Environment and Climate Change Canada | Environnement et Changement climatique Canada

Canada

ACF - 11: Verification of the FMA 2023 season
ACF – 11: Seasonal forecast for the JJA 2023 season

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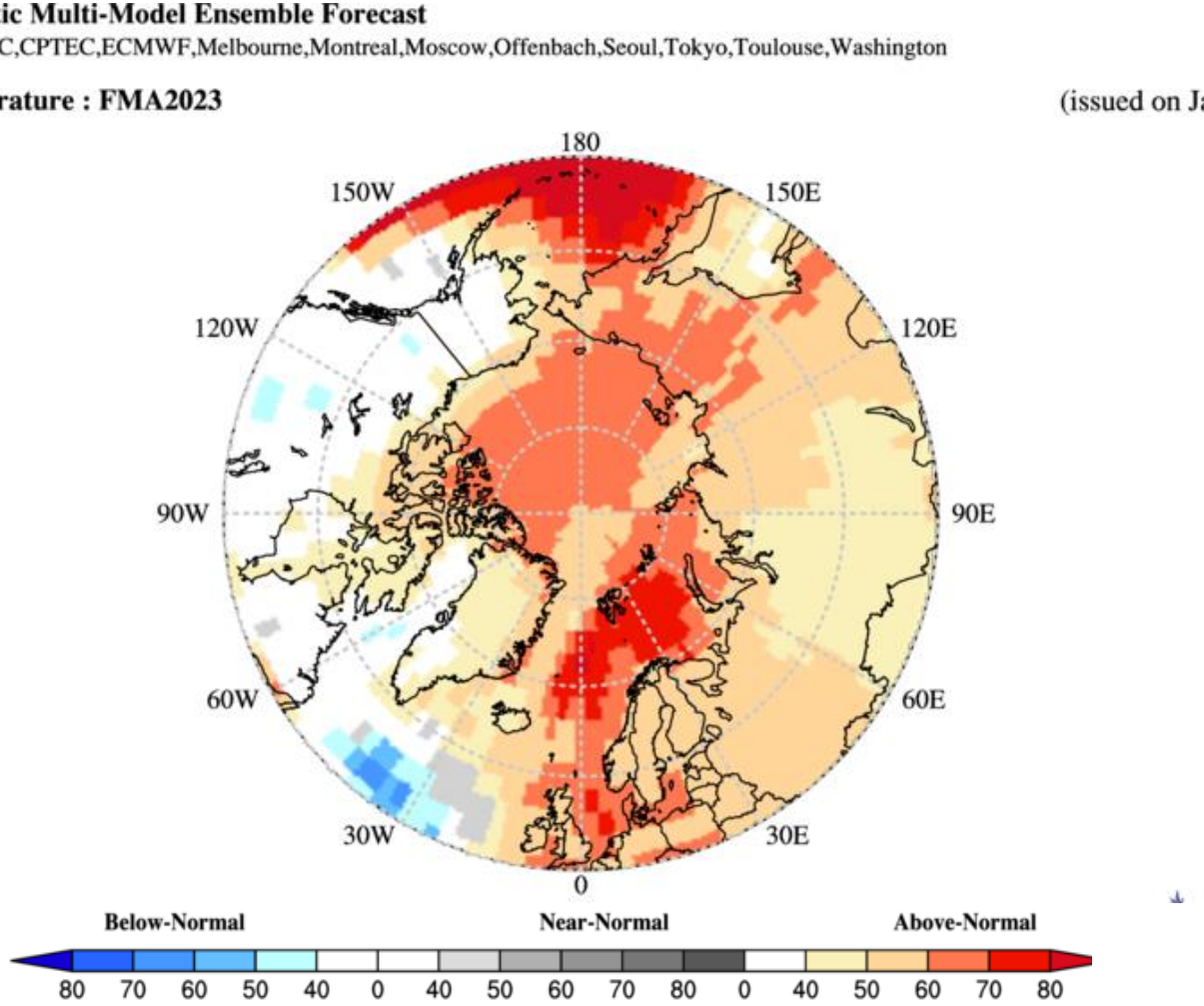
Meteorological Service of Canada
Environment and Climate Change Canada

WMO

ACF
Arctic Climate Forum

Seasonal forecast over the Arctic, FMA 2023

reminder

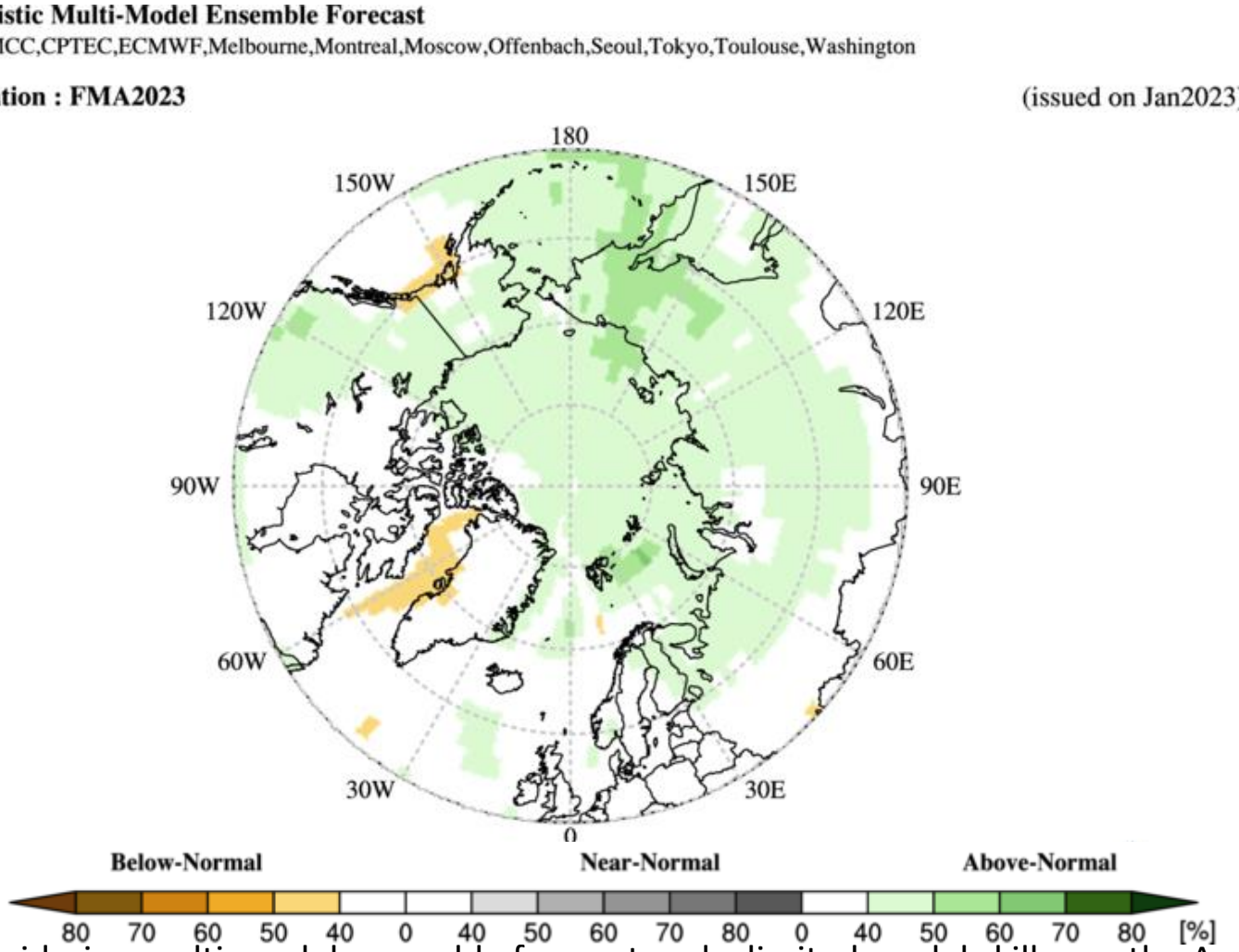


Considering multi-model ensemble forecast and a limited model skill over the Arctic:

Temperature: For February-March-April 2023 (FMA23), there is a probability of 40% or more that temperatures will be above normal in all regions across the Eastern Hemisphere. The highest probabilities were in the eastern Siberian, Chukchi and Bering regions. Alaskan and western Canada region is expecting equal probability chances.

Seasonal forecast over the Arctic, FMA 2023

reminder



Considering multi-model ensemble forecast and a limited model skill over the Arctic:

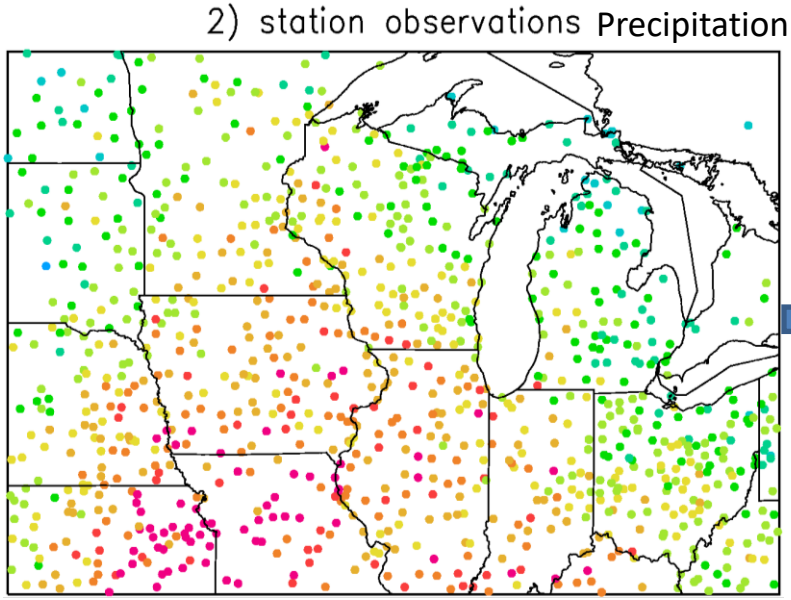
Precipitation: Over the largest part of the Arctic region, there are expectances for an above normal precipitation. These probabilities are rather moderate (40% or more) for most of the Arctic domains with an exception of the central and southern parts of Chukchi and Bering region where the probability expectancies reach 50-60% or more. Indecisive precipitation were forecast over the eastern Canada, western Nordic region and over central and western portions of the eastern Nordic region.

