MEI-YU OF TAIWAN: WHAT'S THE BECOMING OF IT?

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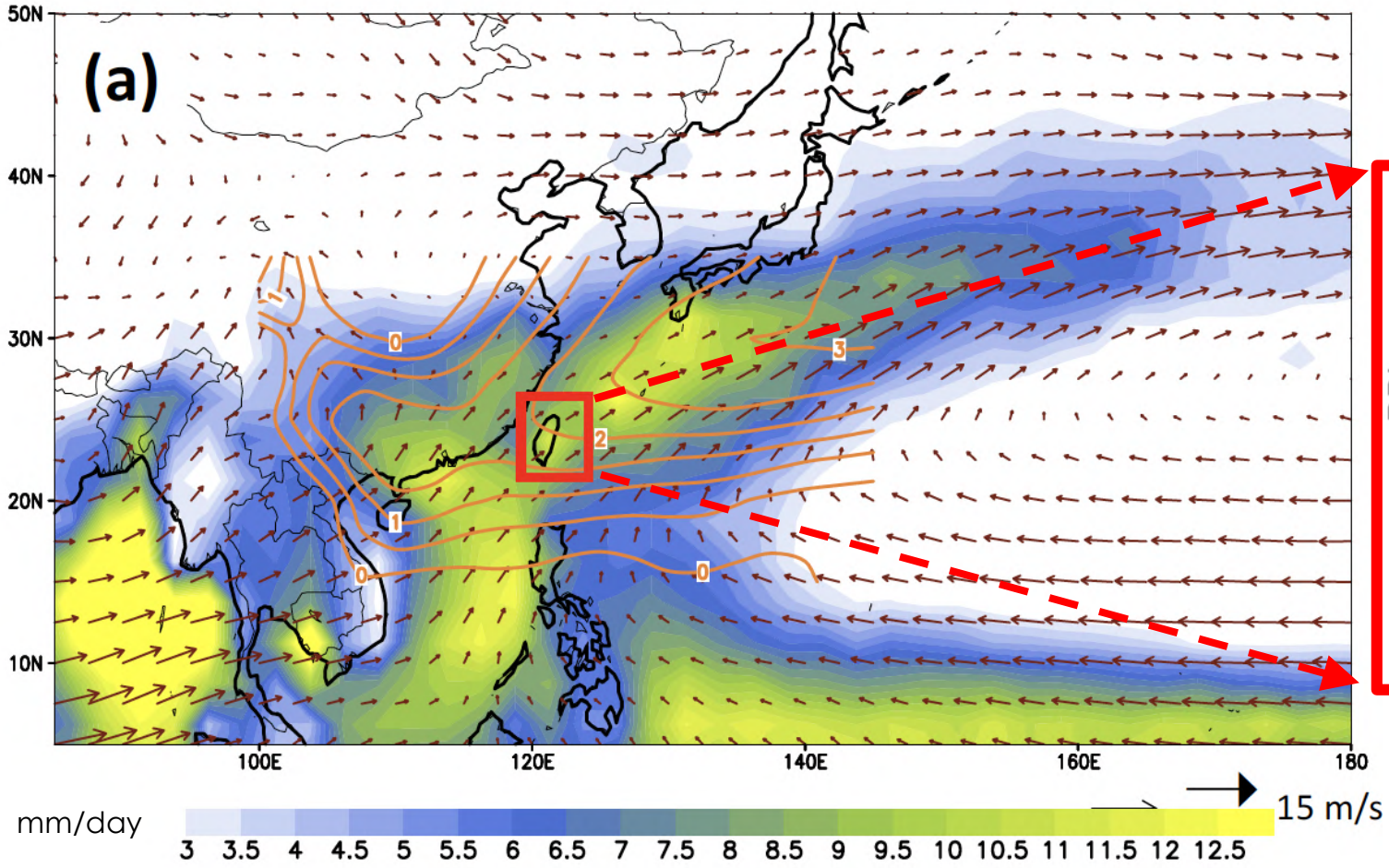
Utah State University, USA

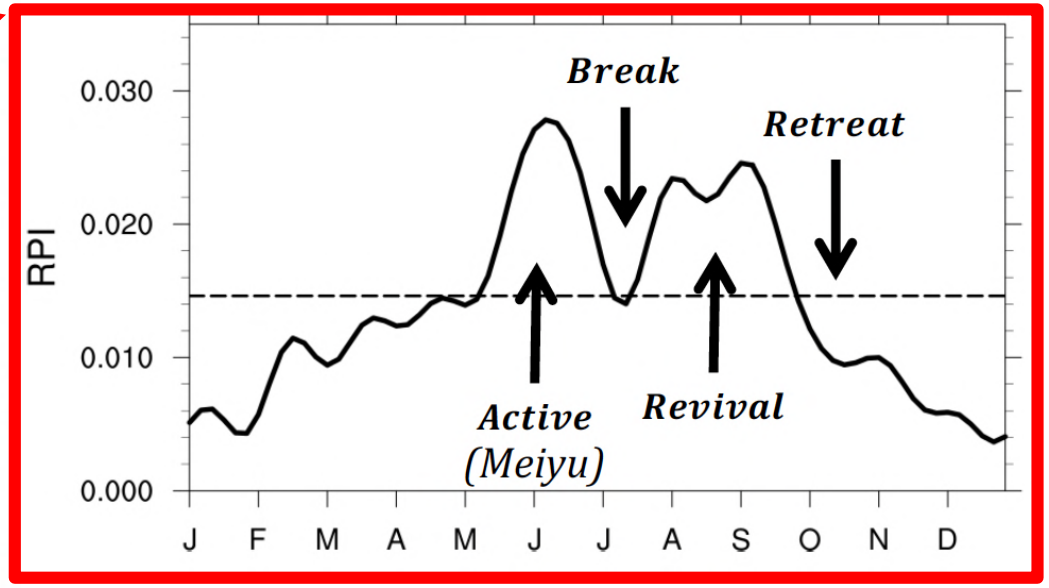
台灣的梅雨季到底是何時？

WHEN EXACTLY IS THE MEIYU SEASON?

(in Taiwan?)

LET'S REVISIT:



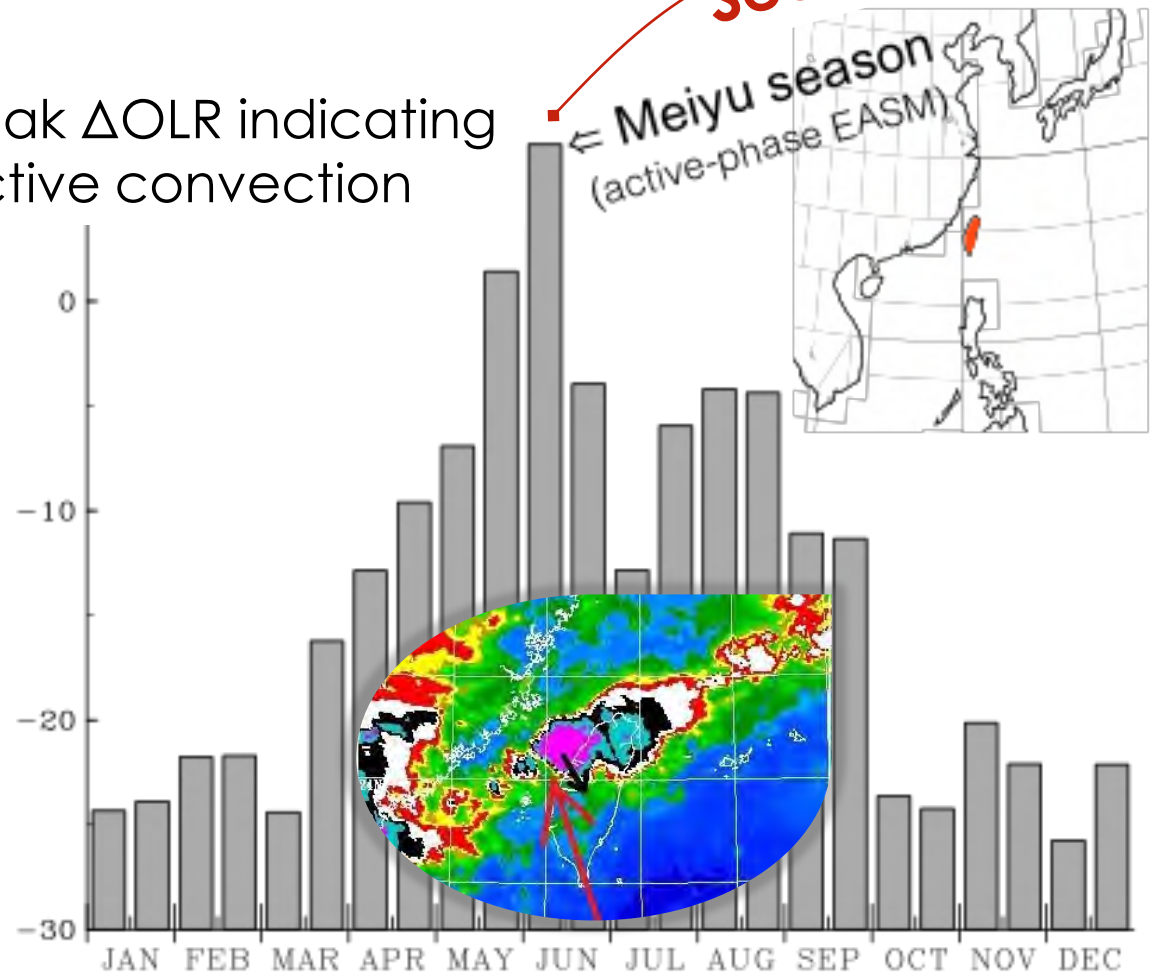


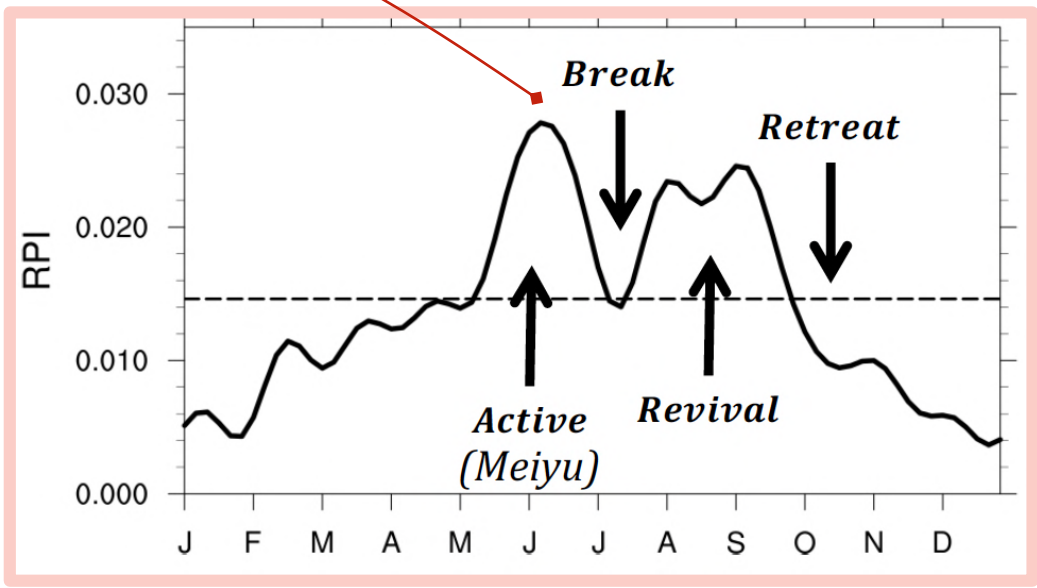
5-day mean normalized precipitation (1981-2000)

LET'S REVISIT:

Seems like in early June!

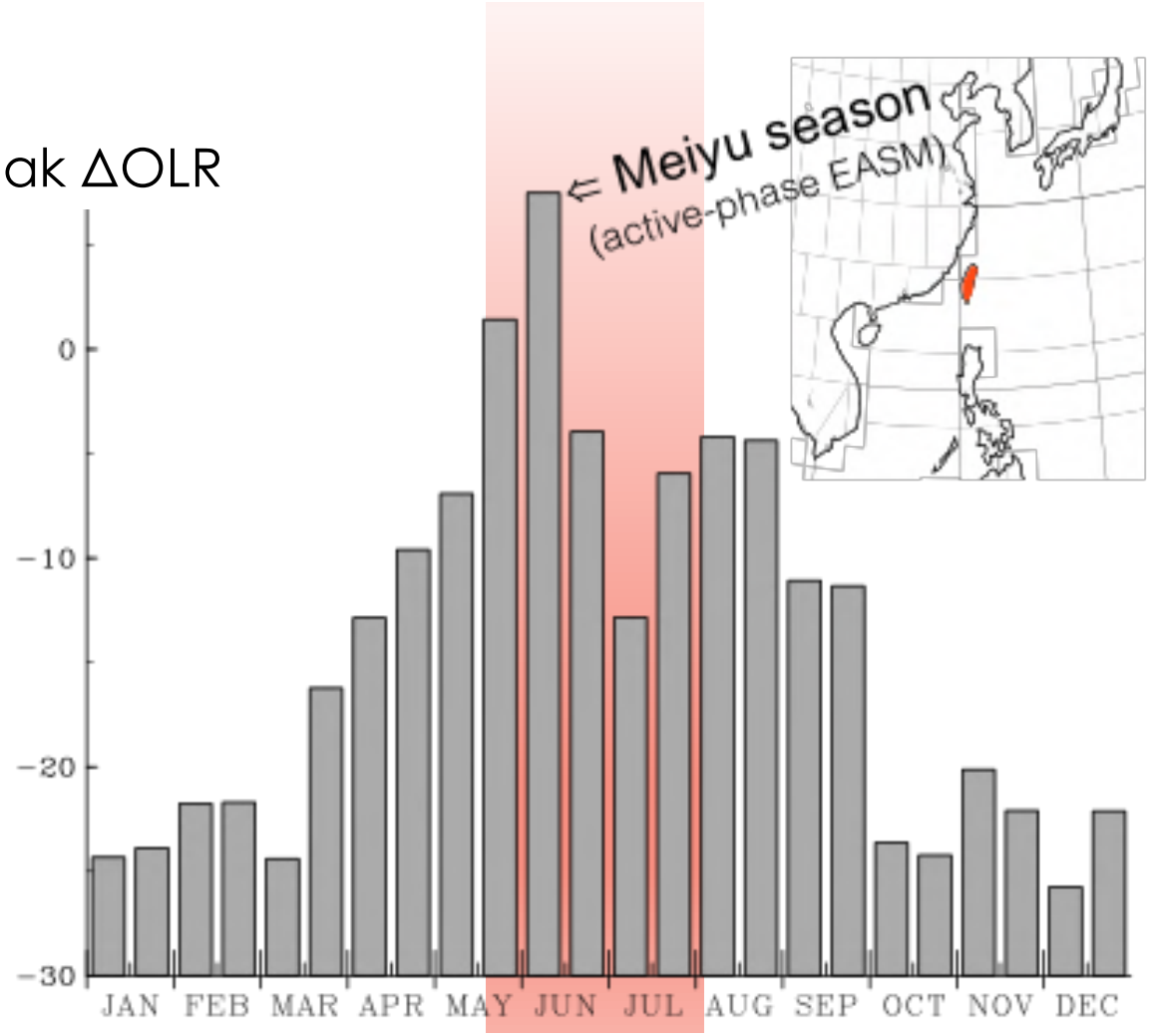
Peak ΔOLR indicating active convection



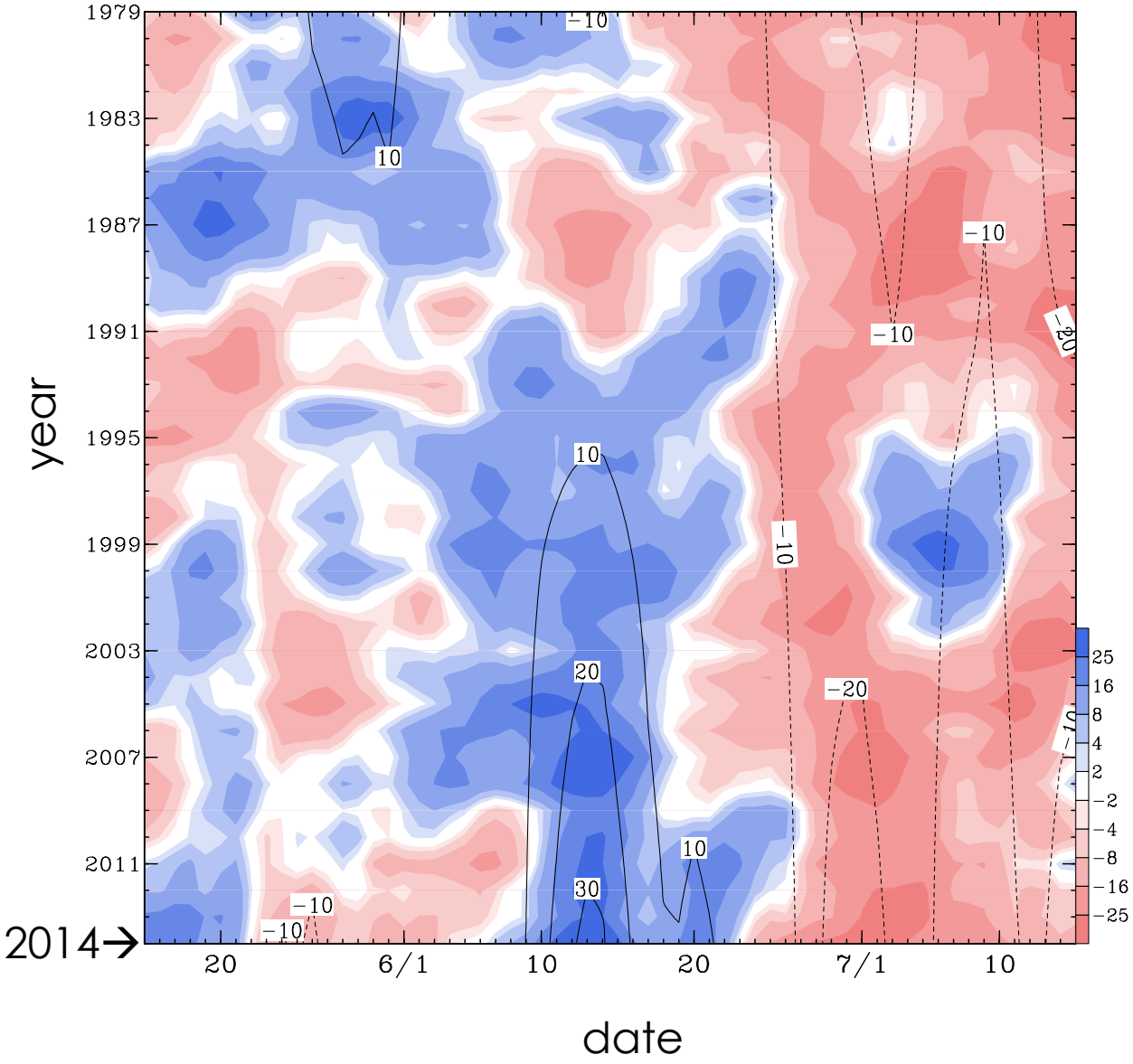


5-day mean normalized precipitation (1981-2000)

