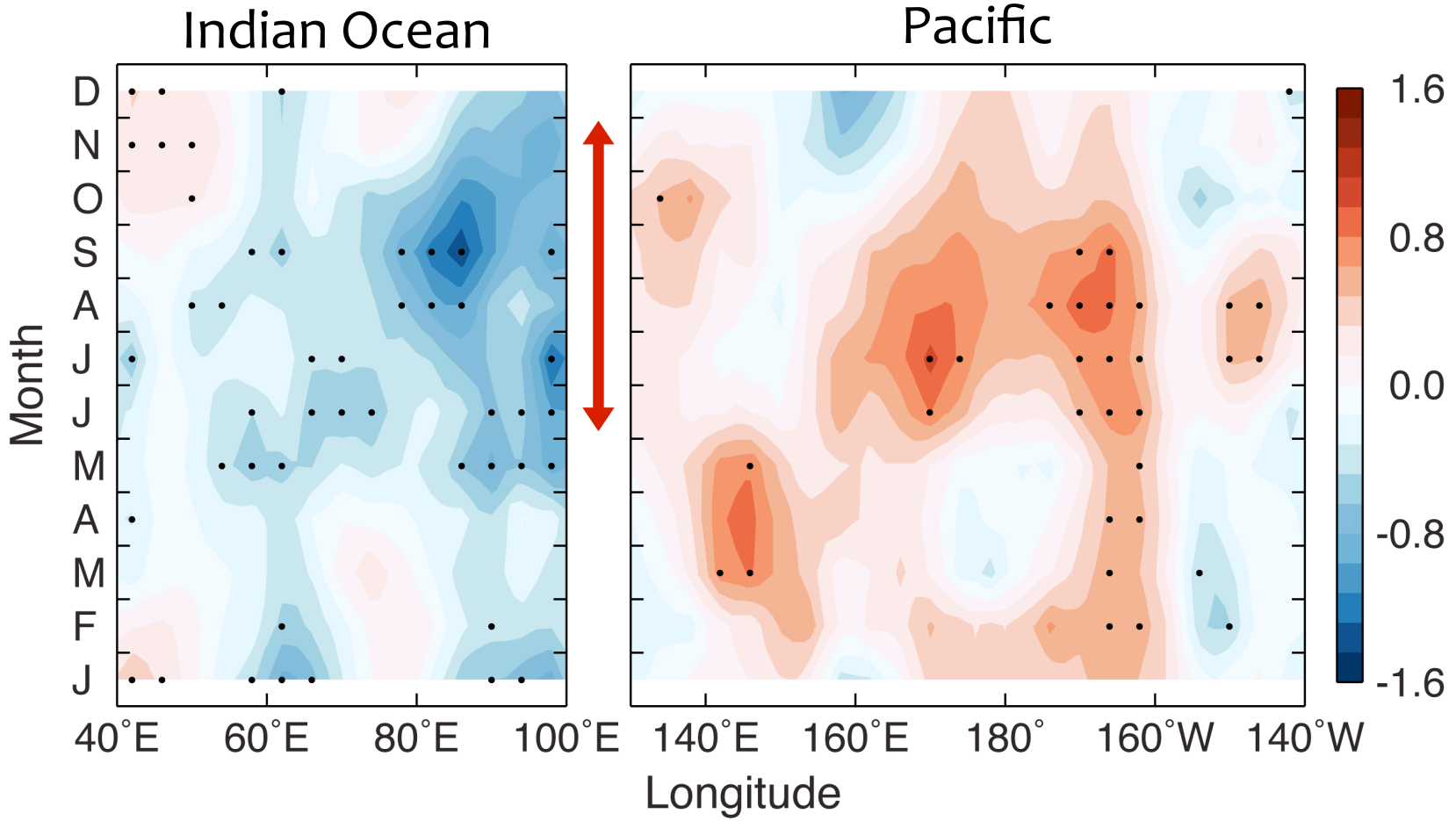
- A new surface wind product, **WASWind**, was constructed for climate change analysis

- WASWind indicates an **eastward shift** of the **Walker Circulation** over the past 60 years

- Patterns of surface wind change are **consistent** with those of **cloudiness**, **SLP**, **precipitation** and **subsurface ocean temperature**

