Interannual SST-rainfall relationship over the equatorial Atlantic

Hyacinth C. Nnamchi[1], Mojb Latif[1], Noel S. Keenlyside[2], Joakim Kjellsson

[1] GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany

[2] Geophysical Institute, University of Bergen, Norway

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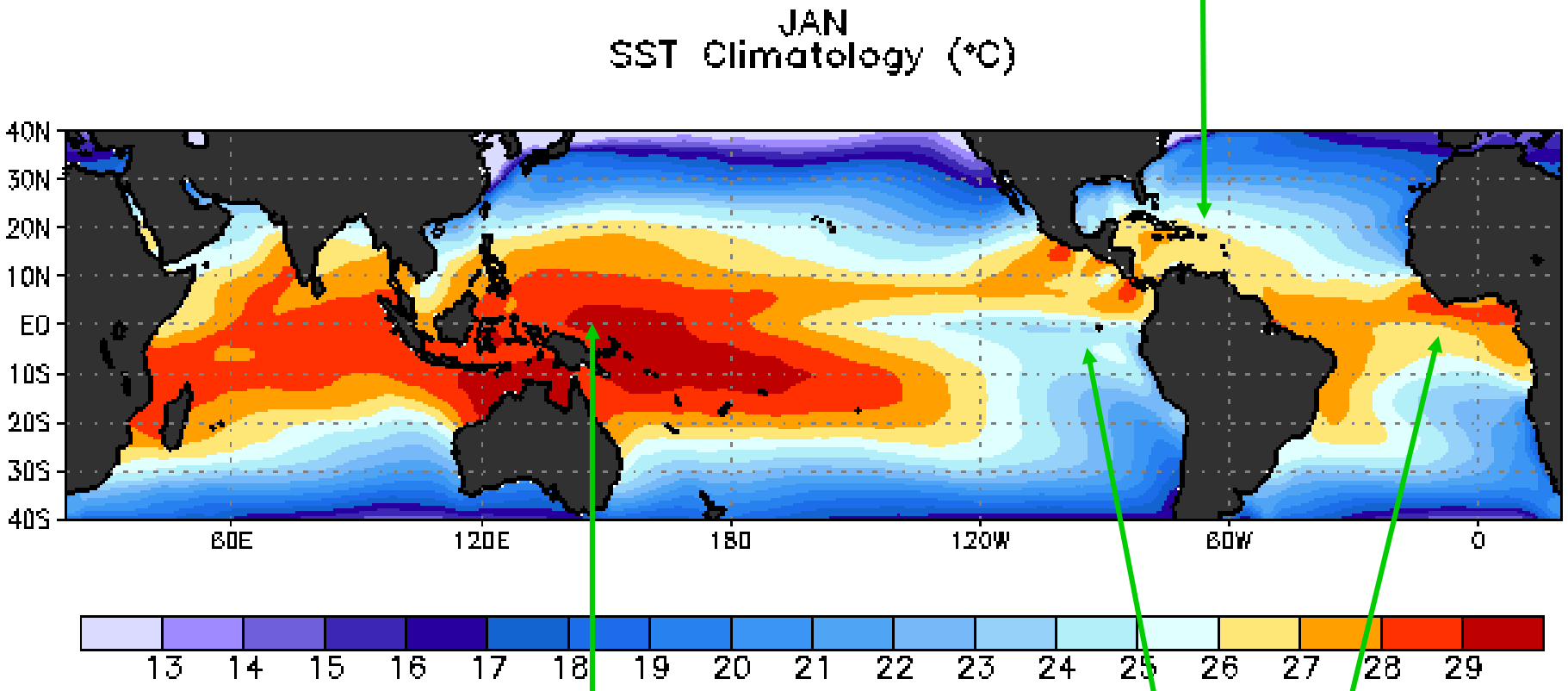
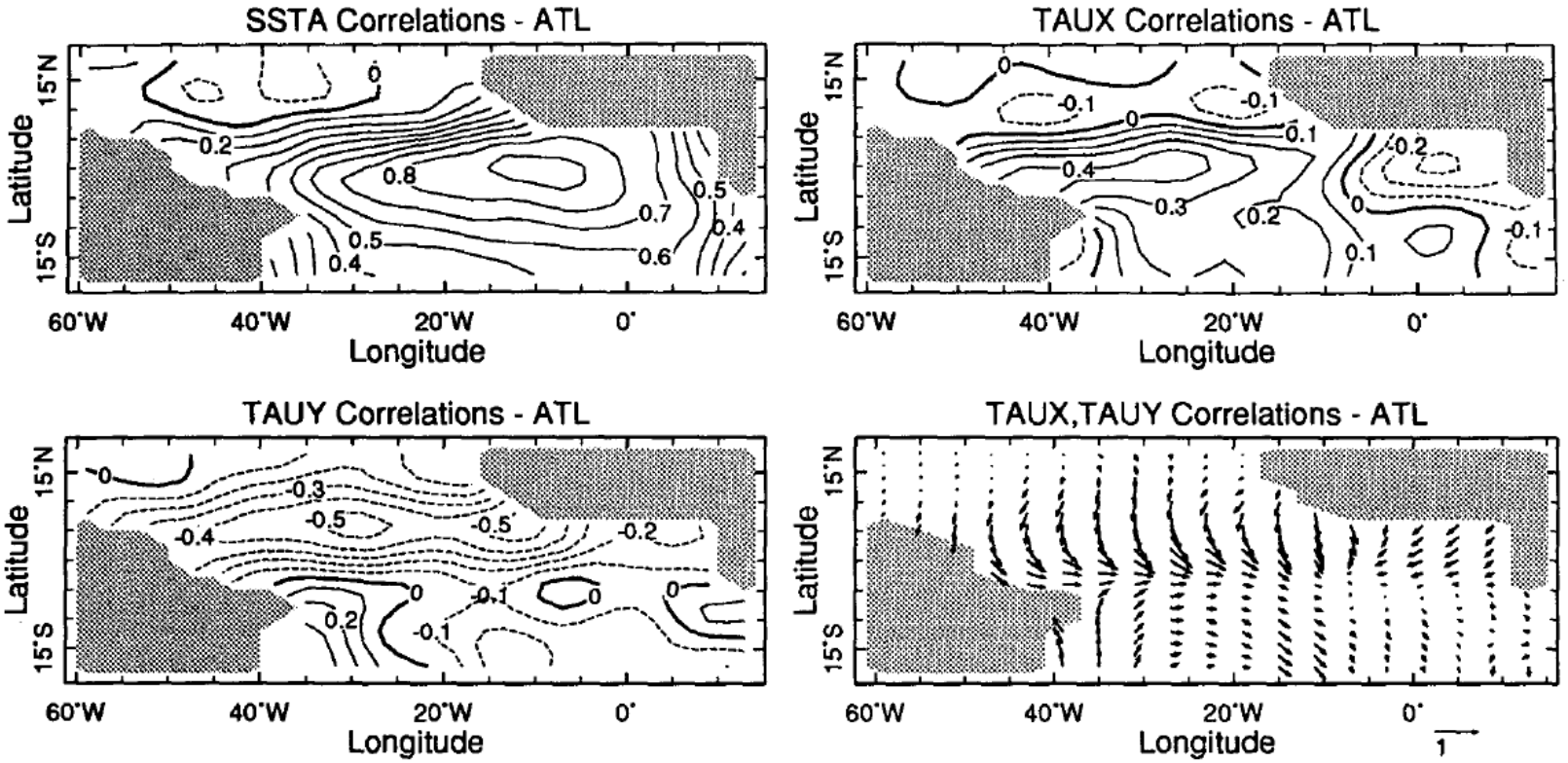
Mean annual cycle



