

**Formation and development of
transient eddies within an MJO**



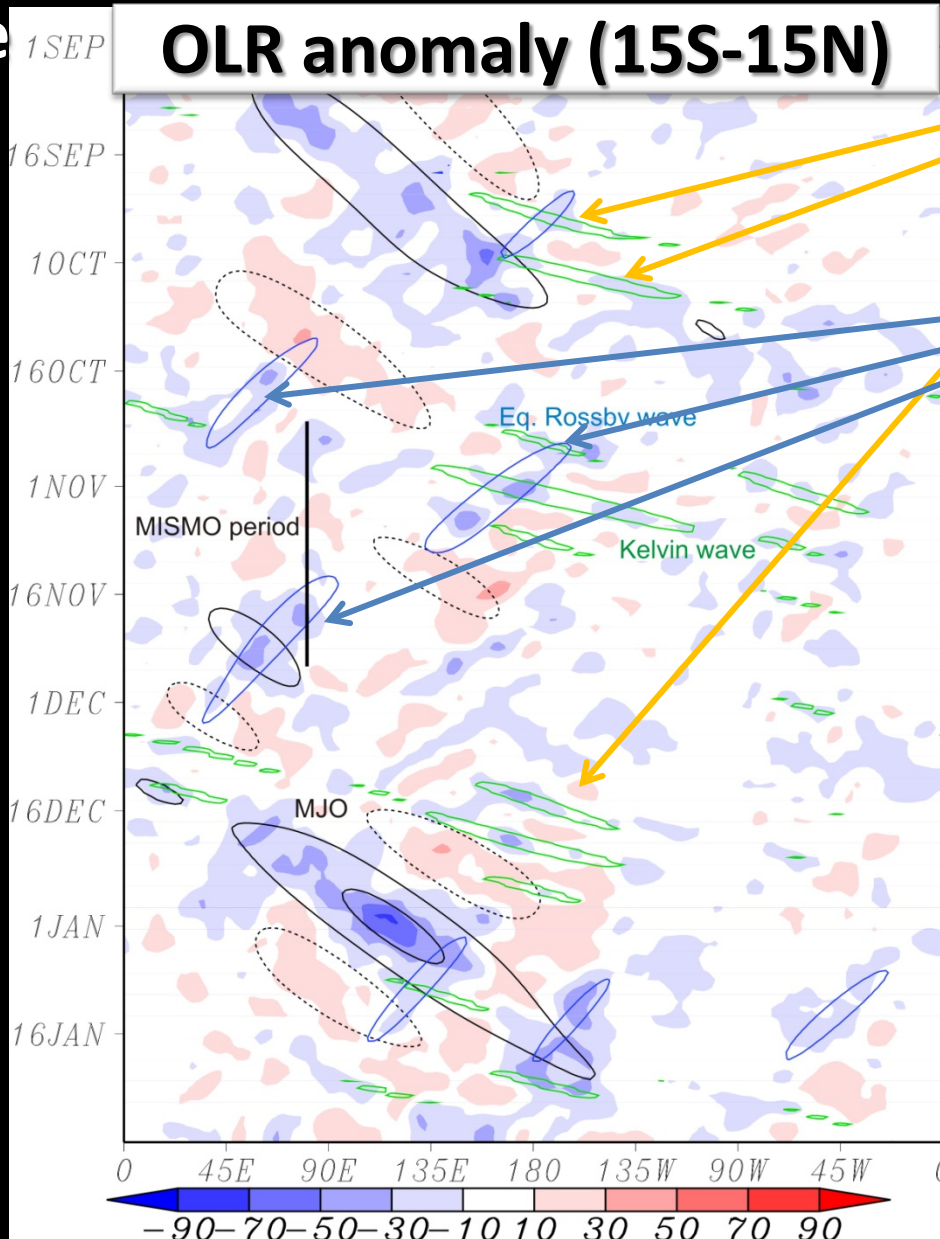
**Differences between Faster vs. Slower
Components of Convectively Coupled
Equatorial Waves**

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Cloud Organization in the Tropics

Time



Kelvin Wave

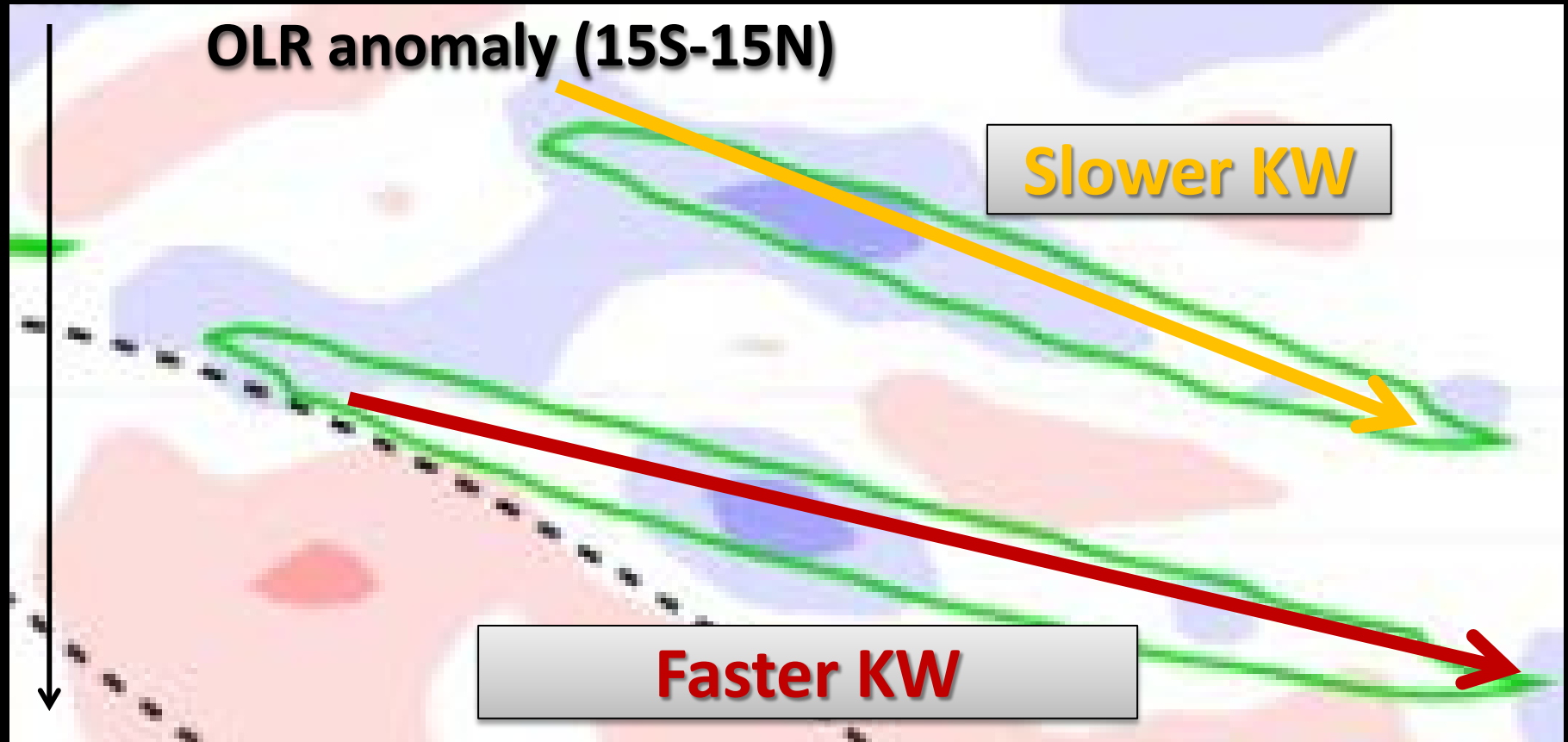
Rossby Wave

Waves

Cloud organization

Fast vs. Slow Kelvin Wave

Time



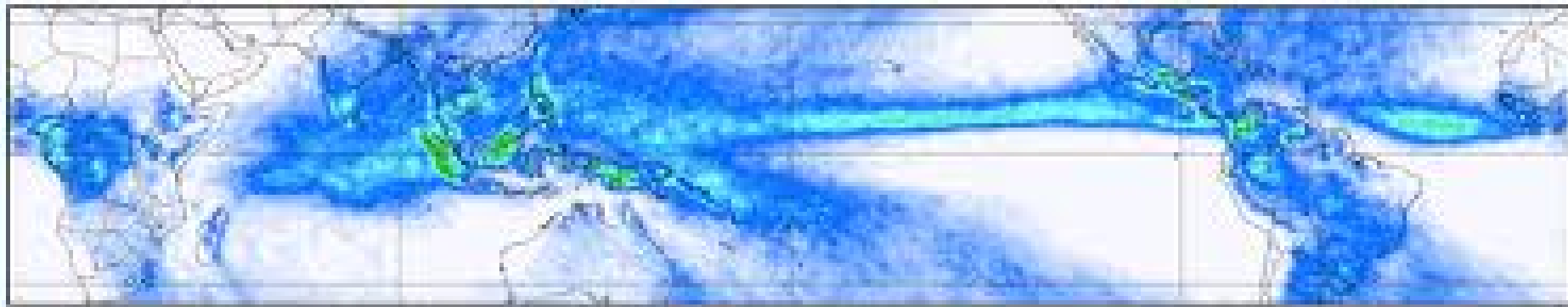
Q: Precipitation characteristics are different ?

