

# A Circulation Pattern that Affects US Heat Wave Likelihood on Subseasonal time scale

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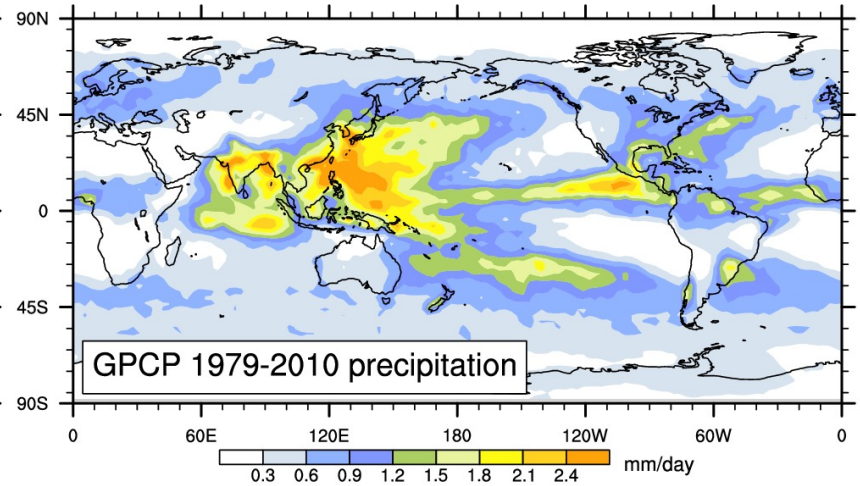
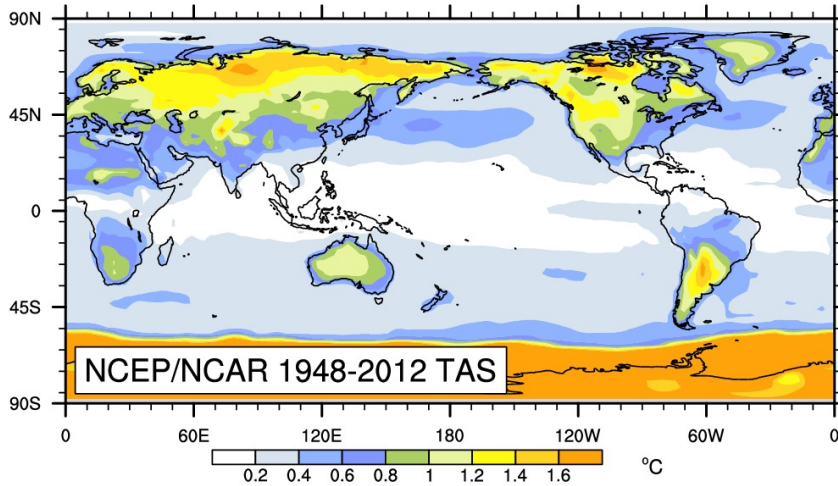
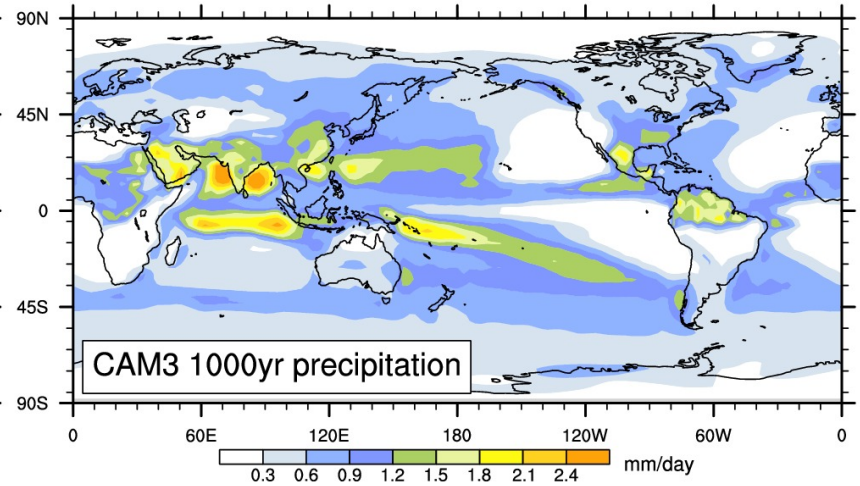
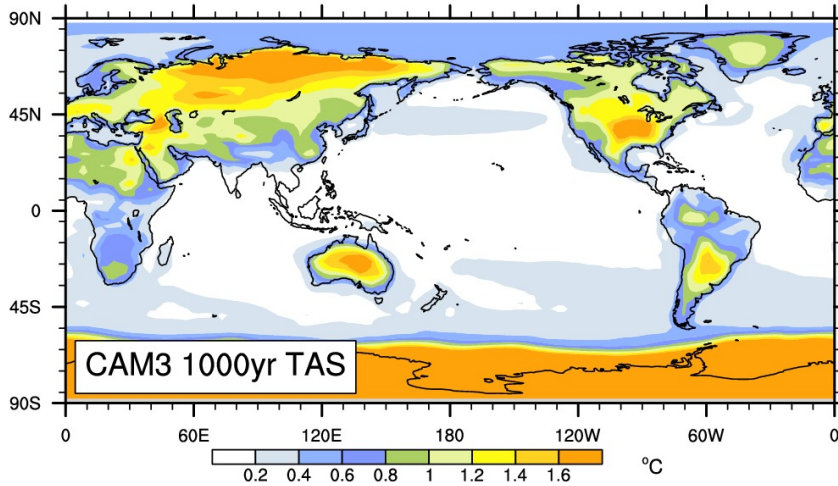
# Scientific questions

