

Extension - 4-H Youth Overlopment

GLOBE Observer: Climate & Weather Science

Youth create educational posters or notebooks on weather and climate topics or display activities from the manuals for the Weather and Climate Science project. Collecting and analyzing weather data through the GLOBE program and other citizen science platforms provides opportunities to integrate data collection and analysis into 4-H Weather and Climate Science projects. Submitting measurements through GLOBE Observer also integrates youth into the scientific process, since NASA uses observations as ground-truth for remotely sensed data.

1. Cloud Data Collection through GLOBE Observer

The *Clouds* data entry protocol on GLOBE Observer includes presence or absence of clouds, percentage of cloud cover, sky color, visibility, cloud types, precipitation, and ground cover. Tutorials during the data collection process will help youth learn about cloud types and contrails.

Before collecting data on cloud cover, it is helpful to calibrate your eyes to different percentages of cover. Use GLOBE's *Estimating Cloud Cover: A Simulation* activity will familiarize youth with what different levels of cloud cover look like. GLOBE also has an online version of this simulation (<u>Atmosphere Cloud Cover Estimation</u>).

2. Using crowd-sourced weather data through the GLOBE platform

Through the GLOBE program's online platform, youth can analyze atmospheric data from across the world that were collected by other GLOBE users, such as air and surface temperatures, water vapor, and aerosols (<u>https://vis.globe.gov/GLOBE</u>). The tutorial below details how to visualize data in GLOBE.



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See T	E ··· ? 🔓	*	The <i>Help</i> panel outlines the next steps and includes supporting tutorials.
Getting Sta	rted:		
Three steps	to visualizing your data:		
1. Sele	ect the protocol data you would lik ize.	e to	
1 . 2. Sel	ect the date		
🕕 3. Clic	k a measurement to retrieve the d	ata	
See a 20 sec	cond demonstration		
<u>See a quick</u>	demonstration of additional feature	res	
<u>Download f</u>	ull tutorial		
GLOBE Data	a User Guide		
Contact GLC	OBE		
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S) 🖾 😶 🕐 🎦	*	Click the <i>Protocol Layers</i> button (主) in the top left corner. Click on the sphere
📚 Pro	tocol Layers		from which you want to analyze data
Choose a there, ope layers that	Sphere below to see protocols. From en each protocol to see the available da t can be added to the map.	ata	[Atmosphere, Biosphere, Hydrosphere, Pedosphere].
Choose sph	nere to explore protocols		
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	 Check to select Protocols Air Temperature Dailies Solar Noon Temperature Dailies Maximum Daily Temperature Minimum Daily Temperature Air Temperature Monthlies Air Temperature Noons Air Temperature Aerosols Barometric Pressure Noons Station Pressure Sea Level Pressure 	Within a sphere, different types of data, such as daily air temperatures or barometric pressure, are available. Click on the data type that you want to visualize to see a drop-down list of available metrics.
<	Check to select Protocols	There might be multiple protocols within a data type. These protocols represent different methods for collecting data or different metrics for representing data (e.g., representing by mean or maximum). Check the box on the left to select which protocol or protocols you want to use for visualization. In this example, daily air temperatures based on the Solar Noon Temperature Dailies protocol are selected for visualization. Click green <i>Submit</i> button once you have selected your protocols. To simultaneously visualize protocols from other sphere, click <i>Check to select</i> <i>Protocols</i> to return to other spheres. Hit <i>Submit</i> only once finished with selecting protocols from other spheres.