- Atlantic Warm Pool
- Pacific Warm Pool
- Cold Tongues

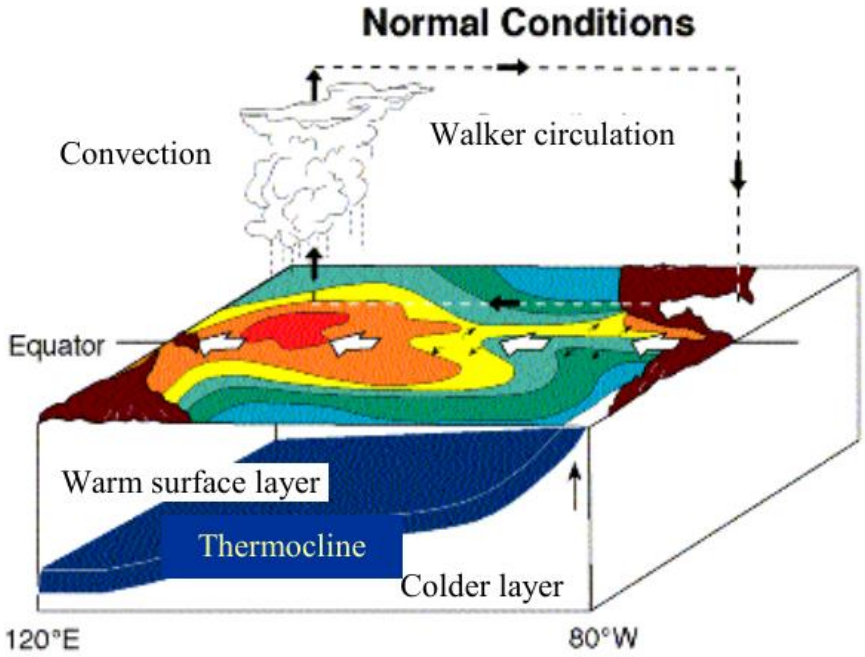
Interannual variability

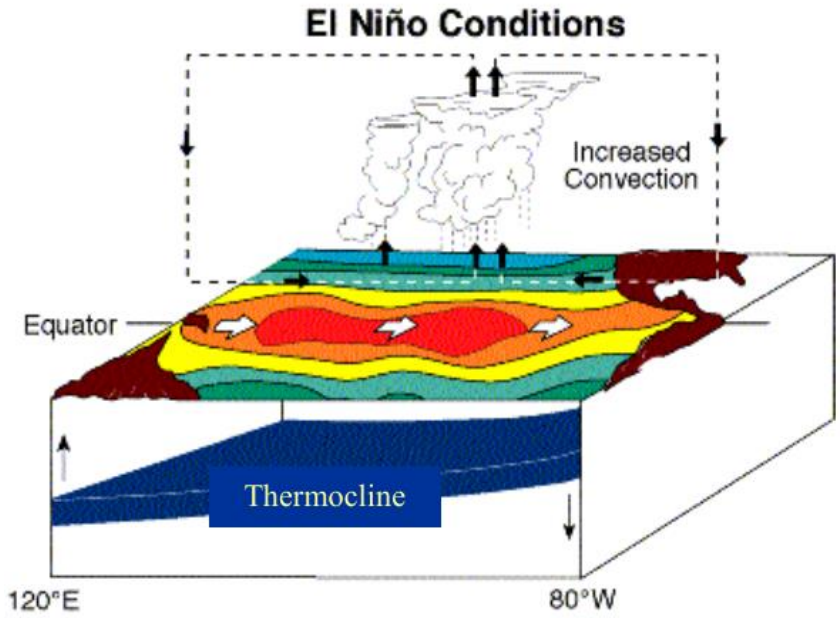
GEOMAR



Interannual variability

GEOMAR

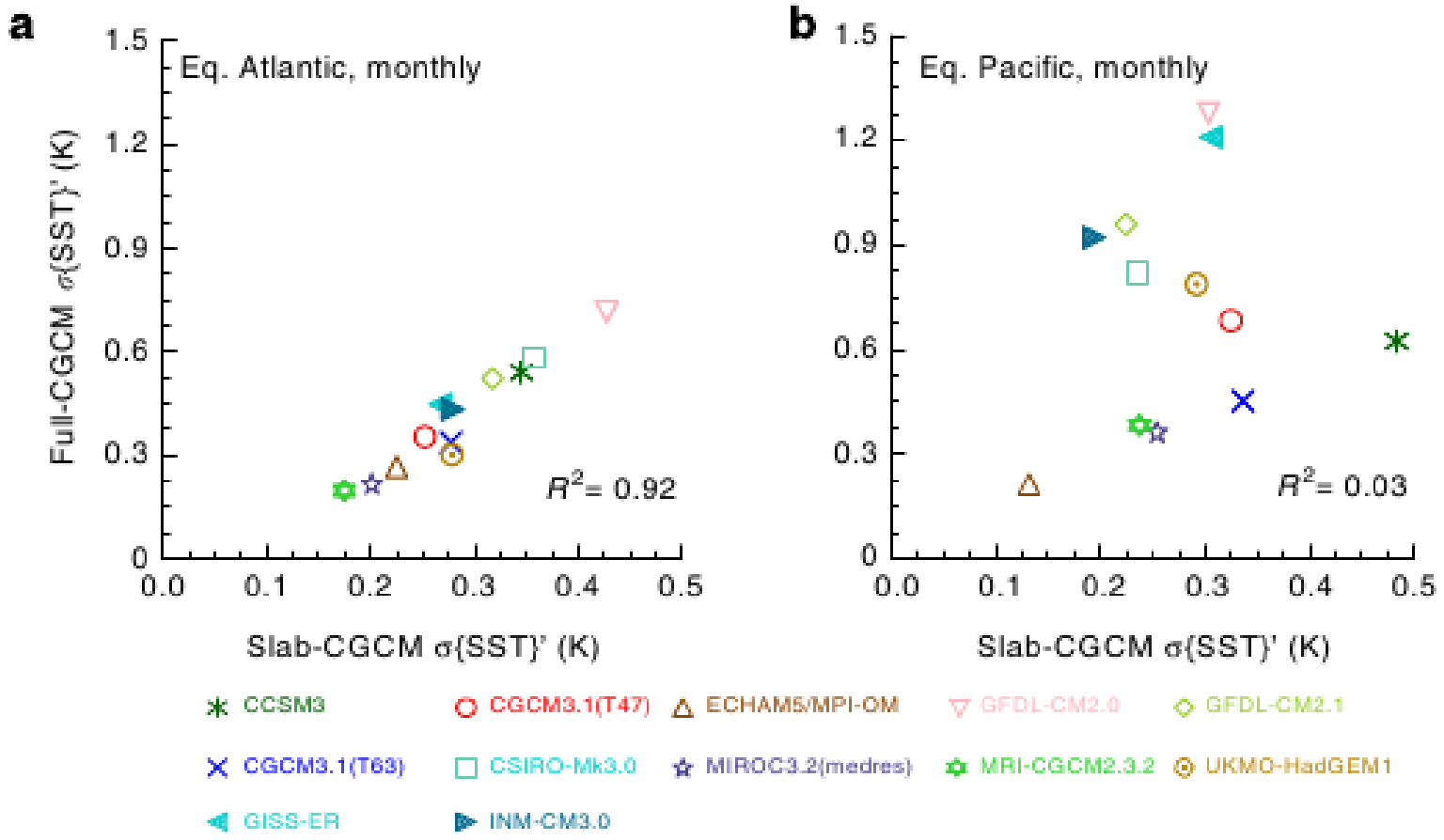




Important differences: Atlantic vs Pacific

- Seasonality
- SST amplitude and frequency
- Bjerkness feedback
- Symmetry between warm and cold events
-
-
-
-
- **Further mechanisms for the Atlantic Nino:**
- Meridional advection (Foltz and McPhaden, 2010; Richter et al., 2013)
- Deep equatorial jets (Brandt et al., 2011)

Interannual variability



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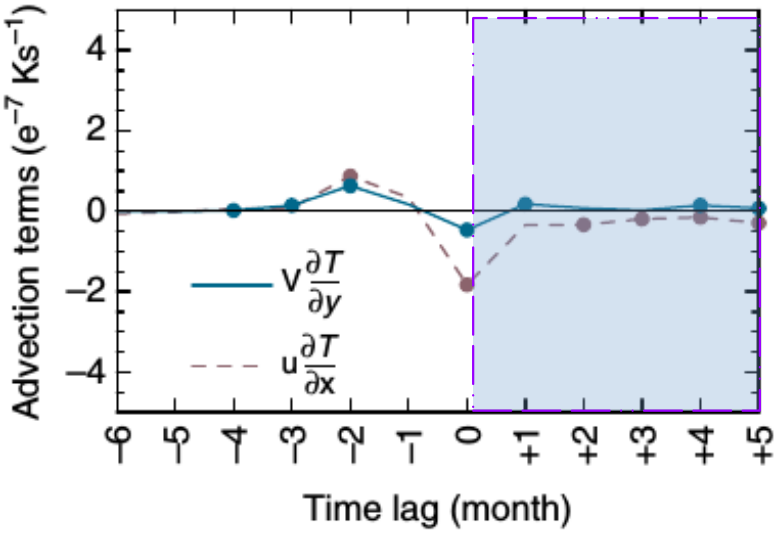
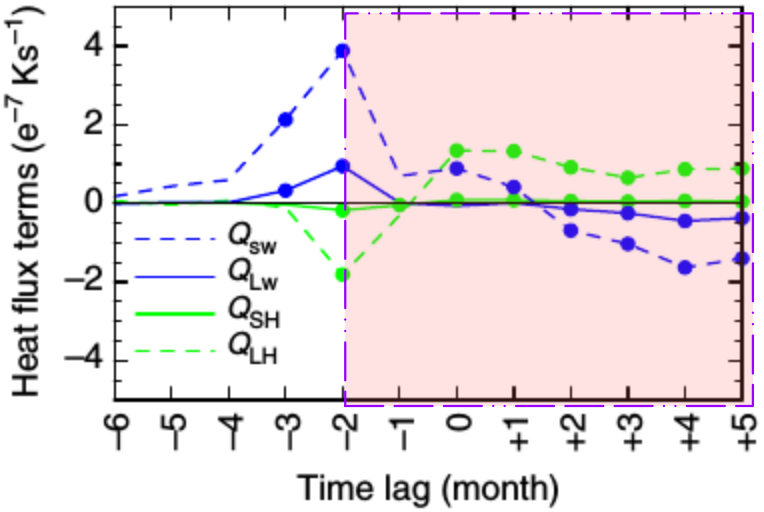
Q_{net} terms lead in GFDL-CM3

Peak lag = 0



Peak lag 2-months earlier



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Problems with the CMIP-class models

- Mean state biases (Richter et al., 2013).
- Overestimation of Qnet contribution (Jouanno et al., 2017).

