Anchorage, Alaska Solar & Weather Information Factsheet

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Narrative Climatological Summary

Anchorage is in a broad valley with adjacent narrow bodies of water. Cook Inlet, including Knik Arm and Turnagain Arm, lies approximately 2 miles to the west, north and south. The terrain rises gradually to the east for about 10 miles, with marshes interspersed with glacial moraines, shallow depressions, small streams, and knolls. Beyond this area, the Chugach Mountains rise abruptly into a range oriented north-northeast to south-southwest, with average elevation 4,000 to 5,000 feet and some peaks to 8,000 to 10,000 feet. The Chugach Range acts as a barrier to the influx of warm, moist air from the Gulf of Alaska, so the average annual precipitation is only 10 to 15 percent of that at stations located on the Gulf of Alaska side of the Chugach Range.

The Alaska Mountain Range lies in a long arc from southwest, through northwest, to northeast, approximately 100 miles distant from Anchorage. During the winter, this Range is an effective barrier to the influx of very cold air from the north side of the Range. Extreme cold winter weather, associated with a high pressure system over Interior Alaska, may lead to a succession of clear days in Anchorage, with temperatures dropping to -15°F to -30°F, as contrasted to the -50°F and even -60°F readings in the Interior. There are some factors, however, which tend to offset the sheltering effect of this mountain barrier. Chief among these is cold air entrapment in various suburban areas during periods of light winds. This results occasionally in temperatures on the outskirts of Anchorage as much as 15°F to 20°F colder than observed at the official observation sites.

The four seasons are well marked in the Anchorage area, but in length, and in some major characteristics, they differ considerably from the usually accepted standards in middle latitudes.

During winter the ponds, streams, and lakes are frozen; this normally extends from mid-October to mid-April. The shortest day of the year has 5 hours and 28 minutes of possible sunshine. Periods of clear, cold weather normally alternate with clouds, mild weather during the Anchorage winter. The clear, cold weather is frequently accompanied by significant fog because of the important low-level moisture source provided by the arms of Cook Inlet which surround the area on three sides; while considerable floating ice is prevalent, the high tides maintain some open water throughout the winter. Visibilities of ½ mile, or less, occur about 5 percent of the time during December and January, and most of these low visibilities are associated with fog. Snow visibilities generally range from 1 to 3 miles though heavier snowfalls will, of course, restrict visibilities to less than a mile on a few occasions. The first measurable snow occurs, on the average, on October 15, but has been as early as September 20; latest measurable snow in the spring averages April 14, but has been as late as May 6. Snow occurs on 20 to 25 percent of the midwinter days, and most of the snow

falls in relatively small daily amounts, with only 2 percent of the midwinter days having more than 4 inches. The heavier snows occur in conjunction with vigorous storm centers moving northward across South-central Alaska. Normally, the depth of snowfall on the ground does not exceed 15 inches. Strong, gusty, north winds which occur, on the average, once or twice during the winter will, under favorable snow conditions, cause drifting and packing of snow cover. Although normally an area of light winds, strong "Northerns" at Anchorage occasionally result from the rapid deepening of storms in the nearby Gulf of Alaska at a time when the Interior is covered by an extensive mass of quite cold air.

Spring is the period immediately following the famed Alaska "Break-up". This season is characterized by warm, pleasant days and chilly nights; the mean temperature rises rapidly; precipitation amounts are exceedingly small.

Summer comprises the period from June through September, and is, in reality, two seasons of about equal length. The first is dry, the second wet. At the time of the summer solstice, possible sunshine in Anchorage amounts to almost $19\frac{1}{2}$ hours, and the sound of singing birds and pounding hammers is nearly as common at midnight as noon. About the middle of July average cloudiness increases markedly, and the remainder of the summer usually accounts for about 40 percent of the annual precipitation.

Autumn is brief in Anchorage, beginning shortly before mid-September and lasting until mid-October. The frequency of cloudy days and precipitation drops sharply in early October. Measurable amounts of snow are rare in September, but substantial snowfalls sometimes reaching 10 or 12 inches occasionally occur in mid-October. Some of the stronger southerly winds, a few with damaging effects, occur in the late summer or fall. These are post-frontal winds following the movement of a storm from the southern Bering Sea or Bristol Bay, northeastward across the Alaskan Interior. Somewhat less frequent, but more damaging, are the southeasterly "Chugach" winds which are funneled down the creek canyons on the northwestern slopes of the Chugach mountains east of the city; gusts estimated at 80 to 100 mph have caused considerable damage to roofs, power lines and trailers on a few occasions. The growing season in Anchorage averages 124 days, with the mean daily temperature above freezing from April 8 to October 23. May 15 is the average date for the last occurrence in spring of a temperature as low as 32°, while September 16 is the average first date with 32° in the fall. The latest date with 32° in spring has been June 6, and the earliest with 32° in the fall August 14.

