ACF
Arctic Climate Forum

Arctic Consensus Statement

Summary of Summer 2021 and Outlook for Winter 2021-2022

What it is and how it is generated

Adrienne Tivy, Environment and Climate Change Canada (ECCC),
ACF-8, October 2021

Arctic Regional Climate Center

What is the ArcRCC Consensus Statement?

A collaborative product developed amongst Arctic meteorological and ice services to synthesize observations, historical trends, forecast models and fill gaps with regional expertise.

The consensus statement provides:

- a review of the major Arctic climate trends of the previous season,
- verification of the previous seasons outlooks and
- outlooks for the upcoming season for temperature, precipitation, sea-ice, snow water equivalent (experimental), sea surface temperature (experimental)

How is it produced?

- Joint effort by all members of the ArcRCC
- Climate monitoring and Forecast information is collected from the Responsible nodes
- Additional regional information is provided
- Consensus statement document draft is circulated among the team
- Final version published after the Arctic Climate Forum

Figure 1: Regions used for the seasonal summary and outlook of temperature and precipitation

NATIONAL		REGIONAL		CIRCUMPOLAR
Countries	Meteorological Organizations	Regional Climate Centres (RCCs)		Arctic Regional Climate Centre
United States	NOAA	North American Node	Forecasting	
Canada	ECCC			
Denmark	DMI	Northern European Node	Data Services	
Iceland	IMO			
Norway	NMI			
Sweden	SMHI			
Finland	FMI			
Russia	AARI	Northern Eurasia Node	Monitoring	

What does it look like?

This is the 7th one – Spring 2021 Forum

Environment and Climate Change Canada | Norwegian Meteorological Institute | Russian Federal Service for Hydrometeorology and Environmental Monitoring | WORLD METEOROLOGICAL ORGANIZATION

First Session of the Pan-Arctic Regional Climate Outlook Forum (PARCOF-1)
Ottawa, Canada, May 2018

Environment and Climate Change Canada | Norwegian Meteorological Institute | WORLD METEOROLOGICAL ORGANIZATION

Second Session of the Pan-Arctic Regional
Forum (PARCOF-2), virtual forum, October

Consensus Statement for the Arctic Winter 2018-2

Third Session of the Pan-Arctic R
Forum (PARCOF-3), Rovaniemi,

Consensus Statement for the Arctic S

To meet climate adaptation and decision-makin
has been made towards the establishment of
(ArcRCC-Network). The ArcRCC-Network i
Organization (WMO) RCC concept with active contributi
member countries. The Pan-Arctic Regional Climate Outloo
activity of the ArcRCC-Network to create a forum to meet di
information, and follows the well-known Regional Climate
supported by WMO and its partners around the world. Th
year of its demonstration phase.

Freezing and thawing periods on the fringes of the warm a
most important considerations for many sectors of the Arcti
twice per year: a face-to-face meeting in May preceding t
virtual meeting in October before the ice returns in the Arctic

The third PARCOF meeting was held May 8-9, 2019 in Ro
Participants of the Arctic Council representatives of Arcti
from all of the Arctic Council Member States, and stakehold
a collaborative effort by the network which reviews the tr

Arctic Regional Climate Centre Consensus Statement

2019 Arctic Summer Seasonal Summary and 2019-2020 Arctic Winter Seasonal Outlook

CONTEXT

Arctic temperatures continue to warm at more than twice the global mean. Annual surface air
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Environment and Climate Change Canada | Russian Federal Service for Hydrometeorology and Environmental Monitoring | WORLD METEOROLOGICAL ORGANIZATION | Norwegian Meteorological Institute | ACF Arctic Climate Forum

Arctic Climate Forum Consensus Statement

2020 Arctic Summer Seasonal Climate Outlook
(along with a summary of 2020 Arctic Winter Season)

CONTEXT

Arctic temperatures continue to warm at more than twice the global mean. Annual surface air temperatures over the last 4 years (2016–2019) in the Arctic (60°–85°N) have been the highest in the time series of observations for 1936-2019[1]. The extent of winter sea-ice is at record low levels, and the volume of Arctic sea-ice present in the month of September 2019 has declined by more than 50% compared to the mean value for 1979–2019[2]. To support Arctic decision makers in this changing climate, the recently established Arctic Climate Forum (ACF) convened by the Arctic Regional Climate Centre Network (ArcRCC-Network) under the auspices of the World Meteorological Organization (WMO) provides consensus climate outlook statements in May prior to summer thawing and sea-ice break-up, and in October before the winter freezing and the return of sea-ice. The role of the ArcRCC-Network is to foster collaborative regional climate services amongst Arctic meteorological and ice services to synthesize observations, historical trends, forecast models and fill gaps with regional expertise to produce consensus climate statements. These statements include a review of the major climate features of the previous season, and outlooks for the upcoming season for temperature, precipitation and sea-ice. The elements of the consensus statements are presented and discussed at the Arctic Climate Forum (ACF) sessions with both providers and users of climate information in the Arctic twice a year in May and October, the later typically held online. This consensus statement is an outcome of the 5th session of the ACF held online on 27-28 May 2020 and coordinated by the Eurasian Node of ArcRCC-Network hosted by the Russian Federation.

