Advection of Dry Air by Transient Eddies within an MJO

Kazu. Yasunaga

(JAMSTEC/Univ. of Toyama)

Importance of horizontal advection of qv

- CINDY/DYNAMO (Kerns and Chen, 2013)

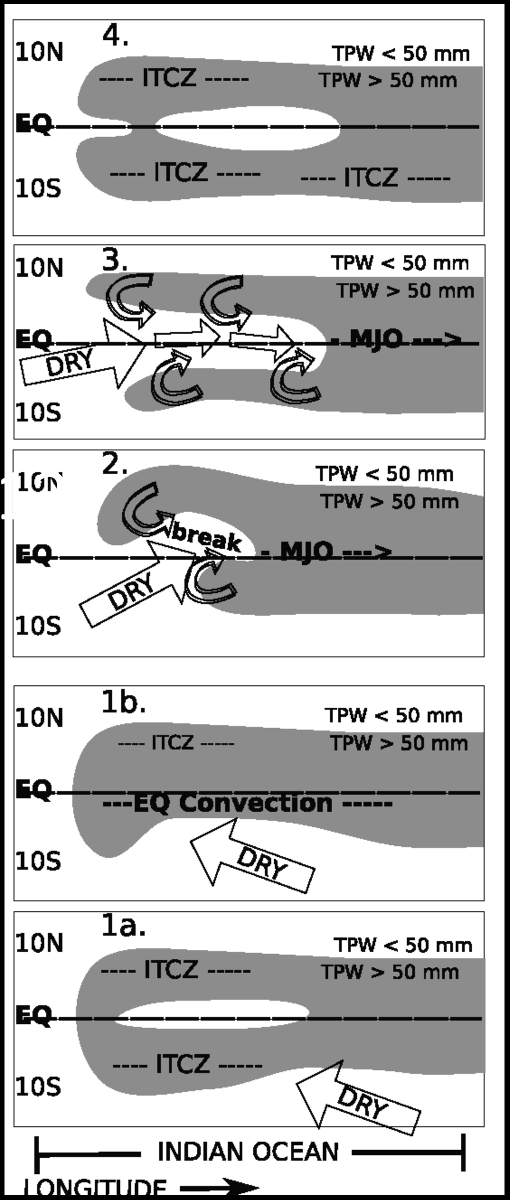
MJO convection (MJO2) was suppressed by dry-air intrusions, and moved to the east.

- Simple linear model (Sobel, and Maloney,201

Synoptic-eddy drying contributes to eastward propagation of the MJO.

- SPCAM (Pritcharda and Bretherton, 2014)

MJO propagation speed is highly sensitive to moisture advection by the rotational component.



Decomposition of horizontal velocity

$$-\mathbf{v} \cdot \nabla q_v$$

↓

ISV component HF component

$$-\mathbf{v}^{MEAN} \cdot \nabla q_v - \mathbf{v}^{ISV} \cdot \nabla q_v - \mathbf{v}^{HF} \cdot \nabla q_v$$

↓

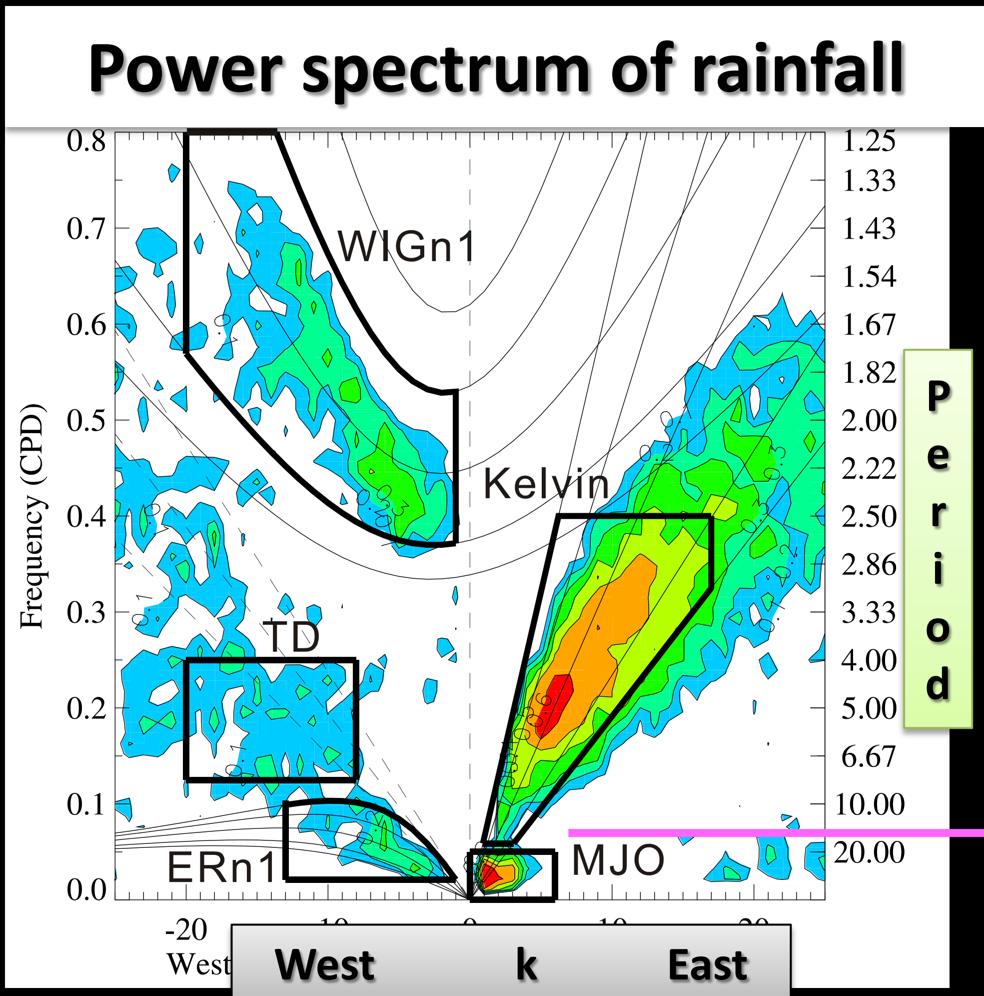
rotational component divergent component

