

Climate Outlook in Korea for Winter 2022/23

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Outlines

- **Dynamic Models**
GloSes6, WMO-LC LRFMME
- **Climate Predictors Affecting Winter Season**
ENSO, Arctic sea ice, snow cover, etc.
- **2022/23 Winter Outlook**

Dynamic Models

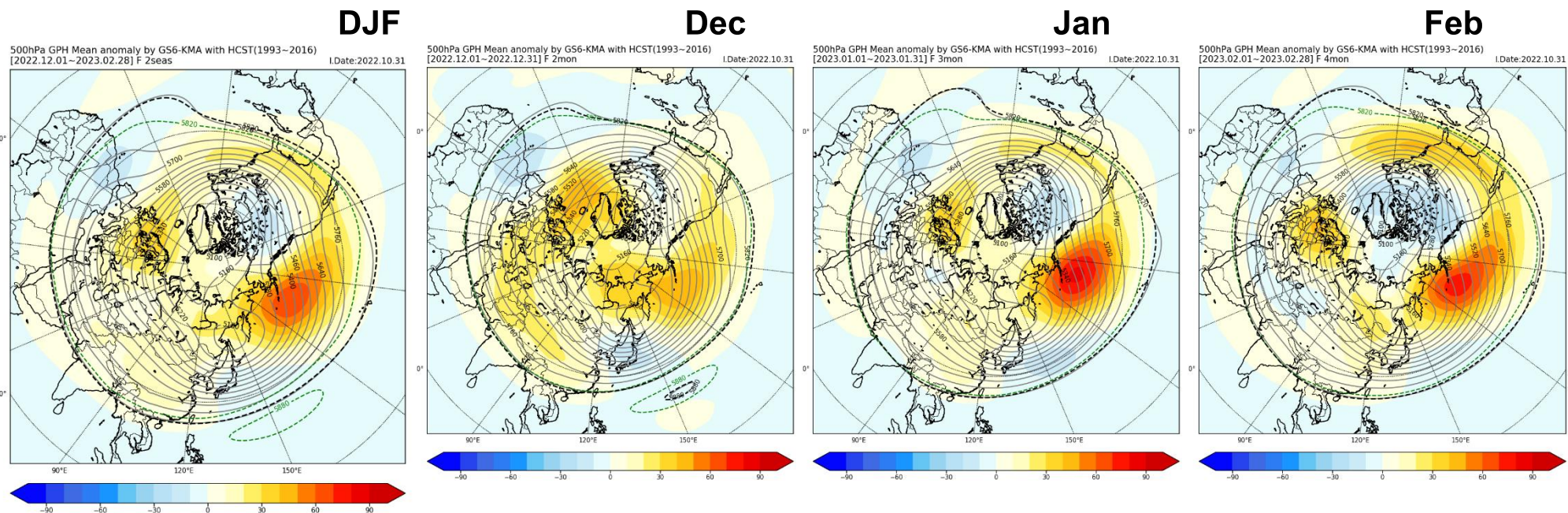
- GloSea6, WMO-LC LRFMME -

S2S Operational Model at KMA

KMA Global Seasonal Forecasting System version 6 (GloSea6)

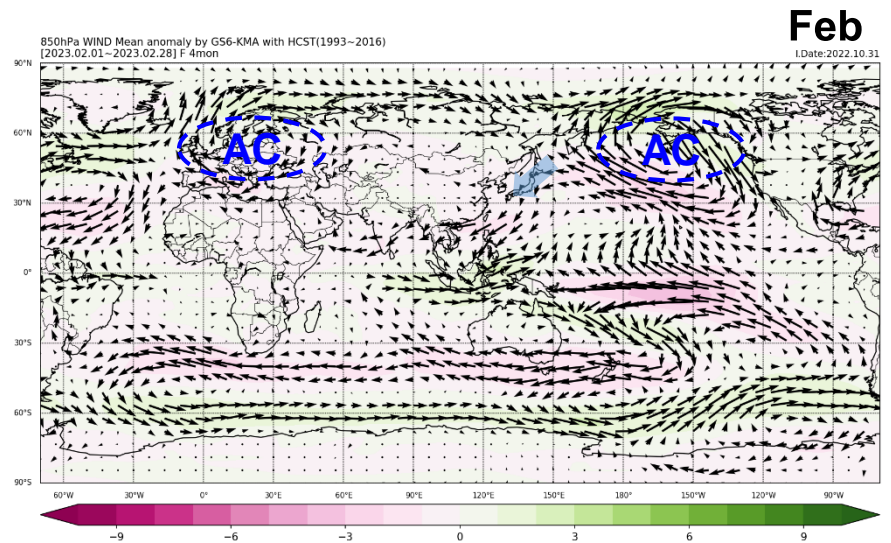
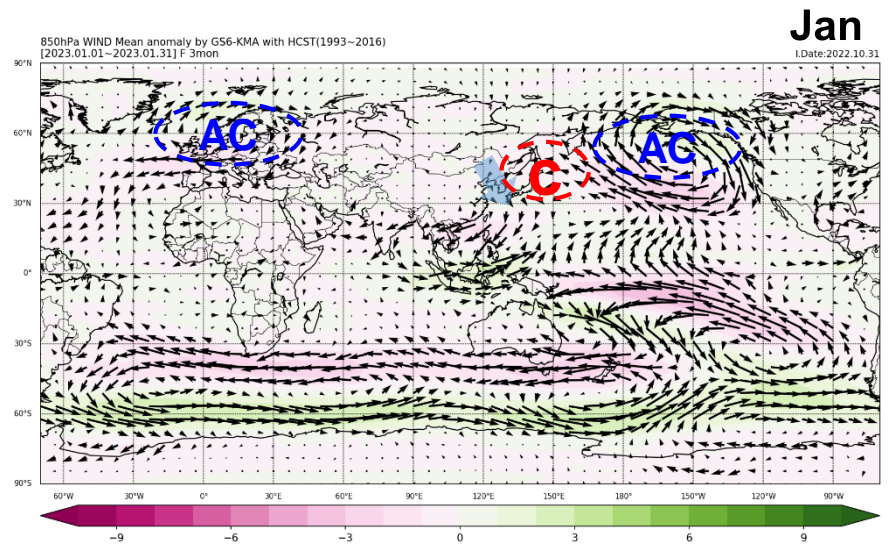
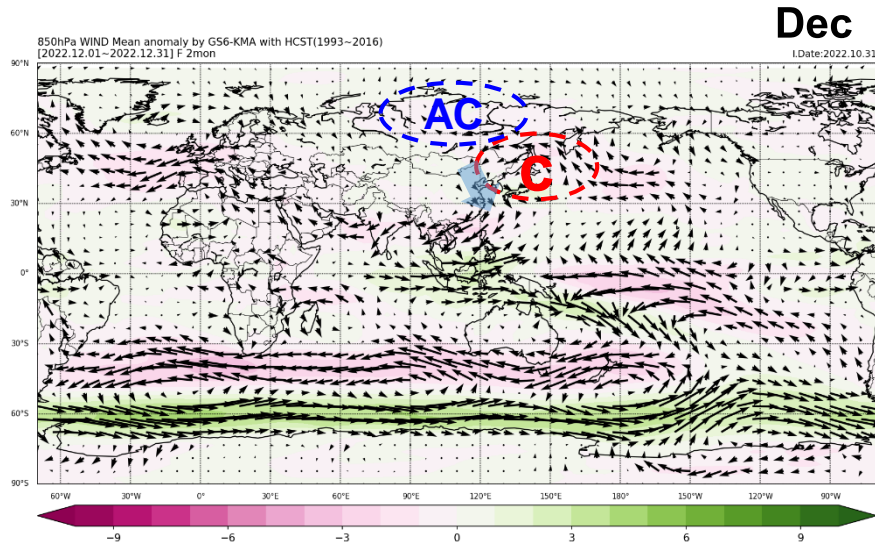
		Hindcast	Forecast
Period		1993~2016 (24years)	2021~
Initial Field	Atmosphere	ECMWF ERA-interim	KMA NWP analysis
	Land	KMA JULES-ERA5	KMA JULES-ERA5
	Ocean/Sea Ice	UKMO NEMOVAR	KMA NEMOVAR
Model	Running Time	00UTC on 1st, 9th, 17th, 25th	00UTC everyday
	Forecast Period	252days	4mem (75days) 4mem (240days)
Ensemble	Member	7mem×24years = 168mem	4mem (75days) 4mem (240days)

