Overview of 2018 Summer Climate over South Korea

@ 6th EASCOF

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Climate Prediction Division, Climate Science Bureau, KMA

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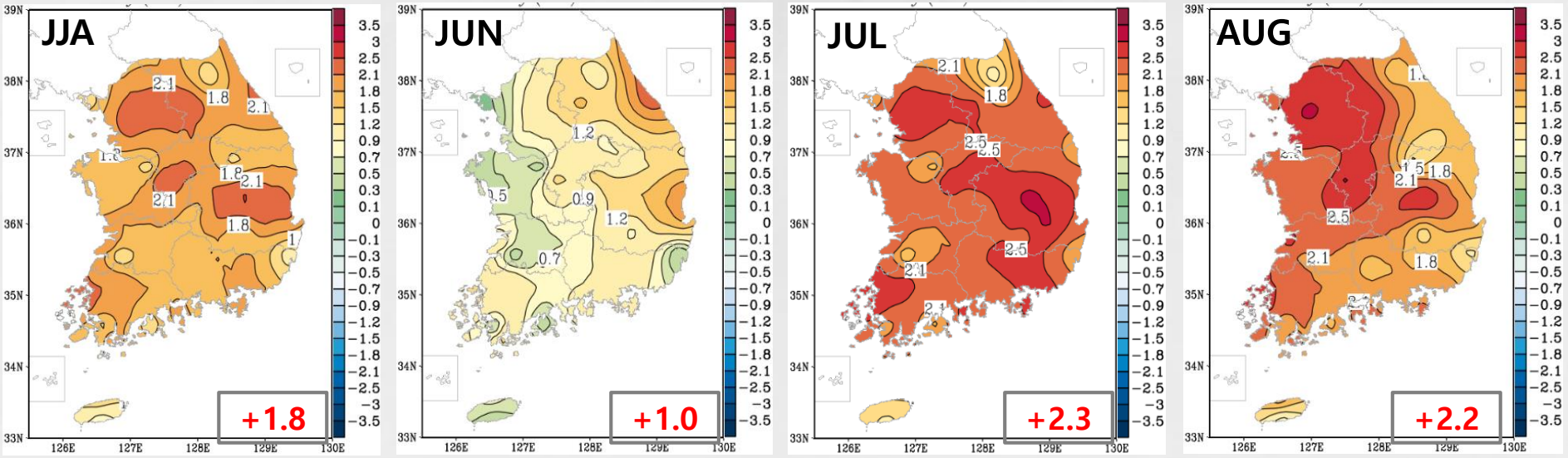
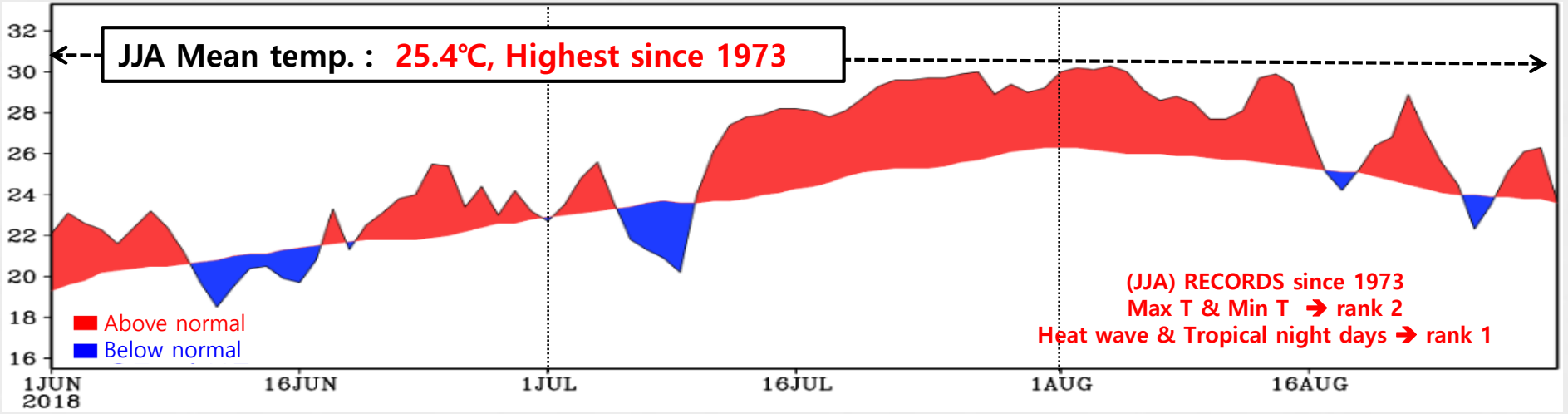
Outlines

- 2018 Summer temperature over south Korea
  - Summer mean temperature
  - Trends in temperature, Heat wave, and Tropical night
  - The factors of hot conditions in 2018 summer
- 2018 Summer rainfall over south Korea
  - Summer rainfall
  - 2018 Changma characteristics
- Summary

2018 Summer temperature over South Korea

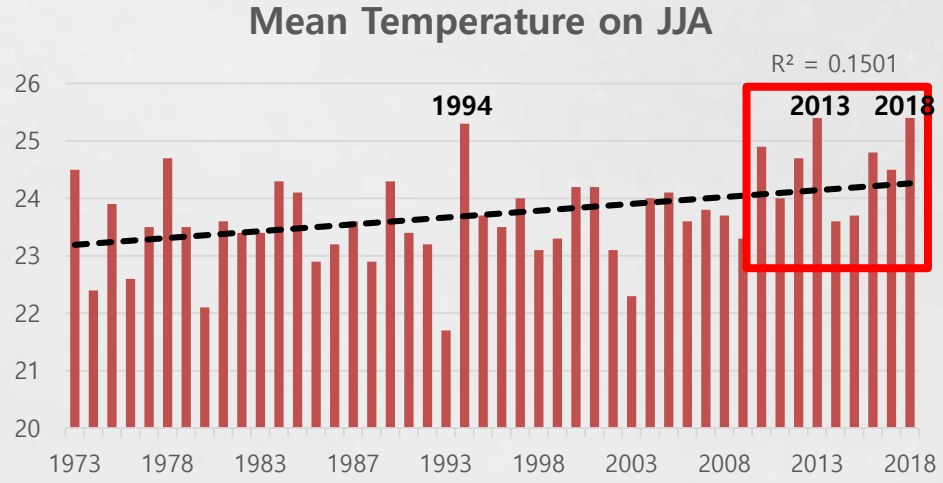
< Spatial and temporal temperature anomalies in JJA, JUN, JUL, AUG >

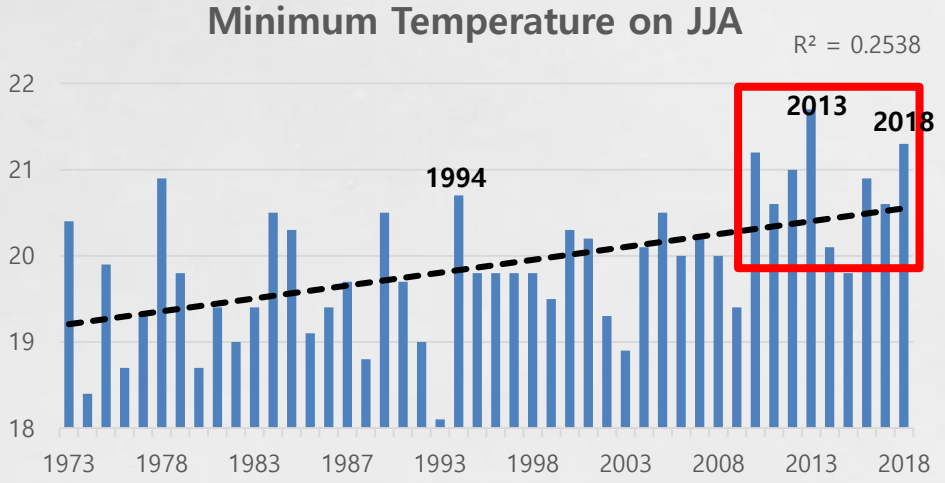




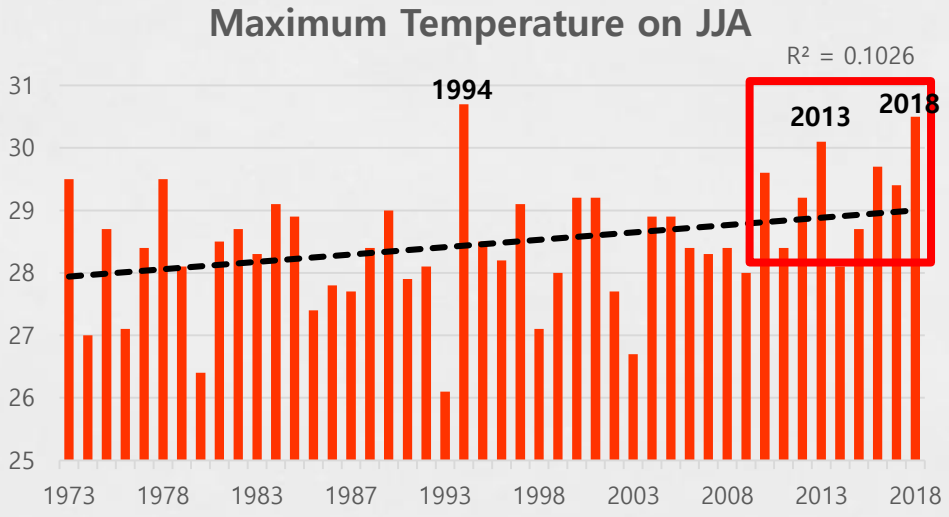
2018 Summer temperature over South Korea

< Time series of JJA temperature over South Korea >



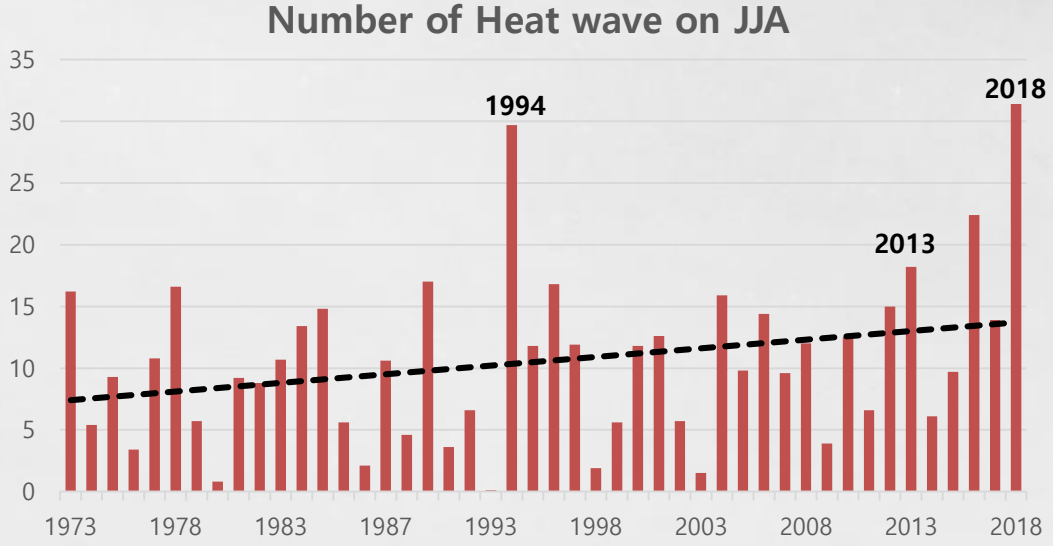


- JJA temperature (Mean, Max, and Min) is going warmer after 1973.
- **Warmer trend of Min. temp. is faster** than the others.
- **The records** were occurred **after 2010**, especially.

