Diagnosing sources of SST drift* in coupled forecast models

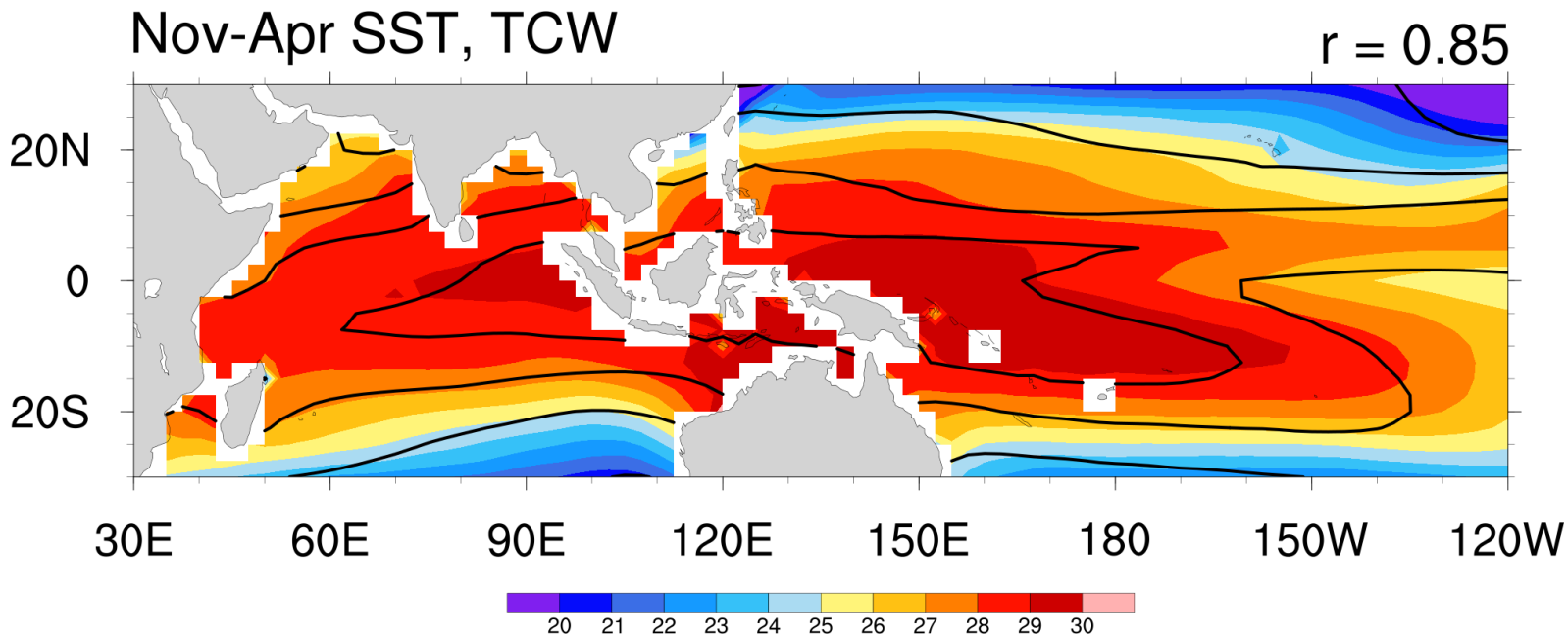
**the tendency for a model initialized with the observed state to evolve to a different state over time*

Charlotte DeMott, Colorado State University

Earth System Prediction Working Group Winter Meeting, 27 January 2021

SST and the MJO

- mean SST and mean column water vapor are highly correlated
- mean state moisture gradients are one key to MJO propagation



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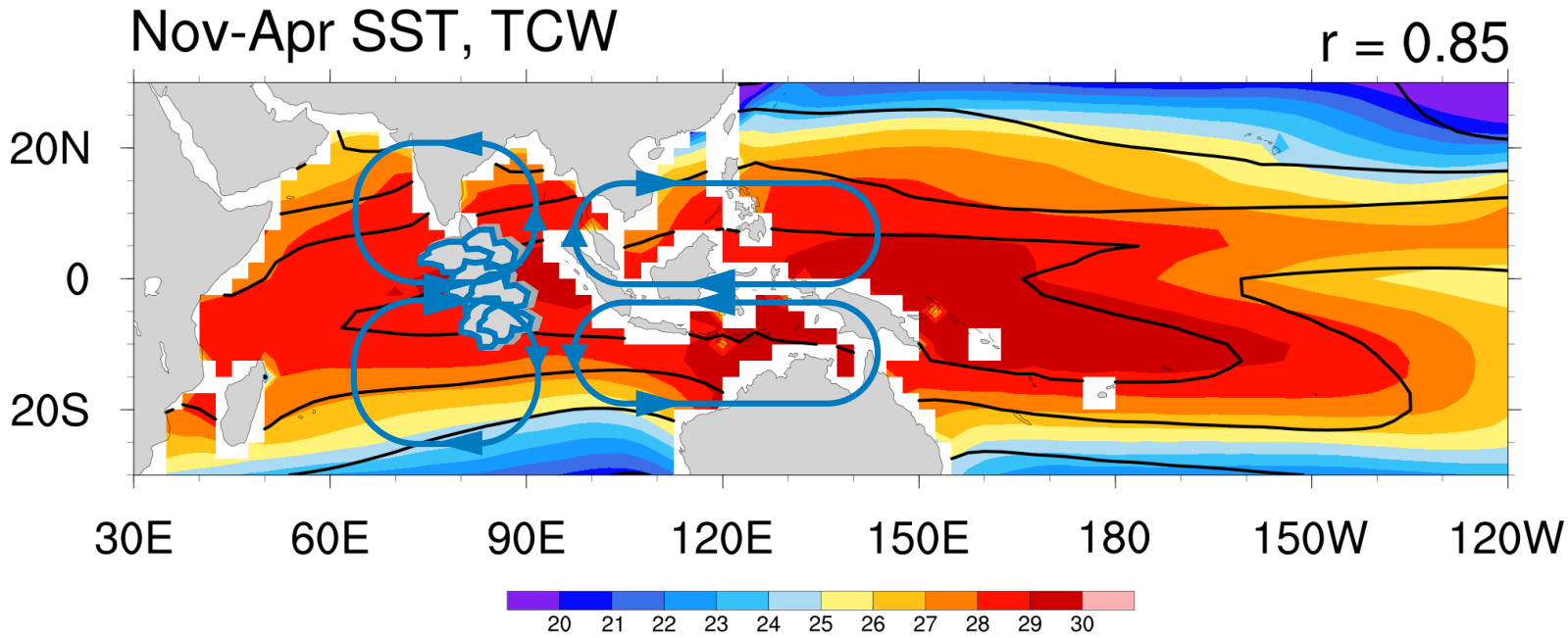