$$-(\mathbf{v}_{\psi}^{ISV} + \mathbf{v}_{\psi}^{HF}) \cdot \nabla q_v - (\mathbf{v}_{\chi}^{ISV} + \mathbf{v}_{\chi}^{HF}) \cdot \nabla q_v$$

Which term is dominant for the drying in an MJO?

Methodology

Linear regression between MJO rainfall anomalies, and various fields from a global reanalysis dataset.



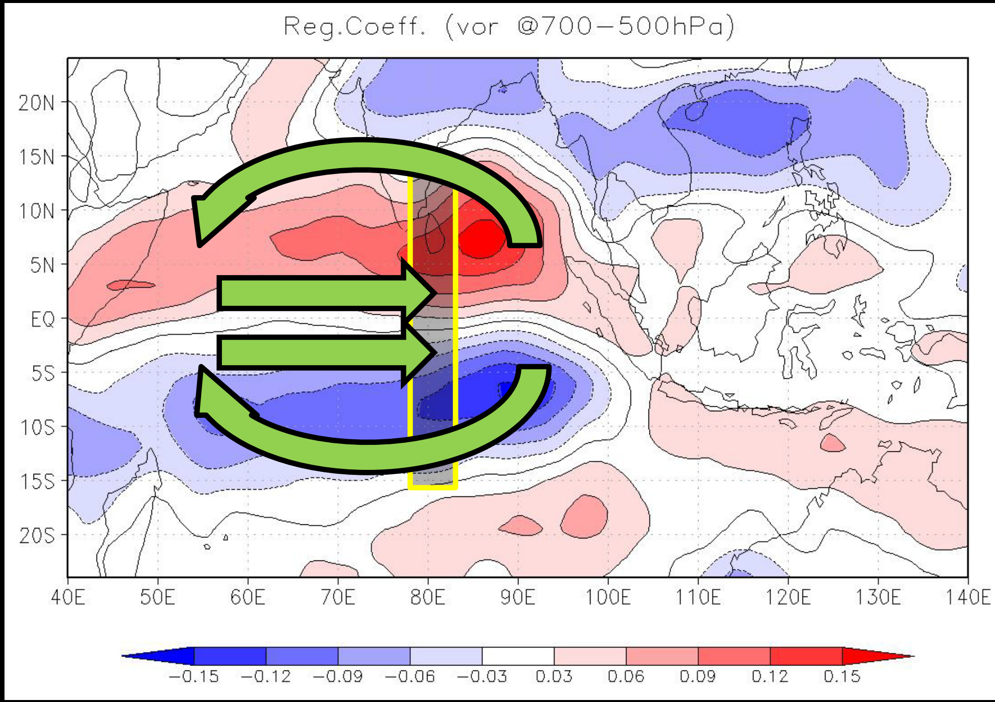
DATA: TRMM-3B42, ERA-Interim

Period: JAN. 1998 to DEC. 2013