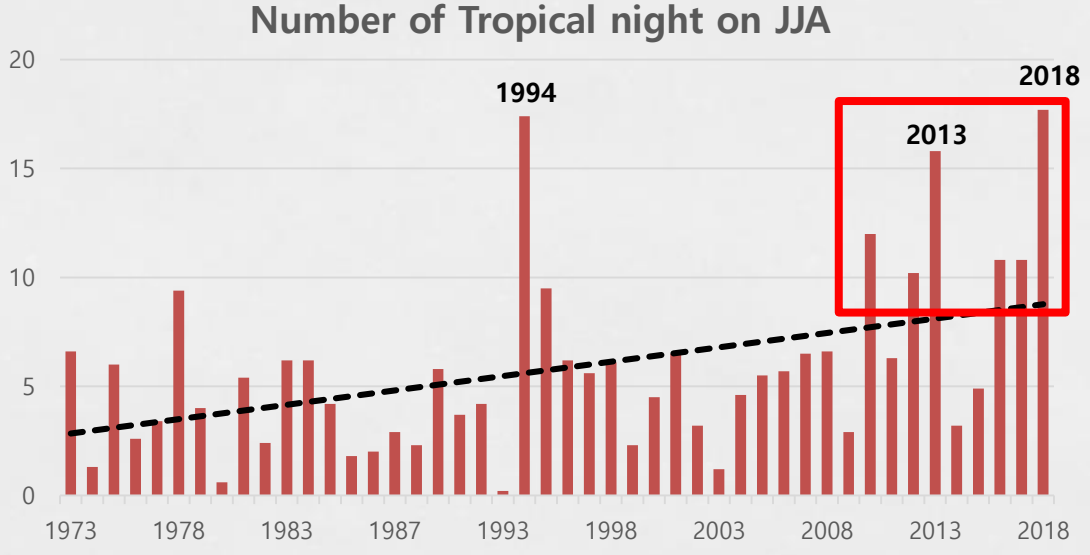


2018 Summer temperature over South Korea

< Heat wave and Tropical night over South Korea during Summer >



- Number of **heat wave was 31.4 days** more than normal, 9.8 days and **ranked first** since 1973.
- Number of **tropical night was 17.7 days** more than normal, 5.1 days and **ranked first since 1973.**

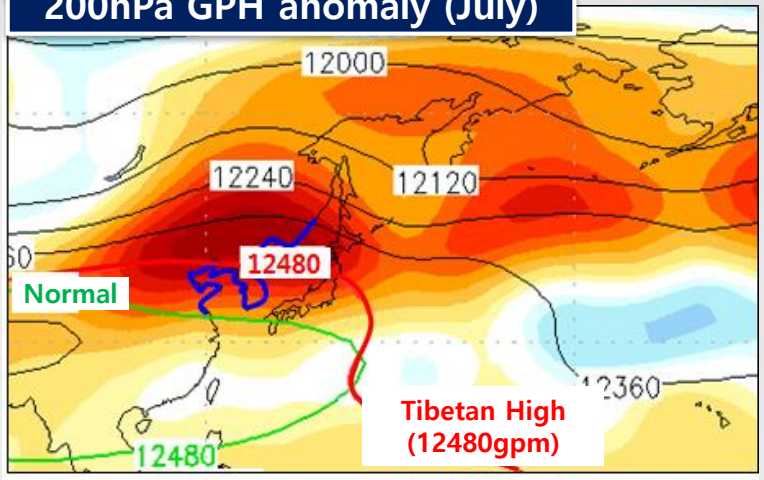


[Definition]

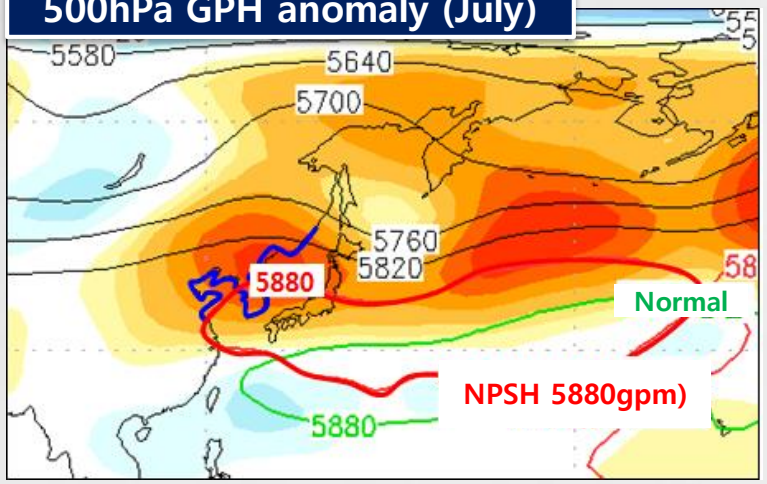
- **Heat Wave:** when the daily maximum temperature is greater than 33 ℃
- **Tropical night:** when the daily minimum temperature during night (18:01~09:00 next day) is greater than 25 ℃.

The factors of hot conditions on JJA, 2018

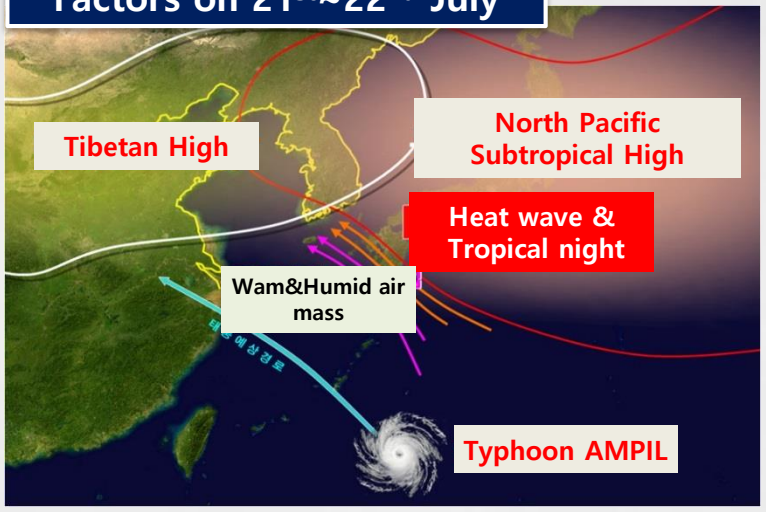
200hPa GPH anomaly (July)



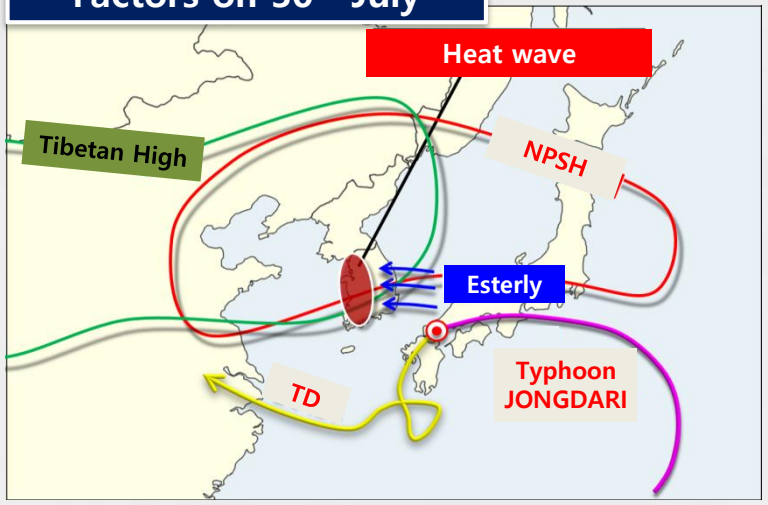
500hPa GPH anomaly (July)



Factors on 21st~22nd July



Factors on 30th July



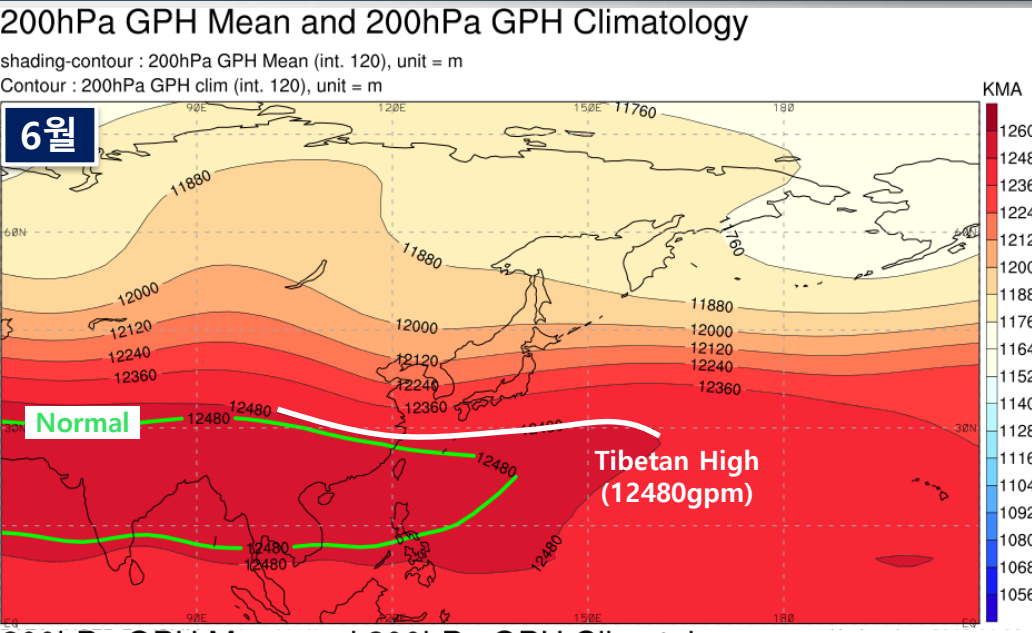
- **Warm moisture inflow** with Typhoon AMPIL

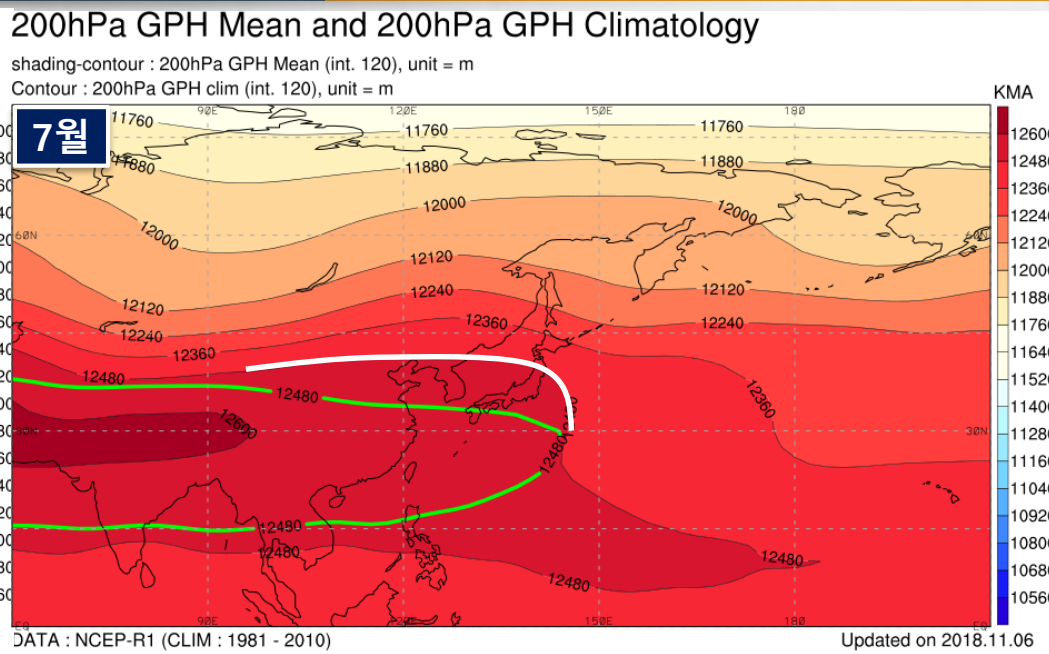
  ➔ strengthen of heat wave & tropical night

