5^{th} Arctic Climate Forum (ACF-5)
Arctic Regional Climate Center – network (ArcRCC-N)

27-28 May, 2020

Videoconferences

Summary version May 28th

Helge Tangen, ArcRCC-N coordinator,
Norwegian Meteorological Institute

Vasily Smolyanitsky, ArcRCC – N Northern Eurasia node coordinator (host)
Arctic and Antarctic Research Institute (AARI)

ACF
Arctic Climate Forum

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

5th Arctic Climate Forum (ACF-5) videoconference - format

- **Schedule**:
  - **May 27th 2020, Wednesday, Day 1, 1600-1740 UTC**, non-technical session, will present: key climate information from Winter/Spring 2019/20 and the Arctic Summer 2020 outlook for 8 regions in the Arctic (see ACF-5 draft as explanation); and the Consensus Statement (see ACF-5 draft as explanation) which provides an overall summary for the circumpolar Arctic;
  - **May 28th 2020, Thursday, Day 2, 1600-1810 UTC**, technical session, will provide greater detail on the Winter/Spring 2019/20 observations, and the modelled and consensus aspects of the temperature, precipitation and sea-ice information used to develop the ArcRCC products.
  - Following each session, the organizing committee will distribute summaries of key points
- **Recording** – sessions will be recorded and available later at **https://arctic-rcc.org/acf-spring-2020**
- **Connection and session rules (same for 2 days):**
  - 16:00 UTC: **https://bluejeans.com/431362831/9648?src=calendarLink**
  - for stable and better performance, you are **very kindly asked to turn off your video** and **mute microphone** for most of the time of the sessions, unless you intend to speak – during the sessions only **moderators will be unmuted** by default
  - During the sessions use the BlueJeans **"CHAT function"** to **ask** the questions, **pass comments** to moderator, everyone or particular person or **rise your hand** for a question during the time for discussion - all notes will be properly considered by the moderator(s) and answered during discussions
- **Access to ArcRCC products and session ppts**
  - All ArcRCC information (including the ACFs) is available at **https://arctic-rcc.org/**
  - Fast access to ACF-5 information (ppts, pdf, docs) is organized at **http://wdc.aari.ru/acf5/**
- **Group Photo ? – at the end of sessions you'll be asked to switch on your cameras and the Secretariat will try to make a screenshot**

Brief review of May 27th Non-Technical Regional Briefing session

ACF
Arctic Climate Forum

- 81 participants at most, slightly varying during the session between 65….73
- 2 non-technical presentations
  - Review on past season climate (winter-spring 2019/2020) by 8 regions – SAT, Prec, sea-ice
    - ✓ Briefs on the forecasted SAT, Prec, sea-ice for the coming summer 2020 for the same 8 regions
    - ✓ Risks and impacts including wildfires, river flooding, erosion, wildlife, hunting and shipping – actually for ACFs for the first time with such details
  - Presentation of the ACF-5 Consensus statement
    - ✓ Content, technique of creation the statement
- 3 on-line discussions , 4 pages doc
  - Questions touched – additional observations at end-user side
  - Normal s– what and where
  - Etc
- General reflection – professional, useful information and presentations

ACF-5 Technical Regional Briefing Agenda

Thursday May 28, 2020, 16:00 – 18:10 UTC

To determine your local time go to: https://www.timeanddate.com/worldclock/timezone/utc

Intended Audience: Users interested in specifics of the climate observations and models

TIME	ITEM	DETAILS
16:00 (10’)	Welcome – Introduce the Arctic Climate Virtual Forum – Brief review of yesterday’s agenda (doc) – Format, how to ask questions and make comments – Where to find the ArcRCC products and presentations	**Vasily Smolianitsky,** AARI
16:10 (20’)	Arctic winter 19/20 and spring 2020 Seasonal Summary: – Temperature, precipitation, sea-ice , ocean, land hydrology – Review of observational and reanalysis data (ppt, pdf)	**Vasily Smolyanitsky**, AARI **Gabrielle Gascon**, ECCC
16:30 (5’)	Using INTAROS project results for ArcRCC Northern Eurasia node: Access to seasonal summary data (ppt, pdf)	**Evgeny Vyazilov**, RIHMI-WDC, Obninsk
16:35 (15’)	On-line discussion (with end-users) on seasonal summary	**Shanna Combley** (moderator) U.S. National Weather Service (NWS)
16:50 (20’)	Temperature and Precipitation (ppt, pdf) – Introducing the multi-ensemble method – Validation of the outlook for winter 19/20 and spring 2020 – Review of model confidence for summer 2020 outlook	**Marko Markovic**, ECCC
17:10 (15’)	On-line discussion (with end-users) on temperature and precipitation outlook	**Valentina Khan** (moderator), HMC Moscow
17:25 (20’)	Sea-Ice Outlook for Summer 2020 (ppt, pdf) – Introducing the models – Validation of outlook for winter 19/20 and spring 2020 – Review of model confidence for summer 2020 outlook	**Scott Weese**, ECCC
17:45 (15’)	On-line discussion (with end-users) on sea ice outlook	**Vasily Smolyanitsky** (moderator), AARI **Scott Weese** (moderator) ECCC
18:00 (5’)	Final thoughts & Wrap-up	Vasily Smolianitsky, AARI Helge Tangen, ArcRCC Network coordinator Anahit Hovsepyan, WMO
18:10	End of ACF-5	

World Meteorological Organization

Weather • Climate • Water

ACF

Arctic Climate Forum

November 2019 – April 2020 Arctic Seasonal Review

Vasily Smolyanitsky

Anna Danshina, Anastassiya Revina

Arctic and Antarctic Research Institute

Arctic Regional Climate Center

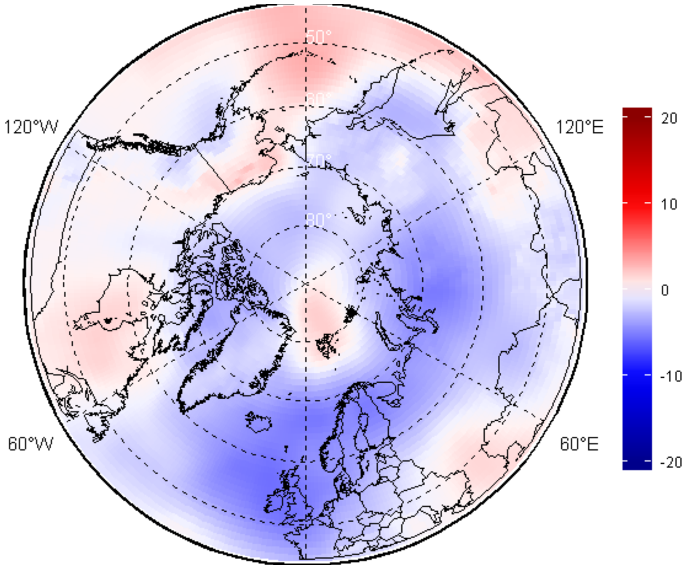
Content of review

- ❖ Review for 2 periods: NDJ 2019/2020 and FMA 2020
- ❖ Atmosphere variables include:
  - ✓ Atmospheric circulation (MSL) and geopotential height (gp50, gp500)
  - ✓ Surface air temperature
  - ✓ Precipitation
- ❖ Sea ice variables include:
  - ✓ atmosphere and polar ocean precursors
  - ✓ Ice extent and ice conditions analysis
  - ✓ Sea ice thickness and volume reanalysis
- ❖ Polar Ocean
  - ✓ SST, waves and swell height (storminess)
  - ✓ pH (acidification/alkalization estimates)
- ❖ Solid precipitation (land snow)
- ❖ Briefs on current status (SAT, winds, Prec, sea ice, snow)

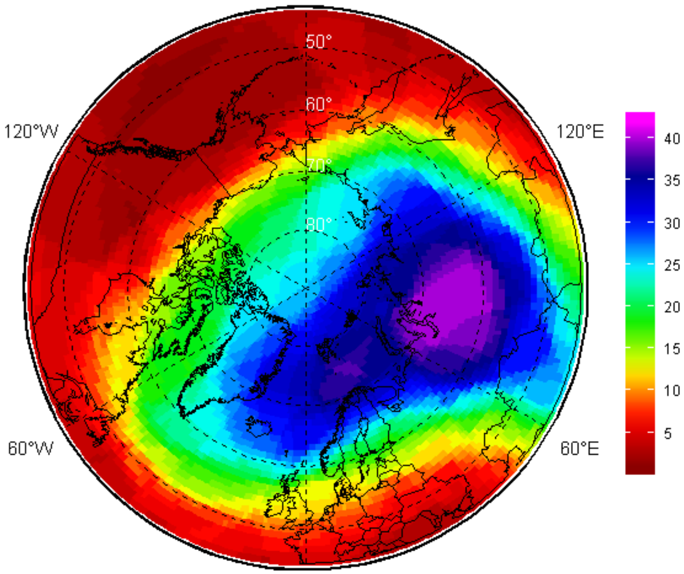
Atmosphere:

- ✓ Precursors - atmospheric circulation patterns
- ✓ Surface air temperature
- ✓ Precipitation

NDJ 2019/2020 atmospheric circulation



MSLP hPa anomalies (norms 1981-2010)



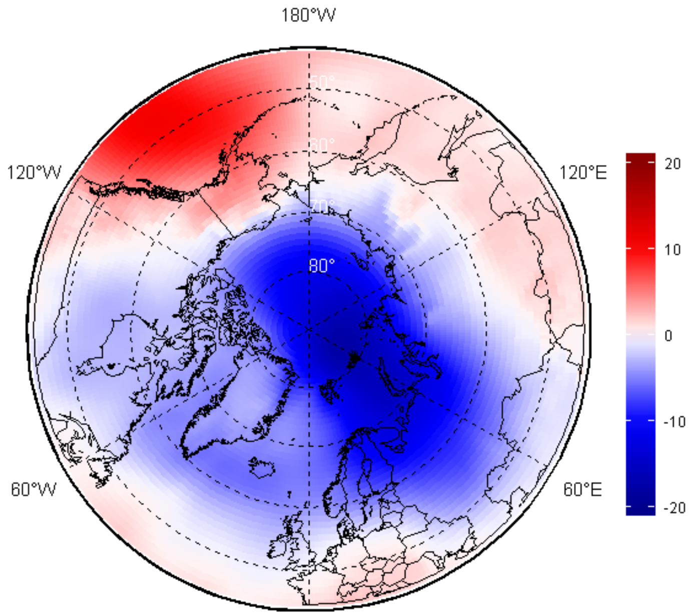
H50 ranks (1979-2020)

- Based on atmosphere numerical model (reanalysis)
- Negative mean sea level atmospheric pressure (MSLP) anomalies (lower pressure, marked in blue) dominated through the European, Siberian and Canadian archipelago regions
- Opposite situation (higher pressure, marked in red) was observed over Svalbard, Canadian and Alaska regions, Bering Sea

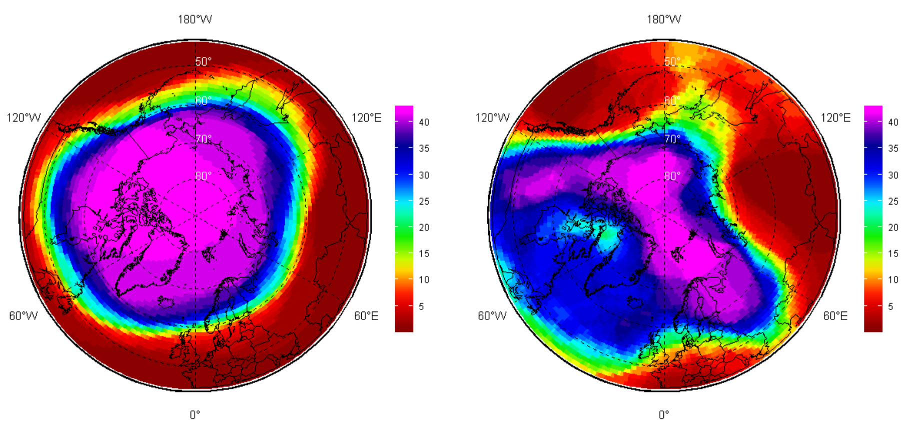
- That led to prevalence of zonal form of circulation (transfer of heal/cold west/east) in the troposphere with the center of polar vortex over western Siberia as seen on the 50 hPa geopotential height (H50)

AARI / ERA5 reanalysis

FMA 2020 atmospheric circulation



MSLP hPa anomalies (norms 1981-2010)

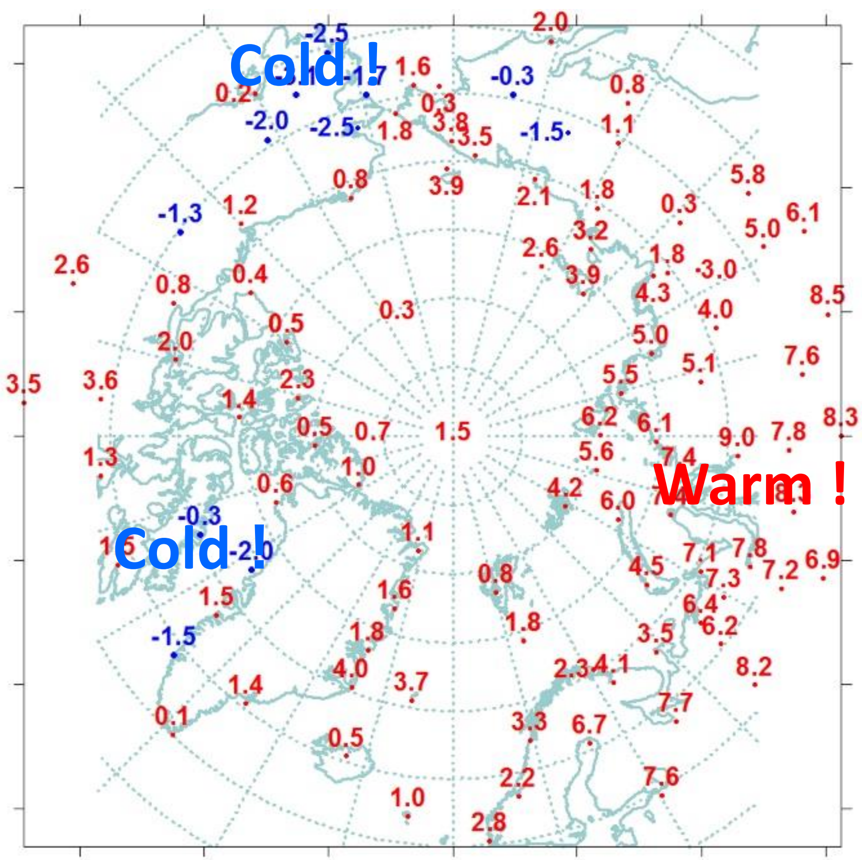


H50 (left) and H500 ranks (1979-2020)

- Much stronger negative MSLP anomalies (lower pressure, marked in blue) were observed during FMA 2020 in the European region, Western Siberia, Arctic Ocean but not in Alaska and Bering Sea
- That again led to increased cyclonic activity, more polar lows with further increased precipitation
- Polar vortex was very intense as observed at H50 pattern and caused meridian type of circulation with several 'heat waves' in Western and Eastern Siberia

[AARI / ERA5 reanalysis]

December 2019 – February 2020 SAT (T2m): anomalies and ranks (observation)



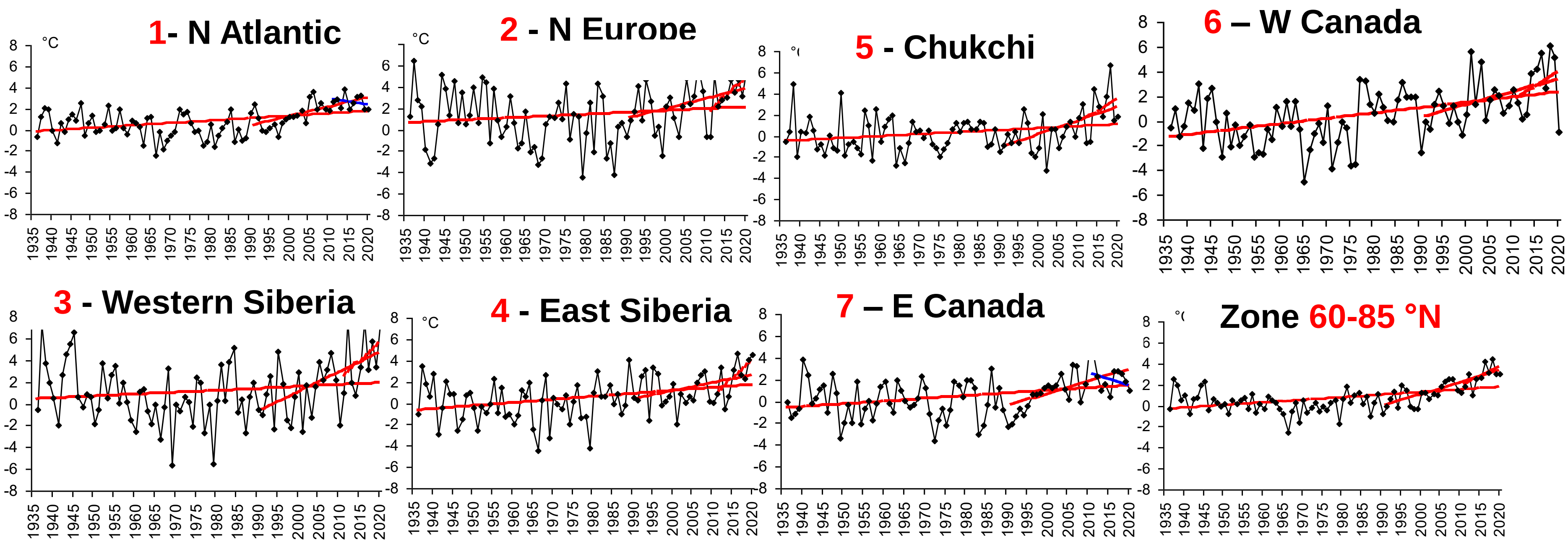
- The winter air temperature across Arctic was above normal except Alaska, Greenland, Svalbard, some parts of Canadian archipelago and Chukchi region.
- The most notable positive anomalies were present across of Western and Eastern Siberia Alaska and some parts of N Atlantic
- Very close to record high temperatures were observed in Eastern Siberia.

[AARI]

SAT anomalies by regions during winter 2019/20 (DJF) (observations)

Region	Anomaly	Rank	The warmest year (anomaly)	The coldest year (anomaly)
North Atlantic	1,9	14	2014 (3,9)	1966 (-2,4)
Barents	5,4	3	1937 (6,5)	1979 (-4,4)
Western Siberia	7,2	3	2012, 2016 (7,6)	1969 (-5,6)
Eastern Siberia	4,6	2	2016 (4,6)	1966 (-4,5)
Chukchi	1,8	13	2018 (6,7)	2002 (-2,3)
Western Canada	-0,9	42	2018 (6,1)	1965 (-5,6)
Eastern Canada	1,2	18	2010 (5,0)	1972 (-3,6)

Reference period: 1961-1990

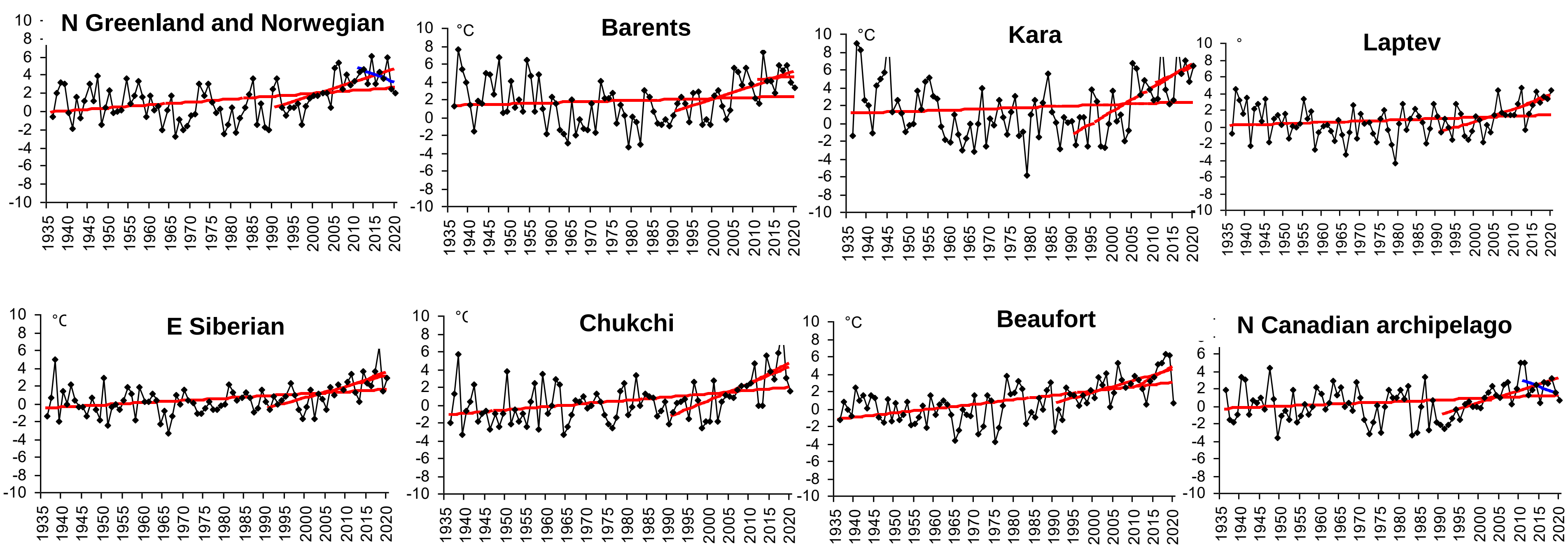


[AARI]

SAT anomalies by Arctic seas during winter 2019/20 (DJF) (observations)

Sea	Anomaly	Rank	The warmest year (anomaly)	The coldest year (anomaly)
Northern part of Greenland and Norwegian Seas	2,1	19	2014 (6,1)	1966 (-2,7)
Barents Sea	3,3	20	**1937** (7,6)	1979 (-3,4)
Kara Sea	6,5	8	1945 (9,8)	1979 (-5,9)
Laptev Sea	4,4	**3**	2012 (4,6)	1979 (-4,4)
Eastern Siberian Sea	2,9	7	2018 (6,5)	1966 (-3,3)
Chukchi Sea	1,6	19	2018 (8,8)	1939 (-3,4)
Beaufort Sea	0,7	29	2018 (6,3)	1966 (-3,1)
N part of Canadian arhipelago	1,0	18	2010 (5,0)	1949 (-3,6)

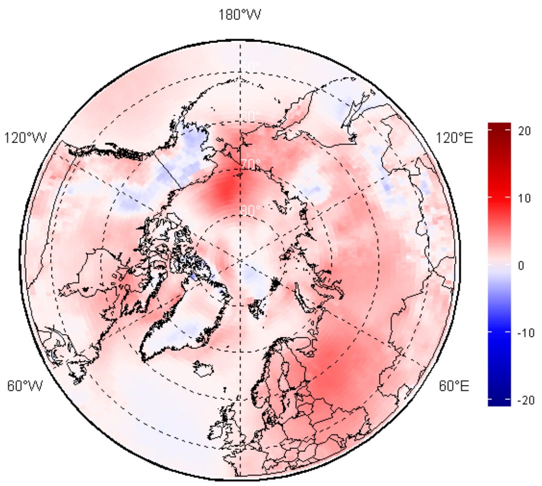
Reference period: 1961-1990



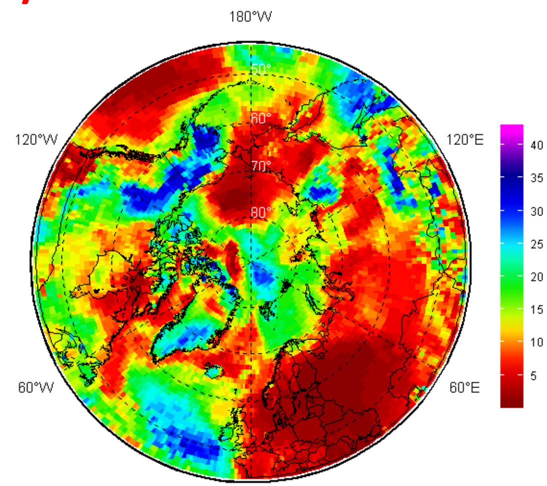
[AARI]

NDJ 2019-2020, FMA 2020 – SAT (T2m): anomalies and ranks

NDJ 2019/2020

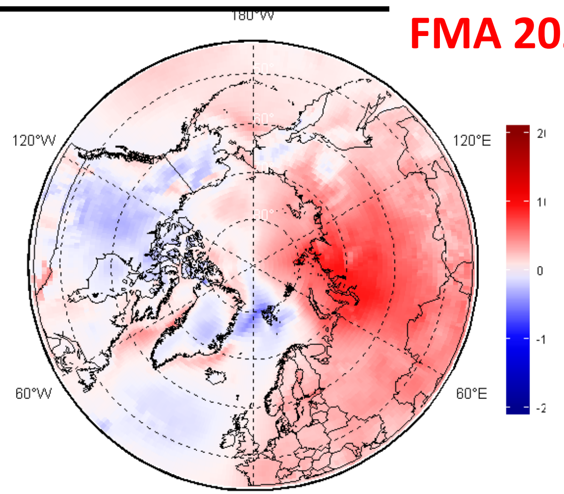


SAT anomaly, 1981-2010

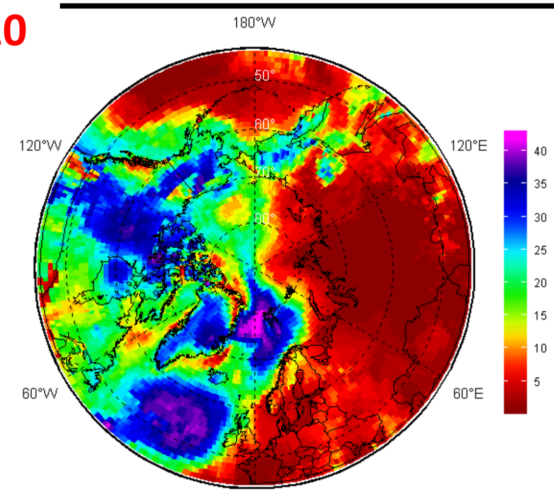


SAT rank, 1979-2020

FMA 2020



SAT anomaly, 1981-2010



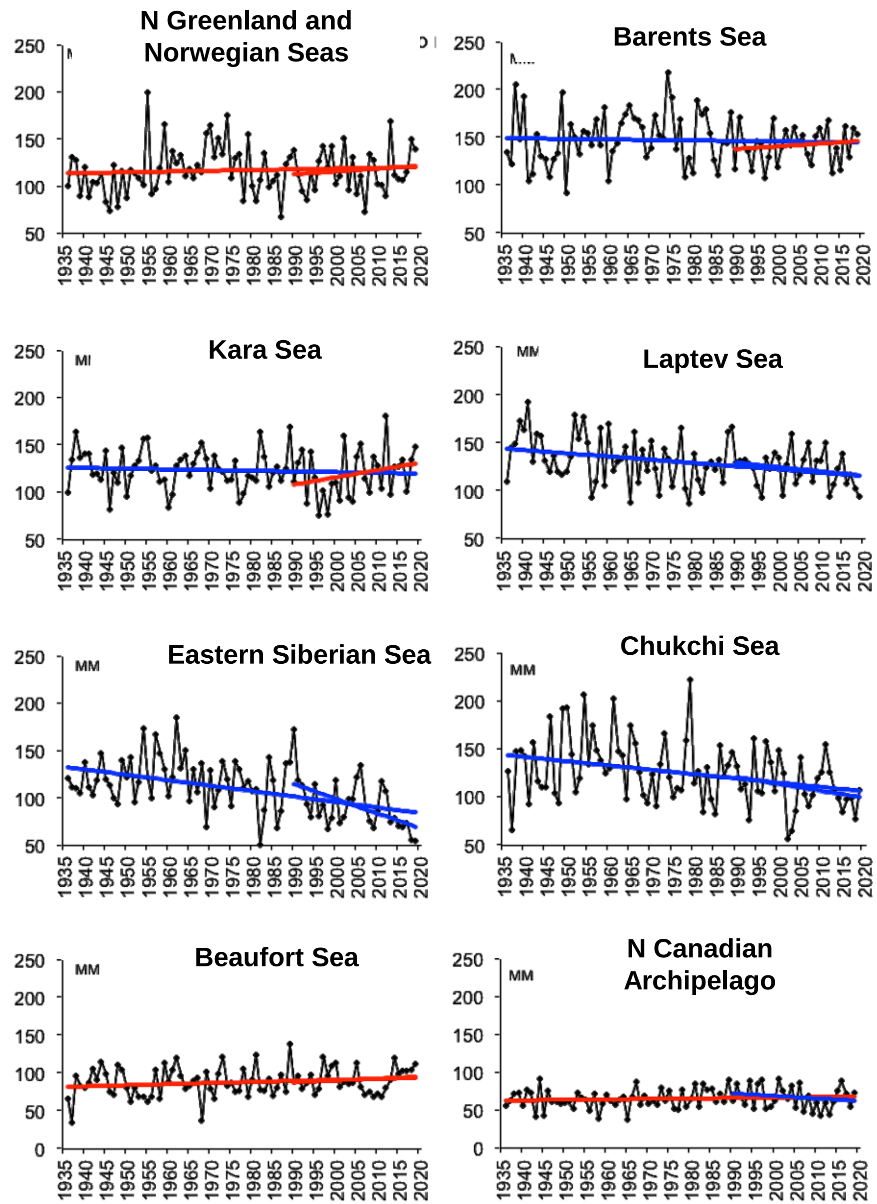
Rank, 1979-2020

- For the whole season from November 2019 – April 2010 positive close to maximum air temperature anomalies prevailed over Western and Eastern Siberia, with negative anomalies prevailing in marine Barents, Alaska and parts of Western Canada
- Atlantic and partly Chukchi areas experienced switch from positive to negative anomalies during NDJ - FMA

