



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

Bettles Winter Weather

December was warmer and snowier than normal in Bettles. The average temperature for the month was 3.8°F, compared to a normal of -5.7°F. It was the 6th warmest December on record. A total of 23 inches of snow fell in the month, containing 1.59" of water (173% of normal). It was a white Christmas, with almost 10" of snowfall Dec. 25-26.

January was slightly colder than normal and dry. The average monthly temperature was -12.6°F, 2.6°F colder than the 1981-2010 normal. Bettles was warmer than normal the 9th to the 21st, but a cold snap the last week of January brought -50°F temperatures for five consecutive days. 6.1" of snow fell in January containing 0.32" of water. This is less than half of the expected normal. Because of above average snowfall in December, snow depth at the end of January was about normal at 17".

February was warmer and drier than normal. The mean monthly temperature was 0.0°F, 5.0°F warmer than normal. The last week of February was particularly warm, with record breaking temperatures on the 17th (30°F), 22nd (34°F), and 23rd (32°F). Precipitation was only about 50% of normal with 0.45 inches of water equivalent in 8.8 inches of snowfall. Normal snowfall for February is 14 inches.

Overall, winter 2014-2015 ranked as the 9th warmest on record with an average temperature of -2.9°F for the December-February period. About 38" of snow fell over the three-month period compared to a normal total of 43.5". The total precipitation (water equivalent) for the winter was 92% of normal. (Figures 1 and 2; Tables 1, 2, and 3)

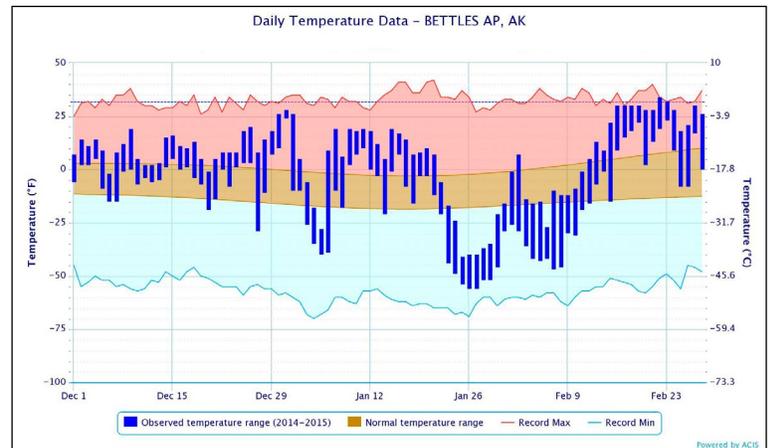


Figure 1. Winter 2015 daily temperatures at Bettles showing **record maximum** (red), **record minimum** (blue), **normal** (brown) and **2015 observed** range (blue bars).

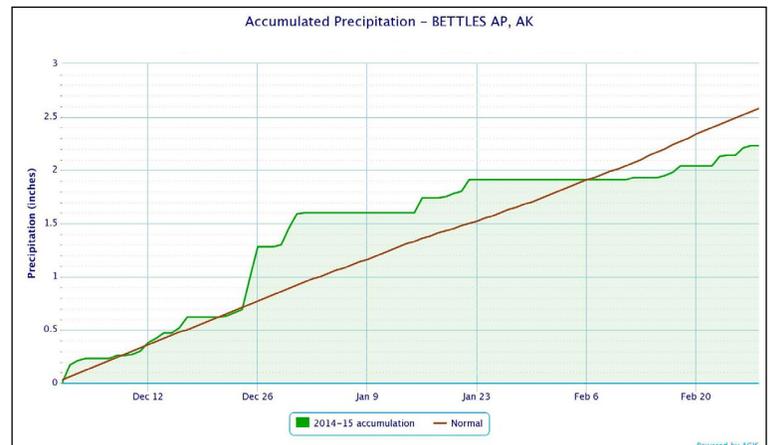


Figure 2. Winter **2015** accumulated precipitation at Bettles (green) compared to **normal** (brown line).

Table 1. Temperature: Winter 2014-2015 average monthly temperatures compared to the 1981-2010 normal.

Winter 2014-2015	Average Monthly Temp °F	1981-2010 Normal °F	Departure from Normal °F	Monthly High °F / Date	Monthly Low °F / Date
December	3.8	-5.7	+9.5	28 / Dec. 31	-29 / Dec. 27
January	-12.6	-10.0	-2.6	26 / Jan. 1	-56 / Jan. 26, 27
February	0	-5.0	+5.0	34 / Feb. 22	-47 / Feb. 7

Winter Season Temperature Departure from Normal: +4.0°F

Table 2. Precipitation: Winter 2014-2015 monthly precipitation totals compared to normal.

