더블 피크 엘니뇨

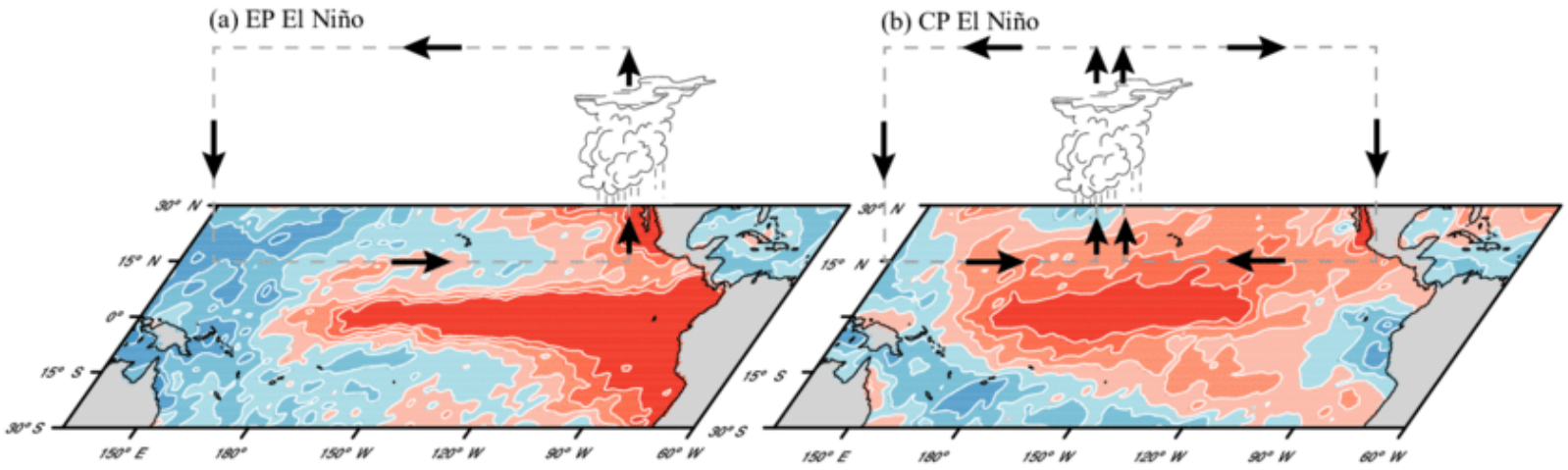
신나연 & 국종성

포항공대 환경공학부

Shin, N.-Y., J.-S. Kug, F. S. McCormack, N. J. Holbrook (2021) The double peaked El Nino and its physical processes. J. Climate, 34, 1291-1303.

1. Background

Two Types of El Nino



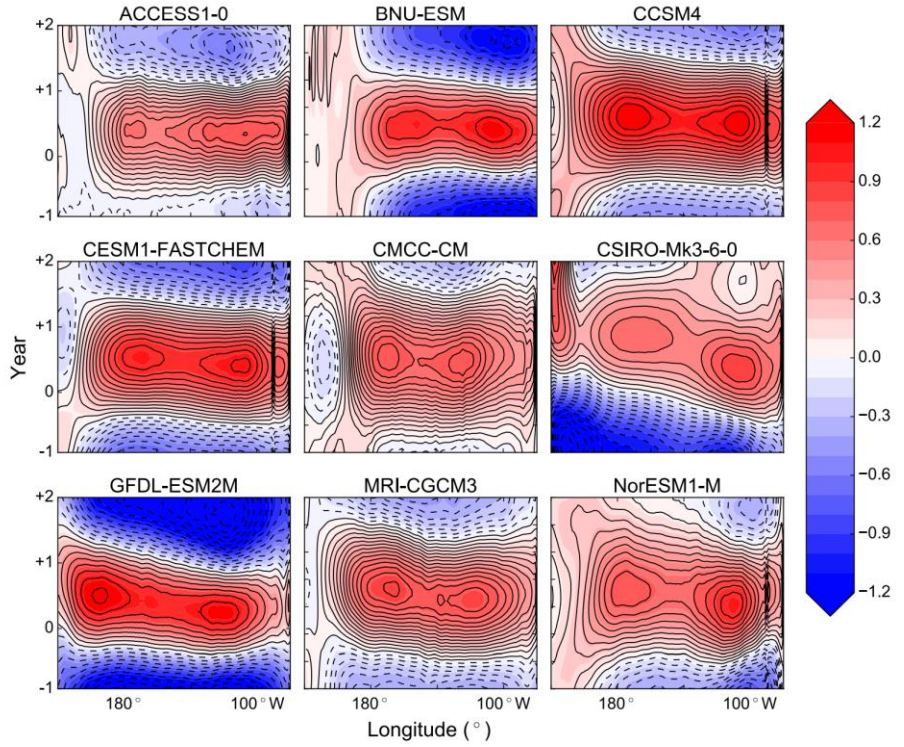
(Wang et al. 2018)

Different **type** → Different **impact**

1. Background

What is the Double peaked El Nino ?