How do we verify seasonal forecasts?

- We need observations!

- Unfortunately we can not measure temperature or precipitation on every single point over the globe.

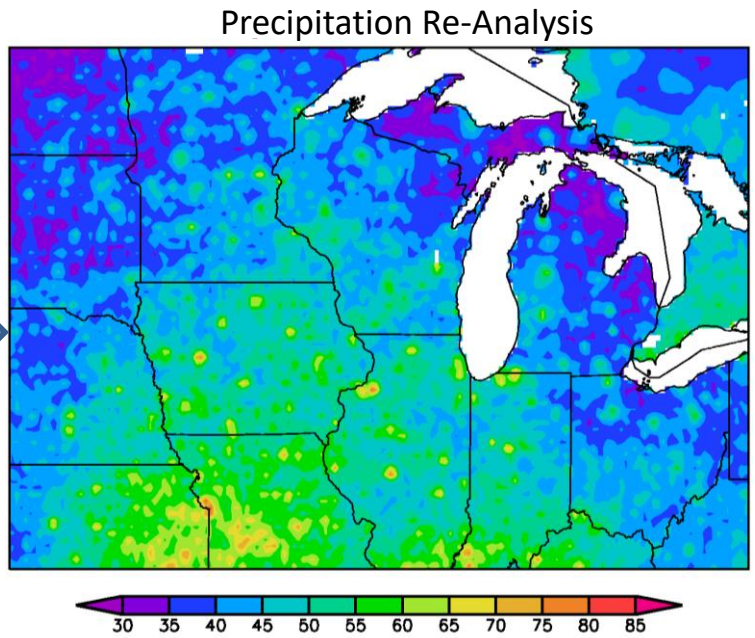
- This is why we use statistical techniques to interpolate measured variables over the regions where we can measure. The results is called **the re-analysis**.



https://dilorenz.github.io/downscaling2/ProbApp/interp.html

Data Assimilation

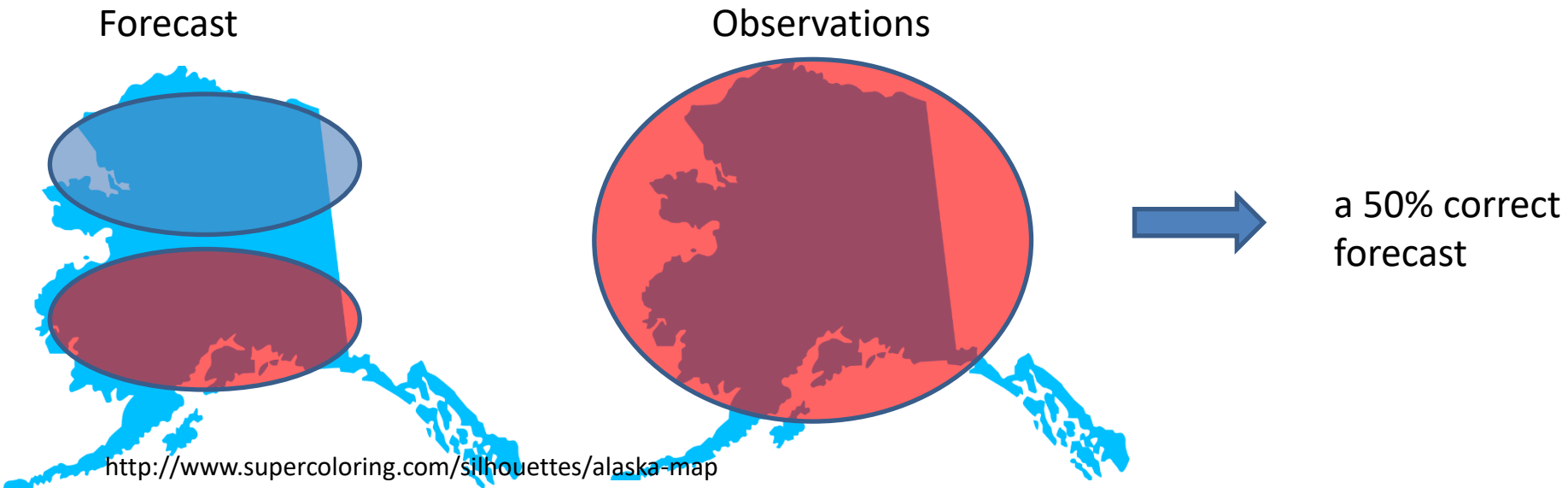
+ numerical modeling



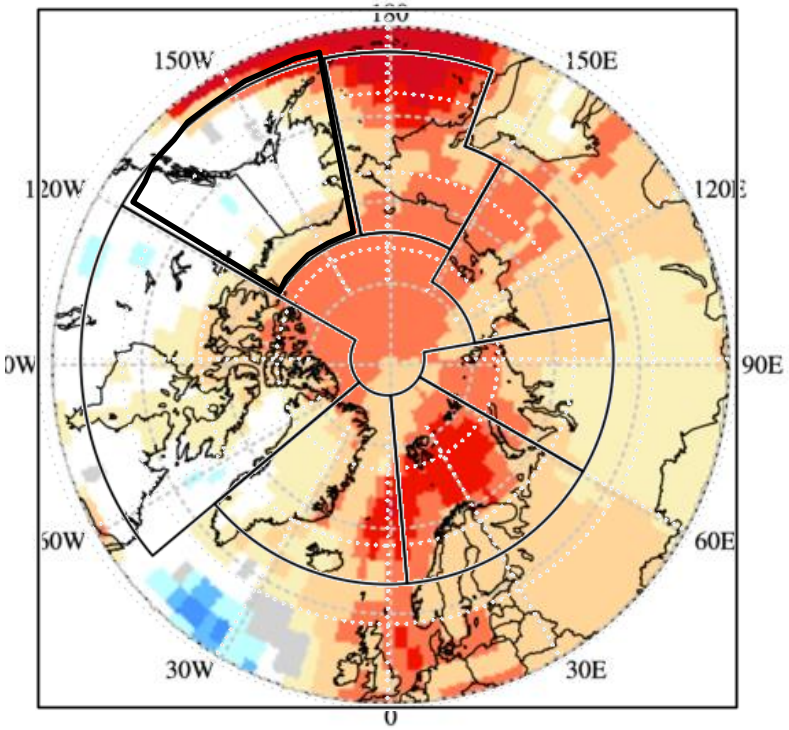
How do we verify seasonal forecasts?

- We need some metric, some number to quantify the verification result
- We call this metric a score

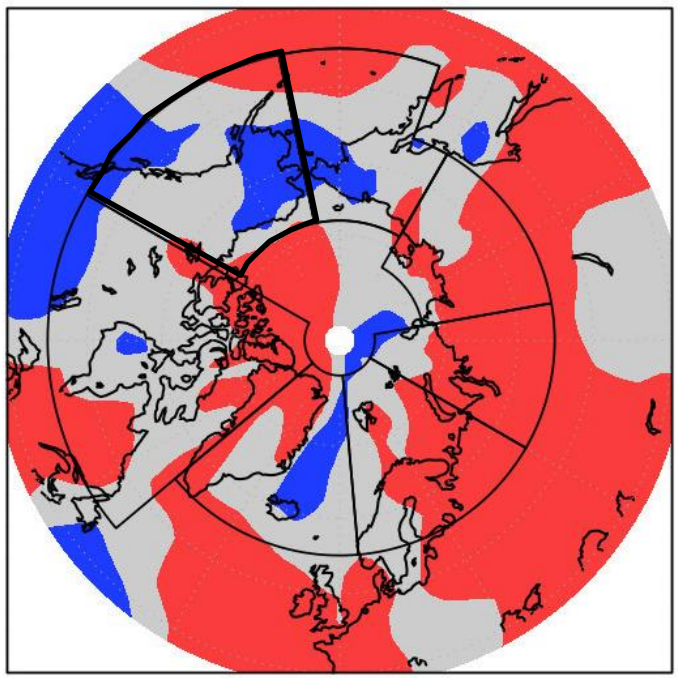
- For the verification over the Arctic we will use a subjective score: a percentage of the correct forecast over a selected region in the Arctic.