Convective rainfall vs. Stratiform rainfall

DATA1: Microwave rain data (TRMM-3B42)

TRMM-3B42 -> Reference of CCEW activity

Mean Precipitation 00LST, TRMM 3B42 Ver. 6, Sep - Nov, 1998-2006



TRMM precip (mm/d)



George Huffman / NASA & SSAI

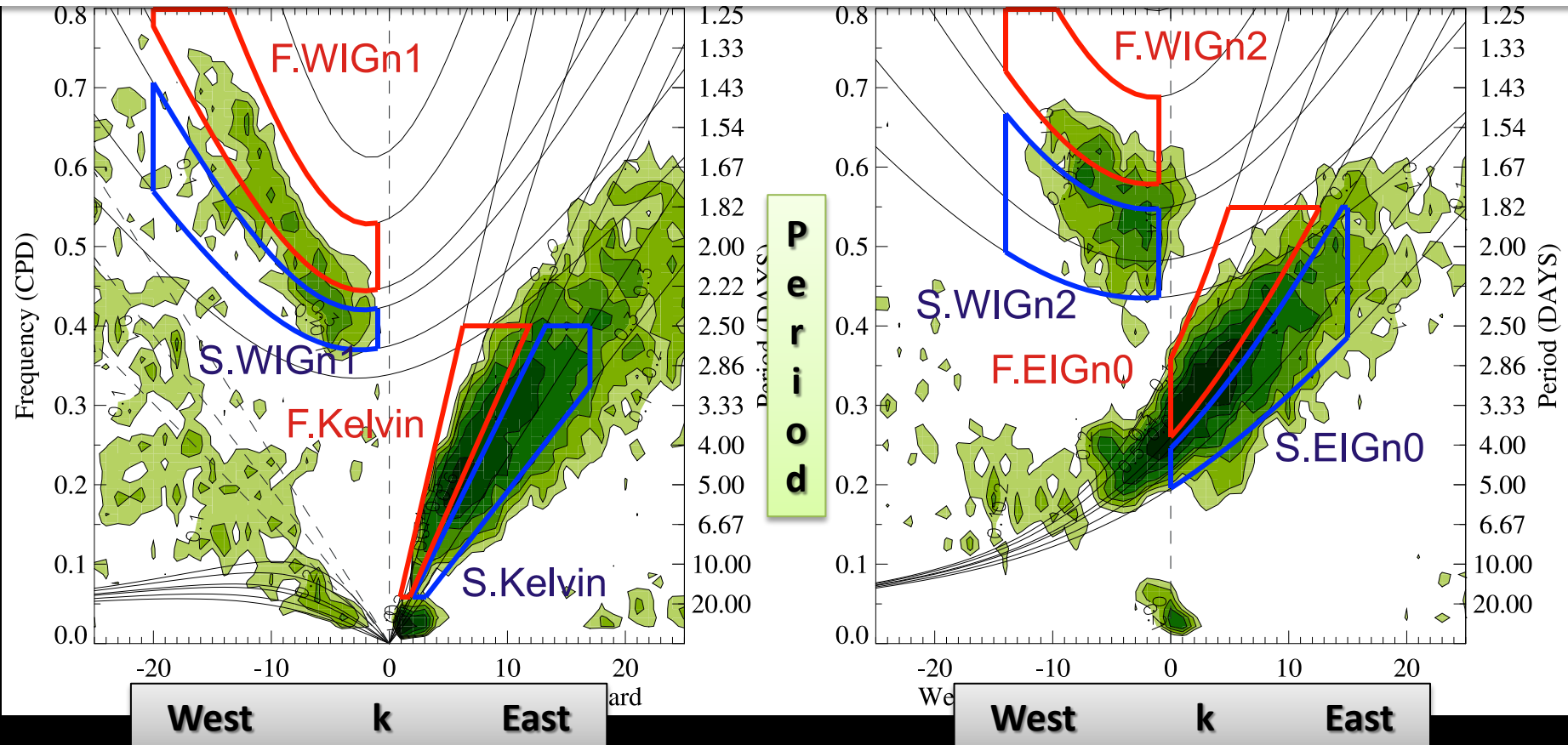
Horizontal resolution : about 25km

Time resolution: 3hour

Coverage: 40S-40N, 0-360E

Definition of Faster and Slower Component

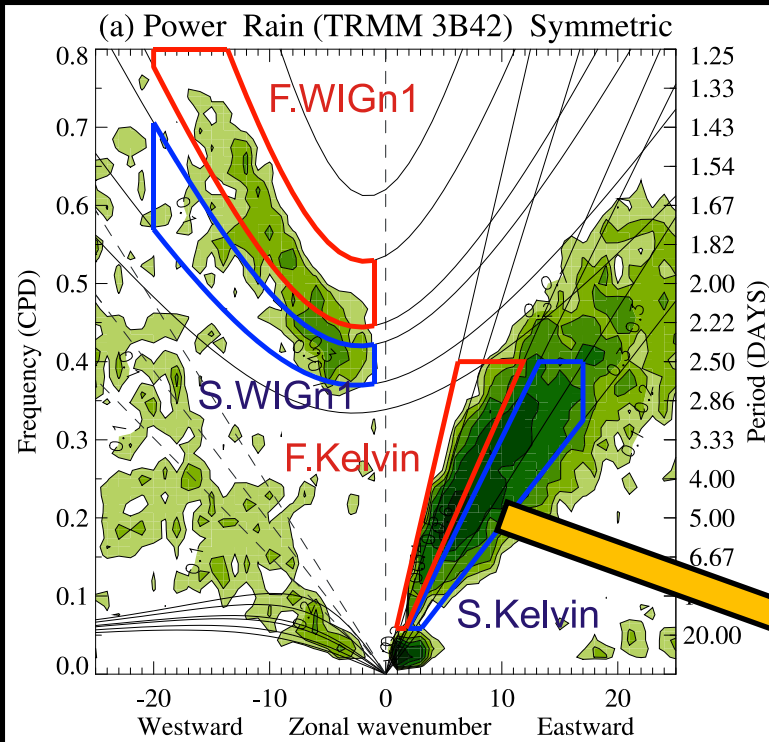
Power spectrum of rainfall (normalized by background)



