The diurnal cycle of wind and convection over the tropical Pacific Ocean

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Observations

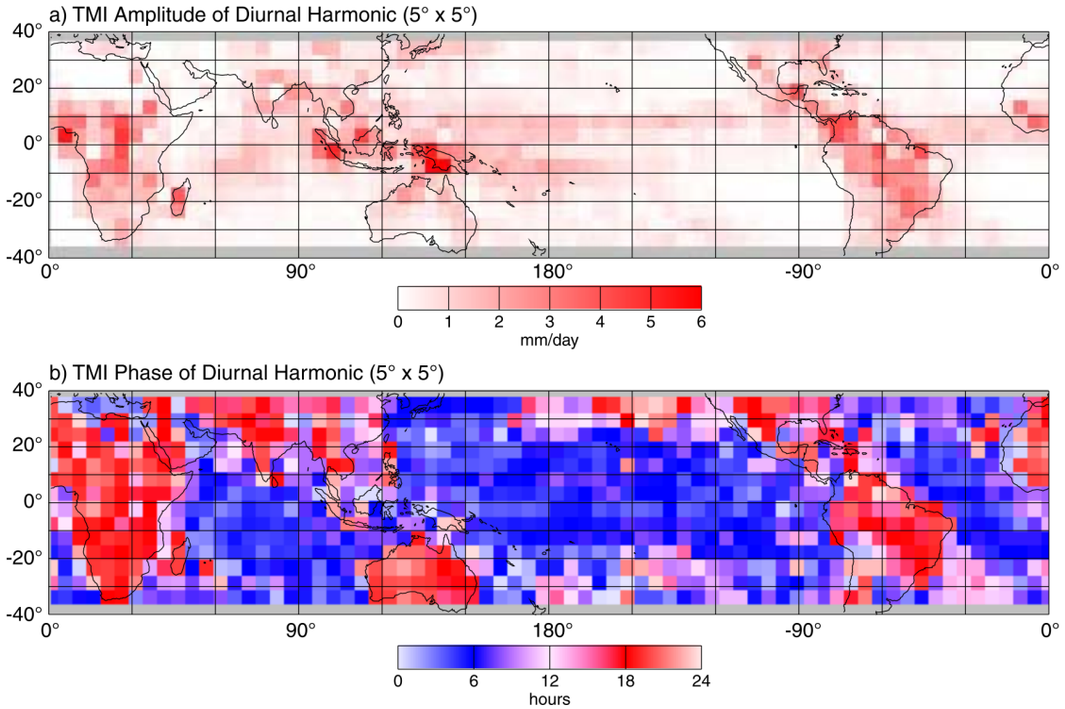


Figure 9. (a) Amplitude and (b) phase of the diurnal harmonic throughout the tropics estimated from TMI 5° × 5° averages.

Bowman et al. 2005

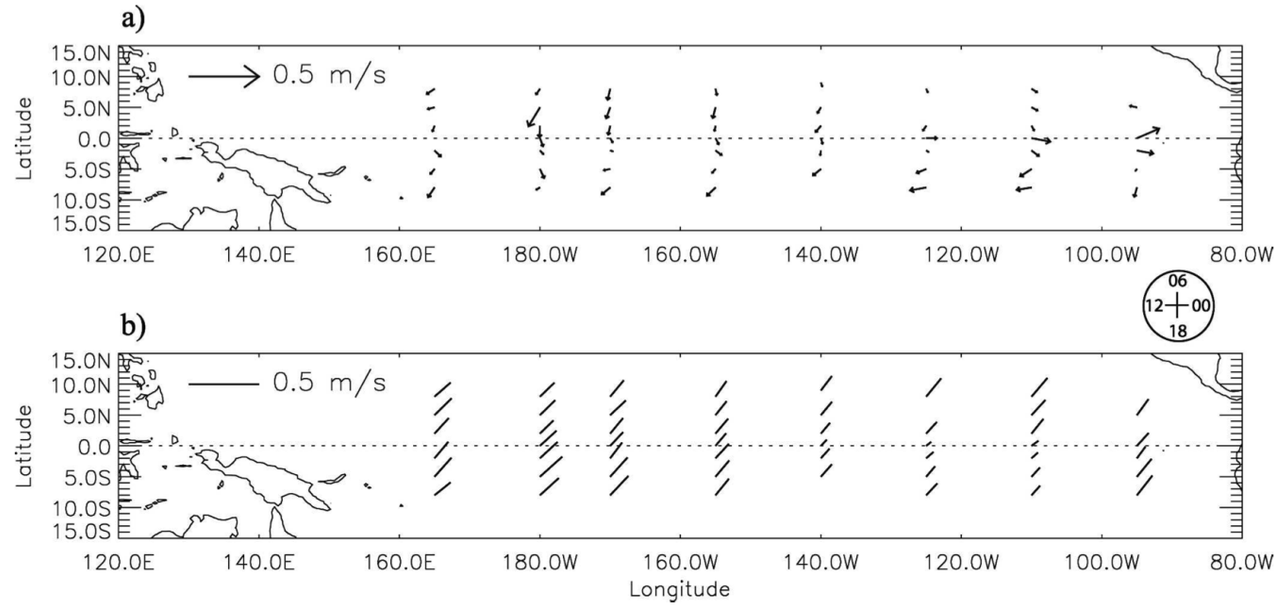


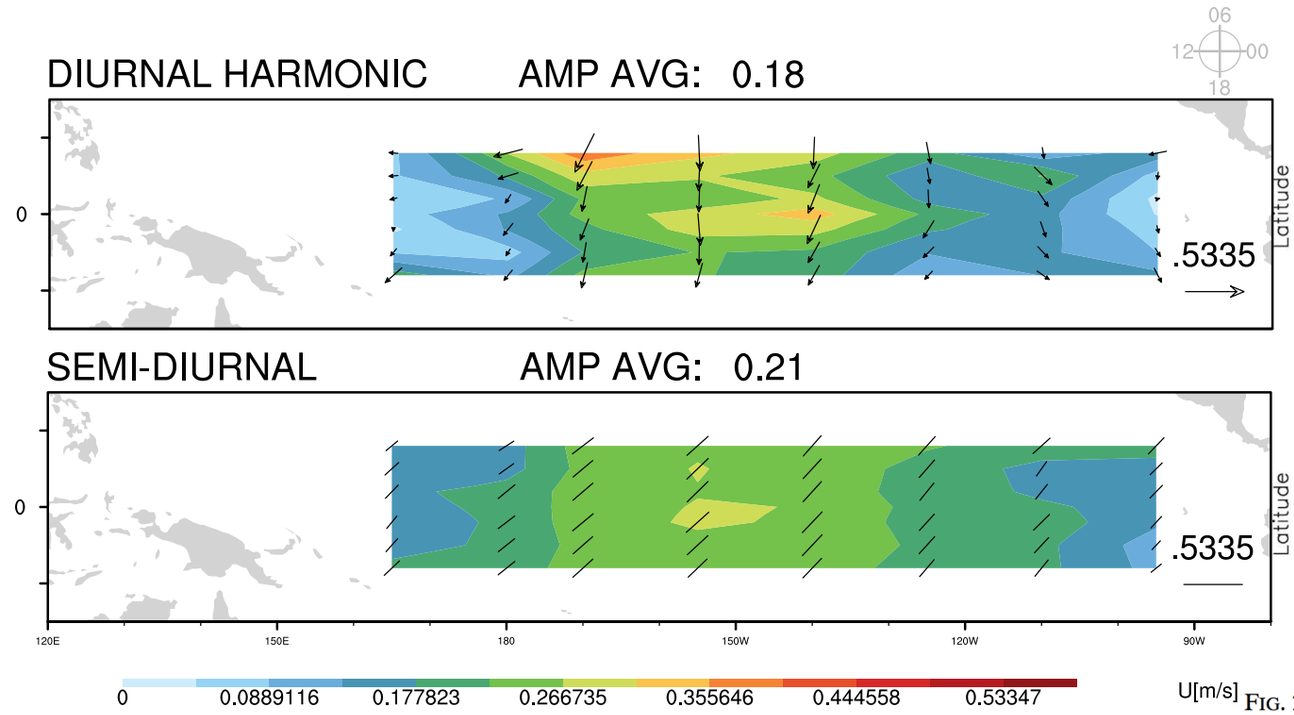
FIG. 2. Annual mean amplitudes and phases of the (a) diurnal and (b) semidiurnal harmonics of the zonal wind. The length of each vector represents amplitude of the corresponding harmonic (scale at top-left corner of both panels) and the direction represents the LT of maximum westerly wind anomaly (clock at middle right). For example, an arrow pointing due north in (a) implies maximum westerly wind anomaly at 0600 LT, and a vertical bar in (b) implies maximum westerly wind anomalies at 0600 and 1800 LT.

