



Climate Outlook for Summer 2022 over Korea

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Outlines



Dynamical Models

(GloSea6,
WMO-LC LRFMME)



Climate Predictors

(ENSO, Snow Cover,
etc.)



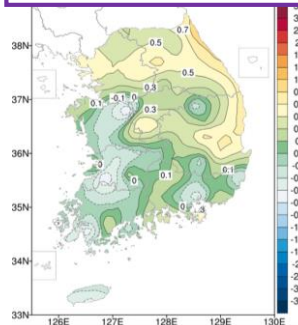
2022 Summer Outlook

The review of the last Summer Seasons (2019~2021)

2019

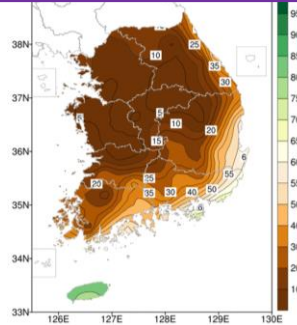
Temperature

24.0°C(+0.3 °C)



Precipitation

510.5mm(13.8%ile)



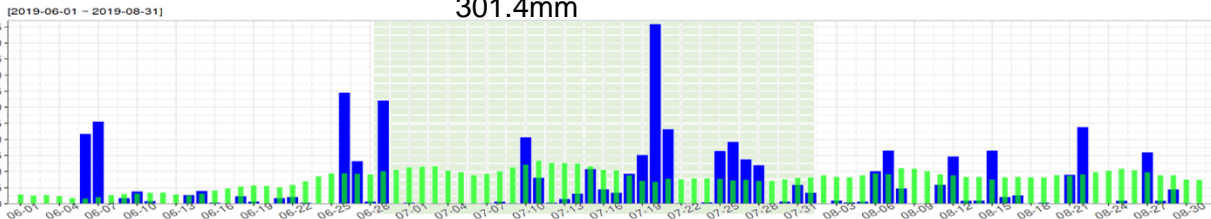
Changma

Summer Monsoon

Changma
6.26~7.29.(34days)
301.4mm

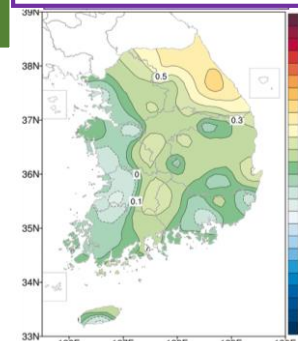
Changma normal period : 6.25.~7.26.

Changma normal precipitation : 356.7mm

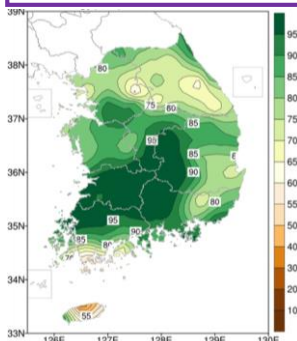


2020

23.9°C(+0.2 °C)



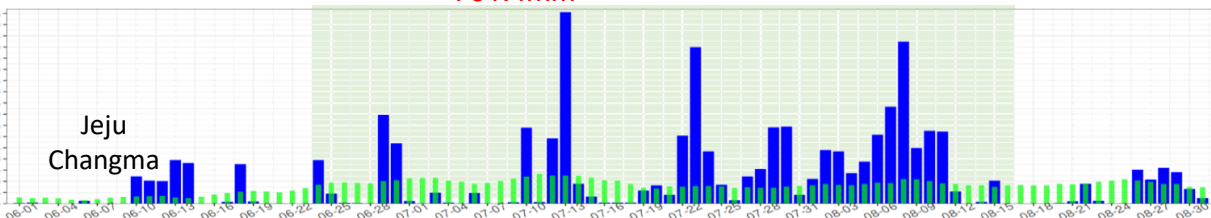
1032.7mm(96.6%ile)



Changma
6.24~8.16.(54days)
701.4mm

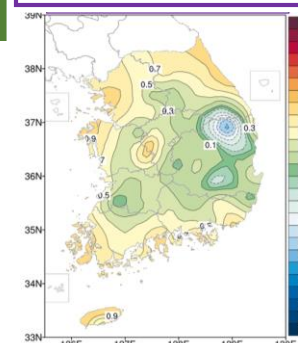
Jeju
Changma

2nd largest Changma Precipitation(701.4mm) in 2020 since 1973

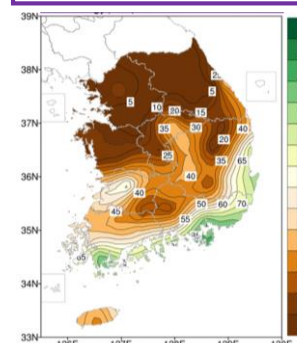


2021

24.2°C(+0.5 °C)

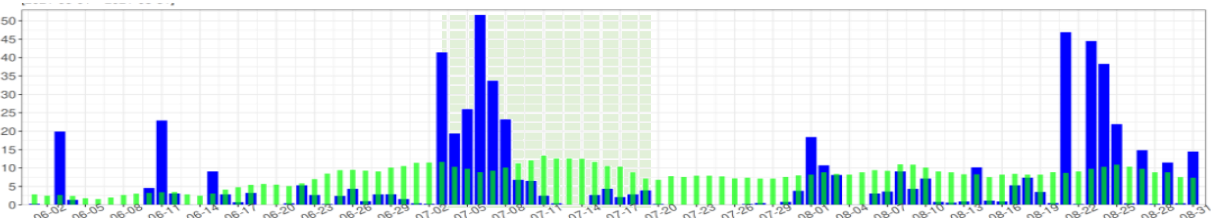


614.9mm(28.6%ile)



Changma
7.3~7.19.(17days)
227.5mm

3rd shortest Changma duration(17days) in 2021 since 1973

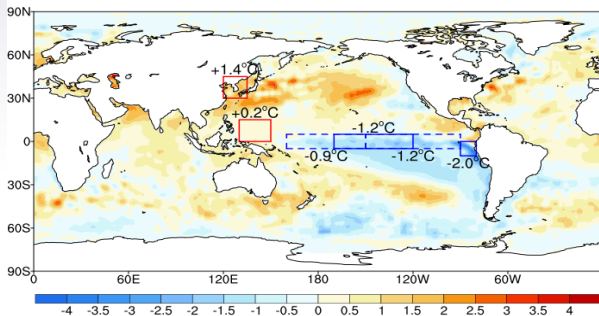


The review of Recent Climate

Period : 3.1.~5.3.

SST anomaly

SST Weekly Anomaly (OISSTv2)
24Apr2022 ~ 30Apr2022

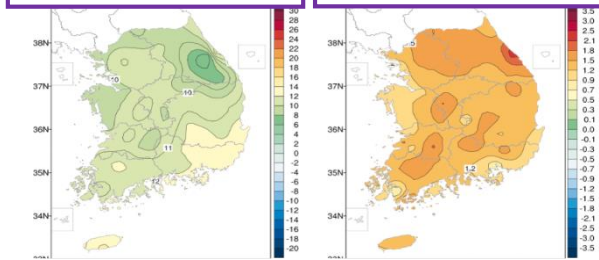


La Niña continued during this Spring.