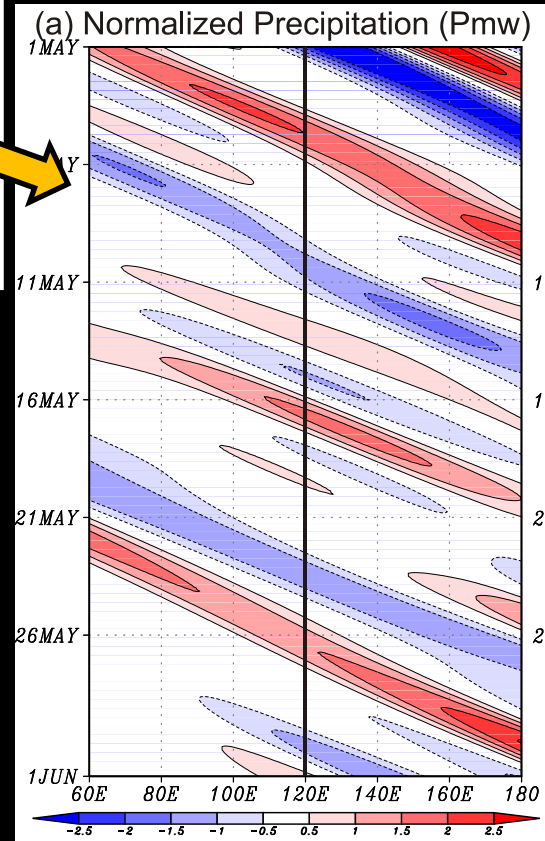
Heq < 20 m -> Slower component

Heq > 25 m -> Faster component

Wave Filtering

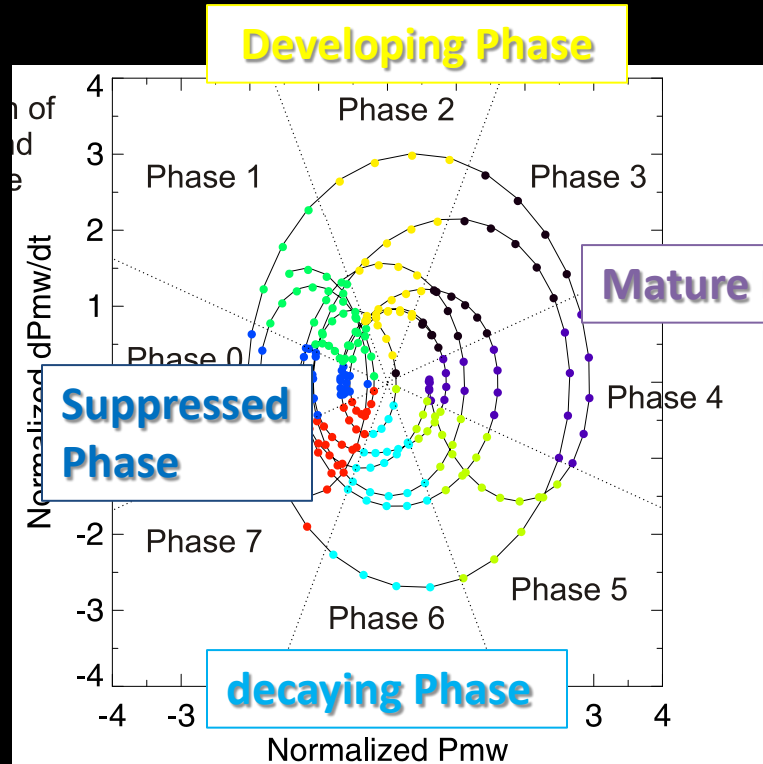
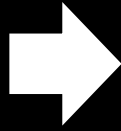
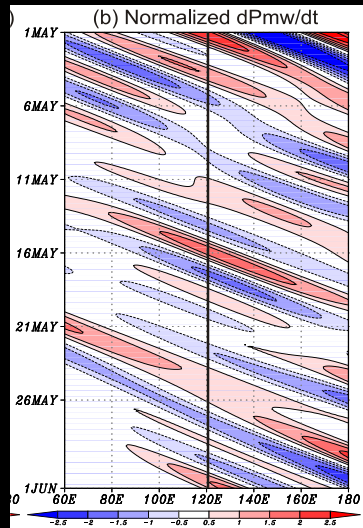


Filtered Rain (Pmw)

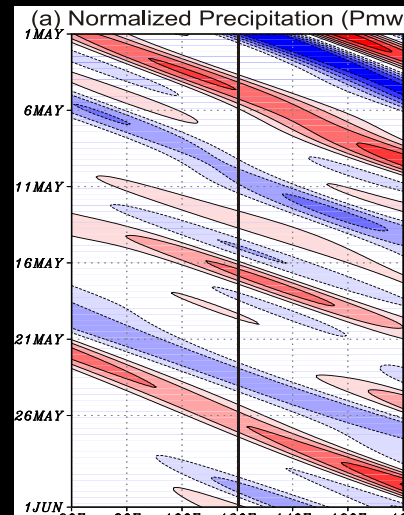


Definition of phase and amplitude

$dPmw/dt$

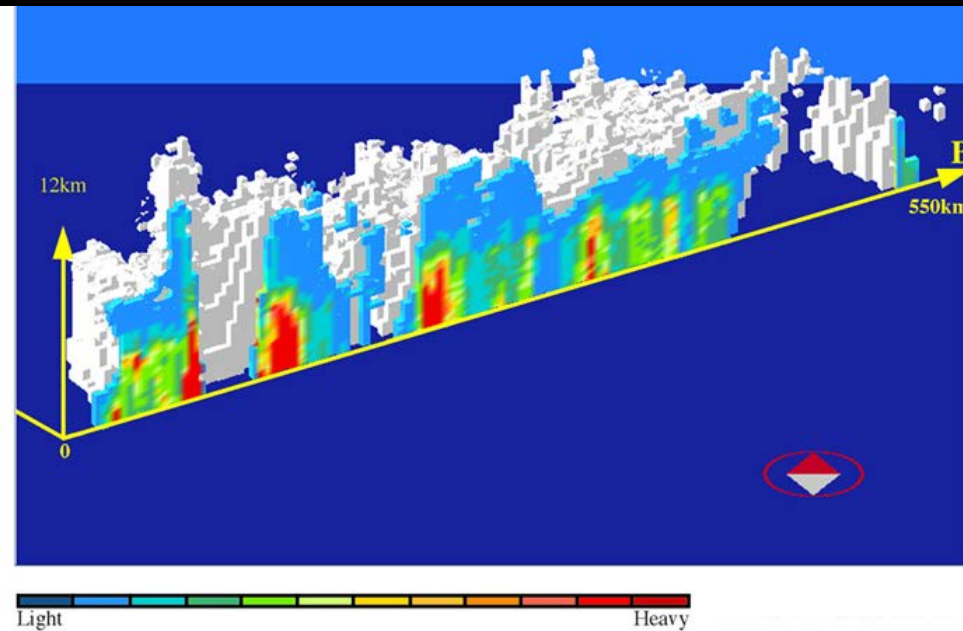


Filtered rain (Pmw)

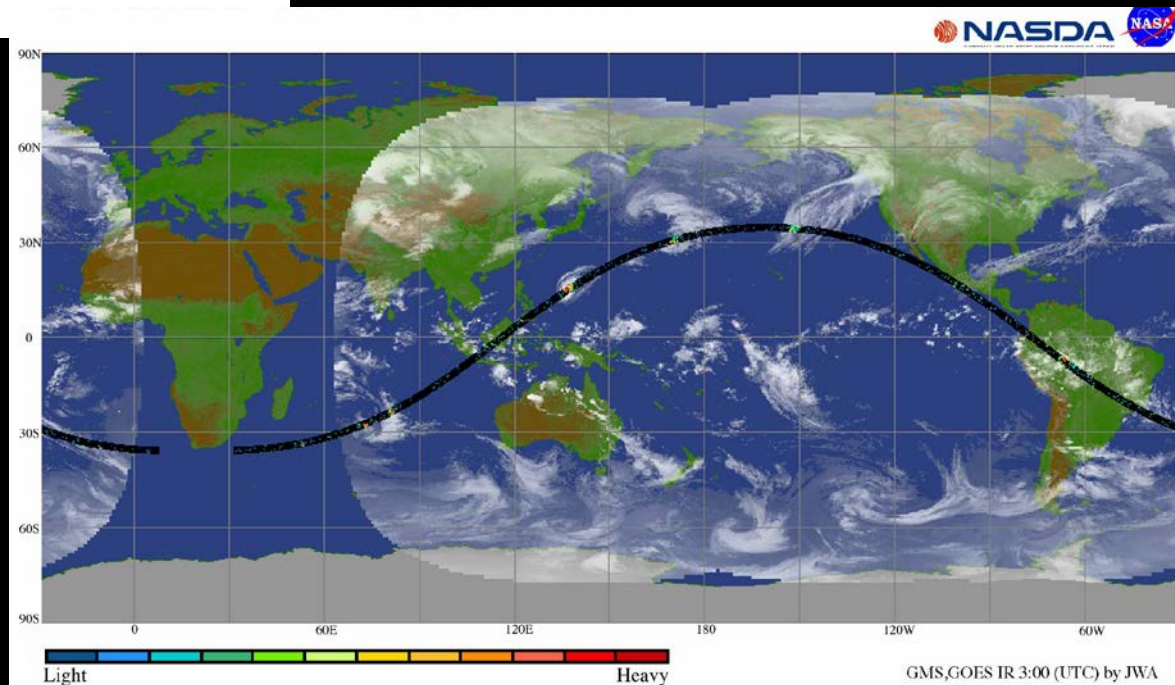


DATA2: TRMM-PR (Spaceborne precipitation radar)

- 3-D precipitation data over the tropics (Convective or Stratiform)
- Horizontal resolution: 4-5km
- Swath width: 200-250km

