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Canada



ACF - 6: Verification of the JJA2020 season

ACF - 6: Seasonal forecast for the NDJ20/21 season

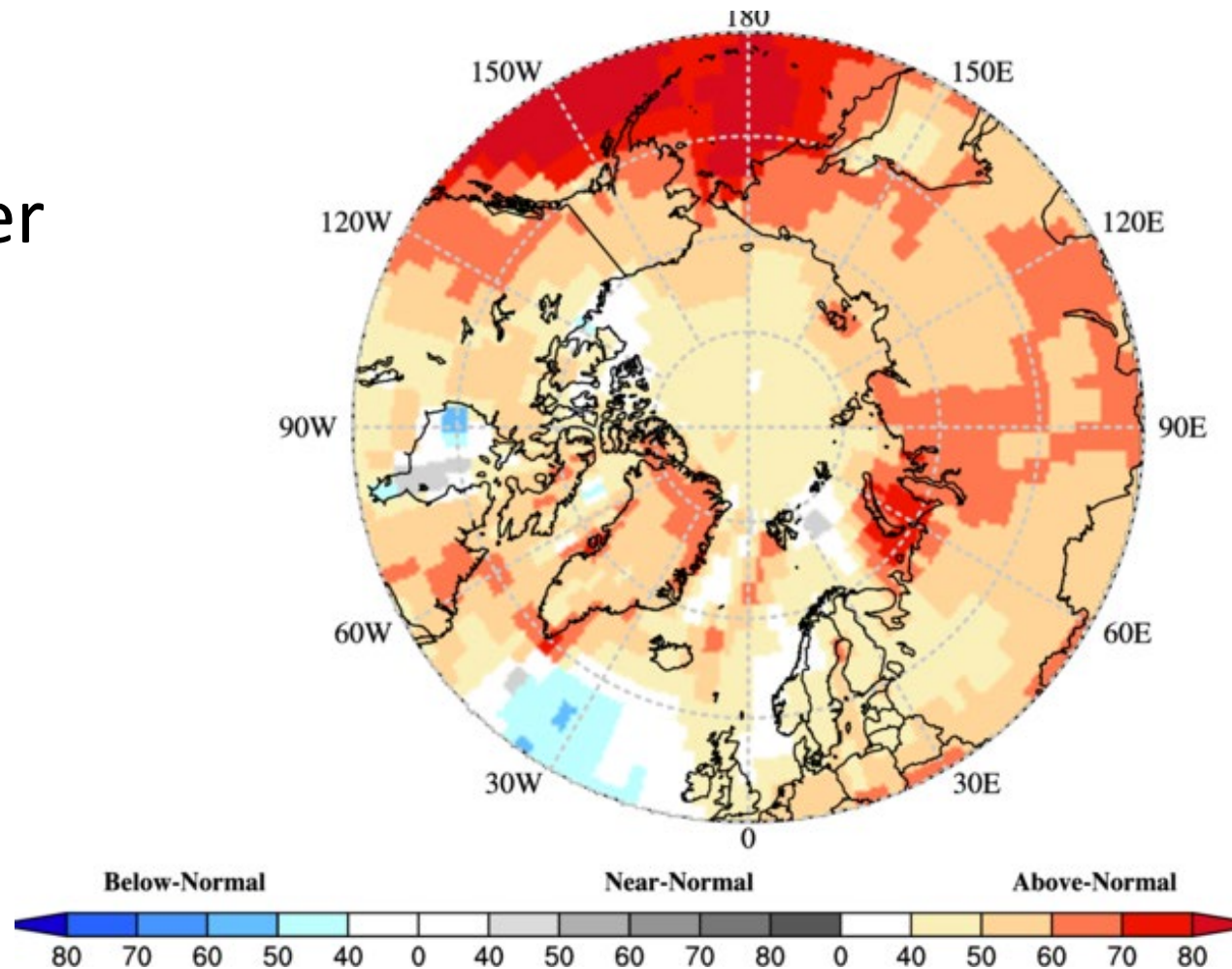
Marko Markovic

Meteorological Service of Canada



Seasonal forecast over the Arctic, JJA 2020

A reminder

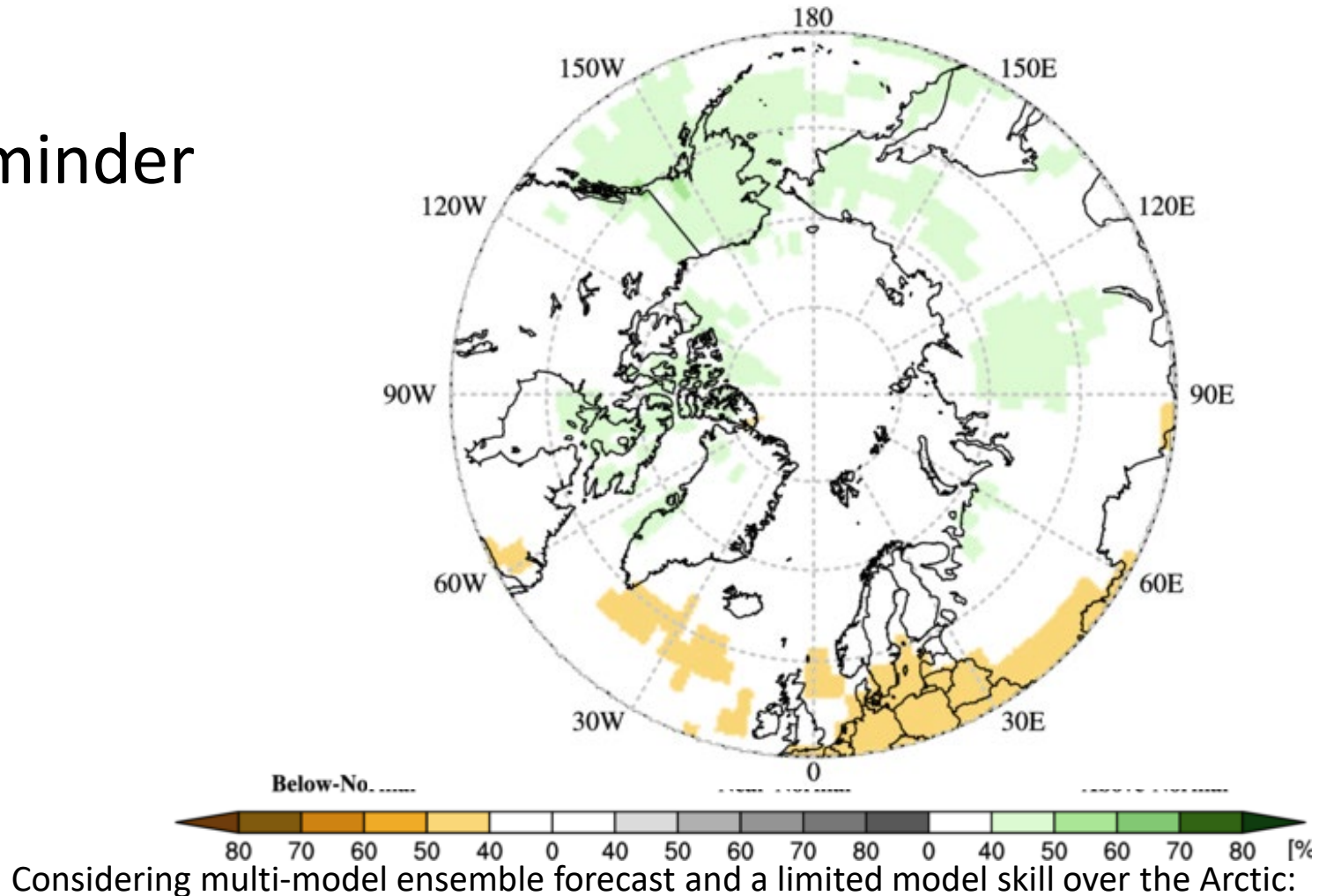


Considering multi-model ensemble forecast and a limited model skill over the Arctic:

Temperature: there is probability of 40% or more that temperatures will be above normal over the Alaska and W. Canada and over most of the continental Canadian Arctic, throughout the Nordic regions and E. Siberia. Same above normal probabilities, but with higher confidence, was forecasted for W. Siberian and Chukchi regions. ²

Seasonal forecast over the Arctic, JJA 2020

A reminder



Precipitation: Mostly equal chances were expected over central and eastern Canada, throughout Nordic regions and W. Siberia. Over other Arctic regions, above normal precipitation probabilities were expected with ~40% chance.