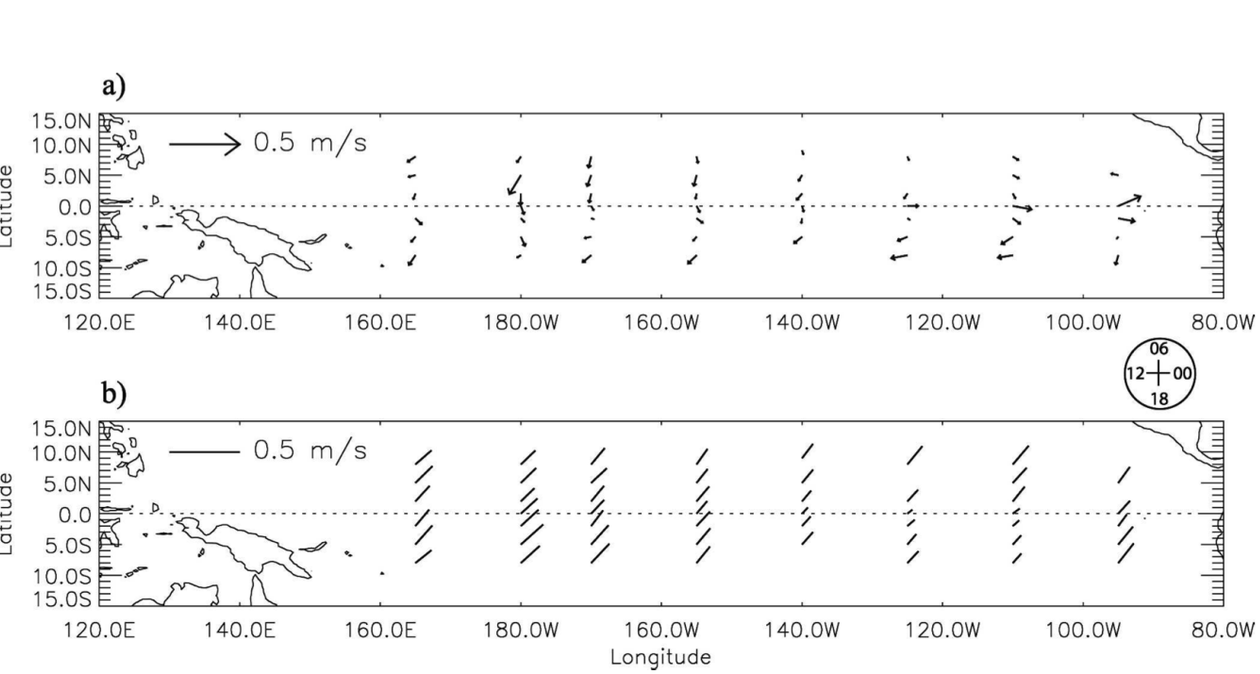
Ueyama & Deser 2008

Does CAM5 simulate a realistic diurnal variation?

Explore using CAPT/TAMIP framework, sampling annual cycle with hind casts initialized from ECMWF YOTC.

