Characteristics of 2014 summer climate over South Korea

October 30, 2014

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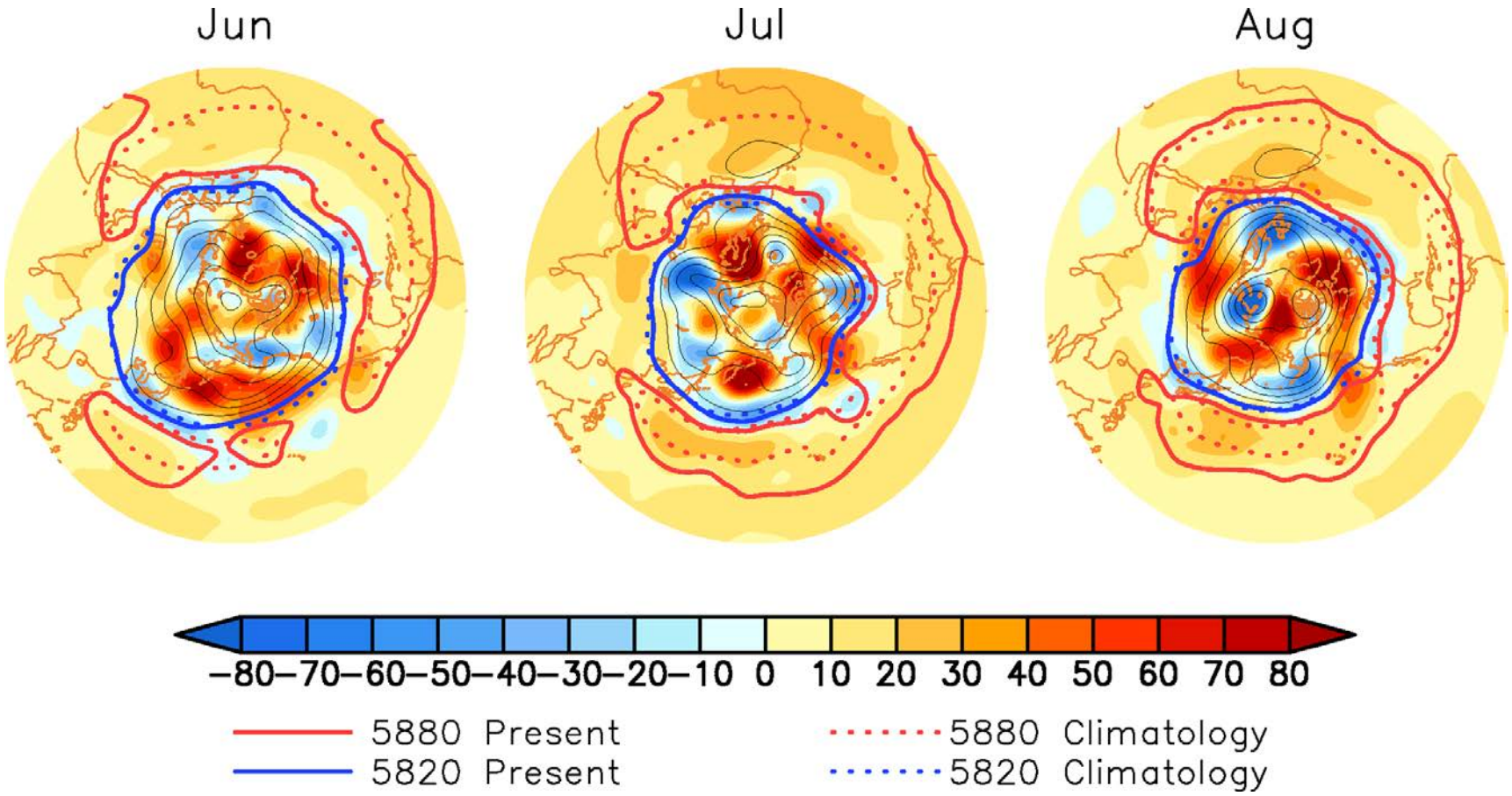
Contents

