An overview of climate characteristics of 2014 summer over China

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30 October 2014, Tokyo

Outline

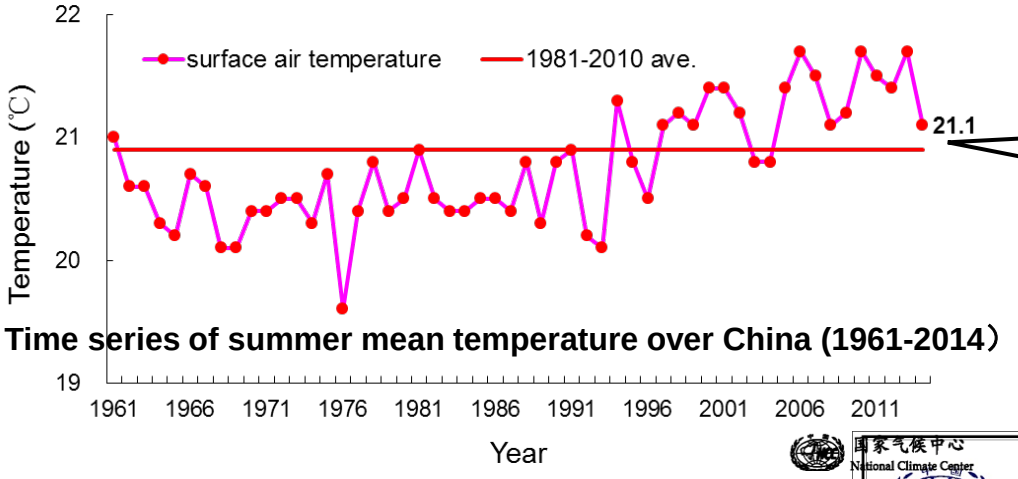
- **Brief climate characteristics of summer over China in 2014**

  (temperature; precipitation; extreme weather and climate events)

- **Overview of the East Asia Summer Monsoon activities in 2014**

  (SCSSM; EASM; SASM)

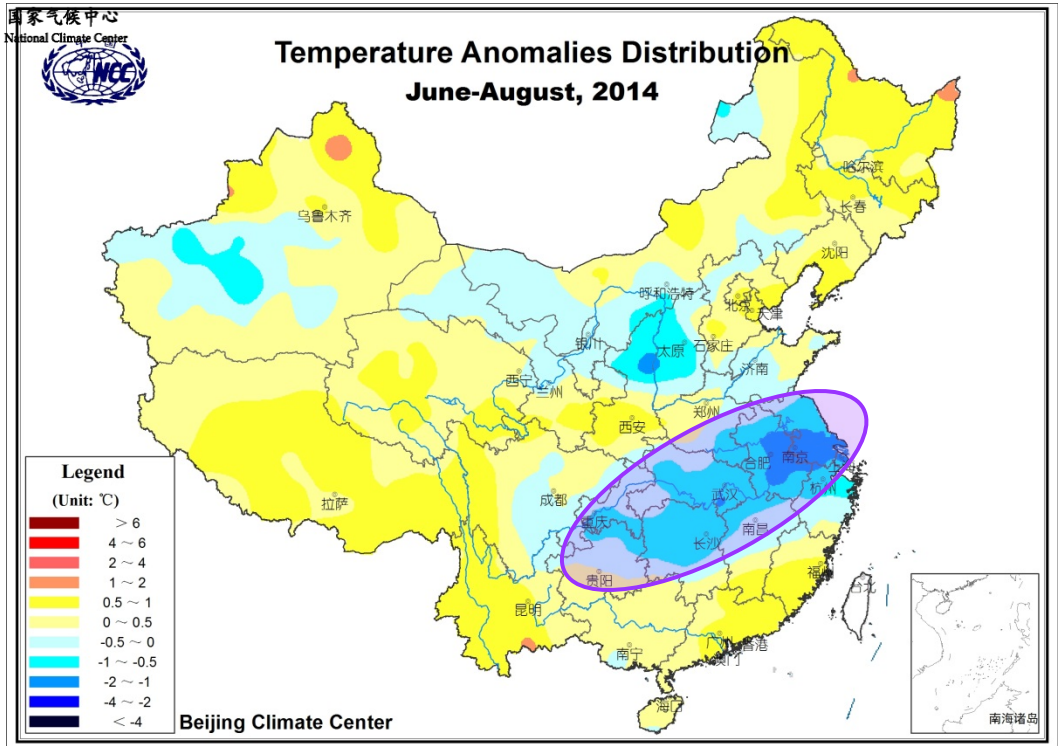
The mean temperature over China was slightly higher than normal, but lower in the Jianghuai region



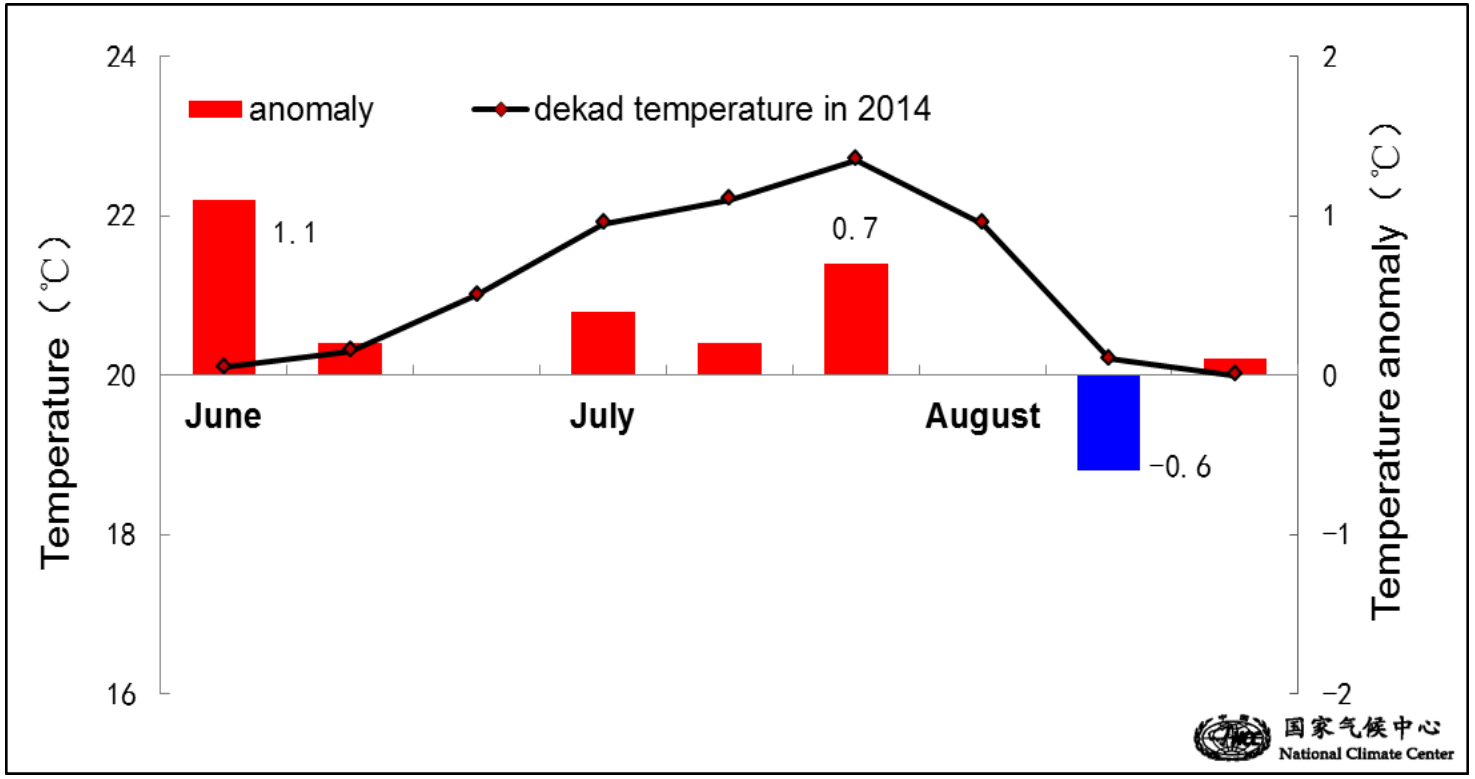
Time series of summer mean temperature over China (1961-2014）

The averaged temperature over China was 21.1℃, which was 0.2℃ higher than the climatic normal.

The spatial distribution indicates that the surface air temperature in most of China was warmer or near to the climatic values, except for parts of the Jianghuai region, with temperature **0.5~2℃** lower than normal.



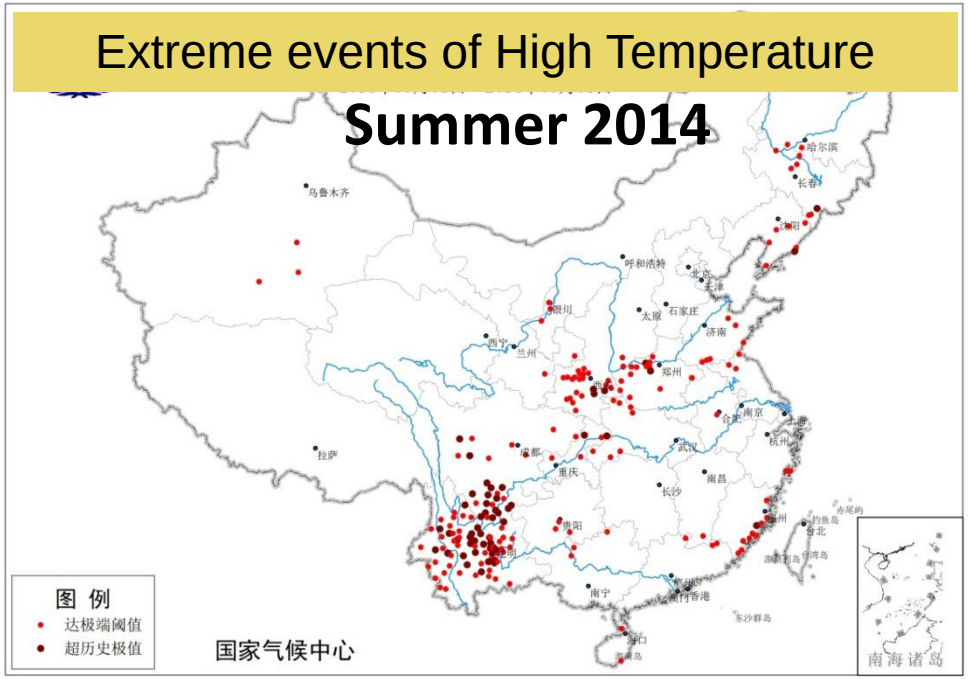
Except in the middle of August, averaged temperature over China was higher than or near to normal.