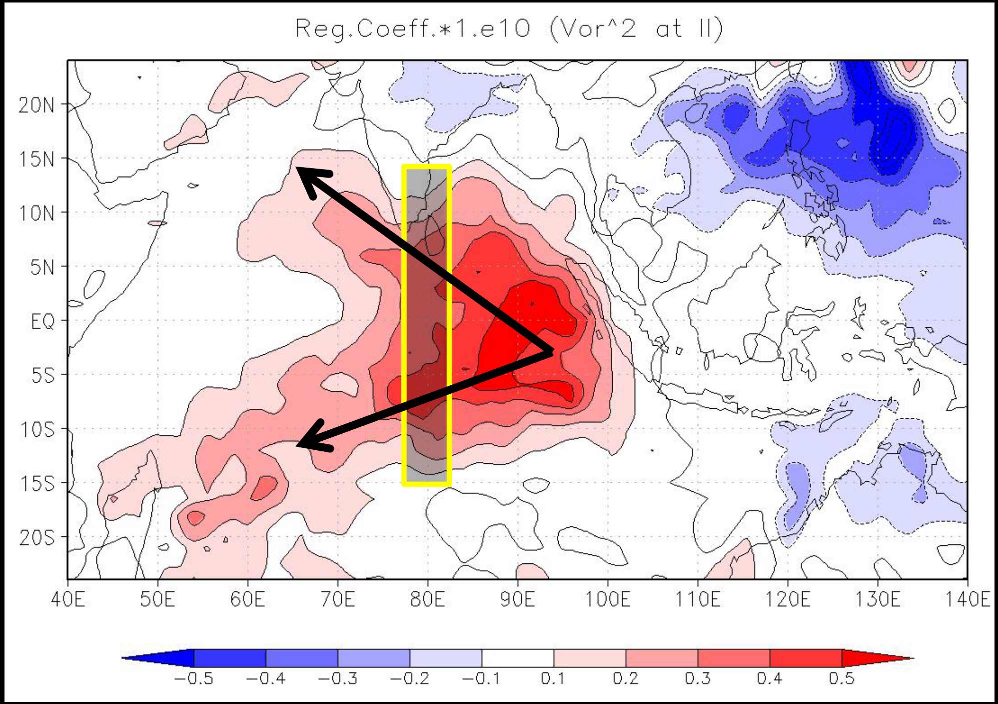
MJO rainfall anomalies

back to a real space from a spectral space

Mid-level vorticity at the peak of MJO rainfall



HF-Eddy activity at the peak of MJO rainfall



Higher frequency component

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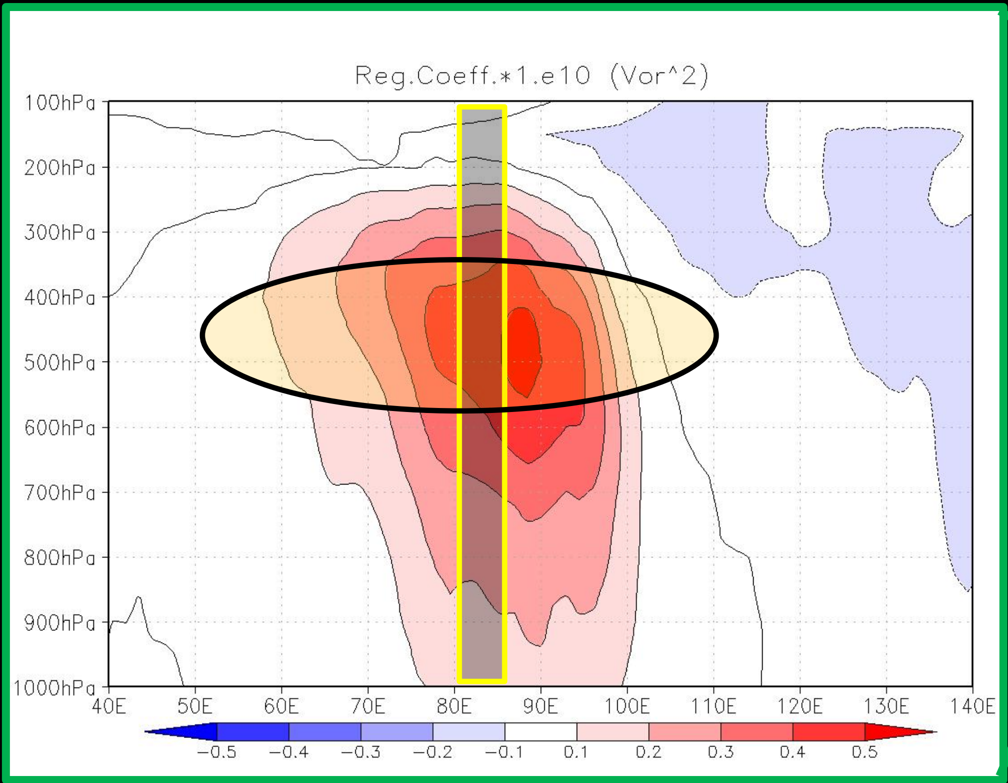
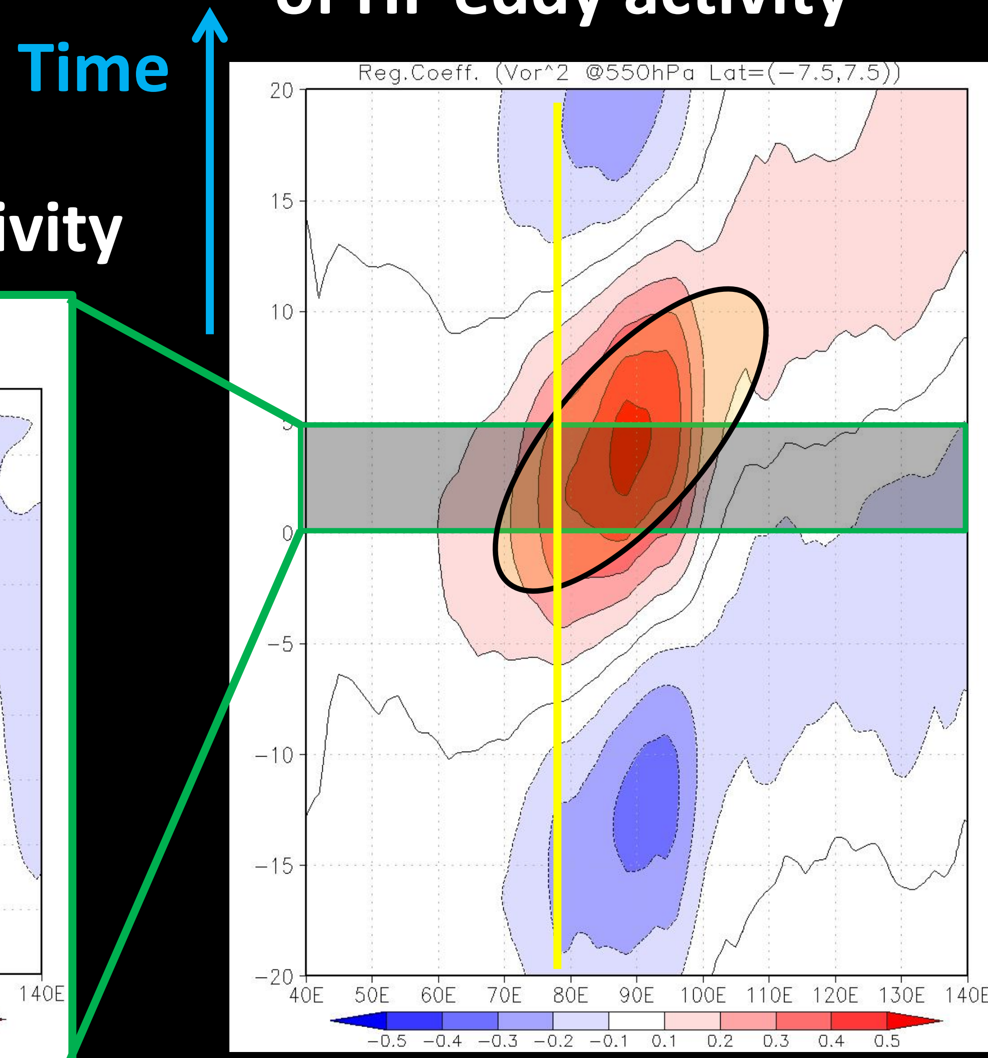
disturbance with a period < 20 days