(GloSea6) 500hPa GPH Anomaly (issued on Oct 31, 2022)



- In winter, positive anomalies are shown over the Eastern Siberia and over the northern part of the North Pacific. On the other hand, negative anomalies are expected around Korea.
- You can see the **positive anomalies over Siberia**, but it changes to normal in February, and positive anomalies appear over the **northern part of the North Pacific from December to February**.
- The **positive anomalies over the Ural Mountains** have an impact on cold air outbreaks over the **East Asia**. The positive anomalies over the **northern part of the North Pacific** will maintain cold air around **Korea**. The cold air is possible to remain over **Korea** and develop the **Siberian High**.

(GloSea6) 850hPa Wind Anomaly (issued on Oct 31, 2022)

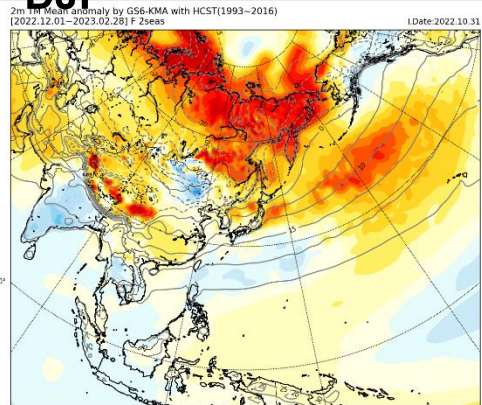


- ▶ (Dec.) Anti-cyclonic anomalies are predicted over Siberia, and cyclonic anomalies are predicted over the eastern part of Japan.
- ▶ (Jan.-Feb.) Anti-cyclonic anomalies are predicted over the Scandinavian Peninsula and the Bering Sea, and more stronger in February.
- ▶ Northwesterly wind anomalies are predicted over Korea from December to January. A cold spell is expected to be caused by a southward inflow of cold air near Siberia.

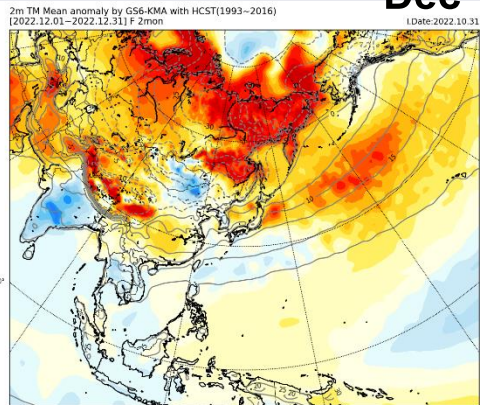
(GloSea6) Temperature and Precipitation (issued on Oct 31, 2022)