Winter 2014-2015	Total Monthly Precip. in.	1981-2010 Normal in.	Departure from Normal in.	Greatest 24 -hr. total in. / Date	# Days with >=0.01 in. water
December	1.59	0.92	+0.67	0.30 / Dec. 25	19
January	0.32	0.81	-0.49	0.14 / Jan. 16	6
February	0.45	0.85	-0.40	0.13 / Feb. 28	9

Winter Season Precipitation Departure from Normal: -0.22 inches (92% of normal)

Table 3. Snowfall: Winter 2014-2015 monthly snowfall totals compared to normal.

Winter 2014-2015	Total Monthly Snowfall in.	1981-2010 Normal in.	Departure from Normal in.	Greatest 24 -hr. snowfall total in. / Date	Cumulative snowfall since 1-July in.
December	23	15.6	+7.4	5.2 / Dec. 25	36.1
January	6.1	13.9	-7.8	2.0 / Jan. 22	42.2
February	8.8	14.0	-5.2	1.5 / Feb. 28	51

NPS Climate Monitoring Stations

We now have additional NPS climate stations in Gates of the Arctic that complement existing National Weather Service stations at Bettles (Figure 3). These new NPS stations will provide critical data on high elevation sites in

the Arctic and will help characterize the climate gradients and patterns affecting resources in the Gates of the Arctic parklands.

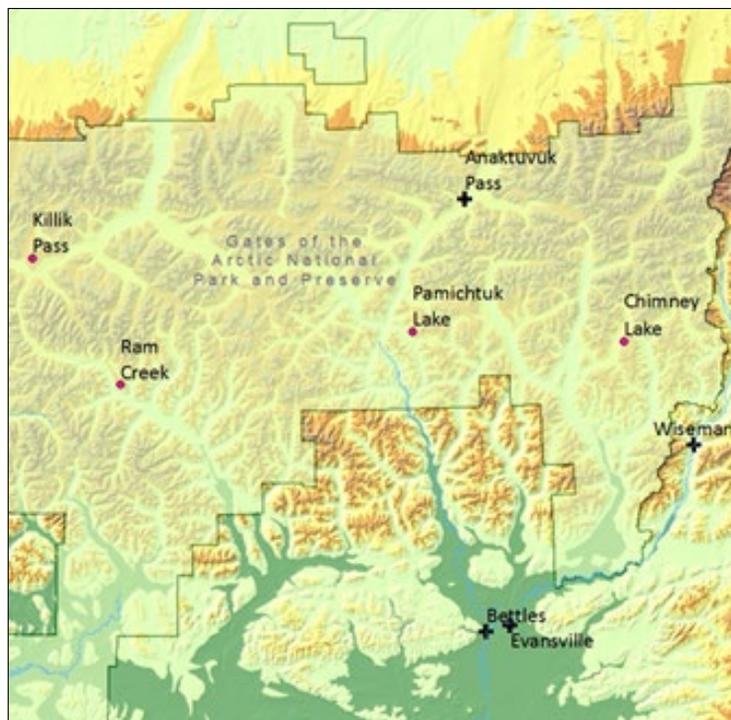


Figure 3. NPS Climate stations in Gates of the Arctic National Park and Preserve.

Table 4. Summary of weather statistics from climate stations in and near Gates of the Arctic. All data are preliminary and subject to review. Sites in **bold font** are NPS stations installed in 2012.

Park	Site	Elev. (ft)	Average Temp °F			Extreme High (°F)	Extreme Low (°F)	Average Temp. Winter Season (°F)	Feb. 28 Snow Depth (inches)	Peak Wind (mph)
			Dec	Jan	Feb					
GAAR	Killik Pass	4355	3.6	5.0	6.8	26	-24	5.1	3	44
	Ram Creek	4100	7.3	8.2	7.5	24	-20	7.7	6	31
	Pamichtuk	3135	7.3	8.0	9.9	30	-25	8.4	5	40
	Chimney Lake	3700	10.8	7.7	10.0	29	-20	9.5	5	43
Other	Ivotuk CRN	1909	-10.7	-6.7	1.5	33	-41	-5.3	--	51
	Wiseman	1147	--	--	--	--	--	--	--	--
	Atigun Pass	4800	4.6	1.2	4.2	27	-36	3.3	28	--
	Norutak Lake RAWs	800	5.1	--	--	--	--	--	--	--

-- Missing data from Wiseman and Norutak Lake. Snow depth is not measured at Ivotuk.

Interesting Notes from the ARCN Climate Stations

- In comparison to winter 2013-2014, the temperature extremes this year were much more subdued at NPS GAAR stations in the central Brooks Range. For example, the extreme minimum and maximum temperatures at Killik last winter season were -40.1°F and +39.2°F. This year the extremes were -24°F and +26°F.
- Very little snow accumulates at the ridge top sites in Gates of the Arctic; the snow that falls near these stations is continuously redistributed by the wind.
- On average, the coldest station analyzed was the NOAA Climate Reference Network (CRN) station at Ivotuk on the north slope (35 miles NW of Killik Pass) with a winter mean of -5.3°F. The warmest station analyzed was Chimney Lake (25 miles NW of Wiseman) with a winter mean of +9.5°F.

