

Alaska Statewide Climate Summary

September 2019

SEPTEMBER 2019 HIGHLIGHTS:

- **ALASKA RECORDED AGAIN WARMER THAN NORMAL TEMPERATURES ALL OVER THE STATE. AN EXTREME NEW SEPTEMBER TEMPERATURE RECORD WAS SET IN UTQIAGVIK.**
- **PRECIPITATION WAS ABOVE NORMAL IN LARGE PARTS OF THE STATE. WHILE DURING THE FIRST HALF OF THE MONTH, RESTRICTIONS WERE IMPOSED IN SOME COMMUNITIES IN THE KENAI PENINSULA DUE TO WATER SCARCITY, STEADY RAINFALL OCCURRED WIDELY OVER THE REST OF THE MONTH OF SEPTEMBER, AND WATER LEVELS ESPECIALLY IN SOUTHERN ALASKA WERE RESTORED.**
- **DUE TO INTENSE STORMS, SOME RIVERS IN THE KENAI PENINSULA AND IN PEDRO BAY WERE PUSHED INTO FLOOD ACTION STAGE. STRONG WINDS AND FLOODINGS WERE RECORDED ALSO IN WESTERN ALASKA AND IN THE ANCHORAGE BOWL.**
- **THE PANHANDLE RECEIVED SIGNIFICANTLY LESS THAN NORMAL RAINFALL, AND CONTINUES TO BE UNDER ABNORMALLY DRY TO EXTREME DRY CONDITIONS.**
- **AROUND SEPTEMBER 19, ARCTIC SEA ICE BEGUN ITS AUTUMN GROWTH. THE 2019 SEASON IS ABOUT TIED FOR NUMBER TWO ALL-TIME LOW WITH THE 2016 LEVEL.**
- **MASSIVE SEABIRD DIE-OFFS, OBSERVED IN ALASKA DURING SUMMER 2019, IS LINKED TO CHANGES IN ZOOPLANKTON AND FISH POPULATIONS, WHICH COULD BE RELATED TO THE OBSERVED DECLINE IN SEA ICE EXTENT AND HIGH SEA SURFACE TEMPERATURES.**

The following report provides an overview of the September 2019 weather. The report is based on data from selected weather stations throughout the state of Alaska. “Departure from normal” refers to the climatological average over the 1981-2010 period.

Temperature

In September 2019, Alaska experienced once again significantly warmer than normal temperatures.

All the analyzed stations recorded positive temperature departures from the 1981-2010 average values (Figure 1, Table 1). Stations along the Arctic Coast measured the highest temperature departures: mean monthly temperatures in Utqiagvik and Kotzebue were equal to 40.8 and 47.5°F respectively, 8.7 and 5.2 °F warmer than normal. Follow St. Paul Island in the Southwest and Anchorage in the South, with temperature departures equal respectively to 4.4 and 4.1°F. Delta Junction and Fairbanks in the Interior, Gulkana in the South, Yakutat along the Panhandle, King Salmon, Kodiak and Cold Bay in the Southwest, and Bethel in the West measured mean monthly temperatures more than 3°F warmer than average values for the period 1981-2010. Bettles, Nome, McGrath, Talkeetna, Homer, and Ketchikan experienced temperature departures greater than 2°F. With a mean monthly temperature of 51.6°F, Juneau recorded the lowest temperature departure (1.6°F) among the analyzed stations.

Two stations set new records of mean temperature for the month of September (Table 2). In Cold Bay the mean monthly temperature was 52°F, 0.8°F warmer than in 2016, the second warmest September on record, and 0.9°F warmer than last year, the third warmest September ever recorded. With 40.8°F, Utqiagvik saw the warmest September on record, almost 3.8°F warmer than the second and third years in the ranking, occurred in 1998 and 2007.

2019-09, Monthly Temperature Departure From Normal (1981-2010)

