

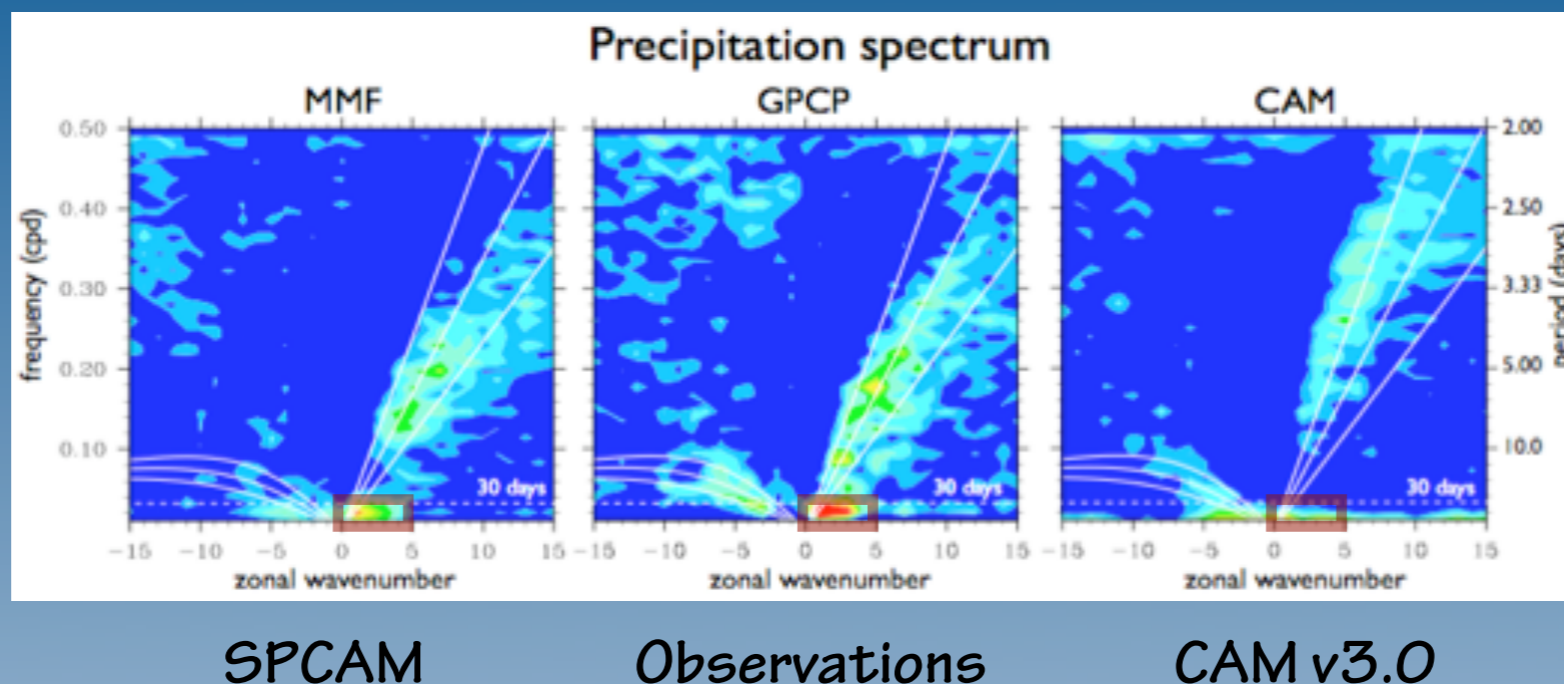


Spatial and Temporal Structures of the SPCAM's Composite MJO Lifecycle

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**CMMAP Semiannual Meeting
29 July 2008**