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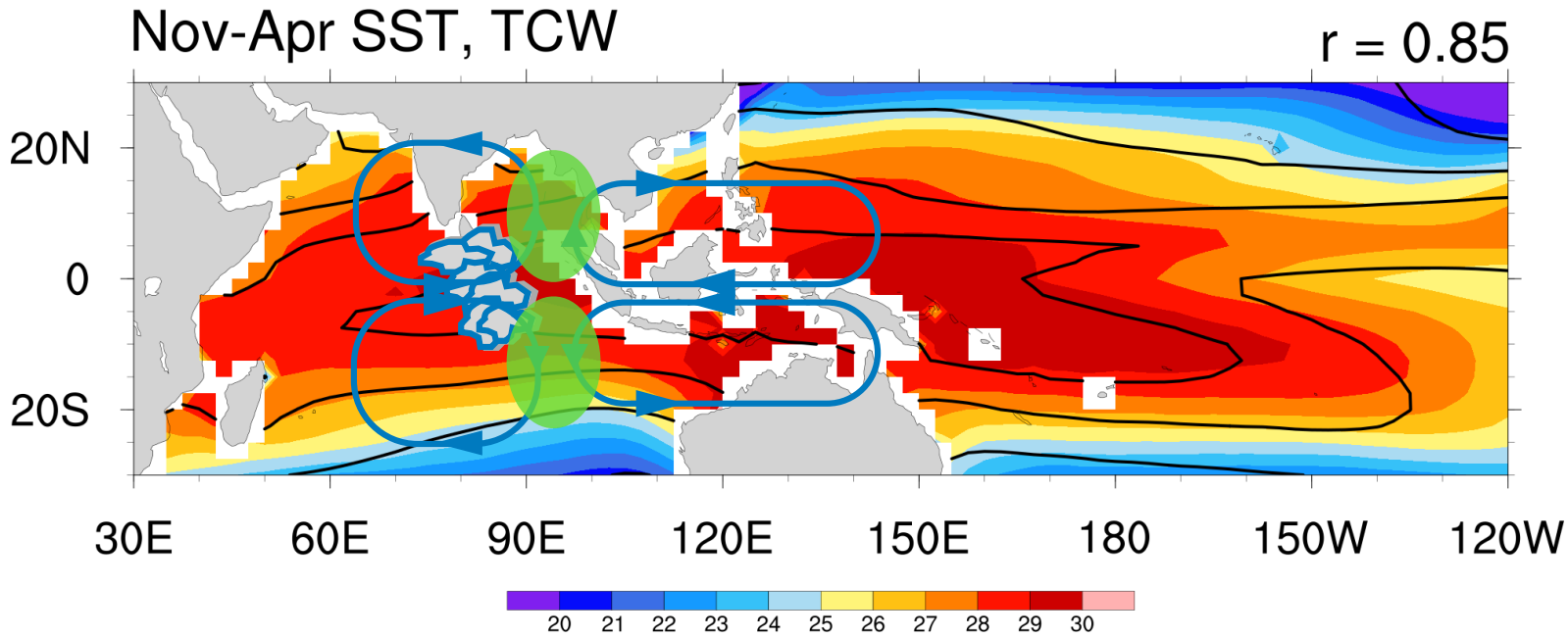

pondering SST drift in coupled forecast models

- is SST drift similar across forecast models?
- what are the leading sources of SST drift?
- does SST drift affect mean state moisture and MJO prediction skill?

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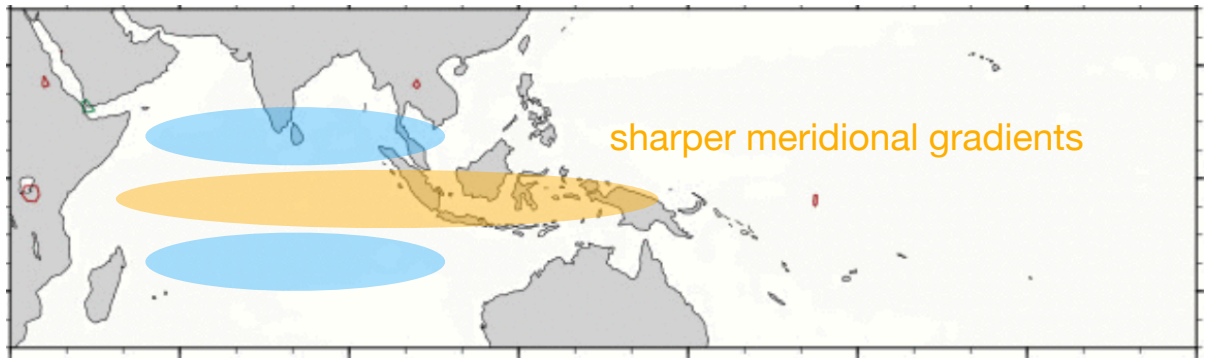