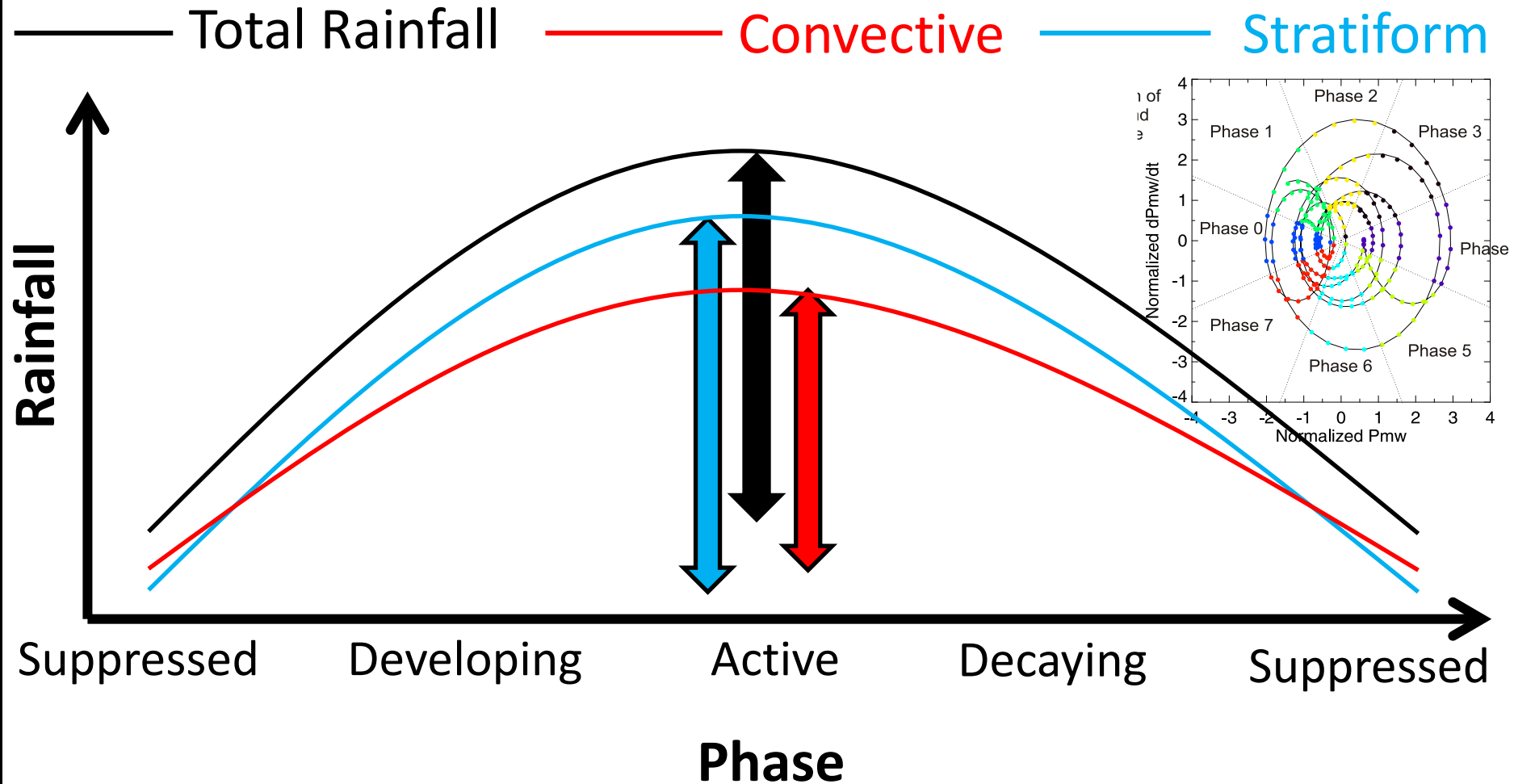


Other data (TRMM-3B42) are needed to identify each wave.



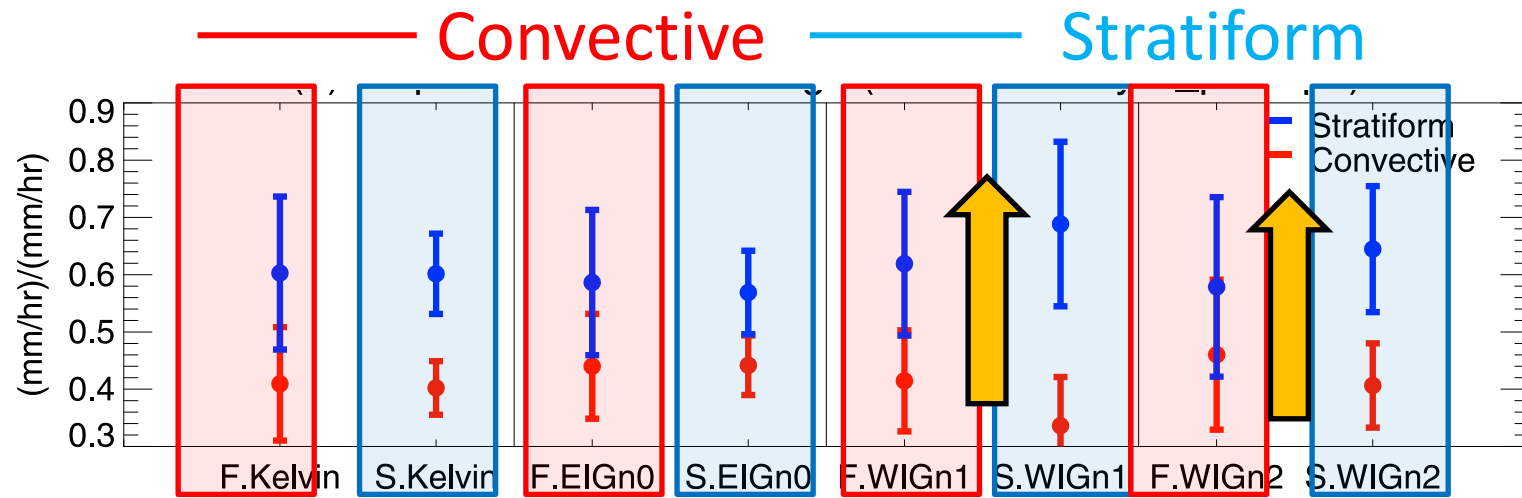
GMS, GOES IR 3:00 (UTC) by JWA

Composites of TRMM-PR (Reference : TRMM-3B42)

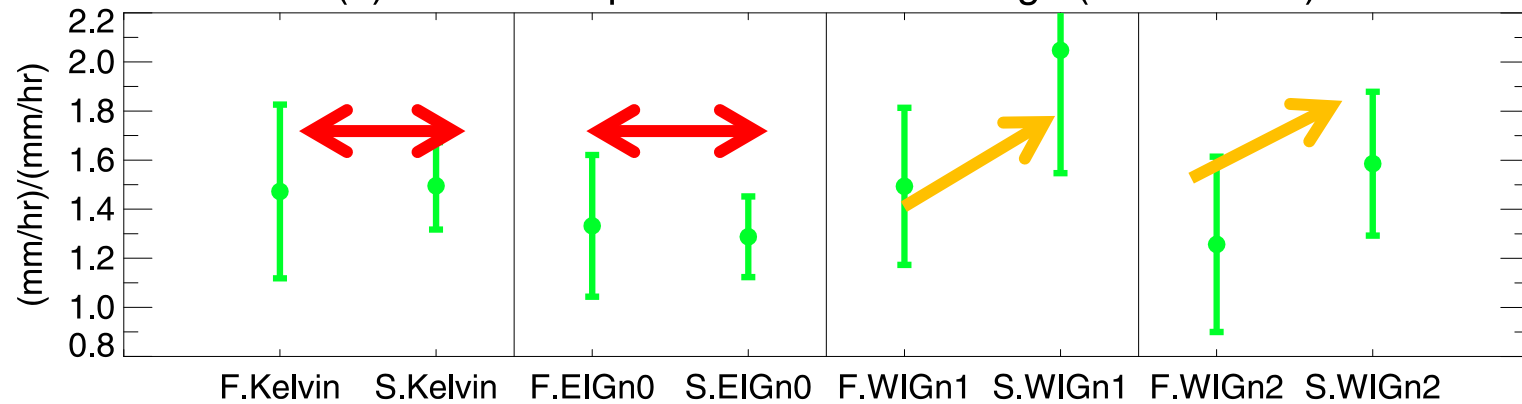


**Rainfall Modulation = rainfall (Active phase)
– rainfall (suppressed phase)**

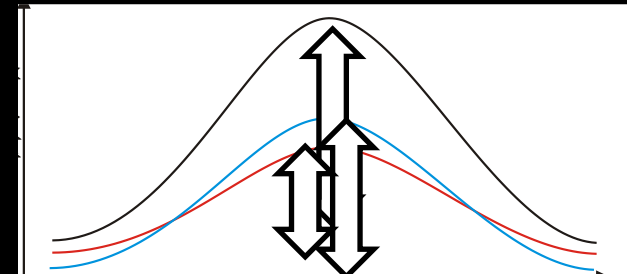
Modulation of Convective and Stratiform Rainfall