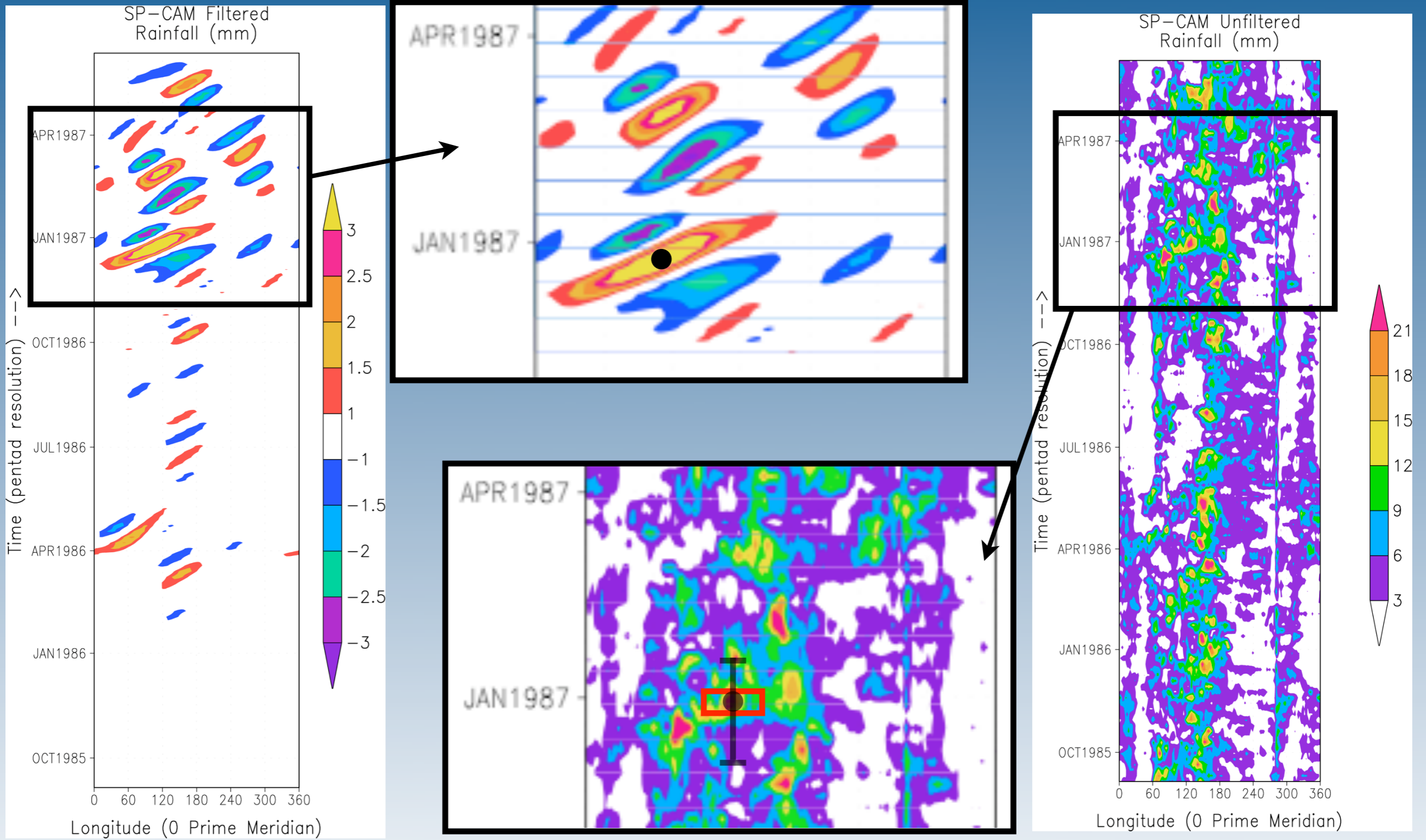
Research Questions



Khairoutdinov et al. 2005

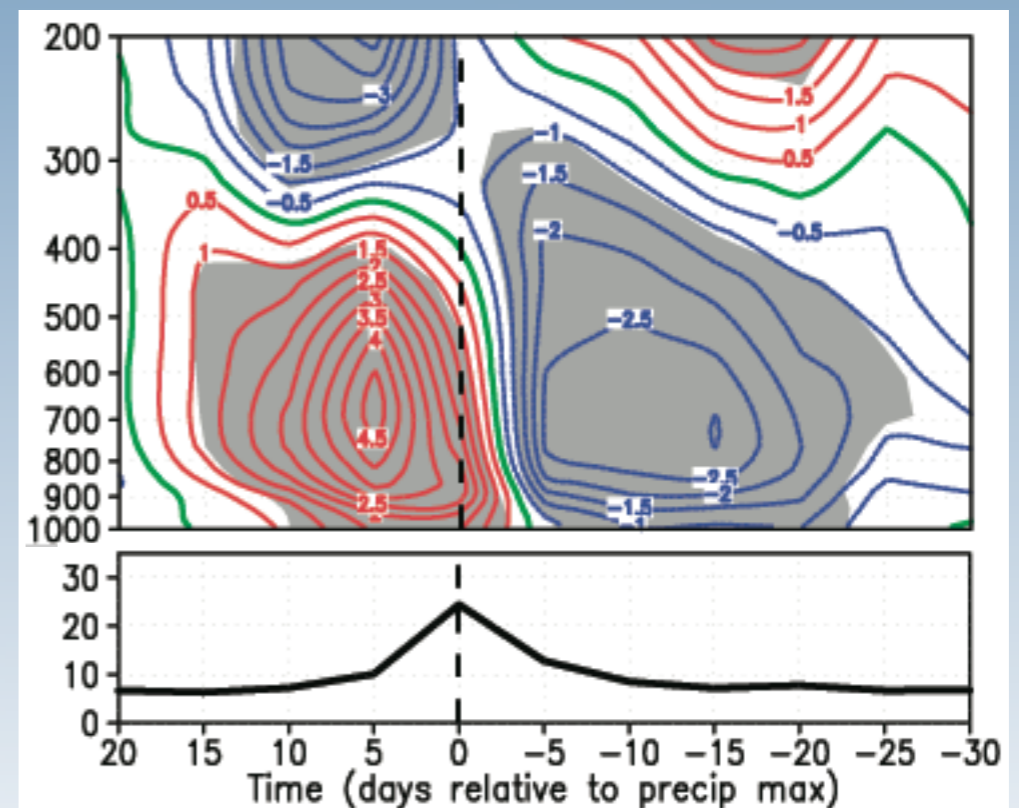
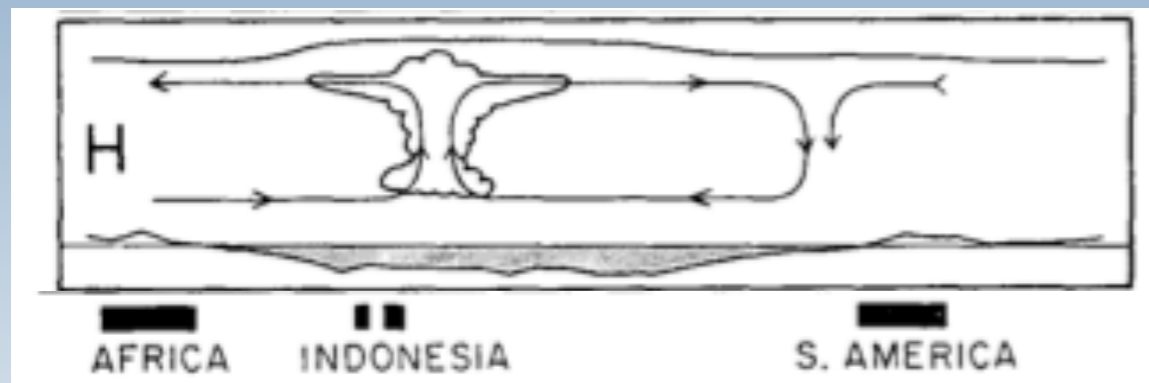
- (1) Spectral diagnostics suggest the SPCAM is closer to observations than CAM 3.0. Does the SPCAM exhibit realistic MJO-like wave features in physical space?
- (2) Why does the SPCAM have a better representation of rainfall (and other variables) related to the MJO?
- (3) How is the MJO initiated in observations?...in the SPCAM?