Forecast, temp FMA 2023



CFSR Reanalysis, Temperature FMA2023



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Verification Temperature

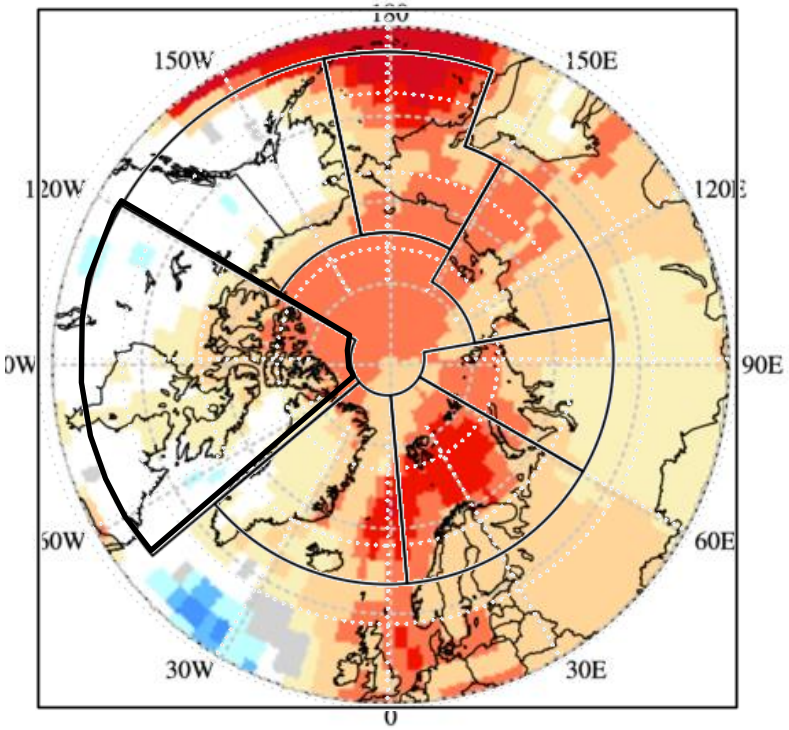
Above normal

Near normal

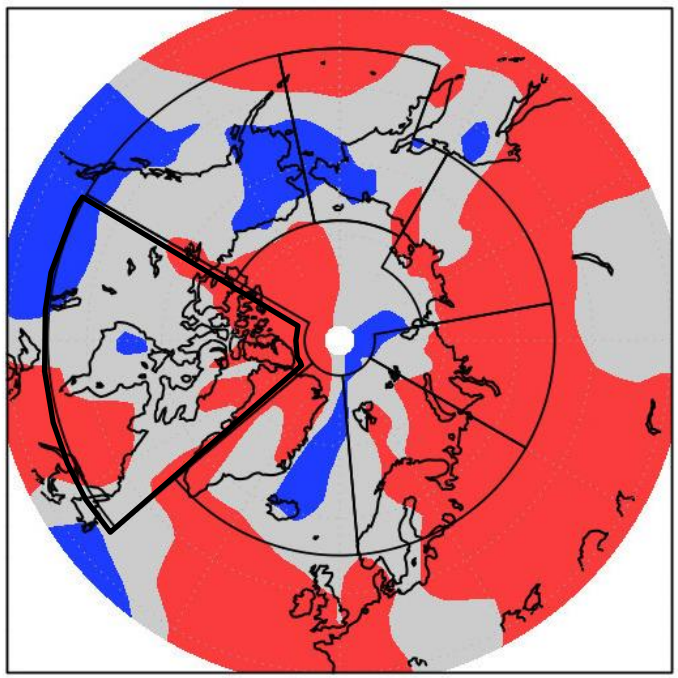
Below normal

Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	**Equal Chances**	**Near normal in the east and SE, above in the west**	**%**
C. - E. Canada			
W. Nordic			
E. Nordic			
W. Siberia			
E. Siberia			
Chukchi-Bering			

Forecast, temp FMA 2023



CFSR Reanalysis, Temperature FMA2023



Environment and Environnement et

Verification Temperature

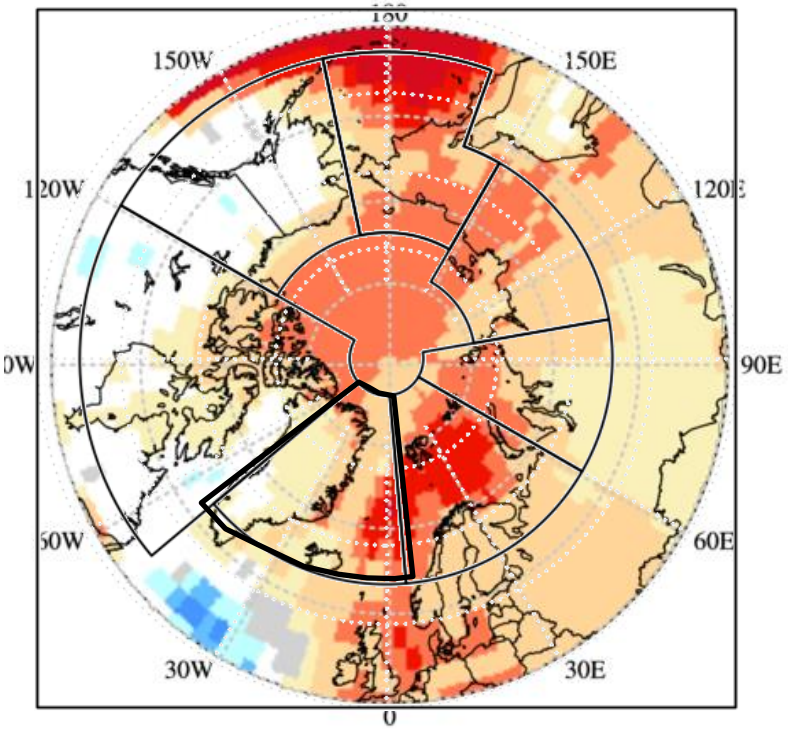
Above normal

Near normal

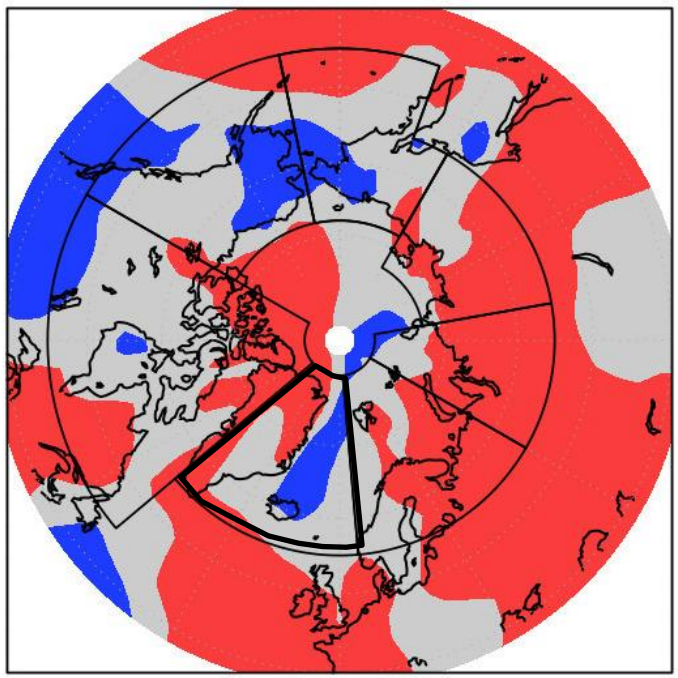
Below normal

Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Equal Chances	Near normal in the east and SE, above in the west	%
C. - E. Canada	**Mostly equal chances**	**Near normal in the west and center above in the SE**	%
W. Nordic			
E. Nordic			
W. Siberia			
E. Siberia			
Chukchi-Bering			

Forecast, temp FMA 2023



CFSR Reanalysis, Temperature FMA2023



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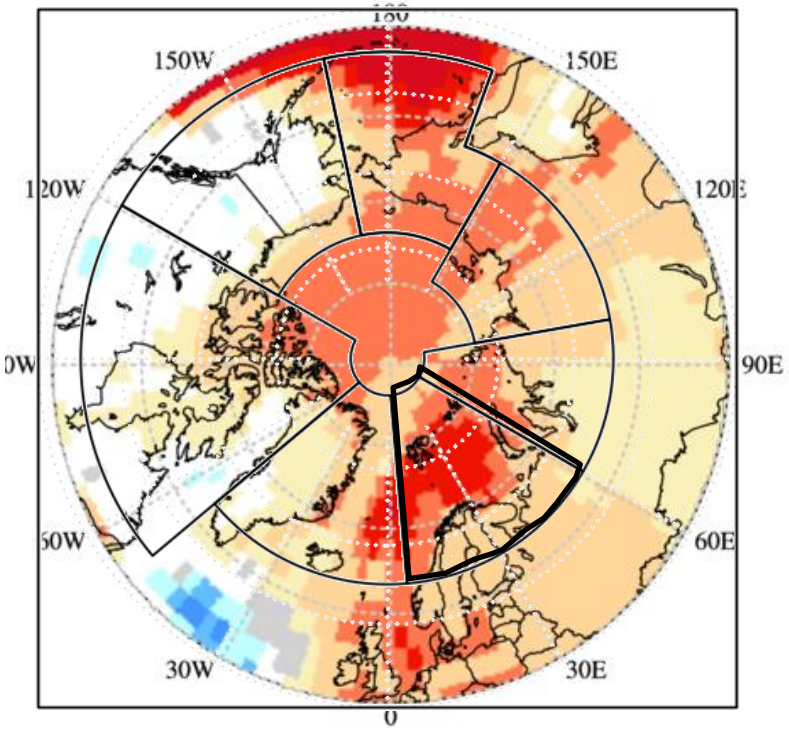
Alaska, W. Can	Equal Chances	Near normal in the east and SE, above in the west	**%**
C. - E. Canada	Mostly equal chances	Near normal in the west and center above in the SE	%
W. Nordic	**Mostly above**	**Mostly near and below normal**	**10%**
E. Nordic			
W. Siberia			
E. Siberia			
Chukchi-Bering			