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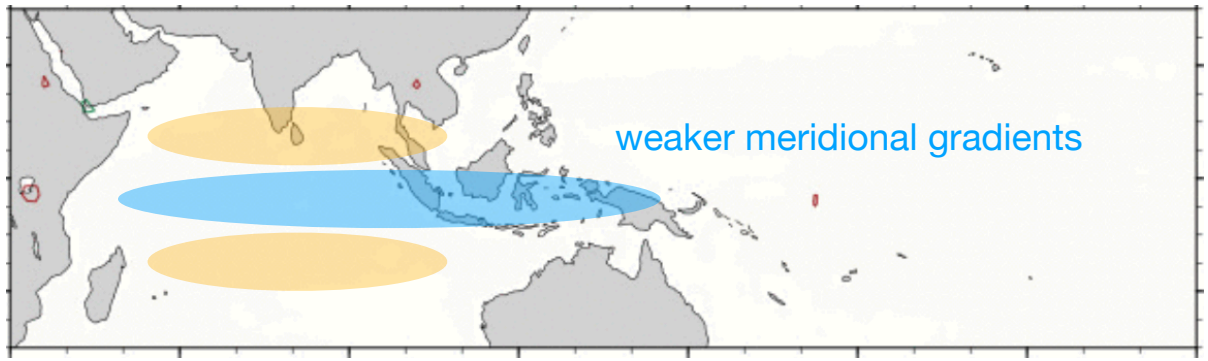
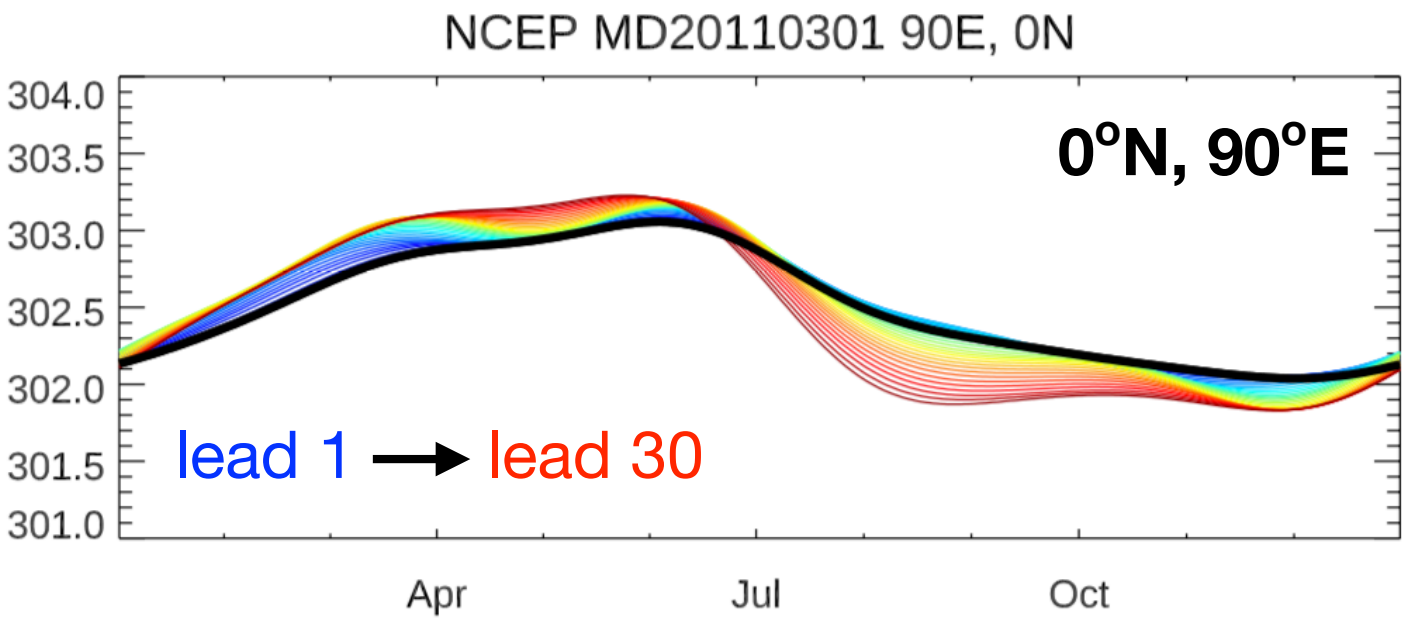
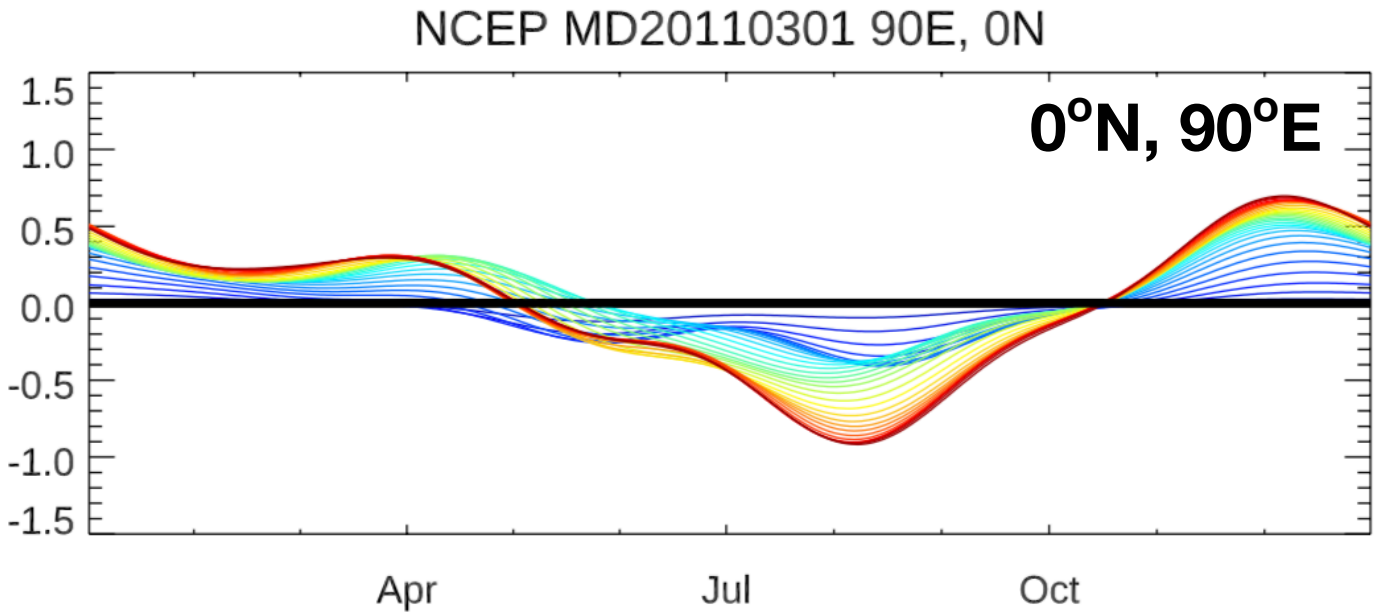


