



Seasonal Climate Outlook for Winter 2018/2019 over China

Zhi Rong , Gao Hui

Beijing Climate Center, China Meteorological Administration

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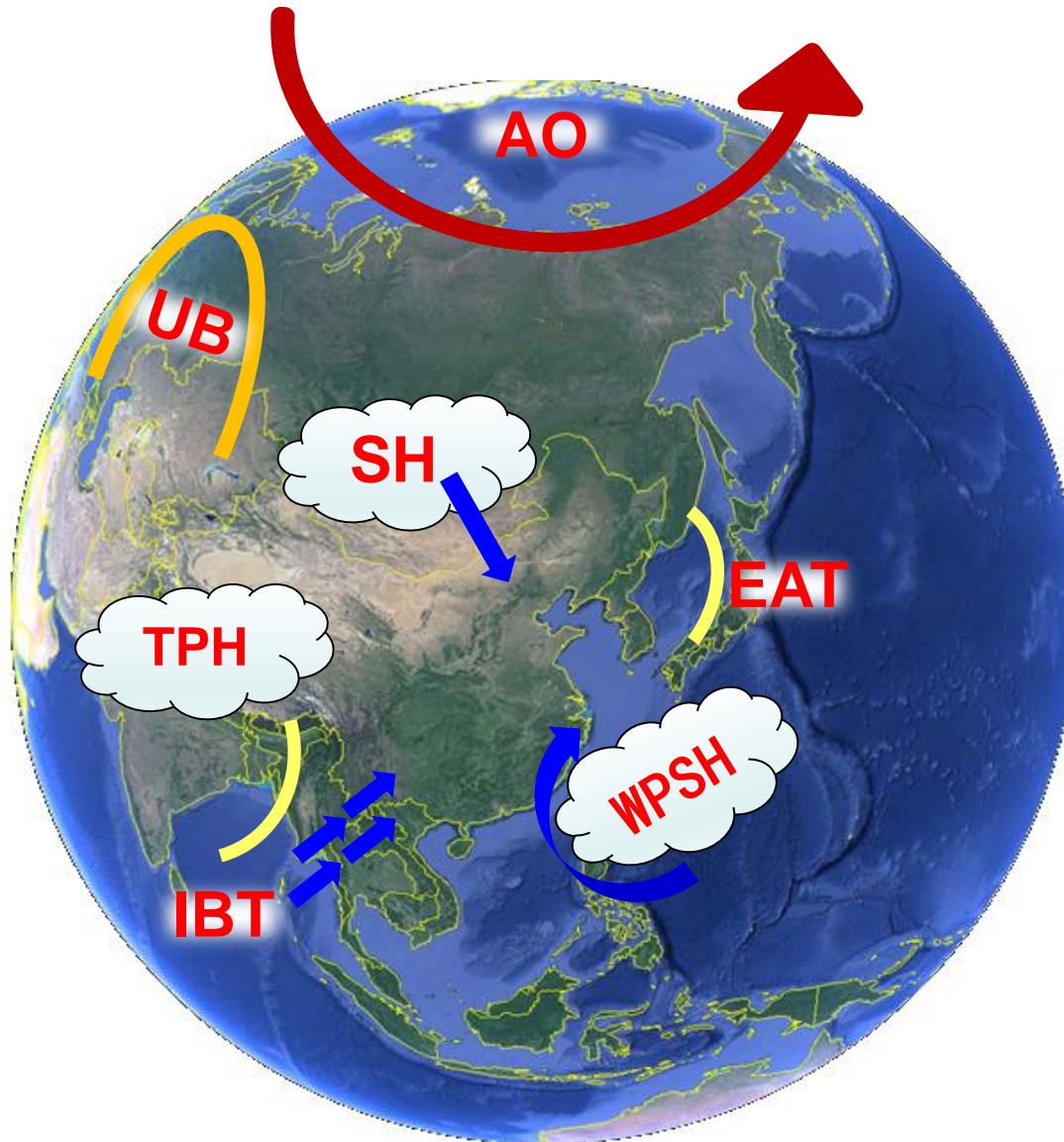


Outline

1. EAWM System
2. Prediction by BCC_CSM 1.1m, BCC/CMA
3. Statistic Analysis and outlook for EAWM
El Niño, NAT, Arctic Sea Ice, Eurasian Snow Cover
4. Outlook for temperature and precipitation over China



EAWM system





Prediction by BCC_CSM1.1m

Model prediction Scheme

Model: Climate System model (BCC_CSM1.1m)

Resolution of Atm. : T106 (~110 km) ; Tropical ocean : 30 km.

Initial data:

Atm.: NCEP daily reanalysis (Air Temp., winds, SLP, etc)

Ocean: NCEP_GODAS monthly, Pentad reanalysis

Ensemble members: 24 (15 LAF+9 SV)

Prediction range: 13 months

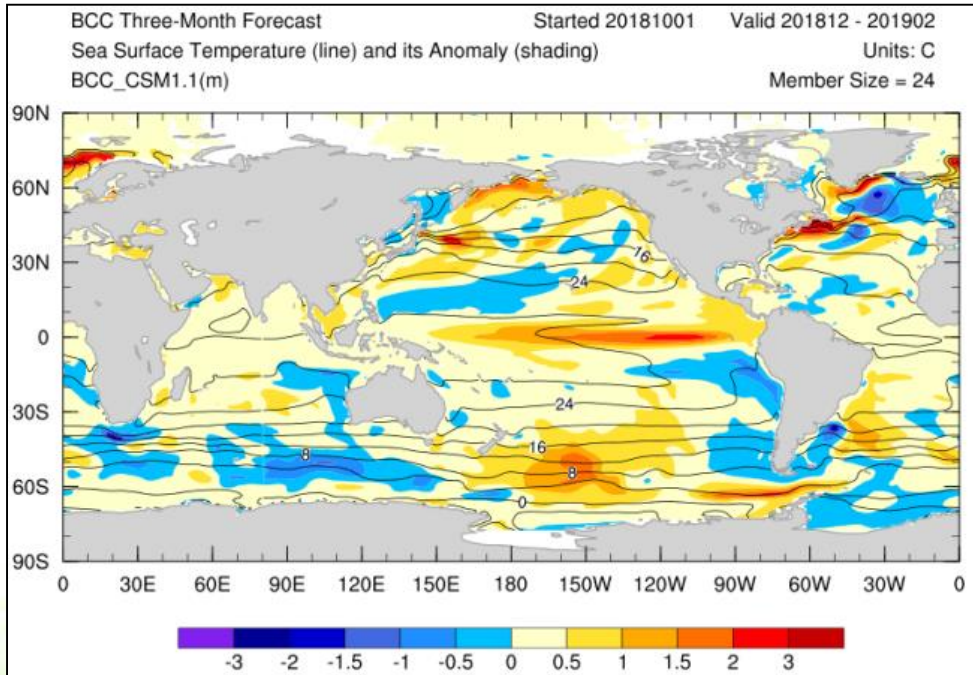
Hindcast time period: 1991~2010

Operational starting date of the model: Dec., 2014

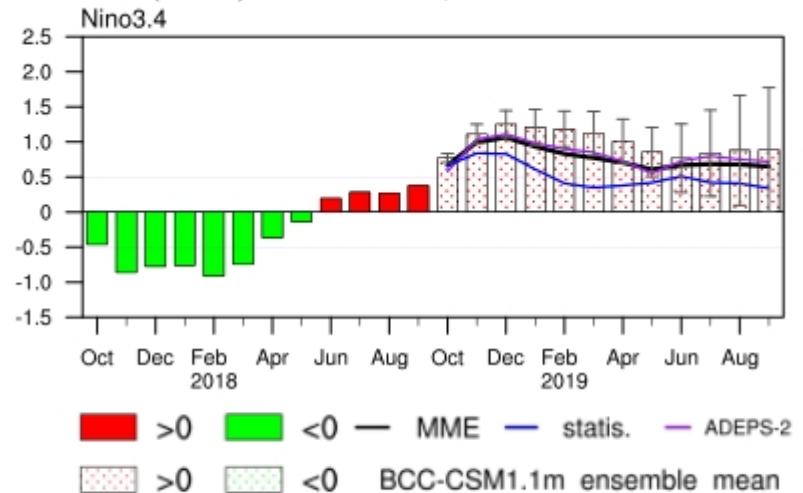




ENSO



ENSO SST Indices (K): BCC SEMAP2.0 forecast
Monitor (OISST): 201710-201809; Forecast: 201810-201909



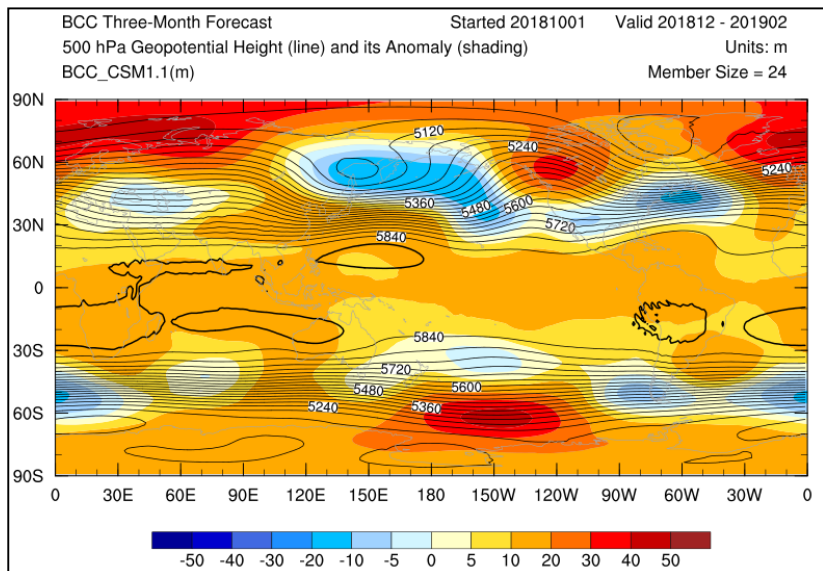
- In October 2018, the Nino3.4 index was above 0.5°C .
- The latest model prediction indicate that positive SSTA is expected to develop in the central and eastern equatorial Pacific, and possibly reach weak-moderate El Niño level during the coming winter.



