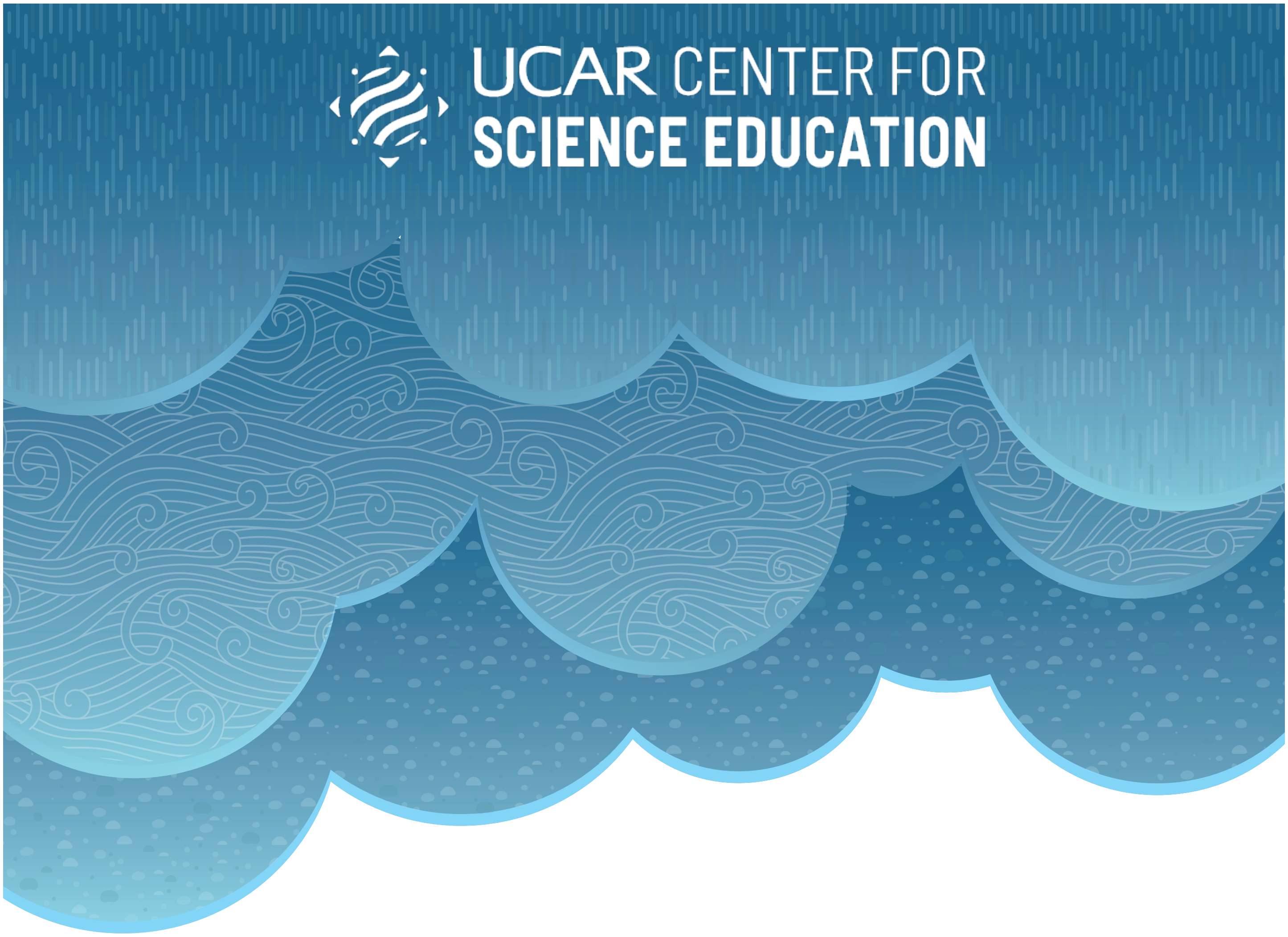


# ASSESSMENTS

THE GLOBE PROGRAM

BSCS SCIENCE LEARNING

NASA

UCAR
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This publication was supported by NASA under award #NNX17AD75G.

