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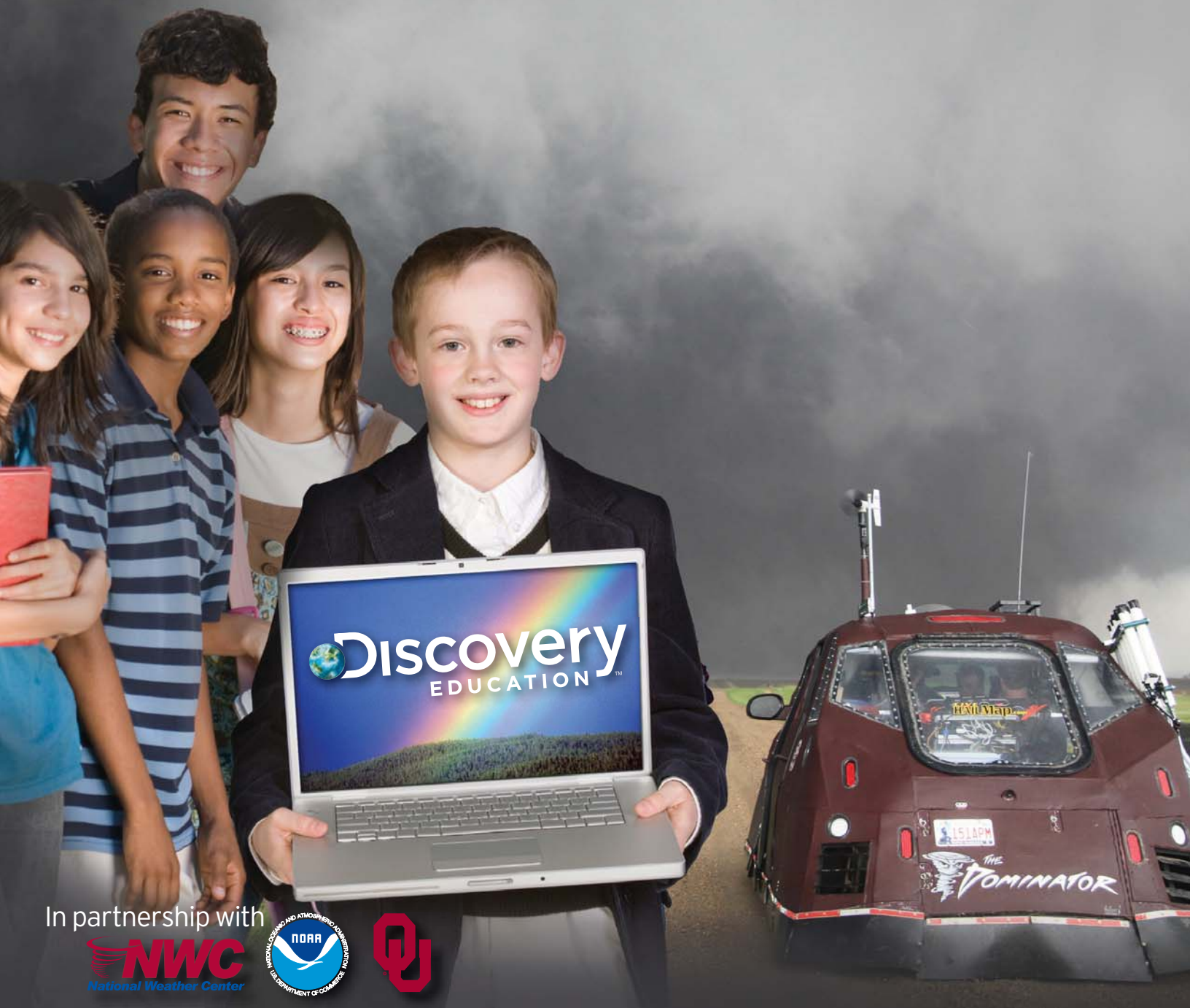
Discovery Education and ESC Region XI

Extreme Weather Virtual Field Trip



In partnership with

Extreme Weather
Grades: 3 – 5
Running Time: Approximately 6 days

Lesson Overview

This science lesson for students in grades 3-5 centers on a virtual field trip to the National Weather Center in Norman, Oklahoma. Before the field trip, students will take advantage of digital resources from Discovery Education; observe, record, and forecast the weather; and learn how to recognize and stay safe in severe weather. Reed Timmer of the Discovery Channel's *Storm Chasers* series will host this virtual field trip. After the field trip, students will make connections between weather events they previously studied and content presented during the field trip. Students will be made aware of careers related to weather and offered options on how to extend their study of weather at home. Both whole class and individual student assessment options are provided at the end of the lesson.