< Temperature (2m) >

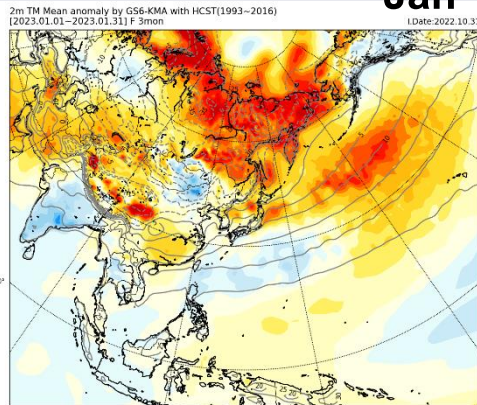
DJF



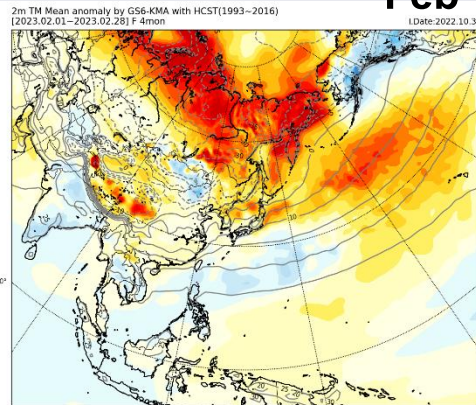
Dec



Jan



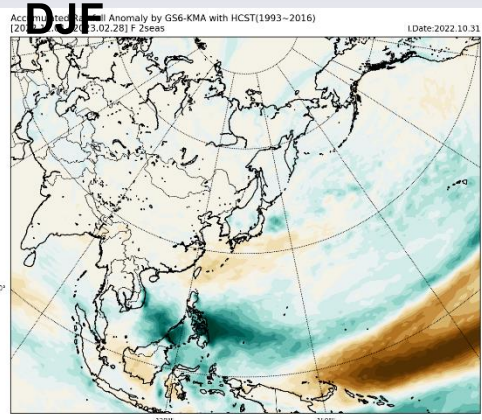
Feb



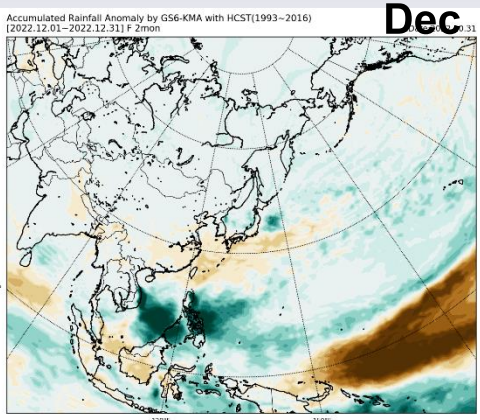
► The temperature will be **below normal** or **near normal** over East Asia and **above normal** over Southeast Asia.

< Precipitation >

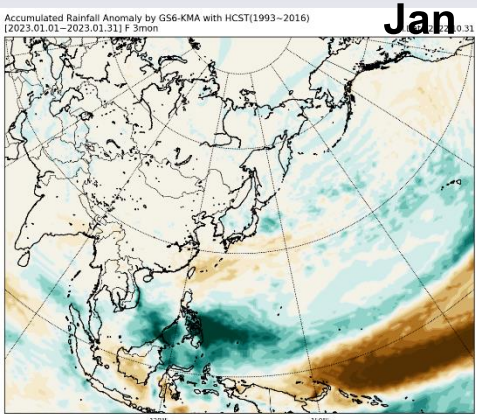
DJF



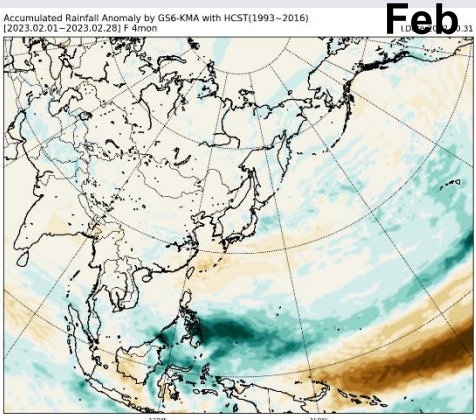
Dec



Jan



Feb



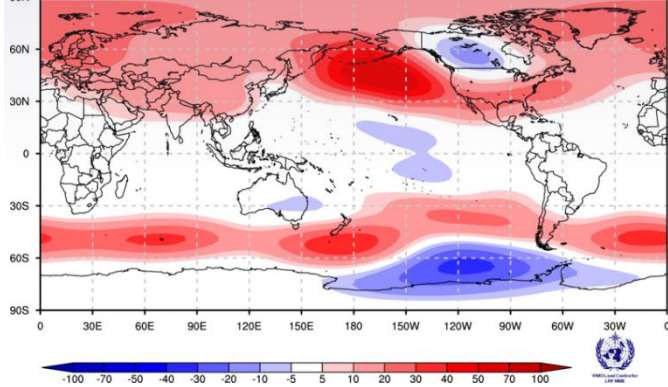
► The precipitation will be **less than normal** over East Asia.

(WMO-LC LRFMME) 500hPa GPH anomaly (issued on Oct 2022)

< SCM >

Simple Composite Map
Beijing,CMCC,CPTEC,ECMWF,Exeter,Melbourne,Montréal,Offenbach,Seoul,Tokyo,Toulouse,Washington

500hPa GPH : DJF2022



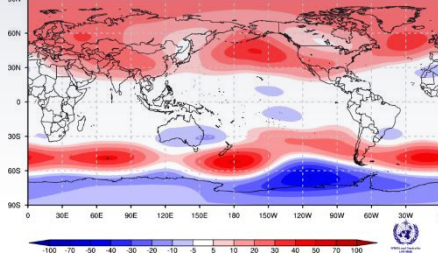
DJF

[Unit : gpm]
(issued on Oct2022)

Dec

Simple Composite Map
Beijing,CMCC,CPTEC,ECMWF,Exeter,Melbourne,Montréal,Offenbach,Prato,Seoul,Tokyo,Toulouse,Washington

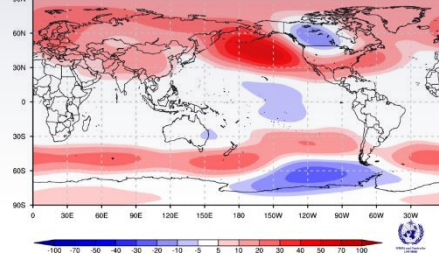
500hPa GPH : Dec2022



Jan

Simple Composite Map
Beijing,CMCC,CPTEC,ECMWF,Exeter,Melbourne,Montréal,Offenbach,Prato,Seoul,Tokyo,Toulouse,Washington

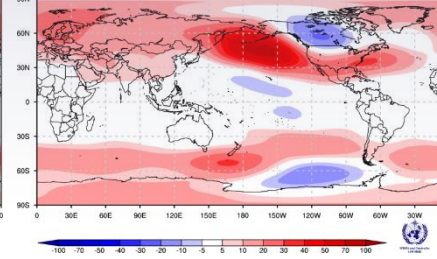
500hPa GPH : Jan2023



Feb

Simple Composite Map
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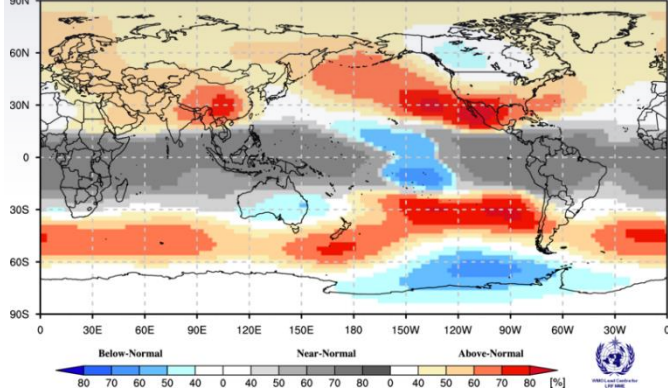
500hPa GPH : Feb2023