lead-dependent SST climatology

total SST

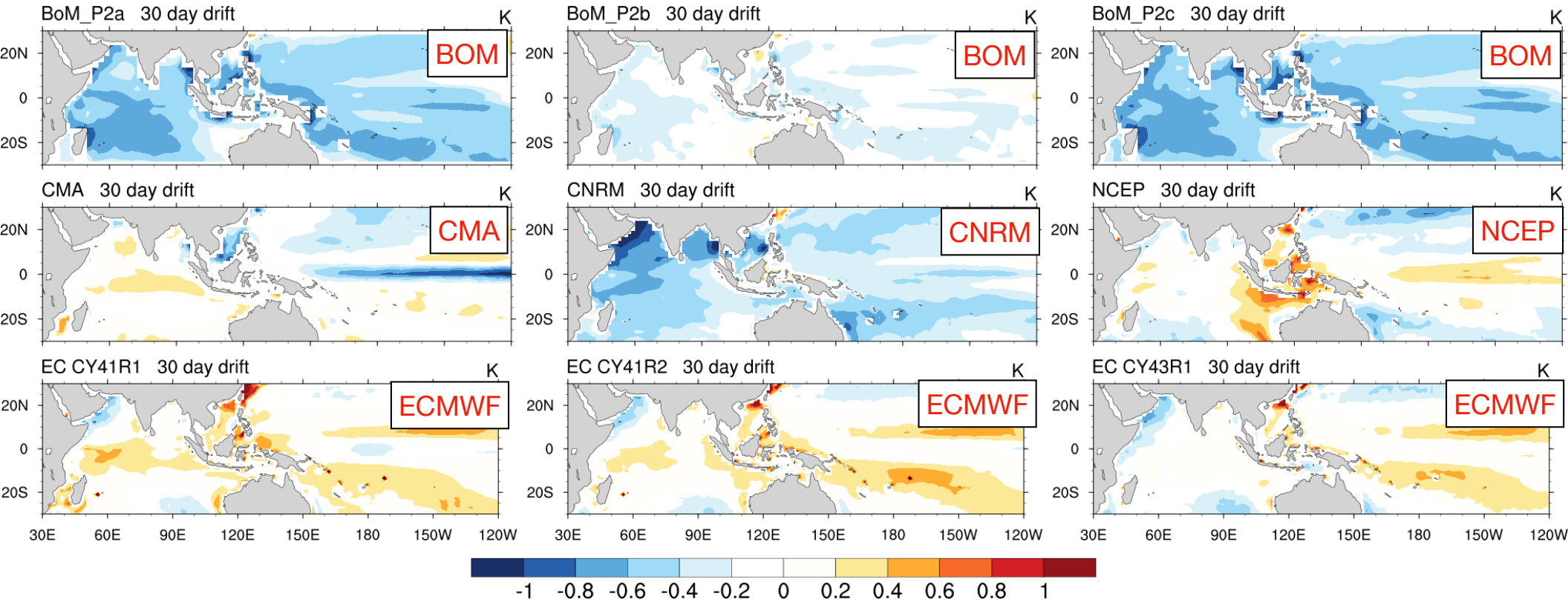


SST drift



SST drift in S2S database models

(Nov-Apr climatology)



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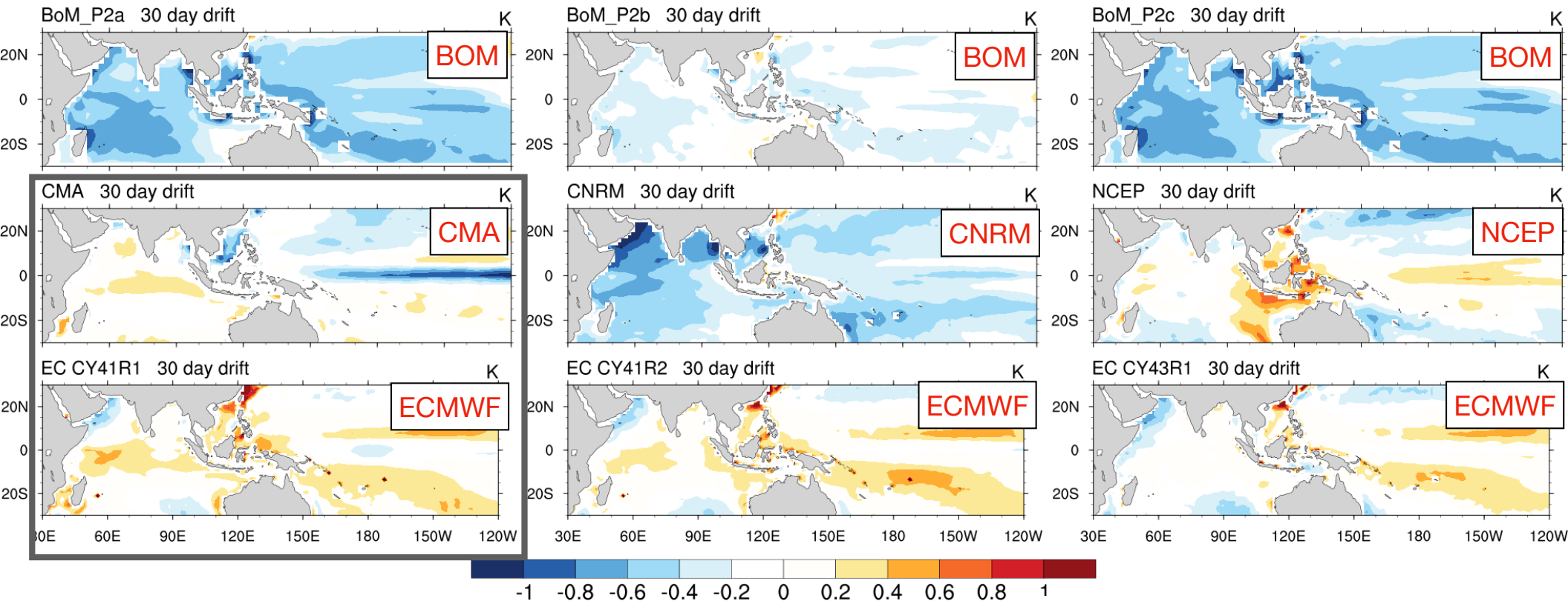
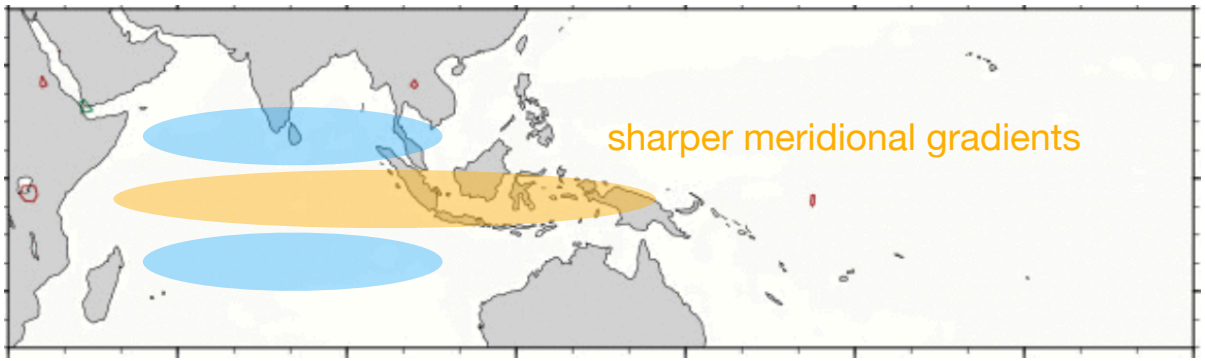
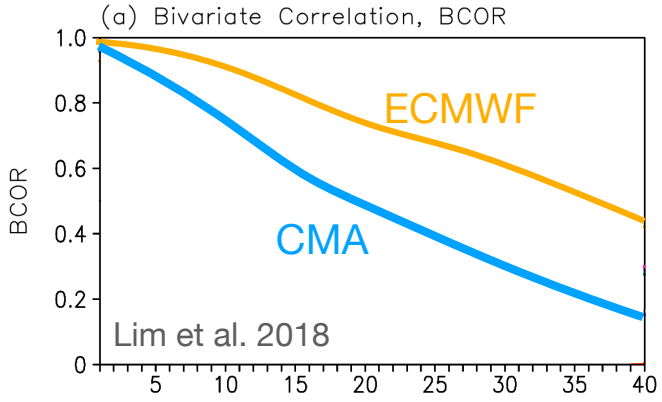
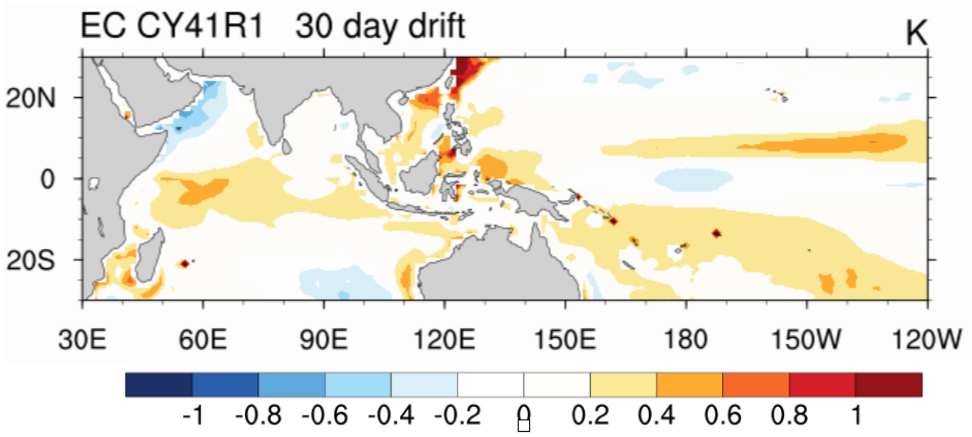