Amplitude & Phase at TAO locations





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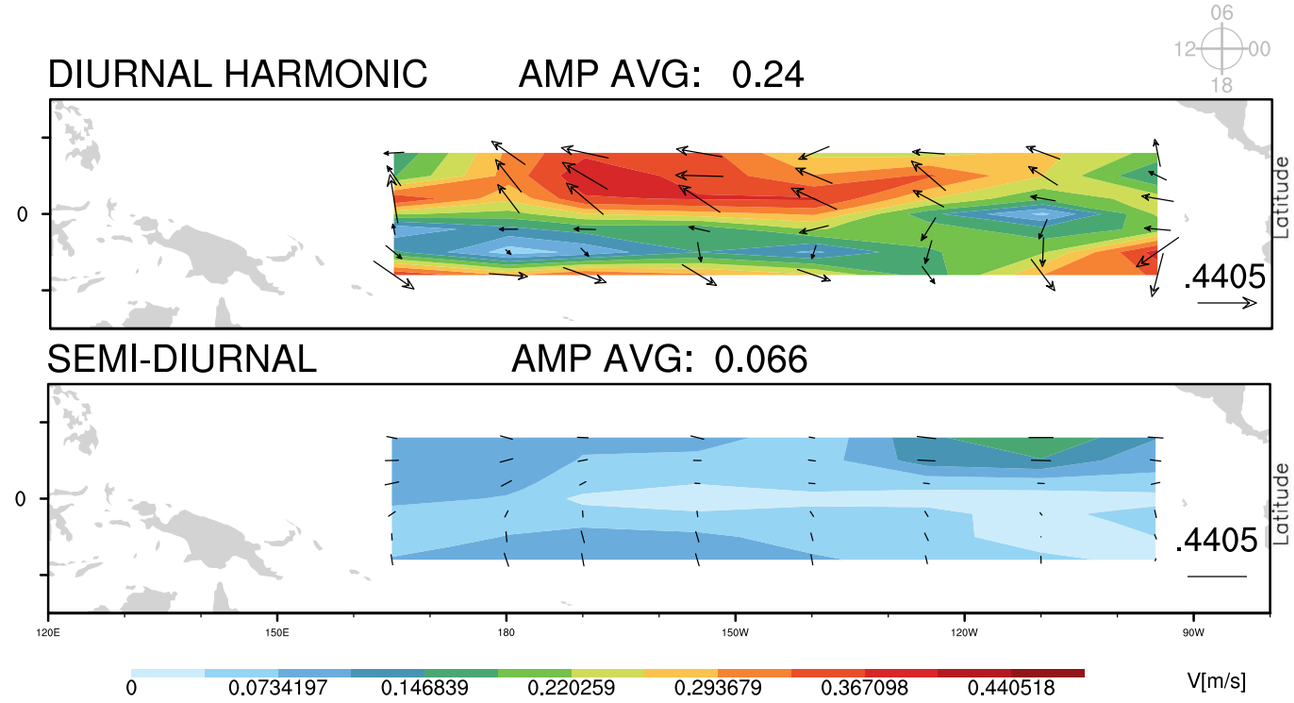
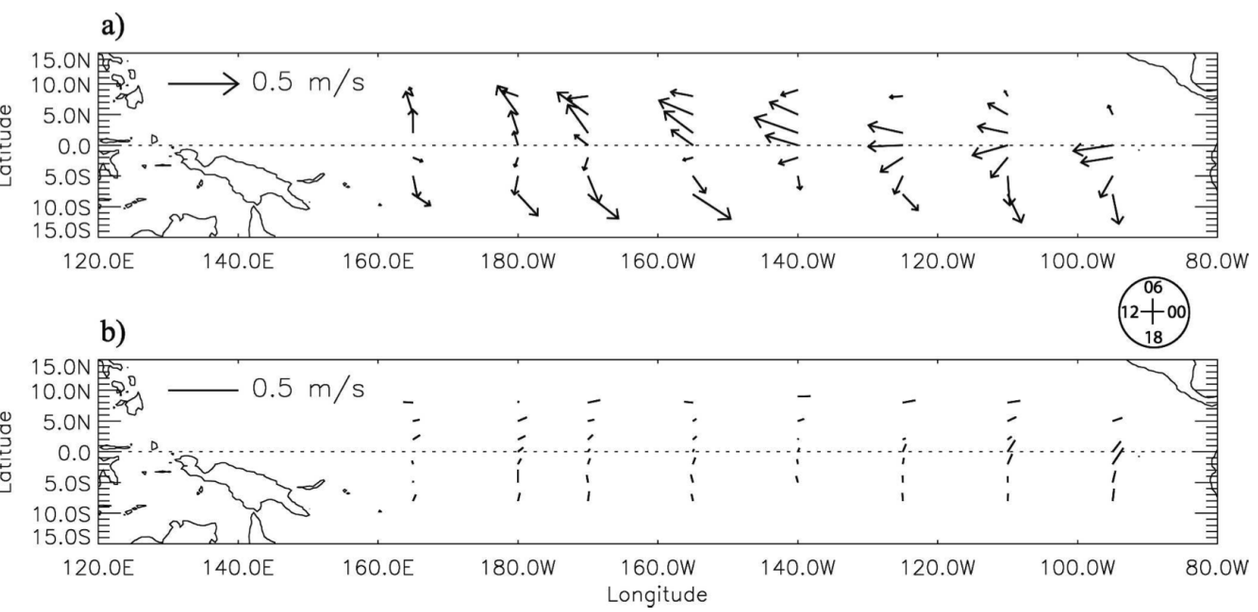
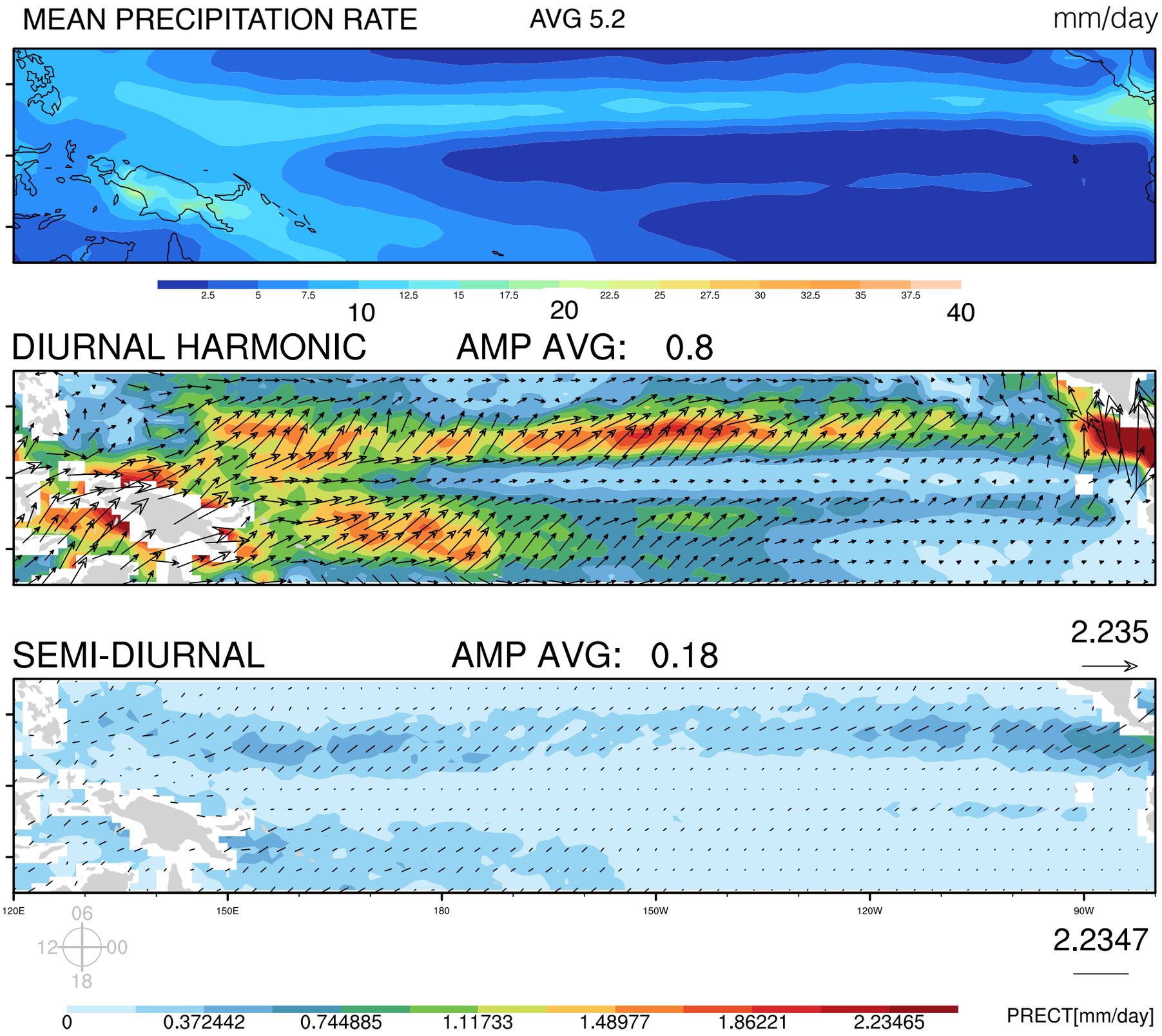




