1971-2000 High-Resolution Temperature and Precipitation Maps for Alaska
Final Report

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August 2009

Introduction

Climate is one of the primary drivers of ecological change in Alaska parks, and the current climate maps are out of date. Climate observations in Alaska are often available for major towns and airports, but are lacking in areas where they are needed most-- in mountainous regions and remote areas. The PRISM Climate Group produces and disseminates the most detailed, and the highest-quality spatial climate datasets currently available. These digital climate maps are created using PRISM, an analytical tool that uses point data, a digital elevation model, and other spatial data sets to generate gridded estimates of monthly, yearly, and event-based climatic parameters, such as precipitation, temperature, and dew point. PRISM is uniquely designed and constantly updated to map climate in difficult situations, including high mountains, rain shadows, temperature inversions, coastal regions, and other complex climatic regimes found in Alaska.

Maps previously available for Alaska were based on the 1961-1990 climatological period. This project was designed to rectify this situation, using the latest applicable climatological period (1971-2000) to produce spatially gridded average monthly and annual, 30-year normal precipitation and temperature (average, maximum, minimum) data sets. Distribution of the point measurements to a spatial grid was accomplished using the PRISM model and verified to PRISM standards, including a product peer-review in cooperation with Alaska state and regional climate specialists.

Updating the Alaska climate maps to 1971-2000 presented an excellent opportunity to increase the resolution of the spatial climate products. Advances in computing power and software execution efficiency have made it possible to increase the spatial resolution of the conterminous US maps from the 2.5 minutes (~4 km) of the 1961-1990 maps to 30 seconds (~0.8 km). This results in a significant increase in spatial detail and accuracy, making for highly accurate estimations of point climate values from the gridded data. Also, in the intervening years since the 1961-1990 maps were created, the PRISM climate mapping system has been significantly improved. The most recent version of PRISM was used to develop the updated maps for Alaska.

Tasks performed in this project were as follows.

Task 1 -- Collect and process data
Task 2 -- Conduct quality control checks
Task 3 – Perform initial mapping
Task 4 – Conduct peer review and create final products

These tasks are discussed below.

Tasks 1 and 2 – Data Collection and Quality Control

Climate Data
Collecting station climate data and metadata for Alaska was a major undertaking. There is no central repository for climate data in Alaska; data reside at a large number of agencies around the state (and country), in various formats, and at various levels of quality and completeness. The metadata are often incomplete, inaccurate, and contradictory, requiring graphical analysis for resolution or official permission for use. "Fragmented" and "unpredictable" accurately describe the state of the data.

Climate data were collected and processed for COOP (National Weather Service Cooperative Observer Program) and WBAN (Weather Bureau Army/Navy) stations from the NCDC (National Climate Data Center); SNOTEL (Snow Telemetry) and snow course stations from the USDA Natural Resources Conservation Service (USDA NRCS); RAWS (Remote Automatic Weather Stations) from the WRCC (Western Regional Climate Center) and MesoWest; and Surface Airways hourly stations from Unidata and the NCDC. Additional data were collected from the Alaska Ocean Observing System (AOOS); Alaska Pacific River Forecast Center (APRFC); Arctic and Bonanza Creek LTER (Long Term Ecological Research) sites; MesoWest; National Data Buoy Center (NDBC); National Snow and Ice Data Center (NSIDC); National Weather Service; University of Alaska Fairbanks Water and Environmental Research Center (WERC); United States Geological Survey (USGS); Environment Canada; and the British Columbia River Forecast Center. Hydrological network precipitation data were obtained through the Unidata Internet Data Distribution (IDD) project. North Slope borehole temperature data were obtained from the USGS (US Geologic Survey); and RWIS (Roadway Weather Information System) data from MesoWest. Attempts to acquire Columbia Ice Field precipitation data in a usable form were unsuccessful.

Station data were filtered to remove extreme values, logical errors, and other contaminants. Native hourly data were converted to daily time step, combined with native daily data, then converted to common units and inserted into a database, creating the longest, most complete record possible for each station. A minimum of 75 percent of hours with valid data were required to make a valid daily value. Daily data were converted to a monthly time step and combined with native monthly data to create yearly and 30-year PRISM files. A minimum of 85 percent of days with valid data were required to make a valid monthly value. Short-period stations (<23 years) within the 30-year files were adjusted to make them more representative of the full period (see Daly et al. 2008 for details). Metadata were collected for stations, many having their components assembled or cross-checked using a mixture of references. Identified errors were corrected. KML and CSV files containing station locations and period of record information were prepared and distributed to outside reviewers. Comments received provided additional station location corrections and data sources.

The use of multiple sources of station data resulted in many “clusters” of stations when plotted on a map, each station from a different data source, and each with a different ID string and location. It became very difficult to determine which stations were unique, and which were duplicates. Many of these station clusters had to be thinned manually once the modeling began. Often, our best judgment was used to determine which to keep and which to omit, based on period of record and perceived quality of the data.