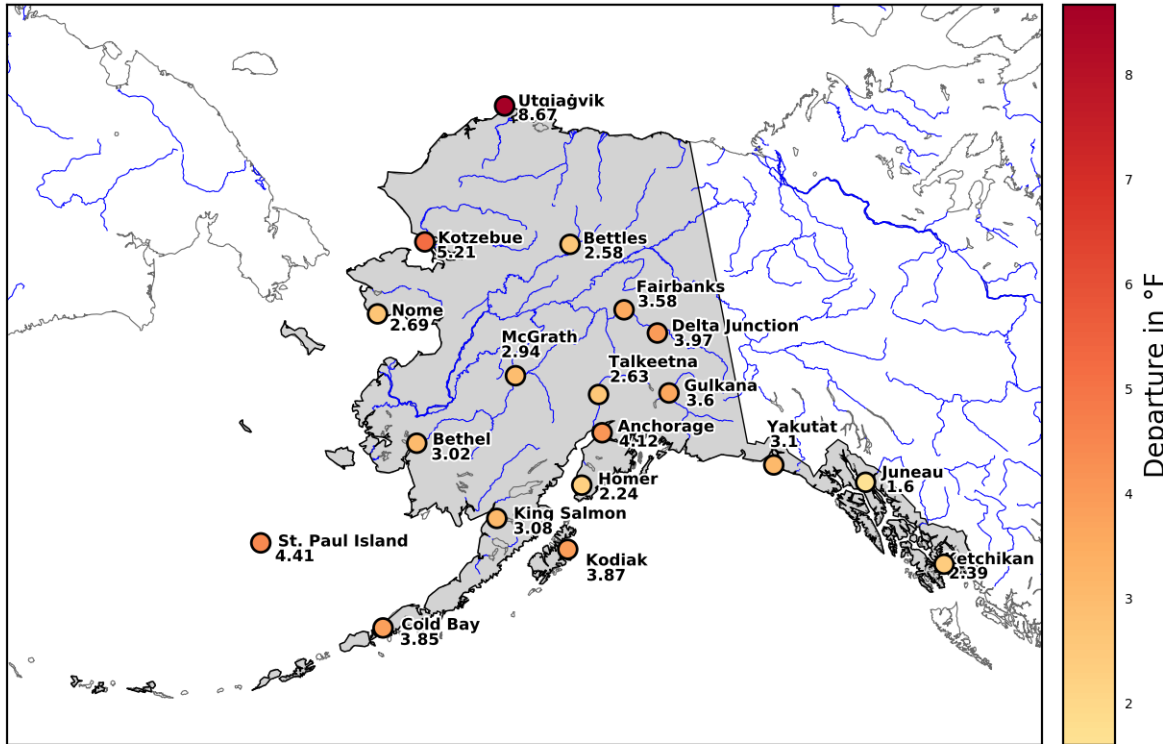


Figure 1: Monthly mean temperature departure from normal, September 2019.

During September 2019, multiple stations set new temperature high records for mean, minimum and maximum daily temperatures on specific days. All values and dates are listed in Table A1, A2 and A3 in the appendix.

Figures 2 and 3 show mean daily temperature departures from normal for 2019 in Kotzebue and in St. Paul Island. While red and blue bars represent positive and negative departures from normal, red and blue lines represent the highest and lowest values of mean daily temperature on record for each day of the year. Days in which red bars (positive departures) are higher than the red line indicate high mean daily temperature records. As an example, in Kotzebue, on 02, 05, 06, 07, 08 September 2019, the mean daily temperatures were the highest ever recorded on these specific days since the beginning of the time series (Figure 2, Table A1). Likewise, on September 13, 15, 18, 26, and 27, 2019, St. Paul Island saw the highest mean daily temperatures ever recorded in these specific days (Figure 3, Table A1).

Table 1: Mean monthly air temperature, normal (1981-2010) and departure for selected stations throughout the state, September 2019.

Station	Observed (°F)	Normal (°F)	Departure (°F)
Anchorage	52.7	48.5	4.1
Bethel	48.6	45.6	3.0
Bettles	43.2	40.6	2.6
Cold Bay	52.0	48.1	3.8
Delta Junction	47.8	43.8	4.0
Fairbanks	48.4	44.8	3.6
Gulkana	47.1	43.3	3.6
Homer	50.4	48.1	2.2
Juneau	51.6	50.0	1.6
Ketchikan	54.9	52.5	2.4
King Salmon	50.7	47.6	3.1
Kodiak	53.3	49.4	3.9
Kotzebue	47.5	42.3	5.2
McGrath	47.5	44.6	2.9
Nome	45.5	42.8	2.7
St. Paul Island	49.6	45.4	4.4
Talkeetna	50.1	47.5	2.6
Utqiagvik	40.8	32.1	8.7
Yakutat	51.5	48.4	3.1

Table 2: Mean monthly air temperature records set in September 2019, old records and years of old records.

Station	New Record (°F)	Year of old record	Old record (°F)
Cold Bay	52.0	2016	51.2
Utqiagvik	40.8	1998	37.7

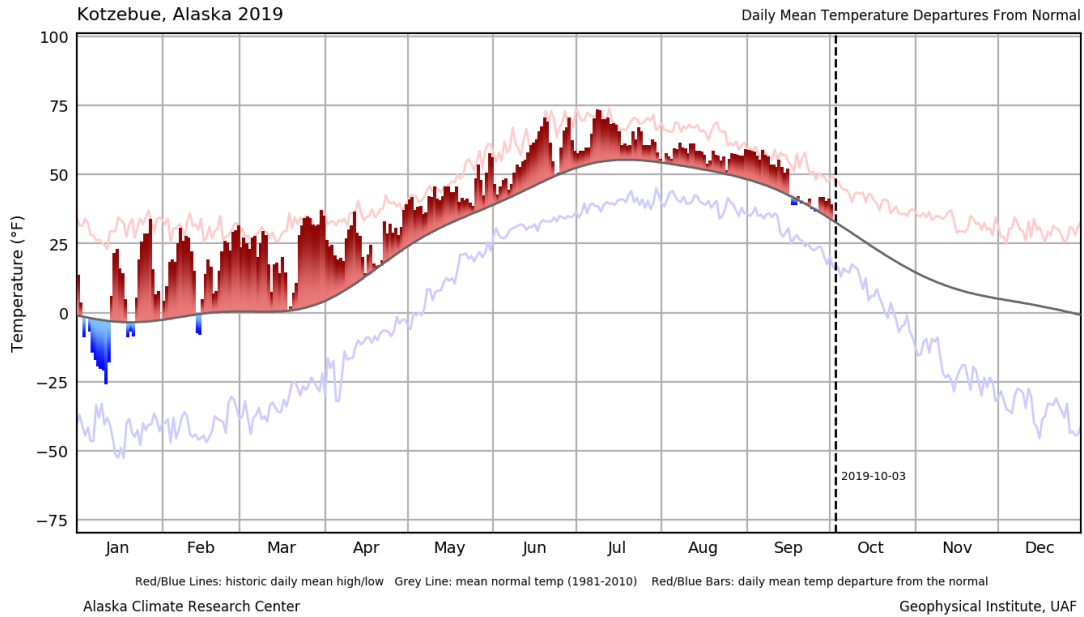


Figure 2: Kotzebue daily mean temperature departures from normal (1981-2010) for 2019. Red and blue bars represent positive and negative temperature departures. Grey line represents the mean normal temperature, red and blue lines represent respectively the historic highest and lowest records of mean daily temperature.