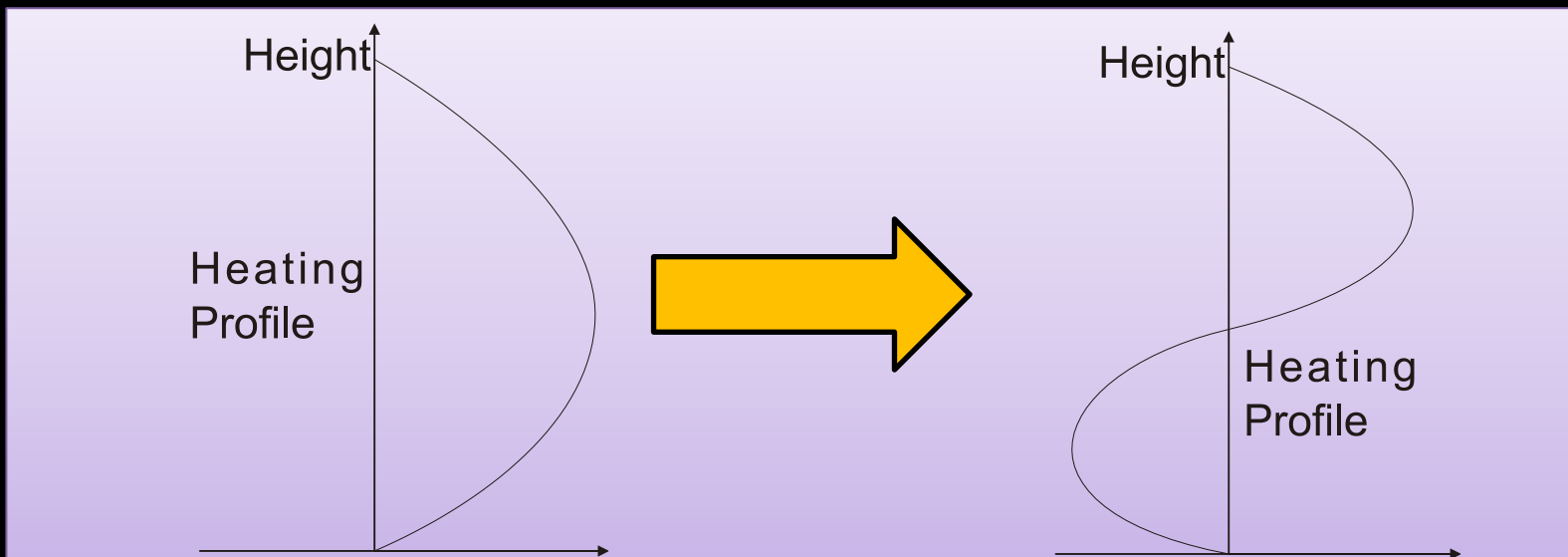
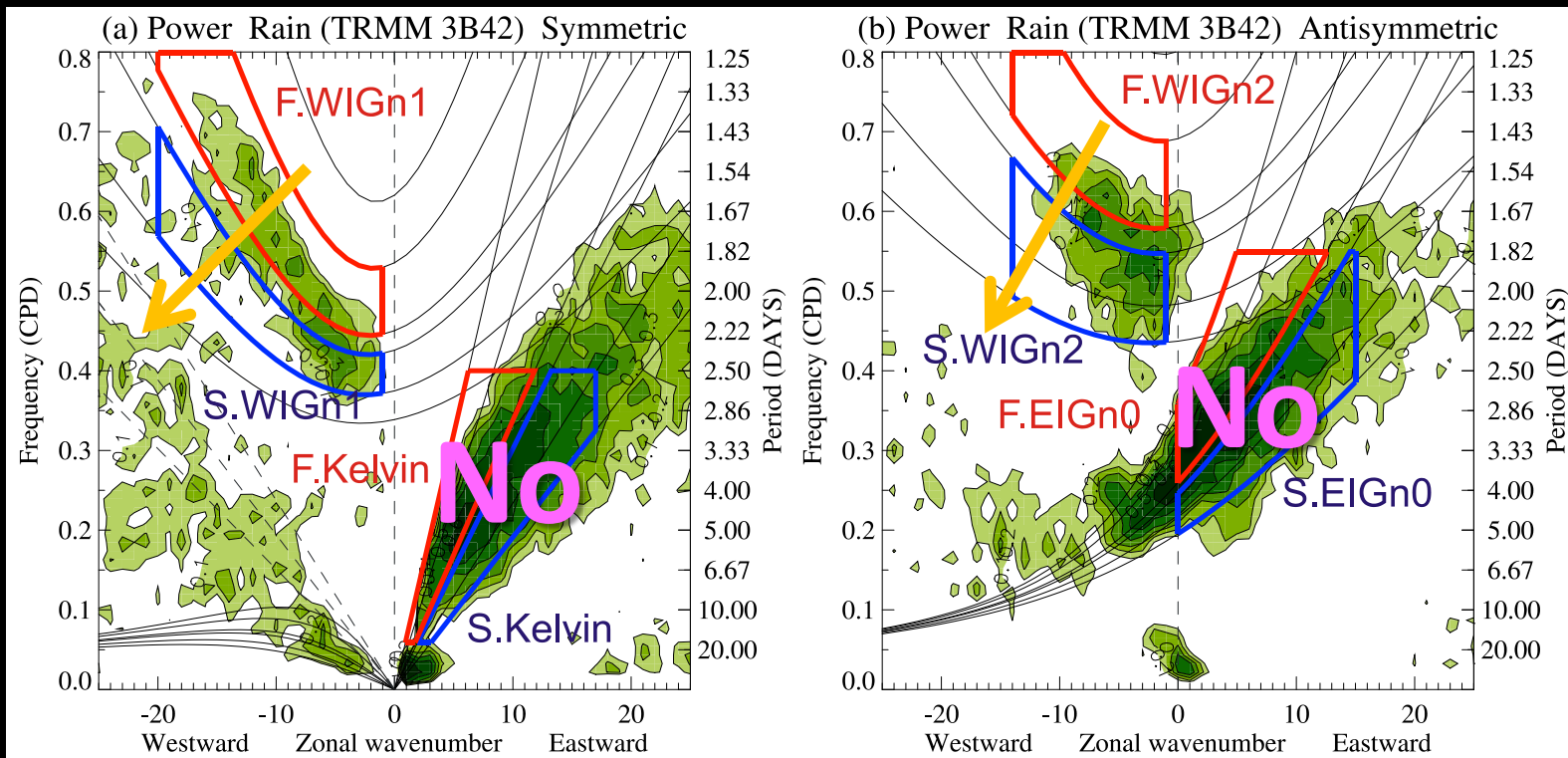
(b) Ratio of slopes of min-to-max range ($P_{\text{str}}/P_{\text{conv}}$)