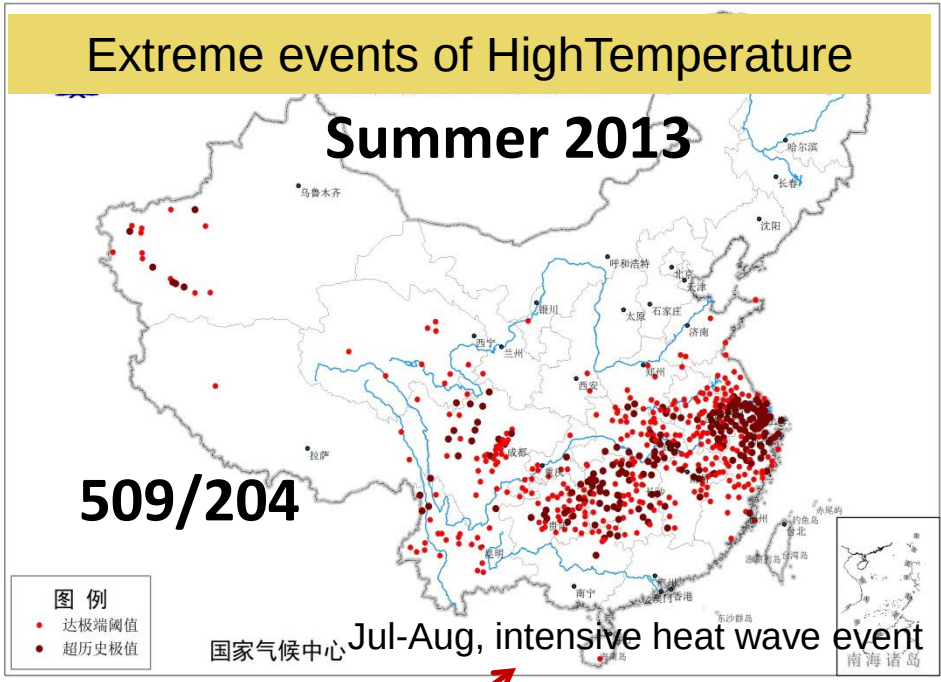


Dekad (ten days) temperature anomalies over China in 2014 Summer

Events of High Temperature observed in China in 2014 Summer

Frequency higher than normal, while frequency and intensity both relatively weaker than the summer of 2013.

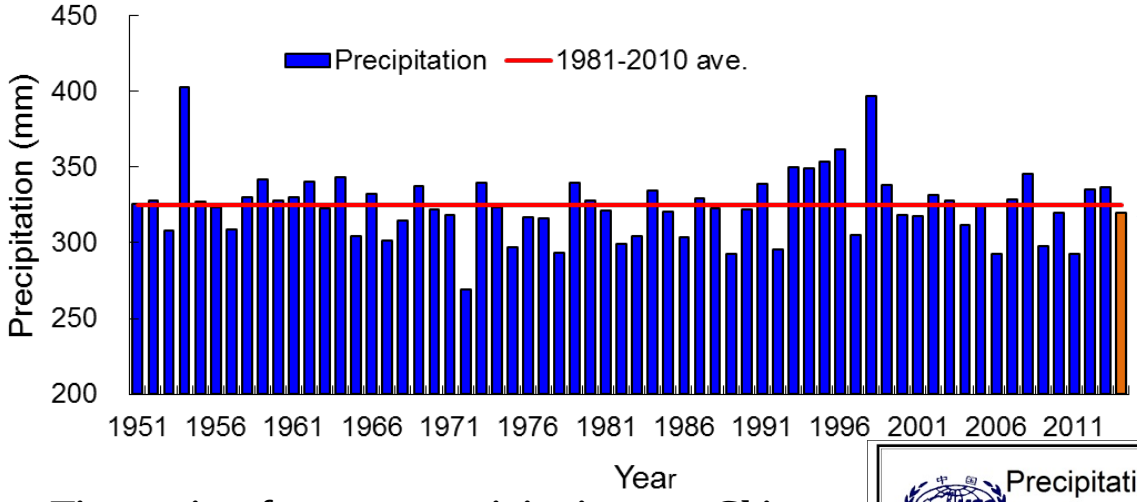




Severe extended heatwaves affected the most populous and economically developed part of China and caused substantial economic and societal impacts. It was estimated that anthropogenic influence has caused a more than **60-fold increase** in the likelihood of the extreme warm 2013 summer since the early 1950s, and project that similarly hot summers will become even more frequent in the future.

Sun Y et al. Rapid increase in the risk of extreme summer heat in Eastern China. Nature Climate Change (2014).

The averaged precipitation over China was a bit less than normal in Summer, but obviously more than normal in the Jiangnan area.



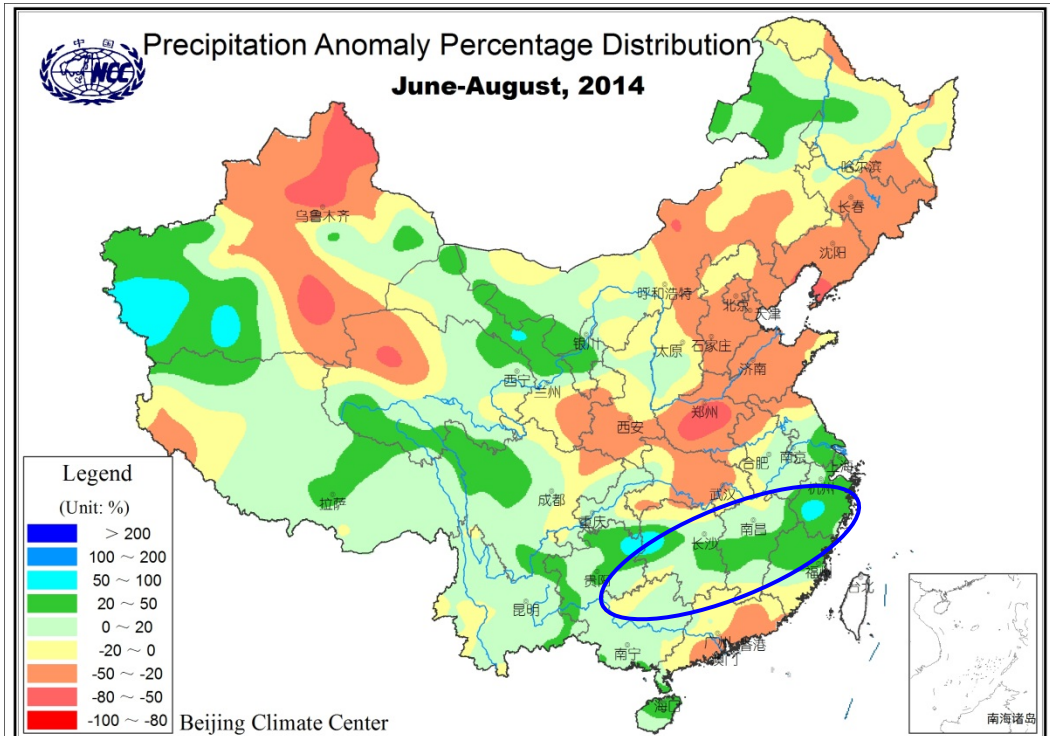
Time series of summer precipitation over China (1961-2014）

The precipitation over China was 320.1mm, which was 1.6% less than normal.

Precipitation in the northern China was obviously less than normal:

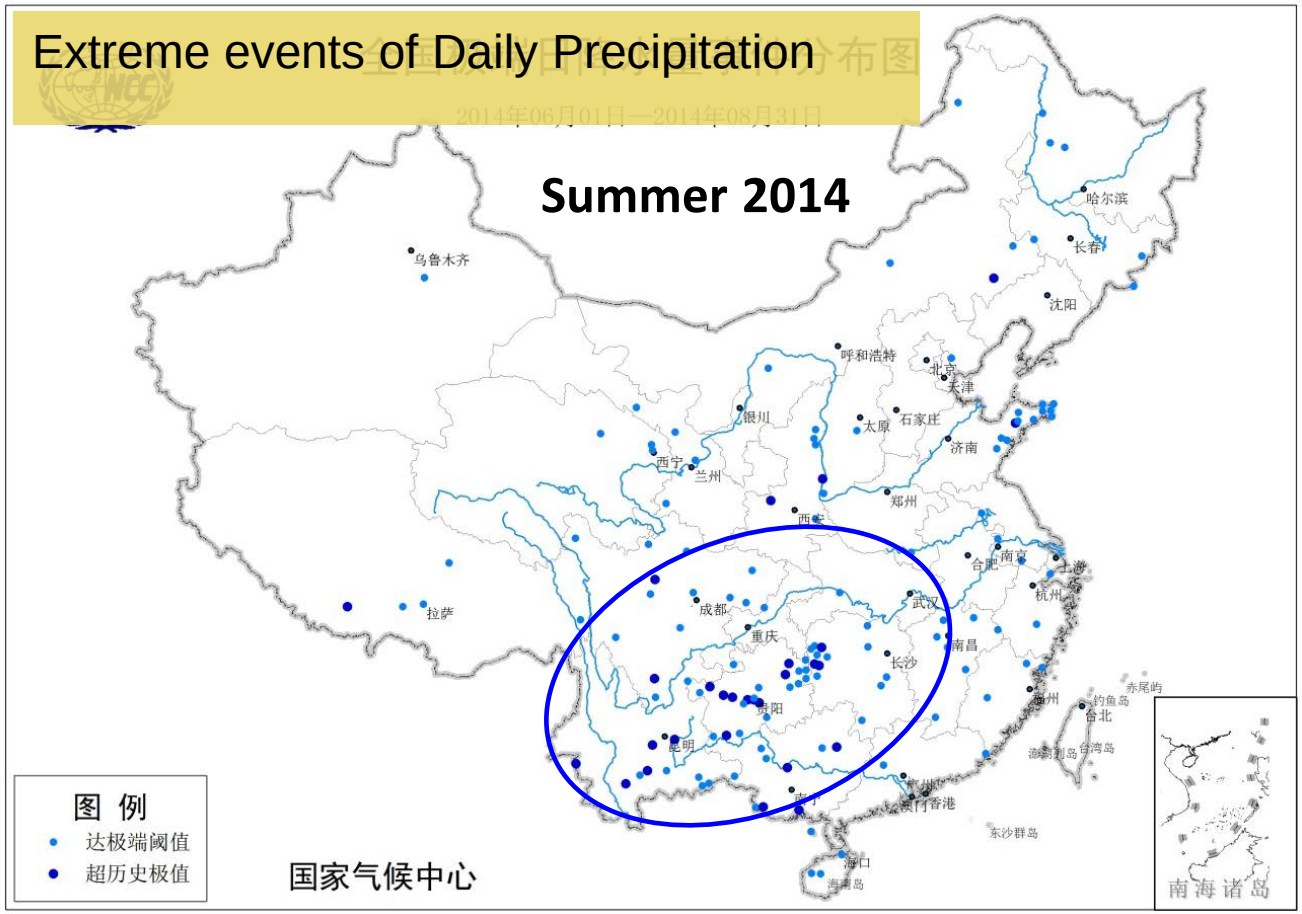
Northeast China (-23%); North China (-20%); Northwest China (-14%)

Precipitation in most part of the southern China was more than normal, *especially in the Jiangnan area and the eastern Southwest China, with the summer total rainfall amounts 20%~50% more than normal.*



Events of daily precipitation observed in China in 2014 Summer

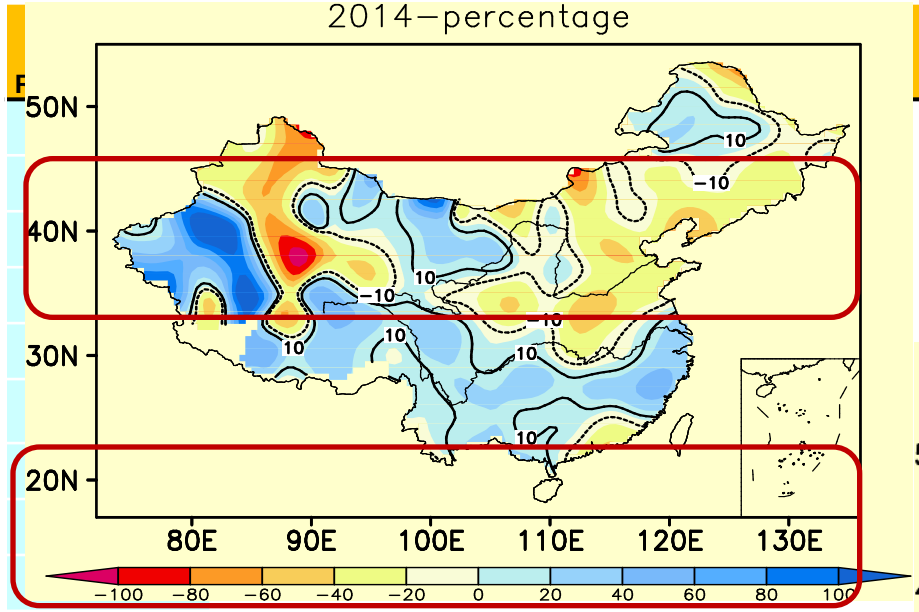
Frequency lower than normal, vast majorities occurred in the southern China