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What does it contain?

8th Forum – Fall 2021

Review of past season large-scale climate

ATMOSPHERIC CIRCULATION

Summary for June, July, and August 2021:

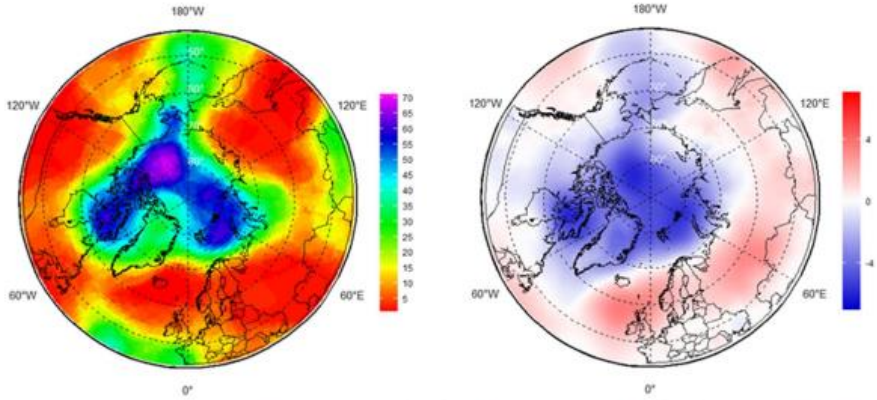

Figure 3: June, July and August (JJA) 2021 Geopotential height 500hPA (H500) rank for 70 observed JJA in the 1950-2021 period (left) and mean sea level pressure anomaly based on the 1981-2010 period (right). Red indicates higher H500 heights, and in general, higher MSLP, while blue indicates lower H500 heights and in general lower MSLP. Maps produced by the Arctic and Antarctic Research Institute http://www.aari.ru. Data sources CCCS ERA5

POLAR OCEAN

Summary for June, July and August 2021:

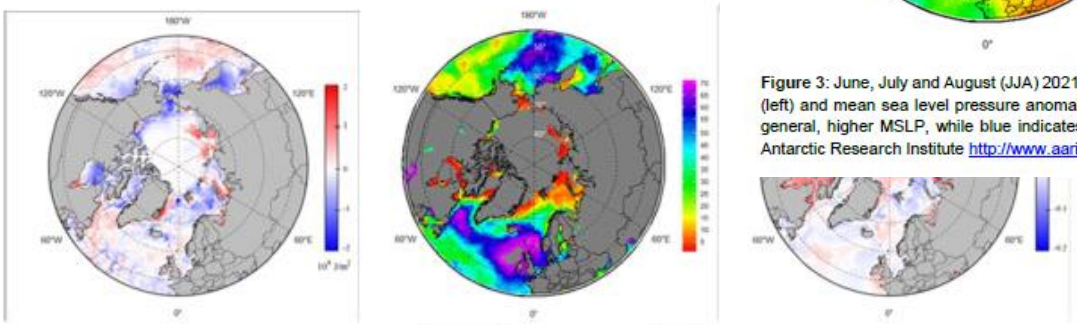

Figure 10. JJA 2021 Heat Content 15 m anomaly (left), wind waves and swell rank (center) and pH anomaly (right). Anomalies are given for 1993-2020 period, rank - for 1950-2021 period. Map produced by the Arctic and Antarctic Research Institute http://www.aari.ru. Data source: ERA5.

What does it contain?