Peak ΔOLR



Each year's peak daily ΔOLR
(running means applied)

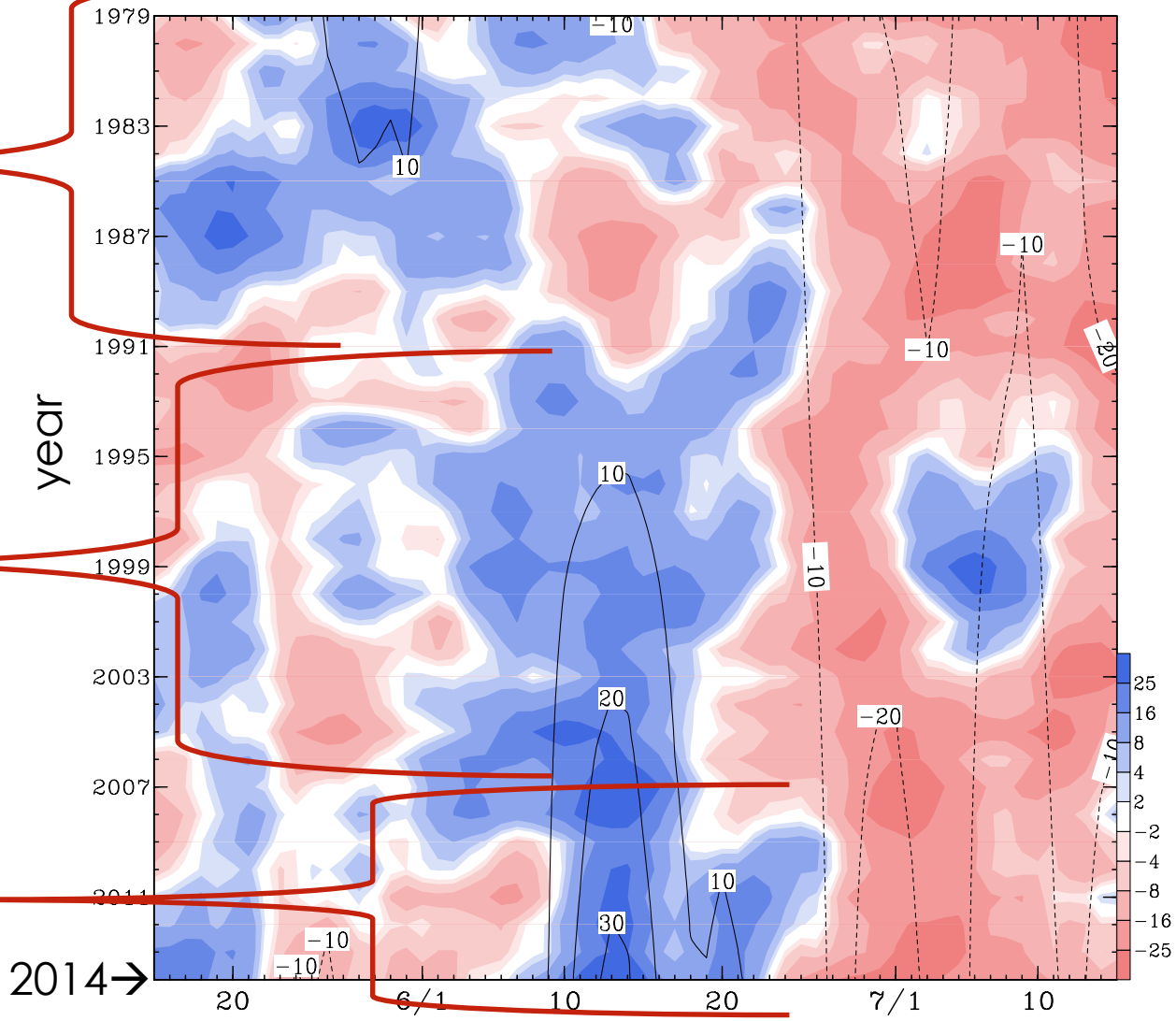


Each year's peak daily ΔOLR
(running means applied)

Textbook Meiyu Season

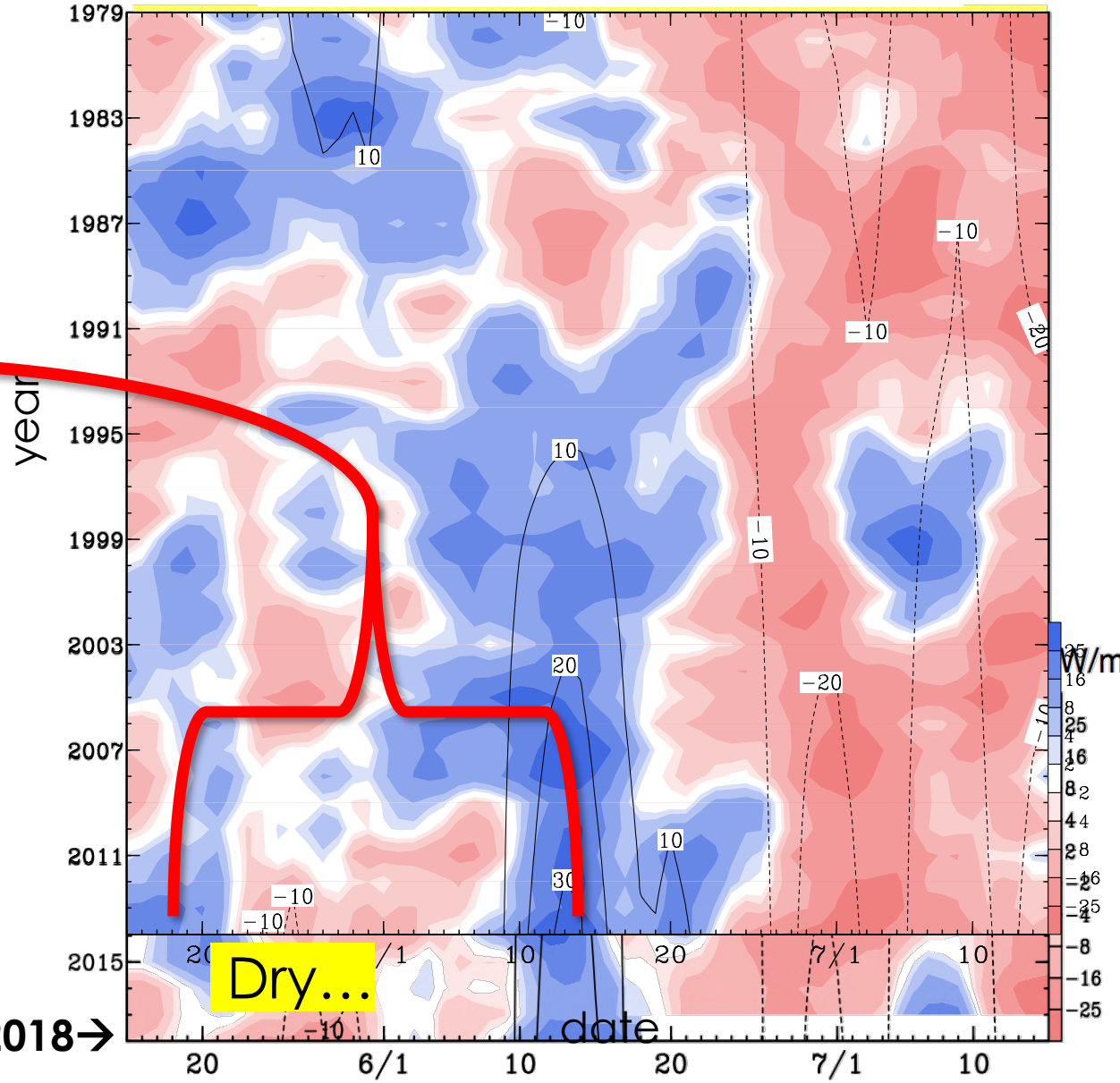
Shifted Meiyu (same length)

Enhanced Meiyu (& shortened)



(Wang et al. 2015)

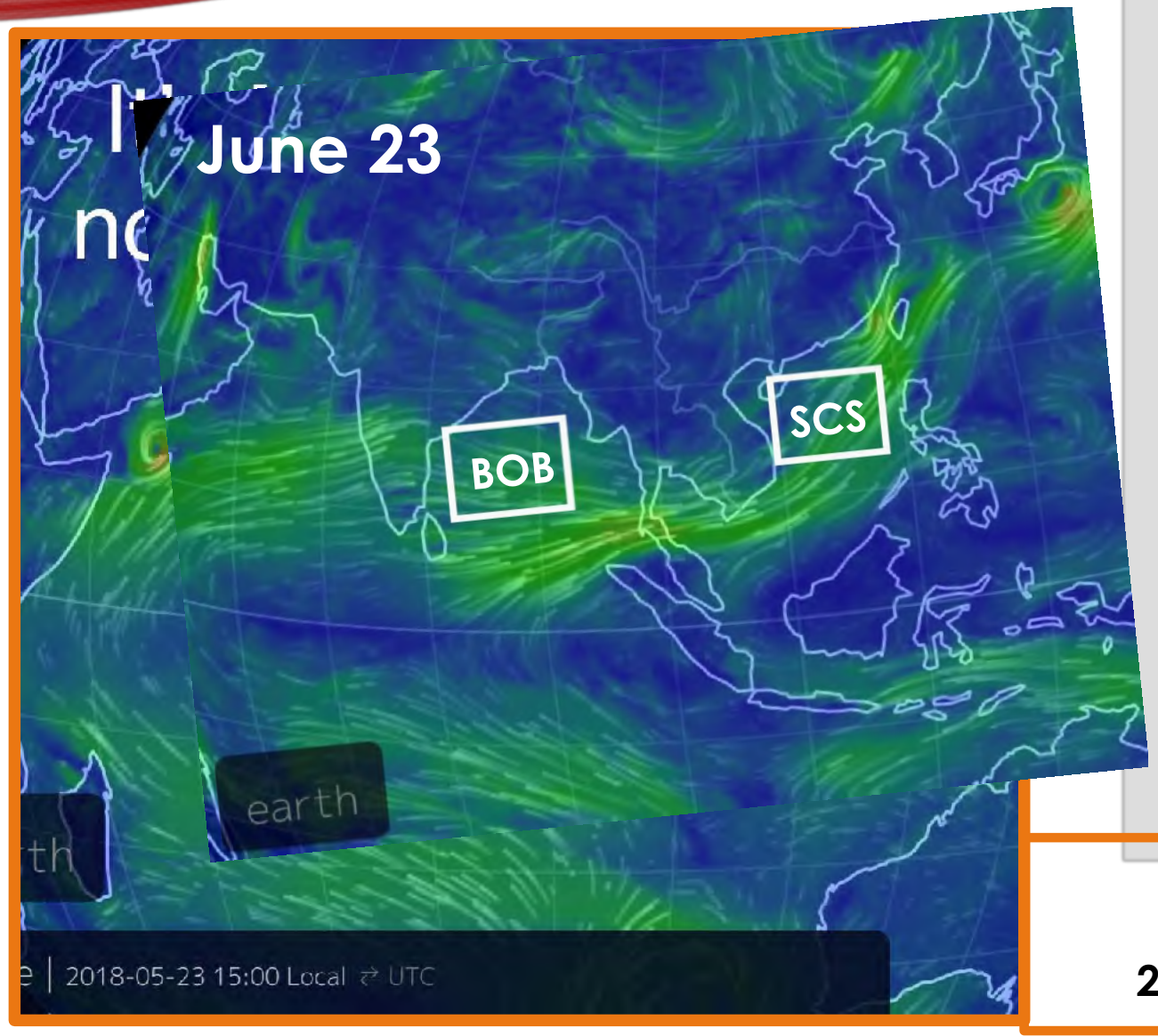
Each year's peak daily ΔOLR
(running means applied)

