

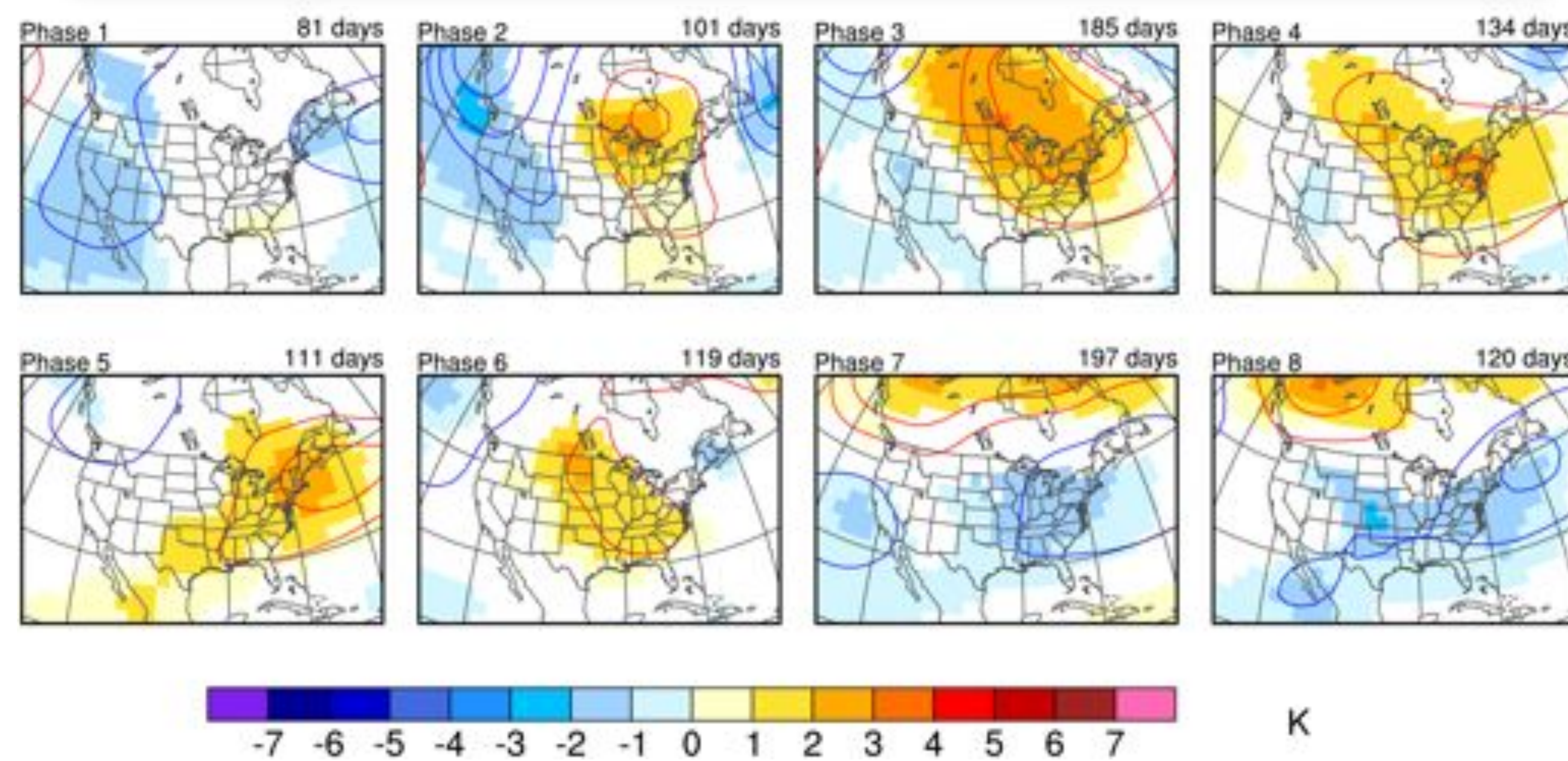
An MJO Index for the Western Hemisphere: Identifying the MJO's Impacts over North America

Carl J. Schreck III¹ and David Margolin²

¹Cooperative Institute for Climate and Satellites-North Carolina (CICS-NC), ²EarthRisk Technologies

Problem:

- The MJO affects weather over the United States
- Can we identify which events produce a response and which do not?

