Environment and Climate Change Canada
Environnement et Changement climatique Canada
Canada

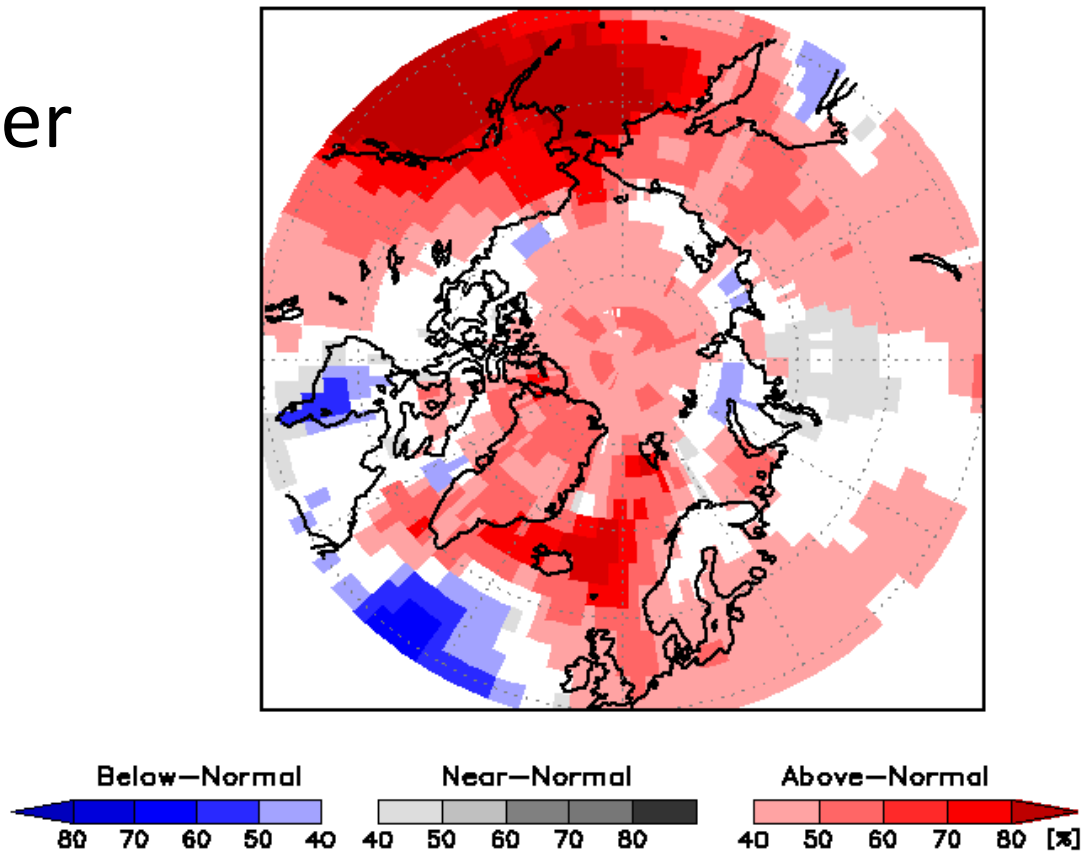
ACF - 4: Verification of the JJA19 season
ACF - 4: Seasonal forecast for the NDJ19/20 season

Marko Markovic
Meteorological Service of Canada

WMO

Seasonal forecast over the Arctic, June-July-Aug. 2019

A reminder

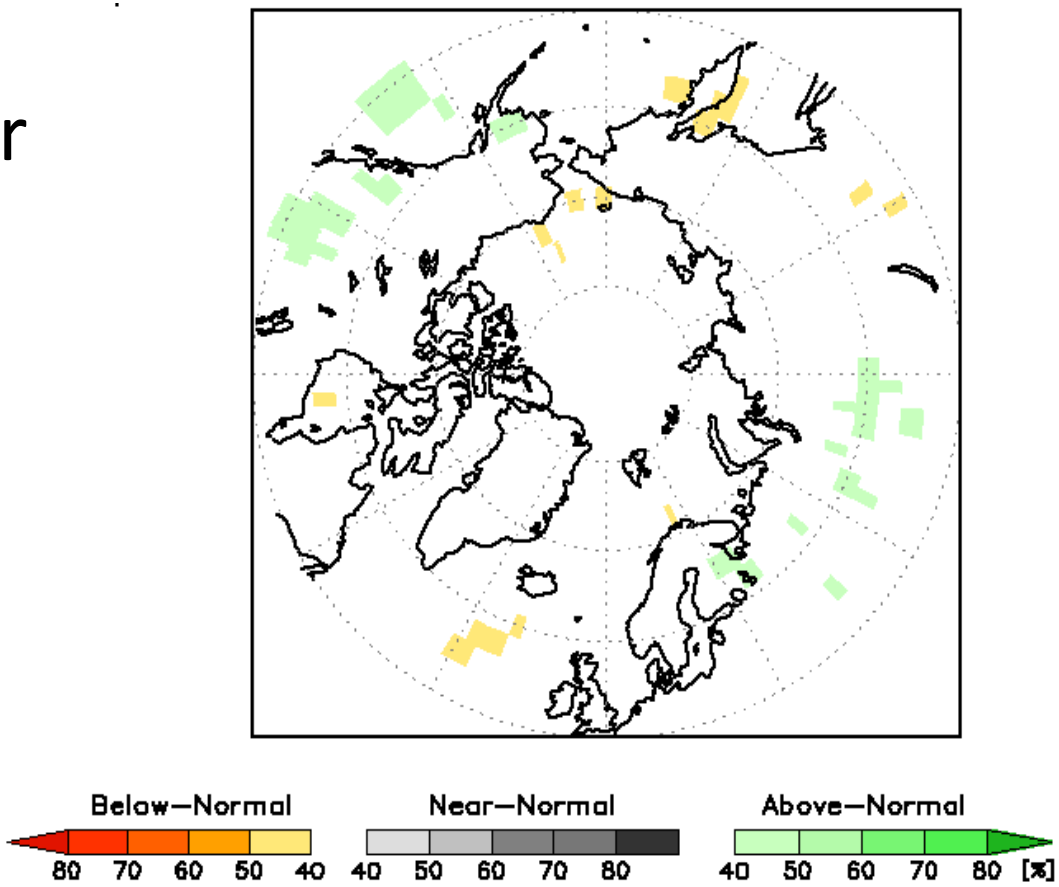


Considering multi-model ensemble forecast and a limited model skill over the Arctic:

Temperature: There is probability of at least 40% or more that the temperature will be above normal over the Alaskan, Eastern Siberian, Chukchi and Atlantic region. Canadian and Eastern Siberian region had equal chances for three probability outcomes.