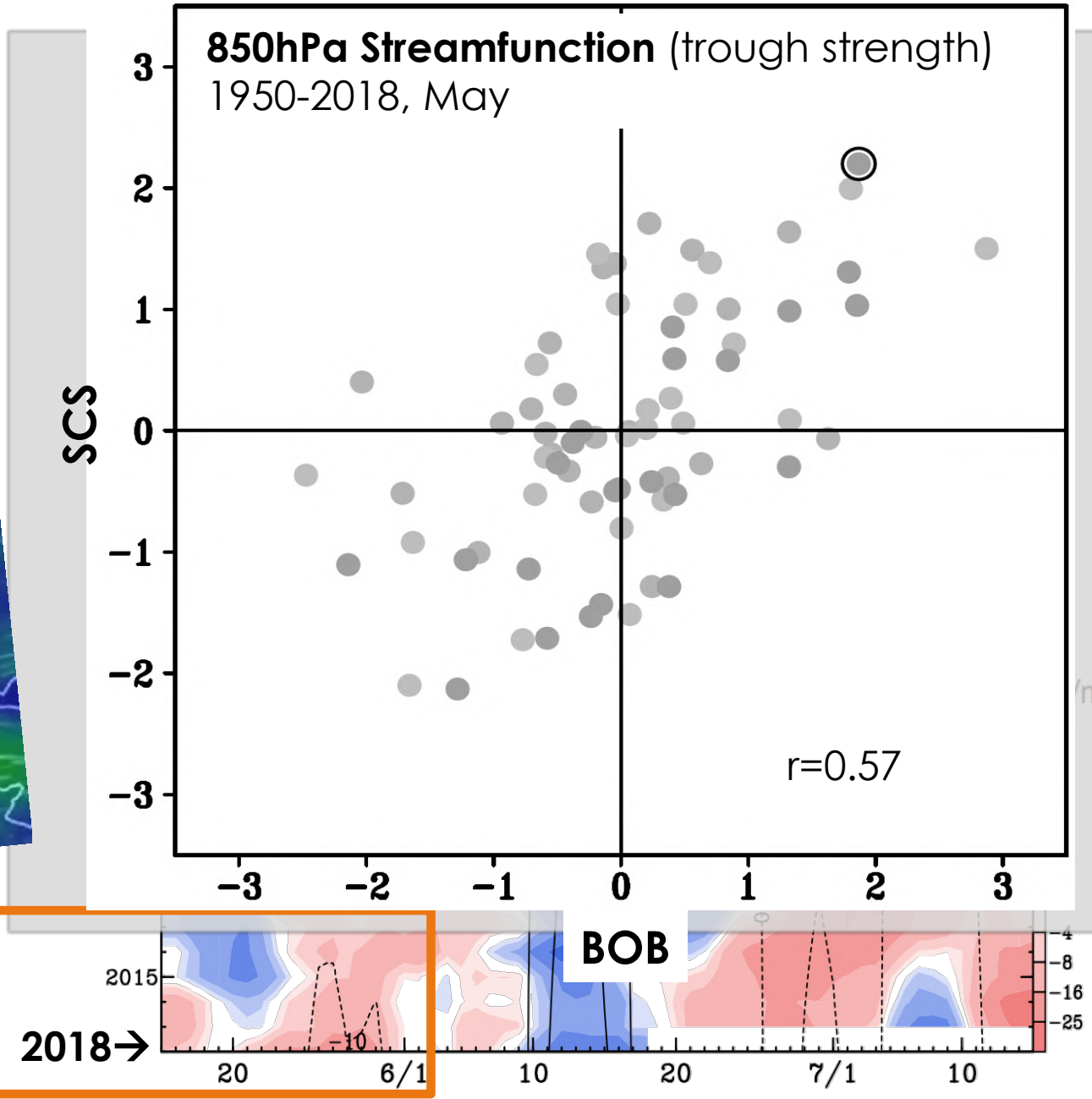


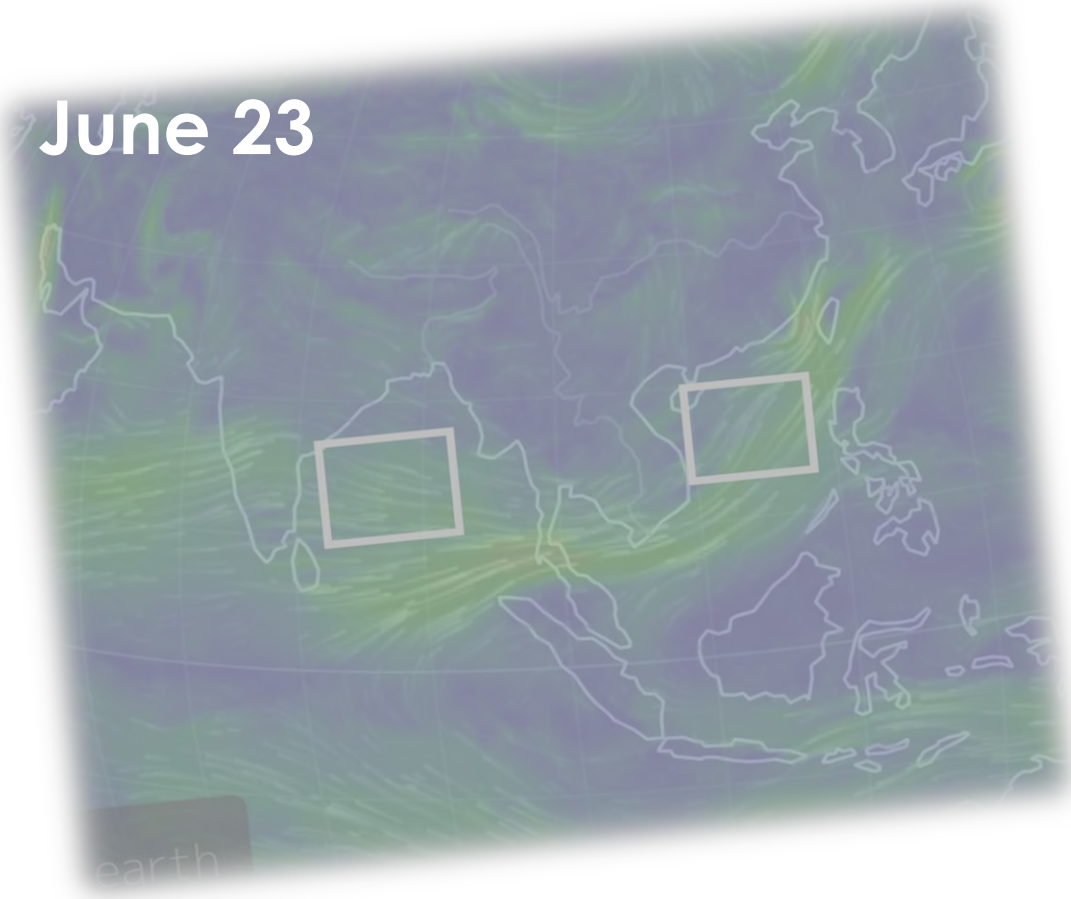
More "subseasonal"…

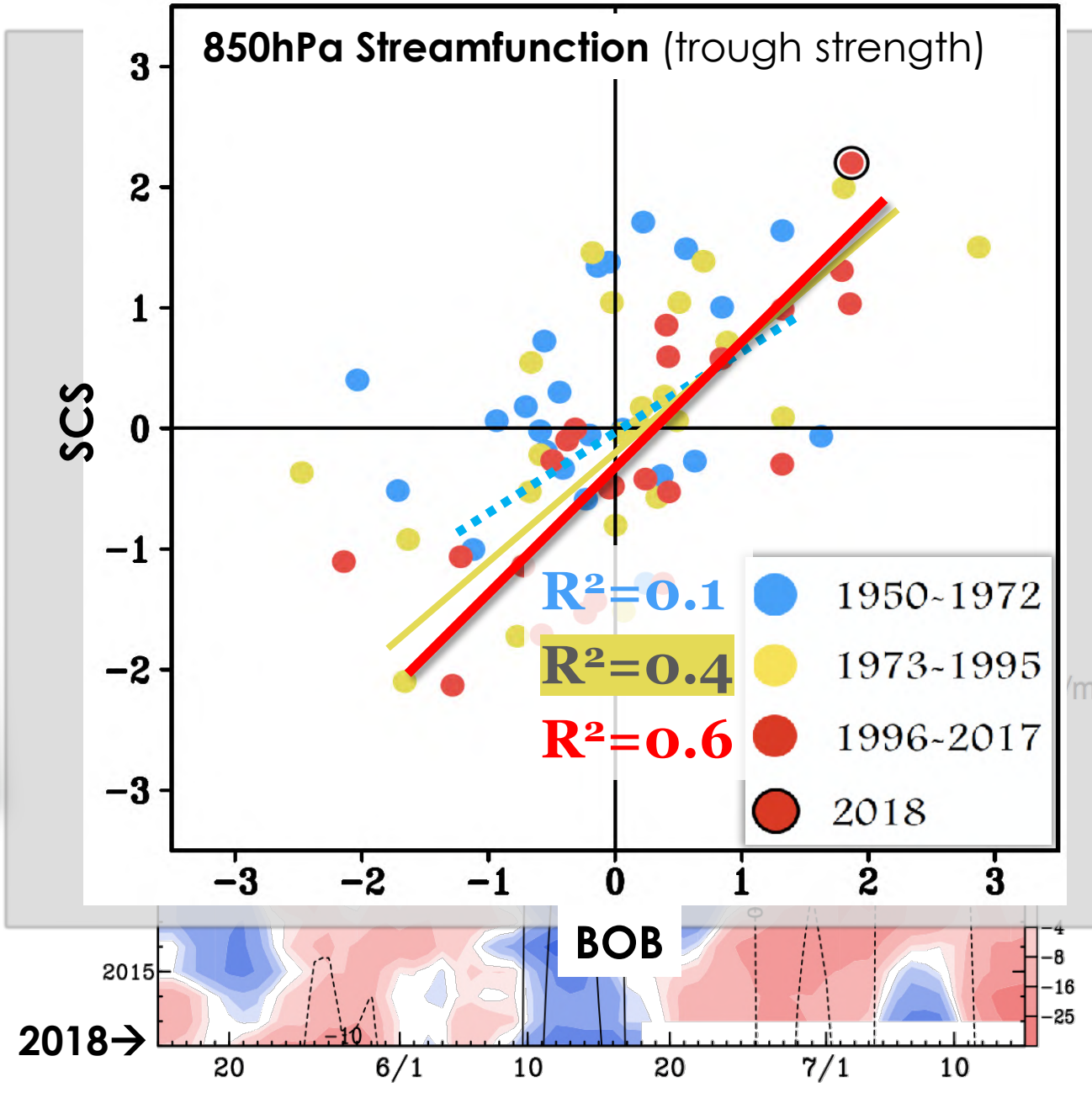
Frontal regime → break → Meiyu

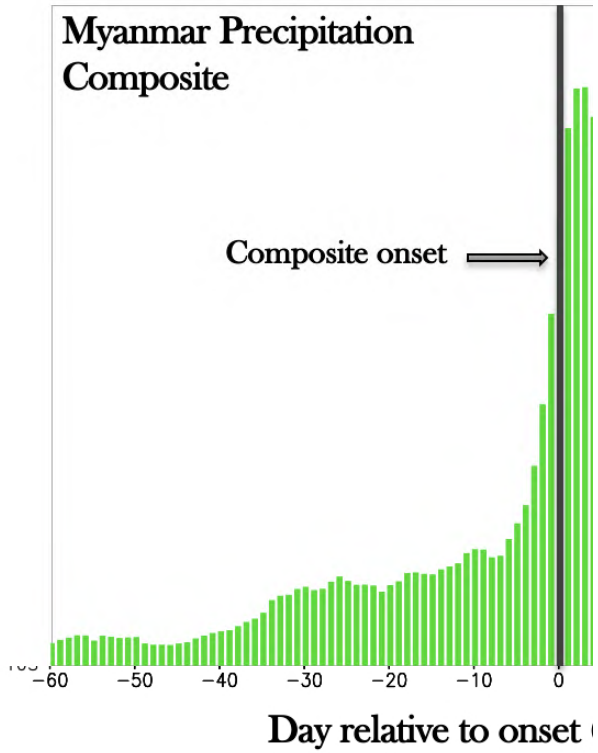
(Wang et al. 2015)


June 23
BOB
SCS
earth
2018-05-23 15:00 Local ⇄ UTC

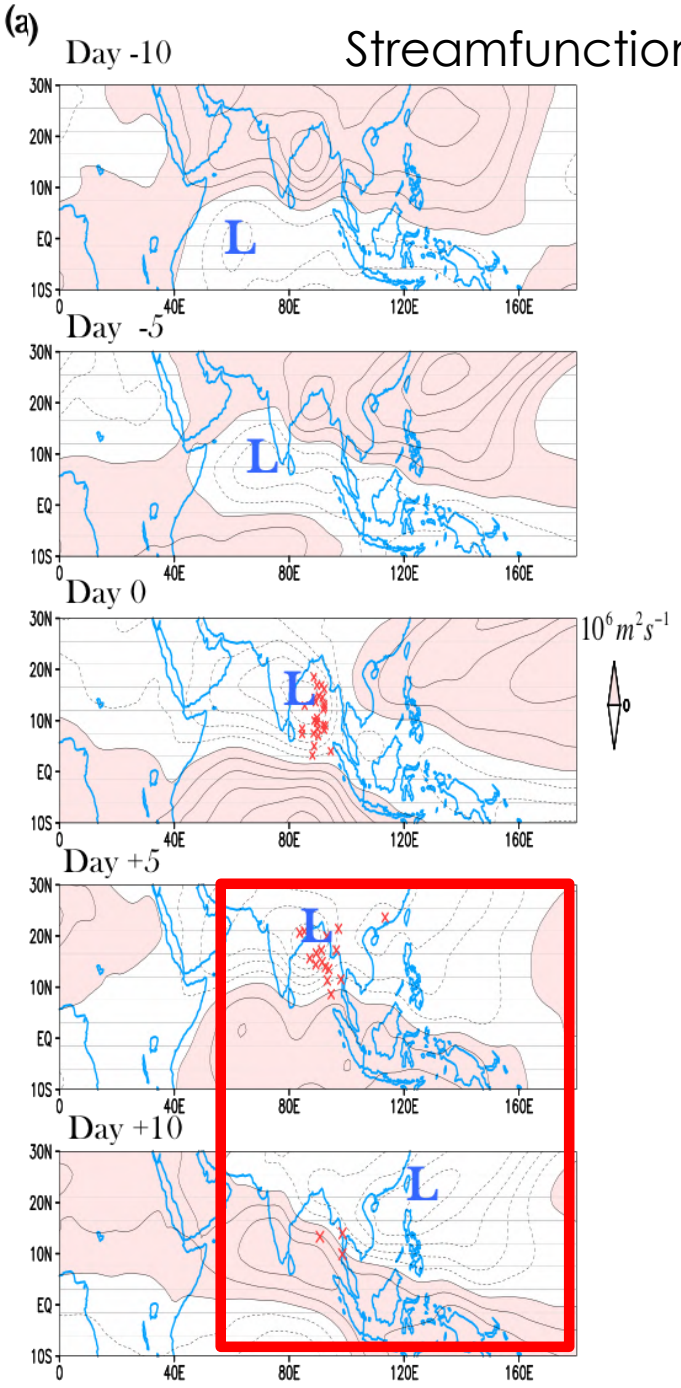

850hPa Streamfunction (trough strength)
1950-2018, May
SCS
r=0.57
BOB
2018→
2015
6/1
7/1


June 23

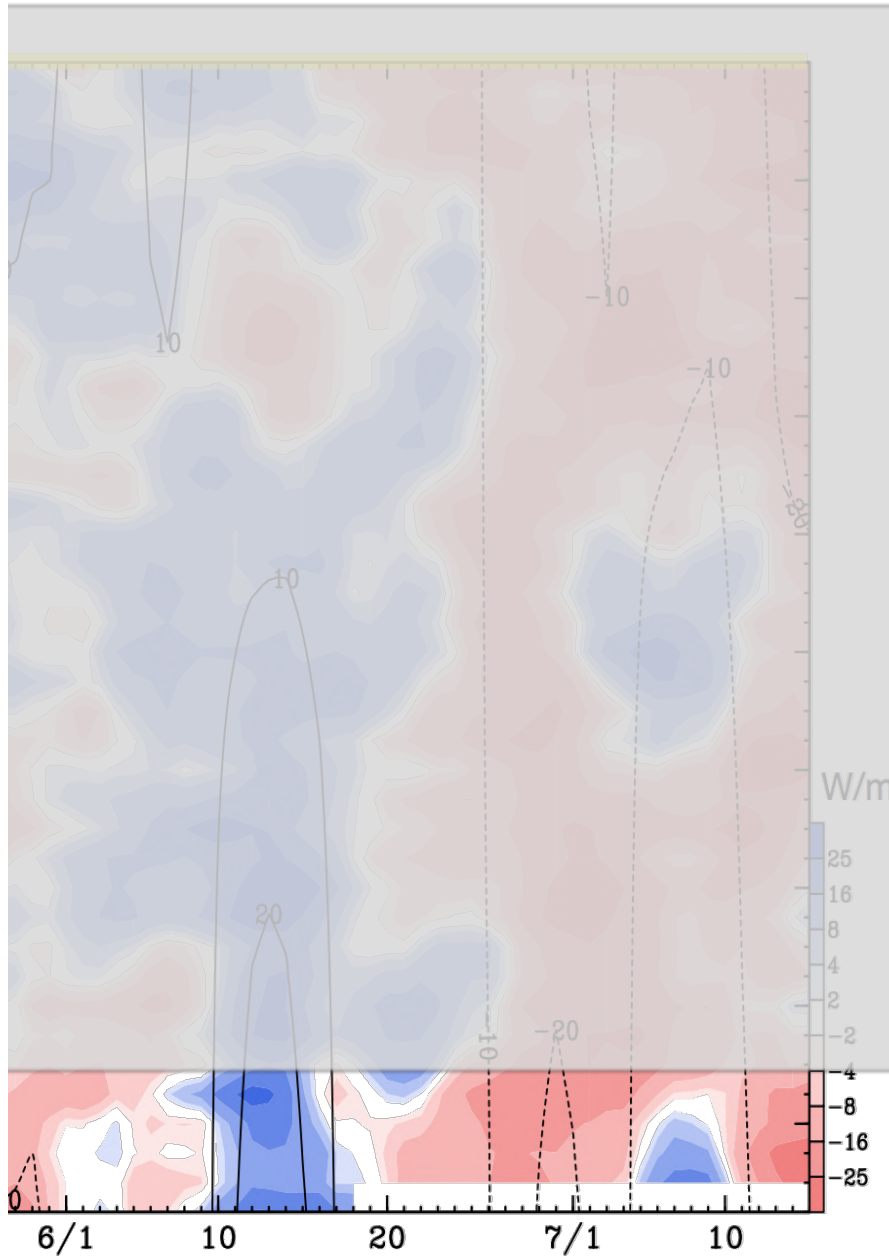

850hPa Streamfunction (trough strength)
SCS
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
R²=0.1
R²=0.4
R²=0.6
1950-1972
1973-1995
1996-2017
2018
BOB
2015
2018→
−10
20
6/1
10
20
7/1
10
−4
−8
−16
−25



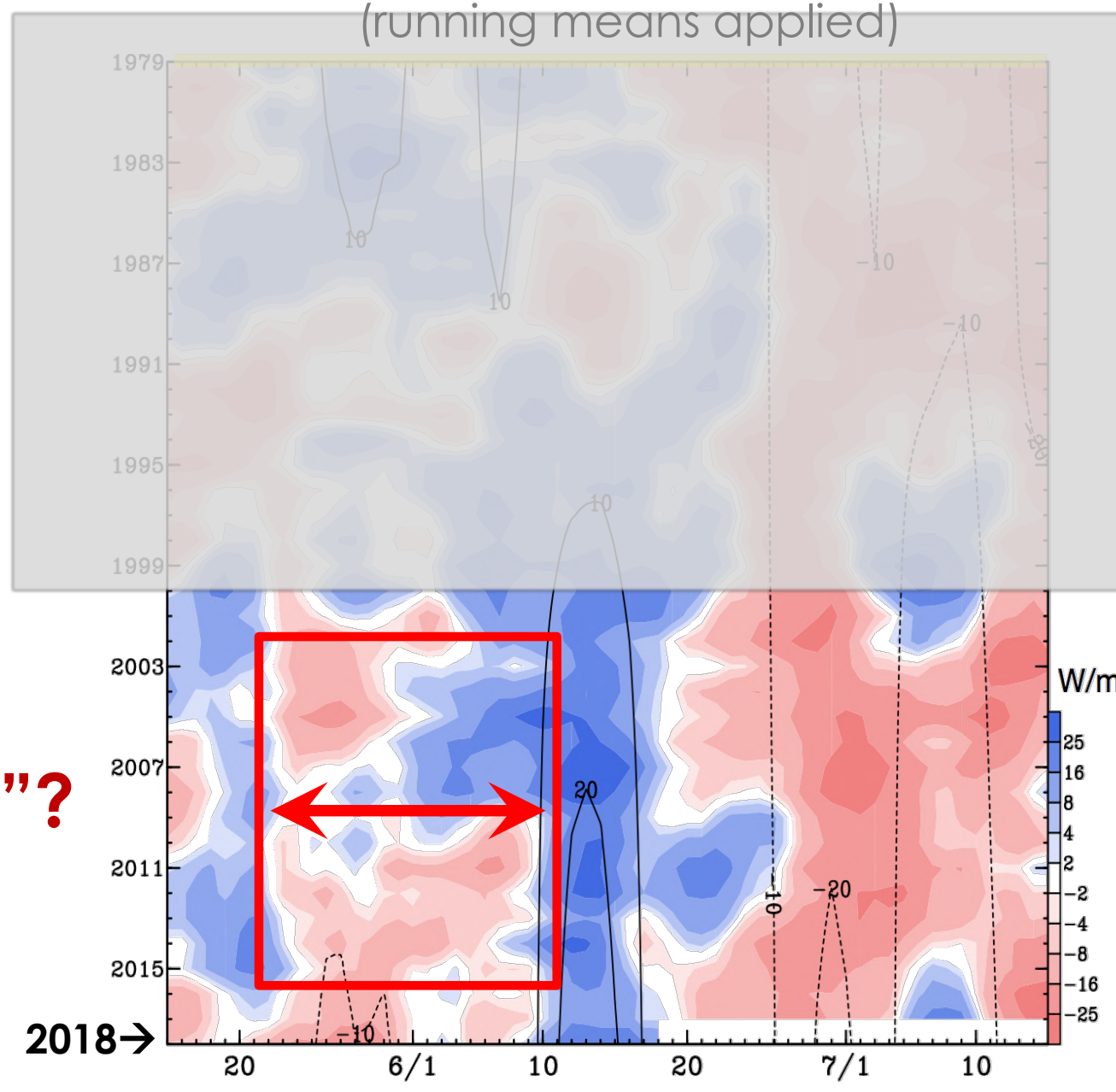
(Fosu and Wang, 2014)



Streamfunction

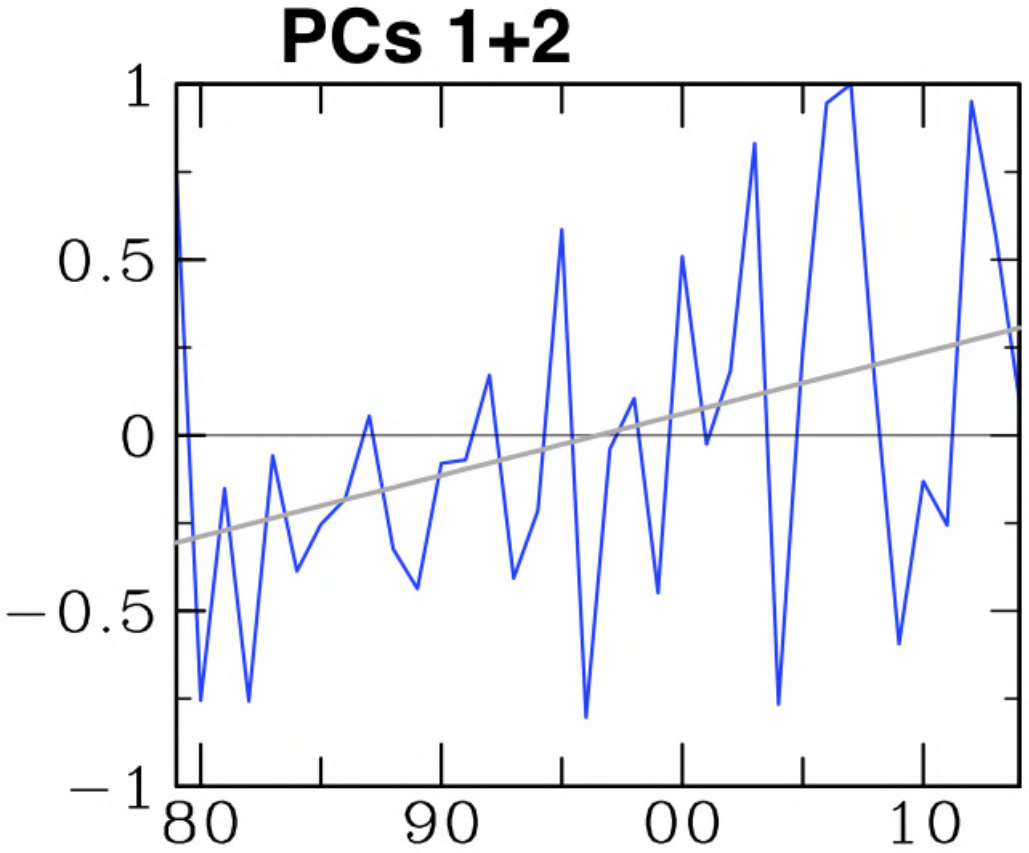


Each year's peak daily ΔOLR
(running means applied)