Background for Teachers

"Everybody talks about the weather, but nobody does anything about it." This popular quotation about weather is generally attributed to Mark Twain, although a friend of Twain's, Charles Dudley Warner, might also be credited with it. The topic of weather can come up in just about any conversation and at any time. The science of weather, meteorology, is an important subject for learners of all ages.

The National Oceanic and Atmospheric Administration (NOAA) defines weather as "The state of the atmosphere with respect to wind, temperature, cloudiness, moisture, pressure, etc. **Weather** refers to these conditions at a given point in time (e.g., today's high temperature), whereas **climate** refers to the "average" weather conditions for an area over a long period of time (e.g., the average high temperature for today's date)."

Energy from the sun heats the landmasses, oceans, and atmosphere and is the primary driver for weather. Both weather and climate depend on the transfer of energy in and out of the atmosphere. The transfer of heat energy between the atmosphere, the landmasses, and the oceans produces layers of different temperatures and densities in the atmosphere and oceans. These different densities cause layers of air in the atmosphere and water in the oceans to produce winds and ocean currents.

Weather forecasts provide vital information for the public about weather to come. In severe weather situations, short-range forecasts and warnings can help save lives. Knowledge of the

many factors that determine weather is crucial for accurate forecasts. Such factors include wind speed and direction, air temperatures aloft and at ground level, humidity, atmospheric pressure, and cloud cover to name a few.

There are many private and governmental agencies devoted to weather. The study of weather is also prominent at many universities. Many of these agencies make weather data and forecasts available to the public as well as provide information related to the science of meteorology. The primary governmental agency devoted to weather is the National Oceanic and Atmospheric Administration (NOAA). The NOAA Weather Partners, located in Norman, Oklahoma, are five federal government organizations involved in severe weather research, forecasting and support. They are: the National Severe Storms Laboratory, the National Weather Service Forecast Office, the Radar Operations Center, the Storm Prediction Center, and the Warning Decision Training Branch. Also located in Norman is the National Weather Center, a research center at the University of Oklahoma devoted to education, training, operations, and research of the University's weather and climate academic programs. The National Weather Center also houses offices of NOAA and is the site for the virtual field trip around which this lesson is designed.

Notes for Teacher

You will be asking students to use a weather chart to record the local weather around the school. What you ask them to record depends on the level of student you're instructing, the materials and equipment available to you, the convenience and logistics of taking students outside, and other factors. Feel free to modify the weather chart provided with this lesson to accommodate your situation. Materials you might want to incorporate, if available, could include:

- thermometer
- rain gauge (class made)
- barometer
- wind vane
- wind sock (class made or observe trees or grasses)
- hygrometer

The only other materials you will need are 2-liter soda bottles and a little bit of duct tape. You have the option of having students make a model tornado using 2-liter soda bottles. Students could be asked to bring empty soda bottles to school for this activity.

If your students would find it difficult to locate and bring in weather maps from the newspaper, you might begin to appropriate some as soon as possible.

If you have access to a weather radio, bring it to class and show students how it works. You might use this opportunity to invest in a weather radio for the classroom or for the school, if one is not already part of the school's safety/emergency program.

Take time to preview the Discovery Education (DE) resources so you can select ones you feel would be most appropriate for your students. Full DE videos referenced this lesson are about 15 minutes long and contain roughly 3 to 8 video segments. Both are listed and linked below and in the lesson.

Texas Indicators

Knowledge and Skills

Grade 3
8A. observe, measure, record, and compare day-to-day weather changes in different locations at the same time that include air temperature, wind direction, and precipitation;

Grade 4
8A. measure and record changes in weather and make predictions using weather maps, weather symbols, and a map key;

Grade 5
8A. differentiate between weather and climate;

Process Skills for Grades 3-5

(2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to:

(B) collect data by observing and measuring using the metric system and recognize differences between observed and measured data;

(C) construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data;
(D) analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations;

(4) Scientific investigation and reasoning. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:

(A) collect, record, and analyze information using tools, including microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, wind vanes, rain gauges, pan balances, graduated cylinders, beakers, spring scales, hot plates, meter sticks, compasses, magnets, collecting nets, notebooks, sound recorders, and Sun, Earth, and Moon system models; timing devices, including clocks and stopwatches; and materials to support observation of habitats of organisms such as terrariums and aquariums.

Essential Questions

How do we observe, measure, describe, and forecast the weather?
What kind of weather is dangerous and how can we stay safe in it?