Are there internally generated large-scale midlatitude circulation anomalies that affect the likelihood of US heat waves on subseasonal time scale?

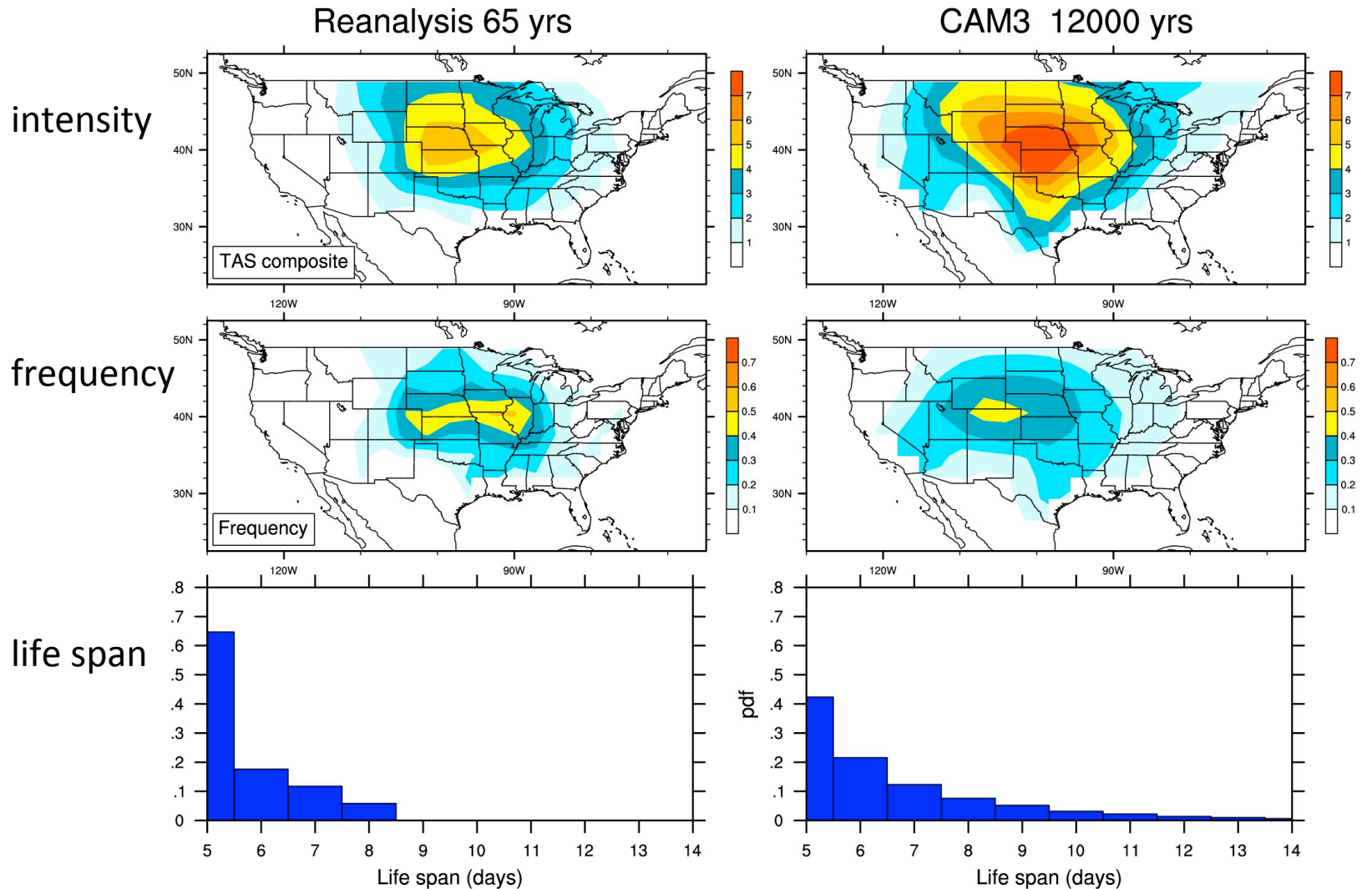
# Experiment

12,000-year CAM3 forced by monthly varying present-day SST and sea ice extent at T42 resolution