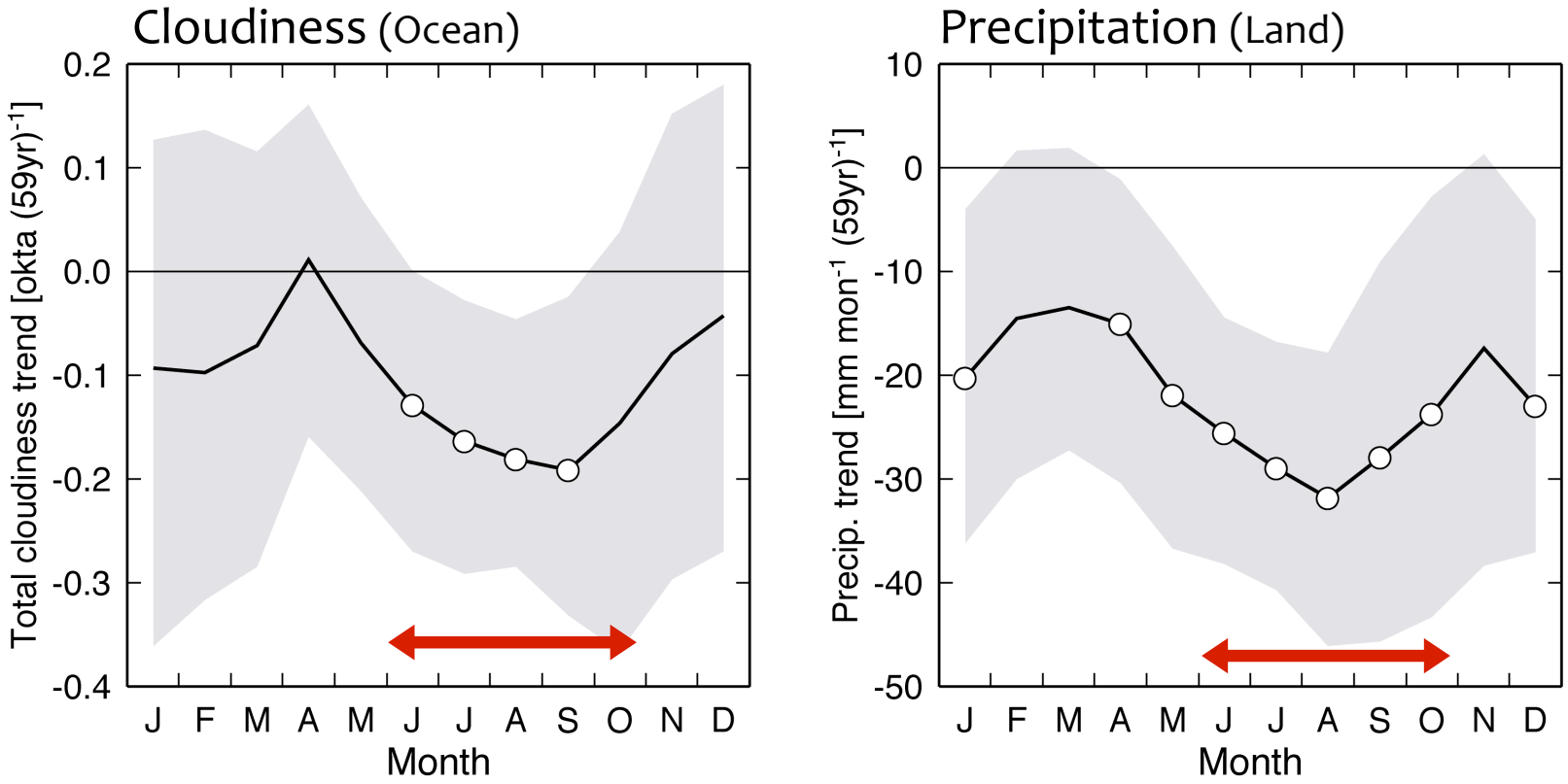
Equatorial zonal wind trend

(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**

Upward wind trends?

Scalar wind trend
(Ships, 1950-2008)

+1.8 ms^{-1}/ 59yr