2014 Northern Hemisphere Circulation

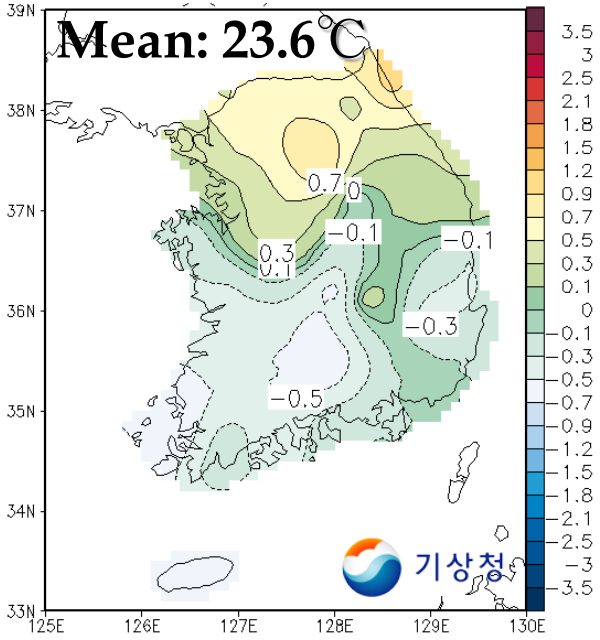


Shadings: GPH anomaly at 500hPa, climatology: 1981-2010

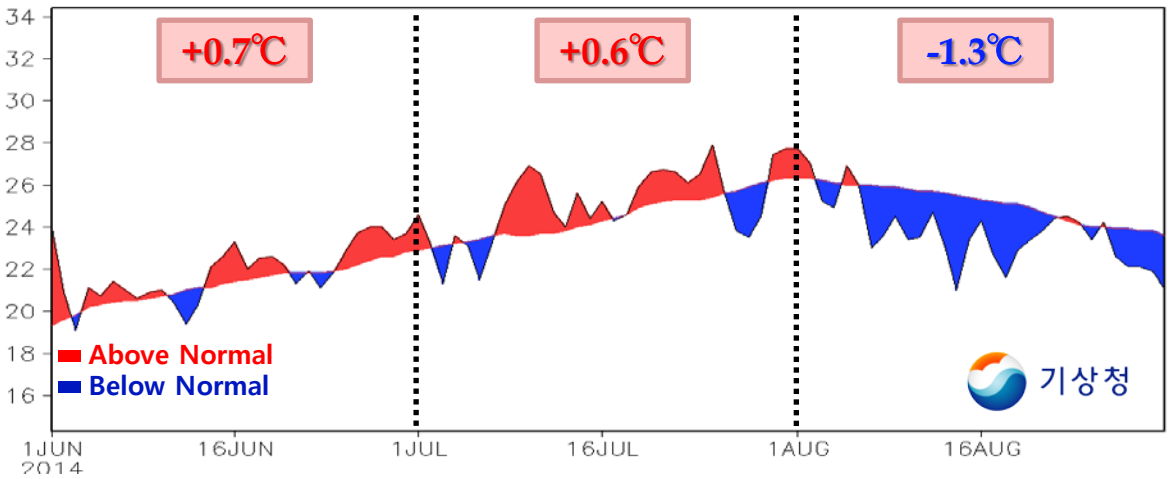
Temperature

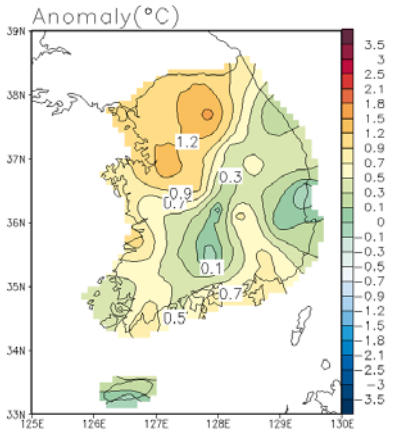
JJA

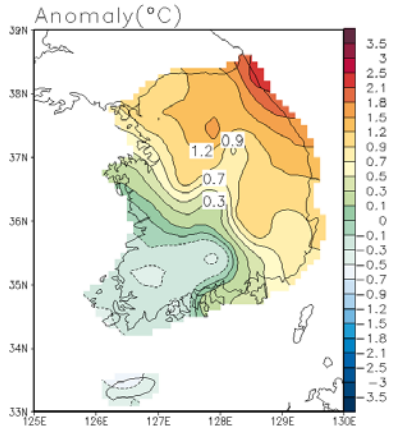
anomaly: 0.0℃

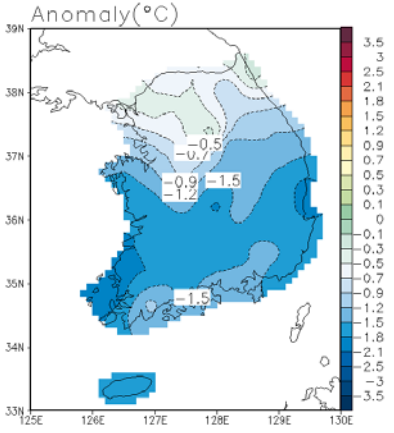


June July August









precipitation

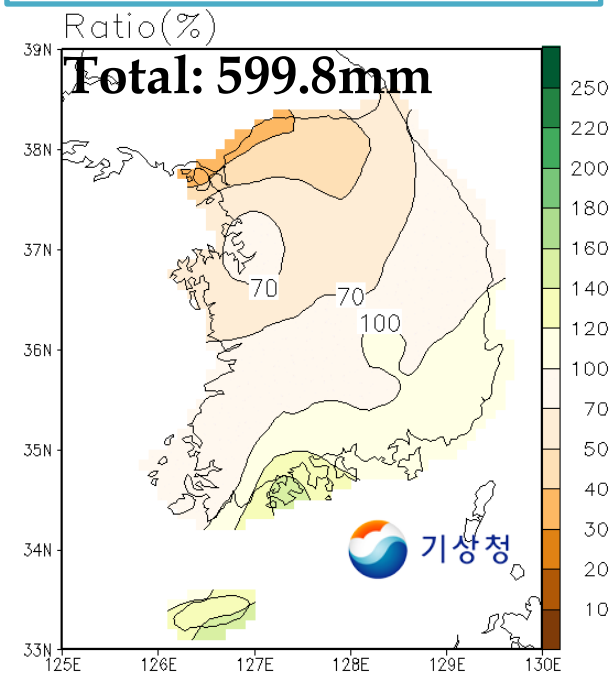
JJA

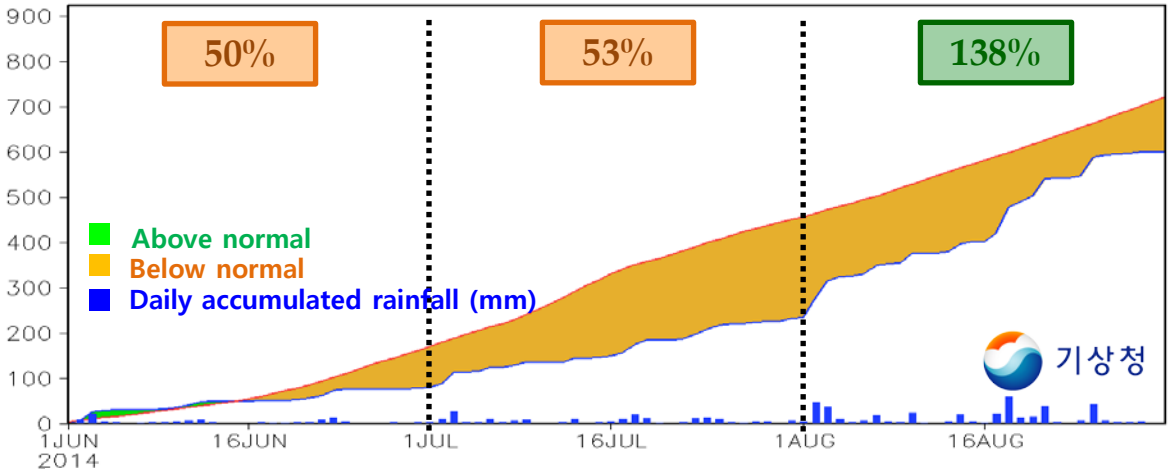
June

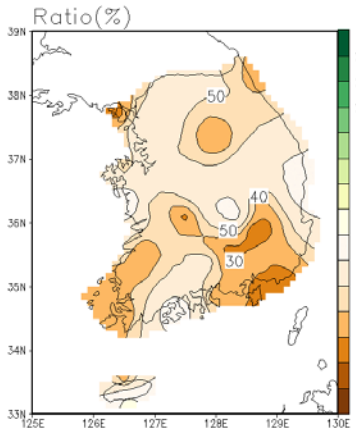
July

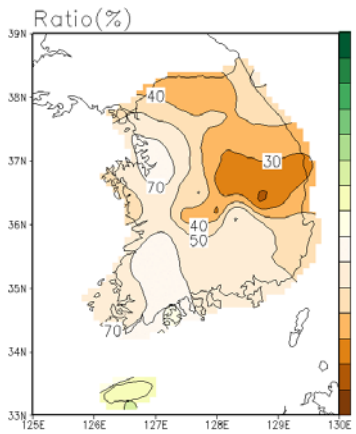
August

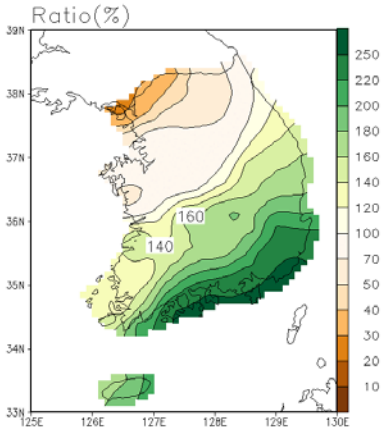