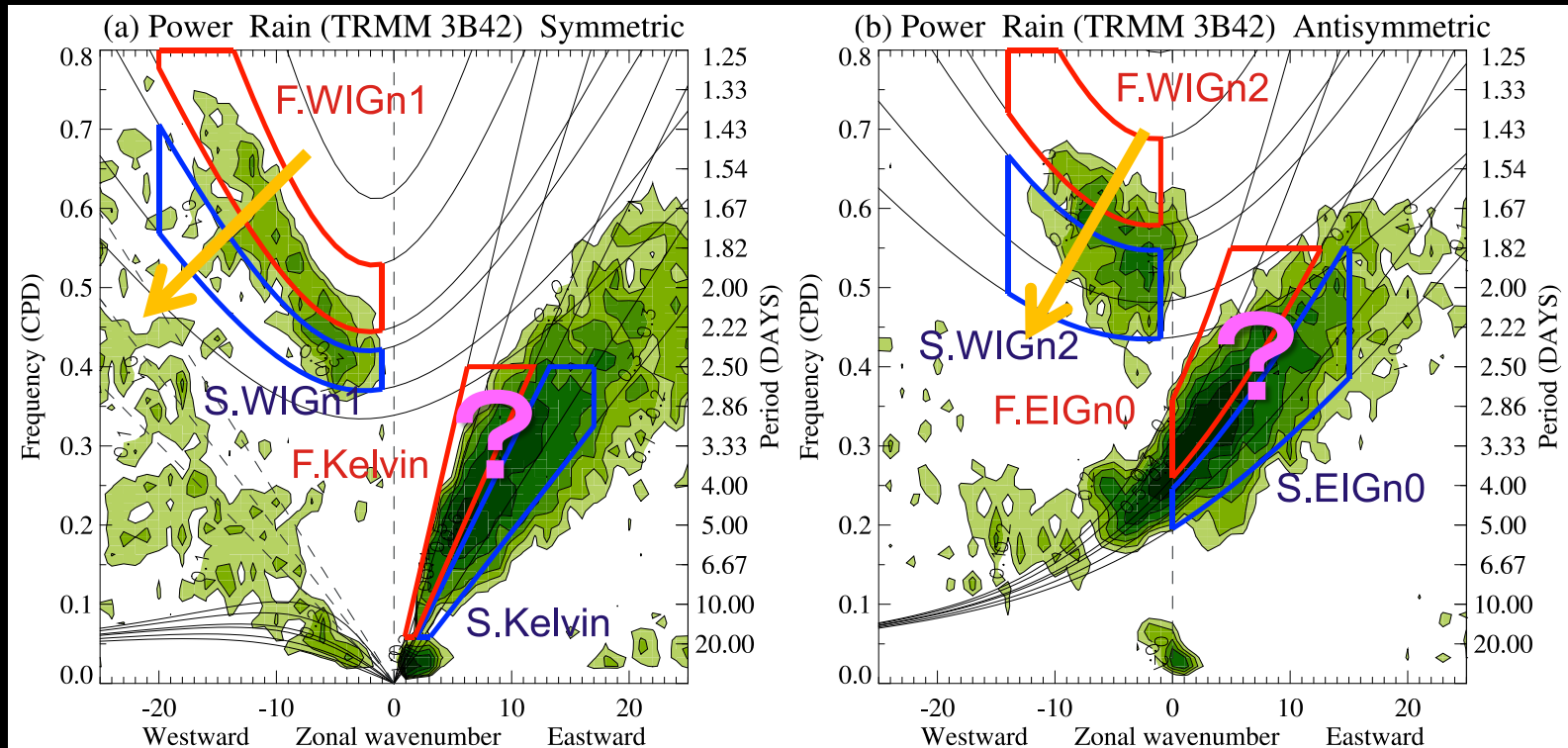
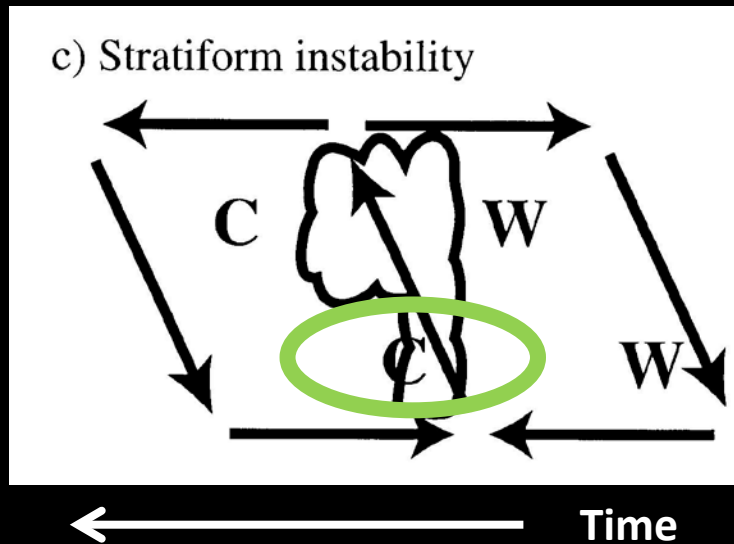
Insensitive to the filtering box!



Results

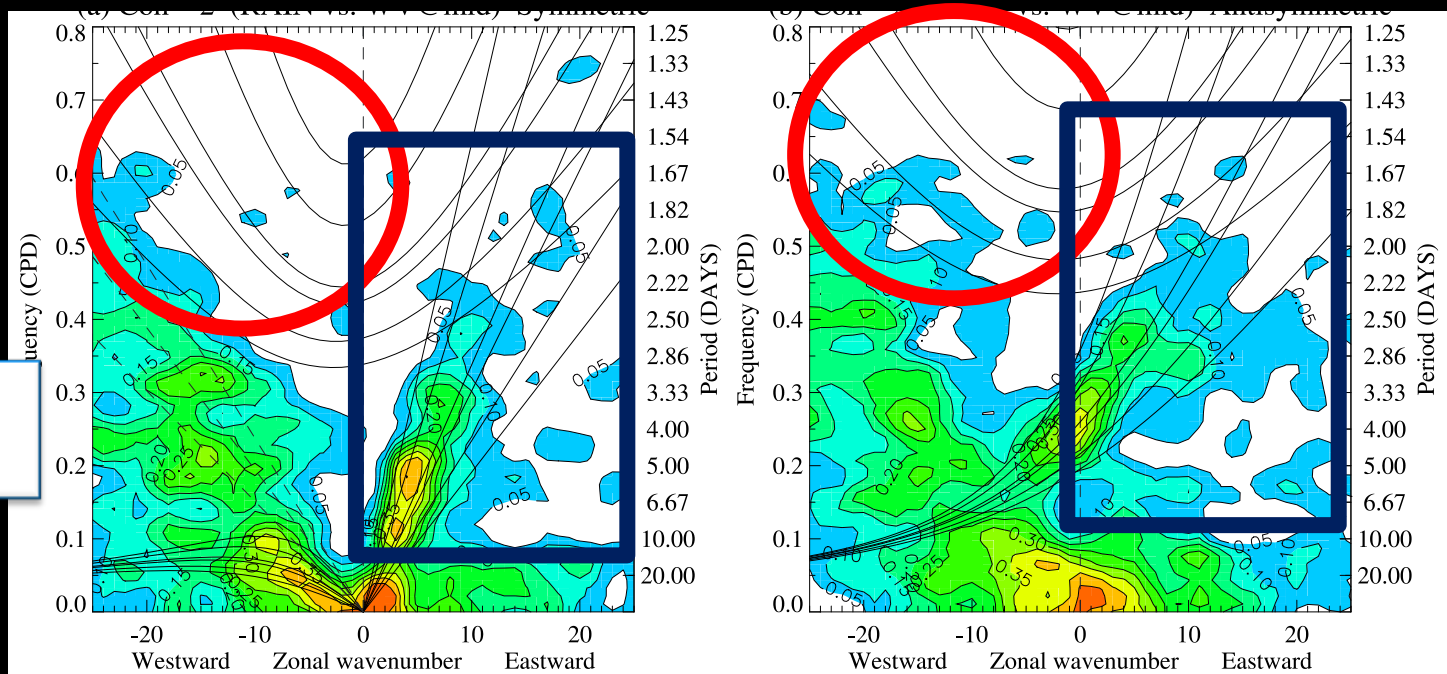


Stratiform Instability (by Mapes 2000)