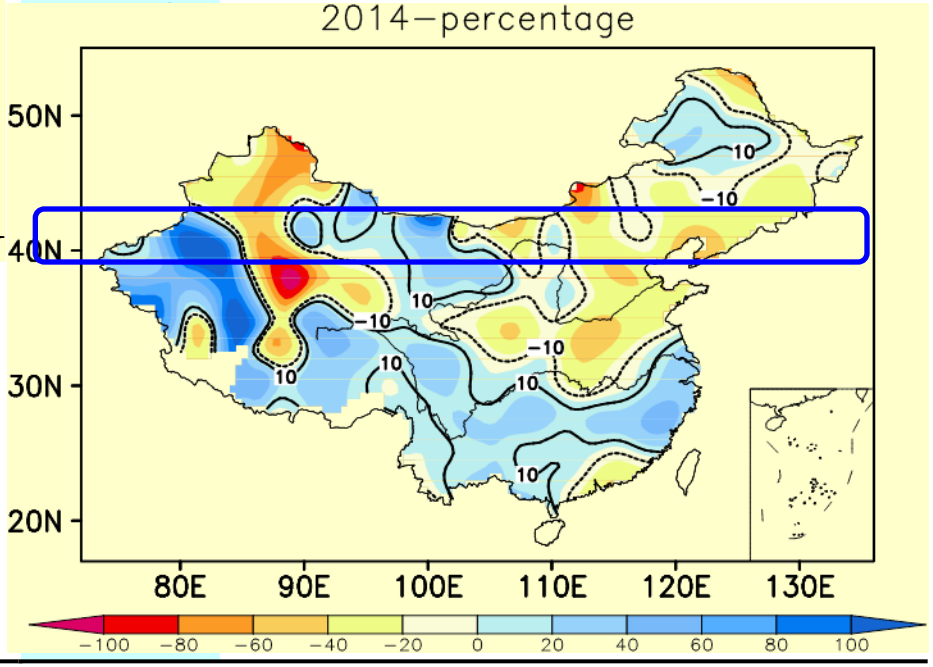
For the season, extreme DP events occurred in **138** stations of Sichuan, Yunnan, Guizhou, Hunan, Guangxi, Shanxi and Shandong, etc., with the daily precipitation of **28** stations breaking historical records, including Qizhou (380.5 mm) in Guangxi, Fenghuang (251.7 mm) in Hunan.

Overall, during summer of 2014,total precipitation over eastern China showed “more in South and less in North” feature.

Statistics Table1. Provinces (autonomous regions and municipalities) averaged seasonal temperature and precipitation characteristics in 2014 summer



Region	Variables T (℃)	TA (℃)	P (mm)	PAP (%)
Henan	25.9	-0.1	226.0	-44.3
Hubei	26.0	-0.7	416.6	-21.0
Hunan	26.6	-0.5	568.4	14.3
Guangdong	28.7	0.6	643.7	-19.9
Shanghai	25.6	-1.0	653.4	31.2
Jiangsu	25.3	-0.9	546.3	5.6
Zhejiang	26.5	-0.5	744.9	31.0
Anhui	25.5	-1.0	552.7	-0.8
Fujian	27.6	0.7	736.8	16.3
Jiangxi	27.5	-0.1	652.2	13.2
Shandong	25.3	0.0	264.1	-34.3



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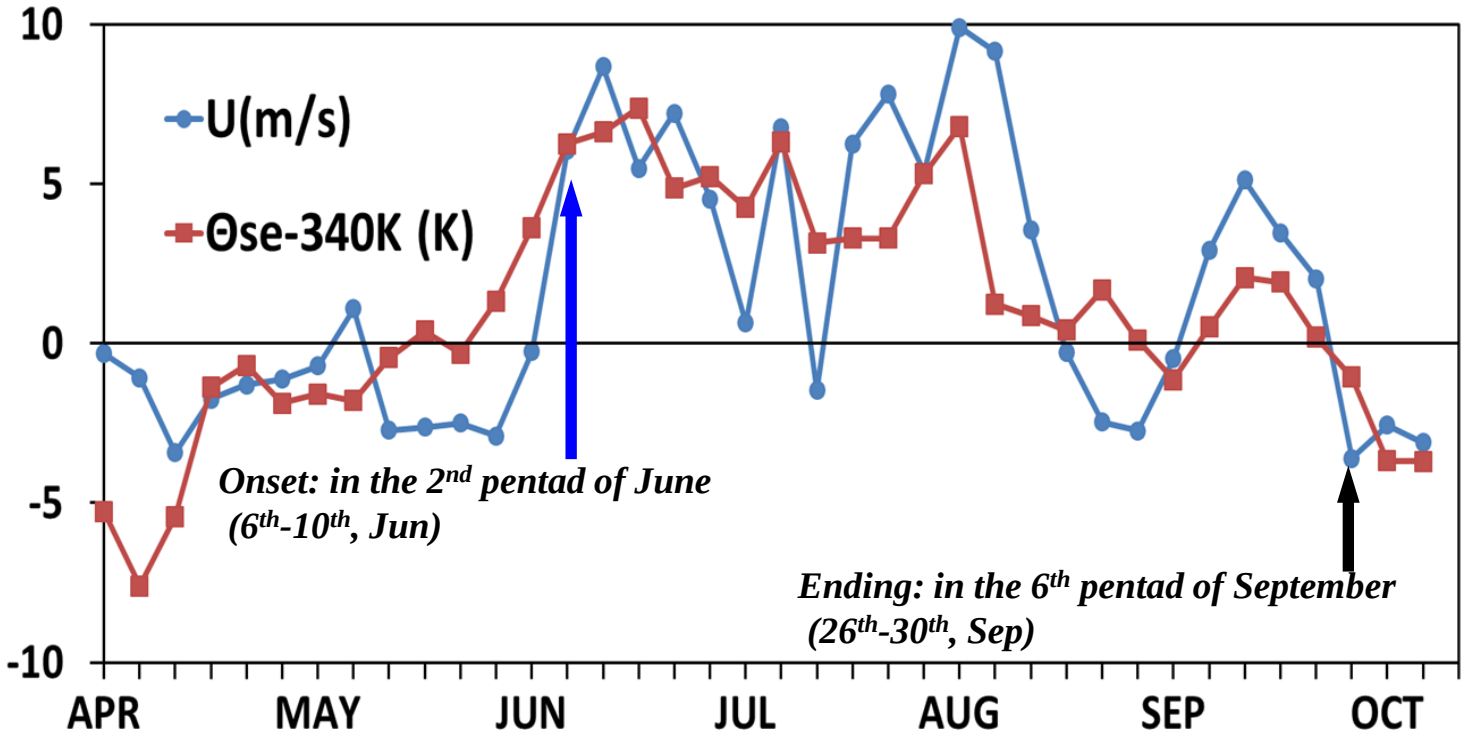
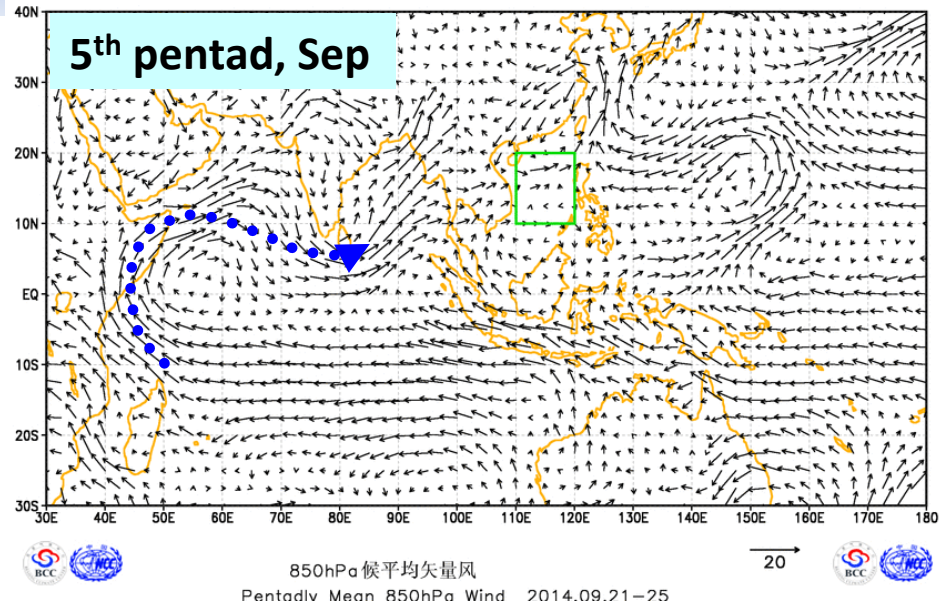
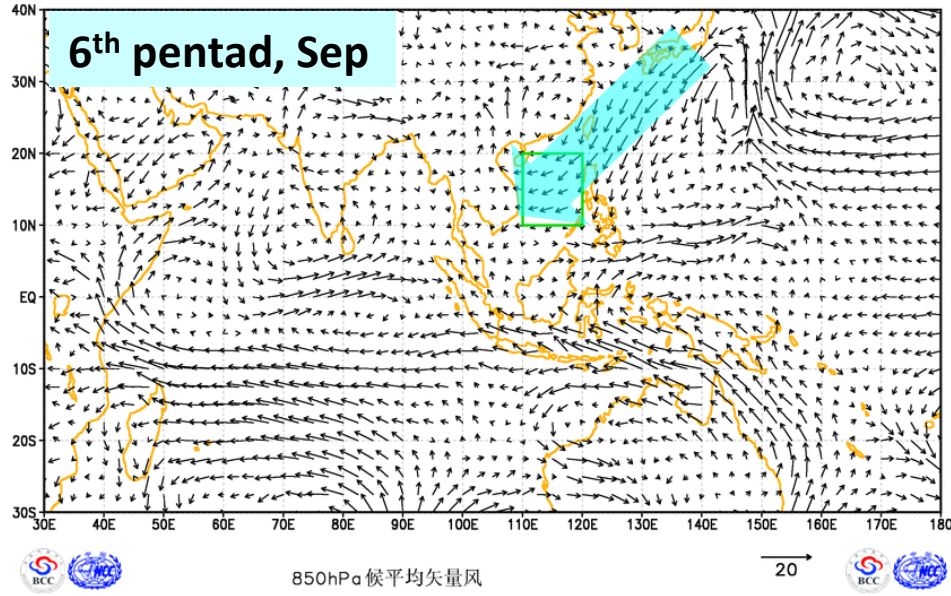
2014 South China Sea (SCS) summer monsoon

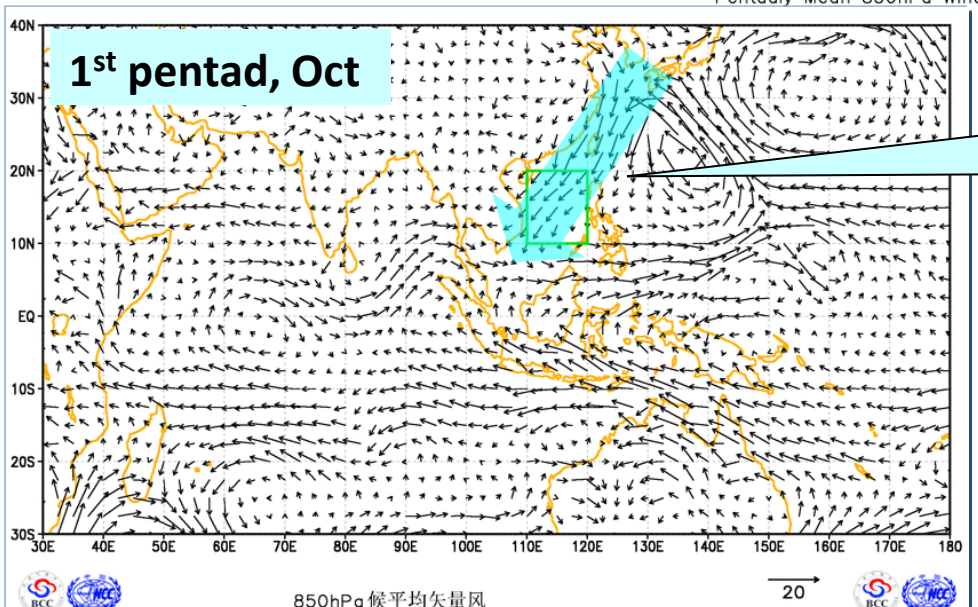


Pentadly mean zonal wind (unit: m/s) and potential pseudo-equivalent temperature (unit: K) over the SCSSM monitoring region in 2014