- ✓ Two separate, concurrently growing, centers of warming are identified.
- ✓ Have been evidenced in CGCMs
- ✓ **Without** precedent in observations



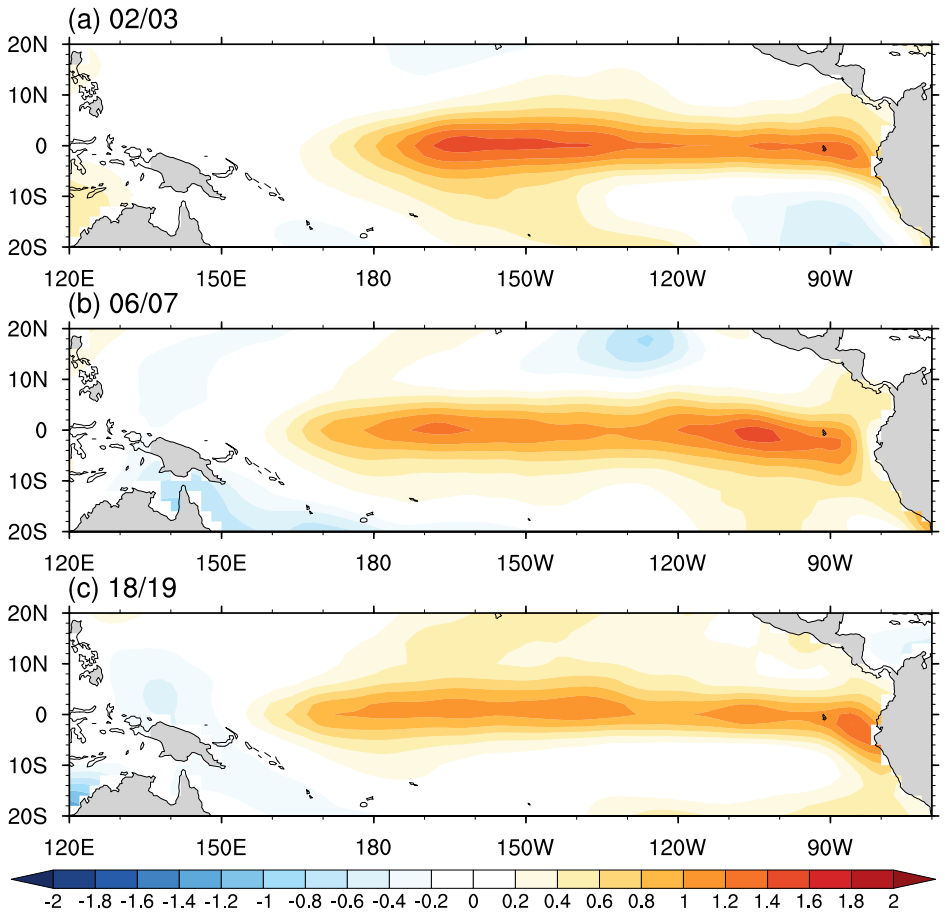
(Graham et al. 2017)

2. Topic of research

BUT!!

Double Peaked El Nino events exist in real world.

What Mechanism ?



3. Data

All data are monthly (1980 - 2019/2)

ERSST	SST
GODAS	Currents (u,v,w)
	Wind stress
	Potential Temperature
CMAP	Precipitation

4. Results

How to define the Double peaked El Nino ?

2S~2N , 160 ~ 270 (interval 30)