A major source of uncertainty in the station data was the measurement of winter precipitation. Surprisingly, very few gauges in Alaska are equipped to capture and store frozen precipitation. Many are small and unshielded, allowing wind-blown snow to blow over the gauge orifice and be lost, or to be buried during heavy snowfalls. Both conditions can lead to an undercatch of snowfall of 100 percent or more. The only gauges found to measure snowfall in a reasonably accurate way were those used by SNOTEL installations.

Snow water equivalent (SWE) from NRCS snow courses also provided useful, but indirect, information on winter precipitation, often in remote locations were other data were unavailable. Using SNOTEL sites with data for both SWE and precipitation, we found that the relationship between winter precipitation and SWE was a function of temperature. (As the temperature increases, chances for melt and rainfall increase, hence less SWE per unit precipitation). We developed a function relating the ratio of winter precipitation to SWE with winter mean temperature. Estimates of temperature needed to predict this ratio at snow course sites were provided by the PRISM gridded temperatures developed in this project.

NARR (North American Regional Reanalysis) gridded free-air temperatures were downloaded and sampled every 1.5 degrees lat/lon at the 1500m, 2500m, and 4500m levels, and averaged to the 1979-2000 period (data did not extend before 1979). Since there were very few surface stations available above 1000m, these data helped map temperature inversions much more effectively and consistently. The main difficulty with using NARR data in this analysis was the discrepancy between conditions in the free atmosphere and those on the surface. These discrepancies varied by season and location, and few high-elevation stations were available for use in adjusting the free-air mean temperatures to reflect surface maximum and minimum temperatures. The free-air temperatures were modified to reflect surface conditions using best judgment.

DEM Elevation Data

The preparation of a 30-arc-second DEM (digital elevation model) for Alaska and adjoining areas of Canada also proved to be a major undertaking. Canadian elevation data were necessary for the use of stations outside Alaska in the interpolation process. There was no high-quality 30-sec DEM for Alaska that extended into Canada in a consistent manner. The GTOPO30 DEM had global coverage at 30 sec, but was of poor quality. SRTM (Space Shuttle Radar Topography Mission) data were discontinuous and limited to latitudes south of 60N. The only remaining option was to manually download 5000 2-arc-second DEM tiles from Alaskan and Canadian repositories, patch these together, and filter them to the desired 30-sec resolution. The sheer size of these data sets (each 1x1 deg box contained 3.24 million grid cells) hit the 2-GB PC operating system limit very quickly when attempts were made to patch multiple tiles together. We dedicated several computers to the patching task, but the process still required months to complete. Software developed in-house was used to downscale the merged and patched datasets, resulting in a high-quality 30-arc-second DEM spanning the entire state of Alaska and adjoining regions of Canada.

Task 3 – Perform initial mapping

Successful climate modeling of a climatically complex and data-poor state such as Alaska requires that the modeler be as well-informed as possible of the patterns of climate in the state. As part of the learning process, a field reconnaissance was made in August 2007 by Daly to visit selected areas, assess the siting and equipment used at existing stations from various networks, and interact with local climate experts. A trip report is provided in Appendix A. A second trip was taken in January 2008 to assess winter conditions and continue discussions with local meteorologists and climatologist.

Using the 30-sec DEM as a basis, PRISM input grids were developed. A modeling mask was created that included all land areas and many near-shore areas within Alaska and small parts of adjacent Canada. A 30-sec DEM filtered to 2.5-min effective wavelength was created for use in precipitation modeling. Other input grids include topographic facets, topographic index, effective terrain height, coastal proximity, and inversion height.

Due to the large size of the Alaskan region at 30-sec resolution, and differences in climatic regime across the state, the state was divided into four overlapping modeling regions: southeast, southwest, south, and north. PRISM was parameterized separately for each region. PRISM was run on the OSU High Performance Computing Cluster, located in the College of Engineering. This parallel cluster allowed the model to be run far more rapidly than on a single machine. Temperature was modeled first, so that the gridded temperatures could be used to estimate winter precipitation at snow course sites.

Several iterations of modeling and data QC were made, and close data scrutiny during modeling revealed additional data quality issues. Initial PRISM parameterizations were made, and adjusted during the process. At least 30 modeling iterations, each using different PRISM parameterizations and station data sets, were made for each climate variable.

Task 4 – Review and creation of final products

Review of the draft maps was done via Internet Map Server (IMS). IMS eliminates the need for reviewers to have GIS capability, thus allowing all to contribute to the analyses. The IMS has capabilities to zoom, pan, query a map layer, and get information on station locations and observed values. Three draft climate maps were selected for review: 1971-2000 mean annual precipitation, mean January minimum temperature, and mean July maximum temperature. The goal of the review process was to ensure that the climate maps reflect, as much as is practical, the current state of knowledge regarding the long-term mean patterns and magnitudes of temperature and precipitation in Alaska. We asked for input on the following:

1. Are the estimates and patterns reasonable when compared to your local knowledge?
2. Are the stations plotted correctly on the map?
3. Are the local high and low values (extremes) in a given region of interest reasonable and located properly?
4. Do you have any supplemental data sets you wish to offer that would significantly improve this analysis?