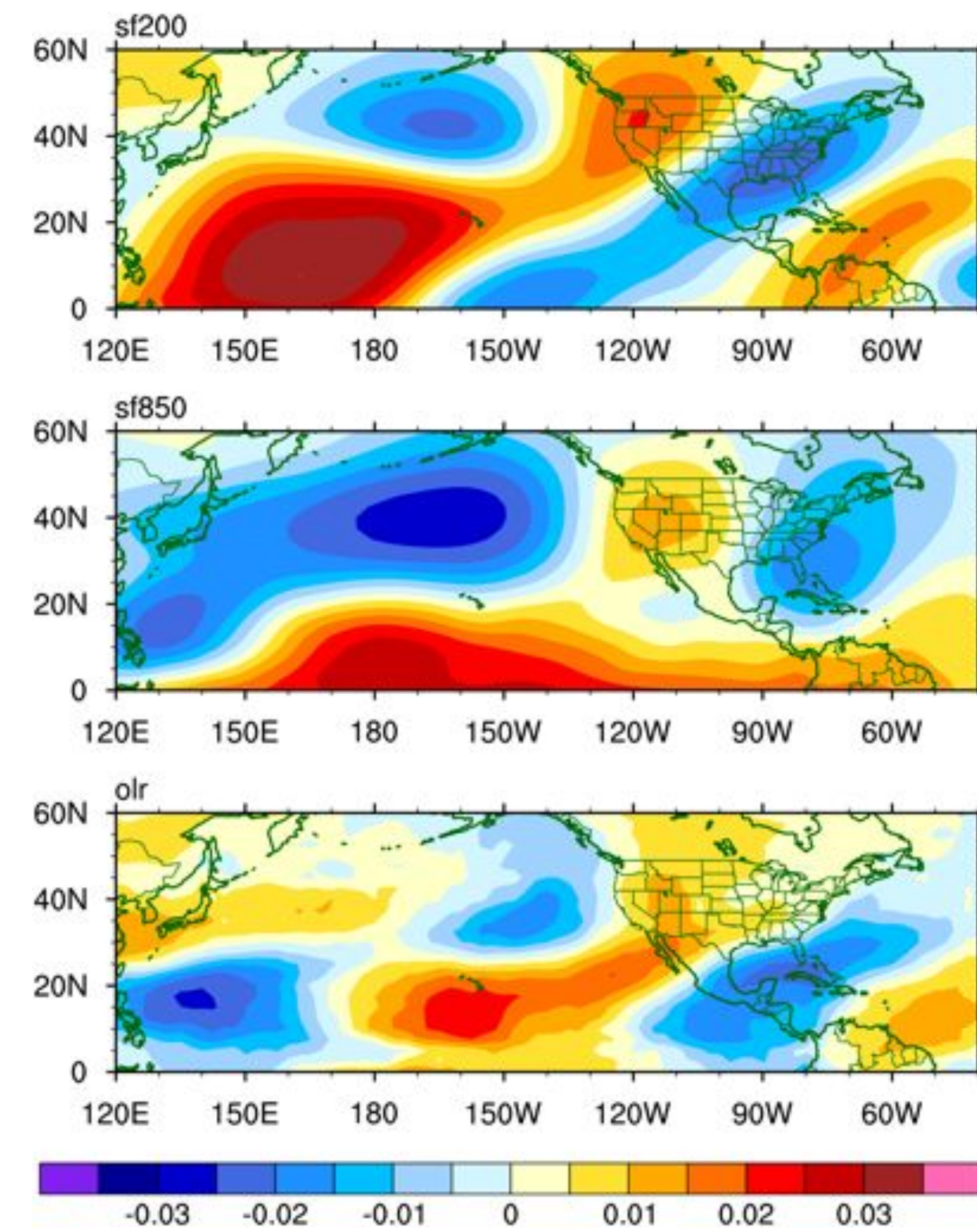


Composite anomalies of 850-hPa Temperature (shading) and 500-hPa Height (contoured) averaged 6–10 days after the Wheeler–Hendon Real-time Multivariate MJO (RMM) index is > 1.5. Temperatures are only shaded when they are significant at the 95% level. Heights are contoured every 20 m with negative contours in blue and positive in red.

Multi-Variate PNA (MVP)

Method:

- Pre-filter data for 20–100 days to focus on the MJO
- Calculate the combined EOF of 200-hPa streamfunction, 850-hPa streamfunction, and outgoing longwave radiation (OLR)
- Focus on the North Pacific and North America
- Project the EOF onto unfiltered data for real-time monitoring



