



Alagnak

Aniakchak

Katmai

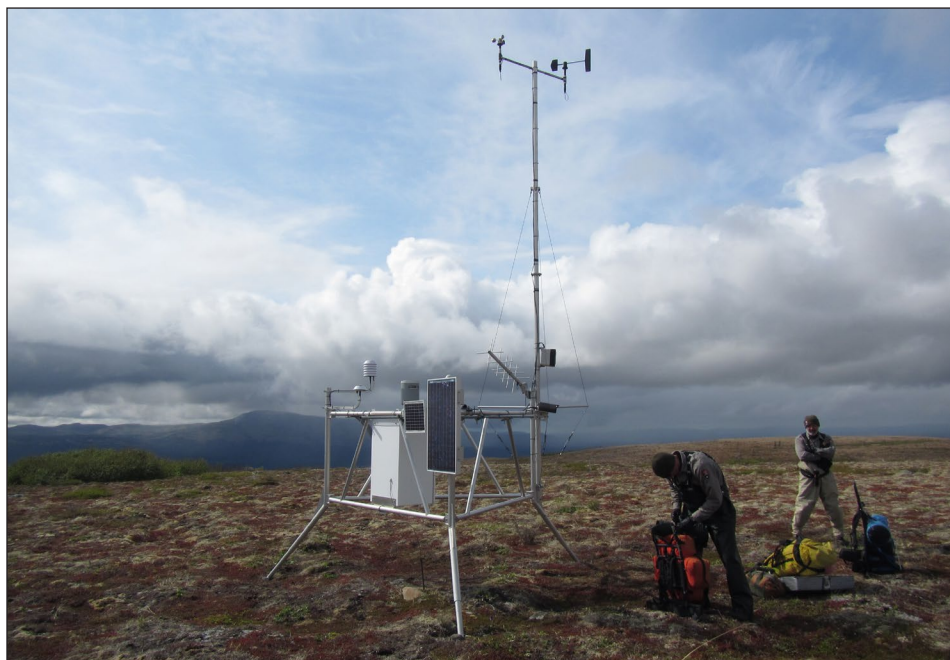
Kenai Fjords

Lake Clark

Climate at Katmai NPP

Katmai National Park and Preserve (NPP) is located between the Bering Sea and the Pacific in the Bristol Bay region of Alaska. Both seas have a strong climatic influence on this region because they mediate the transfer of heat and water vapor to and from the atmosphere. These transfers of energy are characterized by persistent seasonal to multi-decadal patterns in particular geographic locations; specifically, seasonal sea ice in the Bering Sea and the distribution of warm vs cool water in the northern Pacific and Gulf of Alaska. The strength of this “maritime” influence can be seen in climate stations where, despite a 1,300’ elevation difference and a wide geographic distribution throughout the park, the mean monthly air temperatures are notably similar (Figure 1).

Oscillations in the multi-decadal patterns of Pacific sea-surface temperatures, of approximately 10 to 30 years, are known as the Pacific Decadal Oscillation (PDO). The PDO oscillates between a negative (cool coastal water) phase and positive (warm coastal water) phase (Mantua and Hare 2002). A relationship between a positive PDO and the southward shift of the persistent low pressure over the northwestern Pacific (the Aleutian low) and a change in the course of the jet stream in the upper atmosphere has also been observed (Trenberth and Hurrell 1994). The combined effect of these patterns can intensify or mute the long-term warming trend regionally observed in land-surface temperatures.



NPS/

The Colville Remote Automatic Weather Station (RAWS) at Katmai NPP.

Weather Highlights

- 2014 was the warmest year on record with a mean annual air temperature of 40.5°F, 5.4°F above the 30-year climate normal of 35.1°F.
- The normal temperatures for King Salmon are below freezing between November 10th and March 15th.
- The impacts of warming temperatures on precipitation are variable, but can be seen over the winters of 2001, 2003, 2014, and 2015 where, in spite of having above-normal winter precipitation, the snow fall was 11, 23, 11, and 21 inches, respectively, below the cumulative normal of 46.5 inches.

How climate and weather are different can be summed up by the phrase:
climate is what you expect; weather is what you get.

Weather refers to atmospheric conditions over short periods of time, typically days to weeks. *Climate* refers to the patterns (statistics) of weather over long periods of time, typically 30 years. *Climate change* refers to changes in climate patterns over long periods of time.