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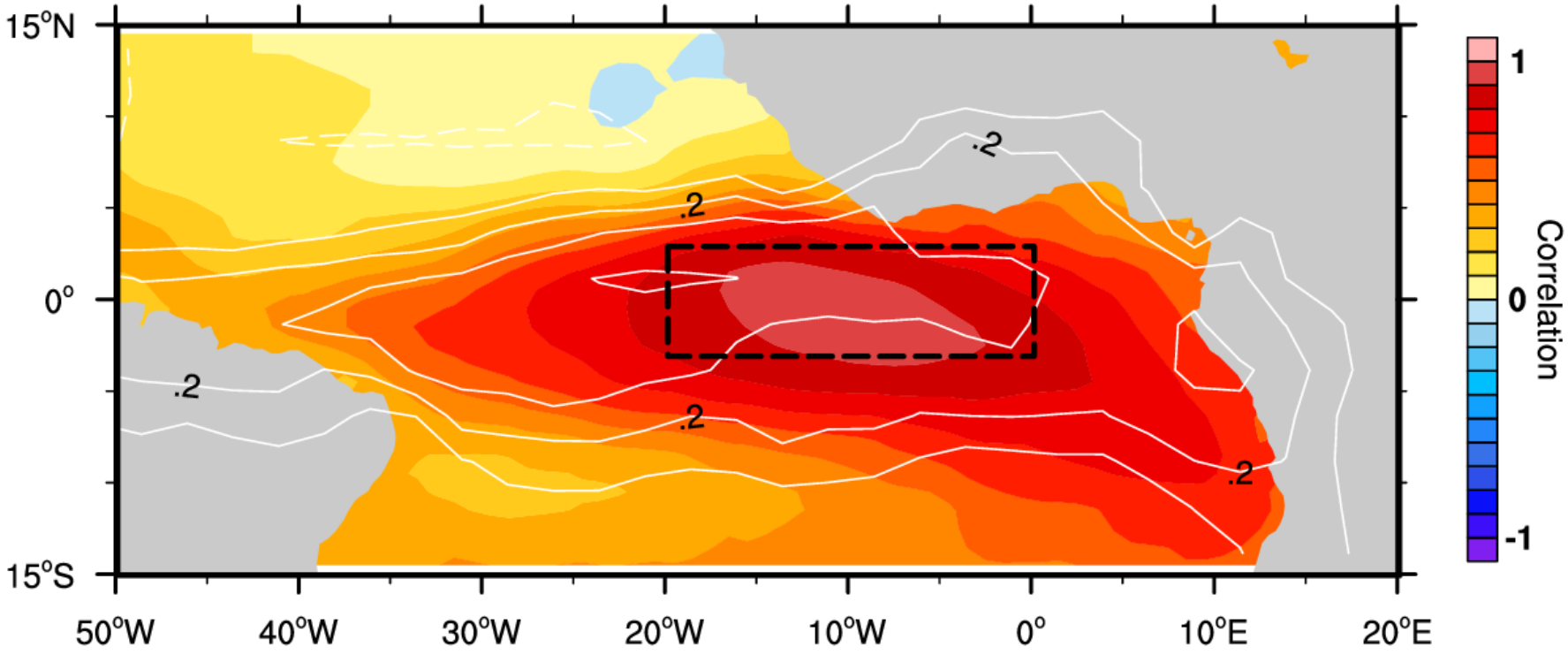
SST–rainfall correlation

- Observations during the satellite era.
- Ensembles: reanalyses, AGCM and coupled modes

SST–rainfall correlation



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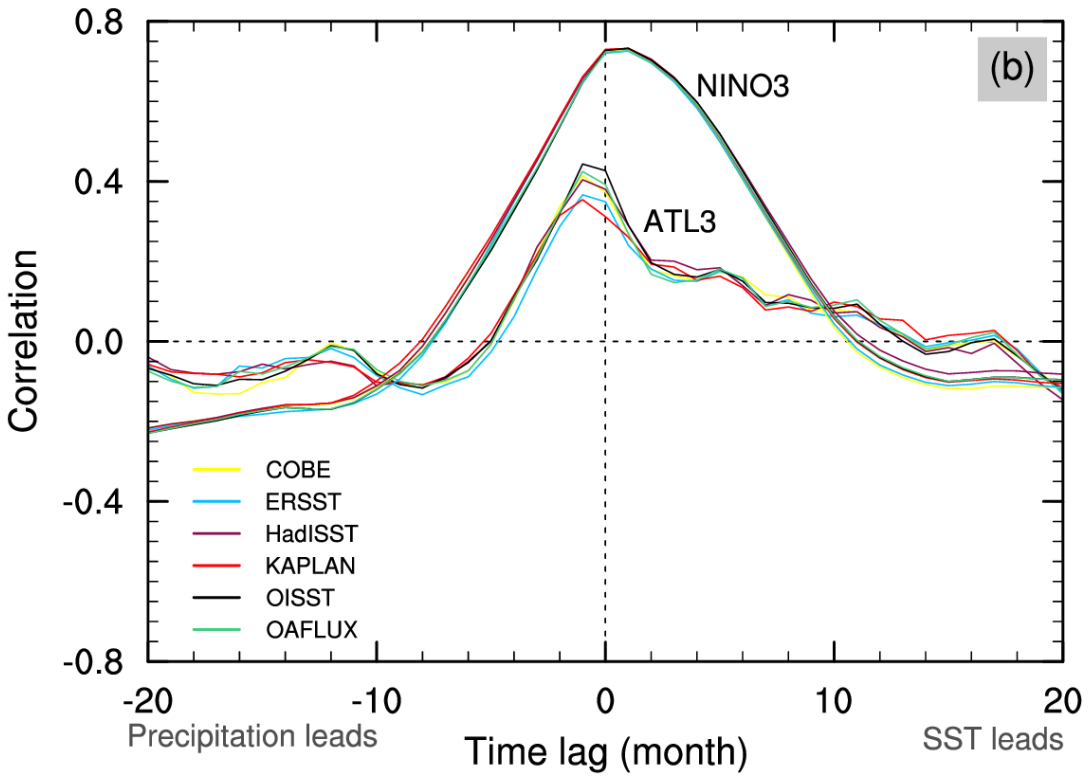

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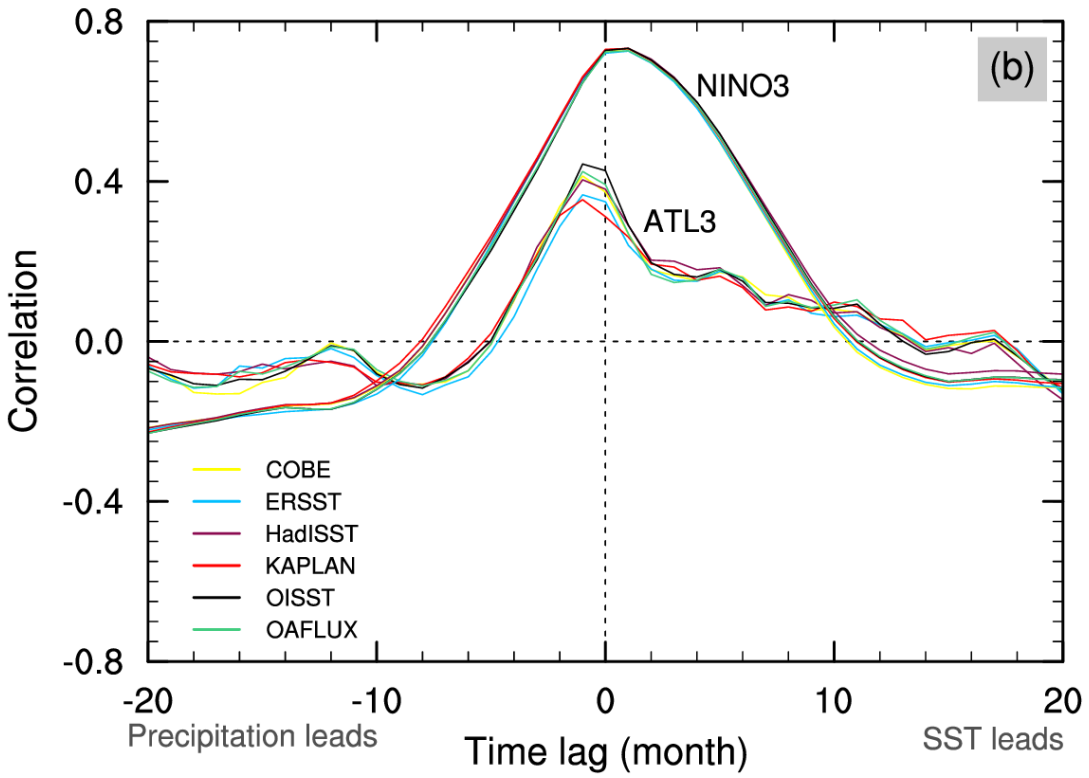