Methods



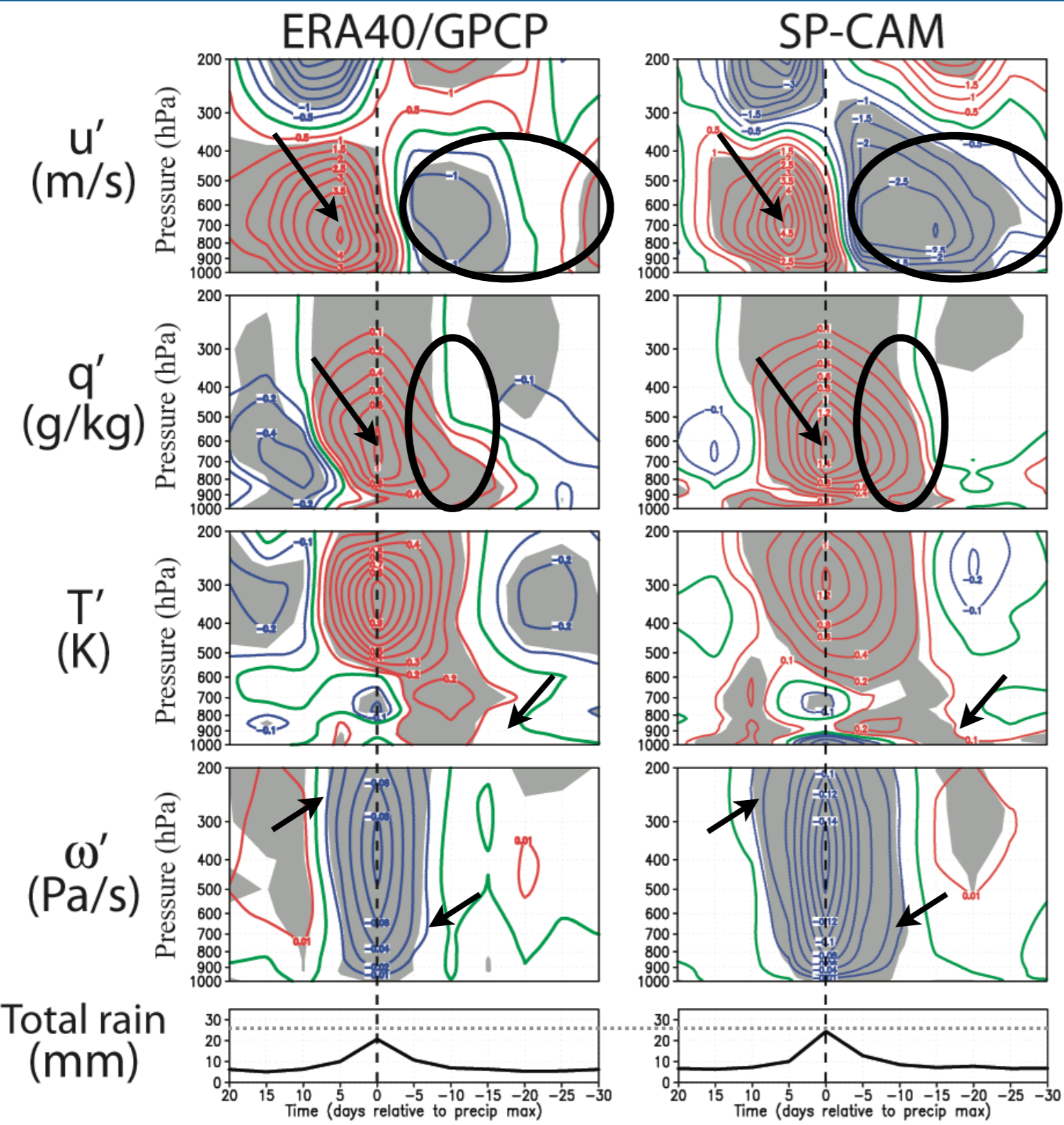
Methods

- MJO events were detected based on rainfall
- 46 (observations) and 50 (SPCAM) MJO events were found between 1985-2004
- All events were composited based on max rainfall to form an “average MJO event”



Results

Compared to reanalysis, SPCAM has...

