

Arctic Regional Climate Centre

**Review of 2018/19 Winter Sea-Ice Outlook
Present the 2019 Summer Sea Ice Outlook**

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Canadian Ice Service**



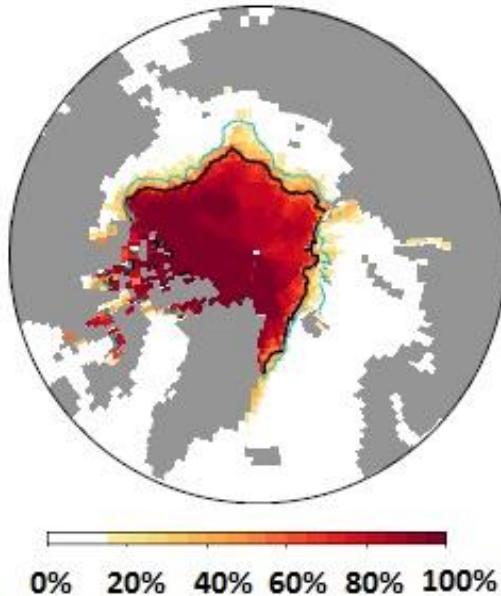
Outline

- **How the outlooks are created**
- Compare the 2018/19 Winter sea ice outlook with what happened
- Summer sea ice outlook
 - Minimum ice extent (September = month with least ice cover)
 - Spring break-up
 - Summer ice conditions in key shipping areas

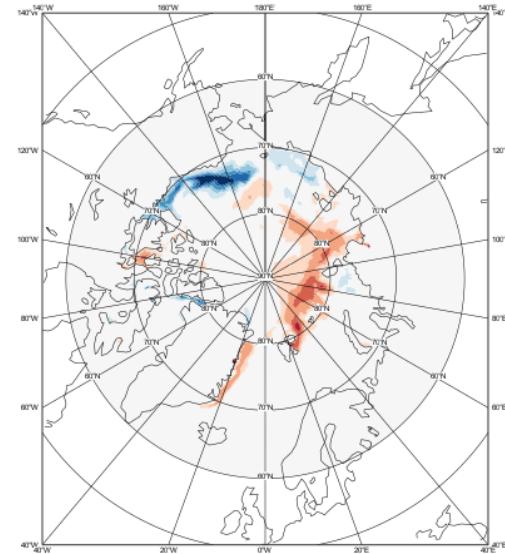
How the ArcRCC develops the Sea-Ice Outlooks

- Based on 4 experimental forecasts from 4 WMO Global Producing Centers Output (3 of the 4 models are shown below)
- Experts at the ArcRCC compare these models, so you don't have to, and develop products for users.

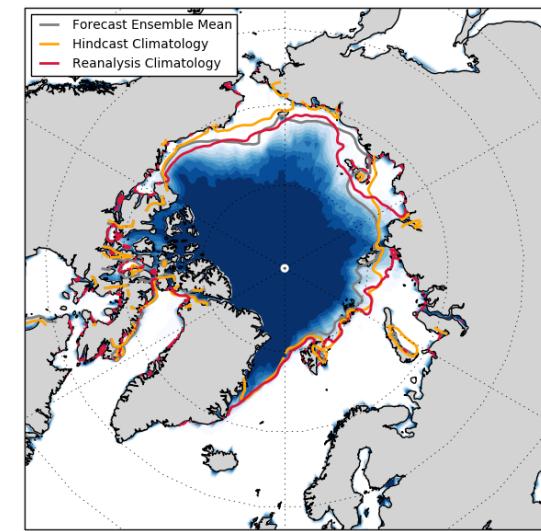
Probability of Sea Ice > 15%
September 2018
ECCC (CanCM3+CanCM4)



Sea Ice Concentration Anomaly
September 2019
ECMWF (SEAS5)