diagnosing mean state SST drift



$$\partial SST/\partial t \sim Q_{net} + ocnproc$$

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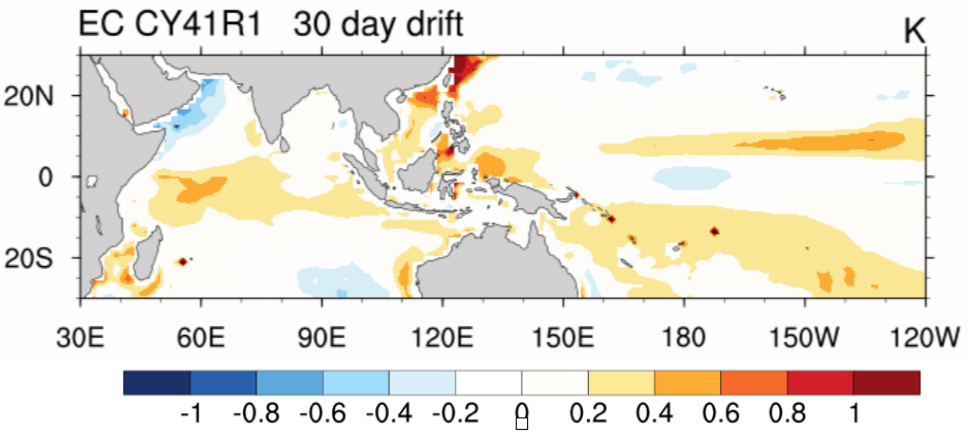
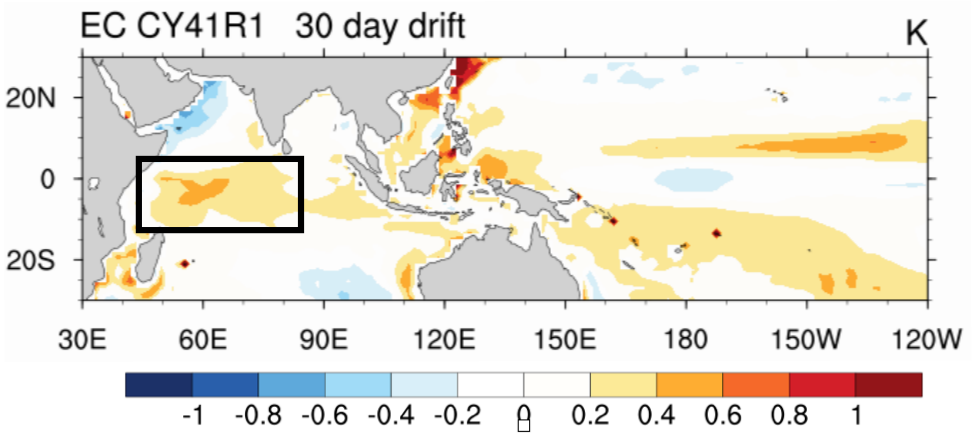


$$\partial SST/\partial t \sim Q_{net} + ocnproc$$

- regress ∂SST/∂t onto Q_{net}
- compute Q_{net}-predicted ∂SST/∂t
- residual is ocean-driven ∂SST/∂t

diagnosing mean state SST drift EC CY41R1



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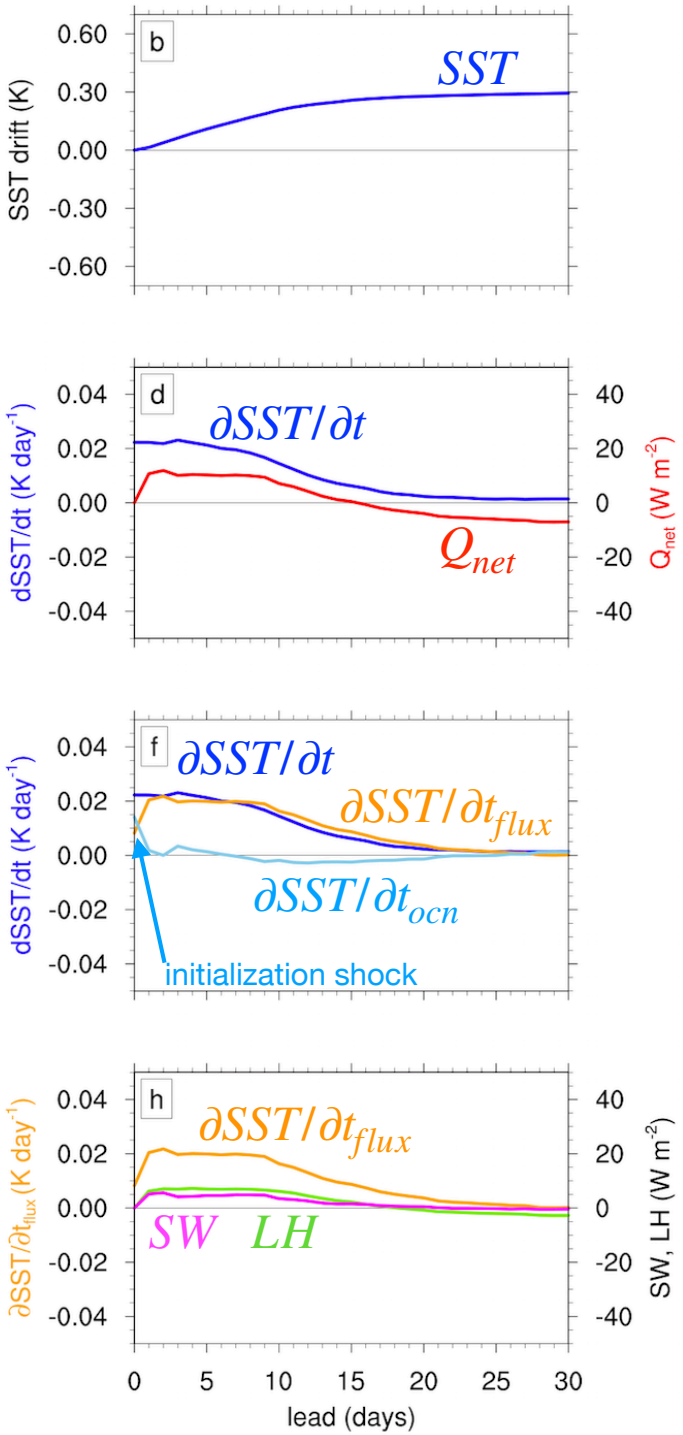