Comments were submitted electronically using the IMS website. The map view the reviewer was examining at the time they submitted their comment was saved along with the comment.

Several experts participated in the review process, and provided a total of 17 comments. The comments were valuable to the revision process, and resulted in significant improvements to the maps. A full presentation of the reviewer comment and our responses to each are presented in Appendix B.

Deliverables

- GIS raster data layers (grids in ARC ASCII GRID format) of 1971-2000 mean monthly and annual precipitation and temperature (average, maximum, and minimum). Grid resolution is 30-arc-second resolution, which is approximately 1 x 0.5 km at 60 degrees north latitude.
- GIS-compatible CSV files of station data used in compiling climate maps, including station parameters, period of record, and network affiliation for each station.
- Browse graphics for GIS raster layers.
- FGDC compliant metadata.

APPENDIX A

Field Notes for Alaska Reconnaissance Trip
Aug 11-25, 2007

Christopher Daly
Director, PRISM Climate Group

Aug 11 - Fly into Fairbanks in evening

Aug 12 - Elliott Highway from Fairbanks to Livengood. Route passes through the White Mountains, and reaches elevations of 2500' or so. Walked Wickersham Dome trail to about 2750' where trees were sparse. Treeline appears to be about 3,000'. Vegetation along the route did not seem much different than that at Fairbanks, despite an expected increase in precipitation due to orographic enhancement. It may be that summer precipitation drives things here; need to check to see if summer ppt varies much here. Few obs, though. Poplars and spruce all the way to Livengood. Scattered showers, temps in the 60s.

Aug 13, 14 AM – Participated in a climate workshop held jointly by NOAA NWS and UAF. Very good meeting with much interest in the new PRISM AK mapping effort. I gave a 90 minute presentation, and was asked many questions about the kinds of spatial climate products can be produced. Was asked to give the presentation again at the NWS/RFC office in Anchorage on Wed, Aug 22 at 3 PM. UAF/UAA and NWS have a very close working relationship. My goal was to gather information on climate data sources for the mapping effort. We identified several new networks and/or stations, including UAF Water Resources stations on North Slope and on Seward Peninsula, network along the Richardson Hwy south of Delta Junction (NWS Ed Plumb to provide data), several new RAWS and SNOTEL stations, CRN site NE of Fairbanks, AK Dept of Transportation stations. I asked Rick McClure, USDA-NRCS Alaska snow survey, to summarize known sources of data. He is probably the single best source of information I have.

Drove to Delta Junction late afternoon. Rain off and on. Took picture of Birch Lake AKDOT station. Has shielded tipping bucket gage, temp and wind. Veg seems a bit more lush along Tanana than in FAI. Visited Rick McClure's SNOTEL shield intercomparison site off AK hwy SE of Delta. Shields included no shield, Alter, Nipher, and Wyoming. Nipher had the most catch that I could see, but the Wyoming-shielded gauge was not visible.

Aug 15 – Delta Junction to Copper Center, Tangle Lakes. Cloudy with poor vsby on north side of AK Range, but higher ceiling on south side. Saw Trim's Camp, where we have a COOP. Also took pic of a AKDOT station there. These are nice looking sites. Mtns on north side of range have less ice and snow than south side. Went to Tangle Lakes on Denali Hwy. Temp 55-60 and very light rain. Buggy. Edge of front visible off to west. Paxson on south side of range is wetter then Delta (and higher) but again veg does not change much, for elevation effects. Raining into Copper Center, 60F.

Aug 16 – Copper Center to Kennicott-McCarthy, via air. First really nice weather day. Took Copper Center Air flight with Pam Sousanes from Gulkana Airport along southern edge of the Wrangells, south over the Chugach to Copper River delta/Henry Glacier near coast, east up the Bagley Ice Field, and north to May Creek. Landed at May Creek and visited SNOTEL and NPS RAWS stations. Flew to McCarthy. Throughout the flight, I asked the pilot to fly at about 7500' as consistently as possible, so that we could compare the amount of permanent snow at that level on the windward side of the Wrangells, and windward and leeward side of the Chugach. The idea was that the amount of ice and snow at the same elevation would correspond roughly to the amount of precipitation during the colder months. This assumes that the temperature is constant at constant elevation among these regions, which is probably not a perfect assumption. For example, the air temperature outside the airplane dropped from about 45-50F in the Wrangells to 37F on the windward Chugach. This trend may be somewhat reversed in winter, however. There was just a little snow at this level in the Wrangells, more on the leeward Chugach, and complete snow and ice cover down to below 4,000 ft on the windward side of the Chugach. North of the Bagley Ice Field the amount of snow decreased dramatically. This suggests a strong rain shadow created by the Chugach, and a further drying with further north in the Wrangells.