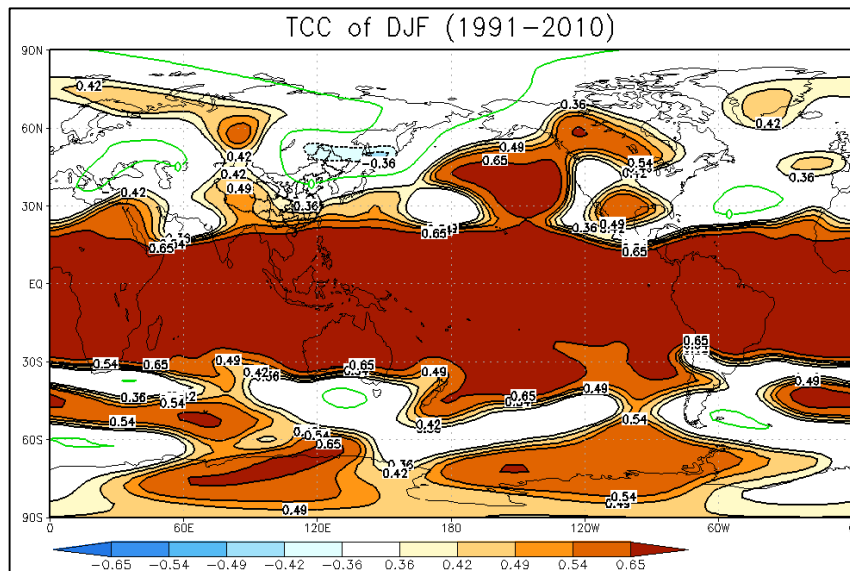


500 hPa GH

Prediction



Hindcast skill



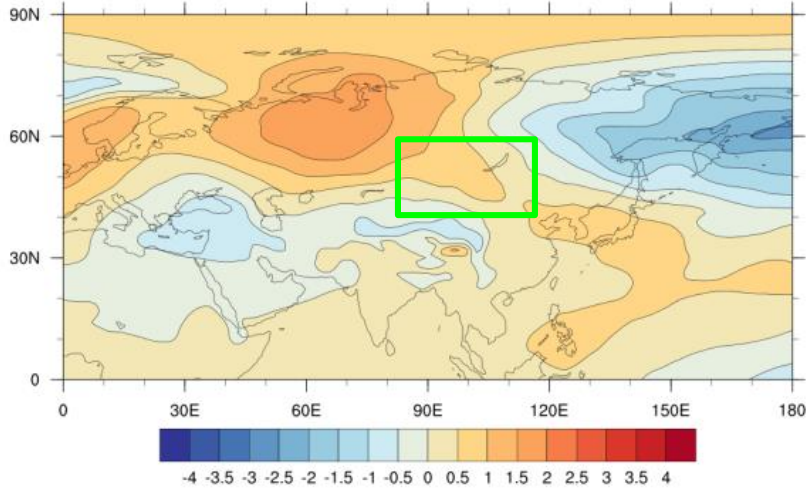
- Zonal circulation over East Asia
- Negative AO
- Weak East Asia trough
- Positive Tibetan Plateau height anomaly
- Strong west pacific subtropical high
- Normal-weak India-Burma trough



SLP

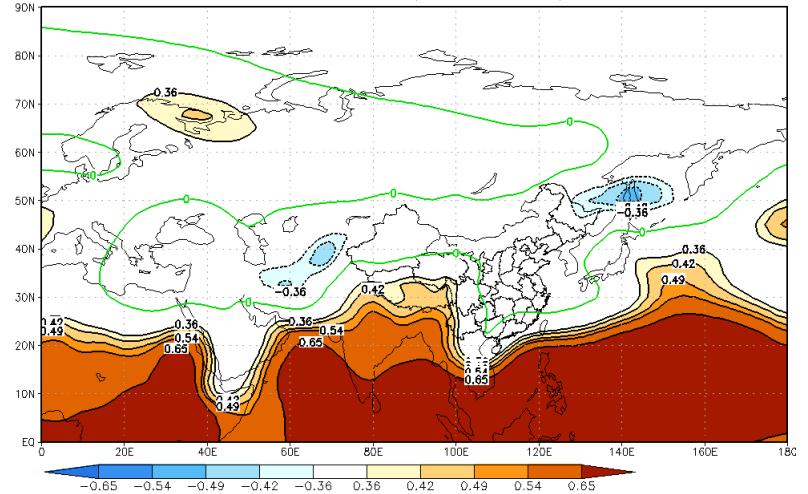
Prediction

SLPanom DJF (201810)



Hindcast skill

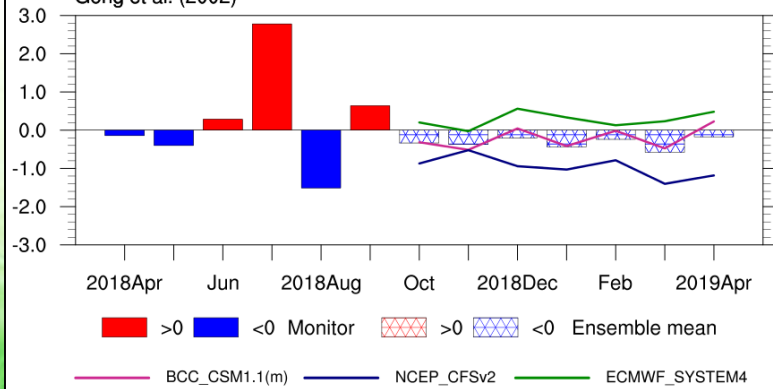
TCC of DJF (1991-2010)



Siberian High (SH) index: MODES forecast

Monitor (NCEP I): 201804-201809; Forecast: 201810-201904

Gong et al. (2002)



Normal-weak Siberian High

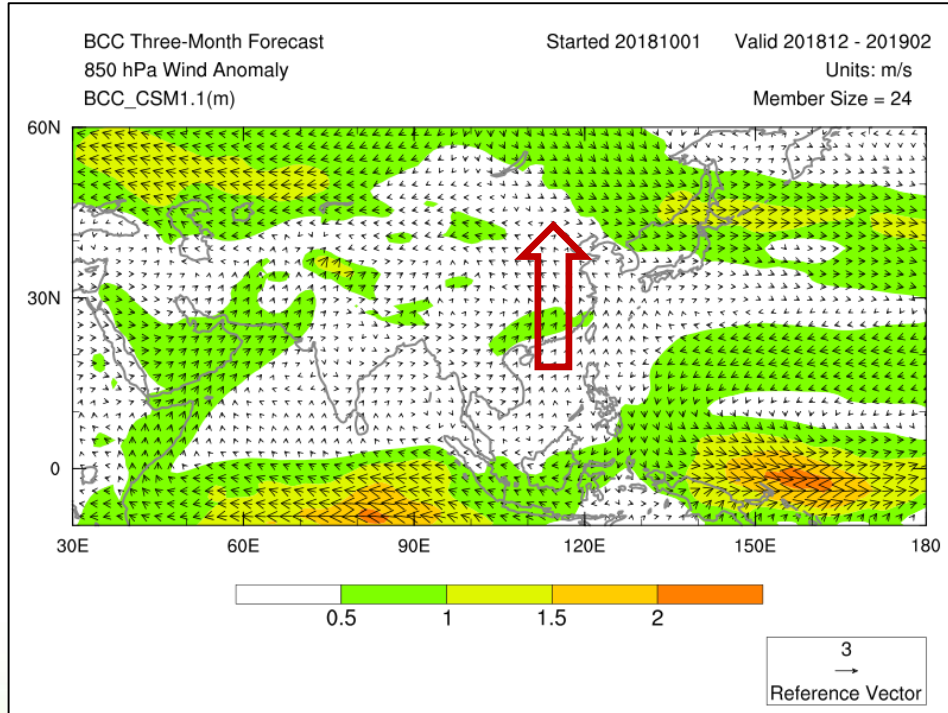
SH is defined by standardized SLP averaged from 40-60N, 80-120E.



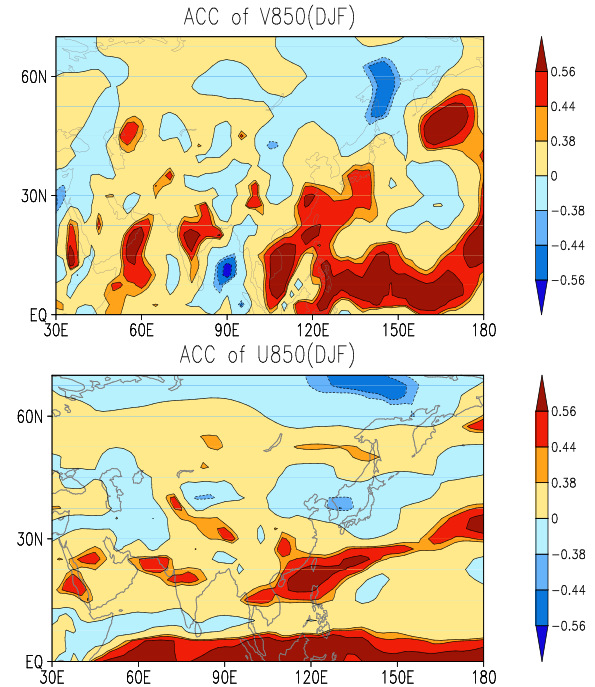


850hPa wind

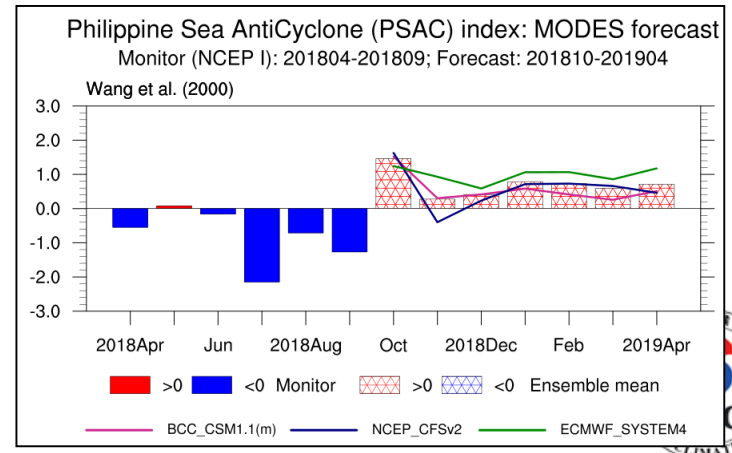
Prediction



Hindcast skill



- Southerly wind anomaly will dominate East Asia in mid-high latitude
- Anti-cyclone anomaly around the Philippines





From BCC_CSM1.1m

- El Niño
- Weak EAWM/Siberian High
- Zonal circulation over East Asia
- Negative AO
- Weak East Asia Trough
- Positive Tibetan Plateau height anomaly
- Strong West Pacific Subtropical High
- Normal-weak India-Burma trough
- Strengthened southerlies over East Asia
- Anti-cyclone anomaly around the Philippines



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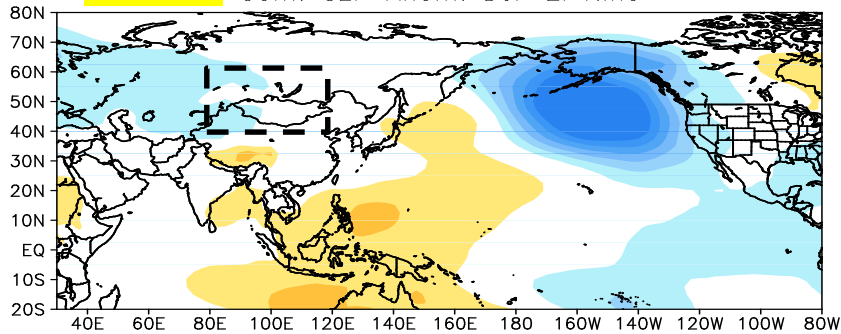