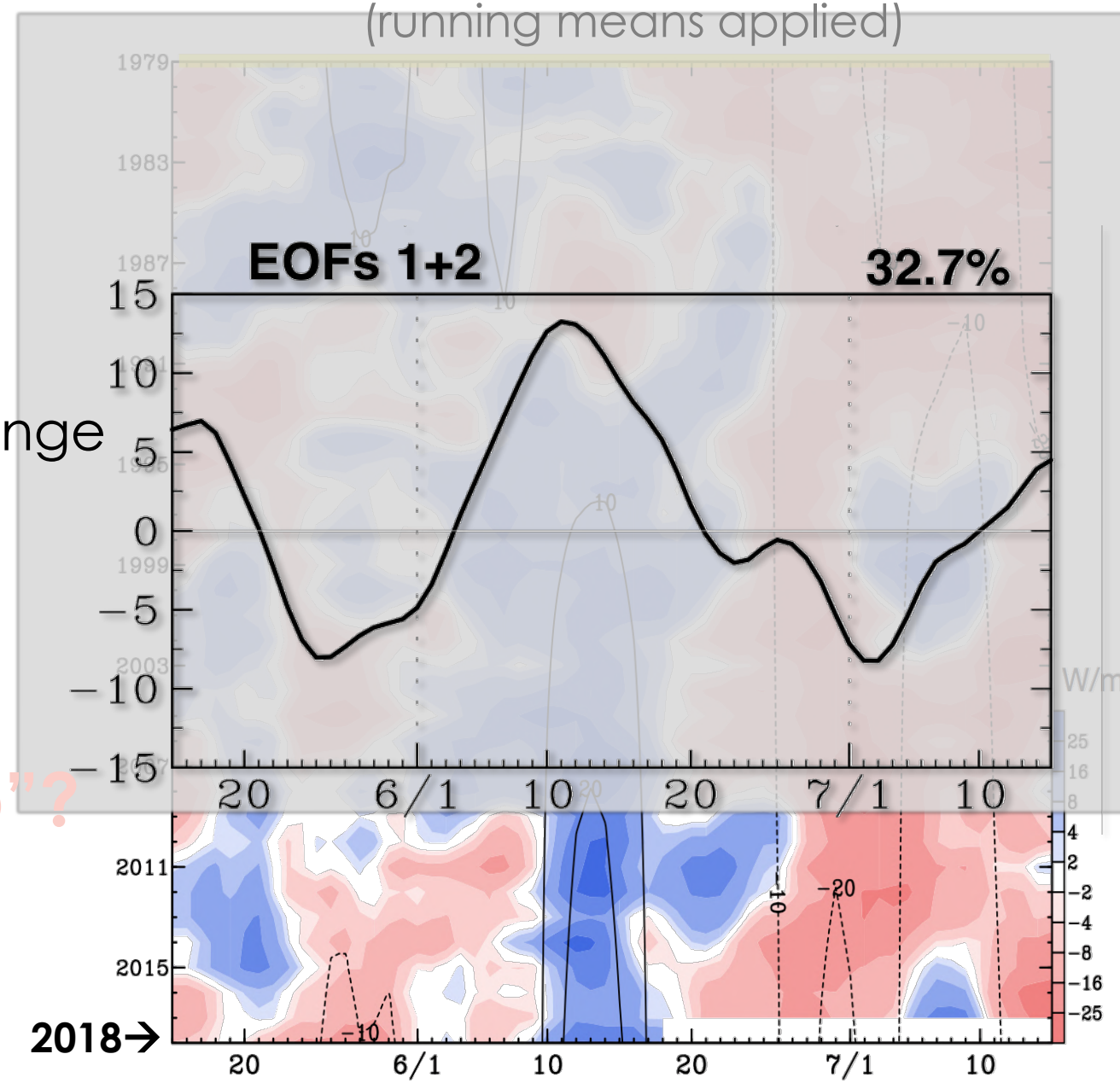
Cause of subseasonal "gap"?

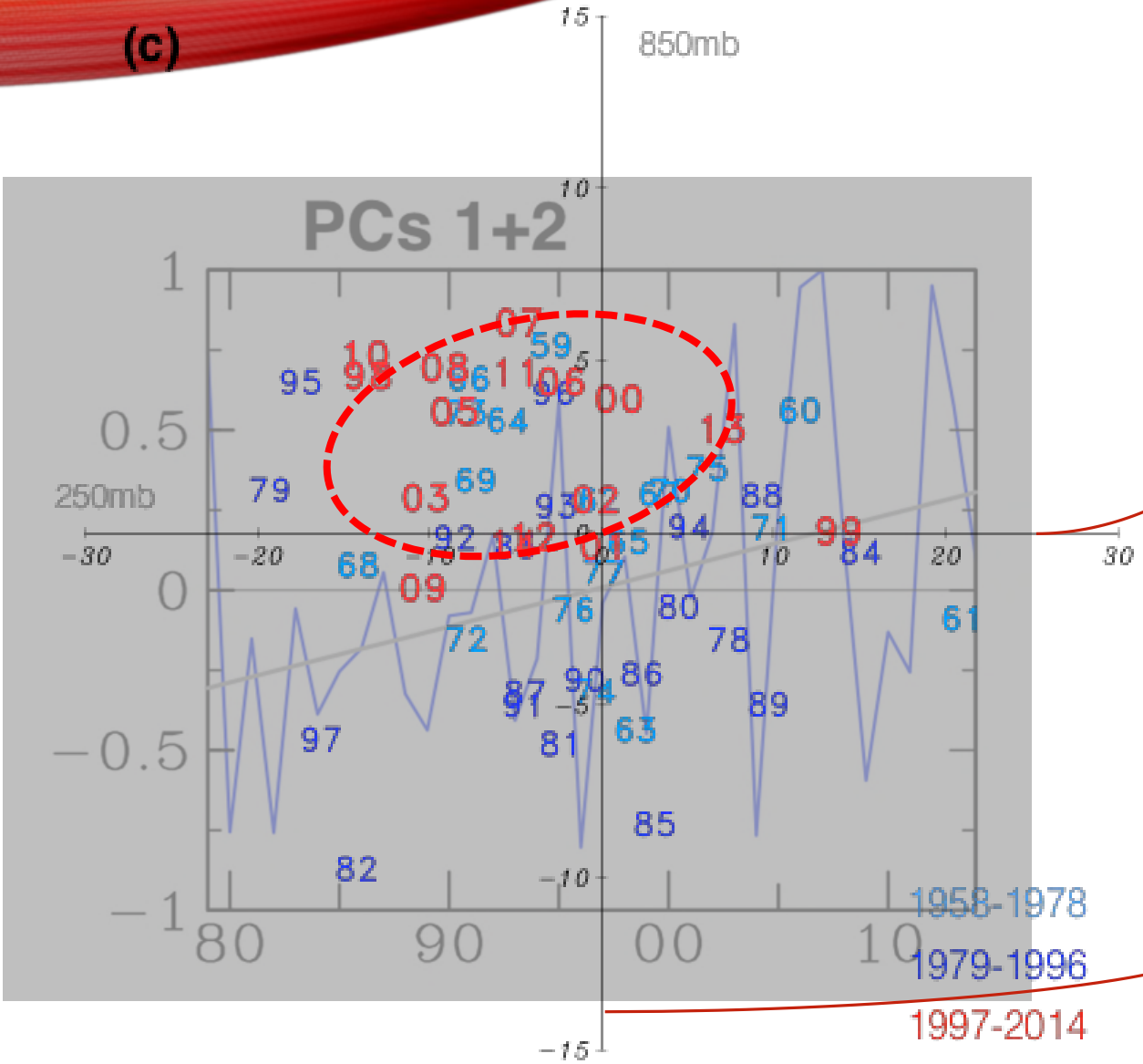
Each year's peak daily ΔOLR
(running means applied)

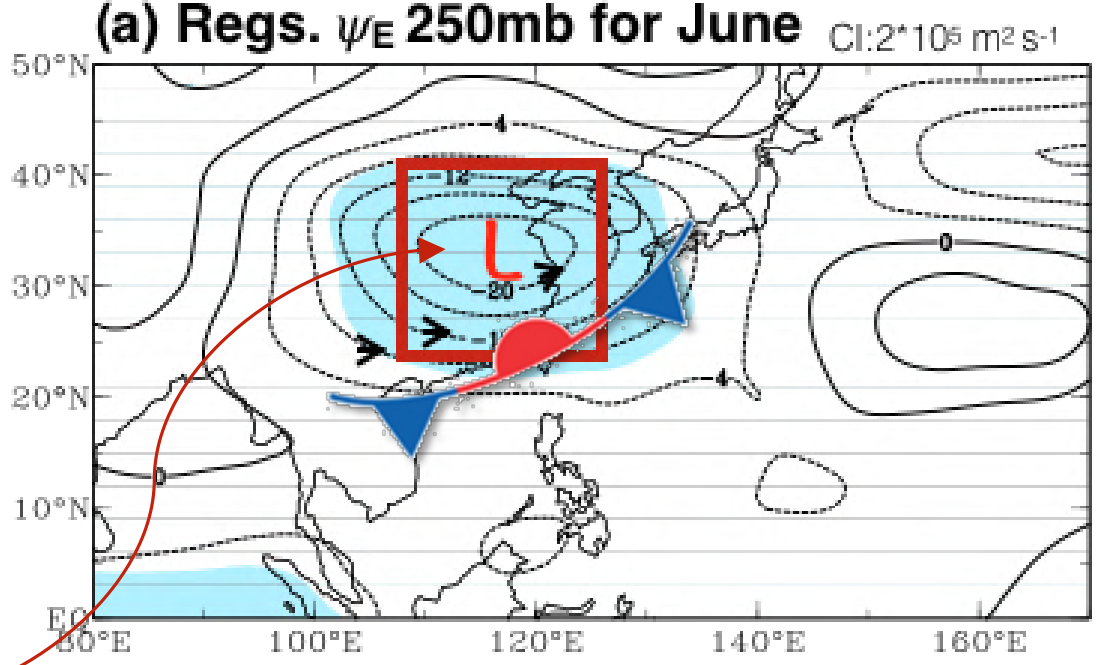


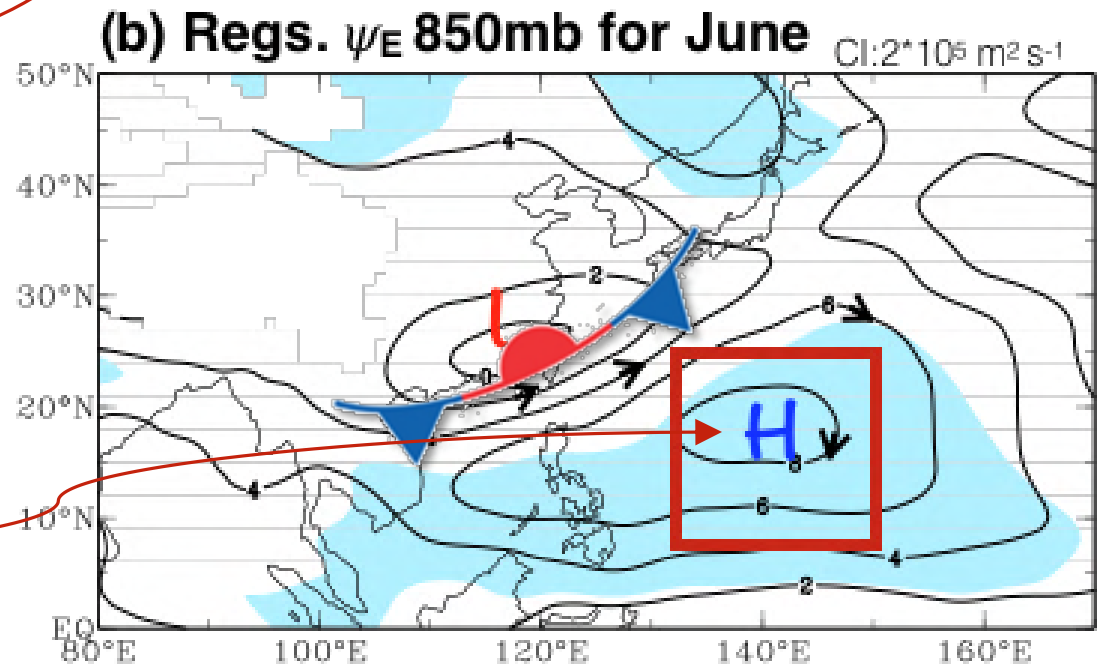
change

ap"?

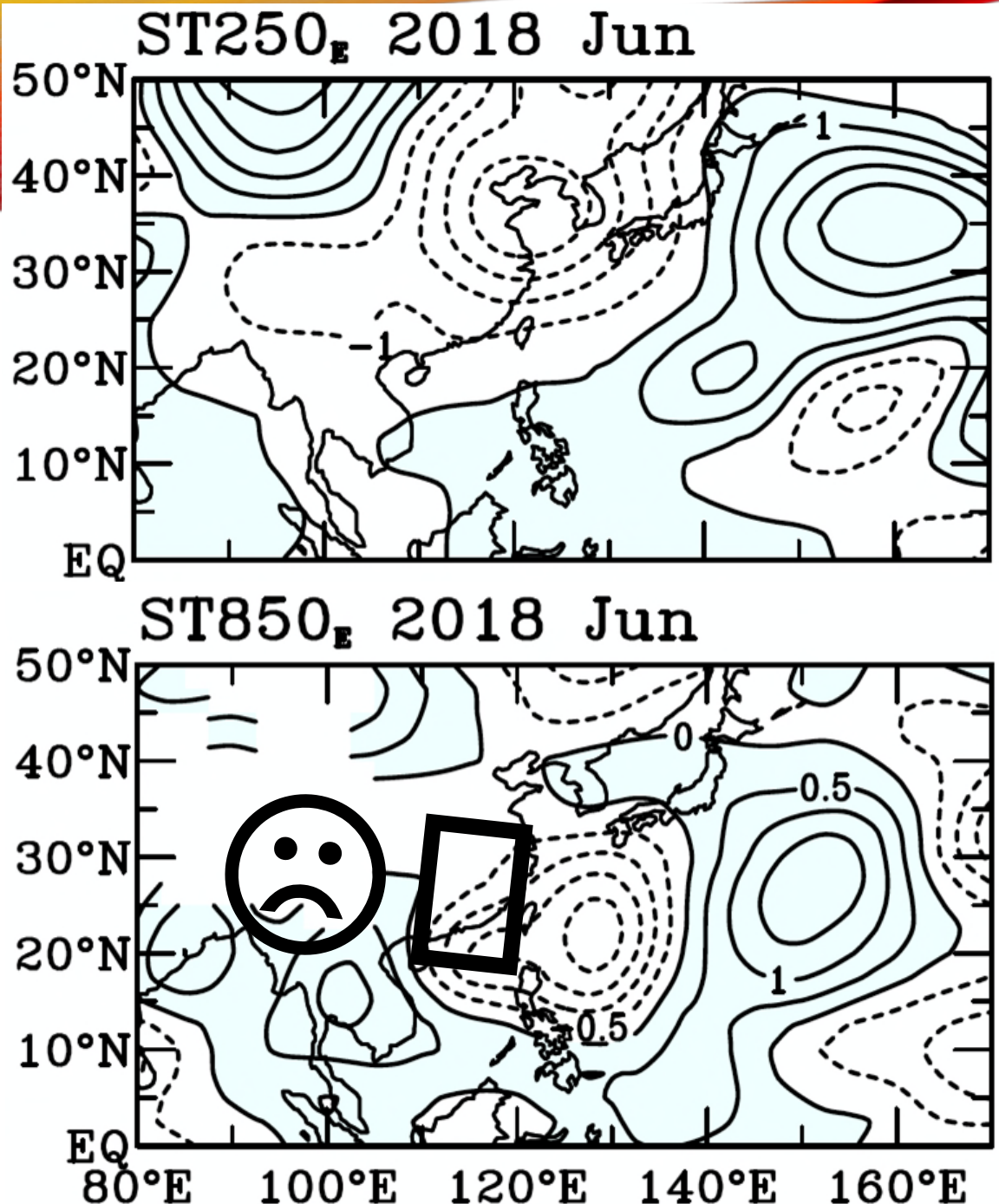


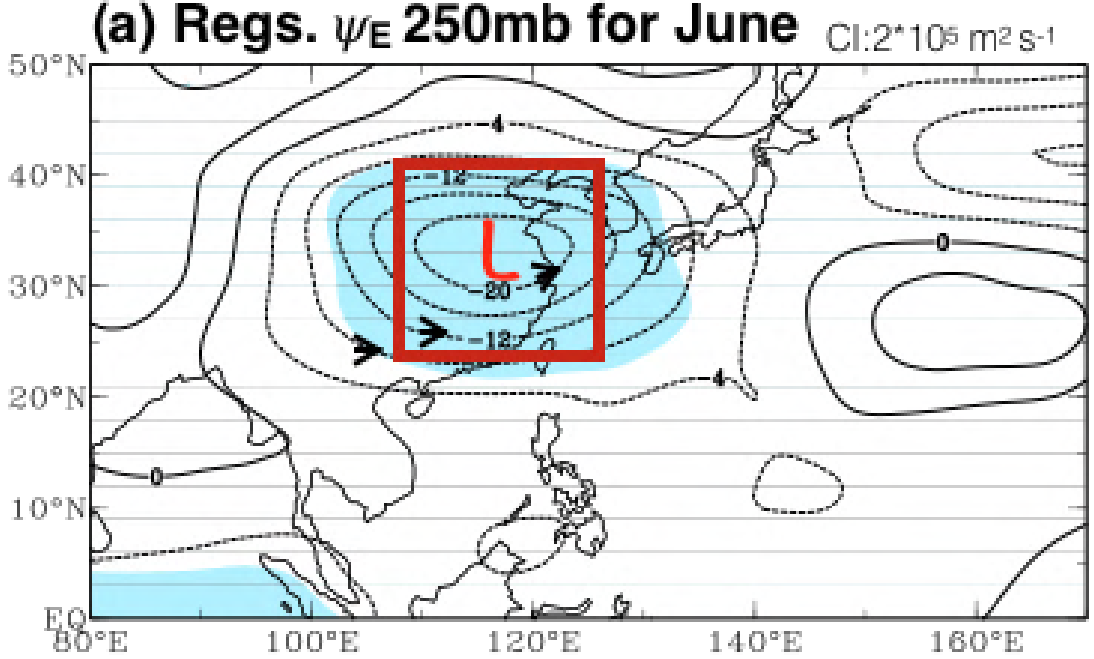


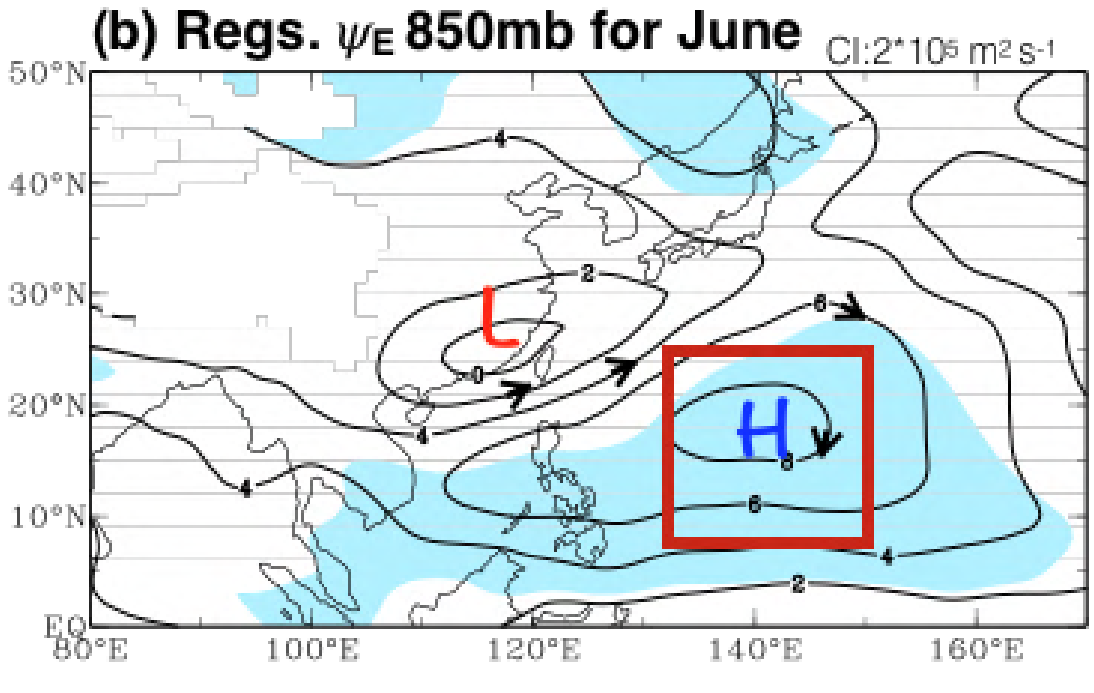




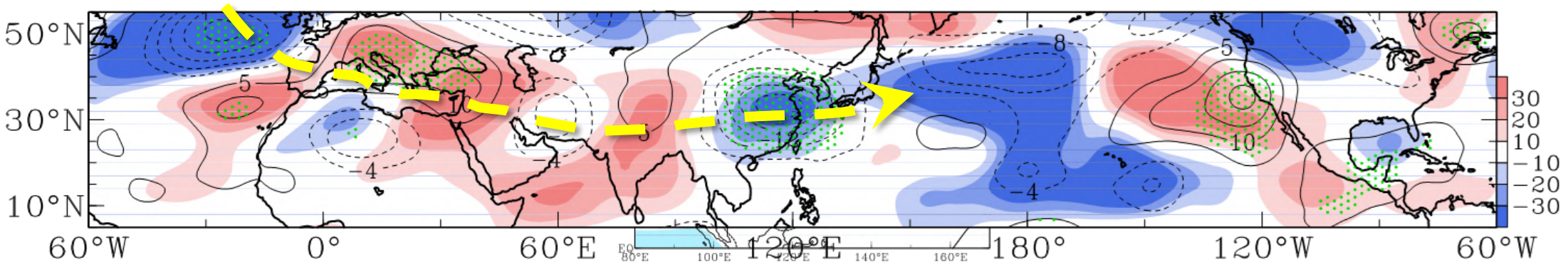
Wang et al. (2015)