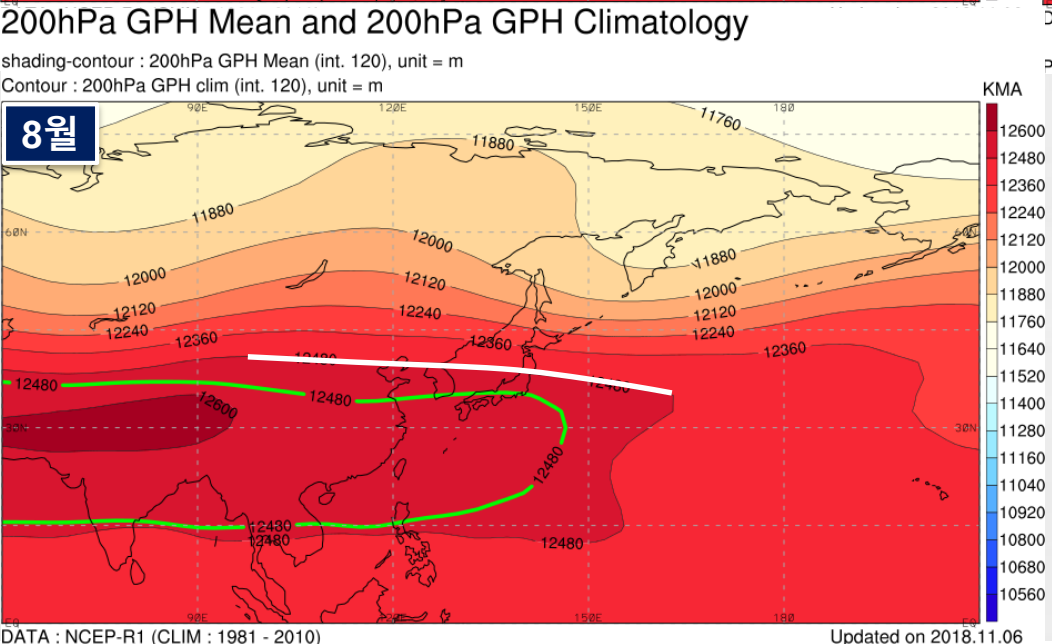
- **Easterly wind** to South Korea due to Typhoon JONGDARI

  → **Strong sunshine & foehn effect** (easterly)

Tibetan High on JJA 2018



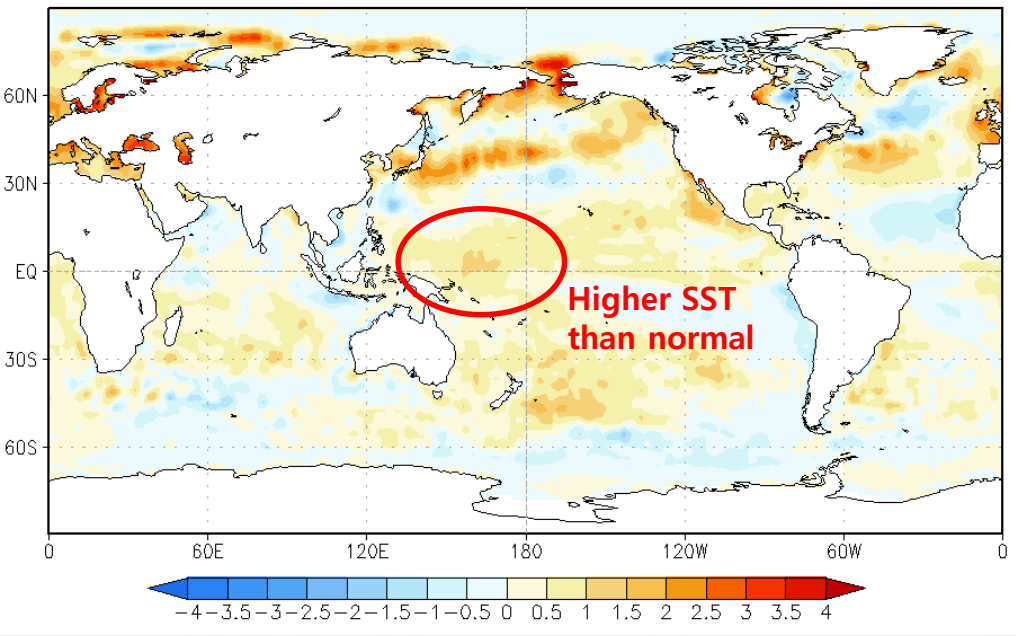




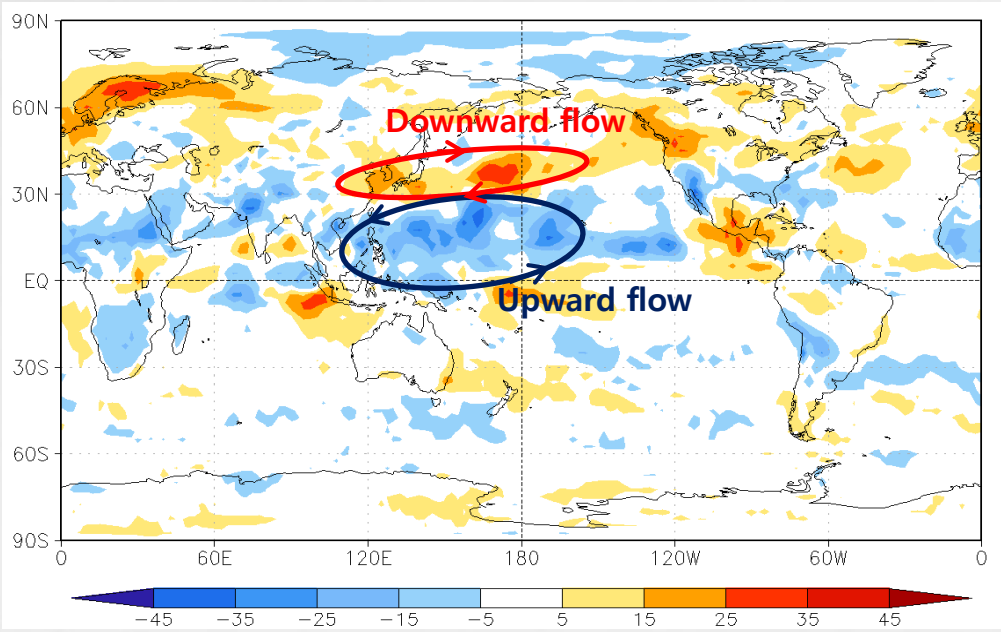
- Strengthening in the late of June
- To maintain its power to the middle of August
- Retreat to southern part of South Korea in the late of August

The factors of hot conditions on JJA, 2018

SST anomaly on July



OLR anomaly on July

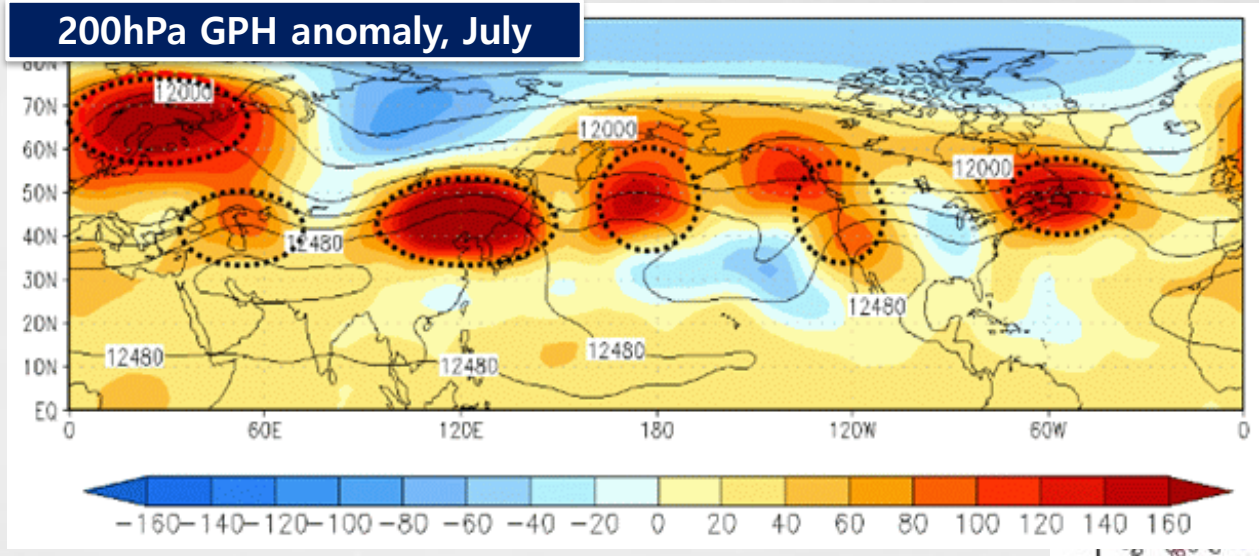


- **(Tropical conditions) western Pacific SST was warmer** than normal and occurred **cyclonic circulation** (upward flow), and **the northern part occurred anticyclonic circulation** (downward flow)

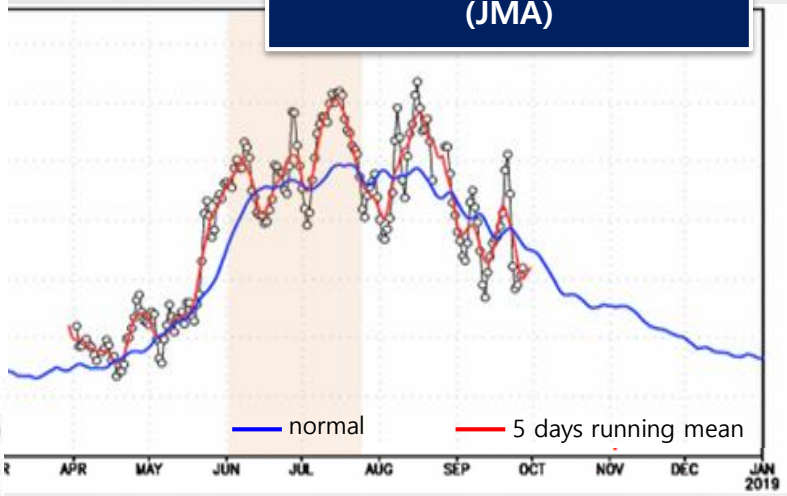
  ➔ **North Pacific Subtropical High was strengthened due to downward air flow**

The factors of hot conditions on JJA, 2018

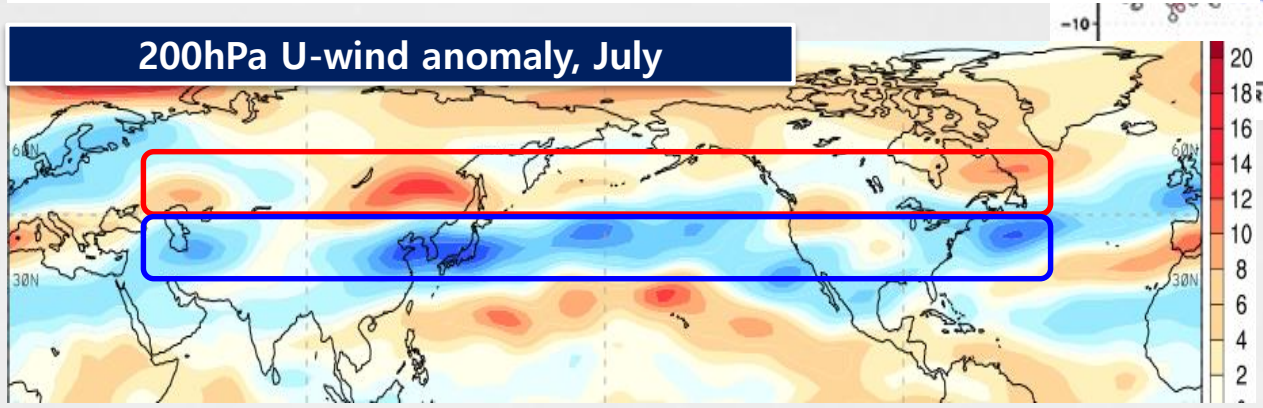
200hPa GPH anomaly, July



Indian Monsoon, JJA 2018 (JMA)



