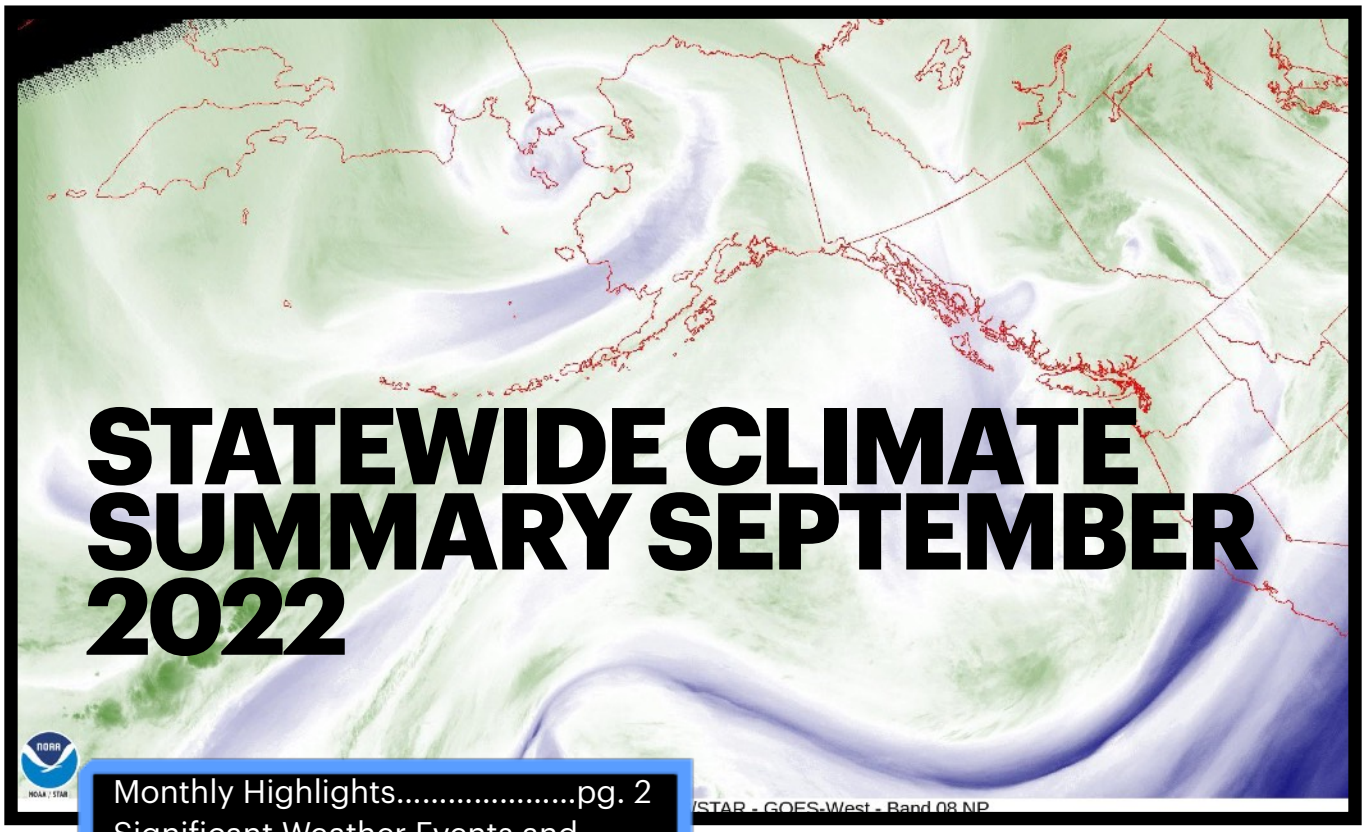
Alaska Climate Research Center
The Alaska State Climate Center



STATEWIDE CLIMATE SUMMARY SEPTEMBER 2022

Monthly Highlights.....pg. 2
Significant Weather Events and Synoptics.....pg. 3
Statewide Temperatures.....pg. 4
Statewide Precipitation.....pg. 8
Wildfire Activity.....pg. 11
State of the Sea Ice.....pg. 12
Newsworthy Information.....pg. 17

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Alaska's Statewide Climate Summary for September 2022 provides an overview of weather for the month based on data from selected weather stations throughout the state. "Departure from normal" refers to the climatological average over the 1991-2020 normal period. Here, we report on temperature, precipitation and drought conditions in the state, as well as the condition of the Arctic sea ice.

HIGHLIGHTS

Widespread storm damage on the West Coast due to ex-typhoon Merbok

Water levels over 10ft above low tide line in Nome during storm surge

Arctic sea ice extent reached its annual minimum on September 18 at 4.67 million square kilometers. The 2022 minimum is the 10th lowest in the satellite record, tied with 2017 and 2018.

Synoptics and Significant Weather Events

September was a stormy month in Alaska, particularly on the Bering coast. Ex-typhoon Merbok caused widespread and major damage in coastal communities and brought historic water levels during the storm surge (see Newsworthy Events at the end of this report). Two other former typhoons - much less intense than Merbok - also reached Alaska after transitioning to extra-tropical systems and brought rain and high winds to the West Coast.

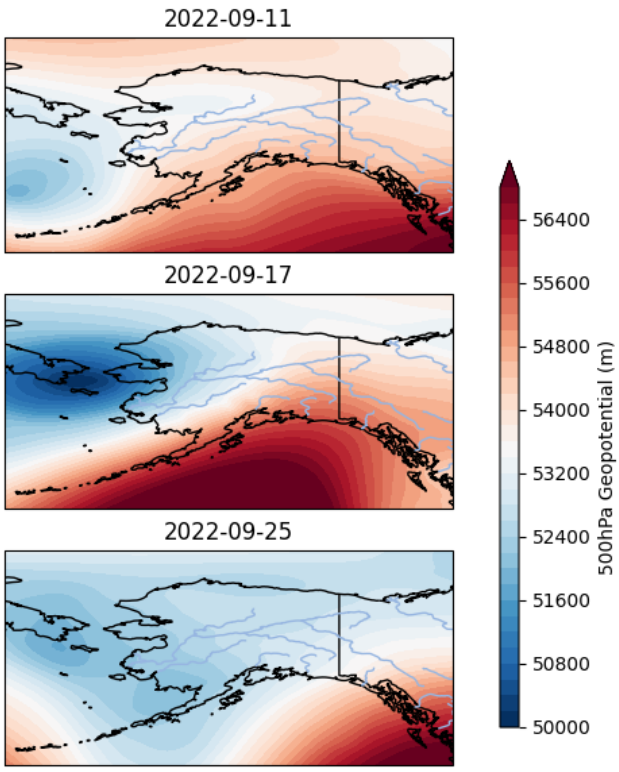


Figure 1: *ERA5 reanalysis data of 500hPa geopotential height for September 11, 17, and 25: Troughing associated with storm Hinnamor (Sep. 11), ex-typhoon Merbok centered near the Bering Straight (Sep. 17) and broad upper level troughing during the last week of September.*

September started out with a long wave trough situated over the eastern Bering Sea and the western parts of the state. The trough axis gradually moved east and a low pressure system developed in the Gulf of Alaska. This system brought unsettled weather with showers and cloudy conditions in much of the state during the first days of September. Another deep long wave trough then developed over Siberia and moved towards Alaska. A cut off low eventually associated with this trough settled over the Bering coast and the northern half of the state for some days in a Rex block pattern.

Around September 10th, the remnants of typhoon Hinnamor reached the Bering Sea and brought precipitation and stormy conditions on the West Coast. The troughing in the Bering Sea produced a southerly flow further east, which led to strong Chinook winds over the Alaska Range. The Bering Sea storm eventually moved east into Alaska, bringing unsettled

weather for much of the state.

By September 12th, forecasts showed that typhoon Merbok was likely to become extra-tropical and track towards the Bering Sea in the coming days. As the forecast solidified, concerns about the strength of the system and potential impacts grew. The intensification and storm track of Merbok through the Bering Sea were well predicted by the weather models and storm and flood warnings were issued by the NWS based on the model guidance. Merbok reached the West Coast on September 16th and brought hurricane force winds and major flooding in many coastal communities as it moved up the coast over the weekend of September 17th and 18th. Conditions calmed as Merbok weakened and drifted broadly north.

Unsettled weather and large-scale upper level troughing persisted throughout the last third of the month. The central and eastern Interior saw some days of calm and sunny fall weather, while conditions remained cloudy and fairly wet in the west and south. During the final days of September another ex-typhoon reached the Aleutians and Bering coast. Storm Kulap brought high winds and rain but did not come close to Merbok in terms of intensity and impact.

Temperature

Monthly mean temperatures in September were largely above normal throughout the state (Fig. 2, Table 1). St. Paul Island and King Salmon were the only two First Order stations to record negative monthly anomalies this month (-0.3 and -0.96°F, respectively). Bettles and Nomes had the highest positive anomalies with 3.2 and 3.5°F above normal, respectively.

Daily anomalies (Fig. 3) were almost entirely positive throughout the month in Utqiaġvik, Bettles, and Nome, which each recorded only one or two cooler than average days. The patterns of daily anomalies is more varied at the other stations, reflecting regional variability in weather patterns. The negative monthly anomalies in St. Paul Island and King Salmon were driven by cool temperatures during the first and last third of the month which other stations experienced to a lesser extent or not at all.

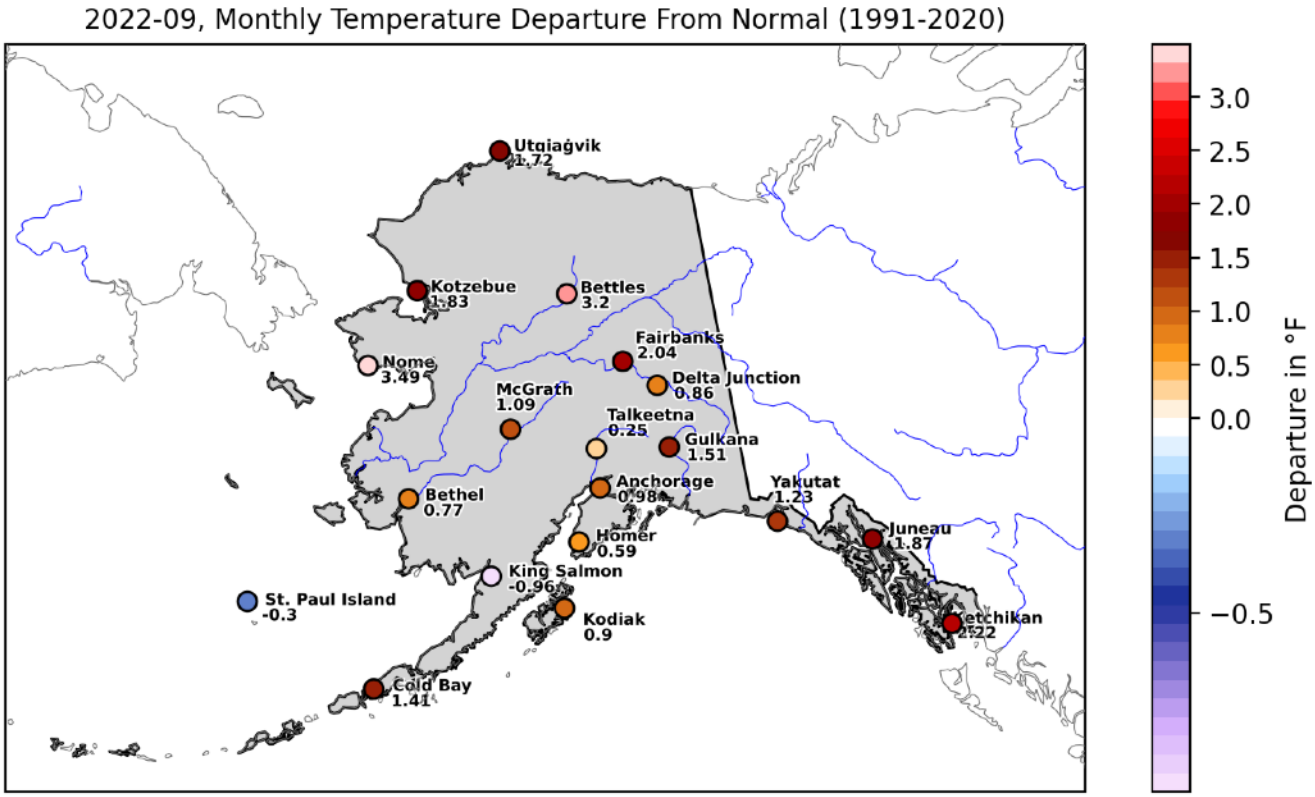


Figure 2. *Monthly mean temperature departure from normal (ºF), September 2022, at the selected First Order stations in Alaska.*

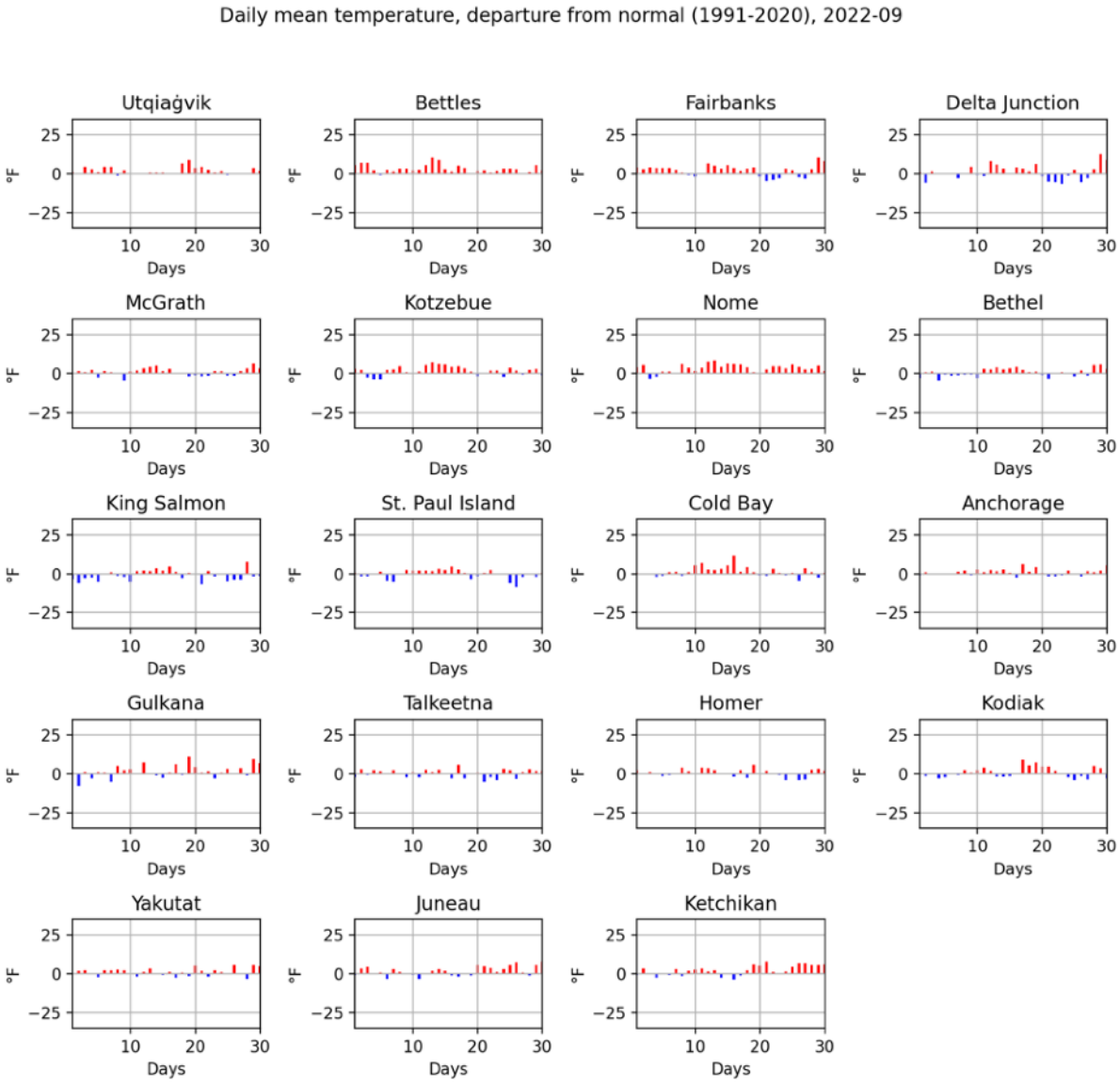


Figure3. *Daily mean temperature departures for each day in September 2022 at the selected stations.*

Table 1. *Mean monthly air temperature, normal (1991-2020) and departure for selected stations throughout the state, September 2022. Color-coded to match Figure 3 (yellow-orange-red = warmer than usual; shades of blue = cooler than usual).*

Station	Observed (ºF)	Normal (ºF)	Departure (ºF)
Anchorage	50.3	49.3	1.0
Bethel	46.8	46.1	0.8
Bettles	44.4	41.2	3.2
Cold Bay	49.8	48.4	1.4
Delta Junction	45.7	44.8	0.9
Fairbanks	47.8	45.8	2.0
Gulkana	45.2	43.6	1.5
Homer	50.1	49.5	0.6
Juneau	52.0	50.1	1.9
Ketchikan	55.8	53.6	2.2
King Salmon	47.7	48.6	-1.0
Kodiak	51.6	50.7	0.9
Kotzebue	44.9	43.1	1.8
McGrath	47.1	46.0	1.1
Nome	46.6	43.1	3.5
St. Paul Island	45.7	46.0	-0.3
Talkeetna	47.7	47.5	0.2
Utqiaġvik	35.4	33.7	1.7
Yakutat	50.6	49.4	1.2

Precipitation

September was relatively wet in most of Alaska. The First Order stations on the western coast and eastern Interior lead this month's list of wettest stations: Gulkana recorded 277% of normal precipitation and Nome and Bethel clocked in at 253% and 194%, respectively. Utqiaġvik was driest in relative terms with 30% of normal. Homer, Kodiak, St. Paul Island, and Cold Bay were also unusually dry (Figures 4, 5; Table 2).

Snow was not recorded at the First Order stations with snowfall measurements. However, it did snow on the North Slope and in mountainous areas during September. Automatically measuring solid precipitation is notoriously difficult, particularly for small snowfalls.

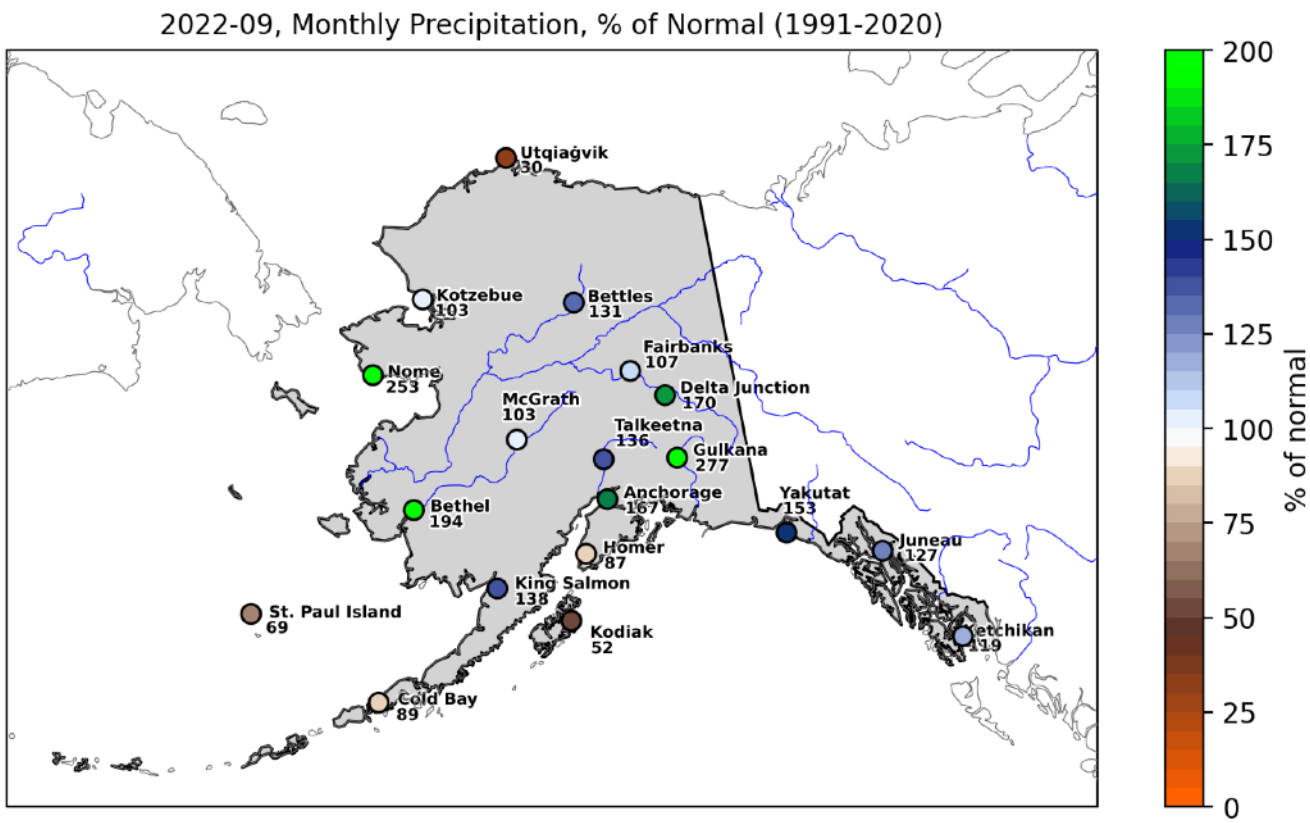


Figure 4. *Monthly mean precipitation departure from normal (in percent), September 2022, for selected stations around the state of Alaska.*

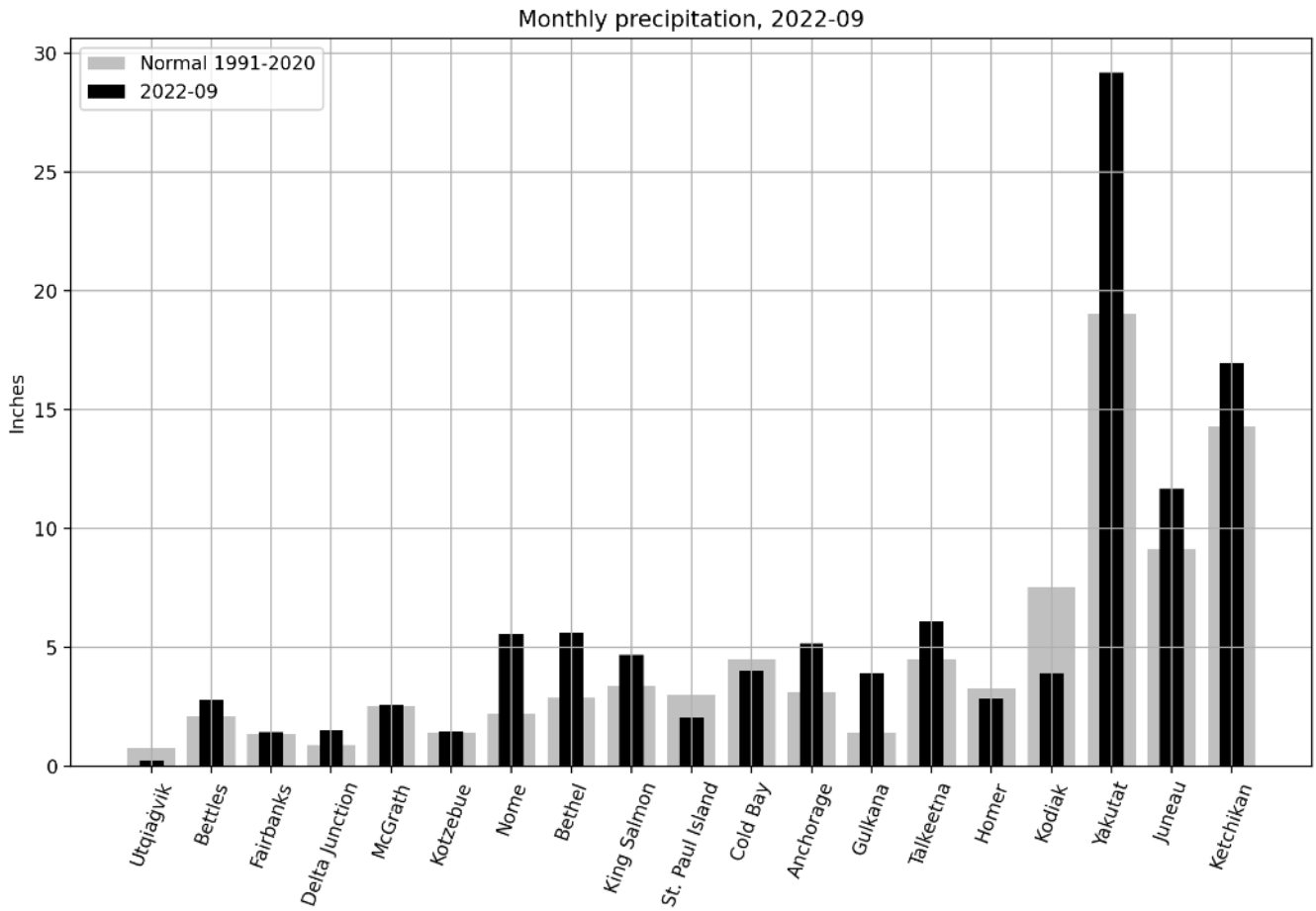


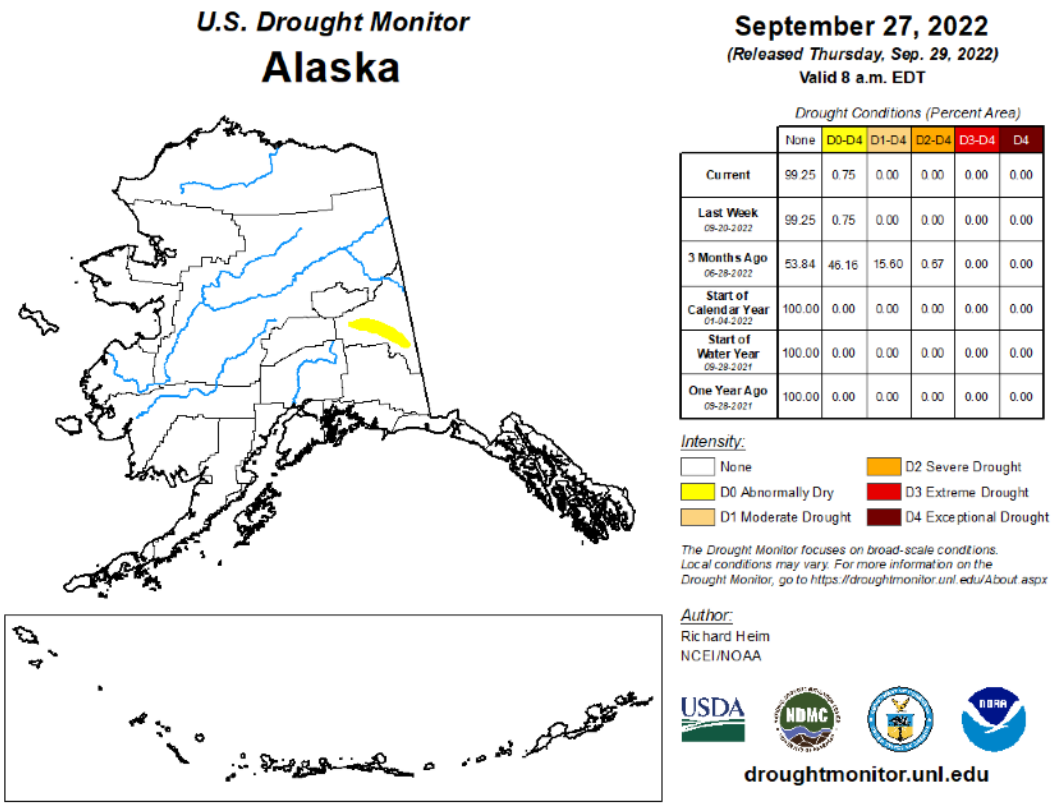
Figure 5. *Monthly precipitation sums for August 2022 at the selected First Order stations compared to the normal (1991-2020), in inches.*

Table 2. *Monthly precipitation sum, normal (1991-2020) and departure expressed as a percentage of the normal (1991-2020) for selected stations throughout the state, September 2022. Shades of brown, blue, and green correlate with Figure 4.*

Station	Precipitation (in)	Normal (in)	% of Normal
Anchorage	5.2	3.1	167.1
Bethel	5.6	2.9	194.1
Bettles	2.8	2.1	131.0
Cold Bay	4.0	4.5	89.3
Delta Junction	1.5	0.9	170.0
Fairbanks	1.5	1.4	107.4
Gulkana	3.9	1.4	276.8
Homer	2.9	3.3	87.2
Juneau	11.7	9.2	127.4
Ketchikan	17.0	14.3	118.7
King Salmon	4.7	3.4	137.9
Kodiak	3.9	7.6	51.8
Kotzebue	1.5	1.4	102.8
McGrath	2.6	2.5	102.8
Nome	5.6	2.2	253.2
St. Paul Island	2.1	3.0	68.7
Talkeetna	6.1	4.5	136.4
Utqiaġvik	0.2	0.8	29.9
Yakutat	29.2	19.0	153.2

Drought

No part of Alaska is currently experiencing drought conditions. Abnormally dry conditions are present locally in parts of the eastern Interior. Figure 7 illustrates the Alaska drought monitor, which is produced through a collaboration of the USDA, NOAA and the National Drought Mitigation Center.



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	99.25	0.75	0.00	0.00	0.00	0.00
Last Week 09-20-2022	99.25	0.75	0.00	0.00	0.00	0.00
3 Months Ago 06-28-2022	53.84	46.16	15.60	0.67	0.00	0.00
Start of Calendar Year 01-04-2022	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 09-28-2021	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 09-28-2021	100.00	0.00	0.00	0.00	0.00	0.00

Figure 7. *U.S. Drought Monitor map for Alaska, updated on September 27, 2022. The table on the right shows the percent area affected by different categories of drought intensity. Figures and data produced and released by the U.S. Drought Monitor, a partnership between the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration (https://droughtmonitor.unl.edu).*

Wildfire Activity

The 2022 fire season has largely come to a close. As of September 30, the year-to-date fires total is 590 (marginally up from 585 at the end of August), with 3,107,469.7 acres burned (Alaska Interagency Coordination Center Situation Report). 288 fires were human-caused, burning 11,818.5 acres, while 281 were lightning-sparked, burning 3,095,611.6 acres. Another 21 fires had undetermined causes according to the AICC.

Please check our UAFSmoke website at http://smoke.alaska.edu for current and updated fire information. UAFSmoke shows current wildfire status information and up to 72 hours forecast of concentrations of black carbon and particulate matter emitted from Alaska wildfires.

Arctic Sea Ice

Arctic sea ice extent reached its annual minimum on September 18 at 4.67 million square kilometers. During the second half of September sea ice extent increased at rates between about 4% and about 7%. Growth is now expected to continue through the winter season but unfavourable weather conditions (high temperatures, specific wind patterns) could still cause a late season reduction in extent. The 2022 annual minimum occurred only a few days later than in 2021 and the course of the 2021 and 2022 seasons to date has been very similar in general. The 2022 minimum extent is the 10th lowest in the 44-year satellite record, tied with 2017 and 2018. Figure 8 shows a time series of sea ice extent while Figures 9 A, B show the sea ice extent and concentrations as of August 30, 2022 compared to the average from 1981-2010.

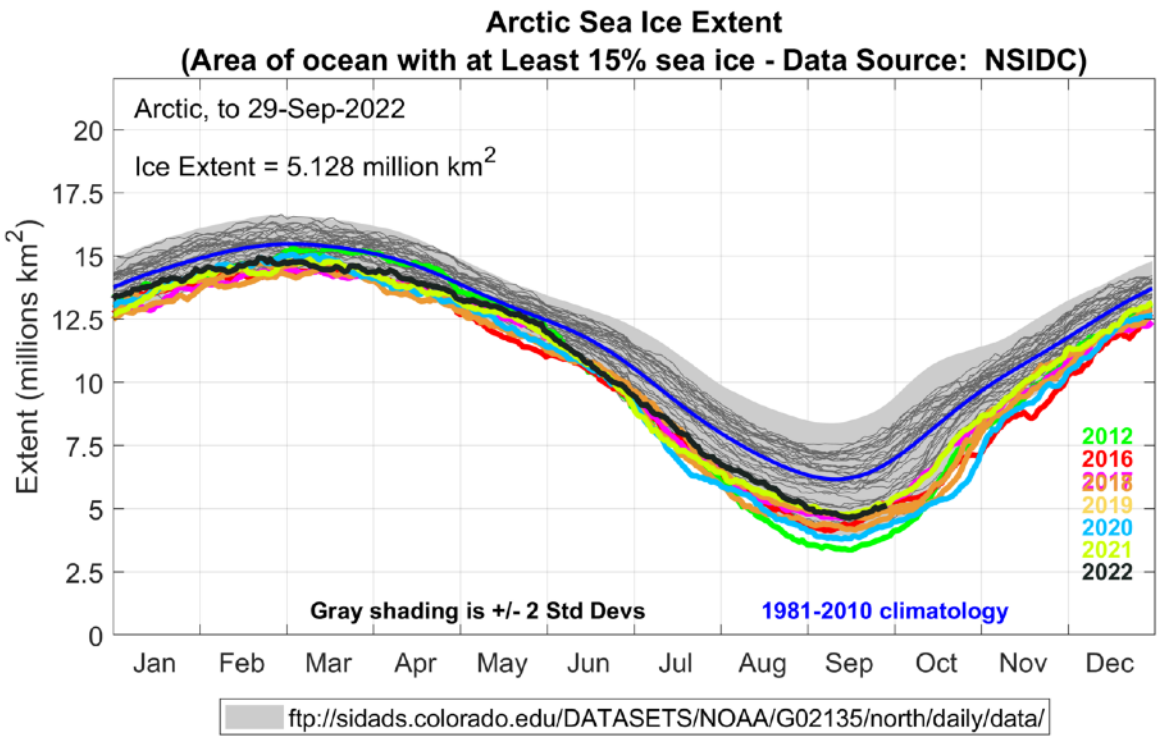


Figure 8. *Time series of daily Arctic sea ice extent. This year's data (black) are updated until September 29, 2022. The median sea ice extent for the 1981-2010 reference period is depicted in blue. Specific years are highlighted in colors. Plot Compiled by: Howard J. Diamond, PhD; Climate Science Program Manager at NOAA's Air Resources Laboratory*

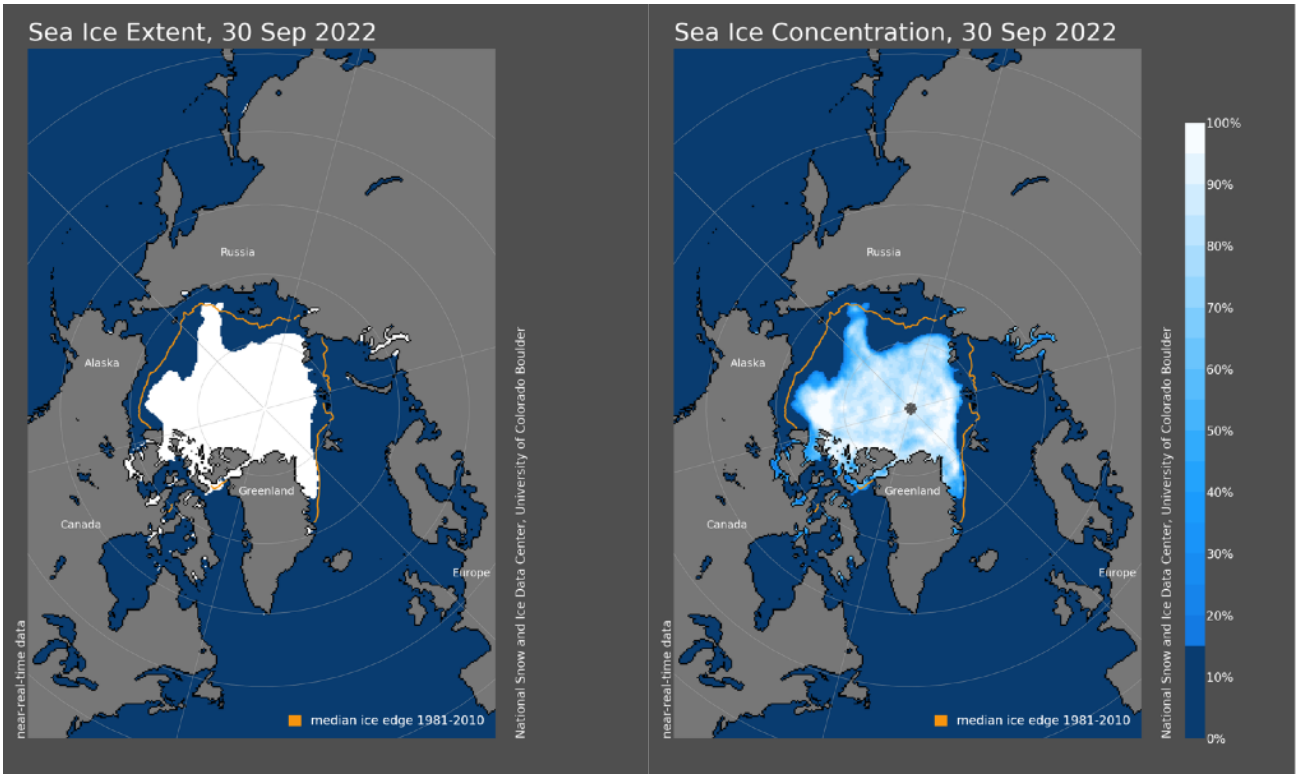


Figure 9. *(A) Sea ice extent and (B) sea ice concentration as of September 30, 2022, and as compared with the 1981 - 2010 median edge. Images: National Snow and Ice Data Center (nsidc.org).*

Newsworthy Information

Ex-typhoon Merbok caused severe and widespread damage along Alaska's west coast from September 16 to September 19. Coastal communities the Kuskokwim delta to Norton Sound and the Bering Strait reported major flood and wind related impacts. Residents were forced to evacuate their homes and shelter in schools or seek higher ground, e.g., in Golovin, Hooper Bay, and Newtok. Flooding led to extensive infrastructure damage including washed out roads, flooded air fields, inundated homes, and destroyed berms and boats. Several homes reportedly floated off their foundations and numerous hunting and fishing camps - essential for subsistence - were destroyed.

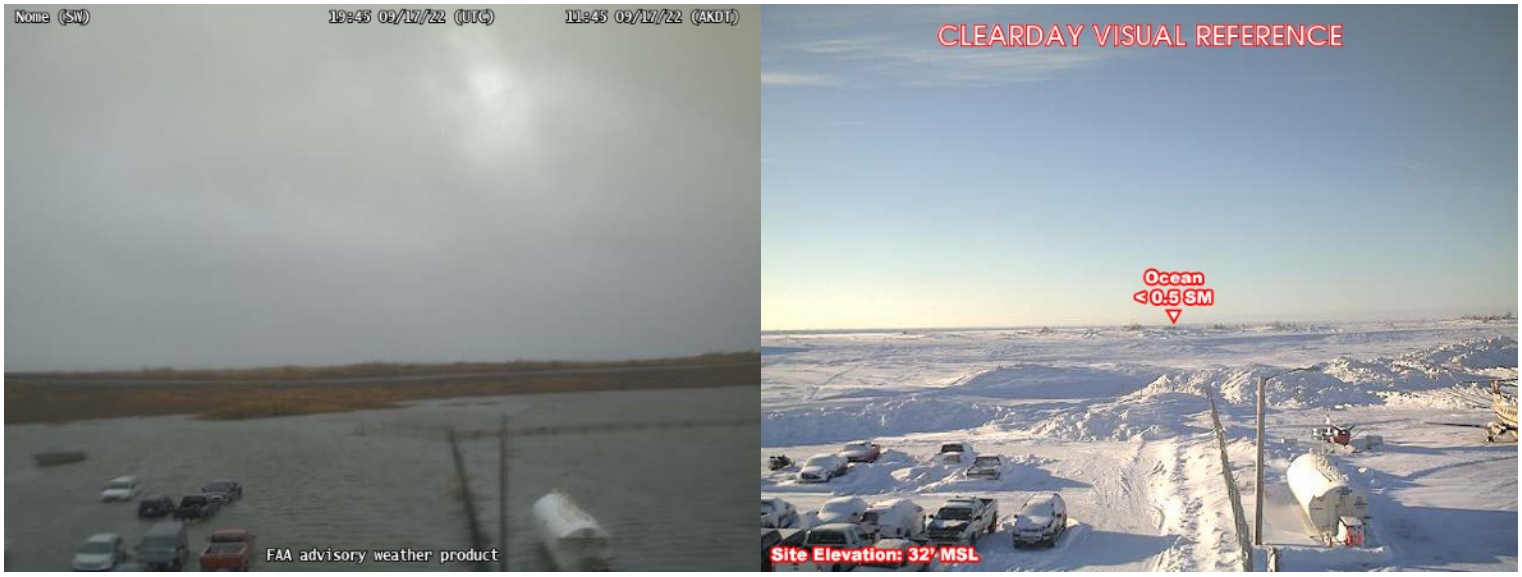
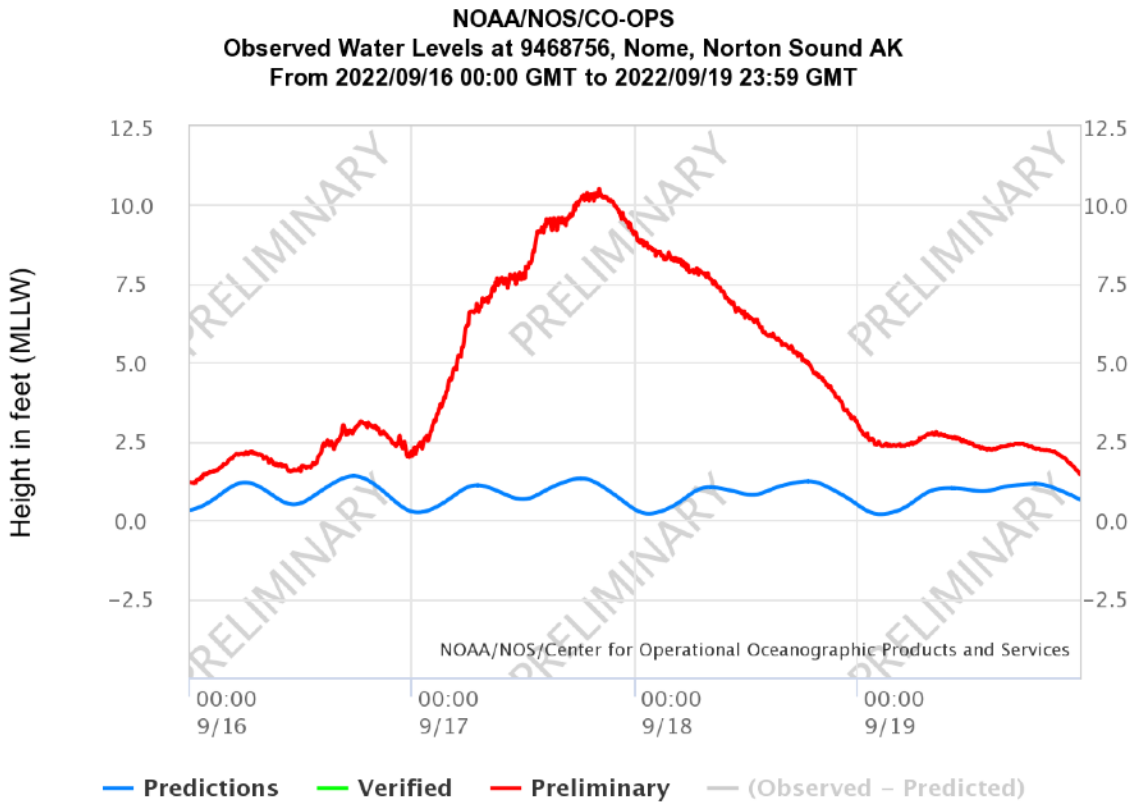
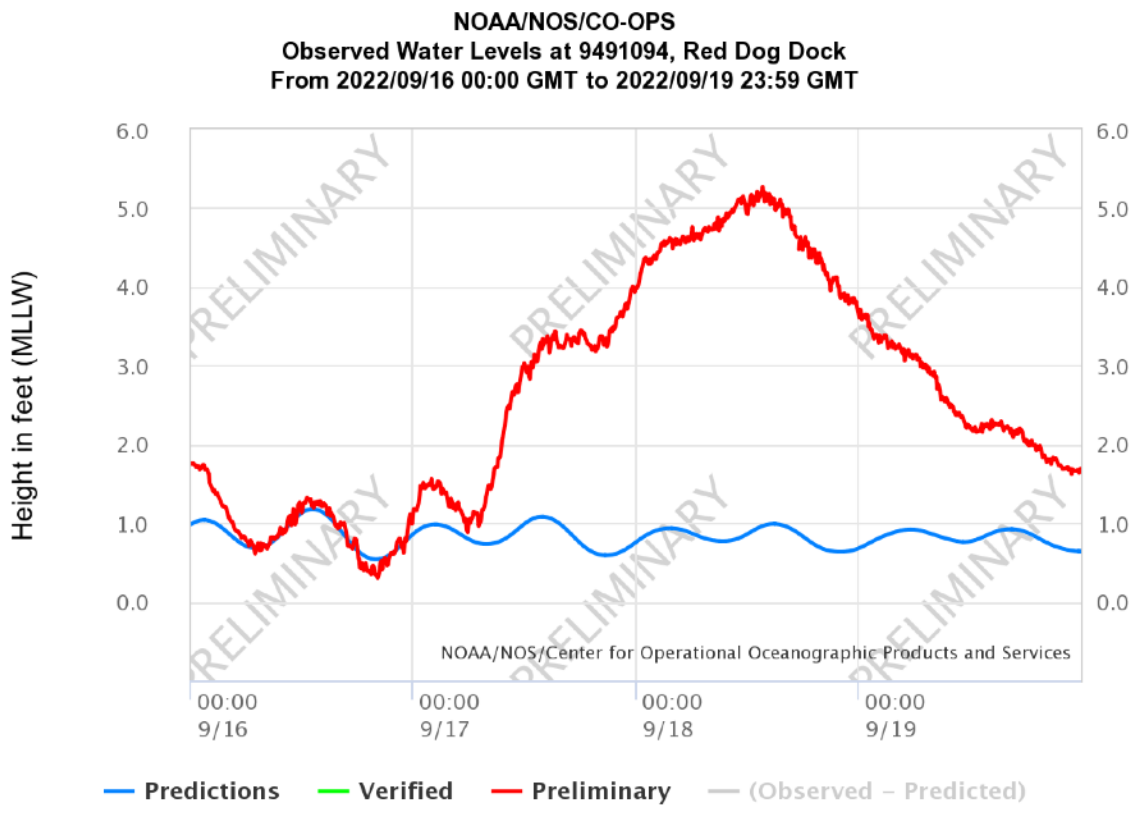


Figure 10. *Left: FAA Nome webcam image from September 17, 2022, shows a flooded parking lot. Right: Clearday reference from the same webcam.*

Merbok was one of the strongest September storms on record for the Northern Bering Sea. Nome reported a water level of 10.5 feet above the low tide level, the highest value since an extremely strong storm in November 1974. The plots below show the water level in Nome and Red Dog Rock from September 16-19 and were obtained from NOAA's tidesandcurrents data platform. Water levels peaked late on the 17th in Nome and around midday on the 18th in Red Dog Rock as Merbok moved from the Bering Sea into the Chukchi Sea.


NOAA/NOS/CO-OPS
Observed Water Levels at 9468756, Nome, Norton Sound AK
From 2022/09/16 00:00 GMT to 2022/09/19 23:59 GMT
Height in feet (MLLW)
12.5
10.0
7.5
5.0
2.5
0.0
−2.5
PRELIMINARY
NOAA/NOS/Center for Operational Oceanographic Products and Services
00:00 9/16
00:00 9/17
00:00 9/18
00:00 9/19
Predictions
Verified
Preliminary
(Observed − Predicted)


NOAA/NOS/CO-OPS
Observed Water Levels at 9491094, Red Dog Dock
From 2022/09/16 00:00 GMT to 2022/09/19 23:59 GMT
Height in feet (MLLW)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
PRELIMINARY
NOAA/NOS/Center for Operational Oceanographic Products and Services
00:00 9/16
00:00 9/17
00:00 9/18
00:00 9/19
Predictions
Verified
Preliminary
(Observed − Predicted)

Appendix

Table A1: September 2022 daily records of mean daily temperature, i.e. highest/lowest values of mean daily temperature ever recorded on specific days. Records are computed since the beginning of the respective time series. Two new highest mean daily temperature records were set and one was set for lowest mean daily temperature record.

Highest Mean Daily Temperature on Record				
Station	**Date**	**New Record (°F)**	**Year of Old Record**	**Old Record (°F)**
Cold Bay	2022-09-16	60.0	1954	57.0
Juneau	2022-09-26	55.5	1943	53.5
Lowest Mean Daily Temperature on Record				
St. Paul Island	2022-09-26	35.0	1992	37.0

Table A2: September 2022 daily records of maximum daily temperature, i.e. highest/lowest values of maximum daily temperature ever recorded on specific days. Records are computed since the beginning of the respective time series. Two new highest maximum daily temperature record were set.

Highest Maximum Daily Temperature Record				
Station	**Date**	**New Record (°F)**	**Year of Old Record**	**Old Record (°F)**
Cold Bay	2022-09-11	63.0	2016	61.0
Cold Bay	2022-09-16	69.0	1954	62.0

Table A3: September 2022 daily records of minimum daily temperature, i.e. highest/lowest values of minimum daily temperature ever recorded on specific days. Records are computed since the beginning of the respective time series. Four new records for highest minimum daily temperature were set late in September in Juneau and Ketchikan. One new record was set for lowest minimum daily temperature.

Highest Minimum Daily Temperature Record				
Station	**Date**	**New Record (°F)**	**Year of Old Record**	**Old Record (°F)**
Juneau	2022-09-26	51.0	1943	50.0
Juneau	2022-09-30	53.0	2008	52.0
Ketchikan	2022-09-26	56.0	1940	54.0
Ketchikan	2022-09-28	55.0	1957	54.0
Lowest Minimum Daily Temperature Record				
St. Paul Island	2022-09-26	26.0	1993	28.0

This information consists of climatological data compiled by the Alaska Climate Research Center, Geophysical Institute, University of Alaska Fairbanks. For more information on weather and climatology, visit the center website at http://akclimate.org. Please report any comments, ideas or errors to uaf-climate@alaska.edu.