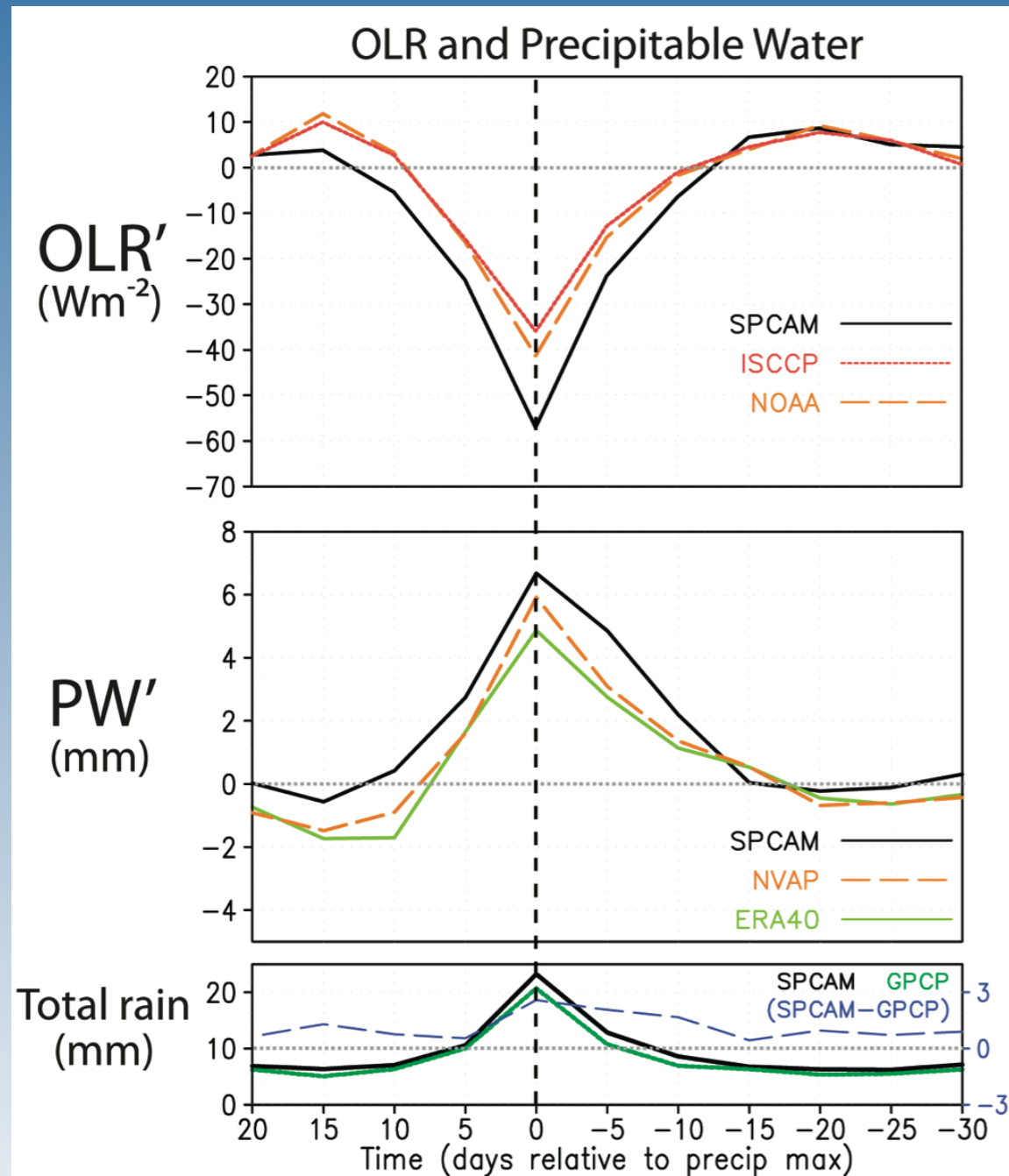


- Easterly wind anomalies that are too strong and extensive
- A favorable comparison of west wind structure
- Unrealistically rapid vertical moistening, insufficient drying
- 40% higher q' magnitude on Day 0
- An upper atmosphere that is too warm
- Pre-MJO PBL warming not seen in reanalysis
- Too strong rising motion, insufficient subsidence
- Stronger evidence of tilting with height
- ~20% more rainfall on Day 0