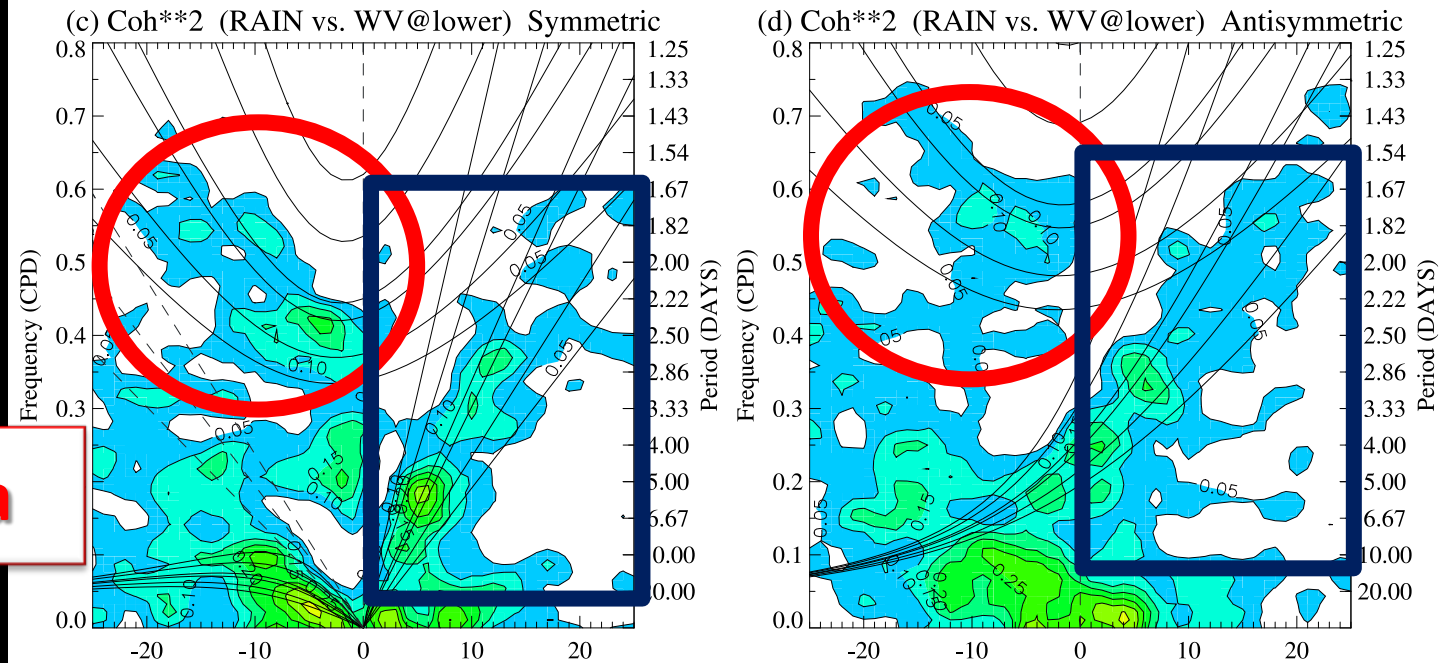


Coherence (Rain vs. Water vapor)

700-300hPa



1000-700hPa



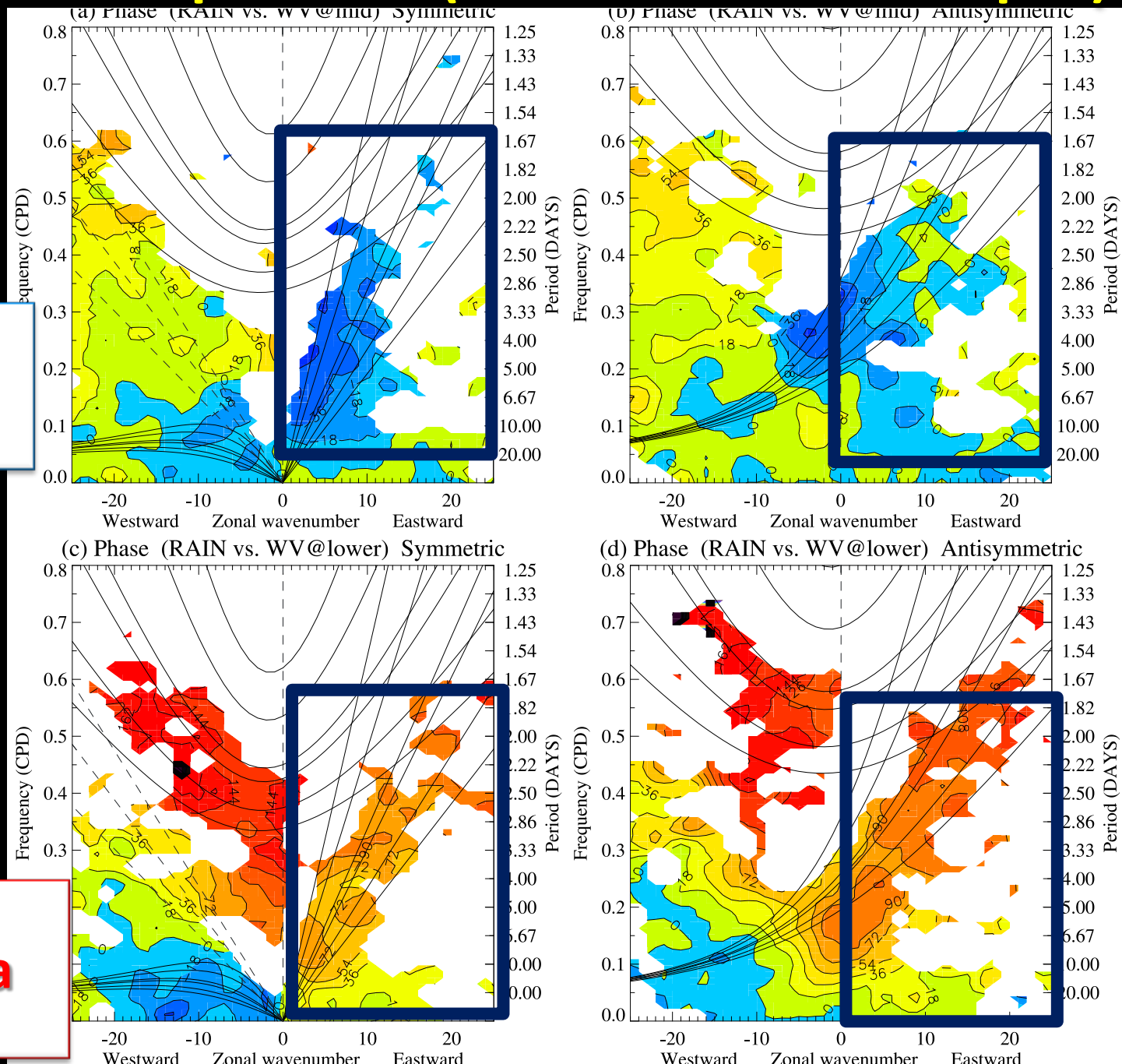
Phase spectrum (rainfall vs. water vapor)

700-300hPa

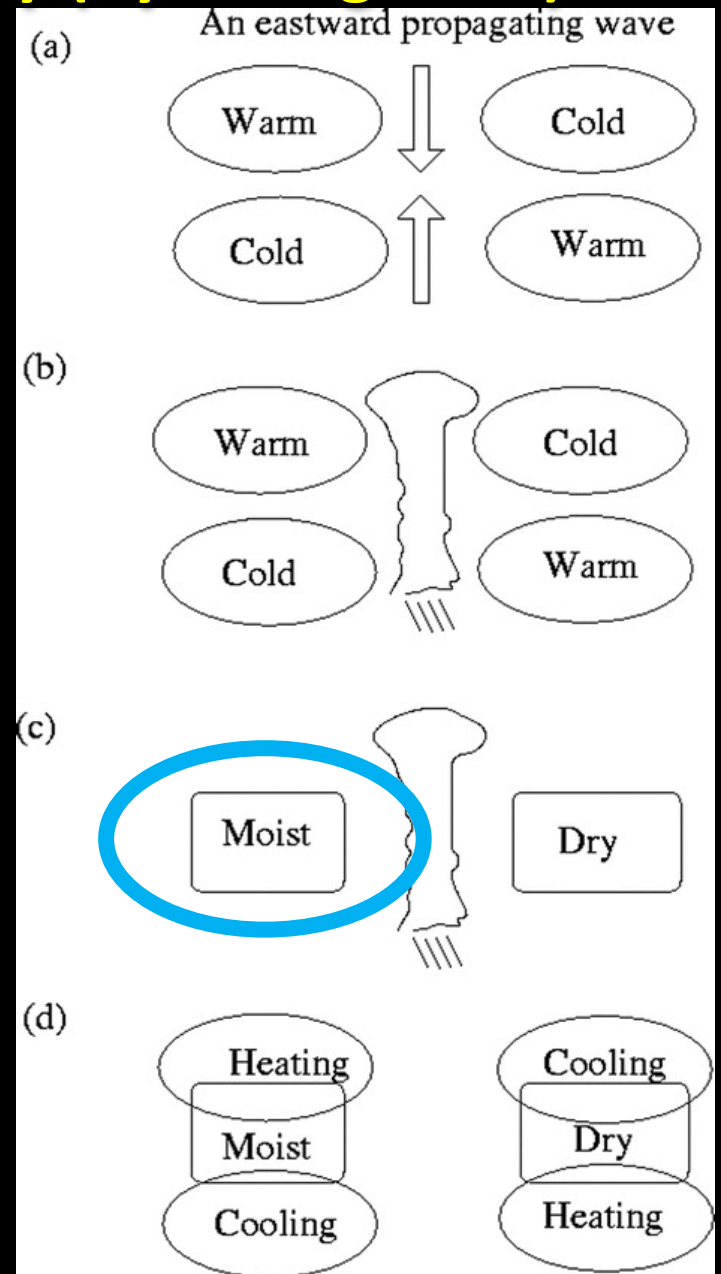
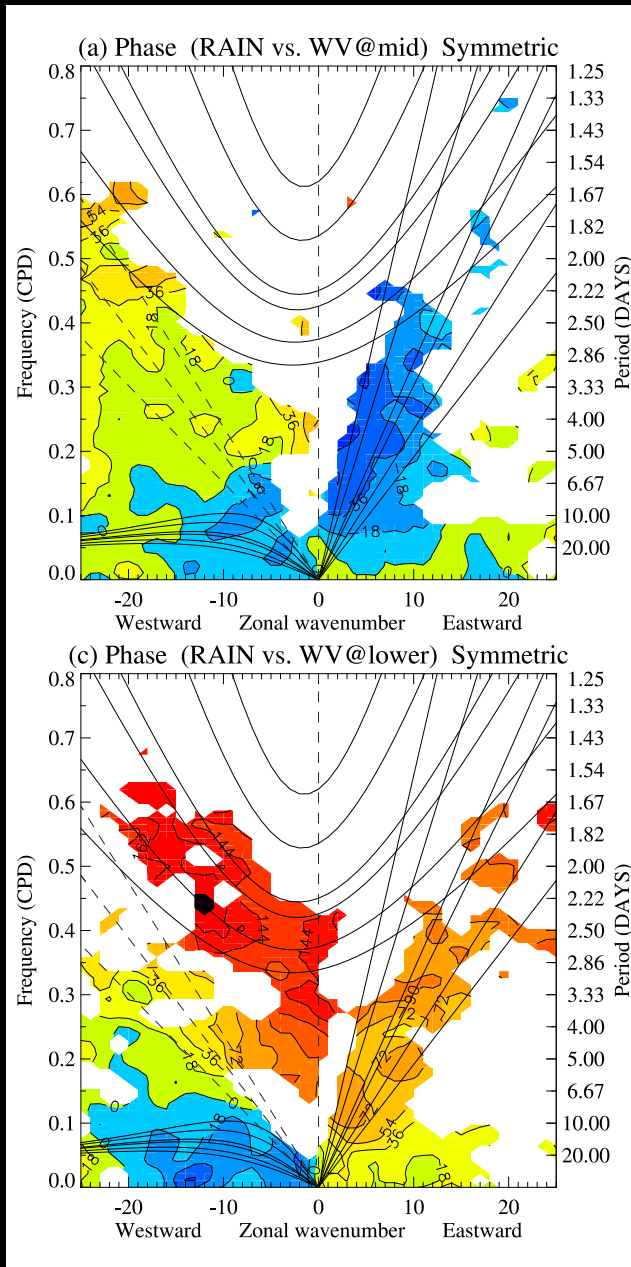
Water vapor
predates rain.