Ueyama & Deser 2008

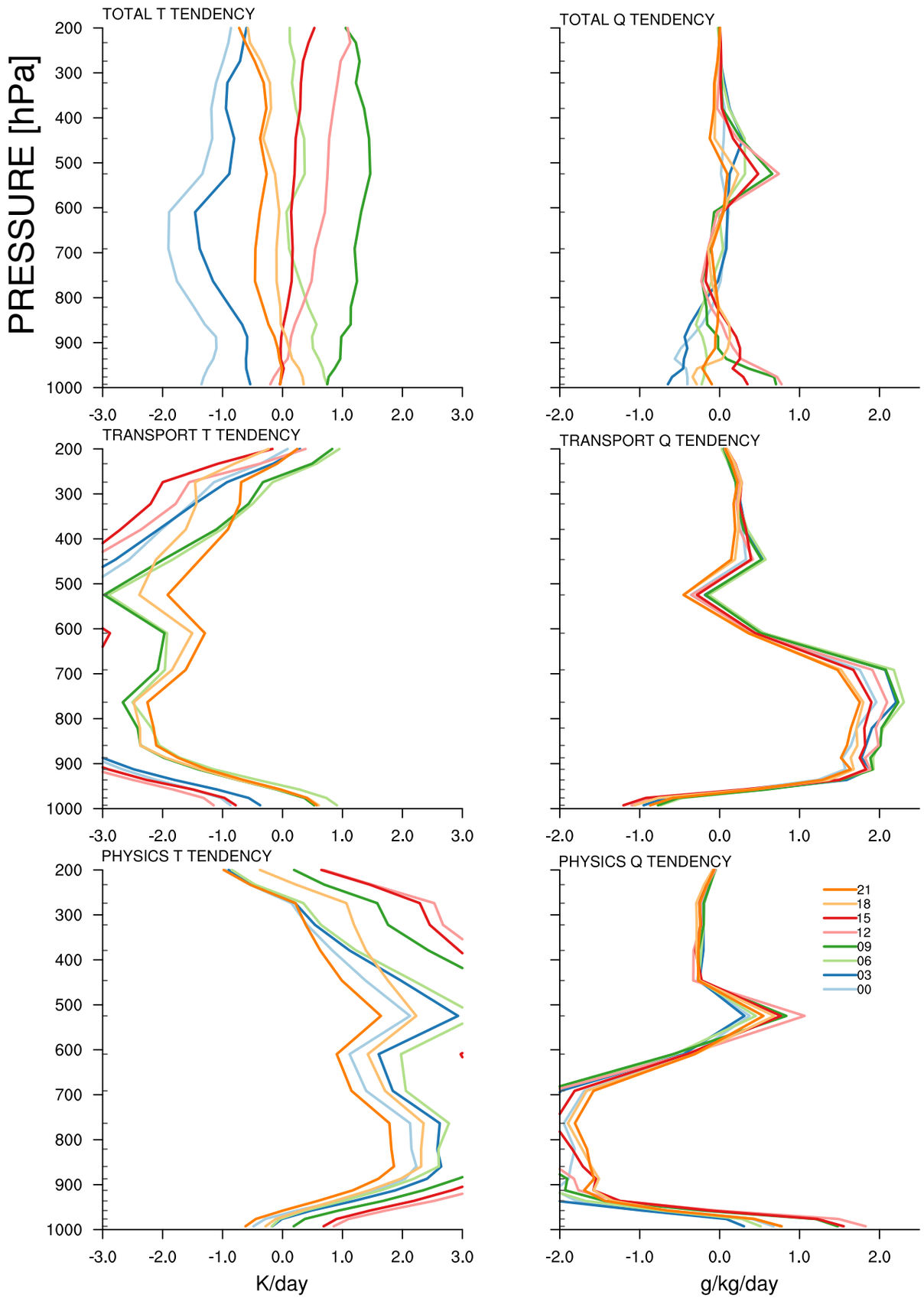
Precipitation diurnal variation



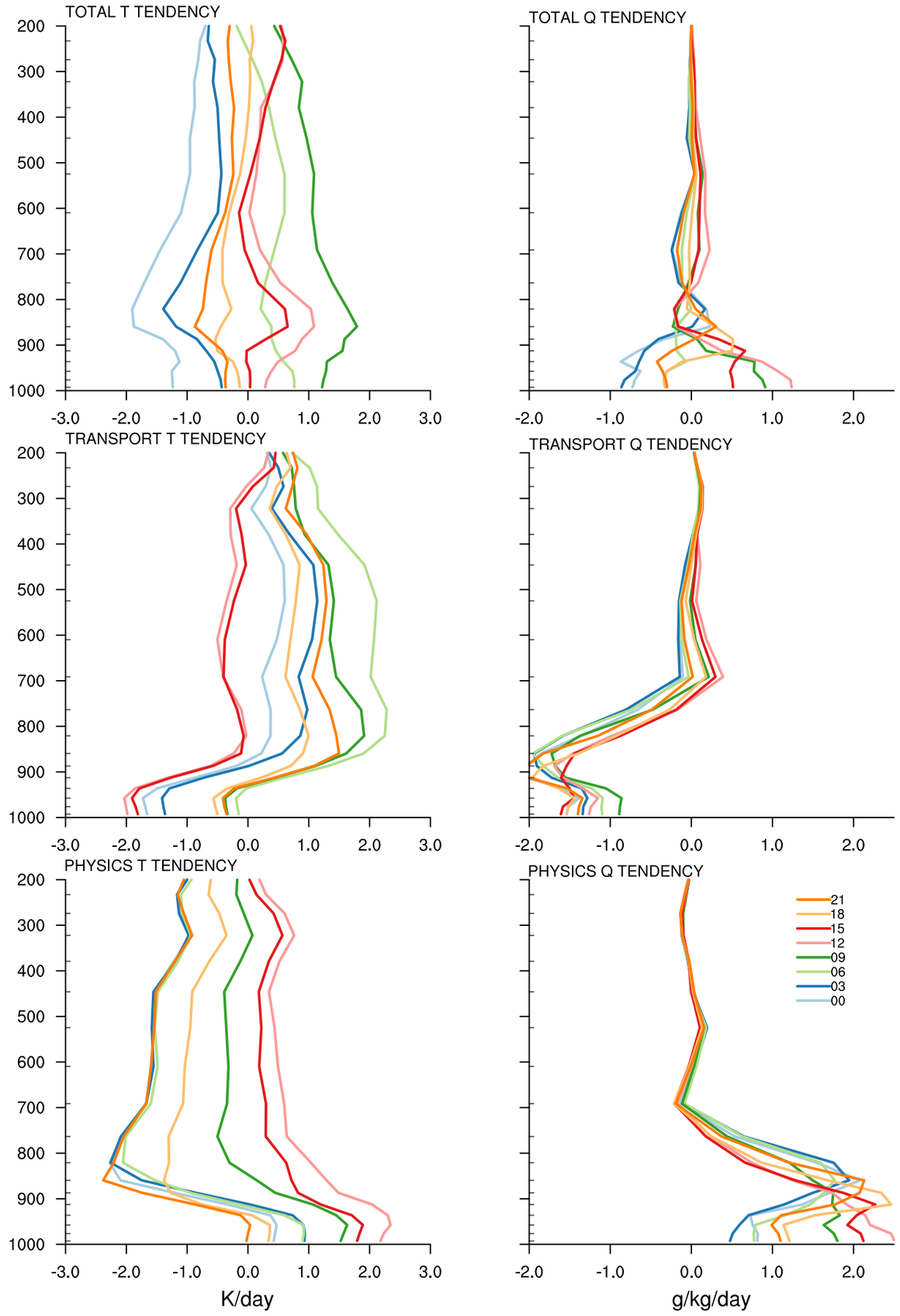
What are the mechanisms of the diurnal variation?

Connections between convection and surface winds?