Seasonal forecast over the Arctic, June-July-Aug. 2019

A reminder



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

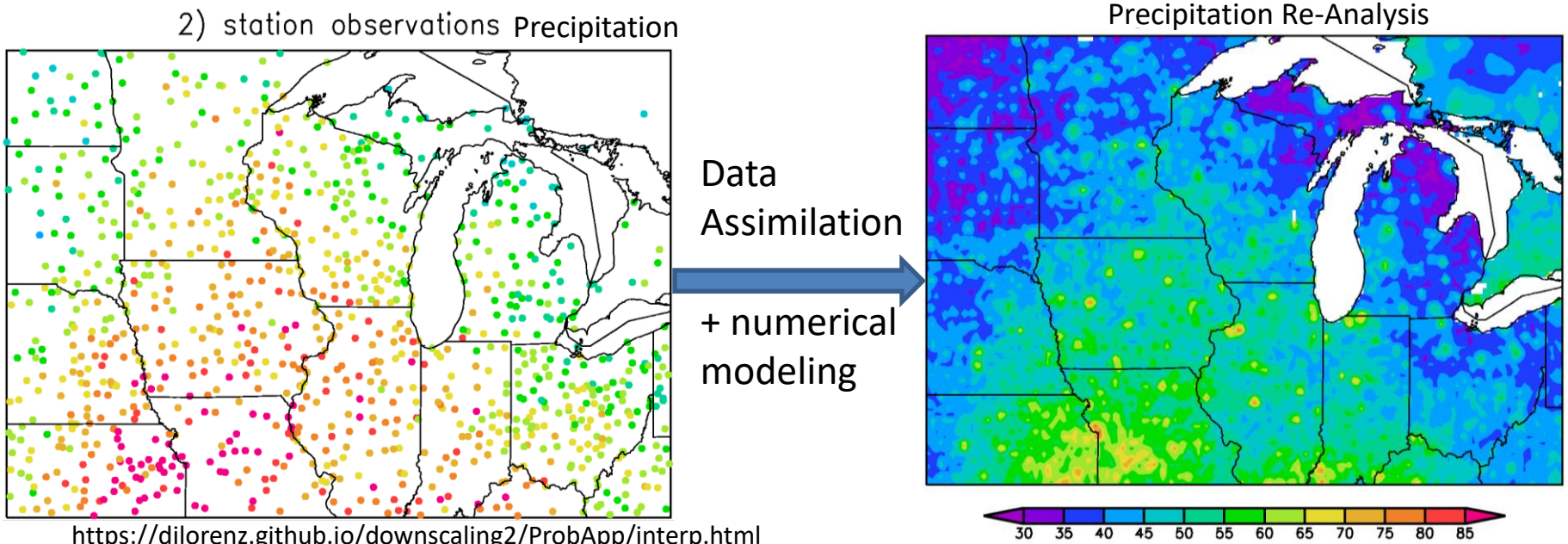
Precipitation: Mostly equal chances were expected over the entire Arctic. Some scattered regions of above normal over Alaska and European Arctic.

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**.

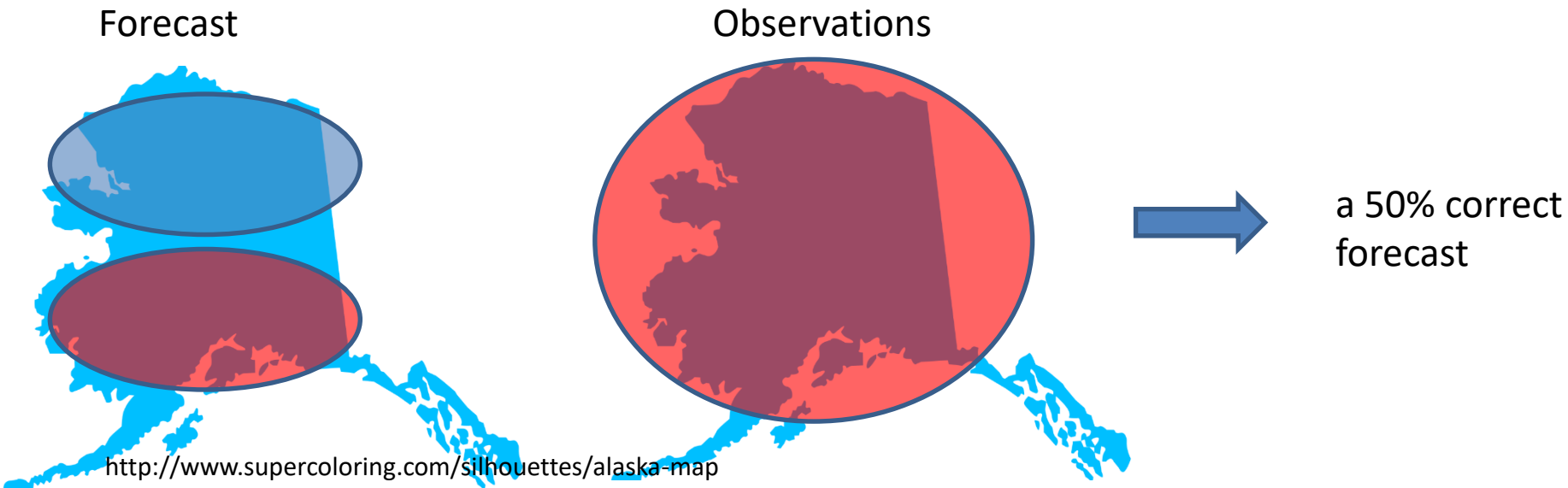


https://dilorenz.github.io/downscaling2/ProbApp/interp.html

How do we verify seasonal forecasts?

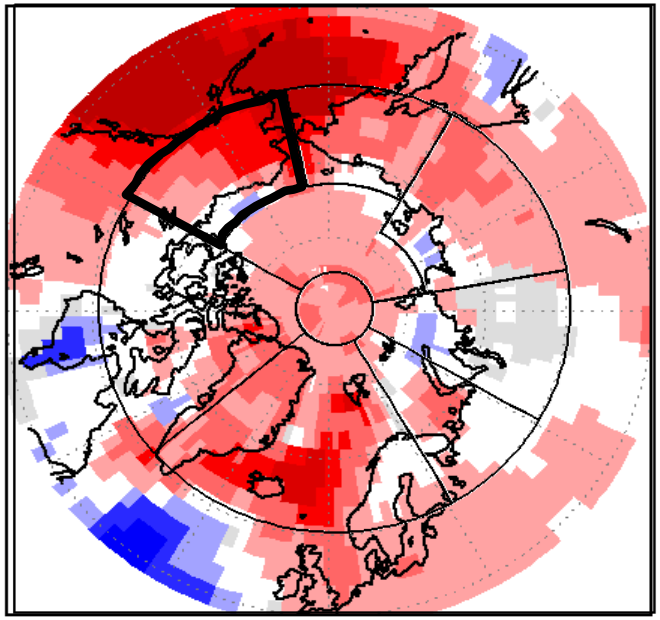
- We need some metric, some number to quantify the verification result
- We call this metric a score

- 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.