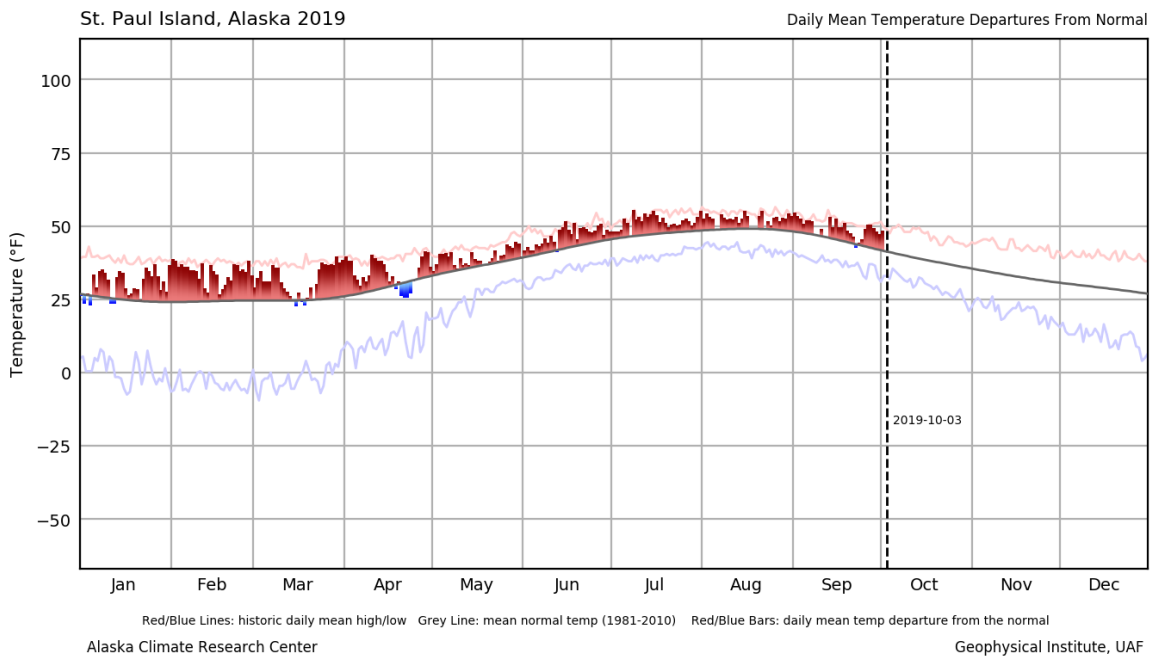


Figure 3: St. Paul Island daily mean temperature departures from normal (1981-2010) for 2019. Red and blue bars represent positive and negative temperature departures. Grey line represents the mean normal temperature, red and blue lines represent respectively the historic highest and lowest records of mean daily temperature.