8th Forum – Fall 2021

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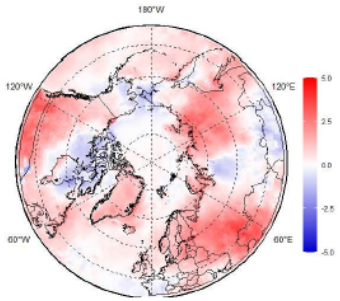
Temperature and Precipitation: *review and verification*

JJA and outlook for NDJ

TEMPERATURE

Summary for June, July, and August 2021:



SAT anomalies

Figure 4: June, July and A
air temperature (SAT) and
2020 reference period. Re
normal temperatures, and
normal temperatures. Ma
and Antarctic Research In
Data source: ERA5

was equal to 2.6C o

Summer 2021 was characterized by surface air temperature (SAT) anomaly (relative to 1961-1990 average) as +1.4°C and was 5th warm since 1936. The SAT anomaly for the latitudinal zone of 70-85°N was equal to +1.2°C or 7th in rank, and for the latitudinal zone 60-70°N - +1.5°C or 4th in rank since 1936. Regional analysis shows presence of the most significant positive SAT anomalies in the Eurasian sector (red areas in Figure 4). Anomaly in the Eastern Siberia region was 2.9C or the highest value since 1936. Southern part of the Chukchi Sea

Table 1. June, July, August 2021: Regional Comparison of Observed and Forecasted Arctic Temperature

Regions (see Figure 1)	MME Temperature Forecast Agreement	MME Temperature Forecast	NCAR CFSR Reanalysis (observed)	MME Temperature Forecast Accuracy
Alaska and Western Canada	Moderate	Above Normal	Mostly near normal	20% hit, 80% miss
Central and Eastern Canada	Low to moderate	Above normal	Below and near normal in the region's center. Above normal in the east and west.	20% hit, 80% miss
Western Nordic	Low to Moderate	Mostly above normal, below normal in the north	Above normal	90% hit
Eastern Nordic	Low to Moderate	Above normal	Above normal	hit
Western Siberia	Moderate	Above normal	Below and near normal in the south and center, above normal in the north	Miss (over land)
Eastern Siberia	Moderate	Above normal	Above normal	hit
Chukchi and Bering	Moderate	Above normal	Near and below normal over land	Miss (over land)
Central Arctic	Low to moderate	Above normal	Mostly near or below normal	20% hit, 80% miss

Outlook for winter 2021-2022:

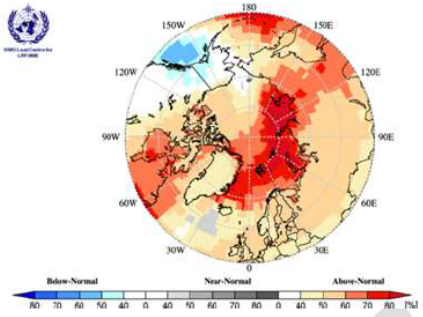


Figure 6: Multi model ensemble probability forecast for surface temperature for November 2021, December 2021, and January 2022. Three categories: below
no agreement am

the forecast is
5) and moder
and Bering S

Surface air temperatures during winter 2021 (NDJ: November 2021, December 2021, and January 2022) are forecast to be above normal across the majority of the Arctic regions (yellow, orange and red areas in Figure 5) with the exception of Alaska and Western Canada where the there is no clear signal or agreement in model forecasts (white areas in Figure 5). Above normal temperatures with moderate confidence (blue areas in Figure 5) is forecast for the North Pacific and coastal areas. The confidence of the

Table 2. Winter (NDJ) 2020-2021 Outlook: Regional Forecasts for Arctic Temperatures

Region (see Figure 1)	MME Temperature Forecast Agreement*	MME Temperature Forecast
Alaska and Western Canada	Low	Below Normal
Central and Eastern Canada	High	Above normal
Western Nordic	High	Above normal
Eastern Nordic	Moderate	Above normal
Western Siberia	Moderate	Above normal
Eastern Siberia	High	Above normal
Chukchi and Bering	Moderate	Above normal
Central Arctic	Moderate	Above normal

*: See non-technical regional summaries for greater detail

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What does it contain?

8th Forum – Fall 2021

Experimental outlooks for SWE and SST

SNOW WATER EQUIVALENT

(experimental product)

Outlook for winter 2021-2022:

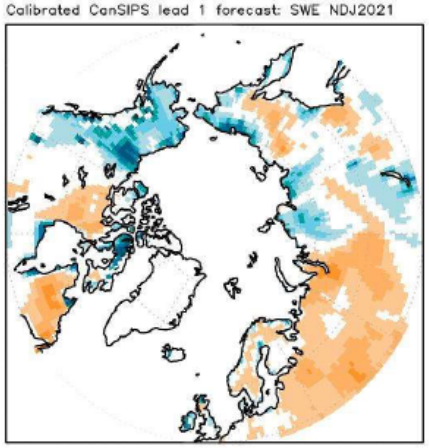

Figure 11: Canadian Seasonal to Interannual Prediction systen forecast for snow water equivalent for November 2021, Decemt and January 2022. Three categories: below normal (blue), nea (grey), above normal (red) and no agreement amongst the mod

SWE (blue areas in Figure 10) is forecast for the Canadian Arctic Archipelago, western Canada, Alaska and along the coast of Chukchi, East Siberian and Bering Seas. Some of these coastal regions of above normal SWE forecasts have moderate confidence (dark blue areas in Figure 10).