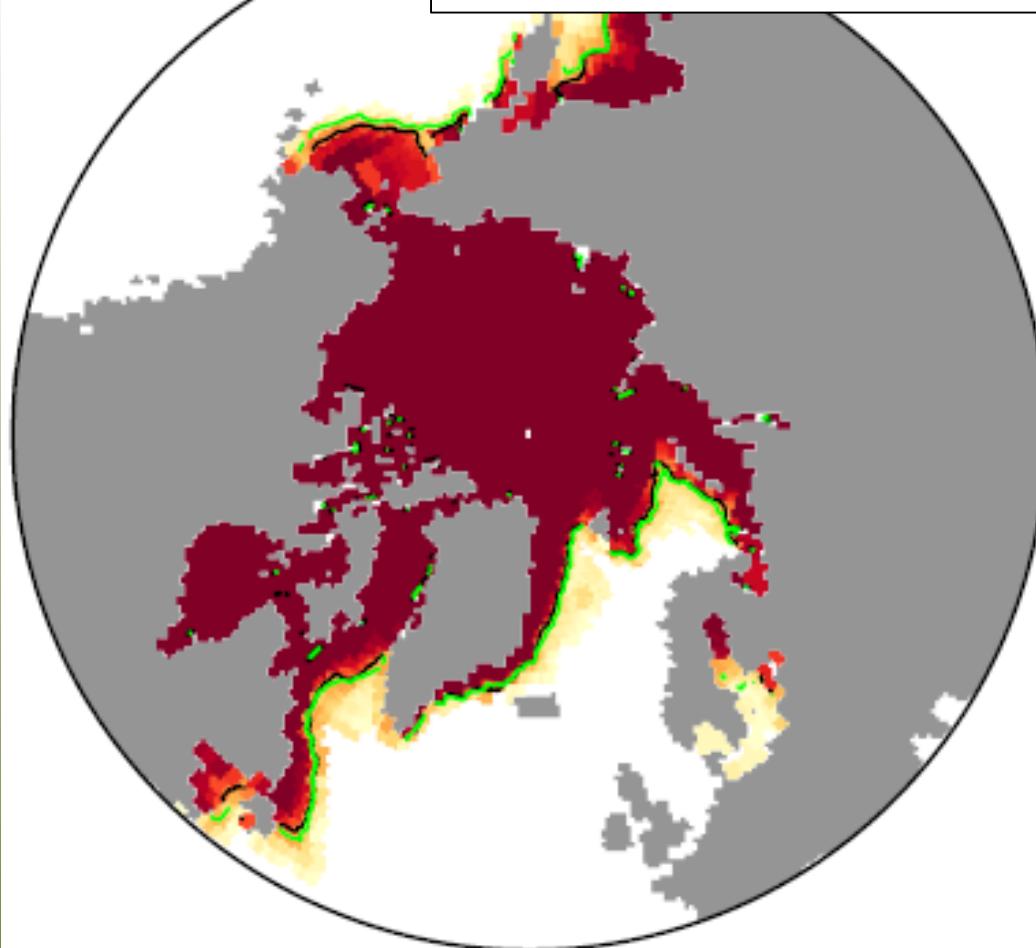
Probability of Sea Ice > 15%
September 2019
UK Met Office (GloSea5)



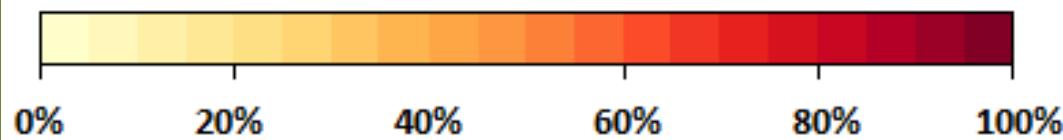
Forecasting Sea-Ice Extent for the Arctic

Maximum = March (Winter)

Minimum = September (Summer)



Probability of ice concentration > 15%



Ice extent = total ice area with a concentration of sea-ice greater than 15%

Note the resolution of the model

Describing the ArcRCC Sea-Ice Outlooks:

Normal Categories:

Normal = average ice extent/area based on a recent 10 year range (2009-2017)

1. **Above normal** = ice extent greater than normal
2. **Near normal** = ice extent normal
3. **Below normal** = ice extent lower than normal

