



Quarterly Weather & Climate Summary Gates of the Arctic National Park & Preserve Fall 2015

Bettles Fall Weather

September was colder and wetter than normal in Bettles. The average temperature for the month was 36.6°F compared to a normal of 40.6°F. Overall, it was the 7th coldest September on record. The coldest temperature recorded for the month was 10°F on September 30. With 3.14 inches of precipitation for the month, it was 164% of normal. Snow came early to Bettles, with 5.8 inches recorded on the 18th, a record for that date. More snow the remainder of the month brought the September snowfall total to 13.1 inches. Only two other years (2004, 1996) have received more snow in September. Despite the high snowfall total, snow depth was only at 3 inches at the end of the month due to warm temperatures after the snow events.

Weather patterns shifted in October and temperatures were well-above normal for most of the month. Overall, the average monthly temperature was 25.2°F, 6.3°F warmer than normal. Almost every day from October 2-21 had maximum daily temperatures exceeding the freezing threshold. Precipitation was just about normal with 1.11 inches for the month. 8.1 inches of snow fell in October; normal is 12.4 inches.

With a monthly average temperature of 7.4°F, it was 8.4°F warmer than normal for November. A cold spell mid-month brought the temperature down to -33°F on November 18 – the coldest reading of the month. Chilly, but far from record-breaking. The coldest November temperature ever recorded in Bettles is -57°F in 1974.

The real story for November was snow – a lot! A trace of snow or more was recorded every day from November 1-28. 50.6 inches of snow fell in November. This demolished the previous record of 41.6 inches set in 1967 (Figure 2). 2015 was also the snowiest fall season for Bettles with 71.8 inches. Normal snowfall for Bettles for the September-November period is only 30 inches. (Figures 1 and 2; Table 1, 2, and 3).

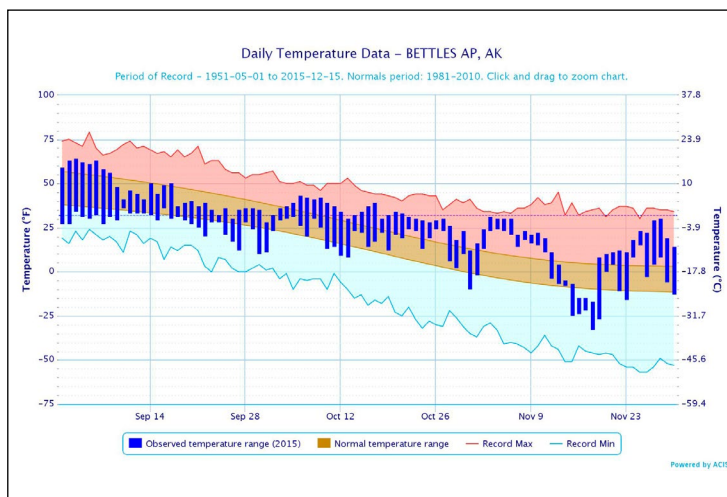


Figure 1. Fall 2015 daily temperatures at Bettles showing **record maximum** (red), **record minimum** (blue), **normal** (brown) and **observed range** (blue bars).

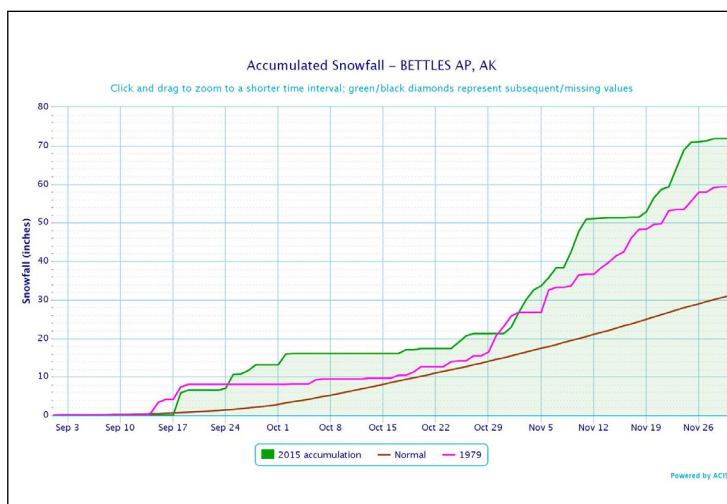


Figure 2. Fall **2015** accumulated snowfall at Bettles (green) compared to **normal** (brown line). 2015 was the snowiest fall on record. 1979 (pink) is ranked second.