Results

Profiles of OLR and PW compared to satellite-based observations



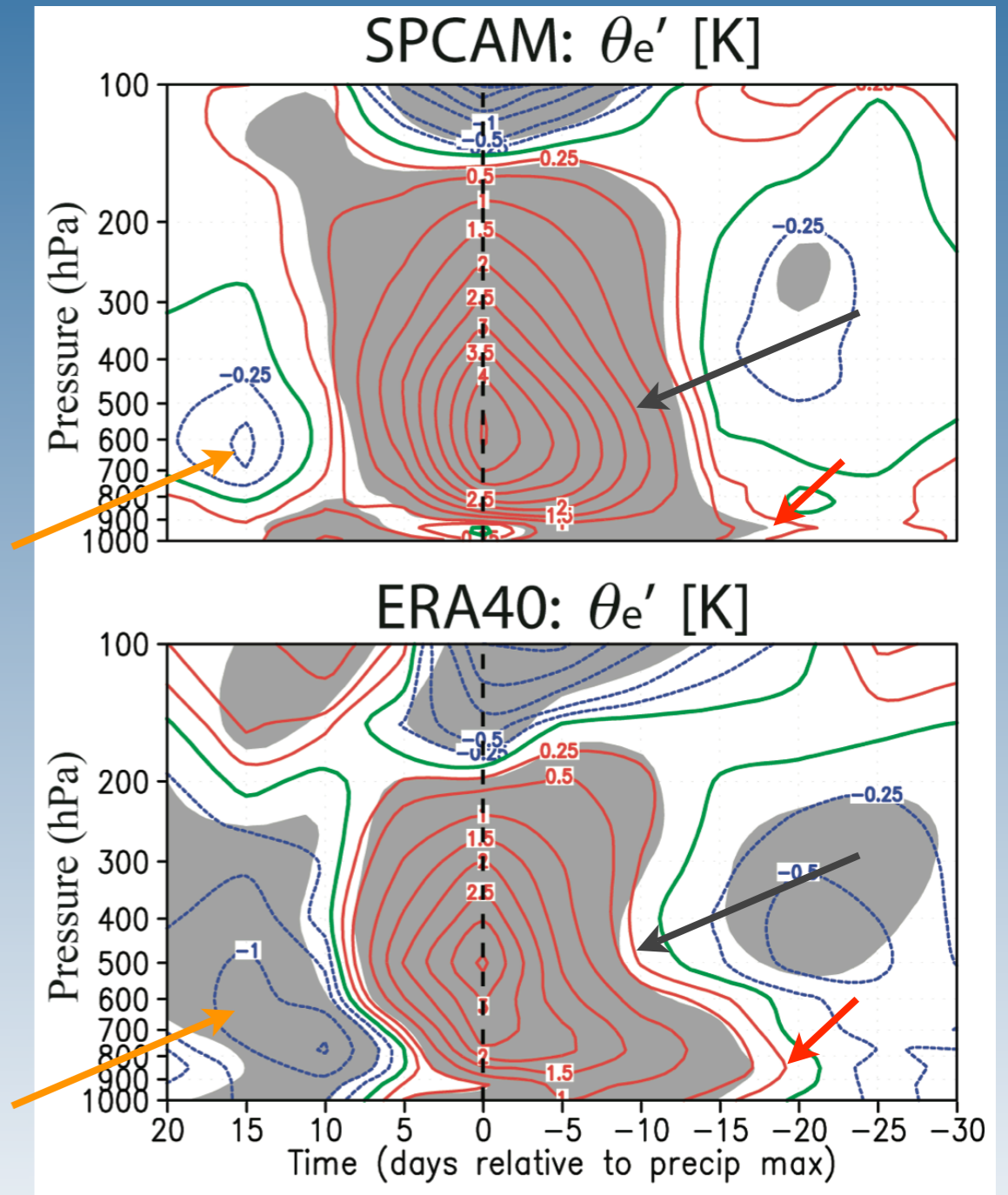
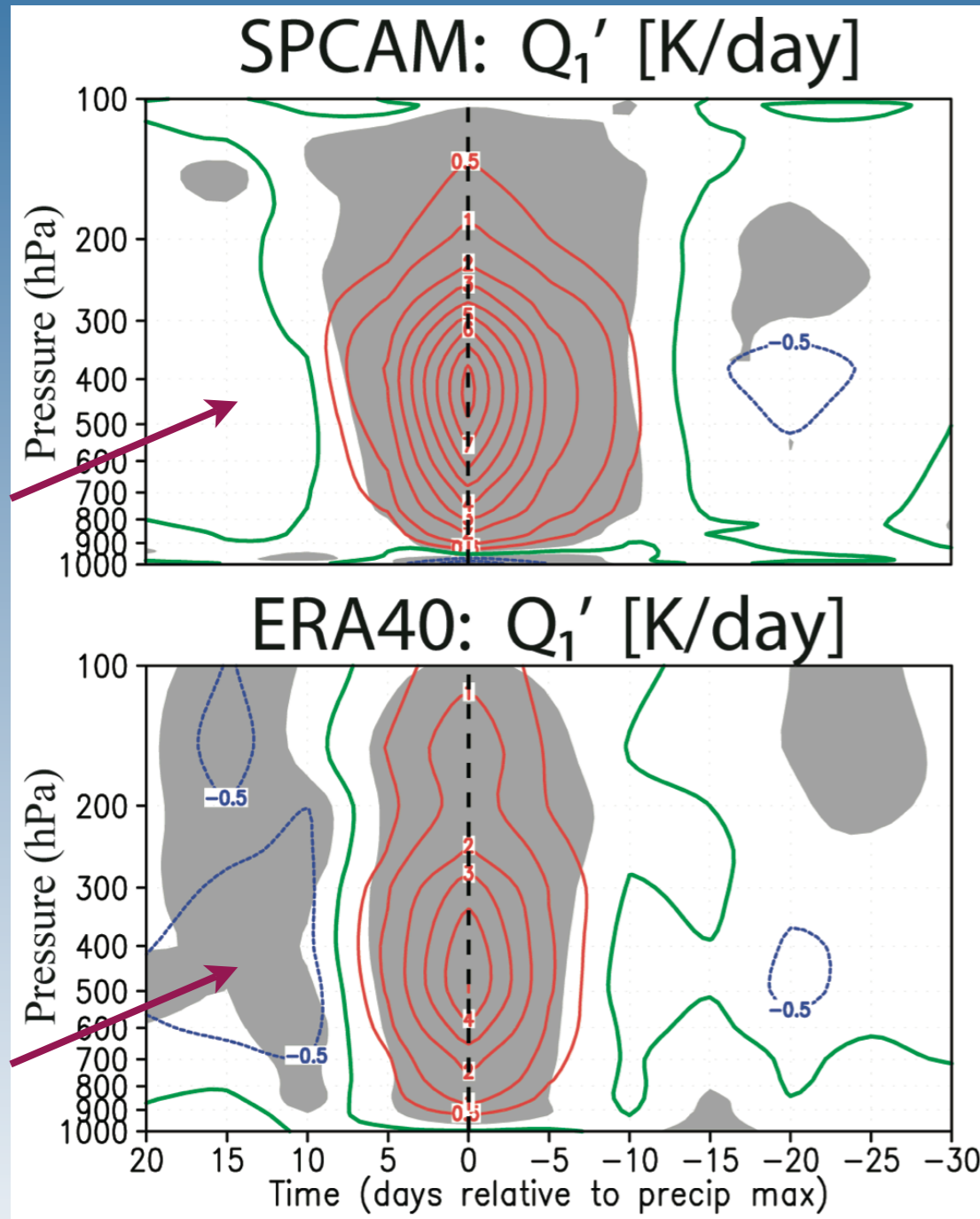
- SPCAM overestimates magnitude of OLR' from Day -10 to Day +15.