Daily mean temperature, departure from normal (1981-2010), 2019-09

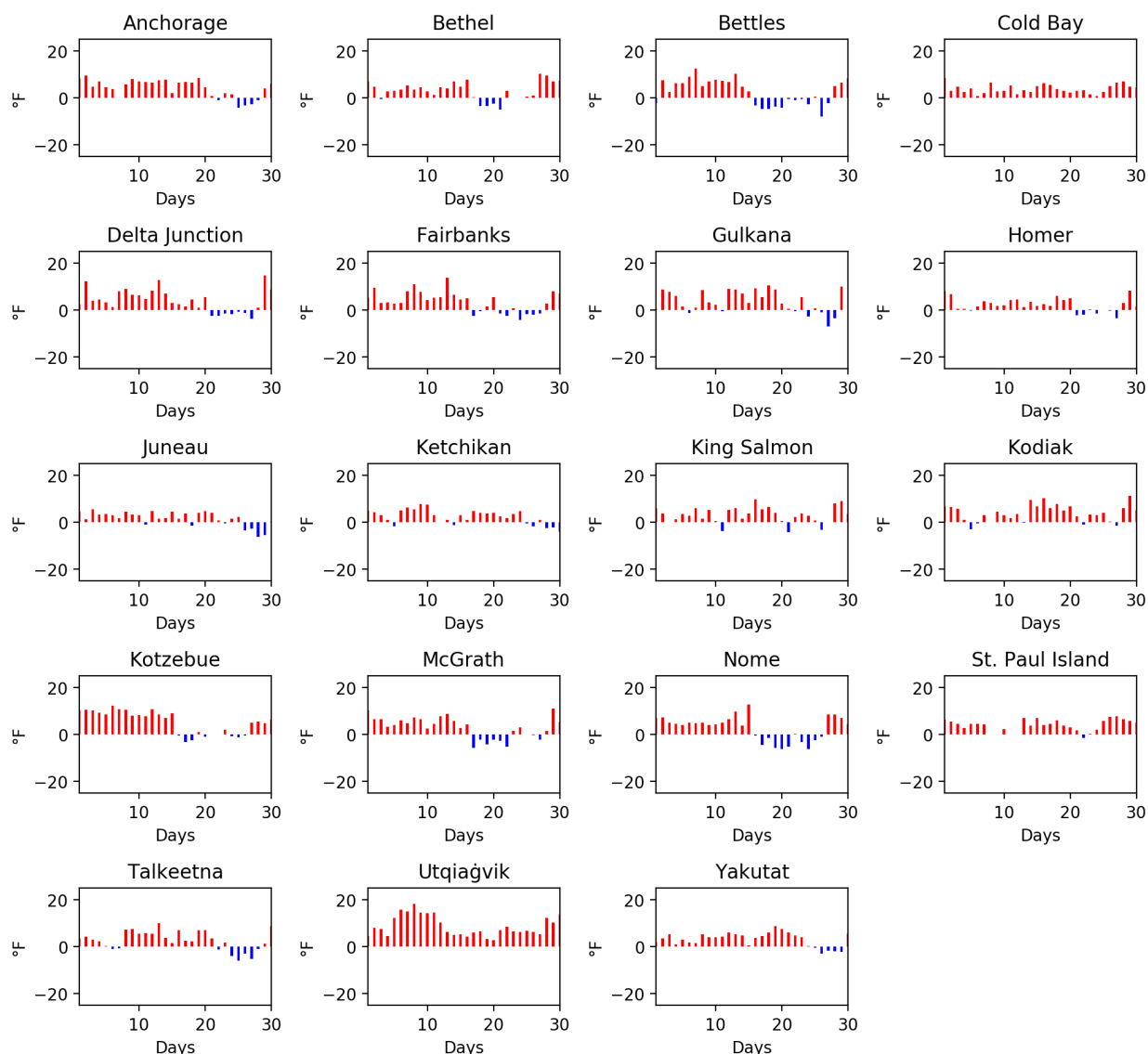


Figure 4: Daily mean temperature departures for each day in September 2019, at the selected stations.

Figure 4 shows temperature deviations at all of the selected stations for each day of the month. All stations show consistent and significant positive deviations from normal throughout most of September 2019 (Figure 4). Utqiagvik and Cold Bay measured warmer than normal temperatures every day of the month. King Salmon, Kodiak and St. Paul Island recorded almost always warmer than normal temperatures, and a few isolated days with colder than normal temperatures. Many stations show significant positive temperature departures during the first half of the month, and smaller positive and slightly negative afterwards. In the Northern and Western part of Alaska, such as in Bethel, Bettles, Kotzebue, Nome, and McGrath this shift from warmer to colder than normal temperature occurred mainly in the middle of the month. In Anchorage, Delta Junction, Fairbanks, Gulkana, Homer, and Talkeetna instead cooler temperatures were recorded

starting from September 20. Yakutat, Juneau, and Ketchikan along the Panhandle experienced colder than normal weather only during last days of the month.

Precipitation

This month, precipitation has been above normal in large parts of Alaska, especially in the southwestern and southcentral regions of the state (Figure 5, Table 3). Conversely, the Panhandle, Kodiak and St. Paul Island experienced drier than normal weather, prolonging the ongoing drought.

The highest deviation from normal precipitation was measured in King Salmon, with 190% of the average value for the period 1981-2010. Nome follows closely with 177% of normal precipitation, while Bethel and Gulkana recorded respectively 169 and 168% of normal rainfall values. In Talkeetna and Kotzebue precipitation was more than 135% of normal, and in Utqiagvik, Anchorage, and McGrath more than 120% of normal values. Cold Bay measure 120% of normal rainfall. With respectively 116%, 109%, and 94.5%, Bettles, Homer and Fairbanks saw close to normal precipitation values (Figure 5, Table 3).

Delta Junction in the Interior experienced drier than normal conditions with 85% of normal precipitation. Juneau, Ketchikan and Yakutat along the Panhandle measured respectively 79%, 61%, and 66% of normal values of rainfall for the month of September. Less than 70% of normal rainfall, more precisely 66% and 69%, was recorded also in St. Paul Island and Kodiak (Figure 5, Table 3).

Figure 6 shows the monthly precipitation sums at each station in inches. It can be seen how strongly precipitation varies between stations not only during the past month but also in the climatological mean, due to the diverse climatological conditions that can be found in Alaska.

The highest reduction of rainfall in absolute terms was experienced in the Panhandle: Yakutat, Ketchikan and Kodiak saw respectively 7.1, 5.4 and 2.3 inches less rainfall than normally. Almost 2 inches less precipitation were measured in Juneau, and 1 inch less in St. Paul Island (Figure 6, Table 3).

With 2.8 inches, King Salmon recorded the highest positive departure from normal in absolute terms. Following Nome and Bethel, which saw respectively 1.9 and 1.8 inches precipitation above normal values. In all other stations the absolute difference to normal precipitation was lower than 1 inch.

In southern Alaska, due to intense storms, the level of rivers rose quite rapidly. The Resurrection River near the Exit Glacier Bridge in eastern Kenai Peninsula and the Iliamna River near Pedro Bay were pushed into flood action stage. Floodings and strong winds were recorded in Western Alaska. The Anchorage Bowl saw minor flooding in small streams after several days of rainfall.