Impact of El Nino -- Circulation

(1982,1986,1987,1991,1994,1997,2002,2004,2006,2009,2014)

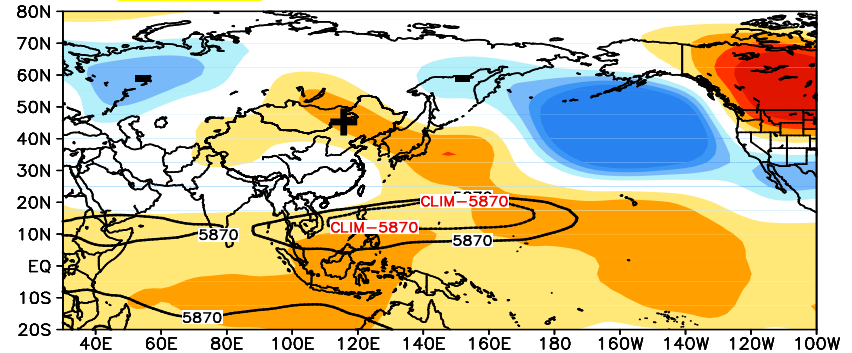
SLP

Com. SLP Anom. DJF El Nino



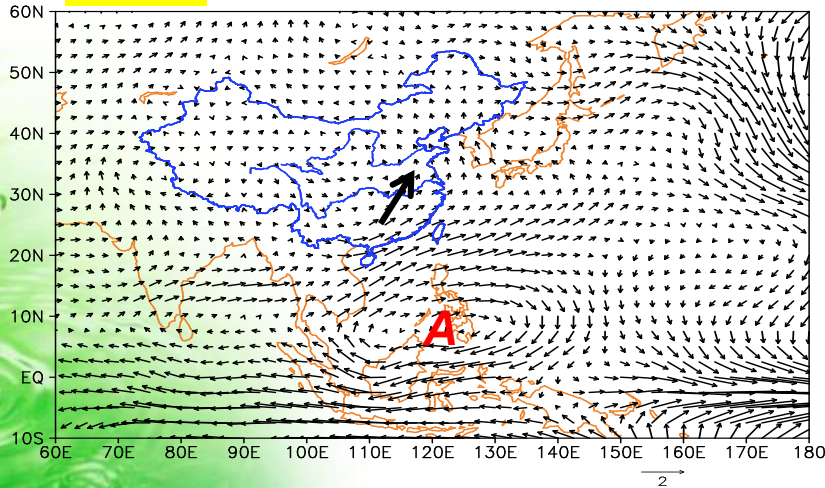
H500

Com. H500 DJF El Nino



V850

Com. V850 DJF El Nino

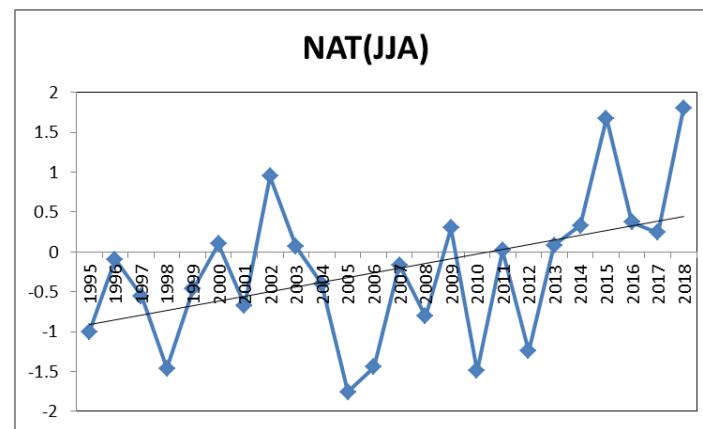
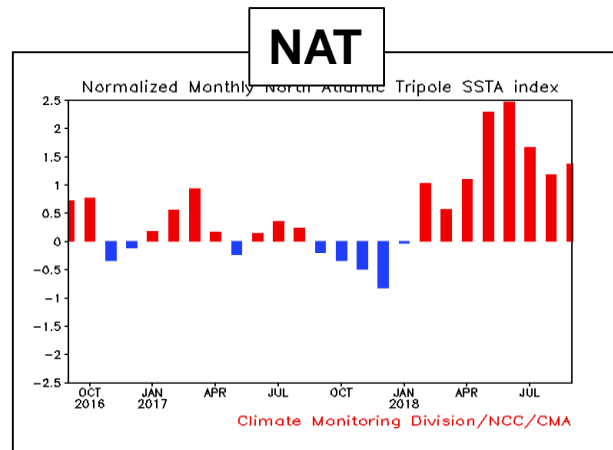
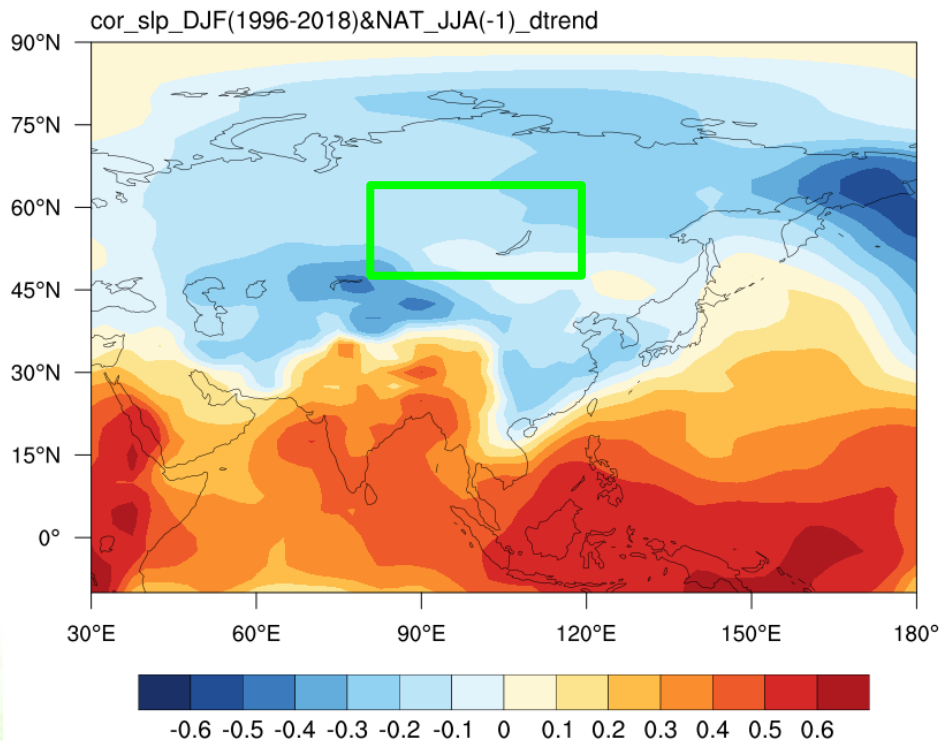


1. **Weak Siberian High;**
2. **Strong WPSH**, extending more westward and southward;
3. **Weak East Asian trough;**
4. Anomalous **anticyclone** around the Philippines;
5. Low-level anomalous **southerlies** over East Asia;





Impact of NAT -- SH

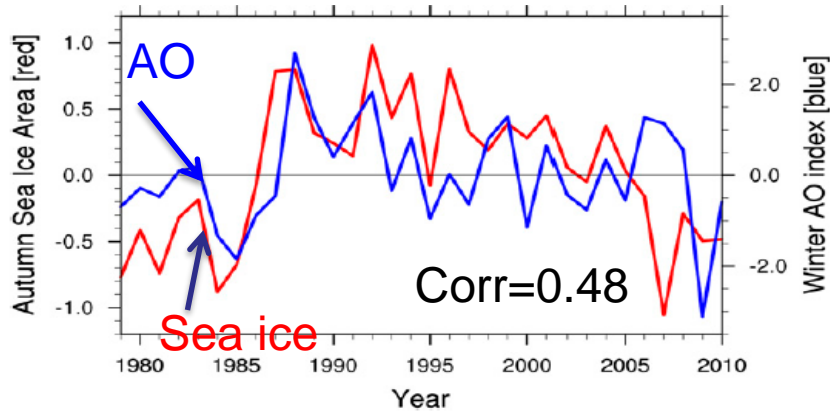


NAT index of JJA 2018 is obviously above normal after removing linear trend, and that favors weak Siberian High in the coming winter.





Impact of SIE -- AO



The negative anomalies of sea ice extent over Arctic, especially in the Barents-Kara seas, indicate **weakened polar vortex and negative AO** in the coming winter.

Fig. 1. Time series of detrended autumn Arctic sea ice area anomaly ($\times 10^6$ km²; black curve) and winter AO index (blue curve).

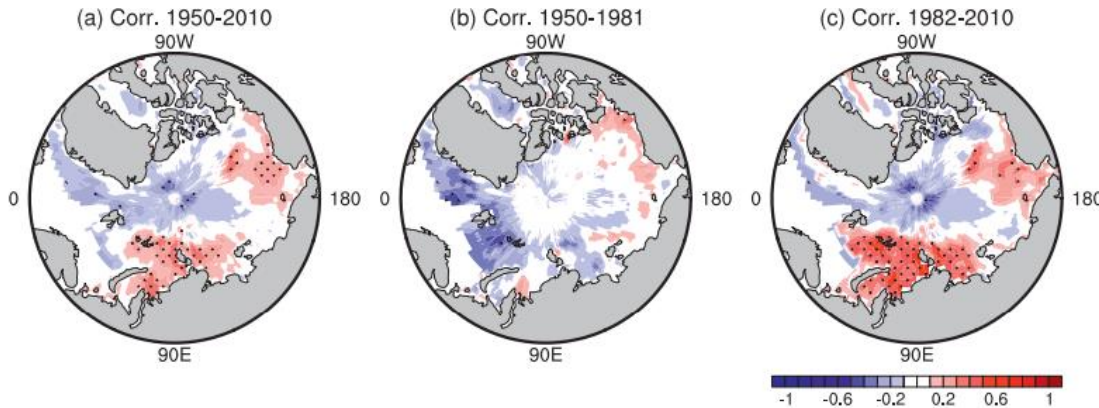
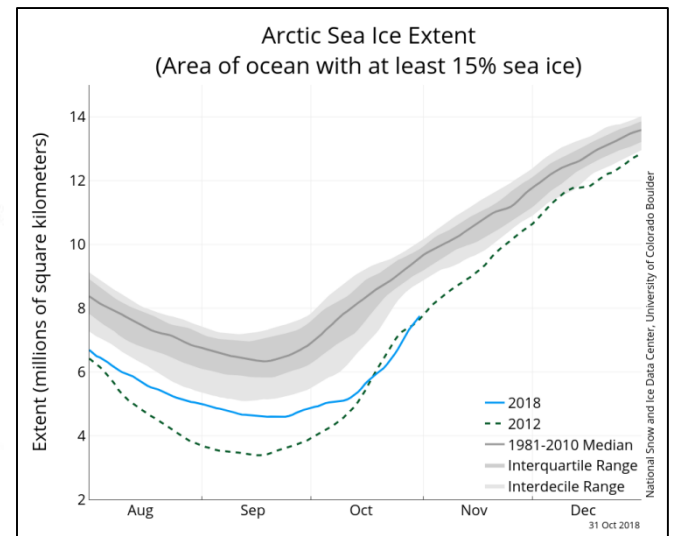


FIG. 1. Correlations of autumn Arctic SIC with winter NAM for the periods (a) 1950-2010, (b) 1950-81, and (c) 1982-2010. The dotted regions have correlations above the 95% confidence level.