Table 1. Temperature: Fall 2015 average monthly temperatures compared to the 1981-2010 normal.

Fall 2015	Average Monthly Temp (°F)	1981-2010 Normal (°F)	Departure from Normal (°F)	Monthly High (°F / Date)	Monthly Low (°F / Date)
September	36.6	40.6	-4.0	64 / Sept. 3	10 / Sept. 30
October	25.2	18.9	+6.3	43 / Oct. 6	-10 / Oct. 31
November	7.4	-1.0	+8.4	31 / Nov. 3	-33 / Nov. 18

Fall Season Temperature Departure from Normal: +3.5°F

Table 2. Precipitation: Fall 2015 monthly precipitation totals compared to normal.

Fall 2015	Total Monthly Precip. (in.)	1981-2010 Normal (in.)	% of Normal	Greatest 24 -hr. total (in. / Date)	# Days with ≥ 0.01 in. water
September	3.14	1.91	164	0.65 / Sept. 13	13
October	1.11	1.04	107	0.24 / Oct. 2	9
November	2.46	0.91	270	0.26 / Nov. 2	22

Fall Season Precipitation Departure from Normal: +2.85 inches (174% of normal)

Table 3. Snowfall: Fall 2015 monthly snowfall totals compared to normal

Fall 2015*	Total Monthly Snowfall (in.)	1981-2010 Normal (in.)	% of Normal	Greatest 24-hr snowfall total (in. / Date)	Cumulative since 1-July (in.)
September	13.1	2.5	524	5.8 / Sept. 18	13.1
October	8.1	12.4	65	2.8 / Oct. 2	21.2
November	50.6	16.1	314	5.2 / Nov. 10	71.8

Fall Season Snowfall Departure from Normal: +40.8 inches (232% of normal)

*Snowiest fall on record

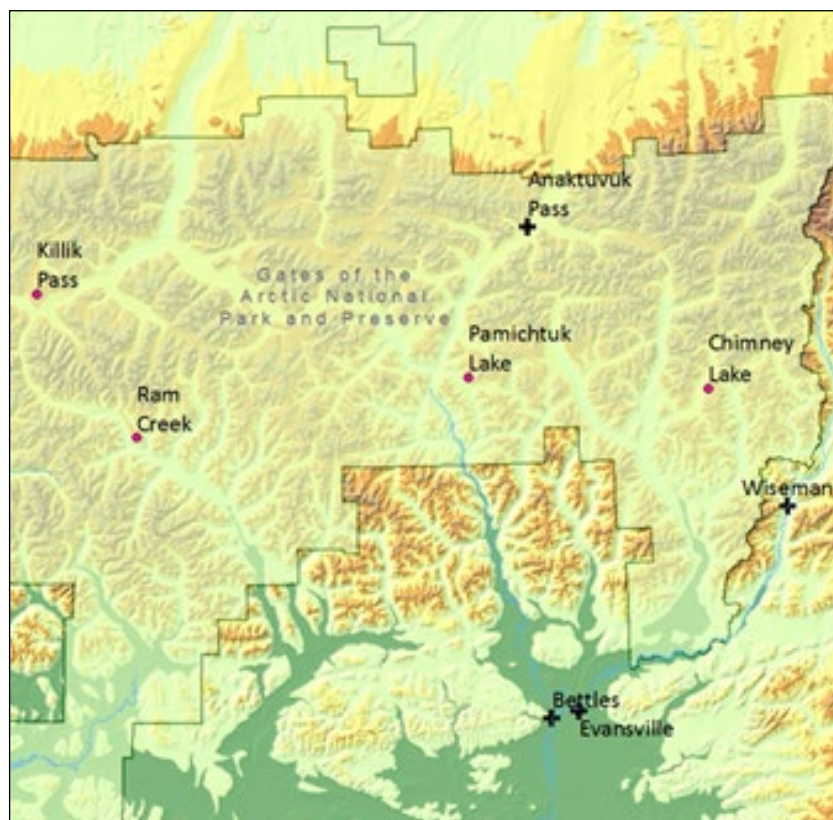


Figure 3. NPS Climate stations in Gates of the Arctic National Park and Preserve.

