



# Estimating Cloud Cover: A Simulation



## **Purpose**

To enable students to understand the difficulties of visually estimating the percentage of cloud cover, to practice estimating cloud cover using paper simulations, and to evaluate the accuracy of their estimates

## **Overview**

Working in pairs or small groups, students will use construction paper to simulate cloud cover. They will estimate the percentage of cloud cover and assign a cloud cover classification.

## **Time**

One class period

## **Level**

Intermediate and Advanced

## **Key Concepts**

Using a simulation to explore the accuracy of observations

## **Skills**

Estimating simulated cloud cover  
Communicating mathematically  
Collecting and recording data  
Organizing data in tables

## **Materials and Tools**

GLOBE Science Notebooks  
Sheets of colored construction paper, one blue and one white per student  
Glue stick or tape

## **Prerequisites**

Familiarity with the cloud cover classification system

Familiarity with fractions and percentages

## **Background**

Even experienced observers have difficulty estimating cloud cover. This seems to derive, in part, from our tendency to underestimate the open space between objects in comparison to the space occupied by the objects themselves, in this case the clouds. Students have an opportunity to experience this perceptual bias themselves, to reflect on its consequences for their scientific work, and to devise strategies to improve their ability to estimate cloud cover.

## **What To Do and How To Do It**

Review the cloud-cover protocol with the students. Explain that they will simulate cloud cover using construction paper and try to estimate the amount of cloud cover represented by white scraps of paper. Demonstrate the procedures covered in steps 3 - 6 below so that students understand how to proceed.

1. Provide each student with the necessary materials:
  - one sheet of light blue construction paper
  - one sheet of white construction paper divided into 10 equal segments
  - GLOBE Science Notebooks
  - glue stick or tape.
2. Organize students into pairs.
3. Tell each student pair to choose a percentage of cloud cover that they wish to represent. They must choose a multiple of 10% (i.e. 20%, 30%, 60%, etc. not 5% or 95%). They should not reveal the percentage they have chosen to anyone else.



4. Working separately, each pair should cut their white paper so that it represents the percentage of cloud cover they have chosen. For example, if they have chosen 30%, they should cut out 30% of their white piece of paper and recycle the remaining 70%.
5. Students then tear their white paper into irregular shapes to represent clouds.
6. The students paste or tape the smaller cloud pieces onto the blue paper, thus representing the cloud cover.
7. Students take turns visiting each others' simulations and estimating the percentage of cloud cover. They also classify each simulation as "clear, scattered, broken, or overcast." They record their estimates in their notebooks, using a table similar to that shown in Figure ATM-L-1.

You may choose to have all students visit all the simulations, or divide the class in some way so that students visit only some of the simulations.

8. When students complete their estimates of cloud cover, create a table on the board to

**Figure ATM-L-1**

| Name        | Estimated percent | Classification |
|-------------|-------------------|----------------|
| Jon & Alice | 40%               | scattered      |
| Juan & Jose | 70%               | broken         |

9. Create a second table that compares correct classifications with incorrect classifications. See Figure ATM-L-3.
10. Discuss with the class the accuracy of their estimates.

Which were more accurate—the percentage estimates or the classifications? Where did the greatest errors occur? Can students come up with a quantitative measure of their collective accuracy? Does the class have a tendency to overestimate or underestimate cloud cover?

What factors influenced the accuracy of the estimates (e.g. size of the clouds, clustering of the clouds in one part of the sky, the percentage of sky that was covered)?

Do students feel that making these estimates is something one has a knack for, or is it something that can be learned? Where else might such spatial estimation skills be valuable?

Which cloud classifications were the easiest and most difficult to identify? What strategies enabled students to succeed?

**Figure ATM-L-2**

| Name        | Actual % | Underestimates | Correct estimates | Overestimates |
|-------------|----------|----------------|-------------------|---------------|
| Jon & Alice | 50       | 4              | 5                 | 12            |
|             |          |                |                   |               |
|             |          |                |                   |               |

**Figure ATM-L-3**

| Name        | Correct classification | Classified too little cover | Classified correctly | Classified too much cover |
|-------------|------------------------|-----------------------------|----------------------|---------------------------|
| Jon & Alice | Scattered              | 4                           | 9                    | 8                         |
|             |                        |                             |                      |                           |
|             |                        |                             |                      |                           |



What strategies might produce more accurate classifications?

**Adaptations for Younger and Older Students**



Younger students may need instruction regarding the identification of fractional *equivalents* and converting simple fractions to percents.



Older students can produce and videotape daily forecasts simulating a local news or weather channel. The broadcast format can include clips of dominant cloud types, percentage of cloud cover and visibility reports.