The relationship is robust after 1982.

SIE in 2018



Li 2012 JC; Serrano 2014 Nat. Geosci; Liu 2012 PNAS





Impact of Eurasian snow cover extent -- AO

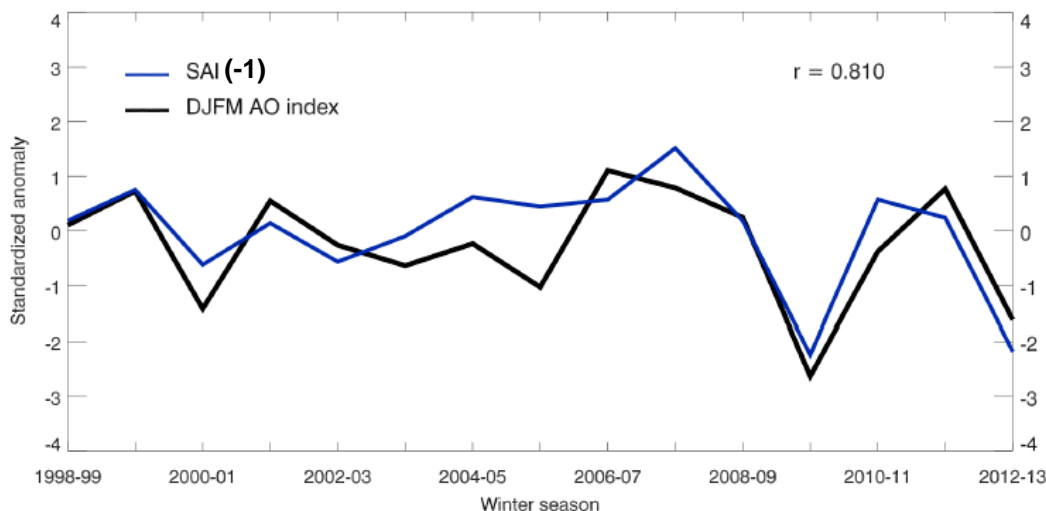
Snow Advance Index: A New Tool for Predicting Winter's Severity

Judah Cohen, PhD
November 14, 2011

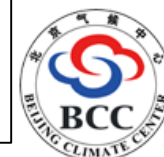


Snow Advance Index: A New Tool for Predicting Winter's Severity

Researchers at AER have developed a new Snow Advance Index that could greatly improve the accuracy of winter seasonal forecasts. Based on research and testing, this index for the first time can accurately predict the severity of the upcoming winter. What makes this discovery so significant is that advances in seasonal forecasting have remained elusive, and for much of the United States seasonal forecasts are no more accurate today than they were decades ago.

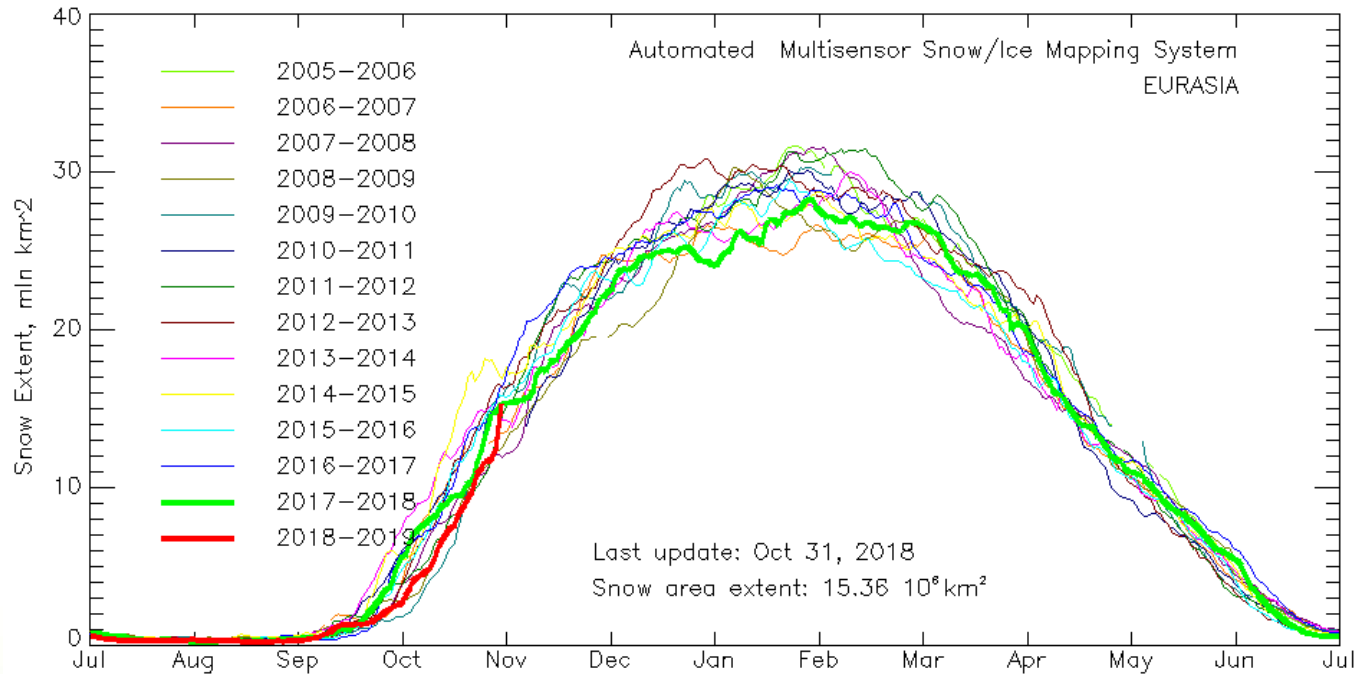


Snow Advanced Index (SAI) derived from antecedent observed daily Eurasian snow cover extent explains a large fraction of the variance of the winter AO. (Judah Cohen et al., GRL, 2011)





Snow Area Extent in 2018

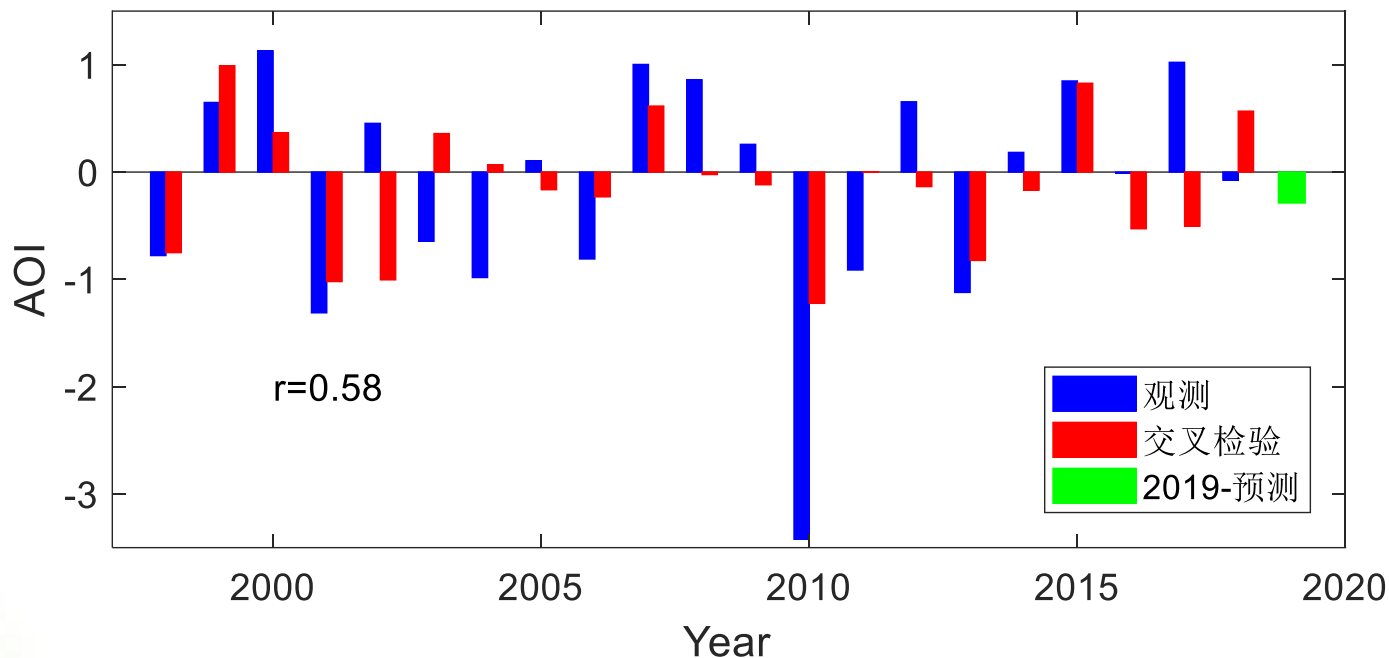


Eurasian snow cover extent increasing rapidly in October favors negative phase of AO in the coming winter.