ITCZ (5-8N, 180-200E)

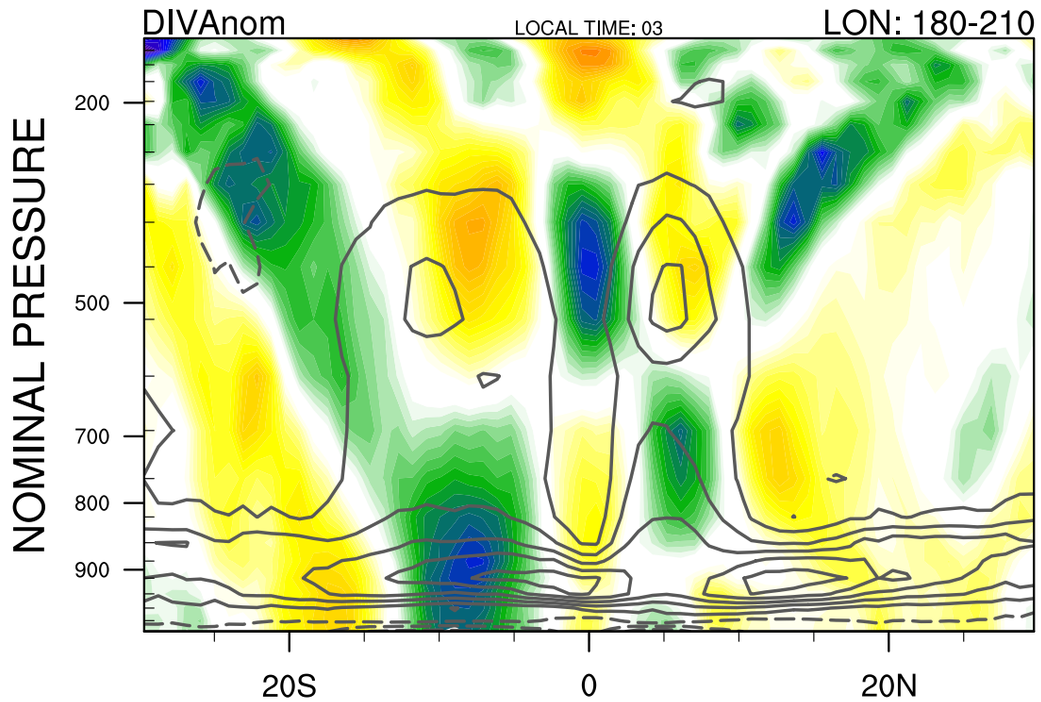


Trades (12-15N, 180-200E)