AARI / ERA5 reanalysis

Precipitation trends for ND 2019 - J 2020

- Analysis based on observations by the Arctic seas
- General positive trends – wetter conditions – for the Nordic seas, Beaufort Sea
- General negative trends – drier conditions - for Siberian shelf seas
- No general significant trends for Canadian Arctic regions

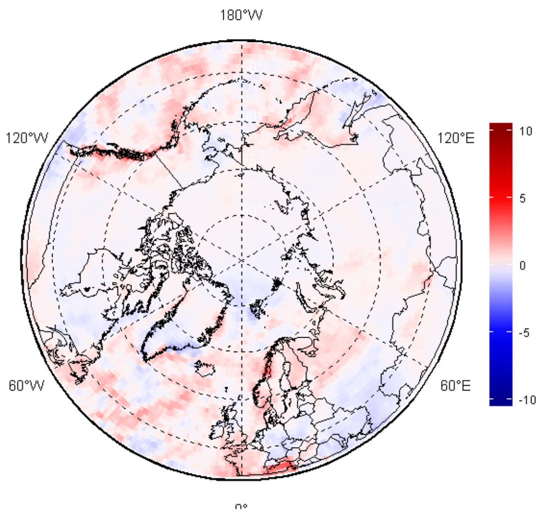


Reference period: 1961-1990

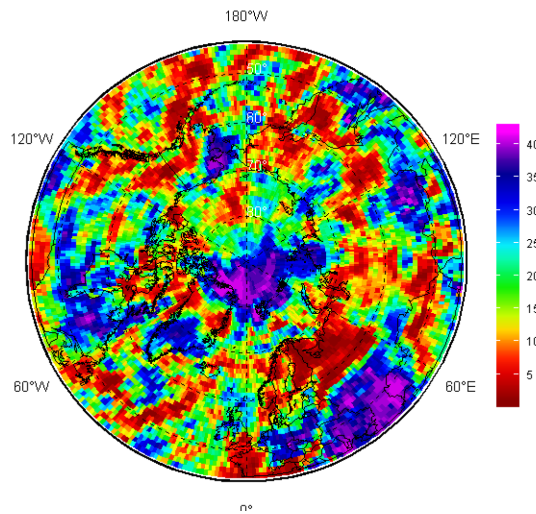
[AARI]

Precipitation (Prec) NDJ and FMA 2019/2020: anomalies and ranks

NDJ 2019/2020

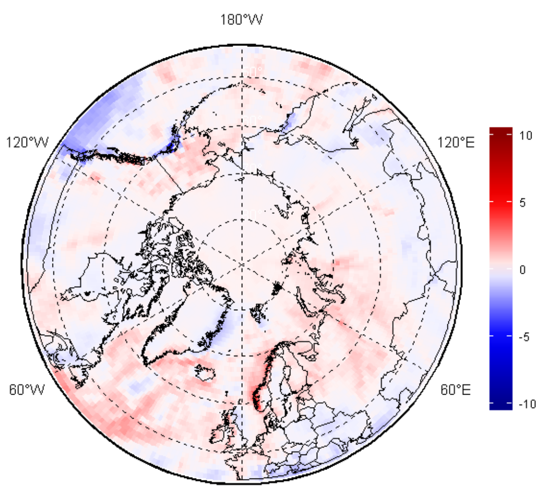


Prec Anomaly, 1981-2010

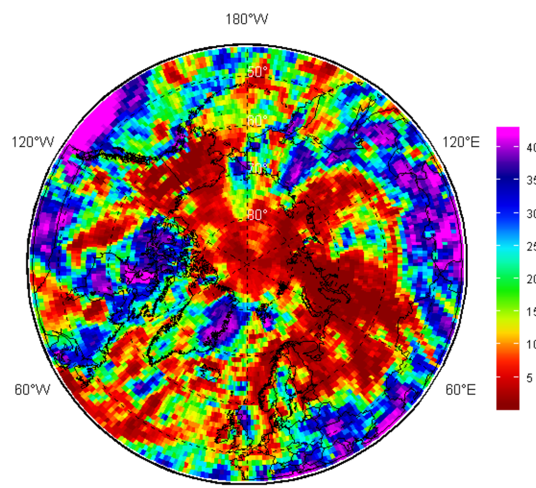


Prec Rank, 1979-2020

FMA 2020



Prec Anomaly, 1981-2010



Prec Rank, 1979-2020

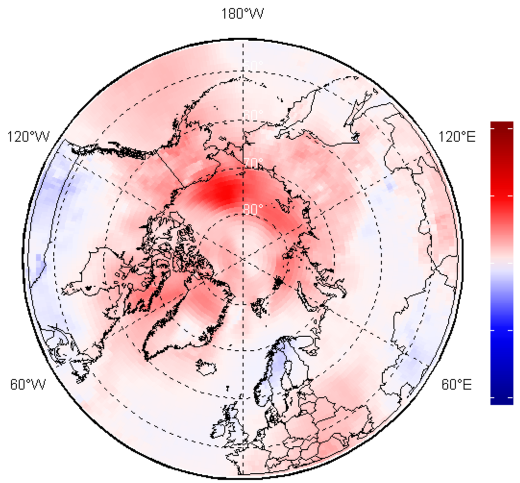
- For NDJ 2019/2020 and FMA 2020 Barents and Western Siberia regions saw very wet seasons
- Same wetter conditions observed for Alaska during FMA 2020
- Drier conditions were observed over Svalbard, parts of Greenland, Sea of Okhotsk

[AARI / ERA5 reanalysis]

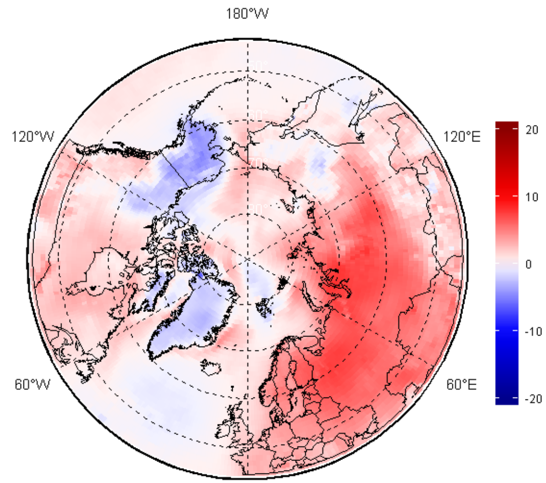
Sea ice:

- ✓Precursors in atmosphere and polar ocean
- ✓Ice extent and ice conditions analysis
- ✓Sea ice thickness and volume based on coastal stations and reanalysis

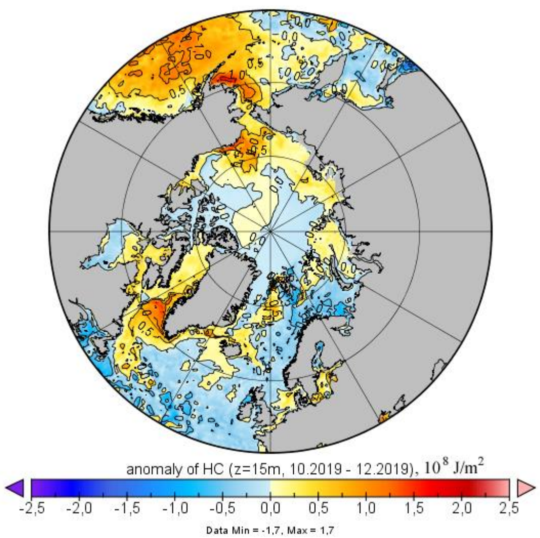
Atmosphere – polar ocean precursors for winter – spring 2019 – 2020 sea ice conditions



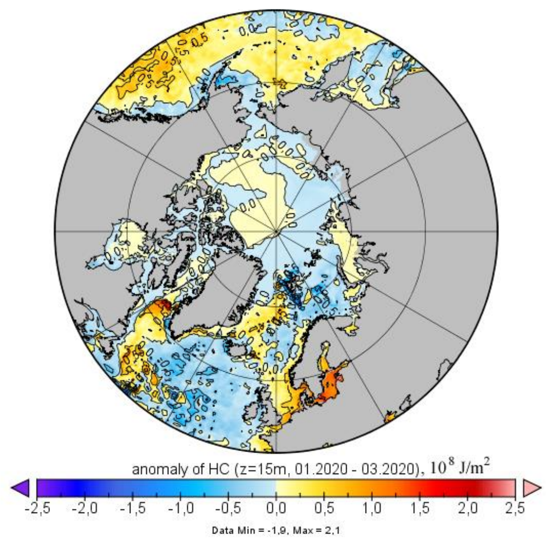
SAT SON anomaly, 1981-2010



SAT DJF anomaly, 1981-2010



Heat Capacity anomaly OND, 2000-2019

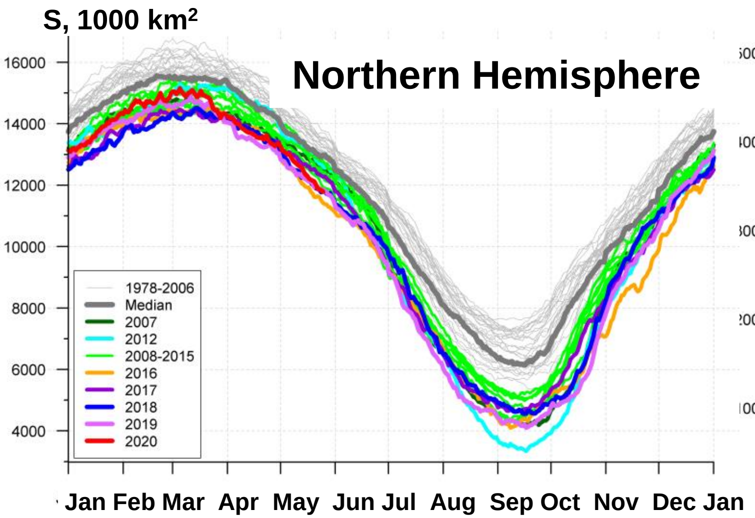


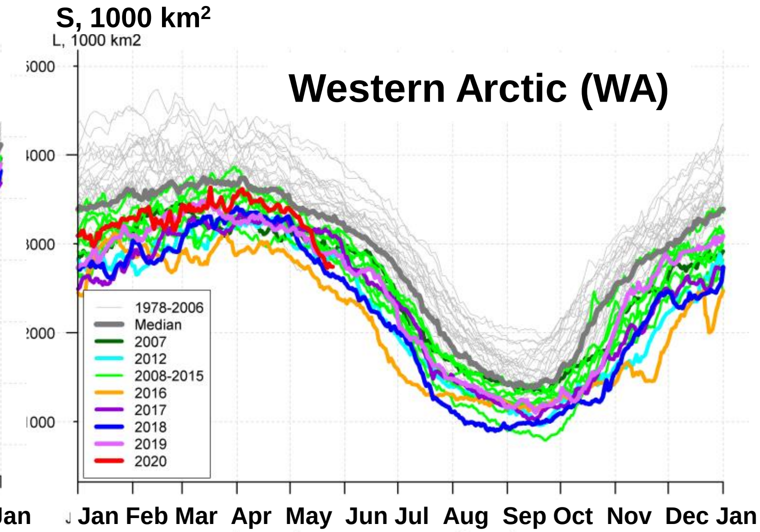
Heat Capacity anomaly JFM, 2000-2019

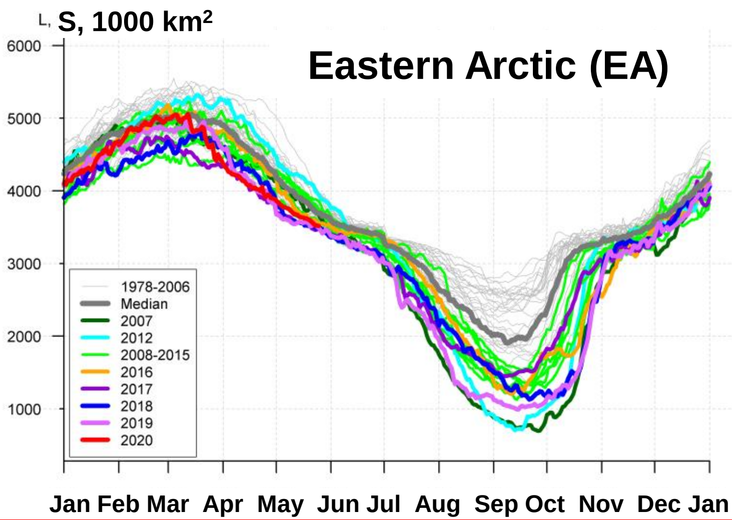
- High positive anomalies in surface air temperature (SAT) as well as prevailing positive polar ocean heat capacity (HC) in upper 15m during OND 2019 slowed in general freeze-up and sea ice growth in the Arctic
- Further in time lesser positive SAT anomalies as well as in general neutral HC anomalies during JFM stimulated ice extent growth
- Prominent negative HC anomalies lead to close to normal ice growth in the N Barents Sea and Sea of Okhotsk

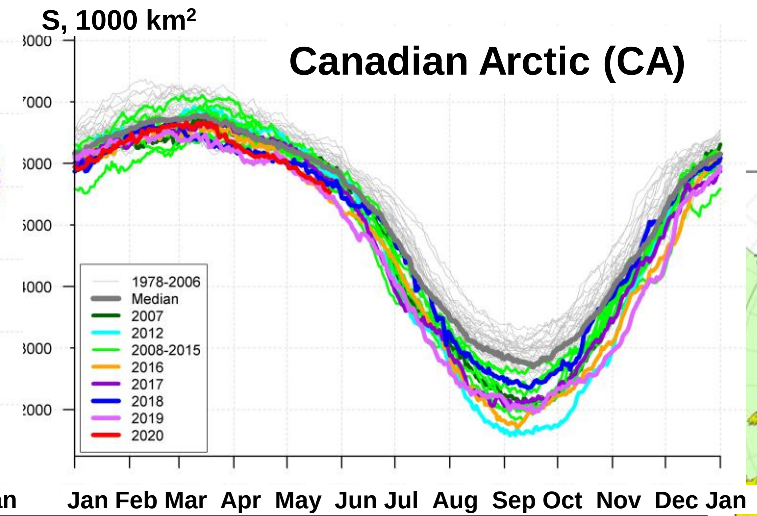
[AARI / Copernicus Climate Change Service (ERA5 & MERCATOR reanalysis)]

Arctic (NH) seasonal ice extent 1978…. 2020





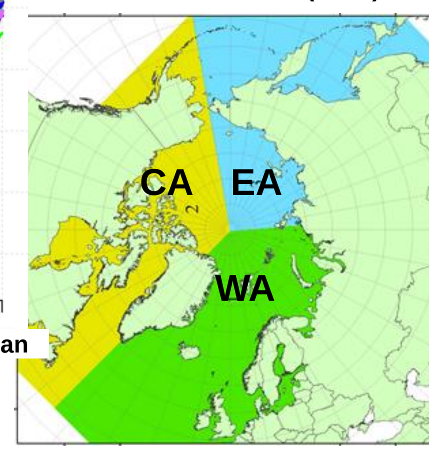




S, 1000 km²*

2017 14467
2018 14516
2015 14526
2016 14580
2011 14701
2006 14867
2019 14891
2007 14931
2014 14972
2005 15101
2020 15159
… …
1988 16461
1983 16547
1979 16769

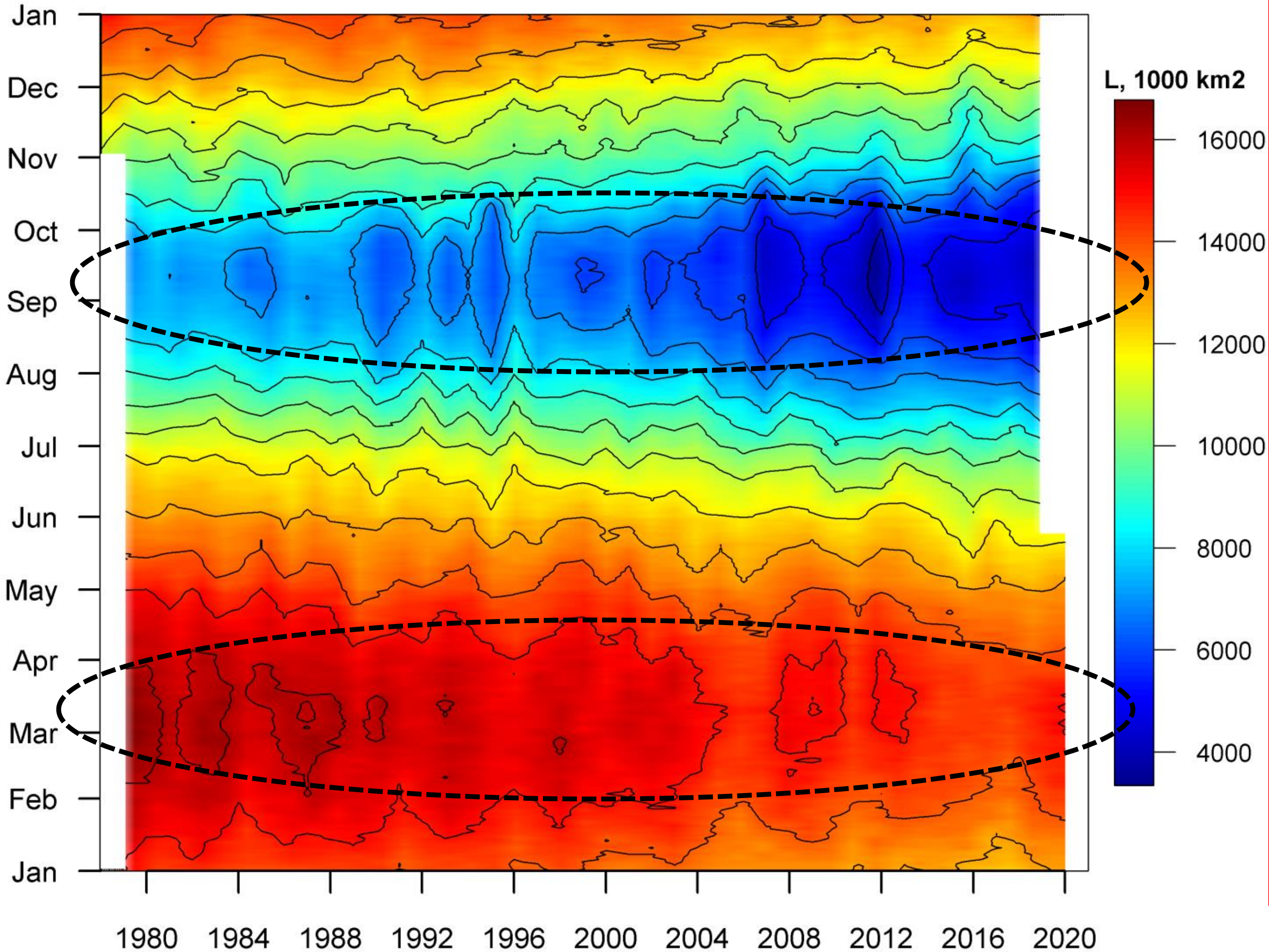
* - maximum for Mar (AARI)



- Maximum winter ice extent, 11th in row, 15,16 mln km² (14,89 in 2019) reached 4 March 2020 (11 March in 2019)
- During freezing period (ND 2019) lowest on record was observed due to extreme minimums in Bering, Chukchi Seas

[AARI, NSIDC]

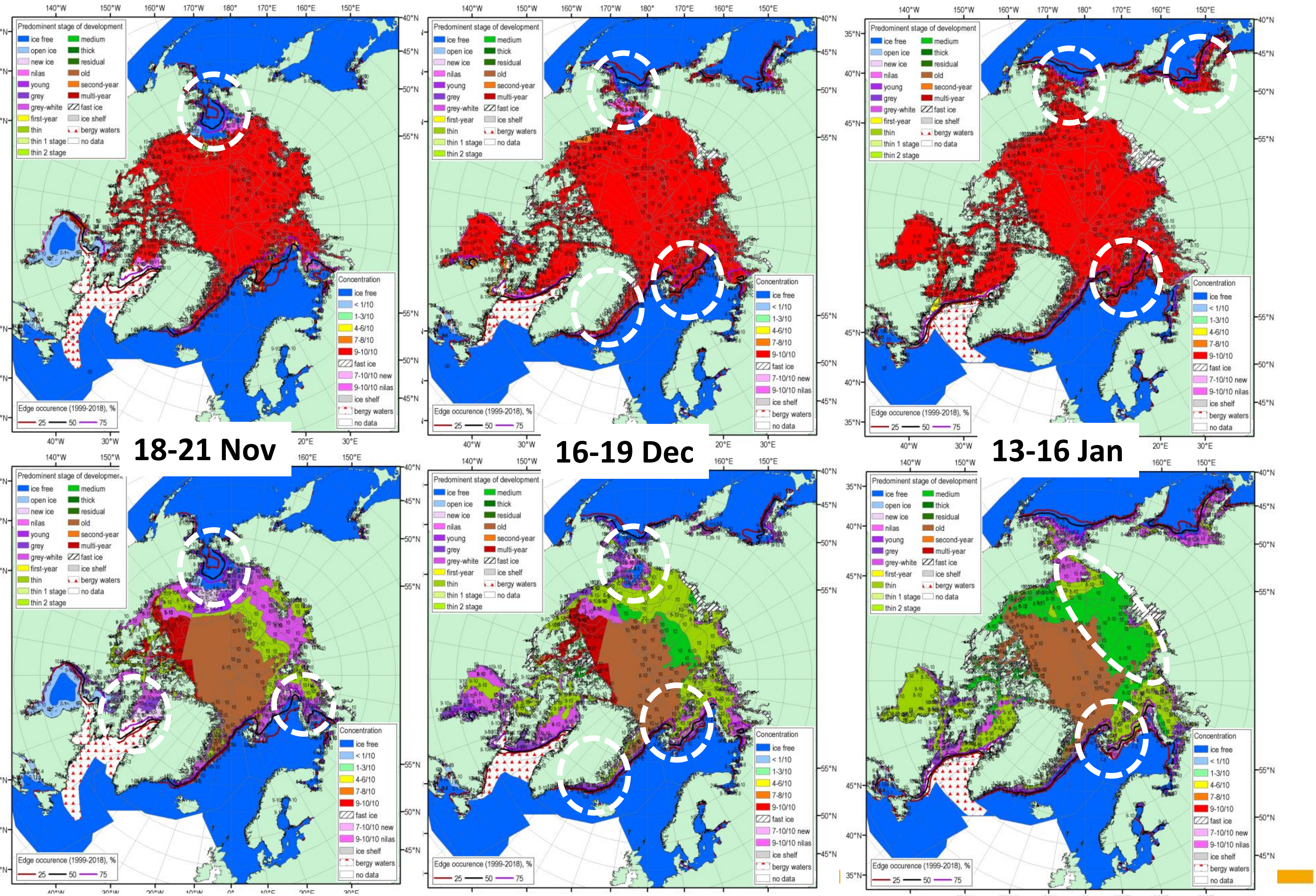
Seasonal NH ice extent variability: 1978 - 2020



- Seasonal patterns of daily ice extent allows to analysis seasonal variability of ice extent
- Both winter maximums and summer minimums continue to diminish
- Though, significant interannual variability of ice extent occurs

[AARI, NSIDC]

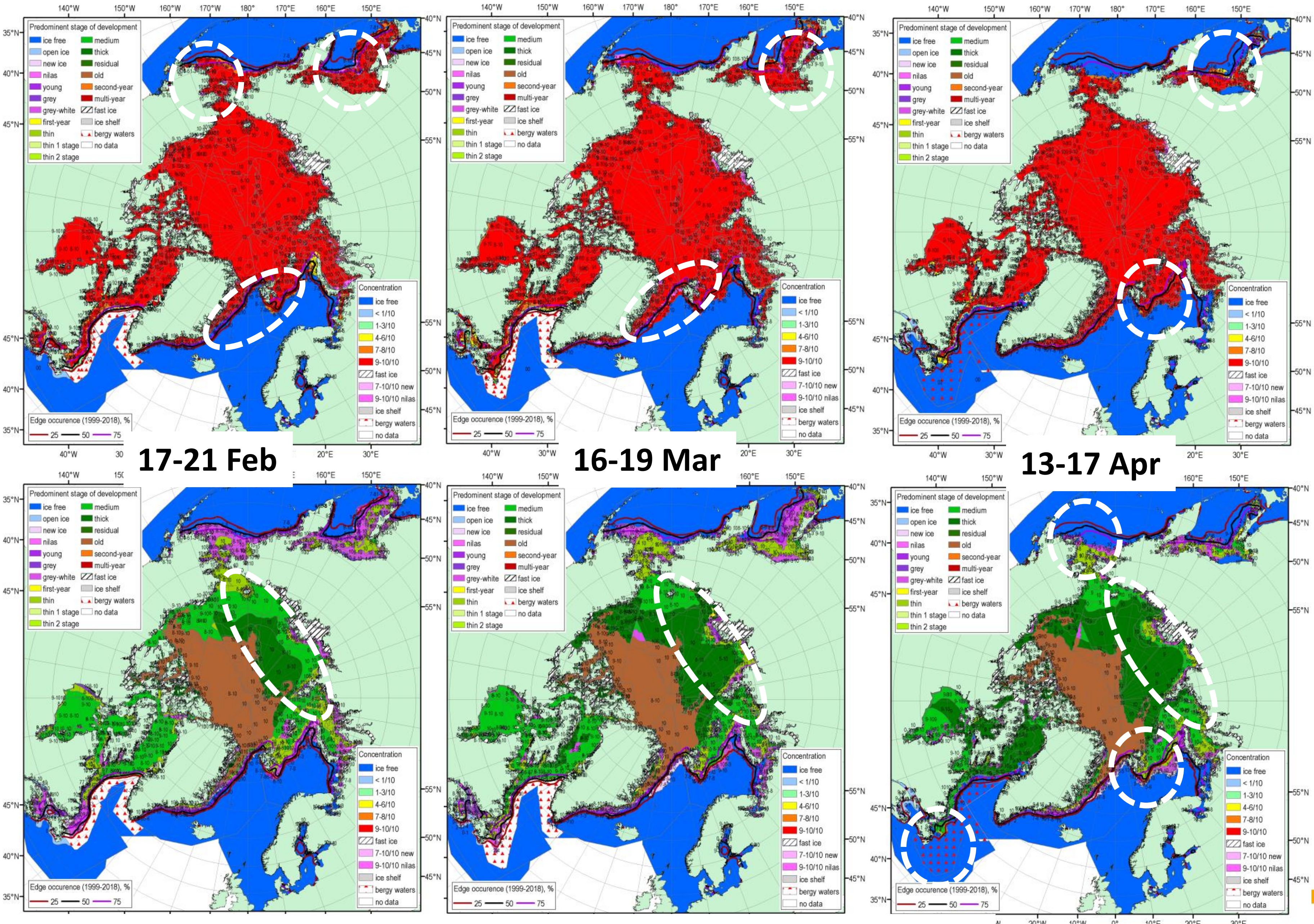
NDJ 2019/2020 Arctic sea ice – concentration and stage of development