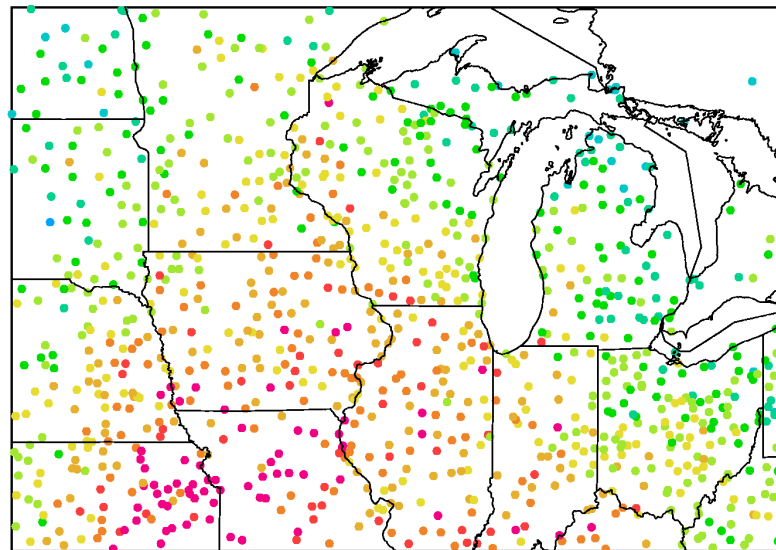
How do we verify seasonal forecasts?

- We need observations!



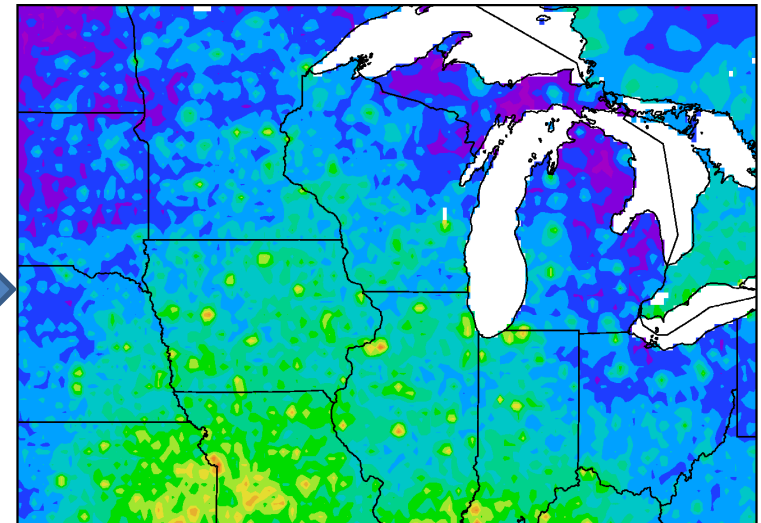
- Unfortunately we can not measure temperature or precipitation on every single point over the globe.
- This is why we use statistical techniques to interpolate measured variables over the regions where we can measure. The results is called **the re-analysis**.

2) station observations Precipitation



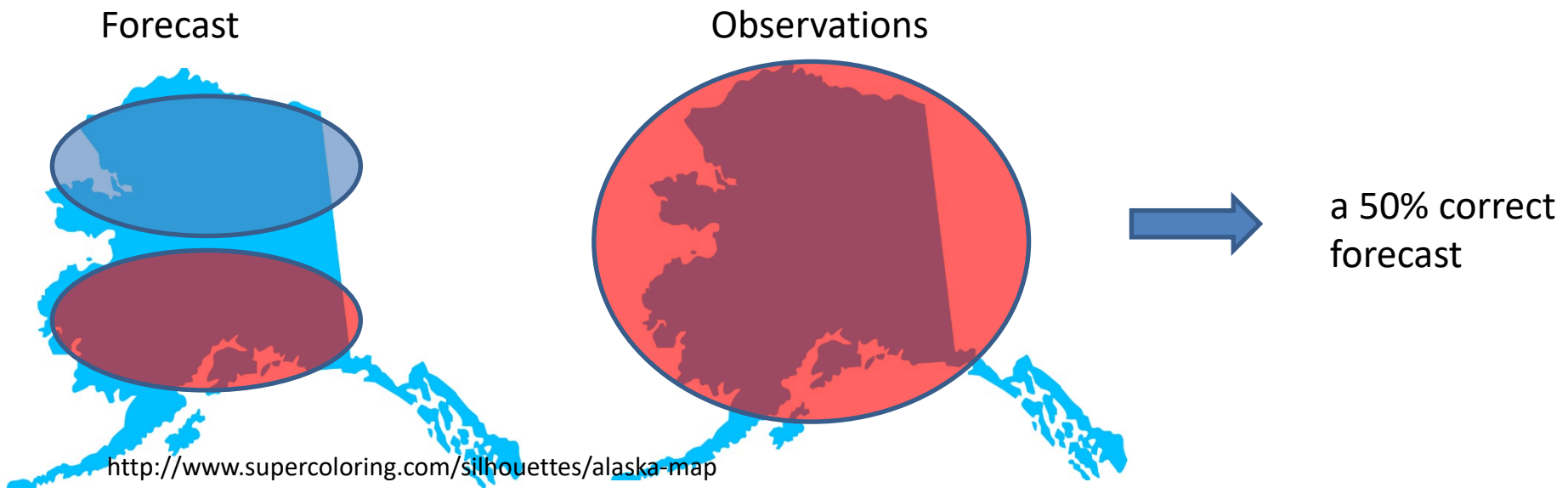
Data
Assimilation
+ numerical
modeling

Precipitation Re-Analysis

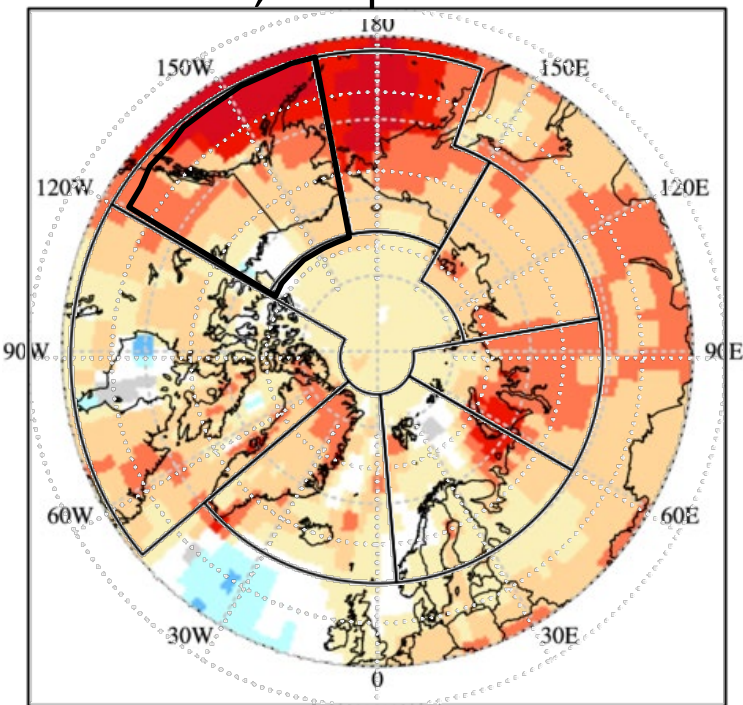


How do we verify seasonal forecasts?