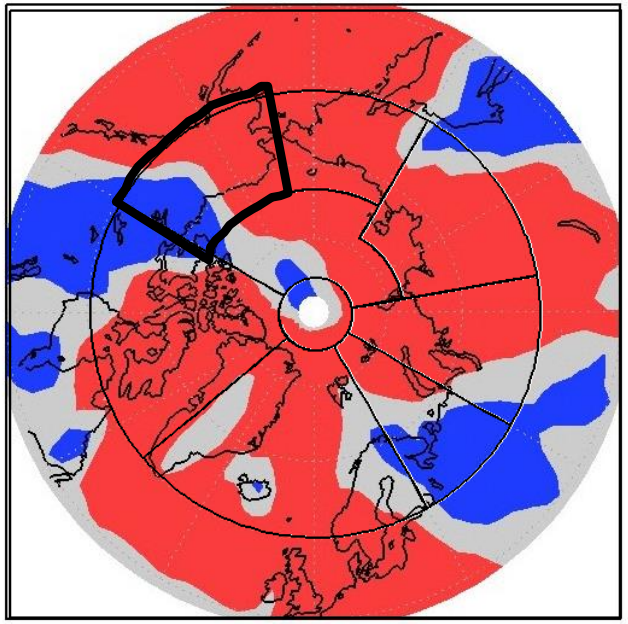


Verification Temperature

Forecast, temp JJA 2019



CFSR Reanalysis JJA 2019

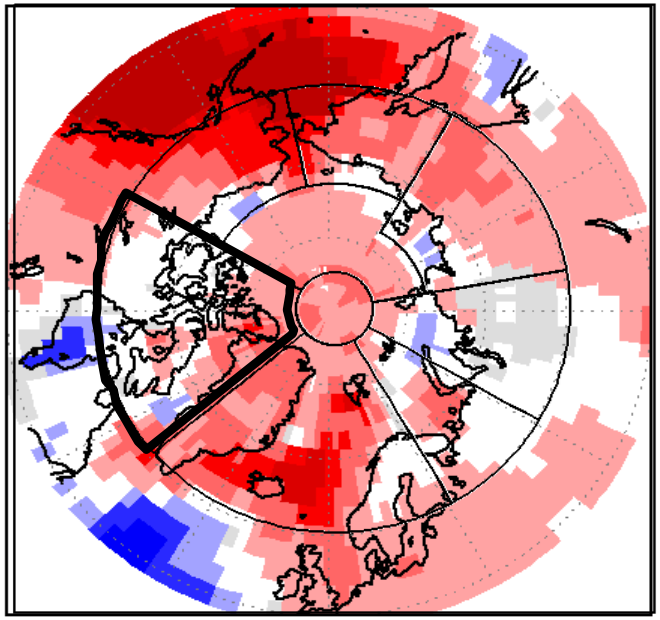


Environment and Environnement et

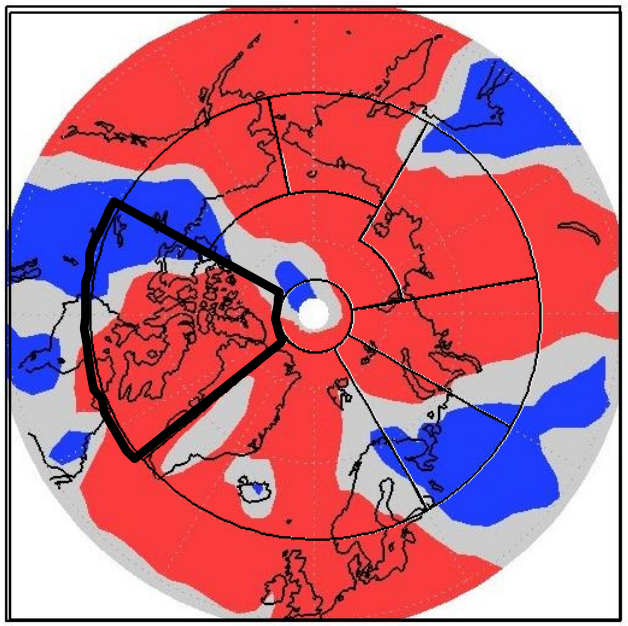
Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska	**Above normal**	**Above normal in west, below in east**	**50% hit, 50% miss**
Canadian			
Atlantic			
European			
W. Siberian			
E. Siberian			
Chukchi			

Verification Temperature

Forecast, temp JJA 2019



CFSR Reanalysis JJA 2019

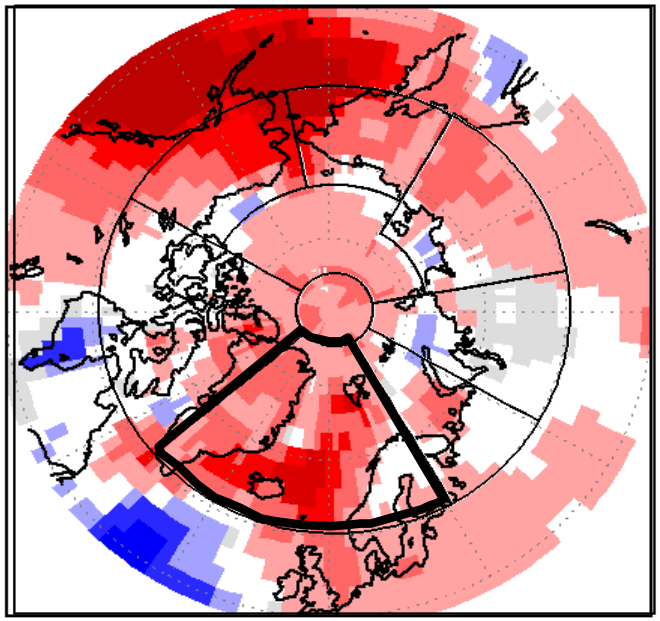


Environment and Environnement et

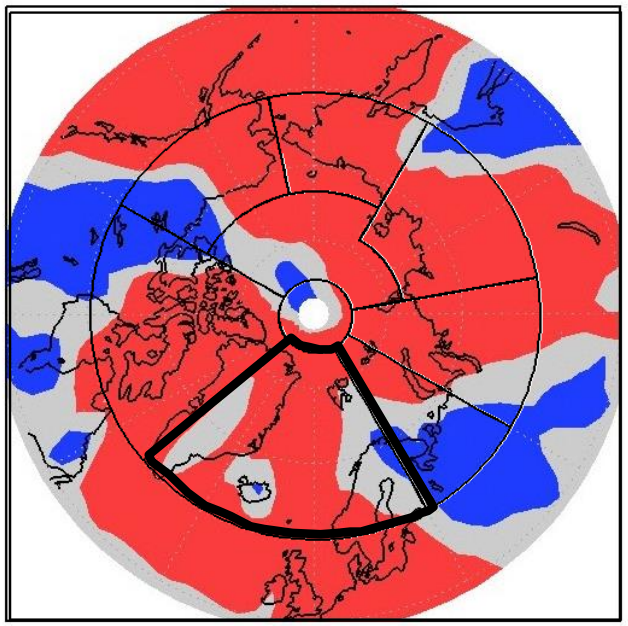
Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska	Above normal	Above normal in west, below in east	50% hit, 50% miss
Canadian	**Above in the west but mostly indecisive**	**Below in the west, above in the east**	**Miss in the west, hit over Archipelago**
Atlantic			
European			
W. Siberian			
E. Siberian			
Chukchi			