Blended AARI/CIS/NIC (JCOMM) ice charts; ice edge – nearest 5days, reference period: 1999-2018

Weather • Climate • Water

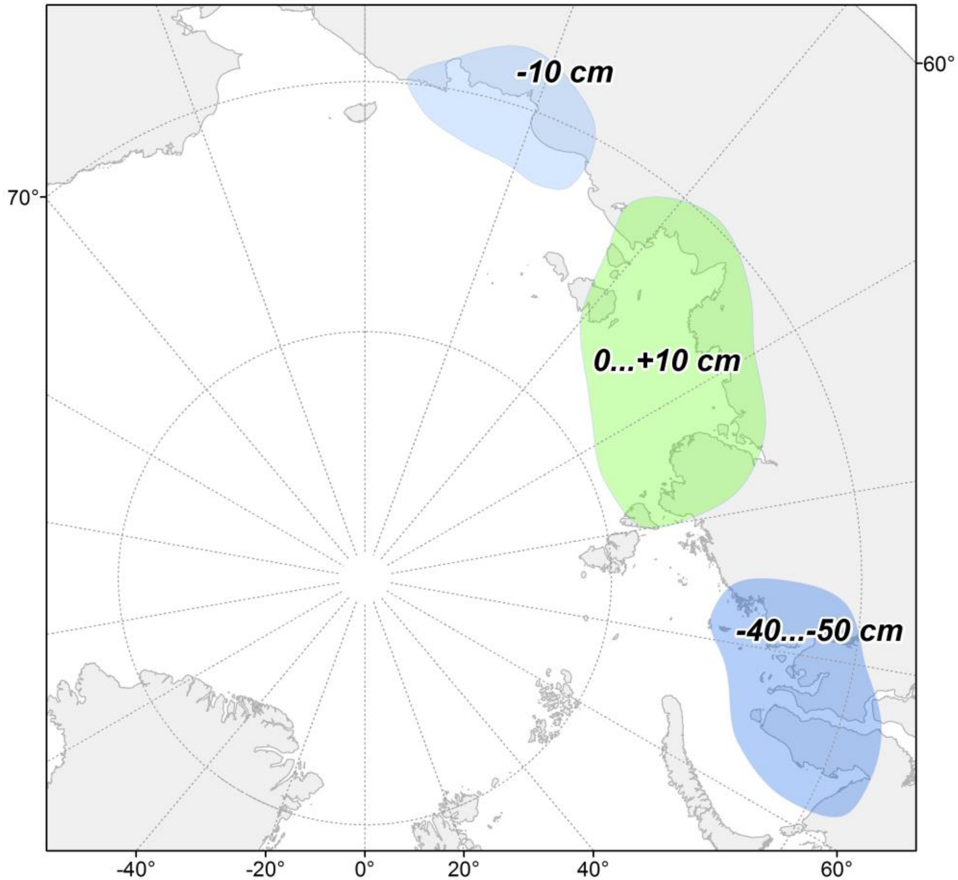
FMA 2020 Arctic sea ice – concentration and stage of development



Blended AARI/CIS/NIC (JCOMM) ice charts; ice edge – nearest 5 days, reference period: 1999-2018

Weather • Climate • Water

Sea ice fast ice maximum thickness values and anomalies by end of April/Mar 2020 (stations)



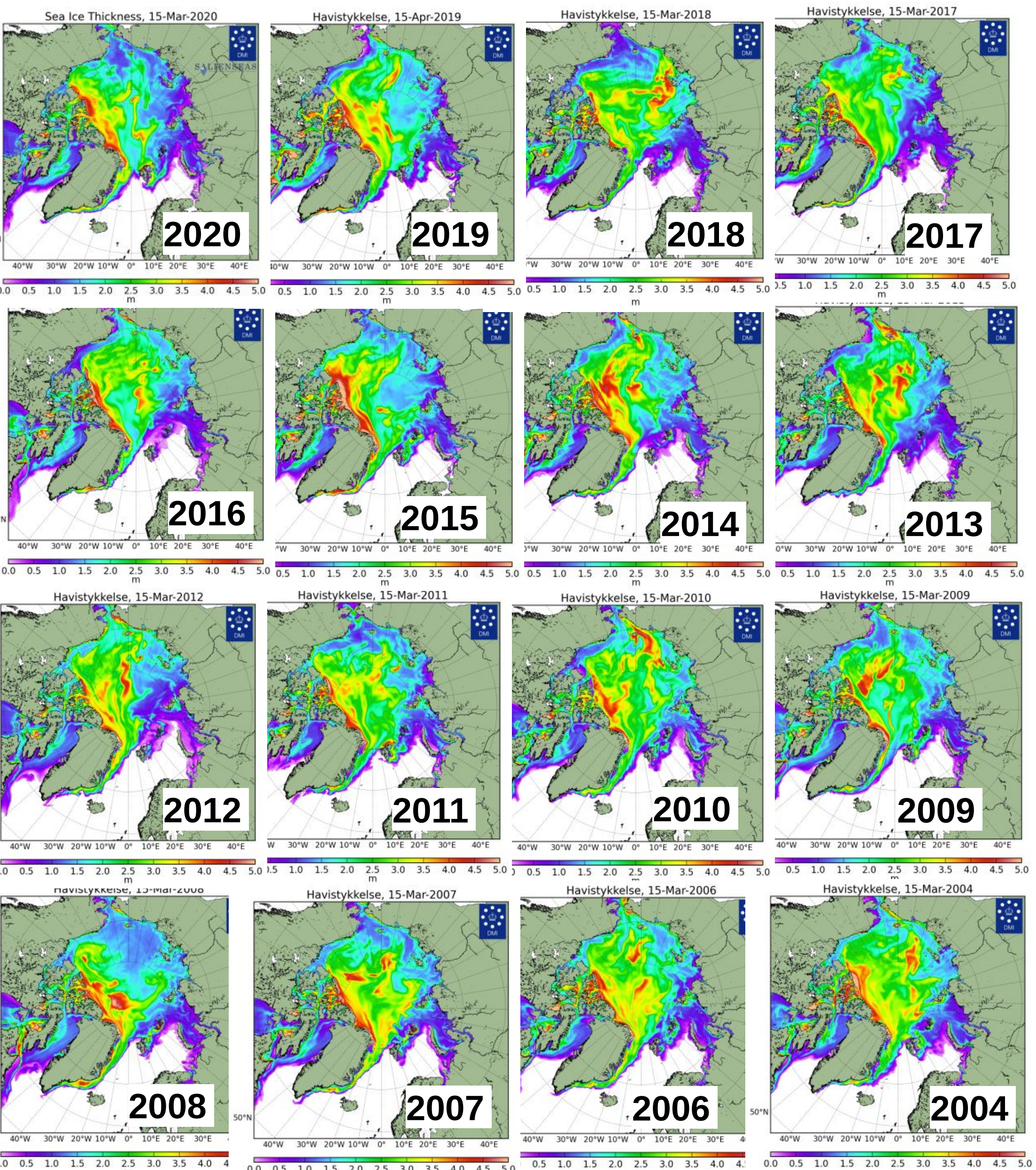
WMO stations used:
Russia: 12 (Varandey, Amderma, Belyi, Dikson, Sterlegova, Cheluskin, Tiksi, Kotelnyi, Sannikova, Ayon, Valkarkay)

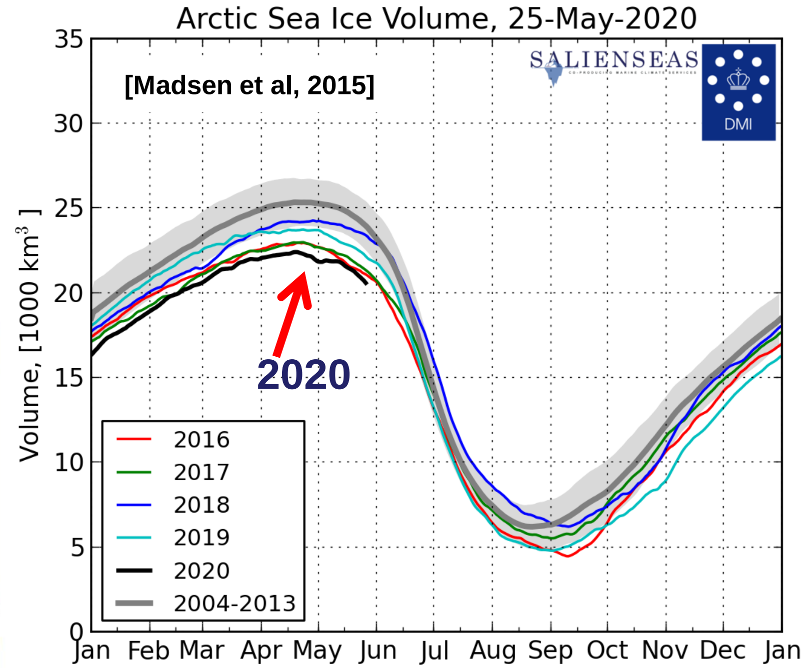
- **Observed maximum winter ice thicknesses significantly less than normal (for the last 30 years) for Kara Sea (up to -50 cm, which is opposite to 2019) and slightly less than normal for Eastern Siberian Sea**
- **Slightly thicker ice observed in Laptev Sea**

Ref [1989-2019]

[AARI]

Sea ice thickness for 15 Mar 2004…2020 and ice volume





- **Models show Arctic ice volume in 2020 the lowest from Oct 2019 for 2004-2020 with 2nd in row in 2016**
- **The present ice extent slightly higher then in 2016 means sea ice thicknesses in winter / spring 2019/2020 are in general lower then in 2019**

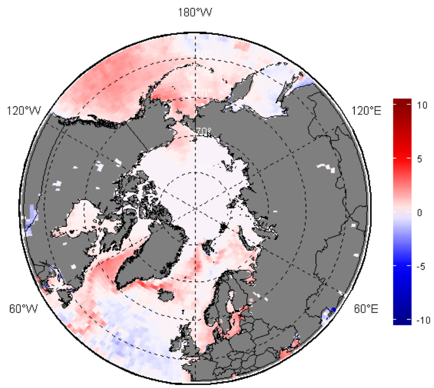
DMI North Atlantic - Arctic Ocean model HYCOM-CICE -
http://ocean.dmi.dk/models/hycom.uk.php

Weather · [DMI] Water

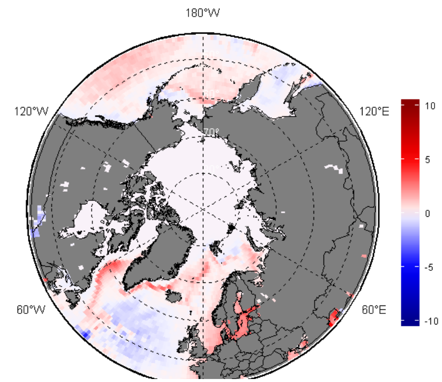
Polar Ocean:

- ✓ Sea surface temperature
- ✓ pH and acidification or alkalization of the Arctic ?
- ✓ Storms - Wave and swell height

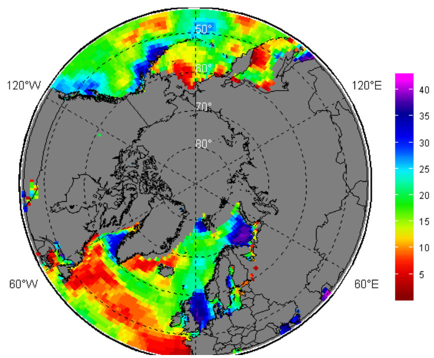
Waves and ph in the Arctic Ocean - NDJ 2019-2020, FMA 2020



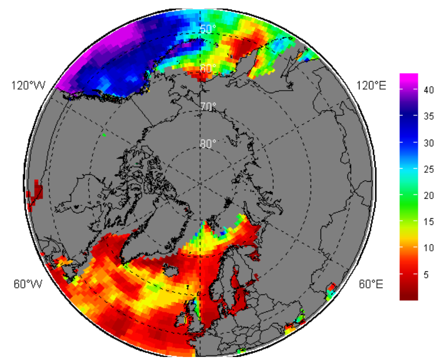
SST NDJ anomaly, 1981-2010



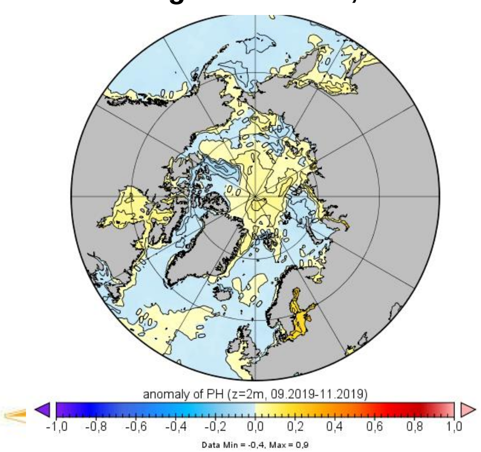
SST FMA anomaly, 1981-2010



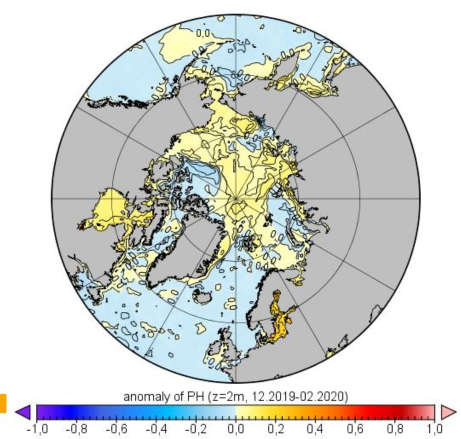
WW&S height NDJ rank, 1979-2020



WW&S height FMA rank, 1979-2020



pH anomaly 2m SON 2000-2019



pH anomaly 2m DJF 2000-2019

- **Boundary seas of the Arctic Ocean were in general warmer and stormy during winter-spring 2019-2020 with exceptions Svalbard and N Greenland (colder, calmer), Sea of Okhotsk (colder)**
- **Numerical models show both positive (Arctic Basin, Chukchi Sea) and negative pH (Barents, Kara Sea, Canadian Arctic) anomalies to the last 20 years, that allows occurrence of both alkalization and acidification processes in the Arctic (no effect to wildlife?**

AARI / Copernicus Climate Change Service (ERA5 & MERCATOR reanalysis)

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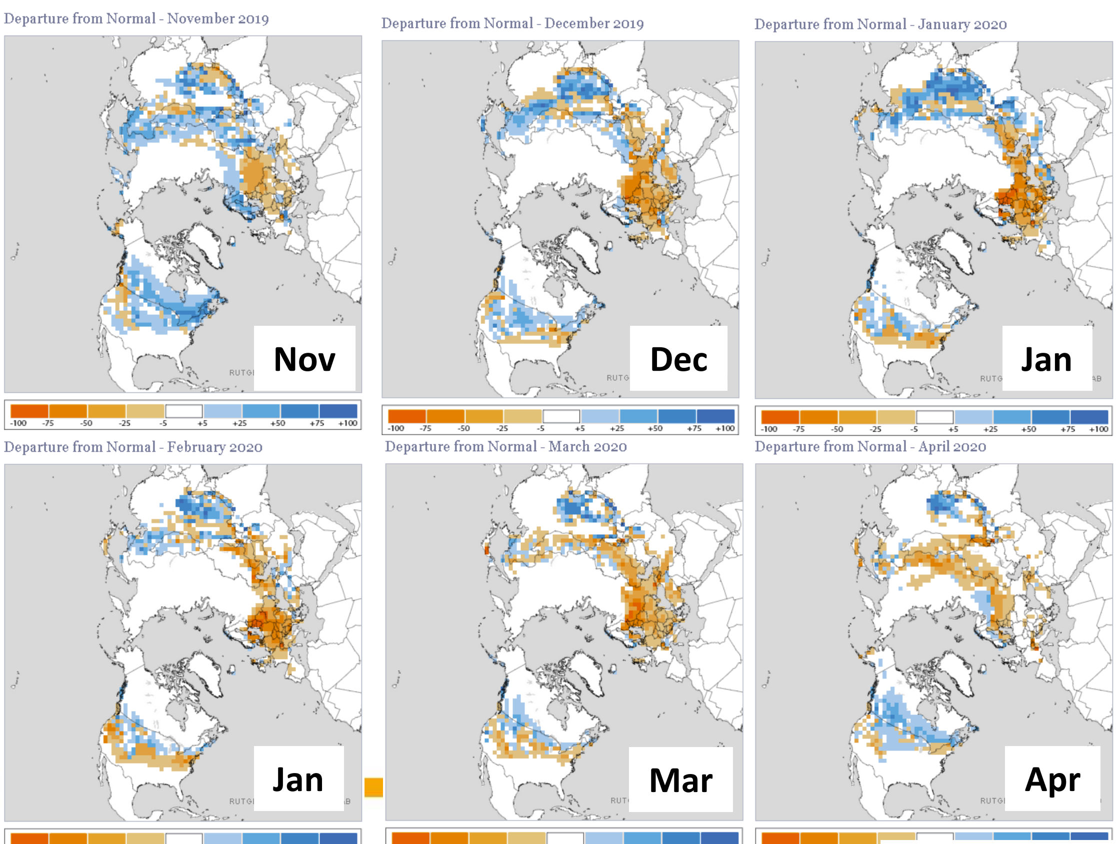
Land Snow:

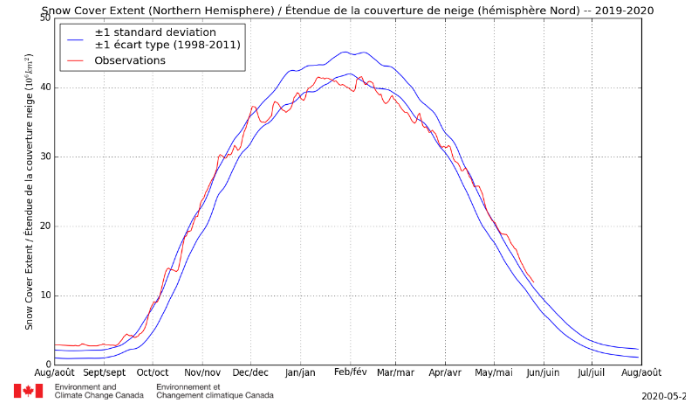
- ✓ Snow water equivalent
- ✓ Snow extent

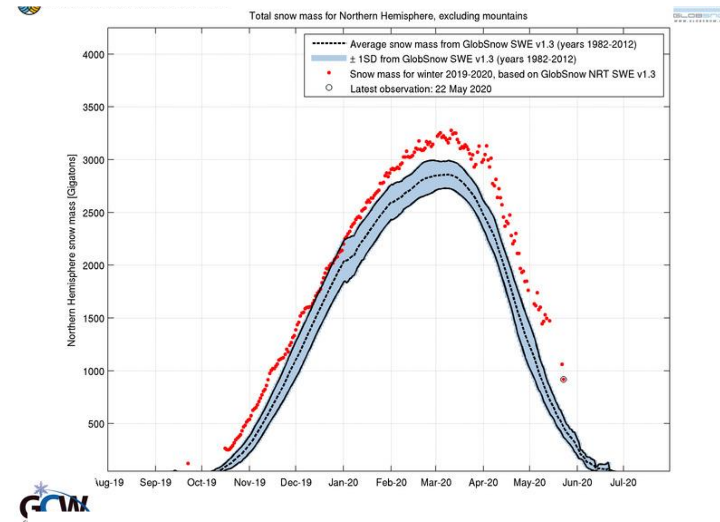
Land snow (satellite, obs)

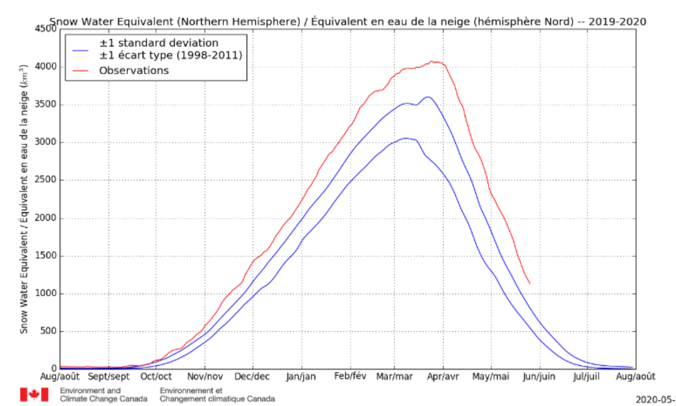
- Snow extent in winter-spring 2019/2020 was less than normal with prominent negative anomalies (no snow) in most of European sector
- Positive anomalies (more snow) were observed in Scandinavia, southern Canada
- Greater Snow Water Equivalent in 2019/2020 means higher snow height observed



Ref [1981-2010]

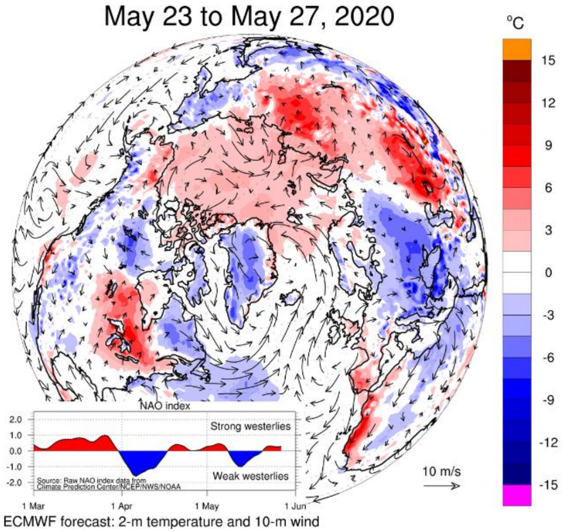


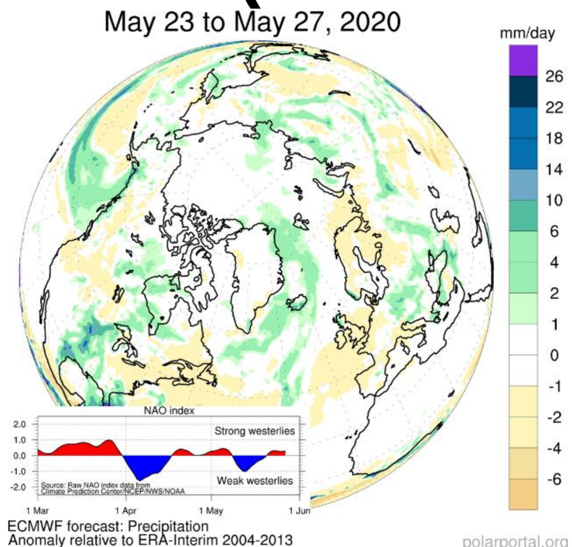




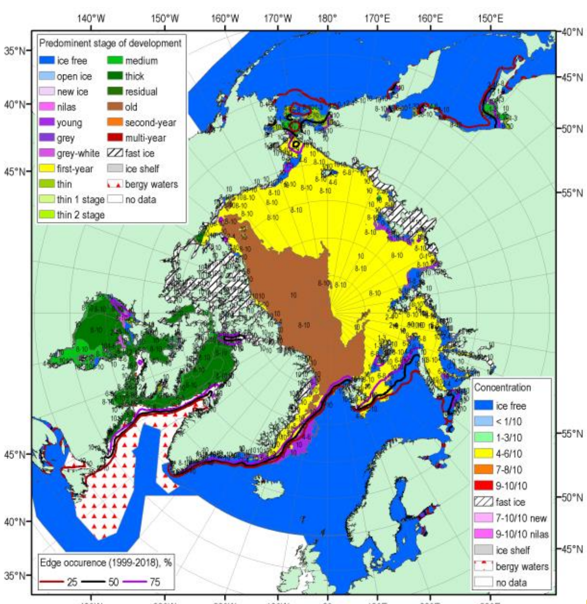
[FMI, ECCC, Rutgers Glob Snow Lab / GCW)]

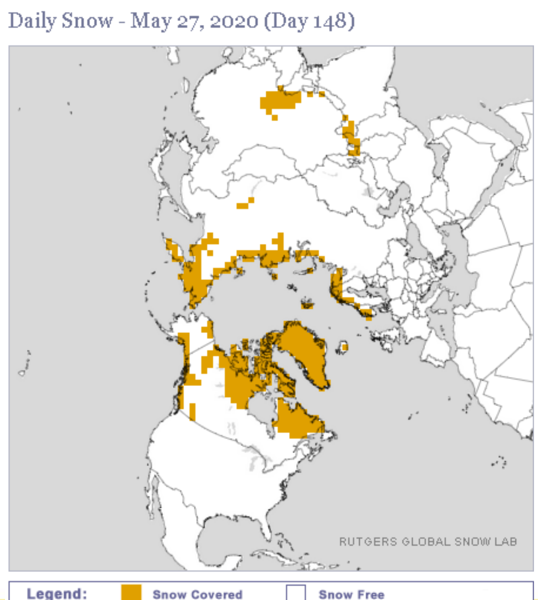
Current Conditions (21-26 May 2020)





SAT, precipitation, mean wind vectors, NAO for 23-27.05.2020 (http://polarportal.dk)





AARI/NIC ice chart for 21-26 May 2020

Snow extent for 27 May 2020, Rutgers Global snow lab

- Till now week westerly, moderate northern winds in European sector and strong southern winds over Siberia (NAO~0) led to lower SAT in European sector, prominent higher SAT over Siberia and the Arctic Ocean ('heat waves')
- Northern Scandinavia, Arctic coasts, Chukchi peninsula are still under snow
- NE part of Barents Sea, Kara, W Laptev Seas, Chukchi Sea are under intense ice melt which is extreme
- However general pattern of TransArctic drift keeps ice conditions in Greenland Sea and Svalbard waters near normal

World Meteorological Organization

Weather • Climate • Water

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Arctic Climate Forum

Using INTAROS project results for North Eurasia node: Access to seasonal summary data

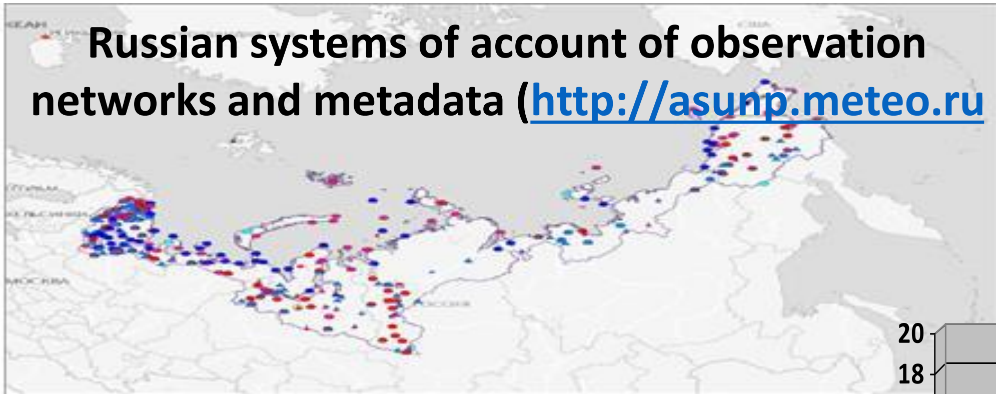
Evgenii Viazilov

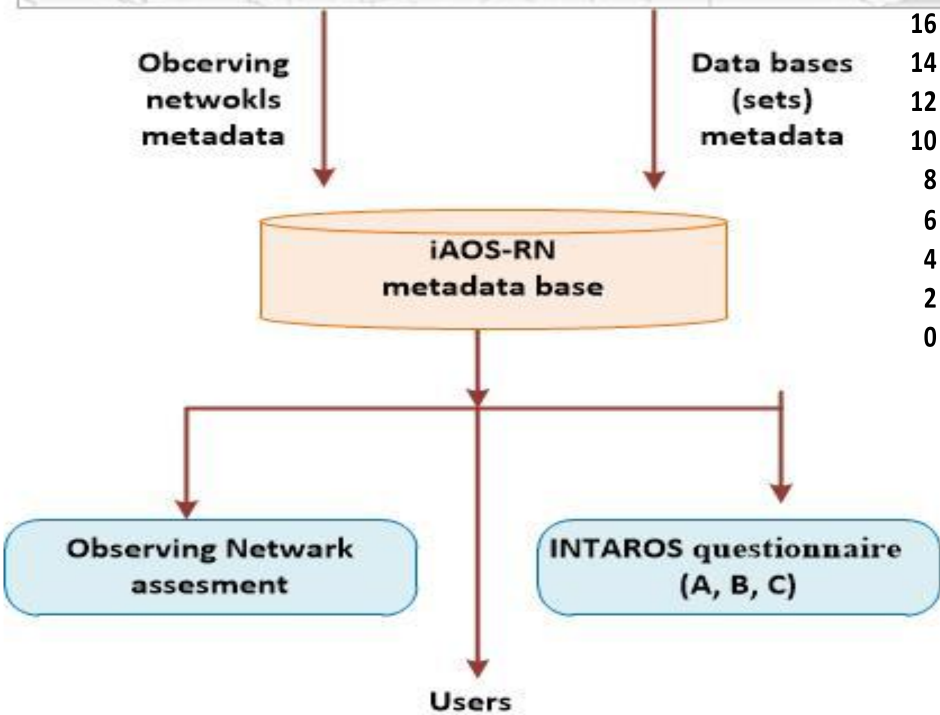
All-Russian Research Institute of Hydrometeorological Information - World Data Center (RIHMI-WDC)