850hPa wind vector evolution in the ending process of SCS summer monsoon in the lower troposphere

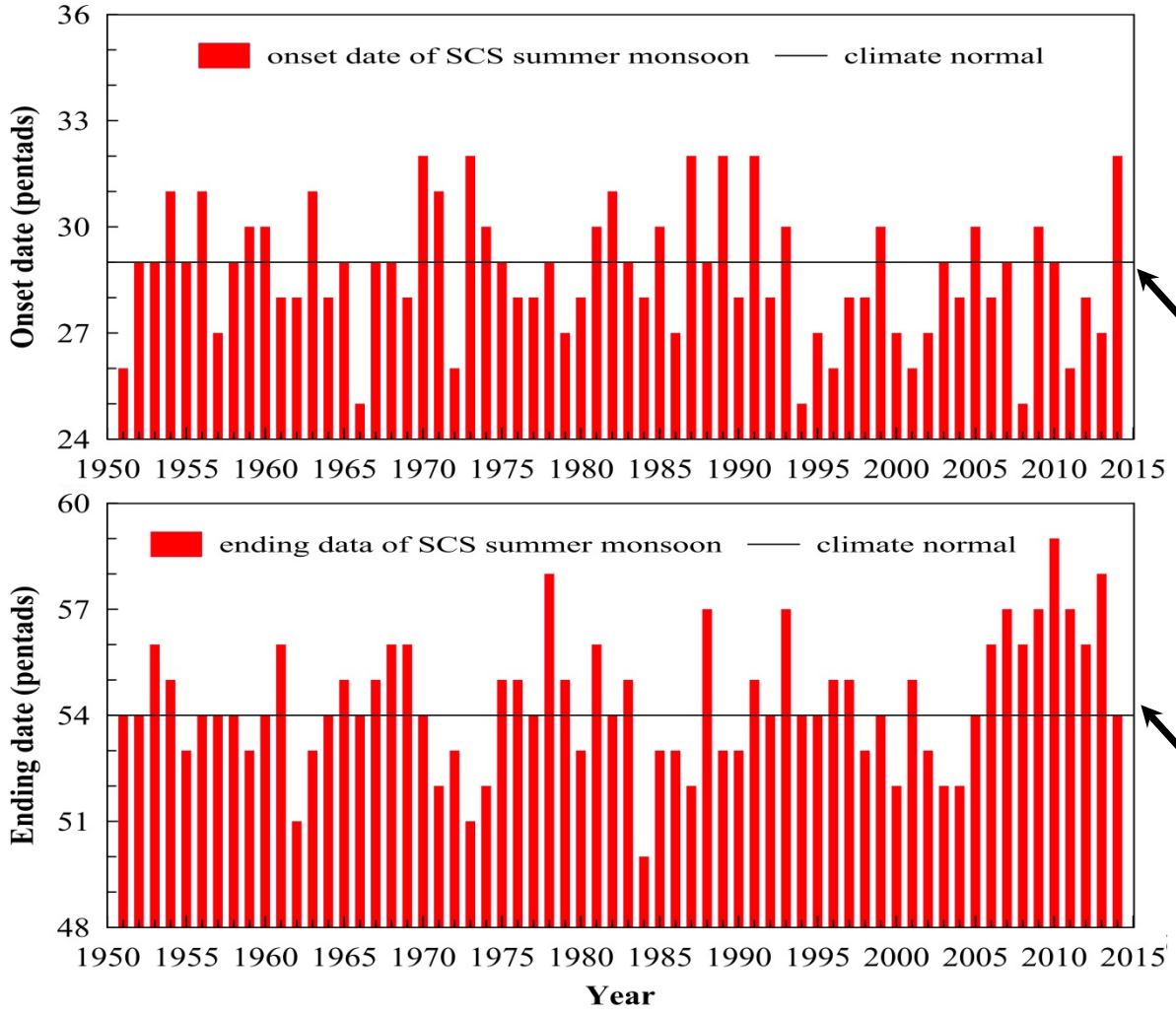






Northeasterly wind

2014 South China Sea (SCS) summer monsoon



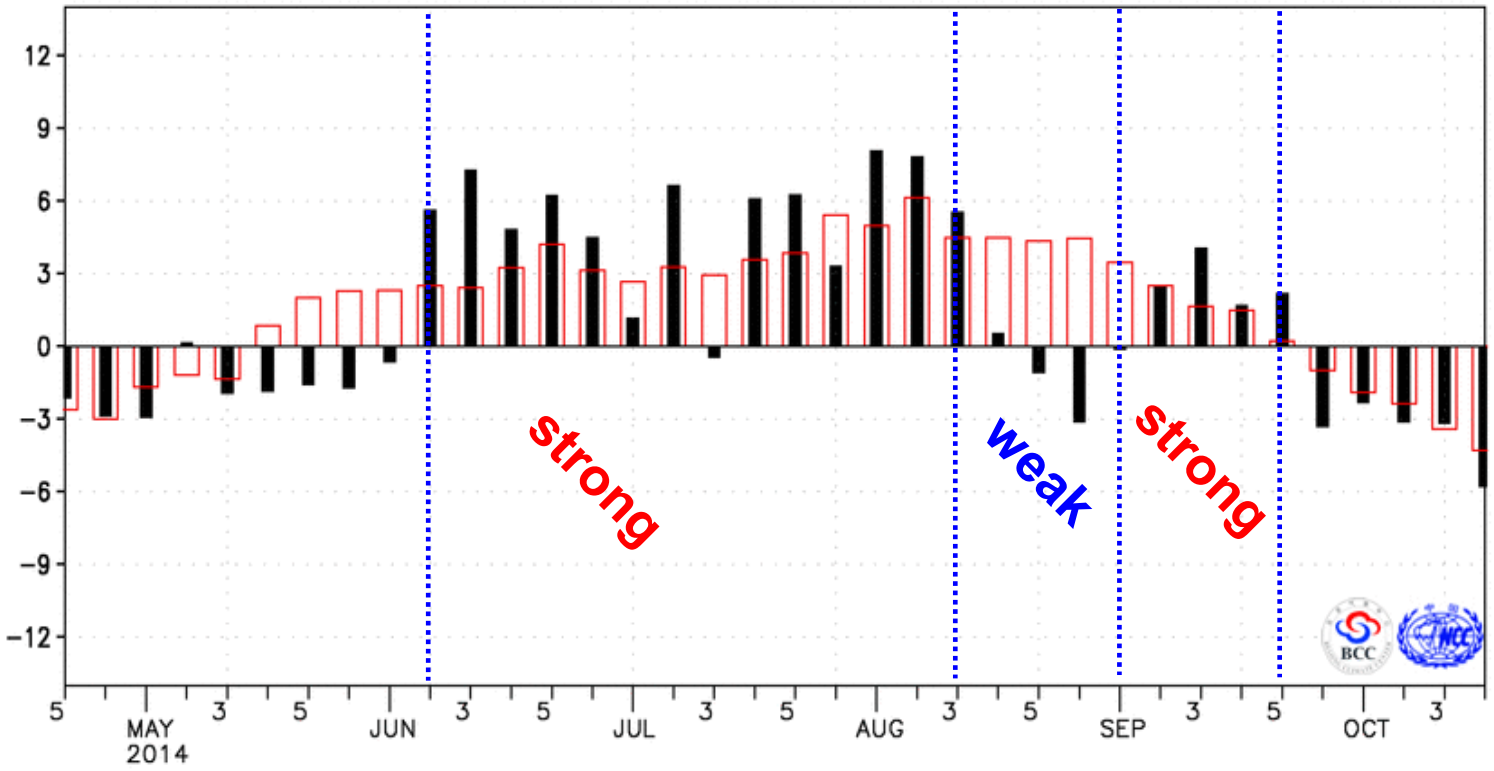
Climatology : onset in the 5th pentad of May

Climatology : ending in the 6th pentad of Sep

Onset (up) and ending (down) date of SCS summer monsoon from 1951 to 2014

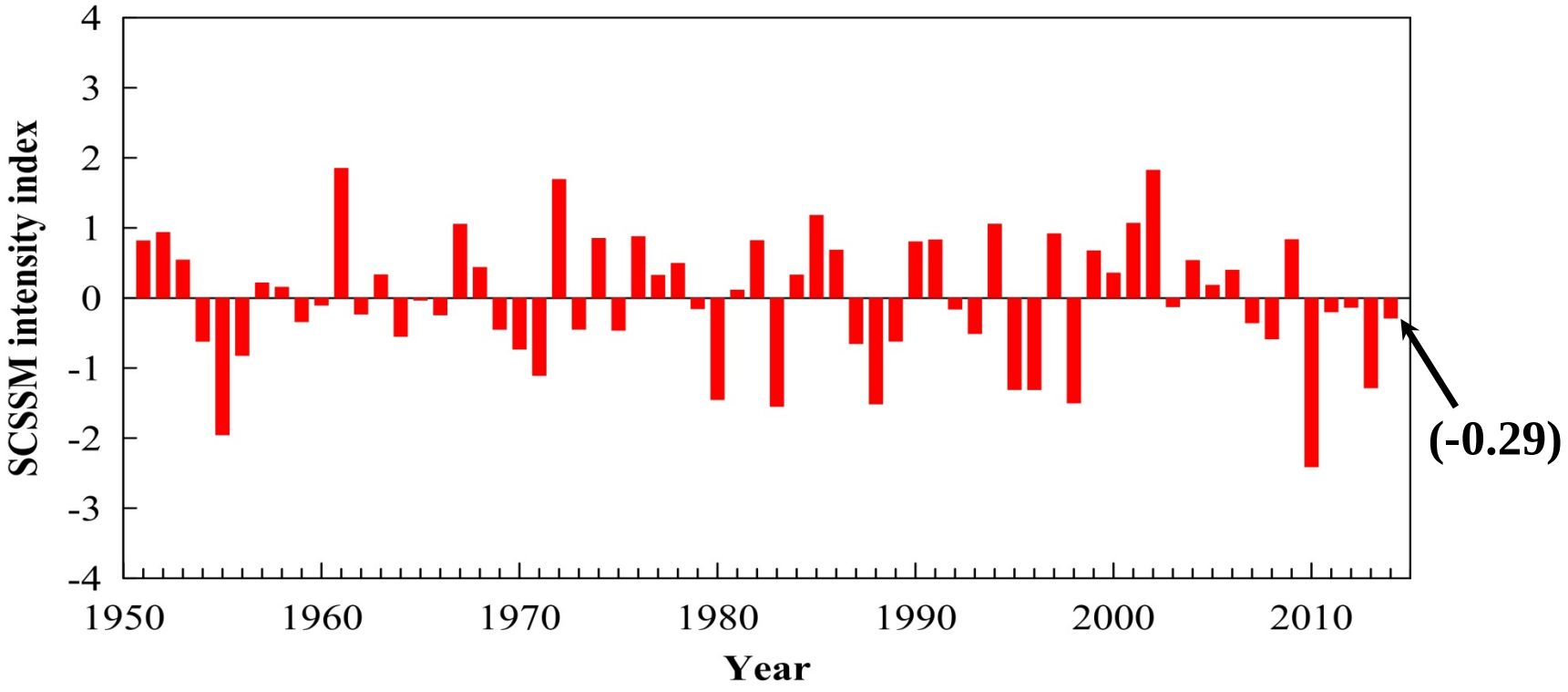
Variation of the zonal wind index (unit: m/s) over the monitoring region (10-20ºN, 110-120ºE）