ASSESSMENTS

# TABLE OF CONTENTS

UCAR CENTER FOR SCIENCE EDUCATION

TEACHER GUIDE

TEACHER GUIDE

# TYPES OF GLOBE WEATHER ASSESSMENTS

BSCS SCIENCE LEARNING

NASA

THE GLOBE PROGRAM

# Types of GLOBE Weather Assessments

## EMBEDDED PRE-ASSESSMENT

**The table below outlines two opportunities for pre-assessment in Lesson 1 and suggests what evidence of student thinking and prior knowledge to look for during the lesson.**

| LESSON 1 PRE-ASSESSMENT OPPORTUNITIES: | LOOK FOR: |
|---|---|
| LESSON 1 **Teacher Guide: 3-4 of "Introduce the Anchoring Phenomenon"**<br><br>**(Student: Lesson 1, Step 1)** | • words and scientific terms they use to describe the water cycle (e.g., evaporation, precipitation and condensation) or expression of these ideas without using these terms.<br>• whether they focus mostly on water moving places or whether they also include sunlight, heat, temperature, or other references to energy. |
| LESSON 1 **Teacher Guide: 1 of "Modeling Storm Formation"**<br><br>**(Student: Lesson 1, Step 3)** | • the water cycle processes students include in their diagram (e.g., evaporation, condensation, precipitation).<br>• whether they use water molecules or a generic macroscale representation of water in their drawing.<br>• whether they include references to sunlight, heat, or energy as a mechanism for moving water around the water cycle. |

## FORMATIVE ASSESSMENT

Each lesson includes a variety of opportunities for formative assessment that correspond to particular parts of the instruction. The table (pages 3-5) summarizes notable formative assessment opportunities focused on three-dimensional learning outcomes that are tied to each lesson and work toward the NGSS Performance Expectations for the unit. Also, Exit Tickets, used at the end of each lesson to inform your instructional decision-making for the subsequent lesson, are listed in the table.

## LEARNING SEQUENCE SUMMATIVE ASSESSMENTS

Each learning sequence has a corresponding summative assessment (pages 7-17) composed of open response questions that prompt students to use their knowledge of disciplinary core ideas and crosscutting concepts as well as engage in the science practices of data analysis and interpretation and modeling. You can use the provided interpretive answer keys to make sense of student learning and to identify productive thinking and counterproductive, incomplete, and inaccurate ideas. The interpretive answer keys suggest where you can revisit instruction based on incomplete and inaccurate student thinking.

## FINAL ASSESSMENT

Intended for the end of the unit, the final assessment (pages 18-21) targets fundamental science ideas learned in the unit as well as the NGSS science practices of data analysis and interpretation and modeling. The assessment also prompts students to share what they know about the NGSS crosscutting concepts of patterns and cause and effect.

| LESSON | PERFORMANCE OUTCOMES | FORMATIVE ASSESSMENT OPPORTUNITIES | EXIT TICKET SUGGESTIONS |
|---|---|---|---|
| LESSON 2 | Develop a model to describe how clouds form during a day and build until they form a rainstorm. | **Teacher Guide: "Diagram a Storm Forming" (Student: Step 3)**<br><br>**Look for:**<br>• student connections to temperature changes over the course of the day or between the ground and clouds.<br>• student explanations about the role of sunlight or energy from the Sun in the storm formation.<br>• water cycling processes like evaporation and condensation. | • Write one idea or concept that you found particularly interesting or important about how a small cloud changes into a storm—the "What?"<br>• Write why that concept or idea is important—the "So what?"<br>• Think about how your thinking has changed based on that new idea—the "Now what?" |
| LESSON 3 | Collect data and analyze data to identify patterns that describe the relationship between temperature and altitude.<br><br>Analyze and interpret data to describe differences in surface temperature and air temperature during a day. | **Teacher Guide: "Collect Temperature Data" (Student: Steps 1-3)**<br><br>**Look for:**<br>• students explaining why the ground could be warmer than the air above it. (Listen attentively to whether students explain that the air is heated from the Sun from above or from the ground below.)<br>• students connecting warmer temperatures at the surface with evaporation of water and cooler temperatures near the clouds with condensation.<br><br>**Teacher Guide: "Model: Heating Earth's Atmosphere" (Student: Steps 5-6)**<br><br>**Look for:**<br>• students describing the pattern that temperature decreases as altitude increases.<br>• students adding ideas consistent with the temperature data and with the underlying mechanisms that explain temperature differences.<br>• students using data to explain temperature differences from the ground to the cloud.<br>• students explaining that heating of the surface by the Sun causes warming of air and evaporation of water, which eventually leads to the storm. | • What questions from the Driving Question Board can we now answer, and how would we answer them?<br>• What new questions do you have?<br>• What parts of the Colorado storm can we explain with our ideas right now? |