Statistic model: AO outlook

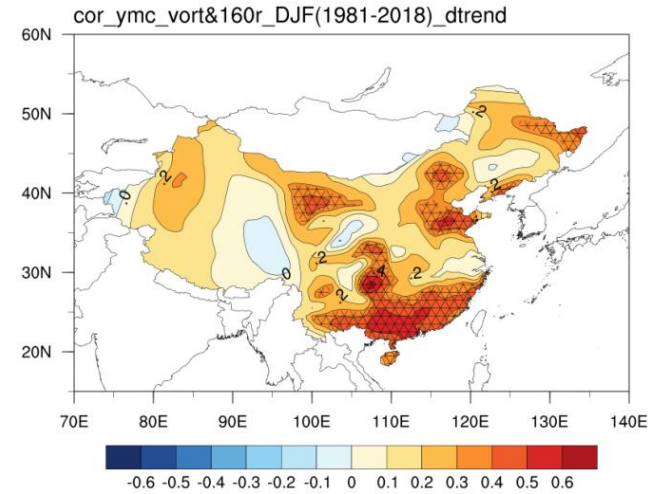
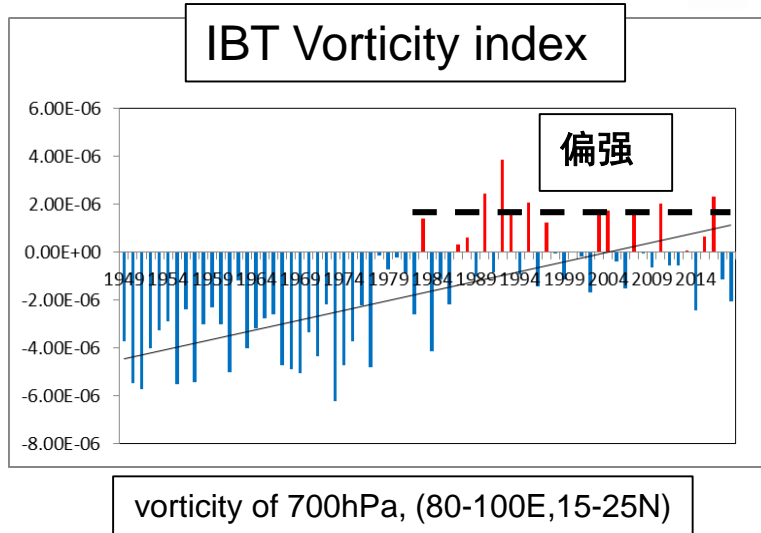


predictors: Main → sea ice extent in September, snow cover extent over Eurasian in October. Secondary → NAT(JAS), ENSO, ...
AO outlook: **weak negative phase**



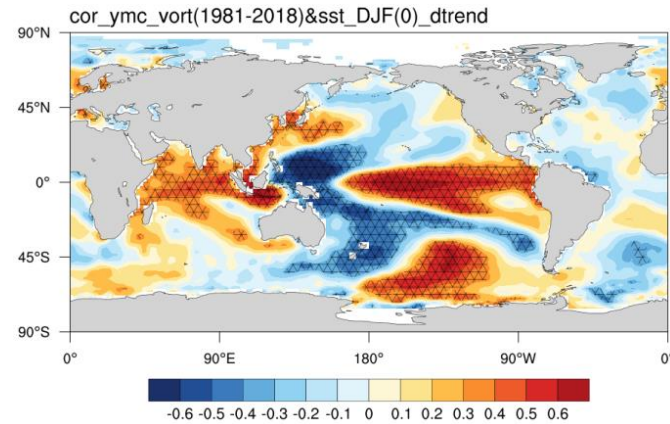
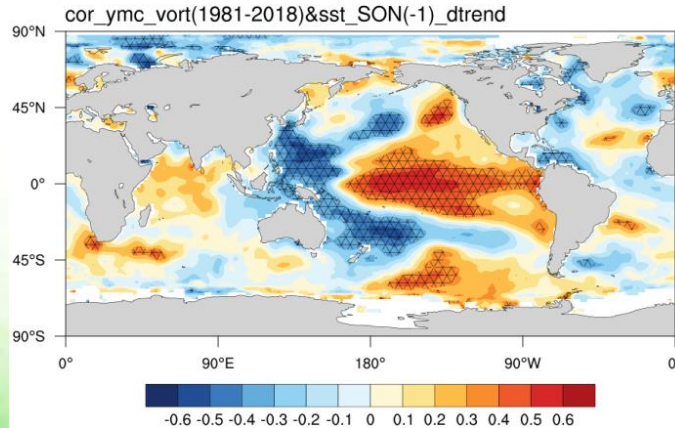


Impact of El nino -- IBT



Another strong epoch of the IBT Vorticity index probably starts since 1980.

Positive correlation with precipitation of winter over Southern China.



Positive ssta over central-eastern tropical Pacific during autumn and winter 2018 indicates strong IBT in the coming winter.





Outline

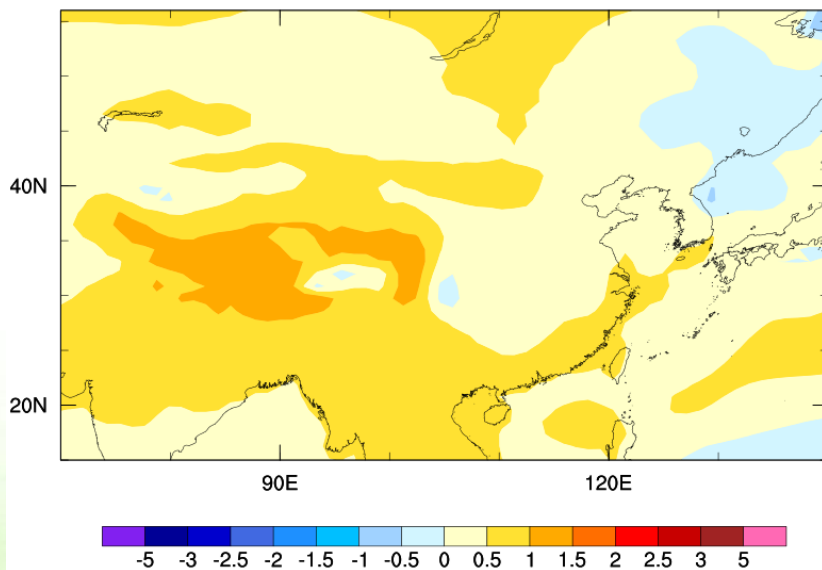
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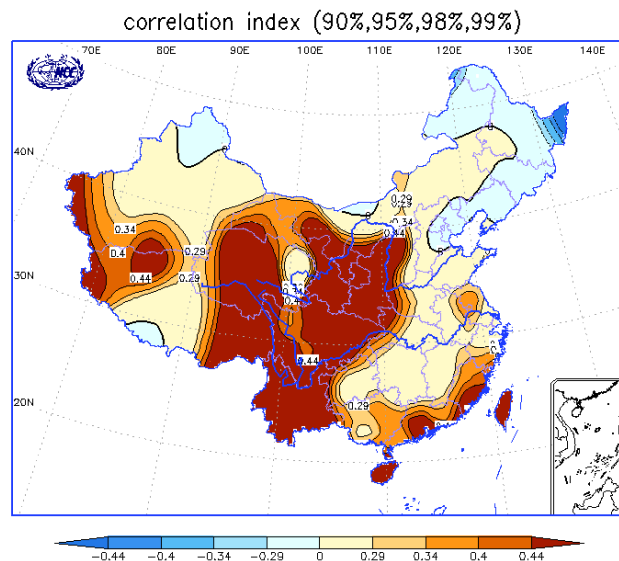
Temperature – BCC_CSM1.1m

Prediction

BCC Three-Month Forecast
2-m Air Temperature Anomaly
BCC_CSM1.1(m)
Started 20181001 Valid 201812 - 201902
Units: degC
Member Size = 24

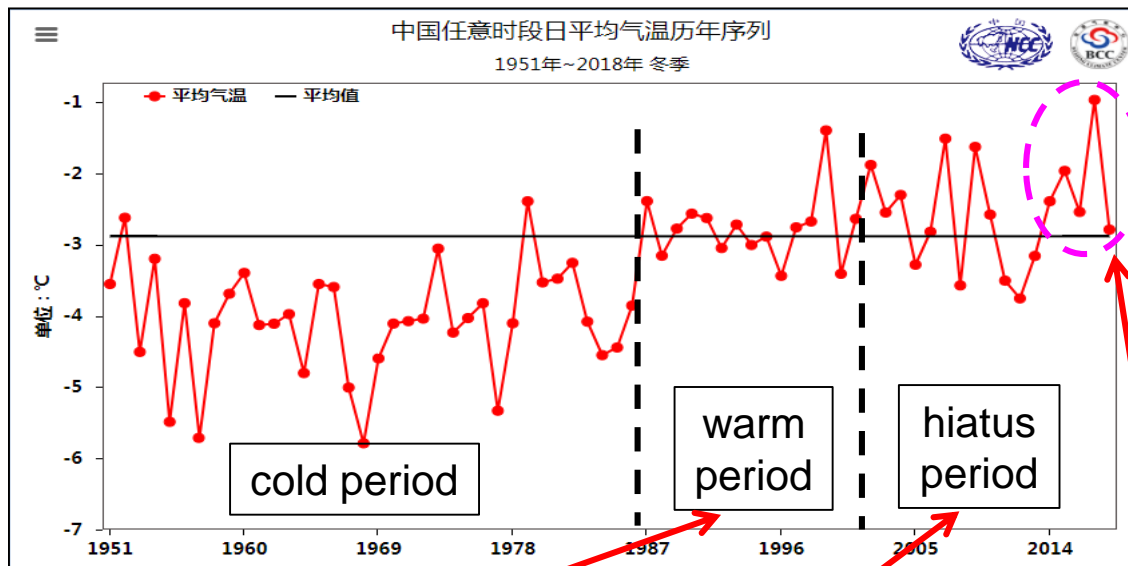


Hindcast skill

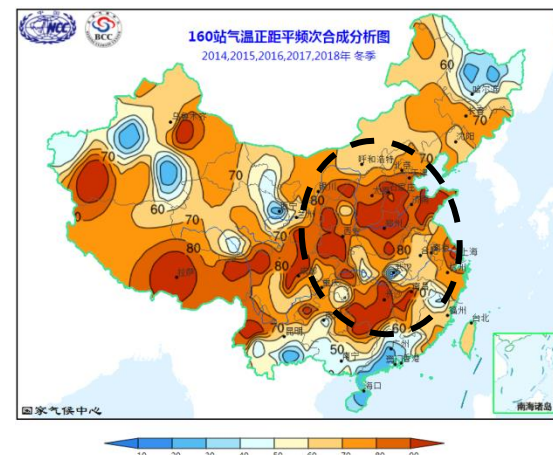
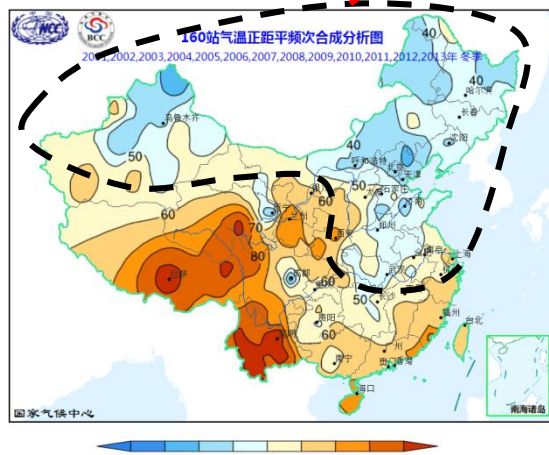
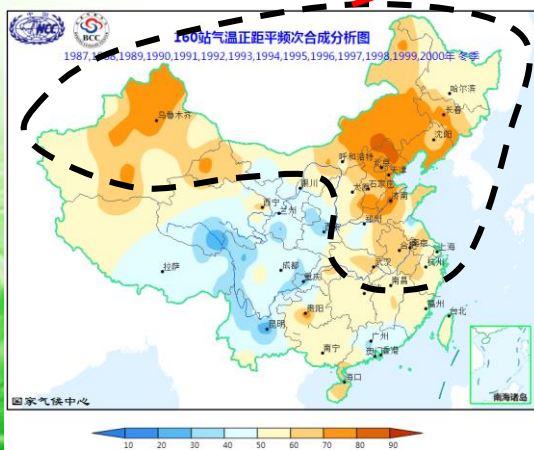