Forecast, temp FMA 2023



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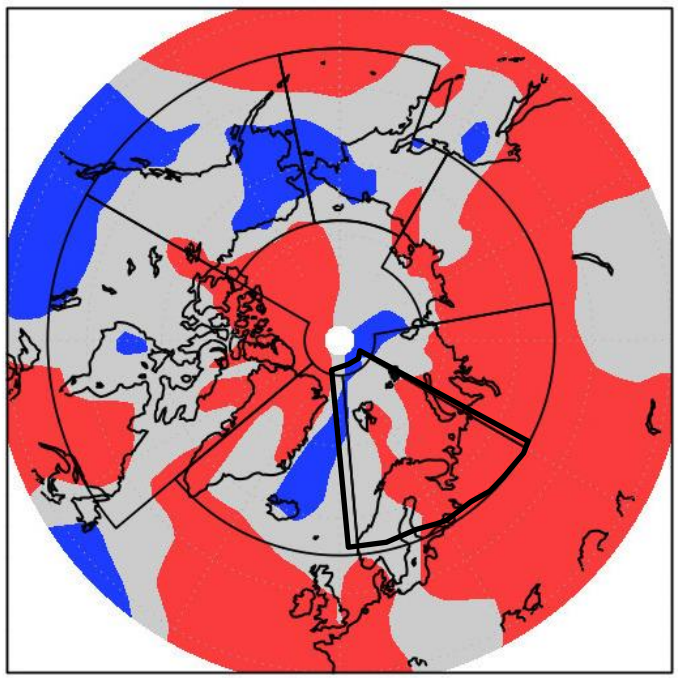

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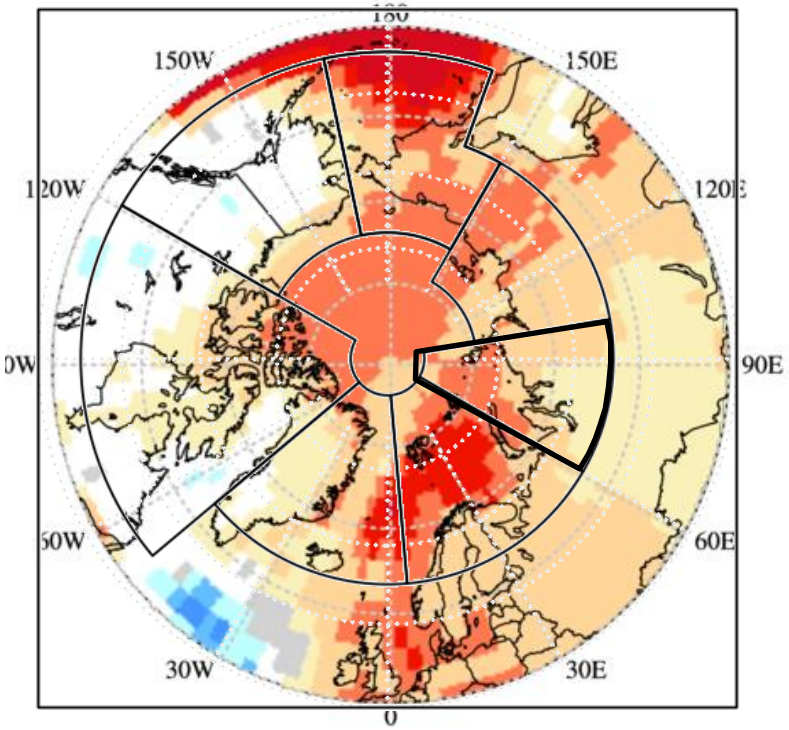
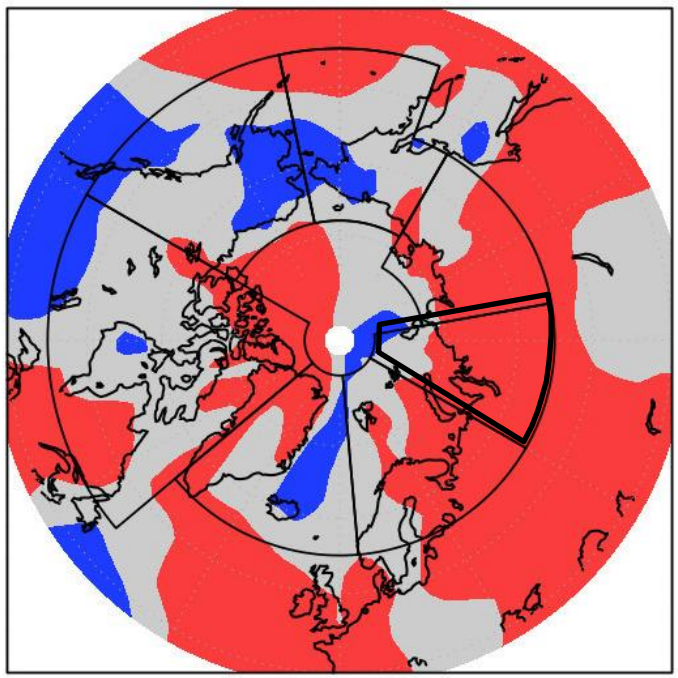
Alaska, W. Can	Equal Chances	Near normal in the east and SE, above in the west	**%**
C. - E. Canada	Mostly equal chances	Near normal in the west and center above in the SE	%
W. Nordic	Mostly above	Mostly near and below normal	10%
E. Nordic	**Above**	**Above in the east and north**	**60%**
W. Siberia			
E. Siberia			
Chukchi-Bering			

Forecast, temp FMA 2023



CFSR Reanalysis, Temperature FMA2023



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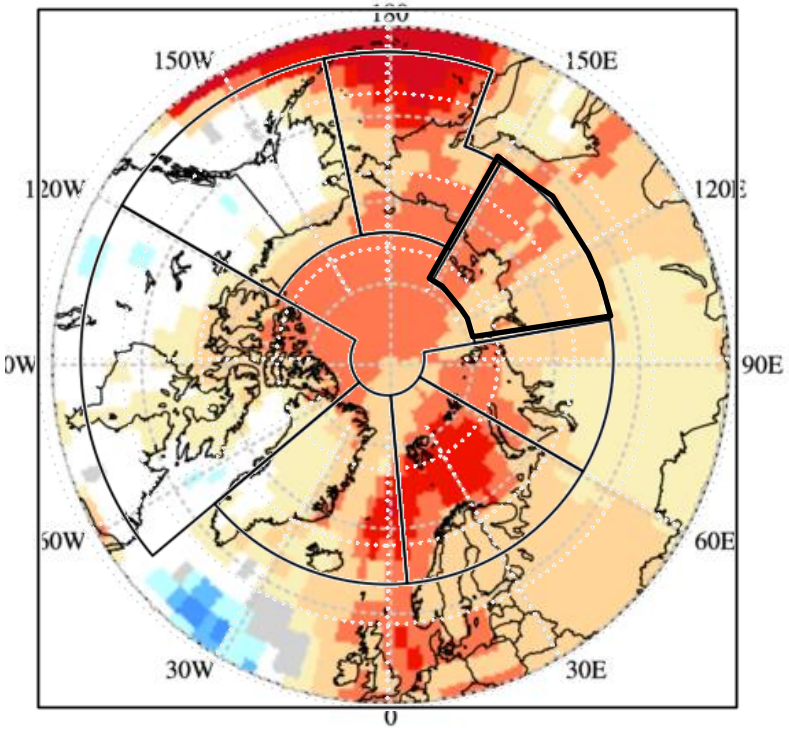
Alaska, W. Can	Equal Chances	Near normal in the east and SE, above in the west	**%**
C. - E. Canada	Mostly equal chances	Near normal in the west and center above in the SE	%
W. Nordic	Mostly above	Mostly near and below normal	10%
E. Nordic	Above	Above in the east and north	60%
W. Siberia	**Above**	**Mostly Above**	**90%**
E. Siberia			
Chukchi-Bering			

Forecast, temp FMA 2023



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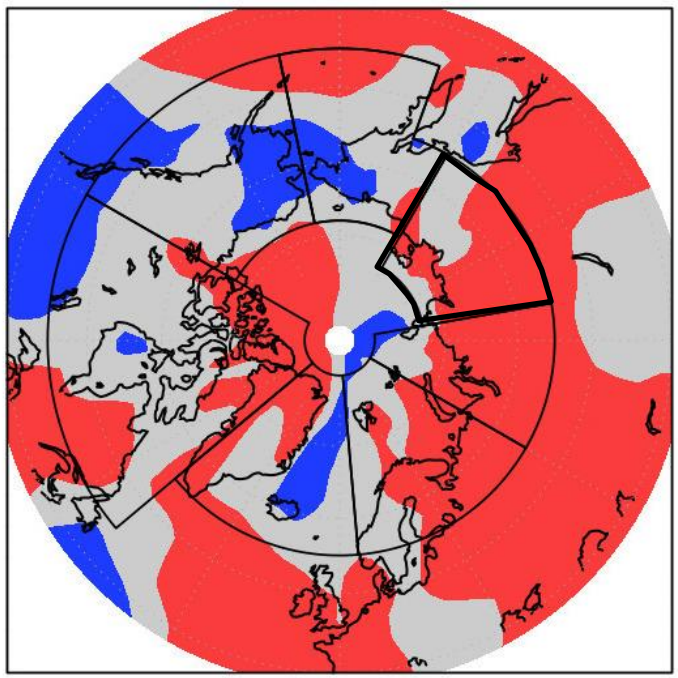