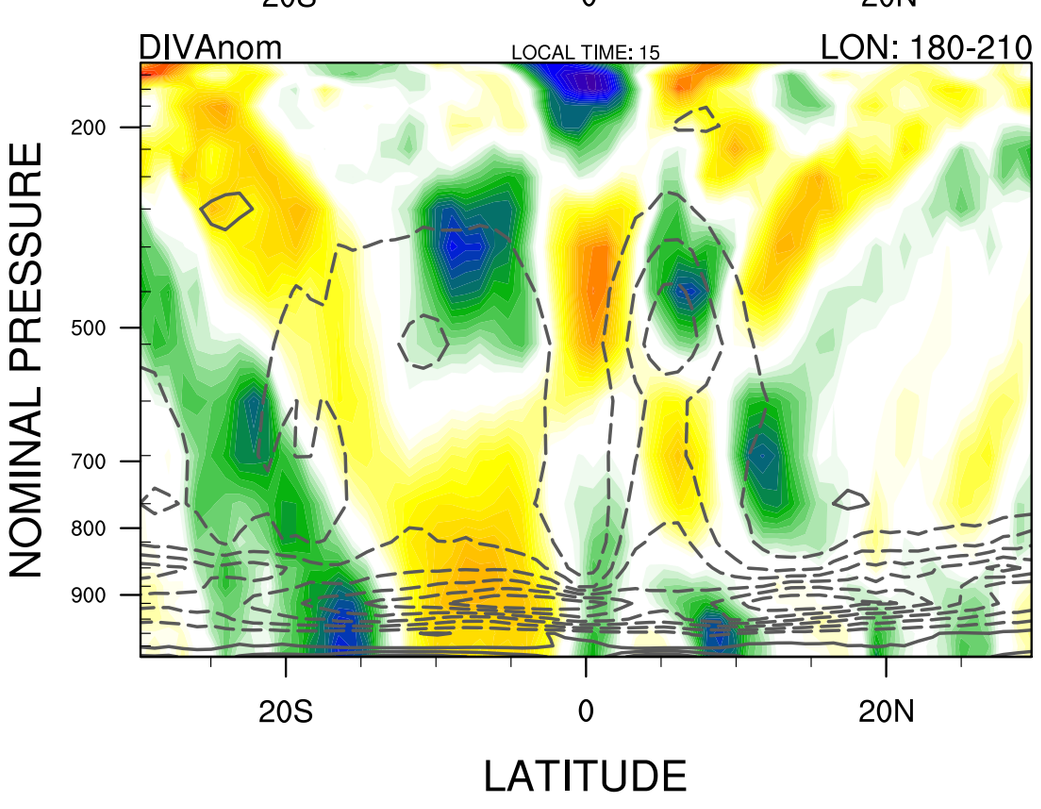


Circulation-Convection-Cloud connections

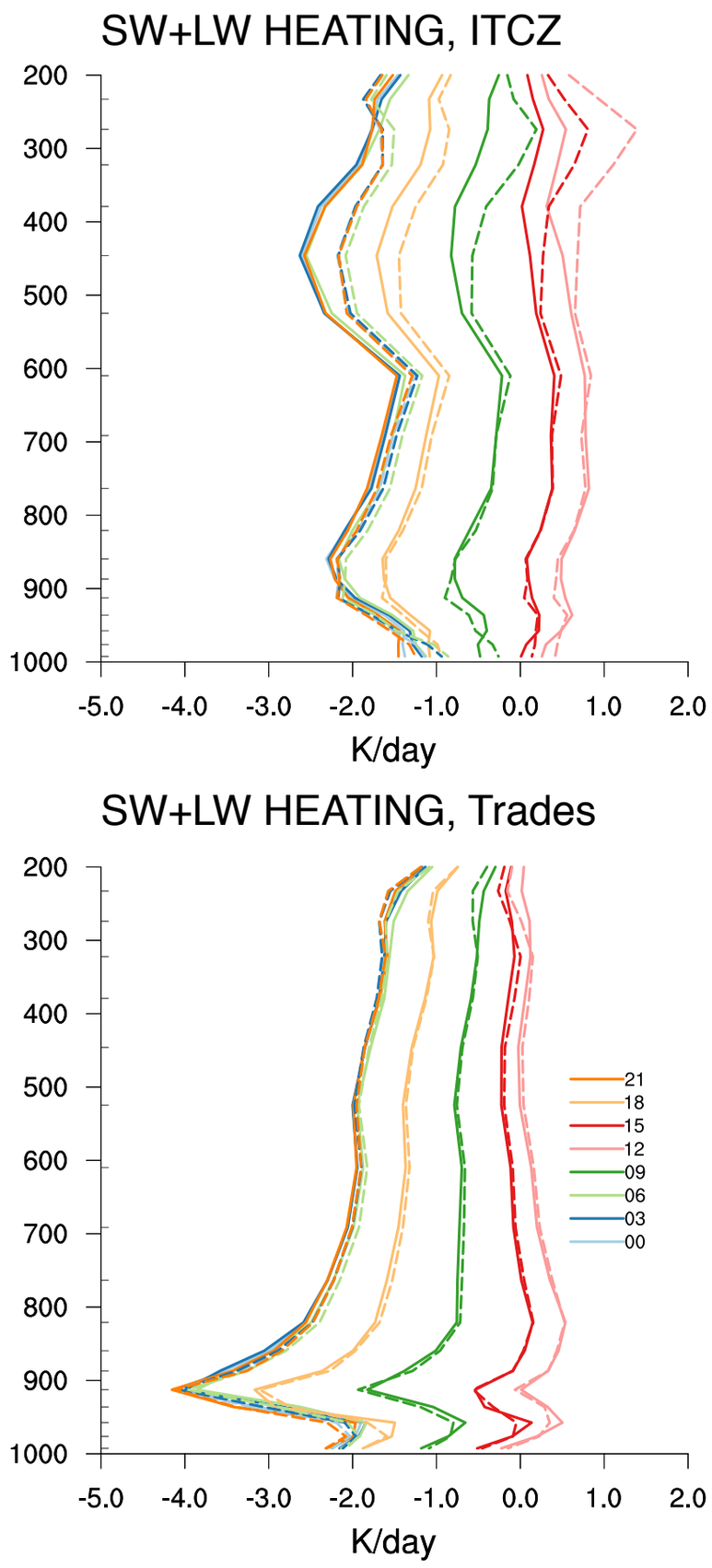
3AM,
max precipitation



3PM,
min precipitation

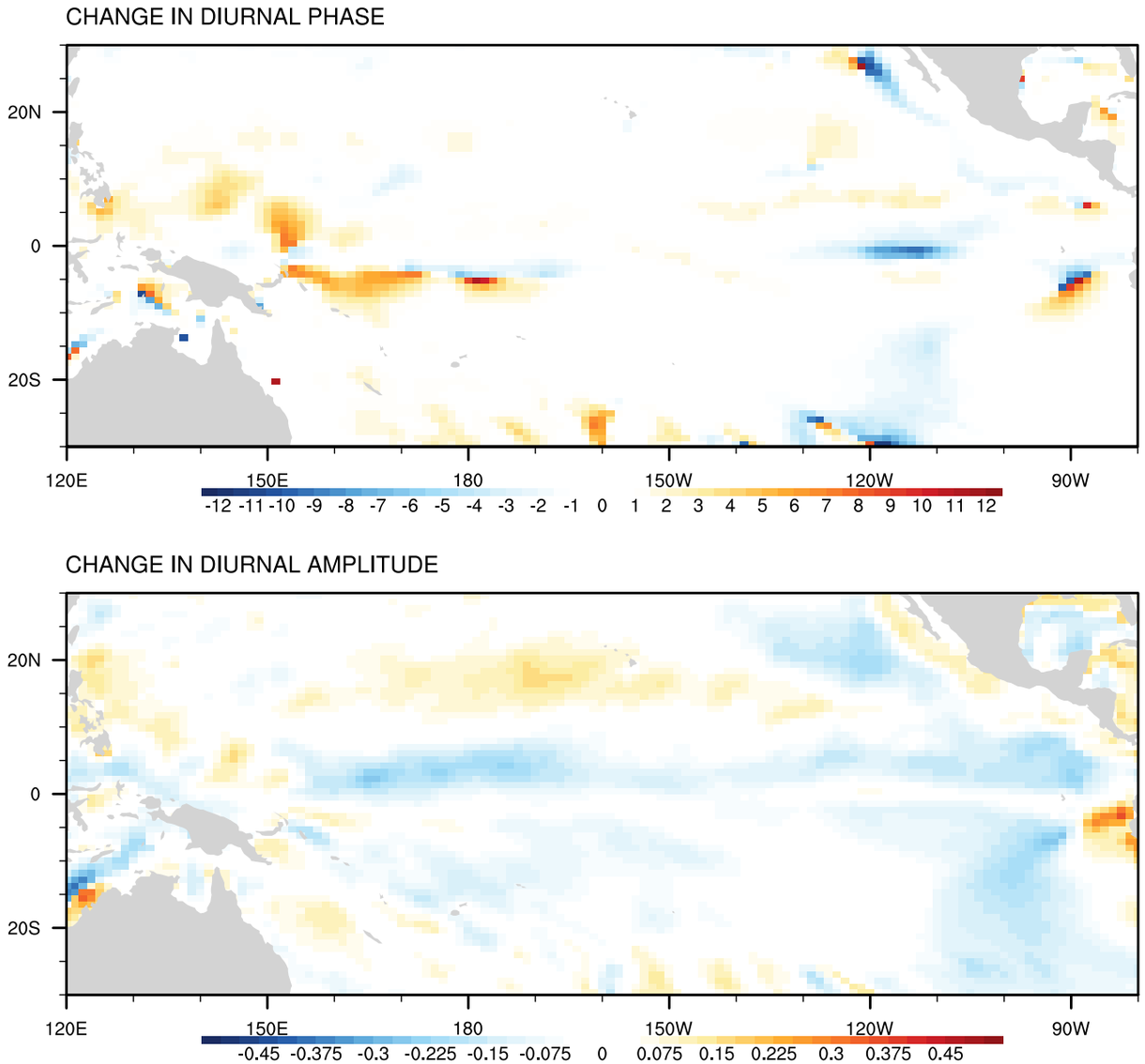


“COOKIE” experiment: Radiative heating

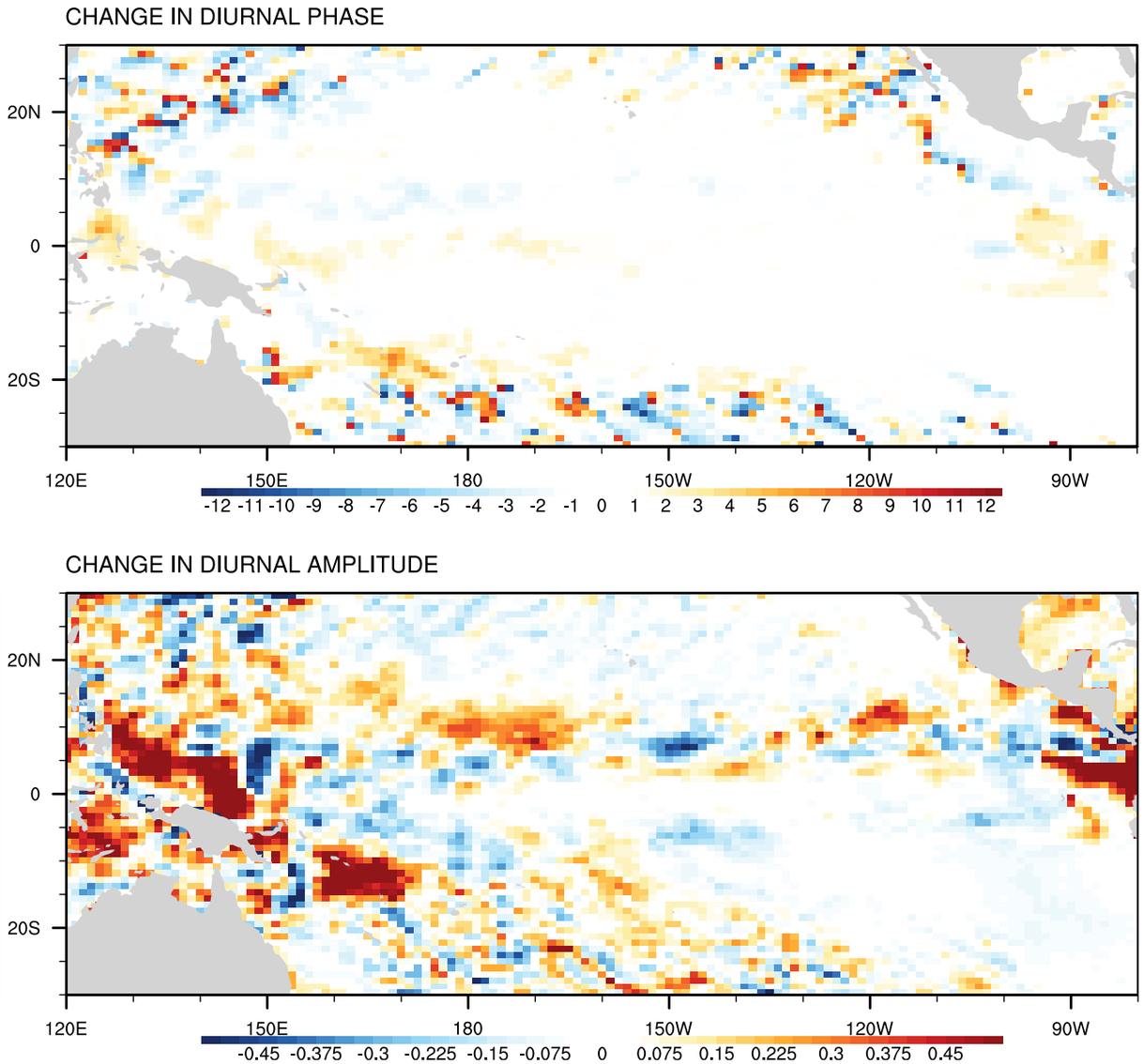


“COOKIE” experiment

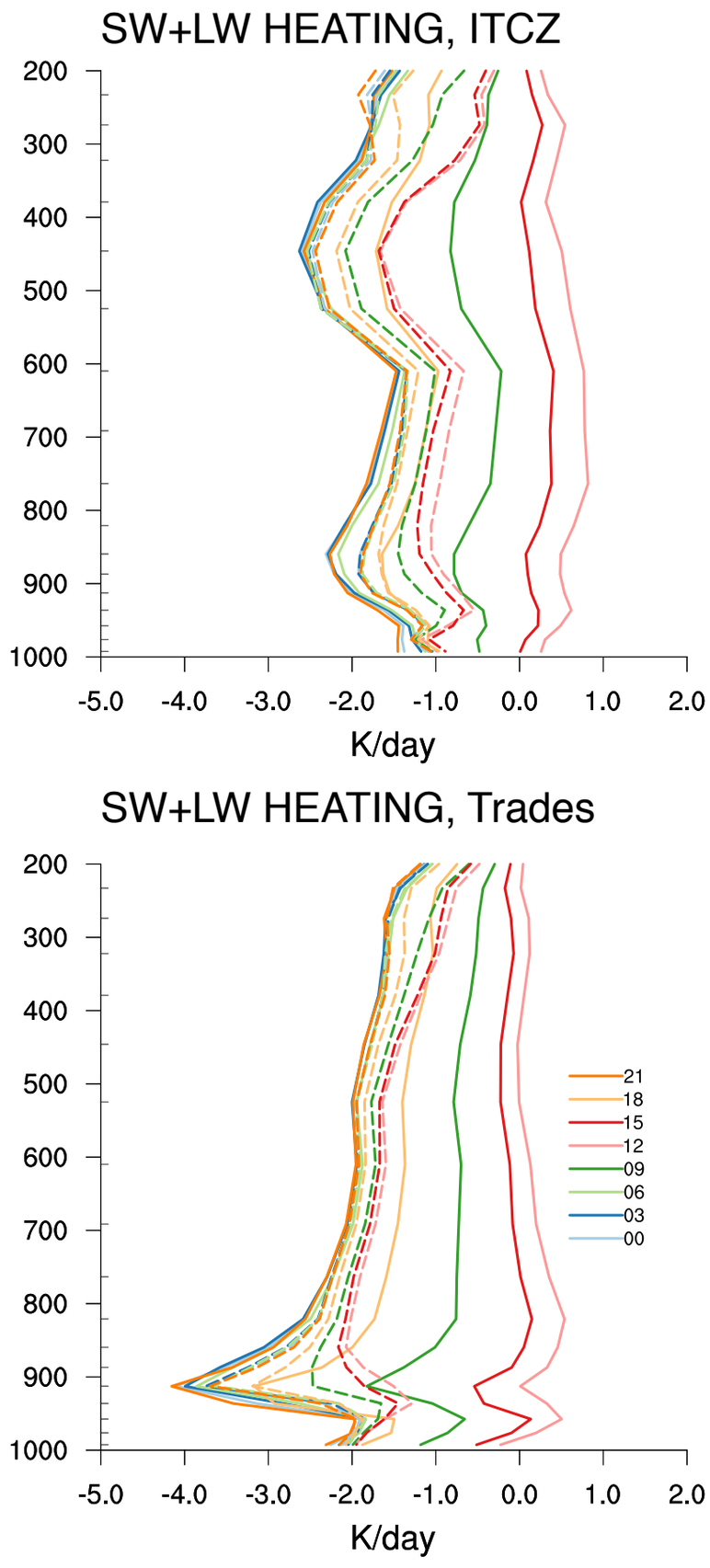
LOW-LEVEL MERIDIONAL WIND



TOTAL PRECIPITATION



H_2O SW experiment: Radiative heating