This information was reprinted to support the Alaska Million Solar Roofs Coalition.

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Reprinted From:

National Oceanic and Atmospheric Administration
Environmental Data and Information Service
National Climatic Center, Asheville, N.C.

Climate Data

Temperature (degrees F)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Average Monthly	13.0	17.9	23.7	35.4	46.3	54.4	58.1	56.2	48.2	34.6	21.6	13.8	35.3
Average Daily Maximum	20.0	25.5	31.7	42.6	54.2	61.8	65.1	63.2	55.2	40.8	27.9	20.4	42.4
Average Daily Minimum	6.0	10.3	15.7	28.2	38.3	47.0	51.1	49.2	41.1	28.4	15.4	7.1	28.2
Winter Design	-23.0	(99% level)											
Total Heating Deg-Days for Month	1612	1319	1280	888	580	318	214	273	504	942	1299	1587	10816
Total Cooling Deg-Days for Month	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent Relative Humidity (Night—3 a.m.)	71	71	69	72	72	74	79	81	81	76	77	74	75
Wind Direction (through 1963)	NNE	N	N	N	S	S	S	S	NNE	N	NNE	NNE	N
Wind Speed (MPH)	6.1	6.7	6.7	7.2	8.3	8.2	7.1	6.6	6.2	6.5	6.1	5.9	6.8

NOTE:
Data is in English units cumulative to 1985. This data does not precisely agree with the newer data that follows, which includes the past 15 years (1985-1999), and also indicates the climate in Anchorage has warmed slightly (246 °F-days less for the last 15 years, on average).

From: Solar Radiation Data Manual for Flat Plate and Concentrating Collectors, NREL, Andrew Walker, April 2000

Latitude: 61.17° N; Longitude: 150.02° W; Elevation: 35 meters; Mean Pressure: 1004 millibars; Station Type: Secondary

Solar Radiation for Flat-Plate Collectors Facing South at a Fixed Tilt (kWh/m²/day), Uncertainty ±9%

Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	0.3	1.0	2.3	3.6	4.6	4.9	4.6	3.5	2.2	1.1	0.4	0.2	2.4
	Min/Max	0.2/0.4	0.7/1.3	1.7/2.6	3.2/4.5	3.8/5.3	4.1/6.0	3.7/5.4	2.9/4.2	1.9/2.6	0.9/1.4	0.3/0.5	0.1/0.2	2.2/2.5
Latitude	Average	0.9	2.1	3.8	4.7	4.9	5.0	4.8	4.1	3.1	2.0	1.1	0.5	3.1
-15	Min/Max	0.4/1.6	1.2/3.8	2.3/5.0	3.9/6.1	3.9/5.9	4.1/6.2	3.5/5.7	3.1/5.0	2.3/3.9	1.2/2.7	0.7/1.6	0.3/0.9	2.8/3.3
Latitude	Average	1.0	2.2	3.9	4.6	4.6	4.5	4.4	3.8	3.1	2.1	1.2	0.6	3.0
	Min/Max	0.5/1.8	1.2/4.3	2.4/5.3	3.7/6.1	3.6/5.5	3.7/5.7	3.2/5.2	2.9/4.8	2.2/4.0	1.2/2.8	0.7/1.8	0.3/1.0	2.8/3.2
Latitude	Average	1.0	2.3	3.9	4.3	4.0	3.9	3.8	3.4	2.9	2.0	1.3	0.6	2.8
+15	Min/Max	0.5/1.9	1.2/4.5	2.3/5.3	3.4/5.8	3.1/4.8	3.2/4.9	2.8/4.5	2.6/4.3	2.0/3.8	1.2/2.8	0.7/1.9	0.3/1.1	2.6/3.0
90	Average	1.0	2.3	3.7	3.8	3.3	3.2	3.1	2.9	2.6	1.9	1.3	0.6	2.5
	Min/Max	0.5/1.9	1.2/4.4	2.2/5.1	3.0/5.3	2.6/4.0	2.6/4.0	2.3/3.7	2.2/3.6	1.8/3.4	1.1/2.6	0.7/1.9	0.3/1.1	2.3/2.8

Solar Radiation for 1-Axis Tracking Flat-Plate Collectors with a North-South Axis (kWh/m²/day), Uncertainty ±9%