Time variations and Vertical profiles of HF eddy.

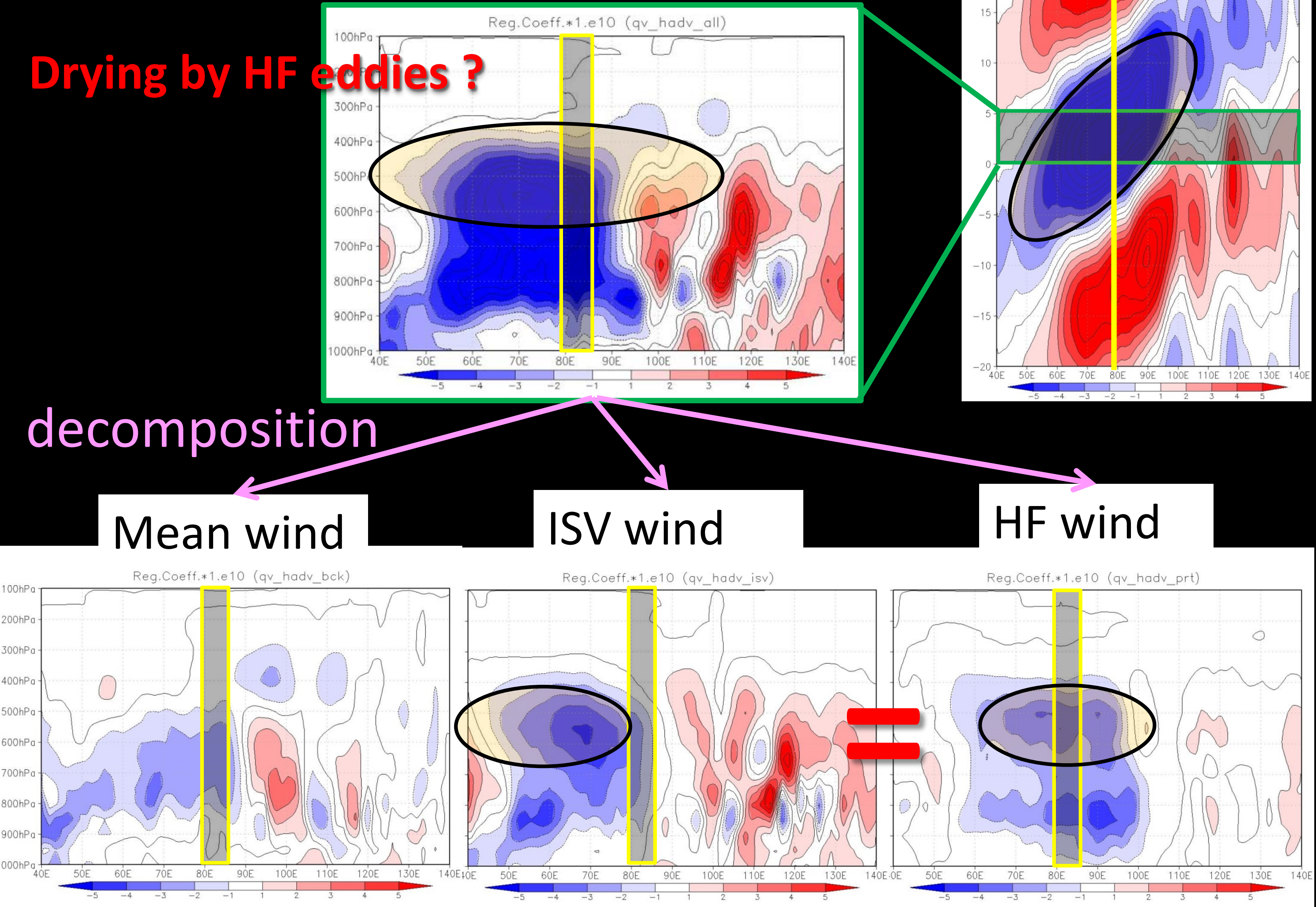
Time-Lon cross-section of HF eddy activity