(Red bars for climatology conditions)



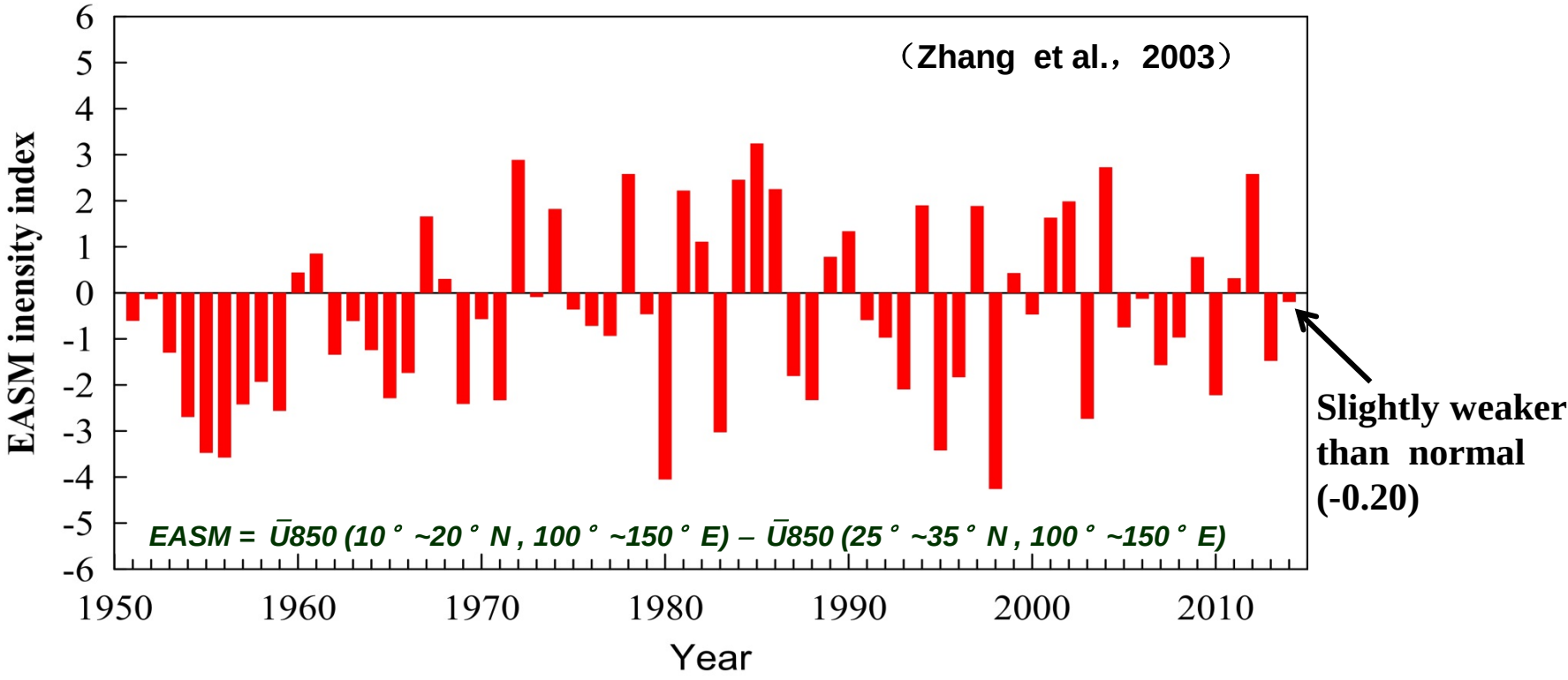
The SCS summer monsoon was stronger from 2nd pentad of June to 3rd pentad of August, while extremely weaker during 4th pentad of August and 1st pentad of September, then became slightly strong from 3rd to 5th pentad of September.

Annual variation of the SCS summer monsoon intensity from 1951 to 2014



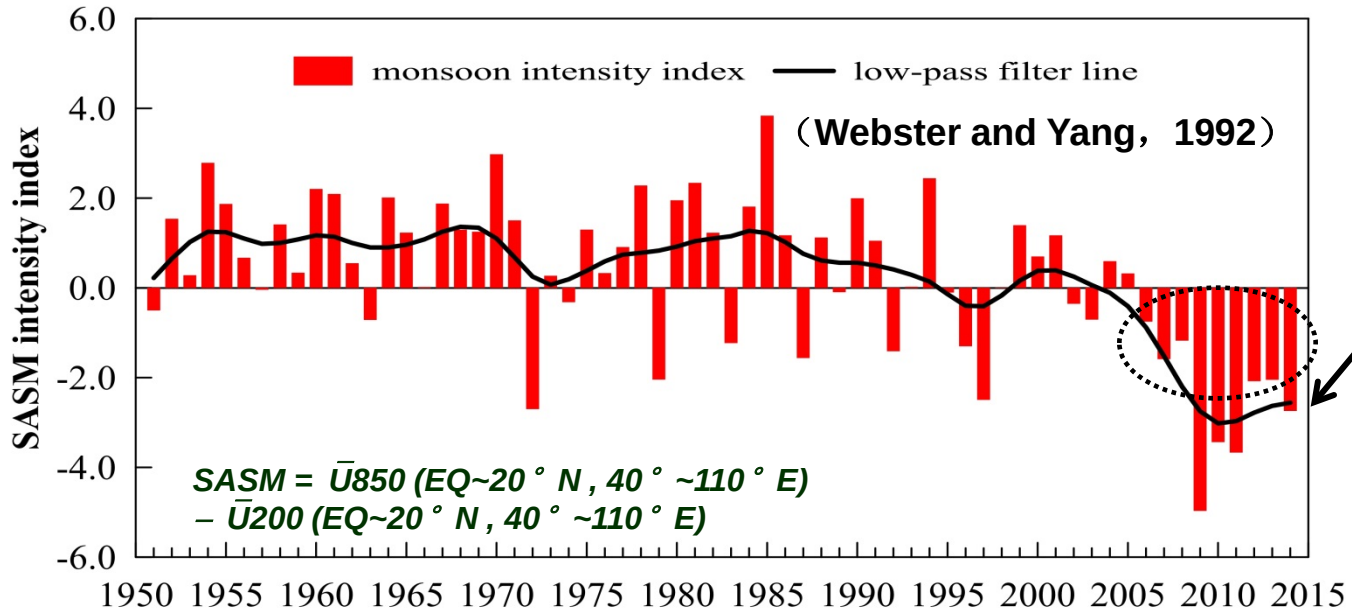
Intensity of the 2014 SCS summer monsoon was a bit weaker than normal.

2014 East Asia subtropical summer monsoon

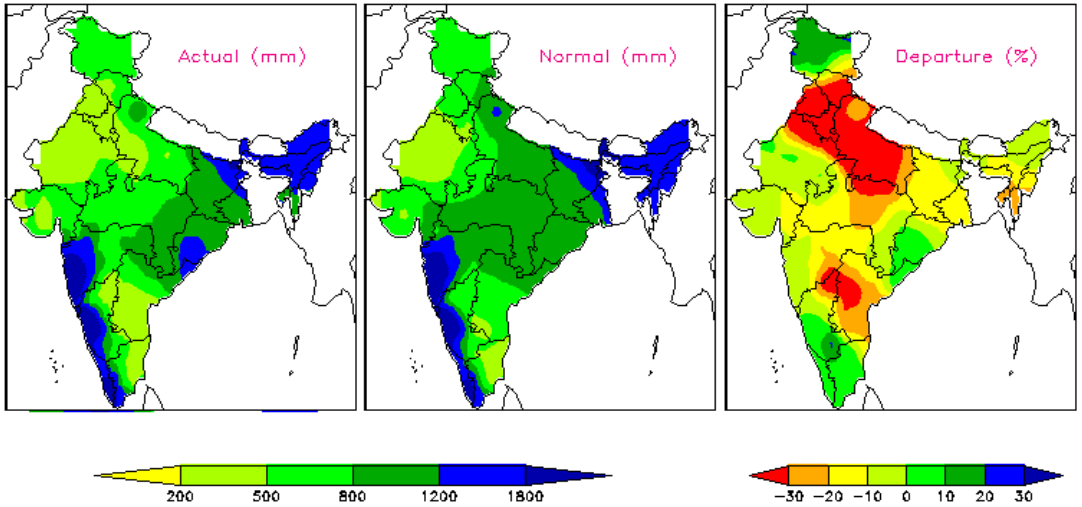


Annual variation of the East Asia subtropical summer monsoon intensity from 1951 to 2014

2014 South Asia summer monsoon

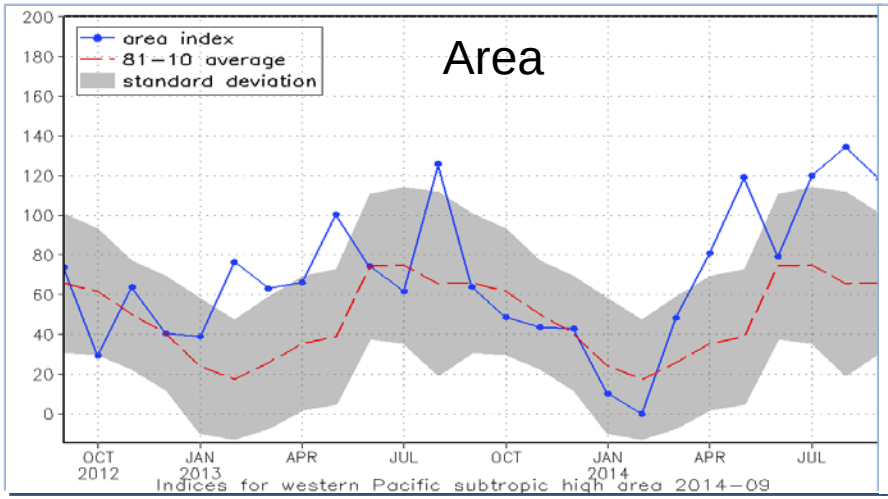


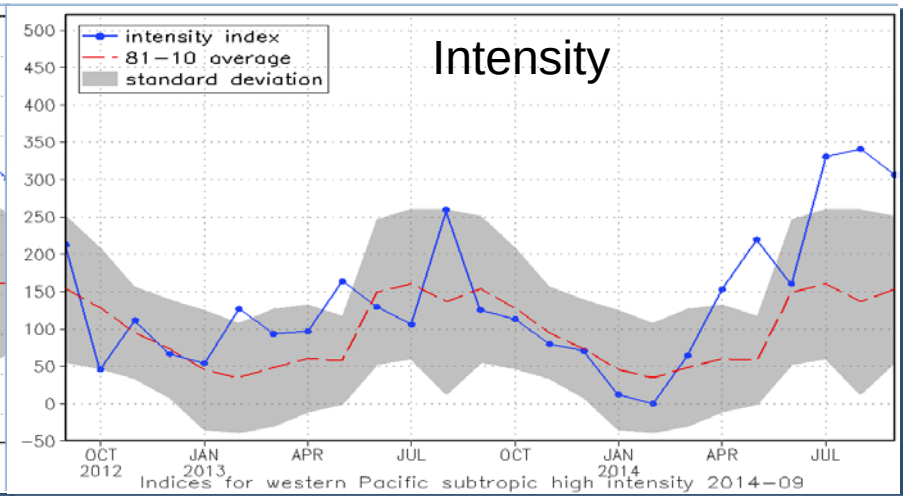
Significantly weaker than normal; (-2.74)