Temperature

Mean temp. 10.8°C

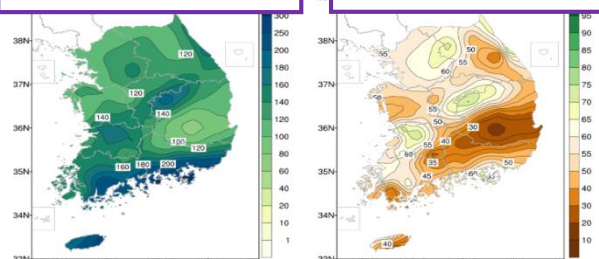
Anomaly +1.4°C



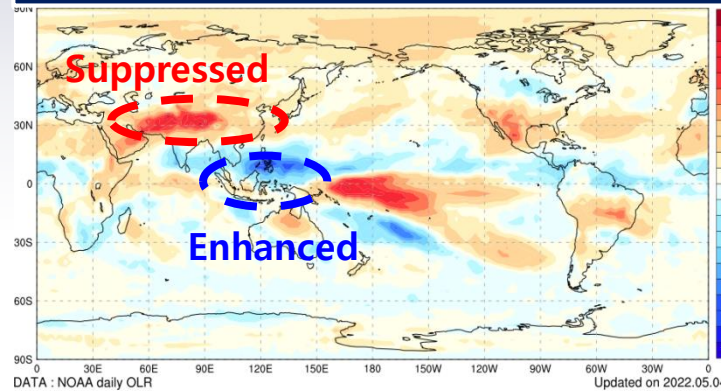
Precipitation

Precipitation 149.2mm

Percentile 52.4%ile

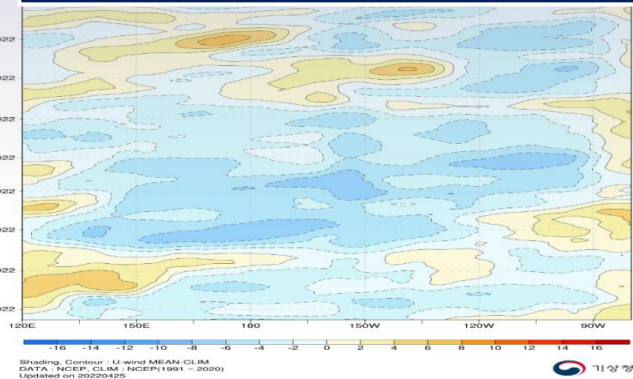


OLR anomaly

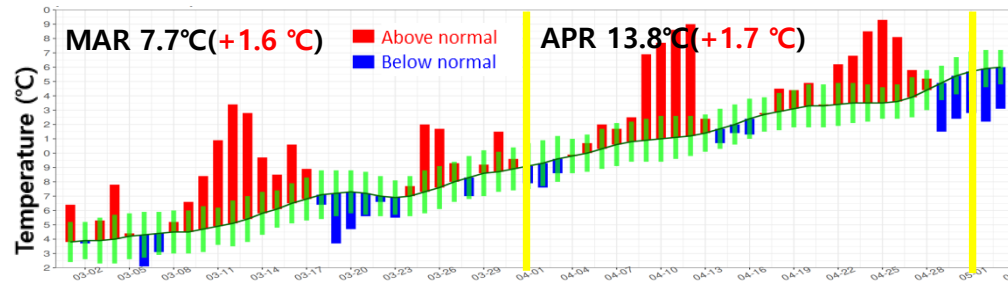


Convective activity inferred from OLR was **enhanced** around **western tropical Pacific** and was **suppressed** in South Asia.

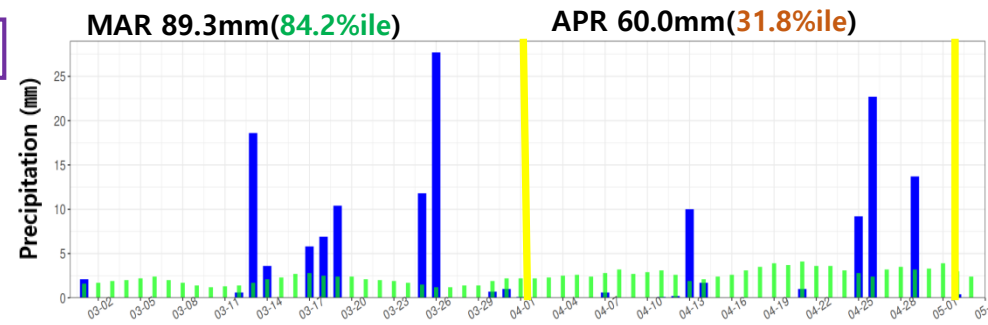
850hPa U-wind anomaly (5S~5N)



Easterly wind continued over the central tropical Pacific.



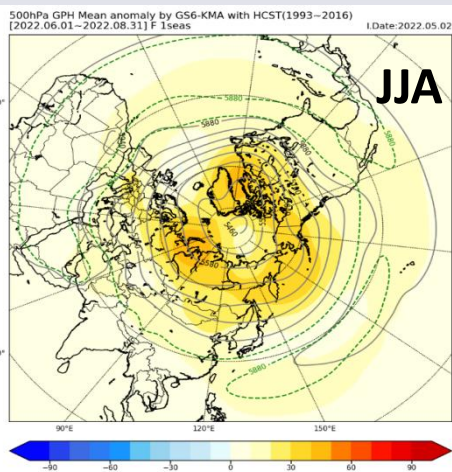
Temperature over Korea is above normal



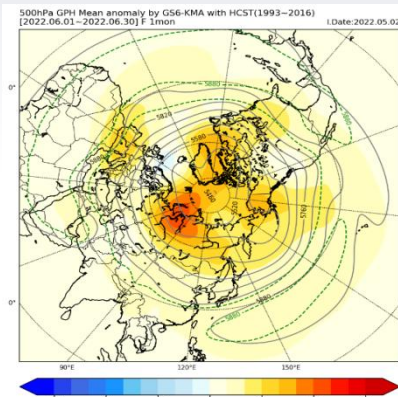
Precipitation is near normal, but the amount varied each months

Prediction of 2022 summer (GloSea6_initial 5.2)

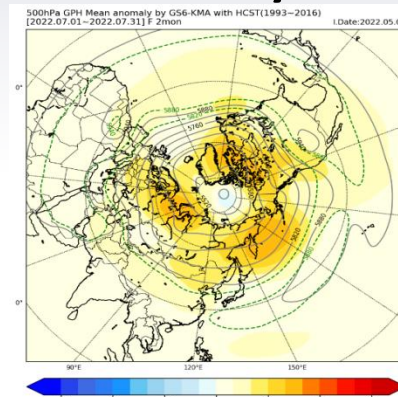
<500hPa>



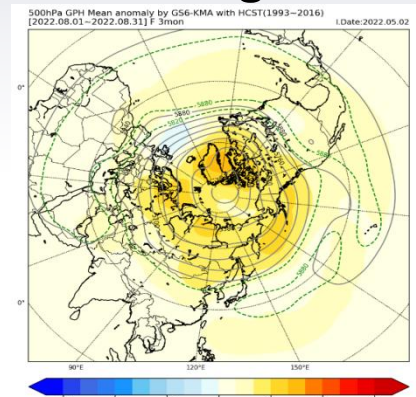
June



July



August



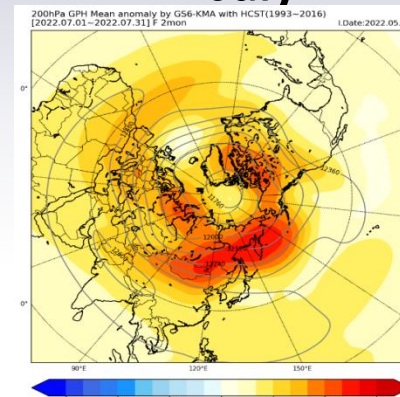
- ▶ Positive anomaly is predicted over the northwest of Lake Baikal for **June**.
→ Leads to inflow of the cold air into Korea.
- ▶ Relatively, Negative anomaly exists over Western North Pacific region. WNPSH is likely to be weaker than normal for **July & August**.
→ Less impacts by WNPSH for July & August

<200hPa>

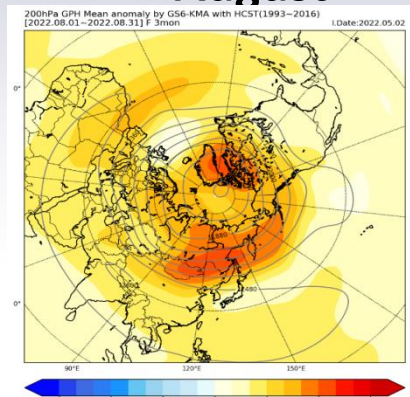
- ▶ Positive anomaly is shown over the north of Korean Peninsula. Tibetan High could extend northeastward for **July & August**.

* The variability of Snow cover in Tibetan and its impact would be needed to monitoring.