< PMME >

Probabilistic Multi-Model Ensemble Forecast
Beijing,CMCC,CPTEC,ECMWF,Exeter,Melbourne,Montréal,Offenbach,Seoul,Tokyo,Toulouse,Washington

500hPa GPH : DJF2022



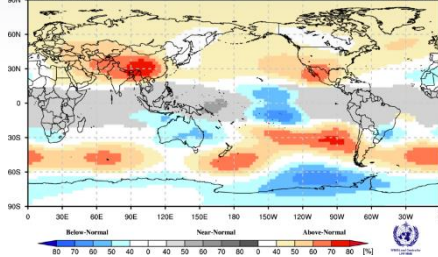
DJF

(issued on Oct2022)

Dec

Probabilistic Multi-Model Ensemble Forecast
Beijing,CMCC,CPTEC,ECMWF,Exeter,Melbourne,Montréal,Offenbach,Prato,Seoul,Tokyo,Toulouse,Washington

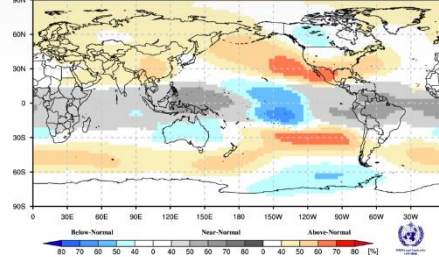
500hPa GPH : Dec2022



Jan

Probabilistic Multi-Model Ensemble Forecast
Beijing,CMCC,CPTEC,ECMWF,Exeter,Melbourne,Montréal,Offenbach,Prato,Seoul,Tokyo,Toulouse,Washington

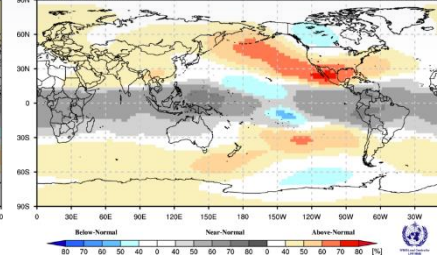
500hPa GPH : Jan2023



Feb

Probabilistic Multi-Model Ensemble Forecast
Beijing,CMCC,CPTEC,ECMWF,Exeter,Melbourne,Montréal,Offenbach,Seoul,Tokyo,Toulouse,Washington

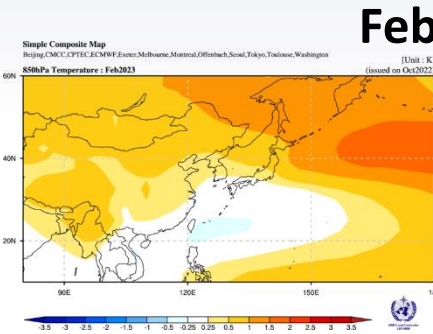
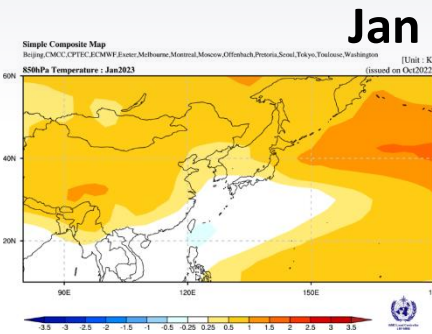
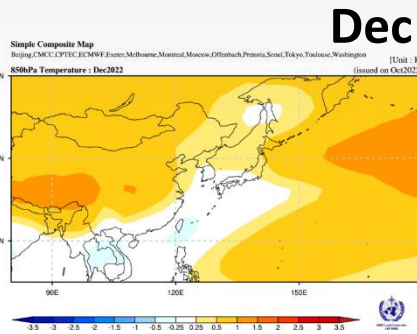
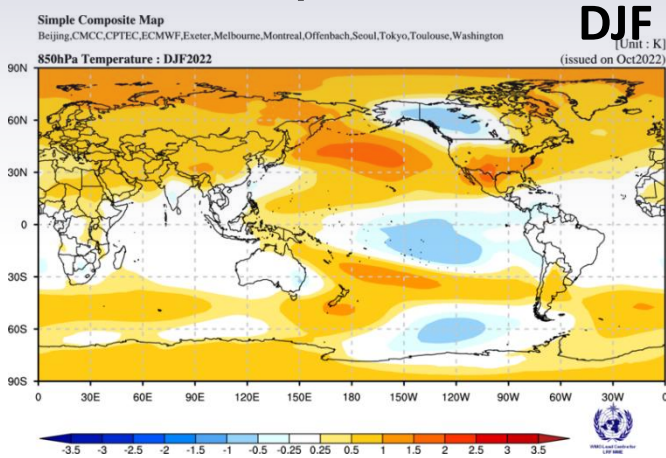
500hPa GPH : Feb2023



- In both models, there are positive anomalies in most part of East Asia and near normal in Korea.