Aug 17 – Kennicott to Gulkana on Wrangell Mountain Air, to Sheep Creek via Glenn Highway. Excellent weather today (about 75F in Glenallen), and saw much from the air. Flew north across the Wrangells to the north side, west to Chisana and Nabesna, around north side of Mt Sanford, landed in Gulkana. Again, Wrangells proved to be a significant rain shadow. Mtns on north side had no snow or ice at all, compared to a little on south side. Saw met station sites on north side, and located RAWS station at Klawasi, on west slope east of Gulkana.

Made contact with George Cebula, a retired NWS forecaster and COOP point of contact out of Anchorage, now living in McCarthy. He provided a good amount of local information about the region's climate. He feels that the Wrangells receive about 80-90" of precipitation annually. Our pilot who also lives in McCarthy provided additional useful information. The area is heavily sheltered from moisture from most directions, but does get spillover precipitation from the southeast. Winds blowing from the SE can sometimes bring rain and coastal-like conditions, even in winter, and can erode the interior temperature inversion. Temperatures can often be warmer than Cordova in these situations, presumably due to downslope warming. Northerly winds also occur, and tend to erode the inversion a bit more easily, because the air is colder than the warm SE winds, which tend to ride up and over the cold air in place in the valley. Kennicott is warmer than McCarthy in winter by about 10F, being above the coldest air. McCarthy COOP site is located at the base of ridge, and is fairly cold. Cold air spilling down the Kennicott Glacier follows the river valley downslope. It is a shallow layer, however, and does not usually reach the height of the airport, just SE of McCarthy and up on a low bench.

McCarthy appears to get only about 0.5" of precipitation per month in summer, compared to 3 inches at McKinley Park. However, McCarthy's annual precipitation is about 19", compared to McKinley's 15". Pam was curious when McCarthy received additional precipitation to make up the difference. I will check the climate data.

Windy at Sheep Mountain, and much cooler than Glenallen. Temperature about 60F today, and low 50s in the evening. Area gets a good amount of snow in winter, according to Lodge staff, and presence of a X-C trail system here. Elevation 2750'. Very much in rain shadow, however, with snowier Chugach to the south and drier Talkeetnas to the north.

Aug 18 – Sheep Mountain to Hatcher Pass to Anchorage. Viewed the Matanuska Glacier, which has been fairly stable over the past 400 years, according to information there. Accumulation zone begins up at nearly 10,000' in the Chugach, which is well-fed with coastal precipitation at high elevation. Visited Hatcher Pass (3,800'), in the Talkeetnas north of Wasilla. Treeline here is about 2,700 feet. Many people were out picking ripe blueberries in the tundra. Climbed above the pass to nearly 5,000'. Temperature was in the mid 50s up high, about 60 at the pass. Very little snow and ice to be seen anyway in this range, indicating winter dryness.

Aug 19 – Anchorage to Denali. Long day driving today. A weak storm moving into Anchorage caused light rain there, but the rainfall did not extend north of Talkeetna. Many storms have this track, moving over the south coast but not extending far into the interior. Vegetation very similar to Anchorage until higher elevations of the Alaska Range were reached. Broad Pass at about 2,500' was near treeline, which was about 3,000'. From this pass (Cantwell is just north of it), precipitation decreases to the north. Denali Park HQ receives about 15" per year, and Healy further north, even less. Once north of Healy, the terrain flattens out and you are in the interior. Healy is at the north end of where the Nenana River carves its way through the Range, and wind is prevalent here. Southerly winds are frequent, from storms passing to the south. But northerlies also occur regularly, depending on the pressure gradient. Northerlies bring cold weather, while southerlies bring Chinook-type conditions with compression heating and warmer temperatures.

Aug 20 – Denali northern range overflight. Overflight took us from Denali Park air strip to the west, north of the McKinley massive. Clouds obscured the summit, but it was possible to view the terrain up to about 10,000'. Flying at 7,500', as done in the Wrangells and Chugach, we saw very little snow and ice. The snow situation was similar to that of the north side of the Wrangells. Locals in the Denali area indicated that the southern (windward) side of this part of the Alaska Range is significantly wetter than the north side. A new SNOTEL site on the windward side at Tokositna, just installed in 2006, should provide some quantitative back up for this. However, the site is rather low (1,000') and will not give information on higher elevations along the windward exposure of the Alaska Range. Pam Sousanes has a local transect of four stations called the Rock Creek transect, which extends from the McKinley Park COOP site at HQ, up convex slopes to 4200' on the southern flank of Mt. Healy. This transect promises to provide very useful data for precipitation as well as temperature for mapping, but is on the leeward side of the range. It may be useful to gather information along a transect further to the south on the windward side, such as above Cantwell or Broad Pass, and compare to the Rock Creek transect. Both have had COOP sites. Pam said Broad Pass used to have a NWS WFO there, but the office closed in the 1970s. The Cantwell COOP is still operational, however. These areas are not fully exposed to windward, as Tokositna is, however. The Parks Highway veers to the NE north of Talkeetna, and becomes somewhat sheltered by the Talkeetna Mountains.