- 35% more negative OLR' value for SPCAM on Day 0.

- Consistent with OLR' and the unrealistic rapid deepening of q' , PW' is overestimated in SPCAM for much of the MJO lifecycle.

Results

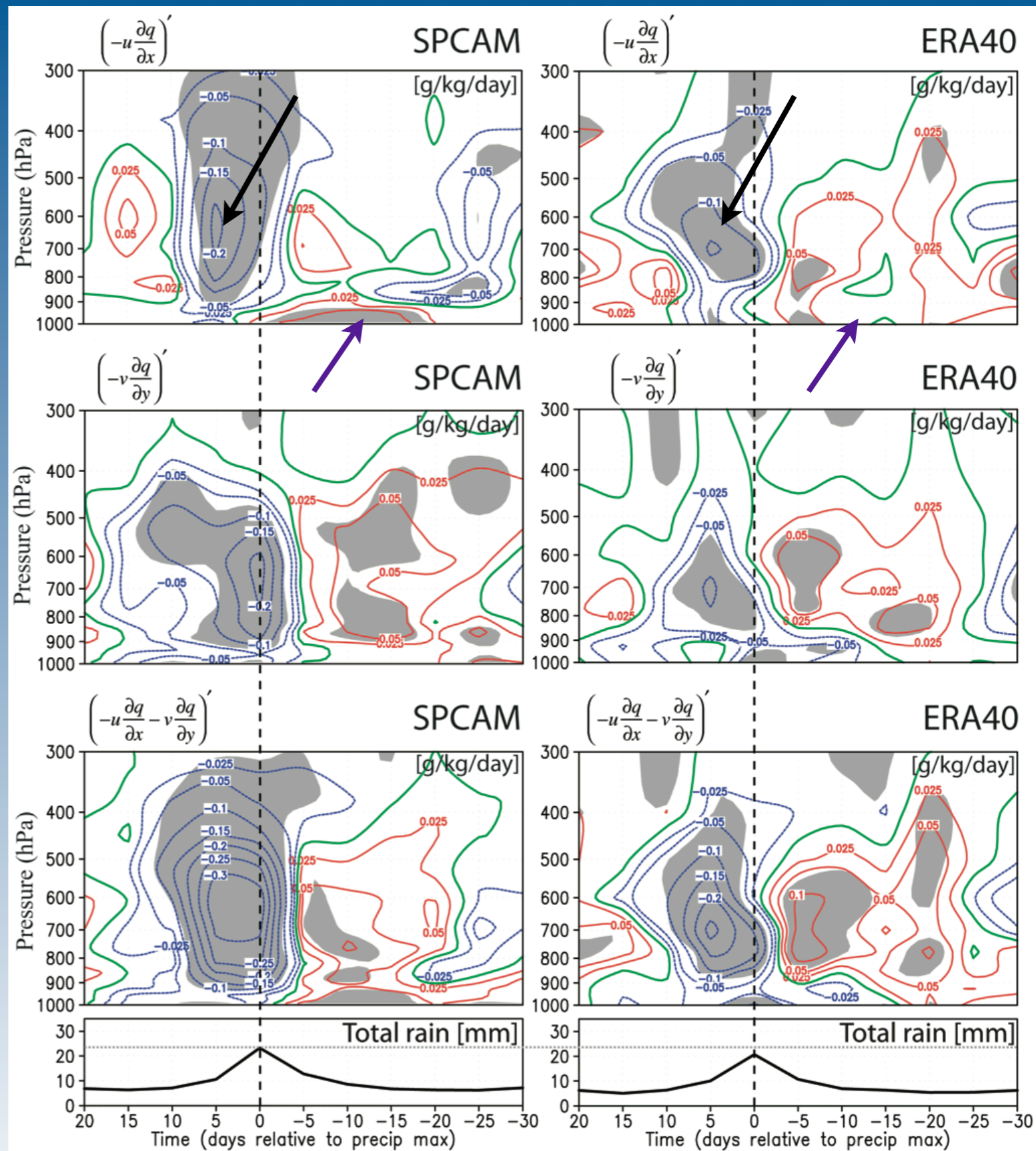
Convective heating and θ_e anomalies



Results

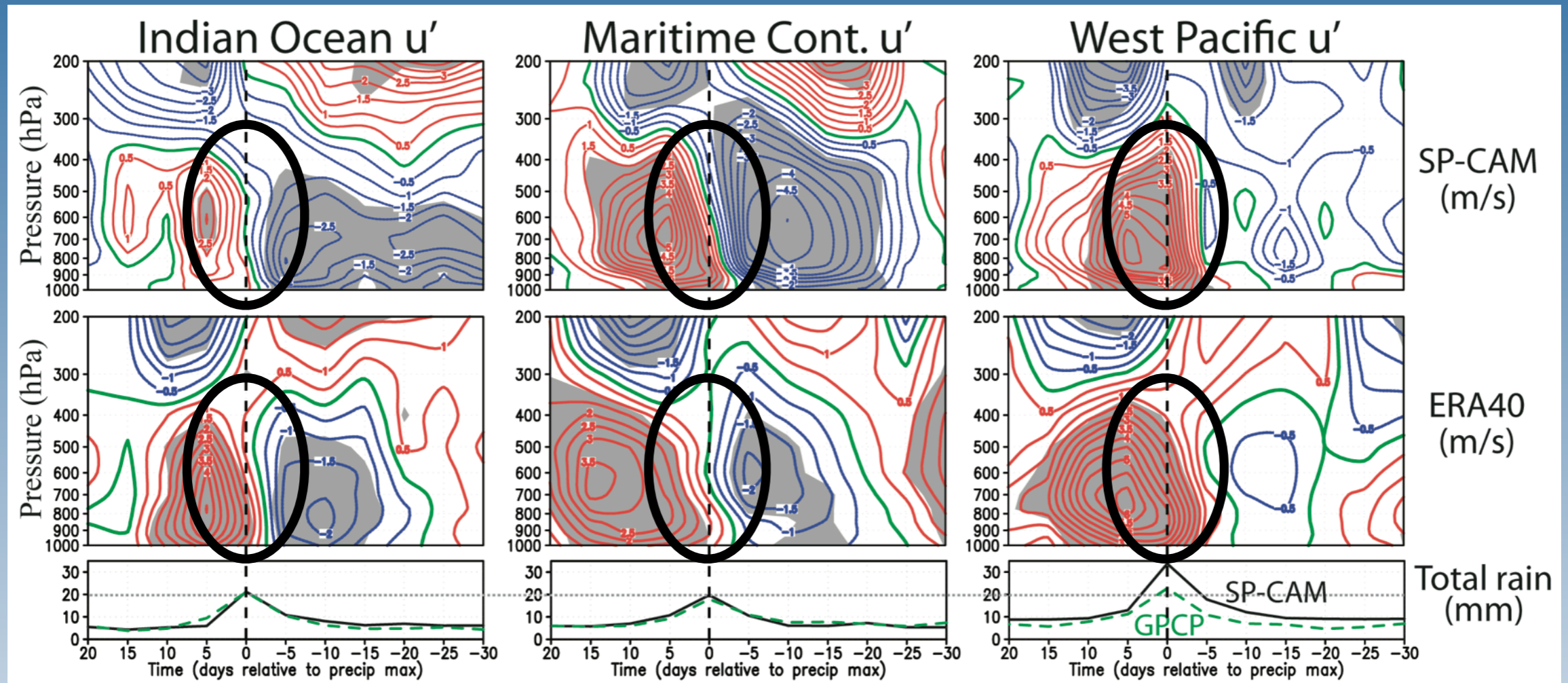