H_2O SW experiment

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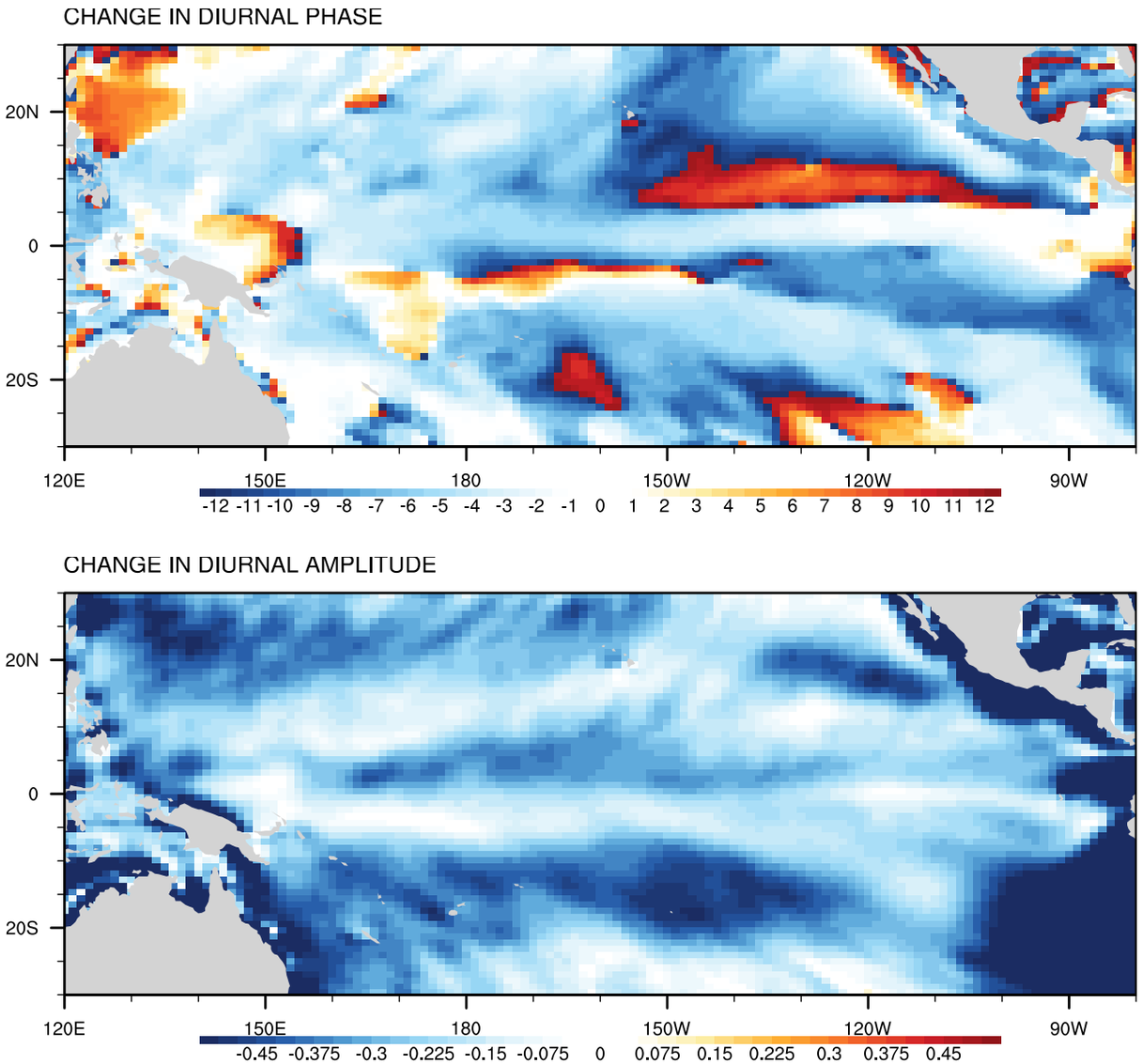
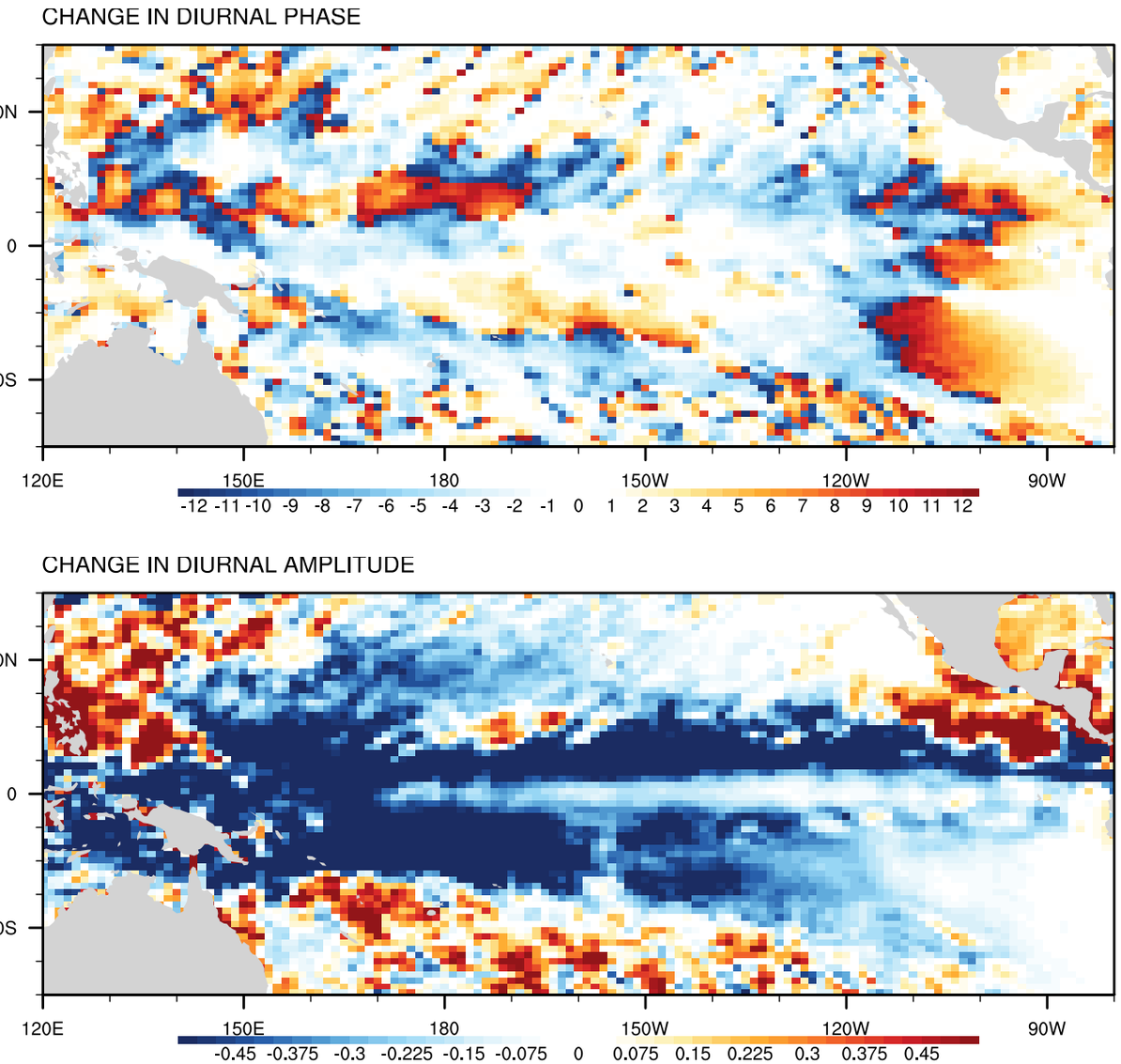


TOTAL PRECIPITATION



Summary & Discussion

CAM5's diurnal variation (over open ocean) is credible. (Allows investigation of mechanisms.)

CRE has little direct impact on diurnal variation (feedbacks required).

Removing SW effects of water vapor damps diurnal cycle

Future:

- *Upper troposphere vs boundary layer H2O SW*
- *Varying SST*
- …

Two related AGU sessions:

Toward Reducing Systematic Errors in Weather and Climate Models: Evaluation, Understanding, and Improvement

Shaocheng Xie, Jui-Lin F Li, Brian Medeiros, and Fanglin Yang
[https://agu.confex.com/agu/fm14/webprogrampreliminary/Session2280.html]

Simulating Organized Convection Across Scales

Kevin A Reed, Ahmed B Tawfik, and Brian Medeiros
[https://agu.confex.com/agu/fm14/webprogrampreliminary/Session1569.html]