Vertical profile of HF eddy activity

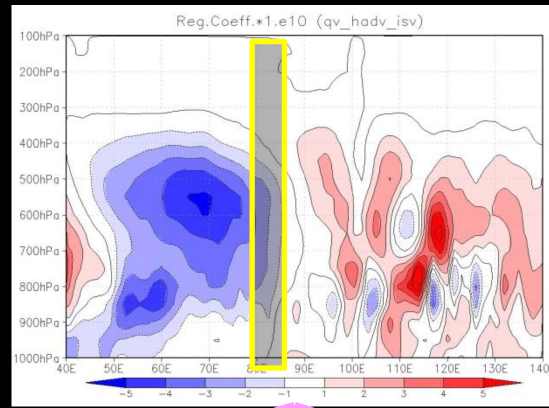




Horizontal moisture advection

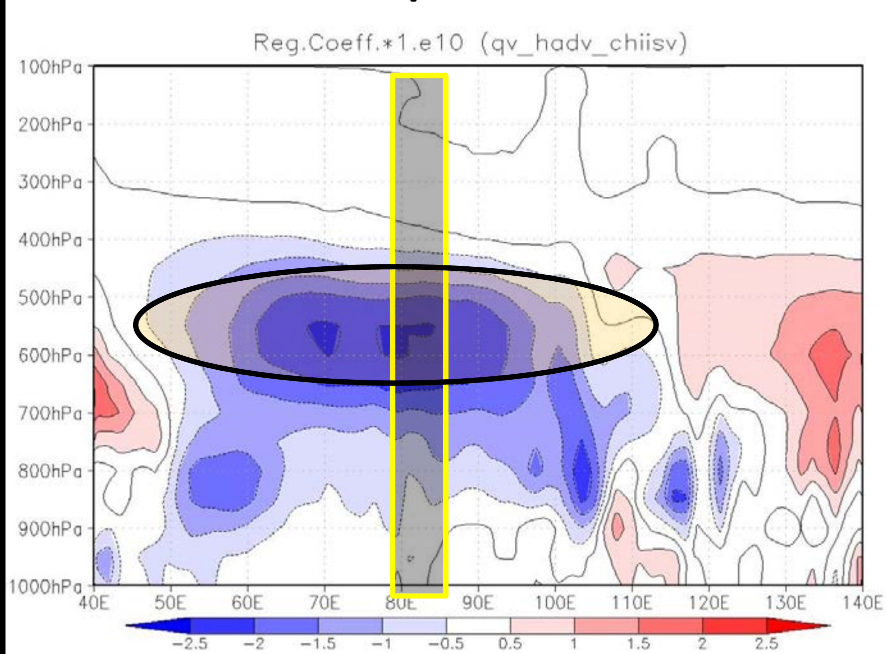


Horizontal advection by ISV components