Aug 21 – Denali Park ground survey. Met with Pam Sousanes at her office at Denali HQ. She showed me the McKinley Park COOP site, which is located near the sled dog kennels, and has been operated by kennel staff for some time. The MMTS temperature shield is located in a poor exposure behind and to the south of the kennel building. There is spruce forest just to the south of the instrument, making the siting problematic. However, Pam has been told by NOAA personnel that the siting is "just fine." The precipitation and evaporation gauges are located within a chain link fenced area overgrown by alder. This is not a freely-flowing wind area and is not exposed to much sun, at least in summer. This must cause underestimates of pan evaporation. Rain gauge is consequently well protected, but in danger of being overgrown. Vegetation around the entire installation needs to be trimmed back. Visited the Savage Creek area, at mile 15 on the highway into Denali. It is mostly treeless, and less than 3,000 ft. Also traveled the Mt. Healy trail, and reached treeline between 3,000 and 3,500 ft.

Aug 22 – Healy to Anchorage, presentation at Anchorage RFC and WSFO. Traveled back down the Parks Highway on a cloudy day with some rain and poor visibility. Fall foliage just starting to turn. It is late this year. Fairly windy coming south of Healy, with winds from the south. There are several AKDOT weather stations along the highway, which would be very helpful for mapping. Gave a 3 PM invited presentation on PRISM climate mapping with an emphasis on the new Alaska project to National Weather Service and River Forecast Center personnel. Invited by John Papineau and Scott Lindsey, who saw my talk at the Alaska Climate Workshop in Fairbanks. Had a very good and lengthy exchange from 3 PM until 5

PM. While NWS personnel were not very engaged in the map review process last time, we can expect that to change this time. Previously, they did not know how to review the maps. Now, having worked with the PRISM data sets for some time, they are ready and willing to engage in the process. They are also eager to help provide data. One network they may be able to contribute data for is the AKDOT, or so-called RWIS stations. I will follow up on that with them. Overall, a good, knowledgeable group that will be great to work with.

Aug 23 – Anchorage to Valdez, via Prince William Sound. Traveled into the Alaska coastal climate regime. Today was wet in Anchorage, but became wetter as one traveled along Turnagain Arm towards Portage Glacier. Alyeska (Girdwood) is clearly wetter than Anchorage, but is still blocked by the Chugach to the east and south. Whittier is much wetter. Took Alaska Marine Highway ferry from Whittier to Valdez. Visibility was poor along the ferry route. Permanent ice and snow down to around 2,000 ft. Temperatures were cooler than experienced in the interior. Showery in Valdez, as the frontal system moved through. Able to see a number of lower peaks, however, in the evening.

Aug 24 – Valdez to Anchorage via Richardson and Glenn Highways. Weather in the process of clearing somewhat today. Drove to Thompson Pass and Worthington Glacier. Thompson Pass COOP station is supposedly near the top of the pass, but could not locate it. There is an ADOT weather station in an exposed location on the very top of the pass, however. Obviously no good for precipitation. Worthington Glacier is retreating rapidly, and leaving a new lake below it. Was able to find the Upper Tsaina SNOTEL site about 3 km below the glacier, off on a pipeline road. Nice location, well sheltered, not far from the river. Definitely in the Thompson Pass rain shadow, however. One we drove down from this location, vegetation and lack of snow and ice indicated a rapid dropoff in winter precipitation into the Copper River Valley. Stopped at the new Wrangell-St. Elias National Park visitor center and purchased an Alaska Atlas and Gazetteer, which will help me in the mapping work. Mountains themselves were obscured by clouds. Was able to see a few of the northern Chugach glaciers on the Glenn Highway on the way back to Anchorage. There has been a cloud bank along the crest of the Chugach and southward both times I have visited this area, indicating a strong precipitation (and temperature, at least in summer) gradient all along the mountain crest.

Aug 25 – Fly home.

Appendix B

Alaska Climate Mapping Reviews and Responses

Christopher Daly
PRISM Climate Group

January Minimum Temperature

Email: carl.dierking@noaa.gov
Name: Carl Dierking
Office: WFO Juneau
Mapname: Alaska tmin
:
URL: Click Here to view

Comments

Looking at the January tmin for the inner channels of Southeast Alaska it doesn't look like there is enough contrast between land areas adjacent to the water and those further inland. The moderating effect of the water can make a significant difference. For example in the Juneau area for the year 2000 the average minimum temperature at JLPA2 (a site adjacent to the water) was 25.9 degrees while at the Juneau Forecast Office (a site well inland) it was 17.6 degrees. Granted 30 yr averages may temper this a little but not to the few decimals that is shown in the PRISM data.