# subseasonal stddev



# Heat wave statistics

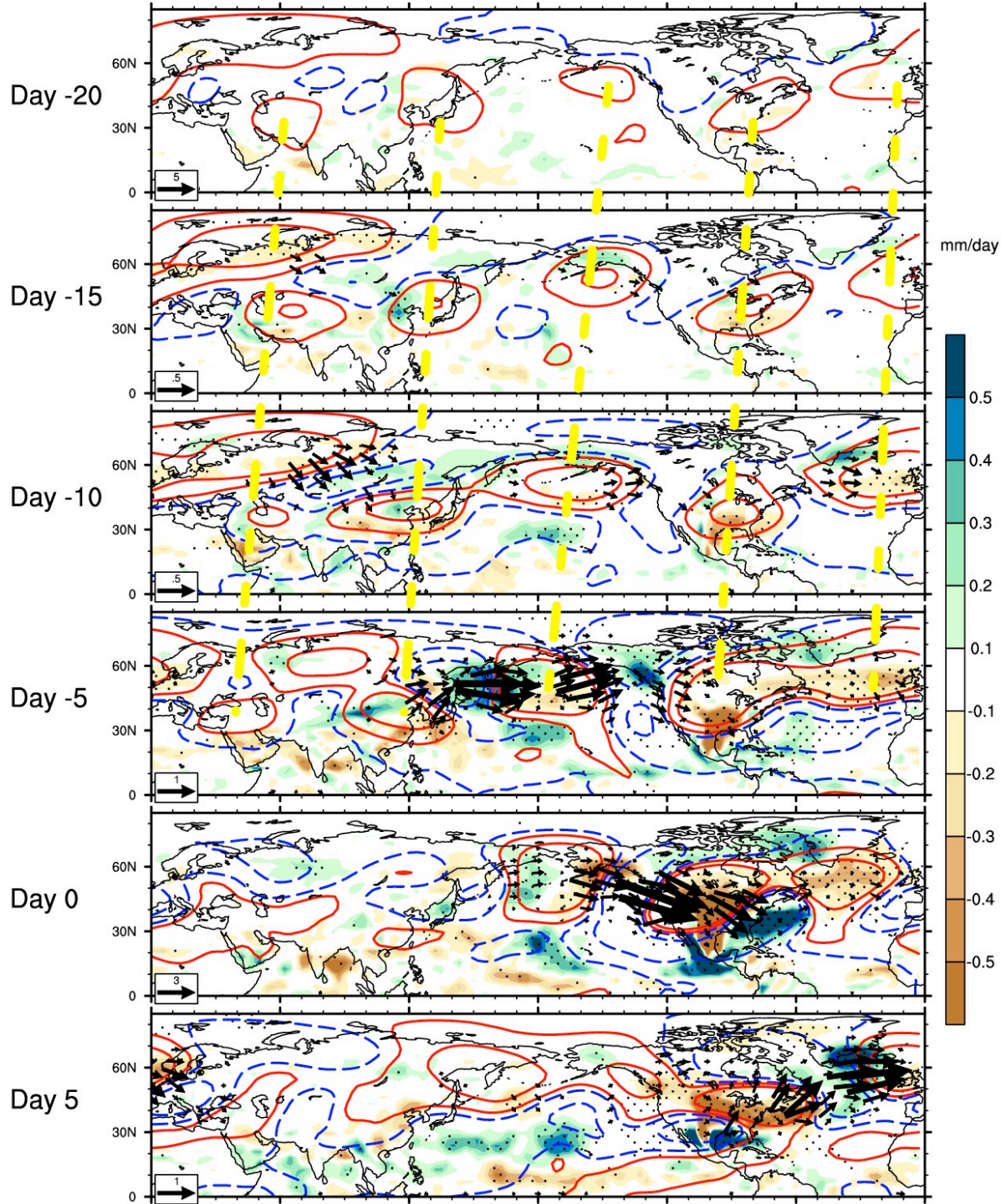


27 heat wave days from 17 events

16199 heat wave days from 5949 events



# Composite

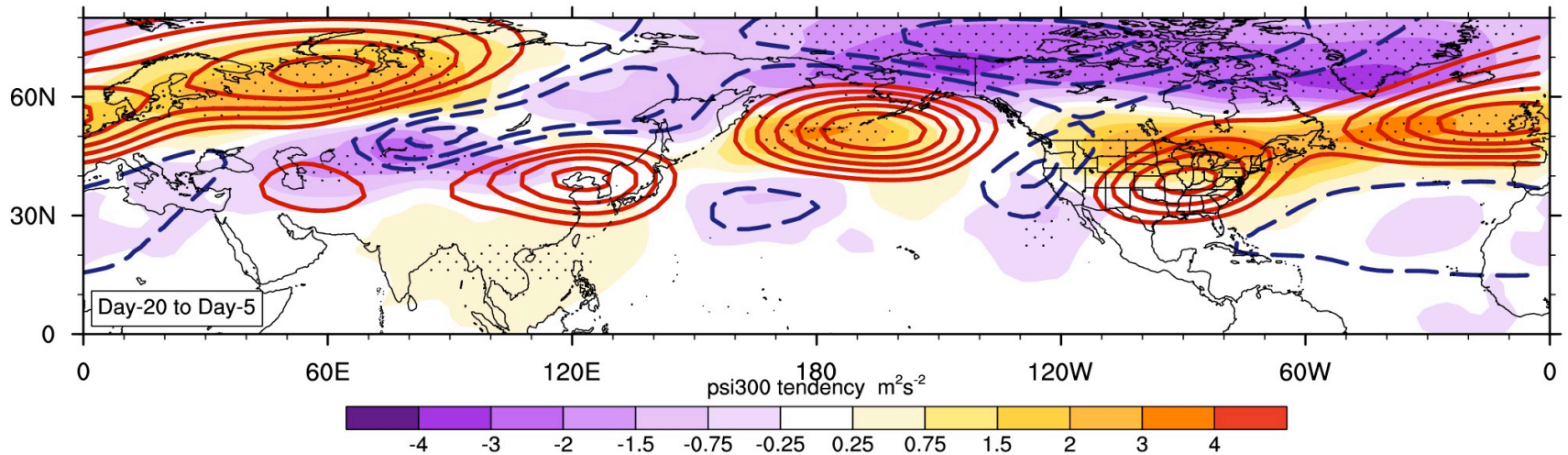


Contours : psi300  
 Shading: precip  
 Stippling: Precip 95% sig

Arrows : Plumb vector  
 (Plumb 1985, Karoly et al. 1989)

$$\vec{F}_s = \sigma \cos \phi \begin{pmatrix} \bar{v}^{*2} - \frac{1}{2\Omega \sin 2\phi} \frac{\partial}{\partial \lambda} (\bar{v}^* \bar{\phi}^*) \\ -\bar{u}^* \bar{v}^* + \frac{1}{2\Omega \sin 2\phi} \frac{\partial}{\partial \lambda} (\bar{u}^* \bar{\phi}^*) \end{pmatrix}$$