SEA SURFACE TEMPERATURE

Outlook for winter 2021-2022:

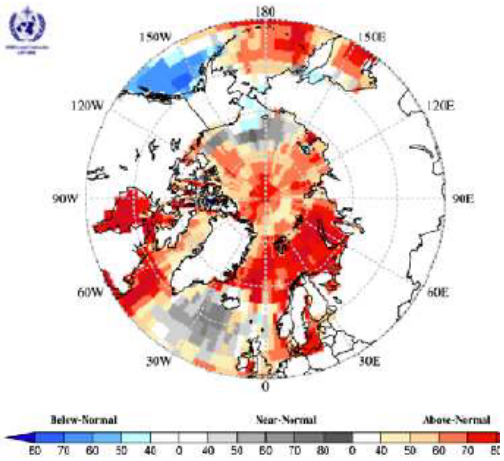

Figure 10. Multi model ensemble probability forecast for sea surface temperature for November 2021, December 2021, and January 202 Three categories: below normal (blue), near normal (grey), above normal (red) and no agreement amongst the models (white). Source www.wmolc.org

Sea surface temperature (SST) during winter 2021-2022 (NDJ: November 2021, December 2021, and January 2022) is forecast to be above normal for most of the Arctic (red areas Figure 9, Table 5). Forecast confidence is highest (dark red areas Figure 9, Table 5) for the Barents, Kara Greenland and South

Table 5. Winter (NDJ) 2021-2022 Outlook: Forecasted Arctic Sea Surface Temperature by Region

Region (see Figure 1)	MME Sea Surface Temperature Forecast Agreement*	MME Sea Surface Temperature Forecast
Alaska and Western Canada: Beaufort Sea, Gulf of Alaska and North Pacific Ocean	Moderate	Below normal in the Gulf of Alaska and North Pacific, near normal in the Beaufort Sea
Central and Eastern Canada: Canadian Arctic Archipelago, Hudson Bay, Baffin Bay and Labrador Sea	Moderate to high	Above normal
Western Nordic: Greenland and Norwegian Seas	Moderate to high	Above normal in the Greenland and Norwegian Seas, near normal in the North Atlantic
Eastern Nordic: Barents Sea	High	Above normal
Western Siberia: Kara Sea	High	Above normal
Eastern Siberia: Laptev Sea	Moderate	Above normal

What does it contain?

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Sea Ice: *review and verification of the September minimum and outlook for freeze-up and March maximum ice extent*

Table 7. Summer 2021: Regional Comparison of Observed and Forecasted Minimum Sea-Ice Extent

Regions (see Figure 2)	CanSIPS Sea-Ice Forecast Confidence	CanSIPS Sea-Ice Forecast	Observed Ice Extent	CanSIPS Sea-Ice Forecast Accuracy
Barents Sea	High			
Beaufort Sea	High			
Canadian Arctic Archipelago	Moderate			
Chukchi Sea	High			
Eastern Siberian Sea	Moderate			
Greenland Sea	High			
Kara Sea	High			
Laptev Sea	High			

Outlook for Fall Freeze-up 2021:

Sea-ice freeze-up is defined as the date where ice concentration exceeds 50% in a region. The outlook for fall freeze-up shown in Figure 12 (left) displays the sea-ice freeze-up anomaly from CanSIPSv2 based on the nine-year climatological period from 2012-2020. The qualitative 3-category (high, moderate, low) confidence in the forecast is based on the historical model skill (Figure 13, right). A summary of the forecast for the 2021 fall freeze-up for the different Arctic regions is shown in Table 8.