Verification Temperature

Forecast, temp JJA 2019



CFSR Reanalysis JJA 2019

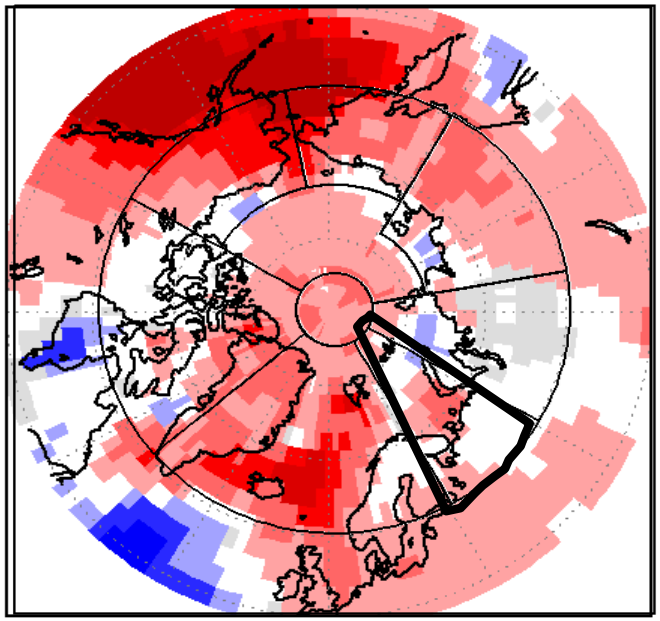


Environment and Environnement et

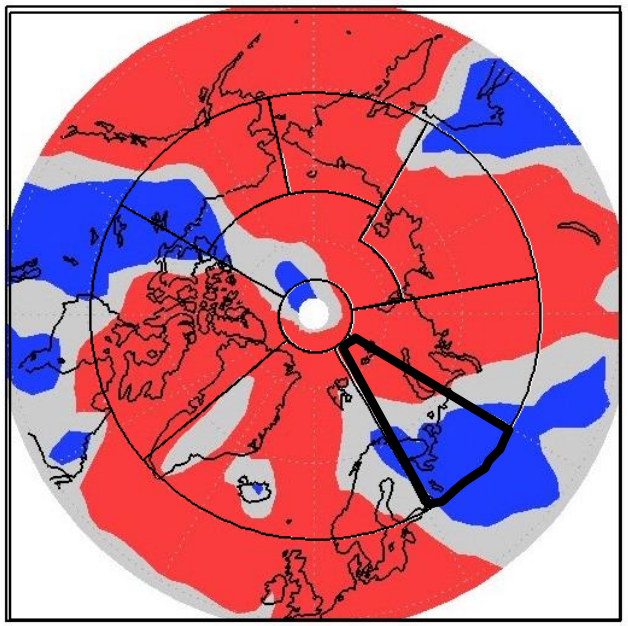
Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska	Above normal	Above normal in west, below in east	50% hit, 50% miss
Canadian	Above in the west but mostly indecisive	Below in the west, above in the east	Miss in the west, hit over Archipelago
Atlantic	**Mostly above**	**Mostly above**	**2/3 hit, 1/3 miss**
European			
W. Siberian			
E. Siberian			

Verification Temperature

Forecast, temp JJA 2019



CFSR Reanalysis JJA 2019

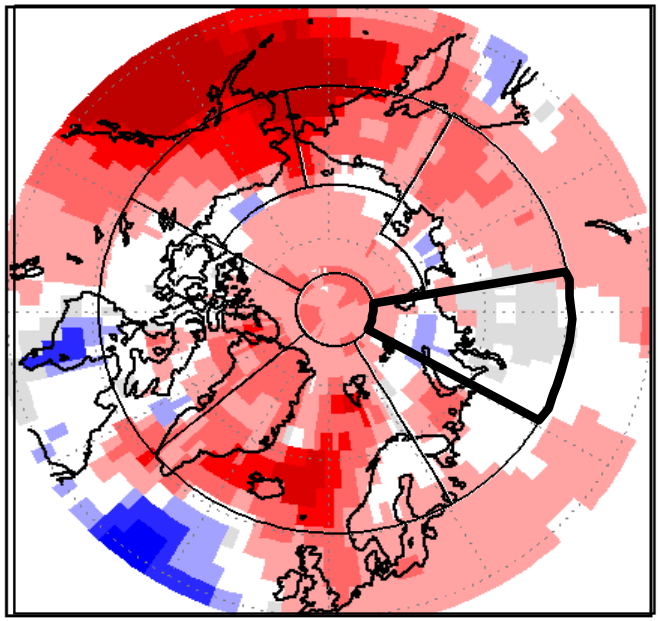


Environment and Environnement et

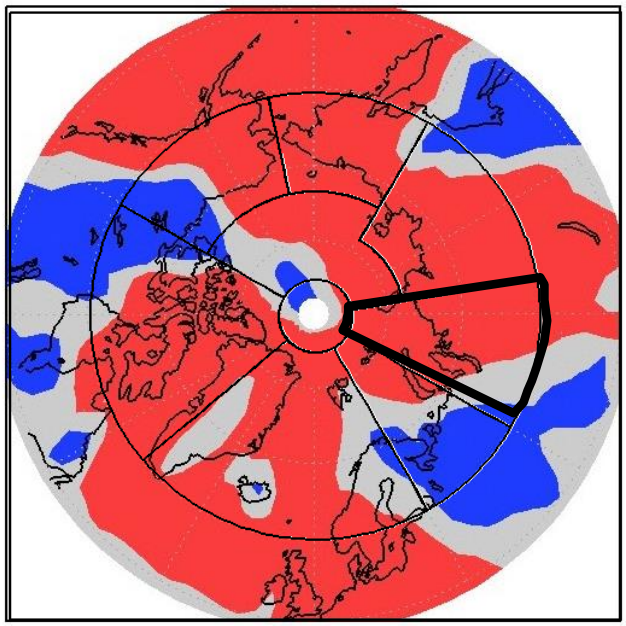
Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska	Above normal	Above normal in west, below in east	50% hit, 50% miss
Canadian	Above in the west but mostly indecisive	Below in the west, above in the east	Miss in the west, hit over Archipelago
Atlantic	Mostly above	Mostly above	2/3 hit, 1/3 miss
European	**Indecisive over land above over see**	**Below normal over land**	**Miss when decisive**
W. Siberian			
E. Siberian			