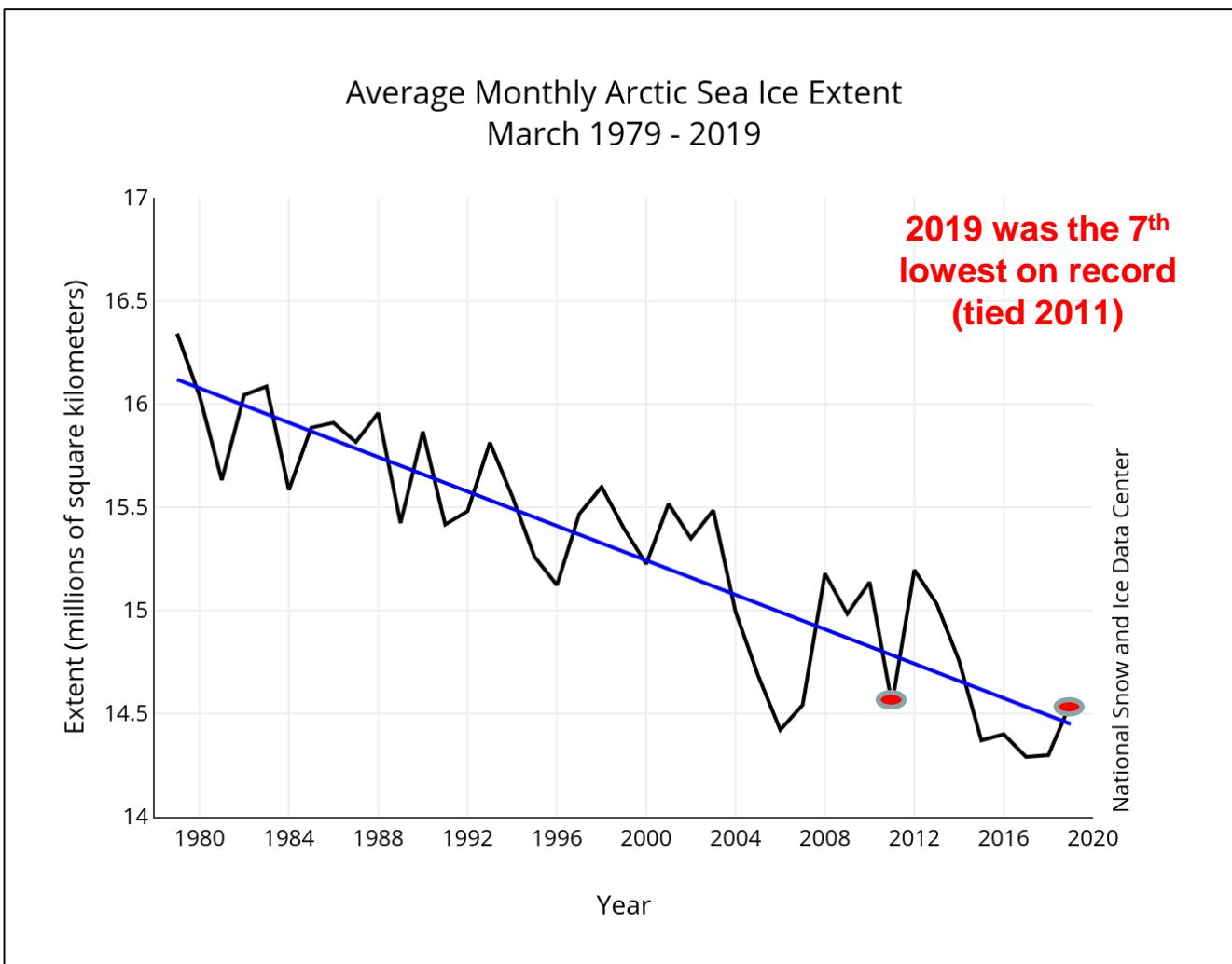
Agreement amongst the Models

- ✗ low agreement = little agreement between the models
- ~ medium agreement = some agreement between models
- ✓ high agreement = good agreement between models

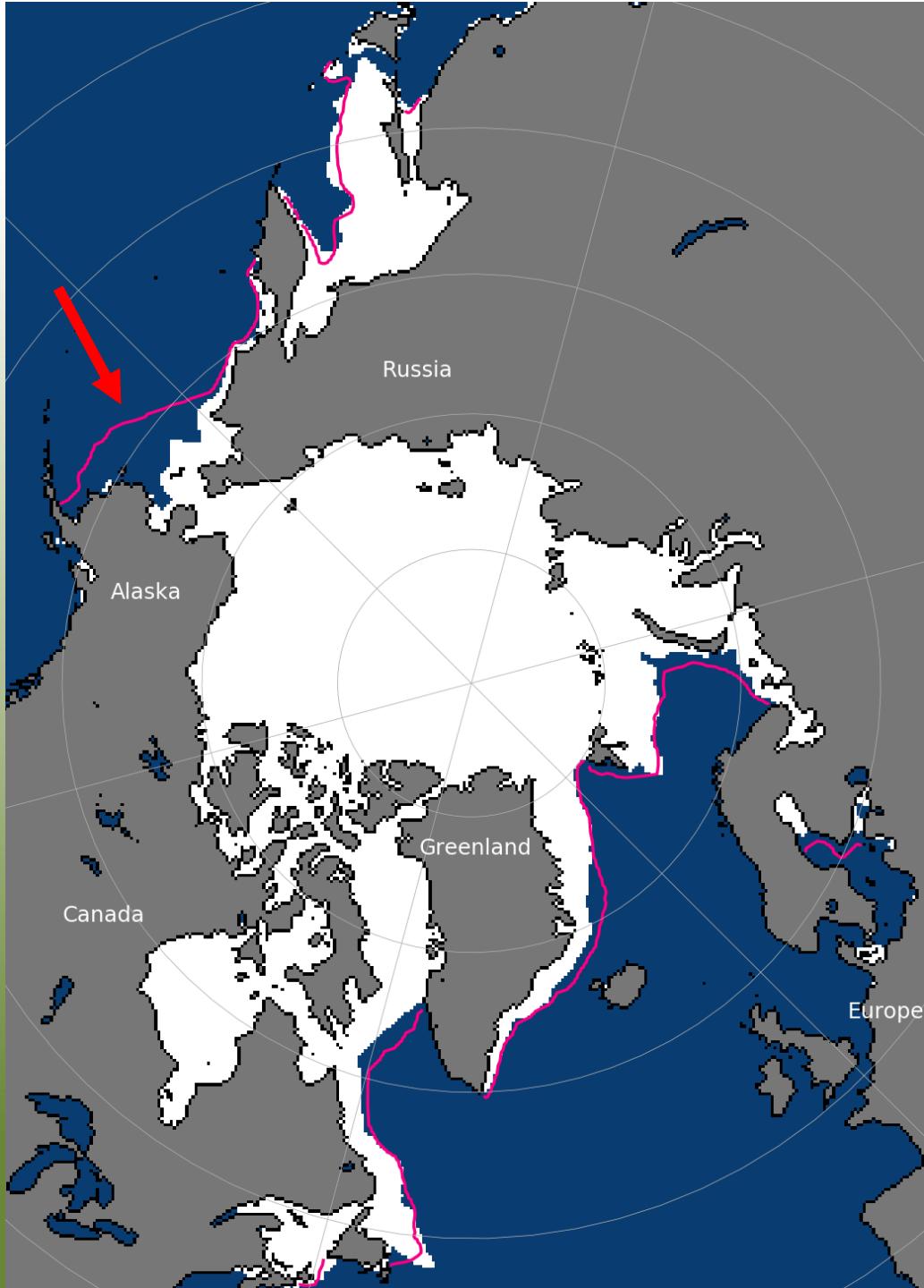
2018/19 Winter Sea-Ice Outlook: Maximum Ice Extent for March