Temperature Anomaly in winter (1951-2018)

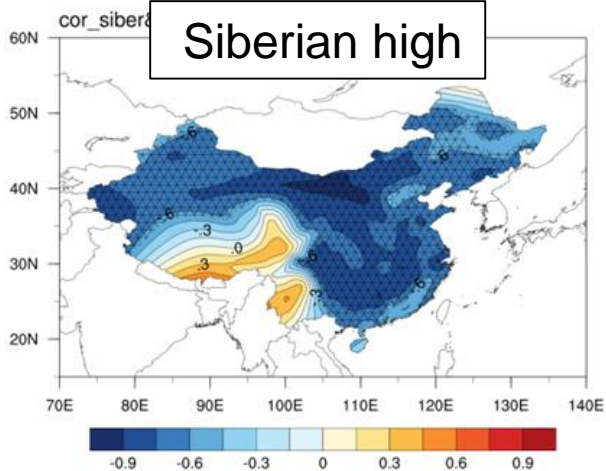


composite of temperature

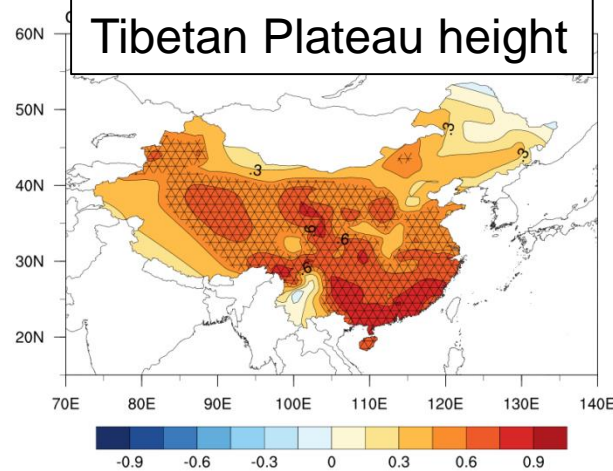




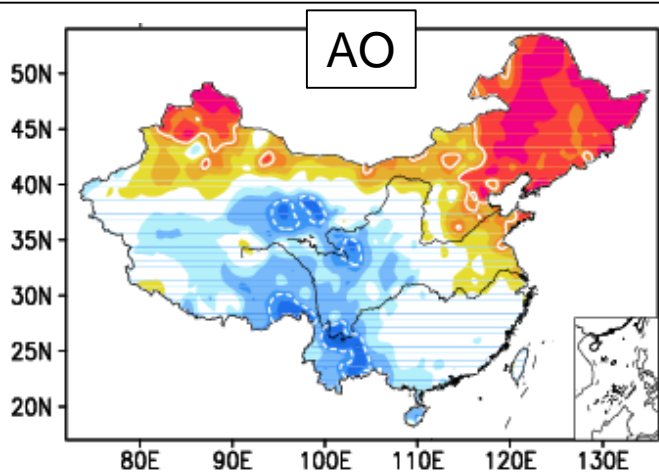
Correlation between circulation indexes and t2m of DJF



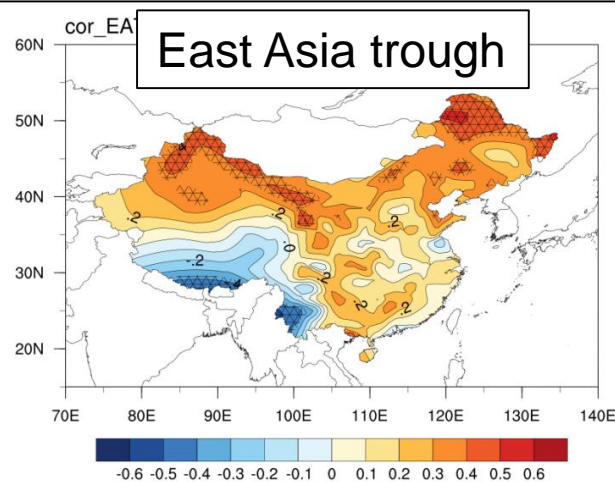
Weak SH (negative index) ->
Above-normal temperature over most of China



Positive TPH (positive index) ->
Above-normal temperature over most of China



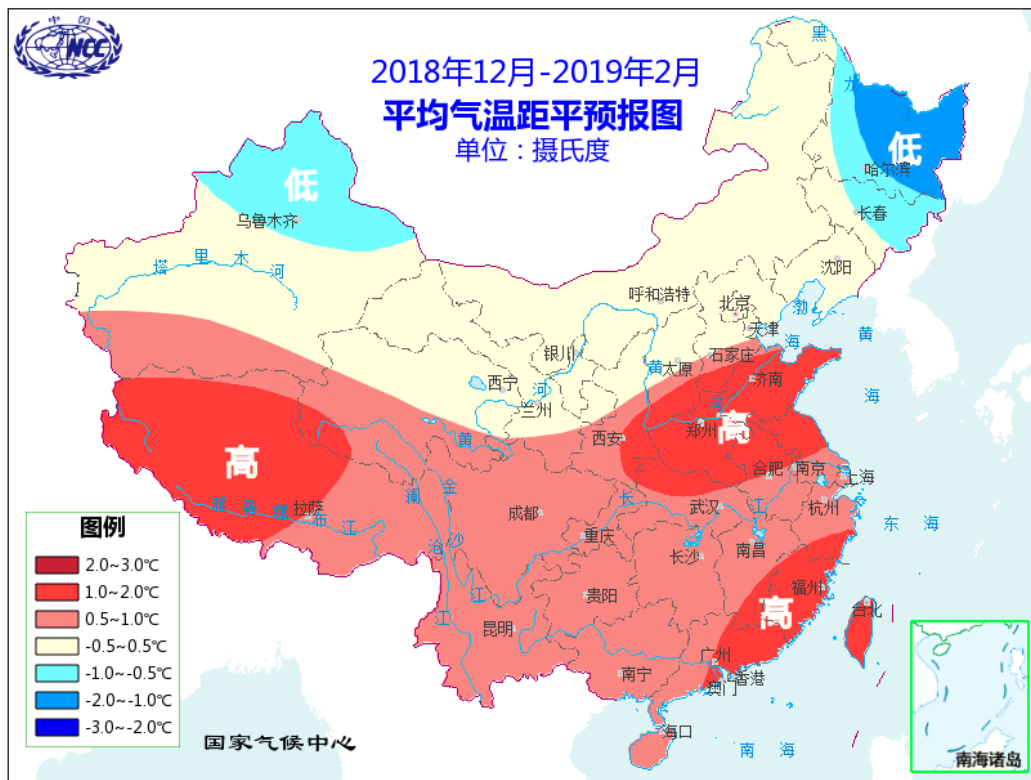
Negative AO (negative index) ->
Below-normal temperature over Northern China



Weak EAT (positive index) ->
Above-normal temperature over Northern China



Temperature forecast

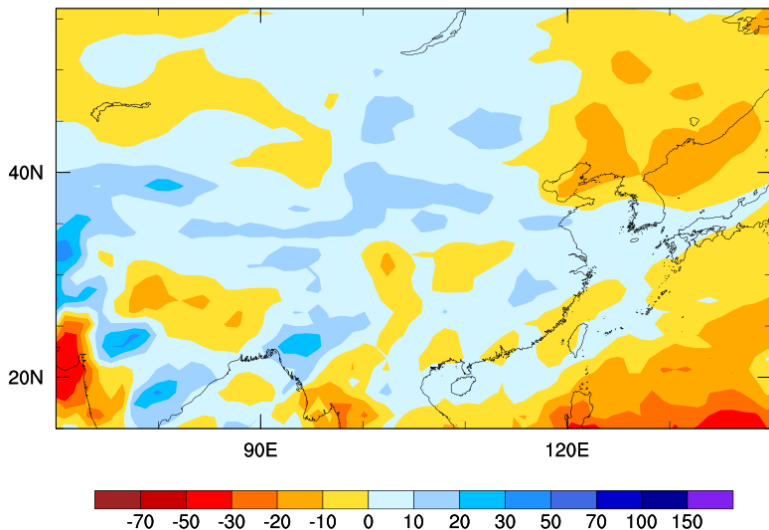




Precipitation – BCC_CSM1.1m

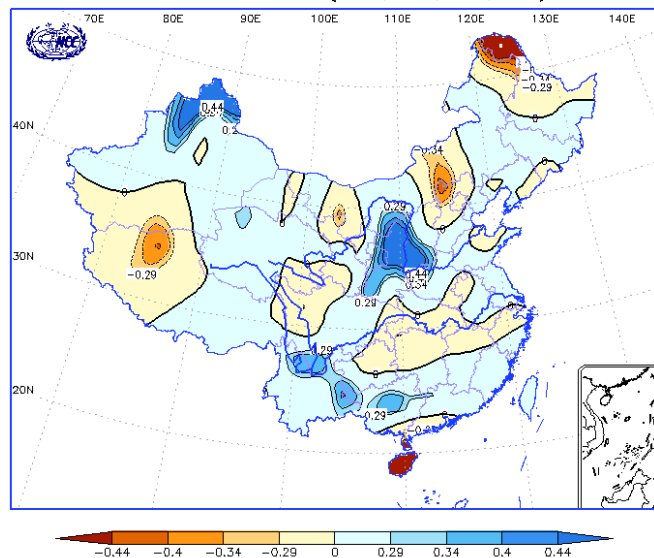
Prediction

BCC Three-Month Forecast Started 20181001 Valid 201812 - 201902
Departure Percentage of Precipitation Rate Units: %
BCC_CSM1.1(m) Member Size = 24