July

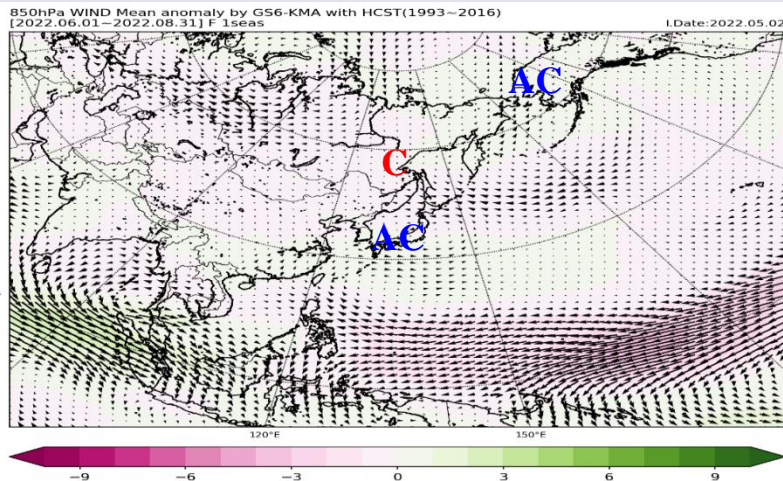


August

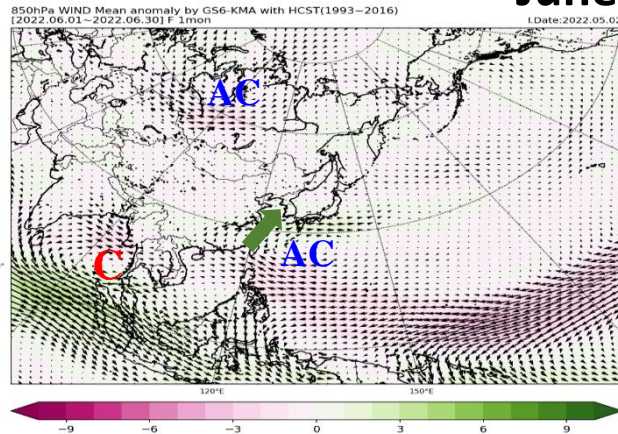


<850hPa wind >

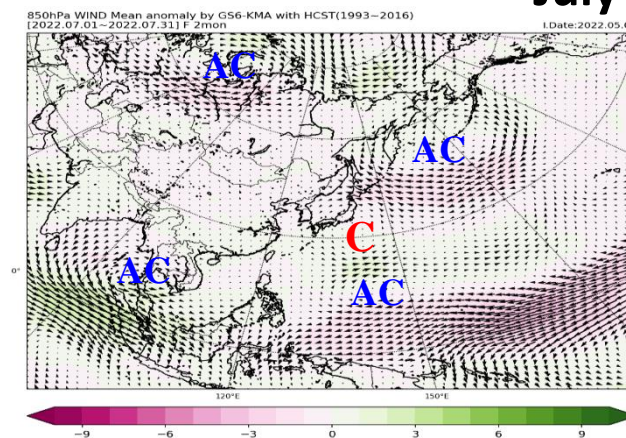
JJA



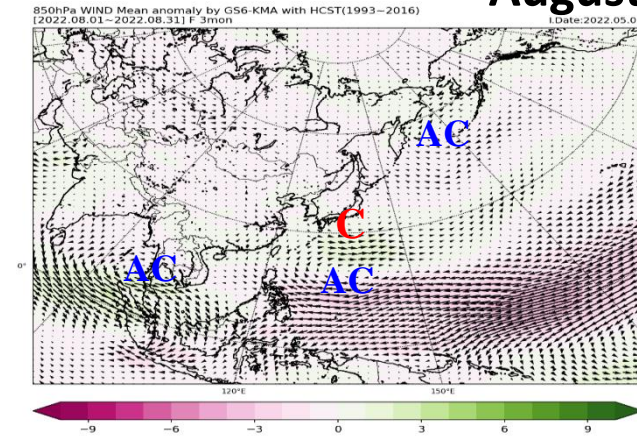
June



July



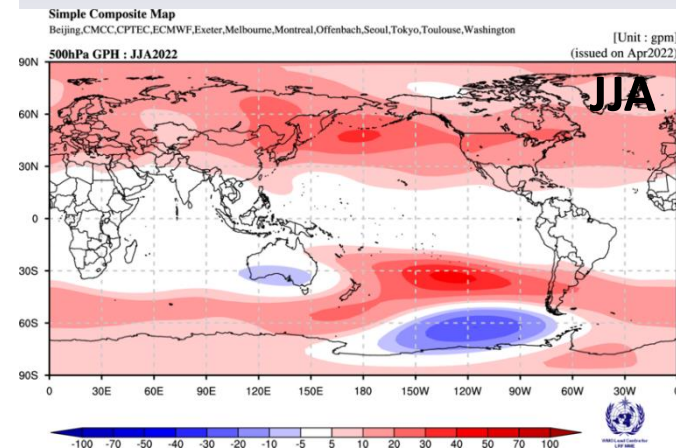
August



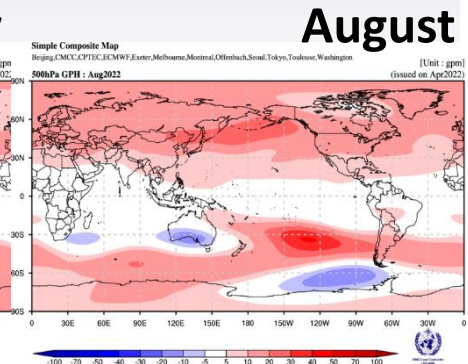
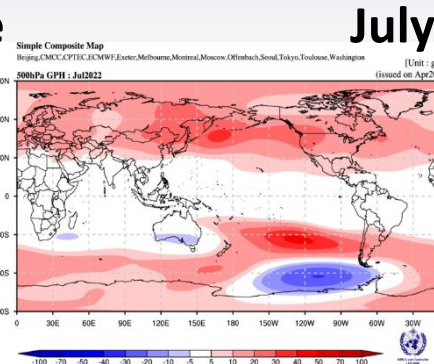
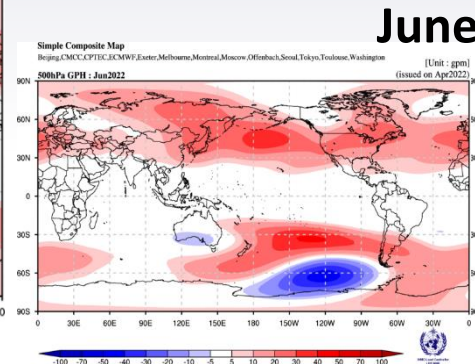
- ▶ **Anti-cyclonic circulation** anomaly over the East China Sea for June → Southwesterly wind occurred → Enhanced warm moist air continue to flow into Korea → **Above normal precipitation**
- ▶ **Cyclonic circulation anomaly** over east of Korea for July & August → Easterly wind occurred → **Below normal precipitation**

Prediction of 2022 summer (WMO LC-LRFMME)