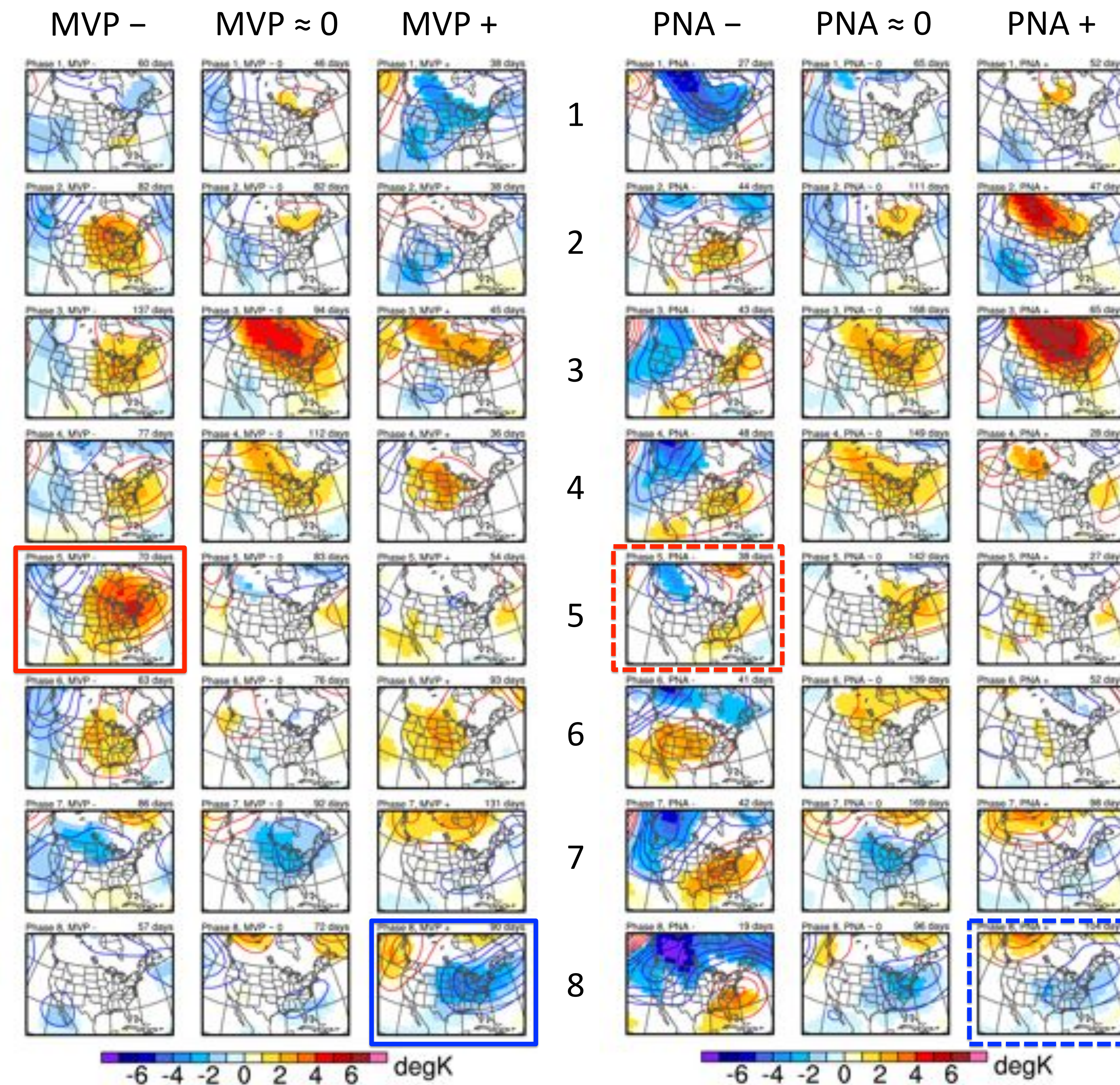
EOF Loading pattern for 200-hPa streamfunction (top), 850-hPa streamfunction (middle), and OLR (bottom).

Description:

- 200-hPa wave train resembles the conventional Pacific North American (PNA) pattern, but shifted 5°–10° southward
- 850-hPa streamfunction identifies anomalous zonal winds near Hawaii
- OLR shows a tripole with a convective anomaly near Hawaii and opposite signs to the east and west

Main Results:

- Warm signal in Phase 5 only occurs for Negative MVP
- Cold signal in Phase 8 only occurs with Positive MVP
- These results cannot be replicated with the conventional PNA



Composite anomalies of 850-hPa Temperature (shading) and 500-hPa Height (contoured) averaged 6–10 days after the RMM is > 1.0. The composites are subdivided by RMM phase and by the MVP and PNA. Temperatures are only shaded when they are significant at the 95% level. Heights are contoured every 20 m with negative contours in blue and positive in red.

Summary:

The Multi-Variate PNA (MVP) index:

- Combined EOF of 20–100 days OLR and streamfunction at 850 hPa and 200 hPa over the North Pacific and North America
- Distinguishes MJO events that affect North American temperatures from those that do not

Key Differences from the conventional PNA:

- Southward shift in the wave guide
- Direct link with tropical convection
- Better distribution of values in all MJO phases

So what matters most?