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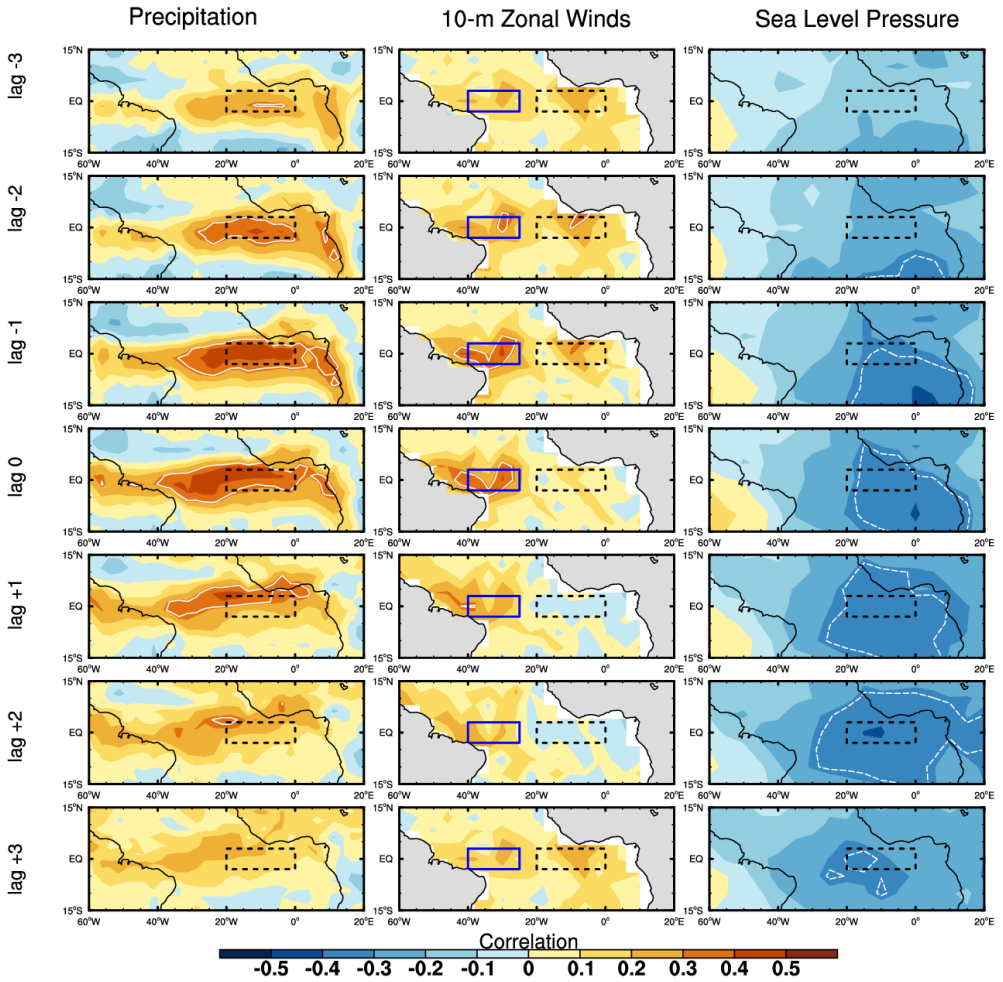
SST–rainfall correlation

- SST leads at positive lags



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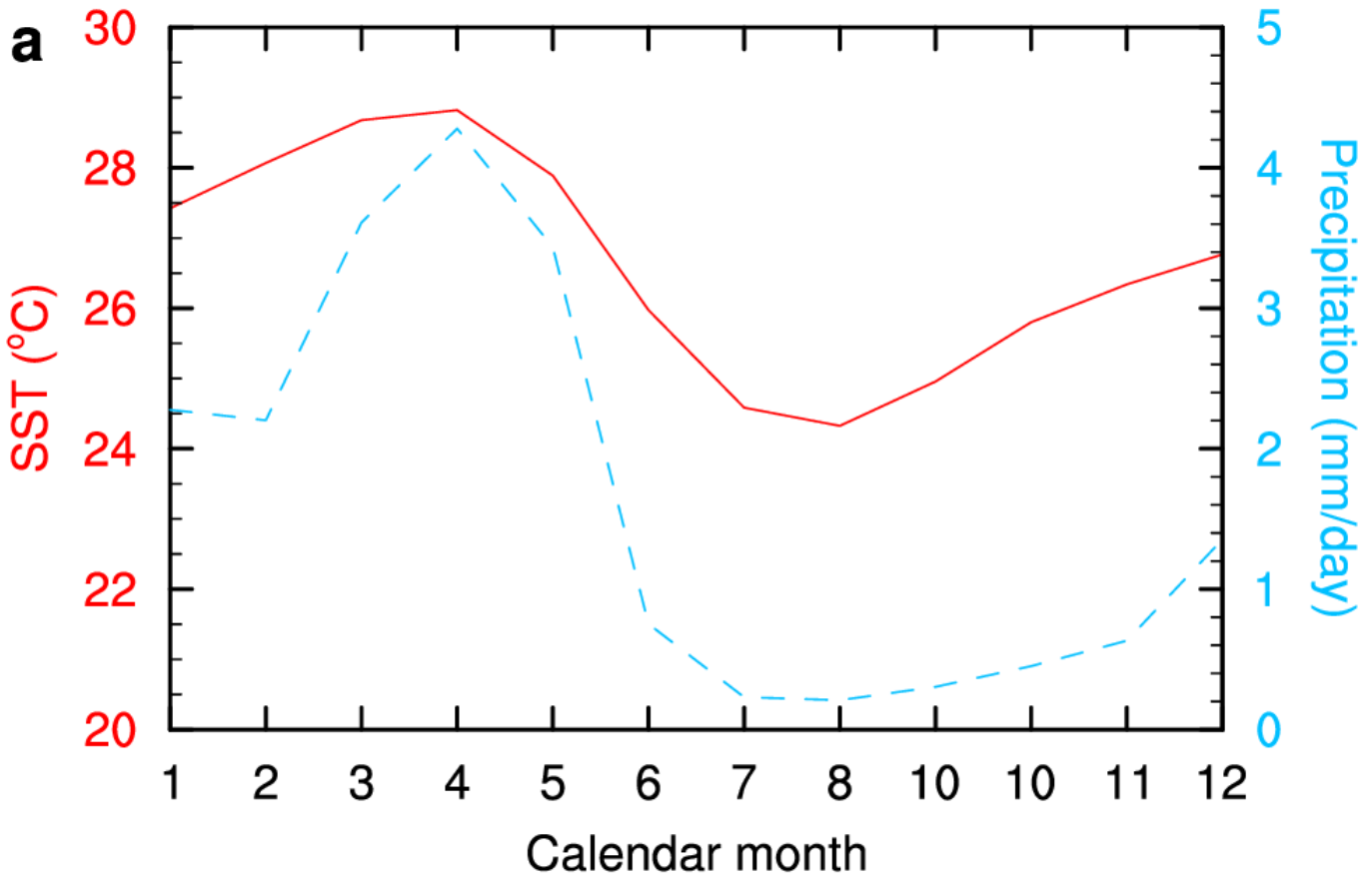