Ratio to normal: 84%



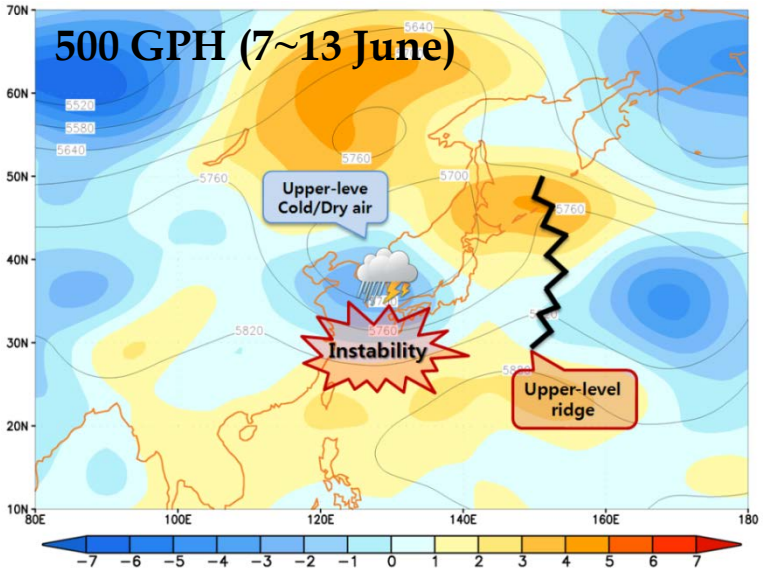








Atmospheric Instability in June



고양에서 '용오름' 관측

지난 10일 오후 7시 20분께 경기도 고양시 장월·나들목 인근 한강둔치에서 평소 보기 어려운 용오름이 관측됐다. 국내에서 용오름이 관측된 것은 이번이 여덟 번째로 과거에는 울릉도와 제주도 인근 해역에서만 관측됐고 육지에서 용오름은 처음이다. 사진은 고양시민이 집 근처에서 촬영한 용오름. 뉨

◇지난 10일 구슬만 한 우박'작은 사진)이 내려 철원군 동송읍 장흥리 이원우씨의 고추, 토마토밭 등이 큰 피해를 입었다. 철원=이정국기자

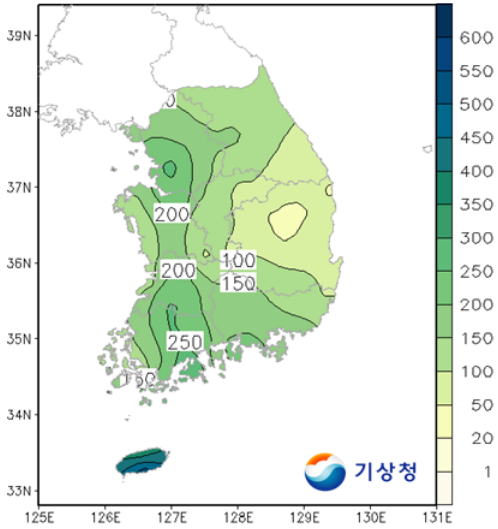
구슬만 한 우박의 공습 … 농가 날벼락

- During 7 to 13 June, the upper-level ridge developed over the Sea of Okhotsk → the cold and dry continental upper air over the Korean Peninsula → Severe atmospheric instability → The heavy rainfall frequently over central and southern regions of South Korea during this period.
  - The crops and vegetable were damaged by a torrential hailstorm in some provinces on 10 June.
  - A tornado was observed at the Il-san province on 10th June.

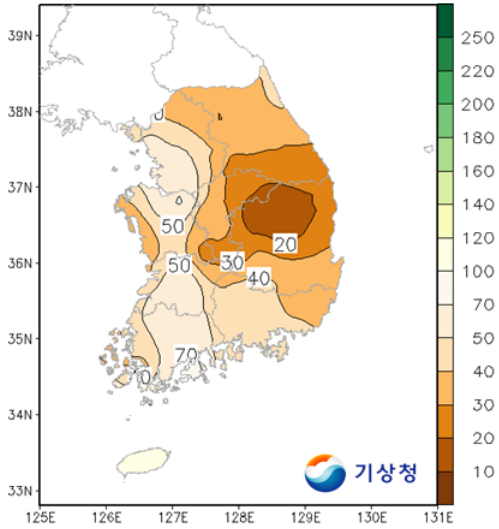
Onset and retreat of Changma

Region	Onset		Retreat		precipitation	
	2014	Normal	2014	Normal	2014	Normal
Central	7.2	6.24~25	7.29	7.24~25	145.4	366.4
Southern	7.2	6.23	7.29	7.23~24	145.9	348.6
Jeju	6.17	6.19~20	7.28	7.20~21	441.5	398.6
Korea					158.2	357.9