Region	Outlook for Maximum Sea-ice Extent Winter 18/19	Agreement amongst the Models
Bering Sea	below normal	~
Sea of Okhotsk	below to near normal	~
Barents Sea	below to near normal	~
Greenland Sea	near normal	✗
Labrador Sea	below to near normal	✗

Actual March Maximum Sea-Ice Extent 1979 to 2019



Actual March 2019 Maximum Sea-Ice Extent (NSIDC)



Pink Line, 1981-2010
average ice extent

Record low in the
Bering Sea

Outlook vs. Actual 2018/19 Winter Maximum Sea-Ice Extent

Region	Outlook for Maximum Sea-ice Extent Winter 18/19	Agreement amongst the Models	Actual	Success
Bering Sea	below normal	~	below normal	✓
Sea of Okhotsk	below to near normal	~	above normal	✗
Barents Sea	below to near normal	~	below to near normal	✓
Greenland Sea	near normal	✗	below to near normal	~
Labrador Sea	below to near normal	✗	below normal	~

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- Verification of 2018/19 Winter sea ice outlook
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2019 September Sea-Ice Extent Outlook: Working with Common Regions





2019 September Sea Ice Extent Outlook

Region	Outlook for Minimum Sea-ice Extent Summer 2019	Model Agreement
Chukchi Sea	below normal to near normal	~
East Siberian Sea	below normal to near normal	X
Laptev Sea	below normal to near normal	X
Kara Sea	below normal to near normal	~
Barents Sea	below normal	~
Greenland Sea	near normal to above normal	X
Baffin Bay	ICE FREE IN SEPTEMBER	
Canadian Arctic Archipelago	near normal	X
Beaufort Sea	below normal to near normal	✓