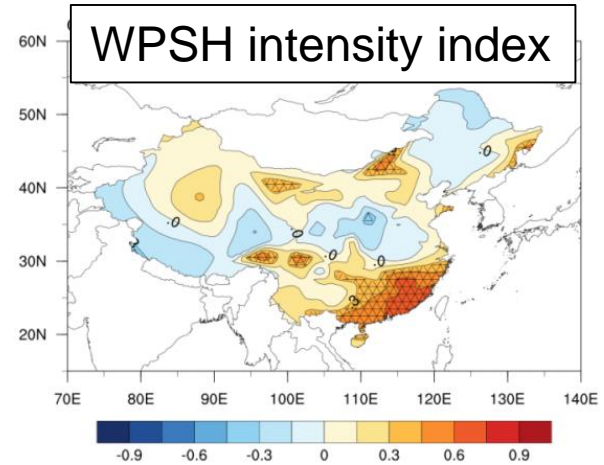
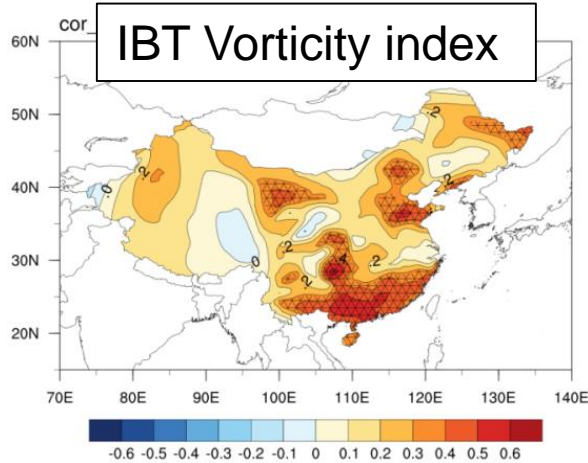
Hindcast skill

correlation index (90%,95%,98%,99%)



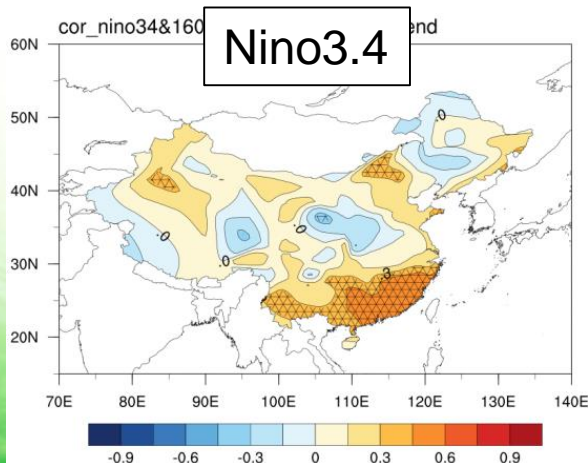


Correlation between circulation/sst indexes and precipitation of DJF



Weak IBT (positive index) ->
Above-normal precipitation over Southern China

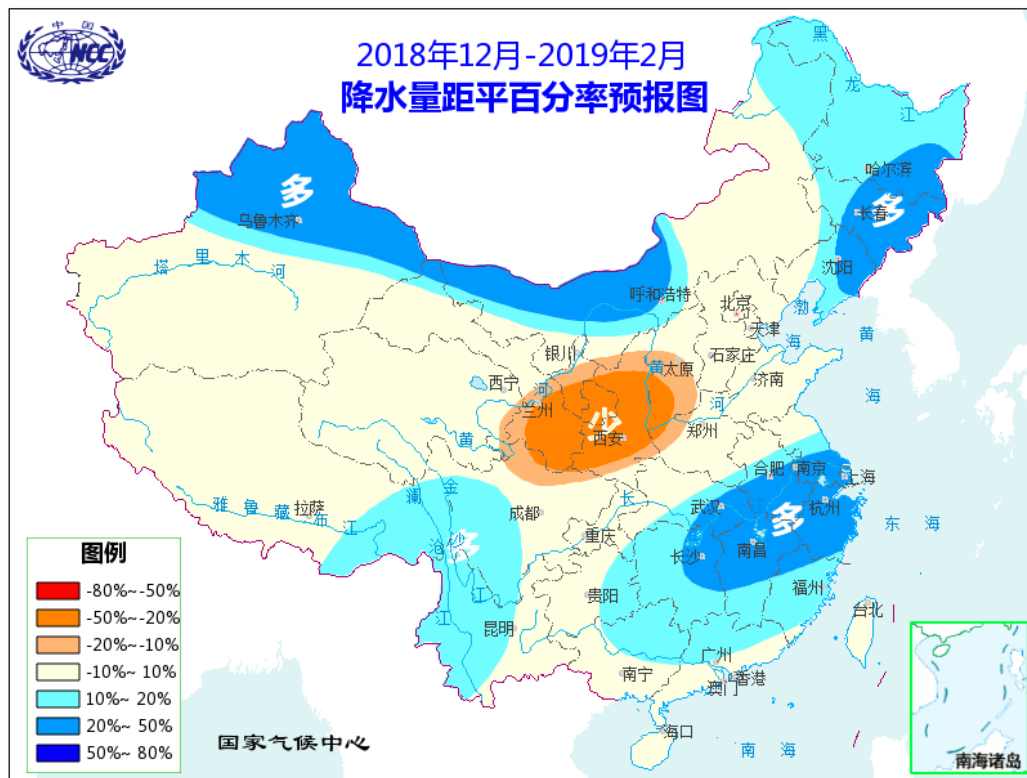
Strong WPSH (positive index) ->
Above-normal precipitation over Southern China



Positive Nino3.4 index (positive index) ->
Above-normal precipitation over Southern China



Precipitation forecast

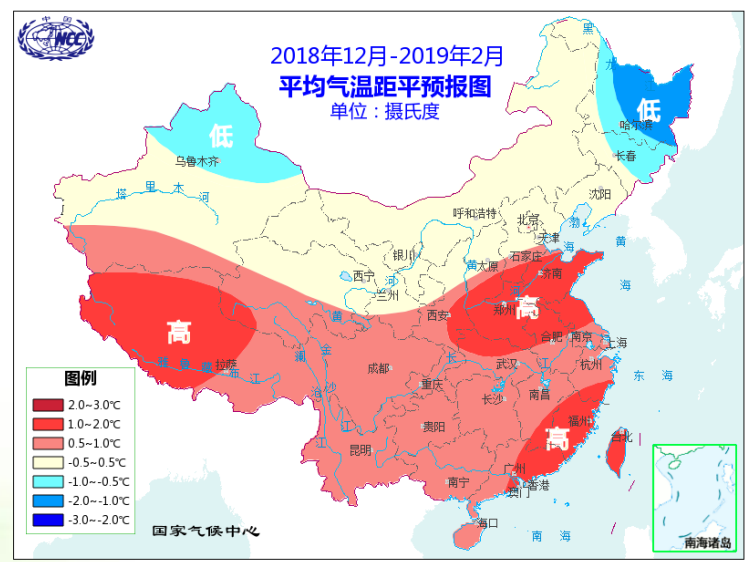




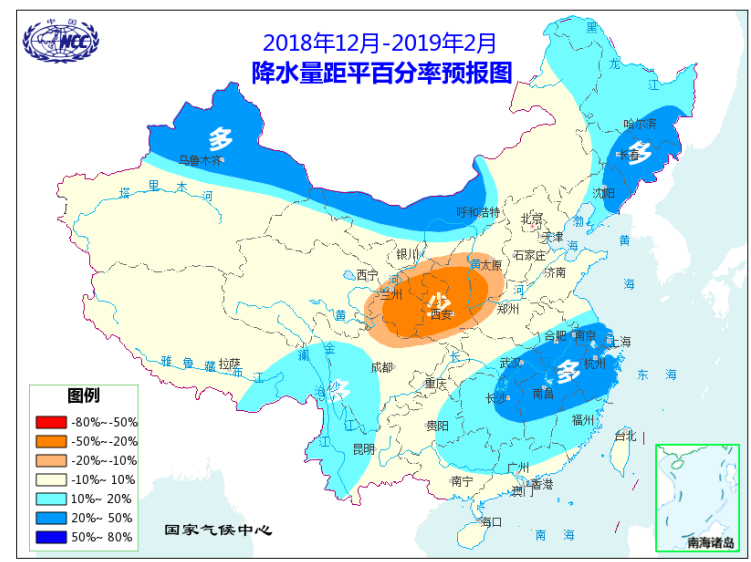
Outlook for 2018/2019 winter

EAWM : weak

Temperature



Precipitation



- The **temperature** of most parts of China will be warmer than normal, excludes northeast of China and north of Xinjiang province.
- The **precipitation** will be above-normal in Northern and Southern China, but near or below normal in Central China.





Thank you!





Figure 1 Deterministic forecast of **Precipitation**



Figure 2 Deterministic forecast of **Temperature**



500hPa

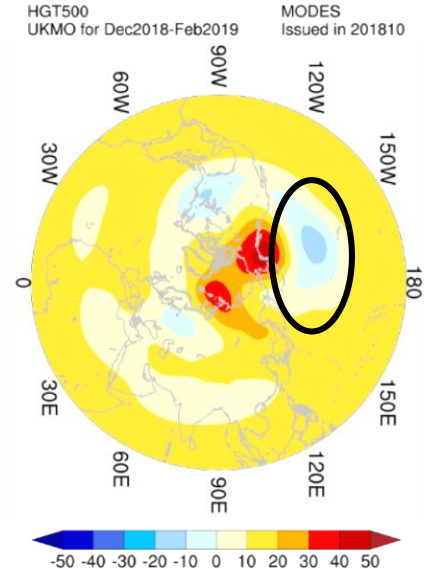
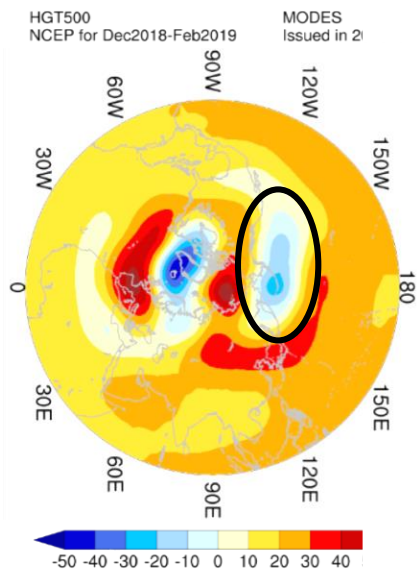
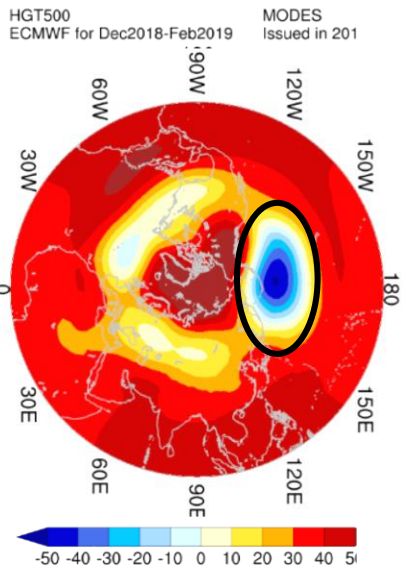