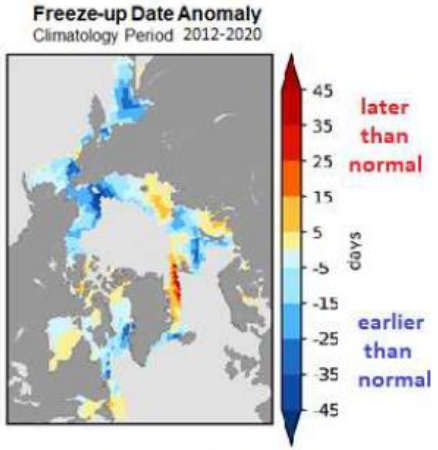

Figure 14: Forecast for the 2022 winter freeze-up (left) expre
up is defined as the date when the ice concentration excee
detrended anomaly correlation coefficient based on the 198

Table 9. Winter 2021 Regional Outlook for March Sea Ice Extent

Regions (see Figure 2)	CanSIPSv2 March Ice Extent Forecast Confidence	CanSIPSv2 March Sea Ice Extent Forecast
Barents Sea	Moderate	Near normal
Bering Sea	High	Near normal
Greenland Sea	Low	Near normal
Northern Baltic Sea	Moderate	Near normal
Gulf of St. Lawrence	Low	Below normal
Labrador Sea	Low	Below normal
Sea of Okhotsk	High	Near normal

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HIGHLIGHTS

HIGHLIGHTS

The combination of an Arctic meridional and zonal atmospheric circulations (north-south and west-east respectively) and lower than in 2020 ocean surface heating this summer (JJA: June, July, August 2020) was the main driver of this past season's temperature, precipitation and sea ice anomalies.

Above normal temperatures forecast for all Arctic regions in the next season (November 2020 to January 2021) will continue to have implications for sea-ice over that time period.

Temperature: The summer 2021 average surface air temperatures were above normal (1961-1990) for most of the Arctic domain, with Eastern Siberia observing record-breaking temperatures. Slightly below normal temperatures were observed in parts of Chukchi Sea and Canadian Arctic. In the Arctic seas, the highest positive anomalies were for the northern part of the Greenland and Norwegian Seas, as well as in the Asian sector - the Laptev and East Siberian seas. In the Laptev Sea area, the anomaly was equal to 2.6C and was the second highest since 1936.

Above normal temperatures are expected to continue across the majority of the Arctic this winter.

Precipitation: On average, precipitation for the Arctic region was equal to 99.1% of normal (1961-1990) during summer 2021. The least amount of precipitation was for the Eastern Siberia and American regions with more abundant precipitation observed in the Nordic region.
Impacts of precipitation and evaporation included lesser drainage than normal (1991-2020) for practically all Great Arctic rivers with more significant negative anomalies for Lena for all months. Greater drainage was seen in some months for Anadyr and Enisey.

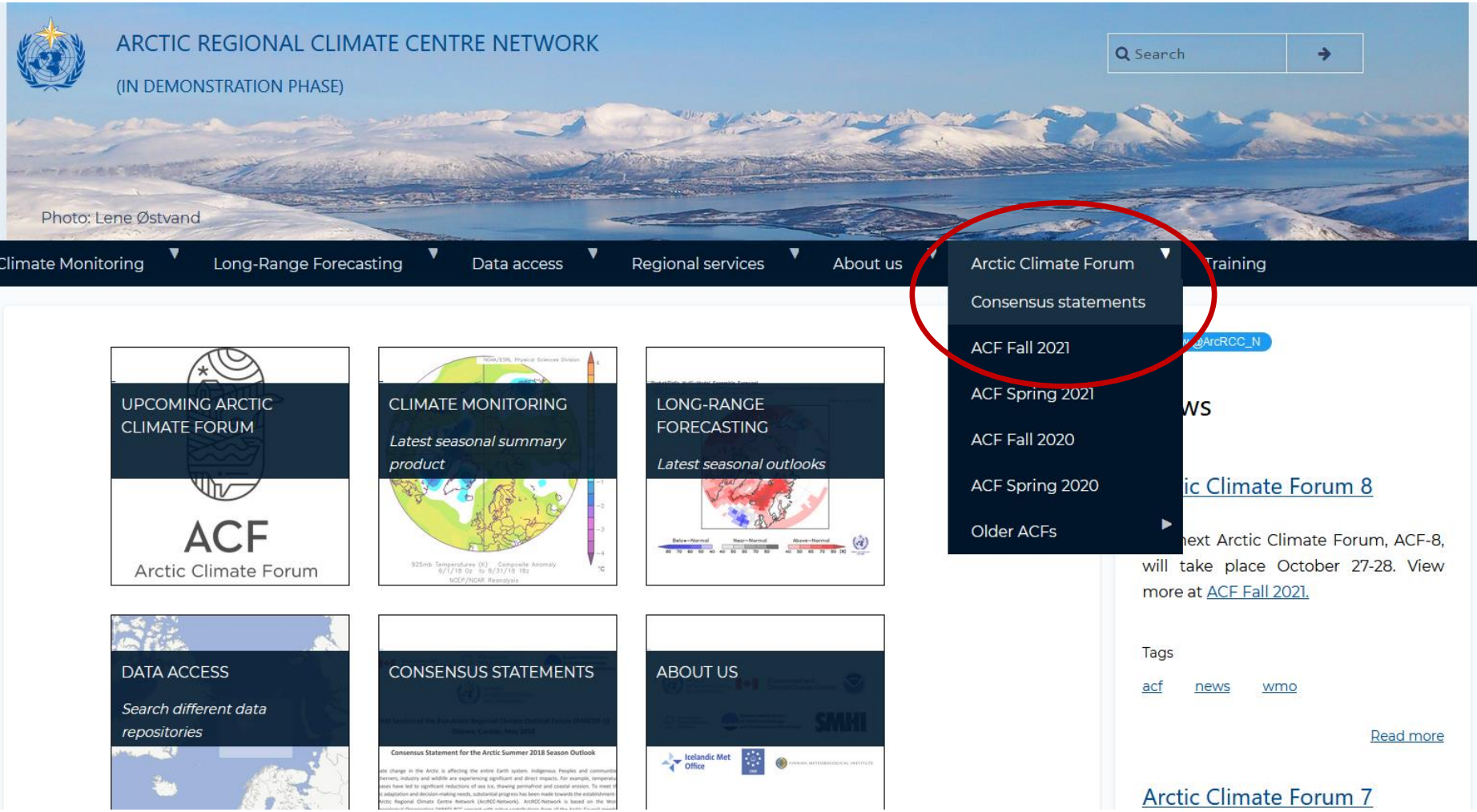
Wetter than normal conditions are expected across the majority of the Arctic region this winter.