Verification Temperature

Forecast, temp JJA 2019



CFSR Reanalysis JJA 2019

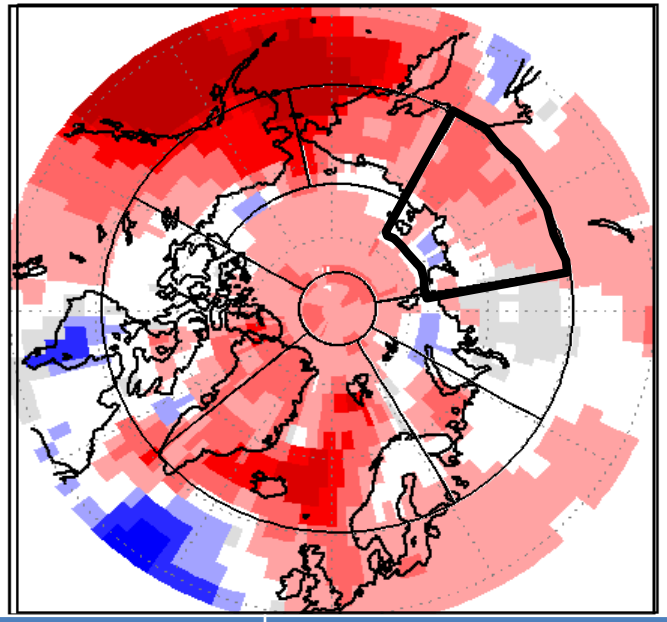


Environment and Environnement et

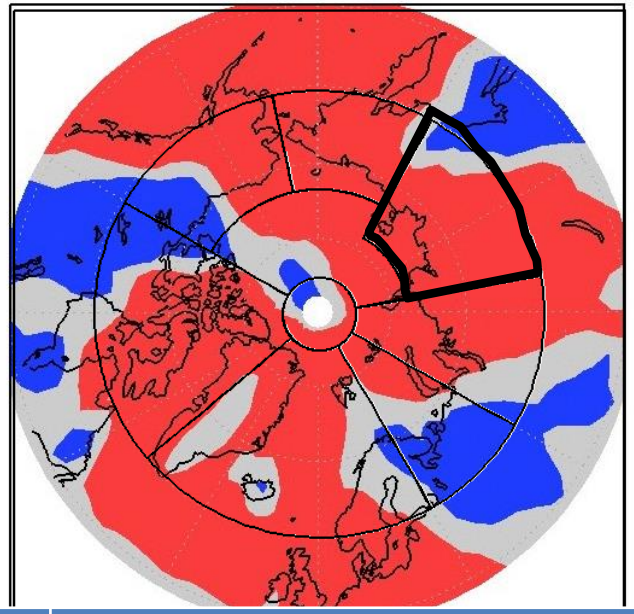
Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska	Above normal	Above normal in west, below in east	50% hit, 50% miss
Canadian	Above in the west but mostly indecisive	Below in the west, above in the east	Miss in the west, hit over Archipelago
Atlantic	Mostly above	Mostly above	2/3 hit, 1/3 miss
European	Indecisive over land above over see	Below normal over land	Miss when decisive
W. Siberian	**Near normal, indecisive**	**Above normal in the east and near normal in the west**	**Miss when decisive**
E. Siberian			

Verification Temperature

Forecast, temp JJA 2019

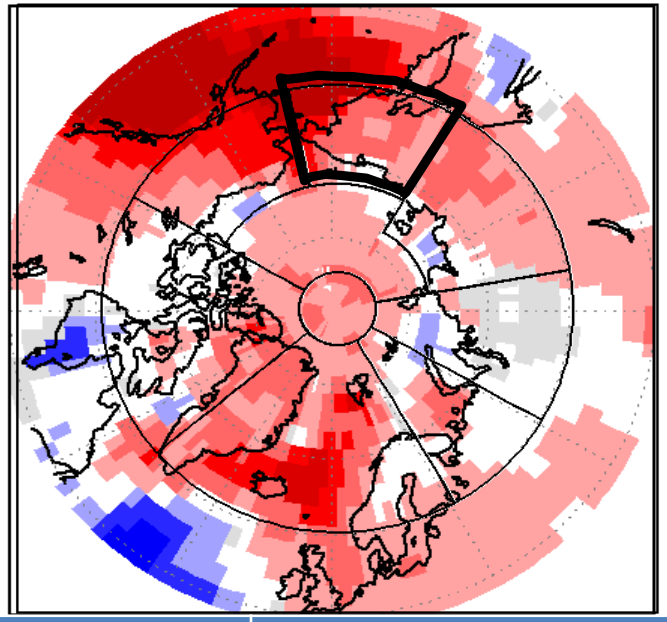


CFSR Reanalysis JJA 2019

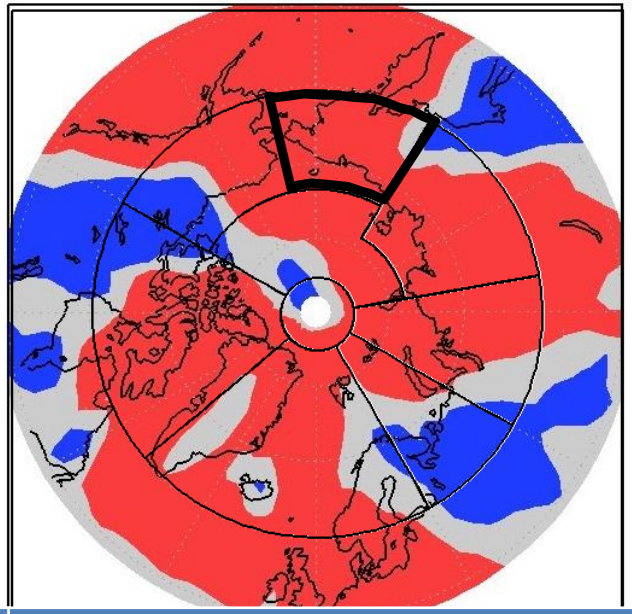


Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska	Above normal	Above normal in west, below in east	50% hit, 50% miss
Canadian	Above in the west but mostly indecisive	Below in the west, above in the east	Miss in the west, hit over Archipelago
Atlantic	Mostly above	Mostly above	2/3 hit, 1/3 miss
European	Indecisive over land above over see	Below normal over land	Miss when decisive
W. Siberian	Near normal, indecisive	Above normal in the east and near normal in the west	Miss when decisive
E. Siberian	**Above normal**	**Above normal, near normal in the south east**	**Mostly hit**
Chukchi			