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Multi-Site Plots	On the <i>Multi-Site Plots</i> pane, selected
School: Cardinal Gibbons High School	stations, date ranges, and
Site: Cardinal Gibbons High School	environmental parameters are listed.
Protocol: Air Temperature Dailies Plot: Solar Noon Temperature Dailies Range: 2016-04-27 to 2023-06-18 Y-Axis: 50 ℃ to 50 ℃	The Plot Date Range can also be modified on this pane.
School: <u>Crestwood High School</u> &	Click the green <i>Plot All</i> button to display multiple sites on the same
Protocol: Air Temperature Dailies Plot: Solar Noon Temperature Dailies Range: 2013-08-28 to 2023-07-24 Y-Axis: 50 °C to 50 °C	visualization.
Plot Date Range:	
2018-07-24 10 2023-07-24	
For optimum performance, the maximum recommended date range is 5 years	
Single Line Plot O Stacked Plot	
Use Auto-Y Axis	
Plot All View Plot Data Clear List	
Solar Hook Temporture Dalles, balar Anno Temporture Dalles, verse Tem	In the resulting time series plot, time is on the x-axis, and temperature is on
	the y-axis. Locations are represented by different colors in the time series plot.
	<i>Note:</i> GLOBE permits user to plot different measures (e.g., precipitation and temperature) on the same time
	series plot by using secondary axes.
Date © Gene States the States the State in the State in the States State State State State States States States State State State State State State States States State State States St	Charts with two different y-axes are
	often misinterpreted by readers and do
	not effectively summarize the
	relationship between the two
	measures, so many data scientists are
	moving away from using secondary
	axes.

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Estimating Cloud Cover: A Simulation



Purpose

To help students better understand percent cloud cover and to take more accurate cloud cover observations

Overview

Working in pairs or small groups, students use construction paper to simulate cloud cover. They estimate the percentage of cloud cover represented by torn pieces of paper on a contrasting background and assign a cloud cover classification to the simulations created by their classmates.

Student Outcomes

Students understand the difficulties of visually estimating the percentage of cloud cover and gain experience estimating cloud cover, evaluating the accuracy of estimates, and using fractions and percentages.

Science Concepts

Earth and Space Science

and spatial scales.

- Clouds can be described by quantitative measurements. Clouds change over different temporal
- Geography

The nature and extent of cloud cover affects the characteristics of the physical geographic system.

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.

Scientific Inquiry Abilities

Estimate cloud cover. Design and conduct scientific investigations. Use appropriate mathematics to analyze data. Communicate results and explanations.

Time

One class period

Level

All

Materials and Tools

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

Preparation

None

Prerequisites

Familiarity with fractions and percentages

What To Do and How To Do It

Introduce students to the idea of observing and quantifying cloud cover. Explain that they will simulate cloud cover using construction paper and estimate the amount of cloud cover represented by white scraps of paper on a blue background. Demonstrate the procedures covered in steps 3 - 6 below so that students understand how to proceed.

You may review the <u>Cloud Cover Protocol</u> with students before doing this learning activity or use the activity as a first step in presenting the protocol to students. Step 7 below requires you to explain the classification categories that are Welcome

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used – no clouds, clear, isolated, scattered, broken, and overcast.

- 1. Organize students into pairs.
- 2. Provide each pair with the necessary materials:
 - one sheet of light blue construction paper
 - one sheet of white construction
 paper divided into 10 equal
 segments
 - GLOBE Science Log
 - glue stick, glue, or tape.
- 3. Have each student pair 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.
- Have each pair 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 should then tear their white paper into irregular shapes to represent clouds.
- 6. Have students paste or tape the cloud pieces onto the blue paper, taking

care not to overlap the pieces of white paper. On the back of the blue paper, record the percentage of cloud cover.

7. Have students take turns visiting each others' simulations and estimating the percentage of cloud cover. For each simulation they should classify the sky as "clear, isolated, scattered, broken, or overcast using Table AT-CO-1." They should then record their estimates in their GLOBE Science Log, using a table similar to that shown in Table AT-CO-2.

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 compare the estimates with the actual percentages. See Table AT-CO-3.
- 9. Create a second table that compares correct classifications with incorrect classifications. See Table AT-CO-4.
- 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?

Table AT-CO-1

Percentage	If less than	If greater or equal to
10%	Clear	Isolated
25%	Isolated	Scattered
50%	Scattered	Broken
90%	Broken	Overcast

Table AT-CO-2

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

Table AT-CO-3				
Name	Actual %	Underestimates	Correct estimates	Overestimates
Jon & Alice	60	4	5	12
Juan & Jose	70	6	9	6

Table AT-CO-4

Name	Correct classification	Classified too little cover	Classified correctly	Classified too much cover
Jon & Alice	Broken	4	9	8
Juan & Jos	e Broken	7	12	2

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 they have a talent for, or is it something that they can learn?

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 correctly estimate cloud cover?

What strategies might produce more accurate classifications?

/ Introduction

Welcome