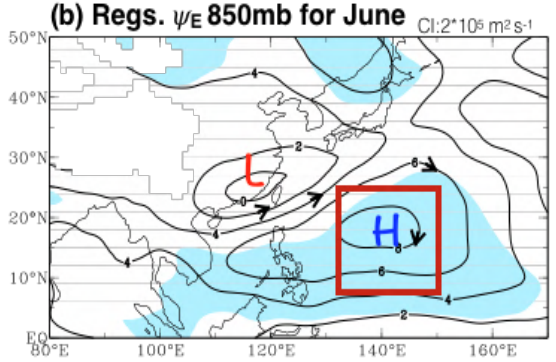

ST250E 2018 Jun
50°N
40°N
30°N
20°N
10°N
EQ
1
-1
ST850E 2018 Jun
0
0.5
1
0.5
80°E
100°E
120°E
140°E
160°E


(a) Regs. ψE 250mb for June
CI:2*10⁵ m² s⁻¹
50°N
40°N
30°N
20°N
10°N
EQ
L
-20
-12
-12
4
0
80°E
100°E
120°E
140°E
160°E


(b) Regs. ψE 850mb for June
CI:2*10⁵ m² s⁻¹
50°N
40°N
30°N
20°N
10°N
EQ
L
H
2
4
6
8
80°E
100°E
120°E
140°E
160°E

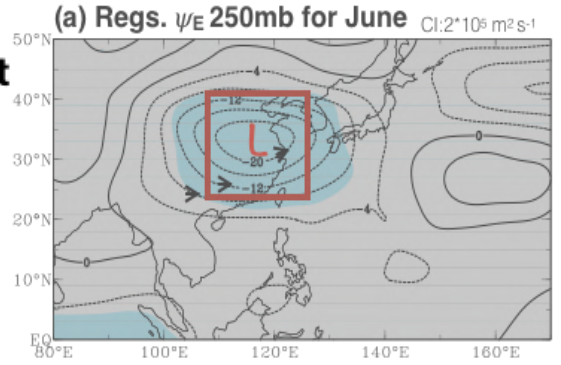
regression pattern of June ψ_E 250 hPa with PC1+2 (contours) overlaid with the linear trend slopes of the June ψ_E (shadings).

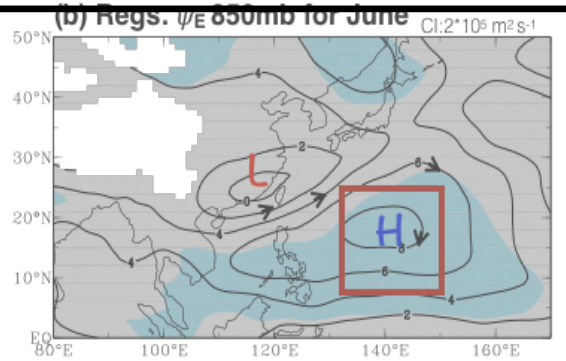




Wang et al. (2015)

AA ⇛ Equatorward shift of polar jet
Amplification of quasi-stationary short-wave trains
vs. poleward shift of subtropical jet

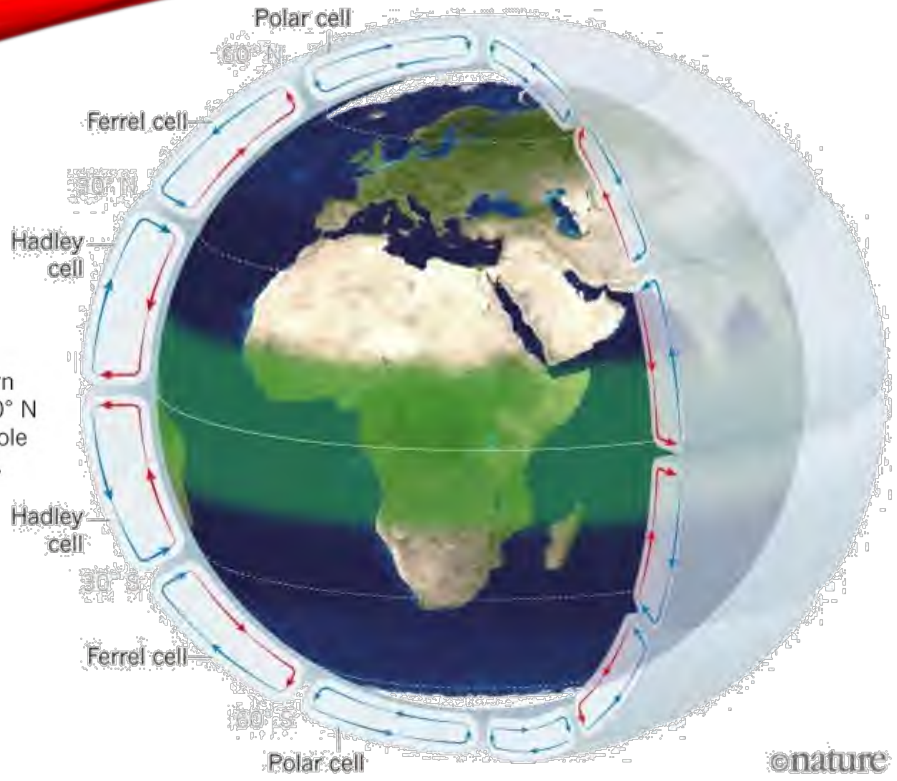


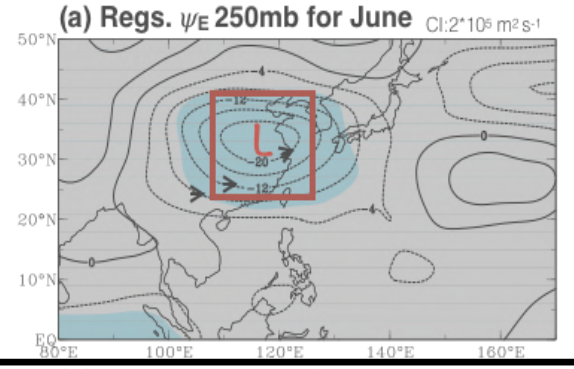


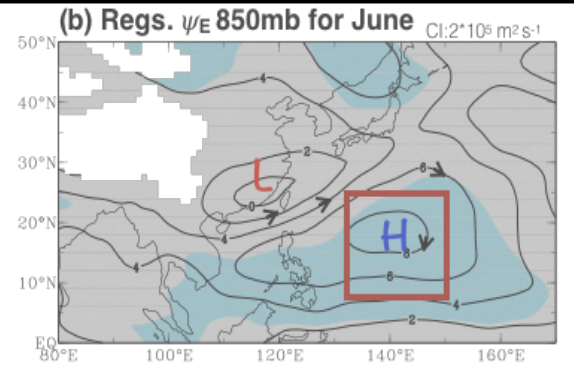
(Coumou et al. 2018)

BULGING WAISTLINE

Expansion of the tropics can be seen in the Hadley cell, the circulation pattern that carries warm air upwards above the Equator and then down at about 30° N and 30° S. The descending limb of each Hadley cell is shifting towards the pole in both hemispheres, potentially altering climatic conditions in some regions.



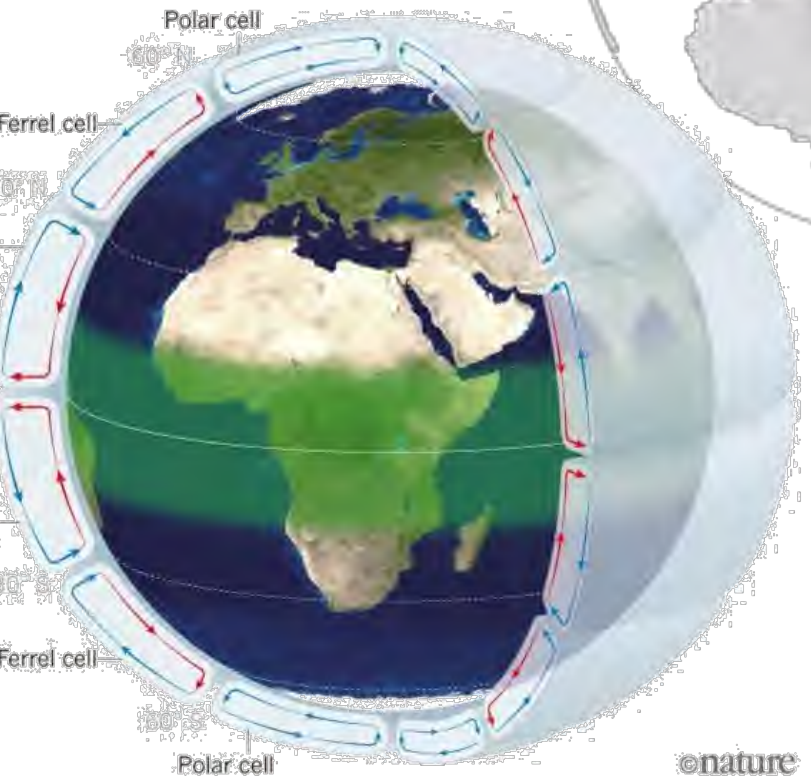


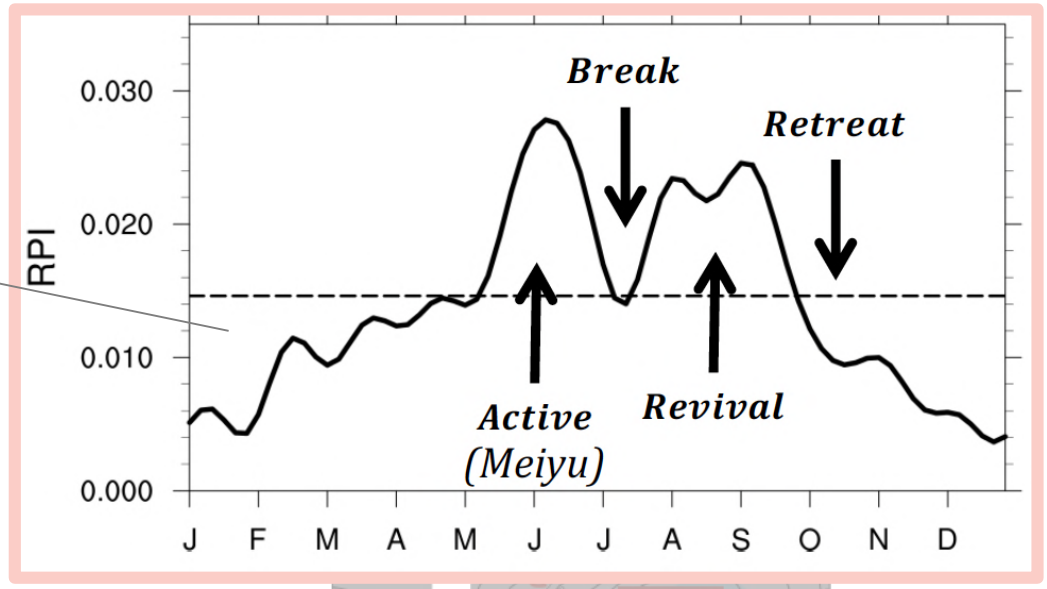


strengthened North Pacific subtropical anticyclone in response to increased SST under global warming

(Li et al., 2012; He and Zhou, 2015; Wang et al., 2013)

← If these are the future trend, then how will Meiyu change?

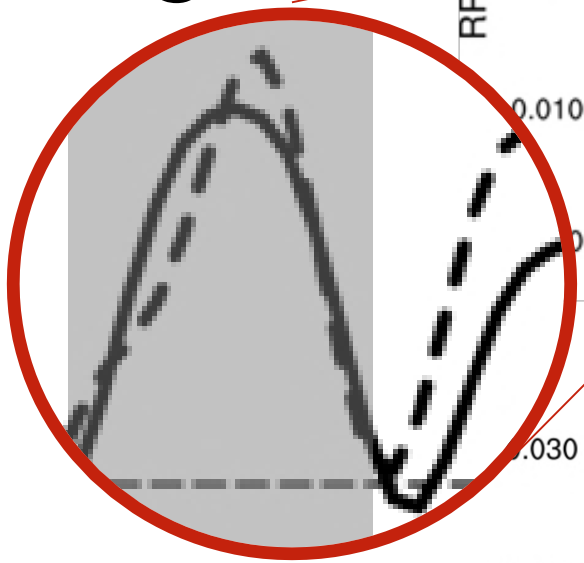


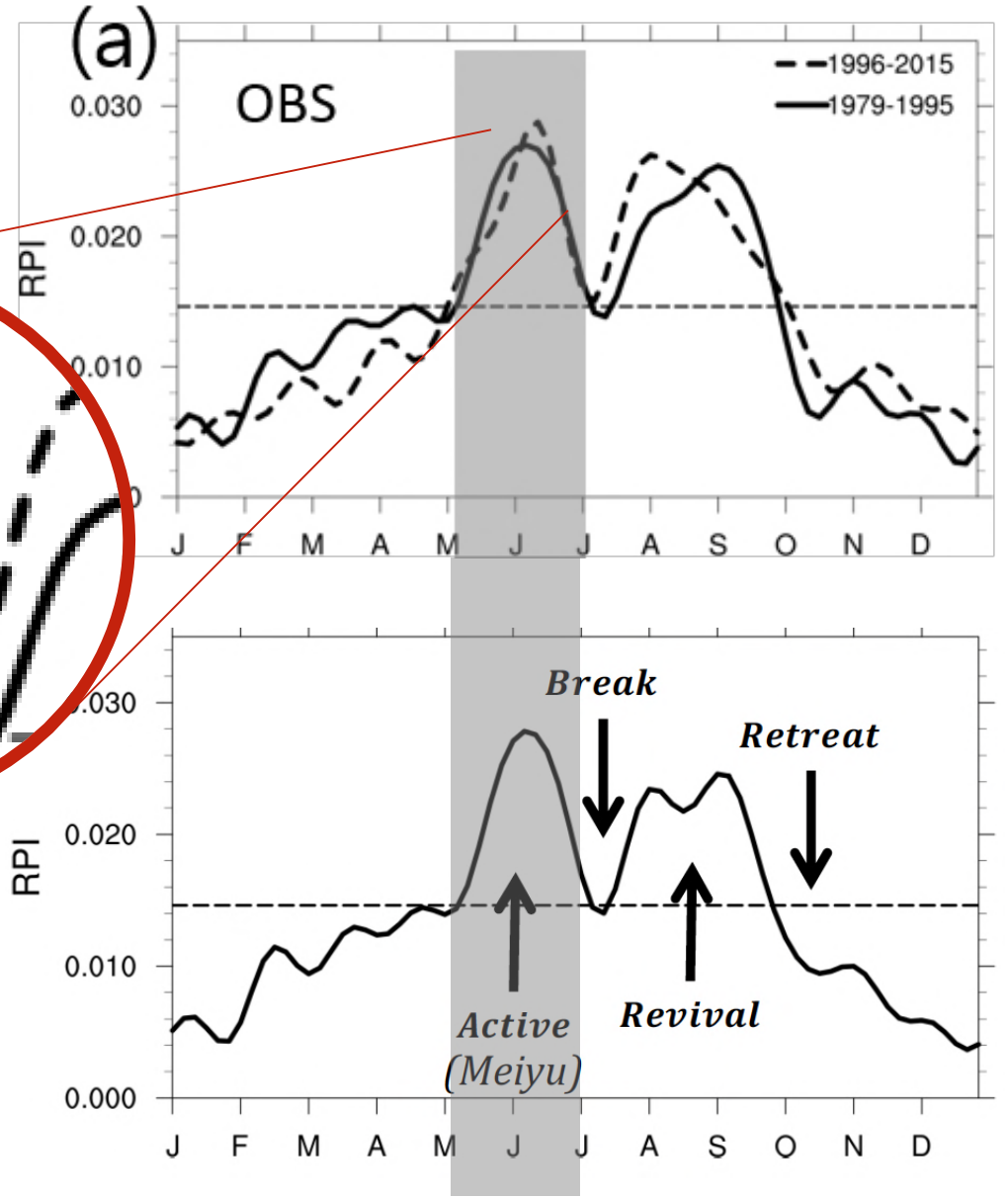


5-day mean normalized precipitation (1981-2000)

Past change:

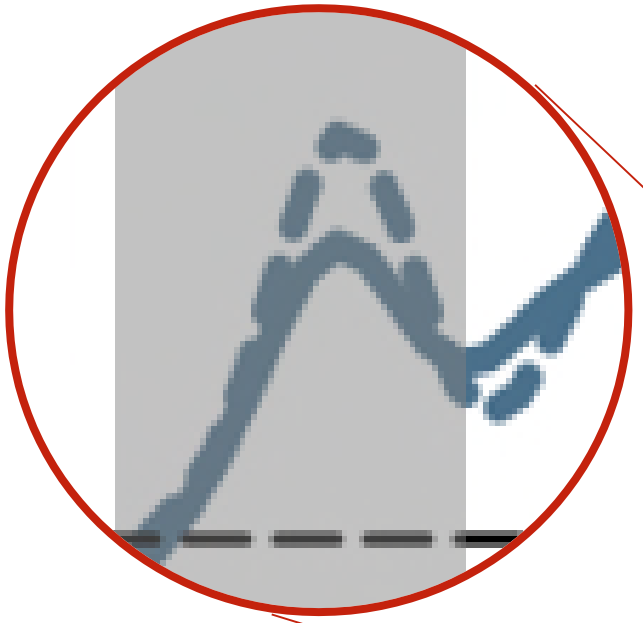
Sharper, more intense

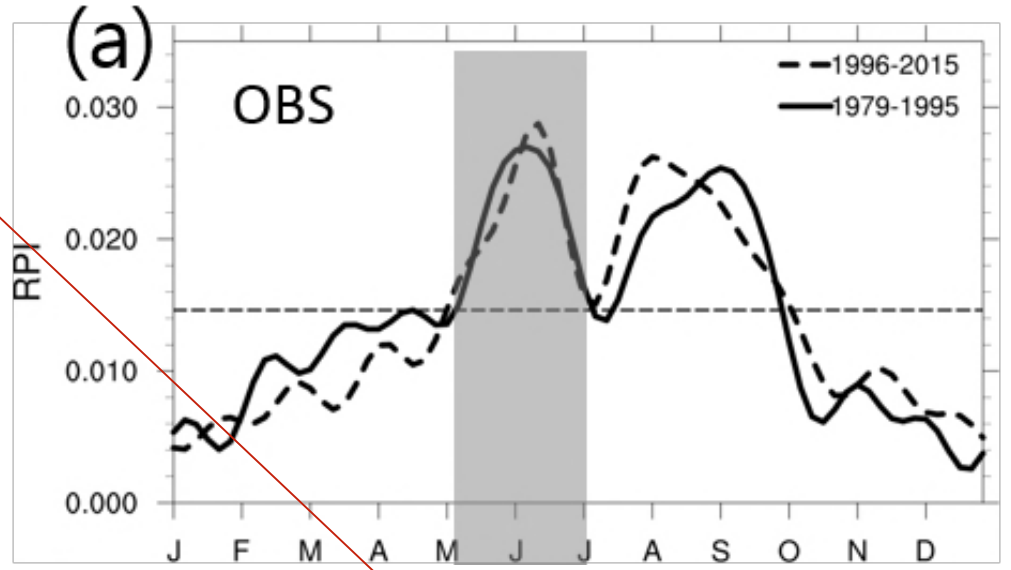


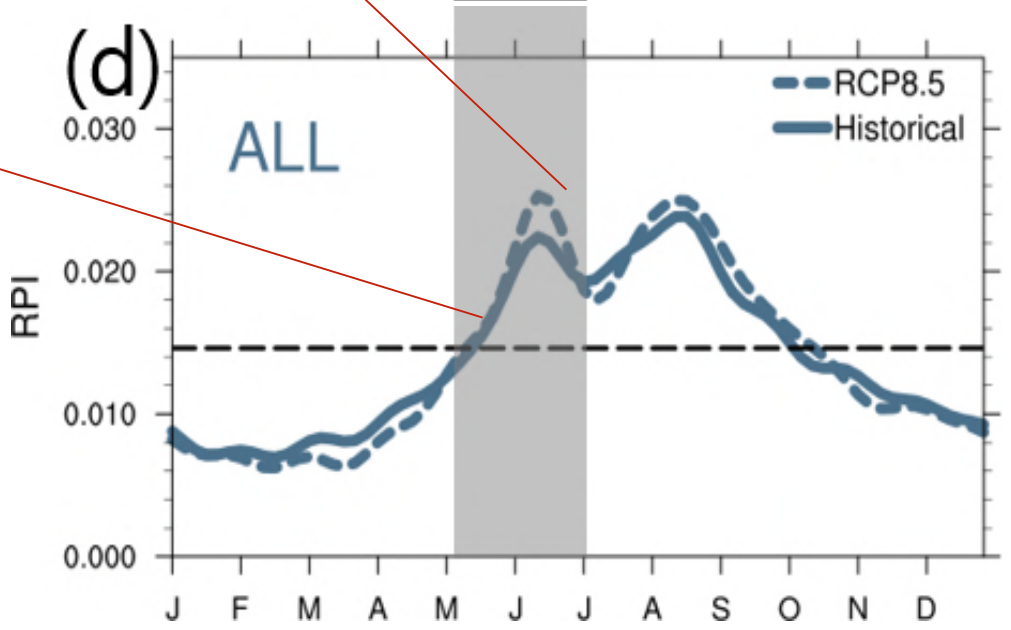


Change in Taiwan's Meiyu

5-day mean normalized precipitation







Projected change:

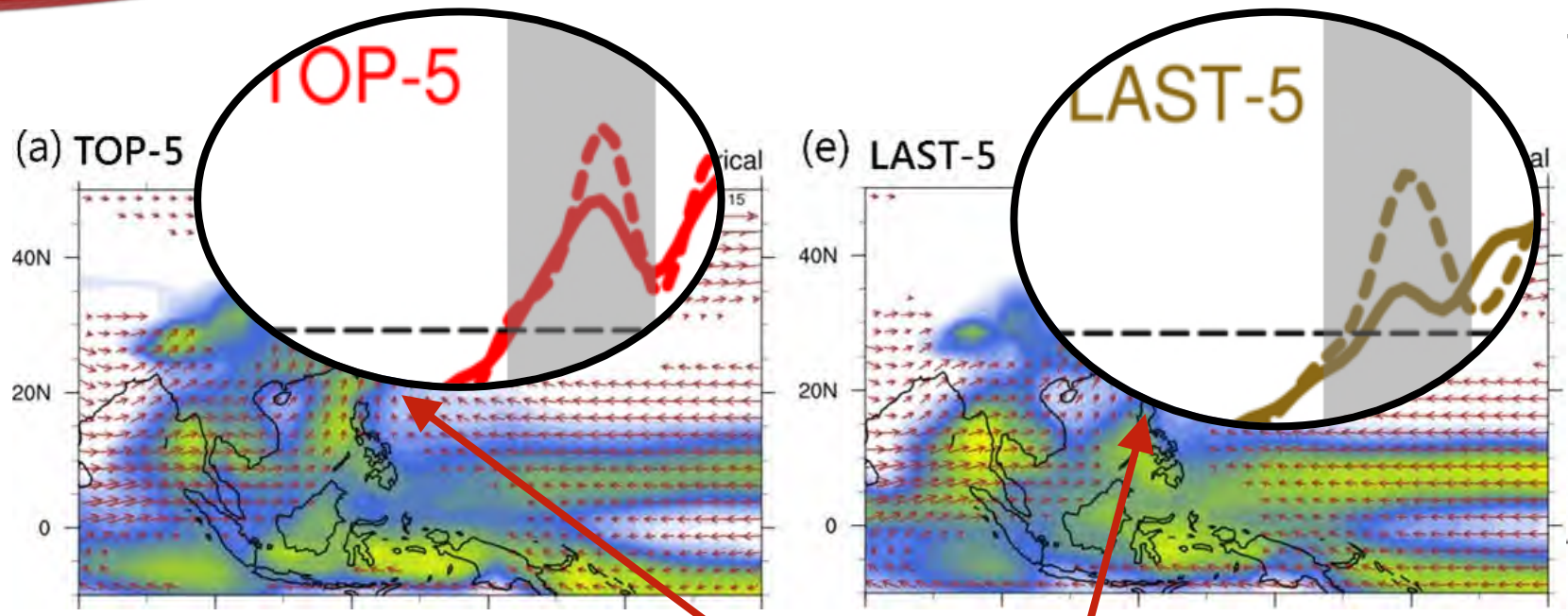
from 17 CMIP5 models

(Tung et al. 2018, in revision)

Meiyu will increase!

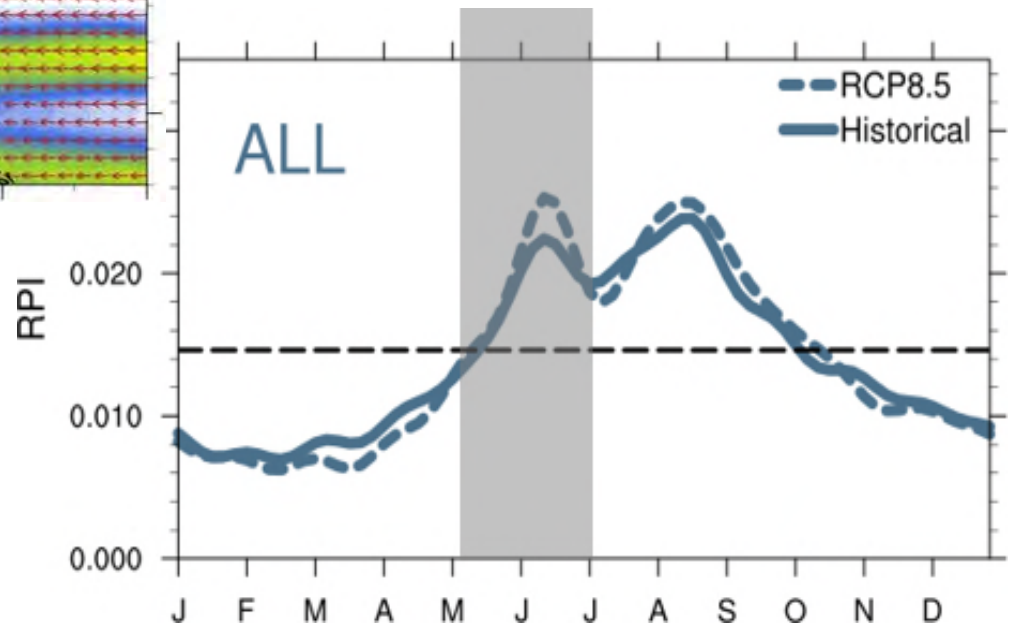
Thermodynamically-

driven, mostly.

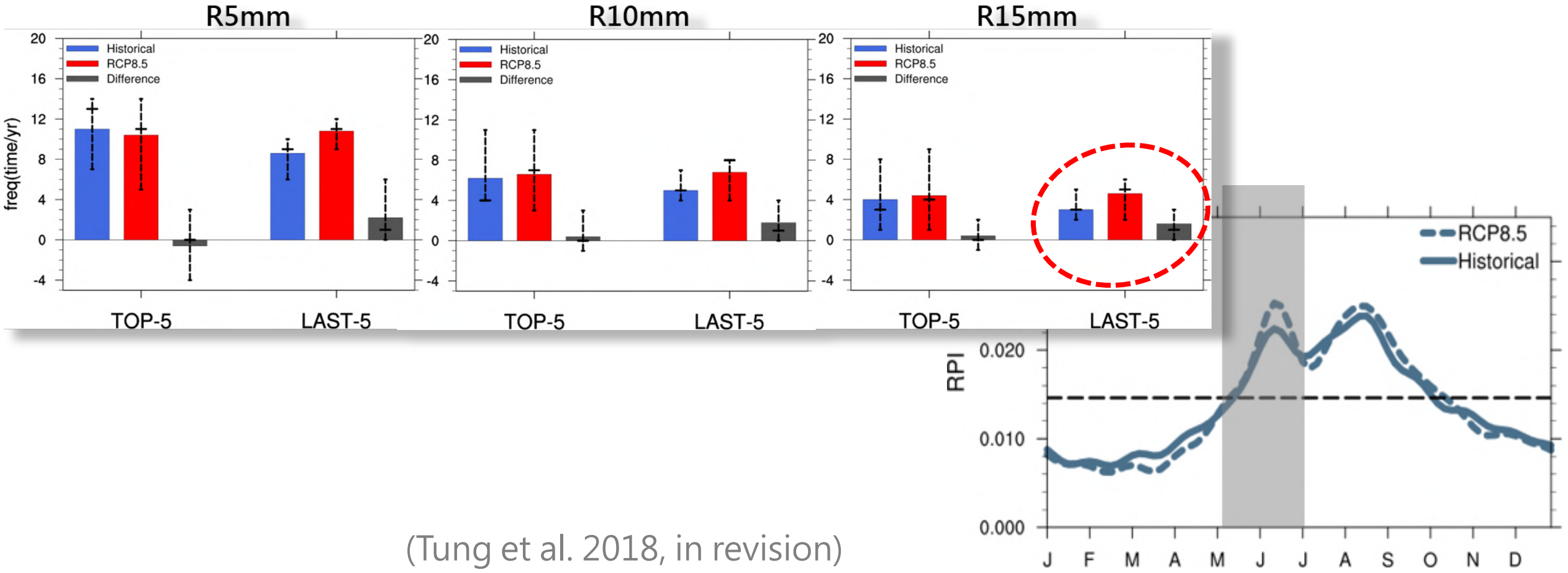


from 17 CMIP5 models

(Tung et al. 2018, in revision)

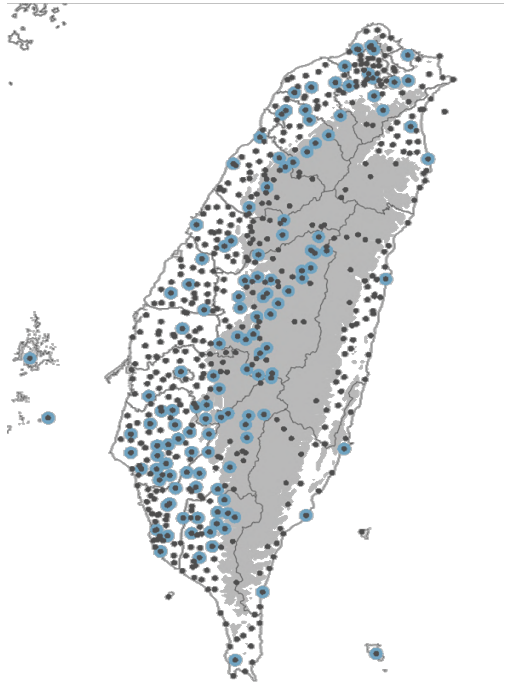


with a subsequent increase in extreme precipitation

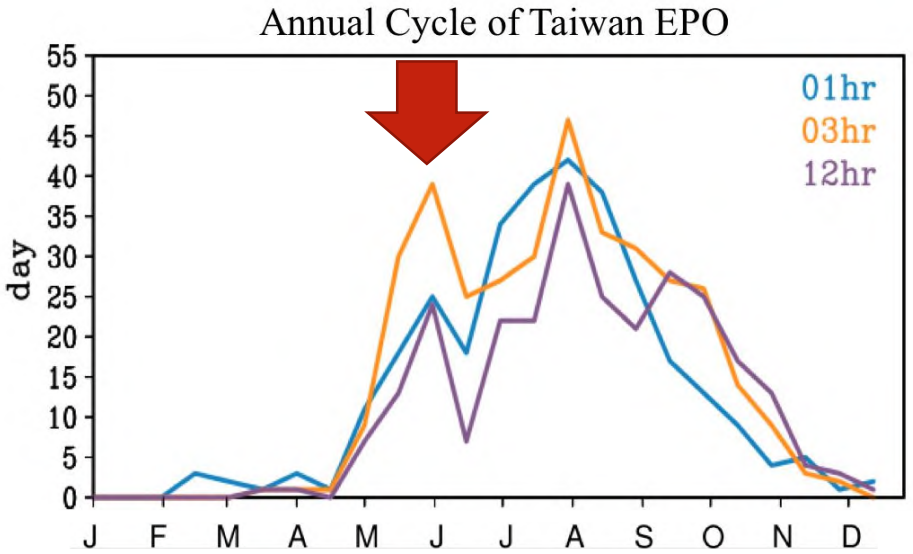


(Tung et al. 2018, in revision)

Has it already?

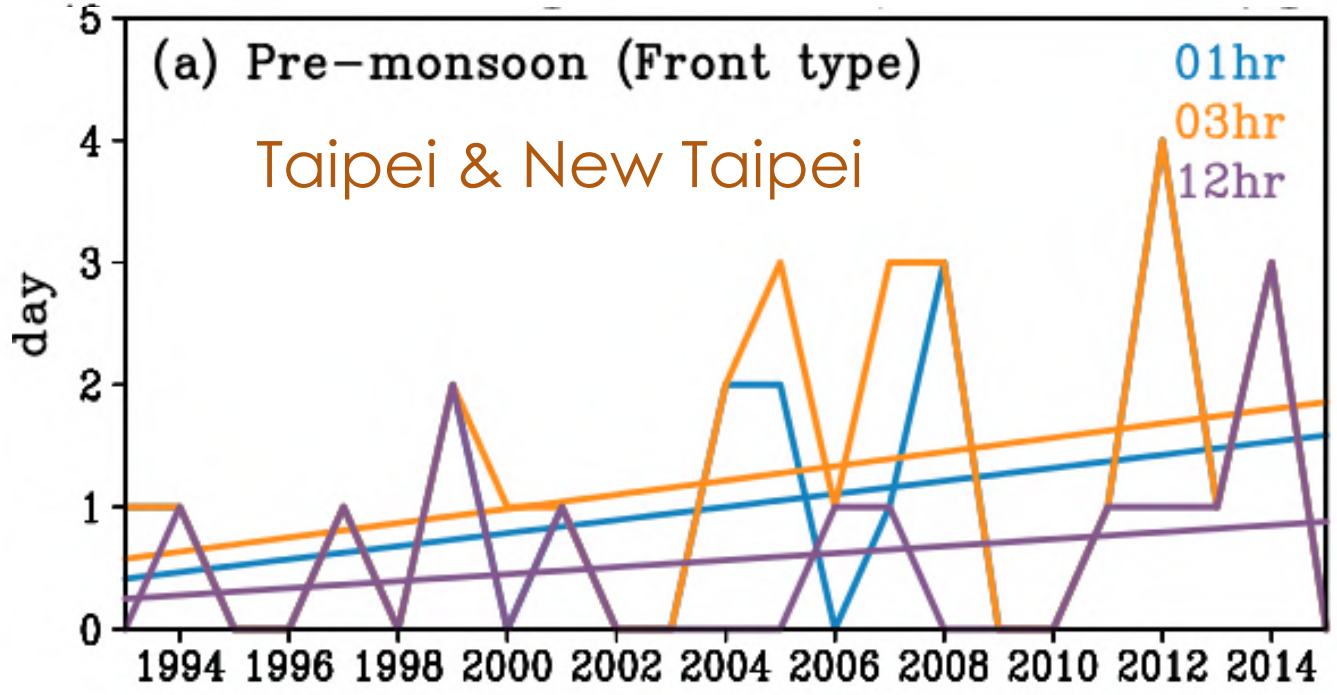


3-hr extreme of 95% percentile

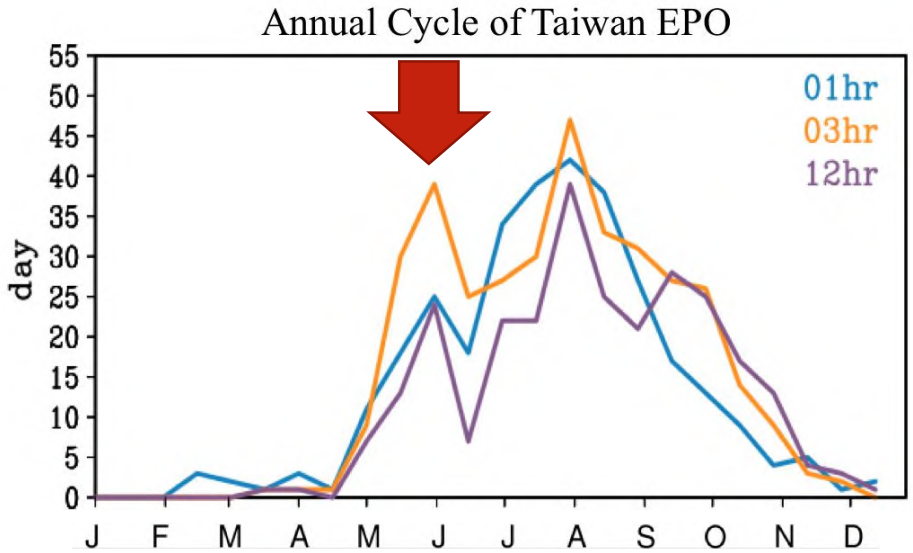


extreme precipitation occurrence

(Wu et al. 2018, in revision)



extreme precipitation occurrence



(Wu et al. 2018, in revision)

