

Anchorage Winds

Overview

Anchorage is the largest population center in Alaska with 228,000 people in 2021. The city is positioned on the Gulf of Alaska and is buffered by the Chugach mountains to the east and Cook Inlet to the west. Due to its location and topography, Anchorage often experiences high wind events. The Chugach mountains strongly contribute to the severity, unpredictability and variability of winds.

High wind events have caused widespread damage to infrastructure and electricity services. Anchorage building codes are specified to deal with windy areas. As the climate continues to change, and storminess is projected to increase, there is the potential for a shifting wind regime within Anchorage.



Winds and Topography

Winds result from differences in air pressure on the surface of the earth as air flows from areas of higher pressure to areas of lower pressure. In Alaska, topography plays a large role in the ways that wind forms. When wind encounters mountains air is forced to flow around, above, or through gaps in these landscape features. When winds are forced over mountain ranges the downslope can experience some of the highest wind speeds. This is the case with the Chugach Mountains.

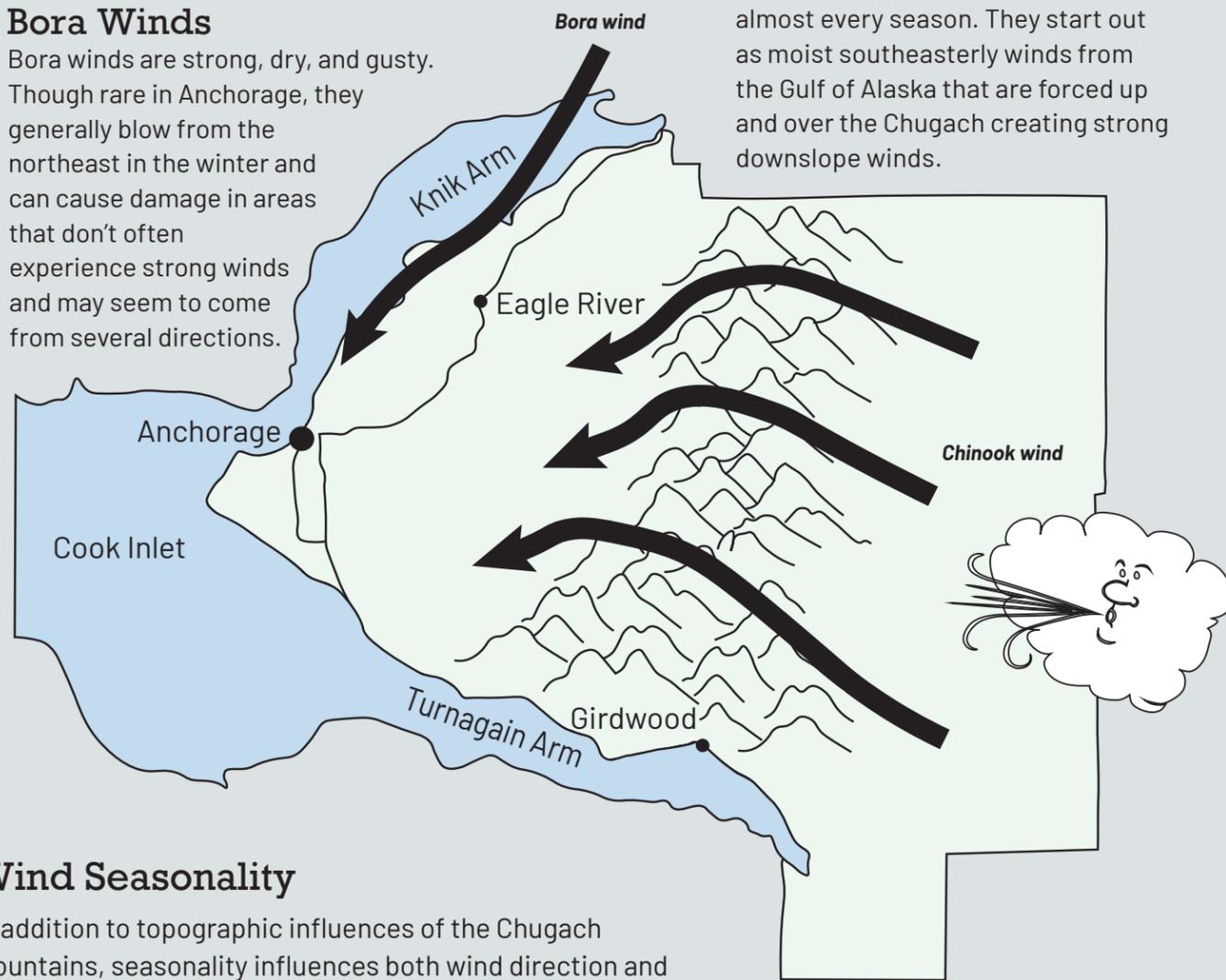


Photo Credit: Flickr DCSL

Anchorage's Dueling Winds

Bora Winds

Bora winds are strong, dry, and gusty. Though rare in Anchorage, they generally blow from the northeast in the winter and can cause damage in areas that don't often experience strong winds and may seem to come from several directions.