# PSI300 tendency from synoptic eddies

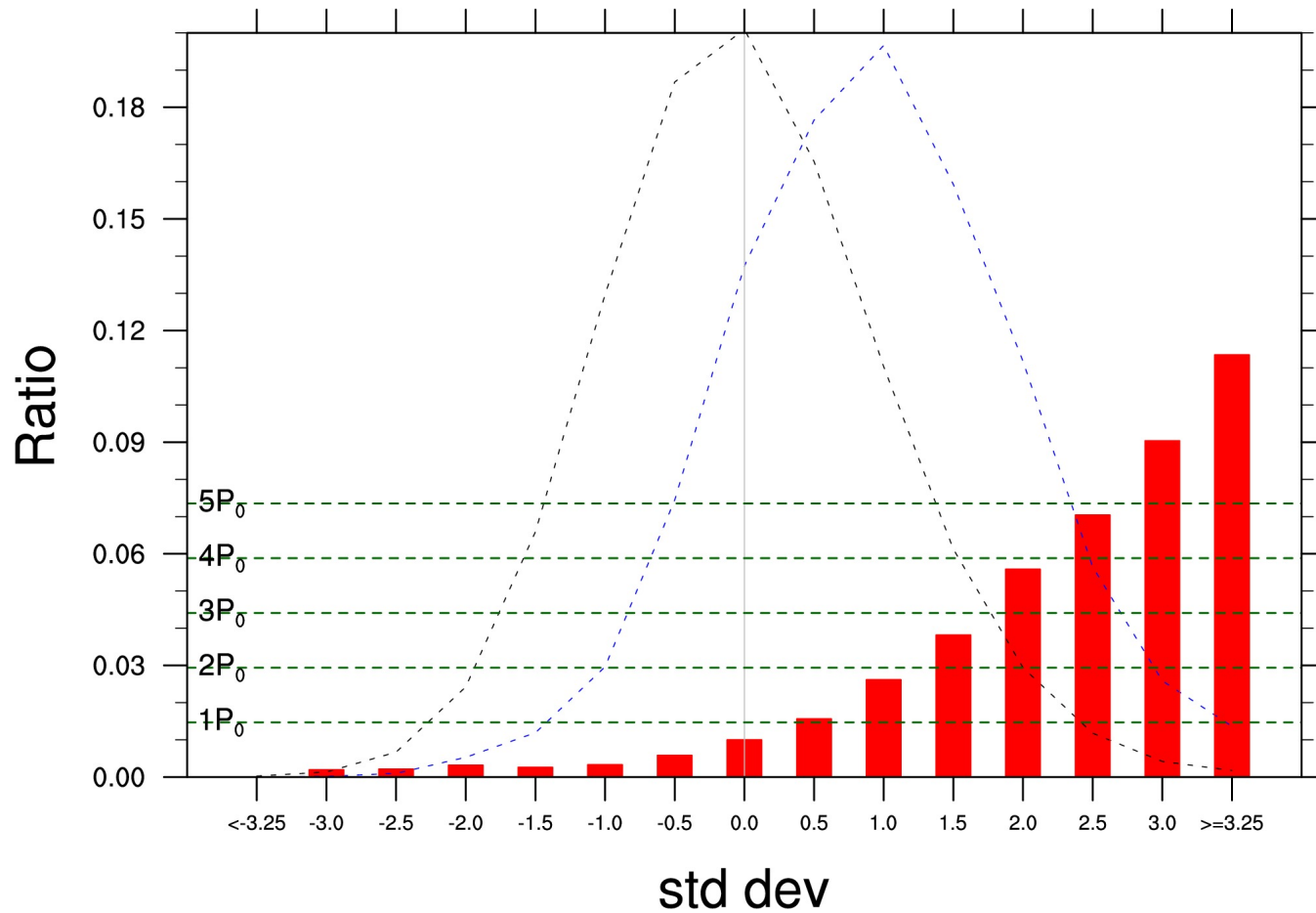


Shading:  $-\nabla^{-2}V'_\psi \cdot \nabla\xi'$

contour: psi300 composite