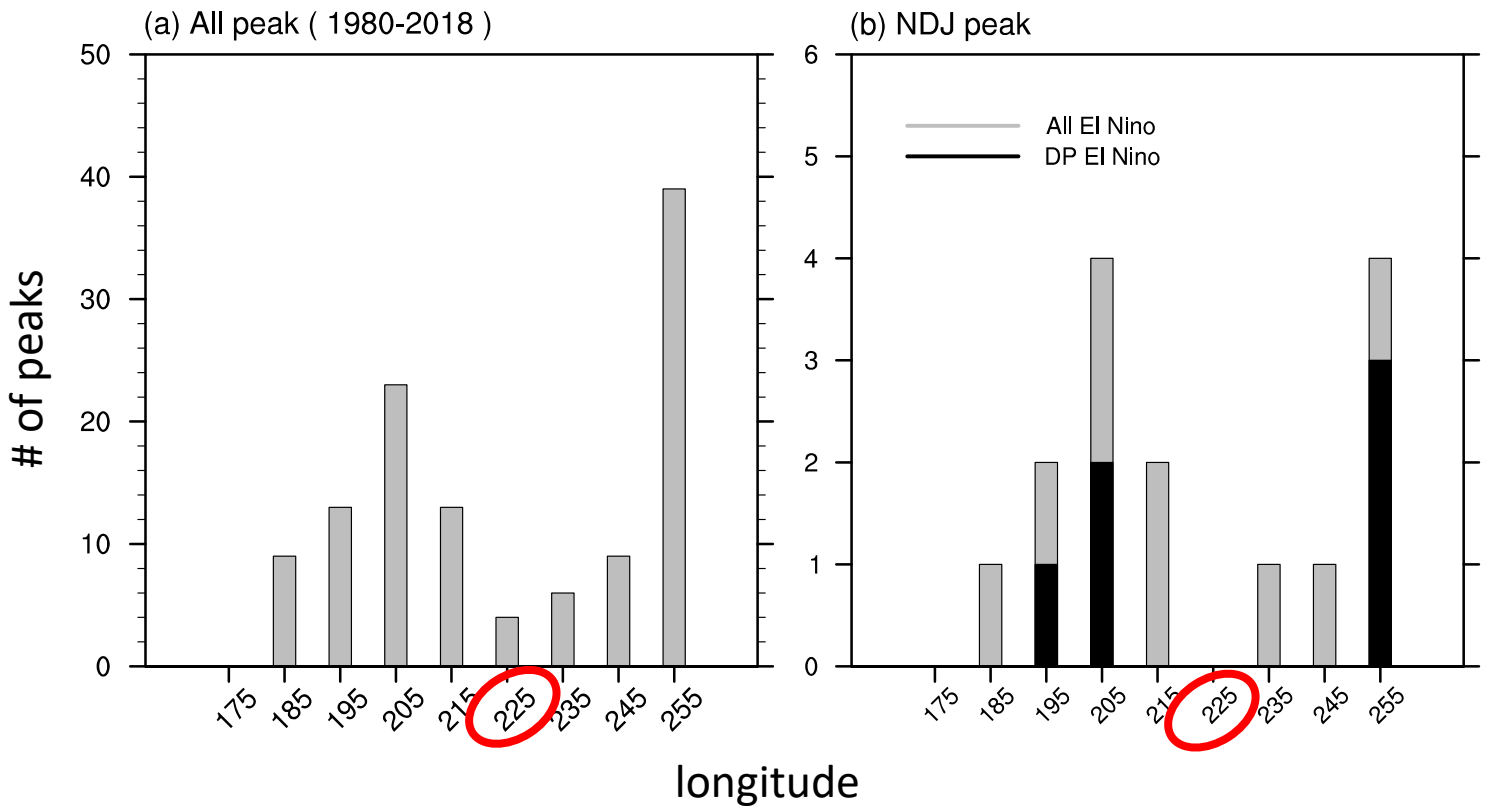
> 1 STD : detect El Nino

Find Peak

If the double peaks exist in NDJ

4. Results

Distribution of El Nino peaks



Double Peaked El Nino (3)

02/03, 06/07, 18/19

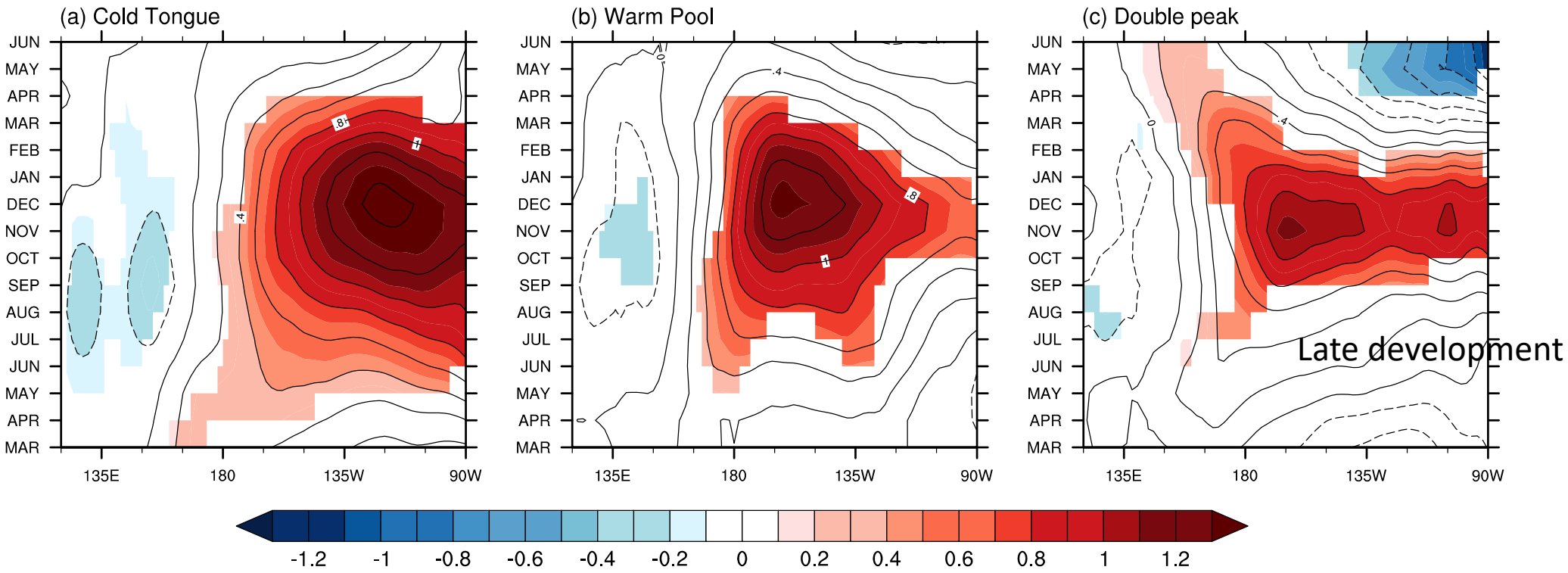
Cold Tongue El Nino (3)

82/83, 97/98, 15/16

Warm Pool El Nino (6)