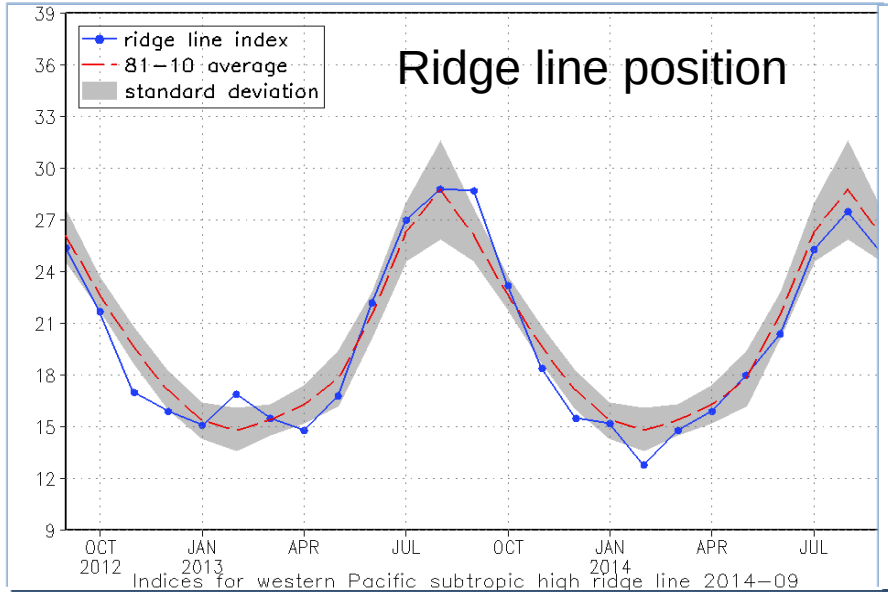


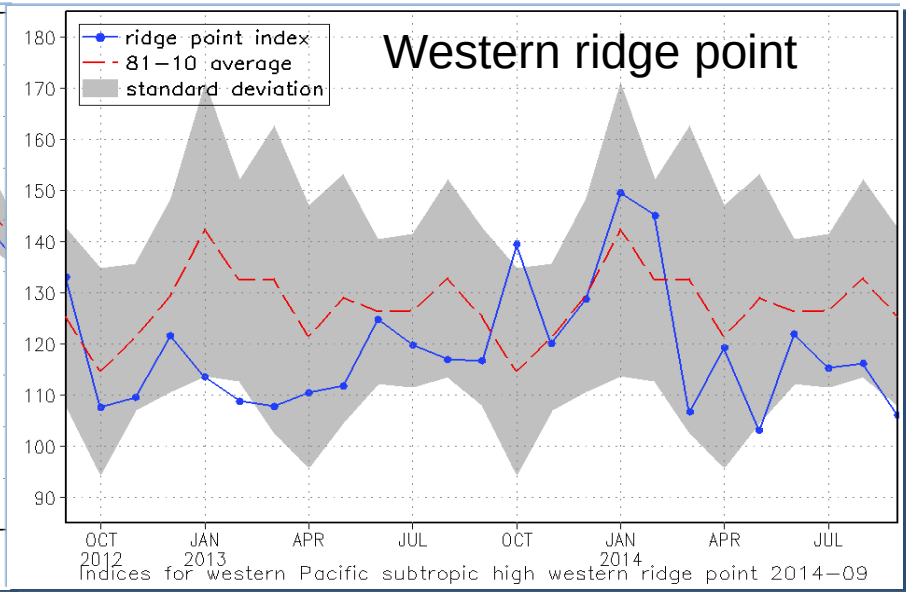
All-India Summer Monsoon Rainfall, -12.5% less than normal in 2014.

Indices of the western Pacific subtropical high (WPSH)

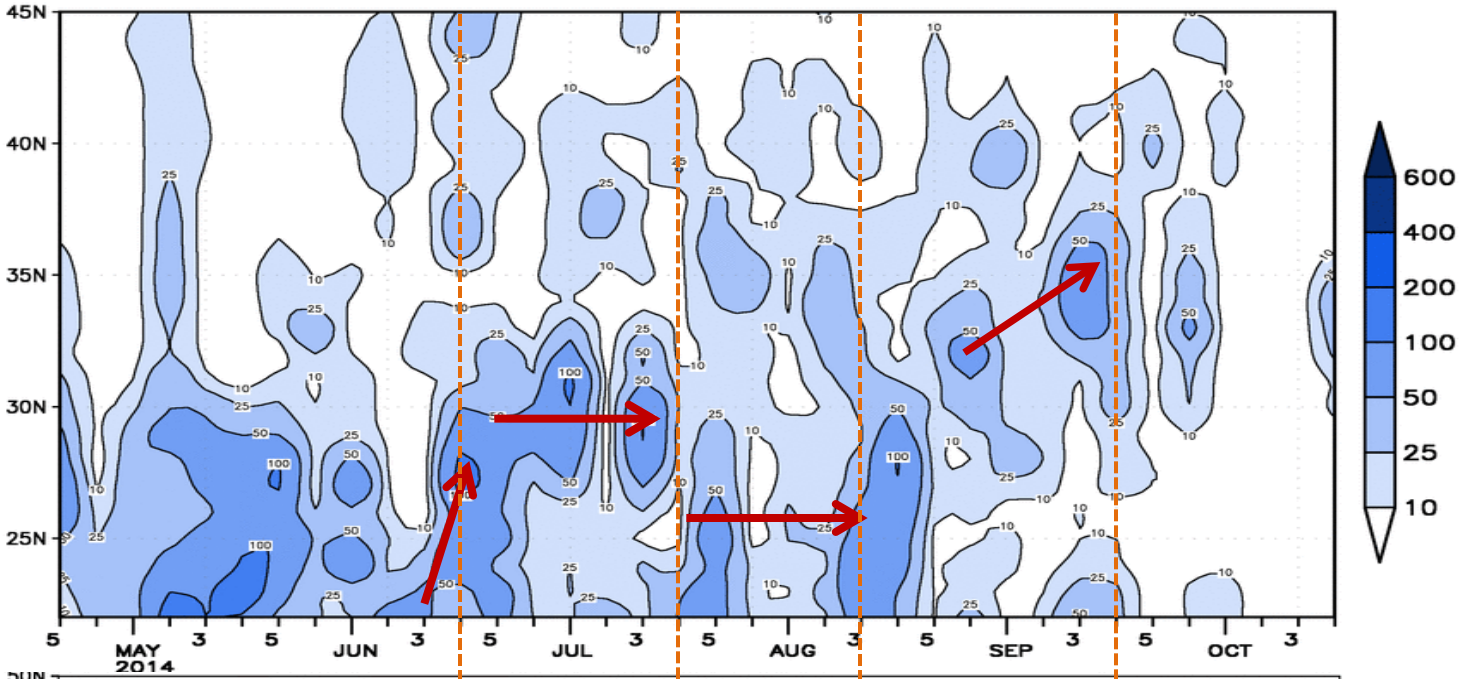








Time-latitude cross section of pentad precipitation over the eastern China (110°-120° E)



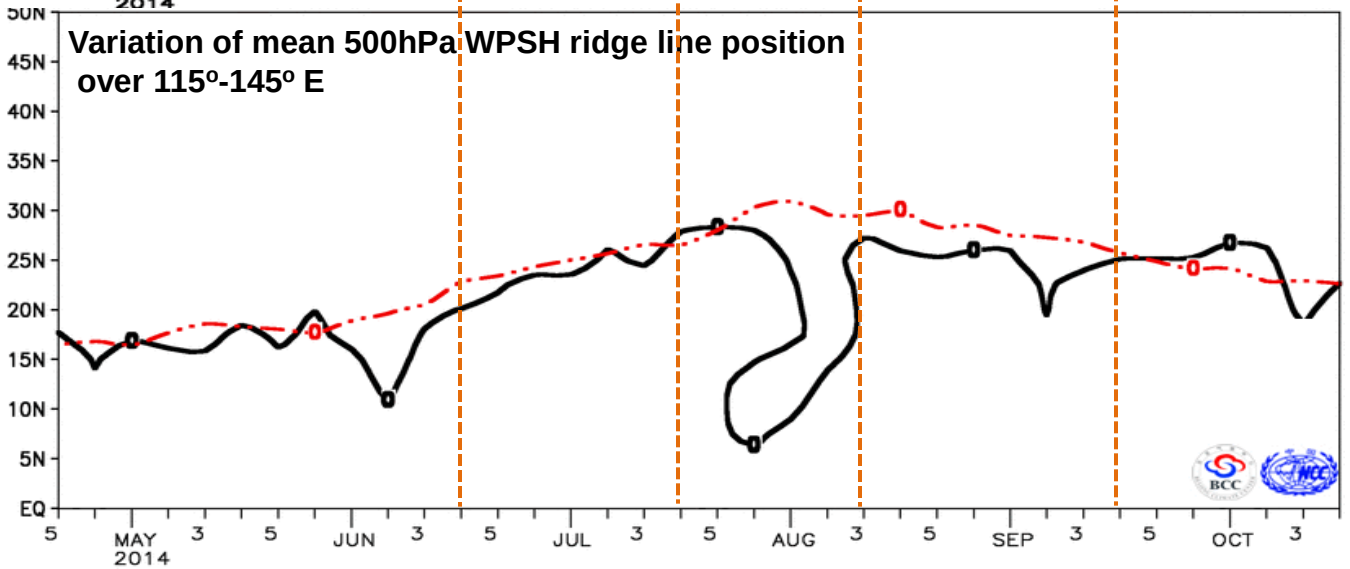


Table2. Summary of China Rainy Seasons in 2014

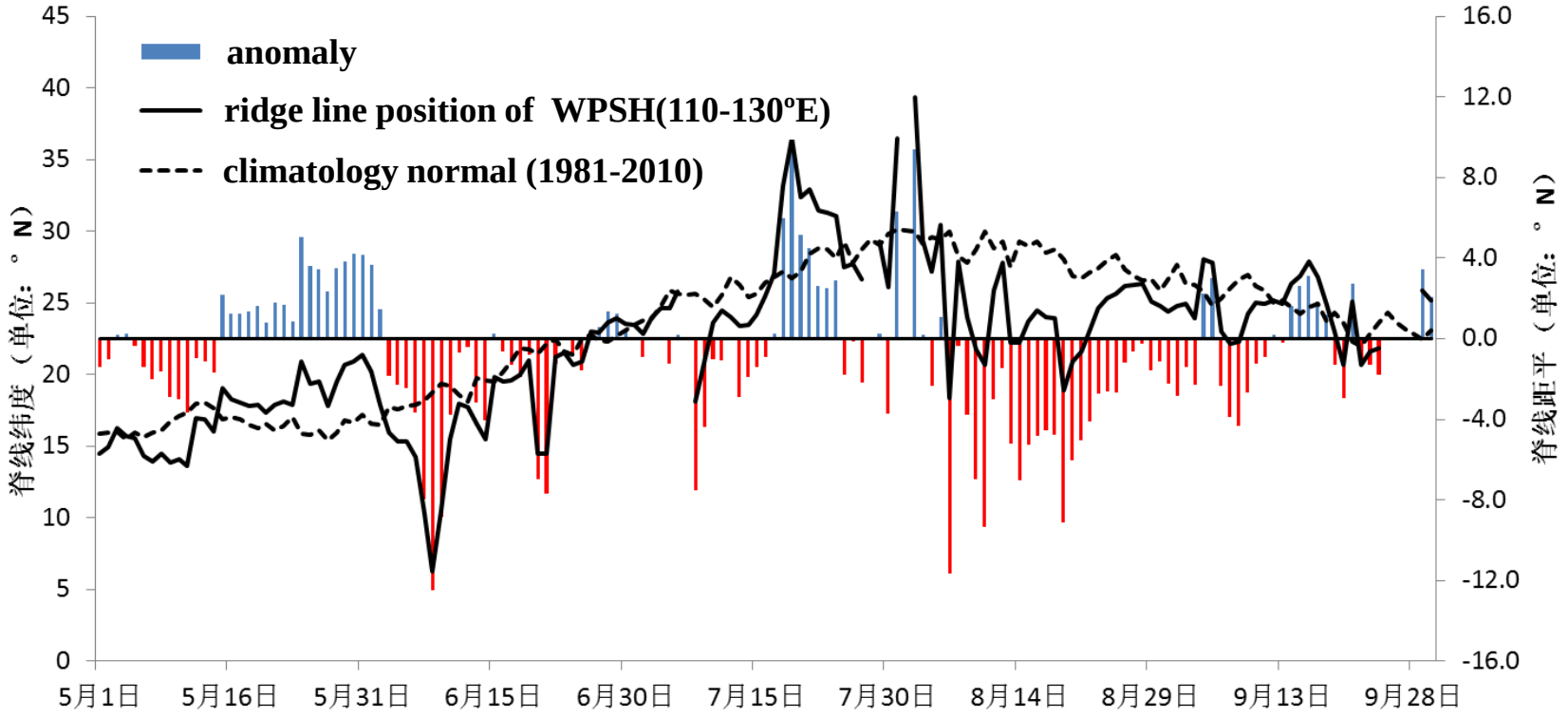
Region	Starting date	Ending date	Duration（days）	Total precipitation (mm) and anomaly percentage (%)
Pre-summer rainy period in South China	**30 March**	**7 July**	**99**	**831.9 (+13.7%）**
Meiyu (Plum-rain season)	**16 June**	**20 July**	**34**	**318.6 (-7.2%）**
Rainy season in North China	——	——	——	**No significant PCP**
Rainy season in southwestern China	**7 June**	**8 October**	**123**	**754.6 (-11.1%）**
Autumn rain in western China	**9 September**	**Not yet over**	——	**181.4** ↑