Prediction

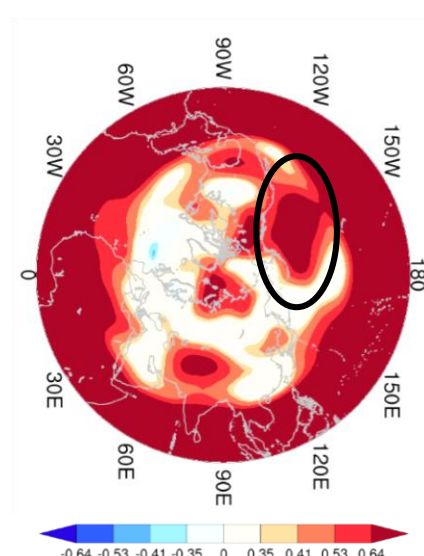
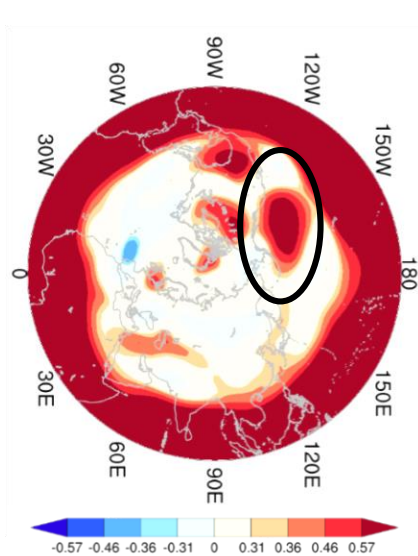
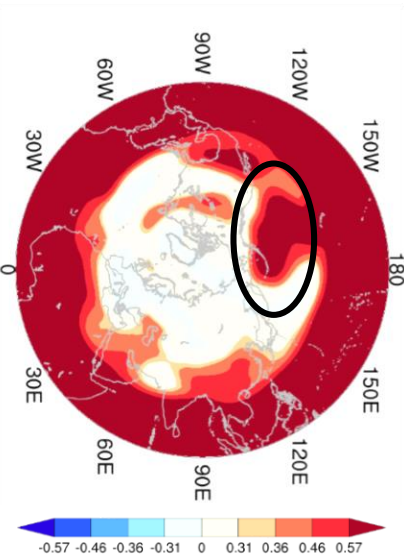
ECMWF

NCEP

UKMO



Hindcast skill





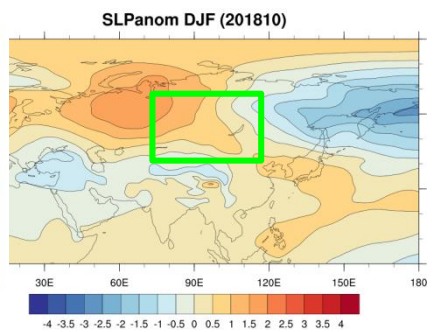
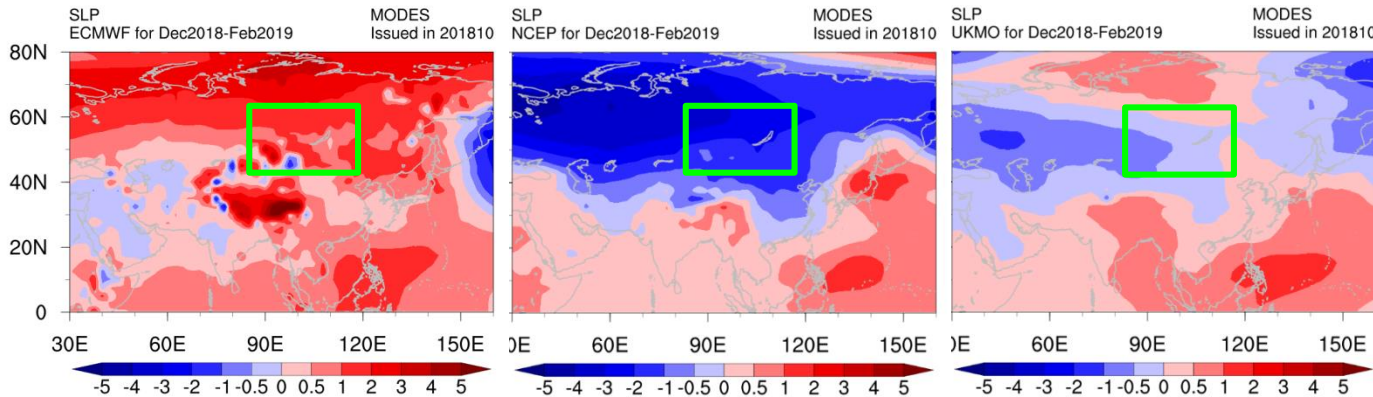
SLP Prediction

ECMWF

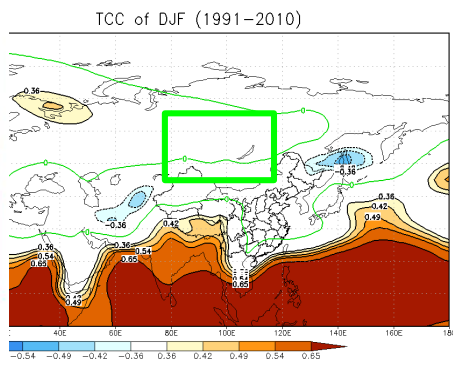
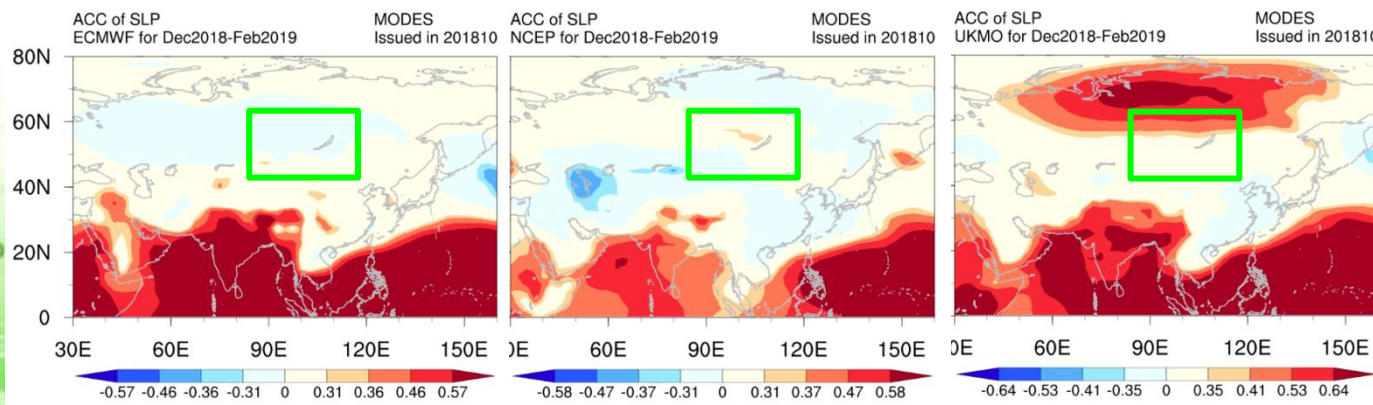
NCEP

UKMO

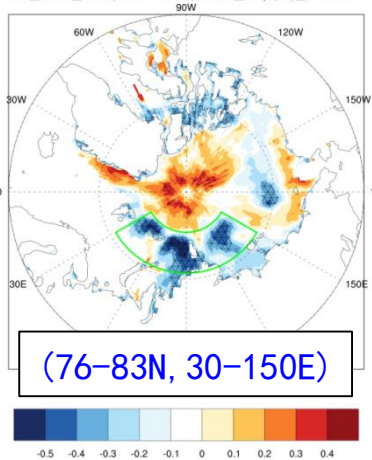
BCC



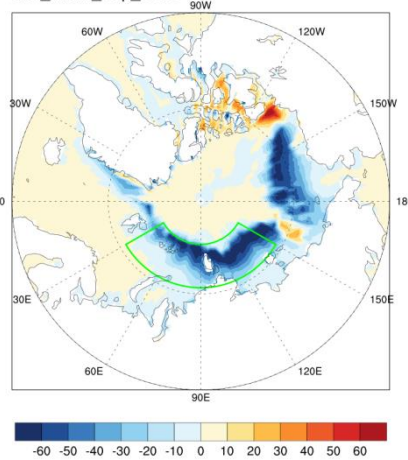
Hindcast skill



cor_siber_DJF(1983-2018)&icec_Sep(-1)_dtrend

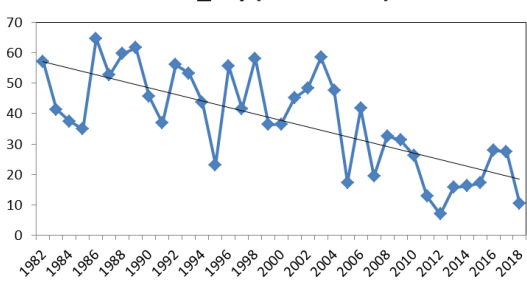


icec_anom_Sep_2018



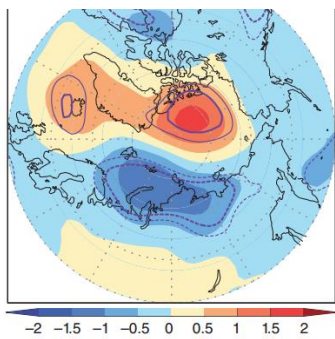
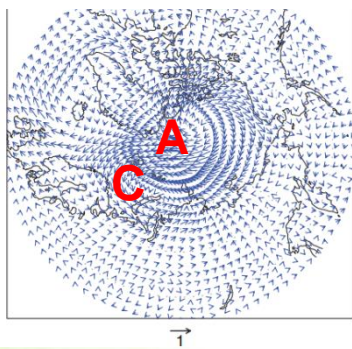
SH

icec_Sep(1982-2018)



Average Monthly Arctic Sea Ice Extent is slightly **below normal** after removing trend → **strong SH?**

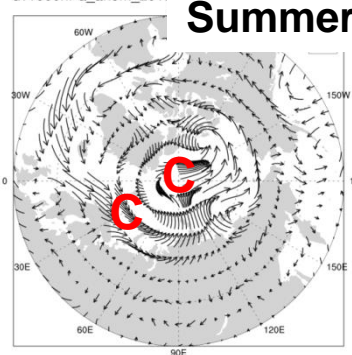
Summer negative AD wind pattern



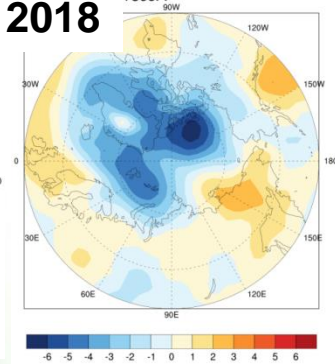
➤ The summer Arctic dipole wind pattern **modulates** winter atmospheric responses to sea ice loss .

uv1000hPa_anom_2018

Summer 2018



18JJA



Winter	2014	2015	2016	2017	2018
ASIE/ Sep/ detrend	B	B	A	A	B
negative AD wind pattern(JJ A)	NO	YES	YES	NO	NO
Winter SH	weak	strong	weak	strong	Strong?
Correctness of ASIE	×	✓	✓	×	?

Arctic dipole wind pattern(Bingyi WU, 2016)