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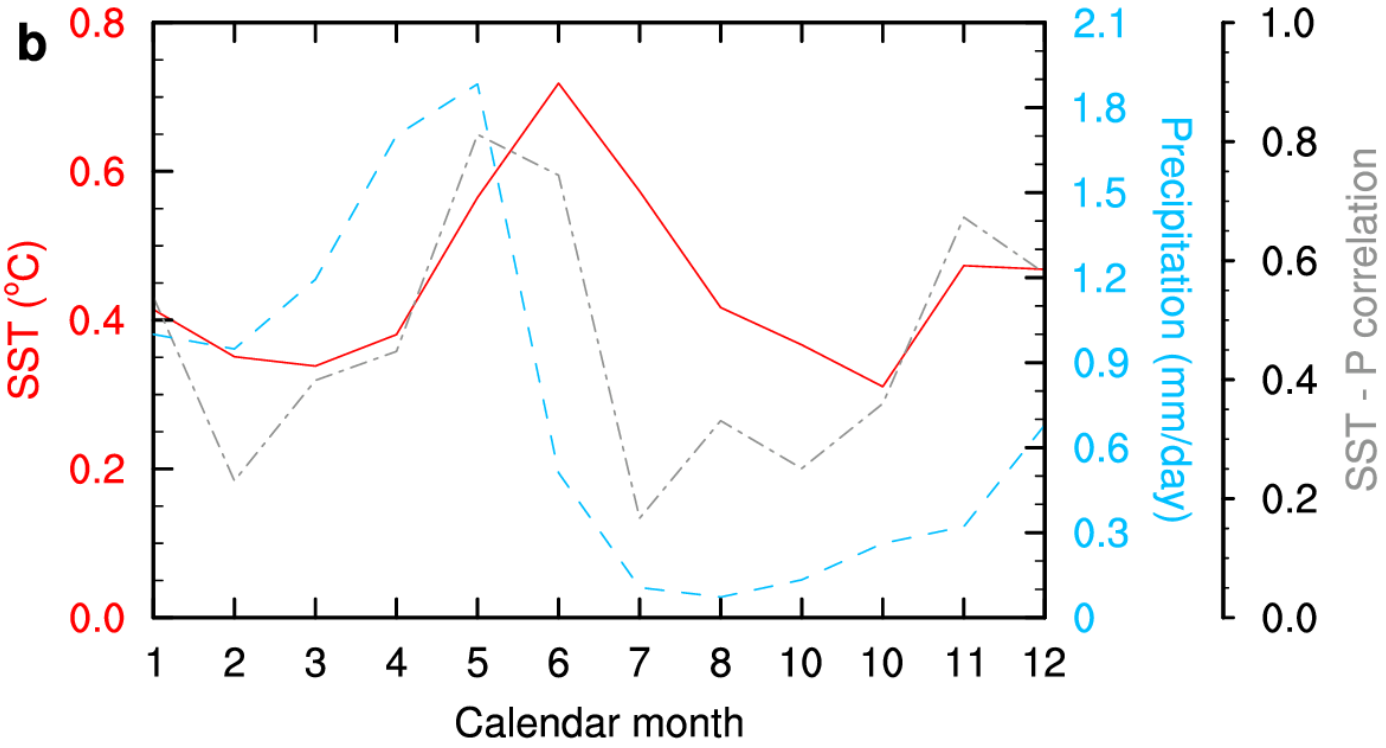

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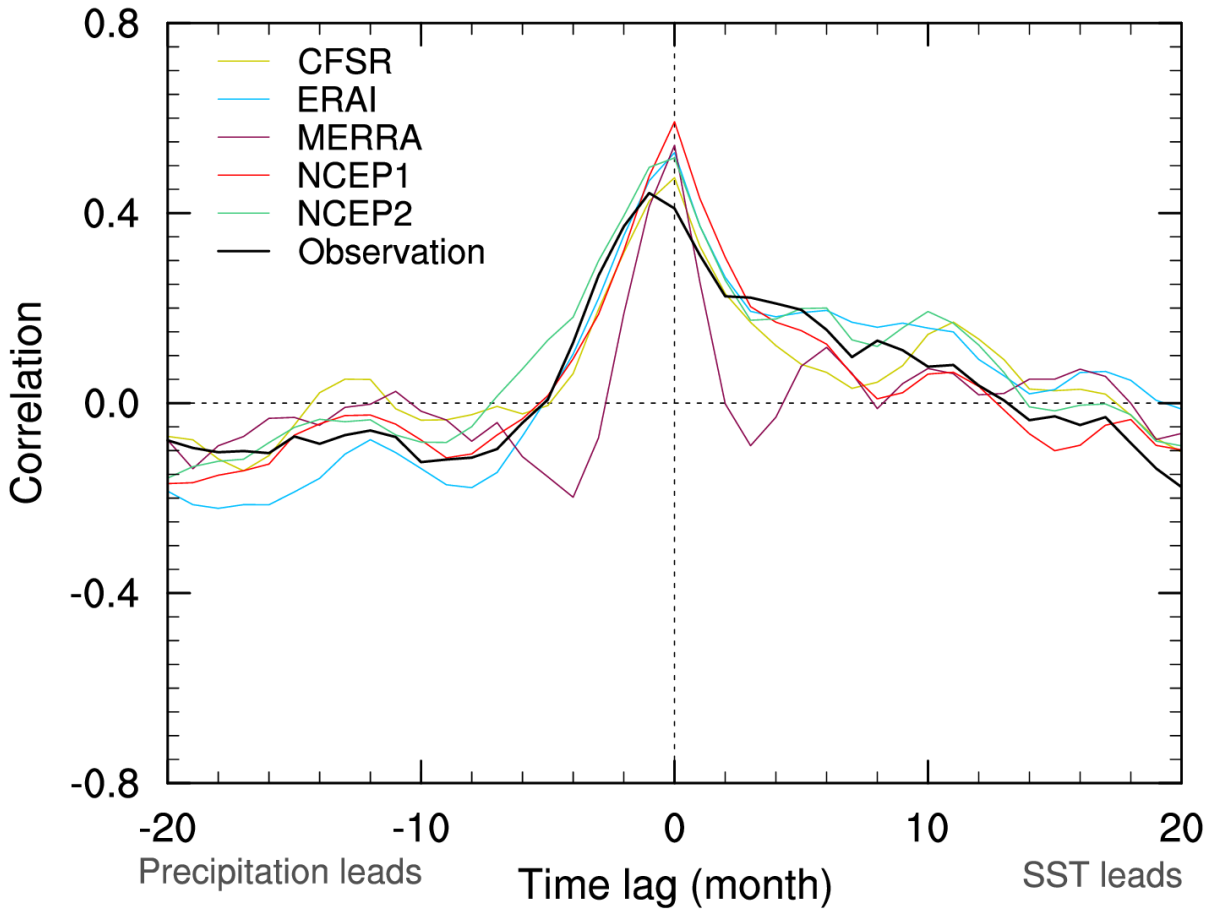
SST–rainfall correlation

- No lags in reanalyses



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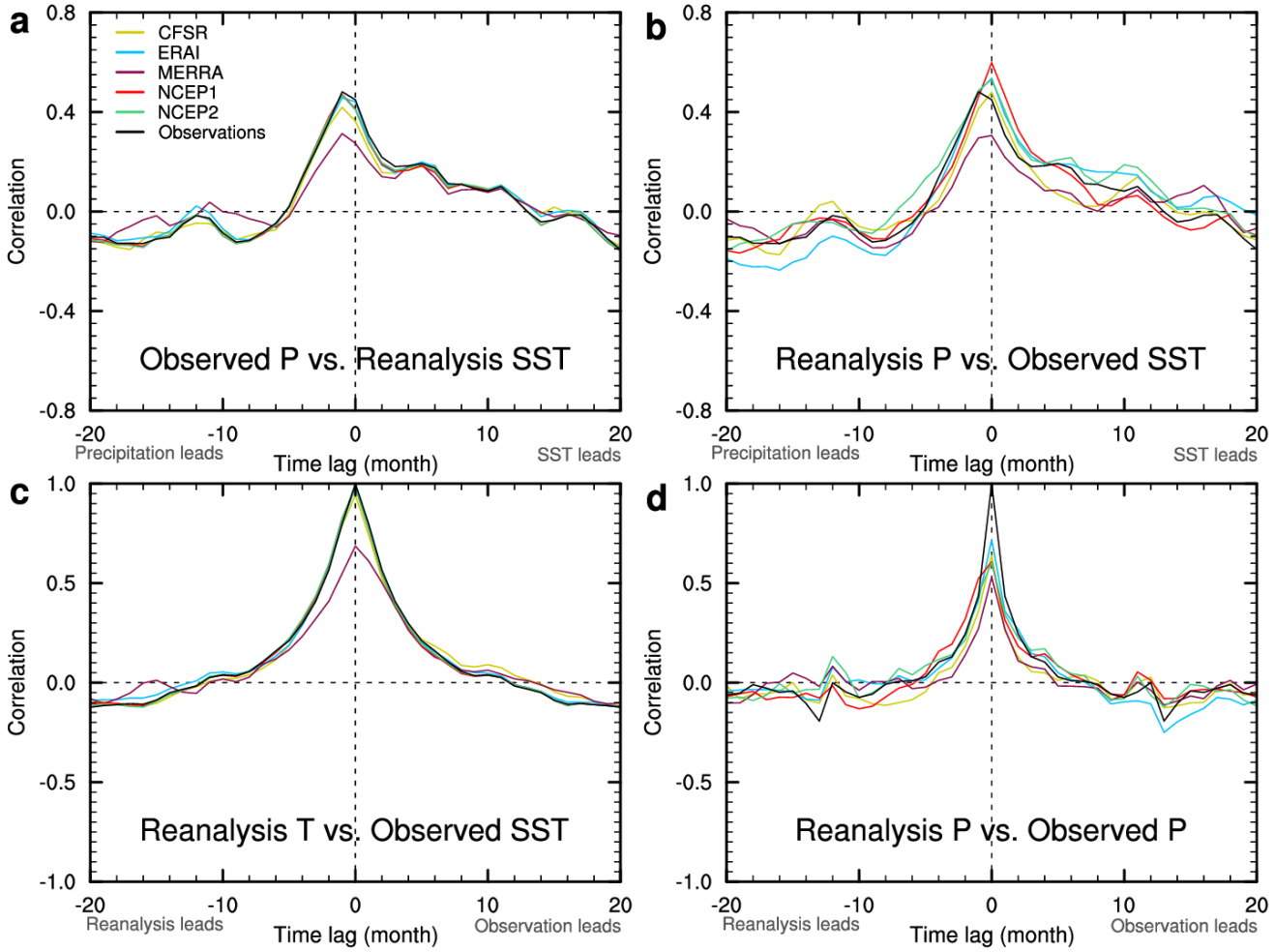