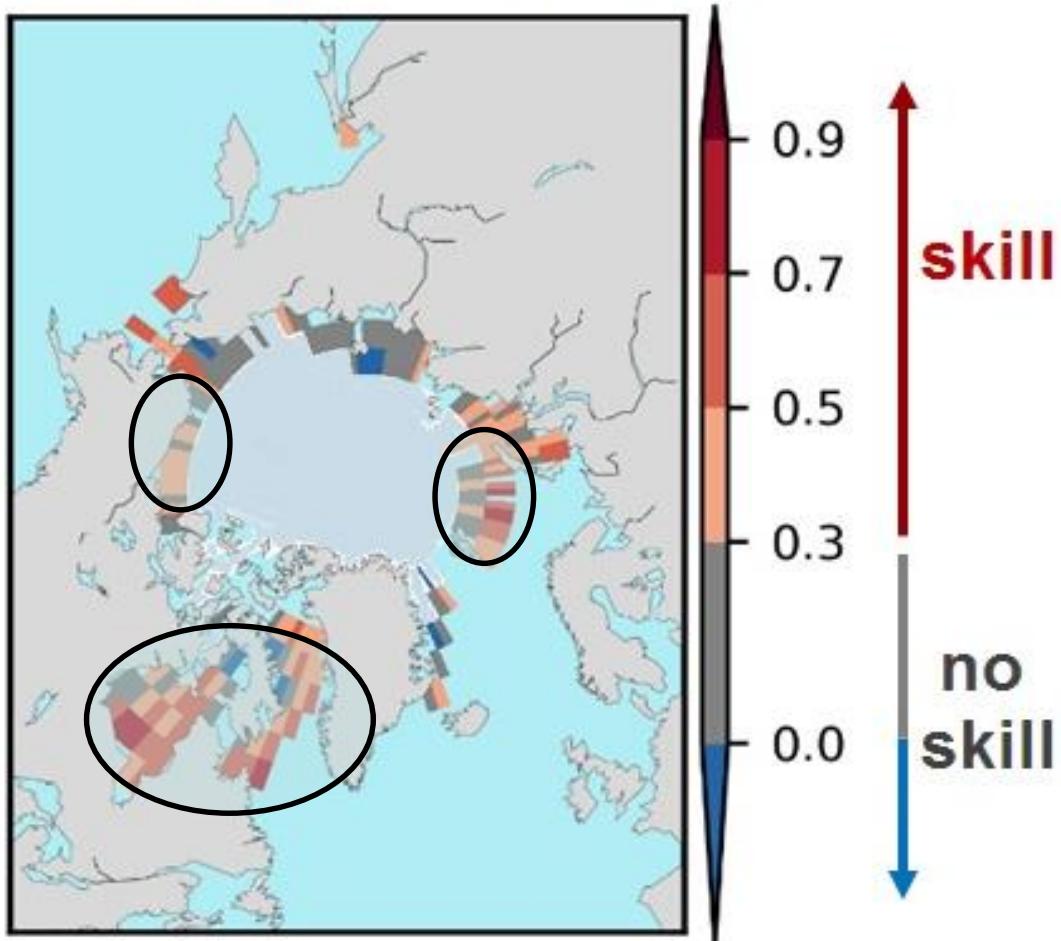
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2019 Spring Break-Up Outlook: For 3 Regions

Historical Forecast Skill

Detrended anomaly correlation coefficient 1981-2010



Based on the Skill and Resolution of this Model the ArcRCC only forecasts for the following 3 regions

1. Hudson Bay/Baffin Bay
2. Barents Sea:
3. Southern Beaufort Sea:

2019 Spring Break-Up Outlook

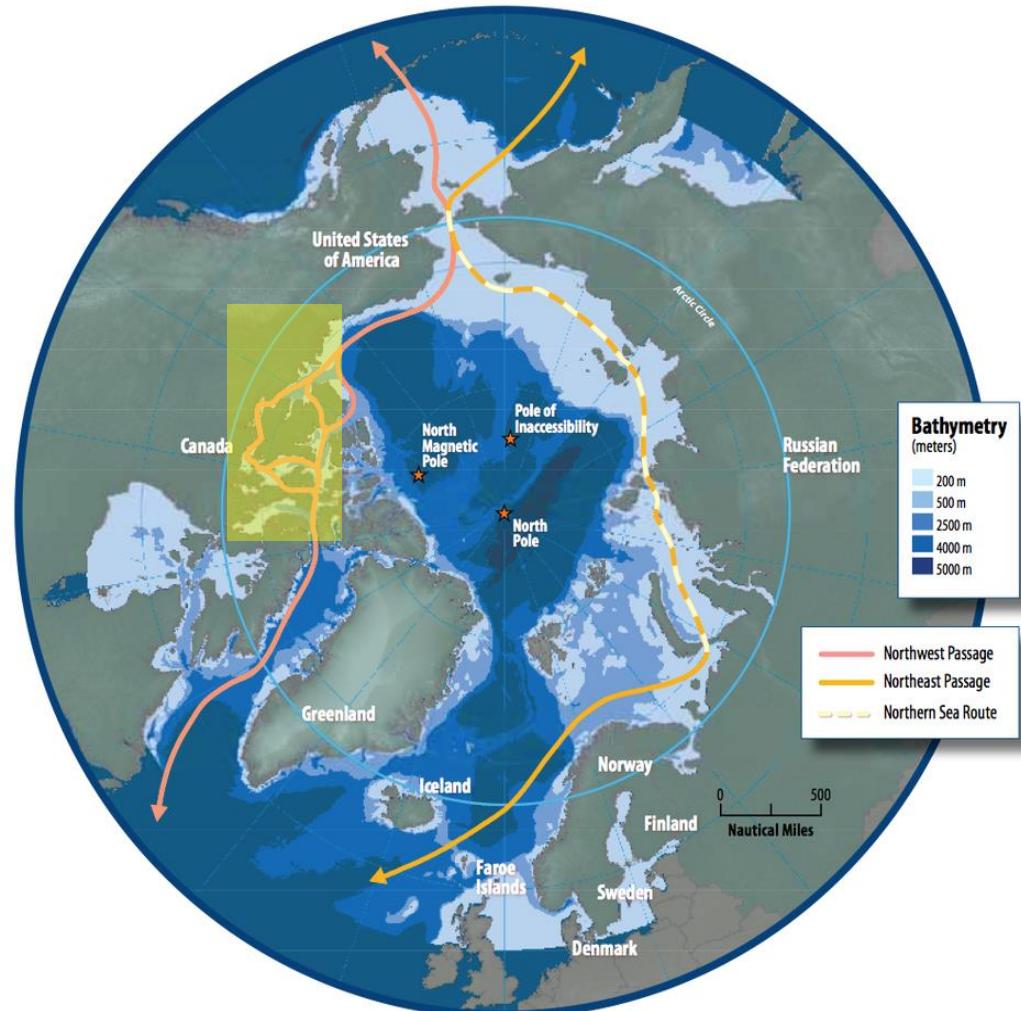
Region	Outlook for Spring Sea-ice Break-up 2019	Model Agreement
Hudson Bay/Baffin Bay	Later than normal	~
Barents Sea	Later than normal	~
Southern Beaufort Sea	Earlier than normal	~