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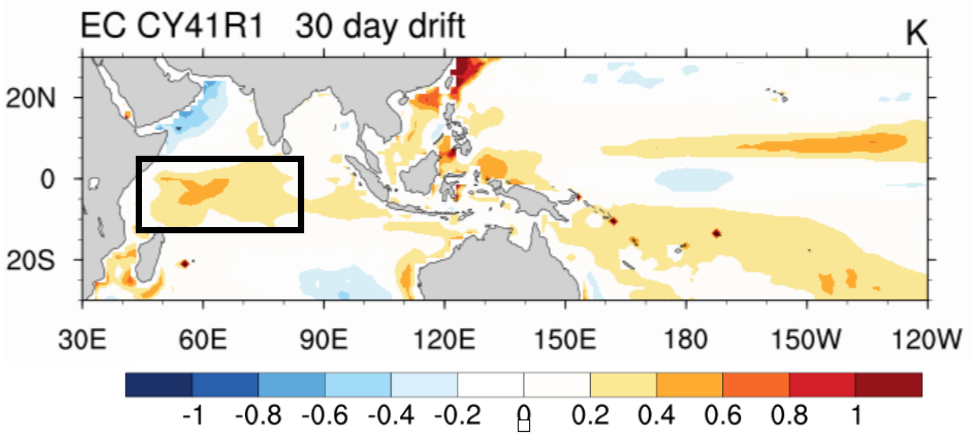

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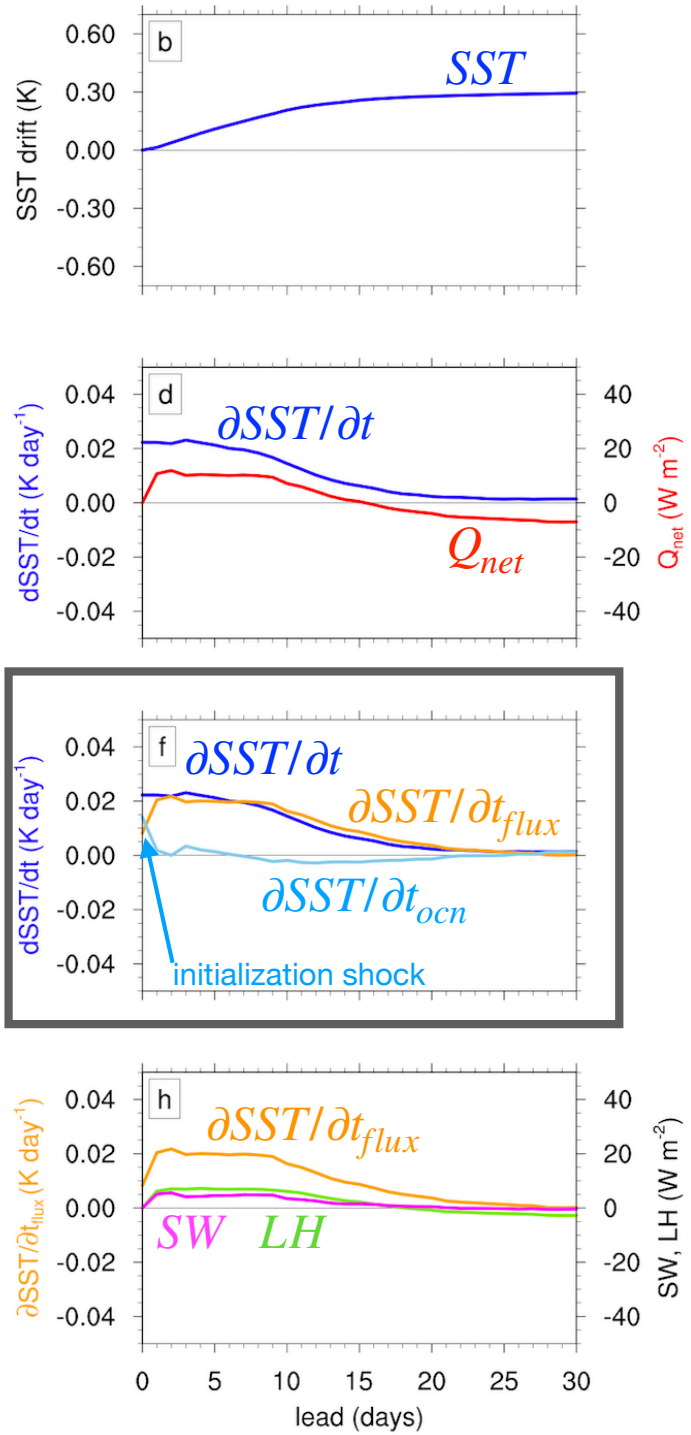
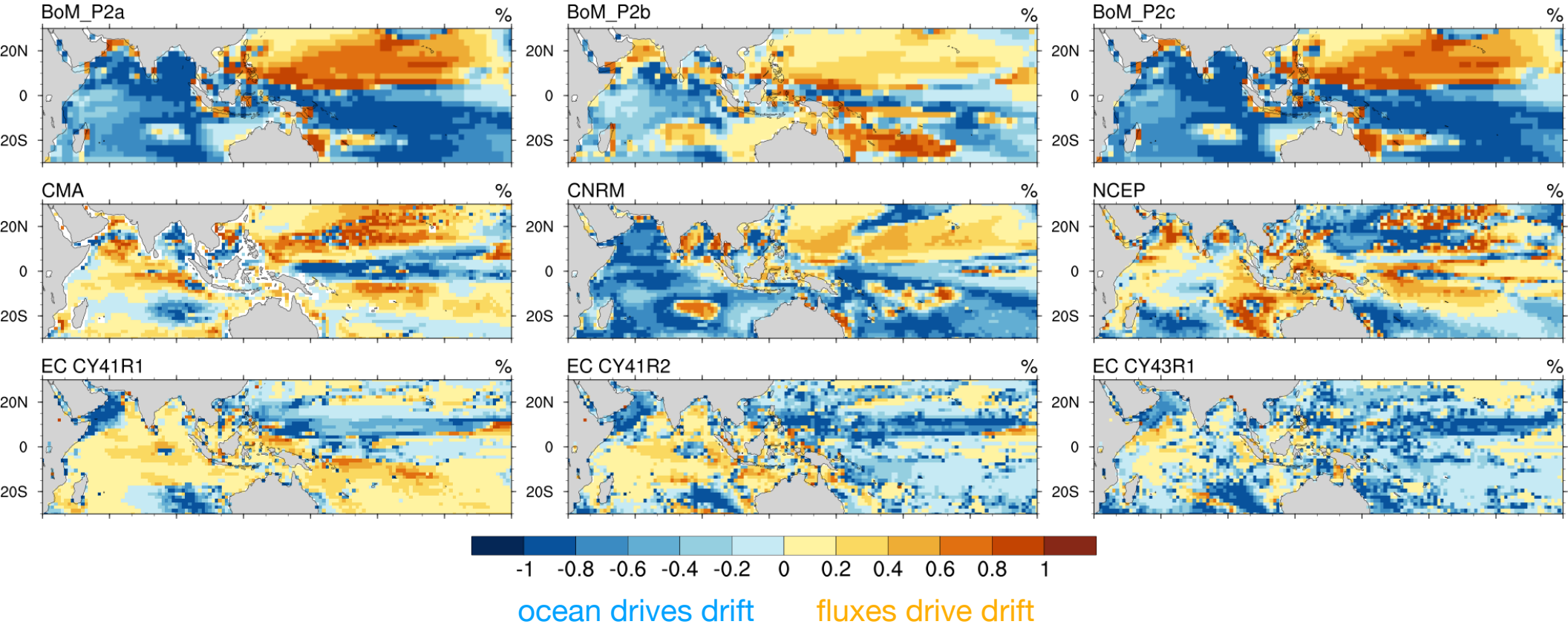