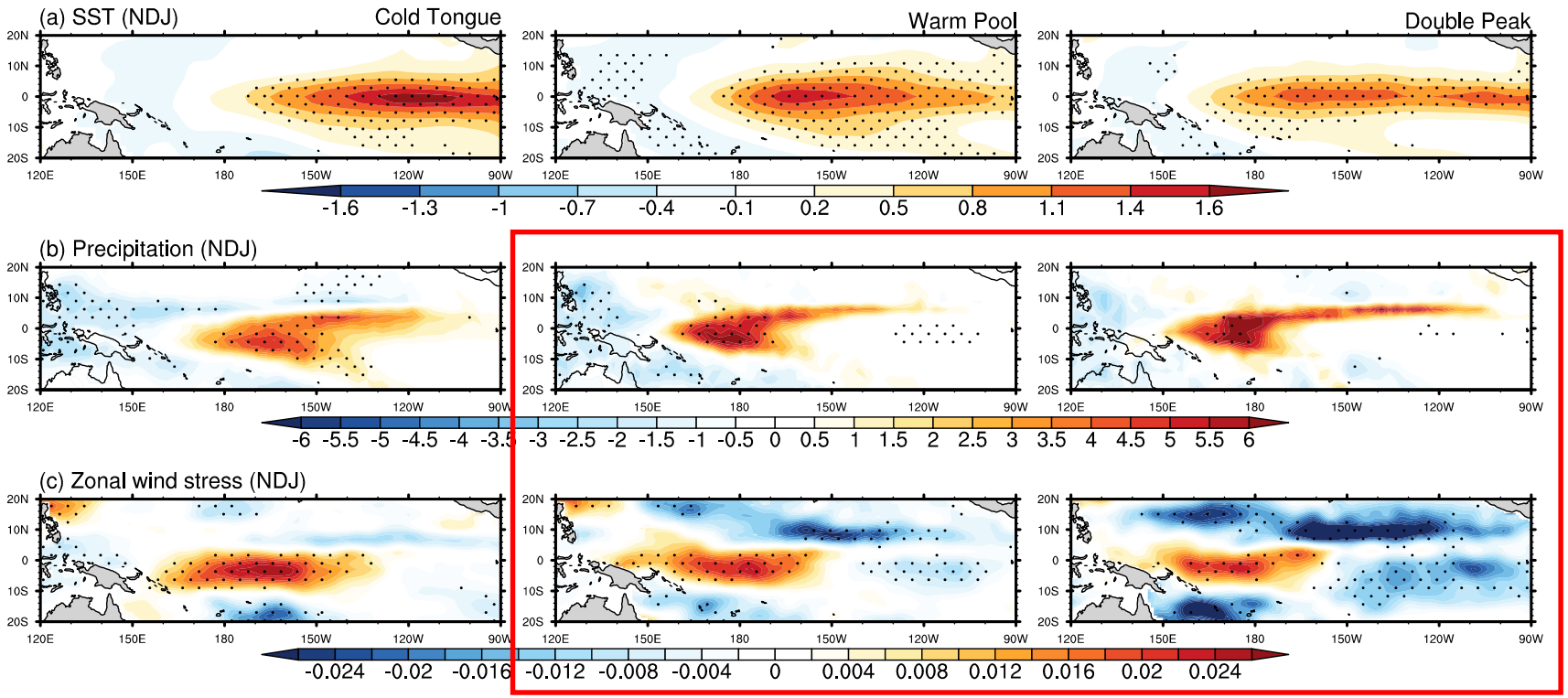
86/87, 87/88, 91/92,
94/95, 04/05, 09/10