Forecast, temp JJA 2019



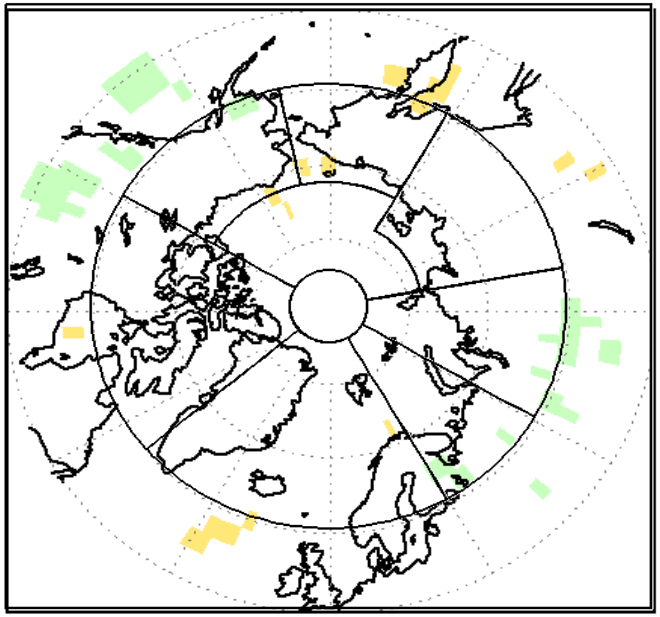
CFSR Reanalysis JJA 2019



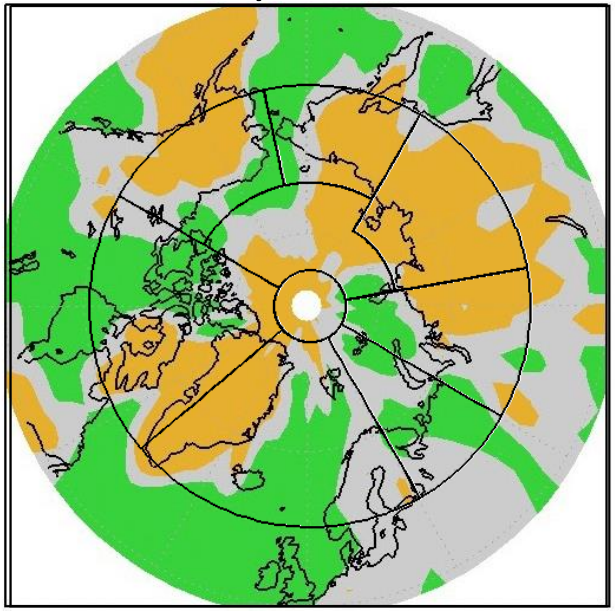
Verification Temperature

Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska	Above normal	Above normal in west, below in east	50% hit, 50% miss
Canadian	Above in the west but mostly indecisive	Below in the west, above in the east	Miss in the west, hit in the Archipel
Atlantic	Mostly above	Mostly above	2/3 hit, 1/3 miss
European	Indecisive over land above over see	Below normal over land	Miss when decisive
W. Siberian	Near normal, indecisive	Above normal in the east and near normal in the west	Miss when decisive
E. Siberian	Above normal	Above normal, near normal in the south east	Mostly hit
Chukchi	**Above normal**	**Above normal**	**hit**

Forecast, prec JJA 2019



CFSR Reanalysis JJA 2019



Verification Precipitation

Verif:	Forecast FMA	CFS Reanalysis	Subj. Result
Alaska	Indecisive	Below	%
Canadian	Indecisive	Above normal in the west, near normal in the east	%
Atlantic	Indecisive	Above over see, near normal over land	Miss where decisive
European	Indecisive, above in Finland and Russia	Above over see, near normal over land	Miss where decisive
W. Siberian	Indecisive, above in the south	Mostly below	Miss where decisive
E. Siberian	Indecisive	Mostly below	%
Chukchi	Indecisive, below in south east	Mostly below	Hit where decisive

Overall result, subjective verification

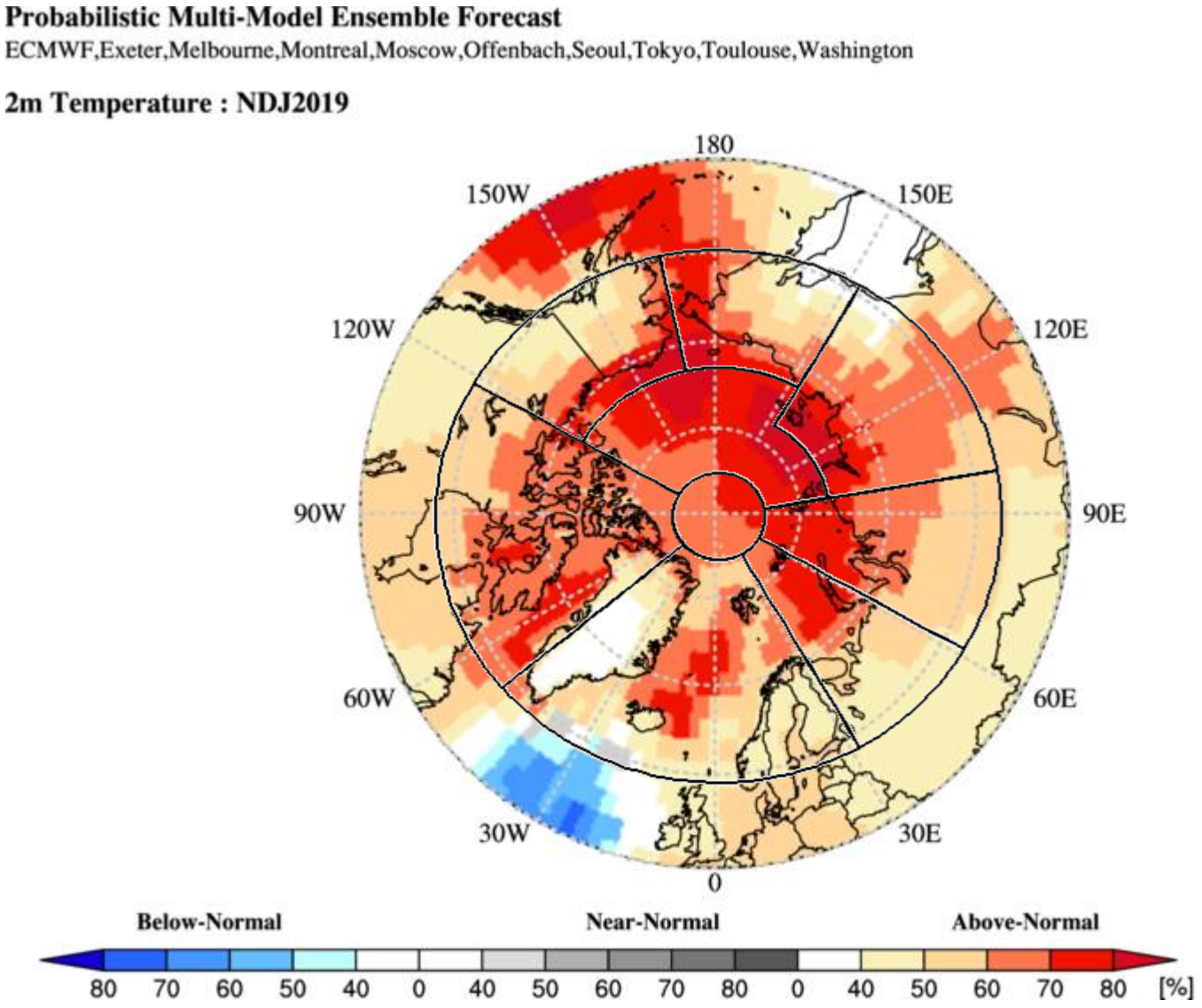
- **Temperature**: In the regions where forecast was decisive the subjective score was 50-60%. This is a good score considering that everything below or equal 33% is considered worse than a pure chance.

- **Precipitation**: mostly equal chances. In the scattered regions where the models did not predict equal chances JJA2019 precipitation were mostly missed.