Bettles Winter Temperature Trend

The average winter temperature in Bettles for 2014 was -2.9°F, the 9th warmest winter on record and 4.1°F warmer than the 1981-2010 normal period. Winter 2015 was 1.3°F warmer than 2014 and the warmest winter since 2003. This year December had the largest deviation from normal; last year it was January.

We calculate the average winter temperature by simply taking the average of December, January, and February monthly temperatures. Average winter temperatures are variable with a range between -21.1°F in 1971 and 2.9° F in 2001.

The overall trend in winter temperatures is positive, with a significant increase of 1.15°F per decade based on a simple linear regression ($p < 0.01$). The 10-year moving average shows that the coolest period occurred in the 1970s (Figure 4).

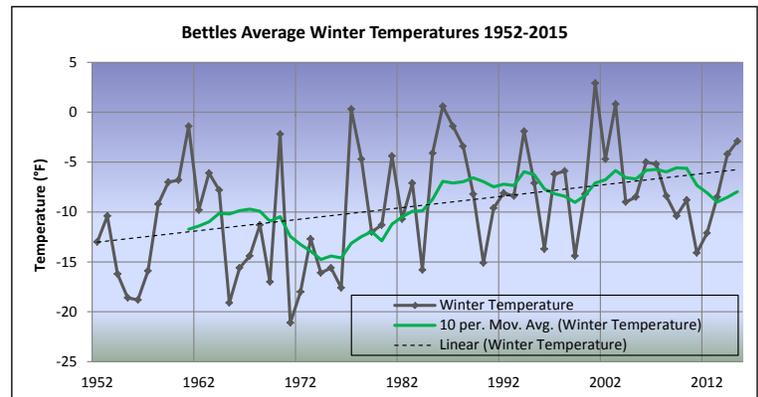


Figure 4. Average winter temperatures (December, January, February) at Bettles since 1952. The green line is a 10-year moving average. The dashed line is a simple linear regression.

Bettles Winter Precipitation Trend

Winter 2015 precipitation was just under both the long-term average (1952-2015) and the latest climate normal period (1981-2010). The total snowfall for December, January, and February was 37.9 inches containing 2.36 inches of water equivalent. Last year was similar, with 2.38 inches of precipitation for the season.

Precipitation amounts in the winter range between <1 inch to almost 7 inches. The winter of 1960-1961 had only 0.77 inches of precipitation over the three month season. 1992-1993 had a total of 88.0 inches of snowfall containing 6.78 inches of water. The average precipitation (water equivalent) for the winter season is 2.47 inches and 2015 ended up at 92% of normal.

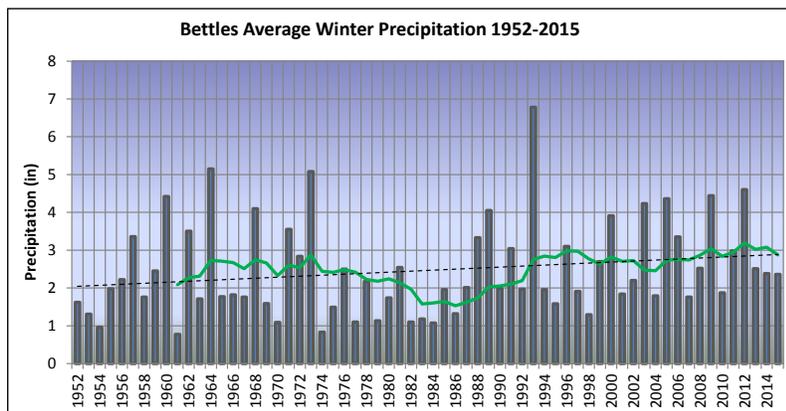


Figure 5. The bars show the winter precipitation totals in Bettles between 1952 and 2015. The green line represents a 10-year moving average and the dashed line is a simple linear regression.

New Phenology Camera at Pamichtuk

The new phenology camera at the Pamichtuk station in Gates of the Arctic National Park and Preserve captured images through most of fall 2013 before it went into hibernation for winter. To the right are photos that capture the onset of the snow with images from September 1,

October 2, and November 5, 2013. The camera captures images five times per day; the images are downloaded once a year. The photos are used to help quantify the snow season, green-up period, and other basic phenologic information.



Figure 6. Images capturing the onset of the snow season at Pamichtuk climate station last year in Gates of the Arctic. The left photo is from September 1, 2013; the middle photo is from October 2, 2013; and the right photo is from November 5, 2013.

Connecting Further

- New paper published – [Strong Temperature Increase and Shrinking Sea Ice in Arctic Alaska](#)
- 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](#)
- Statewide summary of weather highlights in the latest [Alaska Climate Dispatch](#) from the Alaska Center for Climate Assessment and Policy

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

More Information

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