Verification Temperature

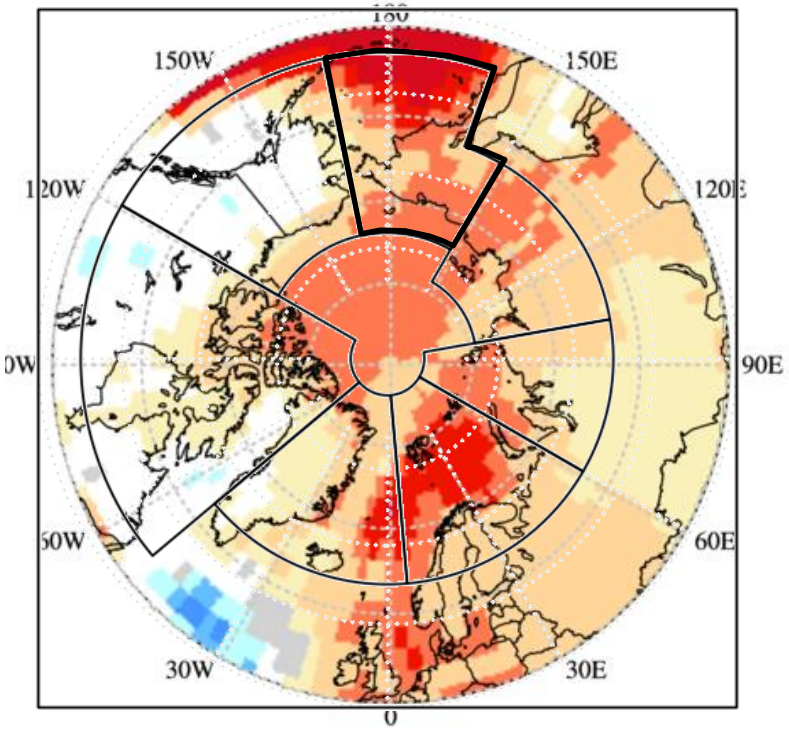
Above normal

Near normal

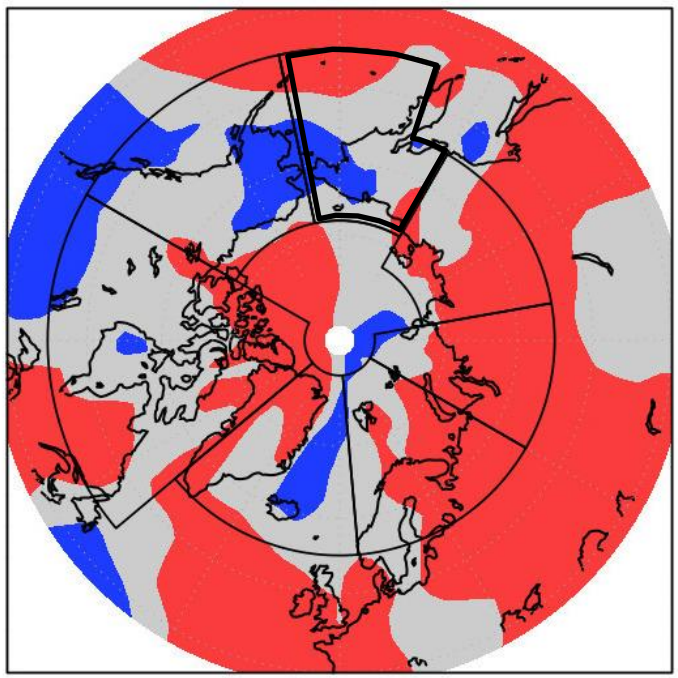
Below normal

Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Equal Chances	Near normal in the east and SE, above in the west	**%**
C. - E. Canada	Mostly equal chances	Near normal in the west and center above in the SE	%
W. Nordic	Mostly above	Mostly near and below normal	10%
E. Nordic	Above	Above in the east and north	60%
W. Siberia	Above	Mostly Above	90%
E. Siberia	**Above**	**Above, except in the south-east**	**70%**
Chukchi-Bering			

Forecast, temp FMA 2023



CFSR Reanalysis, Temperature FMA2023



Verification Temperature

Above normal

Near normal

Below normal

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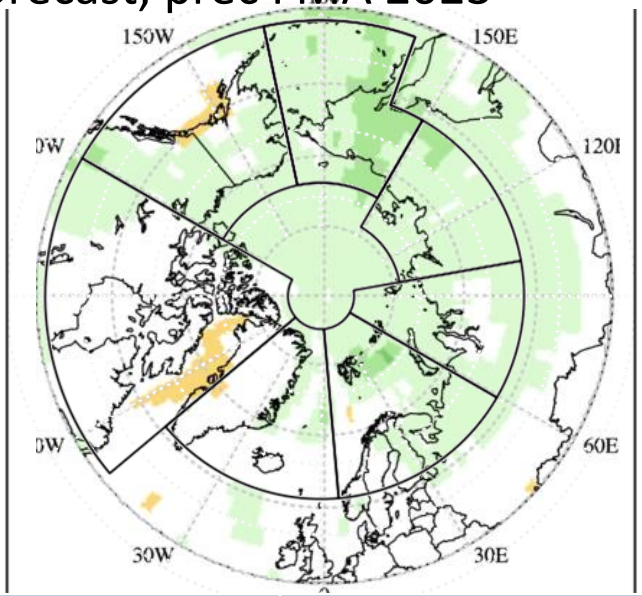
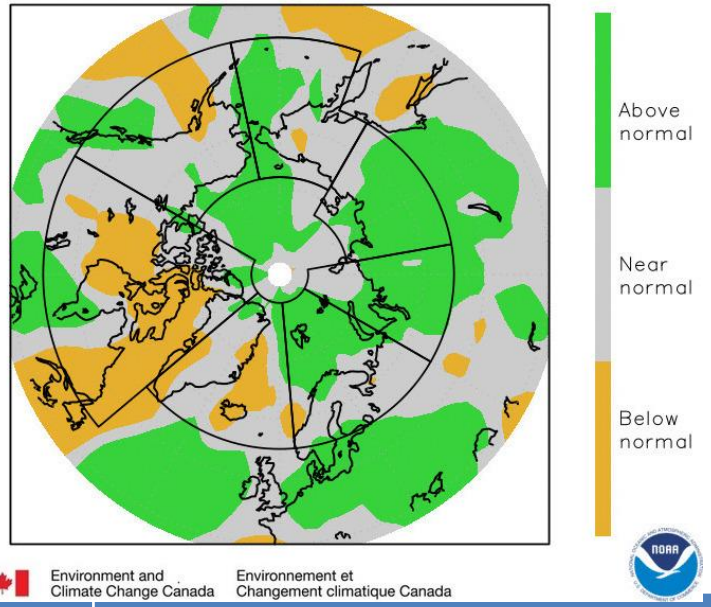
Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Equal Chances	Near normal in the east and SE, above in the west	**%**
C. - E. Canada	Mostly equal chances	Near normal in the west and center above in the SE	%
W. Nordic	Mostly above	Mostly near and below normal	10%
E. Nordic	Above	Above in the east and north	60%
W. Siberia	Above	Mostly Above	90%
E. Siberia	Above	Above, except in the south-east	70%
Chukchi-Bering	Above normal	Near normal, below normal in the east	miss

Verification Precipitation

Forecast, prec FMA 2023



CFSR Reanalysis, Precipitation FMA2023



Verif:	Forecast FMA	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above normal	Mostly near normal	miss
C. - E. Canada	Equal chances, above in the south west	Below normal in the north, east and west, near normal in the south	Miss, where forecasted
W. Nordic	Equal chances	Mostly near normal, below in the central parts	%
E. Nordic	Equal chances in the west, above in the east	Near normal in the south, above in the north	30% hit
W. Siberia	Above normal	Mostly above normal	90% hit
E. Siberia	Above normal	Mostly above normal	90% hit
Chukchi Bering	Above normal	Mostly near normal	10% hit