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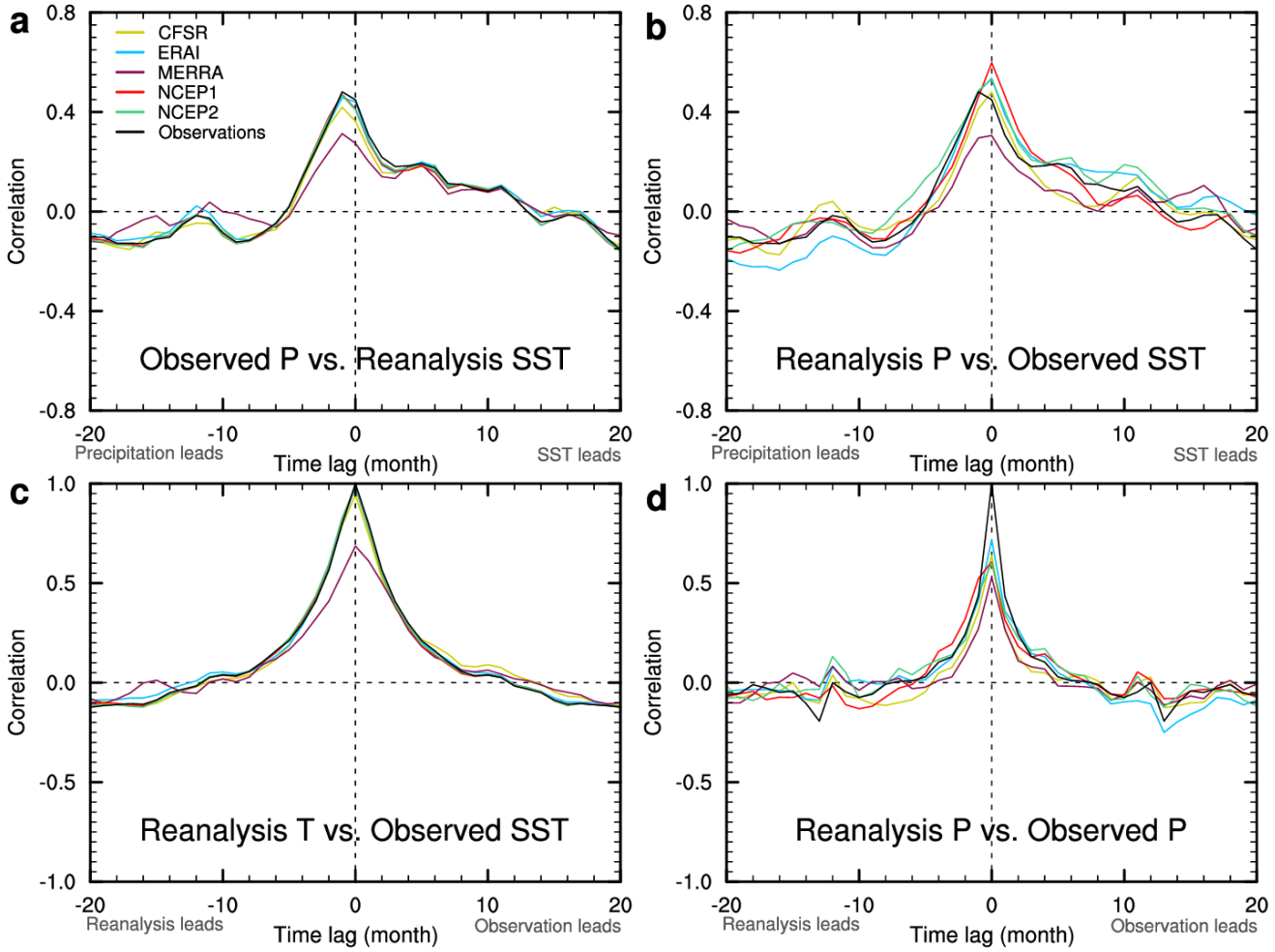
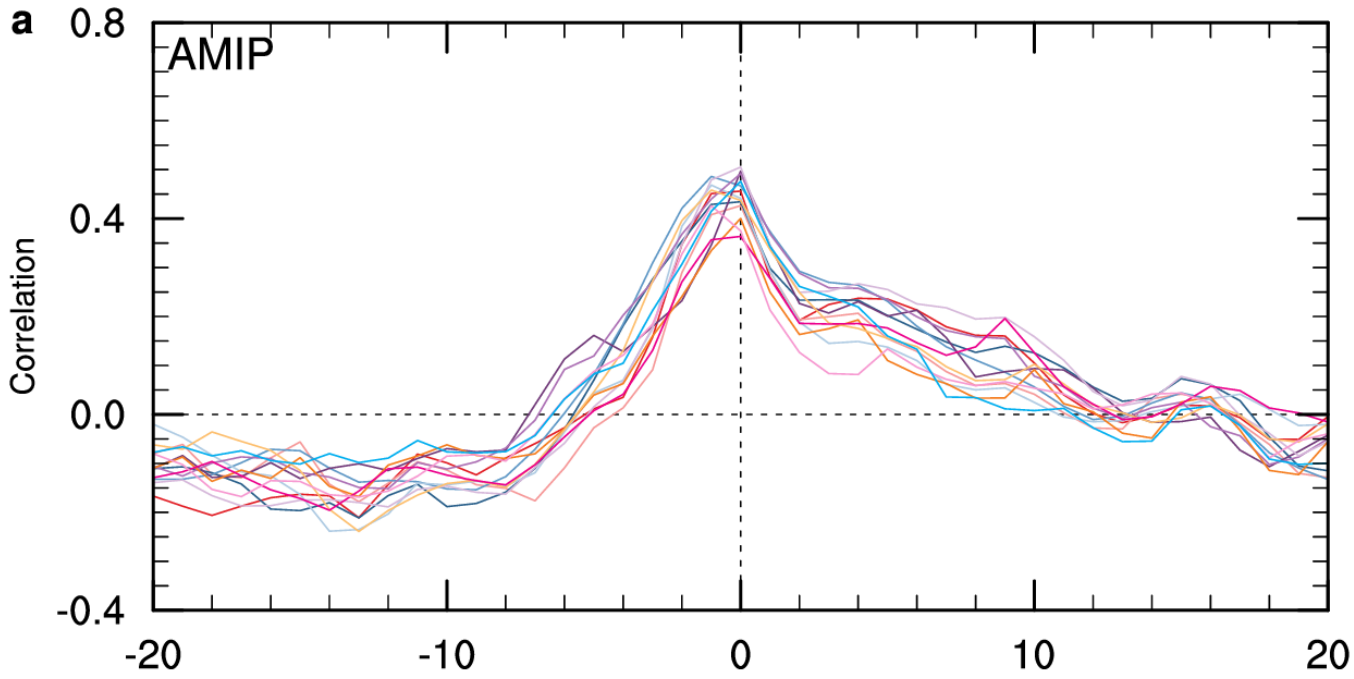


SST–rainfall correlation

- 1- lags in AMIP experiment



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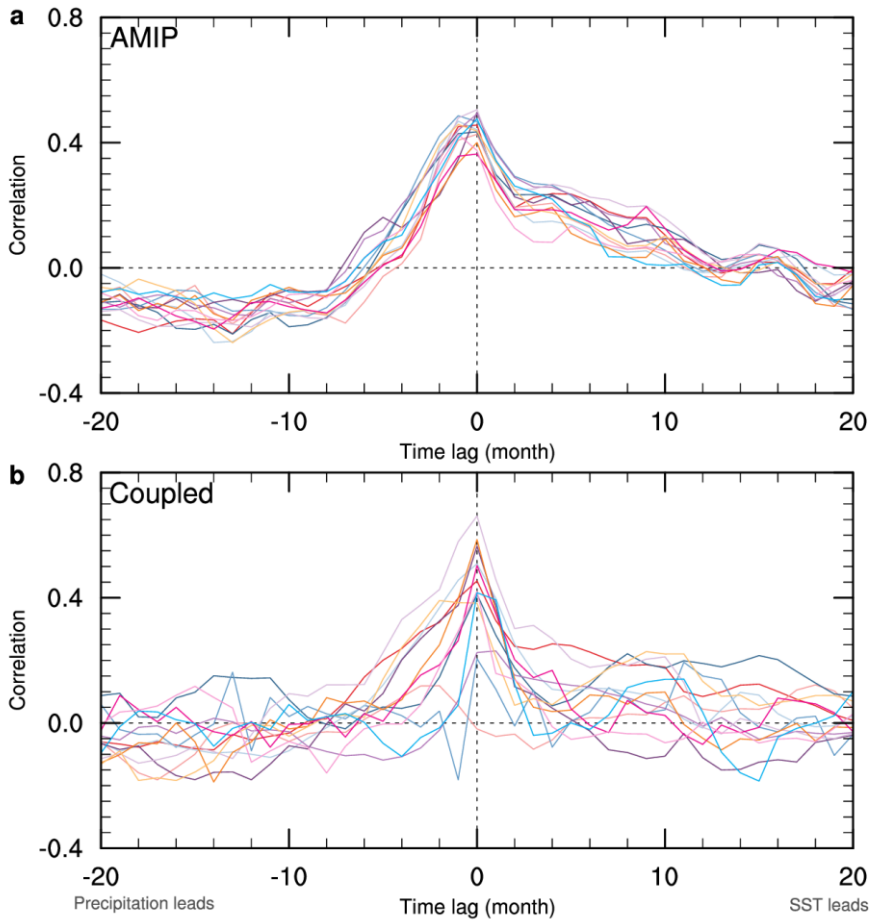
SST–rainfall correlation