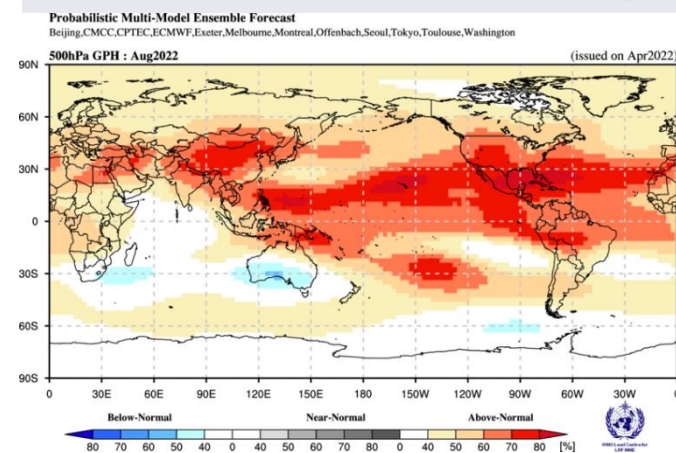
<500 hPa anomaly>



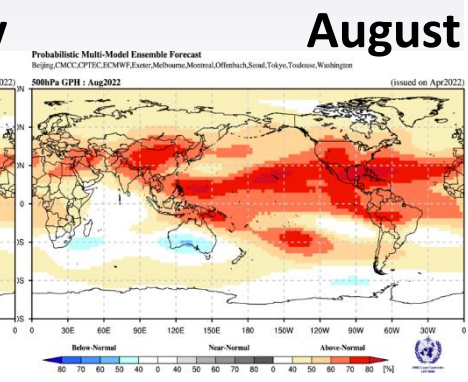
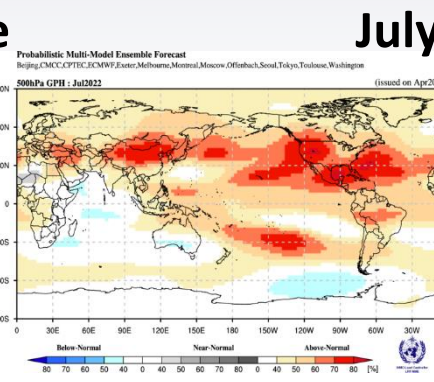
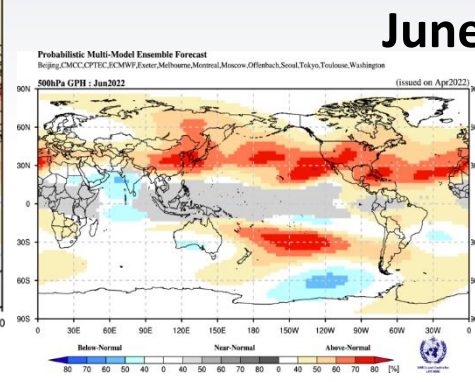
<SCM>



JJA

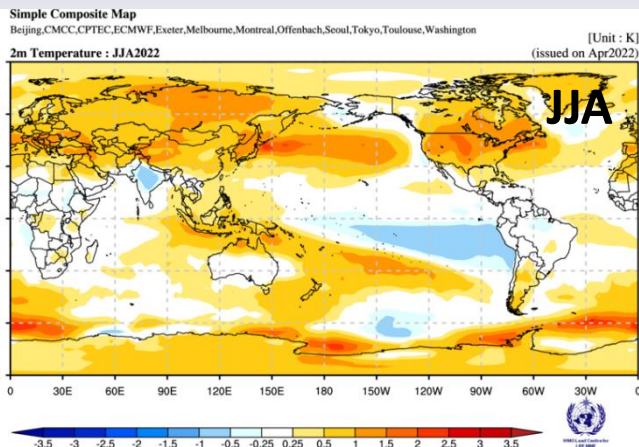


<PMME>

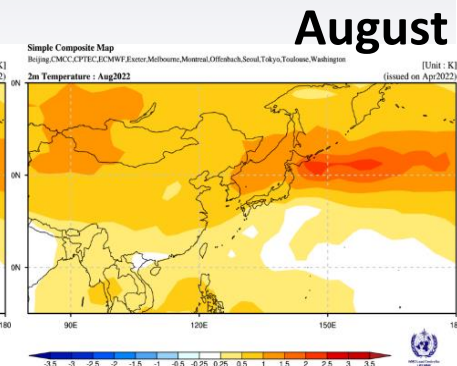
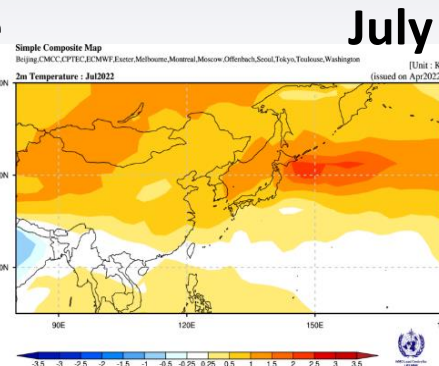
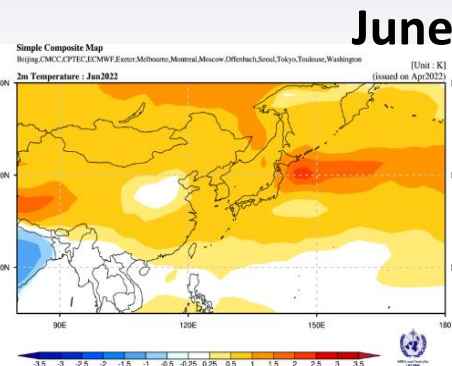


► In both, positive anomaly over East Asia

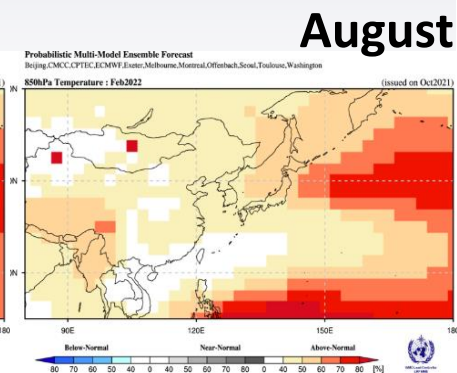
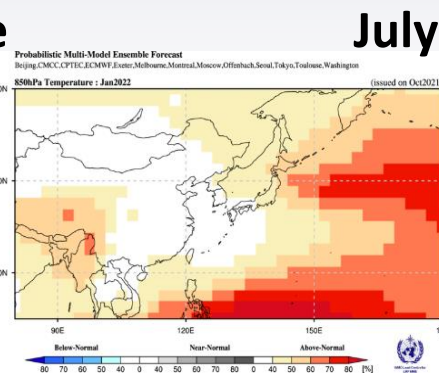
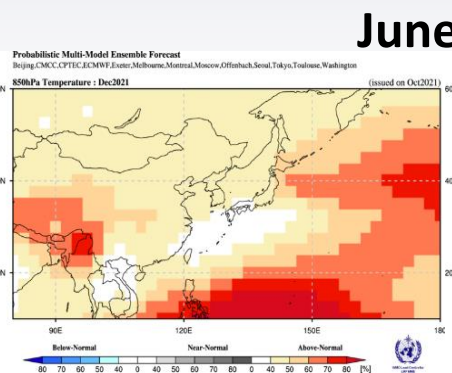
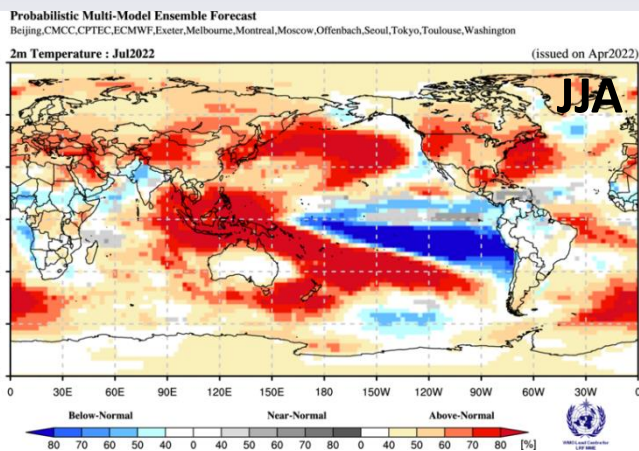
<T_{2m} anomaly>