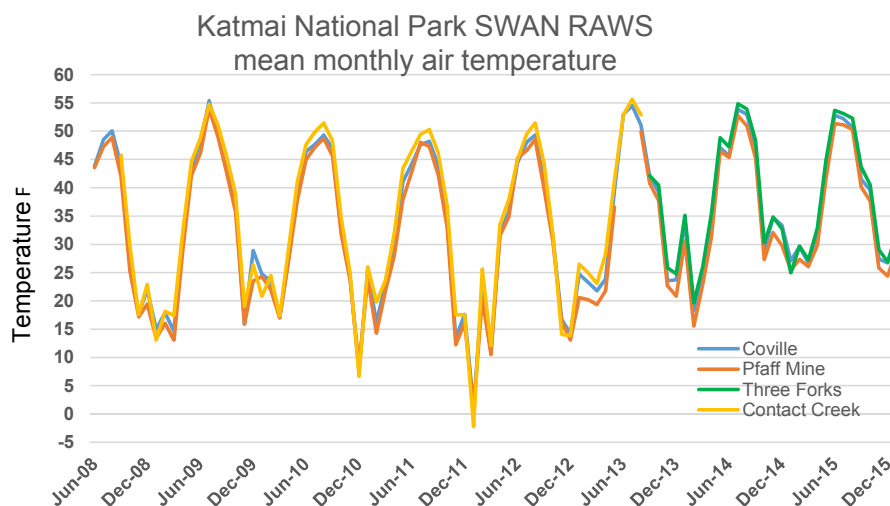


Figure 1. Mean monthly air temperatures from remote automated weather stations (RAWS) in Katmai show climatic similarities, despite elevational differences and geographic distribution, due to the strong maritime influence.

The phase of the multi-decadal PDO shifted abruptly in the late 1970s to a warm phase and then to shorter oscillations of warm and cool phases. These shifts exert a strong influence on land-surface temperatures, and at times may mask a global warming trend in the local instrumental record during cool-phase years. However, when records from King Salmon are plotted with the PDO, a warming trend is evident; for example, 2014 was the warmest on record (Figure 2).

King Salmon has one of the longest continuous instrumental climate records in the region, starting in 1919 with continuous records since 1947. The past three years inclusive of 2015, have had 11 to 15 record daily high temperatures with extended periods of above-normal temperatures in December, January, and February of each year. The combined effects of these patterns have the greatest impact on whether precipitation falls as rain or snow and longevity of the snowpack.

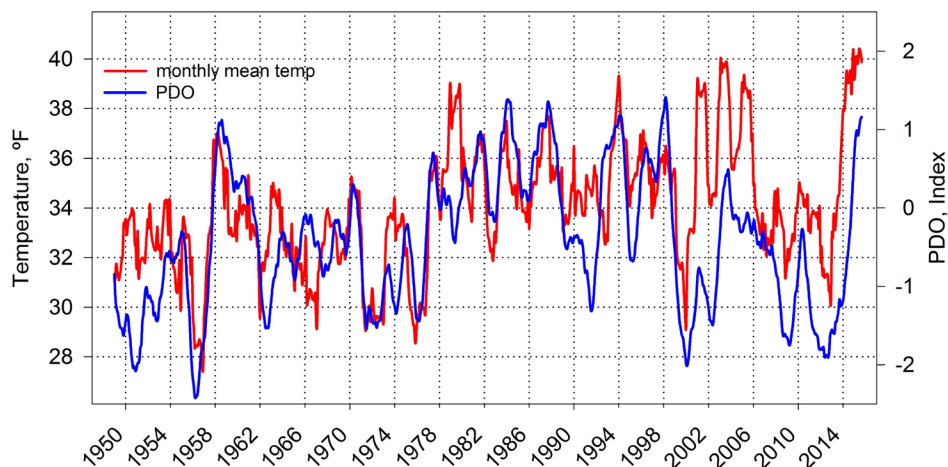


Figure 2. The one year running mean of the King Salmon mean monthly air temperature and the PDO index of sea surface temperatures (Smith et al. 2008).

References

- Mantua, N. and S. Hare. 2002. The Pacific Decadal Oscillation. *Journal of Oceanography* 58(1):35-44.
- Smith, T. M., R. W. Reynolds, T. C. Peterson, and J. Lawrimore. 2008. Improvements on NOAA's Historical Merged Land-Ocean Temperature Analysis (1880-2006). *Journal of Climate* 21:2283-2296.
- Trenberth, K. E. and J. W. Hurrell. 1994. Decadal atmosphere-ocean variations in the Pacific. *Climate Dynamics* 9:303-319.

More Resources

Alaska's Climate

accap.uaf.edu/

www.snap.uaf.edu/

www.aaos.org/

Snow and Climate

nsidc.org/cryosphere/snow/climate.html

Climate and Sea Surface Temperatures

www.ncdc.noaa.gov/teleconnections/pdo/

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