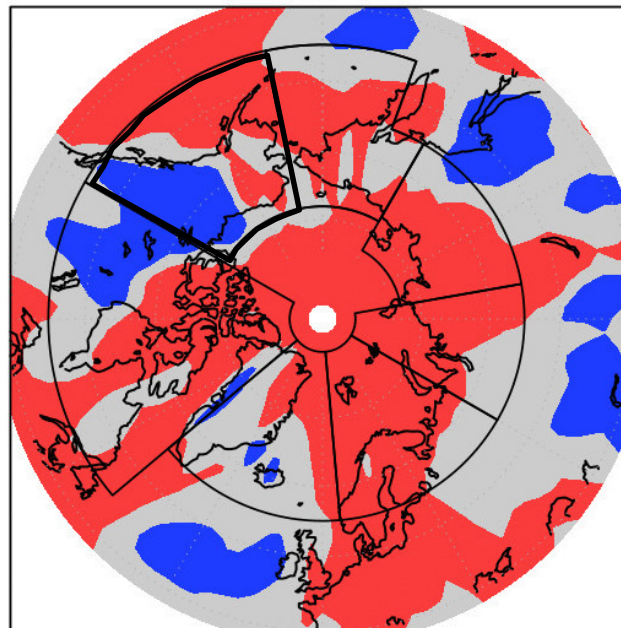
- ❑ We need some metric, some number to quantify the verification result
- ❑ We call this metric a score
- ❑ For the verification over the Arctic we will use a subjective score: a percentage of the correct forecast over a selected region in the Arctic.



Forecast, temp JJA 2020



CFSR Reanalysis, Temperature JJA2020



Verification Temperature

Above
normal

Near
normal

Below
normal

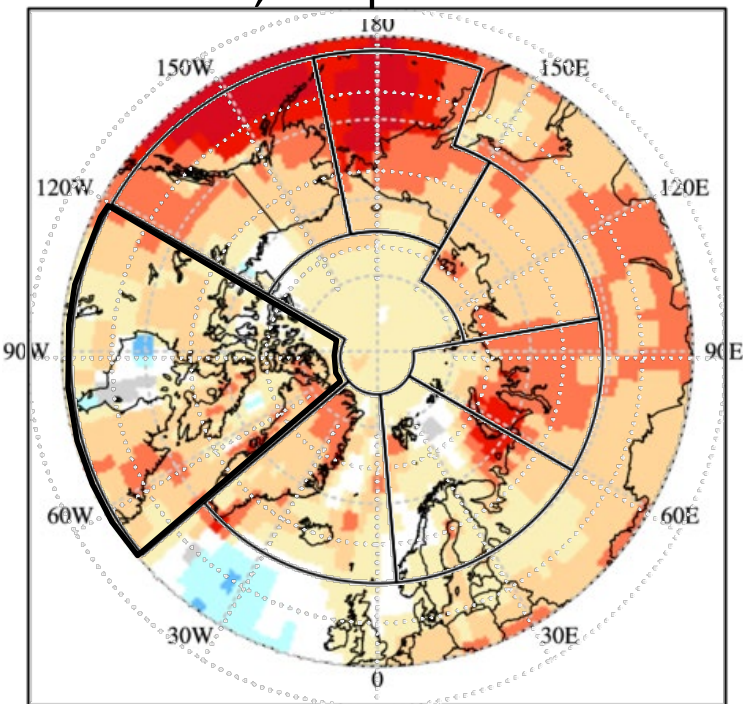


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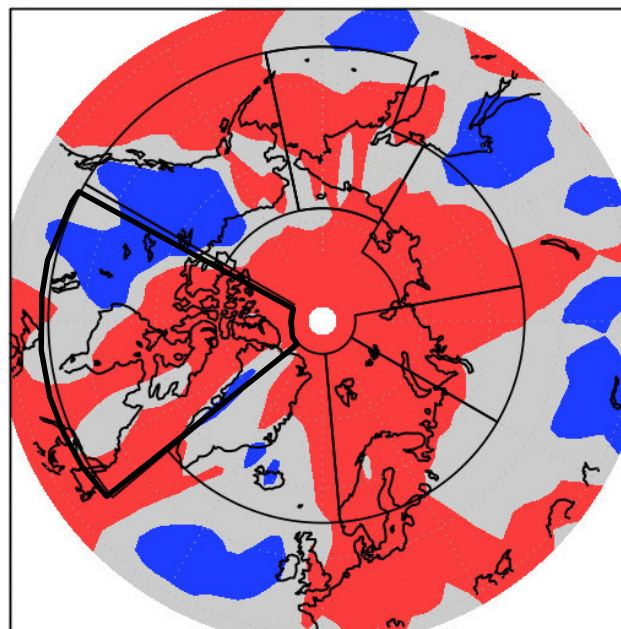
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Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above normal	Below Normal -> W. Canada, above normal -> central Alaska	Miss 70%, hit 30%
C. - E. Canada			
W. Nordic			
E. Nordic			
W. Siberia			
E. Siberia			
Chukchi-Bering			

