

## Southern Lights

### Overview:

To conceptualize the presence of an aurora oval above the South Pole, students use a globe to determine locations where the aurora is likely to be visible. Students determine locations where the aurora might be visible when strong solar winds cause the oval to expand northward.

### Objectives:

The student will:

- approximate the location of the southern aurora oval based on data about the northern aurora oval;
- use a scale to measure distance on a map;
- understand the global placement of Antarctica, and what it means in terms of weather and seasonal differences; and
- identify the best time of year to view the aurora australis.

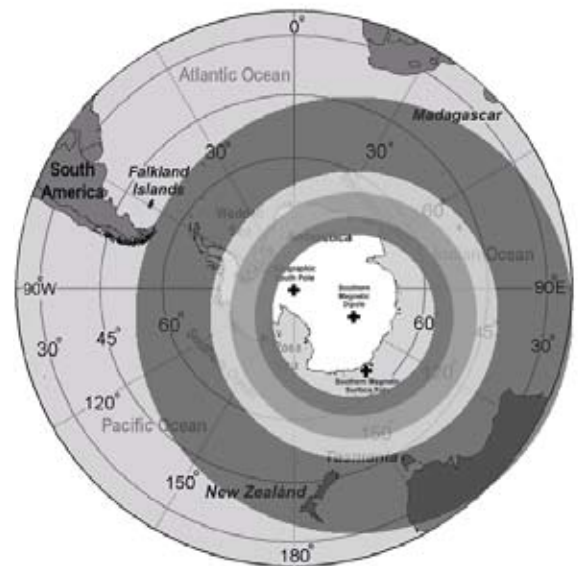
### Materials:

- Globe
- Colored pencils
- Drawing compasses
- STUDENT INFORMATION SHEET: “Fun Antarctica Facts”
- VISUAL AID: “Southern Magnetic Dipole”
- VISUAL AIDS: “Ring 1,” “Ring 2,” “Ring 3,” and “Ring 4”
- STUDENT WORKSHEET: “Southern Lights”

### Answers to Student Worksheet:

See map at right to correct student’s auroral rings.

1. Antarctica
2. April - September; these months are darkest in the North
3. Antarctica



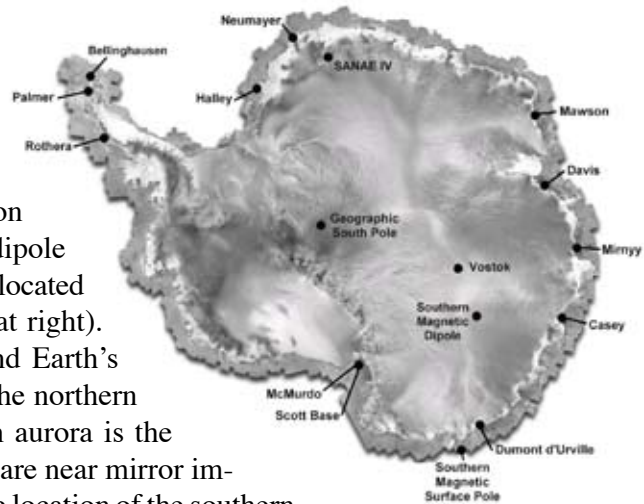
## Southern Lights

### *Activity Procedure:*

**Teacher Information:** Like the aurora borealis, which lights up the night sky in an oval over Alaska, Siberia, Northern Canada and Greenland, the aurora australis creates a crown of lights over the southernmost part of the world. The aurora australis is usually not visible beyond Antarctica. Sometimes, however, strong solar winds cause the oval to extend northward toward more populated continents.