Structure of horizontal moisture advection anomalies

- Strongest zonal advective drying 5 days after intense rain
- Gradual PBL moistening via zonal wind in SPCAM
- Overall, SPCAM replicates horizontal moisture advection well



Results

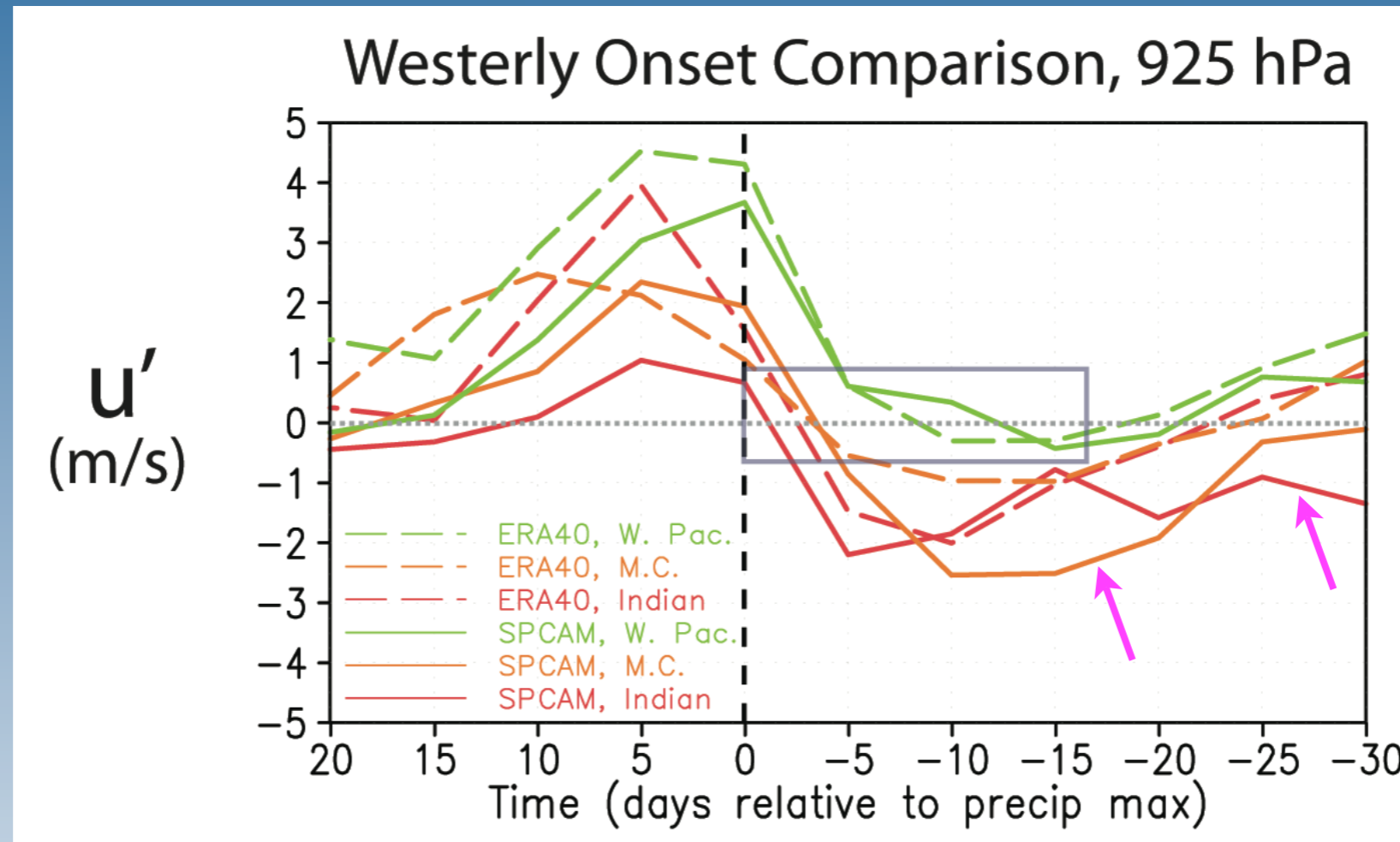
Structure of zonal wind anomalies relative to location of MJO event