Forecast, temp JJA 2020



CFSR Reanalysis, Temperature JJA2020



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Verification Temperature

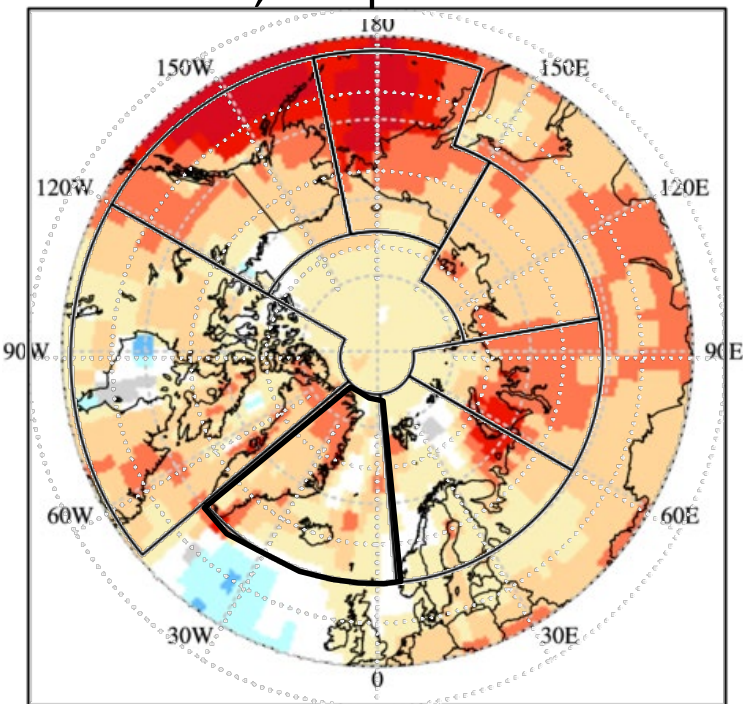
Above
normal

Near
normal

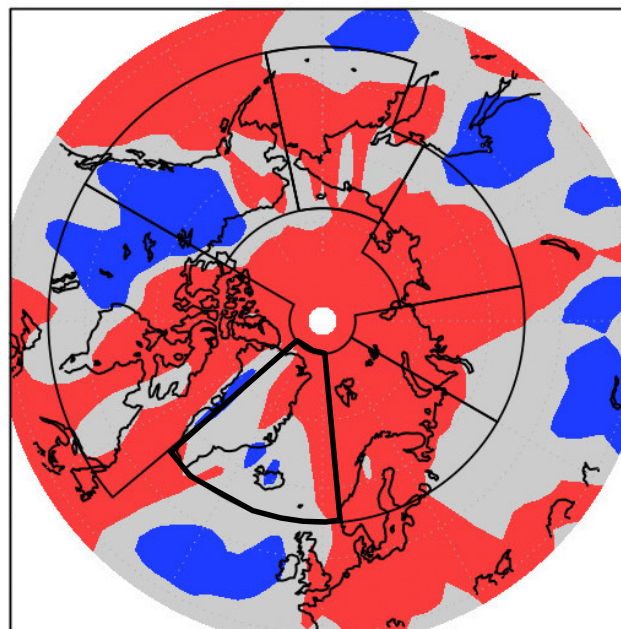
Below
normal

Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above normal	Below Normal -> W. Canada, above normal -> central Alaska	Miss 70%, hit 30%
C. - E. Canada	Above normal	Below/near -> west, above/near -> east	60% miss, 40% hit
W. Nordic			
E. Nordic			
W. Siberia			
E. Siberia			
Chukchi-Bering			

Forecast, temp JJA 2020



CFSR Reanalysis, Temperature JJA2020



Verification Temperature

Above
normal

Near
normal

Below
normal

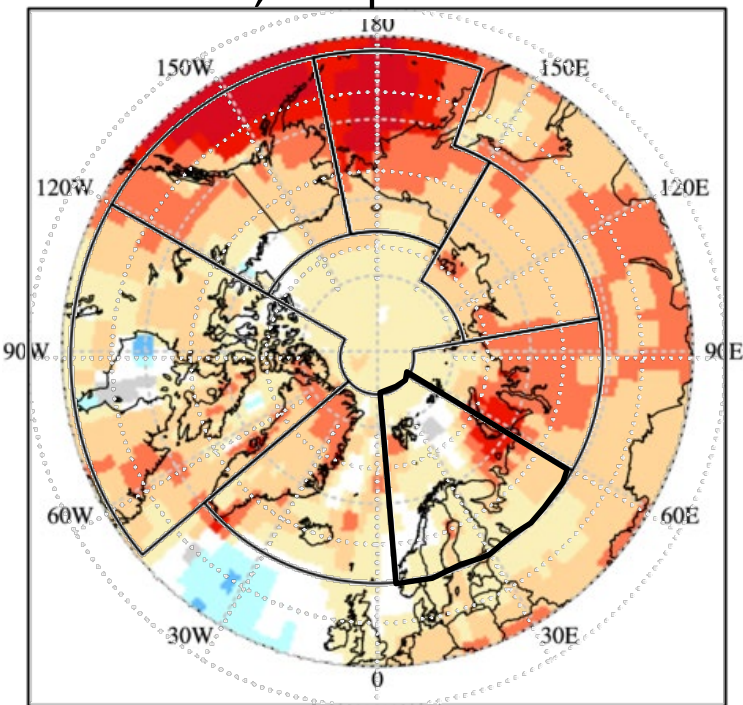


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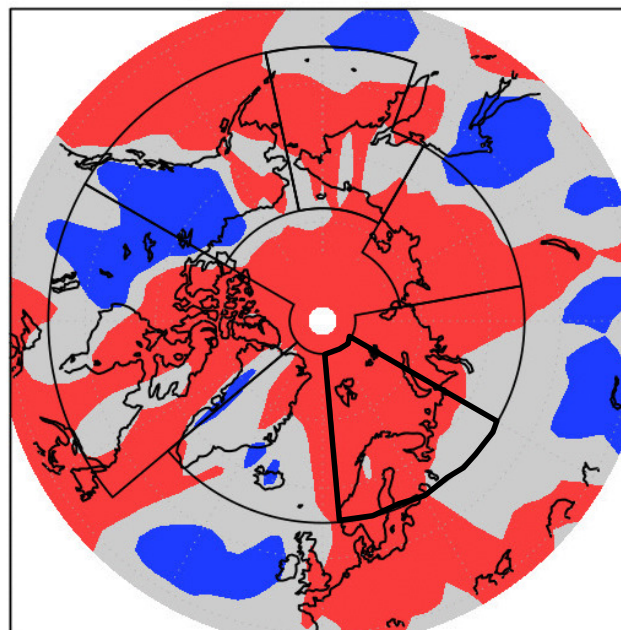
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W. Nordic	Above normal	Near normal mostly	miss
E. Nordic			
W. Siberia			
E. Siberia			
Chukchi-Bering			

Forecast, temp JJA 2020



CFSR Reanalysis, Temperature JJA2020



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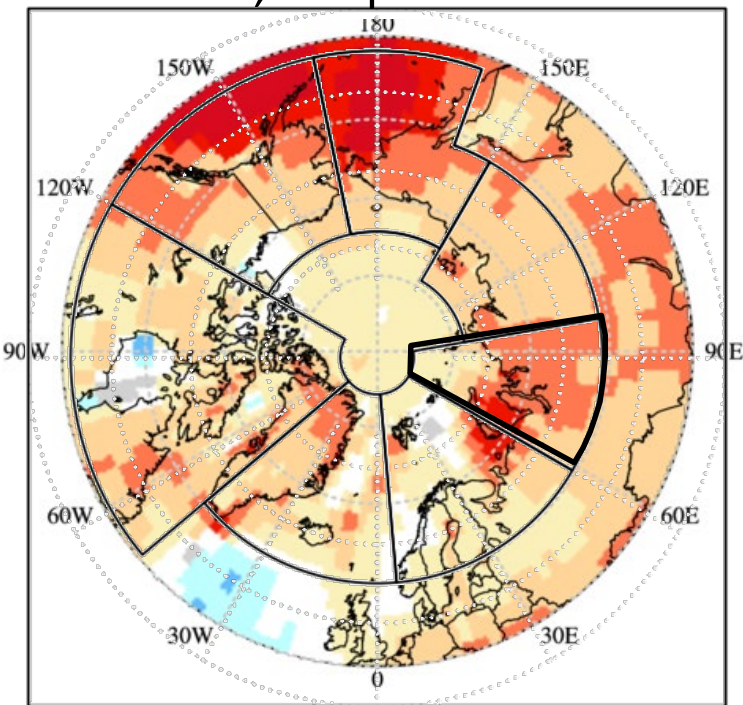


