

# ANTARCTIC WEATHER MACHINE

GRADE LEVEL 4-5





Photo: BBC NHU

ANTARCTICA EDUCATOR GUIDE

## ANTARCTIC WEATHER MACHINE

### GRADE LEVEL 4-5

- (1) 90 minute Lesson OR
- (2) 45 minute Lessons

### Standards (NGSS):

4-ESS2-2

Analyze and interpret data to describe patterns of Earth's features.

### From the Film:

In the film, *Antarctica*, we learn that ocean currents, wind patterns, and temperature shifts play a significant role in what happens across the entire planet. Due to its place on the South Pole and its unique characteristics, this continent can shift climates, affect the movement of air, and change what weather looks like in the places that we live.

### Lesson Overview:

Students label and decorate a world map with ocean currents, wind patterns, and climate to represent the connections between Antarctica and their home. Students then construct an Antarctic Machine to represent how an event in Antarctica can result in an event where they live. When they are finished, they use their illustrated map to answer questions about how wind or ocean currents in Antarctica may affect other parts of the world. Emphasize that what happens here affects us all.

### Materials:

- Map of the World
- Colored pencils
- Digital or printed access to:
  - <http://oceanmotion.org/html/impact/conveyor.htm>
  - <http://oceanmotion.org/images/impact/global-currents.png>
  - <https://www.youtube.com/watch?v=M0NoOtaFrEs&t=1s>
- Data Sheets for students, pp. 42-45
- Global Weather Activity Sheet, p. 41
- Ping Pong balls (*one or more for each group*)
- Recycled materials like toilet paper, paper towel rolls, cardboard, plastic bottles
- Masking tape, duct tape, scotch tape
- Books (*to use as ramps*)
- String
- *If Available:*  
Toy cars, dominoes, ramps (*from car toy sets*), small fans, pulleys.

# ANTARCTIC WEATHER MACHINE

## EDUCATOR PREP:

Ensure students have access to a physical or digital copy of the handout to use in creating their globes. Gather the materials for each group to be able to use in this activity.

## EDUCATOR GUIDE:

1. In the film, *Antarctica*, we learn that ocean currents, wind patterns, and temperature shifts play a significant role in what happens across the entire planet. Due to its place on the South Pole and its unique characteristics, this continent can shift climates, affect the movement of air, and change what weather looks like in the places that we live.

2. Inform students that today, we will create a model that will help to visualize and analyze how Antarctica seems so far away, but has a huge impact on what happens in our current location. This cause and effect relationship is similar to a domino effect or a Rube Goldberg Machine. Covid-19 is a great example as a virus that started in China has caused a domino effect of people getting sick, some dying, which led to closures of schools, shutting down of businesses, sports, etc.

Show students a video of a Rube Goldberg machine to show how something that happens in one place can affect things in another.

Here is a commercial for *Goldie Blox* toys using a Rube Goldberg device:

<https://www.youtube.com/watch?v=M0No0taFrEs&t=1s>

Ask students the following questions:

**How did one single event inside the house cause something else to happen in another house down the block?**

*Answers will include descriptions of chain reactions as one thing causes another which causes another and so on.*

**How could you estimate the number of different things (or events) that happened between the first and the last?**

*Answers may vary, but could include: counting them, counting a set of them and then guessing based on that, or estimating using the distance from the beginning of the machine to the end.*



Clouds over Mt. Erebus, Mcurdo, Antarctica

Photo: Shutterstock / Michael Lodge

# ANTARCTIC WEATHER MACHINE

**Imagine if you could only see the first step and the last two steps and everything else was hidden behind a curtain. How could you piece together all the in-between steps?**

*If you are close enough to hear what was happening, you could record it and try to piece together the sequence of events. You could also use an imaging machine, like an x-ray machine that might be able to see through at least part of the curtain.*

**4.** Inform students that the global weather patterns are like this Rube Goldberg machine, but even more interconnected and far reaching. Imagine instead of a machine, it is a house. When something occurs in one house it also has an effect on all of the houses around it. Not only that, it affects houses across the city. That's an accurate illustration of the impact Antarctica has on what happens across the globe.

**5.** Students will use the blank map of the earth to label the ocean currents, prevailing winds, and temperatures across the globe to try to illustrate how something that happens in Antarctica could impact where they live.