Conclusions

- **In 2014 summer, mean temperature over China was slightly higher than normal. The averaged precipitation over China was a bit less than normal, while extreme events of daily precipitation occurred in parts of the southern China.**
- **The 2014 SCS summer monsoon broke out in the 2nd pentad of June, 3 pentads later than normal, ending on its normal date (the 6th pentad of September). The intensity of the SCS summer monsoon and East Asia subtropical summer monsoon were slightly weaker than normal, while South Asia summer monsoon was significantly weak.**
- **Influenced by the East Asia monsoon activities and WPSH, total precipitation over eastern China showed "more in South and less in North" feature.**

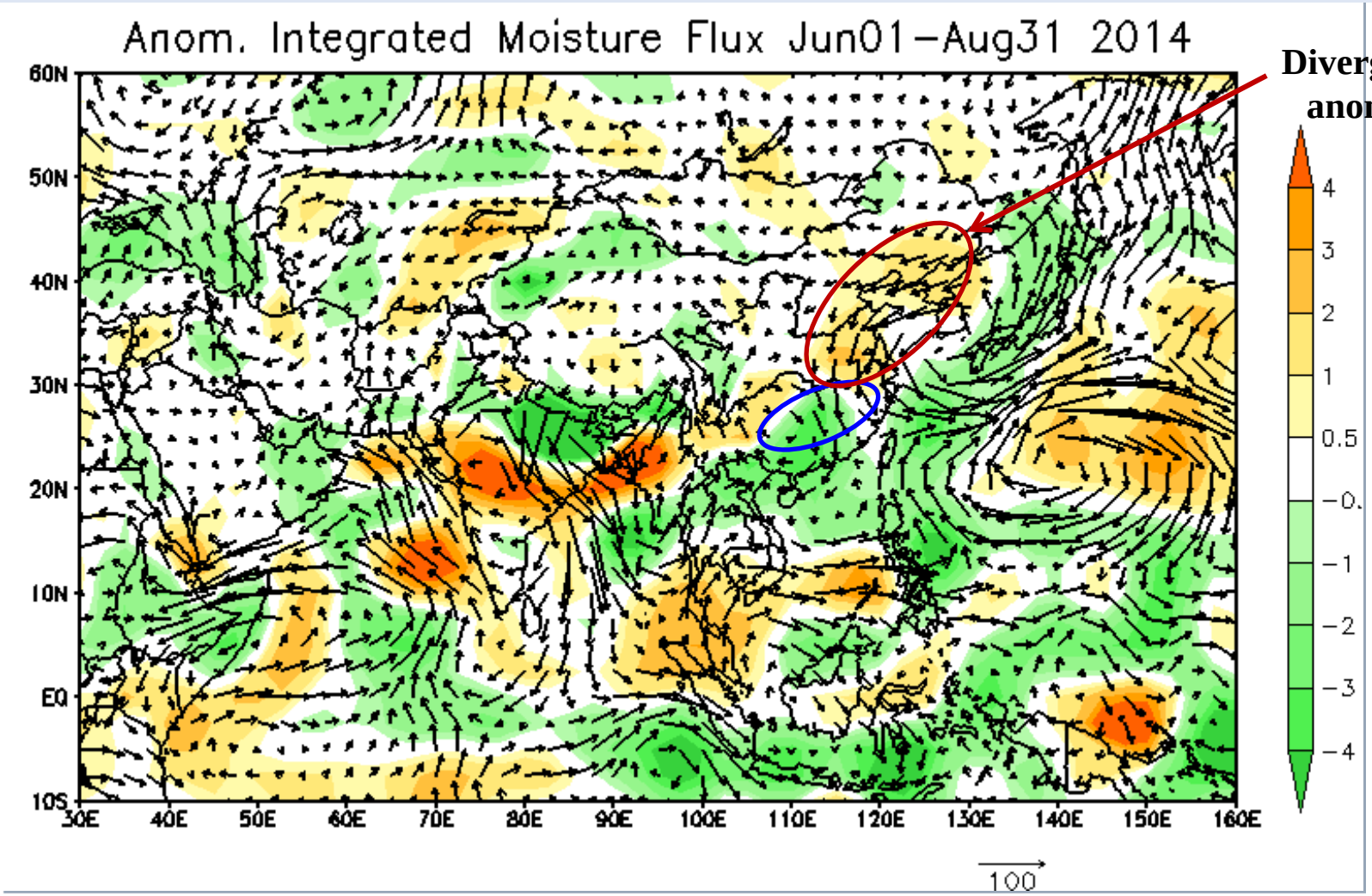
Thank you for attention !

Why “more in South and less in North ” precipitation over eastern China in the past summer?



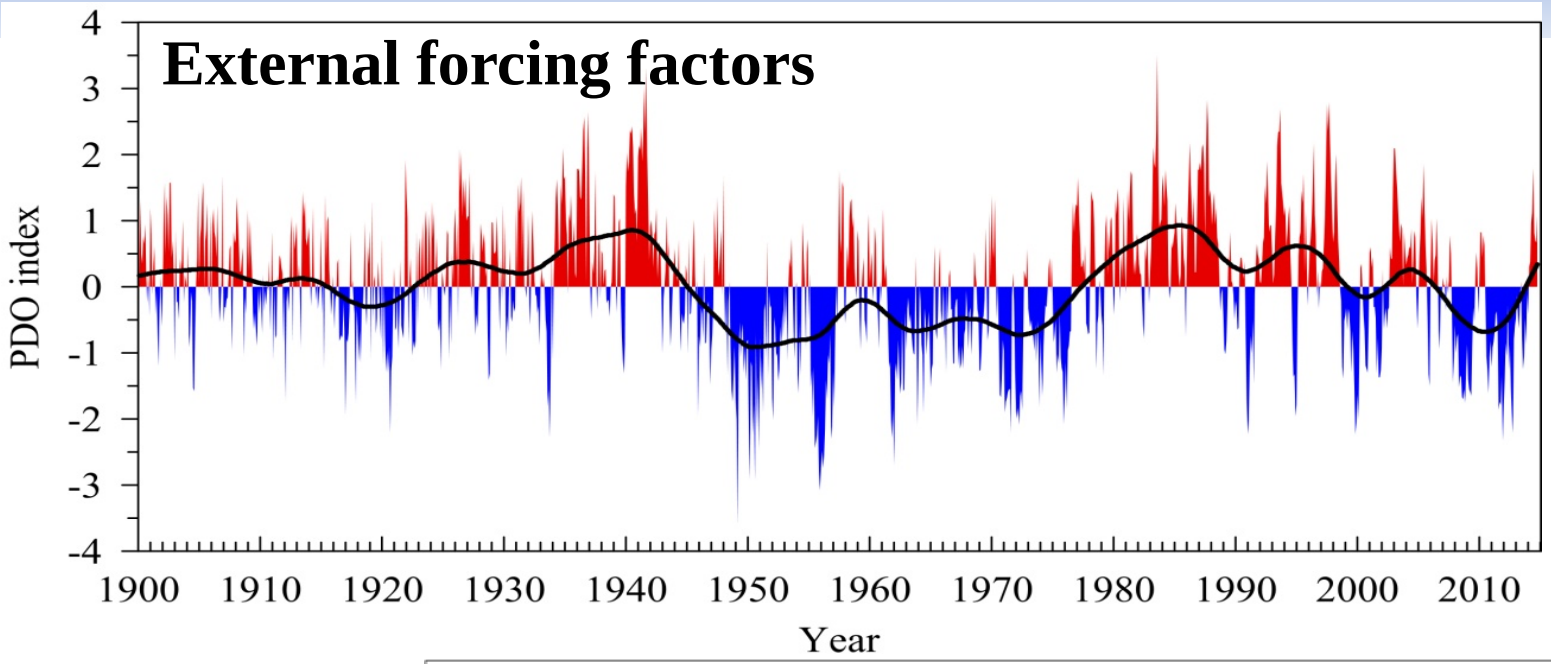
Atmospheric circulation anomalies： weaker East Asian summer monsoon ; WPSH ridge line position persistently southward in summer.

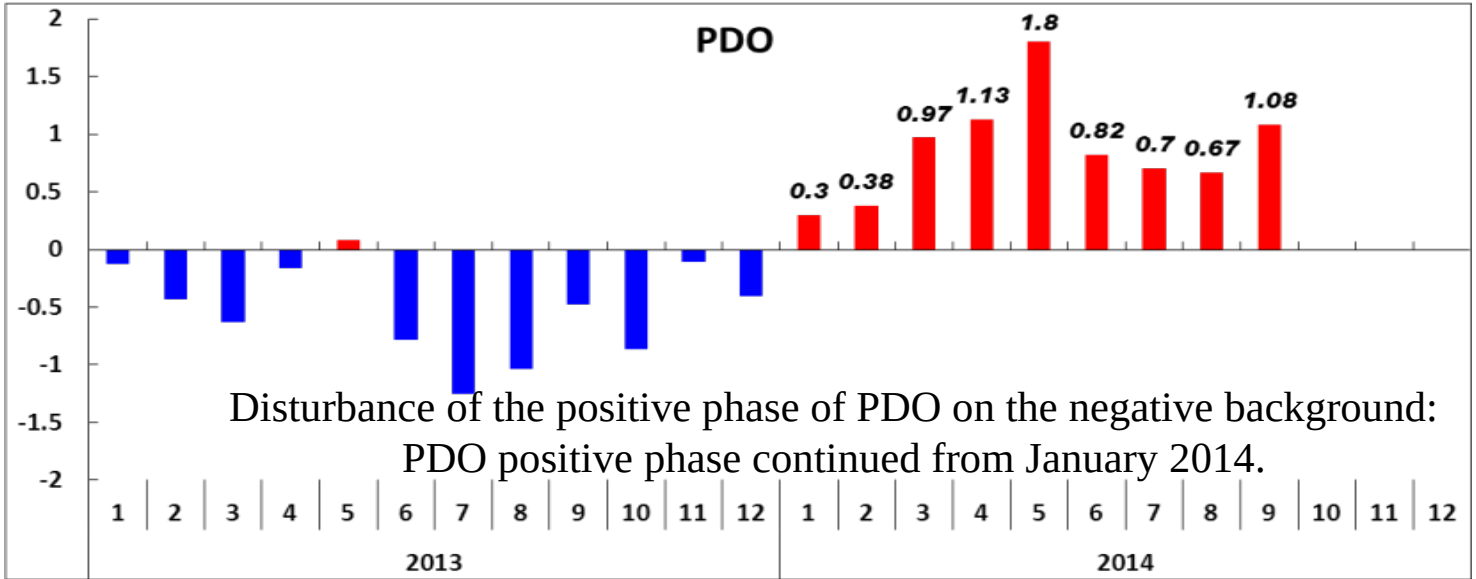
Why “more in South and less in North ” precipitation over eastern China in the past summer?