Verification Temperature

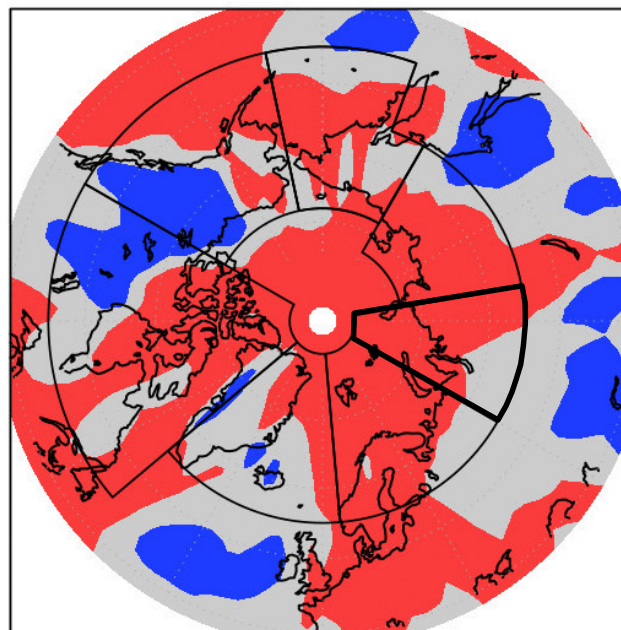
Above normal
Near normal
Below normal

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C. - E. Canada	Above normal	Below/near -> west, above/near -> east	60% miss, 40% hit
W. Nordic	Above normal	Near normal mostly	miss
E. Nordic	Above normal	Above normal	90% hit
W. Siberia			
E. Siberia			
Chukchi-Bering			

Forecast, temp JJA 2020



CFSR Reanalysis, Temperature JJA2020



Verification Temperature

Above
normal

Near
normal

Below
normal

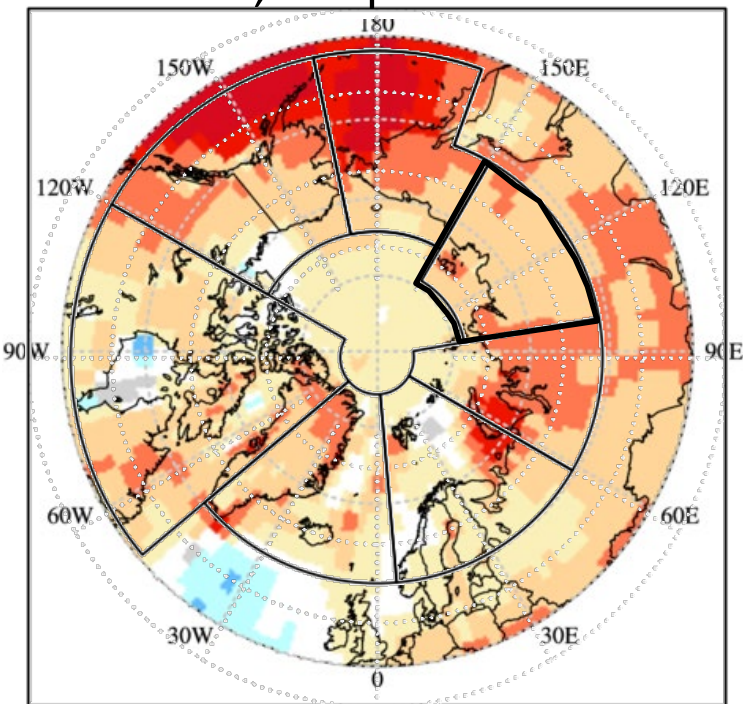


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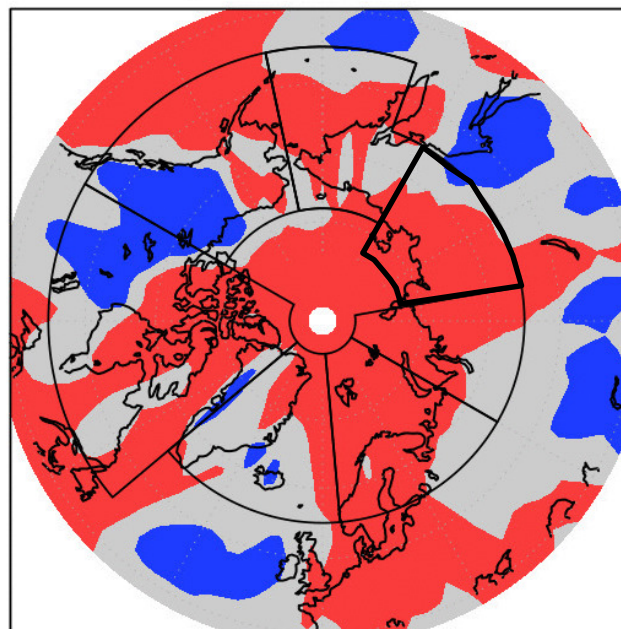
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W. Nordic	Above normal	Near normal mostly	miss
E. Nordic	Above normal	Above normal	90% hit
W. Siberia	Above normal	Near normal in the SE, above normal	70% hit
E. Siberia			
Chukchi-Bering			

Forecast, temp JJA 2020



CFSR Reanalysis, Temperature JJA2020



Verification Temperature

Above
normal

Near
normal

Below
normal

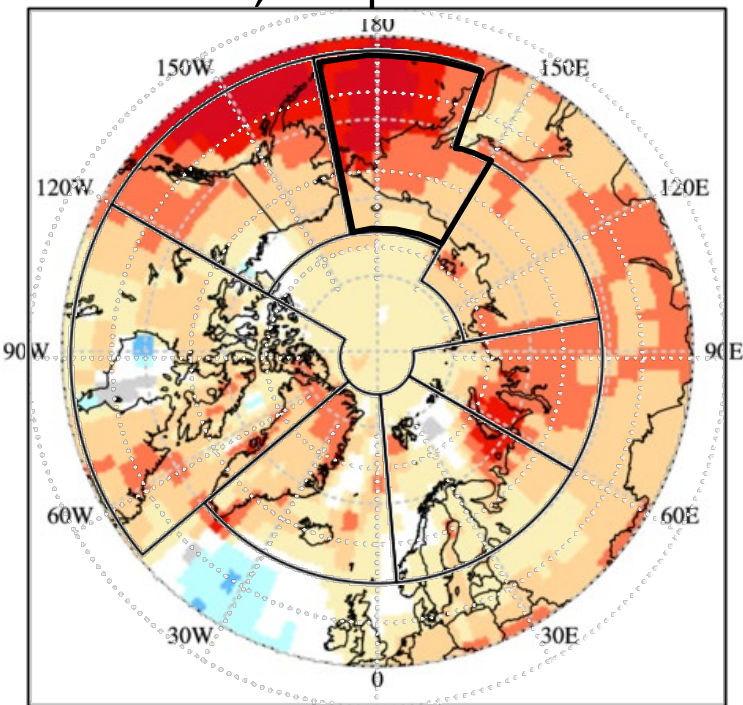


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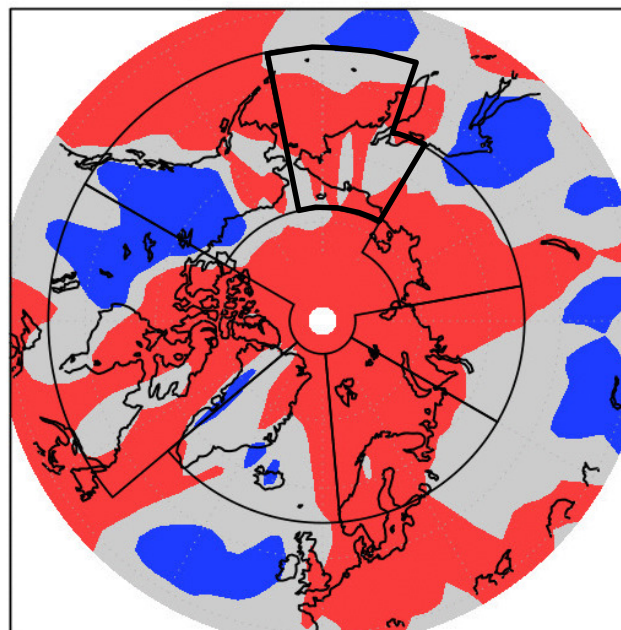
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W. Nordic	Above normal	Near normal mostly	miss
E. Nordic	Above normal	Above normal	90% hit
W. Siberia	Above normal	Near normal in the SE, above normal	70% hit
E. Siberia	Above Normal	Mostly above normal	90% hit
Chukchi-Bering			