- General SPCAM zonal wind structure compares favorably to ERA40 wind structure
- Onset of west winds based on geography is well simulated

Results

Timing of westerly wind onset relative to location of MJO event

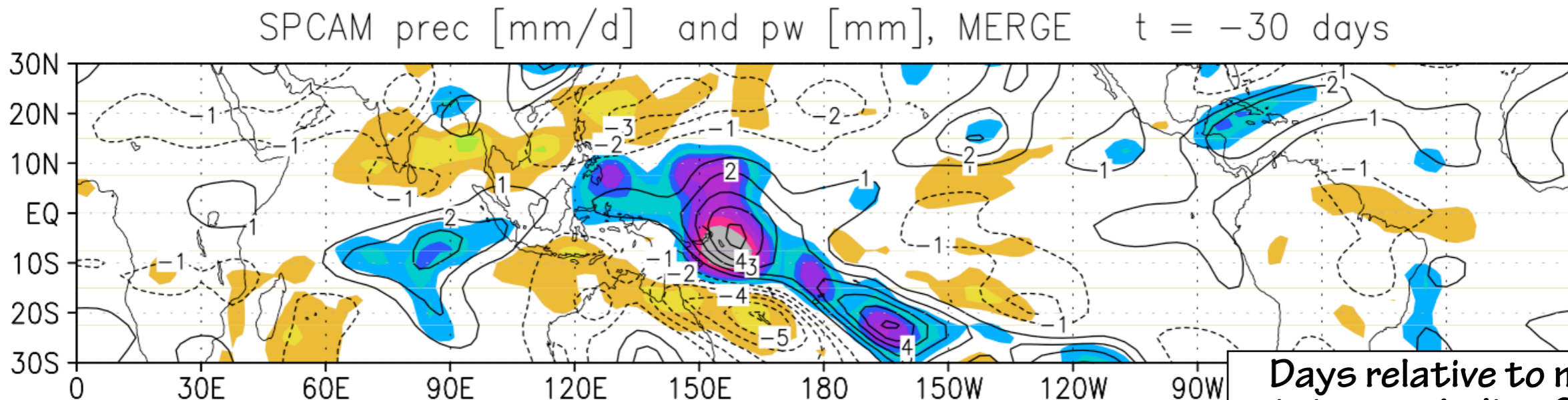


Model = solid lines, ERA40 = dashed lines

- Both SPCAM and ERA40 have earlier onset of westerly wind anomalies as MJO-related convection propagates eastward
- Unrealistic pre-MJO easterlies noted in Indian and Maritime Continent regions

Results

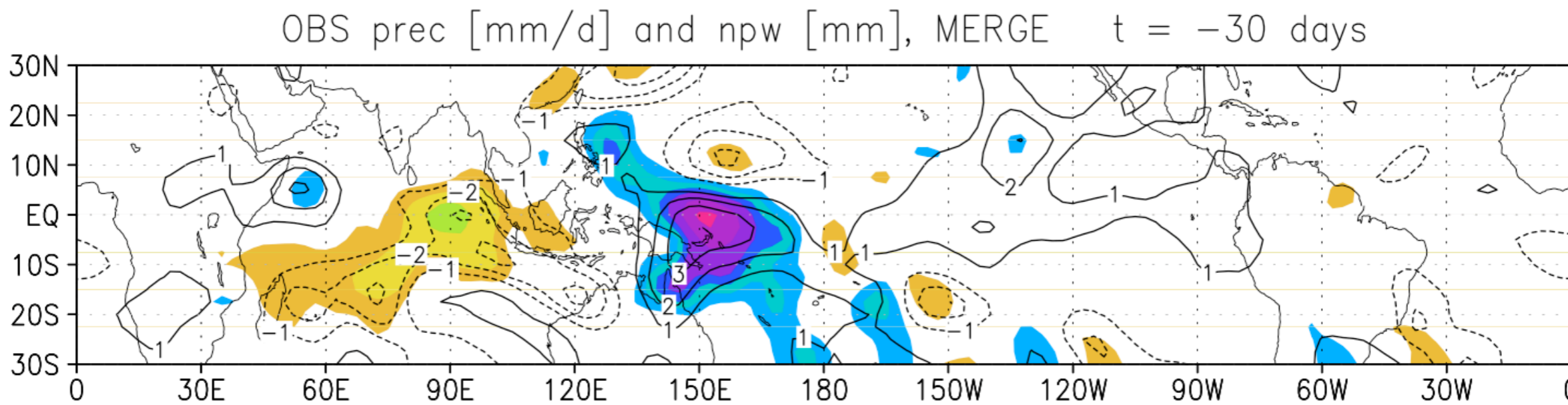
SPCAM



Days relative to max rain in east Indian Ocean

Shading - rainfall Contours - precipitable water

OBSERVATIONS



Rainfall anomaly [mm/day]



Future Work

- Continue to examine behavior of basic variables in SPCAM and compare to observations
- Look into “return flow” of moisture into Indian Ocean and how that might relate to initiation of MJO
- Investigate other possible mechanisms of MJO initiation in west Indian Ocean using model data and observations



Acknowledgements...

- Dave Randall, Marat Khairoutdinov, Eric Maloney
- NSF-CMMAP, NASA, DoE

Thank you... Questions?