Water vapor
lags rain

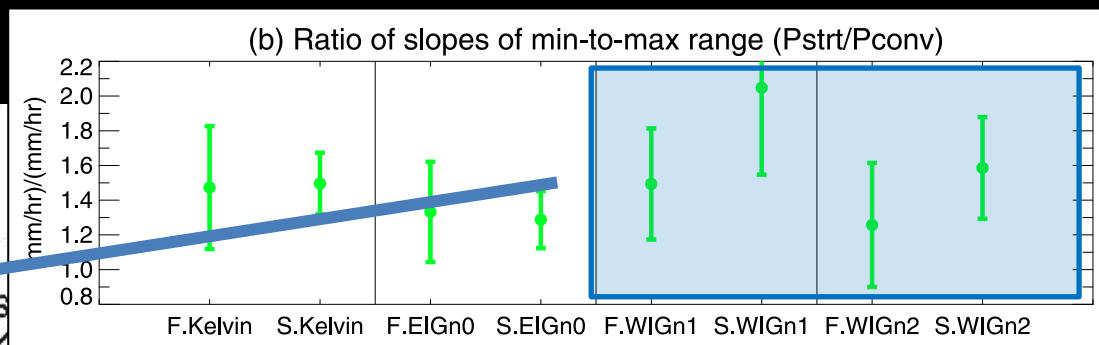
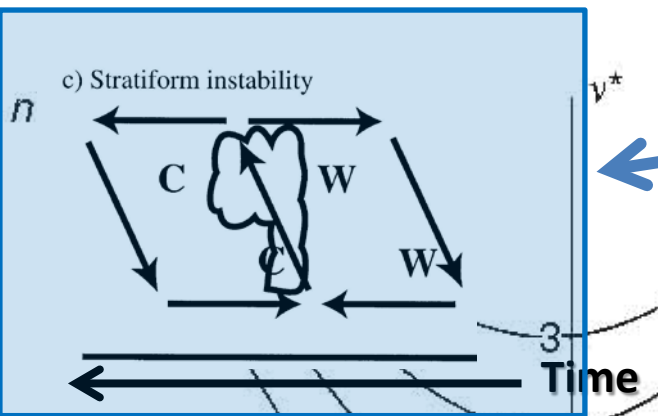
1000-700hPa



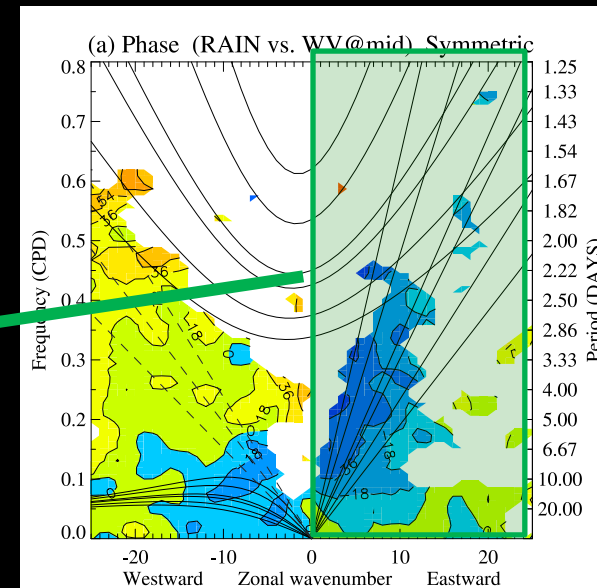
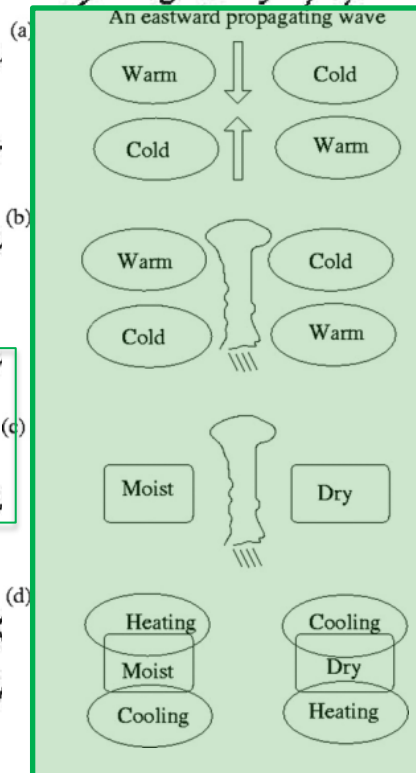
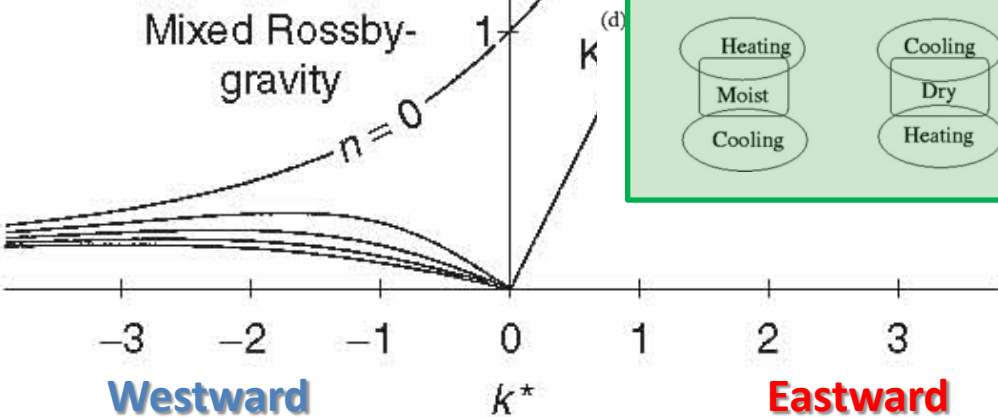
Moisture-Stratiform Instability (By Kuang 2008)



Stratiform Instability ?



Moisture-Stratiform Instability?



Other mechanism ?

- Moisture mode?

- Gross Moist Stability ?