Total precipitation (mm)



Ratio to normal (%)



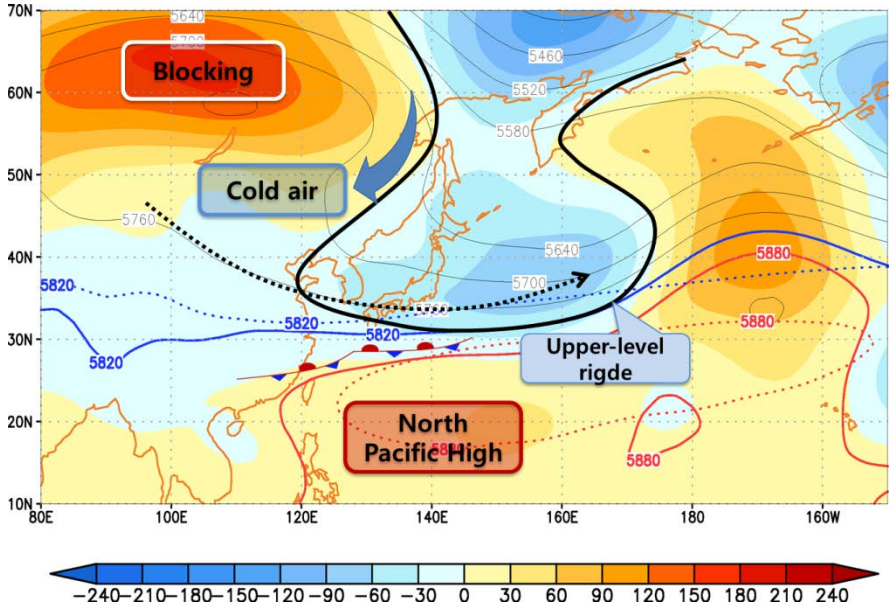
- The Changma front started on 2 July and ended on July 29 in the southern and central part of South Korea, which represents late onset and retreat Changma over those regions.

- Total amount of Changma rainfall was 158.2mm, which was less than half of normal precipitation.

Cause of late Changma

2014 Changma

Mean(2014. 6.18~6.24)



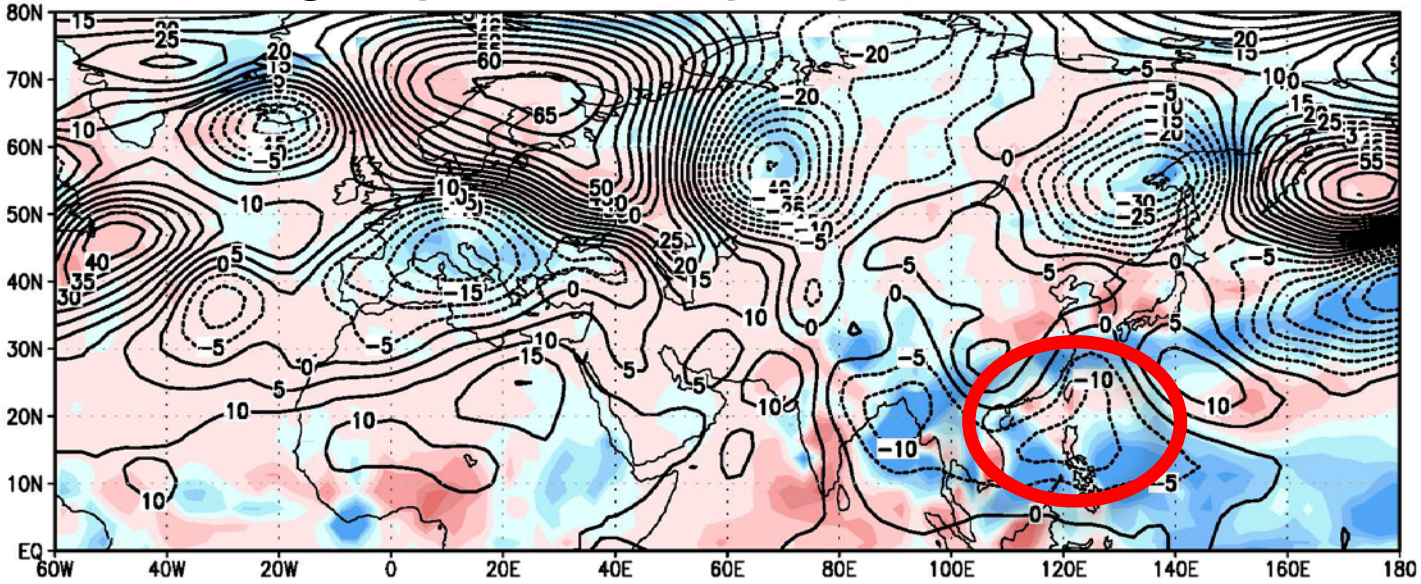
Shadings: GPH anomaly at 500hPa

• Upper-level high in the eastern Lake Baikal and Bering Sea
→Slow atmospheric flow
→Upper-level trough penetrated deep into southern part of Japan.
→Changma front was not able to move northward to southern and central regions.