Moisture flux transport anomalies [vector, kg/(m.s)] and divergence of moisture flux transport anomalies [shaded areas, unit: 10^{-6}kg/(m^2.s)]vertically integrated from surface to 300hPa in 2014 summer

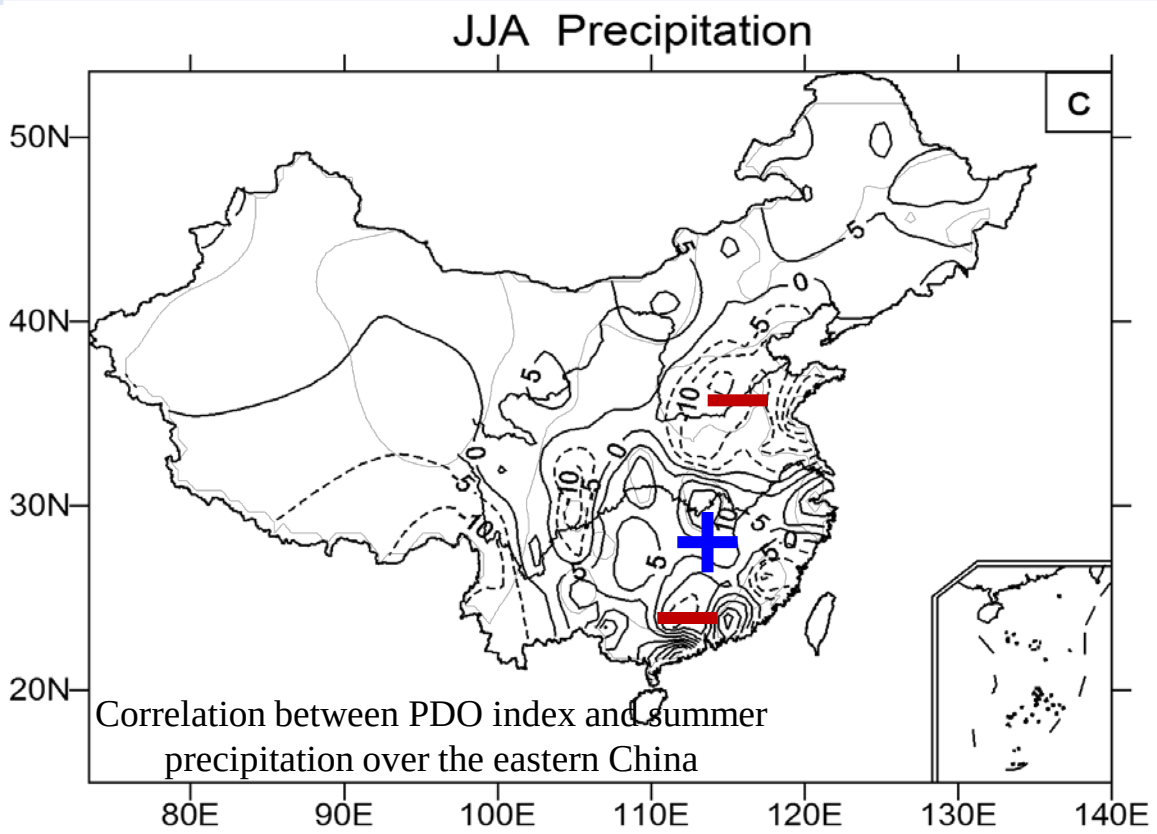
Why “more in South and less in North ” precipitation over eastern China in the past summer?





Disturbance of the positive phase of PDO on the negative background: PDO positive phase continued from January 2014.

Why “more in South and less in North ” precipitation over eastern China in the past summer?

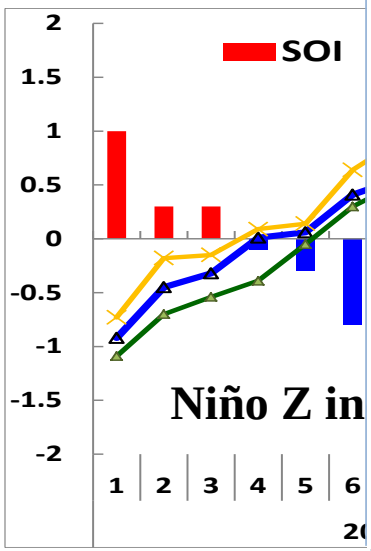


Correlation between PDO index and summer precipitation over the eastern China

PDO Positive phase → **weak EASM**; **WPSH westward;stronger** → **More precipitation along the Yangtze river and Jiangnan; less in North China and South China in summer**

Why “more in South and less in North ” precipitation over eastern China in the past summer?

	Niñ 1+
May	1.3
June	1.7
July	1.3
August	1.2
September	0.9
October	0.6



Niño Z in

气候监测快报

2014 年第 49 期（总第 168 期）

A new El Niño event developed!

国家气候中心　　气候监测室　　2014 年 10 月 29 日

一次新的厄尔尼诺事件已形成

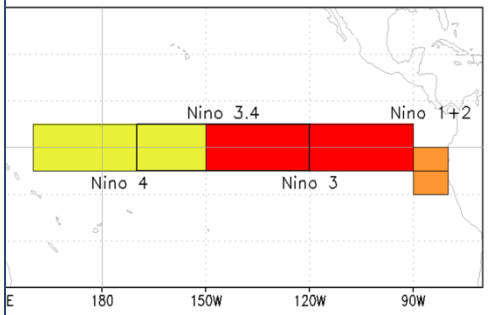
摘要：国家气候中心最新 ENSO 监测表明，2014 年 5-10 月 Nino Z 区海表温度距平指数已连续 6 个月达到或超过 0.5℃；7-10 月南方涛动指数（SOI）也已连续 4 个月为负值。10 月以来，Nino Z 指数为 0.6℃，SOI 指数为-0.7，赤道中东太平洋次表层为异常暖水覆盖，并已向上抬升至表层。上述特征表明，一次新的厄尔尼诺事件于 2014 年 5 月开始、10 月形成。预计未来 3 个月本次厄尔尼诺事件将持续发展，并可能于 2014 年 12 月达到峰值。

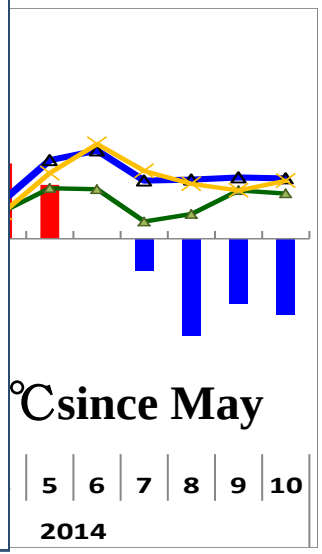
一、近期 ENSO 演变分析

1）海表温度分布特征

2014 年 4 月，赤道中东太平洋海温迅速上升导致 ENSO 中性状态结束并进入暖水状态。5-10 月，Nino Z 区海表温度距平指数连续 6 个月达到或超过 0.5℃，6 个月指数之和为 3.8℃。10 月（截至 27 日），Nino Z 指数为 0.6℃，Nino1+2、Nino 3、Nino 4、Nino 3.4 指数分别为 0.7℃、0.6℃、0.6℃和 0.4℃（图 1）。从空间分布看，10 月以来，赤道中东太平洋大部

rnal forcing factors





℃since May

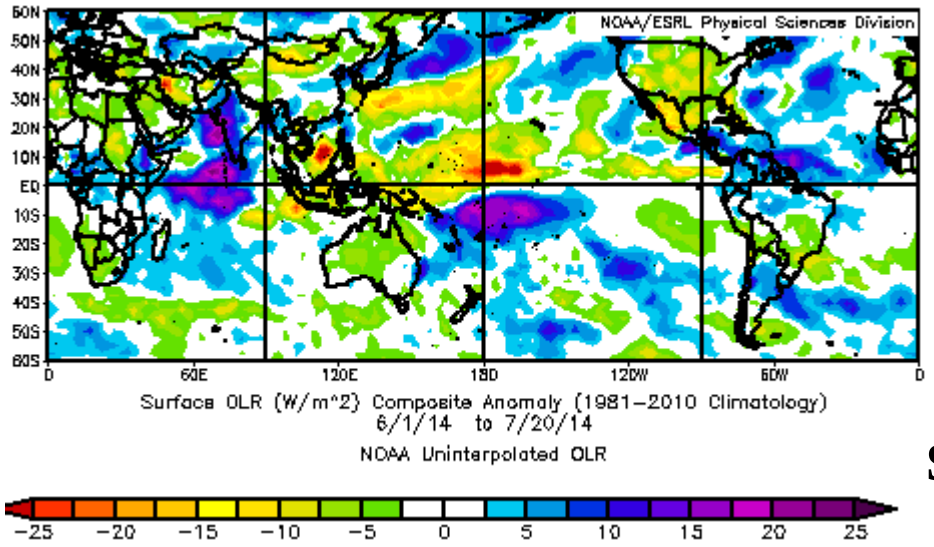
5 6 7 8 9 10

2014

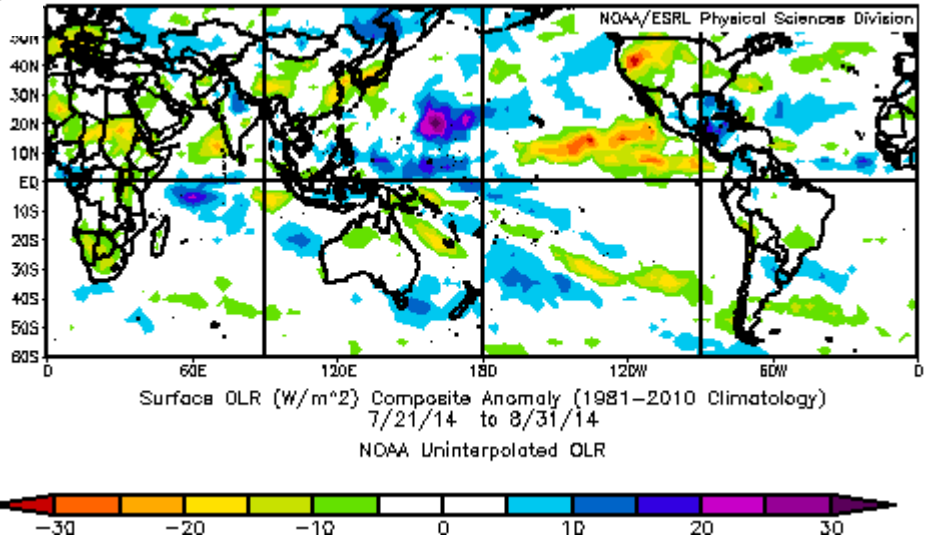
Why “more in South and less in North ” precipitation over eastern China in the past summer?

—*Atmospheric responses to El Niño status*

Surface OLR anomaly（Jun to mid-Jul)



Surface OLR anomaly（late Jul to Aug)



The tropical atmosphere responsed to El Niño status since late July.