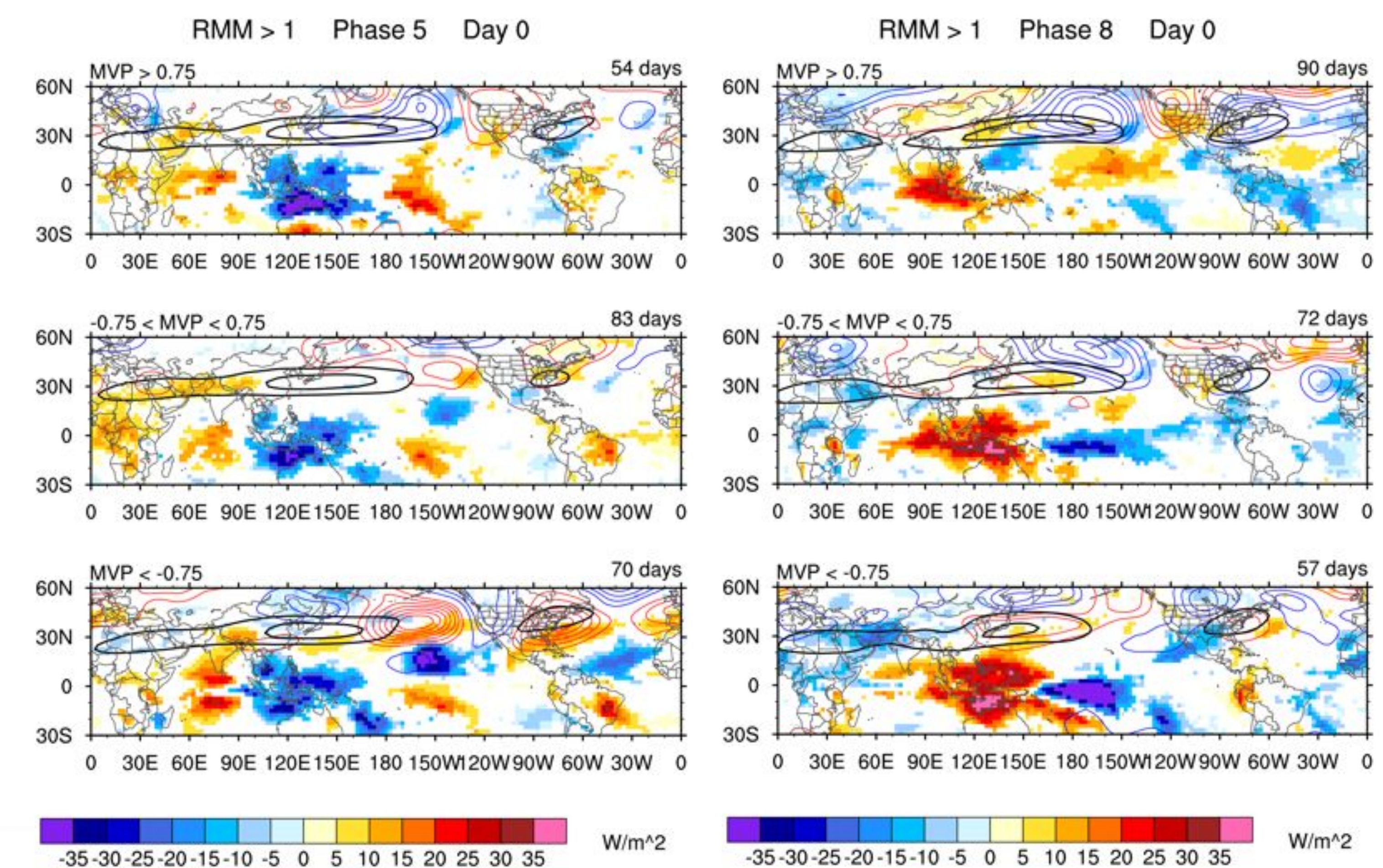
- Convection in the Eastern Hemisphere?
- Convection in the Western Hemisphere?
- Pre-existing extratropical wave state?

Phase 5:

- Enhanced convection over Maritime Continent regardless of MVP
- Central Pacific convection is strongest for negative MVP and absent for positive MVP

Phase 8:

- Eastern Hemisphere convective anomalies are strongest for negative MVP...
- But positive MVP produces a stronger extratropical response



Composite OLR anomalies (shading), total 200-hPa zonal winds (black contours), and 500-hPa height anomalies. Composites are for MJO Phase 5 (left) and Phase 8 (right). OLR anomalies are only shaded when they are significant at the 95% level. Heights are contoured every 20 m with negative contours in blue and positive in red.