



## Introduction to Satellite Data Using HoloGLOBE

**Authors:** Peter Dorofy, Institute for Earth Observations at Palmyra Cove  
Tracy Ostrom, Berkeley University

**Overview:** These series of activities introduce students to observing global satellite data with the HoloGLOBE augmented reality app along with the Merge Cube. Combining the HoloGLOBE activities with the recommended GLOBE protocols will allow students to make more meaningful connections between local ground observations and global satellite data.

**Time:** 25-30 minutes

### Objectives:

1. Students will explore the various features of the HoloGLOBE app.
2. Students will explore global satellite datasets using NASA and NOAA resources.
3. Students will compare ground observations to satellite data.
4. Students will compare real-time cloud data to a simple global air currents model.
5. Students will differentiate real data vs simulated data in modeling.

**Grade Level:** 3-9

**NGSS:** DCI:ESS2.D Weather and Climate  
DCI:ESS3.D Global Climate Change

### Materials and Equipment:

1. Smartphone/iPad or other camera enabled device with touchpad
2. HoloGLOBE app downloaded on device (Free on Google Play Store or iTunes)
3. Optional: Merge Cube (highly recommended for the complete augmented reality experience)
4. Optional: GLOBE Observer installed on device

**Wireless Network Preparation:** In order to use real-time data or to stream video, your device will need internet access. It is recommended that a wireless network is used rather than cellular data, as costs may be incurred on a cellular data plan. HoloGLOBE has a wifi indicator that allows you to determine if your device is connected to wifi. Located at the top right main bar is a blue  to indicate the device is connected to wifi. If it is red  then the device is not connected. Your IT department should be able to assist.

**Note on Touch vs Gaze Mode:** The app offers two ways to experience augmented reality, with or without a mobile VR Headset .  is used without a headset. In this mode, all interaction is best done through

touch clicking.  is used with a headset. In this mode, all interaction is done through gaze. VR gaze is the technique of moving your head until the center reticle  is on top of a button.

The material in this document is based upon work supported by NASA under grant award No. NNX16AC54A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.





**Procedure:**

It is recommended you do the activities in numerical order as the activities are designed to take you through the various features of HoloGLOBE.

**Activity 1: Blue Marble at Night (5 min)**

1. Turn on your mobile device and open up the HoloGLOBE app  Click on 
2. Click the  icon at the top of your screen. This button opens up an information window about what you are seeing. A message appears about the Blue Marble at Night. **READ THIS MESSAGE.**
3. Touch drag to rotate the globe around and see both daytime and nighttime views of the earth.
4. Click on  This turns off the user interface, leaving only the globe.
5. Click on  This turns on the user interface.
6. Click on  This toggles the earth modules on and off.
7. Position the Merge Cube on the desk and your mobile device on the device stand. (You can also hold both if you prefer.) Point the device camera at the merge cube and you should see a globe appear.
8. Rotate the merge cube to see both daytime and nighttime views of the earth.
9. You can touch click any of the buttons while in merge cube mode.

**Activity 2: Cloud Coverage (5 min)**

**Pre-Activity Recommendation: GLOBE Protocol – Clouds.** Take students outside and complete the cloud protocol.

1. Click on the satellite icon  at the top of your screen so it looks like  This toggles near real-time data modules  to satellite mission modules 
2. Click on the NASA icon  on the right side of the screen. A message appears about the data. It says: “This models provides data....” **READ THIS MESSAGE.** As you observe the data, look for patterns within each map and factors that could influence these patterns. Click  to close the message box.



3. Now click on the light blue  TWICE on the right. “Cloud Coverage” should be the title. Click  to open the message box. A message appears about the data you are seeing. It says: “Cloud coverage is the percent.....” READ THIS MESSAGE. Notice that each month of the year appears every second and a blue and white image of the Earth are associated with each month. You should see the rotating blue and white data images with the month at the top of the globe.
4. Click  to pause the animation. Click it again to resume.
5. Reposition your Merge Cube so you are looking at North America and answer the questions.

**Questions:**

- a. What does cloud coverage mean?
- b. What is the color range in the images?
- c. In what month(s) of the year do you see the highest percentage of cloud cover over North America? Based on what you know happens during this (these) month(s), identify some factors that may influence these percentages.
- d. Month(s) most cloud coverage:
- e. I think the cloud coverage is higher in this (these) month(s) because during this (these) month(s)

**Activity 3: Real-time Clouds (5 min)**

1. Click on the satellite icon  at the top of your screen so it looks like  This brings up the near real-time satellite imagery. These data represent the “vital signs” of the earth.
2. In order to download this data, be sure your app has access to wifi. Located at the top right main bar is a blue  to indicate the device is connected to wifi. If it is red  then the device is not connected.
3. Click on cloud icon . Allow the data to download. Identify the date of this image.
4. Click . A message appears about cloud images. READ THIS MESSAGE.



5. In the main bar, click on the overlays toggle  at the top of your screen to turn on the two overlay buttons  . Clicking on each of these multiple times will cycle through the overlays. Keep clicking the first one until you get to Continent .
6. Find your place on earth. For example, if you are in the United States, rotate the globe until North America comes into view. Where on the continent are you located?
7. Examine the cloud cover over your area of the globe. How does the cloud cover compare to your GLOBE cloud observation? (If you did not make the GLOBE cloud observation, simply look outside the window to see if the sky is clear, cloudy, or partly cloudy).
8. Compare today's date to the image date. The image maybe 1-2 days behind (it takes about 24 hours to process this particular global dataset).
9. Click on the second overlay until you get Air Currents . The arrows indicate the general motion of global air currents. Using this model, the clouds you see today probably came from the North, South, East, or West?
10. Click on the right arrow  Title is Forecast Model Clouds. An animation of the clouds moving will begin after all the images have been downloaded.
11. Click . A message appears about cloud images. READ THIS MESSAGE.
12. The forecast model clouds uses "simulated" data. This data can be used to predict what global cloud cover may look days from now.
13. After the images have downloaded, observe the motion of the clouds and compare to the Air Currents. Does the Forecast Model agree with the Air Current model? What areas on the globe do the models agree? What areas on the globe to they seem to disagree?

#### Activity 4: Fire Fuel (5 min)

**Recommended Pre-Activity: GLOBE Protocol - Fire Fuel.** Take students out to learn about the different types of living and dead organic materials that can become fuels for wild land fires.

**Introduction:** Show students the *Grassland* maps for each month. These maps are part of the Land Classification Maps provided by NASA through a teacher data portal called MyNASAdata.

1. Click on the satellite icon  at the top of your screen so it looks like .
2. Click on the fires icon  Title is Fires Realtime Allow the data to download. Identify the date of this image.
3. Click . A message appears about cloud images. READ THIS MESSAGE.

The material in this document is based upon work supported by NASA under grant award No. NNX16AC54A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration.





4. Rotate your Merge Cube and look for fire “dots”.
5. Choose a continent on the MyNASAData *Grasslands* map for the current month.
6. Compare this continent to the continent on the globe (Note: if you don’t have the continents identified on your image, click on the first globe overlay until you get  ) As you compare the grassland data to the number of fires data, look for patterns and identify factors that could influence these patterns. Remember, the grasslands map may be a few years behind your HoloGLOBE data.

**Questions:**

- a. What typically causes naturally occurring fires?
- b. What is the fire scale that you see on your HoloGLOBE image?
- c. How do the data compare/contrast?