Forecast, temp JJA 2020



CFSR Reanalysis, Temperature JJA2020



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Verification Temperature

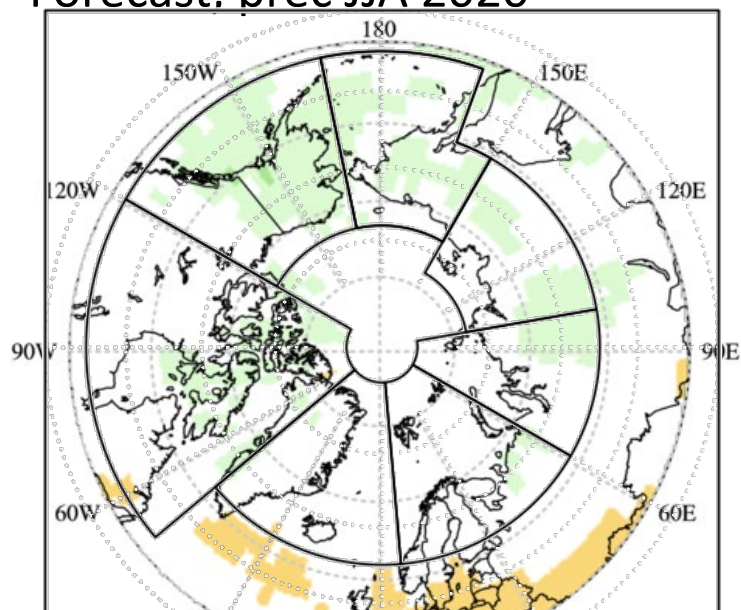
Above
normal

Near
normal

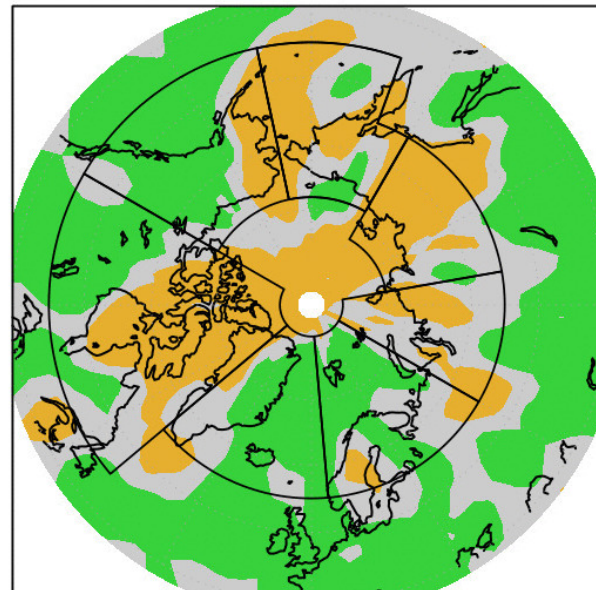
Below
normal

Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above normal	Below Normal -> W. Canada, above normal -> central Alaska	Miss 70%, hit 30%
C. - E. Canada	Above normal	Below/near -> west, above/near -> east	60% miss, 40% hit
W. Nordic	Above normal	Near normal mostly	miss
E. Nordic	Above normal	Above normal	90% hit
W. Siberia	Above normal	Near normal in the SE, above normal	70% hit
E. Siberia	Above Normal	Mostly above normal	90% hit
ChukchiBering	Above normal	Near normal in the west and central	50% hit

Forecast. prec JJA 2020



CFSR Reanalysis, Precipitation JJA2020



Verification Precipitation

Above
normal

Near
normal

Below
normal

Verif:	Forecast FMA	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above over Alaska	Above over central and w Alaska	70% miss
C. - E. Canada	Mostly equal chances	Above over the continental parts, below over the Archipelago	%
W. Nordic	Mostly equal chances	Mostly above	%
E. Nordic	Mostly equal chances	Mostly above, central and south Scandinavia below and near normal	%
W. Siberia	Mostly equal chances, above in the east	Below normal in the east near normal in the west and south	miss
E. Siberia	Above normal over the eastern and w. parts	Below in the west, near normal in the east	miss
ChukchiBering	Mostly above normal	Below in the south, near normal in the north and center	miss

Overall result, subjective verification

- ❑ **Temperature:** Considering all Arctic regions the subjective score is ~60 %. This is a good score considering that everything below or equal 33% is considered worse than a pure chance.
- ❑ **Precipitation:** In the regions where the models were decisive, the forecast did not perform well. Given the historical skill scores we know that precipitation forecasts are usually not this skilful over the Arctic.