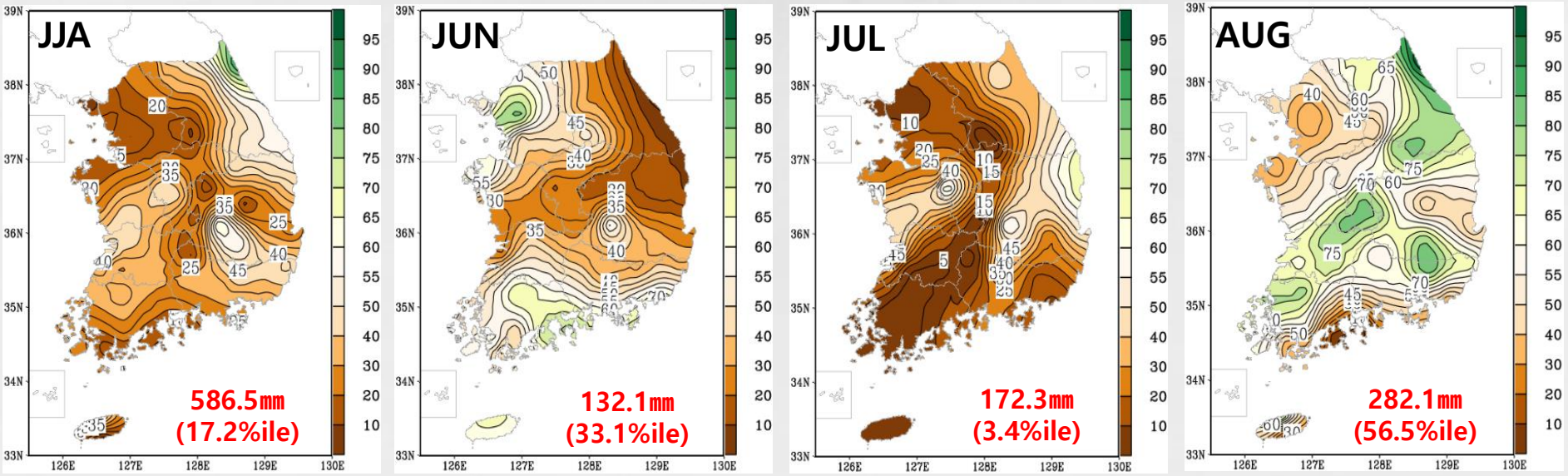
200hPa U-wind anomaly, July

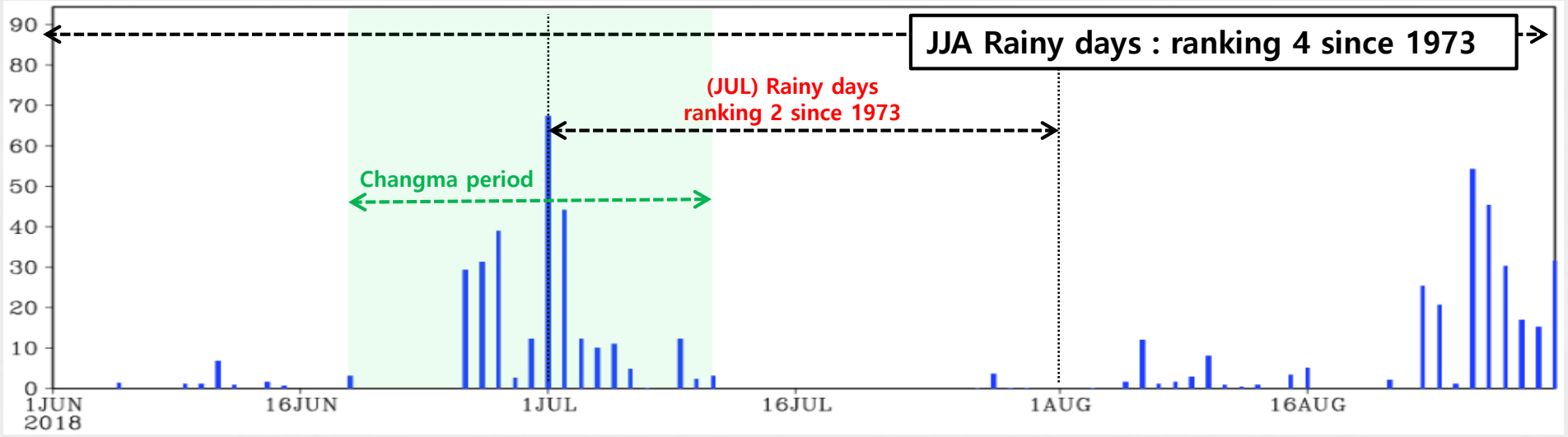


- **(Wave on upper layer) Subtropical front jet stream was weakening** and **the flow in upper layer was slower** and Indian monsoon was stronger than normal ➔ **Circumglobal Teleconnection (CGT)**

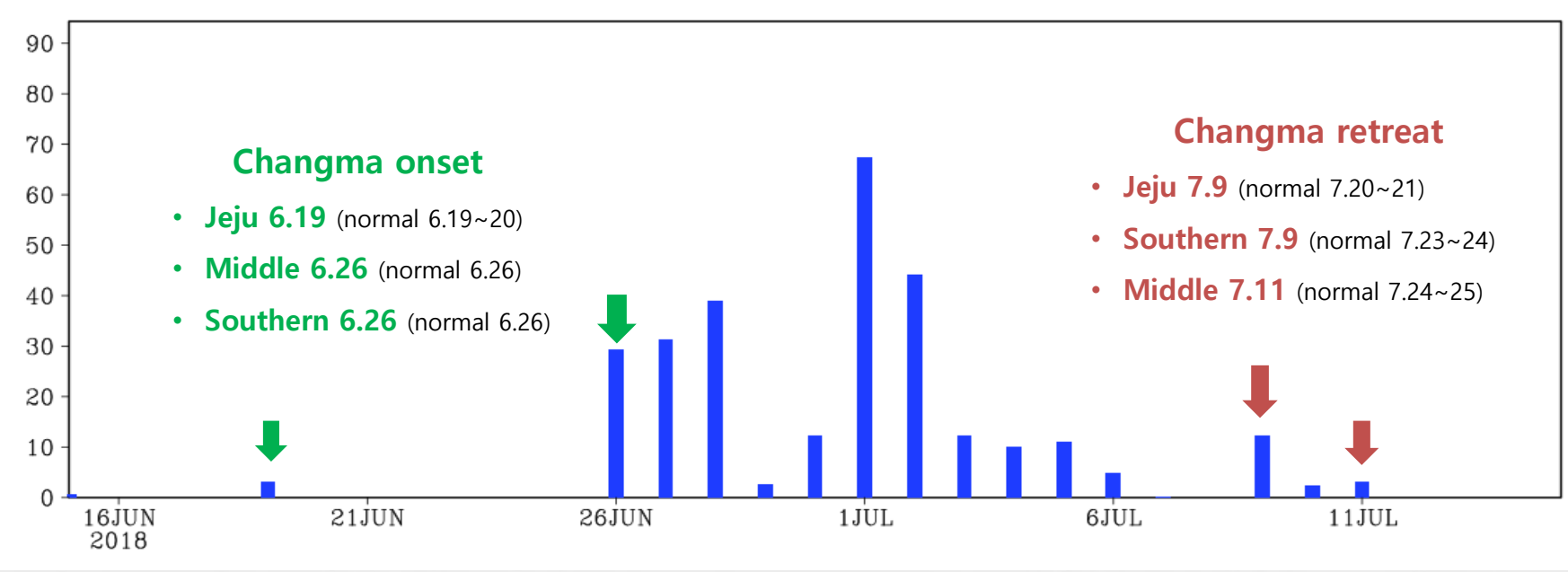
2018 Summer Rainfall over South Korea

< Spatial and temporal rainfall anomalies in JJA, JUN, JUL, AUG >





2018 Changma characteristics



- **Changma period** was 14~16 days and **second shortest** since 1973.

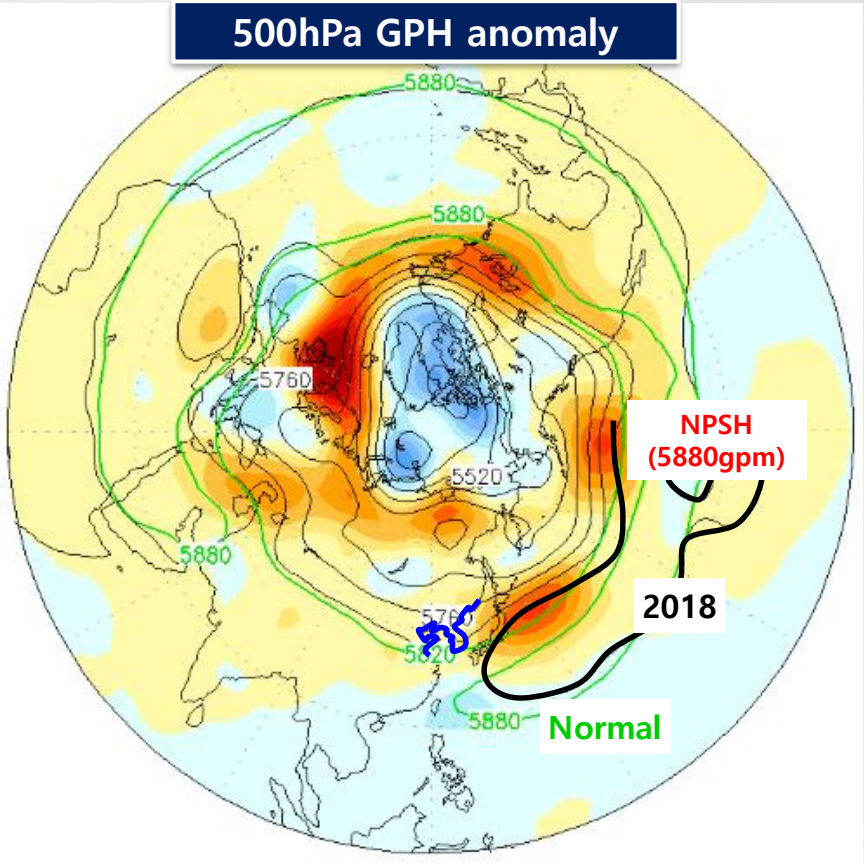
  ※ The shortest year: 1973, Jeju 7 days, Middle&Southern 6 days

- **Rainfall amount** during Changma was **283.0 ㎜ less than normal** (356.1㎜).