Overall result, subjective verification

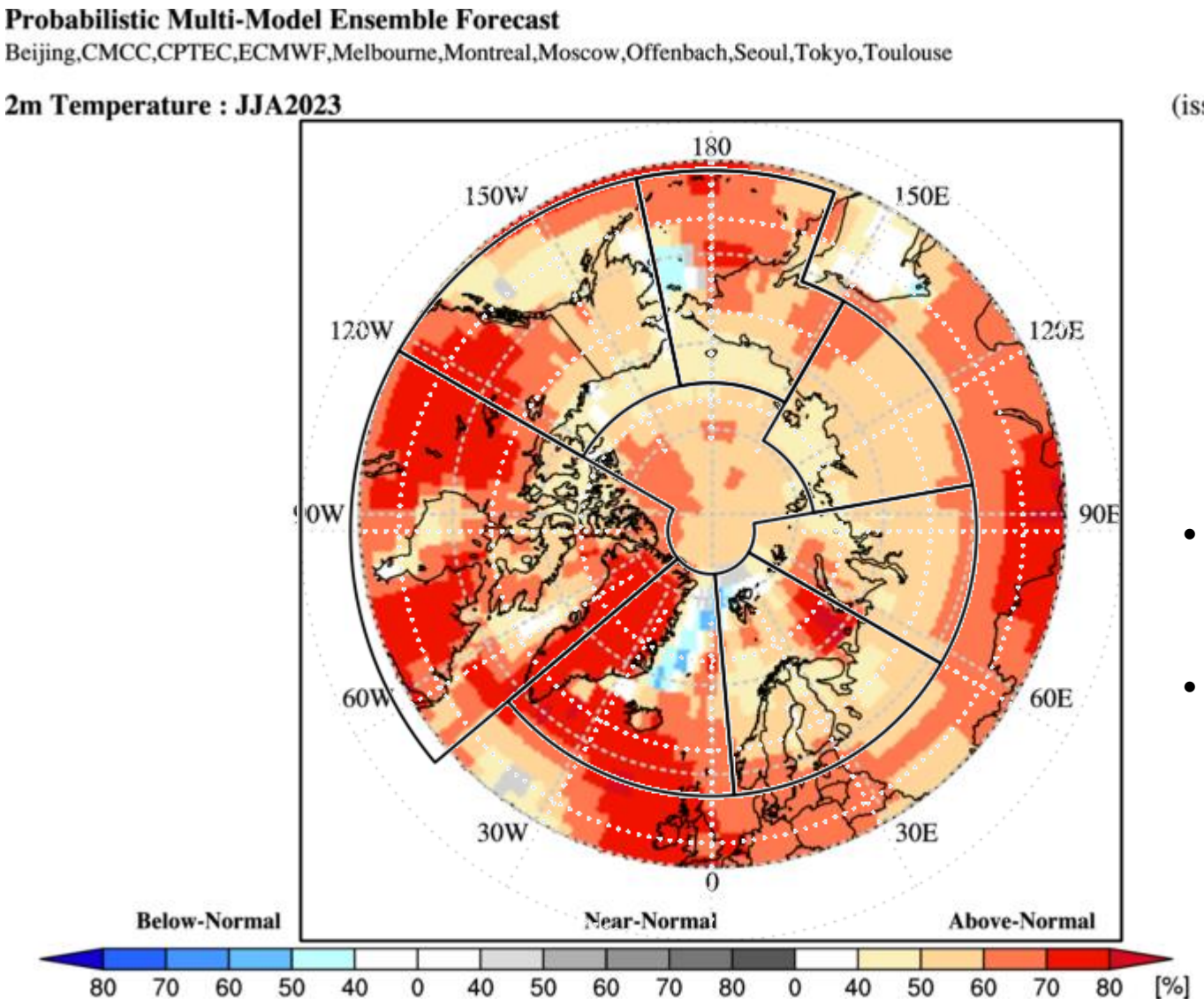
- **Temperature**: Considering all Arctic regions the subjective score is between 40-50%.

- **Precipitation**: In the regions where the models were decisive, the forecast did nor perform well. The exception is over two Siberian regions where precipitation forecast was a success. Given the historical skill scores, precipitation forecasts are usually not very skilful over the Arctic.

Actual (real time)seasonal forecasts over the Arctic JJA 2023

- Temperature
- Precipitation
- Sea Surface Temperature
- Snow Water Equivalent

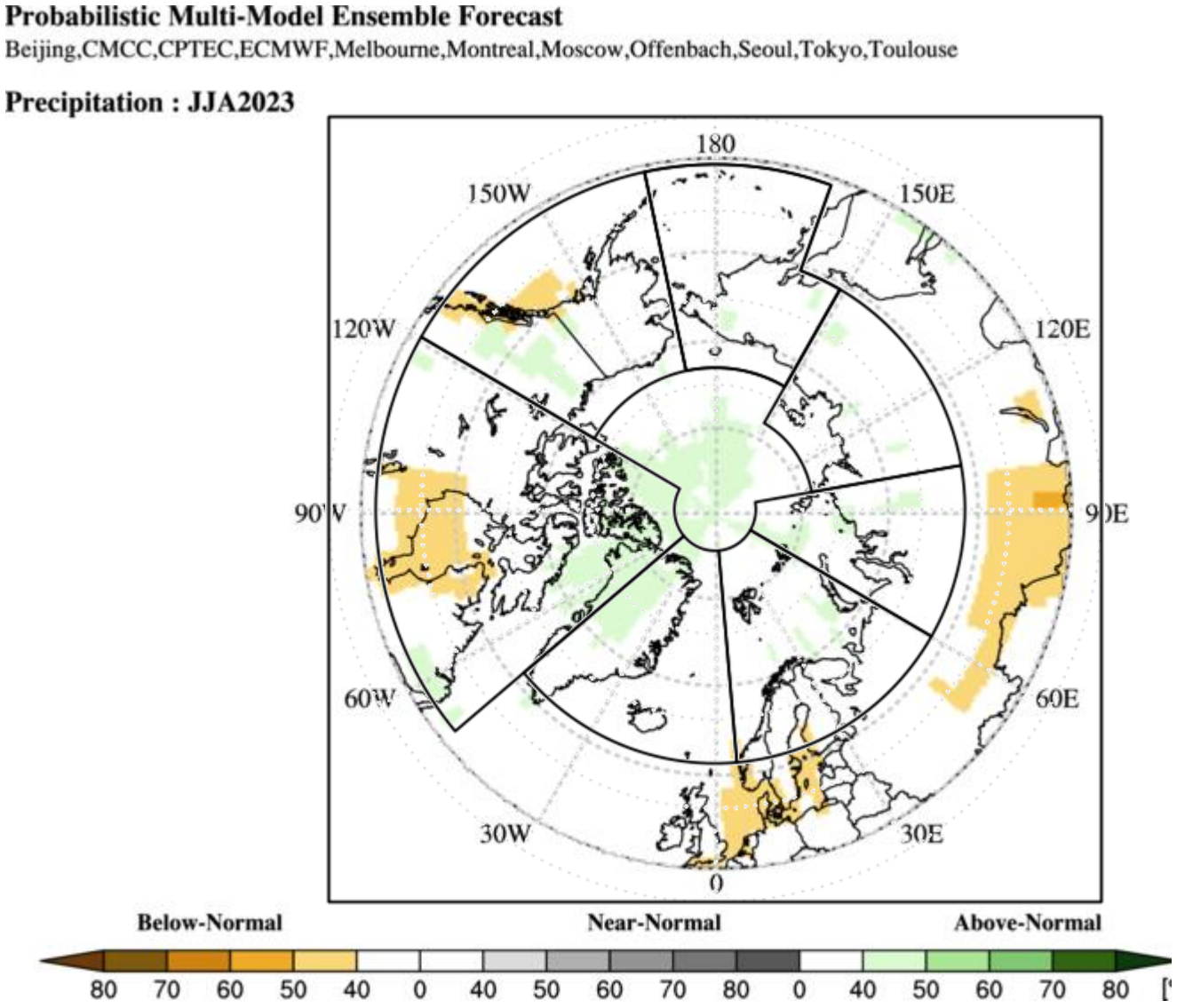
Temperature outlook over the Arctic: Jun-Jul-Aug 2023



1. Alaska W. Canada
2. Eastern Canadian Arctic
3. Western Nordic
4. Eastern Nordic
5. West Siberia
6. East Siberia
7. Chukchi and Bering

- The redder the color doe not mean it is warmer.
- It means we have more confidence in the above normal forecast over that region.

Precipitation outlook over the Arctic: Jun-Jul-Aug 2023



1. Alaska W. Canada
2. Eastern Canadian Arctic
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4. Eastern Nordic
5. West Siberia
6. East Siberia
7. Chukchi and Bering

- The greener the color does not mean it will precipitate more.
- It means we have more confidence in the above normal precipitation forecast over that region.

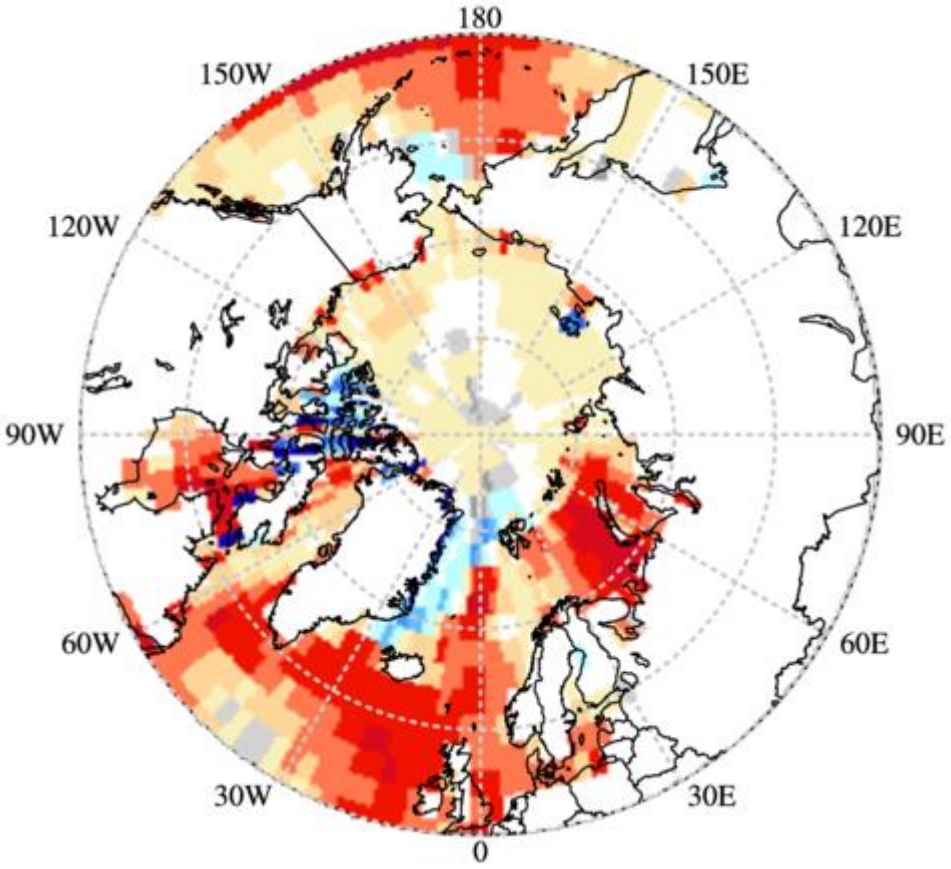
Global Seasonal Climate Update by WMO

- Global information on state of climate (monitoring and prediction)
- The plots get updated once a month and are available from