Actual (real time)seasonal forecasts over the Arctic NDJ-2020/2021

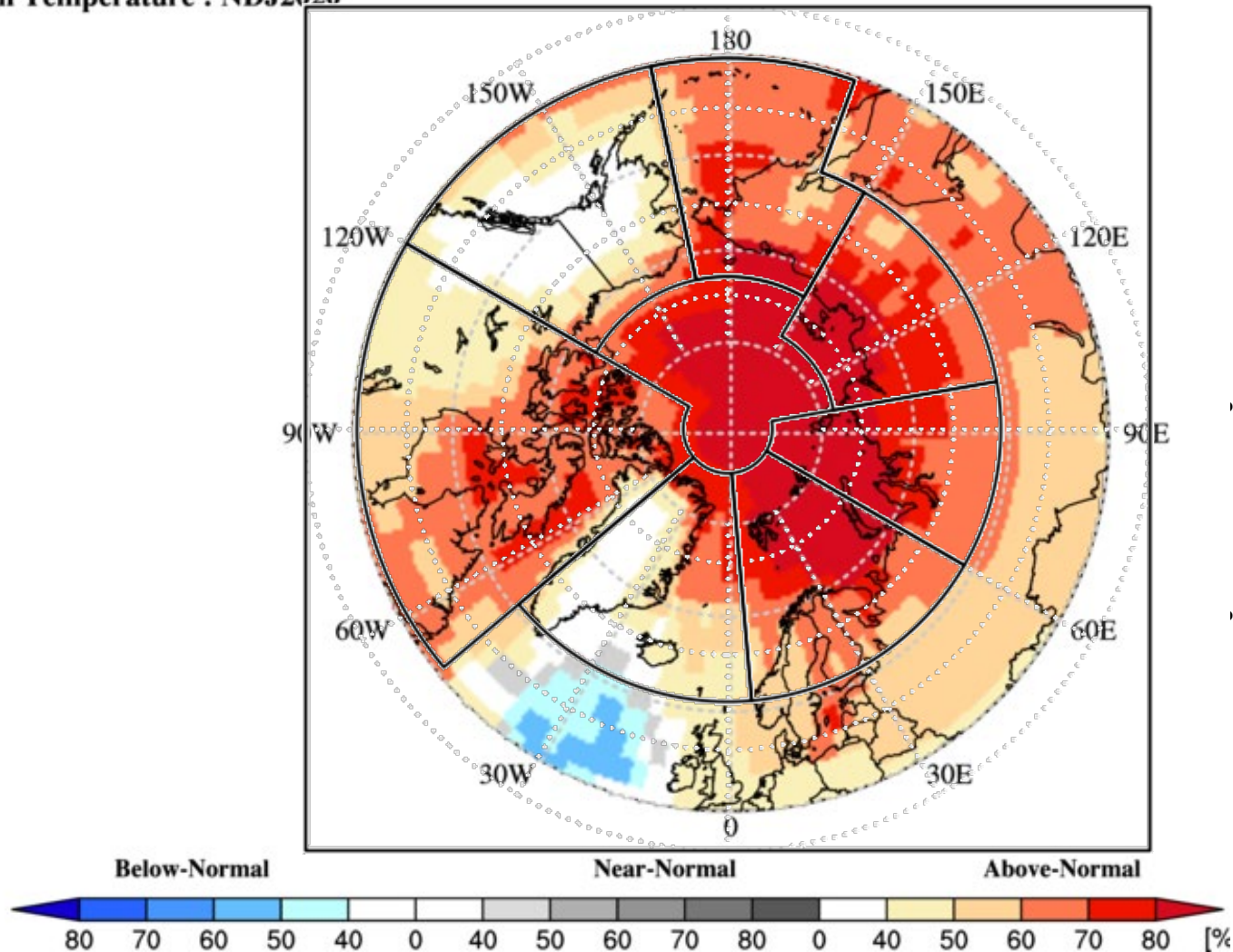
- temperature
- precipitation

Temperature outlook over the Arctic: November-December-January 2020/21

Probabilistic Multi-Model Ensemble Forecast

Beijing,ECMWF,Exeter,Melbourne,Montreal,Moscow,Offenbach,Seoul,Tokyo,Toulouse,Washington

2m Temperature : NDJ2020

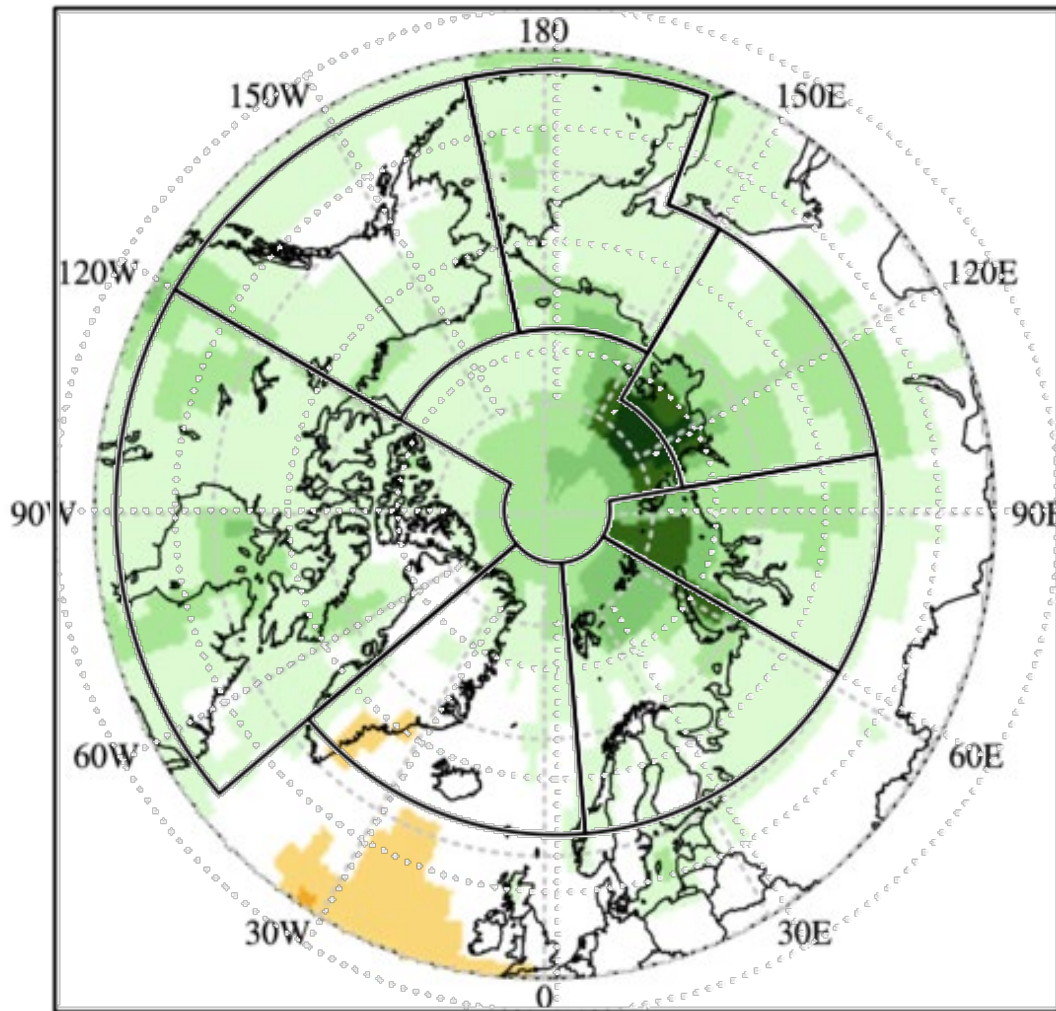


1. Alaska W. Canada
2. Eastern Canadian Arctic
3. Western Nordic
4. Eastern Nordic
5. West Siberia
6. East Siberia
7. Chukchi and Bering

The redder the color does not mean it is warmer.

It means we have more confidence in the above normal forecast over that region.