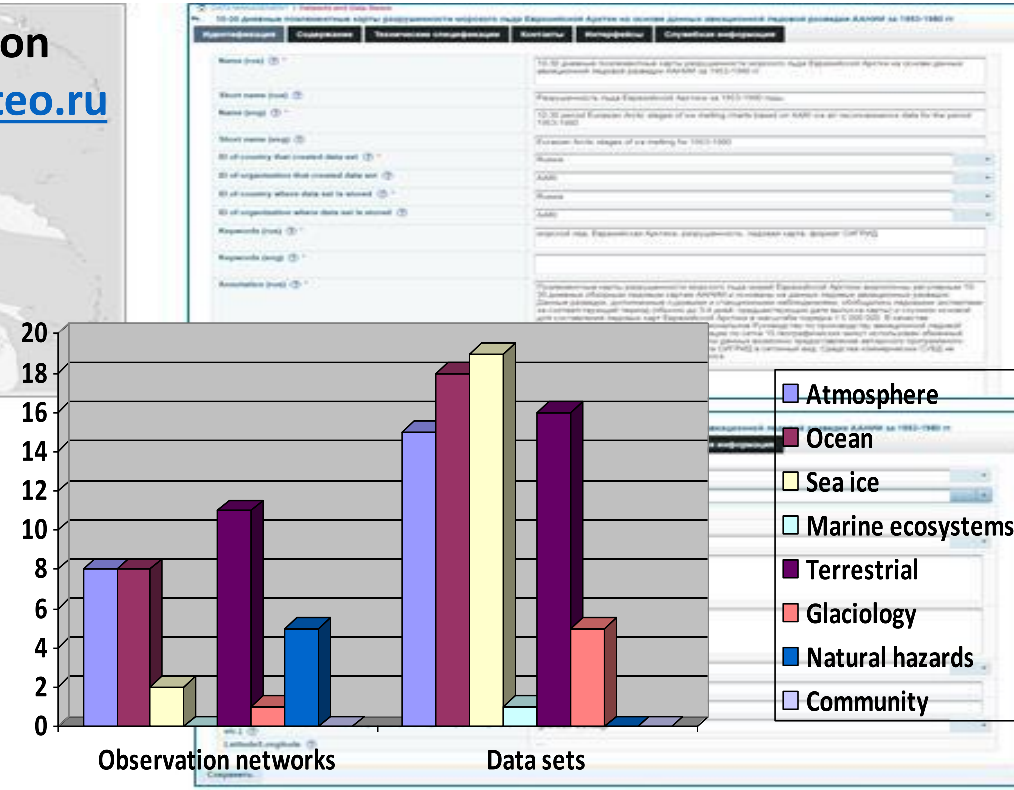
Arctic Regional Climate Center

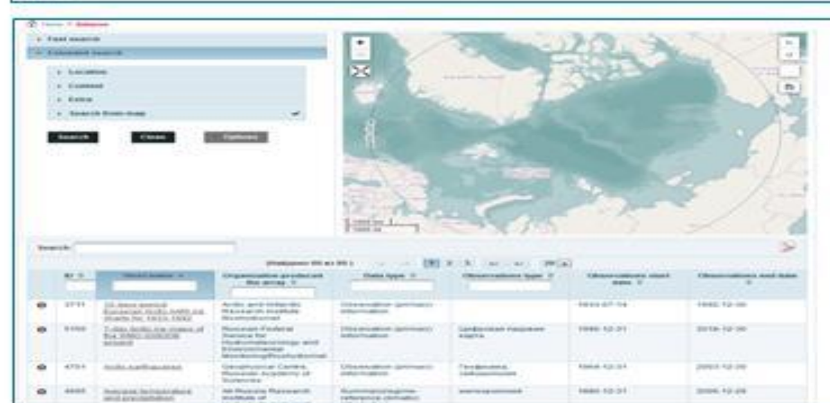
Assessment of Russian observing systems and databases

http://portal.intaros.meteo.ru/portal/intaros/meta



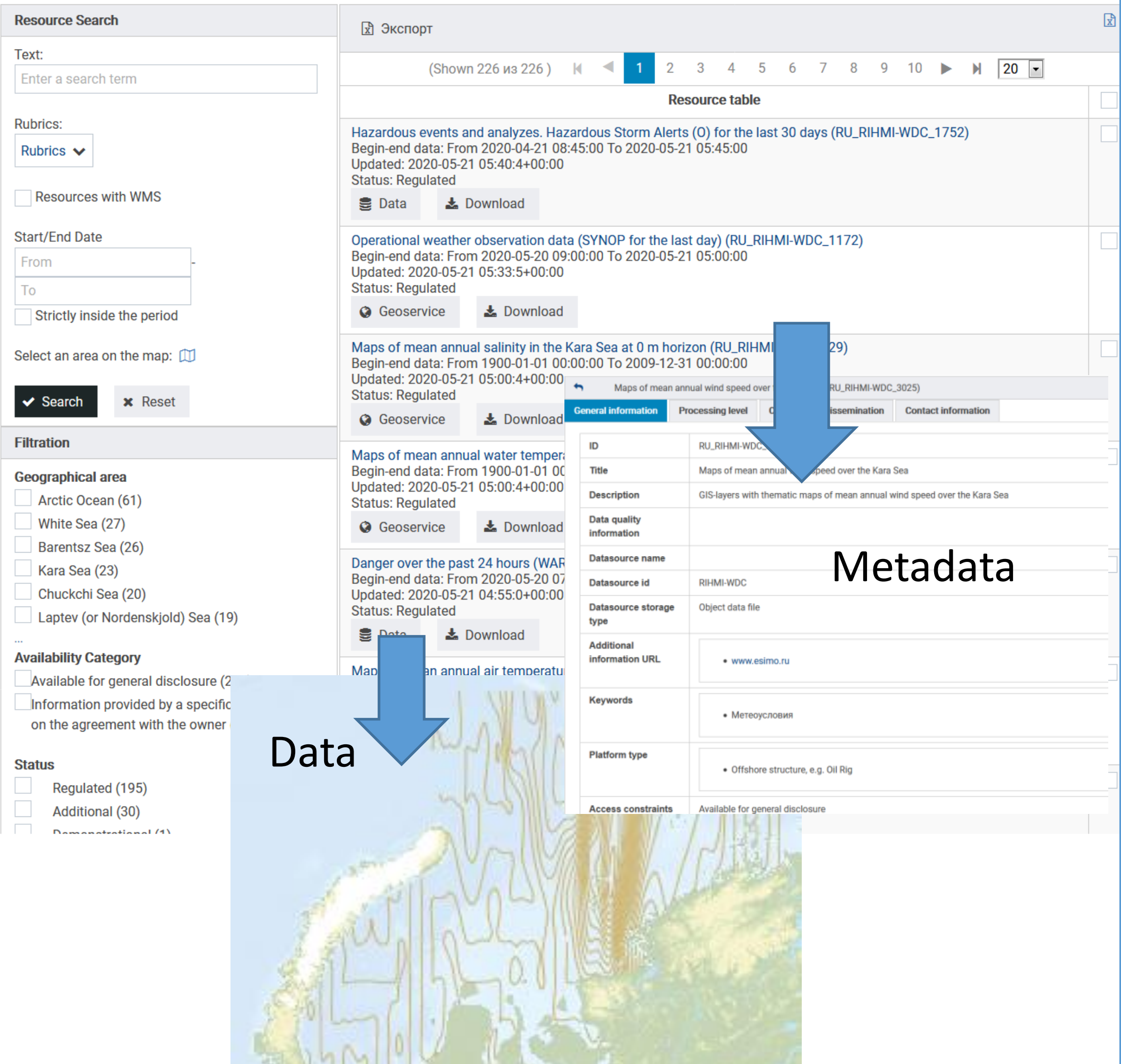






Integration of multidisciplinary, distributed and heterogeneous databases within iAOS-Russian Node

http://portal.intaros.meteo.ru/portal/intaros/data



Short information:

Total - 226 information resources

RIHMI-WDC	- 165
AARI	- 59
Nansen Centre	-2

Rubric

Meteo	- 112
Data for river	- 63
Hydrochemistry	- 24
Ice	- 24

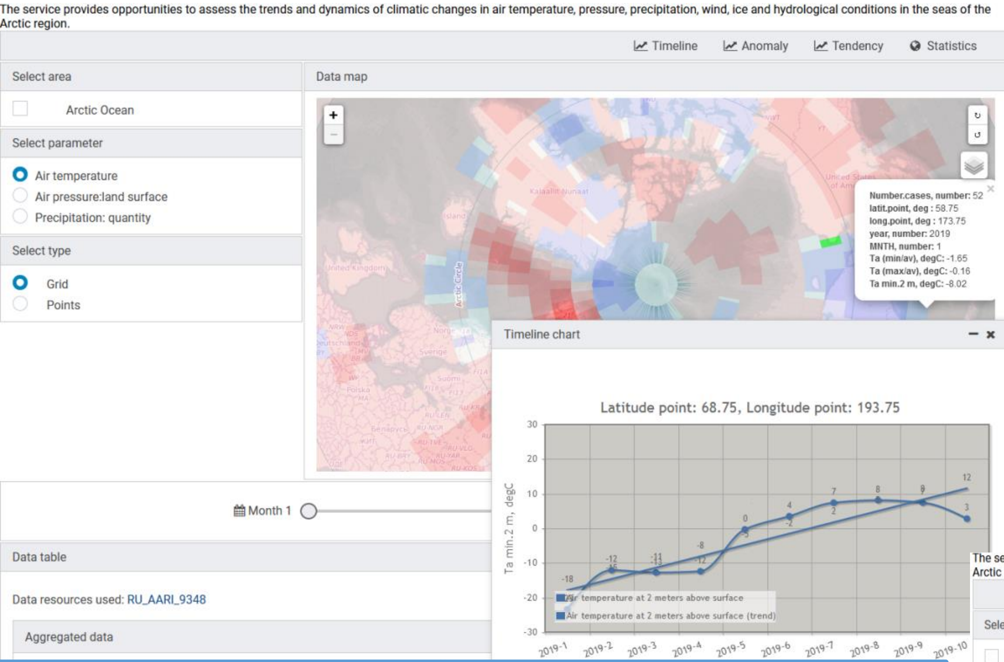
Function:

- integration data
- metadata access
- search information resources
- data access
- data exchange
- data delivery to ftp or e-mail
- visualization data (map, graphic, table)

Link for "Data Access" is on ArcRCC site https://arctic-rcc.org

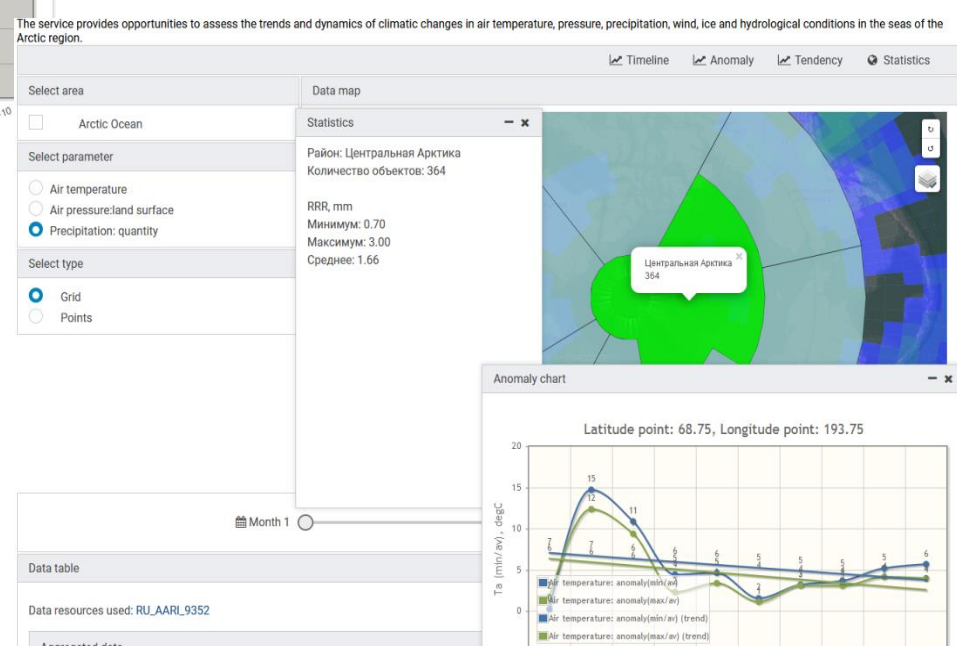
iAOS applications for information support of marine activities in the Arctic

http://portal.intaros.meteo.ru/portal/intaros/services/climate_monitoring



Applied tasks:

- Disasters and support decision
- Assessment of climate
- Monitoring of climate
- Support of Long-Range forecasts
- Hydrometeorological support of transport operations



Functions:

- Configuring information resources, portlets, tools, geo-area, parameters for applied tasks
- Calculation of anomalies, trends, rank, extrema, statistical characteristics by macro-regions
- Data visualization (map, graph, table)
- Preparation of materials for the report

Thank you for your attention !

INTegrated ARctic Observing System (INTAROS)

EC HORIZON 2020-BG-09-2016

Agreement between Ministry of Education and Science of Russia and RIHMI-WDC № RFMEFI61618X0103

Participants of project:

- All-Russian Research Institute of Hydrometeorological Information - World Data Center (RIHMI-WDC)
- Arctic and Antarctic Institute (AARI)
- Nansen International Environmental Remote Sensing Center (NIERSC)

On-line discussion with end-users on seasonal summary

✓ **Shanna Combley**

Possible themes - points for discussion (using CHAT function raise your hand or ask a question):

✓ Is the content of the summary appropriate (details, variable) ?

✓ What parameters are missing ?

✓ What regions are missing ?

✓ Any other ?

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Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canada

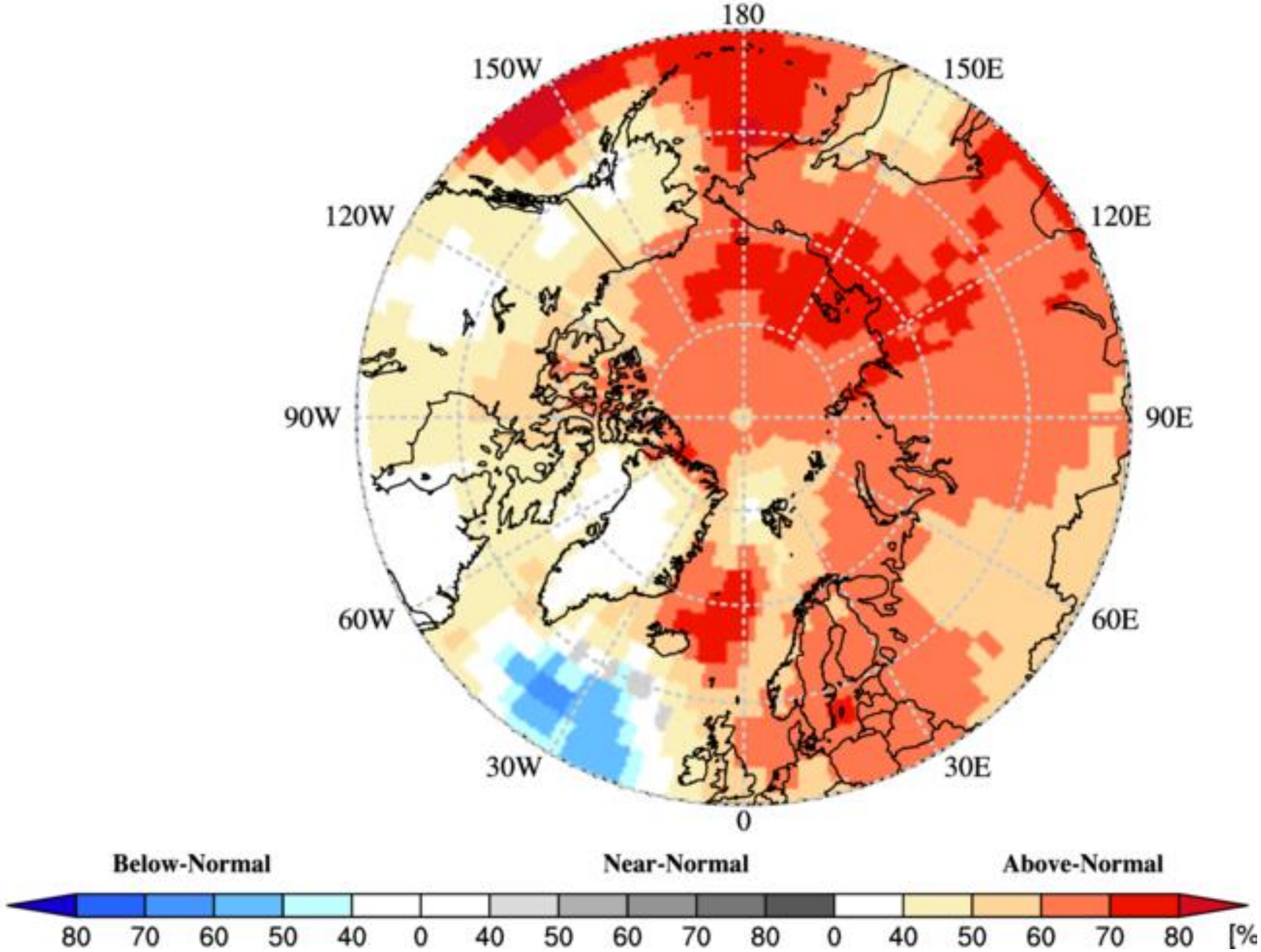
ACF - 5: Verification of the FMA2020 season
ACF - 5: Seasonal forecast for the JJA2020 season

Marko Markovic
Meteorological Service of Canada

WMO

Seasonal forecast over the Arctic, Feb-March-April 2020

A reminder

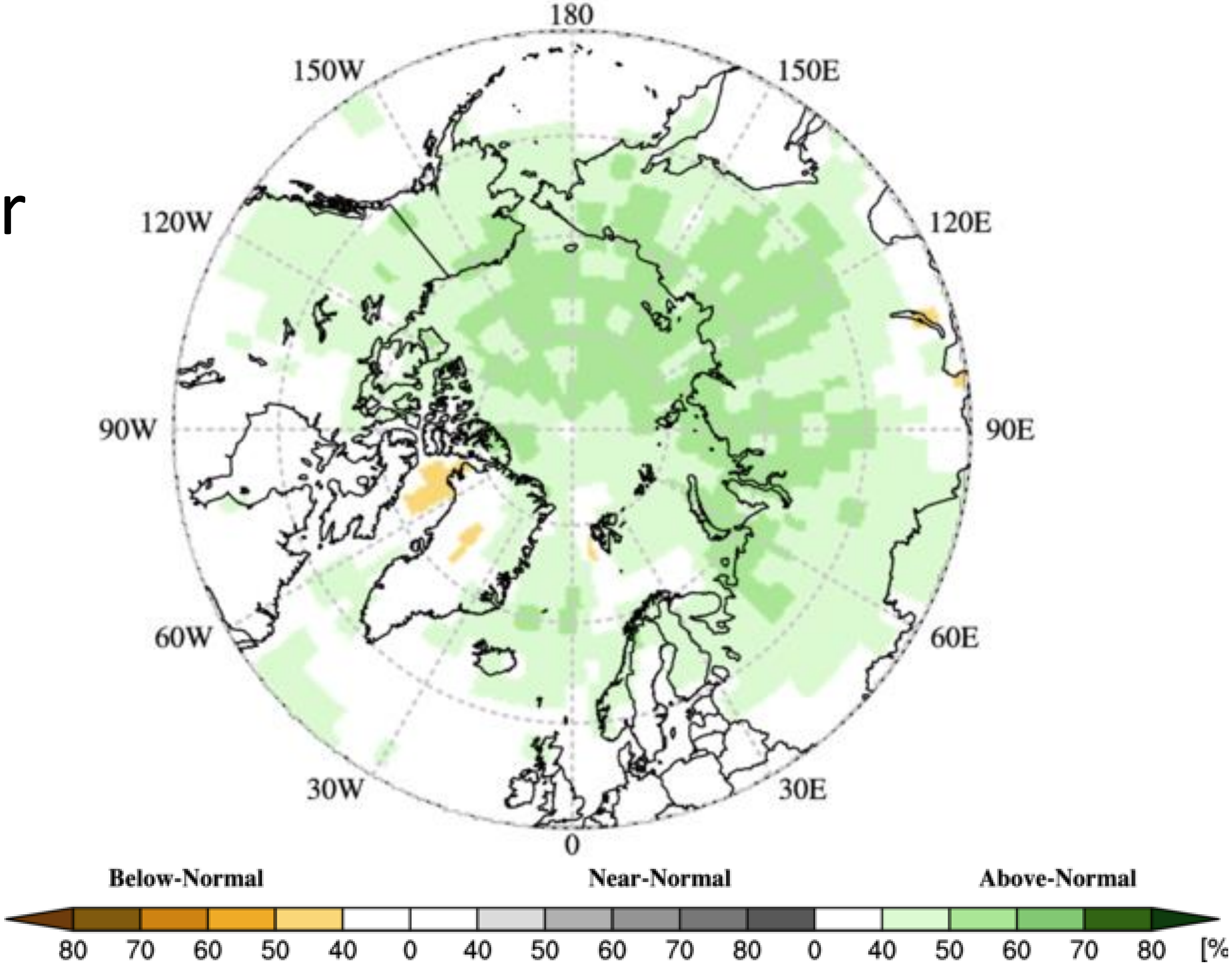


Considering multi-model ensemble forecast and a limited model skill over the Arctic:

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. Same above normal probabilities, but with higher confidence, was forecasted for European, Atlantic, W and E Siberian and Chukchi regions.

Seasonal forecast over the Arctic, Feb-March-April 2020

A reminder



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

Precipitation: Mostly equal chances were expected over eastern Canada and and some parts of Atlantic region (mostly Greenland). Over other Arctic regions, above normal precipitation probabilities were expected with ~40% chance.

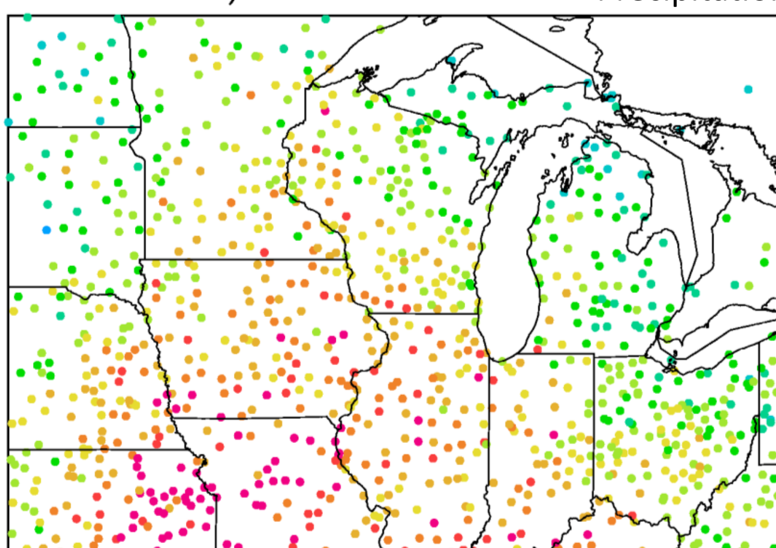
How do we verify seasonal forecasts?

- 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**.

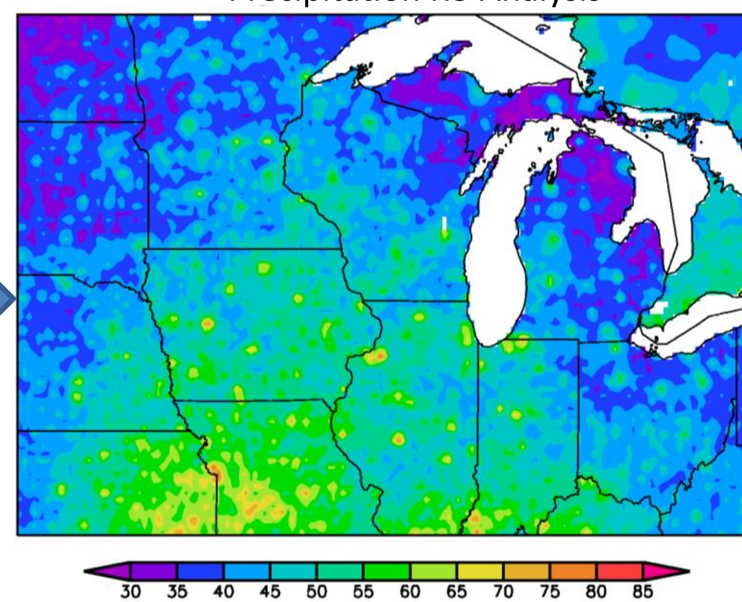
2) station observations Precipitation



Data Assimilation

+ numerical modeling

Precipitation Re-Analysis

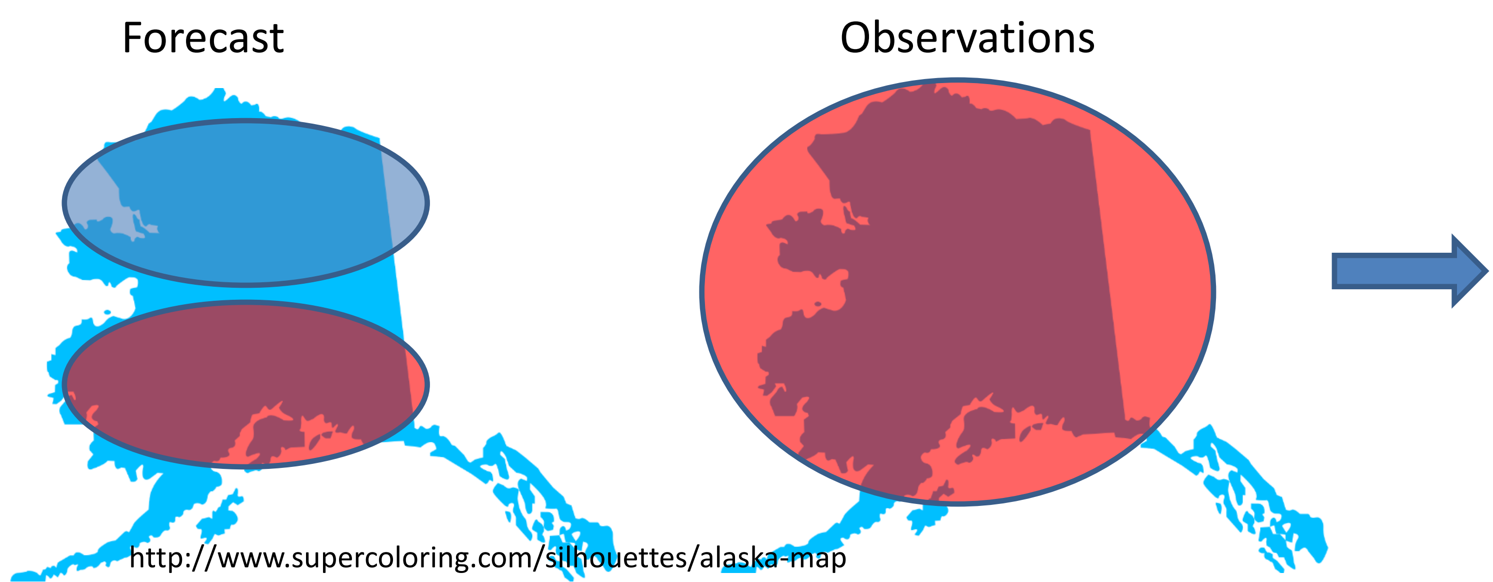


https://dilorenz.github.io/downscaling2/ProbApp/interp.html

How do we verify seasonal forecasts?