Evolution of SSTA



4. Results

Mature phase of each El Nino case



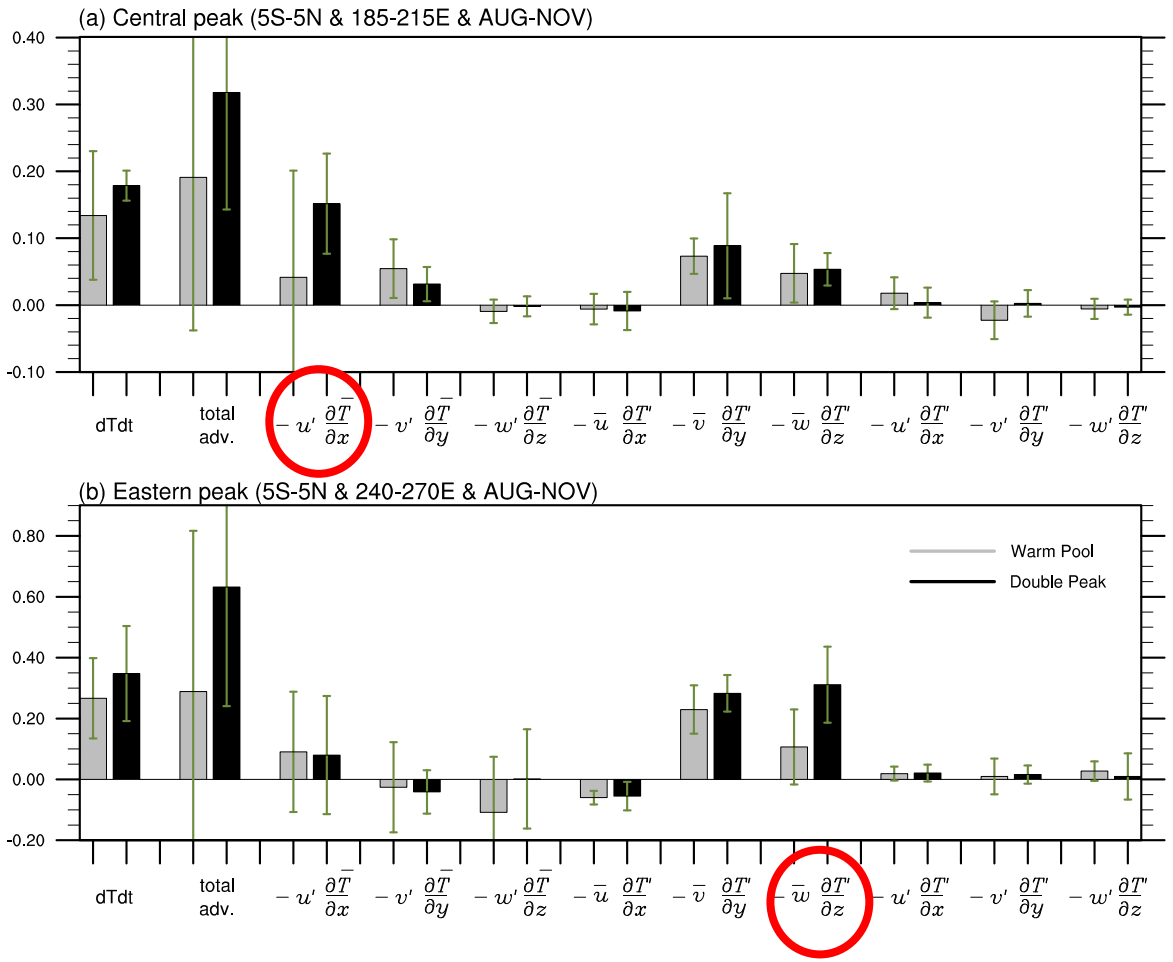
WP & DP

PRCP , zonal wind stress

Similar pattern

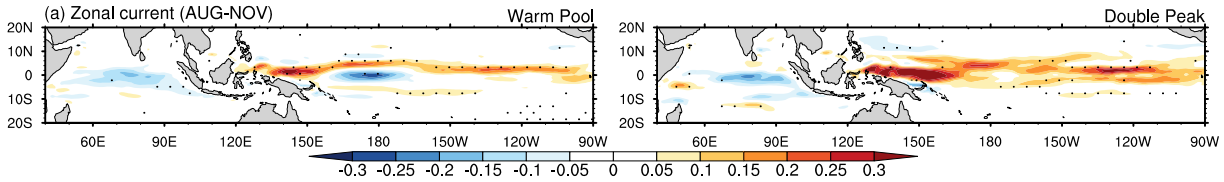
4. Results

Advection terms of each peak



Central peak

Zonal advection Feedback



