

Tracking Ash Plumes

Overview:

Composite volcanoes usually erupt with large clouds of ash, called “ash plumes.” Volcanologists track ash plumes and relay the information to air traffic controllers so that airplanes do not fly through them. Engines can become clogged if an airplane flies through an ash plume. During this activity students will use satellite images to track the movement of an ash plume from Mt. Spurr in Alaska.

Objectives:

The student will:

- measure the length of an ash plume on a satellite image;
- calculate the length of an ash plume by using a ruler and the scale on a satellite image;
- graph the growth of an ash plume; and
- use graphed information to predict the length of an ash plume 260 minutes after eruption.

Materials:

- Rulers (metric—one per student)
- Calculators
- Student Information Sheet: “Ash Plume 1”
- Student Information Sheet: “Ash Plume 2”
- Student Information Sheet: “Ash Plume 3”
- Student Information Sheet: “Ash Plume 4”
- Student Worksheet: “Measuring Ash Plumes”
- Student Worksheet: “Graphing Ash Plumes”

Answers to Student Worksheet:

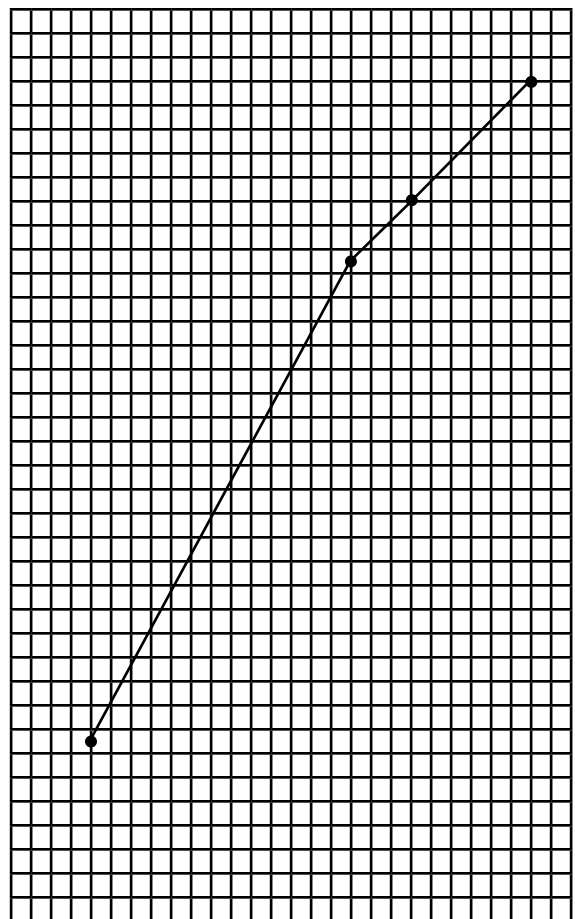
Measuring Ash Plumes:

1.

| Satellite Image | Minutes Since Eruption | Plume Length in centimeters (cm) | Actual Plume Length in kilometers (km) |
|-----------------|------------------------|----------------------------------|--|
| #1 | 40 | 3 | 75 |
| #2 | 170 | 11 | 275 |
| #3 | 200 | 12 | 300 |

2. Acceptable answers: any number from 340 - 360 km
 3. True

Graphing Ash Plumes:



Tracking Ash Plumes

Activity Procedure:

- Shield volcanoes, such as those in Hawai‘i, rarely produce ash plumes, however, composite volcanoes, such as those found in Alaska, produce large plumes. Explain that the wind can carry volcanic ash far from a volcano’s vent. Scientists track ash plumes to warn pilots of plume locations because airplanes can be disabled if they fly through an ash plume. Volcanic smog, a common hazard in Hawai‘i, also is transported by the wind, though not as far as airborne ash.
- Explain that students will track the movement of an ash plume from Mt. Spurr volcano in Alaska using satellite images. Distribute rulers, calculators, Student Information Sheets: “Ash Plume 1,” “Ash Plume 2,” “Ash Plume 3” and “Ash Plume 4,” and Student Worksheets: “Measuring Ash Plumes” and “Graphing Ash Plumes” to each student. Students can work in pairs to share the Student Information Sheets.
- Ask students to arrange their satellite images in the proper time sequence.
- Ask students to look at the chart on the Student Worksheet: “Measuring Ash Plumes.” Point out that the first blank column on the chart reads “Minutes Since Eruption.” Ask students to locate the amount of time that has passed since the eruption on the bottom of each image, then record this information on the chart.
- Ask students to look at the column “Plume Length in Centimeters.” Using a ruler, demonstrate how to measure the ash plume from one end to the other at its longest point (end to end). Round the measurement to the nearest centimeter. Ask students to write the results of their measurements for each image in the appropriate chart box.
- Ask students to look at the column “Actual Plume Length in Kilometers.” Using the scale on one of the satellite images, demonstrate that four centimeters represent 100 kilometers. Write the following on the board: 4 cm = 100 km
- To find how many kilometers are represented by one centimeter, use the following equation: $100 \text{ km} \div 4 \text{ cm} = 25 \text{ km/cm}$. Therefore, to find the actual plume length, ask students to multiply the plume length in centimeters by 25 km/cm.

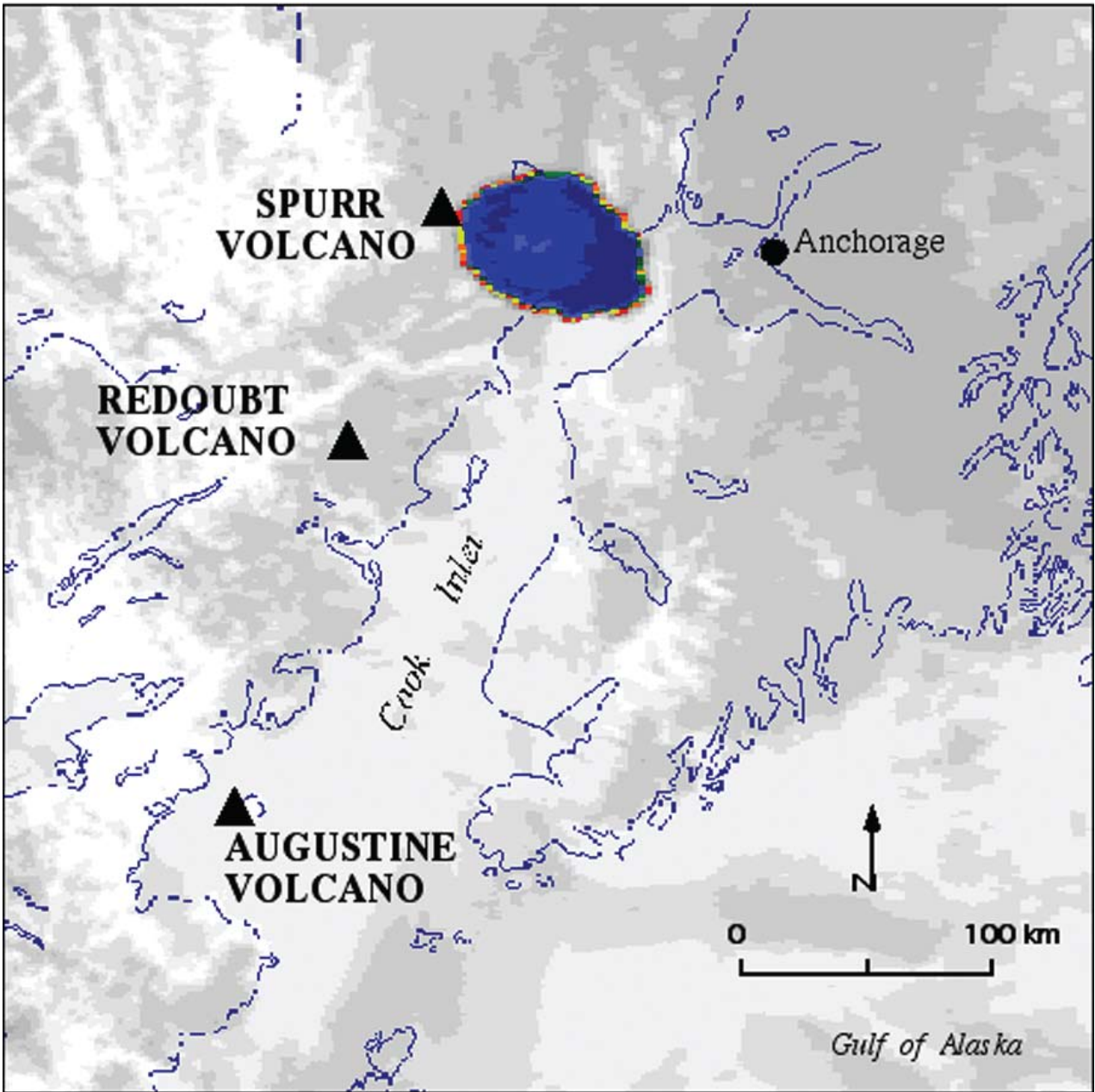
$$\text{Plume length in cm} \times 25 \text{ km/cm} = \text{Plume length in km}$$
- Ask students to perform the calculation for each ash plume and write their answers in appropriate chart boxes.
- After all students have completed their charts ask them to look at the Student Worksheet: “Graphing Ash Plumes.” Demonstrate how students can use the information in their chart to plot the growth of Mt. Spurr’s ash plume over time.
- Ask students to extend the line on their graphs to 260 minutes to estimate the length of the ash plume at that time. Point out that Ash Plume #4 goes off the image, so they are unable to measure it. Student estimates should be between 340 and 360 km.