- No lags in Coupled experiment



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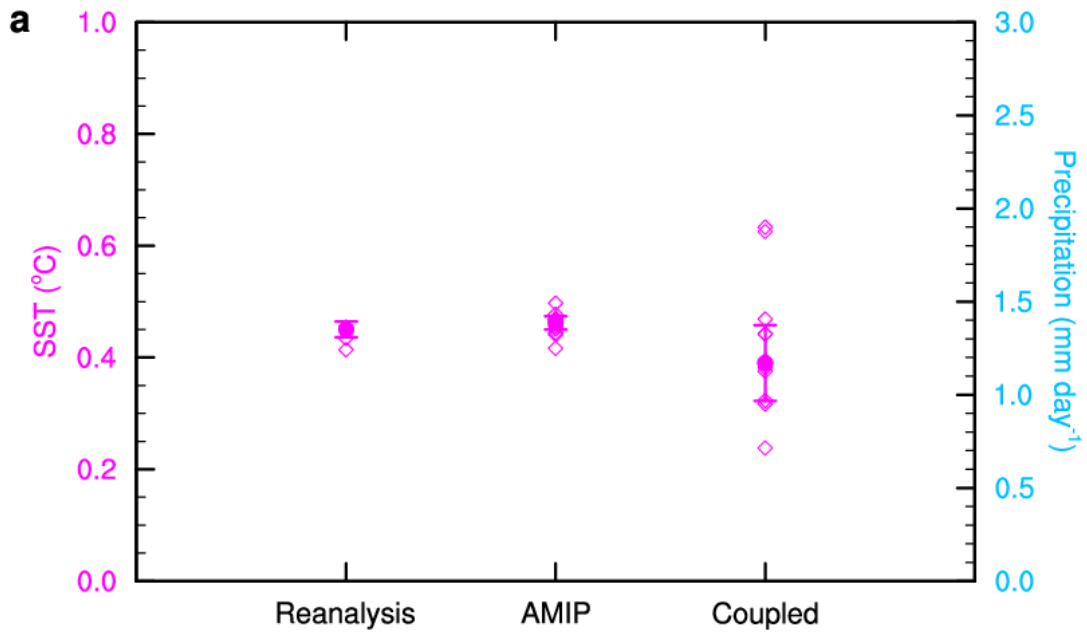
SST variability vs rainfall variability

- **How much of the rainfall variability is explained by the SSTs?**



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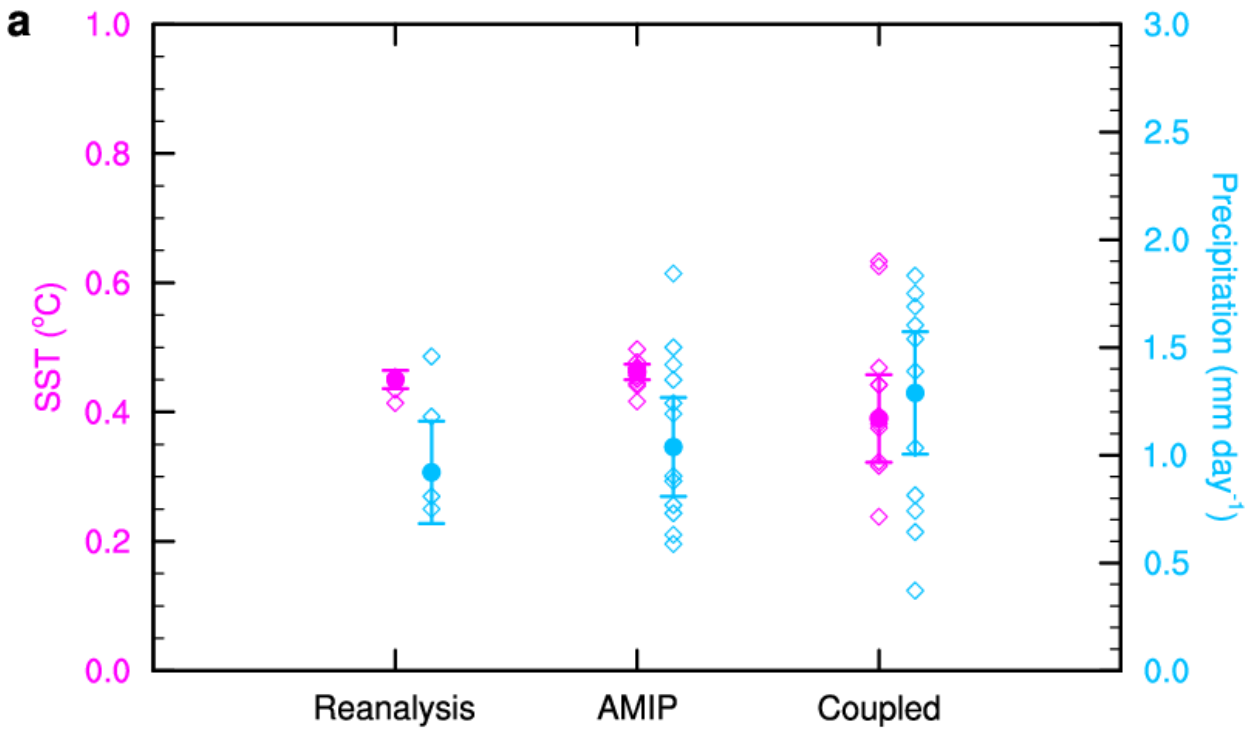
SST variability vs rainfall variability

- SST constant, ***rainfall spreads***



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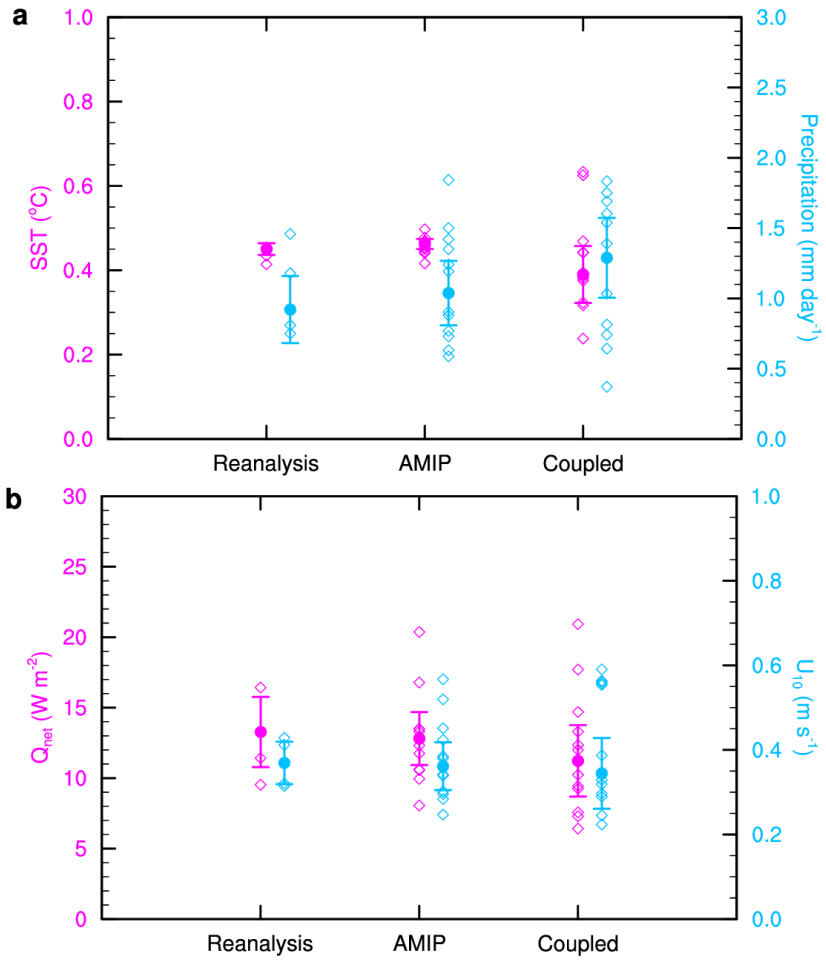
SST variability vs rainfall variability

- Rainfall spread may be attributed to the atmosphere.