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2019 Summer Ice Conditions in Key Shipping Areas

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



Northwest Passage

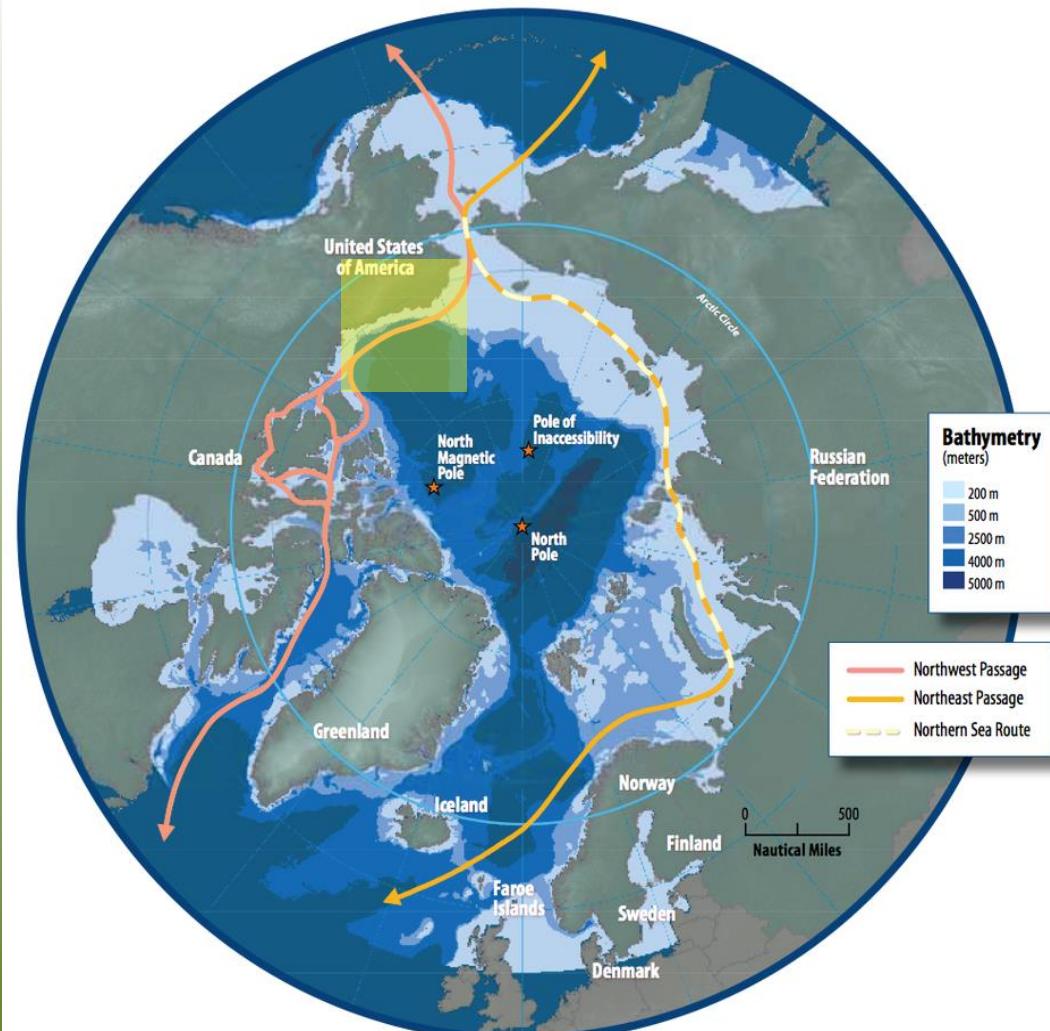
A return to normal concentrations of multi-year ice along the southern route of the NWP.