<SCM>

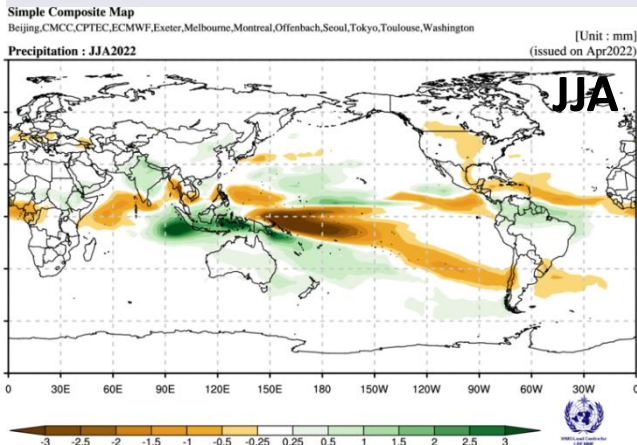


<PMME>

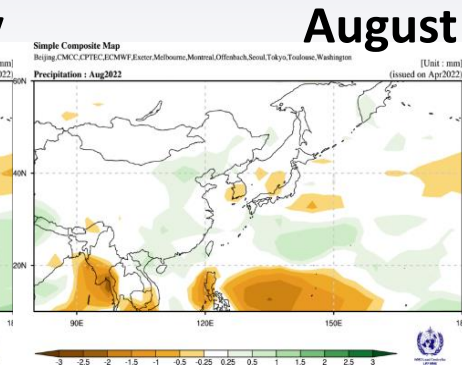
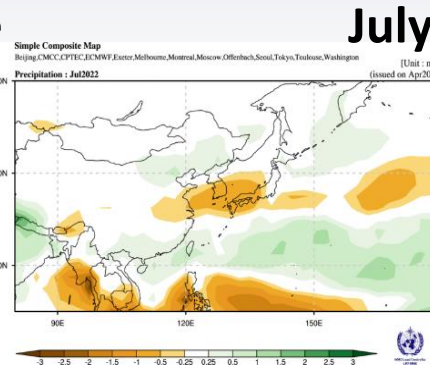
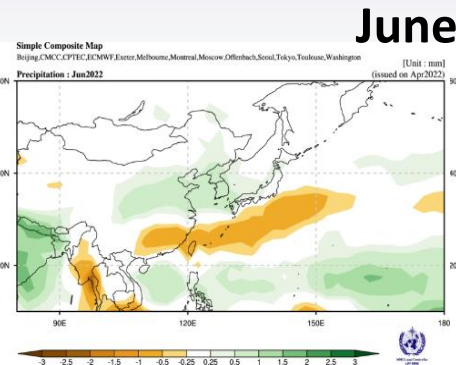


► Most East Asian region shows near normal or above-normal temperature

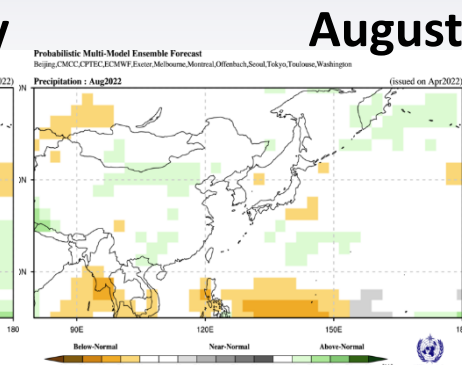
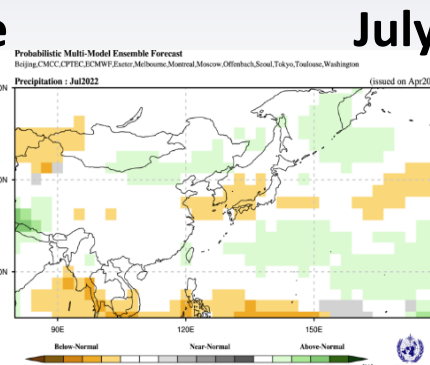
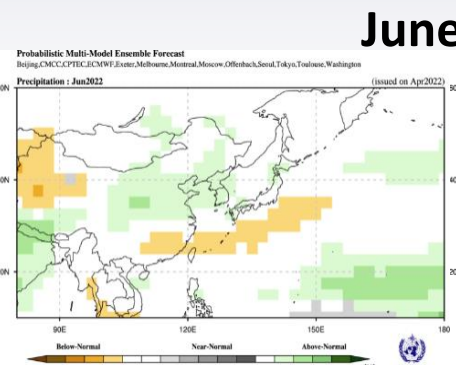
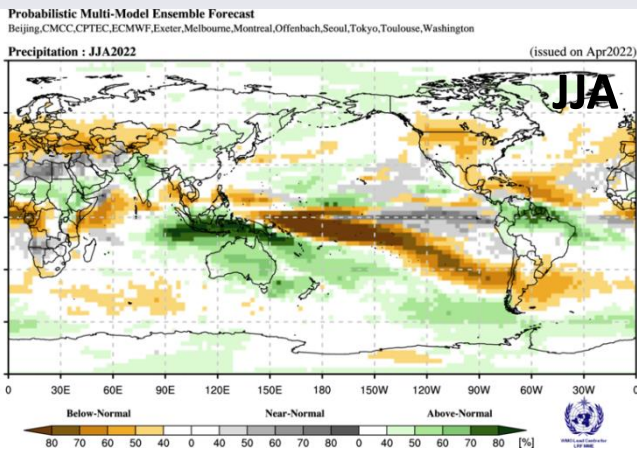
<Precipitation anomaly>



<SCM>



<PMME>



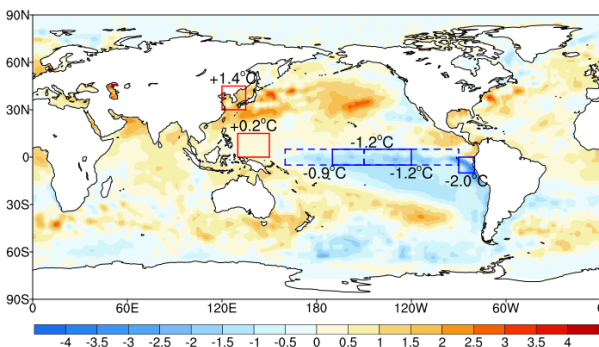
► Above normal over South Korea and eastern part of China for June

► Below normal or near normal precipitation for July and August

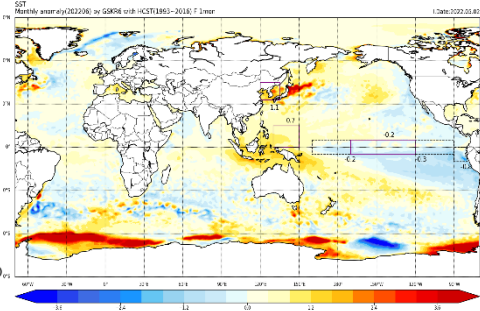
ENSO Prediction

<SST Weekly Anomaly (Recent)>

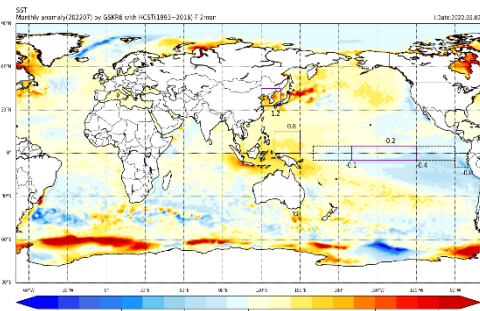
SST Weekly Anomaly (OISSTv2)
24Apr2022 ~ 30Apr2022