**6.** Pass out to students the blank map and divide them into pairs to work together.

**7.** Using sites like *weather.com*, the *National Weather Service*, or *Accuweather data*, have students look up the high and low temperatures for this month, in a few major cities around the world, including the city in which they live. Label these temperatures on their map, near the cities.

**a. Sydney, Australia**

**c. Beijing, China**

**e. London, United Kingdom**

**g. San Francisco, United States**

**b. Toronto, Canada**

**d. Johannesburg, South Africa**

**f. McMurdo Station, Antarctica**

**h. Buenos Aires, Argentina**

**8.** Next, If using digital resources, help them navigate to the *Ocean Currents* data using:

<http://oceanmotion.org/images/impact/global-currents.png>

If using the printed format, pass out the map and help students understand what they are seeing. Ask students to look at the data and talk to their neighbor about what they notice.

**9.** Encourage students to draw and label the ocean currents on their own maps using a *blue* pencil.

Educator Notes:

## ANTARCTIC WEATHER MACHINE

**10.** Once they finish the ocean currents in blue, direct them to use the map on their data sheets to label the prevailing wind currents in **brown**. Let students know that it's okay if some of their wind lines overlap with their ocean currents.

**11.** Inform students that their diagram shows how global currents, temperature, and wind can take something that happens in Antarctica and affect us where we live. Now, we will build a simple model of a chain reaction to show how this happens, their Antarctica Machine. Chain reactions are what caused the Rube Goldberg device at the beginning to work – one thing led to another, and then another, and then another and so on.

**12.** Divide the class into groups of four students. Give each group the materials that they will use to build their Antarctica Machine, including one or more ping pong balls, recycled materials like toilet paper and paper towel rolls, tape, dominoes, books, toy cars, small fans, duct tape etc. Each group should have access to the same materials.

**13.** Have students mark, using masking tape, on their table that their machine starts in Antarctica and finishes where they live.

**14.** Inform students that using the materials provided, they are to build a machine (no more than five steps) that shows effects of global warming, whaling, or pollution can travel from Antarctica to where they live.

**15.** Give students about 30 minutes to build their machine.

**16.** Once the students have a working model of the machine, do a gallery walk so that they can see what others have designed. To do this, have one person stay behind to demonstrate the machine while the rest of the group travels to other groups to hear about their model.

**17.** Instruct students to use their map to answer the questions on their reflection sheets and consider how something that happens in Antarctica could affect them where they live, or other places around the globe.

**18.** Remind students that heat is energy which cannot be destroyed. Since both water and air are able to hold and move heat around the globe ocean currents and wind patterns, in addition to direct sunlight have a big impact on temperature, precipitation, and overall climate in places.



A tropical storm comes ashore in the Caribbean.

Photo: Shutterstock / Drew McArthur

## ANTARCTIC WEATHER MACHINE

**19.** After students have finished creating explanations for how what happens in Antarctica affects what happens where they live, go around the room and ask each pair to share some of their interpretations with the class. When responding to their explanation, focus on highlighting their thought process and analysis over whether their explanation is correct or not. For example, respond by saying”

*“Your connection between the ocean current around Antarctica and the one on the southern tip of South America also makes sense to me. Have you thought about...?”*

**20.** Wrap up the lesson by reminding students that through modeling and data analysis, scientists work hard to understand connections across seemingly disconnected events. This work is similar to the *Rube Goldberg Machine*, except that everything between the first and the last event is behind a curtain and scientists try to reveal or see those events. Today, they played the role of scientists and tried to peek behind the curtain and created a model of how different pieces interact across the globe.

Educator Notes:

## Global Weather Activity Sheet

**Directions:** Use the following to collect information about weather patterns that connect Antarctica to where you live:

Where I live:

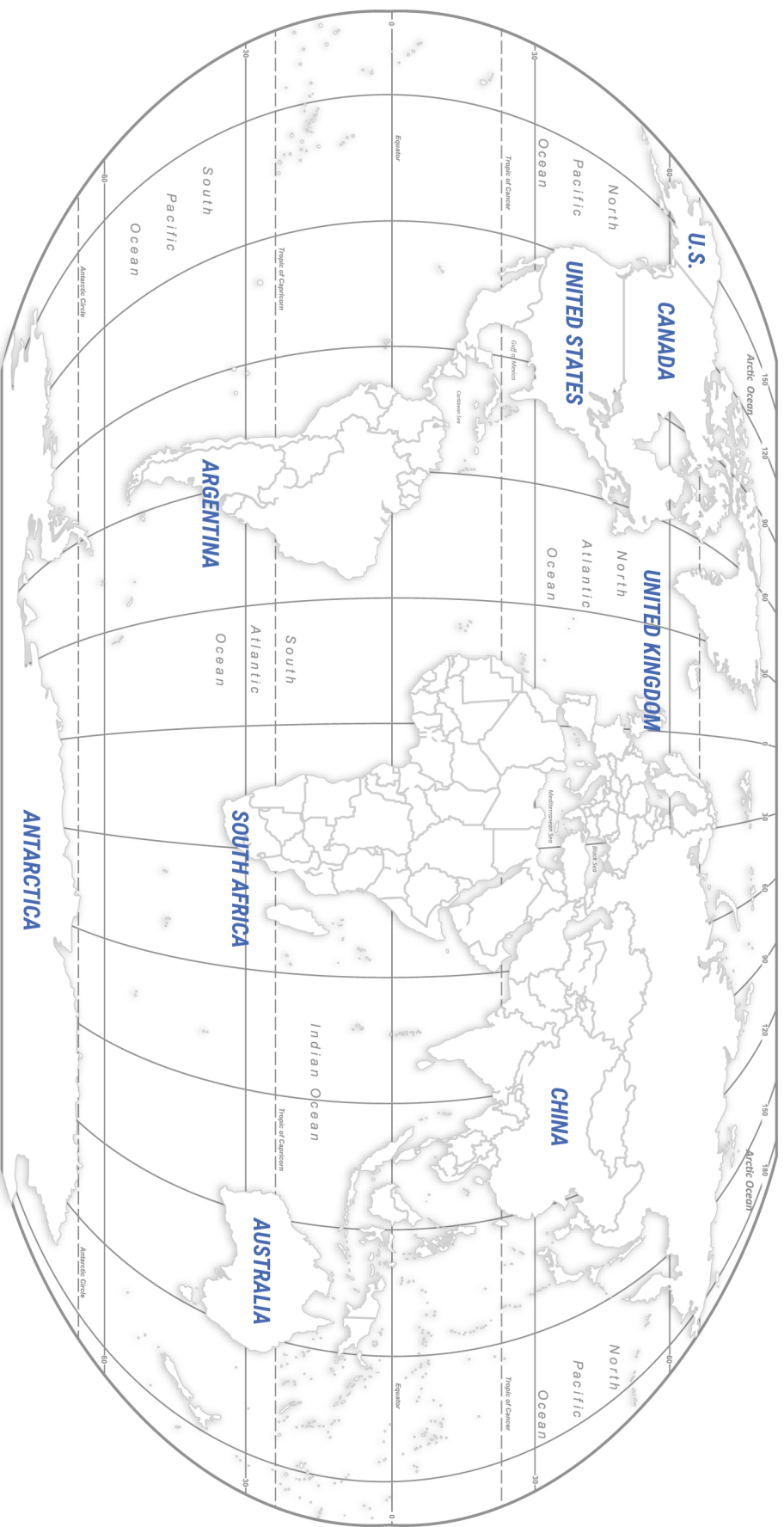
Closest Big City (*City, State, Country*):

Current Month of the Year:

City, Country	Average High Temp.	Average Low Temp.
My home		
McMurdo Station, Antarctica		
Buenos Aires, Argentina		
Beijing, China		
Johannesburg, South Africa		
London, United Kingdom		
San Francisco, United States		
Sydney, Australia		
Toronto, Canada		

# Global Weather Activity Sheet

1. Mark your hometown or closest big city on the map below.
2. Find the big cities and note their temperatures on the map below.
3. Draw the Ocean Currents in blue on the map below.\*
4. Draw the Prevailing Winds, in brown, from page #, on the map below.
5. Highlight a path from Antarctica to where you live, using the Ocean Currents and Prevailing Winds.

