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Multiscale interactions between the MJO, equatorial waves, and the diurnal cycle over the Maritime Continent

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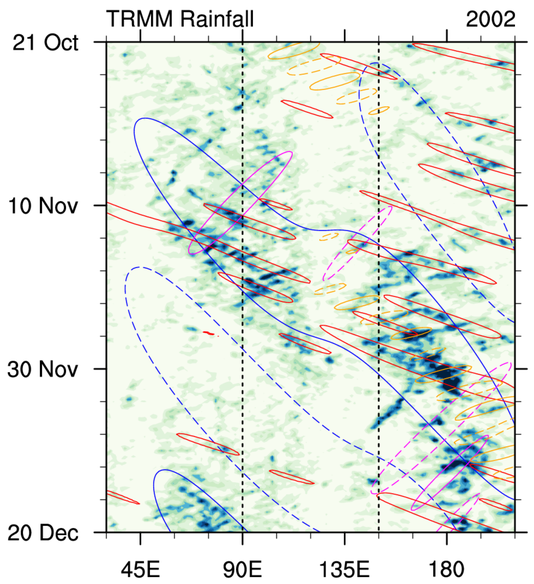
Objectives

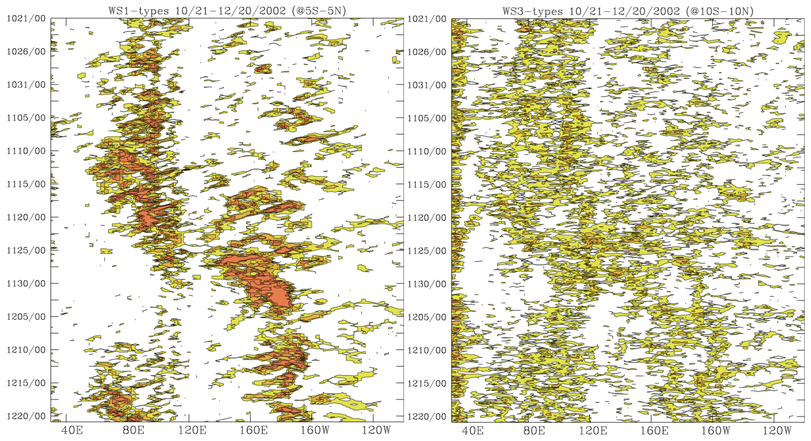


Hovmöller of total rainfall (shading). MJO (blue), equatorial Rossby waves (magenta), and Kelin waves (red) are contoured. Vertical dashed lines outline the Maritime Continent

MJO's propagation across the Maritime Continent is a major subseasonal predictability problem.

- How do equatorial waves modulate diurnal cycle of convection over the Maritime Continent?
- What role do equatorial waves play in the MJO's transition across the Maritime Continent?
- How well do numerical models like the CFS predict equatorial waves over the Maritime Continent?

Diurnal Cycle of Convection



Homoller counts of ISCCP Weather States (WS) of MCSs (left) and disorganized convection (right).

ISCCP IR weather states (IR-WS) identify eight cloud regimes based on their cloud-top pressure (CTP) and their corresponding IR-regime in the ISCCP D1 data. IR-WS1 (left) corresponds to well organized convection (i.e., MCS) and IR-WS3 (right) represents isolated cumulonimbus or cumulus congestus clouds. The diurnal cycles of these IR-WS data will be compared with TRMM Precipitation Feature (PF) data over the Maritime Continent.

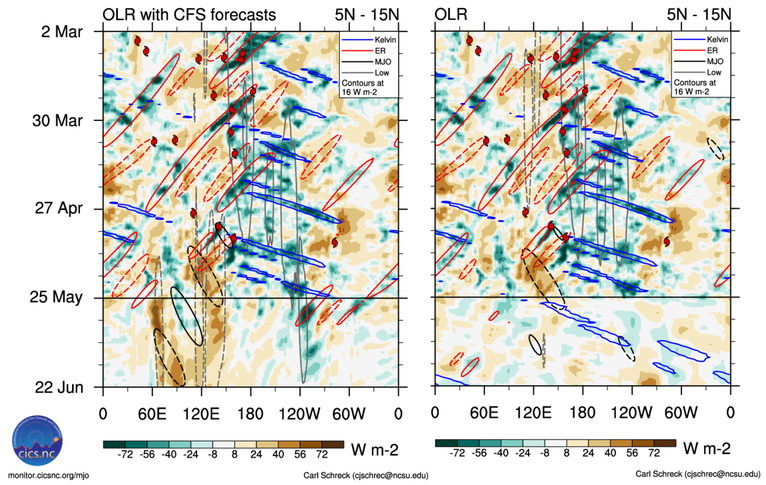
Hypothesis 1:
- Like the MJO, equatorial waves favor upscale growth of convection
- However, their shorter periods reduce the interaction with the diurnal cycle

Task 1:
- Identify the diurnal cycle of convection in each phase of Kelvin and Equatorial Rossby waves
- Compare results with ISCCP, TRMM PF, and TRMM/IMERG rainfall

Hypothesis 2:
- The population of equatorial waves dictates which MJO events traverse the Maritime Continent
- Being less sensitive to the diurnal cycle, equatorial waves provide a bridge for the MJO

Task 2:
- Compare wave variance between MJOs that do or do not propagate across Maritime Continent

Forecasting Convective Envelopes



Example forecast Hovmöllers of OLR anomalies (shading) and filtered wave modes. (left) Observations are appended with climatological values for filtered (Wheeler and Wieckmann 2000). (right) Observations are appended with CFS forecasts.

Hypothesis 3:
- The CFS is more skillful at forecasting the convective envelopes of the MJO and equatorial waves than actual rainfall

Task 3:
- Filter CFS Reforecast to create retrospective forecasts of OLR and rainfall
- Examine anomaly correlations with observed data

Hypothesis 4:
- The CFS skill at forecasting the MJO, equatorial waves, and the diurnal cycle are all correlated with each other

Task 4:
- Identify good and bad forecasts of the MJO over the Maritime Continent
- Compare the wave activity, wave forecasts, and diurnal cycles between each