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

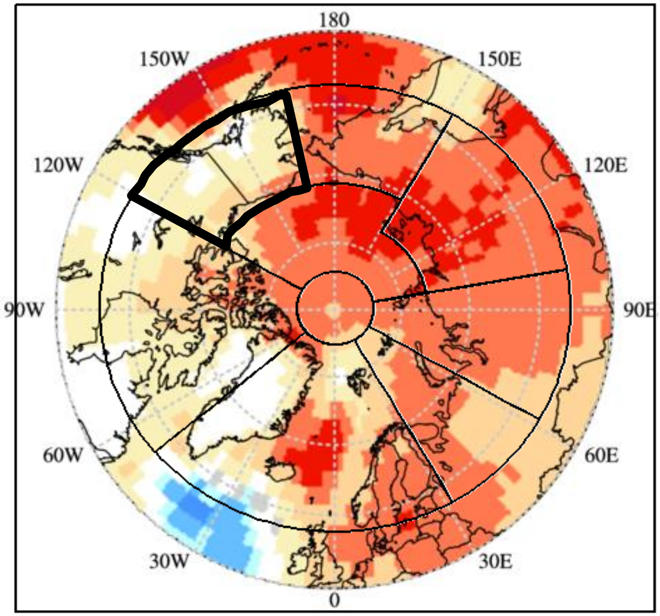
- For the verification over the Arctic we will use a subjective score: a percentage of the correct forecast over a selected region in the Arctic.



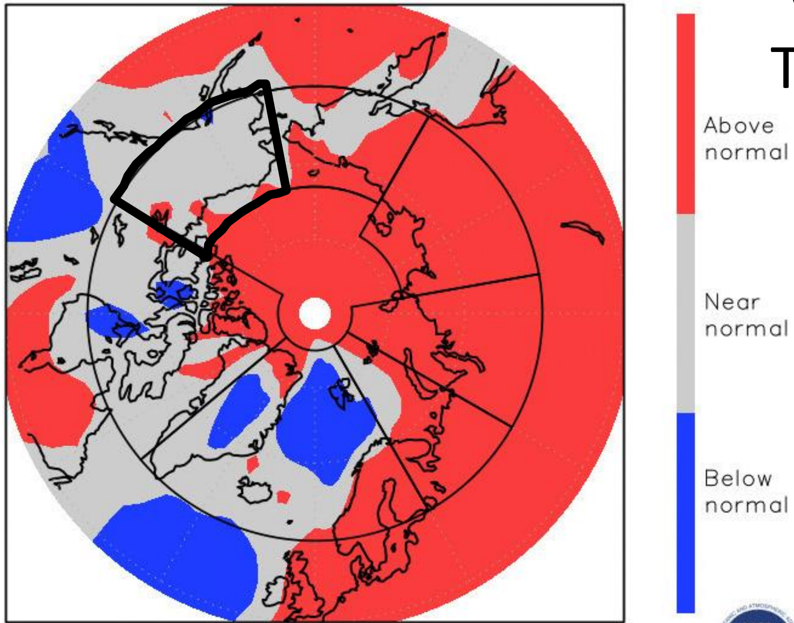
a 50% correct forecast

http://www.supercoloring.com/silhouettes/alaska-map

Forecast, temp FMA 2020



CFSR Reanalysis, Temperature FMA2020

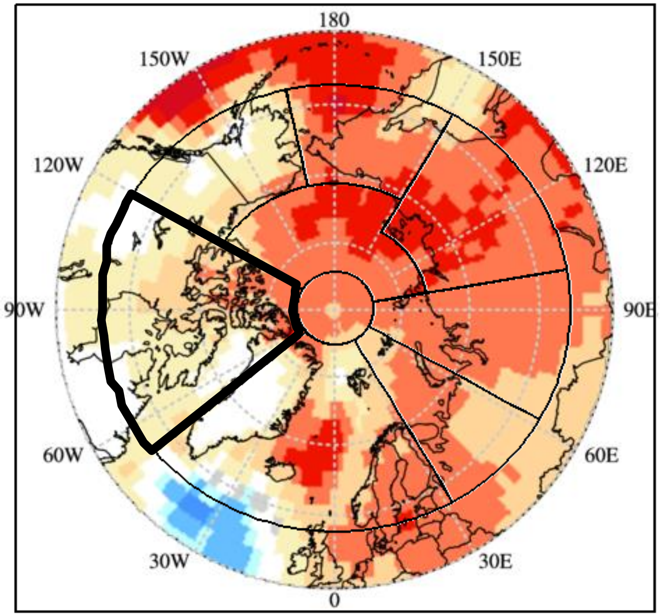


Verification Temperature

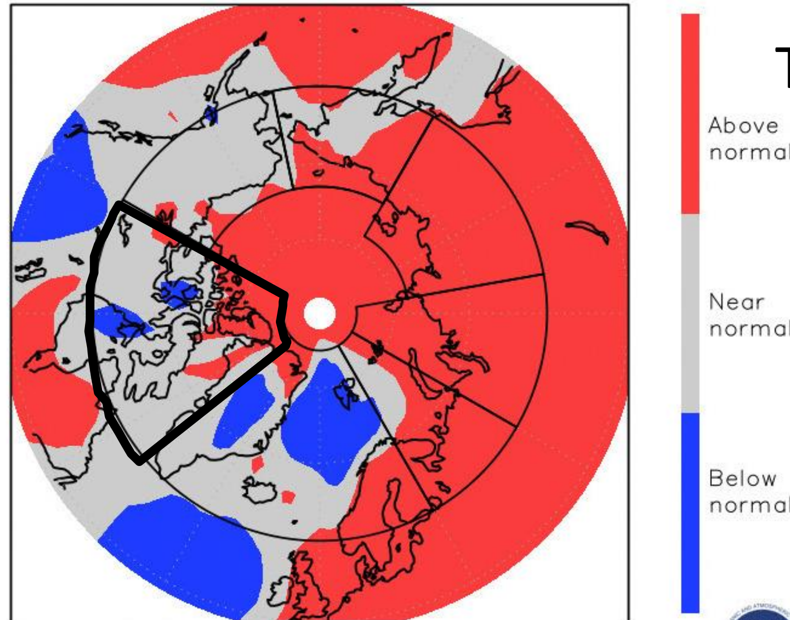
Environment and Climate Change Canada | Environnement et Changement climatique Canada

Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	**Above normal**	**Near normal**	**miss**
E. Canada			
N. Atlantic			
European			
W. Siberia			
E. Siberia			
Chukchi			

Forecast, temp FMA 2020



CFSR Reanalysis, Temperature FMA2020

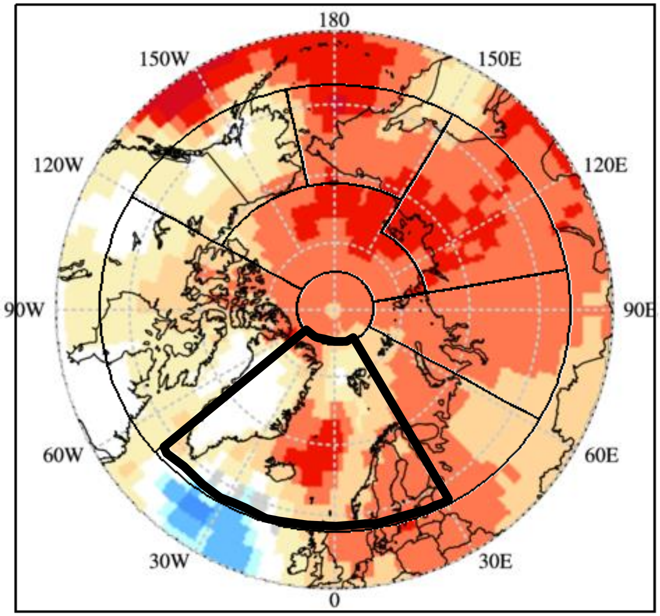


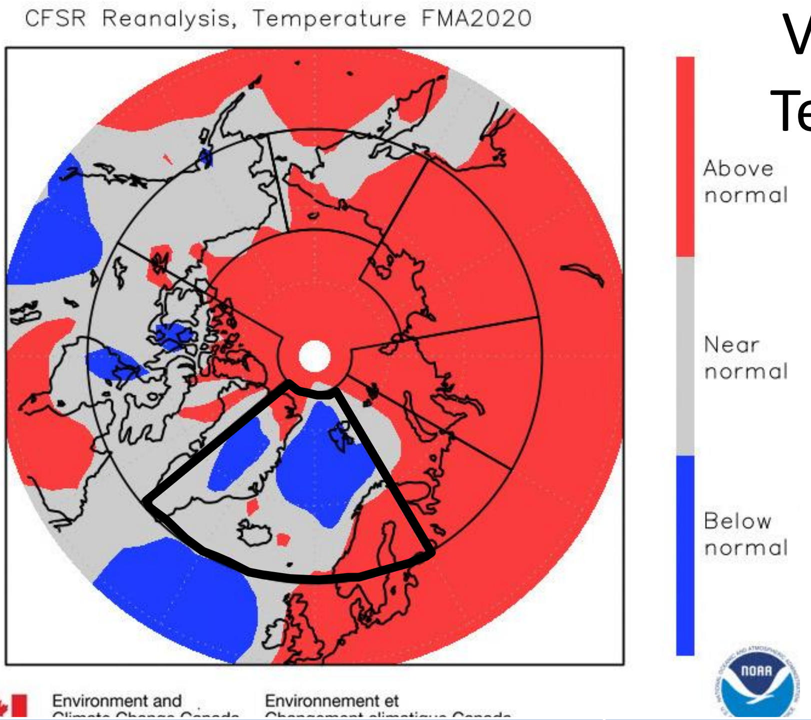
Verification Temperature

Environment and Climate Change Canada
Environnement et Changement climatique Canada

Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above normal	Near normal	miss
E. Canada	**Mostly above normal**	**Mostly near normal**	**miss**
N. Atlantic			
European			
W. Siberia			
E. Siberia			
Chukchi			

Forecast, temp FMA 2020



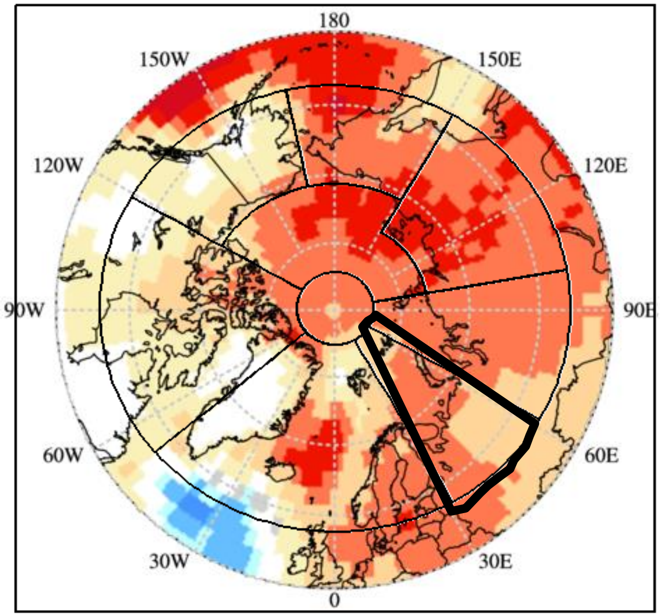


Verification Temperature

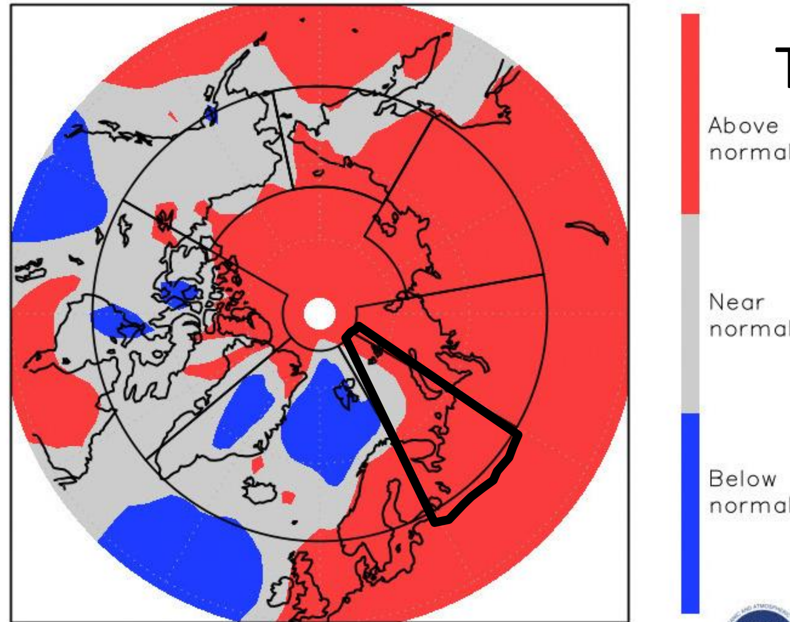
Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above normal	Near normal	miss
E. Canada	Mostly above normal	Mostly near normal	miss
N. Atlantic	**Equal chance over east, above normal over Scand. and Island**	**Above over Scandinavia, near norm over Island**	**30% hit, 70miss**
European			
W. Siberia			
E. Siberia			
Chukchi			

Verification Temperature

Forecast, temp FMA 2020



CFSR Reanalysis, Temperature FMA2020

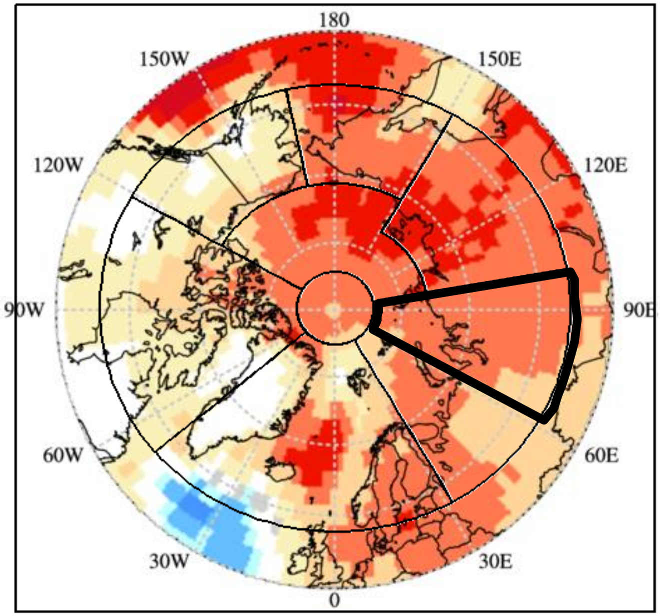


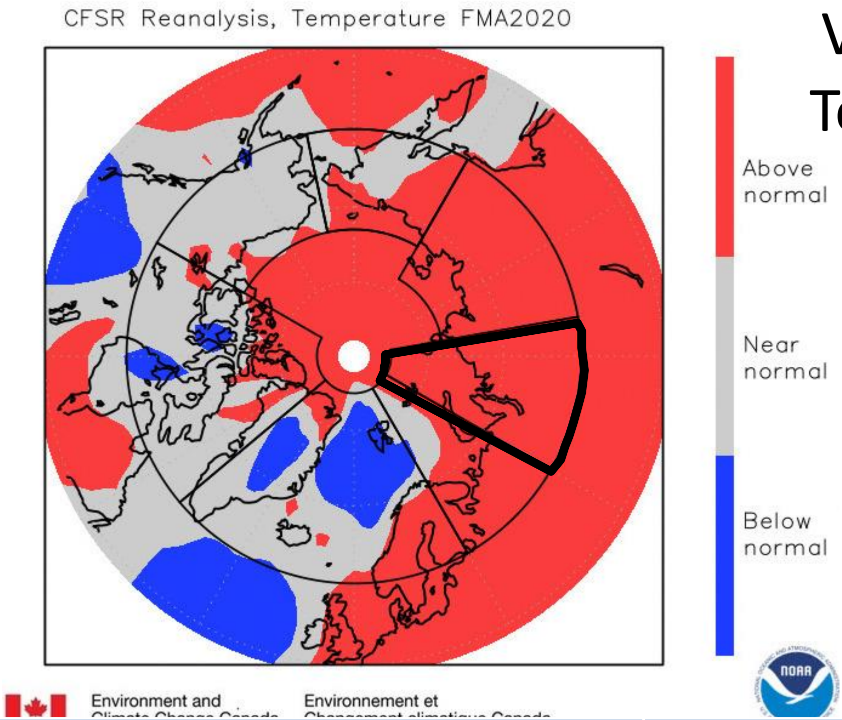
Environment and
Environnement et

Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above normal	Near normal	miss
E. Canada	Mostly above normal	Mostly near normal	miss
N. Atlantic	Equal chance over east, above normal over Scand. and Island	Above over Scandinavia, near norm over Island	30% hit, 70miss
European	**Above normal**	**Above normal**	**hit**
W. Siberia			
E. Siberia			
Chukchi			

Verification Temperature

Forecast, temp FMA 2020

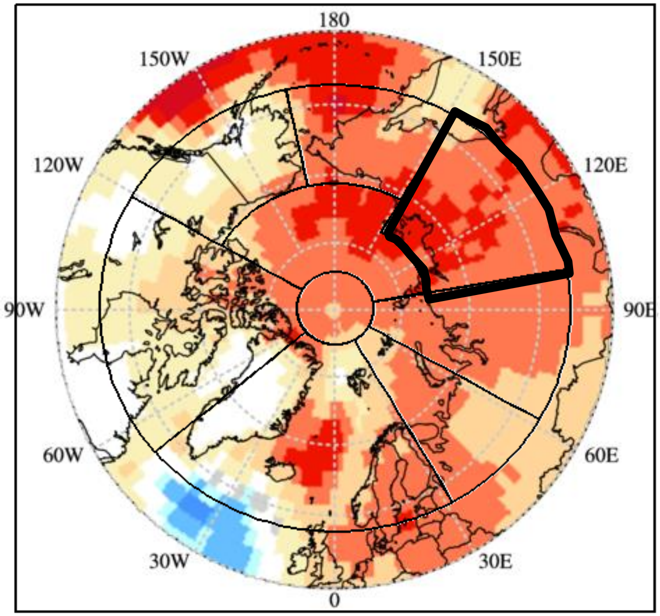


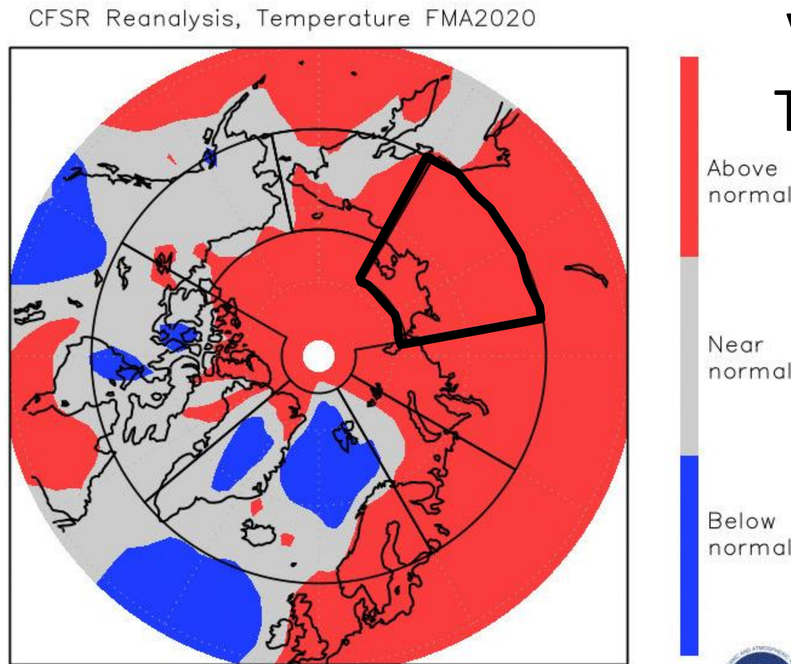


Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above normal	Near normal	miss
E. Canada	Mostly above normal	Mostly near normal	miss
N. Atlantic	Equal chance over east, above normal over Scand. and Island	Above over Scandinavia, near norm over Island	30% hit, 70miss
European	Above normal	Above normal	hit
W. Siberia	**Above normal**	**Above normal**	**hit**
E. Siberia			
Chukchi			

Verification Temperature

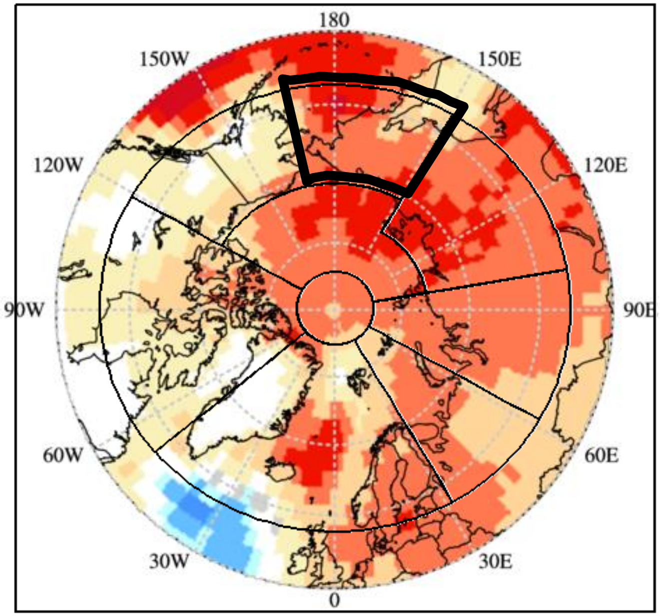
Forecast, temp FMA 2020

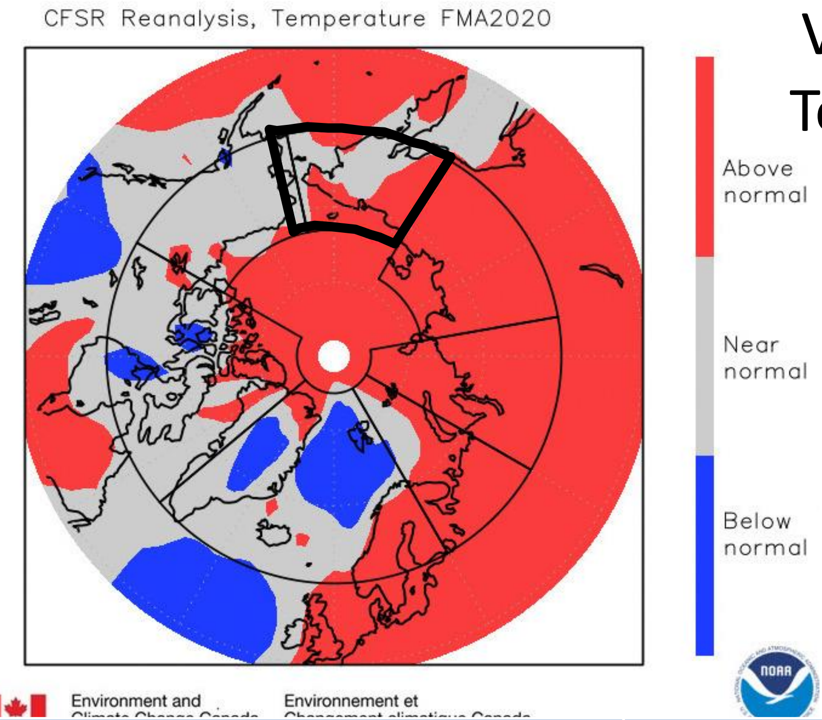




Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above normal	Near normal	miss
E. Canada	Mostly above normal	Mostly near normal	miss
N. Atlantic	Equal chance over east, above normal over Scand. and Island	Above over Scandinavia, near norm over Island	30% hit, 70miss
European	Above normal	Above normal	hit
W. Siberia	Above normal	Above normal	hit
E. Siberia	**Above normal**	**Above normal**	**hit**
Chukchi			

Forecast, temp FMA 2020

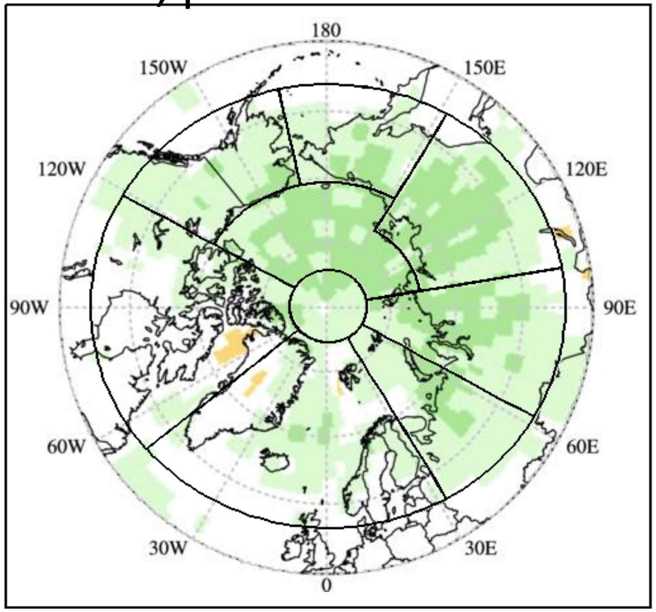




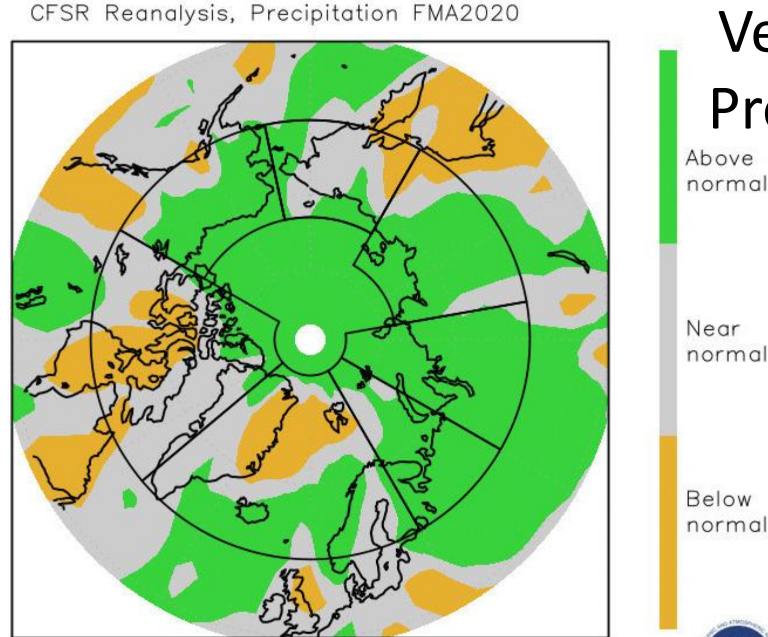
Verification Temperature

Verif:	Forecast	CFS Reanalysis	Subj. Result
Alaska, W. Can	Above normal	Near normal	miss
E. Canada	Mostly above normal	Mostly near normal	miss
N. Atlantic	Equal chance over east, above normal over Scand. and Island	Above over Scandinavia, near norm over Island	30% hit, 70miss
European	Above normal	Above normal	hit
W. Siberia	Above normal	Above normal	hit
E. Siberia	Above normal	Above normal	hit
Chukchi	**Above normal**	**Above normal, near normal**	**50% hit/miss**

Forecast, prec FMA 2020



Verification Precipitation



Environment and Climate Change Canada / Environnement et Changement climatique Canada

Verif:	Forecast FMA	CFS Reanalysis	Subj. Result
Alaska, W. Can	Mostly above	Mostly above	80% hit
E. Canada	Mostly Indecisive	Near normal in the south and west, below in the center	%
N. Atlantic	Indecisive, above normal	Above over Island and W and E Scandinavia.	mostly hit where decisive
European	Above	Above	hit
W. Siberia	Above	Above	hit
E. Siberia	Above	Above	hit
Chukchi	Above	Mostly near normal	Mostly miss

Overall result, subjective verification

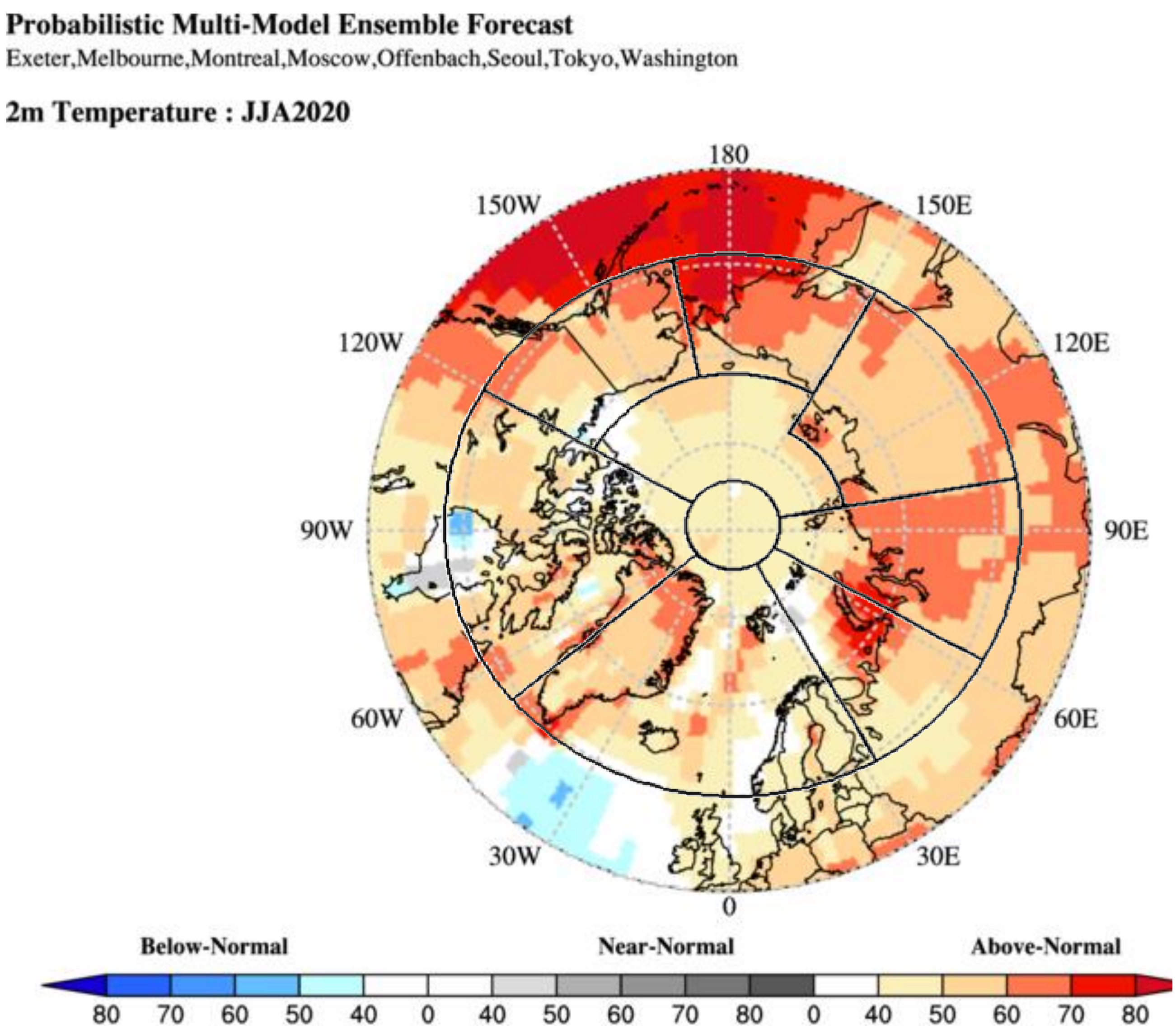
- **Temperature**: In the regions where forecast was decisive the subjective score was 50-60%. This is a good score considering that everything below or equal 33% is considered worse than a pure chance.