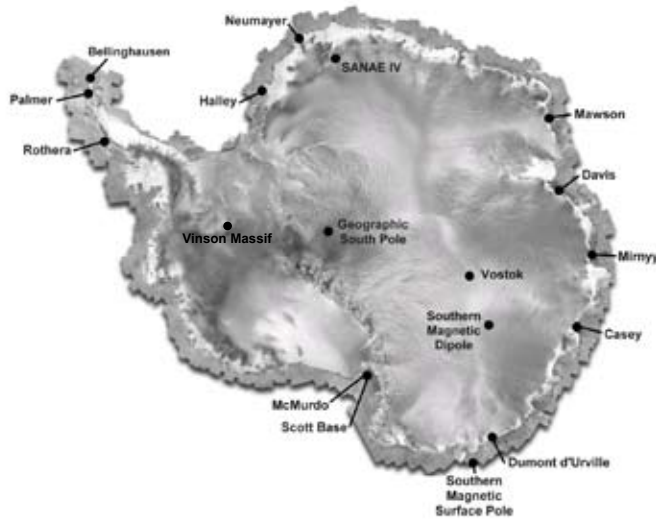
Aurora ovals occur above both the northern and southern hemispheres simultaneously. Because the northern hemisphere tilts away from the sun, and experiences winter during the time when the southern hemisphere tilts toward the sun and experiences summer, both auroras are usually not visible from Earth at the same time. The exception to this is during the fall and spring equinox, when both regions of Earth experience some darkness for a portion of each day.

- As in the North, the South has a geographic pole, a magnetic surface pole and a magnetic dipole. The southern magnetic surface pole is located 1,700 miles from the geographic south pole, off Terre Adelie, in the ocean (nearest to the Dumont d'Urville science station on the map at right). The southern magnetic dipole (which affects the location of the aurora oval) is located on the continent (nearest Vostok on the map at right). Explain that the aurora occurs in ovals around Earth's north magnetic and south magnetic dipoles. The northern aurora is the aurora borealis and the southern aurora is the aurora australis. Because the two aurora ovals are near mirror images of each other, students can approximate the location of the southern aurora oval using data about the northern aurora oval.



- Distribute colored pencils, a drawing compass and the STUDENT WORKSHEET: "Southern Lights" to each student. Divide students into groups of 3 or 4. Make a globe available for use.
- Project VISUAL AID: "Southern Magnetic Dipole." Use VISUAL AIDS: "Ring 1," "Ring 2," "Ring 3," and "Ring 4" to demonstrate their locations around the southern magnetic dipole. Ask students to follow the steps on the STUDENT WORKSHEET to draw rings on the map representing aurora visibility. Demonstrate by using a compass and the map scale.
- After students complete the map, discuss the location of the southern aurora oval. Distribute and read the STUDENT INFORMATION SHEET: "Fun Antarctica Facts." Explain that the southern hemisphere experiences opposite seasons of light and dark to those in the northern hemisphere, so the aurora australis is usually visible April through September when the skies are dark enough to reveal the lights (see "Teacher Information" below). Ask students to answer the remaining questions.

## Fun Antarctica Facts



### *What is the weather like?*

During the winter, Antarctica doubles in size due to the huge amount of sea ice forming along the coast. Frequent blizzards plague the interior. Winds as high as 200 mph have been recorded, creating life-threatening wind chill conditions. On July 21, 1983 a temperature of  $-89.2$  degrees C was recorded—the coldest temperature ever recorded on Earth!

Antarctic summers are milder, with coastal temperatures hovering near or above freezing.

### *What makes Antarctica unique?*

The Antarctic summer occurs from October—March, when the sun shines almost continuously. The rest of the year (April—September) the land lies in darkness, with stars spinning overhead and the aurora rippling across the sky. 98 percent of Antarctica is covered by ice, and the remaining 2 percent is barren rock, including some ice-free coastal areas.

The ice layer covering the continent is remarkably thick, containing about 70 percent of the world's fresh water. Because of all this ice, Antarctica is the highest continent on Earth, with an average elevation of 7,500 feet. The highest point on Antarctica is Vinson Massif with an elevation of 16,066 feet.

### *To whom does Antarctica belong?*

No nation owns Antarctica, but 27 nations maintain seasonally staffed research stations on the ice-covered continent. About 4,000 researchers and support staff spend several months a year in remote camps where they study the aurora, global change, the stars, and other phenomena.