Cultural Tie

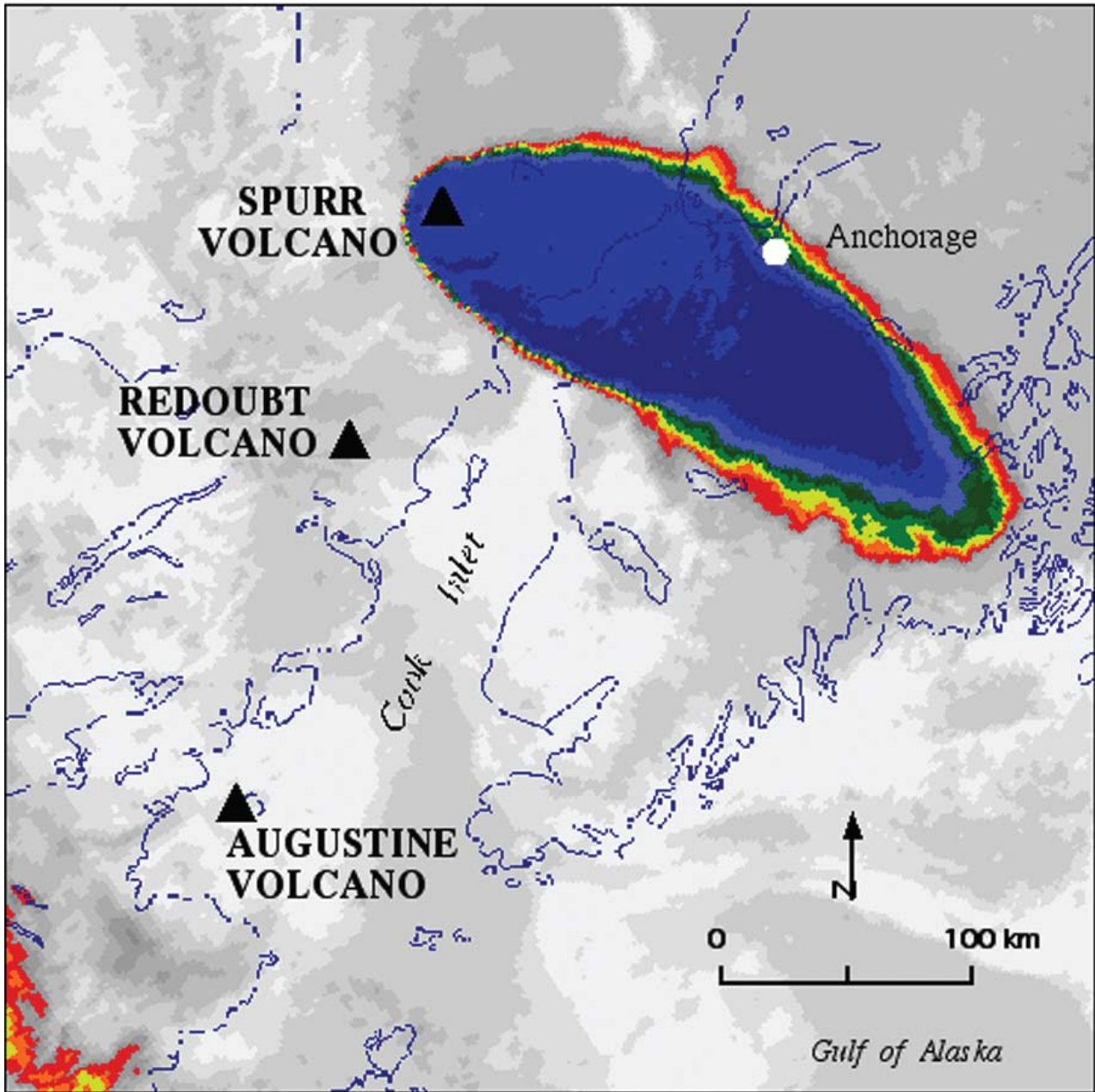
The wind carries ash around the world. Ask students to interview Hawaiian language experts to learn local words for the winds.