Resources

Student Resource Page 1 – Weather Chart
Student Resource Page 2 - Tornadoes – Where and When?

Discovery Education Resources

Video Segments

Tornado Drills: Preparing Students for the Worst (3:33 min.)
The Likelihood of Tornadoes: A Matter of Geography (:42 min.)
Storm Chasers: Documenters of the Tornado Life Cycle (:53 min.)
Understanding Tornadoes: Searching for Environmental Clues (2:15 min.)
Lightning: How It Happens and How to Stay Safe (2:48 min.)
Flash Floods (:52 min.)
Lightning: How It Happens and How to Stay Safe (2:48 min.)
The Dangers of Severe Weather (1:04 min.)
Safety Precautions Involving Severe Weather (3:51 min.)
Tornadoes and Severe Thunderstorms (1:02 min.)
How to Stay Safe in the Event of a Tornado (:59 min.)
Tornadoes (1:48 min.)
The Importance of Weather Forecasting (1:45 min.)
Forecasting the Weather (1:01 min.)
Using Weather Instruments to Forecast Weather (2:39 min.)
Lightning (3:11 min.)
Meteorologists and Weather Forecasting (2:12 min.)
Forecasting the Weather (1:01)
How Maps, Graphs, and Charts Help Meteorologists Observe the Weather (:48 min.)

Videos

Weather Smart: Thunderstorms (15 min.)
Weather Smart: Tornadoes (15 min.)
Weather Smart: Climate (15 min.)
Weather Smart: Forecasting and Weather Instruments (15 min.)
Severe Weather Safety: Watch for the Warning (18:07 min.)
Enviro-Tacklebox: Module 02: Decisions Based on Science: Extreme Weather (19:55)
DragonflyTV: Tornado F-Scale and Tornado Model: Meteorology (14:01 min.)
Electricity and Magnetism: Static Electricity (23:45 min.)

Images

A tornado in Denver

Song

Teacher and the Rockbots: How's the Weather

Teach

Engage

1. Ask students to look out the window and describe the weather. As they provide their descriptions, write key words or concepts they share on the board. Engage them in a discussion about the weather, terms they might use, and make note of any misconceptions they might hold. How would they compare today's weather with yesterday's weather or the day before? Can anyone suggest what the weather might be like tomorrow? Elicit any stories students could share of a memorable experience they might have had with weather.

2. Optional: show the Discovery Education image A Tornado in Denver. If this is not convenient now, simply ask how many students have seen a tornado? How many have seen pictures of a tornado? Ask if any students have ever been in bad weather and to describe the experience to the class. Add any relevant key words to the list you had started on the board. Try to limit lengthy narrations so more students can share; this might allow a variety of types of weather to be mentioned. Tell students that in this lesson they will learn about different types of bad weather - specifically lightning, flash floods, and tornadoes. They will learn about forecasting weather and how to stay safe in the event of bad weather.

Explore

3. Mention to students that observing and recording the weather has a long history in the science of the study of weather, called meteorology. Show the DE video segment The Importance of Weather Forecasting. Tell students that you would like them to observe the weather outside the school for several days and to make a record of it. Look over the list you made from the students' experiences with weather to brainstorm what aspects of the weather they could observe and record. Hand out Student Resource Page 1, **Weather Chart**, to each student and enter the quantities or aspects students have brought up and that you feel you and they have the capability to record. Depending on what equipment you have available, arrange to take students outdoors to make their observations on a daily basis, if possible.

4. As you continue this daily recording of weather with your students, you can expand your students' exposure to weather instruments and introduce them to weather forecasting. One option is to show the DE video Weather Smart: Forecasting and Weather Instruments. The video segment you showed in step 3 above was the introduction to this 15-minute video. The video contains 13 segments that deal with specific instruments such as thermometers and barometers as well as more sophisticated technologies such as weather satellites and radar. Alternatively, you could show individual segments as you deem appropriate.

5. To introduce students to weather maps and symbols, show the DE video segment Weather Fronts and Weather Maps. Tell students you want them to look for a map of the United States in this video segment and to watch how knowing about a weather feature in one part of the county can help predict the weather in another part of the country. After viewing the segment, briefly discuss what a front is (a boundary between two masses of air of different densities or temperatures) and remind students of the symbol that was shown moving from west to east across the country. Tell students that this symbol and others are always shown on weather maps that can be found in most newspapers. Assign students the task of locating and bringing to class a weather map from a newspaper. Alternatively, students could find a weather map on the Internet. Once students have found and brought in weather maps, help them locate and discuss the key for weather symbols displayed on the map. Talking about temperatures, precipitation, and fronts would be appropriate, but at this point, it is probably not necessary or appropriate to discuss high and low pressure centers.