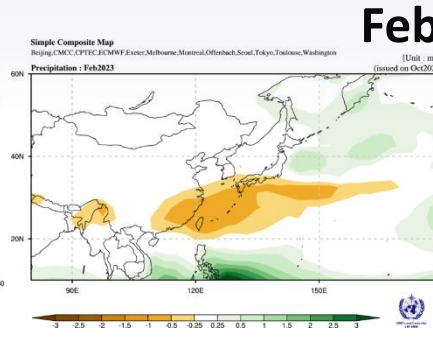
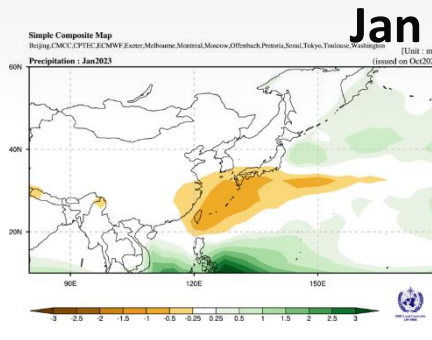
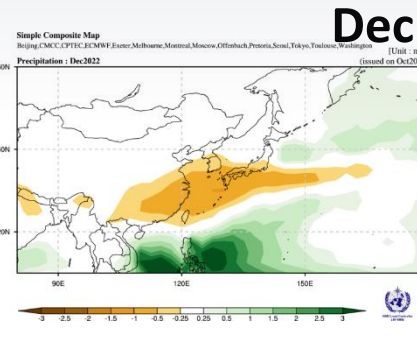
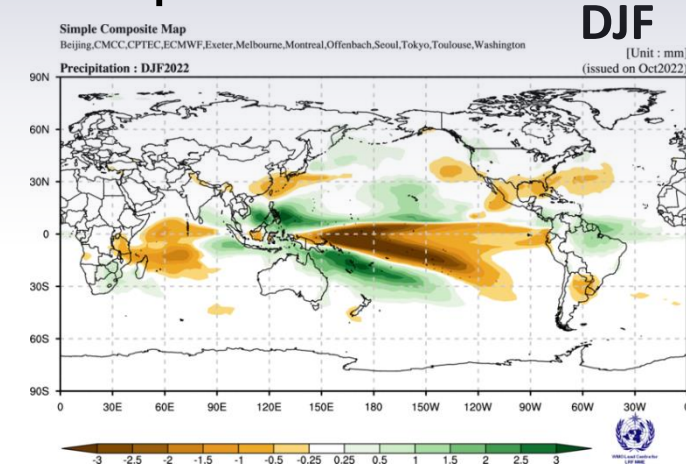
(WMO-LC LRFMME) Temperature and Precipitation (issued on Oct 2022)

< 850hPa Temperature >



► In the 850hPa height field, the temperature is predicted to be near normal or above normal over East Asia.

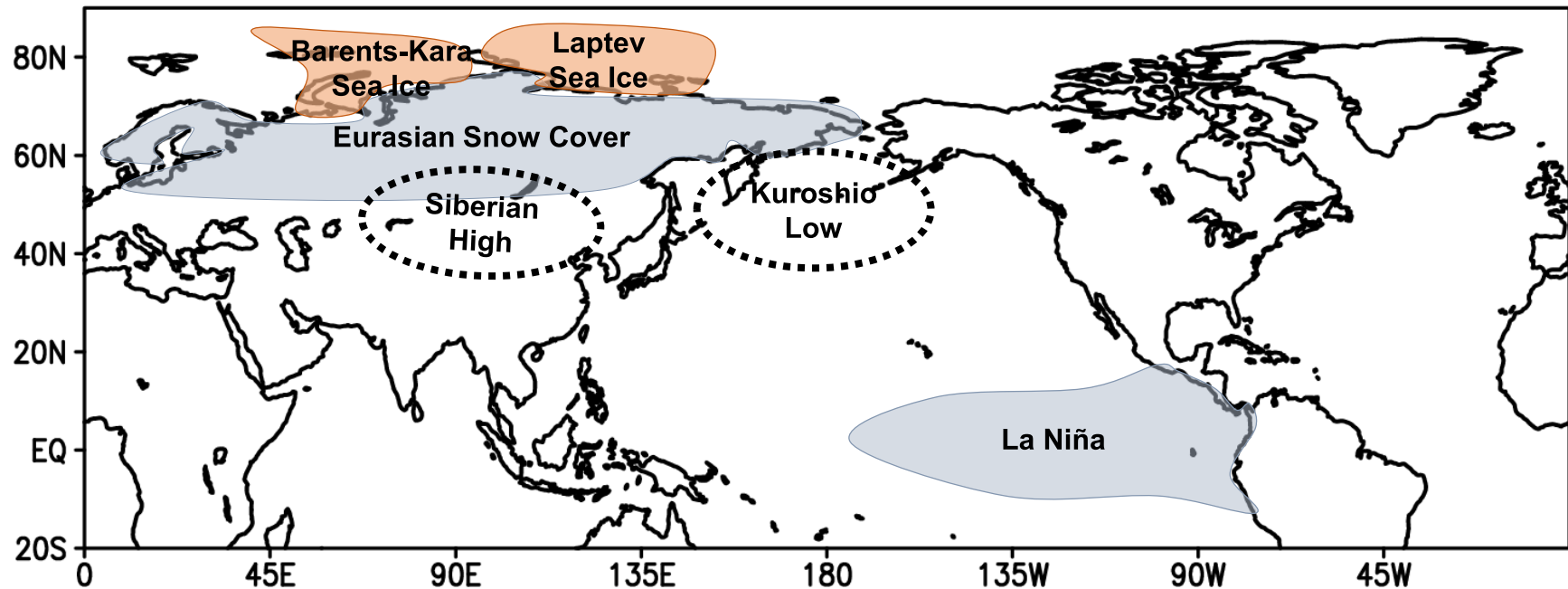
< Precipitation >



► The precipitation is predicted to be below normal over South Korea in Dec. and Jan., but near normal in Feb.

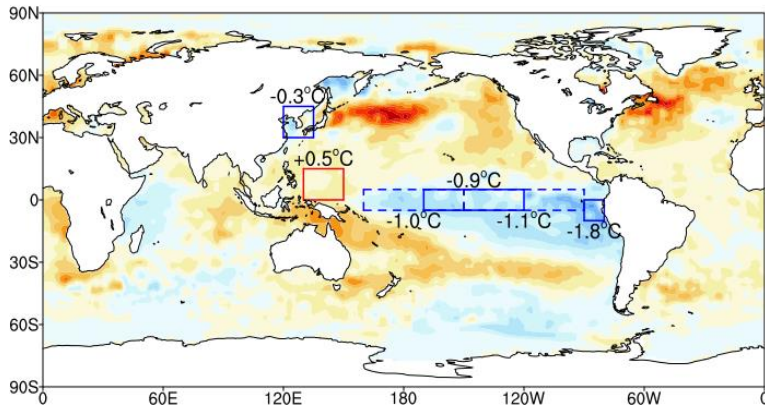
Climate Predictors Affecting Winter Seasons