This could delay melt and the start of the shipping season and is expected to be a hazard throughout the shipping season.

Along the northern route of the NWP, current concentrations of multi-year ice are the 7th highest since 1980 and are expected to keep the route closed this season.

Figure from Arctic Council - Arctic marine shipping assessment

2019 Summer Ice Conditions in Key Shipping Areas



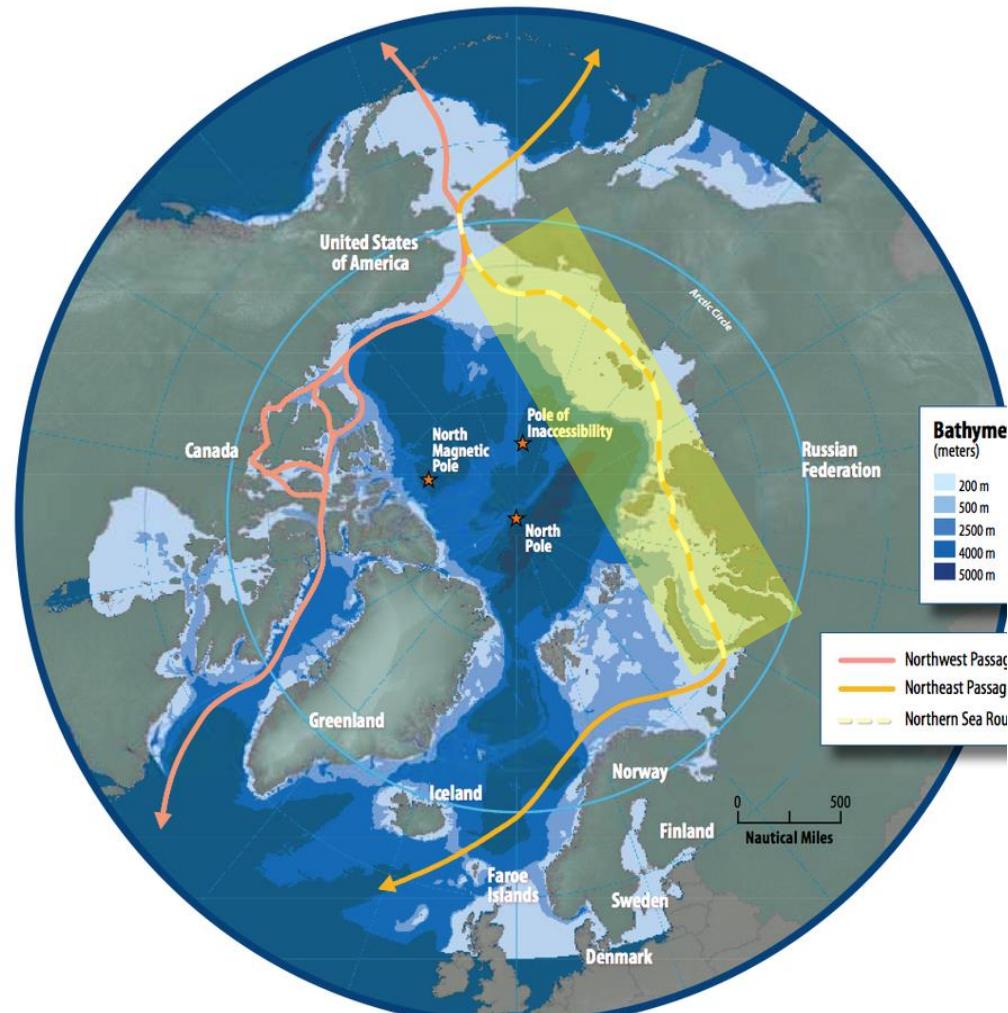
Coastal Beaufort Sea

Although there is less multi-year ice in the Beaufort Sea than normal this winter, it is expected that some multi-year ice will persist near the Alaska coast into late summer which could impact shipping.

In the Eastern Beaufort there is a possibility (low risk) that multi-year ice could drift south of Banks Island as in September 2018, restricting ship traffic through Amundsen Gulf.

