Arctic Microclimates

ARM Education Program

Objective

To identify, measure, and average microclimatic temperatures in a particular region.

Materials

Large white piece of paper
Pencils and erasers
1 thermometer per student or group

Important Points to Understand

Have you ever noticed how much cooler it is in the shade than in direct sunlight? Of course! Temperature differences within a small area are indications of *microclimates*: very small-scale climate conditions. The following are a few examp les of microclimactic variation:

- Dense, cold air sinking into the bottom of a valley can make the valley floor 20º colder than a slope only 30 feet higher.
- When there is sunlight, a south facing slope will be significantly warmer than a north facing slope which spends more of its day in the shade.
- If it is a windy day, an area sheltered from the wind, such as a small crevice or hollow will have air with no wind movement, and thus will be warmer.

Small animals and plants such as tundra experience temperature changes on even small scales. Such small-scale temperature variations might seem unimportant, but they help set the distribution and abundance.

Air temperature varies from one location to another (spatially) and from one time to another (temporally). For example, there are large variations in temperature with latitude (it is warmer at the equator and cooler at the poles) and over the seasons (it is warmer in summer and cooler in winter). Given these variations, how do meteorologists know what the planet's temperature is? Average global temperature can be determined by dividing the globe into a grid and averaging temperatures collected from weather stations in each cell of the grid. Local temperatures reported on the evening news and in daily newspapers are determined in much the same way, but on a regional scale. The same principle of averaging temperatures to calculate a single temperature for an area can be applied to the classroom and the schoolyard.

Preparation

Discuss the difference between the following pairs of terms: climate versus microclimate; spatial versus temporal variation; climate versus weather. Give examples of each.

Temperature is a good example of an important environmental condition that might vary on a microclimatic scale. List other environmental factors which might vary on a relatively small or microclimatic scale.

Procedure

1. Working individually or in small groups, identify and draw a small-scale map of an area to be sampled (classroom, playground, park, backyard).

2. Divide the map into a grid and identify potential locations for microclimatic differences. Can you predict which places might have warmer or cooler microclimates? Write down your predictions.

3. Take thermometers to different locations identified on the map. Record air temperatures in these locations, making sure enough time is allowed for thermometers to acclimatise to their surroundings (approximately 5 minutes).
   Note: Be sure to try taking temperature measurements in locations such as on the sunny side of a building, under the snow, on top of a hill and in a dip in the land if possible.

4. Record the data on the appropriate grid of your map, and calculate an average of all that you have collected.

Exercises

1. Compare the different temperatures on the map. Were temperatures relatively similar at all locations, or were there large variations? Is the average temperature closer to the maximum or the minimum recorded?

2. Repeat the experiment on a day when the weather is quite different (perhaps due to cloud conditions), and compare the results.

3. Go out on a day when there is snow on the ground. Take the temperature of the air just above the snow. Take the temperature under the snow. Is there a difference? How do you think this affects small animals, such as the red-backed vole, which spend the winter under the snow cover?

4. Sometimes a small air pocket with a thin cover of ice will form in snow. This happens when sunlight warms an object on the ground and it melts the snow from below. On a sunny day, slide a thermometer into one of these little air pockets. What is the air temperature inside?

5. Can you identify some locations which are characterized by warmer or cooler temperatures than others?