Eastern peak

Thermocline feedback

4. Results – Central peak

180E

Negative wspd anomaly

⬇

Less evaporation cooling

⬇

Contribute to developing warm center

135W

Positive wspd anomaly

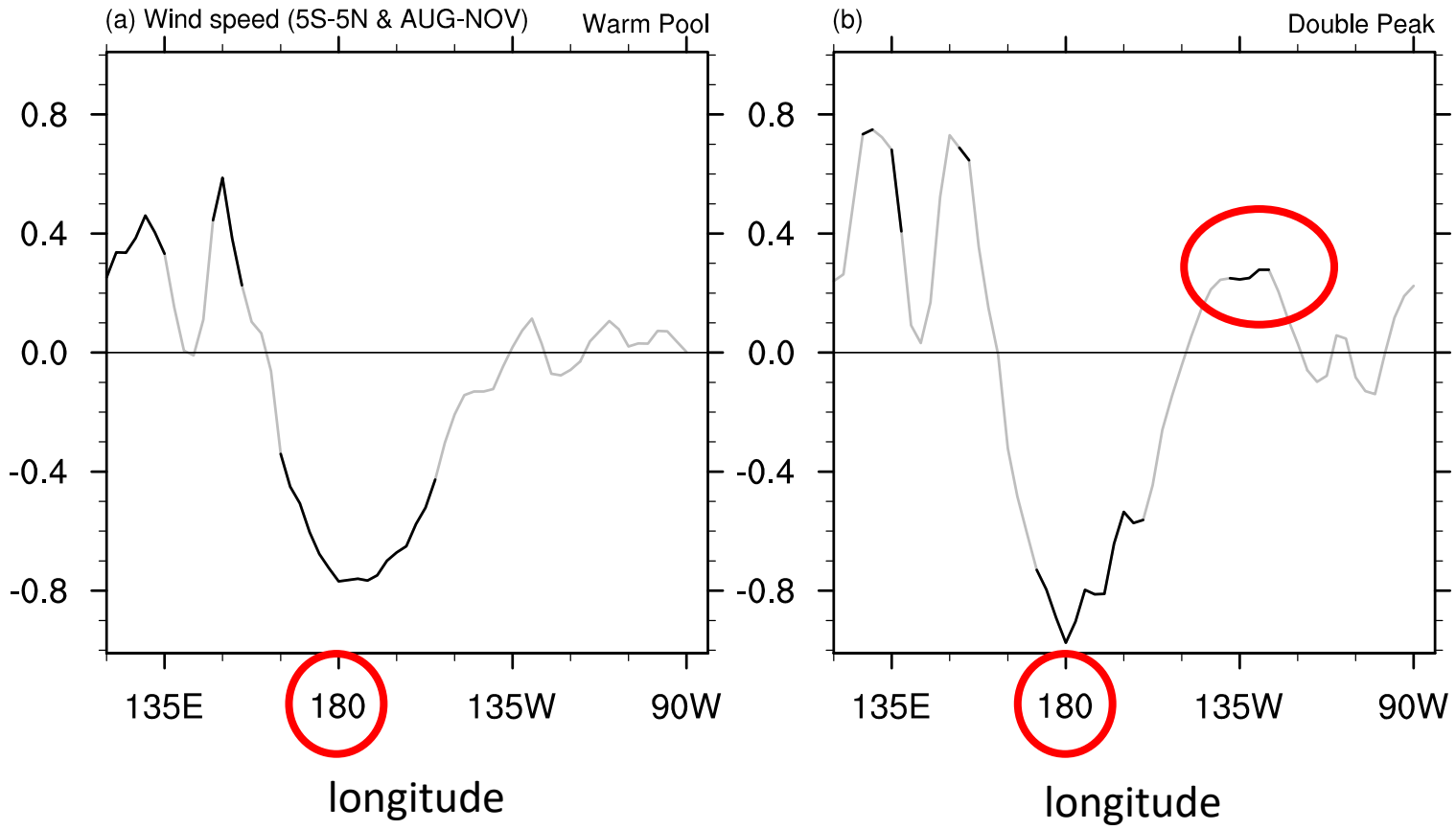
⬇

More evaporation cooling

⬇