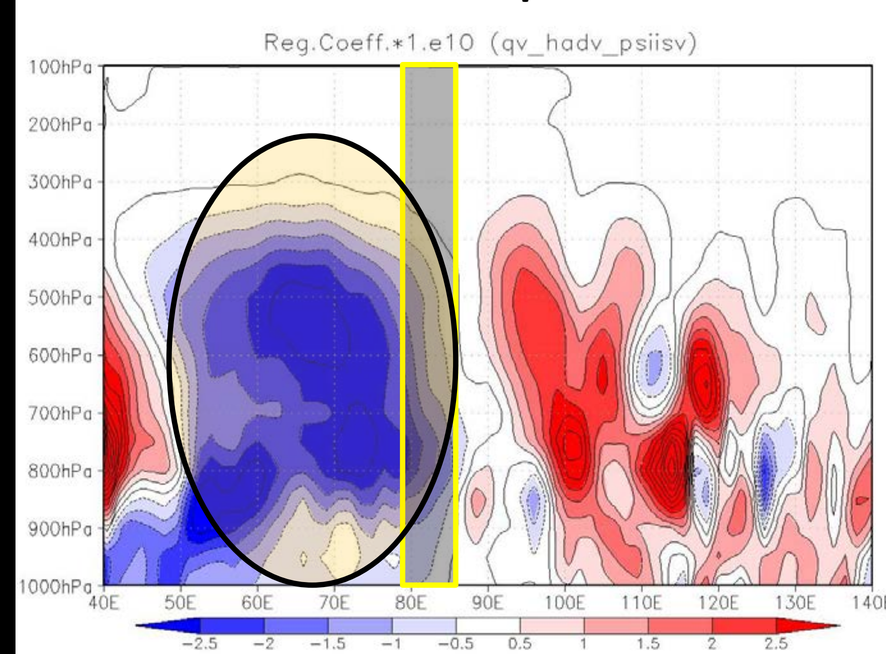


decomposition

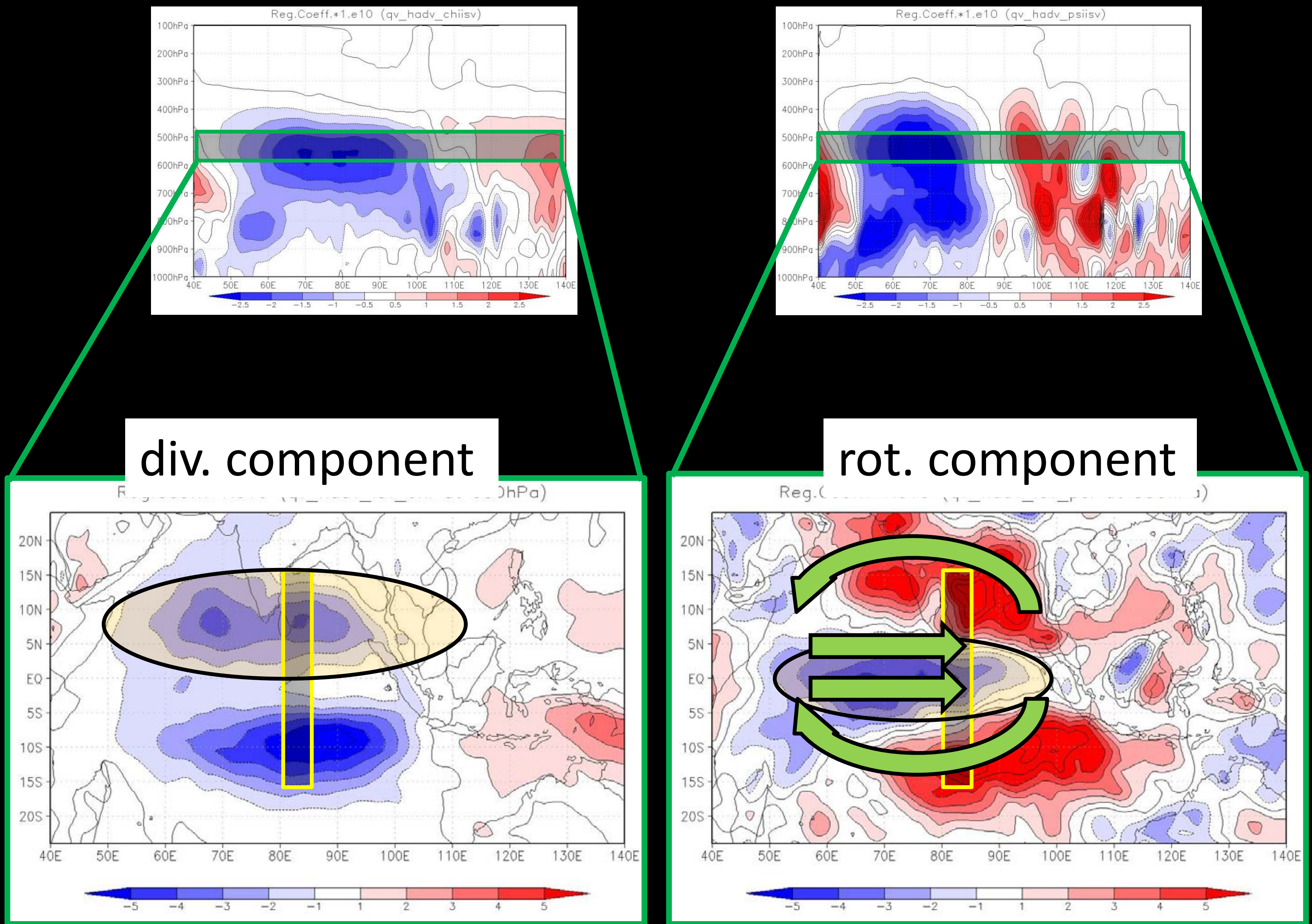
div. component



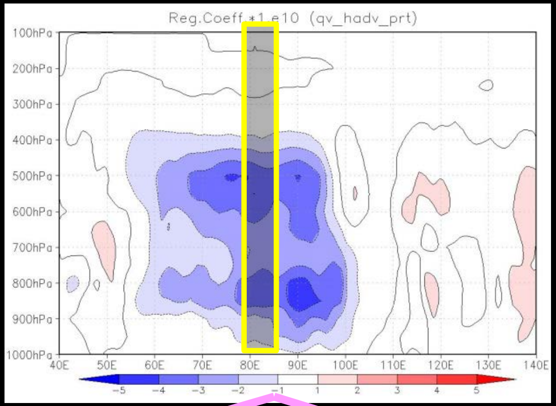
rot. component



Horizontal patterns of the advection(ISV)