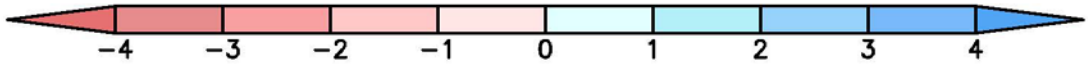
Below normal Changma Rainfall

2014 Changma

2014 Changma period mean precipitation and HGT850

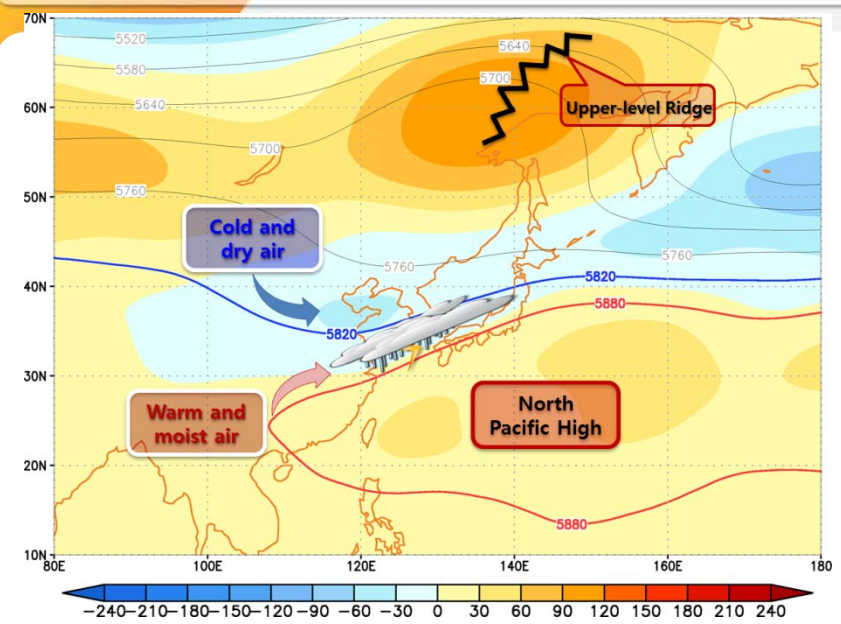


Shading: Precipitation anomaly, Contour: GPH at 850hPa

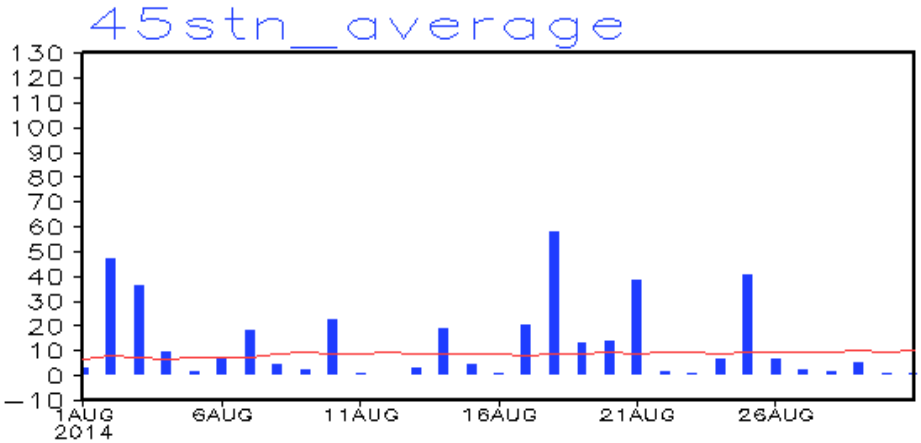


Below normal changma rainfall in Korea due to weak WNPSH!

Above-normal precipitation in August



Features causing above normal rainfall during Aug, 14 ~ 23.



Early August: Typhoon Nakri and Halong

The pronounced anticyclone anomaly was seen in the western North Pacific, which enhanced southwesterly winds along the flank of the anomalous anticyclone. The other anticyclone was seen over the Sea of Okhotsk, which brought cold air from north to meet with warm and moist southwesterlies.

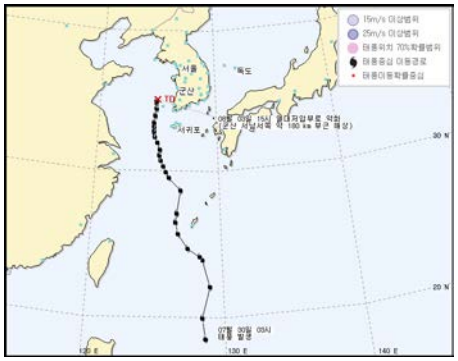
→ the 2nd longest rainy days(18.2 day/month) and 4th lowest record in mean temperature since 1973.

Typhoon

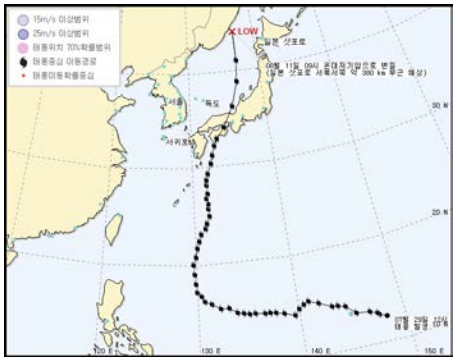
- In summer, 8 typhoons occurred and 3 typhoons directly affected to South Korea, which was above normal frequency for 1981~2010.

NEOGURI

NAKRI



HALONG



	Month	June	July	August	Total
2014	Occurrence Hit	2 (0)	5 (3)	1 (0)	8 (3)
Climatology (1981-2010)	Occurrence Hit	1.7 (0.3)	3.6 (0.9)	5.9 (1.0)	11.2 (2.2)

Summary

1. Temperature and precipitation over Korea

○ Temperature: normal (+0.0℃)

. June: above normal with +0.7°C

. July: above normal with +0.6°C

. August: below normal with -1.3°C

○ Precipitation: normal (84%)

. June: below normal with 50%

. July: above normal with 53%

. August: below normal with 138%

2. Characteristics of 2014 summer climate

○ **Late onset and retreat of Changma over South Korea, below-normal Changma rainfall**

○ **(Above normal rainfall/below normal temperature in August)** In August, South Korea was influenced by two anticyclonic system over WNP and Sea of Okhotsk and was easy to be instable. → the 2nd longest rainy days (18.2 day/month) (above-normal rainfall) since 1973 and below-normal temperature

○ (**Typhoon**) 8 typhoons occurred in 2014 summer and **3 typhoons** (normal:2.2) directly affected to South Korea.

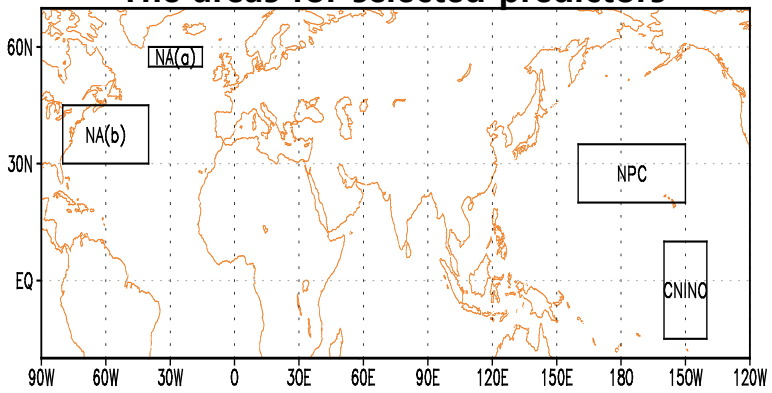
Thank you~!

KMA

Prediction for Changma rainfall (1)