- **Precipitation**: In the regions where forecast was decisive, the subjective score is ~70%. Very good precipitation forecast for FMA2020!!!
- Precipitation forecasts are usually not this skilful over the Arctic, the chance was on our side this time!!

Actual (real time)seasonal forecasts over the Arctic JJA-2020

- temperature
- precipitation

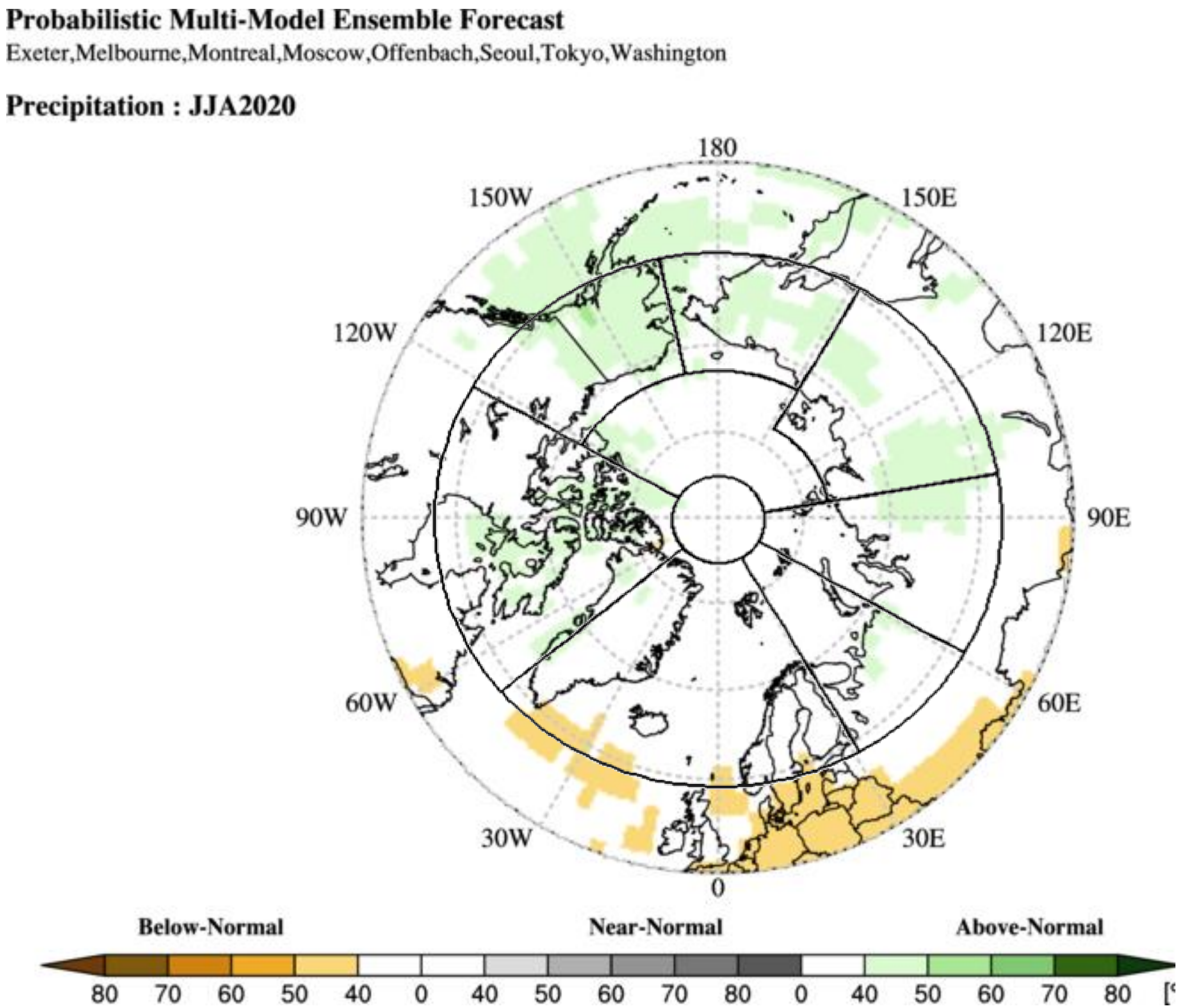
Temperature outlook over the Arctic: Jun-July-August 2020



1. Alaska W. Canada
2. Eastern Canadian Arctic
3. N. Atlantic region
4. European region
5. West Siberia
6. East Siberia
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: Jun-July-August 2020

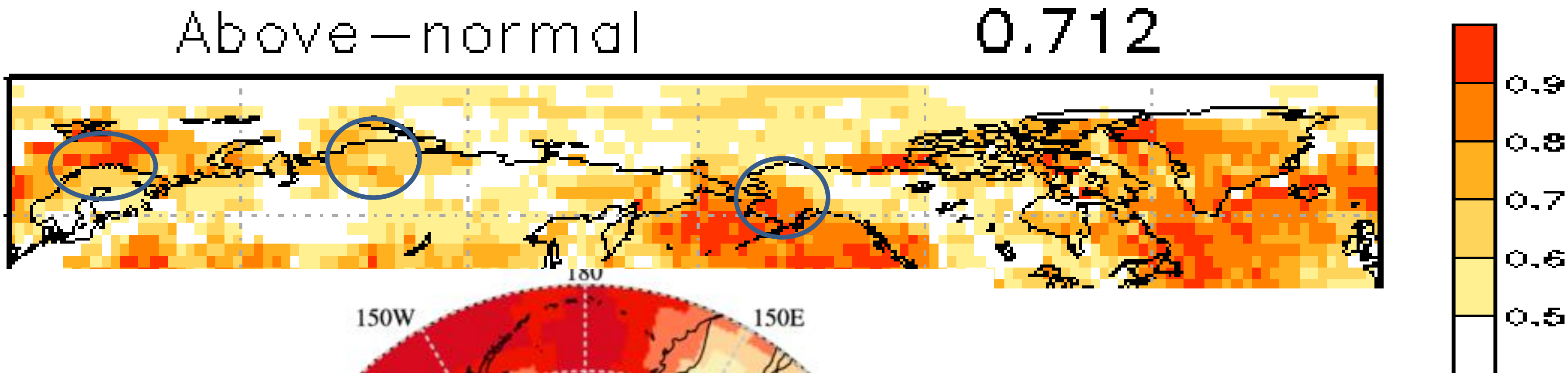


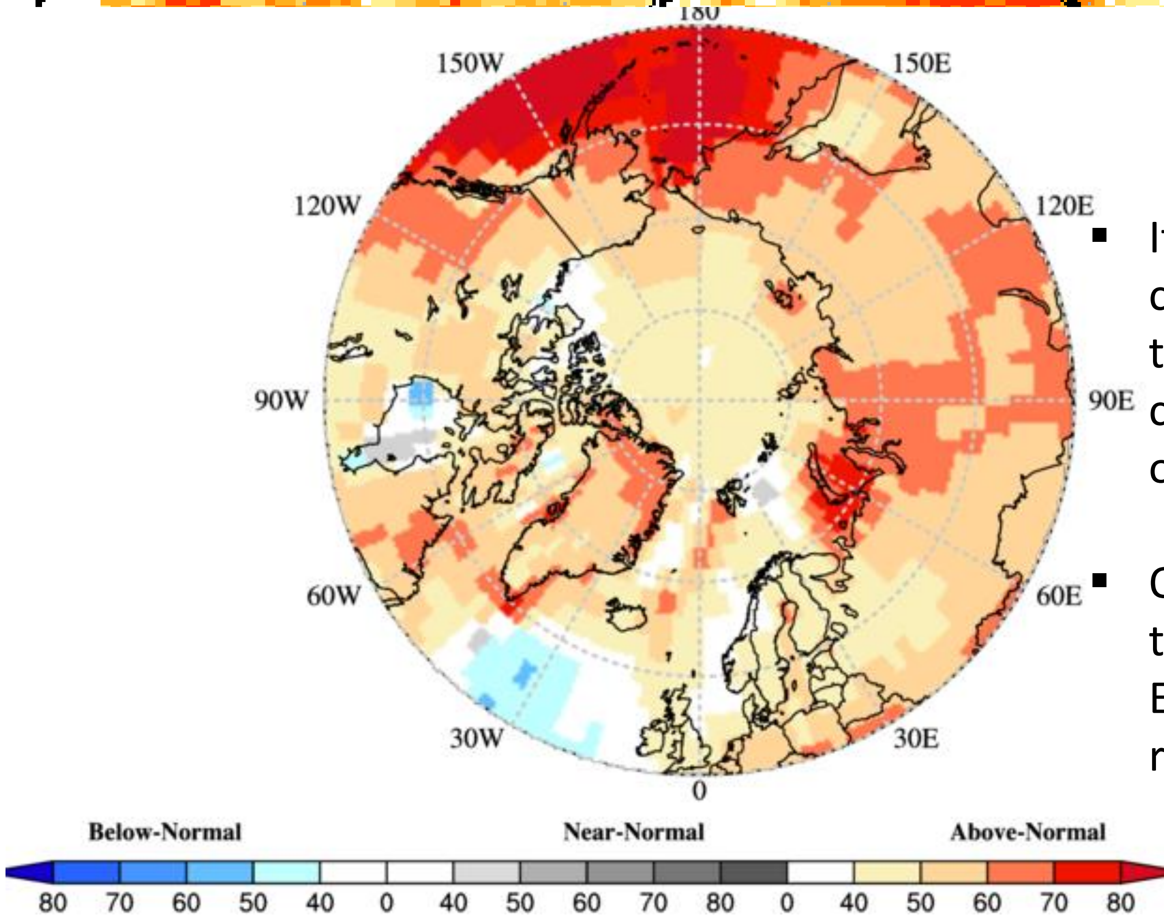
1. Alaska W. Canada
2. Eastern Canadian Arctic
3. N. Atlantic region
4. European region
5. West Siberia
6. East Siberia
7. Chukchi

- 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)



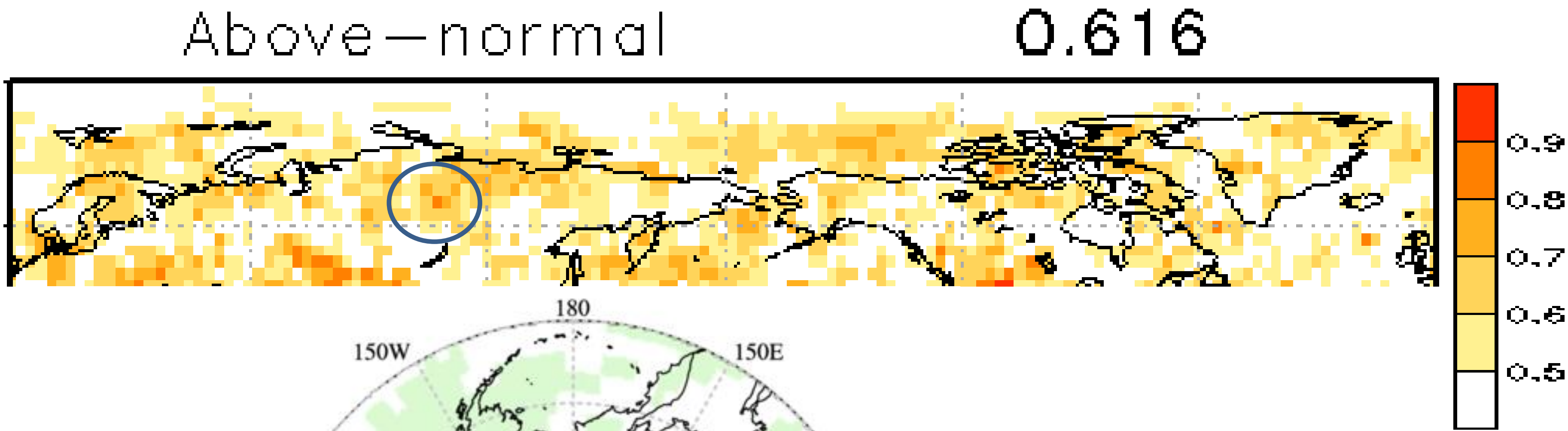


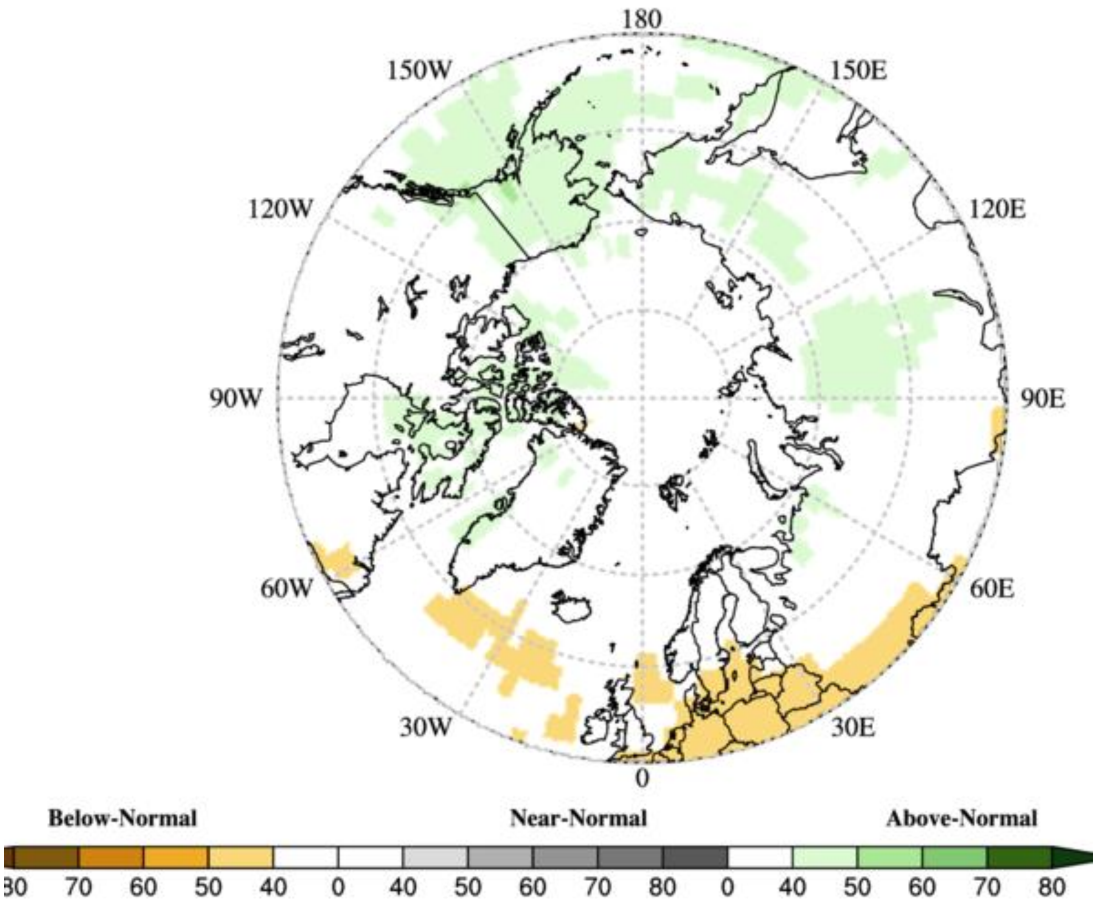
- If a historical skill was good over a certain region (e.g. colored region on the upper figure) we are more confident about the forecast results over the same region

- Overall confidence is weak in JJA over the Arctic with the exception of the European (Scandinavia), East Siberian region and south Alaska.

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 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.
- FMA2020 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 all Arctic regions in JJA2020.
- We expect above normal precipitation over the Alaskan Arctic, Chukchi, East Siberian and west Siberian region. Other Arctic regions mostly have equal chances for precipitation except Canadian Archipelago where we expect above normal precipitation in JJA20. **Historically, we do not have a high confidence in precipitation forecast over the Arctic in JJA**.

Thank you!

On-line discussion with end-users on seasonal SAT and Prec outlook

ACF
Arctic Climate Forum

✓ Valentina Khan

1. Until now, consensus statement provides outlook for the upcoming season for precipitation, surface air temperature and sea-ice break-up and minimum Ice extent in September.
Additional parameters in the outlook can be included to meet the user needs.
Beyond precipitation, surface air temperature and sea-ice characteristics, which meteorological parameters are of primary interest?
(Zonal and meridional components of the wind, snow cover depth, snow water equivalent, mean sea level pressure, others?)

2. Climate extremes such as cold waves, long-lasting excessive precipitation, etc. may negatively impact on everyday life and economy/ What kind of extreme climate events cause major risk and hazards in your activity sector?

Environment and Climate Change Canada / Environnement et Changement climatique Canada

Canada

Review of 2019/20 Winter Sea-Ice Outlook
Present the 2020 Summer Sea-Ice Outlook

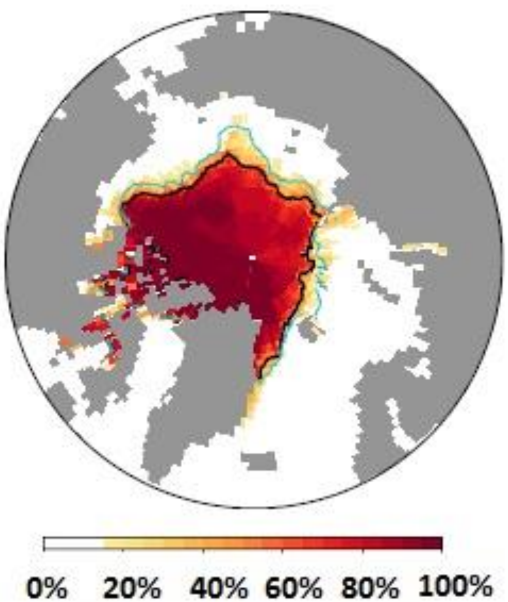
Scott Weese and Katherine Wilson
Canadian Ice Service

WMO

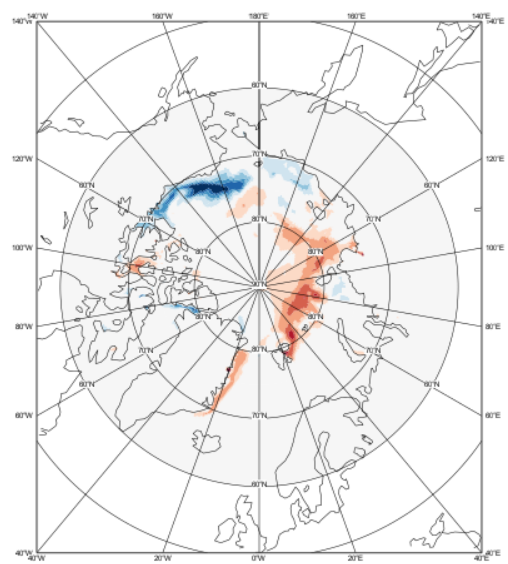
Models used for the ArcRCC Sea-Ice Outlooks

- **Based on 4 experimental forecasts from 4 WMO Global Producing Centers Output:** France - ECMWF, United States- NOAA/CPC, Canada - ECCC/CCCMA and the UKMetOffice, 3 shown below)
- **Experts at the ArcRCC compare these models, so you don't have to, and develop products for users.**

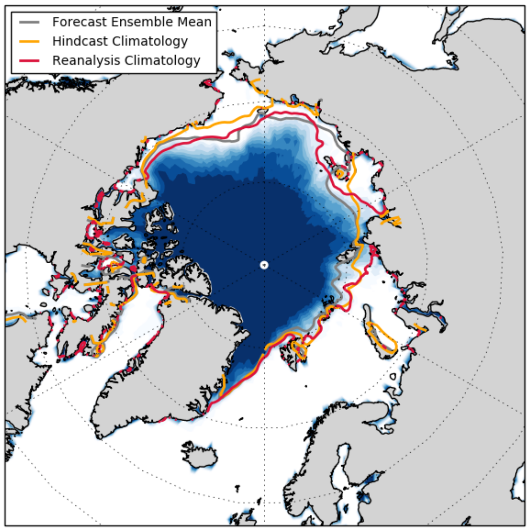
Probability of Sea Ice > 15%
September 2018
ECCC (CanCM3+CanCM4)



Sea Ice Concentration Anomaly
September 2019
ECMWF (SEAS5)

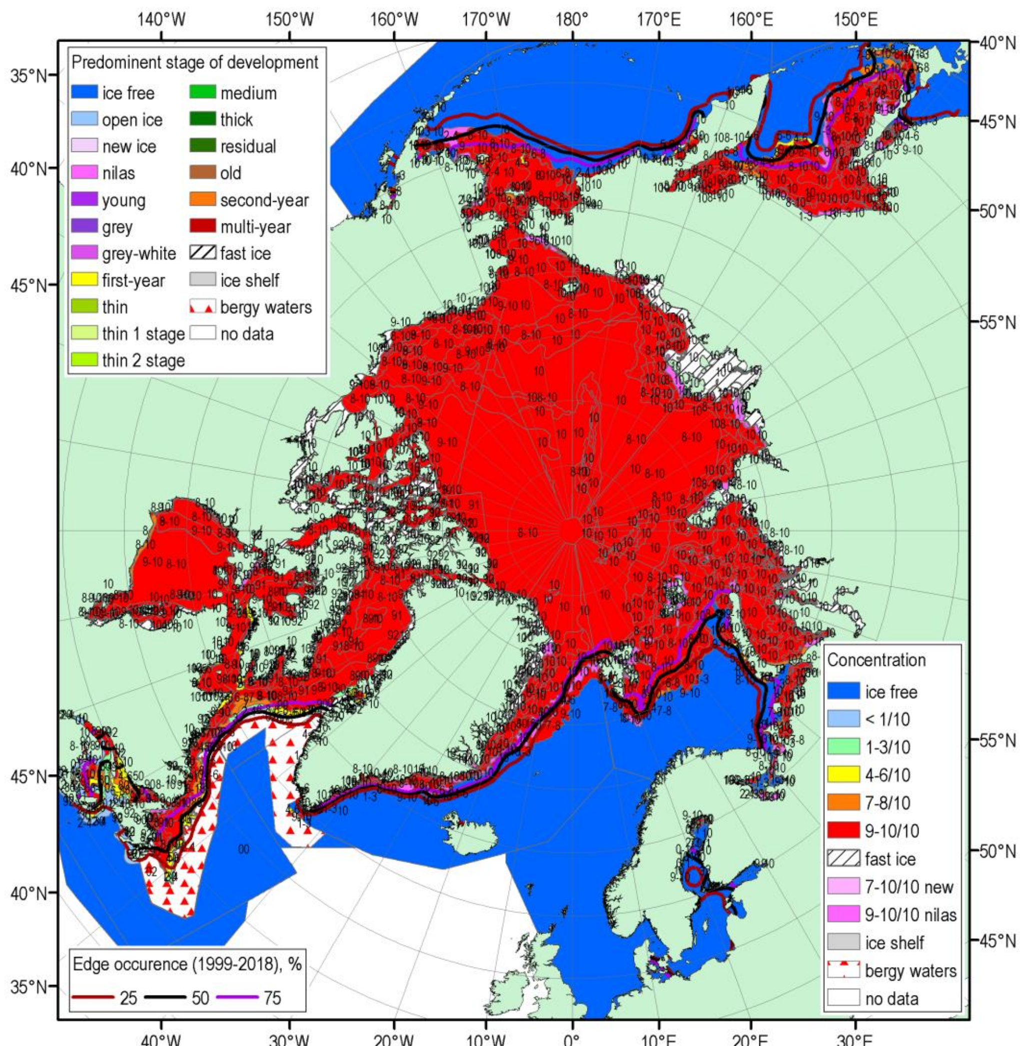


Probability of Sea Ice > 15%
September 2019
UK Met Office (GloSea5)