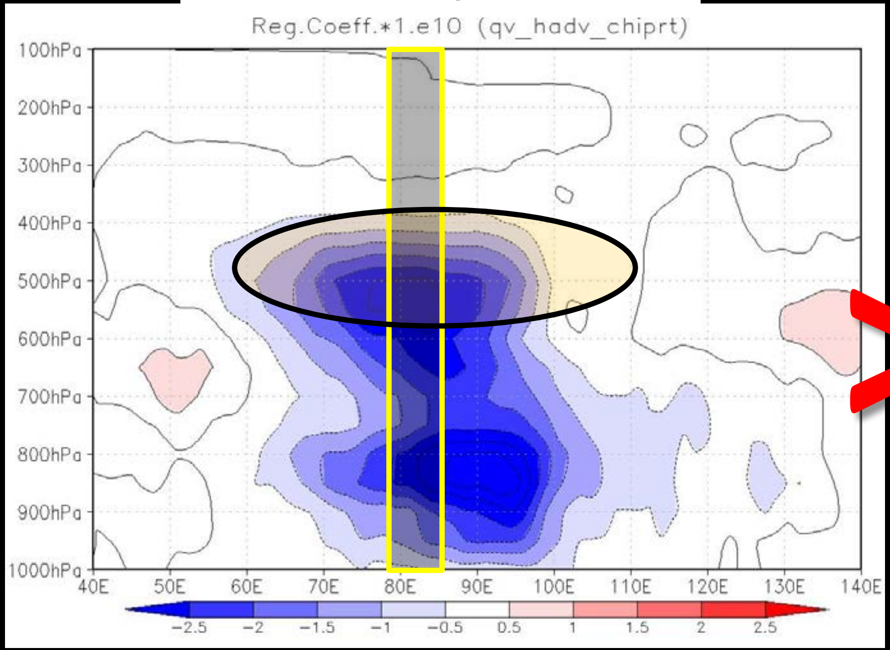


Horizontal advection by HF components



decomposition

div. component



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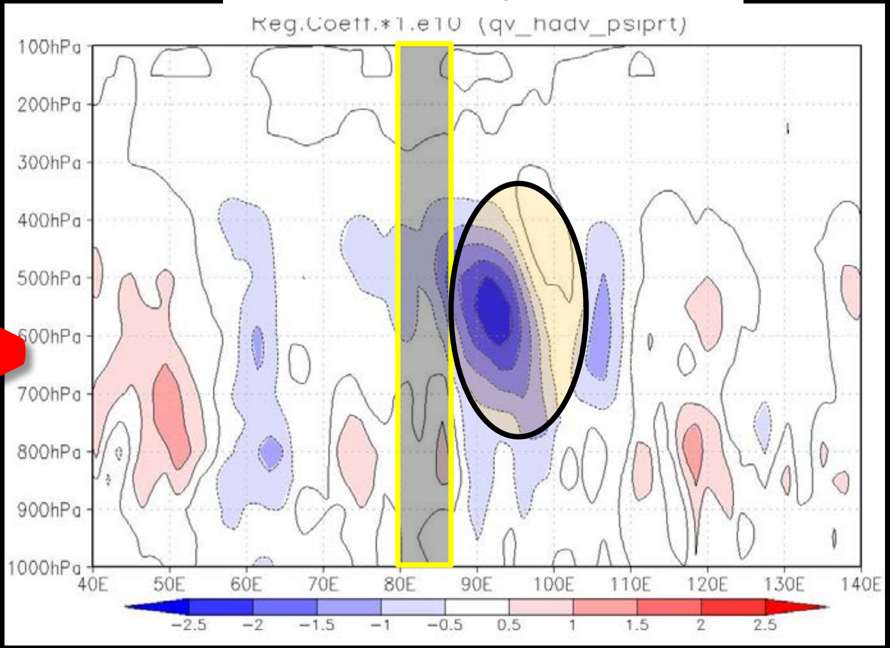
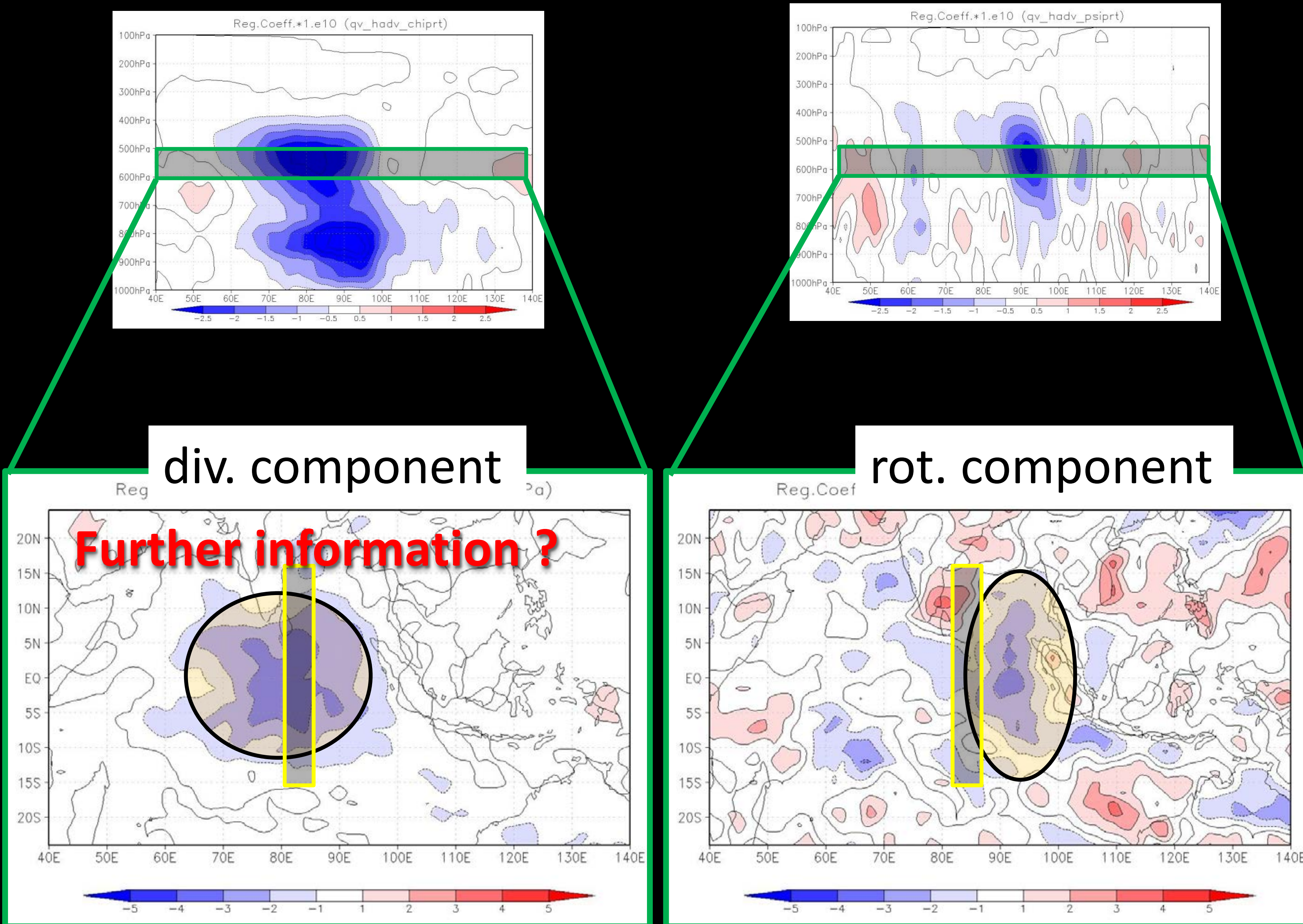
rot. component