- ENSO, Arctic sea ice, snow cover, etc. -

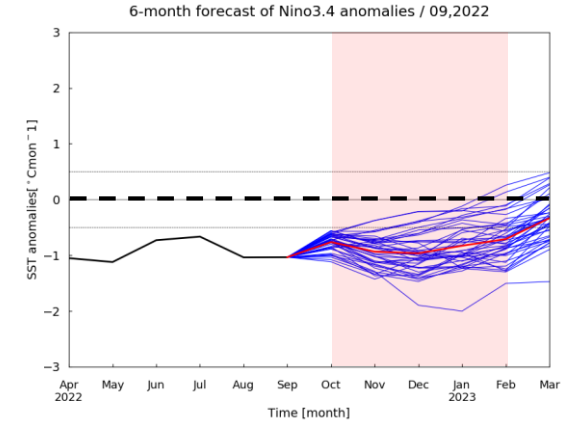
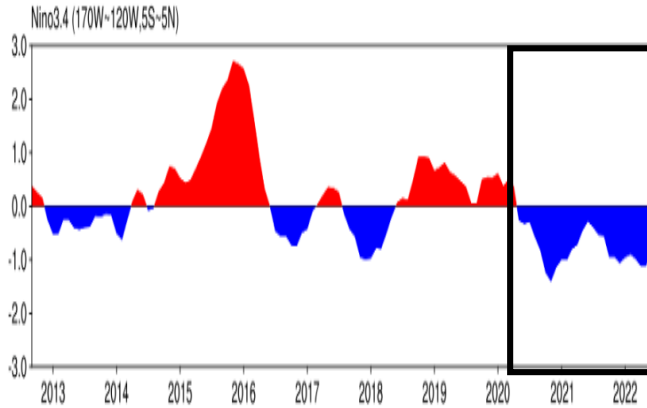


① ENSO Condition and Prediction

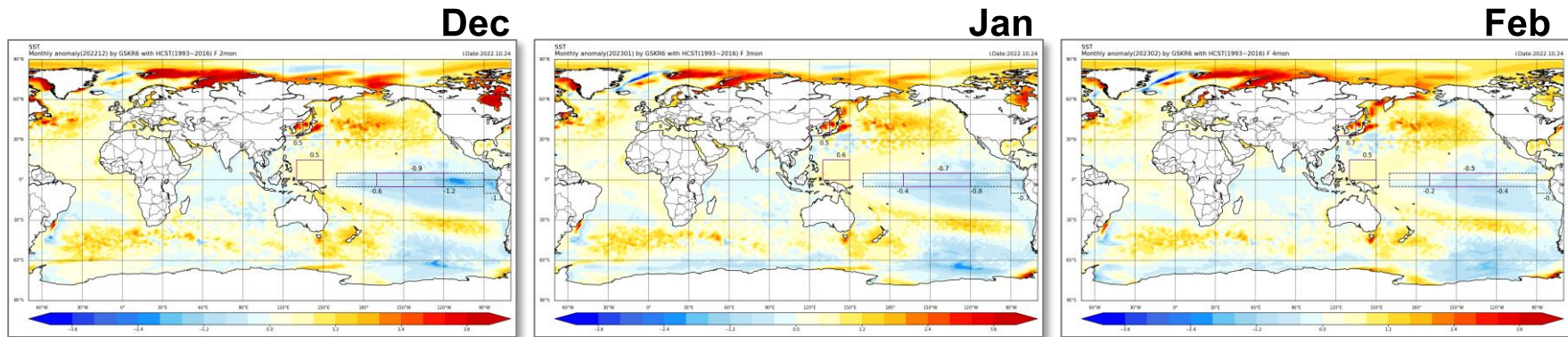
< SST Weekly Anomaly (OISSTv2) >



< KMA Nino3.4 Anomaly (GloSea6) >



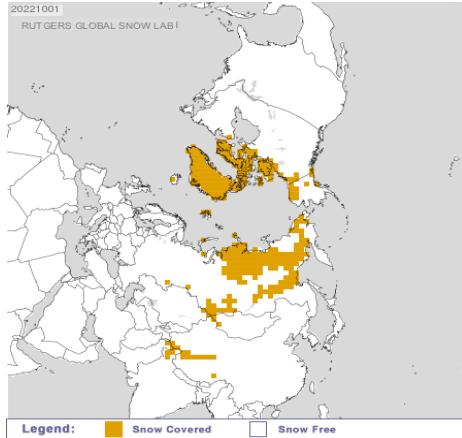
< SST Anomalies Forecasts (GloSea6) >



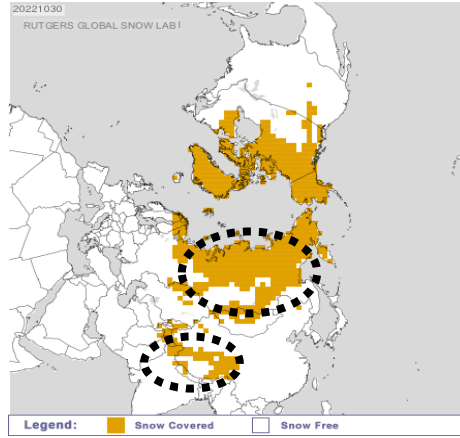
- ▶ Recently, the SST anomalies in the Niño3.4 region were 0.9°C cooler than normal.
- ▶ GloSea6 predicts that La Niña conditions will continue during the winter, becoming the first “triple-dip” La Niña of the 21st century.
- ▶ Statistically, during a La Niña winter in Korea, temperatures are near normal or below normal and precipitation is below normal.