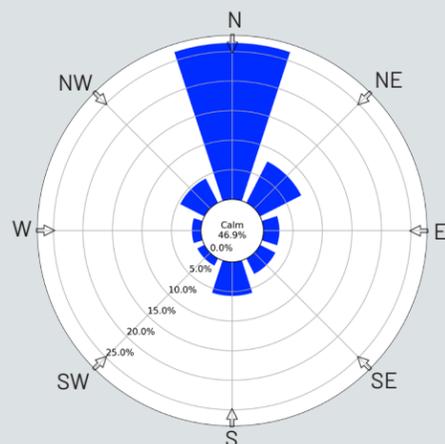
Coastal Chinook Winds

Chinook winds arise primarily in the colder months of the year and occur almost every season. They start out as moist southeasterly winds from the Gulf of Alaska that are forced up and over the Chugach creating strong downslope winds.

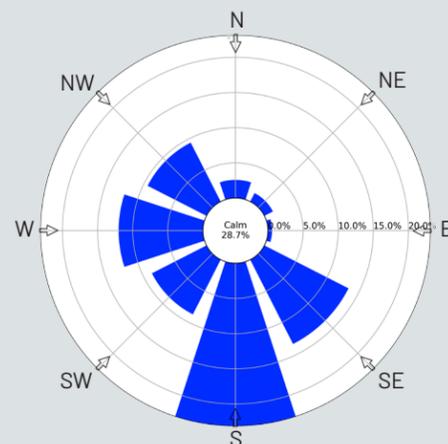
Wind Seasonality

In addition to topographic influences of the Chugach Mountains, seasonality influences both wind direction and overall turbulence. Most strong winds occur during the colder months due to larger temperature gradients between air masses. During summer, winds are more localized. Temperature differences between the cool air over Cook Inlet and the warmer air found inland often drive wind. However, on rare occasions larger scale Chinook winds have happened in the summer.

December 1994-2023



June 1994-2023



These Anchorage International Airport wind roses show how often winds blow from a particular direction. Data provided by Iowa State University

Northeasterly Wind Storms

- 1978 **November 15**
 - Wind gusts of 50 mph across Anchorage, roofs, buildings and small planes damaged, flights canceled
- 1979 **February 14**
 - Wind gusts of 70 mph, flights diverted from Anchorage Airport, building damage reported
- 1989 **March 4**
 - Maximum gusts of 75 mph at the Anchorage airport, but gusts only reached 28 mph near Rabbit Creek
- 2003 **March 6 - 14**
 - Winds over 100 mph, a Bora wind, 92-94 mph sustained winds at Anchorage Airport air traffic control tower, flights diverted, roofs torn from buildings, public facilities (schools, airports) severely damaged, power outages, \$3.5 million in damages in Municipality of Anchorage, FEMA declared emergency April 26
- 2022 **December 23**
 - 68 mph winds at Anchorage Airport; highest since the March 2003 wind storm

Southeasterly Wind Storms

- 1980 **April 4**
 - Hillside wind gusts of 134 mph, Gov. Hammond declared disaster, 5,000 homes & businesses damaged
- 1982 **December 27**
 - East anchorage winds over 100 mph, building under construction collapsed causing 2 fatalities, millions in damage, moving cars blown off roads, Anchorage airport peak gust of 48 mph
- 1994 **December 3**
 - Hillside wind gusts of 101 mph, trees uprooted, power outages, planes flipped at airport
- 2000 **February 2**
 - High winds gusted to 100 mph along the Seward Highway, road crews prevented from opening the road after an avalanche occurred between Anchorage and Girdwood
- 2004 **February 10**
 - Wind gusts of 100 mph along the hillside, temperature of 45 °F degrees tied the 1926 record for high temperature, wind gauge at the Chugach foothills registered 122 mph, beetle-killed spruce trees toppled
- 2005 **April 21-22**
 - Strong gap winds gusted to 90 mph along upper hillside, wind gusts of 86 mph along Turnagain Arm, damages in downtown Anchorage, \$100K in damages for a building that lost its roof
- 2011 **December 3-4**
 - Glen Alps reported gust of 118 mph, numerous trees toppled, widespread damage to power utilities
- 2012 **September 4-5**
 - Peak gusts of 70-90 mph along the upper hillside, unofficial peak gust of 130 mph, most of Anchorage lost power, school canceled, preliminary damage estimated at \$200,000
- 2013 **October 28**
 - Wind gusts of 80-100 mph on the Hillside, many trees toppled, 500 customers lost power in Anchorage
- 2015 **December 29-30**
 - Unofficial gusts of ~100 mph reported on the Hillside, 48 mph at Anchorage Airport, power outages
- 2017 **October 26**
 - 85 mph at Glen Alps, 87 mph near Potters Marsh, considerable property damage, 3000 without power
- 2018 **April 24**
 - Wind gusts of 55 mph at Anchorage Airport and 60 mph at Merrill Field, hillside winds were clocked at 90 - 100 mph in some places, numerous trees toppled in the wind, nearly 25,000 customers from Anchorage to Chugiak lost electrical power: some for more than 12 hours
- 2020 **September 6**
 - Widespread wind gusts of 60 to 80 mph reported on the Anchorage hillside in this short-lived event, knocked out power to thousands of customers in the Anchorage area

Photo Credit: K-State Research and Extension

Note: Many lower impact windstorms were excluded for clarity and brevity



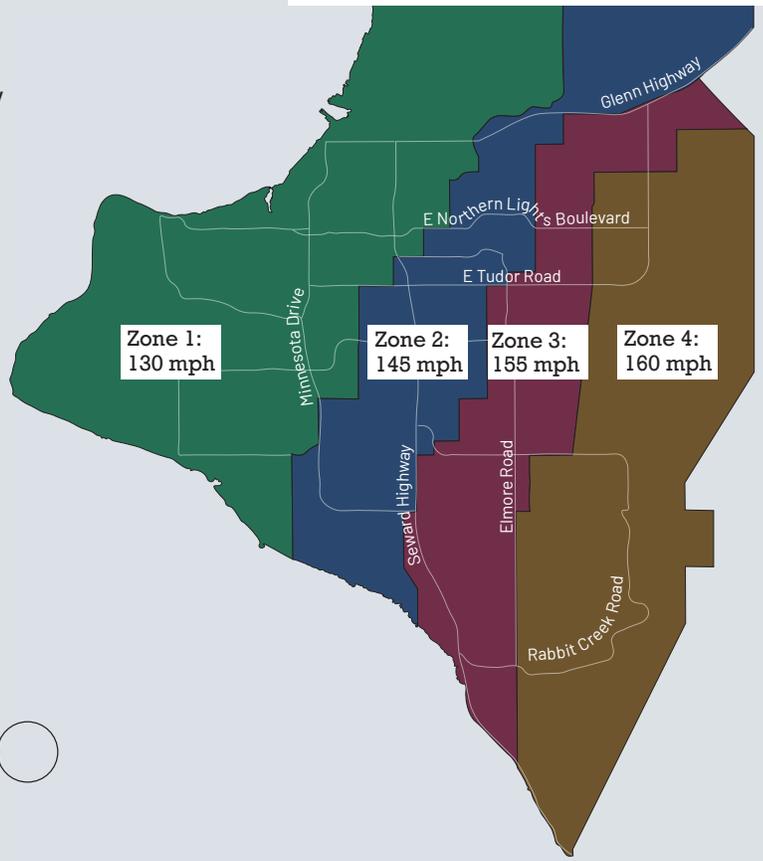
Measuring Winds

Anchorage residential building construction requirements to withstand wind gusts

Airports

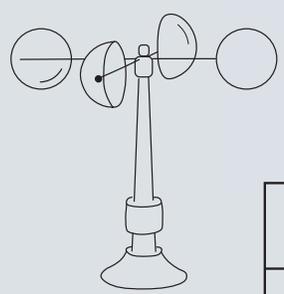


Wind speed measurements are sensitive to many factors. For instance, the height above recording sensors and proximity to obstacles can alter readings. Also, wind speeds can vary greatly in short periods of time. Airports often have the longest historical record of wind measurements due to the key role wind plays in aircraft operation safety, flight cancellations and delays. In Anchorage, the Anchorage International Airport, Elmendorf Air Force Base, and Merrill Field have the longest data record. Because the airports are built on flat ground away from the mountains, the recorded winds are nearly always far lower than those that occur on the hillside.



Q: What's an Anemometer

A: It is a device that measures wind speed and direction. Different types include: cup, vane, and ultrasonic anemometers



Types of Wind Data



Similar to the limited monitoring stations, the type of wind information collected varies. The ways wind is commonly reported may not adequately communicate impacts or show how residents experience winds. It is worthwhile to explore the different types of reported data to gain a sense of how individuals interface with wind data.

Measurement	Definitions: As used in airport observations
Sustained Wind	Wind speed determined by averaging observed values over a two-minute period.
Gust	A fluctuation of wind speed with variations of 10 knots or more between peaks and lulls in the 10 minutes preceding observation
Peak Gust	The maximum instantaneous wind speed since the last observation that exceeded 25 knots

Note: Definitions according to those used by NOAA/FAA for airport observations

To learn more visit us at: uaf-accap.org/projects/extreme-events-library

Sources: Alaska State Disaster List, Municipality of Anchorage, Anchorage Daily News, Rowan Williams & Irwin Inc - Anchorage Wide Wind Speed Study (1998), NOAA Storm Data, Iowa State University - Iowa Environmental Mesonet, Alaska Public Media, K.Redilla et al - Wind Climatology for Alaska: Historical and Future (2019), A. Artzer et al - A Case Study of the September 2012 Anchorage Windstorm (2014), Daily Sitka Sentinel