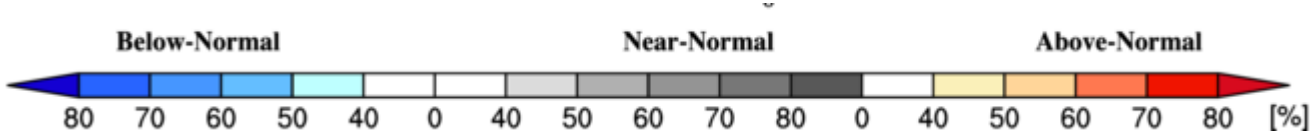
https://public.wmo.int/en/our-mandate/climate/global-seasonal-climate-update
https://wmolc.org/gscuBoard/list

- Climate report is available for download

Sea Surface Temperature outlook over the Arctic: Jun-Jul-Aug 2023

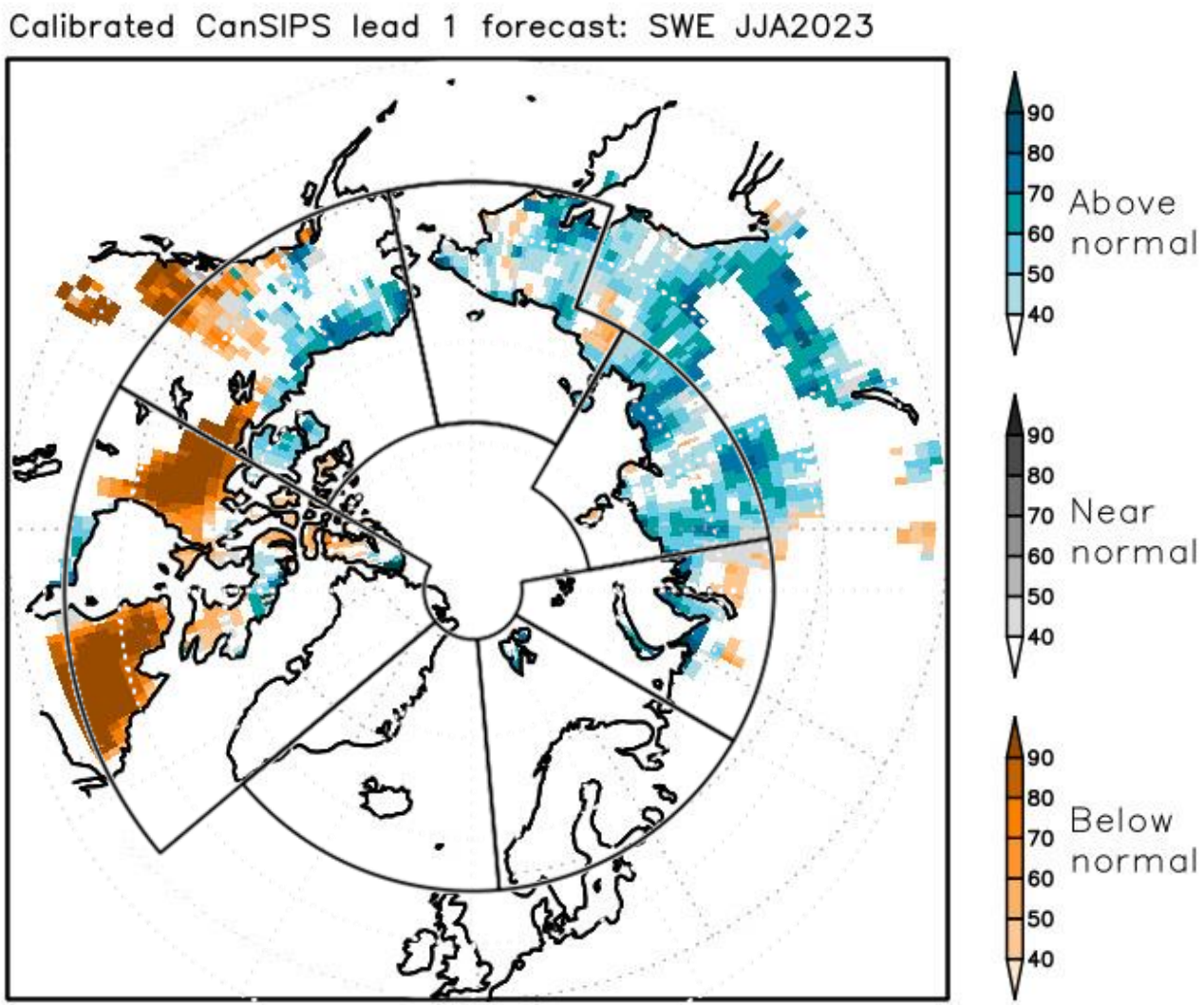


https://nsidc.org/arcticseaicenews/map-of-the-arctic-ocean/



Snow Water Equivalent outlook over the Arctic: Jun-Jul-Aug 2023

Experimental product



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2. Eastern Canadian Arctic
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7. Chukchi and Bering

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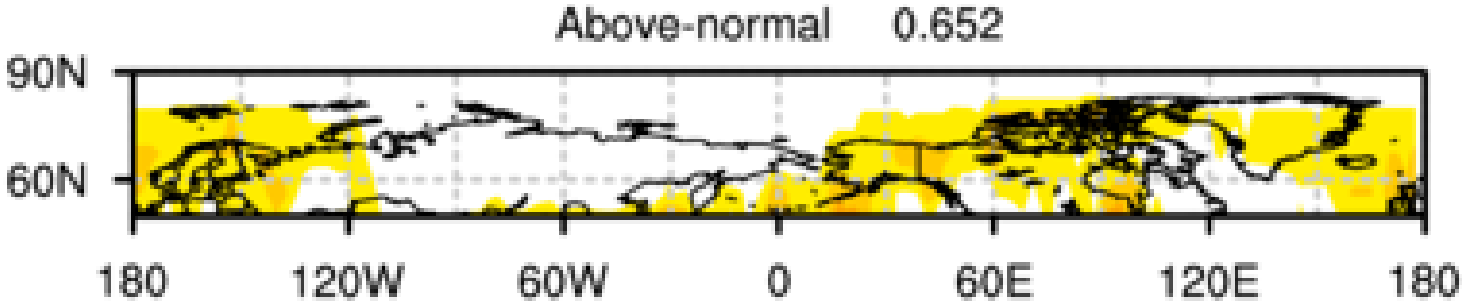
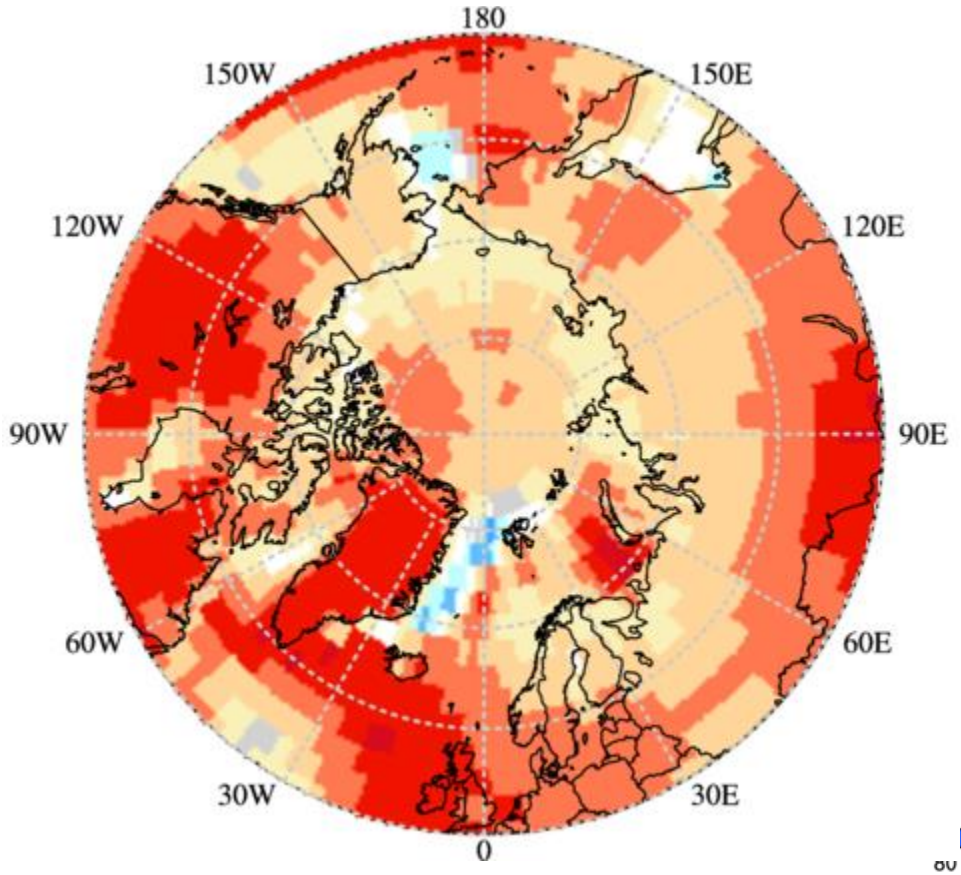
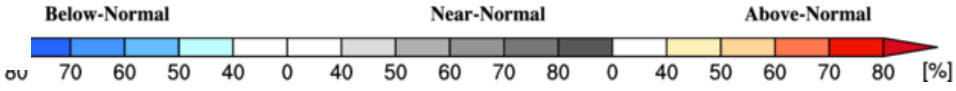
Discussing historical skill over the Arctic, Temperature