② Snow Cover

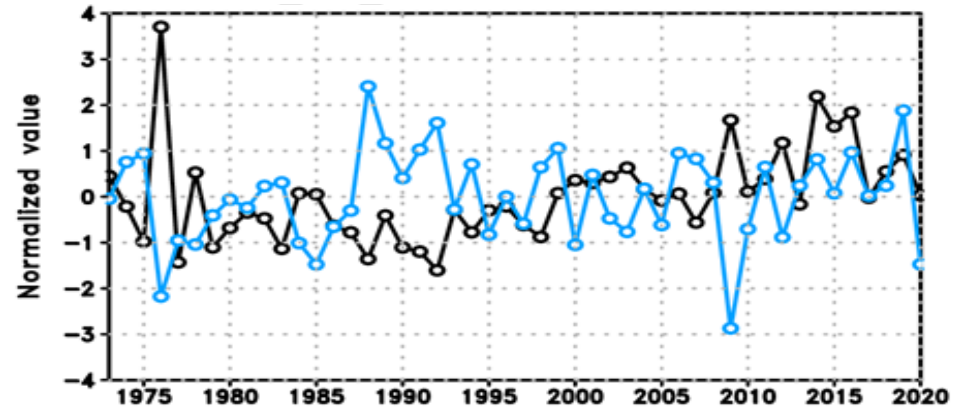
< Snow Cover (Oct. 1) >



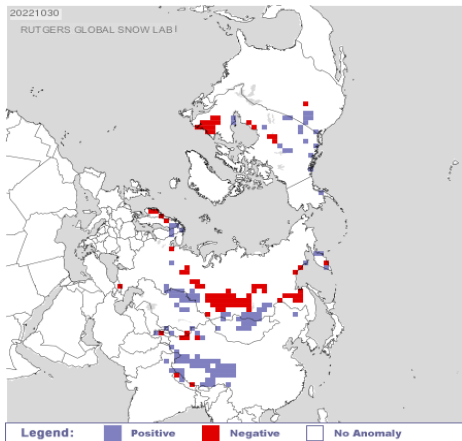
< Snow Cover (Oct. 30) >



< October Snow Advanced Index & AO index >



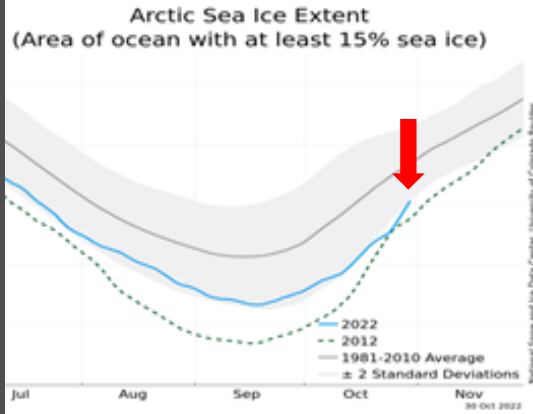
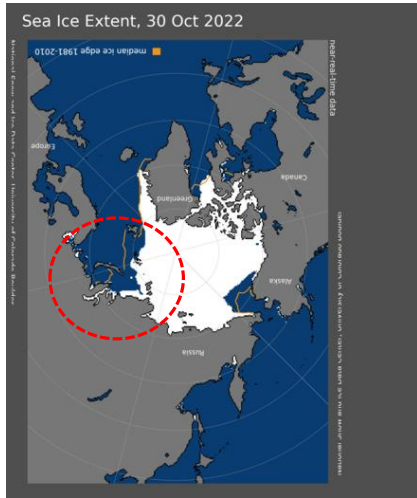
< Snow Cover Anomaly (Oct. 30) >



- ▶ Recently, the snow cover over the Tibetan Plateau and Eurasia is above normal and snow cover has increased rapidly in October.
- ▶ It is highly correlated with the negative Arctic Oscillation.
And more snow cover will strengthen the Siberian High, leading to colder surface temperature over Korea.

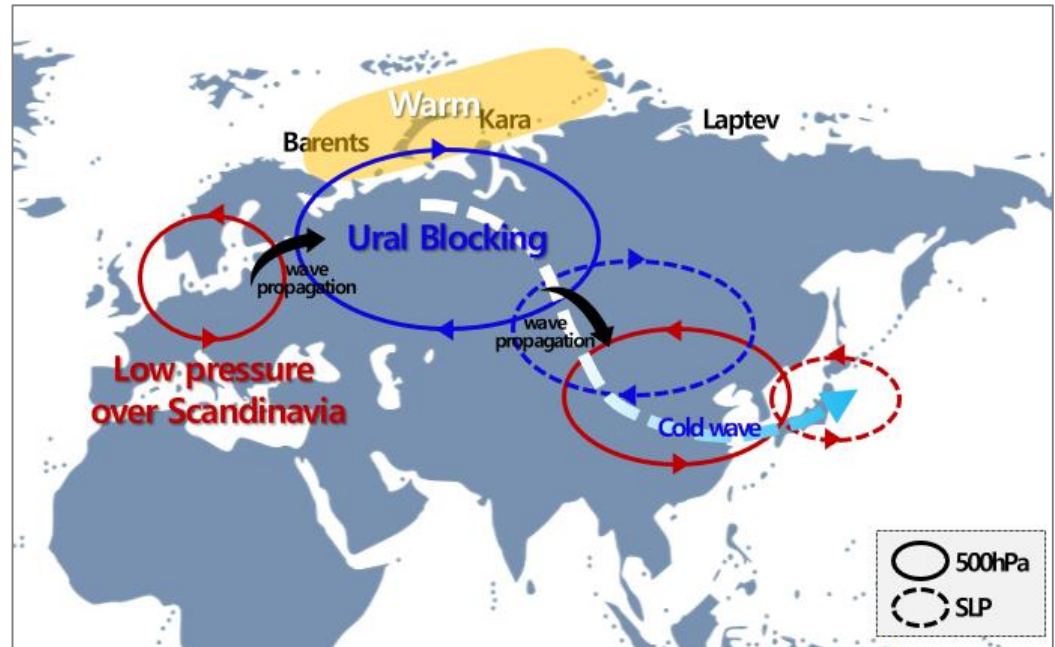
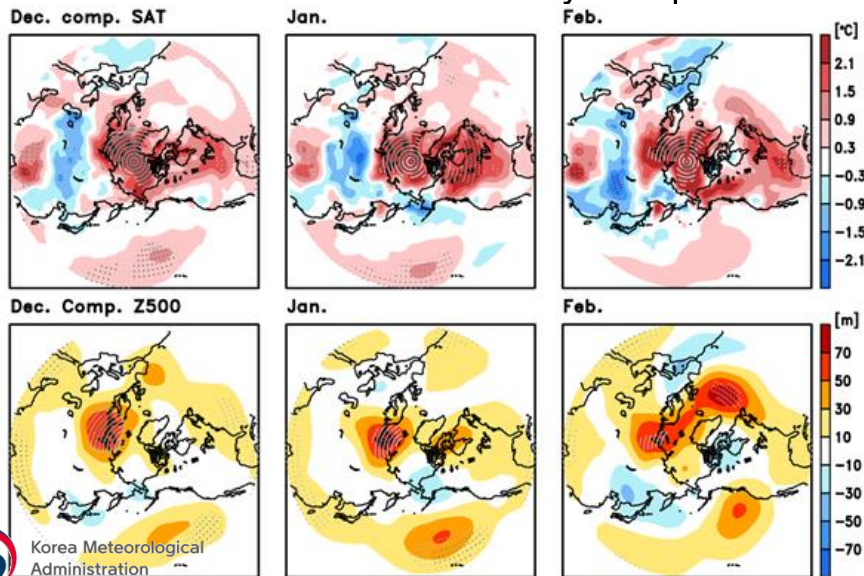
③ Arctic Sea Ice