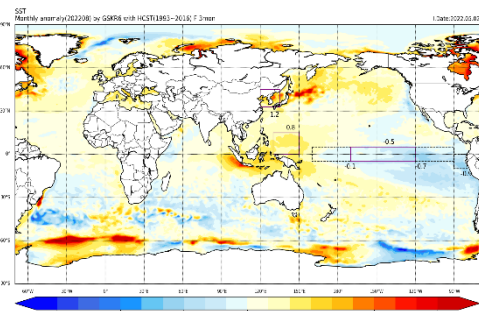
June



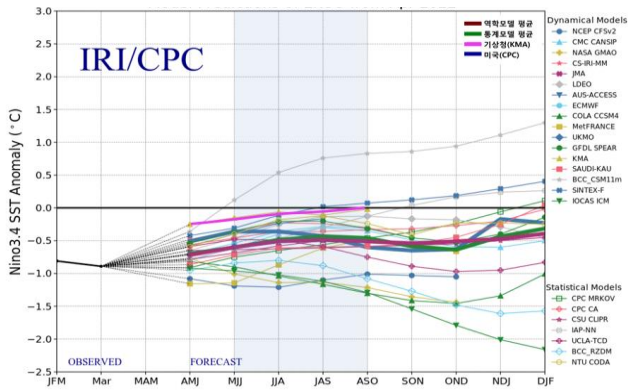
July



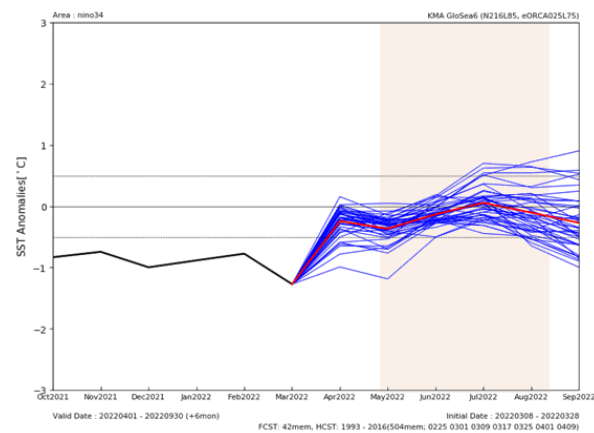
August



<Model predictions>



<KMA Nino 3.4(GloSea6)>



<Mean Temperature anomaly and precipitation at La Niña>

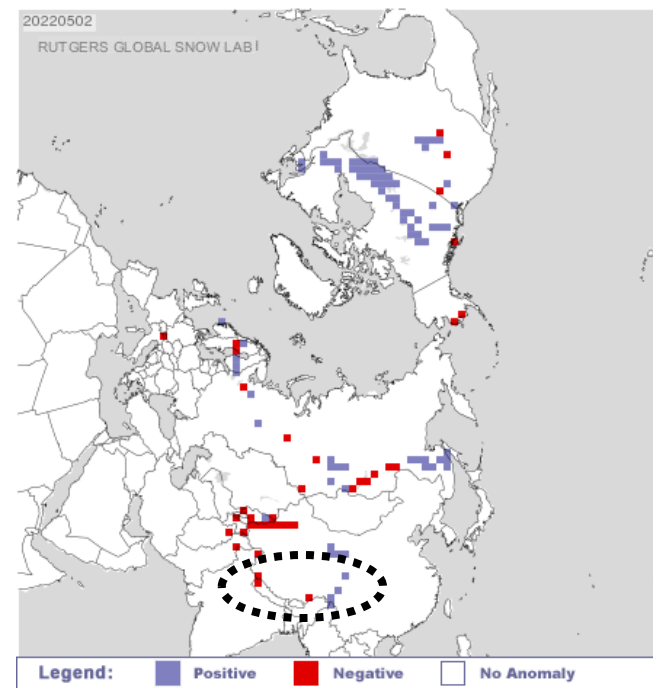
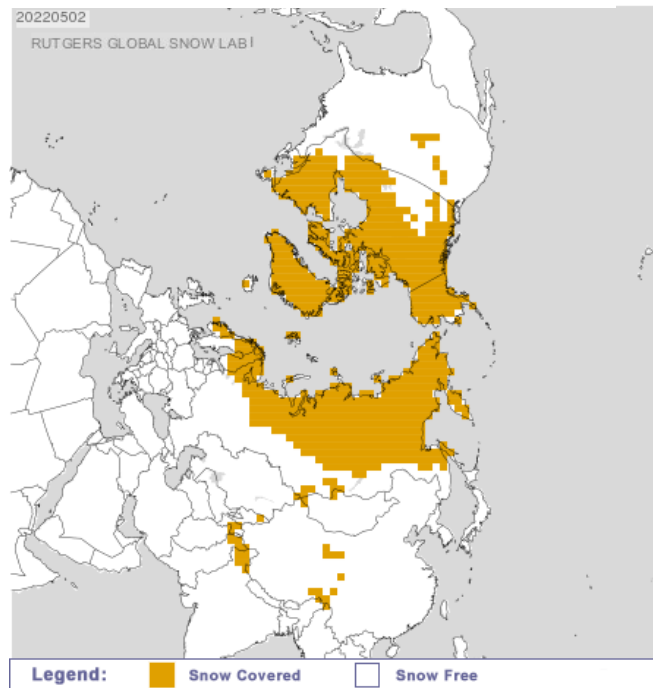
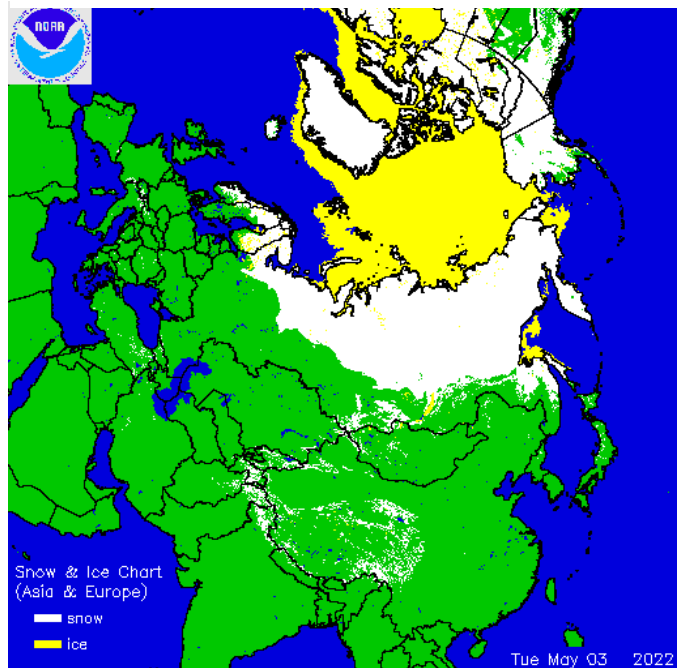
연도	June		July		August	
	Temp (°C)	Prcp (mm)	Temp (°C)	Prcp (mm)	Temp (°C)	Prcp (mm)
	±0.3	181.6~174.0	±0.6	245.9~308.5	±0.5	225.3~346.7
1985	-0.7	212.4	0.6	219.6	1.1	301.2
1989	-1.3	188.2	-0.8	377.5	-0.5	220.8
1996	-0.5	302.8	-0.7	221.9	0.0	116.2
2000	0.0	166.5	0.8	245.4	0.1	392.1
2008	-1.1	186.9	1.3	246.2	-0.6	191.1
2012	0.5	76.2	0.6	298.8	1.1	405.2
Tendency	-	+	0-	0+	0+	0+

1999	0.1	168.9	-0.9	287.3	-0.8	360.9
2011	0.4	285.3	0.3	498.1	-0.2	284.8
2017	0.2	59.7	1.6	313.5	0.1	239.5
Tendency	0+			0+	0-	0+

- ▶ Recently sea surface temperature of the Nino3.4 region is negative anomaly(-1.2°C)
- ▶ La Niña condition is likely to continue during this summer
- ▶ Statistically, during La Niña precipitation over Korea tends to be above normal for June

Snow Cover condition

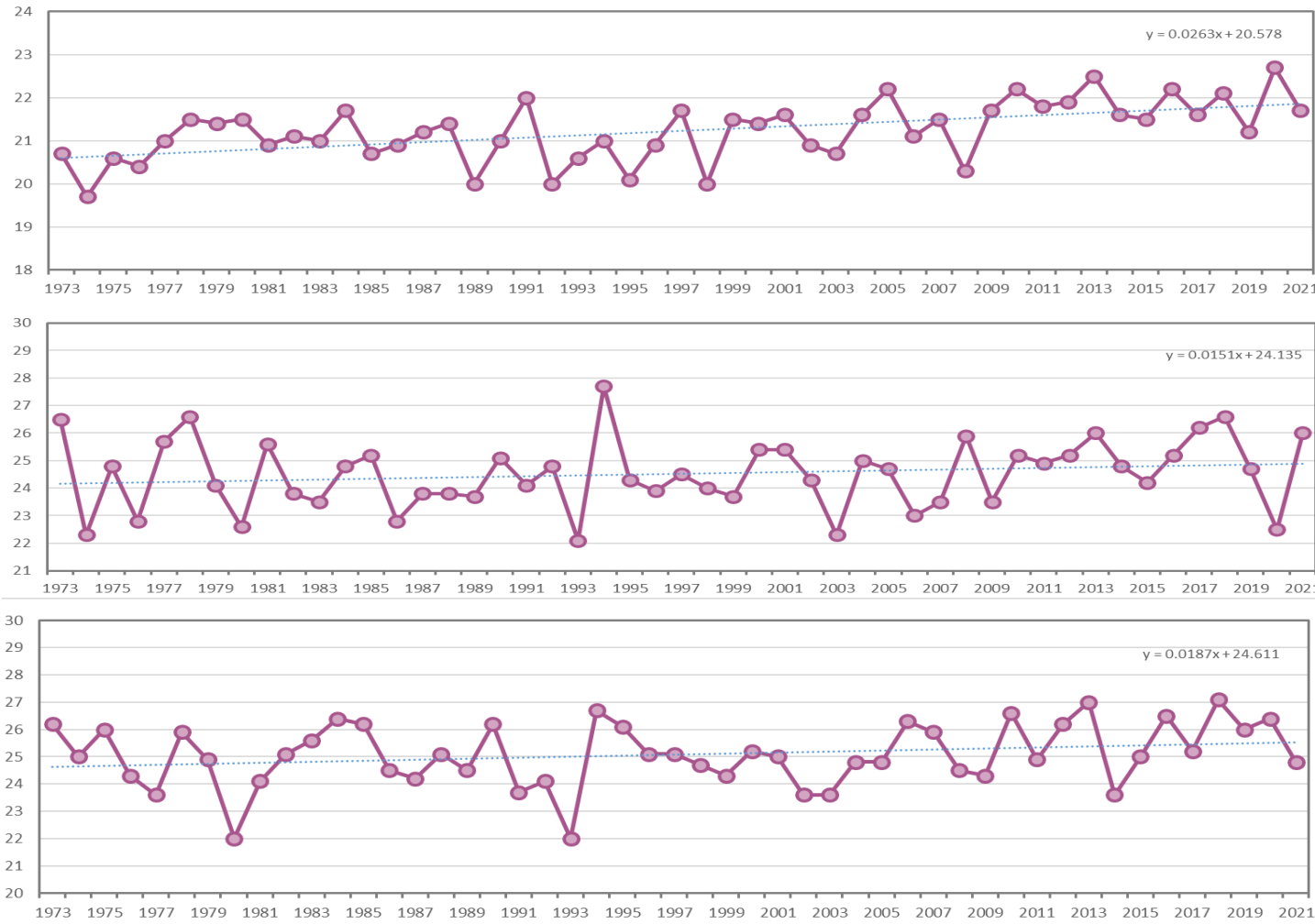
<Snow cover>



► Recently Snow Cover in Tibetan Plateau is normal.

- However the fluctuation still remain high, so monitoring is needed continuously
- If less Snow cover in Tibetan for Spring, it could lead to strengthened Tibetan High feeds back to higher surface temperature over Korea for summer

<Trend of Mean Temperature over Korea>



June

- average 21.4°C
- **+1.3°C** / 49years

July

- average 24.6°C
- **+0.7°C** / 49years

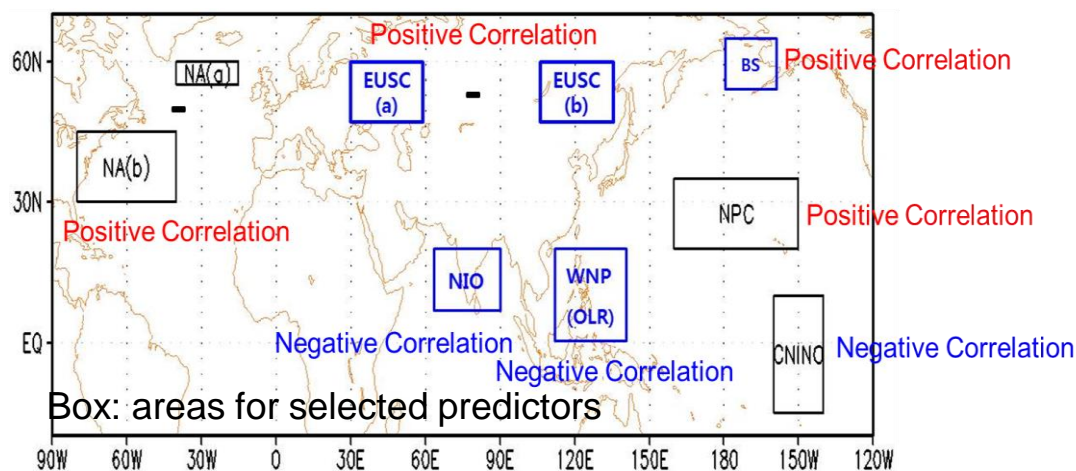
August

- average 25.1°C
- **+1.0°C** / 49years

► The temperature of Korea is increasing trends for each month of summer

Changma prediction using predictors

<Precipitation>



NA: North Atlantic
EUSC: Eurasian Snow Cover
BS: Bering Sea
NIO: Northern Indian Ocean

WNP: Western North Pacific
CNINO: Central Pacific NINO
NPC: Northern Pacific Change

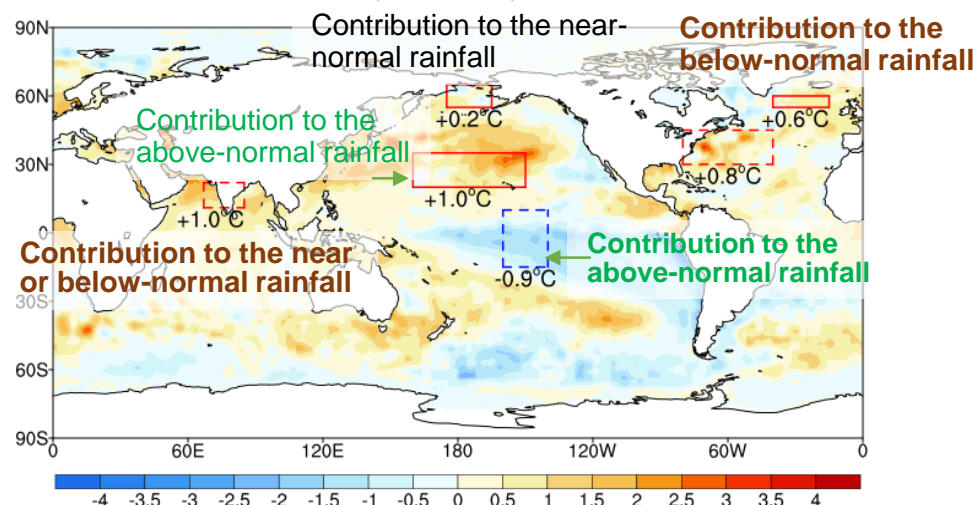
Selected predictors for Changma Onset

Predictor	Date	Predictor	Date
North Atlantic(NA(a)-NA(b)) region SST [NA]	4/6~4/25	Northern Indian Ocean[NIO]	4/16~4/30
Central Pacific NINO [CNINO]	4/1~4/20	Bering Sea[BS]	3/12~3/31
		Eurasian Snow Cover[EUSC]	3/1~5/31
Northern Pacific change [NPC]	(4/11~4/30) -(3/22~4/10)	Western North Pacific[WNP(OLR)]	5/11~5/30

* Source: Lee and Seo(2013), The development of a statistical forecast model for Changma, Weather and forecasting, 28, 1304-1321, doi.org/10.1175/WAF

SST Weekly Anomaly (OISSTv2)

24Apr2022 ~ 30Apr2022



Statistical forecast model for predicting the Changma precipitation

$$\text{Changma precipitation} = +0.41 \times \text{NA(sst)} + 0.46 \times \text{NPC(sst)} - 0.40 \times \text{CNINO(sst)}$$

$$\text{Changma precipitation} = +0.49 \times \text{NA(sst)} - 0.49 \times \text{NIO(sst)} + 0.33 \times \text{BS(sst)}$$

$$\text{Changma precipitation} = +0.57 \times \text{NA(sst)} + 0.33 \times \text{NPC(sst)} - 0.41 \times \text{WNP(olr)}$$

$$\text{Changma precipitation} = +0.54 \times \text{NA(sst)} - 0.39 \times \text{NIO(sst)} + 0.42 \times \text{EUSC}$$

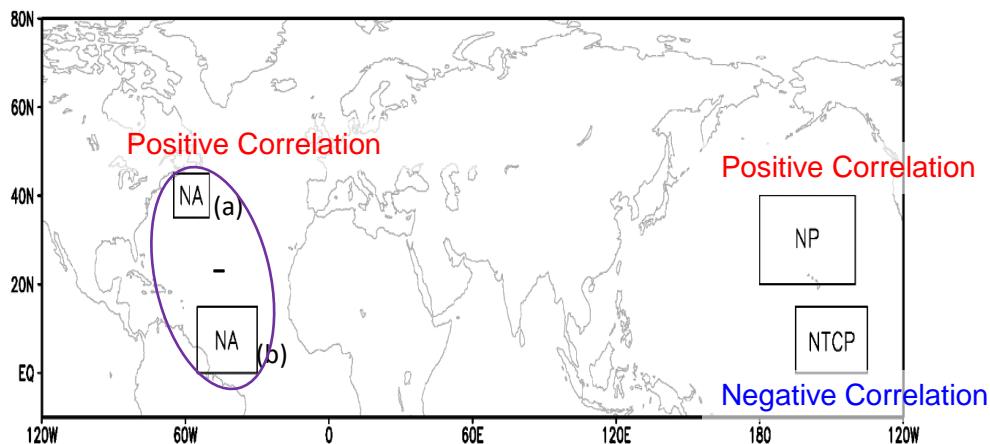
► The Changma precipitation is near or below normal

- (Near normal) Based on 5 predictors*

* Five predictors : NA, CNINO, BS, NIO, NPC

- (Below normal) Predictor **NA**, which has the positive correlation with precipitation, shows a negative condition at the moment

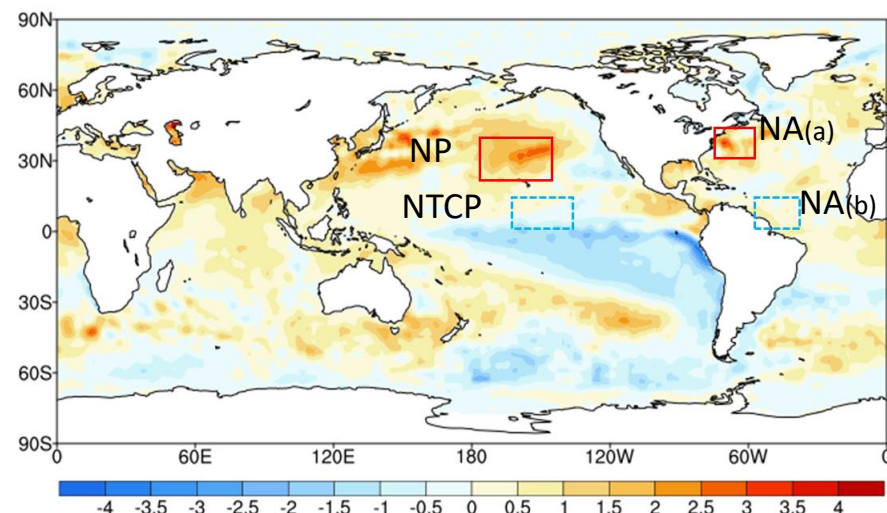
<Changma Onset>



NA: North Atlantic
NP: Northwest Pacific
NTCP: North tropical central Pacific

SST Weekly Anomaly (OISSTv2)

24Apr2022 ~ 30Apr2022



Statistical forecast model for predicting the Changma Onset

$$\text{Changma Onset} = 2.437(\text{NCTP}) - 4.322(\text{NA}) - 2.842(\text{NP}) + 171$$

Selected predictors for Changma Onset

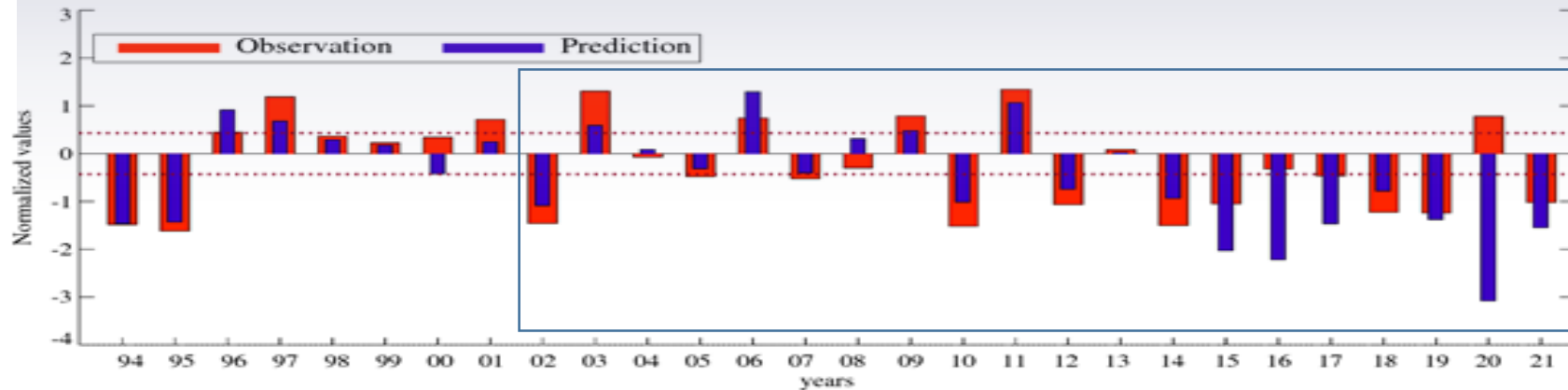
Predictor	Date
North Atlantic(NA _(a) -NA _(b)) region SST [NA]	March~June Positive lead to an early Changma onset
Northwest Pacific region SST [NP]	April~June Positive lead to an early Changma onset
North tropical central Pacific region SST [NTCP]	May~June Negative lead to an early Changma onset

► The Changma is likely to start earlier than normal by the statistical model.

* Source : Park et al.(2015), Development of a Dynamics-Based Statistical Prediction Model for the Changma Onset, 28, 6647-6666, doi.org/10.1175/JCLI-D-14-00502.1

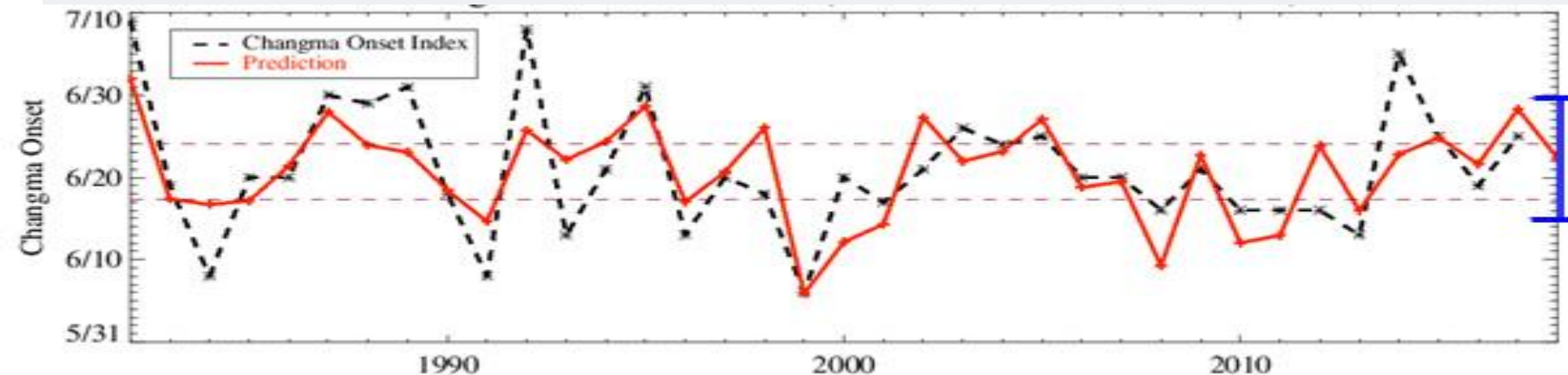
Verification of Changma prediction

< Changma precipitation >



- Tendencies of lower precipitation are similar to observations, but mostly underestimated.

< Changma Onset >



- Correlation of the Changma onset is 0.73.

Summary

- **La Niña condition** is likely to continue during this summer
- **Summer Monsoon**
 - The westward extension of WNPSH will be weaker than normal for July and August
 - This Summer Monsoon is weaker than normal over Korea
- **2022 Summer outlook over Korea**
 - **(Temperature) Above normal, (Precipitation) Near normal**
 - The uncertainties are very strong and monitoring is needed during summer
 - * The variabilities are high in terms of ENSO, WNPSH, Tibetan snow and Arctic activities etc.

Temperature	Precipitation
Above Normal	Near normal

Thank you !!