Long-Term Perspective

Temperature

The average fall temperature for 2015 in Bettles was 23.1°F which is 3.6°F warmer than the 1981-2010 normal and 3.4° F warmer than the long-term record beginning in 1951. 2015 ranks as the 10th warmest fall on record.

We calculate the average fall temperature by simply taking the average of September, October, and November monthly temperatures. Average fall temperatures show great variability with a range between 11.1°F in 1956 and 29.1°F in 1979 (Figure 4).

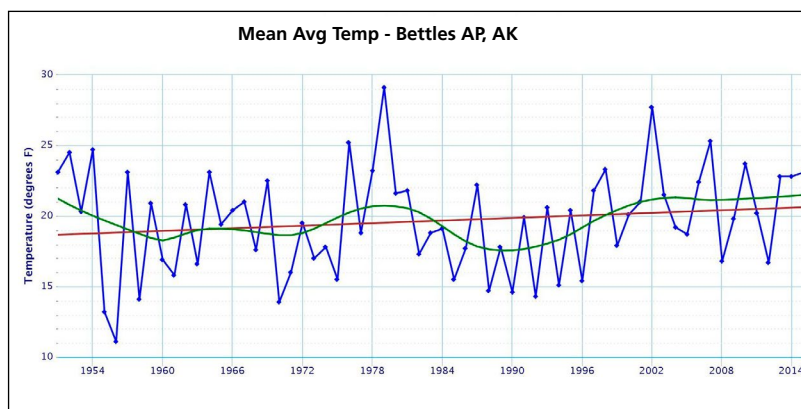


Figure 4. Average fall temperatures (September-November) at Bettles since 1951. The green line is locally weighted scatterplot smoothing (LOESS). The brown line is a simple linear regression.

Snowfall

The fall season snow total for 2015 was 71.8 inches which is 43 inches more than the 1981-2010 normal and 41 inches more than the long-term record beginning in 1951. 2015 was the snowiest fall on record in Bettles. Fall season snow is extremely variable with values as low as 3.1 inches recorded in 2002 (Figure 5).

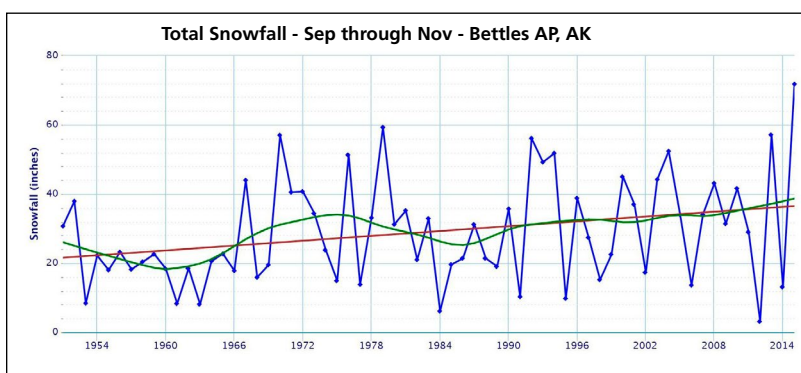


Figure 5. Fall (September-November) precipitation totals at Bettles since 1951. The green line is locally weighted scatterplot smoothing (LOESS). The brown line is a simple linear regression.

Rime Ice

Rime ice forms when supercooled water droplets freeze to the outer surfaces of exposed objects. Rime usually forms during weather conditions with some wind (> 5 mph), high relative humidity (often fog), and relatively mild temperatures (10-30°F). Weather stations are prime targets for riming (unfortunately) because of their exposed location above the ground surface. Rime is usually white in color and less dense than freezing rain or glaze.

ARCN weather stations do not directly measure any form of ice, but rime formation and persistence can be inferred through wind speed, air temperature, relative humidity, and other measurements. The easiest way to identify potential riming events is to monitor the wind speed sensor. When rime ice forms on the sensor, the propeller stops spinning and the sensor incorrectly records measurements of zero (Figure 7).