Review of 2019/20 Winter Arctic sea-ice conditions

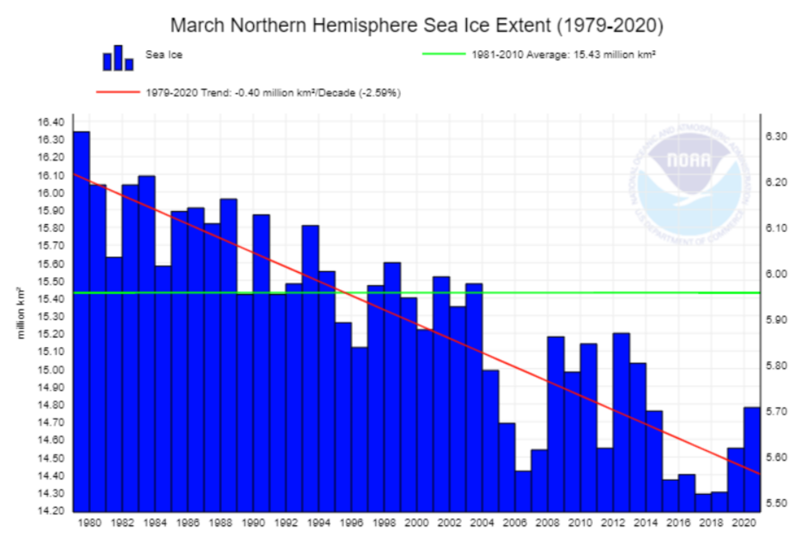
Actual March 2020 Maximum Sea-Ice Extent



Source: Arctic and Antarctic Research Institute

Left: Blended weekly ice charts for mid-March 2020

Below: March Northern Hemisphere sea ice extent

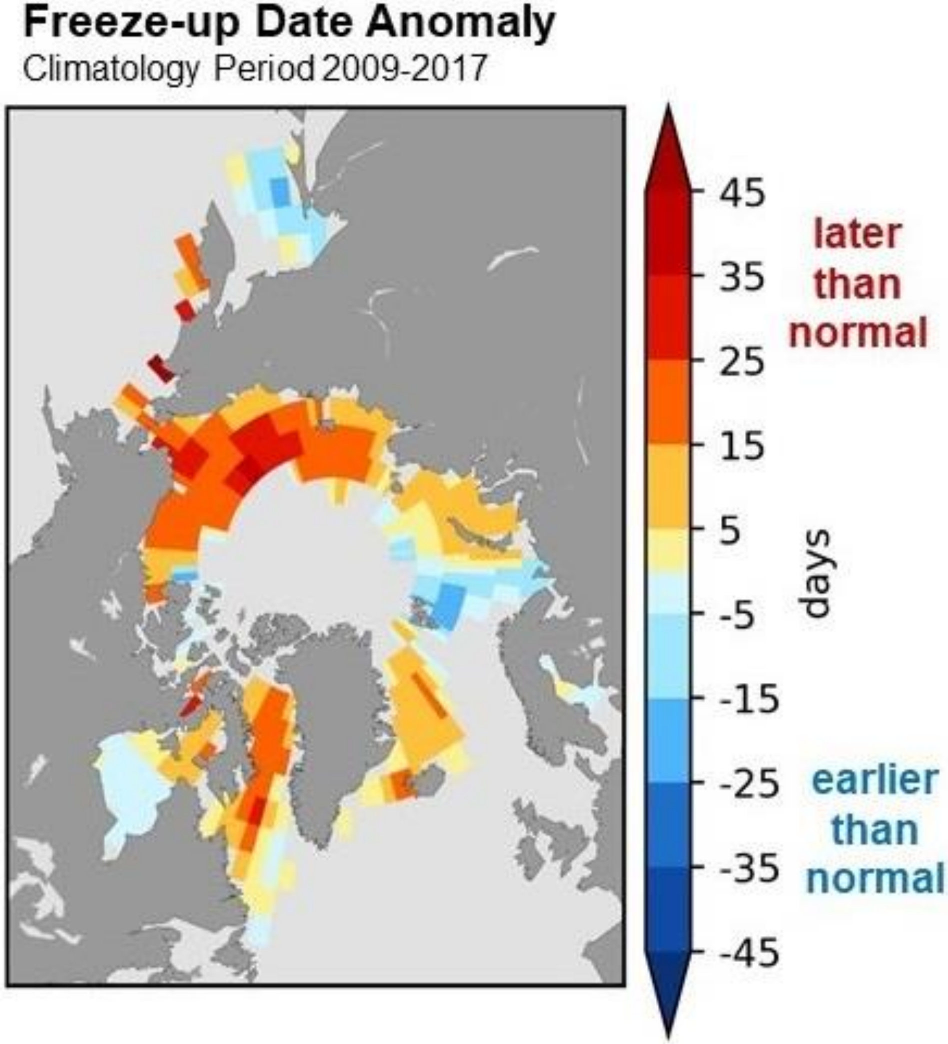


Source: National Snow and Ice Data Center (NSIDC)

Source: National Snow and Ice Data Center

Comparison: Actual Winter 2019/20 Conditions with ArcRCC Sea-Ice Winter 2019/20 Outlook

A. ArcRCC Sea-Ice Freeze-up Outlook 2019 Categories



Source: Canadian Seasonal to Inter-Annual Prediction System (CanSIPS, courtesy ECCC)

What is Normal freeze-up?

- The average date when the ice concentration rises above 50%
- based on climatological period (2009-2017)

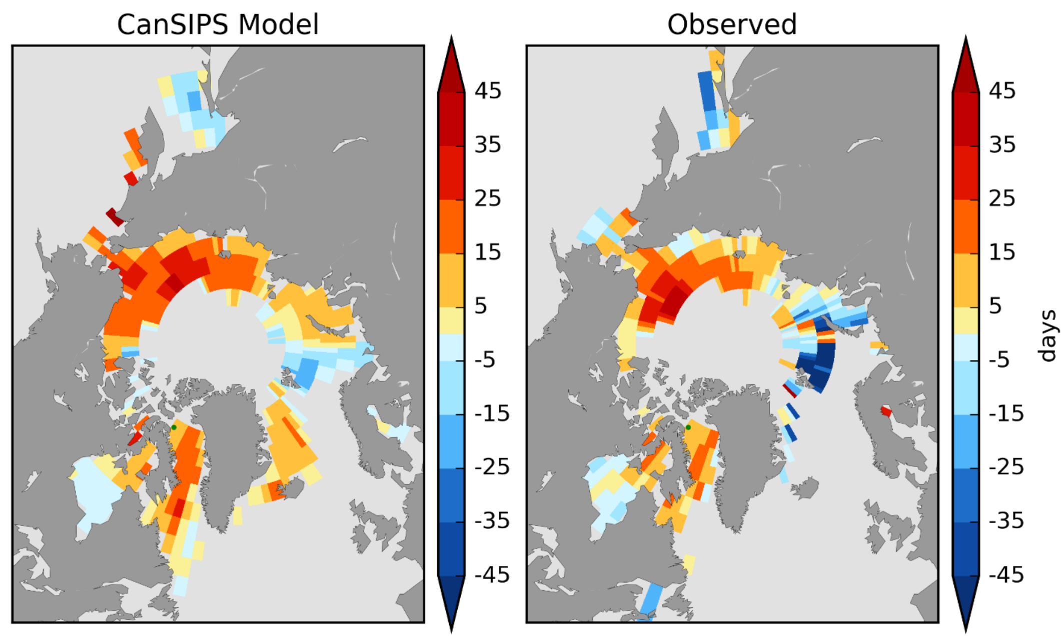
<u>Freeze-Up Categories</u>:

- Late freeze-up
- Near normal freeze-up
- Early freeze-up
- Only regions where the model has historical skill are included in the outlook The freeze-up outlook has three confidence categories; low, moderate and high

A. ArcRCC Sea-Ice Freeze-up Outlook 2019/20

Actual vs. Outlook

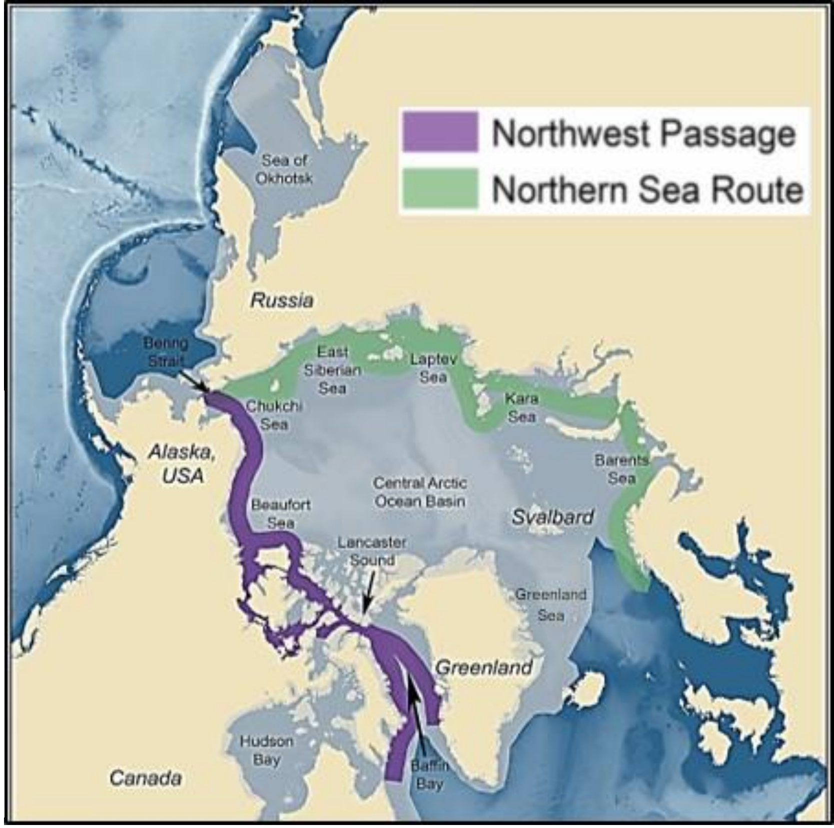
Regions	CanSIPS Sea-Ice Forecast Confidence	CanSIPS Sea-Ice Forecast	Observed Freeze-up	CanSIPS Sea-Ice Forecast Accuracy
Hudson Bay	moderate to high	near normal	late freeze-up	low
Baffin Bay/Labrador Sea	moderate to high	late freeze-up	late freeze-up	high
Greenland Sea	moderate	late freeze-up	near normal to early freeze-up	low
Barents Sea	moderate	early freeze-up	early freeze-up	high
East Siberian/Laptev Seas	moderate to high			
Kara Sea	moderate			
Chukchi Sea	high			
Beaufort Sea	high			
Sea of Okhotsk	low			
Bering Sea	low			



B. ArcRCC Sea-Ice Extent Outlook Winter 2020

Actual vs. Outlook

Maximum = March (Winter)



Forecast Categories:
- Above normal ice extent
- Near normal ice extent
- Below normal ice extent

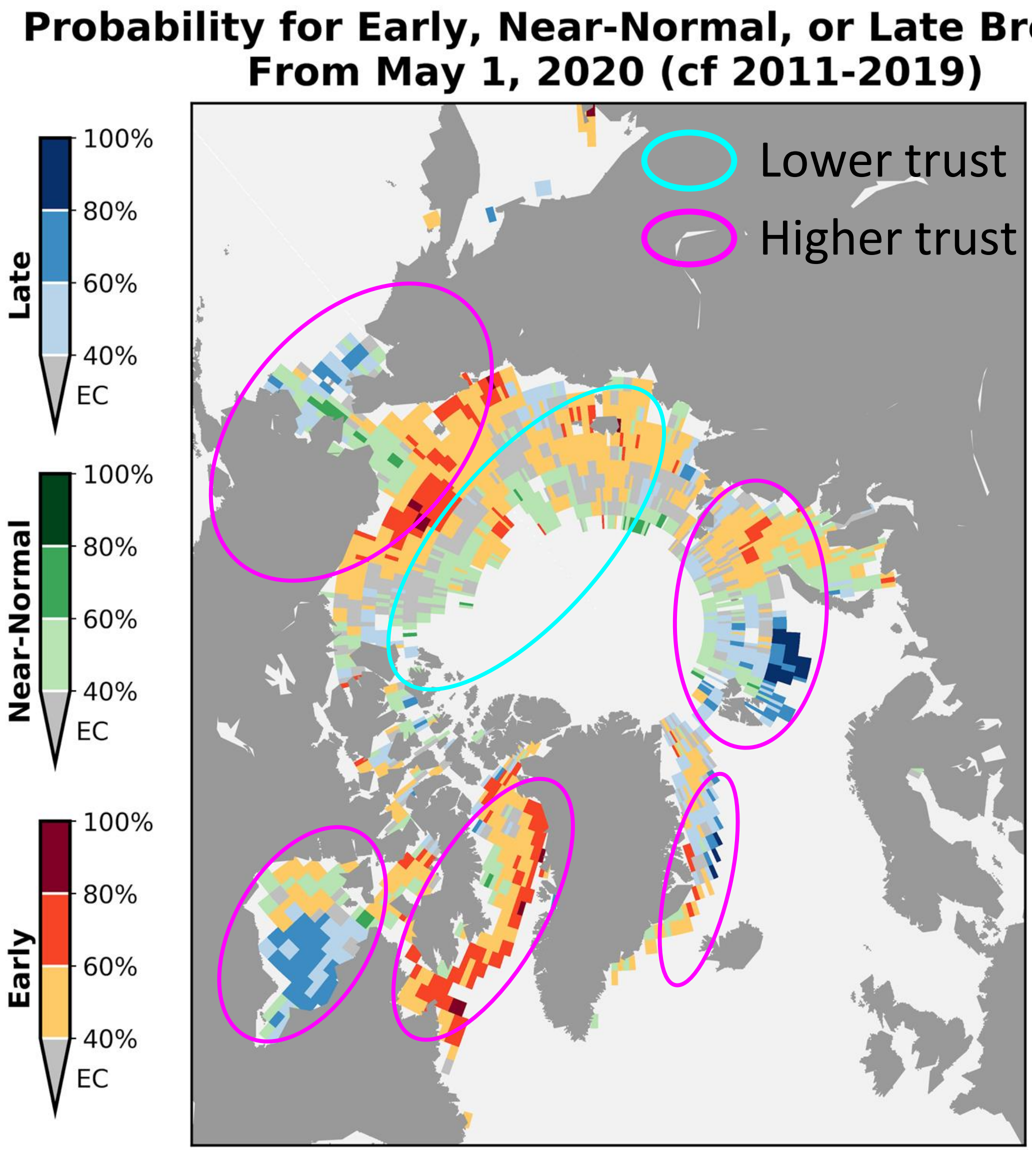
Outlook Confidence Categories
- low agreement between the models
- moderate agreement between models
- high agreement between models

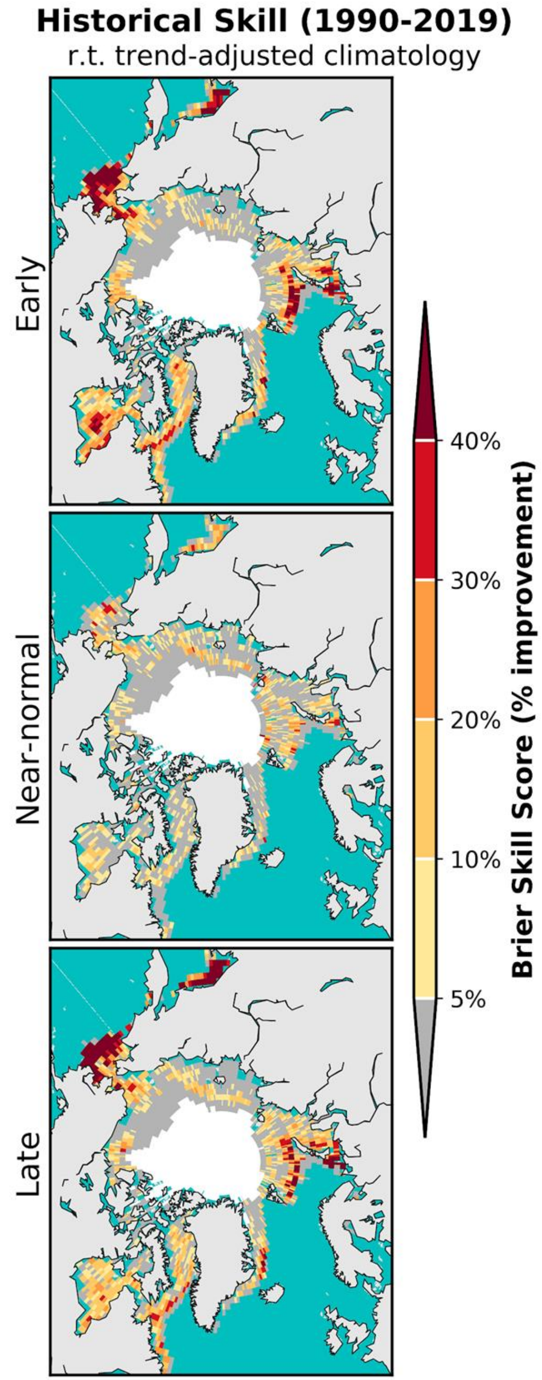
Regions	CanSIPS Sea-Ice Forecast Confidence	CanSIPS Sea-Ice Forecast (2009-2017 climate normal)	Observed Ice Extent (2009-2017 climate normal)	CanSIPS Sea-Ice Forecast Accuracy
Bering Strait	low	below normal	normal	low
Sea of Okhotsk	low	below to near normal	below to near normal	high
Barents Sea	low	near normal	below normal	low
Greenland Sea	high	near normal	below to near normal	moderate
Gulf of St. Lawrence	low	below normal	below to near normal	high
Labrador Sea	moderate	below normal	below to near normal	moderate

ArcRCC Sea-Ice Outlook

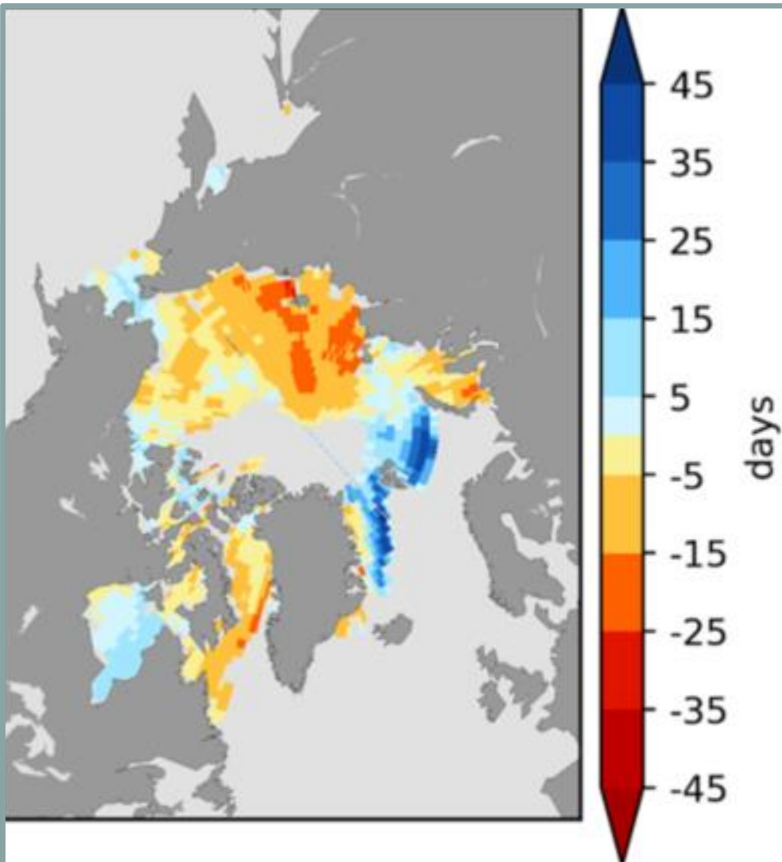
Summer 2020

C. ECCC Ice-Free Date Probability Forecast Summer 2020 (Experimental)





C. ArcRCC Sea-Ice Break-up Outlook 2020



Forecast for the 2020 spring/summer break-up expressed as an anomaly (difference from normal) where break-up is defined as the first day in a 10-day interval where ice concentration falls below 50%.
Source: CanSIPS (ECCC)

What is Normal break-up?

- The date when the ice concentration goes above 50%
- based on climatological period (2009-2017)

Break-Up Categories:

- Late break-up
- Near normal break-up
- Early break-up

Regions	CanSIPS Sea-Ice Forecast Confidence	CanSIPS Sea-Ice Break-up Forecast
Baffin Bay	**High**	**Early**
Barents Sea	High	Late in northern section
Beaufort Sea	High	Early
Bering Sea*	Moderate	Near normal to late
Chukchi Sea	High	Early
East Siberian	Low	Early southern section, near normal northern section
Greenland Sea	High	Late
Hudson Bay	Moderate	Late eastern half, near normal western half
Kara Sea	Moderate	Early in the west, near normal in the east
Labrador Sea	High	Early
Laptev Sea	Low	Early

D. ArcRCC Sea-Ice Extent Outlook Summer 2020

Minimum = September

What is Normal ?

Average ice extent based on conditions from 2009-2017.

<u>Forecast Categories</u>:

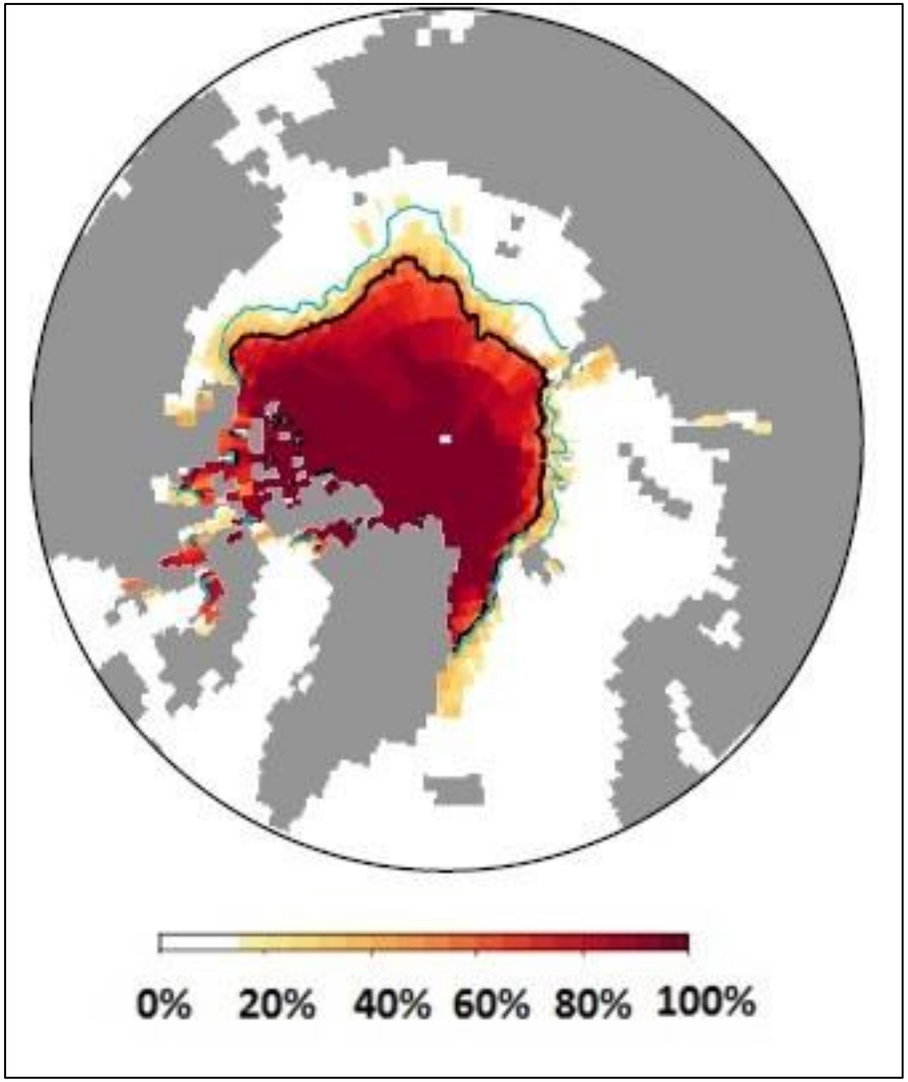
Above normal ice extent

Near normal ice extent

Below normal ice extent

<u>Outlook Confidence</u>

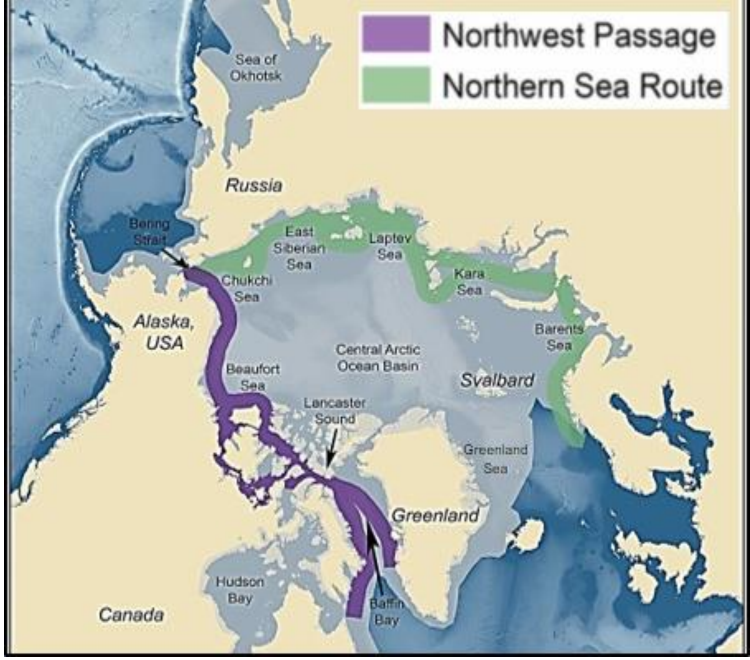
- low agreement between the models
- moderate agreement between models
- high agreement between models



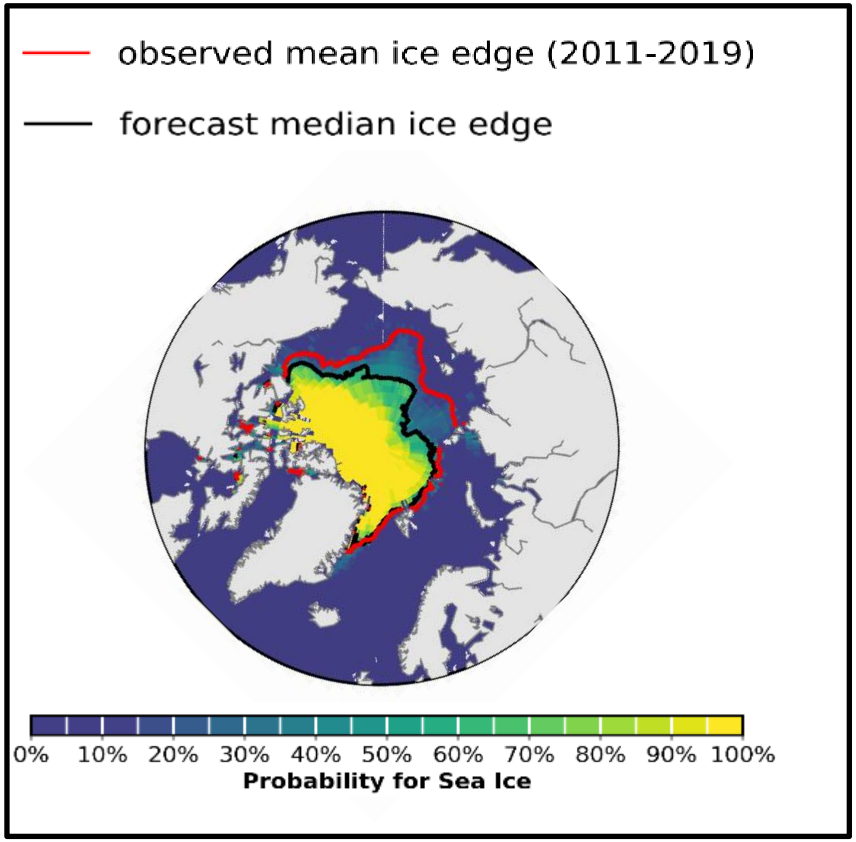
Source: CanSIPS (ECCC)

D. ArcRCC Sea-Ice Extent Outlook Summer 2020

Minimum = September



September 2020 sea ice probability of ice concentration > 15%



September 2020 probability of sea ice at concentrations greater than 15% from CanSIPSv2 (ECCC). Forecast median ice extent from CanSIPSv2 (black) and observed mean ice edge 2011-2019 (red).