2019-09, Monthly Precipitation, % of Normal (1981-2010)

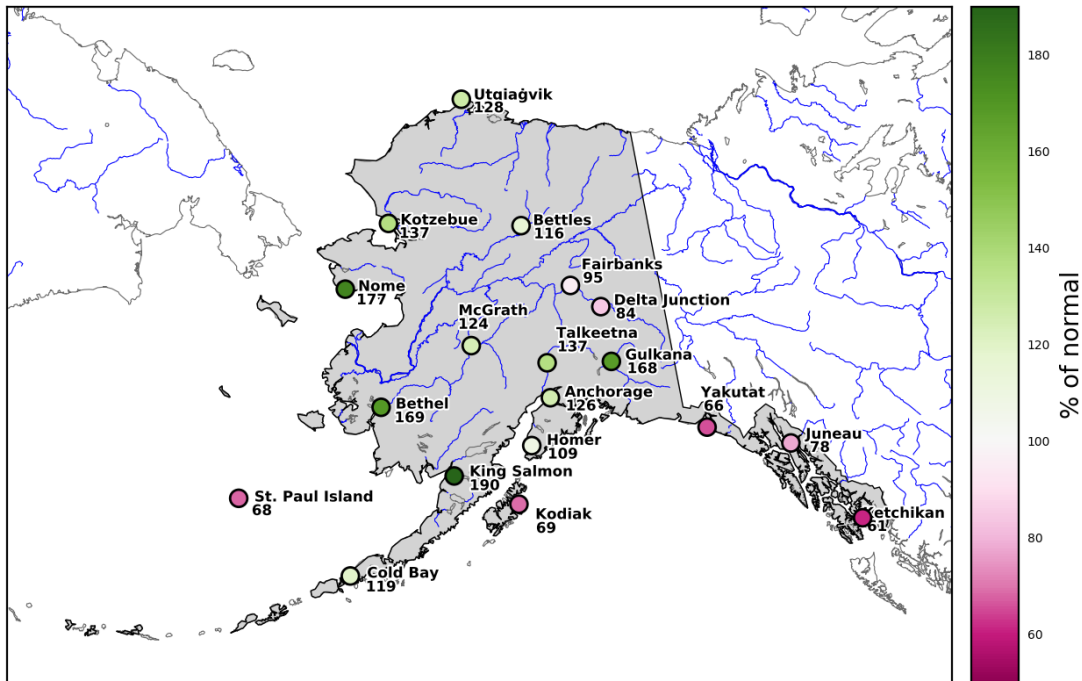


Figure 5: Monthly precipitation sums expressed as percent of normal (1981-2010), September 2019.

Table 3: Monthly precipitation sum, normal (1981-2010) and departure expressed as a percentage of the normal (1981-2010) for selected stations throughout the state, September 2019.

Station	Precipitation (in)	Normal (in)	% of normal
Anchorage	3.8	3.0	126.4
Bethel	4.6	2.8	168.7
Bettles	2.2	1.9	115.7
Cold Bay	5.6	4.7	119.0
Delta Junction	0.9	1.0	84.5
Fairbanks	1.0	1.1	94.5
Gulkana	2.7	1.6	167.7
Homer	3.6	3.3	109.1
Juneau	6.8	8.6	78.5
Ketchikan	8.4	13.8	60.8
King Salmon	6.0	3.2	189.7
Kodiak	5.1	7.4	69.3
Kotzebue	2.2	1.6	136.7
McGrath	3.1	2.5	124.5
Nome	4.3	2.4	177.1
St. Paul Island	2.0	3.0	67.6
Talkeetna	5.9	4.3	137.3
Utqiagvik	0.9	0.7	127.8
Yakutat	14.0	21.1	66.1

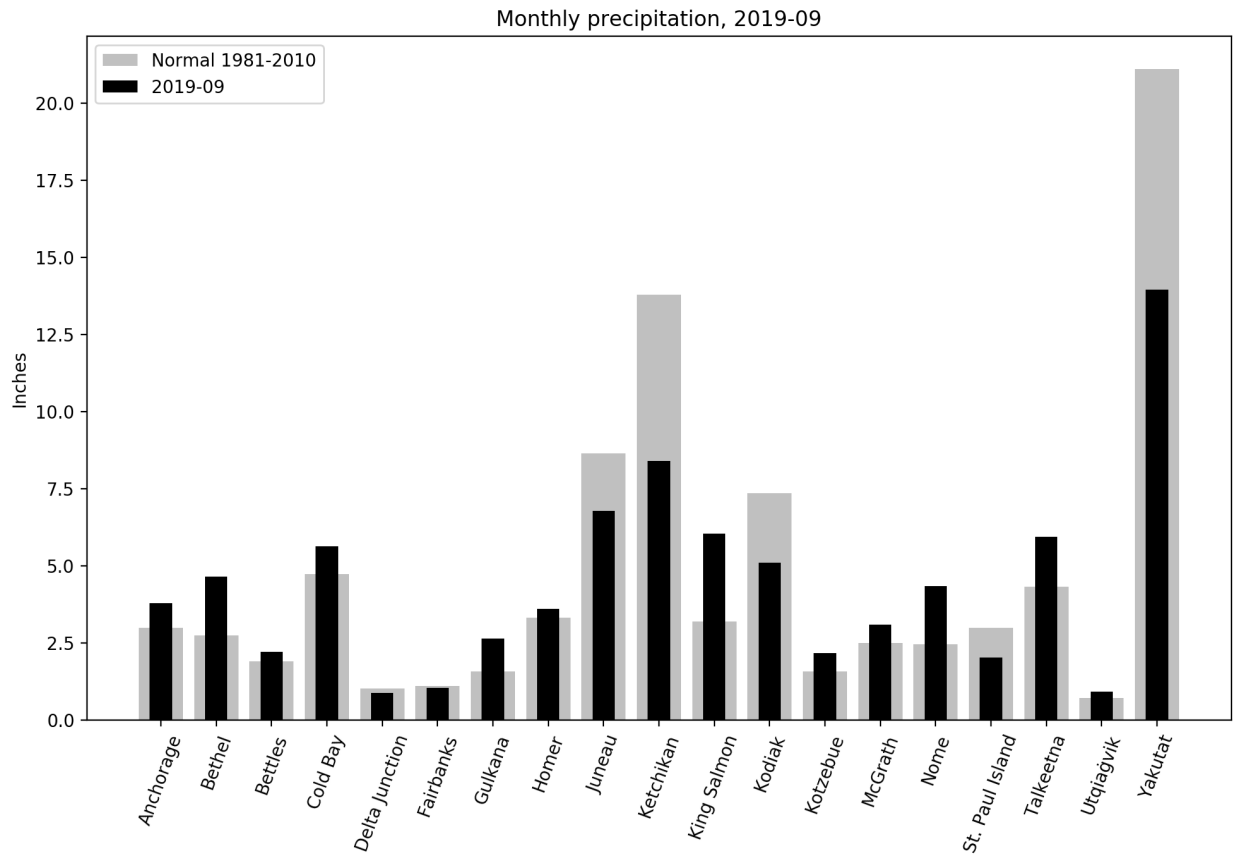


Figure 6: Monthly precipitation sums for September 2019 at the selected stations compared to the normal (1981-2010), in inches.

Drought Conditions

Above normal precipitation observed during the last month of September 2019 in large parts of Alaska (Figure 5, Figure 6) improved drought conditions in the South and Southwest. Conversely, significantly lower than normal rainfall recorded along the Panhandle (Figure 5, Figure 6) prolongs the ongoing drought (source: <https://droughtmonitor.unl.edu>).

Currently, a portion of the Aleutian and the Kenai Peninsula experiences abnormally dry conditions, Anchorage is experiencing moderate drought (Figure 7). Along the Panhandle, drought severity increases from West to East. While the region of Yakutat is abnormally dry, Juneau is under moderate drought and the southeastern part is subject to severe and extreme drought (Figure 7).

During the first part of last month, restrictions were imposed to some communities of the Kenai Peninsula hit by severe drought conditions. In Nanwalek and Seldovia, water supply was shut off for 12 hours per day and restaurants were serving food on paper plates. Rainfall events, occurred

later in the month, have restored water levels of local reservoirs, on which communities rely, and restrictions have been lifted.

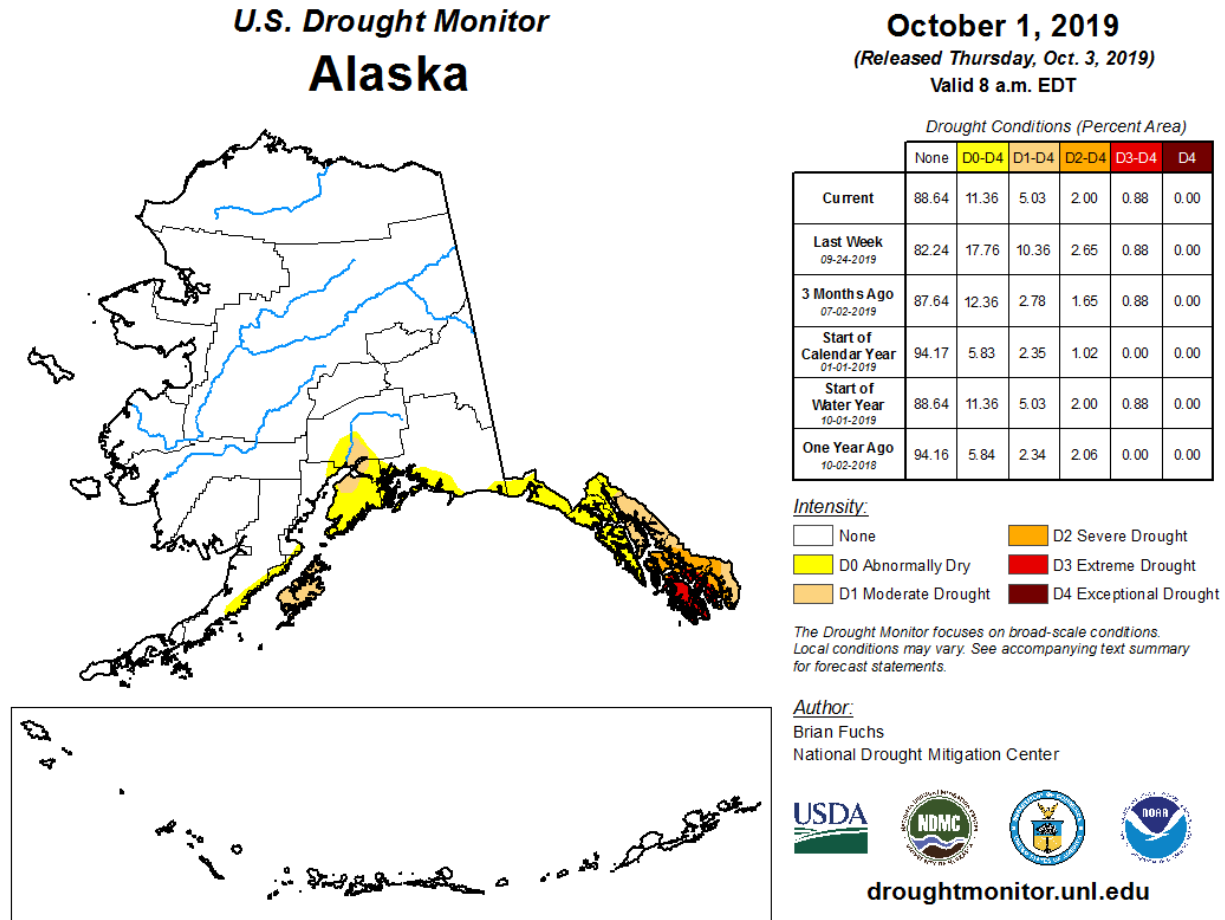


Figure 7: U.S. Drought Monitor map for Alaska, updated on October 03, 2019. The table on the right shows the percent area affected by different categories of drought intensity. Figures and data produced and released by the U.S. Drought Monitor, a partnership between the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration (<https://droughtmonitor.unl.edu>).