Rime ice may have formed at some stations in GAAR in fall 2015. Air temperatures from 15-25°F, high relative



Figure 6. An extreme example of rime ice at the Midnight Mountain meteorological station on the Seward Peninsula in 2012. The ice encased and destroyed the 10-foot tall tripod. The station was downsized in 2013 and now only measures air and soil temperatures. (photo Walker Gusse)

humidity (90-100%) and moderate wind speeds (5-20 mph) were measured at most stations in early November. Following these meteorological conditions, some wind sensors began recording values of 0 mph, indicating that the propellers may have been affected by icing.

In total, icing on the wind sensor at Ram Creek may have

persisted for over 3 weeks in November 2015. The Killik Pass station may have also been affected by rime for about one week in mid-November. The wind sensors at the two stations farther east (Pamichtuk Lake, Chimney Lake) did not indicate icing, suggesting that rime may not have formed at these locations over the same time period. Station locations are shown in Figure 3.

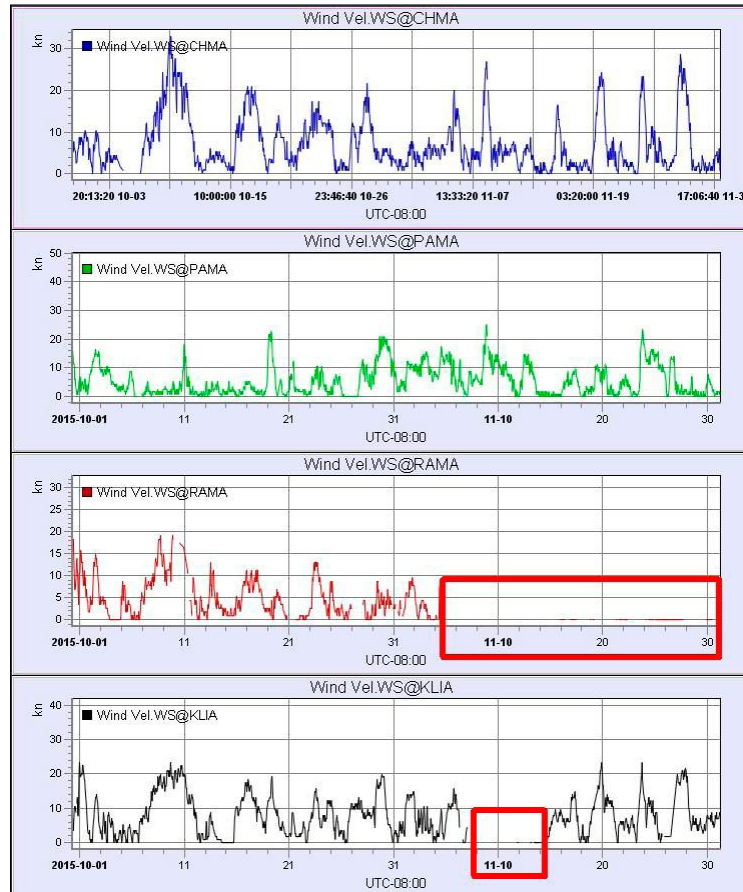


Figure 7. Wind speed at Chimney Lake (top; blue), Pamichtuk Lake (green), Ram Creek (red), and Killik Pass (bottom; black) for October-November 2015. Boxed areas indicate time periods of potential rime ice. Please note: all data are preliminary and subject to review.



Figure 8. View from Pamichtuk station time lapse camera in January 2015 (top). Rime ice is visible on the fence post, electric fence wires, and exposed vegetation. The bottom image shows an example of riming at a station on the Seward Peninsula in September 2014.

Connecting Further

- Previous weather summaries and other climate monitoring documents on the [Arctic Network web portal](#)
- Access near real-time data from [Western Regional Climate Center](#) and [MesoWest](#)
- The 2015 [Arctic Report Card](#) was recently released. Highlights include updated trends on sea ice, air temperature, snow cover, ocean temperatures, wildlife, and vegetation.

- [Maps](#) of projected temperature and precipitation changes for Gates of the Arctic National Park and Preserve

More Information

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