6. When students have finished recording the daily weather conditions at school, review their weather charts. Did everyone record similar data? Were there any noticeable trends in the data during the period? To show students what professional meteorologists

do with weather data, show and discuss the DE video segment How Maps, Graphs, and Charts Help Meteorologists Observe the Weather.

7. Introduce students to forecasting by showing the two DE video segments Forecasting the Weather and Using Weather Instruments to Forecast Weather. The later segment shows students who have made and used a chart to record weather and children reading weather maps from the newspaper and the Internet. Use some of the weather maps students have brought in from the newspaper to discuss and predict what the weather might be like a day later. Remind students that generally weather patterns tend to move from west to east across the country and that knowing the direction of the wind is often a good indicator of future weather. If students have several days of schoolyard weather data they have recorded, they could try their hand at weather prediction by looking for any trends in the data and forecasting the next day's weather. Anticipate and tell students that the virtual field trip might explain how complicated and involved it is to make an accurate weather forecast.

8. Show the DE video segment The Dangers of Severe Weather to students and tell them they will now spend some time studying severe weather and what they and their families can do to stay safe in the case of this kind of weather. Recall any experiences students might have shared with the class earlier in the Engage section.

9. There are a number of excellent DE video resources available on the subject of severe weather and staying safe in severe weather. The three types of severe or extreme weather that are the focus of this lesson are lightning, flash flooding, and tornadoes. As you view and discuss any of the following resources with students, keep in mind that as the resources show and describe different types of severe weather, they also discuss appropriate safety measures. Make this weather and the respective safety measures as appropriate to your particular location as you can and try to bring in local stories and examples to make this part of the lesson more meaningful for your students. Since the following resources are numerous and extensive, you have the option of selecting as few or as many as you feel are suitable for the time you have available. You might find that some of the full videos have segments you can skip and some of the video segments might have related video segments of interest you can easily link to.

Video segments:

Meteorologists and Weather Forecasting (2:12 min.)
Tornado Drills: Preparing Students for the Worst (3:33 min.)
The Likelihood of Tornadoes: A Matter of Geography (:42 min.)
Storm Chasers: Documenters of the Tornado Life Cycle (:53 min.)
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Weather Smart: Forecasting and Weather Instruments (15 min.)

10. Focus students' attention on tornadoes with the following activities.
    a. Ask students what they already know about when and where tornadoes occur in Texas and in the United States generally. If you showed either the video segment The Likelihood of Tornadoes: A Matter of Geography or Tornadoes, students should have an idea of the location of tornado alley and some sense of the factors that help determine these particular locations within the country. Hand out the Student Resource Page 2, **Tornadoes: Where and When**, to each student. Tornado Alley is already outlined on the map. Provide color markers or crayons for students and ask them to shade in the area that represents Tornado Alley. Relate and discuss your particular location to the area shown on the map in terms of the likelihood of a tornado occurring locally.

    b. On this same page is a table of data showing the frequency with which tornadoes occur in the United States (for the period 2003 – 2005). Have students apply their graphing skills to make a bar graph (on the back) that shows the number of tornadoes that occur each month of the year. When they are finished, again relate this data to the present time of year in terms of the likelihood of a tornado occurring.

    c. Optional activity: model a tornado using two soda bottles. Students can make and manipulate a water-based tornado using two empty 2-liter soda bottles. Fill one bottle almost full with water and invert the empty second bottle over the first. Seal the two bottles together at the necks using duct tape. Quickly turn both bottles over so the bottle with the water is on top and the empty bottle is

on the bottom. Begin to spin the very top (originally its bottom) of the bottle with water in a circular motion to start the water rotating. Hold the bottom of the empty bottle steady on a surface. A vortex of spinning water will form in the bottle of water as the water drains down into the empty bottle. This models the spinning vortex of air in a tornado. (Inexpensive commercial connectors are available that allow two soda bottles to be easily connected together.) Depending on time and materials you have available, suggest that students vary some parameters of this soda bottle tornado model: amount of water used, items such as glitter or food coloring added to the water, speed of spinning used to start the vortex, and size of restricting hole to name a few. This could be an opportunity for students to get involved in an inquiry-based investigation, varying input variables, gathering, graphing, and analyzing data, and drawing conclusions.