Regions	CanSIPS Sea-Ice Forecast Confidence	CanSIPS Sea-Ice Forecast
Barents Sea	Low	Above normal (northern section)
Beaufort Sea	Moderate	Below normal
Canadian Arctic Archipelago	Moderate	Below normal
Chukchi Sea	High	Below normal
Eastern Siberian Sea	Moderate	Below normal
Greenland Sea	High	Above normal
Kara Sea	High	Below normal
Laptev Sea	High	Below normal

E. 2020 Summer Ice Conditions in Key Shipping Areas

Produced by the National Ice Services (forecaster experience and statistical methods)

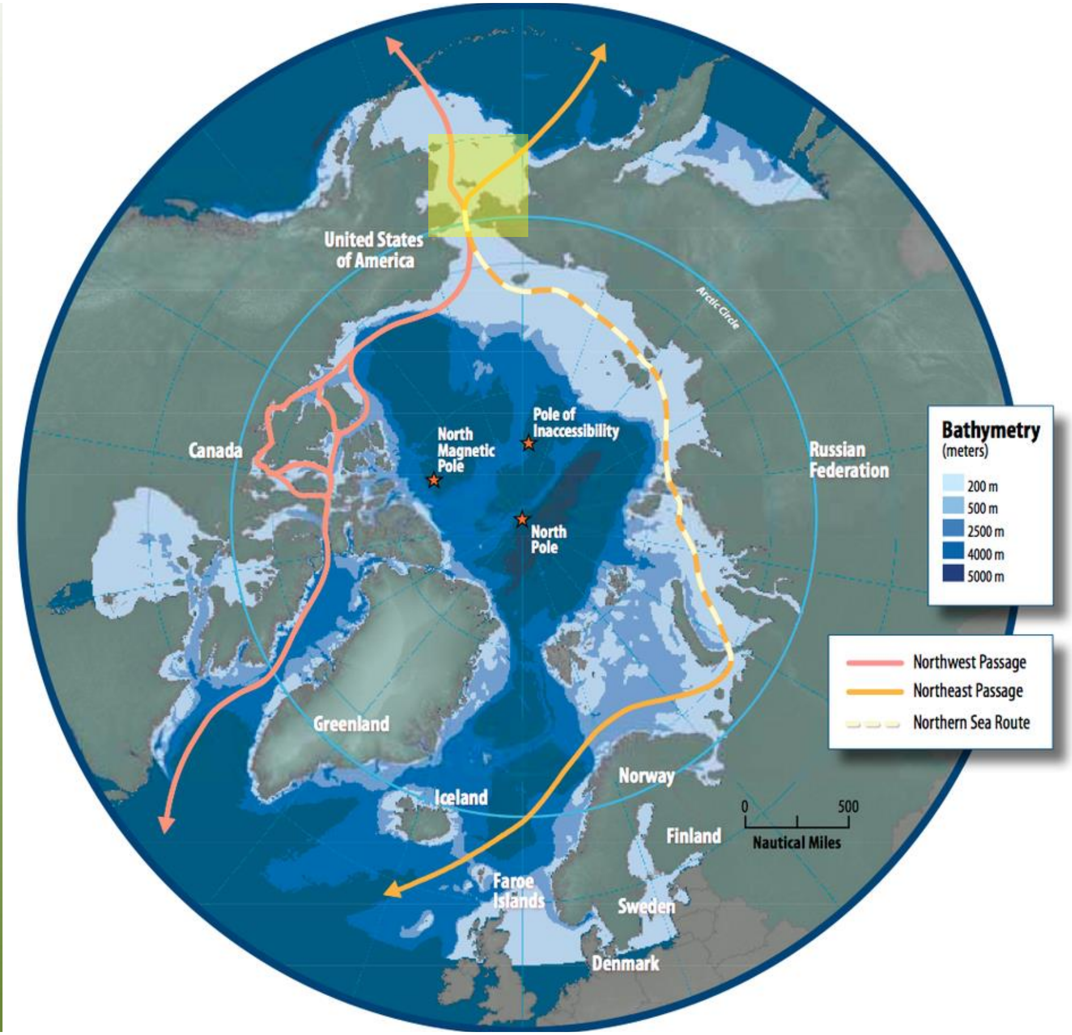


Figure from Arctic Council - Arctic marine shipping assessment

Bering Sea

Bering Sea ice extent has been below 1981-2010 average since early March and is currently at about 75% of the 30-year median for this date.

There will be limited ice remaining in the Bering Sea by the end of May 2020

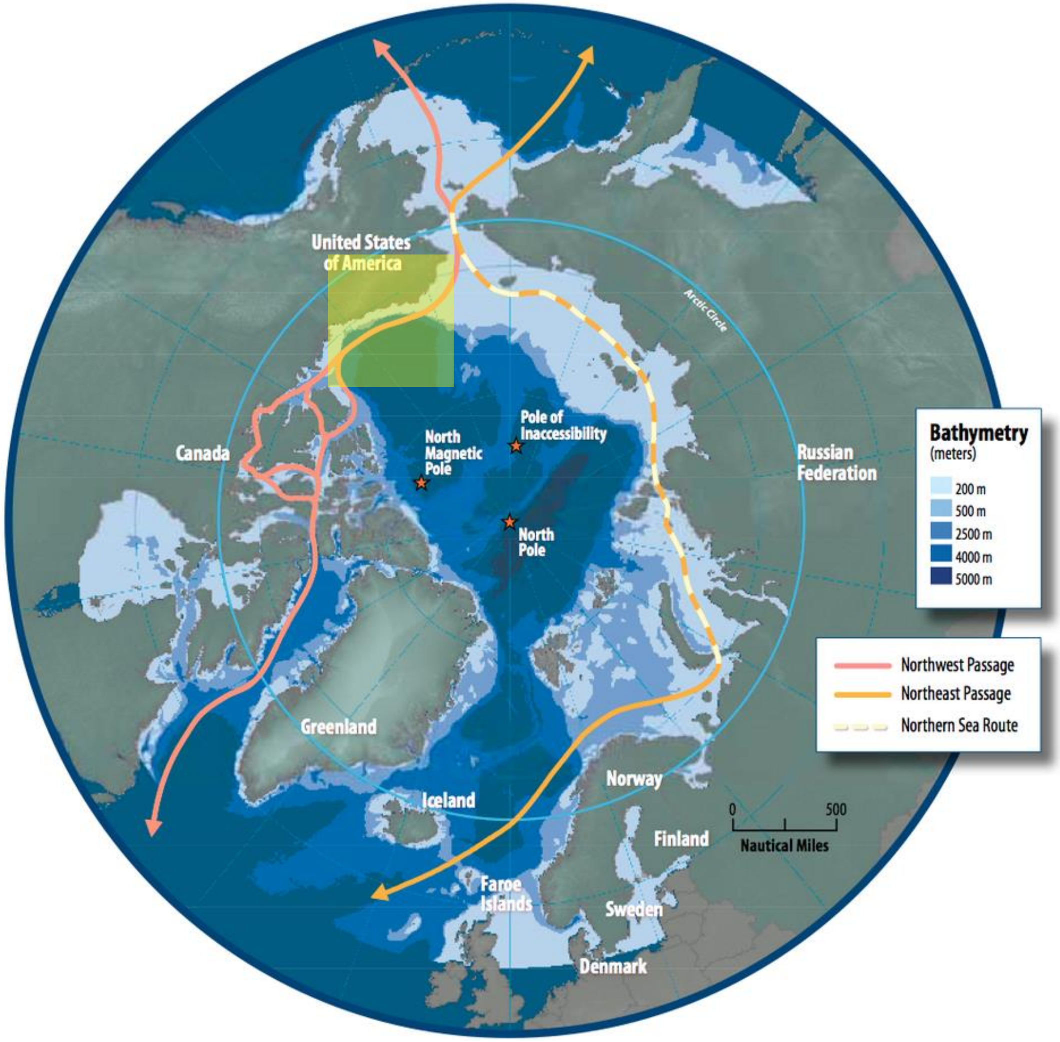


Figure from Arctic Council - Arctic marine shipping assessment

Coastal Beaufort Sea

Break-up of sea ice is expected to be earlier than normal throughout the Northwest Passage this summer, and areas of consolidated ice will become mobile earlier in the season than normal.

Anomalous concentrations of old ice are a potential hazard for the northern route and the western portion of the passage, as higher than normal amounts of old sea ice are present in these areas.

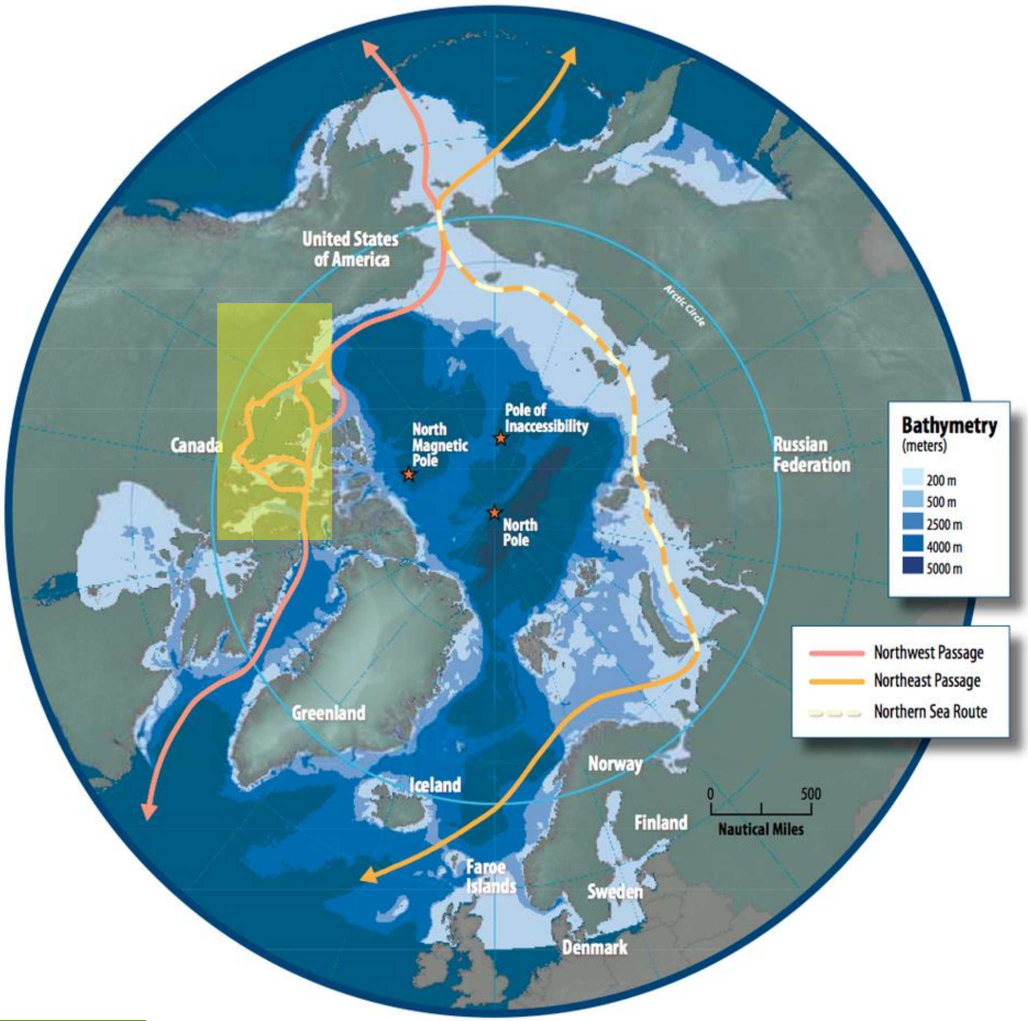


Figure from Arctic Council - Arctic marine shipping assessment

Northwest Passage

Break-up of sea ice is expected to be earlier than normal throughout the Northwest Passage this summer, and areas of consolidated ice will become mobile earlier in the season than normal.

Ice conditions will be light in the southern route of the Northwest Passage in August with lessening ice conditions following in northern route by early September.

Enhanced mobility of sea ice in the Canadian Arctic Archipelago could maintain elevated old ice concentrations in the aforementioned sectors throughout the summer 2020 period.

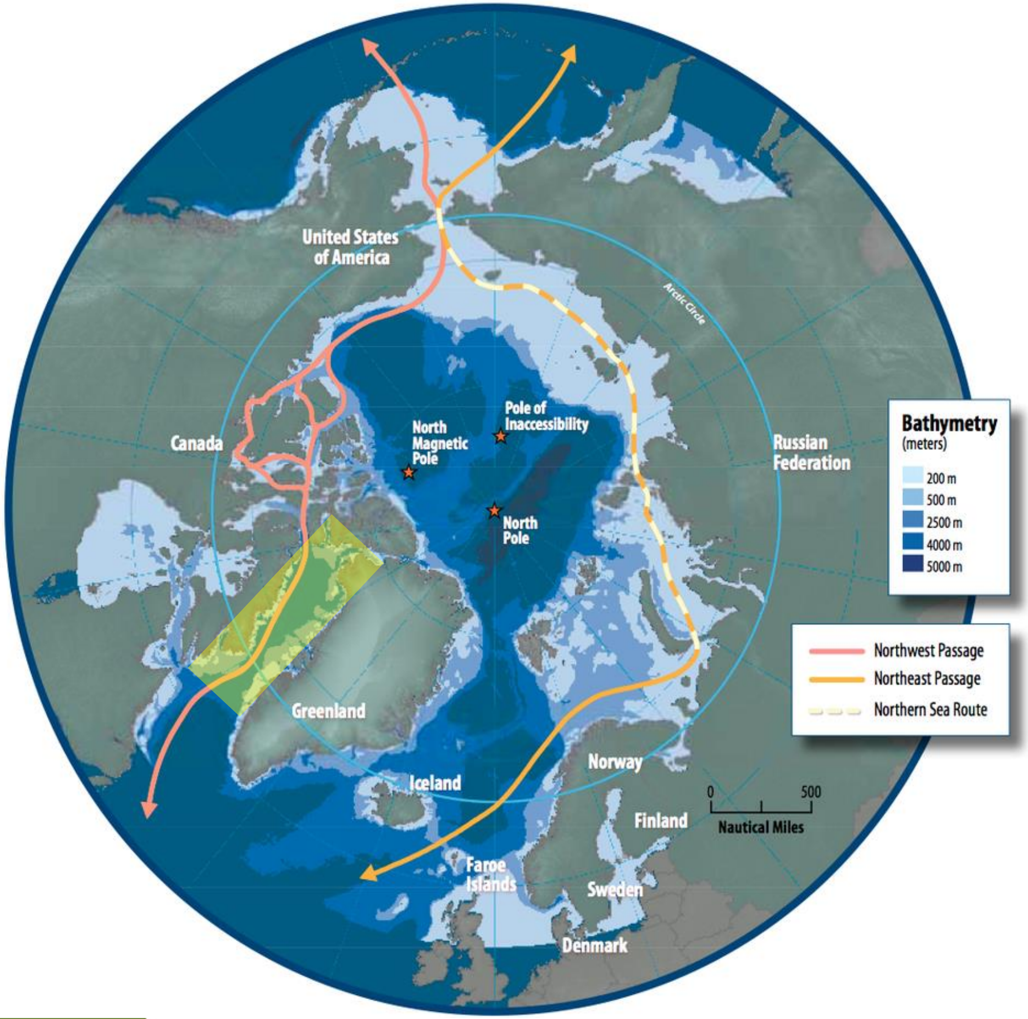


Figure from Arctic Council - Arctic marine shipping assessment

Baffin Bay

Early than normal sea ice break-up is forecasted for Baffin Bay this summer, due to current lower than normal ice extents in the region and predicted warmer than normal temperatures in the area of interest.

Old ice concentrations in the bay are in line with climatological normals and no specific hazards are anticipated. The presence of an ice bridge in Nares Strait well into this spring has cut off the inflow of old ice from the Arctic Ocean into northern Baffin Bay, thereby maintaining a limited influx of old ice into the region.

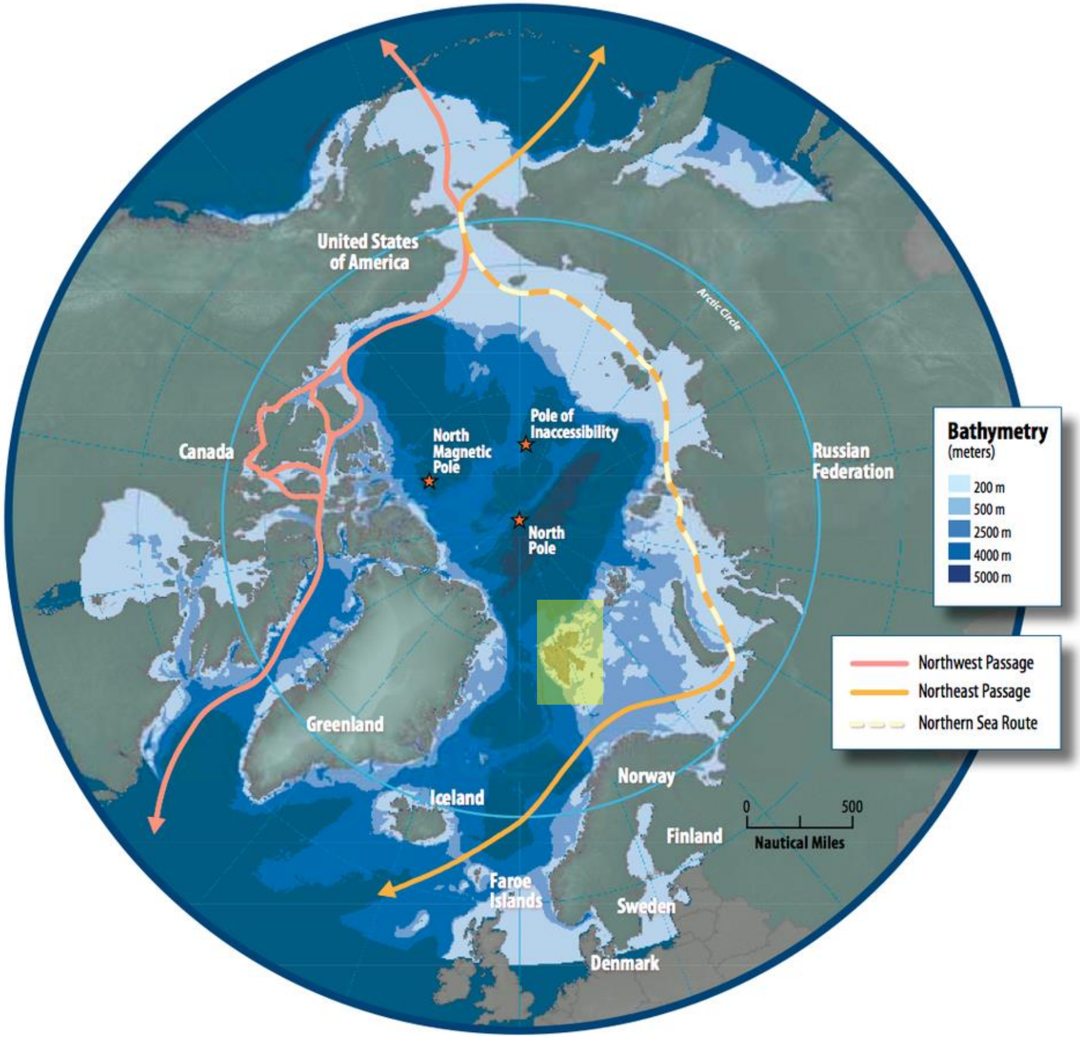


Figure from Arctic Council - Arctic marine shipping assessment

Svalbard

Summer minimum sea ice extent is forecast somewhat above normal, but with low forecast confidence. Expecting near normal impacts from sea ice cover around Svalbard for the 2020 summer indicating normal shipping activities.

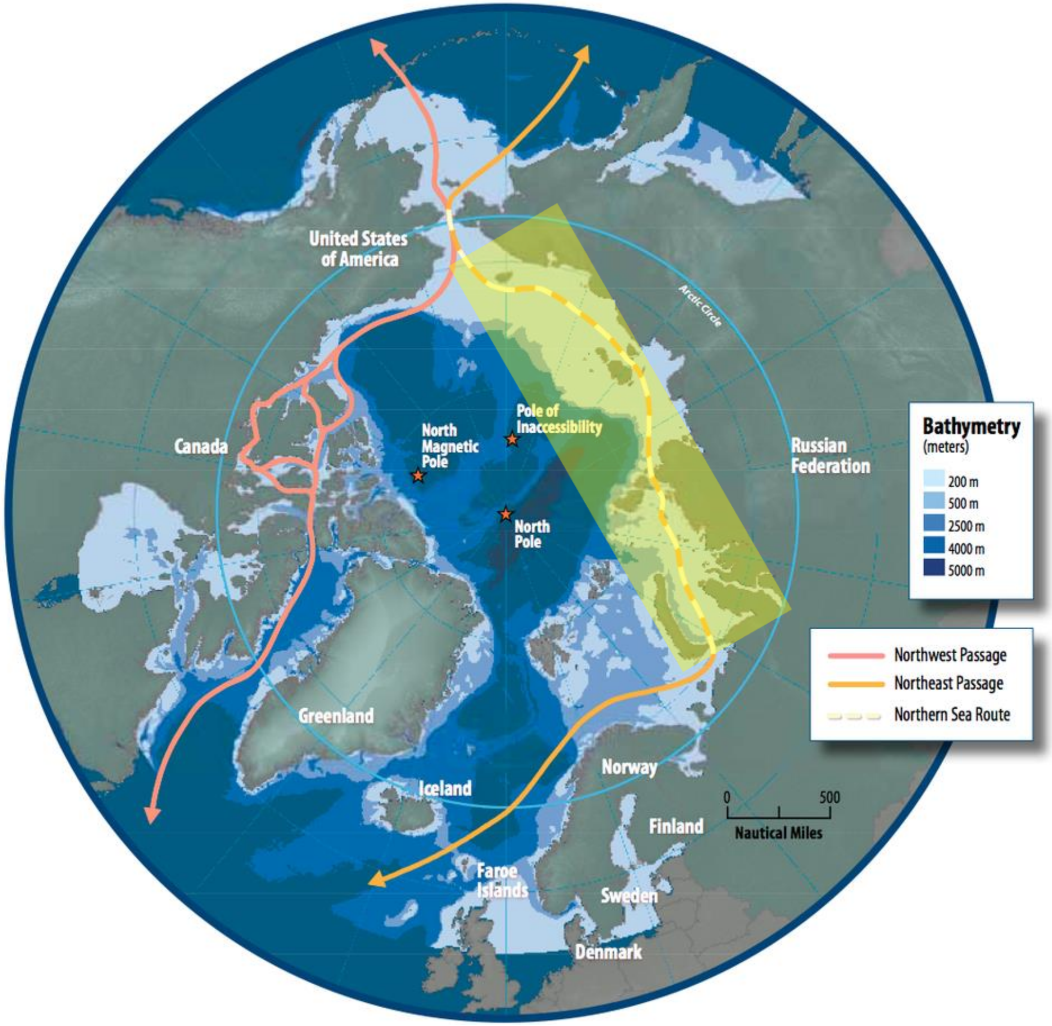


Figure from Arctic Council - Arctic marine shipping assessment

Northern Sea Route

Ice conditions are not expected to be problematic for the whole of the NSR during the spring and summer seasons in 2020.

Currently observed below normal ice conditions, and projected above normal air temperatures and earlier than normal sea ice deterioration form the basis for this assessment.

Light ice conditions will prevail throughout the sector and areas of landfast ice will break-up earlier than normal. Significant incursions of old ice are not expected along the route this summer season.

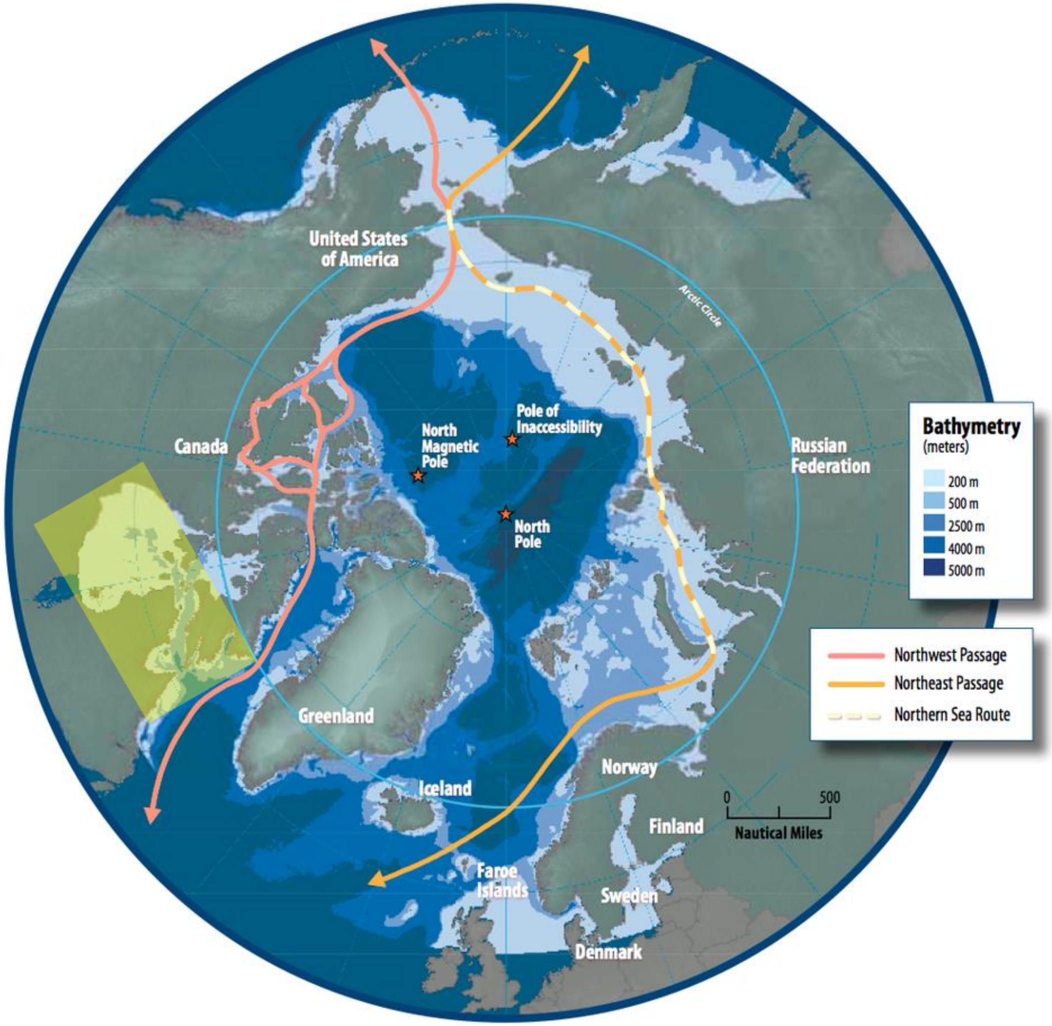


Figure from Arctic Council - Arctic marine shipping assessment

Hudson Bay and Hudson Strait

Faster than normal sea ice break-up is underway in Hudson Strait with areas of open water expanding in the northern portion of the strait this spring

Near normal break-up forecasted for the western portion of Hudson Bay and later than normal in the eastern section.

Ice thicknesses throughout Hudson Bay are thicker this spring than spring 2019, as predominantly thick first-year ice covers the western and central portions of the bay while in 2019 medium first-year ice comprised a significant fraction of the ice cover

Thicker ice coverage along with forecasted colder than normal surface air temperatures over Hudson Bay could lead to a more challenging navigation season, particularly in the eastern half of Hudson Bay

On-line discussion with end-users on sea-ice outlook

ACF
Arctic Climate Forum

- ✓ Scott Wiese, Canadian Ice Service / ECCC
- ✓ Vasily Smolianitsky, AARI

Possible themes - points for discussion (using CHAT function raise your hand or ask a question):

- ✓ Is the content of the outlook appropriate (A, B, C, D, E) ?
- ✓ Whether C & D should include more sea ice parameters
- ✓ Did the section E have enough details ?
- ✓ Any other ?

Final thoughts and & Wrap Up

- ✓ Reflections on the forum from all
- ✓ Vasily Smolianitsky, AARI
- ✓ Helge Tangen, ArcRCC Network coordinator
- ✓ Anahit Hovsepyan, WMO

Arctic Regional Climate Center

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Thank you! Merci! Takk! Спасибо! Tak! Tack! Kiitos! þakka þér fyrir! Naqurmiik ! Qaĝaasakuq ! Grazie! Giitu! Vielen Dank! Dhanyavaad !

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale