

# Unit 5 Lesson: Climate Projections

## Projecting The Future

### Overview

In this lesson, learners will download a KML file to open in (free) Google Earth™ software and use it to access and compare climate projections for communities in Alaska.

### Objectives

The learner will:

- download a KML file and open it in Google Earth; and
- access Scenarios Network for Alaska Planning (SNAP) data for Alaskan communities in Google Earth; and
- draw conclusions about how projected climate may impact snowfall.

### Materials

- Computer with Internet access
- Google Earth program installed on computer

### Background Information

#### Climate Projections:

A climate projection is an estimate of future climate based on a certain scenario. A climate projection does not include a climate prediction, which gives a sense of the likelihood of the scenario.

Climate projections rely on global climate models. The models simulate changes that may occur over a long time period due to changes in the atmosphere, particularly an increase in greenhouse gases. SNAP produces climate projections for communities across Alaska, and for the state as a whole. SNAP community projections represent average outputs of five different global models that have been scaled down to the local level.

#### Emission Scenarios:

SNAP uses a scenario approach to planning. Scenario planning involves planning for a variety of different plausible futures.

The outcomes of climate models vary with differing estimates of future greenhouse gas emissions and differing sensitivity of future climate to these gases. Greenhouse gases, such as carbon dioxide, methane and water vapor, can occur naturally or come from human sources. SNAP projections are based on three different scenarios for greenhouse gas emissions: low, medium, and high. This covers a wide range of possible future climate conditions.

#### Temperature and Precipitation:

SNAP projects future temperature and precipitation for over 350 communities in Alaska. Alaska is expected to warm during the next 100 years. SNAP projections show a shift in the date of autumn freeze-up and spring thaw for most regions of Alaska. The time between these dates is called the growing season. With an earlier thaw and later freeze-up, the length of the growing season is projected to increase across the state.

Projections show that Alaska is also likely to have more precipitation in the next 100 years. Due to warming, much of the precipitation may fall as rain instead of snow. However, even as the climate warms, extreme cold weather events will still occur.

### Vocabulary

<i>climate:</i>	The average weather conditions in a certain place.
<i>climate projection:</i>	An estimate of future climate based on a certain scenario.
<i>gas emissions:</i>	Gases that are released into the atmosphere.
<i>greenhouse gas (GHG):</i>	A gas in the atmosphere that traps heat. It permits the sun's rays to heat Earth and restricts heat from escaping back into space.
<i>precipitation:</i>	Any form of water, liquid or solid, that falls from clouds and reaches the ground.
<i>scenario:</i>	An imagined sequence of possible events.
<i>scenario planning:</i>	A planning method that considers several different plausible futures. These are based on information about how things are now, how things are changing, and choices that may shape the future.
<i>temperature:</i>	A measure of the average kinetic energy of particles in matter. A measure of how hot or cold something is.

## Getting Started

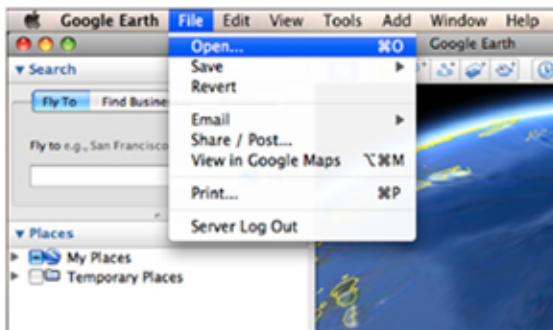
STEP 1. Download Google Earth if it is not already installed on your computer.



- Go to: <http://www.google.com/earth/index.html>.
- Available for free on PC, Mac, and Linux.
- Download Google Earth to your computer.
- Drag Google Earth to your desktop.

STEP 2. Open the KML File in Google Earth

- Download the [Alaska\\_Weather\\_Stations.kml](#) file to your computer if it is not already downloaded.
- Double-click Google Earth to start the program.
- Go to the File dropdown menu, and select Open...



- Navigate to the [Alaska\\_Weather\\_Stations.kml](#) file and click Open.

(NOTE: This should zoom to the extent of the KML file - in this case, the state of Alaska.)

STEP 3. Access SNAP Data

- Click on the square box next to Fairbanks.  
This opens a balloon with information and links to data and graphs about Fairbanks weather and climate.
- Click on the SNAP Projections - Fairbanks link at the bottom of the balloon.



## Fairbanks Climate

Fairbanks is located in the Tanana Valley in the interior of Alaska. It has a distinctly continental climate, with large variation of temperature from winter to summer. There are rolling hills reaching elevations up to 2,000 feet above Fairbanks to the north and east of the city.

[Climatological Data - Fairbanks](#)

### Precipitation

Snow cover is persistent in Fairbanks, without interruption, from October through April. Snowfalls of 4 inches or more in a day occur only three times during winter. Precipitation normally reaches a minimum in spring, and a maximum in August, when rainfall is common. During summer, thunderstorms occur in Fairbanks on an average of about eight days. Thunderstorms are about three times more frequent over the hills to the north and east of Fairbanks. Precipitation in the uplands around Fairbanks is heavier than it is in the city by roughly 20 to 50 percent.

[Seasonal Snowfall \(1930-2009\)](#)

[Seasonal Snow Depth \(1930-2009\)](#)

### Temperature

The climate in Fairbanks is conditioned mainly by the response of the land mass to large changes in solar heat received by the area during the year. The sun is above the horizon from 18 to 21 hours during June and July. During this period, daily average maximum temperatures reach the lower 70s. In contrast, from November to early March, when the period of daylight ranges from 10 to less than 4 hours per day, the lowest temperature readings normally fall below zero quite regularly. Low temperatures of -40 degrees or colder occur each winter. The range of temperatures in summer is comparatively low, from the lower 30s to the mid 90s. In winter, this range is larger, from about 65 below to 45 degrees above. During winter, the surrounding hills are often warmer than Fairbanks, as cold air settles into the valley.

[Annual Temperature \(1930-2009\)](#)

### Wind

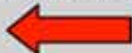
Blizzard conditions are almost never seen, as winds in Fairbanks are above 20 miles an hour less than 1 percent of the time. The large winter range of temperature reflects the great difference between frigid weather associated with dry northerly airflow from the Arctic to mild temperatures associated with southerly airflow from the Gulf of Alaska, accompanied by chinook winds off the Alaska Range, 80 miles to the south of Fairbanks.

[Wind Data \(Averages 1971-2000\)](#)

### Climate Projections

The Scenarios Network for Alaska Planning (SNAP) provides and integrates data on climate change in Alaska. SNAP climate projections run through the year 2100, and are used for community planning. The program serves more than 350 Alaska communities. Local-scale projections of future conditions are not directly available, but can be modeled based on local topography. Projected temperatures and precipitation for Fairbanks are based on three levels of future greenhouse gas emissions.

[SNAP Projections - Fairbanks](#)



Climate information and data courtesy of the Alaska Climate Research Center and the National Climate Data Center (NCDC)



Access the **Temperature** tab on the SNAP community chart for Fairbanks under a **Medium Emissions** scenario.

Be sure to learn more about low, medium or high emissions scenarios by hovering your mouse over the words "low", "medium", or "high."

The screenshot shows the SNAP community chart interface for Fairbanks. At the top, there are three tabs: "Temperature", "Precipitation", and "Details". The "Temperature" tab is selected and highlighted with a red arrow. Below the tabs is a box titled "Future Greenhouse Gas Emissions" with three options: "Low", "Medium", and "High". The "Medium" option is selected and highlighted with a red arrow. To the right of this box are three icons with labels: a printer icon for "Print", a download icon for "Download", and a plus sign for "Model Variability". Below this is a main chart area with the SNAP logo on the left and the text "Historical and Projected Average Monthly Temperature (°F) Mid-range emissions (A1B)".

Answer questions 1-6 on the worksheet.

Access the **Precipitation** tab on the SNAP community chart for Fairbanks under a **Medium Emissions** scenario.

The screenshot shows the SNAP community chart interface for Fairbanks. At the top, there are three tabs: "Temperature", "Precipitation", and "Details". The "Precipitation" tab is selected and highlighted with a red arrow. Below the tabs is a box titled "Future Greenhouse Gas Emissions" with three options: "Low", "Medium", and "High". The "Medium" option is selected and highlighted with a red arrow. To the right of this box are three icons with labels: a printer icon for "Print", a download icon for "Download", and a plus sign for "Model Variability". Below this is a main chart area with the SNAP logo on the left and the text "Projected Average Monthly Precipitation (inches) Rapid increase in emissions (A2)".

Answer questions 7-9 on the worksheet.

- Click **Back to Google Earth** button or return to the Google Earth window.



- Click on the square box next to **Anchorage**.
- Click on the **SNAP Projections - Anchorage** link.

Access the **Temperature** tab on the SNAP community chart for Anchorage with a **Medium Emissions** scenario.

Answer questions 10-14 on the worksheet.

Access the **Precipitation** tab on the SNAP community chart for Anchorage with a **Medium Emissions** scenario.

Answer questions 15-17 on the worksheet.