	Rainfall during Changma	
	2018	normal
Middle	281.7	366.4
Southern	284.0	348.6
Jeju	235.1	398.6
South Korea	283.0	356.1

2018 Changma characteristics

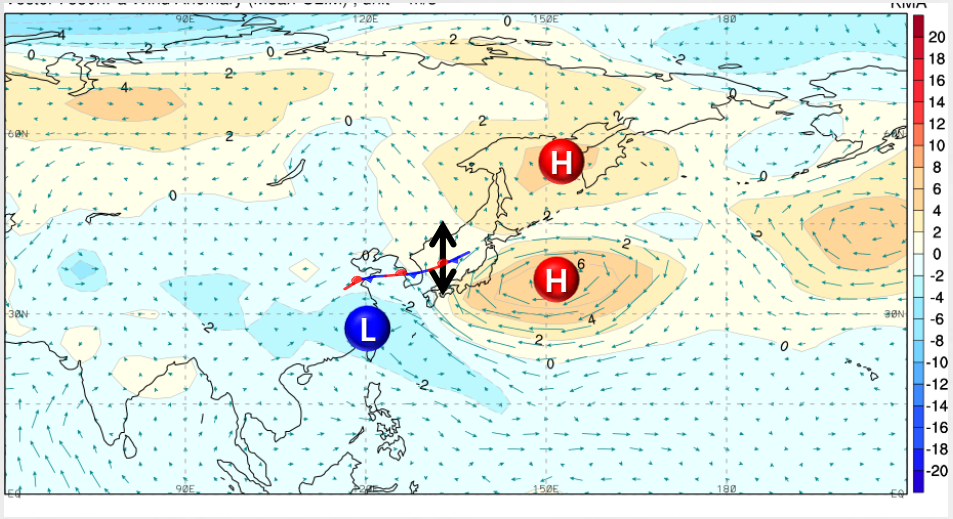
500hPa GPH anomaly



- **NPSH** was extended to **northwestward** more than normal
- **Trough in northern part** of South Korea

➔ **Moisture convergence way**

Sea level pressure anomay & 850hPa wind anomaly

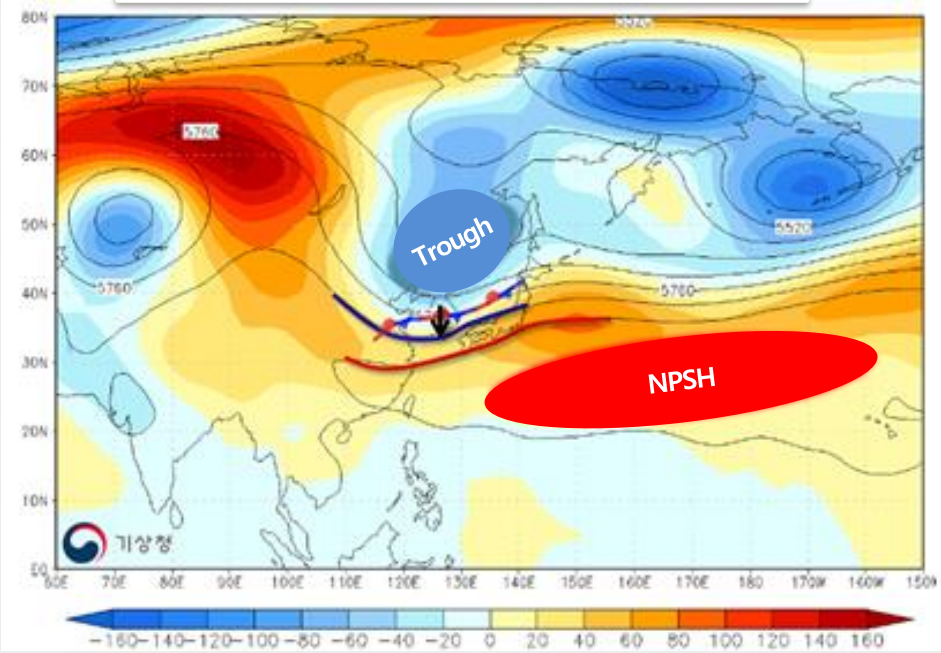


- **NPSH** in southern sea of Japan and **Okhotsk High** was **strengthened** more than normal.
- **Cyclonic circulation in Southern and eastern of China**

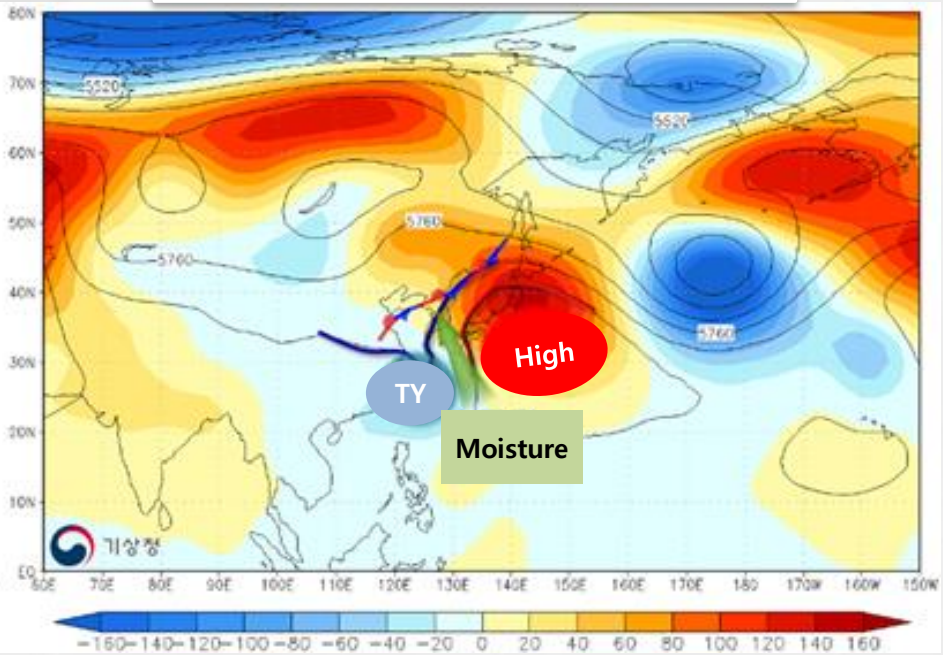
➔ **Changma front was strengthened** around South Korea

2018 Changma characteristics: Two heavy rain cases

500hPa GPH anomaly (6.26~28.)



500hPa GPH anomaly (7.1~2.)



Case 1: Trough

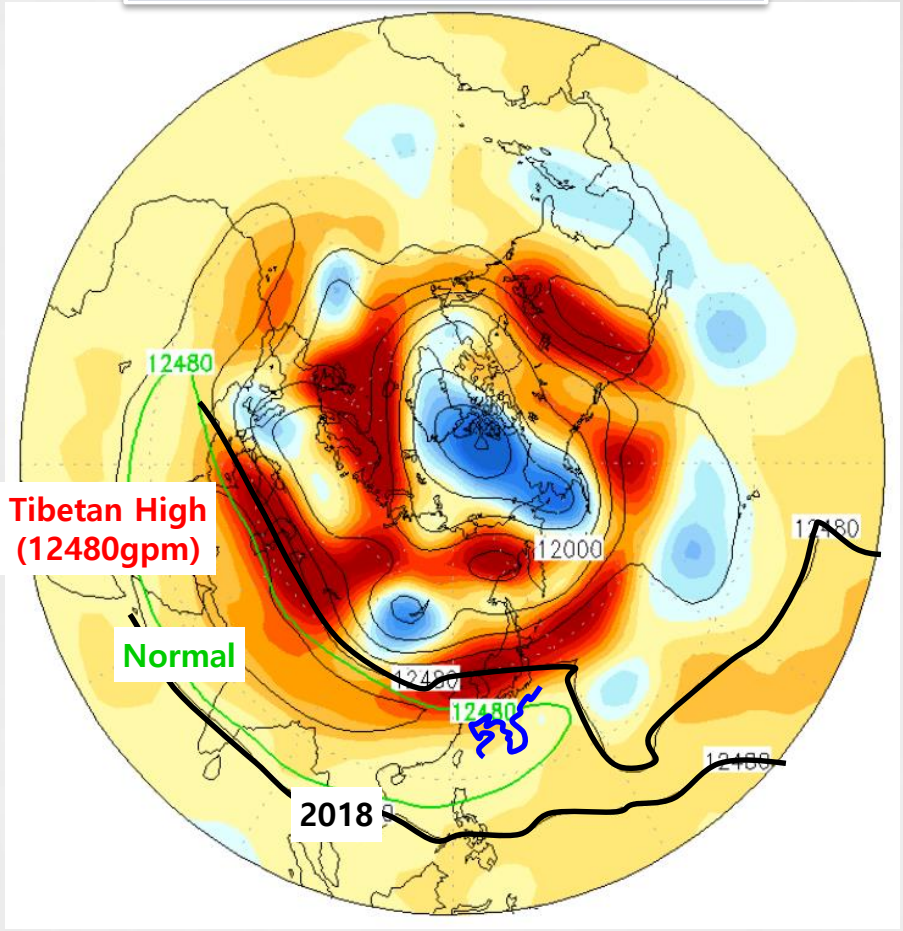
- **Warm and humid air mass** inflow along the edge of NPSH & **Cold air mass** with Trough in the northern of South Korea
  ➔ **Changma front was activated**
- Rain band developed from this Changma front was moving from middle to south part through narrow path ➔ heavy rain

Case 2: Typhoon PRAPIROON

- **A Lot of moisture inflow** with Typhoon moving northward ➔ **Changma front was activated**
- **Heavy rain over South Korea**, expecially West coast and the middle part

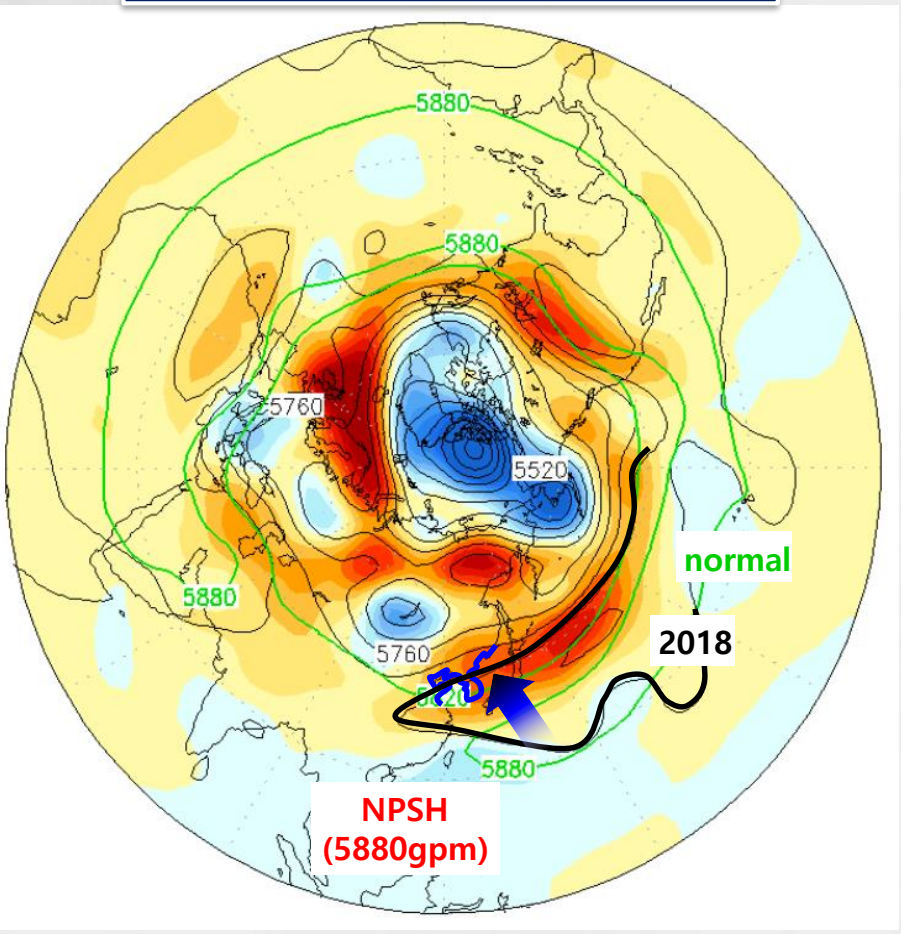
2018 Changma characteristics: Earlier retreat

200hPa GPH anomaly(7.8~11.)



- **Tibetan high extended** to South Korea
  → **Upper layer around South Korea was warming**

500hPa GPH anomaly(7.8~11.)