Sea-ice: The Northern Hemisphere September 2021 minimum sea-ice extent was the 12th lowest since 1979. While Barents, Laptev seas were completely ice free in advance of this date, the ice conditions in parts of Kara, Eastern Siberian, Beaufort Seas, parts of Canadian archipelago were close to 40 years normal with both the NW passage and the NSR remaining blocked in the transit straits which is opposite to last 5 years period. Area and thickness of both residual and second year ice in September this year for the Arctic Basin was much greater than that for 2019 or 2020.

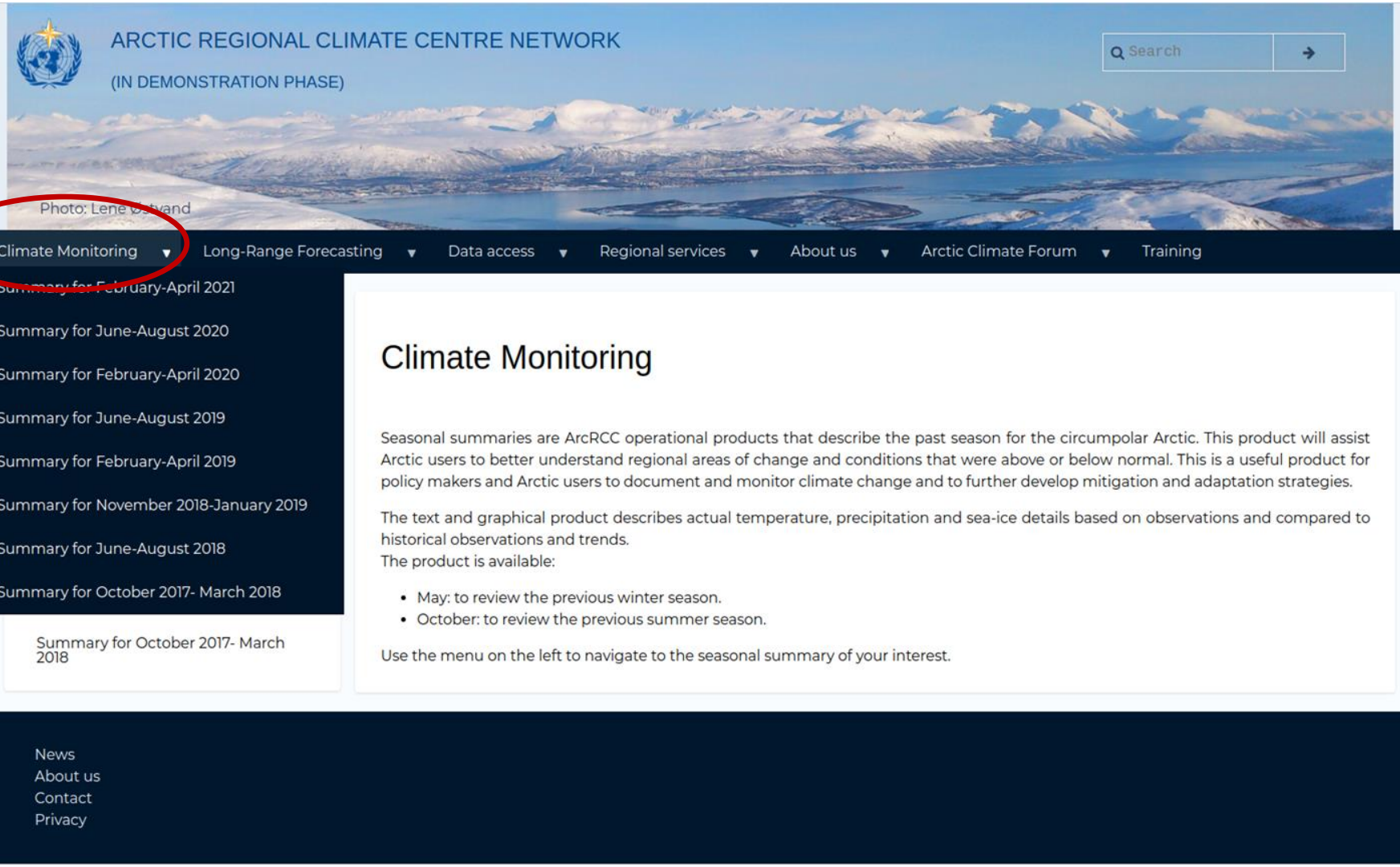
Later than normal fall freeze-up is expected for Baffin Bay, East Siberia, and the Kara, Labrador, and Laptev Seas; near normal to early freeze-up is expected for all other regions. Below to near normal 2021 maximum sea ice extent are forecast for the majority of the Arctic.