Ash Plume 1



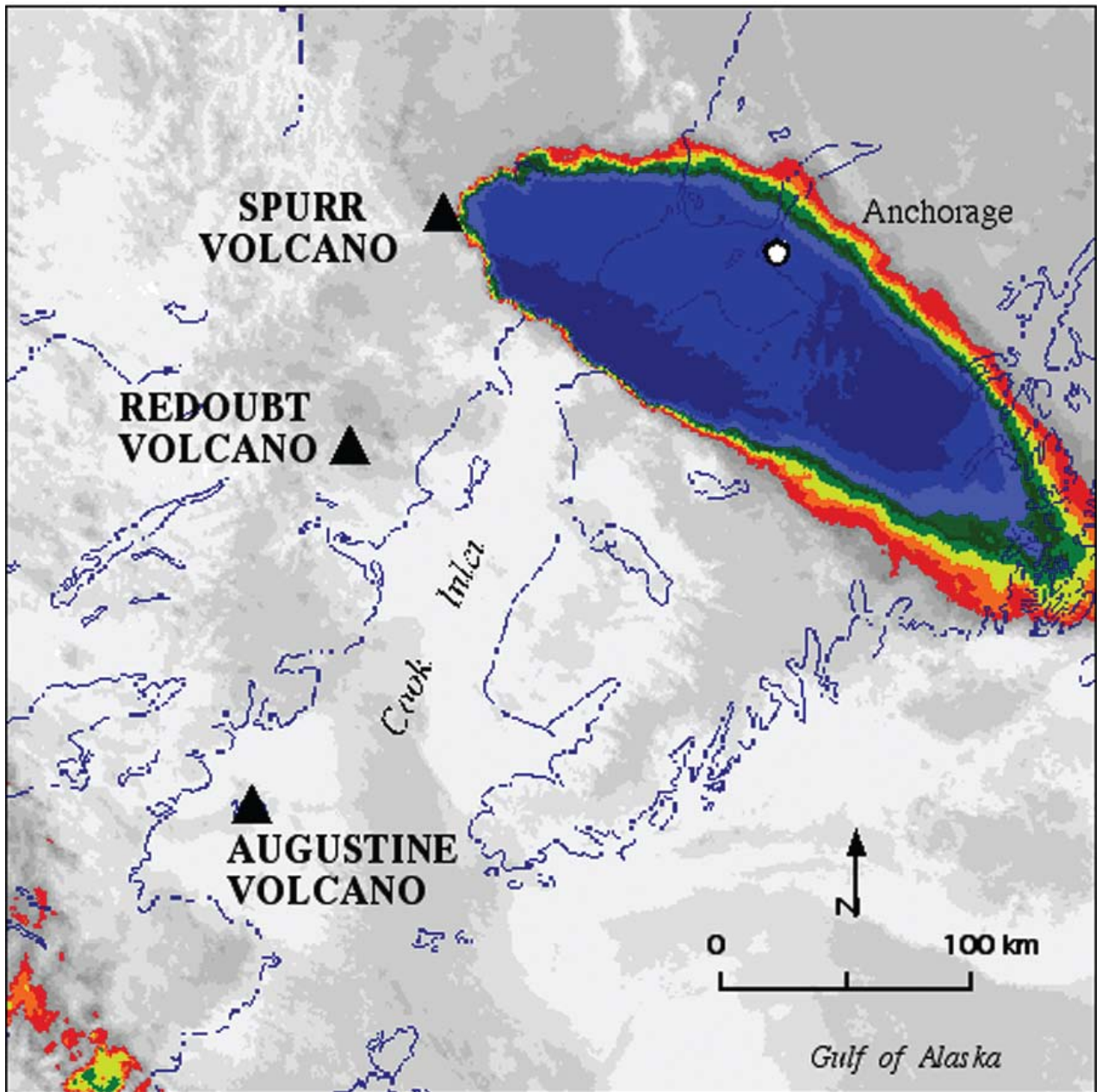
40 Minutes After Eruption

Ash Plume 2



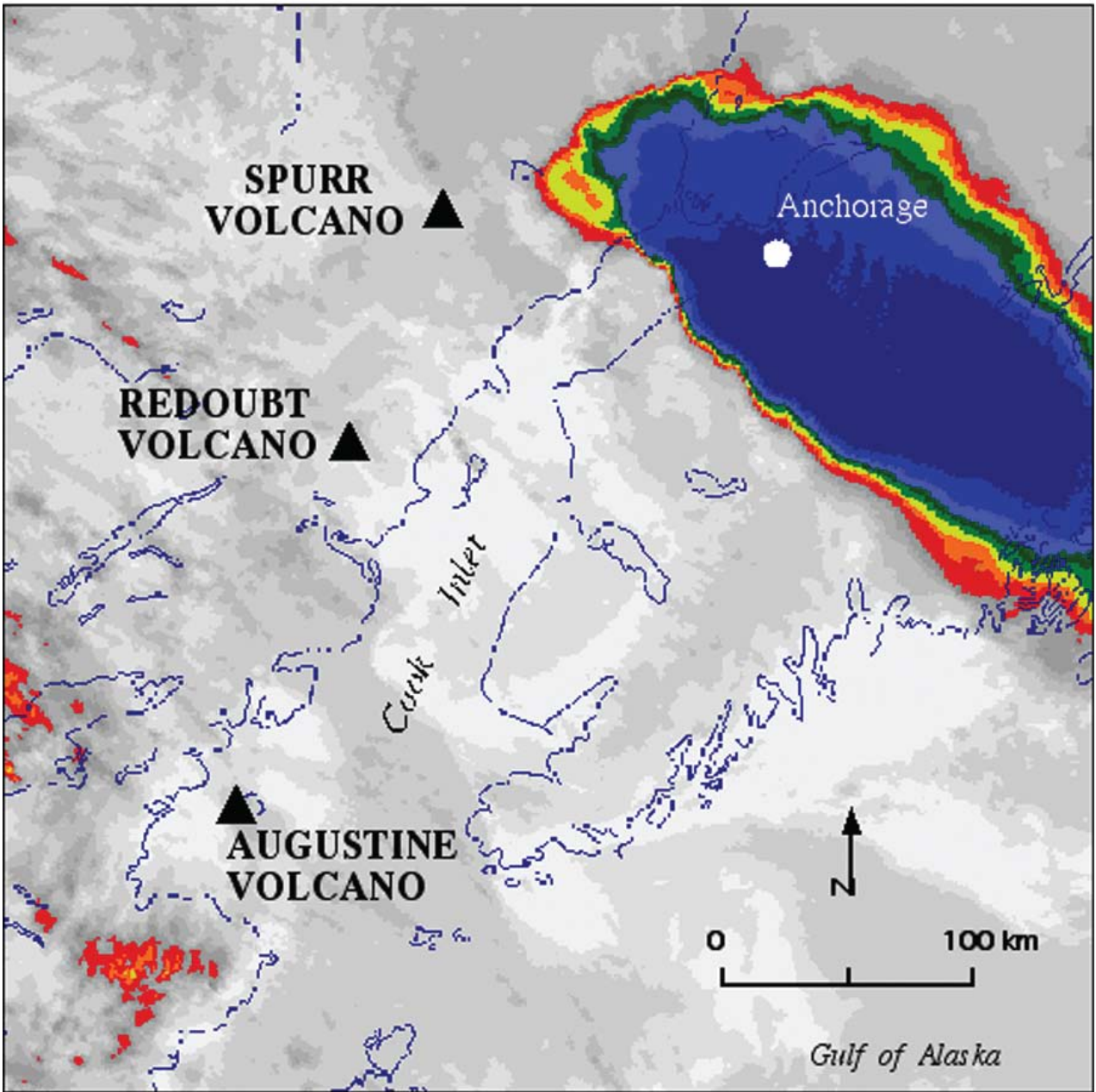
170 Minutes After Eruption

Ash Plume 3



200 Minutes After Eruption

Ash Plume 4



260 Minutes After Eruption

Measuring Ash Plumes

Mt. Spurr, a volcano near Anchorage, Alaska, has just erupted. The eruption created an ash plume that poses a danger to air traffic in the area. When planes fly into an ash plume, engines can be disabled. Volcanologists track ash plumes and report their findings to air traffic controllers who warn pilots to avoid dangerous ash-filled areas.

- Look at the satellite images of Ash Plumes #1-4. Place them in the correct time sequence, then use the information on the images and a ruler to help you find the minutes since eruption, the length of the plume on each image, and the actual plume length. Remember this formula:

$$\text{Plume length in cm} \times 25 \text{ km/cm} = \text{Plume length in km}$$

Complete the chart below.

| Satellite Image | Minutes since eruption | Plume length in centimeters (cm) | Actual plume length in kilometers (km) |
|-----------------|------------------------|----------------------------------|--|
| Ash Plume #1 | | | |
| Ash Plume #2 | | | |
| Ash Plume #3 | | | |

- When the chart is complete, use the information it contains to plot the growth of the ash plume on your Student Worksheet: "Graphing Ash Plumes." Now look at the satellite image of Ash Plume #4 (260 minutes after eruption). Notice that the plume continues off the edge of the image. Estimate the length of the plume at this time by extending the line on your graph to the 260 minute mark.

About how long in kilometers is Ash Plume #4 at 260 minutes? _____

- Circle the correct answer, True or False: When planes fly into an ash plume, engines can be disabled.

Graphing Ash Plumes

Directions: Use the information from the chart on your Student Worksheet: “Measuring Ash Plumes” to complete the graph below.