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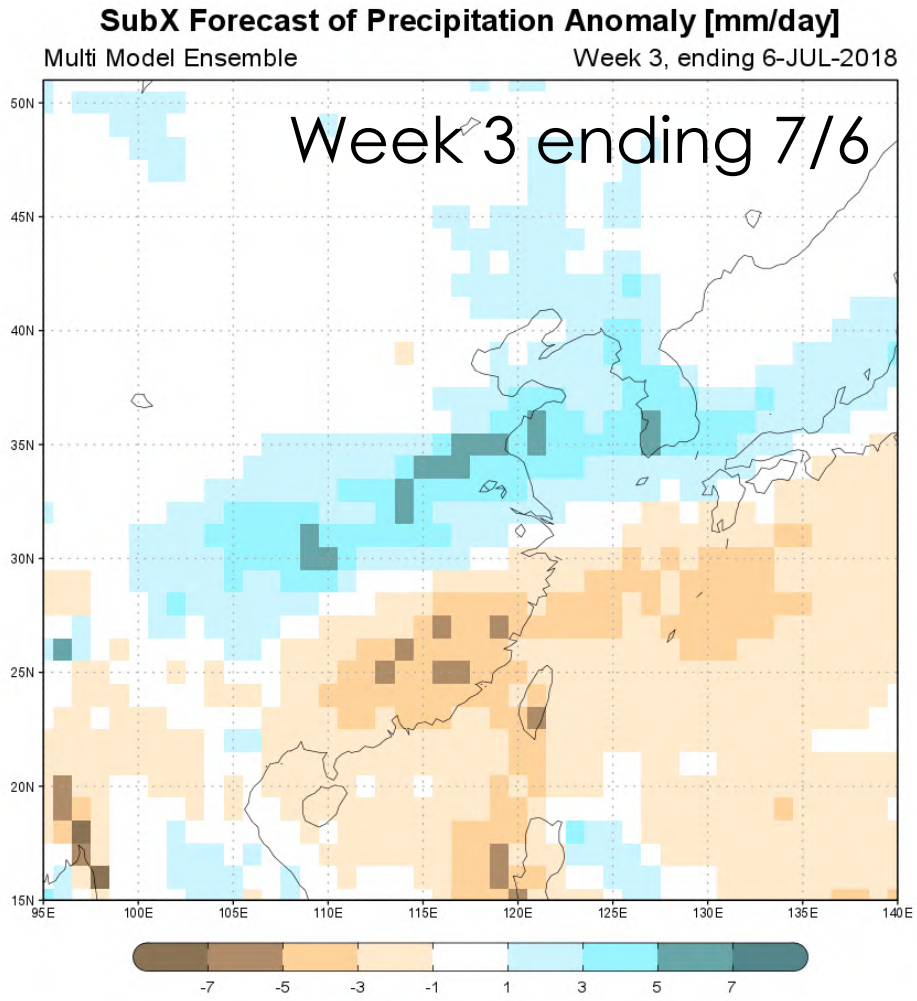
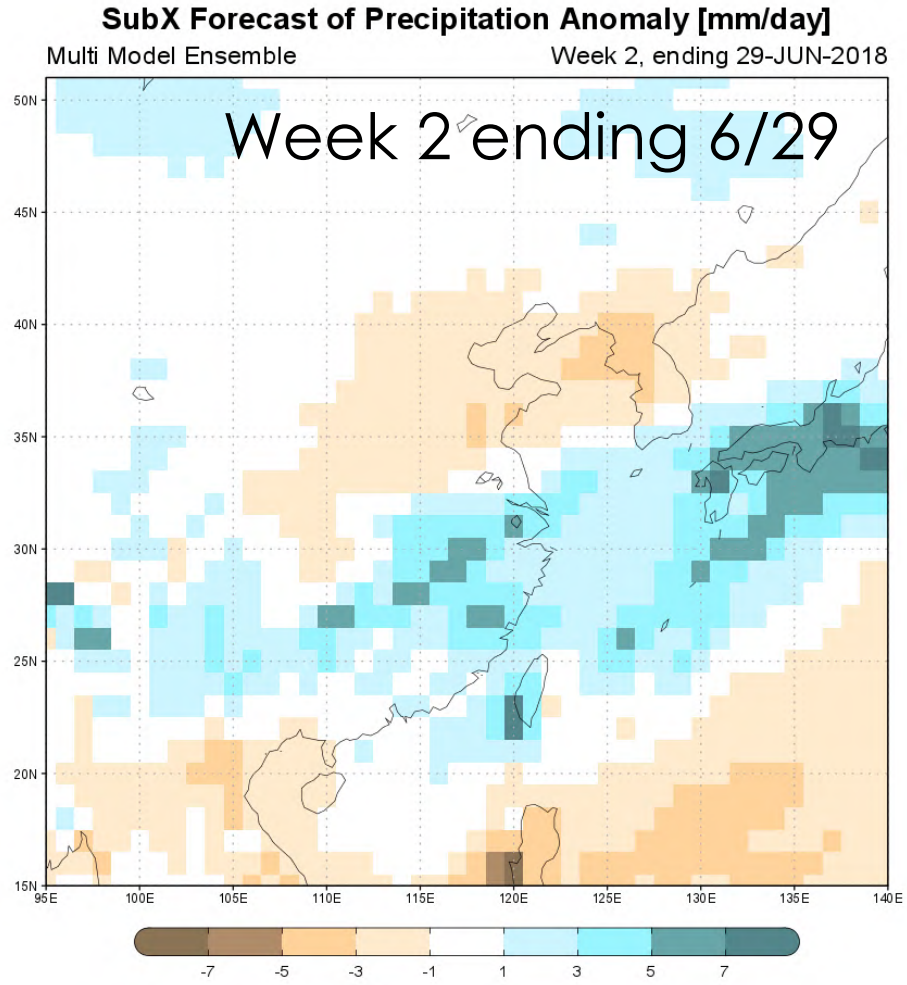
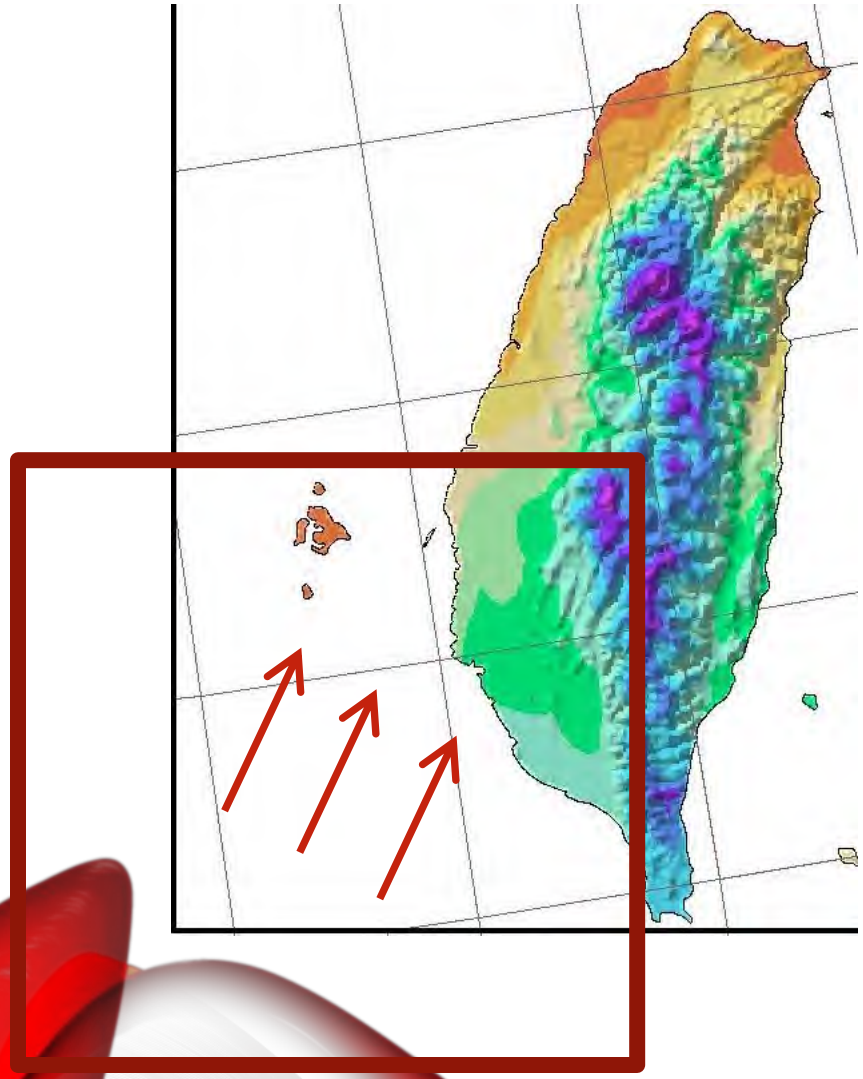
Inside

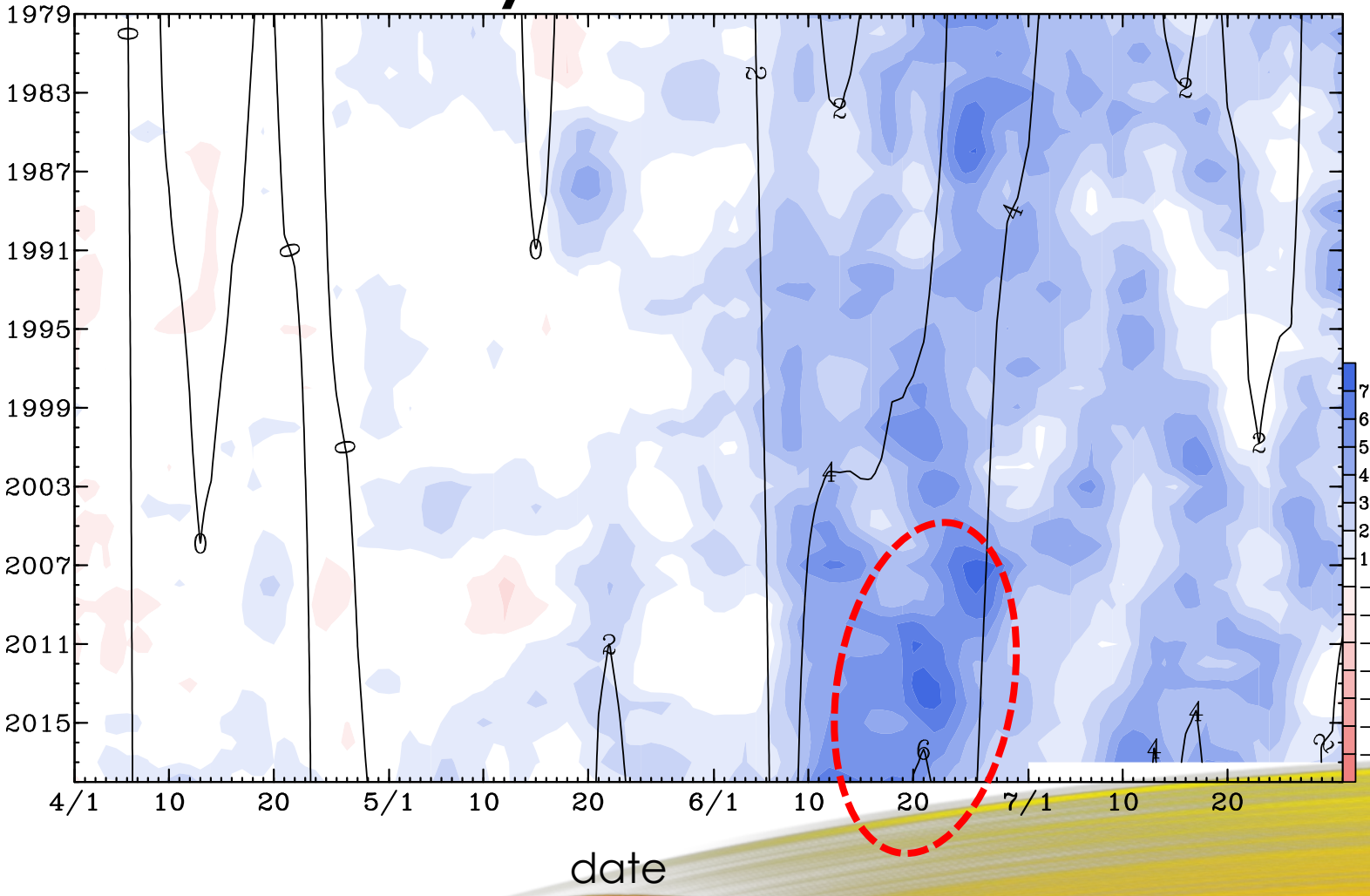
SubX Project





Daily v-wind @ 925mb





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水情慘了 氣象局：今年梅雨史上最晚

自由時報 2018世足賽 Net

即時新聞 報紙總覽 影音 NEW 財經 娛樂 汽車 時

恐17年來最晚梅雨！氣象局憂「空梅」、水利會長失眠

udn / 生活 / 生活新聞

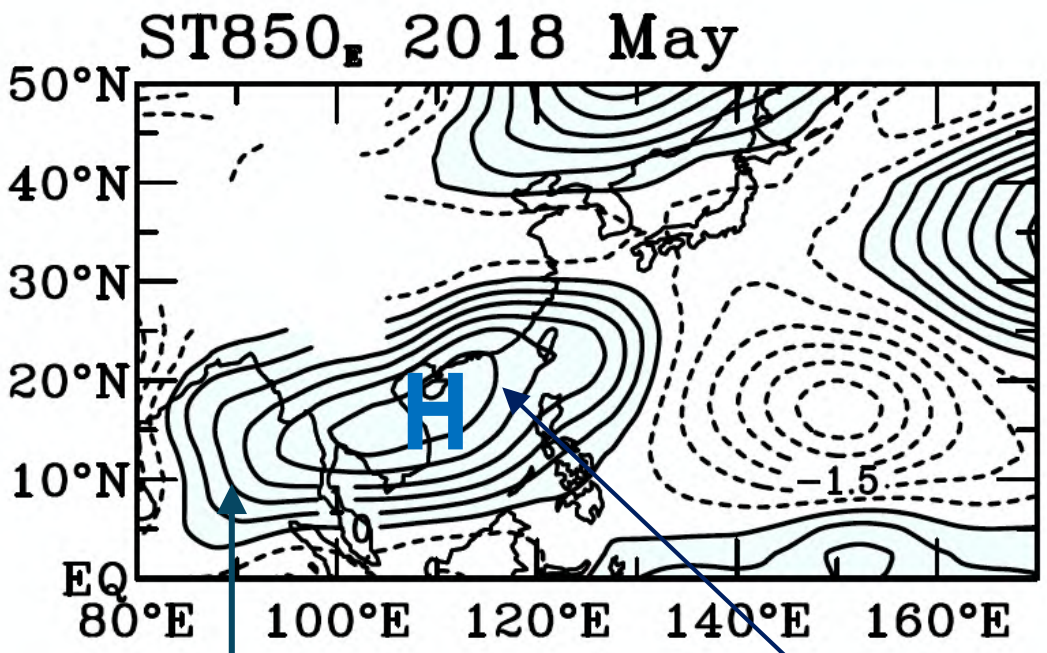
梅雨遲沒雨 乾旱在眼前

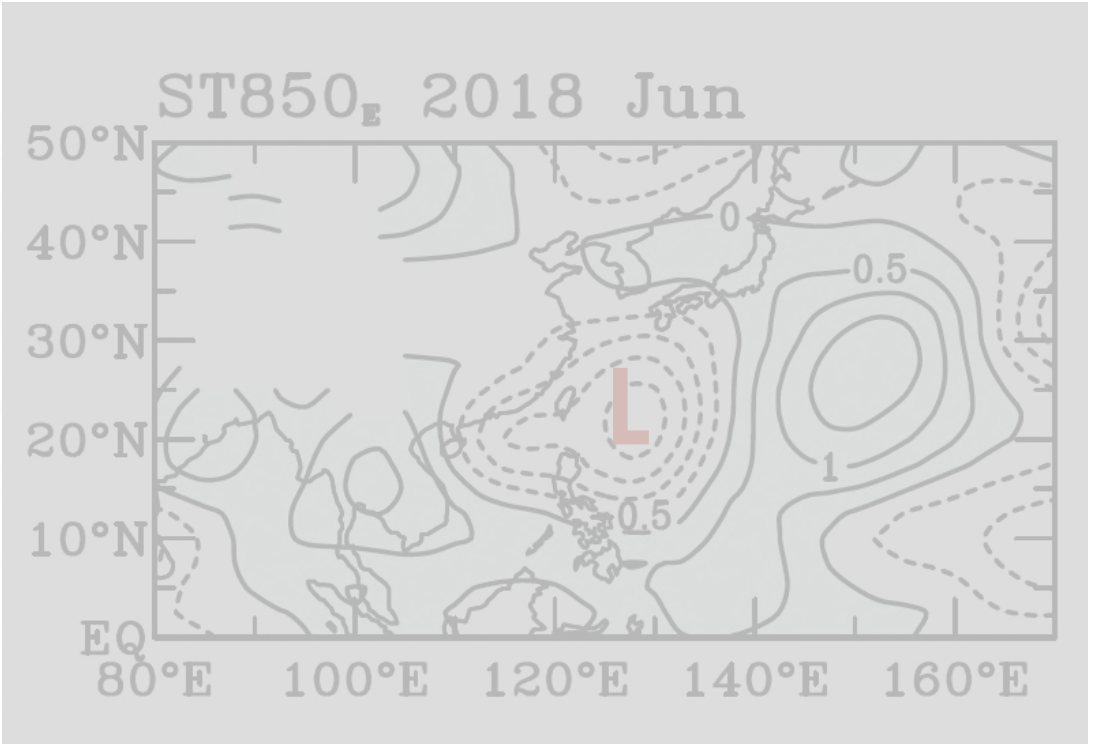
梅雨來不來？台南忙抗旱　盼6月底前不進入三階限水

2018/06/02 12:13:00 中央社

SETN 三立新聞網 SETN.COM

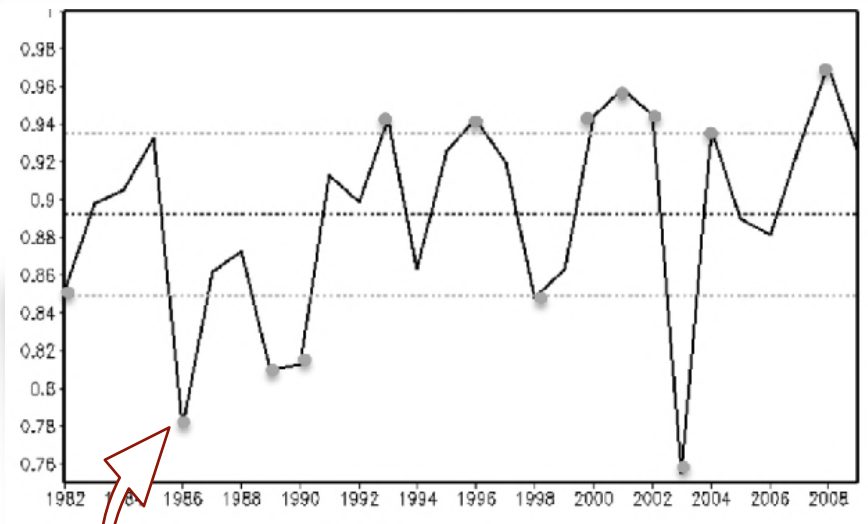
"pre-Meiyu drought"