### *Who lives there?*

There is no evidence to suggest that Antarctica ever had an indigenous population, despite being the fifth largest continent in the world. Located almost entirely south of the Arctic Circle ( $66.33^{\circ}$ S latitude), it was not discovered until the early 1800's. No land animals inhabit Antarctica, but the ocean around the continent contains large populations of seals, whales and fish, and four species of penguin nest on the continent.

# Southern Lights

**Directions:** The aurora occurs in ovals around Earth’s magnetic dipoles. The northern aurora is the aurora borealis and the southern aurora is the aurora australis. Because the two aurora ovals are near mirror images of each other, you can approximate the location of the southern oval using data about the northern oval. The chart below shows the percent of nights the aurora borealis is overhead at specific distances from the north magnetic dipole. The aurora australis is overhead about the same percent of nights at these distances from the south magnetic dipole. Follow the steps below to draw rings illustrating the visibility of the aurora australis. Then answer the questions that follow.

- Step 1: Use the map scale to set your compass to a width representing 1300 miles (the first distance listed in the chart). Put the point of your compass on the south magnetic dipole and draw a circle.
- Step 2: Repeat Step 1, this time setting your compass to a width representing 1600 miles.
- Step 3: Shade the space between your circles yellow. This yellow ring represents the area where the aurora australis is overhead 85% to 100% of the time (see chart).
- Step 4: Repeat Step 1, drawing circles at 2000, 2300, and 3500 miles. Use the Color Key on the chart to determine the colors to shade each of these rings.

1. From which continent can the aurora australis be viewed most frequently?

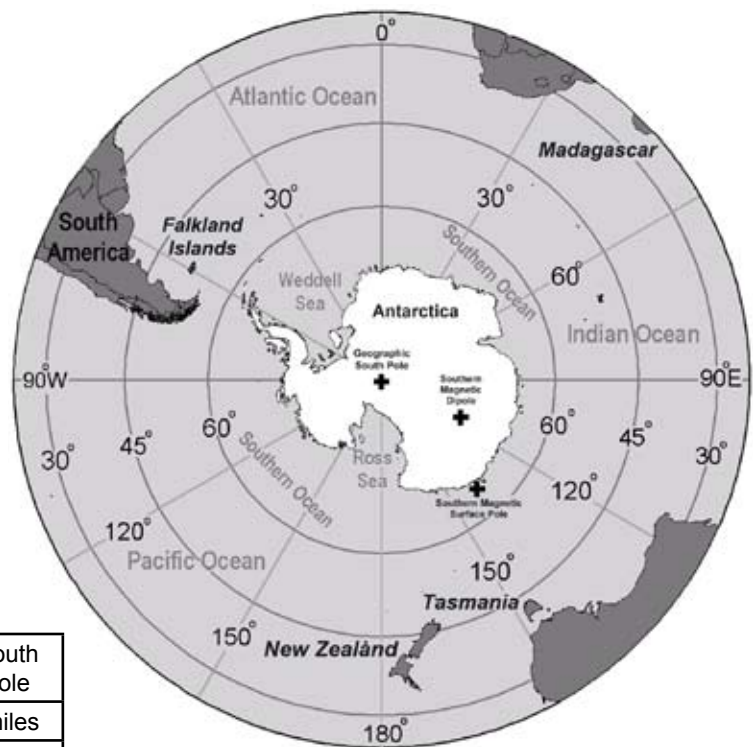
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2. What months of the year are likely to be best for viewing the aurora australis and why?

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3. What is the name of the continent where the south magnetic dipole is located?

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Color Key	Percent of Nights Aurora is Overhead	Distance to South Magnetic Dipole
Yellow	85% - 100%	1300 - 1600 miles
Green	40% - 84%	1601 - 2000 miles
Blue	10% - 39%	2001 - 2300 miles
Red	Less than 10%	2301 - 3500 miles