| LESSON | PERFORMANCE OUTCOMES | FORMATIVE ASSESSMENT OPPORTUNITIES | EXIT TICKET SUGGESTIONS |
|---|---|---|---|
| LESSON 4 | Analyze and interpret data to identify differences in patterns in air temperature and humidity during stormy days and sunny days.<br><br>Conduct an experiment and collect and analyze data to compare changes in humidity in sunny and in stormy conditions. | **Teacher Guide: "Data Analysis: Sunny and Stormy Day" (Student: Steps 1-2)**<br><br>Look for:<br>• students identifying that rising temperature paired with high humidity increases the chance of storms.<br>• students identifying that rising temperature with falling humidity decreases the chance of storms.<br>• students identifying that humidity is a critical component of the system.<br><br>**Teacher Guide: "Bottle Model Lab" (Student: Step 3)**<br><br>Look for:<br>• students connecting the sunny day and stormy day graphs with the observations of bottle models.<br>• students identifying the pairing of warm temperatures and high humidity with increased chances of afternoon storms.<br>• students realizing that the reason storms happen in the afternoon is due to the time needed to warm the air and evaporate water from the surface. | • How did the water from the bottom of the bottle get up on the sides of the bottle? |
| LESSON 5 | Develop and use a model to explain how energy from the Sun, convection, water on the surface and in the air, and variations in temperature and humidity create conditions/cause the formation of isolated storms. | **Teacher Guide: "Consensus Model" (Student: Steps 3-6)**<br><br>Look for:<br>• students sharing ideas about warm air from the surface rising and then cooling near the clouds.<br>• students sharing ideas about warm air holding more moisture near the surface that condenses when it reaches cooler temperatures near the clouds.<br>• the possible student misconception that warm air is located closer to the Sun.<br>• progress in students representing science ideas in their models and the accuracy of the models.<br>• students including all the required information listed in the checklist in the instructions located at the top of their models.<br>• students using model ideas in their written explanations, particularly those related to heating of the surface and air, the connection between temperature and water cycling processes, and the conditions of warm, rising air with moisture, which are necessary for a storm. | • How could we test whether our model can help us predict when precipitation happens in an isolated storm? |
| LESSON 6 | Collect, analyze, and interpret data to describe temperature and humidity conditions on the ground and in the clouds that create conditions/ cause the formation of a storm. | **Teacher Guide: "When Did It Rain?" (Student: Step 3)**<br><br>Look for:<br>• accuracy of student ideas.<br>• which model ideas students use and do not use in their explanations.<br>• whether students are supporting their explanations with evidence and/or model ideas. | • Describe a storm you've experienced that doesn't fit our model. |

| LESSON | PERFORMANCE OUTCOMES | FORMATIVE ASSESSMENT OPPORTUNITIES | EXIT TICKET SUGGESTIONS |
|---|---|---|---|
| LESSON 7 | Use a model to make predictions about characteristics of air before, during, and after a cold front. | **Teacher Guide: "What's a Cold Front Like?" (Student: Step 3)**<br><br>**Look for:**<br>• students using model ideas from LS1 to help them explain their initial observations of the cold front. | • Use what you know now to draw a temperature graph for one day before the front, the day the front arrives, and the day after the front. Explain why you drew the graph the way you did. |
| LESSON 8 | Analyze graphs to describe the changes in temperature and humidity before and after a cold front. | **Teacher Guide: "Model Idea Tracker Discussion"**<br><br>**Look for:**<br>• students explaining how the regular diurnal pattern gets disrupted before the front and returns after the front, but it's colder.<br>• students explaining temperature patterns starting warmer and getting colder after the front.<br>• students explaining humidity starting high and becoming low after the front.<br>• students connecting some of their understandings about what causes an isolated storm to what causes precipitation along a cold front, such as high humidity. | • What questions on the Driving Question Board can we now answer, and how would we answer them?<br>• What new questions do you have?<br>• What parts of the Colorado storm can you explain with our ideas right now? |
| LESSON 9 | Develop a model to show how differences in temperature and humidity before and after a cold front interact to cause a storm. | **Teacher Guide: "Consensus Model: Precipitation along a Cold Front" (Student: Step 3)**<br><br>**Look for:**<br>• progress in students representing science ideas in their models and the accuracy of the models.<br>• students including all the required information noted in the model checklist.<br><br>**(Student: Step 5)**<br><br>**Look for:**<br>• students using model ideas in the written explanation, particularly those related to temperature differences in air masses, cold air pushing warm air up, and warm air having high humidity and condensing to form precipitation. | • How could we test whether our model can help us predict precipitation along a cold front? |
| LESSON 10 | Analyze patterns in data to describe how pressure changes before and after a cold front. | **Teacher Guide: "Pressure: Data Analysis"**<br><br>**Look for:**<br>• students sharing ideas that air pressure is higher before a cold front and lower just before and during the storm.<br>• students connecting ideas about air pressure with air temperature and humidity. | • Write down an initial list of model ideas you believe will help you explain the Colorado storm.<br>• What questions do you still have about the Colorado storm? |

