Arctic Climate Forum October 2020



Regional Overview: Summary of Summer 2020 and Outlook for Winter 2020/2021



Arctic Regional Climate Center Network

Temperature and Precipitation Terrestrial Regions



North American Node

- Alaska & Western Canada: Includes the Yukon and the Northwest Territories
- Central & Eastern Canada: Central and Eastern Canada and Western Greenland

Northern European Node

- Western Nordic: Western Greenland, Iceland, Svalbard and Scandinavia
- Eastern Nordic

Eurasian Node

- Western Siberian
- Eastern Siberian
- Chukchi & Bering

Central Arctic

Sea-Ice Navigational Regions



Sea-Ice Regions. Map Source: Courtesy of the U.S. National Academy of Sciences.

How this summary was developed Available observations +State of the art modeling for temperature, precipitation and sea-ice + Arctic regional climate expertise from National meteorological organizations*

*As a result, the regional outlooks may not always match the model output



North American Node



Arctic Regional Climate Center Network





Alaska & Western Canada (Yukon, NWT)

Seasonal Summary: Summer 2020					
	Observations above (+) and b	pelow (-) normal			
Temperature Normal 1961-1990	+0.7°C 12 th warmest year on record	Warmest year was 2004 (+2.9°C)	Coldest years were 1945 & 1955 (-1.3°C)		
Precipitation Normal 1961-1990	 On average drier (-15%), BUT not everywhere 	Wettest year was 1951 (+65 %)	Driest year was 1968 (-46 %)		
Sea-Ice Since 1979	Break-up • Chukchi - early • Bering Sea – near normal • Beaufort Sea – early	September minimu • Chukchi – far be • Beaufort Sea - I normal	ember minimum sea-ice extent: hukchi – far below normal eaufort Sea - below normal to ormal		



https://www.drought.gov/drought/sites/drought.gov.drought/files/media/reports/regional outlooks/AK-CAN%20Summer%202020.pdf

Alaska & Western Canada (Yukon, NWT)

OBSERVED EXTREME CLIMATE EVENTS SUMMER 2020					
Category	Location	Rarity	Impacts associated with event		
Sea-Ice	Chukchi	3 rd lowest minimum ice extent	Early break-up contributed to early open northern Sea Route.		
Wildfires	Alaska, Yukon and NWT	Alaska lowest on record since 2008 Yukon, NWT lowest on record since 1988	Impacted the local economy. Lost firefighting employment opportunities. Ability to deploy elsewhere limited due to COVID-19.		

The COVID-19 pandemic meant that tourism (on land and cruise ships) was negligible, therefore difficult to compare climate effects on the tourism sector.

Alaska & Western Canada

Outlook: Winter 2020/2021				Multi Model Agreement		
		Forecast		High	Moderate	Low
Temp *	Bering and Chukchi Se	eas		\checkmark		
	Northern Alaska ,Yukon and NWT		Warmer		\checkmark	
	Southern inland Alaska		No model agreement			
* d	Northern Alaska, Yukon and the NWT		Wetter			\checkmark
Preci	Southern Alaska		No model agreement	No model agreement		t
		Chukchi Sea	Near Normal		\checkmark	
се	Freeze-up	Western Beaufort Sea	Early – Near Normal	\checkmark		
Sea-I		Bering Sea				\checkmark
	Max. Ice Extent March 2021 Bering Sea		Near Normal	\checkmark		

Alaska & Western Canada: Possible Impacts WINTER 2020/2021

Economy sector/ Livelihood conditions	Outlook	Impacts associated
Community Infrastructure	 Wetter and warmer conditions La Niña year = large variability in weather and increase in coastal storms and changes in wind direction 	 Reduced visibility for transportation Dangerous driving conditions (freeze/thaw) Changing conditions from what Indigenous Knowledge would predict Increased risk of coastal flooding and erosion Thawing permafrost affecting community freezers for harvest safekeeping Increase costs to purchase more deep freezers and energy costs to run them
Harvesting Activities on the land and sea-ice	 Chance for increased snowfall/blizzards 	 Rising costs (fuel, supplies), travel risk and time for hunters to travel greater distances to harvest Reduced sea-ice season for hunting and travel between remote communities
Bering Sea Fisheries	 Near-normal ice edge forecasted, but with low confidence. Fishing conducted near the ice edge. 	If ice edge significantly below/above normal leads to a reduction in volume of the crab fisheries

Ongoing Impacts of Climate Change

- Increase risk of coastal flooding and thawing permafrost coastal erosion and community infrastructure
- All marine mammals with habitat on sea ice may be more difficult to harvest
- Crabbing for coastal communities may be impacted owing to lack of stable ice nearshore

Central & Eastern Canadian Arctic



Seasonal Summary: Summer 2020					
	Observations above (+) and b	elow (-) normal			
Temperature Normal 1961-1990	+1.5°C 6 th warmest year on record	Warmest year was 2012 (+2.3°C)	Coldest year was 1972 (-1.6°C)		
Precipitation Normal 1961-1990	 On average – slightly drier (-14%) Drier in Kitikmeot and Kivalliq regions of Nunavut Wetter in Nunavik and Nunatsiavut (August) 	Wettest year was 2005 (+23.5 %)	Driest year was 1977 (-25 %)		
Sea-Ice Since 1979	 Break-up: Baffin Bay - Early Hudson Bay - Late eastern half, near normal western half Labrador Sea - Early 	September minimum Below normal in th Archipelago 	sea-ice extent: e Canadian Arctic		

Northwest Passage
Northern Sea Route
and the second s
Russia
Bering Strat Siberian Lapley
Sea Chukchi Sea Sea Sea
Alaska, USA Central Arctic Sea
Beaufort Ocean Basin Sea Lancaster Svalbard
Sound Greenland
Sea
Greenland
Hudson
Canada Batin Bay

OBSERVED EXTREME CLIMATE EVENTS						
SUMMER 2020						
Category	Location	Rarity	Impacts associated with event			
Temperatures	Makkovik,	Three days this				
(1981-2010)	Nunatsiavut	summer with	Extreme physical discomfort.			
		temperatures	 Increased purchase of fans 			
Over 75		above 30+ °C	across Nunavut to cope with the			
records were	Nain,	Had its warmest	extreme heat which rarely hits			
broken in	Nunatsiavut	July on record	above 24C.			
Nunavut for		this year	High mid-June heat warning for			
maximum	Baker Lake	 2nd warmest 	Kugluktuk prompted the			
temperature	Nunavut	summer on	Meteorological Service Canada to			
		record	establish new extreme heat			
		• +2.1 °C warmer	procedures			
		than normal				

Central and Eastern Canadian Arctic

Out	Outlook: Winter 2020/2021			Μι	ılti Model Agreemer	nt
		Forecast		High	Moderate	Low
Temp	Kitikmeot region of Nuna	avut		√		
	Western northwest pass	age, Foxe Basin and Baffin Bay		\checkmark		
	Kivalliq and Qikiqtaaluk regions of Nunavut, Nunavik and Warmer				\checkmark	
	Hudson Bay, Hudson Strait and Labrador Sea				\checkmark	
c	Hudson's Bay, western Nunavik, eastern Qikiqtaaluk region of Nunavut and Baffin Bay		Wetter		\checkmark	
Preci	Kitikmeot and Kivalliq regions of Nunavut		weller			\checkmark
	Nunatsiavut, Labrador Sea			No model agreement		t
	[
		Baffin Bay	Late		✓	
e	Freeze-up	Hudson Bay	Early to normal		\checkmark	
ea-lc		Labrador Sea	Late		\checkmark	
õ	Max Ice Extent	Labrador Sea	Polow Normal			\checkmark
	March 2021	Gulf of St. Lawrence	Below Normal		✓	

Central and Eastern Canada: Possible Impacts WINTER 2020/2021

Economy sector/ Livelihood conditions	Outlook	Impacts associated
Community Infrastructure	 Wetter and warmer conditions La Niña year = large variability in weather and increase in coastal storms and changes in wind direction. Less of 	 Reduced visibility for transportation Dangerous driving conditions (freeze/thaw) Changing conditions from what Indigenous Knowledge would predict Thawing permafrost affecting community freezers for harvest safekeeping Increase costs to purchase more deep freezers and energy costs to run them
Harvesting Activities on the land and sea-ice	 an impact as you move to central and eastern Canadian Arctic. Chance for increased snowfall/blizzards 	 Rising costs (fuel, supplies), travel risk and time for hunters to travel greater distances to harvest Reduced snow/sea-ice season for hunting and travel between remote communities
Shipping	 Below normal sea-ice conditions are expected this winter along the eastern coast of Canada Freeze-up may be delayed significantly and reduced ice thickening may lead to rapid and early spring break-up. 	 Forecasted lighter ice conditions should mitigate any significant difficulties encountered in the Gulf and in individual ports. Allow for shipping later into the fall and earlier in the spring



Northern European Node



Arctic Regional Climate Center Network

Western Nordic



Seasonal Summary: Summer 2020							
	Observations above (+) and below (-) normal						
Temperature 1.3 deg above normal on continent Warmest year was Cold							
Normal 1961-1990	1.2 deg above normal in N.	2003 (+1.9°C)	1965 (-0.7°C)				
	Greenland and Norwegian seas.						
	0.9 deg above normal in Iceland						
Precipitation	Slightly drier than normal (-4%)	Wettest year was	Driest year was				
Normal 1961-1990	Wetter than normal in Iceland (+20%)	1964 (+20.5%)	1968 (-24.9%)				
Sea-Ice	September minimum sea-ice extent:						
Since 1979	Below normal for Greenland Sea						

OBSERVED EXTREME CLIMATE EVENTS SUMMER 2020					
Category	Duration	Rarity	Impacts associated with event		
Rain in NV and N Iceland	24 hours	Records broken at a few stations	Mud slides, swollen rivers but no flooding		

Western Nordic

Outlook: Winter 2020/2021			Μι	ulti Model Agreeme	nt	
		Forecast		High	Moderate	Low
	Northern, southern and continental Greenland		No	model agre	ement	
Temp	Iceland		Warmer			\checkmark
	North Atlantic		Colder		\checkmark	
	Greenland seas	Warmer		\checkmark		
cip	Northern Greenland seas and Northern Greenland		Wetter		\checkmark	
Pre	Greenland, Iceland, Northern Atlantic		No	model agree	ement	
_	Freeze-up		Near normal to early	\checkmark		
Sea-Ice	Max Ice Extent March 2021	Greenland Sea	Normal		\checkmark	



Seasonal Summary: Summer 2020							
Observations above (+) and below (-) normal							
Temperature	1.7 deg warmer on continent	Warmest year was	Coldest year was				
Normal 1961-1990	2 deg warmer on Barents Sea	2013 (+2.8°C)	1969 (-1.6°C)				
Precipitation	Wetter (+11%) than normal this	Wettest year was	Driest year was				
Normal 1961-1990	summer	1981 (+28 %)	1980 (-32 %)				
Sea-Ice	September minimum sea-ice extent:						
Since 1979	Below normal for Barents Sea						





Seasonal Summary: Summer 2020								
	Observations above (+) and below (-) normal							
Temperature	1.7 deg warmer on continent	Warmest year was	Coldest year was					
Normal 1961-1990	2 deg warmer on Barents Sea	2013 (+2.8°C)	1969 (-1.6°C)					
Precipitation	Wetter (+11%) than normal this	Wettest year was	Driest year was					
Normal 1961-1990	summer	1981 (+28 %)	1980 (-32 %)					
Sea-Ice	September minimum sea-ice extent:							
Since 1979	Below normal for Barents Sea							
	-							

OBSERVED EXTREME CLIMATE EVENTS SUMMER 2020

Category	Duration	Rarity	Impacts associated with event
Mean and max temperature in Svalbard	5 days (25-29 July)	Unprecedented, new all-time high max temperature and 5-day mean air temperature of 16 C, >2 deg higher than previous record, series going back to 1899	Severe high-Arctic heat wave in the Svalbard and Barents region with striking impacts on cryosphere
Sea ice area	August 2020	Record-low sea ice area in the Svalbard region (72-85N,0-40E) This occurs after a winter of larger-than-normal ice area and after surprisingly "normal" ice conditions in 2019.	Large areas with open water and large increase in SST. Impacts on ecosystems



LOCAL COMMUNITIES FEEDBACK SUMMER 2020

It seems like there are no frozen grounds anymore as it was before (..) which is necessary for a good reindeer grazing pasture.

The Summer months arrived with no greening, the summer plants/herbs came at the same time as the mushrooms.

Snow went late compared to the last many years but normal related to the 80s. Rapid greening and a lot of berries.

Many calves were born late, resulting in them being small in the fall (..) concern that calves born late, will struggle through the coming Winter

Especially hot from the middle of June. The greening came fast when the heat came, but overall because of the late melting it was late this year. These fast changes from one day to another is a frustrating situation for the reindeer herders because it is impossible to plan the herding work, e.g. one day of rain, then the next day of snow and minus degrees, and then raining the third day, etc

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Outl	Outlook: Winter 2020/2021				Multi Model Agreement		
		Forecast		High	Moderate	Low	
	Svalbard, Barents Sea	Warmer	√				
Temp	Murmansk/White Sea/Continer	Warmer		\checkmark			
	Nordic Sea, Scandinavia	Warmer		\checkmark			
cip	Svalbard, Northern Barent Sea	Wetter		\checkmark			
Pre	Southern Barents Sea, Scandinavia, Murmansk region		Wetter			~	
e	Freeze-up	Paranta soa	Near normal	√			
Sea-Ic	May los Futant Marsh 2024	Darents sea	Near normal		√		
		Northern Baltic Sea	Below normal		\checkmark		

Economy sector/	Possible risk	Impacts associated
Livelihood conditions		

Navigation in the Baltic Sea will be affected by ice mainly in the Bay of Bothnia and in the eastern Gulf of Finland. A mild winter with its fluctuating weather typically causes ice deformation and brash ice barriers to form at the ice edge, both of which are difficult for shipping.

Reindeer herding

Extremes (Thawing, ROS-events etc) are the worst scenario, and a yearly returning event unfortunately.



Eurasian Node



Arctic Regional Climate Center Network

Western Siberia



	Seasonal Summary: Summer 2020					
		Observat	tions above (+) and	d below (-) normal		
Temperature	e +2.	. <mark>8°C</mark> 2	-nd warmest year on	Warmest year was	Coldest year was	
Normal 1961-199	0		record	2016 (+3.6°C)	1968 (-1.6°C)	
Precipitation	n Pero	cent of ave	erage precipitation	Wettest year was	Driest year was	
Normal 1961-199	0	98% (ne	ear average)	2002 (+ 23 %)	1946 (- 28 %)	
Sea-Ice	Septer	nber minir	mum sea-ice extent:			
Since 1979						
		OBSE	RVED EXTREME C	LIMATE EVENTS		
			SUMMER 2	020		
Category	Durati	Raritv	Impa	cts associated with	event	
	on		•			
Heat	Jun-		The forest fire se	eason had started ea	rlier and caused	
waves	Jul	Extre	more long-term	damage to local eco	systems.	
Yamalo-	01.07.	me	Khanty-Mansi Au	utonomous Okrug - 4	485 forest fires,	
Nenets 2020 – 146160 ha						
Autonom	15.09.		Yamalo-Nenets Autonomous Okrug - 118 forest fires.			
ous	2020		2226 ha			
Okrug			Melting of perma	frost also contribute	ed to industrial	
eniug			disastor (20000 +	onnos oil snill) in Na		
	1	I		0111185 011 501111 111 INC	JIII3N.	







Western Siberia

Outlook: Winter 2020/2021					Multi Model Agreement			
				Forecast		High	Moderate	Low
	Western Kar	a Sea				✓		
emp	Continent				Above normal		\checkmark	
	Eastern Kara	a Sea						
cip	Continent				Above normal	√	\checkmark	
Pre	Barents sea,	, Kara sea	a		Above normal	√		
e	Freeze-up Kara Sea			Later than normal	✓			
Sea-	Max Ice Exte March 2021	ax Ice Extent arch 2021 Barents Se		ea	Near normal		\checkmark	
E S Liv CO	Economy sector/Possible riskImpacts aLivelihood conditionsImpact a		Impacts ass	ociated				
Live cond	lihood ditions	Therm comfor under	al rt is not risk	Bioclimatic therm	al conditions are favoral	ble		
Navi	gation			Possible extending the duration of the period independent navigation of large-capacity tan vessels for gas and oil exports in Northern S			er conditions for is carriers and bu e	ılk
Energy Mining		Saving of energy resources including of the transport fleet and icebreaker fleet assistance escort Stable production schedules of mining, oil and gas complexes for the shipment. Normal industrial and mining activities in Kara, Barents and Pechora seas.				eaker e d		

Eastern Siberia



Seasonal Summary: Summer 2020					
	Obser	vations above (+) and	d below (-) normal		
Temperature	+2.4°C	5-th warmest year on	Warmest year was 2019	Coldest year was	
Normal 1961-1990		record	(+2.9°C)	1989 (-1.2°C)	
Precipitation	Percent of average precipitation		Wettest year was	Driest year as	
Normal 1961-1990	87% (-13% bellow average)		1988 (+25.2%)	1967 (-21.6%)	
Sea-Ice	ea-Ice September minimum sea-ice extent:				
Since 1979					

OBSERVED EXTREME CLIMATE EVENTS SUMMER 2020

Category	Duratio	Rarity	Impacts associated with event
	n		
Record-	June-	Record	The forest fire season had started earlier and
breaking	July	At some	caused more long-term damage to local
heatwave		locations	ecosystems.
		the	Krasnoyarsk region - 1386 forest fires, 459958 ha
The		monthly	Yakutiya – 2061 forest fires, 6315696 ha
temperatu		average	Emissions of ~59 megatonnes of CO2.
re in		temperatur	Thawing of permafrost – additional emissions of
Verkhoya		es was as	CO2
nsk hit		high as 10-	The proliferation of pests such as Dendrolimus
38°C		12°C above	sibiricus, that attack pine tree.
		normal	

Eastern Siberia

Out	look: winter 2020/	Multi Model Agreement				
		High	Moderate	Low		
Temp	Laptev sea and contir	nental regions	Above normal		\checkmark	
dia	Laptev Sea		Above normal	✓		
Prec	Continental regions		Above normal		\checkmark	
ce	Freeze-up	Lantev sea ice covered	Later than normal	✓		
Sea-I	Max Ice Extent March 2021	no ice edge for extent	Near normal			

Economy sector/ Livelihood conditions	Possible risk	Impacts associated
Livelihood conditions	Thermal comfort is not under risk	Bioclimatic thermal conditions are favorable
Terrestrial hunting	Excessive snowfall reduce animals mobility	Favorable
Mining Energy		Stable production schedules of mining, oil and gas complexes for the shipment. Normal industrial and mining activities in Laptev Sea. Saving of energy resources for local infrastructure.

Chukchi & Bering

Sacanal Summany



Seasonal Summary. Summer 2020					
	Observ	ations above (+) and	d below (-) normal		
Temperature	+1.7°C	6-th warmest year	Warmest year was	Coldest year was	
Normal 1961-1990		on record	2007 (+2.9°C)	1949 (-1.3°C)	
Precipitation	Percent of a	verage precipitation	Wettest year was	Driest year was	
Normal 1961-1990	78% (-22% bellow average)		1954 (+39.6 %)	1982 (-39.8%)	
Snow Cover Normal 1981-2010	much less than normal				
Sea-Ice	September minimum sea-ice extent:				
Since 1979					

2020



OBSERVED EXTREME CLIMATE EVENTS SUMMER 2020



Category	Dura tion	Rarity	Impacts associated with event
Heat waves SST positive anomalies	Prol onge d	Unusual	Massive die-off of bentic marine organisms in Kamchatka peninsula was mostly likely caused by toxic algae and anoxic conditions. The forest fire season had started earlier and finished later. Chukchi region - 111 forest fires, 146160 ha Magadan region - 266 forest fires, 394331 ha

Chukchi & Bering

Outlook: winter 2020/2021				Multi Model Agreement					
	Forecast					High	Moderate	Low	
Temp	Bering sea					✓			
	Eastern and Southern continental regions				Above normal		\checkmark		
	Eastern Siberia regions	an Sea, (Chukchi sea, Northern co	astal		✓			
cip	Bering Sea and continental regions				Above to normal			√	
Pre	Eastern Siberian Sea, Chukchi sea				Above normal		\checkmark		
Sea-Ice	Freeze-up		Chukchi Sea		Near normal		\checkmark		
			Bering Sea		Near normal to early			 ✓ 	
	Max Ice Extent March 2021		Bering Sea		Near normal	\checkmark			
Economy sector/ Livelihood conditions		Possible risk		Impacts associated					
Seal fishing		Increased storm activity		Reduction of seal fishing					
Hunting		Excessive snowfall reduce animals mobility		Increased hunting activity					
Energy				Saving of energy resources including of the transport fleet and icebreaker assistance escort					
Mining and industry				Stable production schedules of mining, oil and gas complexes for the shipmer Normal industrial activities (ship repair factories and fish processing enterprises) in Okhotsk Sea				shipment.	

Central Arctic



Seasonal Summary: Summer 2020									
Observations above (+) and below (-) normal									
Temperature Normal 1961-1990		1.8°C	3-rd warmes on reco	st year ord	Warmest year was 2012 (+2.0°C)		Coldest ye 1963 (-0	Coldest year was 1963 (-0.7°C)	
Precipitation Normal 1961-1990		Percent of a 92% (-8 %	verage precipi bellow avera	itation age)	Wettest year was 1989 (+27%)		Driest yea 1998 (-	Driest year was 1998 (-16%)	
Sea-Ice Since 1979									
Outlook: winter 2020/2021 Multi Model Agreeme							ment		
		Fo	recast			High	Moderate	Low	
Temp	Near the A and Weste	askan, Chukcl n Siberian reg	hi, Eastern jions	Above normal		√			
	North pole, regions	European and	d Atlantic			√			
Precip	All regions			Above normal		✓			
Sea-Ice	Freeze-up	Ice cover	ed, no foreca	ast					



Thank you for your attention!



Arctic Regional Climate Center Network