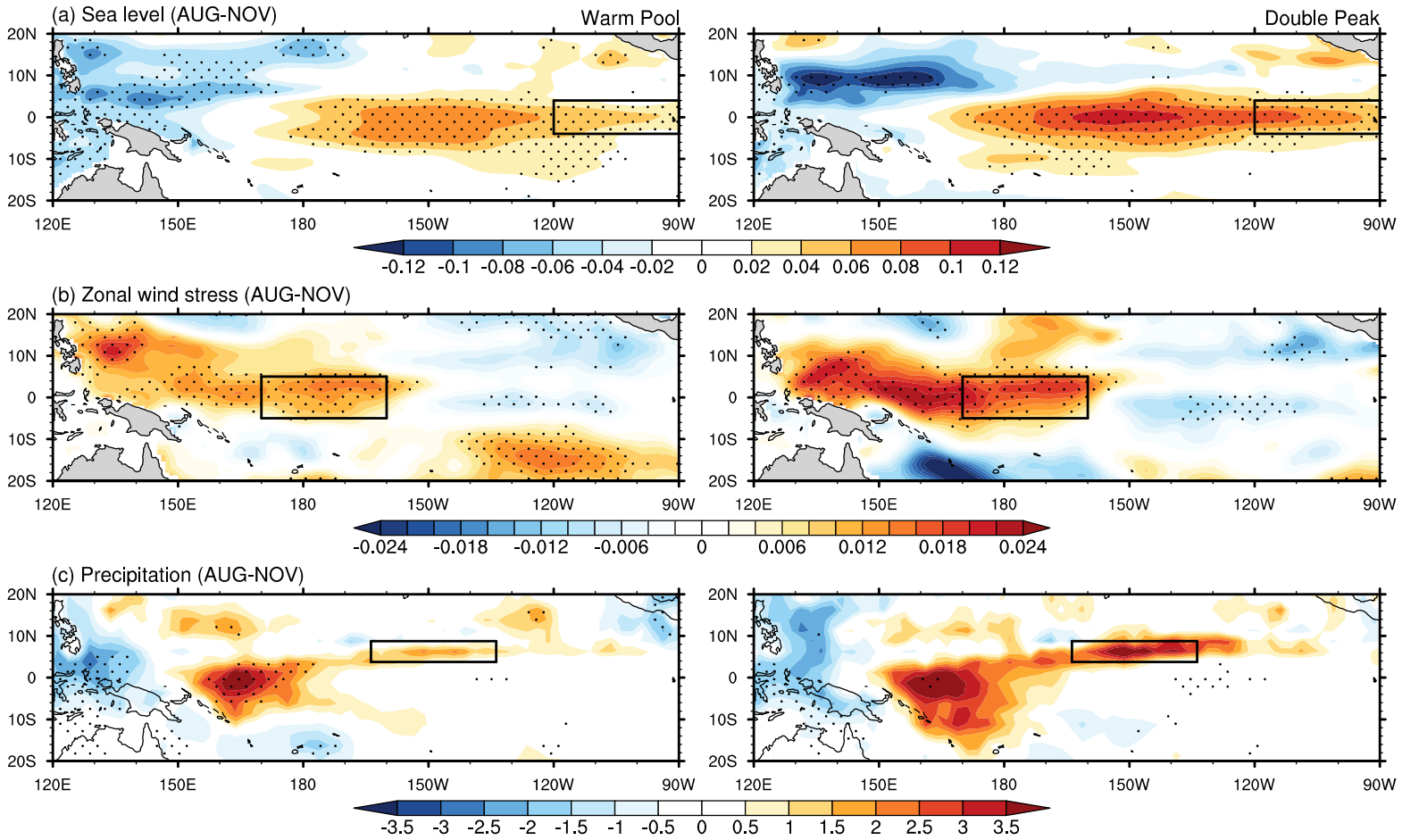
Cutoff the peaks

Developing phase of Wind Speed anomaly



4. Results – Eastern peak

Developing phase



Strong **ITCZ prcp**

⬇

Strong **Westerly**
in the central pacific

⬇

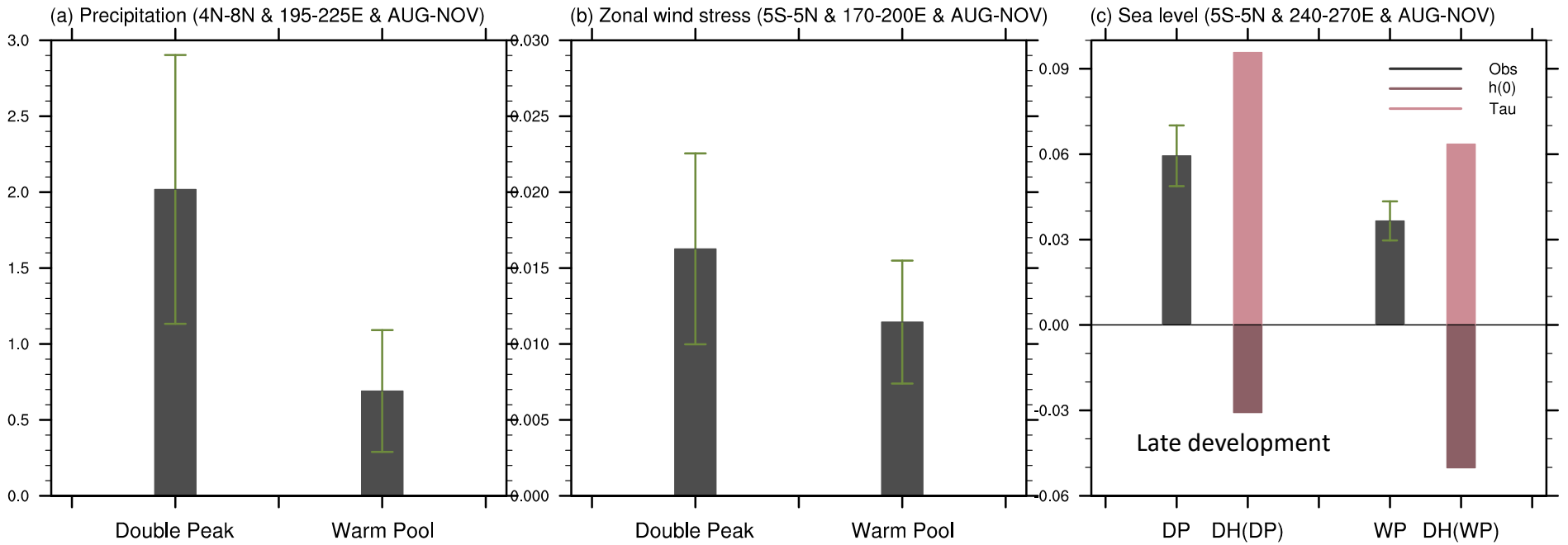
High **sea level**
in the eastern pacific