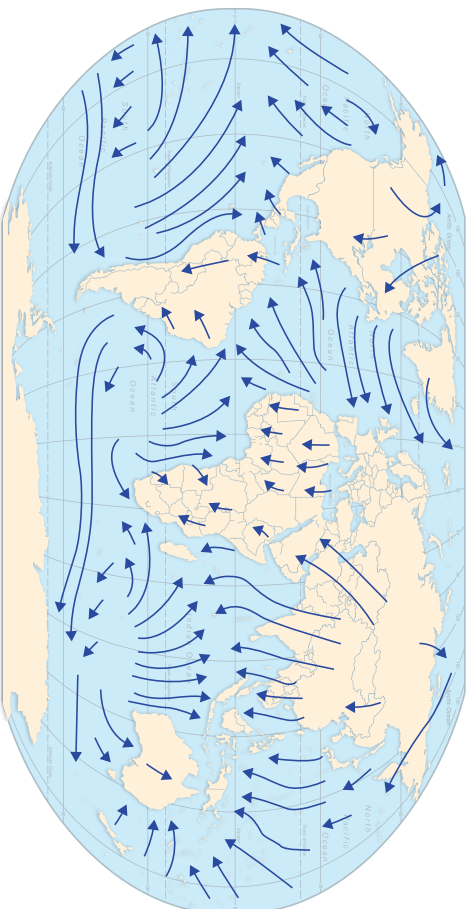


\*Use <http://oceanmotion.org/html/background/wind-driven-surface.htm> to draw the ocean currents around the world.

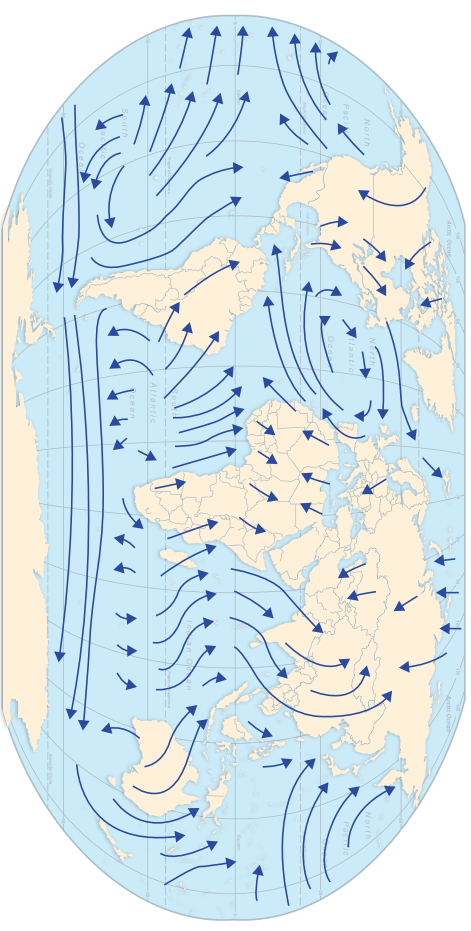


# Global Weather Activity Sheet

## SEASONAL VARIATION OF GLOBAL WIND PATTERNS



JANUARY



JULY

### Reflection

If temperatures increase in Antarctica, causing glaciers to start melting, what impact could that have on the weather where you live? Explain using the currents, winds, and temperatures on your activity sheet.