Actual (real time)seasonal forecasts over the Arctic NDJ-2019/2020

- temperature
- precipitation

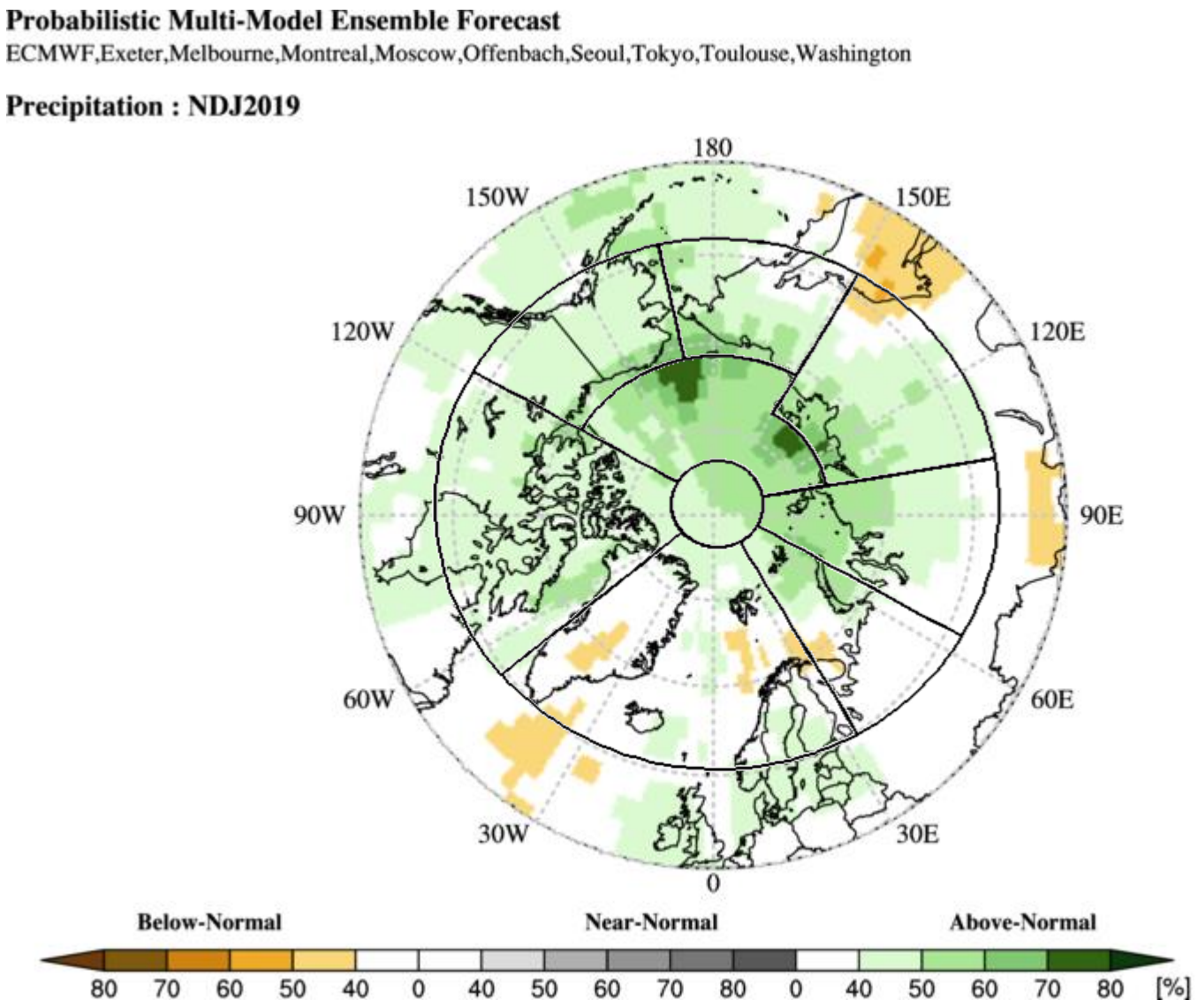
Temperature outlook over the Arctic: November-December-January 2019/2020