# Conditional probability of heat waves

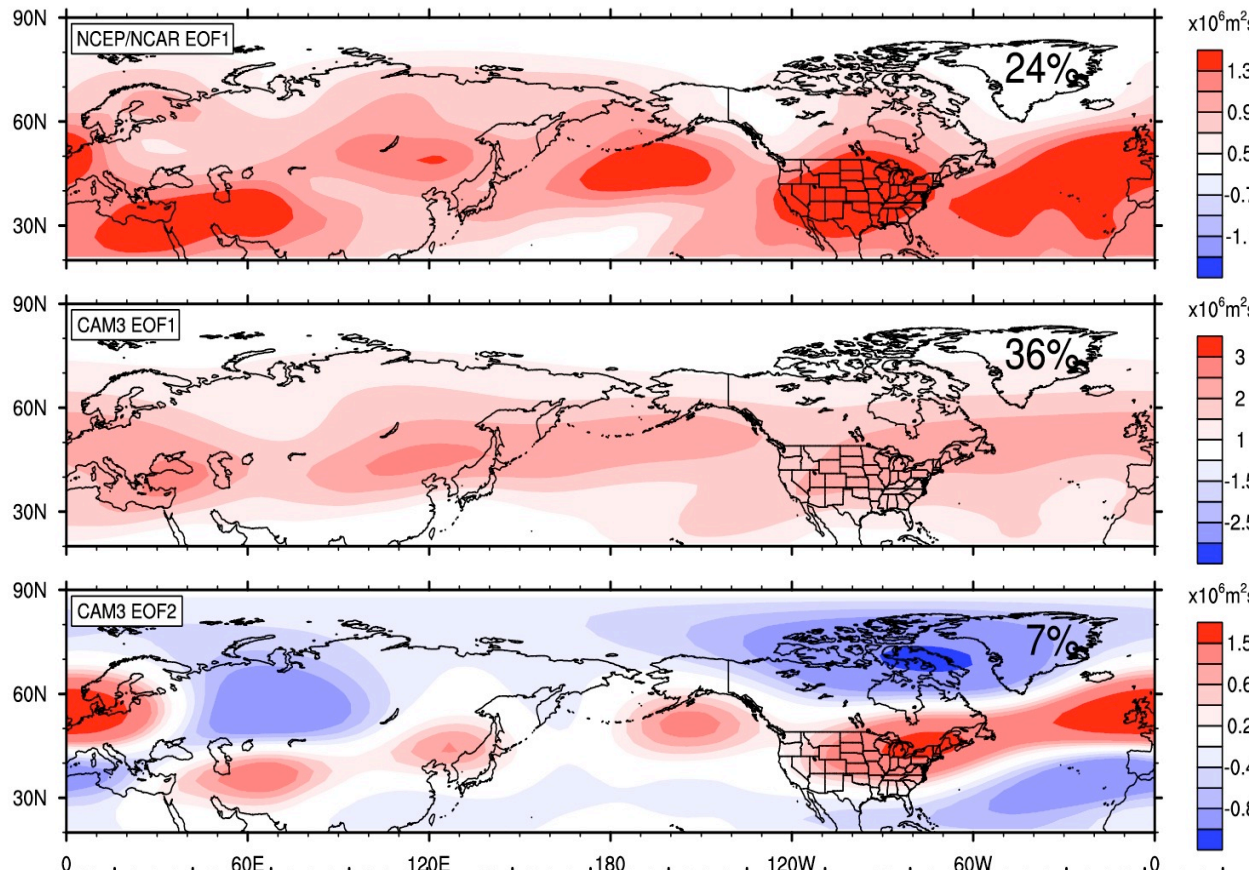
on the amplitude of the wavenumber-5 pattern 15 days earlier