surface flux vs ocean dynamics for SST drift



as determined by a “balance factor” that compares RMSE of each time series (Halkides et al. 2015)

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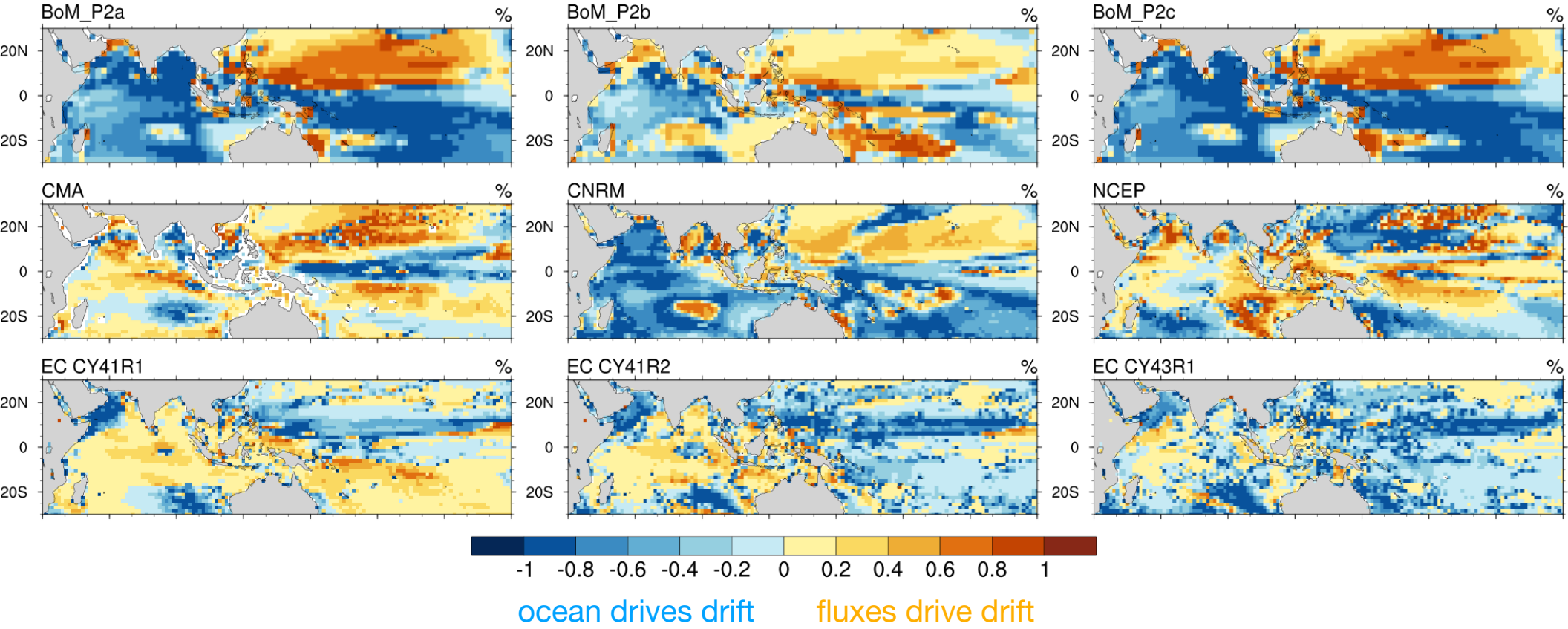


- large variety of SST drift sources across models
- ocean sources of drift: initialization shock, lack of coupled DA, insufficient observations?