Selection of Potential predictors

The areas for selected predictors

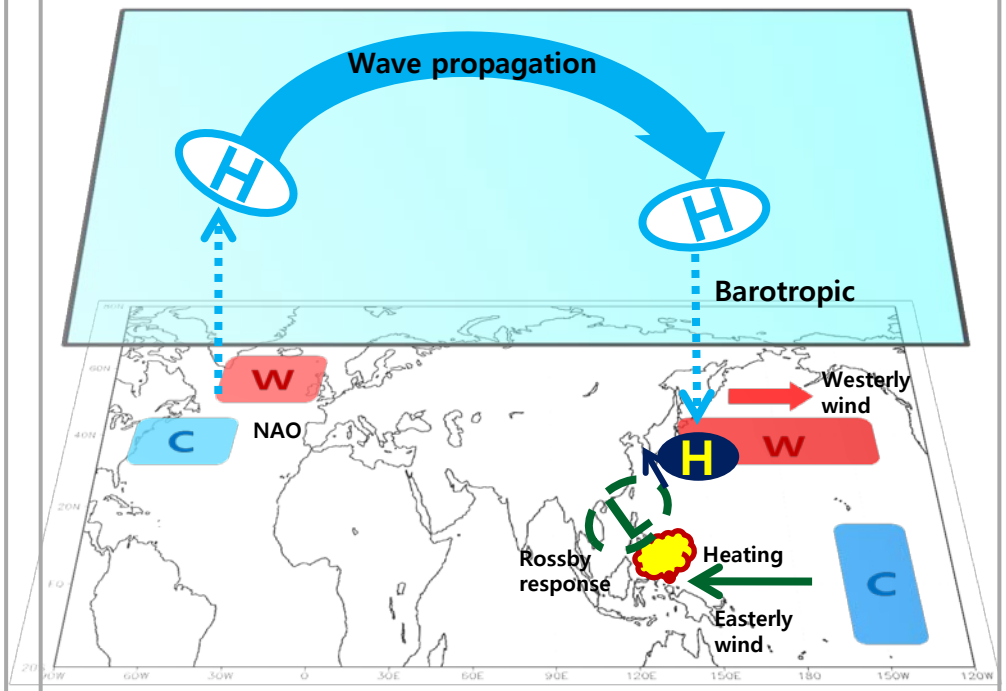


✓ used in spring season SST anomaly.
(High correlation with Changma index)

✓ SST is a slowly varying boundary conditions.

Potential predictors for Changma rainfall
North Atlantic 1 [NA]
Northern Pacific Change [NPC]
Central Pacific NINO [CNINO]

The Dynamic process summary

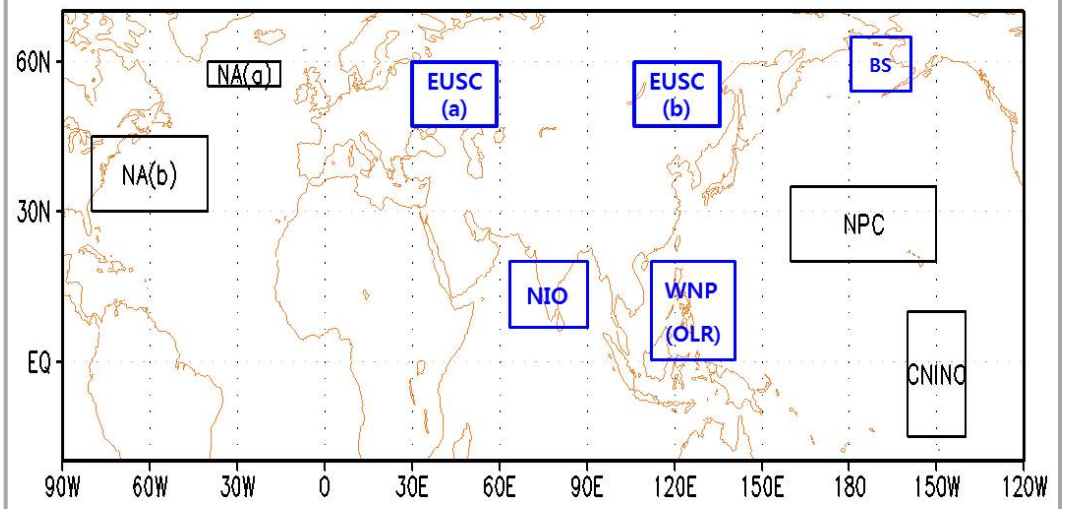


Recent research for Changma rainfall prediction

Lee S.-E., K.-H. Seo, 2013; The development of a statistical forecast model for Changma, Weather and Forecasting **28**, 1304–1321.

Prediction for Changma rainfall (2)

The areas for selected predictors



1st regression model

Y = + 0.53 * [NA] + 0.44 * [NPC] — 0.52 * [CNINO]

Correlation = 0.81 , RMSE = 0.65, GMSS = 0.73

2nd regression model

Y = + 0.59 * [NA] — 0.50 * [NIO] + 0.31 * [BS]

Correlation = 0.81 , RMSE = 0.64 , GMSS = 0.65

3rd regression model

Y = + 0.61 * [NA] + 0.36 * [NPC] — 0.44 * [WNP(OLR)]

Correlation = 0.85 , RMSE = 0.58 , GMSS = 0.65

4th regression model

Y = + 0.69 * [NA] — 0.47 * [NIO] + 0.45 * [EUSC]

Correlation = 0.84 , RMSE = 0.60 , GMSS = 0.66

Area difference
NA(a)-(b)
EUSC(a)-(b)

WNP Predictor
Spring season OLR anomaly

Model	Prediction (2014)	Intensity
1st regression model	-0.39	Near Normal
2nd regression model	-1.07	Below Normal
3rd regression model	-1.21	Below Normal
4th regression model	-0.98	Below Normal

Taken by Prof. KH Seo' research in PNU