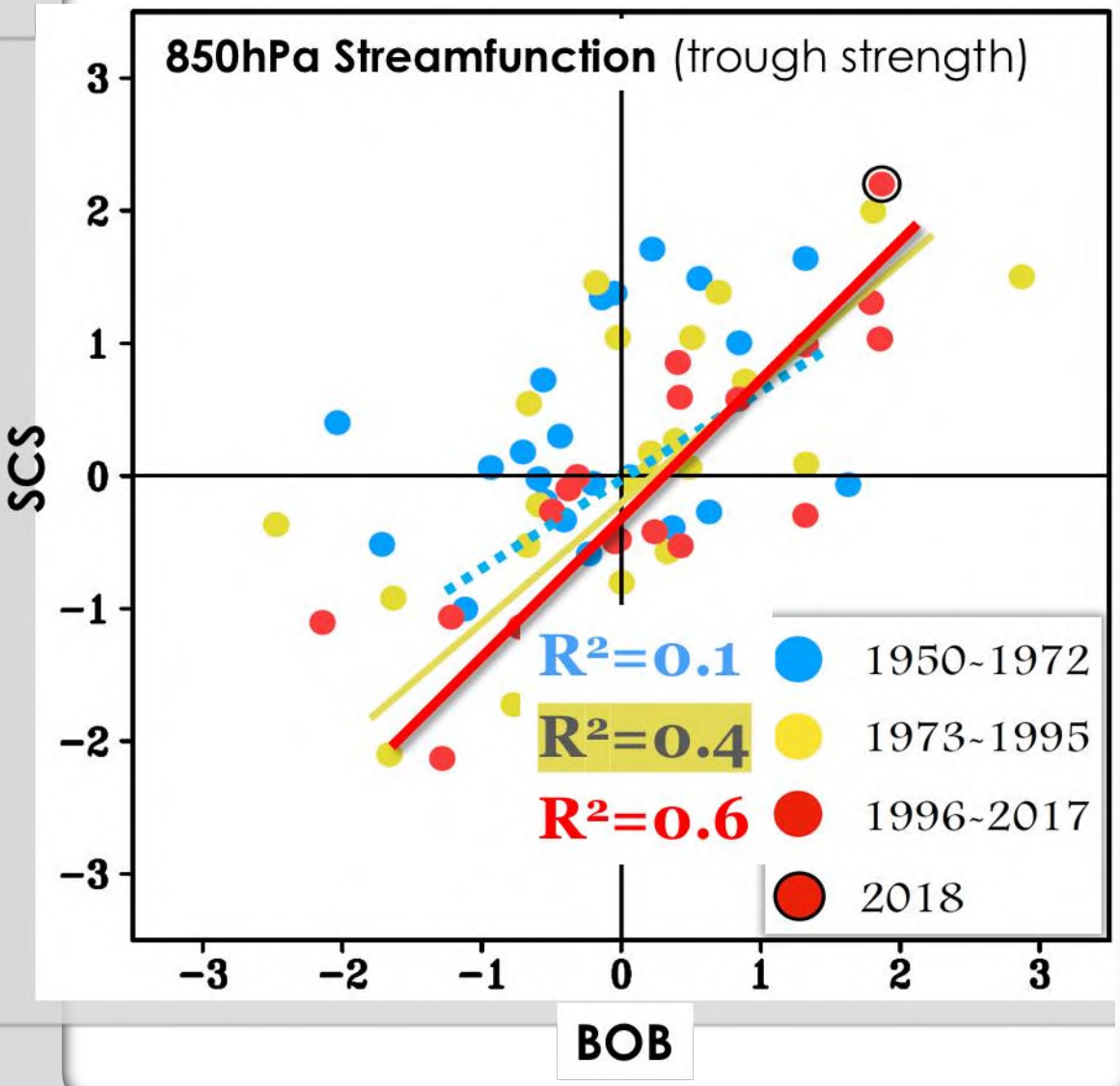
Late onset

Late onset

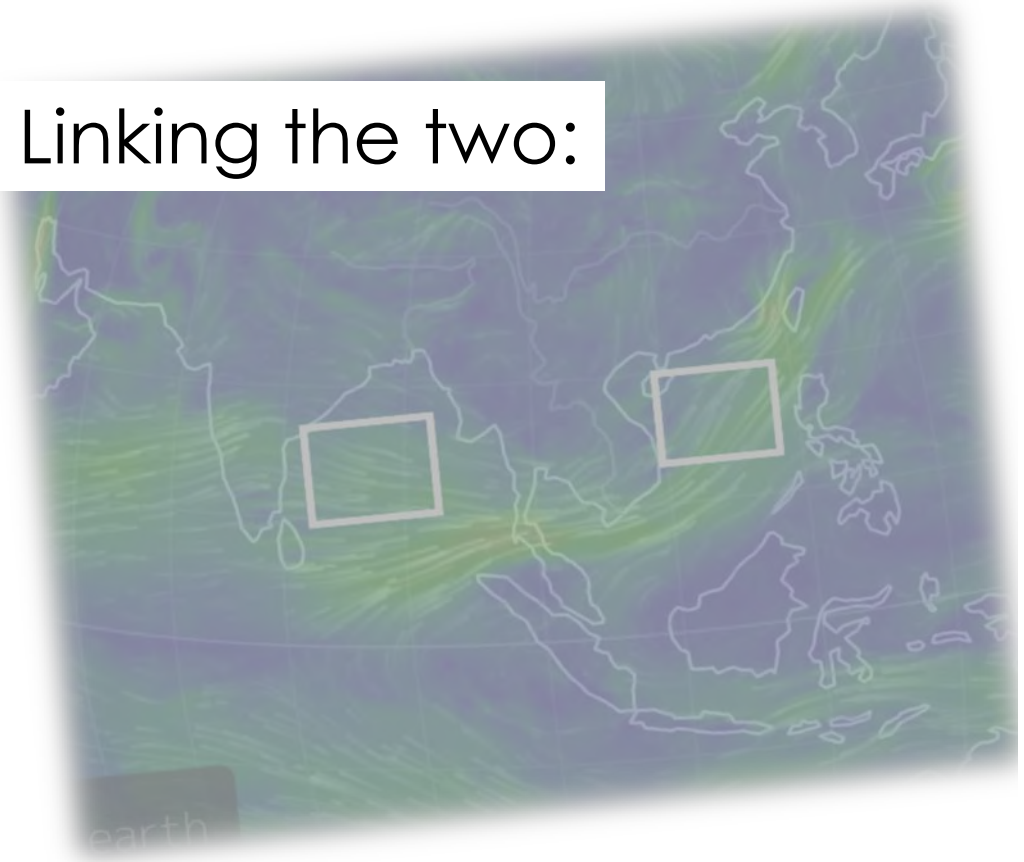


r_S=0.88

CFSv2 reforecast of BoB monsoon trough:
week-2 for May



Linking the two:



Applying the relatively stable prediction skill of the Bay of Bengal monsoon onset for the prediction of SCS monsoon onset and improve long-range forecast for the Meiyu.

民視新聞

水庫進帳不如預期 二期稻作恐面臨休耕

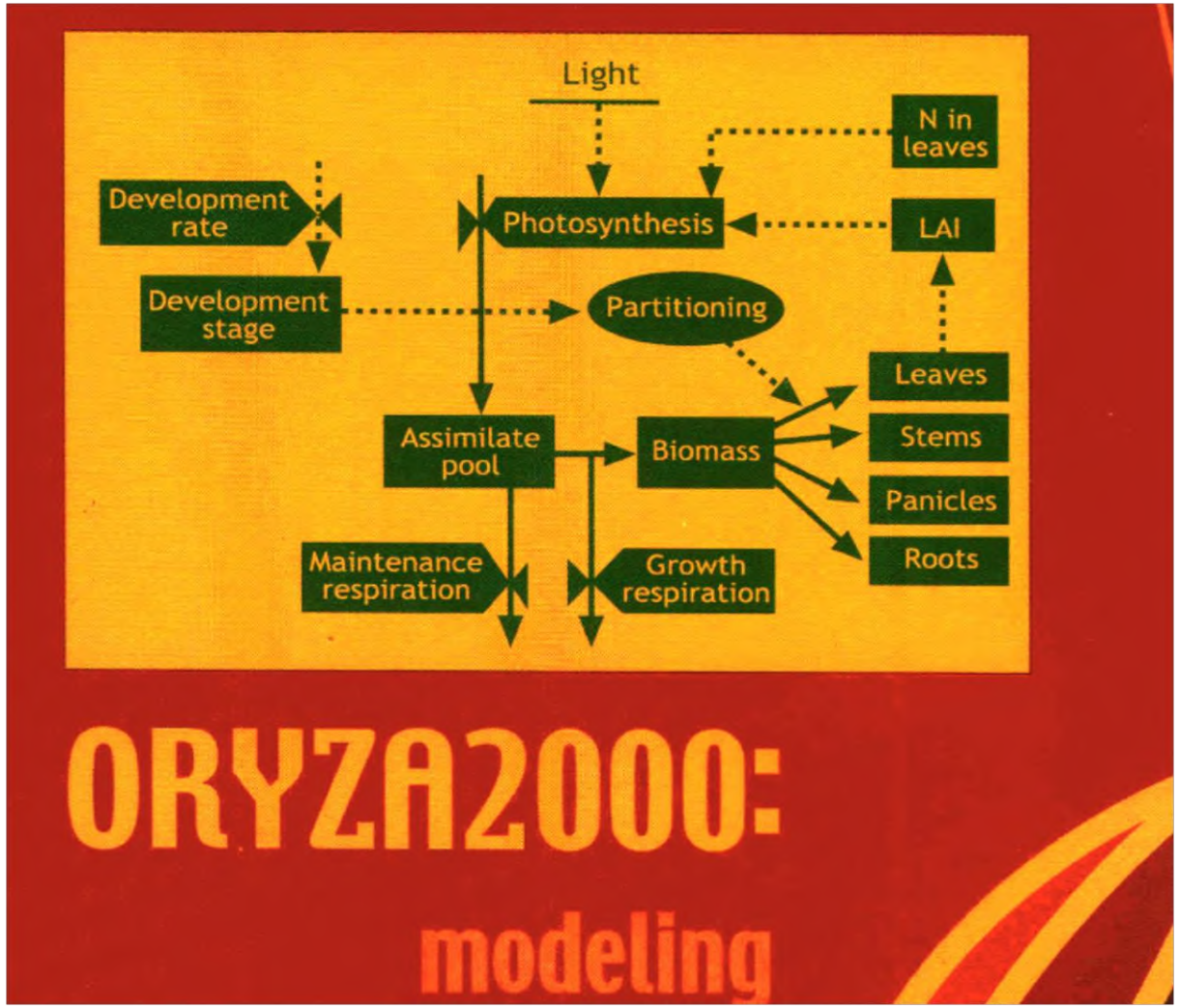
梅雨延遲! 嘉南一期稻恐減收3成

華視 2018年5月22日 下午7:29

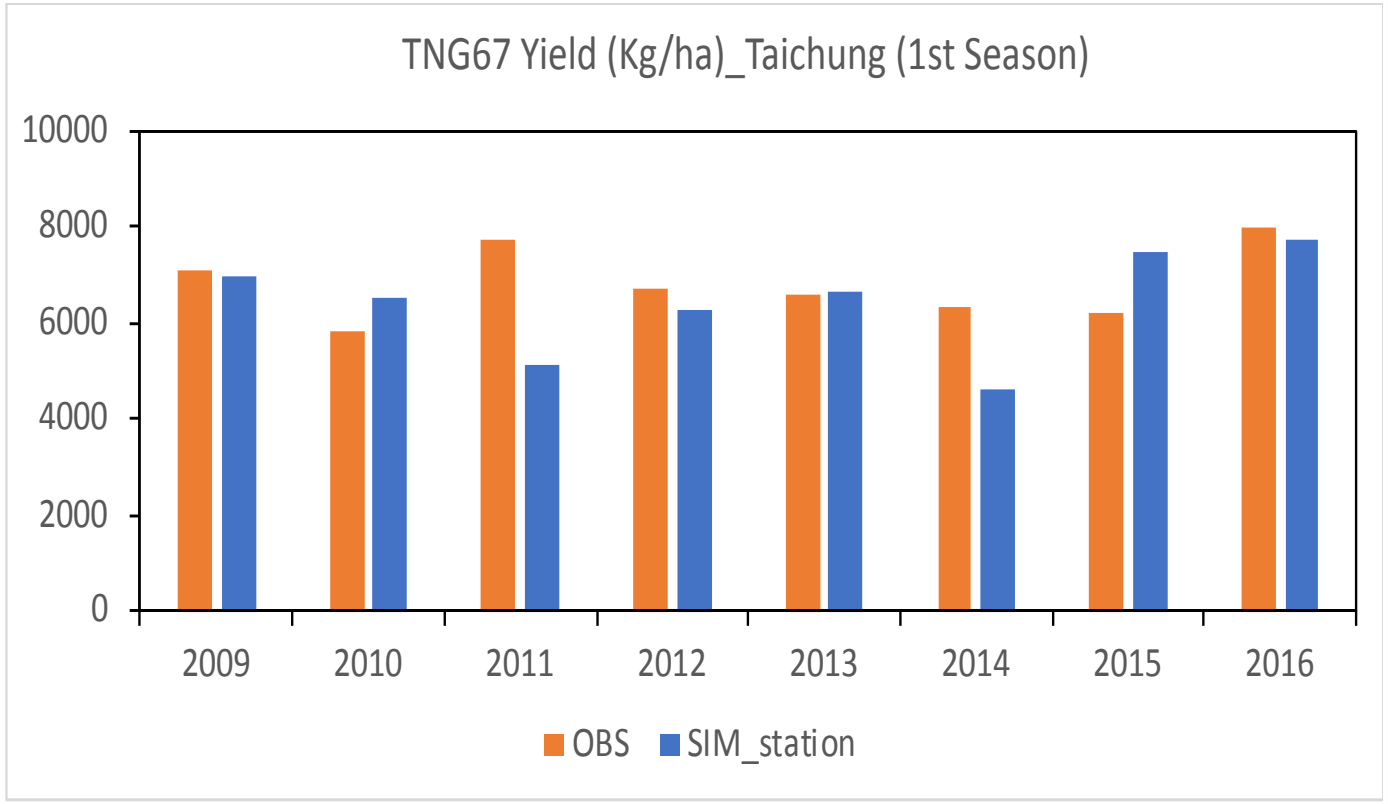
RICE CULTIVATION vs. RICE SIMULATION MODEL

CLIMATE DATA

- Weather station
- CODEX [1981-2050] RCP8.5
- Statistical downscaling



RICE CULTIVATION vs. RICE SIMULATION MODEL

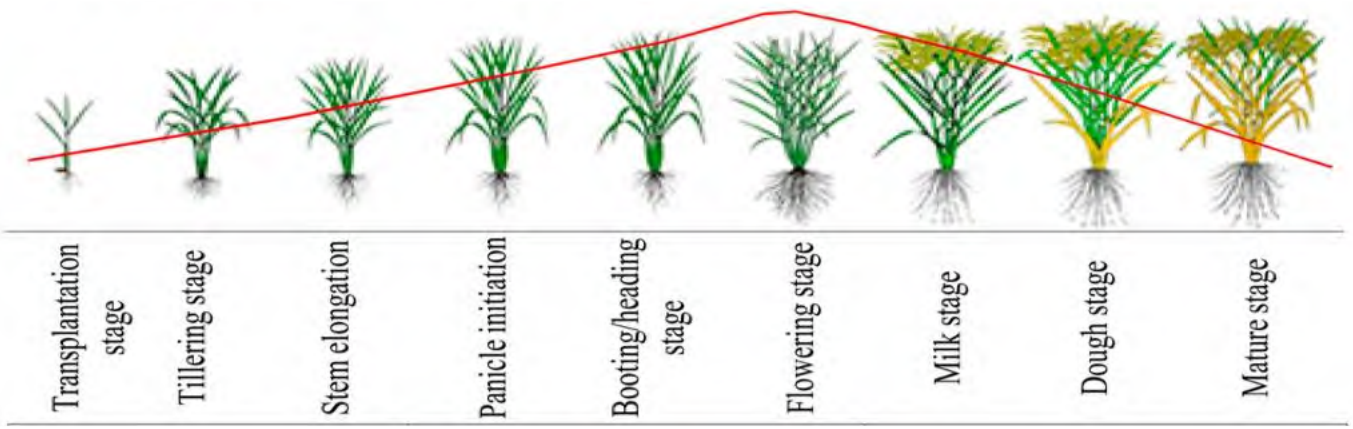


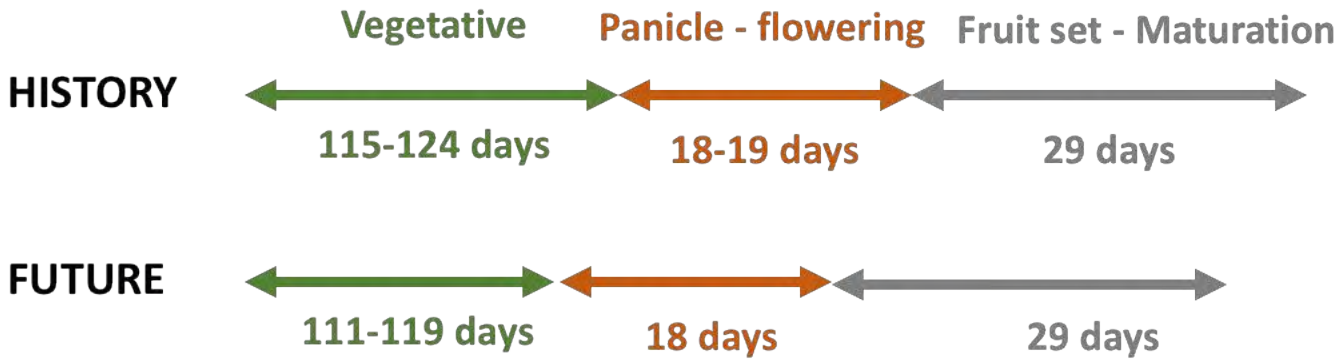
RICE CULTIVATION vs. RICE SIMULATION MODEL

Next step:

Testing SubX hindcasts on predicting phenological stages and yields of rice

- **Three phenological stages projected to be earlier about 5 days by 2050**





☝ coping mechanism by cropping late?

THANK YOU!

And brace for typhoon!