1. Alaska
2. Canadian Arctic
3. Atlantic Arctic
4. European Arctic
5. West. Siberian
6. Eastern Siberian
7. Chukchi

- 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 2019/2020

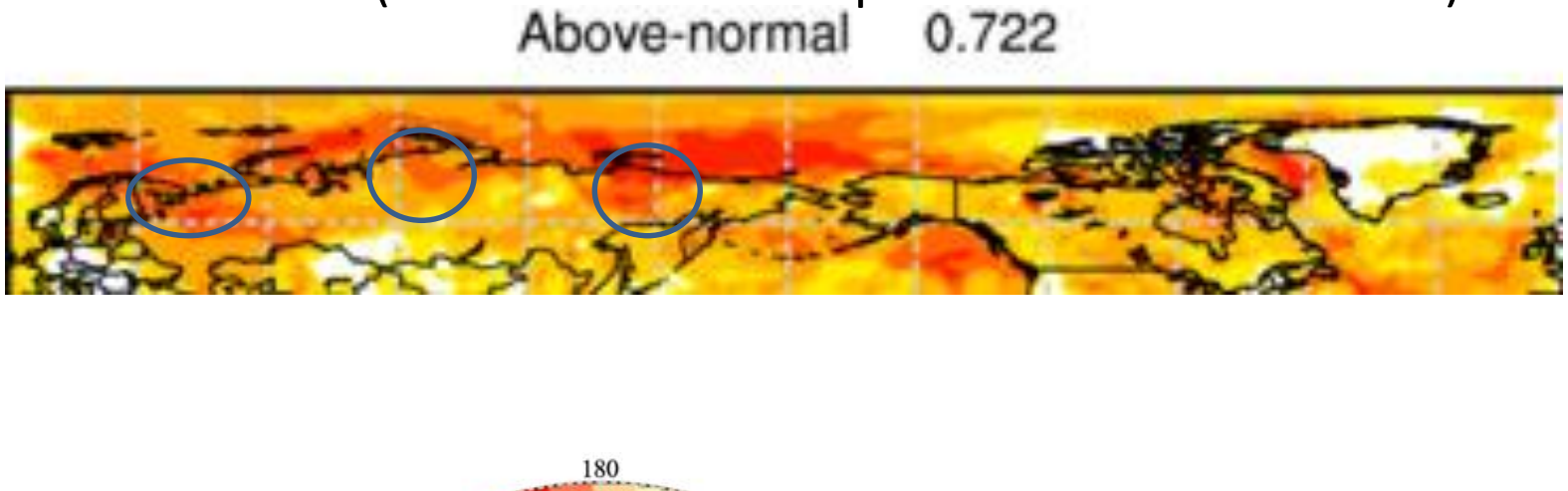


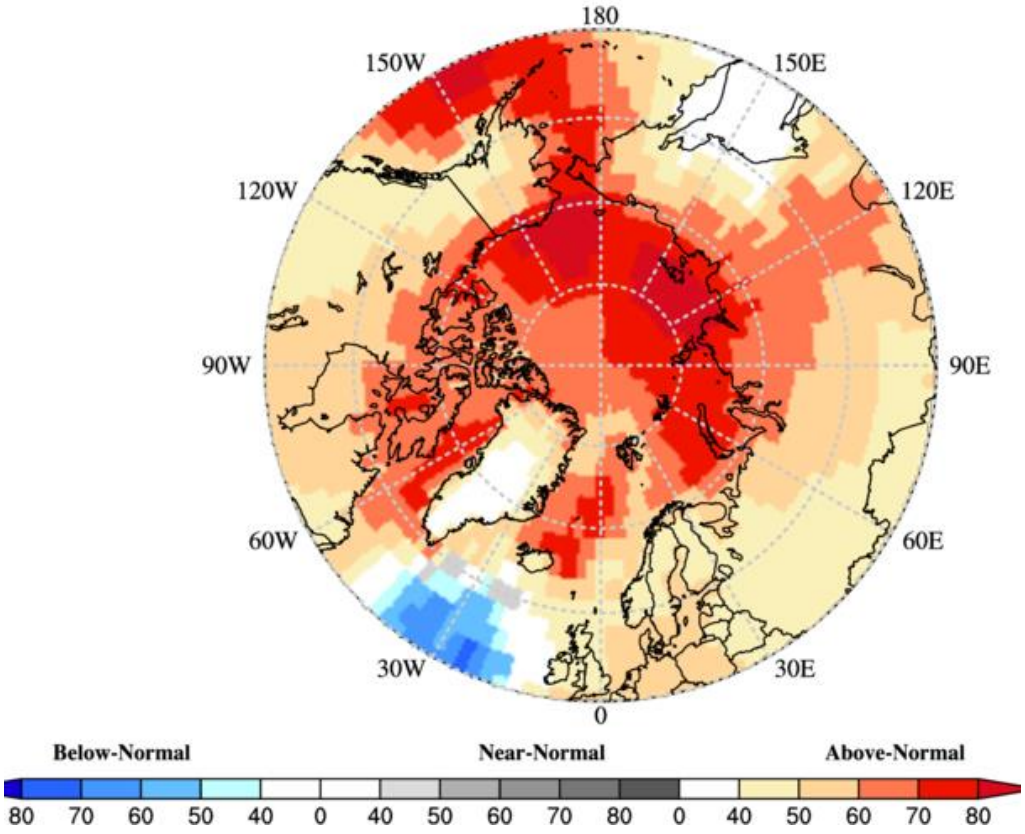
1. Alaska
2. Canadian Arctic
3. Atlantic Arctic
4. European Arctic
5. West. Siberian
6. Eastern Siberian
7. Chukchi

- 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)

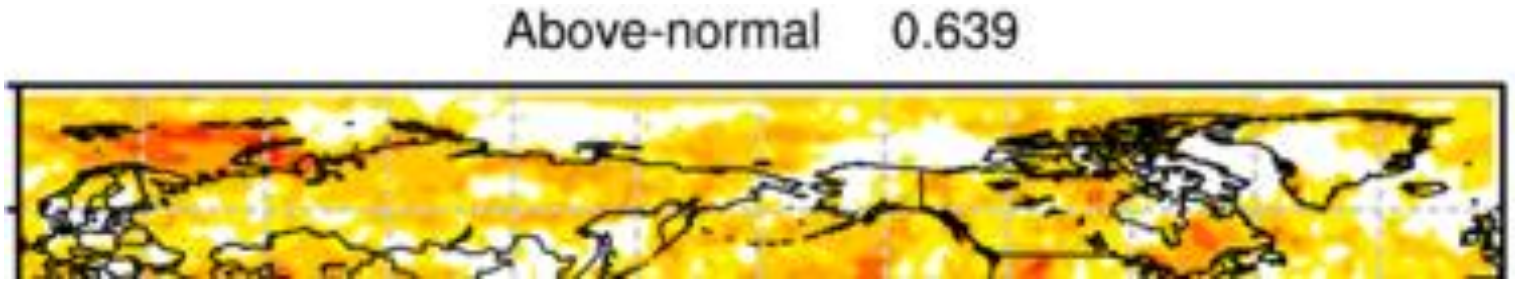


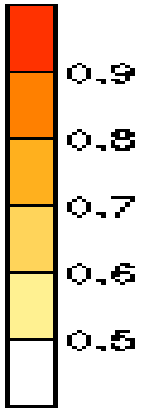


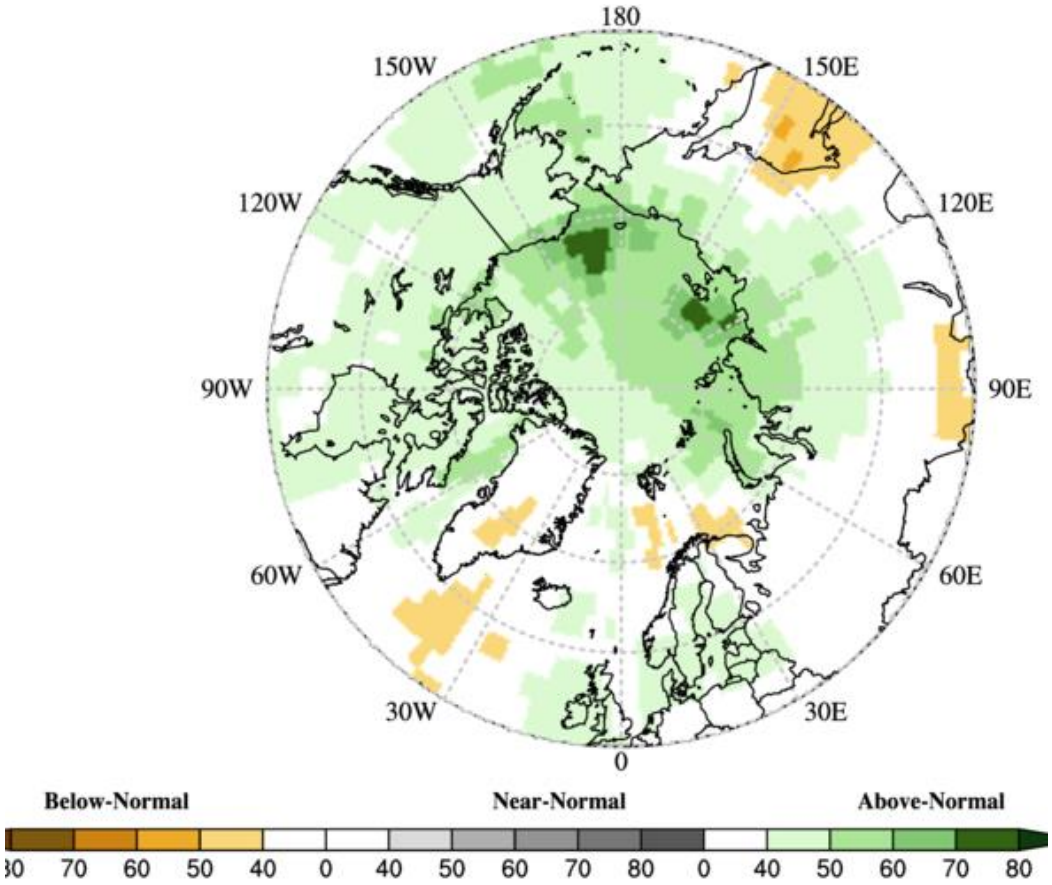
- If a historical skill was good over a certain region (e.g. colored region on the upper figure) we are more confident about the forecast results over the same region
- Overall confidence is weak in NDJ over the Arctic with the exception of the European (Scandinavia), West Siberian and Chukchi regions.

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.

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.
- JJA2019 MME temperature forecast over the Arctic region was 50-60% correct, which is generally good result and much higher than a pure chance (i.e. 33%).
- We expect above normal temperatures over the Arctic in NDJ2019/2020.
- We expect above normal precipitation over the Alaskan Arctic, Chukchi and East Siberian region and over Canada. Atlantic region mostly has equal chances for precipitation except southern Norway, Sweden and southern Finland where we expect above normal precipitation in NDJ19/20. **Historically, we do not have a high confidence in precipitation forecast over the Arctic in NDJ**.

Thank you!