Arctic Sea Ice

Figure 8 and Figure 9 show the time series of daily Arctic sea ice extent and the ice concentration updated respectively until September 26 and October 05, 2019.

During the first half of September 2019, the sea ice extent has decreased by roughly 9%, from about 4.6 M km² measured on August 29 to an annual minimum of 4.2 M km² measured on

September 19 (yellow line in Figure 8). During the last 12 days of September, Arctic sea ice has begun its autumn regrowth. The sea ice has expanded along a broad front, in the northern Beaufort and Chukchi Sea, and the extent measured on September 26 is around 4.5 M km² (Figure 8), for a total growth of roughly 7%. The average sea ice extent for September 2019 was 4.3 M km², which ranks as the third lowest in the 41-year record, after 2012 and 2007.

The 2019 sea ice extent line (yellow line in Figure 8) has now started heading back up and the 2019 season is most likely about tied for number two all-time low with the 2016 level (red line in Figure 8).

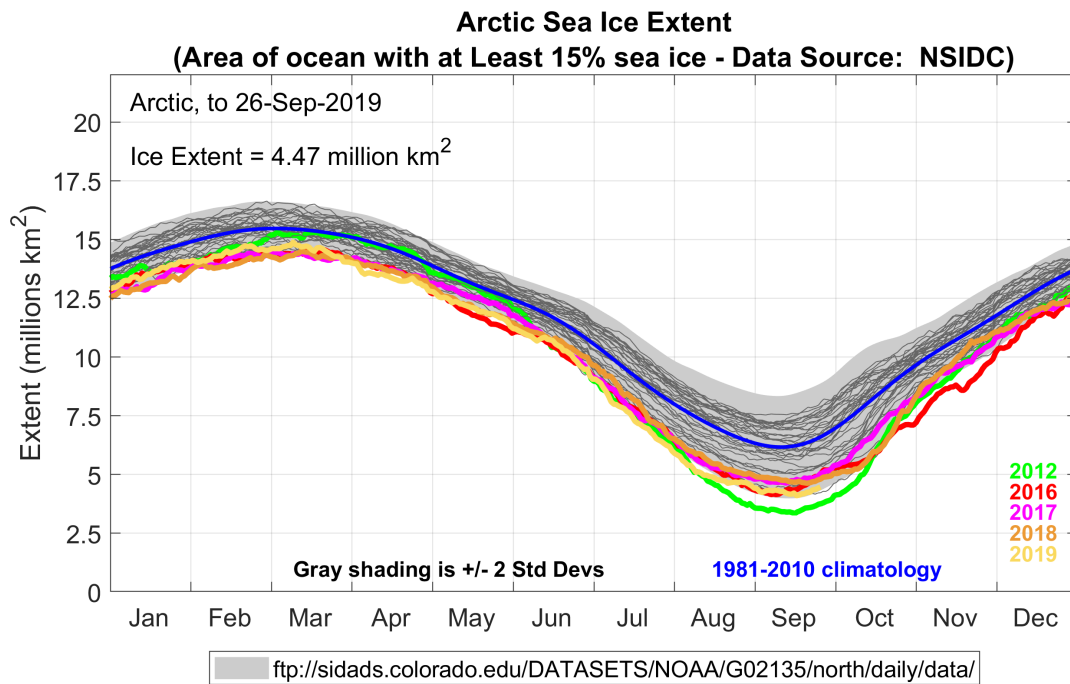


Figure 8: Time series of daily Arctic sea ice extent. This year's data (yellow) are updated until September 26, 2019. The median sea ice extent for the 1981-2010 reference period is depicted in blue. Specific years are highlighted in colors. Plot Compiled by: Howard J. Diamond, PhD; Climate Science Program Manager at NOAA's Air Resources Laboratory Data Source: National Snow & Ice Data Center (NSIDC; <https://nsidc.org/>).