Where is it published?

Website: arctic-rcc.org



arctic-rcc.org/climate-monitoring
Climate monitoring summary for past periods



arctic-rcc.org/long-range-forecasting
Archive of previous outlooks

ARCTIC REGIONAL CLIMATE CENTRE NETWORK

(IN DEMONSTRATION PHASE)

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Photo: Lene Østvand

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- WMO Global Seasonal Climate Update

Outlook for June-Au
Outlook for Februar
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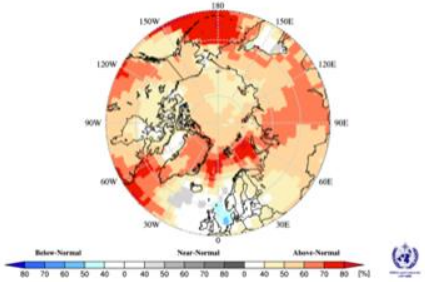
outlook for June-August 2021

how seasonal outlooks for June to August 2021, for temperature, precipitation and sea ice. More details can be found ook for June-July-August 2021 presentation and the Sea-Ice Outlooks Summer 2021 presentation.

erature JJA 2021 Outlook

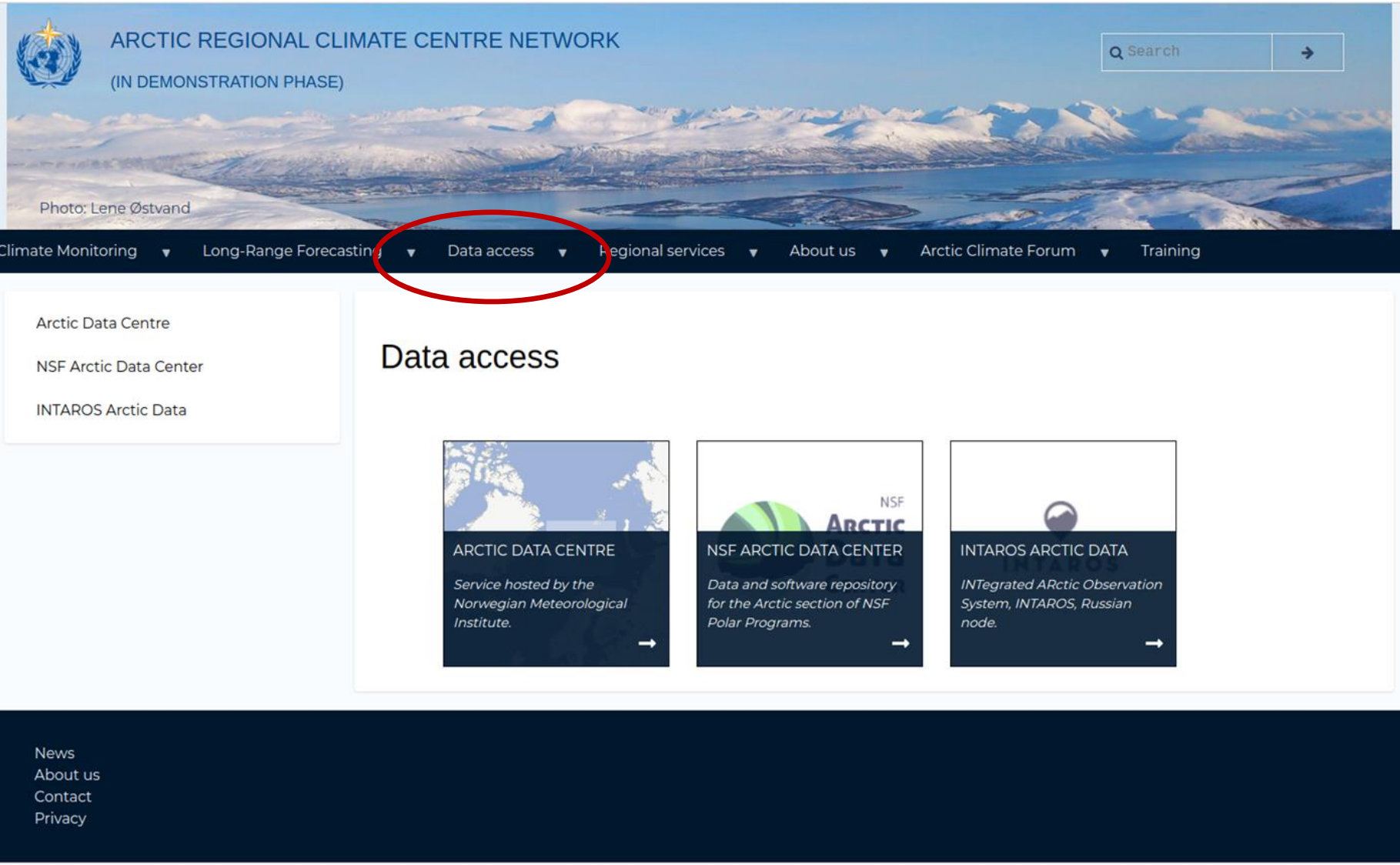
e air temperatures during summer are forecast to be above normal in almost all regions across the (orange and red areas in the figure below). The confidence of the forecast is low to moderate for most land areas