summary

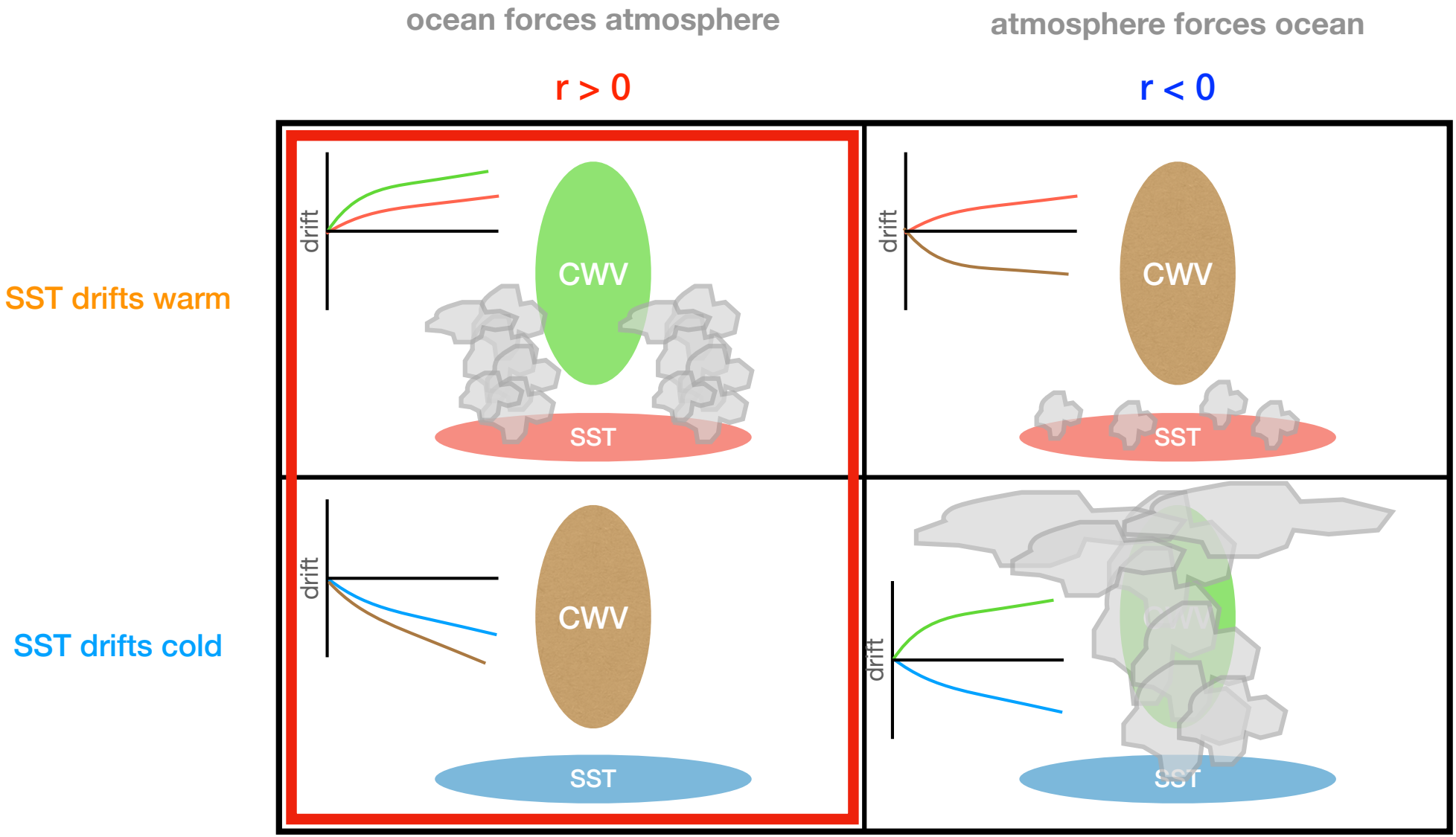
- SST drift can lead to background moisture patterns that affect moisture advection and MJO propagation
- SST drift patterns and their sources are both highly variable across S2S database models

ongoing work

- can we quantify: SST drift —> CWV drift —> MJO prediction skill

extra slides

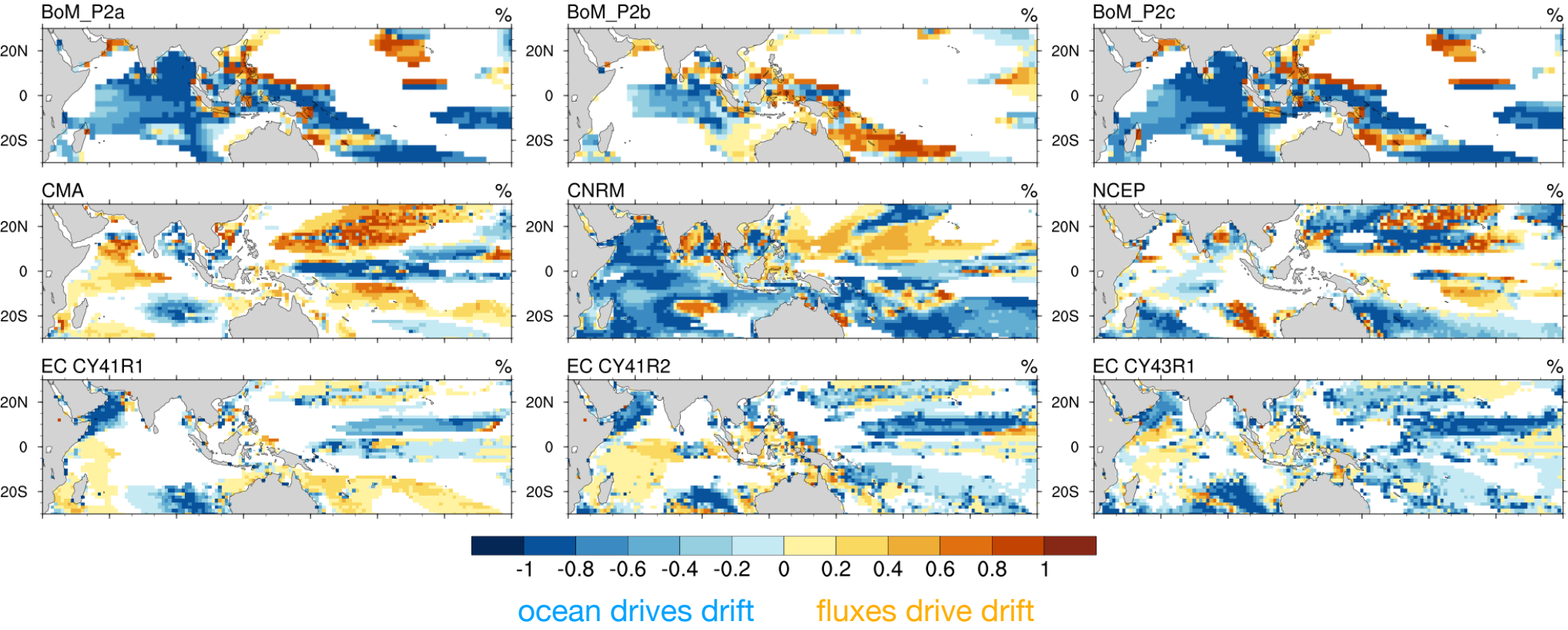
where does SST drift influence moisture drift?



see Kalnay et al. 1986

surface flux vs ocean dynamics for SST drift

only where SST drift drives CWV drift



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