Our data base shows that the long-term differences are fairly subtle over the 1971-2000 period. The Juneau Airport, near the water, had a 1971-2000 mean January minimum temperature of 21.2 degrees, while the forecast office was 19.2 degrees. However, we did find that our coastal proximity grid did not resolve the narrow inlet adjacent to the airport well. The distances involved are small, and near the resolution of our grid, as well as the accuracy of our information on the locations of the coastline and the stations. The grid was modified to better reflect this feature. In addition, we increased the model's sensitivity to coastal proximity. The coastal gradient in minimum temperature is now better defined.

Email: michael.j.mitchell@noaa.gov
Name: Michael Mitchell
Office: WFO Juneau, AK
Mapname: Alaska tmin
:
URL: Click Here to view

Comments

Noted that the Jan min temp at the Juneau airport (PAJN) and at WFO Juneau (PAJK)are the same although experience tells me that PAJK is consistently colder. After looking at climate records I noticed the early 70s where very cold at PAJN. PAJK records only go back to 1999. When I compared PAJN to PAJK between 1999-2009 PAJN average min is 24.2 while PAJK average is 21.2. When you use 1970-2000 PAJN min is 20.6F. Also noted an unlikely cold spot on a spit of land extending into Auke Bay between AUKE and LENA that appears to be plotted at an elevation that is too high.

Your analysis confirms the subtle differences between the airport and the forecast office when the full 1971-2000 period is considered. However, there still should have been greater contrast between the inland and coastal areas, and this has now been improved. The cold spit into Auke Bay has also been reduced and confined to the higher elevation area just to the north.

Email: richard.thoman@noaa.gov
Name: Rick Thoman
Office: WFO Fairbanks
Mapname: Alaska tmin
:
URL: Click Here to view

Comments

There is coop climate data from Marys Igloo and Pilgrim Hot Springs (inland Seward Peninsula north of Nome) from before 1945 that does not appear to have been used. Also, I might have guessed that the Quartz Creek and Hoodoo Hill RAWS in the inland Seward Pen would have enough January data to be of use.

We were able to retrieve intermittent data for Marys Igloo for the period 1919-1928, which is far removed from the target period of 1971-2000. However, given that the station occupies a cold, interior basin which is not well-represented in the draft map, we adjusted the data to 1971-2000 using Nome as the anchor station, and included these values in the analysis. Hoodoo Hill had sufficient data to form 1971-2000 means for all months but January and March. Quartz Creek had sufficient data for all months except January and December.

Email: richard.thoman@noaa.gov
Name: Rick Thoman
Office: WFO Fairbanks
Mapname: Alaska tmin
:
URL: Click Here to view

Comments

The Mosquito Flats, NNE of Tanacross, should probably be as cold as the Chicken area for January tmin: this area is often amongst the coldest areas in eastern Interior on IR imagery.

Two estimated stations, based on data from Chicken, were established: one at Mosquito Flats, and one in a valley to the east of Mosquito Flats. The result is much colder temperatures in these valleys.

Email: richard.thoman@noaa.gov
Name: Rick Thoman
Office: WFO Fairbanks
Mapname: Alaska tmin
:
URL: Click Here to view

Comments

I would expect the Porcupine River Valley to show up a bit warmer due to very frequent winds, and the minT value for Graphite Lake RAWS look much too cool looking at the WRCC summary data. Might be enough January data from Helmut Mtn RAWS (not plotted) to be of use.

We only had a few years of valid data for Graphite Lake, mostly in the late 1990s and 2000s, but in those years the January tmin values match almost perfectly with those available from WRCC. The simple average of the available years is -25.6C. Our statistical adjustments to the 1971-2000 period came up with an average of -28.9C. We also had three years of data in the late 1960s from Canyon Village, not far northeast of Graphite Lake. The simple average was -38.2C. Our adjusted 1971-2000 average was -35.6C. For comparison, in 1966 (the only year of overlapping data), the mean January tmin at Canyon Village was -42.8C, slightly colder than the -41.6C observed at Fort Yukon. The 1971-2000 average January tmin at Fort Yukon was -34.3, slightly warmer than Canyon Village. Clearly, at least some parts of the Porcupine River Valley are just as cold, or colder, than the Yukon Flats. Helmut Mtn RAWS had insufficient data quality for mapping in January and February, but was included for all other months.

Email: richard.thoman@noaa.gov
Name: Rick Thoman
Office: WFO Fairbanks
Mapname: Alaska tmin
:
URL: Click Here to view

Comments

Seems the like North Slope needs more detail. Inland river valleys should have minT in the -30s. The coastal areas should have more definition. The Chukchi coast should in general be warmer than the Beaufort coast. Barrow area should be about the warmest area north of the Lisburne Peninsula.