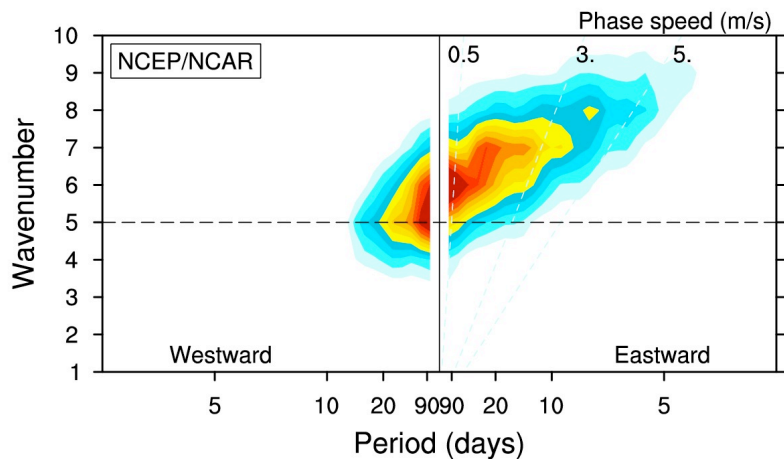


# Are these results applicable to the real world?

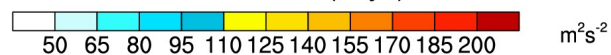
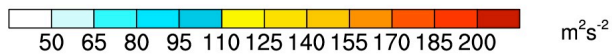
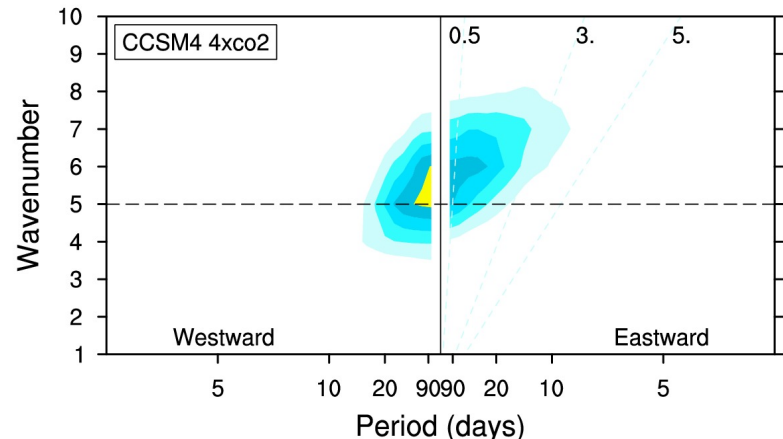
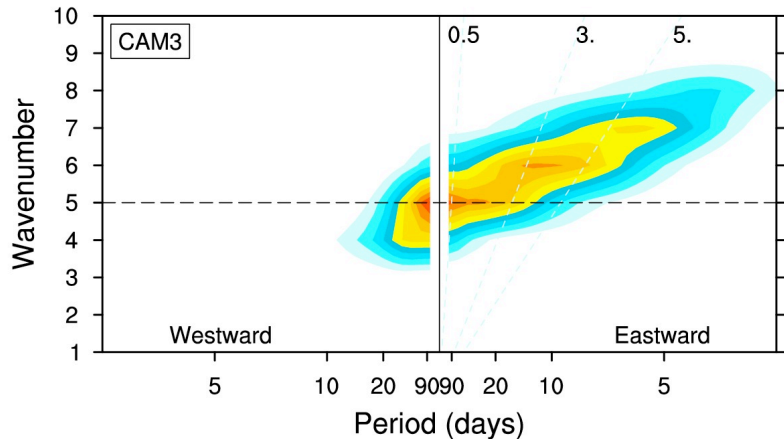
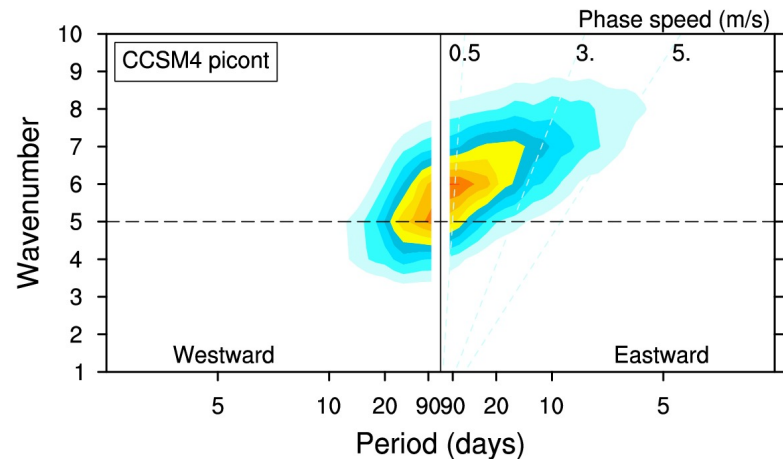
Leading psi300 subseasonal variability patterns



JJA V300 Wavenumber-frequency Spectra at 35-50N



JJA V300 Wavenumber-frequency Spectra at 35-50N





# Summary

- Based on a 12,000-year CAM3 integration, we show that the US heat waves tend to be **preceded** by amplification of a **zonal wavenumber-5** planetary wave pattern by 15-20 days.
- This intrinsic circulation pattern **resembles the observed** leading pattern of subseasonal variability and it may **affect likelihood** of US heat waves on subseasonal time scale.
- Variability of the wavenumber-5 pattern can be generated solely by **internal dynamics** rather than being a response to Asian Monsoon rainfall. Hence accurate predictions of the tropical intraseasonal variability may not guarantee subseasonal predictions of US heat waves.