of the Arctic region (light red areas in the figure below). The forecast confidence is high for land, Western Siberia and southern parts of the Chukchi and Bering regions (dark red areas in the below). There are equal chances for an above, below or near normal summer temperature over Iceland estern part of the Eastern Nordic region, meaning that the multi-model ensemble of climate models is cisive over these regions (white areas in the figure below).



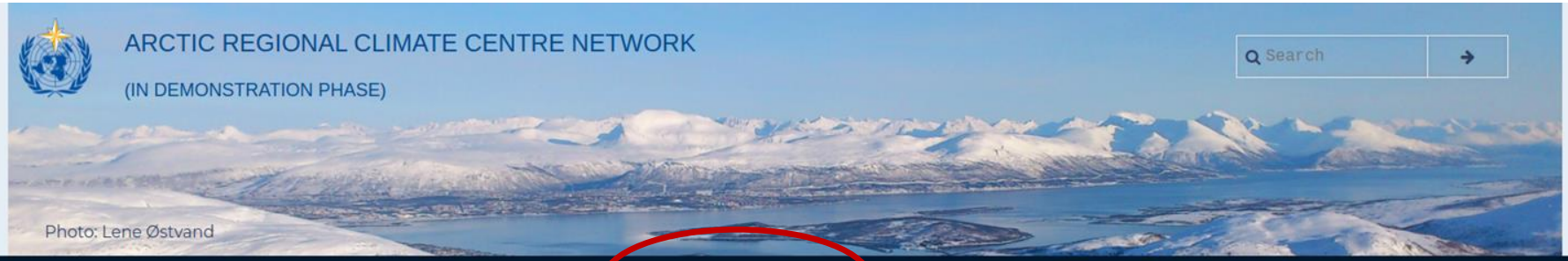
Precipitation JJA 2021 Outlook

arctic-rcc.org/data_access2

Pointer to data access portals



arctic-rcc.org/regional-services
Pointers to regional products



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- Northern Eurasia Node

Regional services

Nordic Node	North American Node	Eurasian Node
Collaboration between Norway, Sweden, Denmark, Finland and Iceland.	Collaboration between Canada and USA.	Led by the Russian Federation.

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Thank you!

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Arctic Regional Climate Center