Figure from Arctic Council - Arctic marine shipping assessment

2019 Summer Ice Conditions in Key Shipping Areas

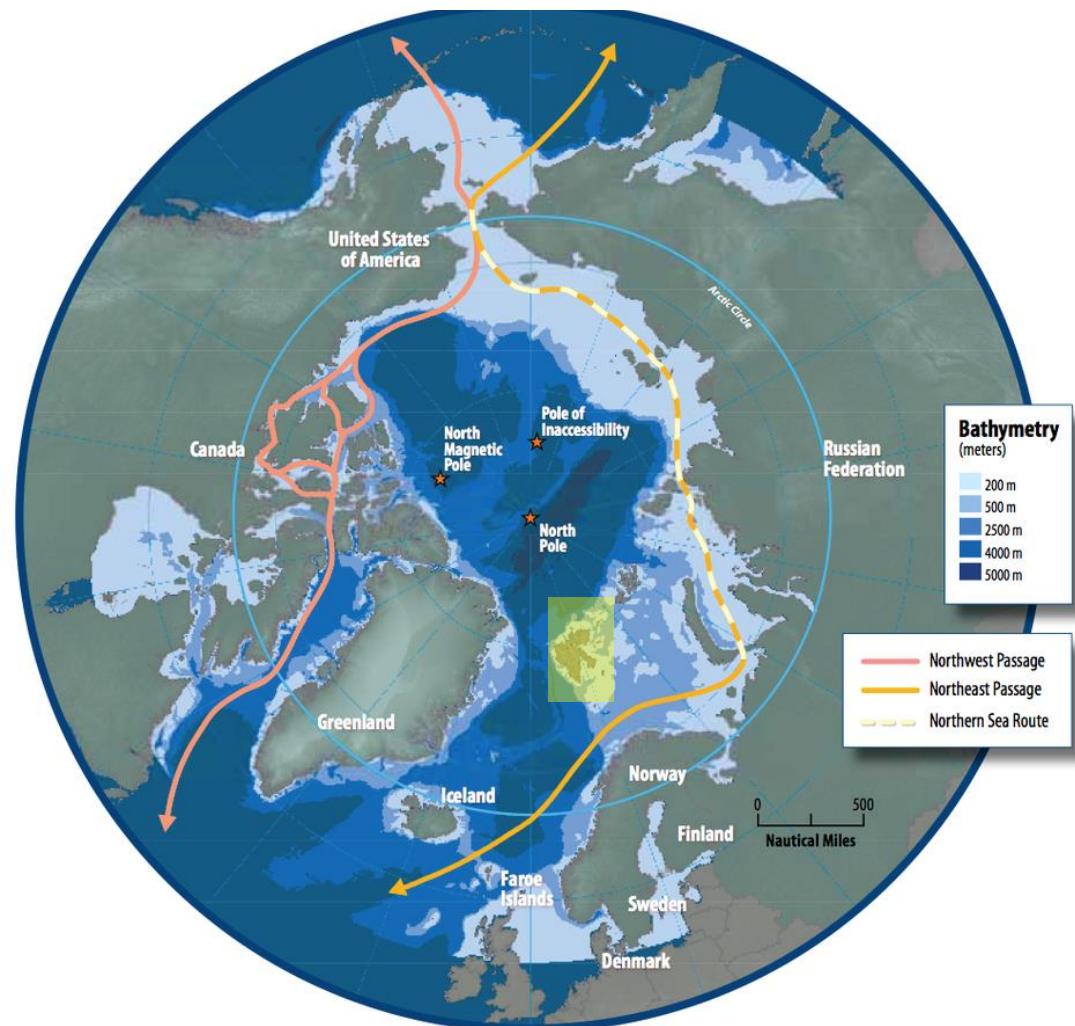


Northern Sea Route

- In the northern parts of the Barents Sea clearing will be later than normal, may delay fishing and tourist vessel activities in this region till July 2019.
- In the western part of the NSR shipping and icebreaking activities will be normal for the summer 2019 season.
- In the eastern Laptev and western Eastern Siberian Seas (ESS) sea ice extent will be normal, may lead to longer icebreaking support or higher ice class vessels needed for this region, in particular if northern navigation routes are chosen.
- There is a probability of old ice occurrence in ESS due to a tongue of sea-ice remaining through late summer 2019, similar to 2018.
- Very easy ice conditions will dominate the Chukchi Sea area.

Figure from Arctic Council - Arctic marine shipping assessment

2019 Summer Ice Conditions in Key Shipping Areas: How it was generated



Svalbard

The ice extent around Svalbard is expected to be below normal throughout the summer season.

Figure from Arctic Council - Arctic marine shipping assessment

Conclusions

- The approach combining models to develop seasonal forecasts for sea-ice is under development
- Biggest challenge with sea ice outlooks moving forward will be generating products at the scale needed by end-users