- **NPSH extended to northern of South Korea**
  → Changma front moved to northern of South Korea and retreated

Summary

- **Early JJA (June)**: Dry condition continued and Changma onset from the late of June

- **Changma (the late of June to the early of July)**
  - **Earlier retreat** than normal (2nd shortest period since 1973)
  - Heavy rain due to Trough (the late of June) and Typhoon PRAPIROON (the early of July)
  - Precipitation amount during Changma but less than normal because of the earlier retreat

- Total precipitation during JJA was less than normal

- **Heat wave and Tropical night**
  - **Stronger Tibetan High and North Pacific Subtropical High** than normal
  - **Active convection in western Pacific** → downward flow around South Korea
  - **Wave pattern in upper layer** → stronger High than normal located horizontally in mid-latitude (CGT)
    → easterly flow was stationary

➔ strengthening Heat wave, Tropical night in mid-latitude

감사합니다

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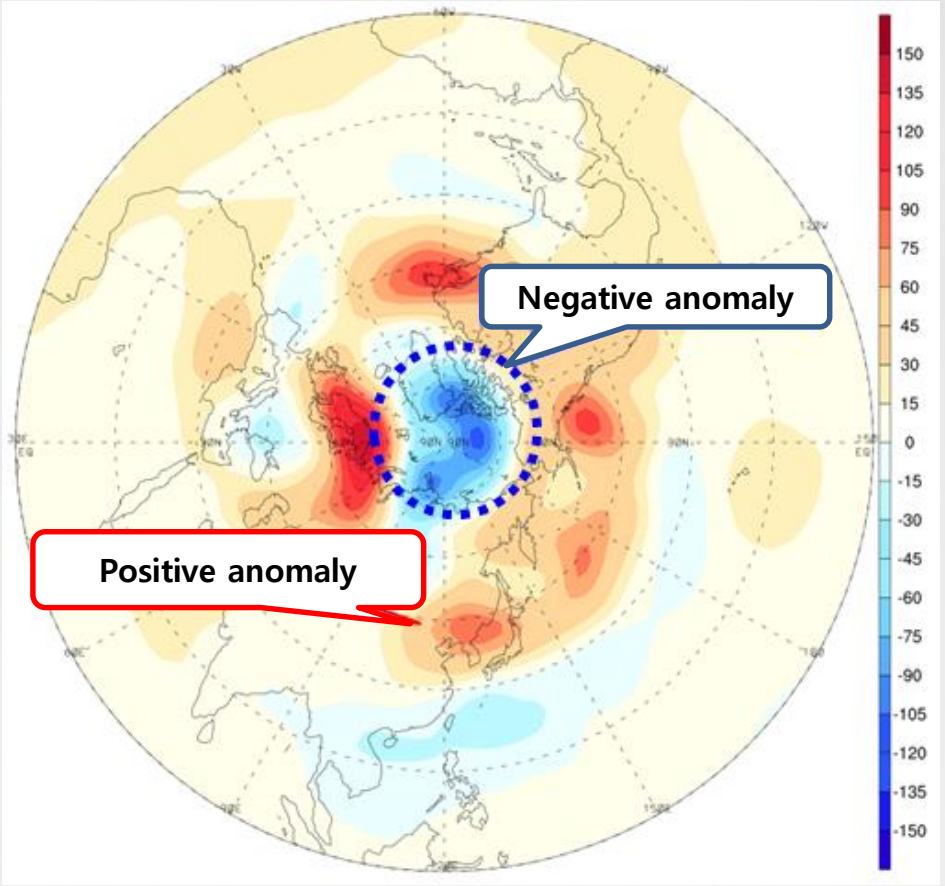
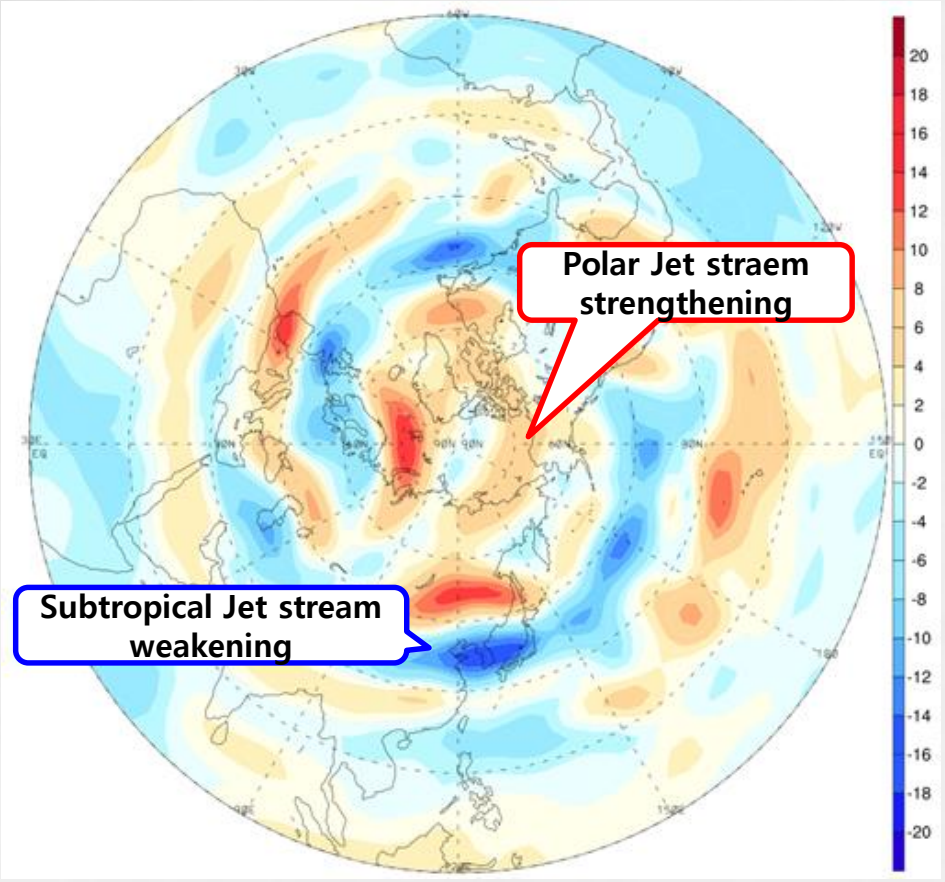
The influence of positive AO ?

500hPa GPH anomaly, July



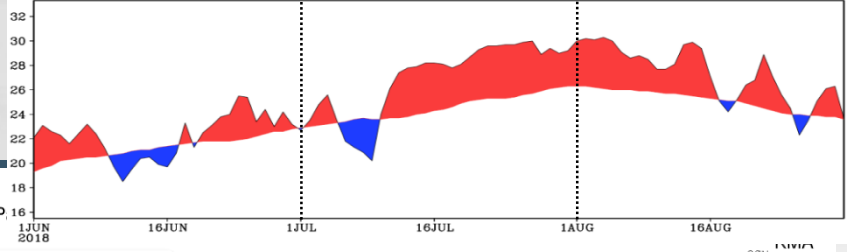
200hPa U-wind anomaly, July



- Polar Jet Stream was strengthening → Cold air was not moving southward
- Subtropical Jet Stream was weakening → horizontal flow was stationary

  → this influenced the occurrence and persistence of heat wave partly

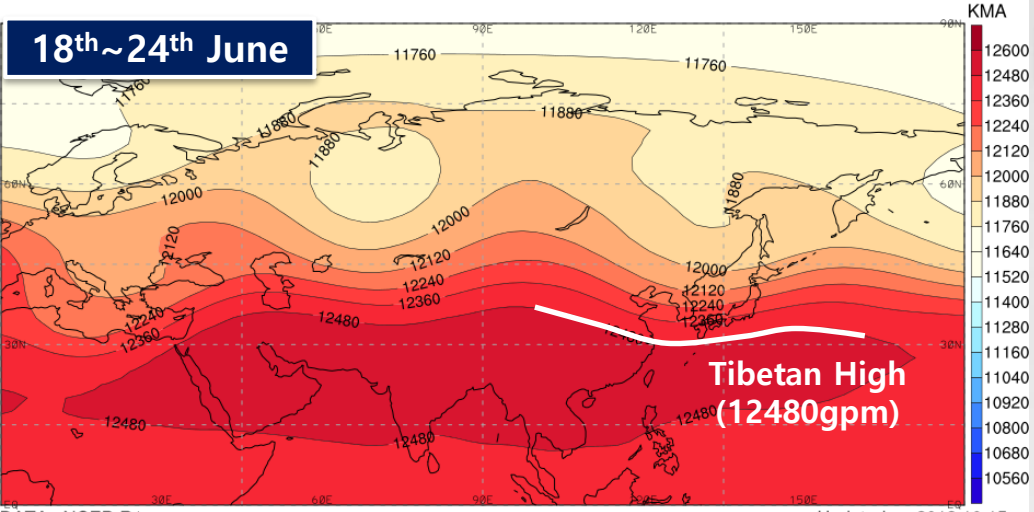
Tibetan High on JJA 2018



200hPa GPH Mean

shading-contour : 200hPa GPH Mean (int. 120), unit = m

18th~24th June



DATA : NCEP-R1

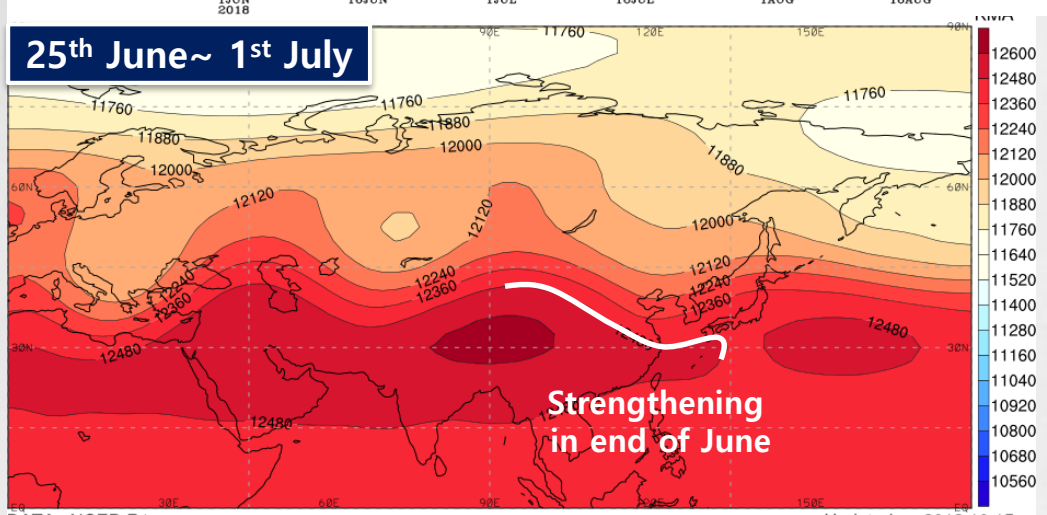
Updated on 2018.10.15

Period1 : 18Jun - 24Jun / 2018

200hPa GPH

shading-contour : 200hP

25th June~ 1st July



DATA : NCEP-R1

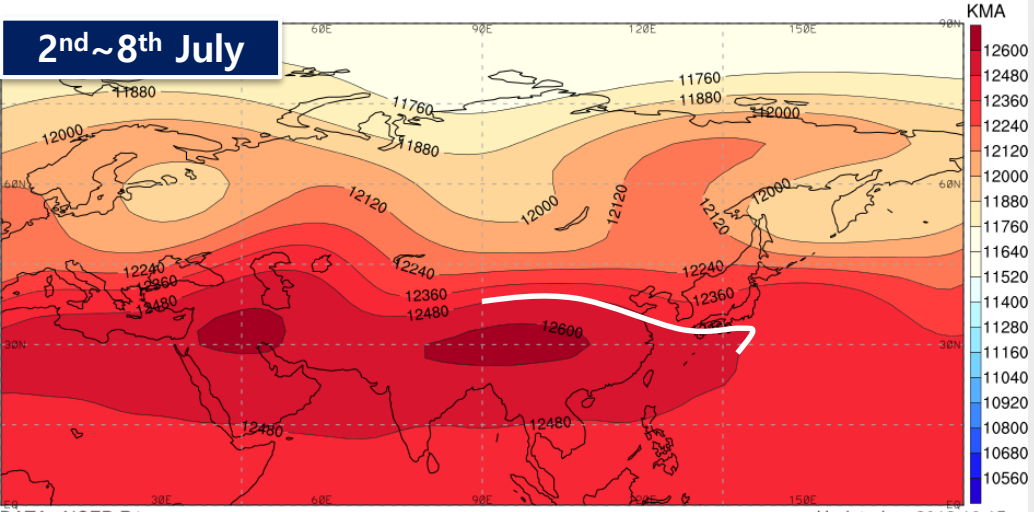
Updated on 2018.10.15

Period1 : 25Jun - 01Jul / 2018

200hPa GPH Mean

shading-contour : 200hPa GPH Mean (int. 120), unit = m

2nd~8th July



DATA : NCEP-R1

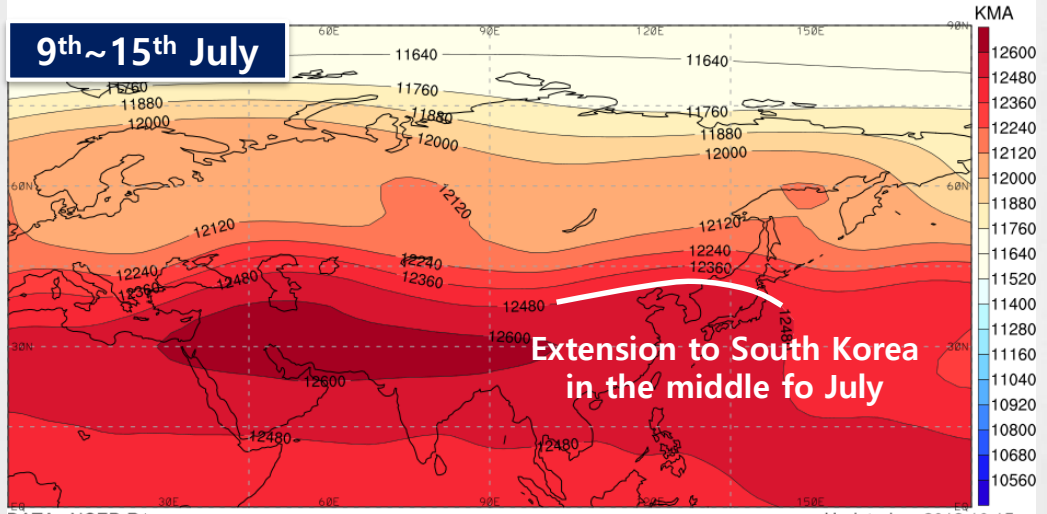
Updated on 2018.10.15

Period1 : 02Jul - 08Jul / 2018

200hPa GPH Mean

shading-contour : 200hPa GPH Mean (int. 120), unit = m

9th~15th July

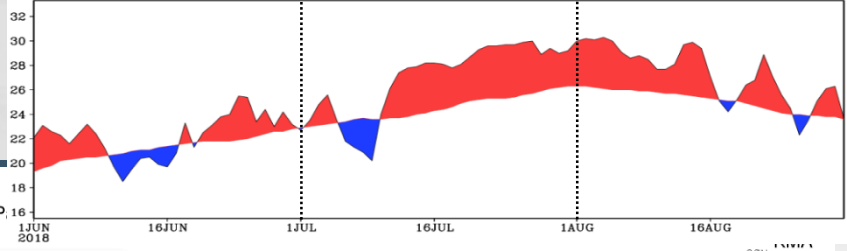


DATA : NCEP-R1

Updated on 2018.10.15

Period1 : 09Jul - 15Jul / 2018

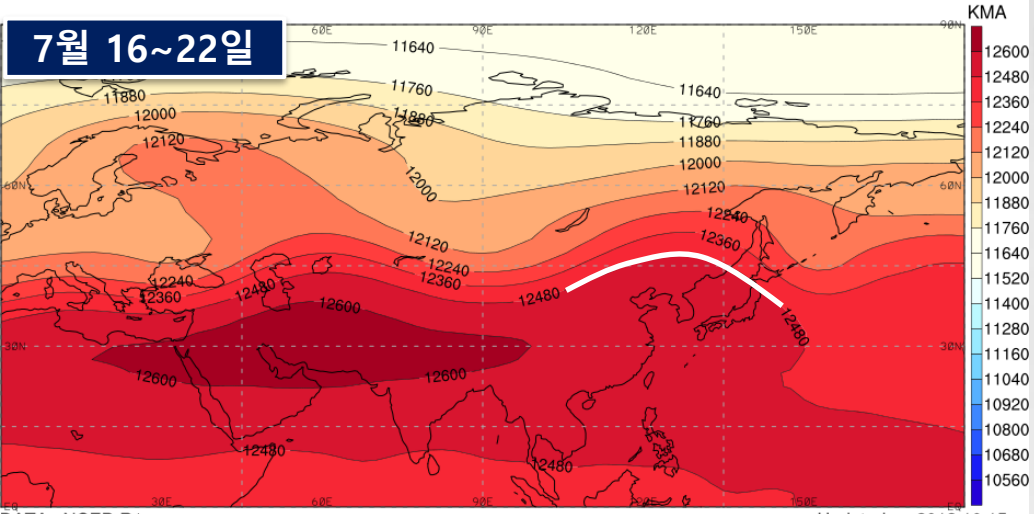
Tibetan High on JJA 2018



200hPa GPH Mean

shading-contour : 200hPa GPH Mean (int. 120), unit = m

7월 16~22일



DATA : NCEP-R1

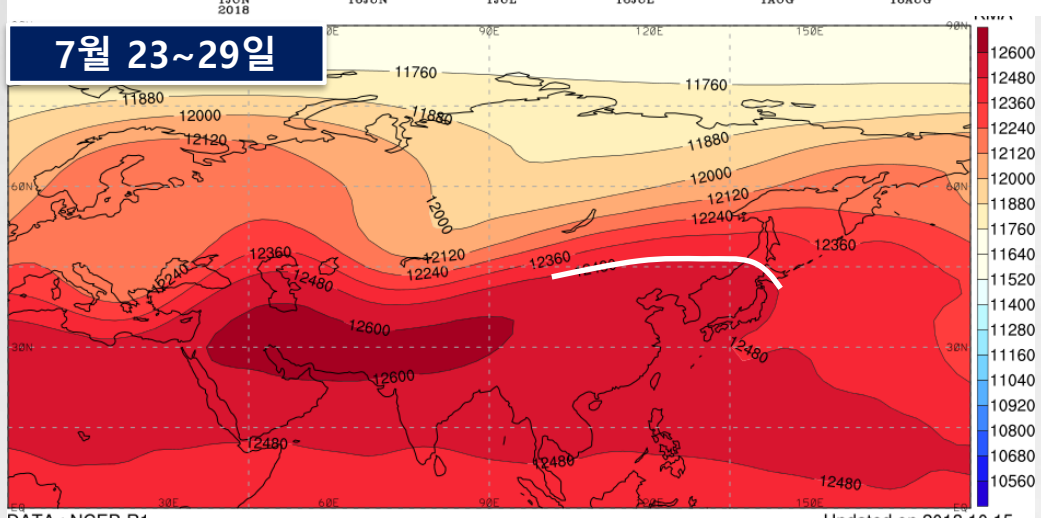
Updated on 2018.10.15

Period1 : 16Jul - 22Jul / 2018

200hPa GPH

shading-contour : 200hP

7월 23~29일



DATA : NCEP-R1

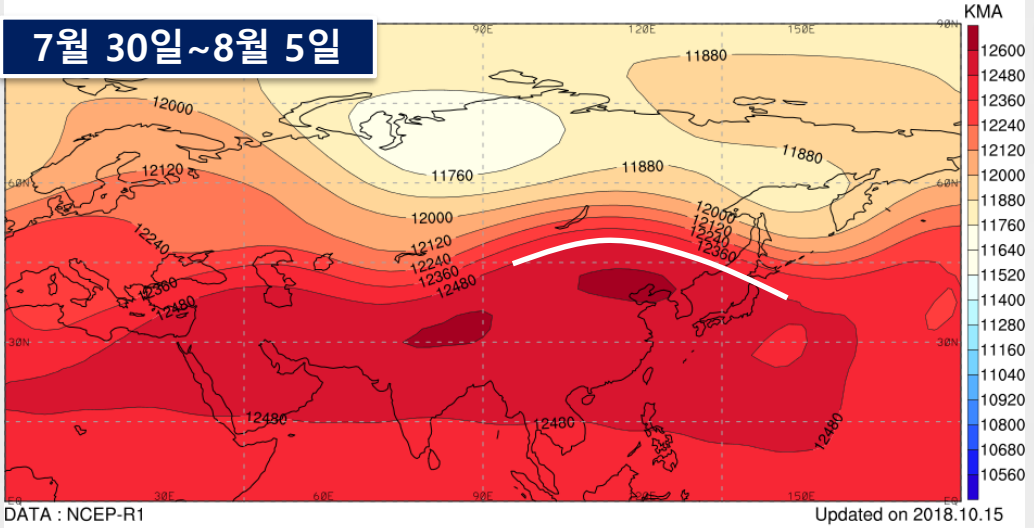
Updated on 2018.10.15

Period1 : 23Jul - 29Jul / 2018

200hPa GPH Mean

shading-contour : 200hPa GPH Mean (int. 120), unit = m

7월 30일~8월 5일



DATA : NCEP-R1

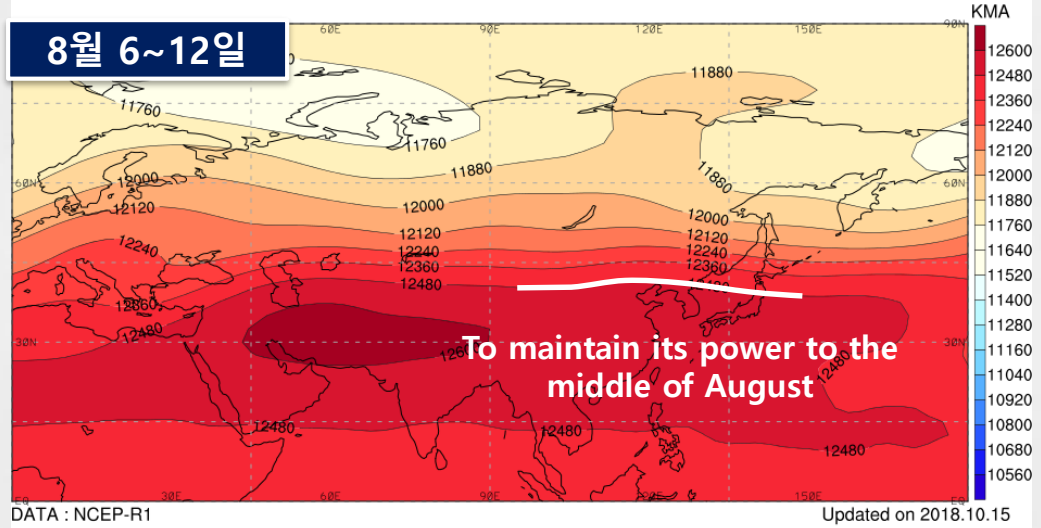
Updated on 2018.10.15

Period1 : 30Jul - 05Aug / 2018

200hPa GPH Mean

shading-contour : 200hPa GPH Mean (int. 120), unit = m

8월 6~12일



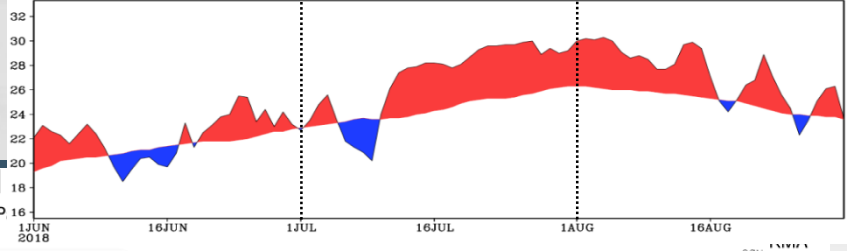
To maintain its power to the middle of August