Precipitation outlook over the Arctic: November-December-January 2020/21



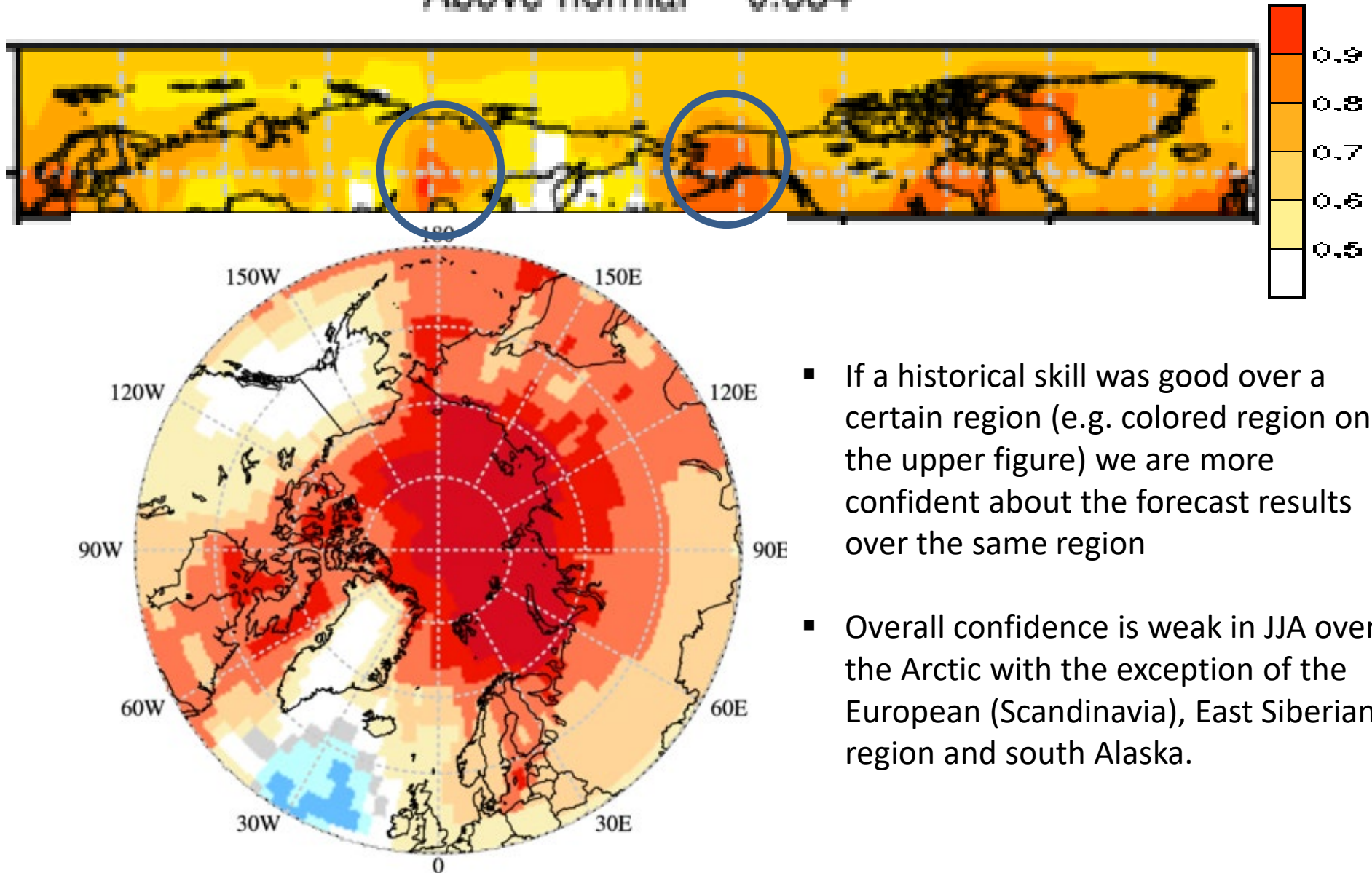
1. Alaska W. Canada
2. Eastern Canadian Arctic
3. Western Nordic
4. Eastern Nordic
5. West Siberia
6. East Siberia
7. Chukchi and Bering

The 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.

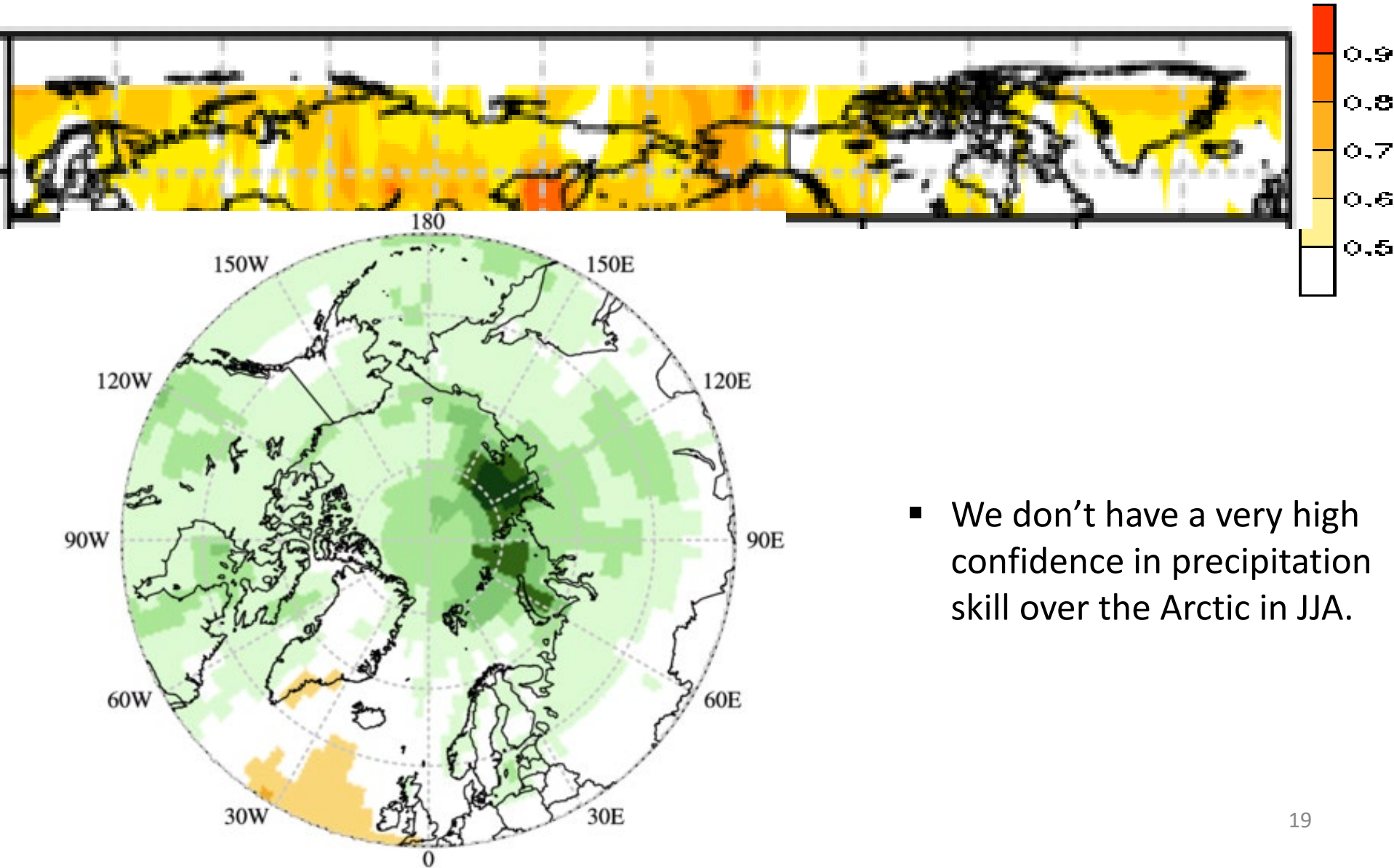
Discussing historical skill over the Arctic, Temperature (confidence with respect to the historical skill)

Above-normal 0.684



Discussing historical skill over the Arctic, Precipitation (confidence with respect to the historical skill)

Above-normal 0.557



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

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.
- ❑ JJA2020 MME temperature forecast over the Arctic region was ~60% correct, which is generally good result and much higher than a pure chance (i.e. 33%).
- ❑ We expect above normal temperatures over majority of the Arctic regions in NDJ2020/21.
- ❑ We expect above normal precipitation over most of the Arctic regions except southern Alaska, western Atlantic and south-east Nordic regions where we expect equal chances. Historically, we do not have a high confidence in precipitation forecast over the Arctic in JJA.

Thank you!