⬇

Strong **thermocline feedback term**

4. Results – Eastern peak

Area average of boxes & Dynamic sea level height

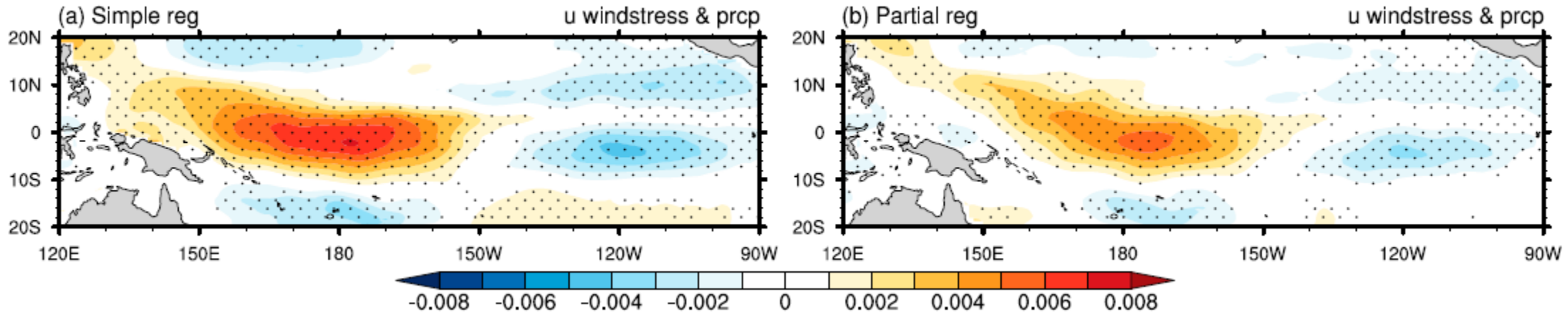


Simplified Sverdrup balance at equator

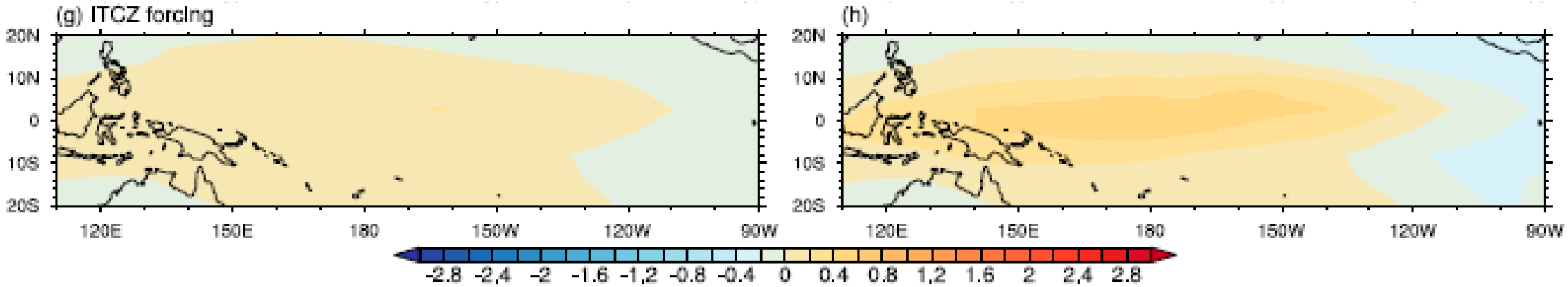
$$g\int_0^x \frac{\partial h}{\partial x}\,dx = \frac{1}{\rho H}\int_0^x \tau_x\,dx \quad \Rightarrow \quad h(x) = h(0) + \frac{1}{\rho g H}\int_0^x \tau_x\,dx$$

4. Results – Role of ITCZ precipitation

Reg. & Patial Reg. w.r.t. the ITCZ Precipitation

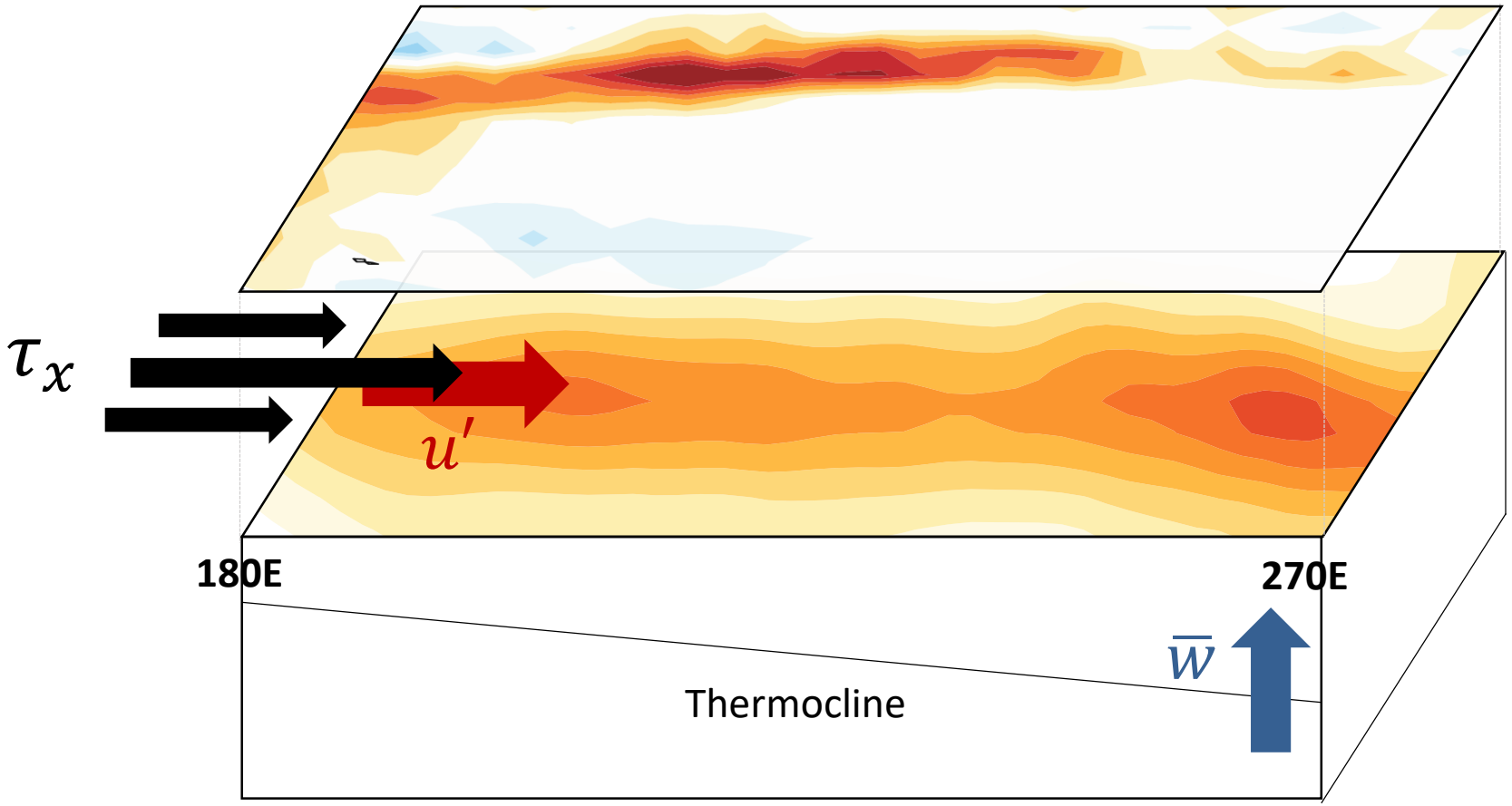


LBM Experiments



5. Summary

< Double Peaked El Nino >



Precipitation anomaly

SST anomaly

ZA & (-)wspd

TH