< Sea Ice Extent (Oct. 30) >



- ▶ Currently, Arctic Sea Ice (Barents-Kara Sea and Laptev Sea) is less than normal.
- ▶ When the Arctic region is warmer than normal, there are anticyclonic anomalies over the Ural Mountains and cyclonic anomalies over the East Asia in the 500hPa height field.
- ▶ This condition might cause strong Ural Blocking, which helps the Siberian High develop and bring cold air to East Asia.

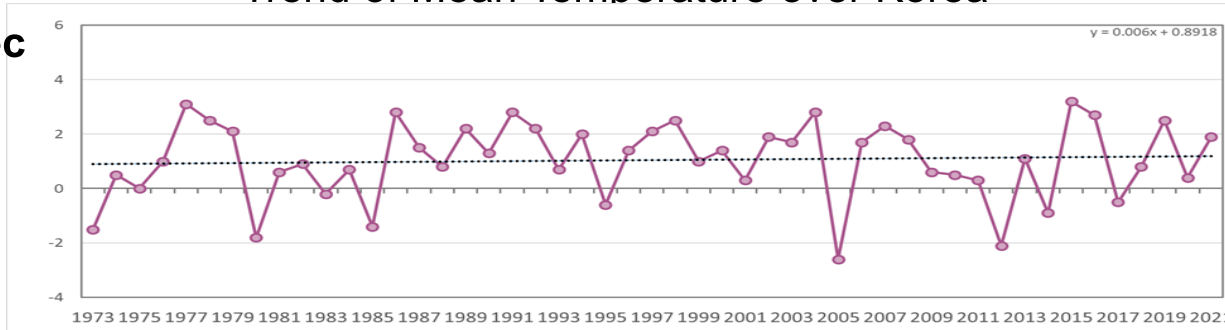
< SAT and 500hPa GPH anomaly composite >



④ Trend of Observed Temperatures

< Trend of Mean Temperature over Korea >

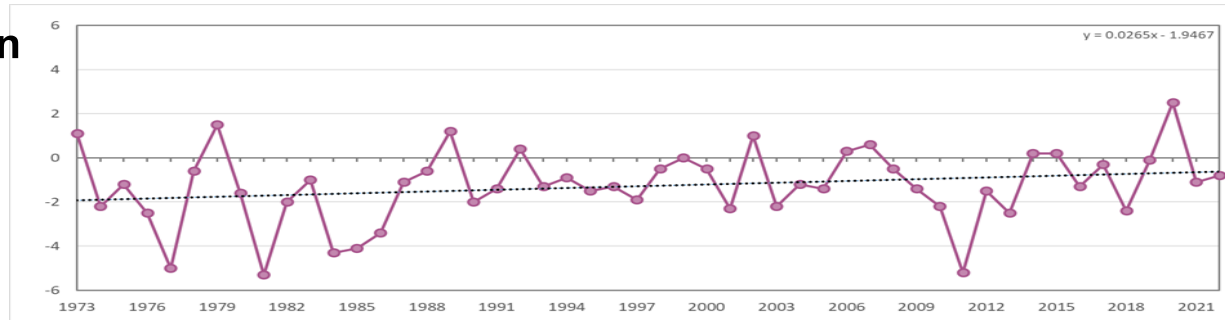
Dec



Dec

- average 1.1°C
- **+0.3°C / 49 years**

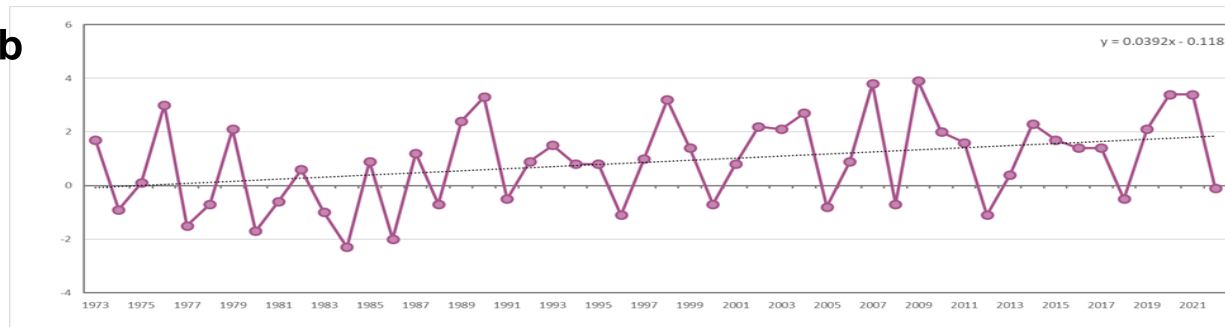
Jan



Jan

- average -0.9°C
- **+1.3°C / 50 years**

Feb



Feb

- average 1.2°C
- **+2.0°C / 50 years**

- ▶ Since 1973, the temperatures in Korea have been increasing during the winter season.
- ▶ In February, the warming trend was significantly higher than other months.

2022/23 Winter Outlook

■ Consideration for prediction

- La Niña conditions are likely to continue during the coming winter.
- Most dynamic model results show **near normal** or **above normal** temperature and **below normal** precipitation over Korea.
- Statistical analysis gives us a **below normal** temperature for winter.

Trend of Temperature	ENSO	Barents-Kara Sea ice	Laptev Sea Ice	Eurasian Snow Cover
Above	La Niña	Below	Below	Above, Fast

■ 2022/23 Winter Outlook over Korea

Temperature	Precipitation
Near Normal	Below Normal

Thank you !!