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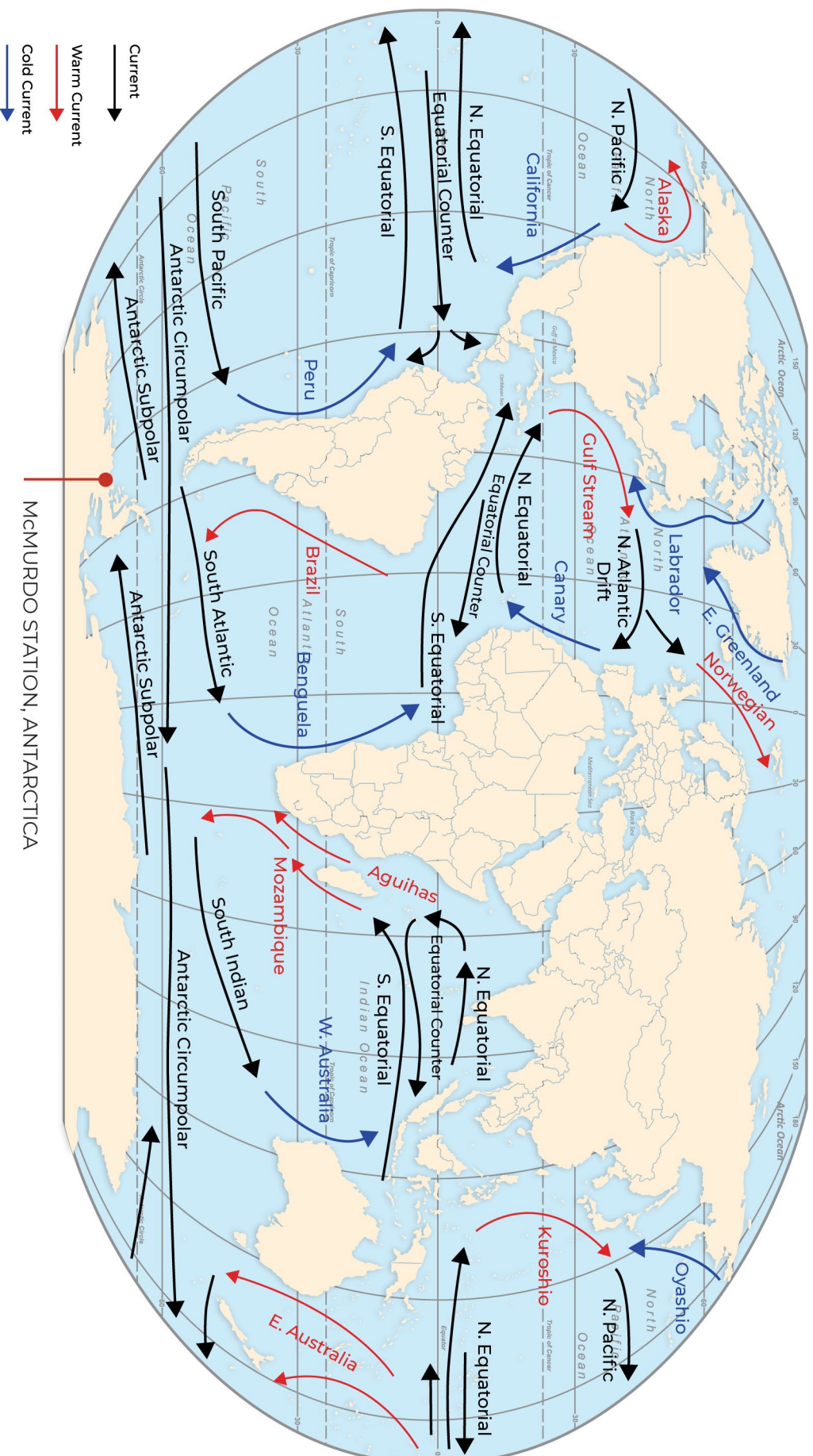
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Seasonal Variation of Global Wind Patterns courtesy of Dr. Jean-Paul Rodrigue, Department of Global Studies and Geography, Hofstra University

# Ocean Currents Data

Directions: Use these data sets if students do not have access to technology to do their own research.



## Temperature Data

**Directions:** Use these data sets if students do not have access to technology to do their own research.

LOCATION	JANUARY		APRIL		JULY		OCTOBER	
	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW
McMurdo Station, Antarctica	-1°C (31°F)	-5°C (22°F)	-17°C (0°F)	-23°C (-10°F)	-20°C (-4°F)	-27°C (-16°F)	-14°C (6°F)	-20°C (-4°F)
Sydney, Australia	°26C (79°F)	°19C (66°F)	23°C (74°F)	15°C (59°F)	18°C (64°F)	10°C (49°F)	22°C (72°F)	14°C (57°F)
Toronto, Canada	-2.5°C (28°F)	-11°C (12°F)	12°C (53°F)	1°C (33°F)	27°C (80°F)	14°C (58°F)	14°C (57°F)	4°C (39°F)
Beijing, China	2°C (35°F)	-10°C (15°F)	20°C (68°F)	7°C (45°F)	30°C (87°F)	18°C (65°F)	19°C (66°F)	7°C (45°F)
London, United Kingdom	8°C (46 °F)	2°C (36 °F)	13°C (56 °F)	5°C (41 °F)	20°C (68°F)	11°C (52°F)	15°C (59°F)	8°C (46°F)
Johannesburg, South Africa	9°C (49°F)	-3°C (26°F)	21°C (70°F)	7°C (45°F)	29°C (85°F)	17°C (63°F)	22°C (71°F)	7°C (45°F)
San Francisco, United States	14°C (57°F)	8°C (46°F)	17°C (63°F)	9°C (49°F)	19°C (67°F)	12°C (54°F)	21°C (69°F)	12°C (54°F)
Buenos Aires, Argentina	29°C (84°F)	20°C (69°F)	22°C (71°F)	15°C (58°F)	15°C (58°F)	8°C (47°F)	21°C (70°F)	13°C (66°F)