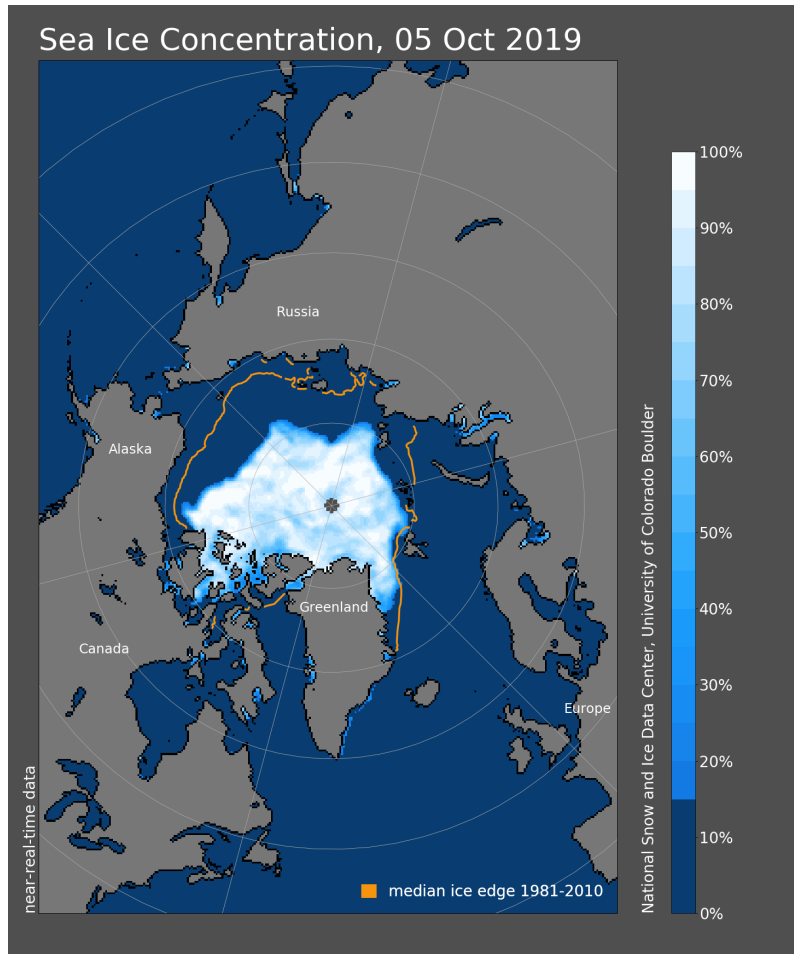


Figure 9: Daily Arctic Sea Ice concentration on October 05, 2019. Median ice edge for the 1981-2010 reference period is depicted in yellow. Very low and equal to zero sea ice concentration are observed in the Bering, Chukchi and Beaufort Sea. Image: NSIDC (nsidc.org)

Notable

A Massive seabird die-off was observed in Alaska this summer, for the fifth straight year. According to the U.S. Fish and Wildlife Service, the death of more than 9000 seabirds along the west coast is associated to starvation. At the basis of the seabird starvation, researchers indicate changes in zooplankton and fish populations, which might be linked to high sea surface temperatures and decline in sea ice extent.

This information consists of preliminary 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 web site at <http://akclimate.org>. Please report any errors to webmaster@akclimate.org.

Appendix

Table A1: September 2019 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. Only highest records were set this month.

Highest Mean Daily Temperature on record				
Station	Date	New Record (°F)	Year of old record	Old record (°F)
Anchorage	2019-09-01	61.5	1978	59
Anchorage	2019-09-02	62.5	1963	61
Bettles	2019-09-07	57.5	2010	54.5
Delta Junction	2019-09-02	62	1942	61.5
Kodiak	2019-09-16	59.5	1954	59
Kotzebue	2019-09-02	58.5	2016	57.5
Kotzebue	2019-09-05	55.5	1974	54.5
Kotzebue	2019-09-06	59	1996	55.5
Kotzebue	2019-09-07	57	1997	56.5
Kotzebue	2019-09-08	56.5	1989	55.5
Nome	2019-09-15	56	2014	54
St. Paul Island	2019-09-13	53	2016	51.5
St. Paul Island	2019-09-15	52.5	1989	51
St. Paul Island	2019-09-18	51	1979	50.5
St. Paul Island	2019-09-26	50.5	1977	50
St. Paul Island	2019-09-27	50.5	1978	49.5
Talkeetna	2019-09-13	58.5	2014	57
Utqiagvik	2019-09-06	51	1986	49
Utqiagvik	2019-09-07	50	1986	46
Utqiagvik	2019-09-08	53	1989	50
Utqiagvik	2019-09-09	49	1940	47
Utqiagvik	2019-09-10	48.5	2007	45.5

Table A2: September 2019 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. Only highest records were set this month.

Highest Minimum Daily Temperature on record				
Station	Date	New Record (°F)	Year of old record	Old record (°F)
Anchorage	2019-09-03	54	1995	53
Anchorage	2019-09-10	53	1957	50
Bethel	2019-09-27	46	1925	45
Delta Junction	2019-09-02	57	1951	56
King Salmon	2019-09-01	56	1942	55
Kodiak	2019-09-01	56	1942	55
Kotzebue	2019-09-01	56	1978	53
Kotzebue	2019-09-02	55	1942	51
Kotzebue	2019-09-03	56	1949	51
Kotzebue	2019-09-04	53	1991	51
Kotzebue	2019-09-05	54	2010	52
Kotzebue	2019-09-06	56	2010	52
Kotzebue	2019-09-07	54	2010	51
Kotzebue	2019-09-08	54	1989	52
McGrath	2019-09-02	52	1942	50
Nome	2019-09-01	51	1910	50
Nome	2019-09-02	53	1942	50
St. Paul Island	2019-09-05	51	1979	50
St. Paul Island	2019-09-26	50	2015	49
St. Paul Island	2019-09-27	48	1978	47
Talkeetna	2019-09-09	53	1965	52
Utqiagvik	2019-09-07	45	2004	44
Utqiagvik	2019-09-08	47	1941	40
Utqiagvik	2019-09-09	43	1940	41
Utqiagvik	2019-09-10	42	1930	40
Utqiagvik	2019-09-11	44	1925	42
Utqiagvik	2019-09-30	37	2016	36
Yakutat	2019-09-19	52	1995	51

Table A3: September 2019 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. Only highest records were set this month.

Highest Minimum Daily Temperature on record				
Station	Date	New Record (°F)	Year of old record	Old record (°F)
Bettles	2019-09-07	70	1951	66
Cold Bay	2019-09-03	63	1970	62
Gulkana	2019-09-08	71	1979	69
Gulkana	2019-09-14	70	2014	68
St. Paul Island	2019-09-01	57	1989	56
St. Paul Island	2019-09-13	57	1992	54
St. Paul Island	2019-09-15	56	1969	54
St. Paul Island	2019-09-18	55	1978	54
Utqiagvik	2019-09-06	61	1978	58