(confidence with respect to the historical skill)



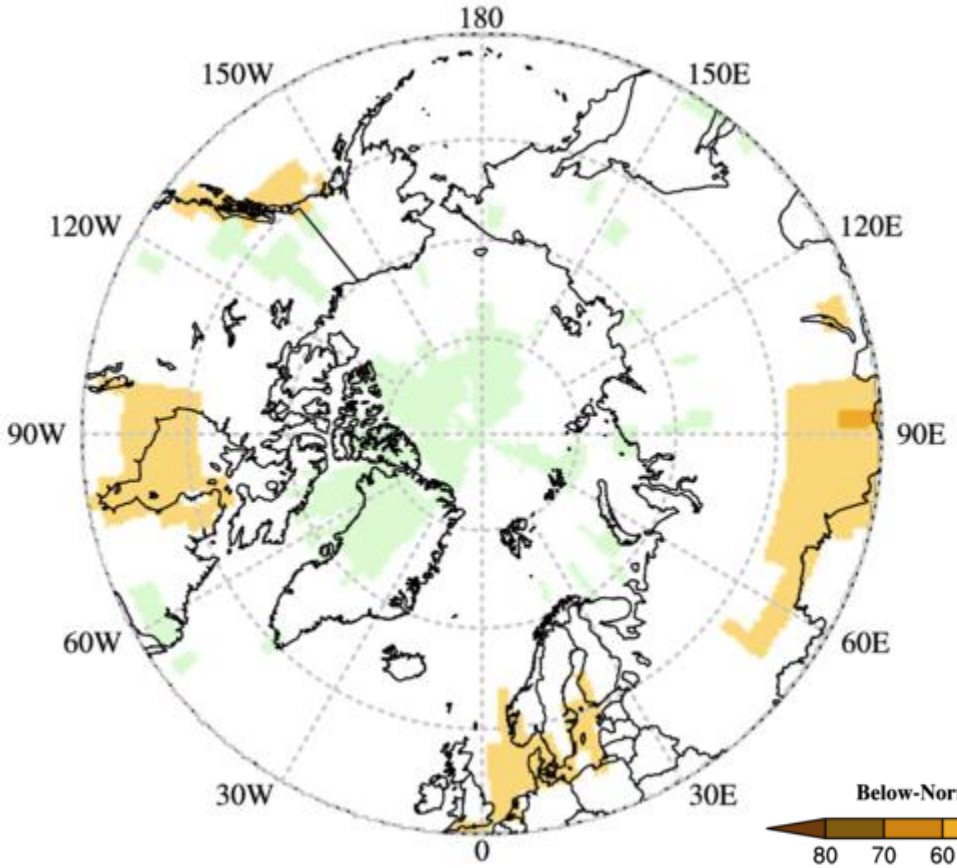


- If a historical skill was good over a certain region (e.g. colored region on the upper figure) we are more confident about the forecast results over the same region
- Overall confidence is moderate in JJA over the Arctic.

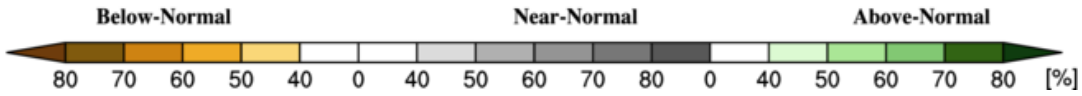


Discussing historical skill over the Arctic, Precipitation

(confidence with respect to the historical skill)

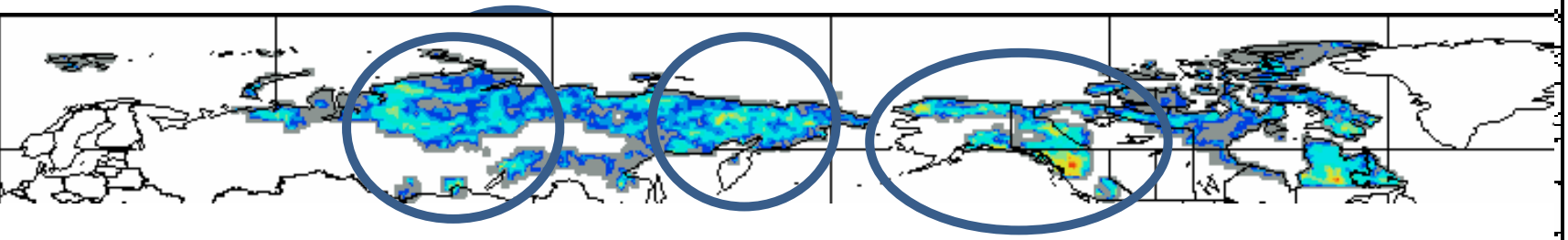


- We don't have a very high confidence in precipitation skill over the Arctic in NDJ.

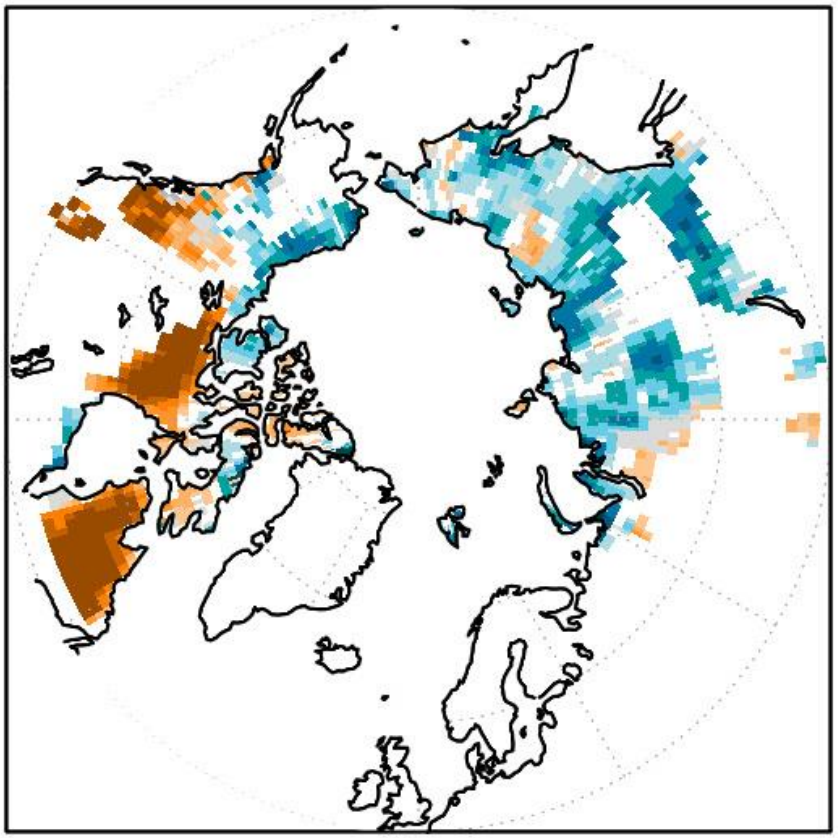


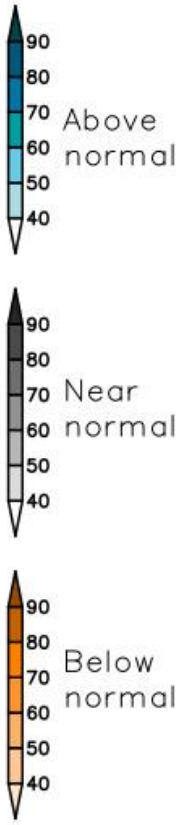
Discussing historical skill over the Arctic, SWE

(confidence with respect to the historical skill)



Calibrated CanSIPS lead 1 forecast: SWE JJA2023





If a historical skill was good over a certain region (e.g. colored region on the upper figure) we are more confident about the forecast results over the same region

Conclusions

- We use Multi Model Ensemble (MME) approach to calculate seasonal forecast.
- We use probabilistic approach to communicate seasonal forecast results.
- For evaluation over the Arctic we use a combination of observations and model results called re-analysis.
- JJA2022 MME temperature forecast over the Arctic region was ~40%-50$ correct. Precipitation forecast was correct mostly over the two Siberian regions.
- We expect above normal temperatures over all Arctic regions this winter with highest probabilities over North American regions and western Nordic region.
- Over the Arctic in JJA23, equal probability precipitation chances are mostly forecasted.
- Above normal SST is forecasted for most of the Arctic seas.
- Above normal snow water equivalent (SWE) is expected over most of the Arctic coastal regions and most of the continental Siberian regions, Chukchi and Bering and Alaska western Canada. Below normal SWE is expected in the eastern North America and southwestern Alaska western Canada.

Thank you!