| LESSON | PERFORMANCE OUTCOMES | FORMATIVE ASSESSMENT OPPORTUNITIES | EXIT TICKET SUGGESTIONS |
|---|---|---|---|
| LESSON 11 | Develop a model to show how differences in pressure cause the movement of moisture that leads to a storm. | **Teacher Guide: "Explaining the Colorado Storm" (Student: Steps 2-3)**<br><br>Look for:<br>• accuracy of student ideas.<br>• which model ideas students use and do not use in their explanations.<br>• whether students are supporting their explanations with evidence and/or model ideas. | • What questions on the Driving Question Board can we now answer, and how would we answer them?<br>• What new questions do you have?<br>• What parts of the Colorado storm can you explain with our ideas right now? |
| LESSON 12 | Make observations to describe the large-scale motion of water in the atmosphere.<br><br>Describe patterns of how water moves through the atmosphere around the world. | **Teacher Guide: "Global Precipitation Patterns" (Student: Steps 3-4)**<br><br>Look for:<br>• students connecting patterns to observations from the video.<br>• students describing patterns of east-west precipitation movement, curling or spinning patterns, and patterns of regular cloud cover in some areas but not others. | • What questions do you have about how precipitation moves around the world?<br>• What have you learned about what causes storms to move that might help explain these patterns of global precipitation movement? |
| LESSON 13 | Analyze a model to describe latitudinal variations in the concentration of sunlight and to explain variations in temperature.<br><br>Analyze data to describe global patterns in average annual temperatures. | **Teacher Guide: "Energy Angles" (Student: Step 3)**<br><br>Look for:<br>• whether students connect the angle of trays to the concentration of solar radiation at the equator and poles.<br>• students connecting the concentration of solar radiation with global temperature patterns.<br><br>**Teacher Guide: "Temperature Data Investigation" (Student: Step 4)**<br><br>Look for:<br>• students understanding that average annual temperatures are consistently warmer near the equator. Temperatures, on average, are cooler near the poles, and there is seasonal variation. (Note: It is not important for students to recognize seasonal shifts in temperature). | • How do average temperatures where you live compare to temperatures in Sri Lanka and why? |
| LESSON 14 | Develop a model to show how air is circulating through the atmosphere in the tropics and midlatitudes. | **Teacher Guide: "Develop a Working Model" (Student: Step 1)**<br><br>Look for:<br>• students connecting warmer temperatures to areas of rising air and cooler temperatures to areas of sinking air.<br><br>**Teacher Guide: "Global Air Circulation Diagram" (Student: Step 5)**<br><br>Look for:<br>• students making connections between convection concepts they learned about in LS1 and LS2, the relationship between convection patterns and global temperature patterns, and the locations of areas of high and low air pressure and the resulting moisture or precipitation patterns. | • How could we test whether our model can help us predict storm movement in the tropics? |

| LESSON | PERFORMANCE OUTCOMES | FORMATIVE ASSESSMENT OPPORTUNITIES | EXIT TICKET SUGGESTIONS |
|---|---|---|---|
| LESSON 15 | Use knowledge of patterns in surface winds to make a prediction of the movement of a storm. | **Teacher Guide: "Explaining Storm Movementtudent: Step 3)**<br><br>**Look for:**<br>• which model ideas students use and do not use in their explanations.<br>• whether students are supporting their explanations with evidence and/or model ideas.<br>• students connecting the storm movement to understandings of both global air circulation and the Coriolis effect. | • What questions on the Driving Question Board can you now answer, and how would we answer them?<br>• What new questions do you have?<br>• What parts of the Colorado storm can you explain with our ideas right now? |