DATA : NCEP-R1

Updated on 2018.10.15

Period1 : 06Aug - 12Aug / 2018

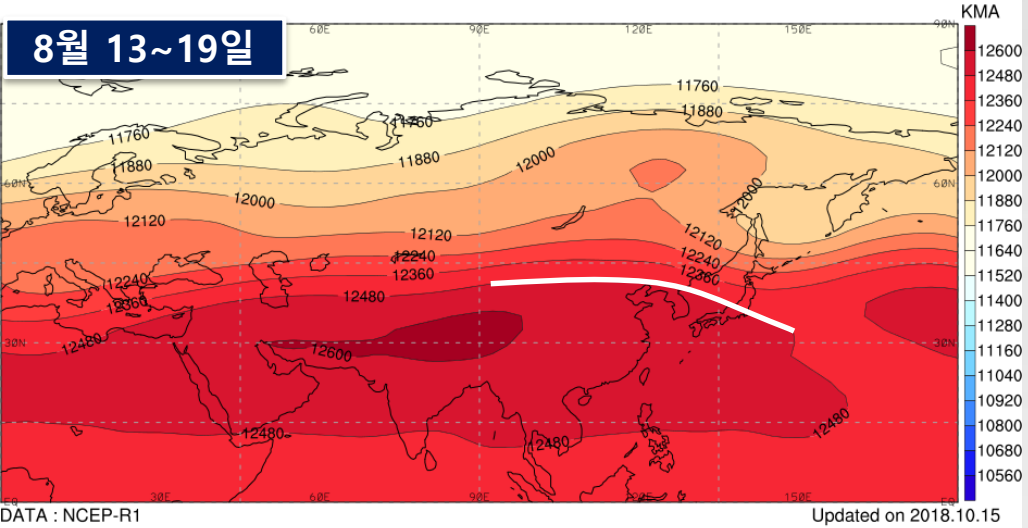
Tibetan High on JJA 2018



200hPa GPH Mean

shading-contour : 200hPa GPH Mean (int. 120), unit = m

8월 13~19일



DATA : NCEP-R1

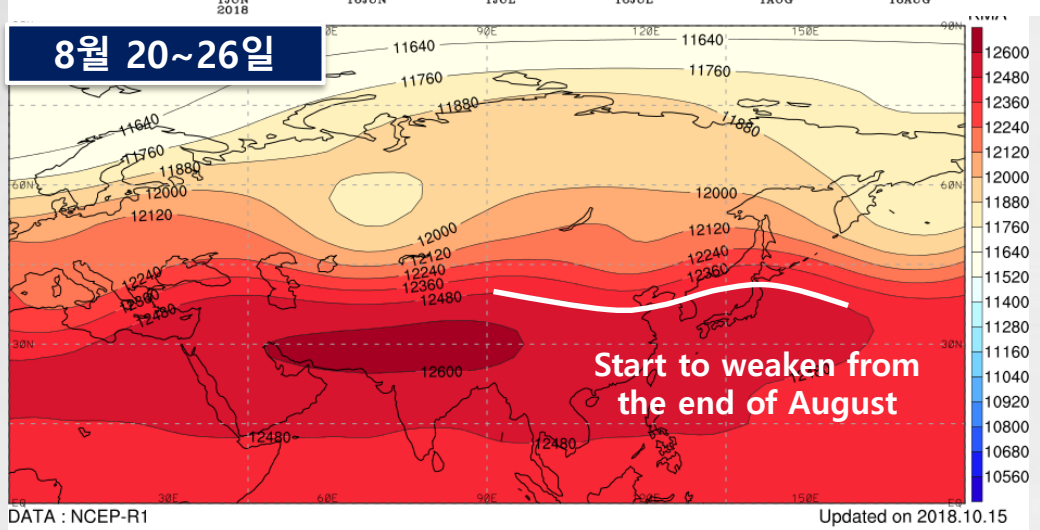
Updated on 2018.10.15

Period1 : 13Aug - 19Aug / 2018

200hPa GPH

shading-contour : 200hP

8월 20~26일



DATA : NCEP-R1

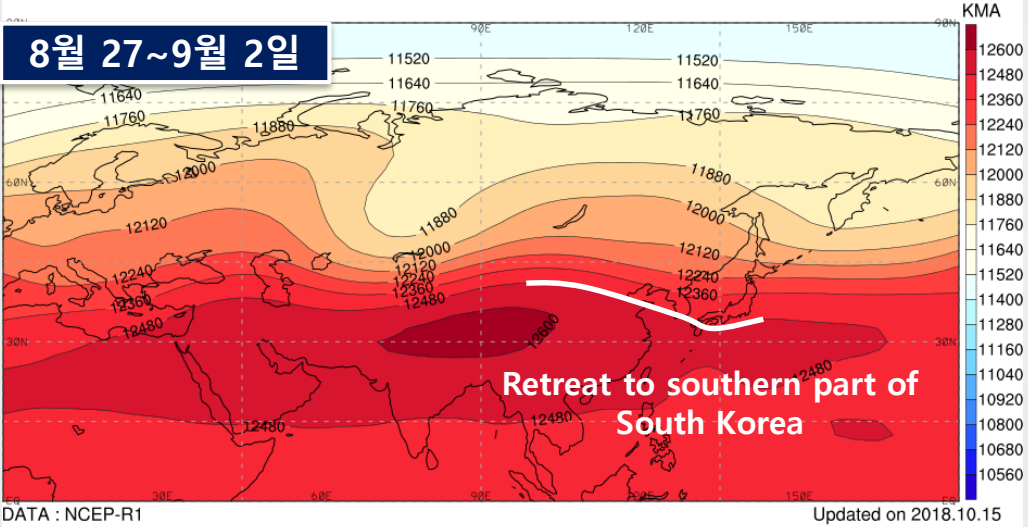
Updated on 2018.10.15

Period1 : 20Aug - 26Aug / 2018

200hPa GPH Mean

shading-contour : 200hPa GPH Mean (int. 120), unit = m

8월 27~9월 2일



DATA : NCEP-R1

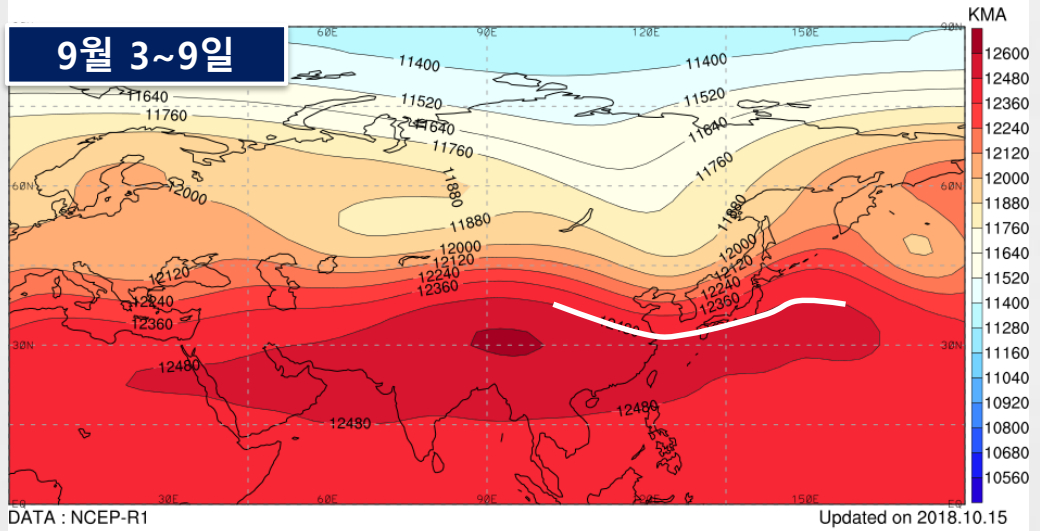
Updated on 2018.10.15

Period1 : 27Aug - 02Sep / 2018

200hPa GPH Mean

shading-contour : 200hPa GPH Mean (int. 120), unit = m

9월 3~9일

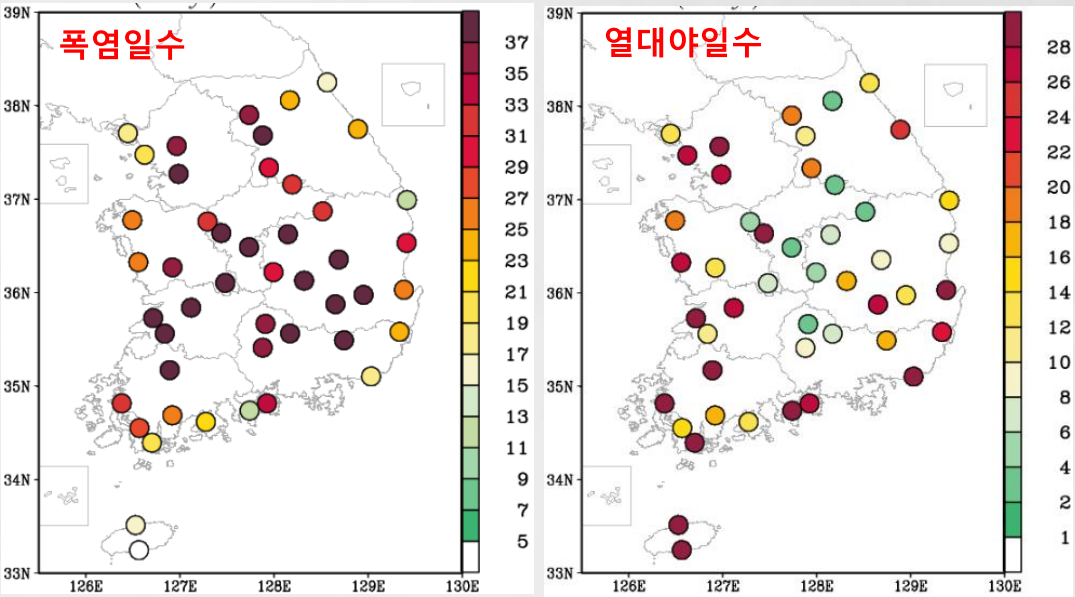


DATA : NCEP-R1

Updated on 2018.10.15

Period1 : 03Sep - 09Sep / 2018

2018년 여름철 폭염과 열대야 현황



<전국 45개 지점의 여름철 (왼쪽) 폭염일수와 (오른쪽) 열대야일수>

- 폭염일수는 31.4일을 기록하여 평년(9.8일)보다 21.6일 많았고, 열대야일수는 17.7일로 평년(5.1일)보다 12.6일 많았음
  - ➔ 1973년 이후 모두 1위 기록
  - ※ 서울: 각 35일, 29일로 1위, 3위 기록
- 특히, 전국적으로 일최고기온과 일최저기온 극값을 경신한 지점이 매우 많았음
  - ➔ 홍천 41.0℃(8.1.) 우리나라 역대 최고 기온 기록
  - ➔ 서울 최고기온 39.6 ℃(8.1.), 최저기온 30.3℃(8.2.) 기록하면서 111년 만에 극값 경신

<여름철 전국 폭염 및 열대야일수 순위 현황 (1973년 이후)>

순위	전국			
	폭염일수(평년 9.8일)		열대야일수(평년 5.1일)	
1위	2018년	31.4일	2018년	17.7일
2위	1994년	29.7일	1994년	17.4일
3위	2016년	22.4일	2013년	15.8일
4위	2013년	18.2일	2010년	12.0일
5위	1990년	17.0일	2017년	10.8일

<여름철 일 극값 현황 (1973년 이후)>

일최고기온 최고 1위		일최저기온 최고 1위	
홍천 (8.1.)	41.0℃	서울 (8.2.)	30.3℃
서울 (8.1.)	39.6℃	포항 (8.5.)	29.3℃
포항 (8.4.)	39.4℃	인천 (8.2.)	29.1℃
대전 (8.15.)	39.4℃	청주 (8.3.)	28.9℃
전주 (8.13.)	38.9℃	대구 (8.5.)	28.6℃
구미 (8.1.)	38.1℃	구미 (7.27.)	27.4℃