Yes. the North Slope does lack detail, due to extreme data sparseness. We made a number of improvements to address this issue. We modified the PRISM coastal proximity algorithms and parameterizations to better delineate the North Slope coastline, and also separate the colder Chukchi coast from the Beaufort coast. Finally, we increased the sensitivity of the PRISM topographic index algorithm and added more estimated stations to improve the detail of the temperature inversions in the inland river valleys. The result is a substantially improved North Slope map.

Email: richard.thoman@noaa.gov

Name: Rick Thoman

Office: WFO Fairbanks

Mapname: Alaska tmin

:

URL: Click Here to view

Comments

USGS Ikpikpuk River gage (WNW of Umiat) has temp data for a few winters

We had Ikpikpuk data for only two years (2006 and 2007), not enough to create a reasonable average.

Email: alspringsteen@alaska.edu

Name: Anna Springsteen

Office: S.N.A.P. (University of Alaska Fairbanks)

Mapname: Alaska ppt

:

URL: Click Here to view

Comments

I work for the Scenarios Network for Alaska Planning. Scott Rupp asked me and a fellow employee to take a look at the maps. All the maps look reasonable to me. I work mostly at a statewide level, so the patterns and values look within a reasonable range at that level to me. Things I looked for were precipitation values at elevation in the Southeast (Juneau, etc.) and in the Yukon Flats area (large basin in the east-central portion of the state). I also paid particular attention to January min temperatures in the Yukon Flats, as well as around Fairbanks, where I am more familiar, and the Anchorage area. Ditto for July max temperatures. These all seemed reasonable. Areas that seemed reasonable for all three maps, but at which I am not locally familiar on a station-data level are in the arctic and the south-western portion of Alaska (Togiak/Dillingham/Aleutians). In general: 1. Are the estimates and patterns reasonable when compared to your local knowledge? Yes. The statewide patterns seem reasonable. 2. Are the stations plotted correctly on the map? Yes. The stations do seem in the right places. 3. Are the local high and low values (extremes) in a given region of interest reasonable and located properly? The extremes do seem reasonable in their values and overall statewide pattern. 4. Do you have any supplemental data sets you wish to offer that would significantly improve this analysis? No. I do not.

No response required.

Email: pam_sousanes@nps.gov
Name: Pam
Office: NPS
Mapname: Alaska tmin
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URL: Click Here to view

Comments

Chicken Creek is a new RAWS site at 5240' above Chisana. Only a few years of data (5) but mean Jan min Ts are warmer than mapped.

Chicken Creek did not have sufficiently complete data to form an adjusted 1971-2000 mean in the conventional manner, and some of the data that were available appeared to be of very poor quality. However, we did have about 18 months of good-quality data from Chicken Creek, and were able to use the Chisana RAWS site as an anchor station to estimate a 1971-2000 mean. It was added to the analysis.

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Comments

There are 2 new RAWS sites in this area at higher elevations. They have very short records, but so far the Jan tmin temps are warmer than the map shows. Chititu is at 4554' above May Creek and Gates Glacier is at 4060' in the Wrangell Mtns NW of McCarthy.

Neither Chititu nor Gates Glacier had sufficient data to form an adjusted 1971-2000 a mean in the conventional manner. However, we did have about 2 years of good-quality data from Gates Glacier, and were able to use the McCarthy 3S COOP site as an anchor station to estimate a 1971-2000 mean. It was added to the analysis. It was not possible to estimate a mean for Chititu.

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Comments

I briefly looked at the dataset from Telequana Lake - it appears that the mean Jan min temp might be lower than mapped. I will send that dataset - it is a local non-network station, but might be useful.

We processed and adjusted the Telaquana Lake data to the 1971-2000 period, and included it in the analysis. The adjusted January tmin value was significantly warmer (+3.3C) than that of the nearby RAWS station STONEY. Overall, the tmins were warmer and the tmaxs were cooler than those from STONEY. The differences may be explained by the proximity of the Telaquana site to the lake.