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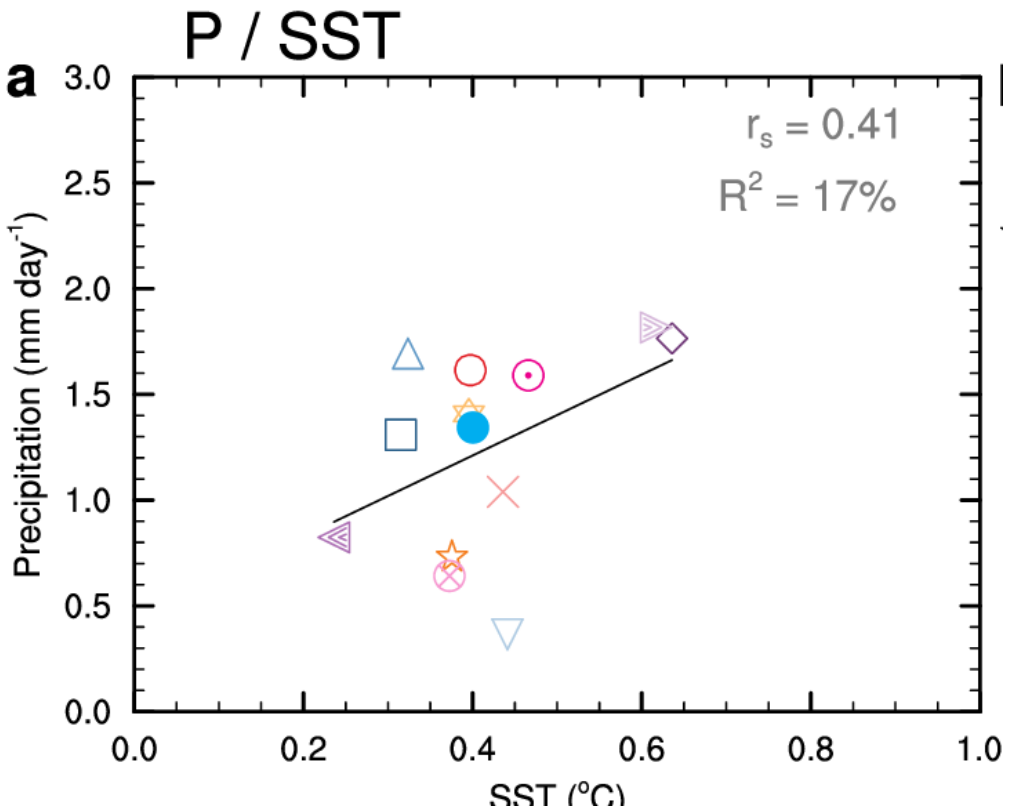
Coupled models

- How much of rainfall variability is explained by the SSTs?



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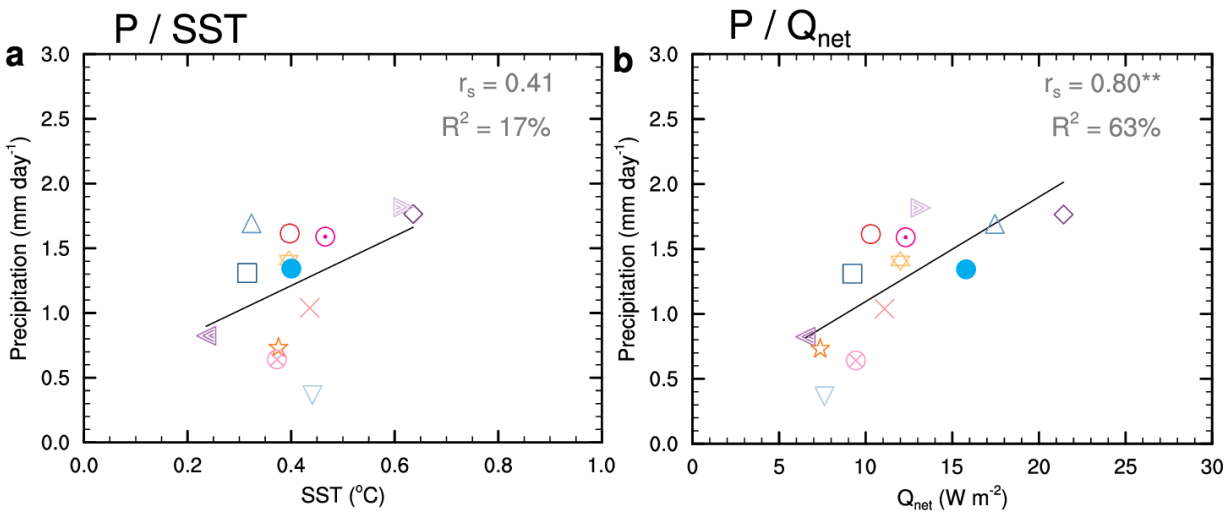

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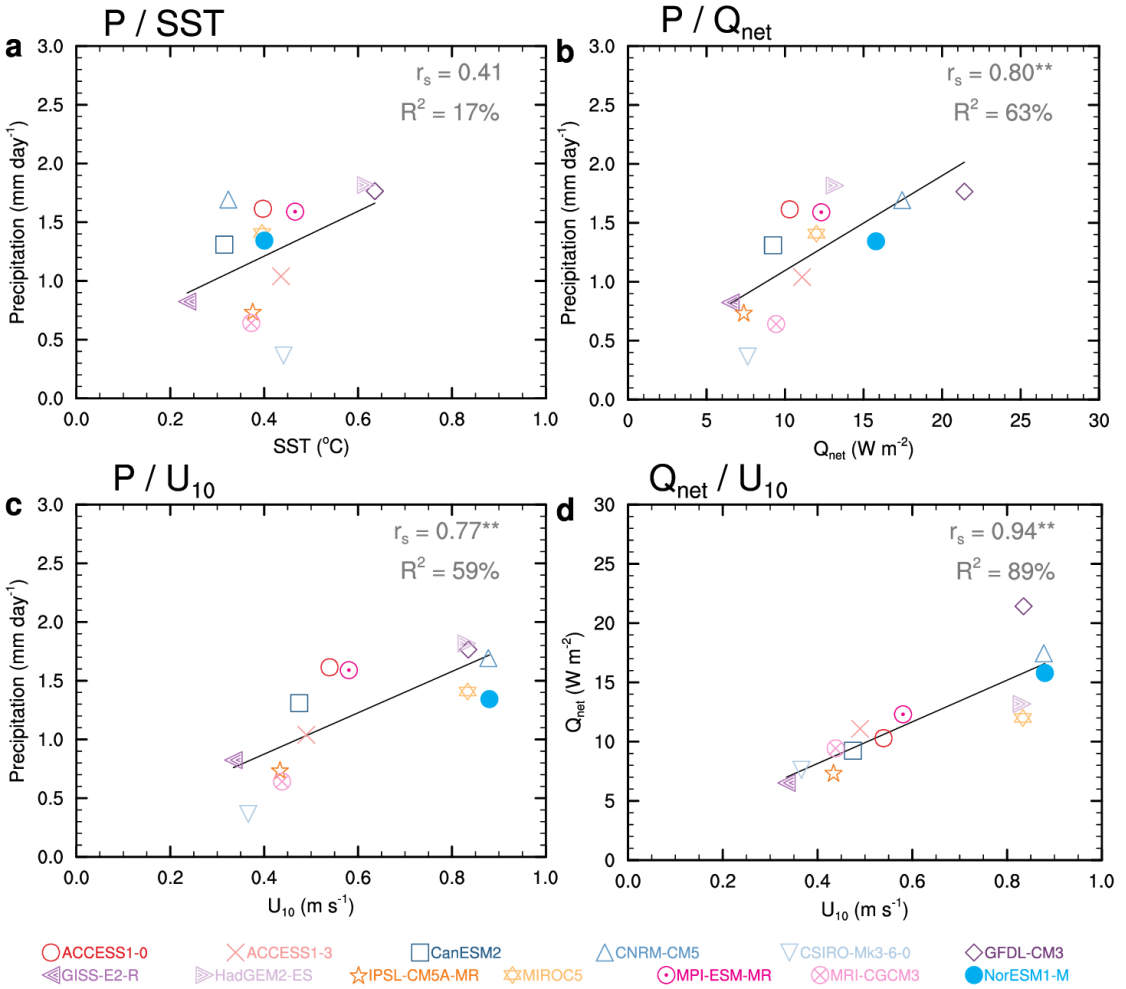

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Summary

- How do you warm equatorial Atlantic?
- Seasonal variability of rainfall leads that of rainfall
- Related ITCZ, dibatic heating/over land/ocean?
- Different atmospheric models respond differently to the same SST forcing
- Simulated SST does not explain the rainfall in coupled models
- **Weak Bjerkness coupling cannot be explained away by badly simulated fluxes**
- **Improving predictability requires understanding (of the atmosphere), possibly beyond simply improving biases**