Axis Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	0.5	1.5	3.5	5.2	6.1	6.3	6.0	4.7	3.1	1.6	0.7	0.3	3.3
	Min/Max	0.3/0.8	0.9/2.8	2.1/4.7	4.1/6.9	4.6/7.6	4.7/8.4	4.3/7.5	3.4/5.9	2.2/3.9	1.0/2.2	0.5/0.9	0.1/0.4	2.9/3.6
Latitude	Average	0.9	2.4	4.6	6.1	6.6	6.6	6.3	5.2	3.8	2.2	1.2	0.5	3.9
-15	Min/Max	0.5/1.7	1.3/4.6	2.6/6.5	4.8/8.3	4.8/8.3	4.8/8.9	4.3/8.0	3.6/6.7	2.5/4.9	1.3/3.2	0.7/1.8	0.3/0.9	3.4/4.2
Latitude	Average	1.0	2.5	4.8	6.1	6.4	6.3	6.1	5.1	3.8	2.3	1.3	0.6	3.9
	Min/Max	0.5/1.9	1.3/5.0	2.7/6.7	4.7/8.3	4.7/8.1	4.6/8.6	4.1/7.7	3.5/6.6	2.5/5.0	1.3/3.3	0.8/2.0	0.3/1.1	3.4/4.2
Latitude	Average	1.1	2.6	4.7	5.8	6.0	5.9	5.7	4.8	3.6	2.3	1.4	0.6	3.7
+15	Min/Max	0.5/2.0	1.3/5.1	2.6/6.7	4.5/8.1	4.3/7.6	4.2/8.1	3.8/7.3	3.3/6.2	2.4/4.8	1.3/3.3	0.8/2.1	0.3/1.2	3.3/4.1

Solar Radiation for 2-Axis Tracking Flat-Plate Collectors (kWh/m²/day), Uncertainty ±9%

Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	1.1	2.6	4.8	6.1	6.7	6.8	6.5	5.2	3.8	2.4	1.4	0.7	4.0
	Min/Max	0.5/2.1	1.3/5.1	2.7/6.7	4.8/8.3	5.0/8.4	5.0/9.2	4.5/8.2	3.7/6.8	2.6/5.0	1.3/3.3	0.8/2.1	0.3/1.2	3.6/4.4

Direct Beam Solar Radiation for Concentrating Collectors (kWh/m²/day), Uncertainty ±8%

Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
1-Axis,E-W	Average	0.6	1.3	2.2	2.6	2.8	2.8	2.6	2.1	1.7	1.2	0.8	0.4	1.8
Horiz.Axis	Min/Max	0.2/1.5	0.4/3.4	0.8/3.7	1.5/4.3	1.6/4.0	1.6/4.5	1.2/3.8	1.2/3.2	0.9/2.6	0.5/1.9	0.3/1.4	0.1/0.8	1.5/2.0
1-Axis,N-S	Average	0.2	0.8	1.9	3.0	3.5	3.4	3.3	2.5	1.7	0.8	0.3	0.1	1.8
Horiz.Axis	Min/Max	0.1/0.5	0.2/2.0	0.6/3.3	1.7/4.9	2.0/5.0	1.8/5.5	1.5/4.8	1.3/3.7	0.8/2.5	0.3/1.4	0.1/0.6	0.0/0.2	1.4/2.1
1-Axis,N-S	Average	0.6	1.5	2.8	3.6	3.7	3.5	3.4	2.9	2.3	1.4	0.8	0.4	2.3
Tilt-Lat.	Min/Max	0.2/1.5	0.4/3.9	1.0/4.8	2.1/6.0	2.2/5.4	1.9/5.7	1.6/5.0	1.5/4.3	1.1/3.5	0.6/2.3	0.3/1.5	0.1/0.8	1.8/2.6
2-Axis	Average	0.7	1.5	2.8	3.7	4.0	3.8	3.7	3.0	2.3	1.4	0.9	0.4	2.3
	Min/Max	0.2/1.6	0.4/4.0	1.0/4.9	2.1/6.1	2.3/5.7	2.1/6.2	1.7/5.4	1.6/4.4	1.1/3.5	0.6/2.3	0.3/1.5	0.1/0.9	1.9/2.7

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-9.5	-7.4	-3.5	2.1	8.1	12.4	14.7	13.5	9.1	1.4	-6.0	-8.7	2.2
Daily Minimum Temp	-13.1	-11.4	-7.7	-1.9	3.8	8.4	10.9	9.7	5.3	-1.8	-9.4	-12.2	-1.6
Daily Maximum Temp	-5.9	-3.4	0.6	6.0	12.4	16.4	18.4	17.2	12.9	4.7	-2.7	-5.3	5.9
Record Mini. Temp	-36.7	-32.2	-31.1	-20.0	-8.3	0.6	3.3	-0.6	-6.7	-20.6	-29.4	-34.4	-36.7
Record Maxi. Temp	10.0	8.9	10.6	18.3	25.0	29.4	27.8	27.8	22.8	16.1	11.7	8.3	29.4
HDD, Base 18.3°C	863	720	677	487	317	177	114	150	277	523	730	839	5872
CDD, Base 18.3°C	0	0	0	0	0	0	0	0	0	0	0	0	0
Relative Humidity (%)	74	71	66	64	62	66	71	75	76	75	77	77	71
Wind Speed (m/s)	2.9	3.1	3.0	3.3	3.7	3.8	3.2	3.1	3.0	3.0	2.9	2.8	3.1

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