July Maximum Temperature

Email: richard.thoman@noaa.gov

Name: Rick Thoman

Office: WFO Fairbanks

Mapname: Alaska tmax

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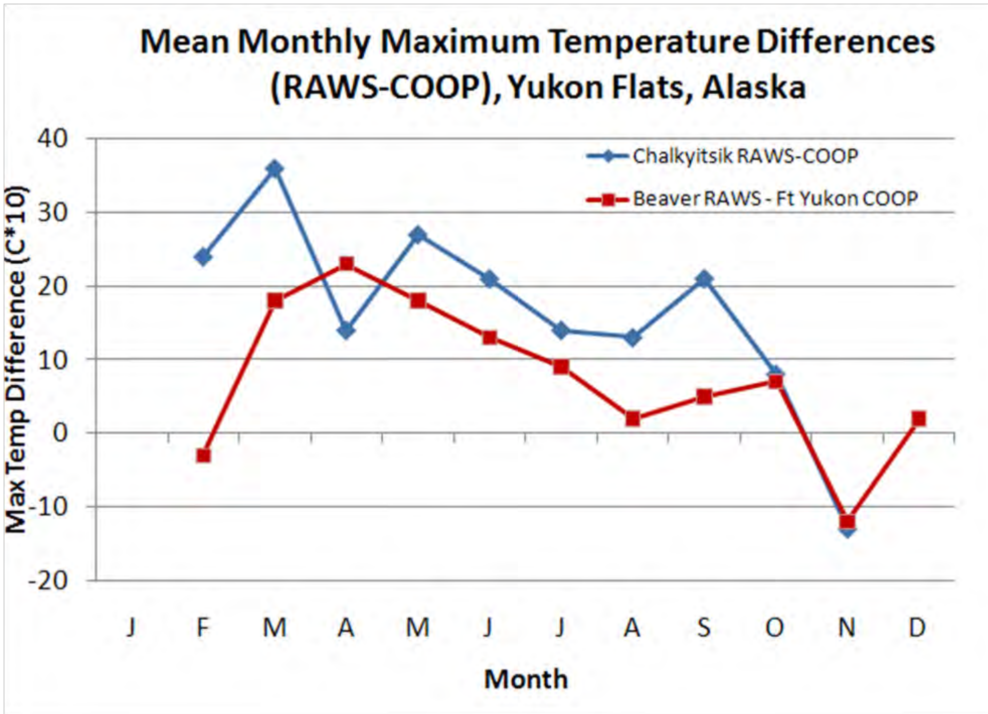
Comments

I think the hot bulleyes on the Yukon Flats are purely an artifact of RAWS platforms that run too warm in full sun.

We performed a comparison between the RAWS and COOP stations on the Yukon Flats, and found that, indeed, there was a warm bias for tmax (see Figure below). The bias was generally greatest in the spring and least in the late fall and winter, which roughly corresponds to the expected maximum solar radiation load in this area. For the PRISM mapping analysis, RAWS station values were reduced to values more in line with the COOP station values.



<u>Annual Precipitation</u>

Email: carl.dierking@noaa.gov
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URL: Click Here to view

Comments

The predominant wind direction in southeast Alaska during precipitation is from the southeast, so southeastward facing terrain will have much higher precipitation amounts than the opposite side due to the upslope forcing. In general the PRISM precipitation data does seem to take this into account with the higher precipitation values shifted toward the southeast, but it appears that the terrain resolution is more course than the shadowed topography would suggest. For example in the Juneau area there are three valleys between downtown Juneau and the airport that should have precipitation troughs and ridges but they are smoothed out in the PRISM data.

The map colors do not show it very well, but the PRISM mean annual precipitation does change over the hills. As one moves north, mean annual precipitation increases from about 95" downtown to about 150" on Mt. Juneau, decreases to about 130" at Salmon Creek Reservoir, increases to about 145" on Blackerby Ridge, decreases to about 85" in the Lemon Creek Valley, increases to about 130" on Thunder Mtn, then decreases to about 65" in the Mendenhall Valley.

Email: richard.mcclure@ak.usda.gov

Name: Rick McClure

Office: NRCS

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URL: Click Here to view

Comments

It appears the Rocky Point estimated 30 year average of 14.2" may have been entered incorrectly, the area/penisula should be one category up in the 300-400 mm range if I am reading the colors correctly. The Nome 20 Mile and Cottonwood Camp colors match correctly.

You are correct, the adjustment process produced a 1971-2000 mean for Rocky Point that was too low. An alternative adjustment process was used that produced a 1971-2000 mean of 15.3". This value was used in the analysis.

Email: richard.mcclure

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URL: Click Here to view

Comments

This looks good. The Kantishna SNOTEL site, near Wonder Lake, has an estimated average of 21.4 inches.

The Kantishna SNOTEL site could not be used in the analysis because it had only 2.5 years of data, but PRISM appears to be estimating the annual value reasonably well.

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Comments

The average annual precipitation at Monahan Flat is 21", I do not believe the Gracious House is 6" more+ to be in the 700-800mm range. I have no evidence for the Alaska Range to the north and east of this area, but I do not feel the average annual precitation in this area is greater than 1500 mm. The storms have lost a good amount of their moisture by the time they get this far inland with the Alaska Range/Mt. McKinley, Talkeetna Mtns, Chugach Range and Wrangle Mtns in the way of most of the storm paths. I will look at the Gulkana Glacier snow survey data for a better analysis.

You are right again, the Gracious House had some bad adjustments. This has been fixed, and the mean annual precipitation at Gracious House is now estimated at about 20".

The PRISM maximum precipitation estimated for the Alaska Range in this area is about 1500-1600 mm, northwest of Gulkana Glacier. Gulkana Glacier receives about 990 m. Given that Gulkana Glacier is a 1479 m and the elevation of the maximum precipitation is about 2000 m, this seems reasonable. Interestingly, Trims Camp, located on the Richardson Highway in a gap in the range, receives 908 mm annually at 735 m elevation. In general, precipitation on the summits of the Alaska Range in this area is estimated to be less than 1500 mm.