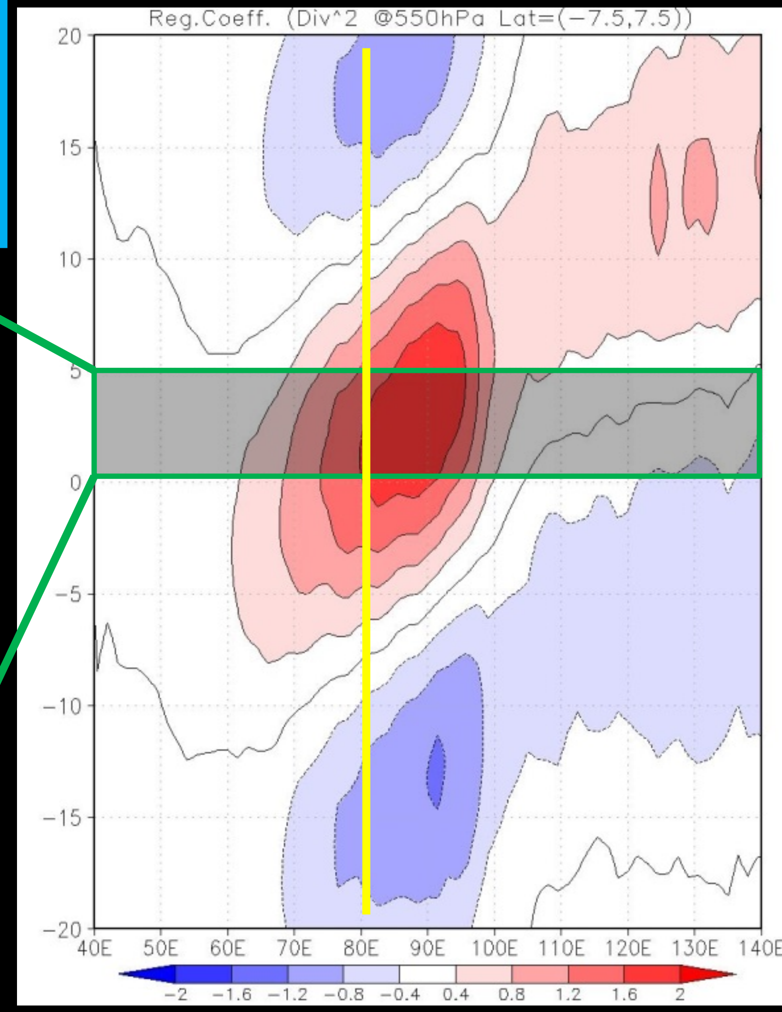
Horizontal patterns of the advection (HF)



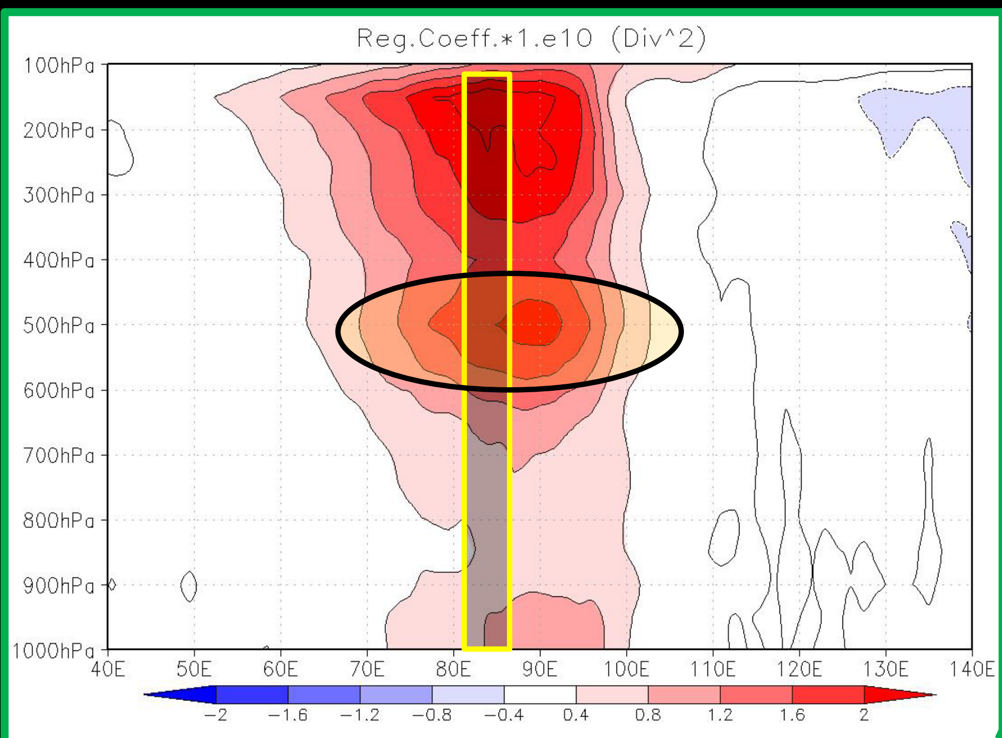
Time variations and Vertical profiles of HF divergence

Time-Lon cross-section of HF divergence

Time



Vertical profile of HF divergence



Summary

- Horizontal wind -> 3 components (Mean, ISV, and HF).
- ISV and HF components -> rot. and div. components.
- Relative importance of the horizontal advection is evaluated.

- Drying by horizontal wind has a peak in the mid-level.
- Drying by HF wind components comparable to that by ISV wind components, and predates that.
- Drying by HF divergent wind is more dominant than that by HF rotational wind (Except in the Eastern IO.)
- HF divergence shows 3 peaks (Surf. 500 and 200hPa lev.)

- Stratiform convergence may be essentially important to the mid-level drying associated with HF disturbances?