11. Focus students' attention on lightning with the following activities.
    a. Show students the DE video segment Lightning. It presents slightly more information than the video segment Lightning: How It Happens and How to Stay Safe. If you would like to involve your students more into the nature of lightning and static electricity, you could show them the full video Electricity and Magnetism: Static Electricity (23:45 min.).

    b. Optional activity: model lightning using a balloon and scarf. Have students blow up and tie off a balloon. Rub the balloon on a wool scarf or towel or other fabric several times then touch it to another student's finger or to metal in the classroom. If the humidity is low enough, students should feel and hear a spark, which in effect is what a lightning strike is. It is possible, if conditions are dark enough, to actually see the spark, much as we see lightning in the sky.

12. Review with students various ways to stay safe during types of severe weather such as tornadoes, lighting, and flash floods. Mention and review weather-related safety items seen in some of the DE resources: weather-alert radio, flashlights, first aid kit, extra food and water, cell phone, etc.

Explain

13. Remind students of the weather charts they made, the instruments people use to measure weather, weather maps and symbols, forecasting, severe weather, and how to stay safe in bad weather. Explain that they will be taking a virtual field trip to the National Weather Center in Norman, Oklahoma and that Reed Timmer of the Strom Chasers series on the Discovery Network will host it. They will learn how professional

meteorologists study weather, especially extreme weather. Students should be on the lookout for the technology and specialized equipment the meteorologists use. During the tour, students should take some notes related to concepts they've already studied in this lesson. They should also be encouraged to write down any questions they have related to weather.

14. Take students on the virtual field trip to the National Weather Center.

15. After the virtual field trip, you might want to show one or more of the DE resources you've shown prior to the trip. After the experience of the virtual field trip, some of these resources might hold more meaning for students. Possible follow-up discussion questions include:

    a. What was their reaction to the virtual field trip?
    b. What specialized instruments or equipment do professional meteorologists use to study weather?
    c. How do scientists work as a team and what advantages might that offer?
    d. How does the work of the scientists at the National Weather Center affect the public?
    e. What are some of the most effective ways people can stay safe during severe weather?
    f. What skills do people need become professional meteorologists?

16. Provide students time to write a reflective piece in their journals about -
    a. An experience they've had with unusual weather
    b. Best practices to stay safe in severe weather
    c. Their reactions to the virtual field trip
    d. A short story centering around weather

Extend

18. Show and discuss with students the DE video Weather Smart: Climate (15 min.). It contains a number of segments that deal with topics such as the influence of the sun on Earth's climate, the role of air in climate, the greenhouse effect and global warming, and how human activities affect climate.

19. If you did not show this resource before in the lesson, show and discuss the DE video Weather Smart: Forecasting and Weather Instruments (15 min.). Instruments featured include the thermometer, anemometer and wind vane, compass, barometer, hygrometer, weather satellites, radar and rain gauges, and maps, graphs, and charts.

20. Students can be directed to any number of Internet sites for directions on how to make their own weather station.

21. Students have been exposed to several weather-related careers while viewing some of the DE resources and during the virtual field trip. Students can be directed to research specific careers that involve weather. Other students might want to research some of the technology and equipment used to study weather, including some of that seen during the virtual field trip.

22. Students could be encouraged to continue their study of weather at home with any of the following activities.
    a. Record the weather conditions at their home for an extended period of time, up to and including months and years.
    b. Involve their family in developing a safety checklist for tornadoes, lightning, and flash floods.
    c. Build a weather station for home use.
    d. Visit the Internet site of any number of government, private, and university agencies that deal with weather.
    e. Visit the Internet site for the Discovery Channel's "Stormchasers" as well as watch episodes on the Discovery Channel.

Evaluate

21. Options for a class summary assessment project
    a. Make a high-quality display showing the frequencies or occurrences of tornadoes across the country. The map of tornado alley that students colored in was a generalization; tornadoes do occur beyond the outline that was shown on that student resource page.
    b. Make a weather safety plan for your school that would detail contingencies for severe weather including who goes where, who does what, what type of communication is essential, what supplies are essential, and what to do after an event.
    c. Make and videotape a working model of a tornado that utilizes air instead of water (as in the tornado tubes students might have made in class.) The DE video segment Tiny Twister: Making a Tornado Model shows students making a working model of a twister using two fans and steam from hot water.
    d. Teams of students (or the entire class) design their own customized storm chase vehicles. The designs could involve specifications for specialized equipment, rendered drawings, and even 3D models.

22. Options for individual student assessment
    a. Show the following DE video segments to students and have each student respond to the questions on paper.
        i. Video Quiz: Weather Smart: Tornadoes
        ii. Video Quiz: Weather Smart: Thunderstorms
    b. Locate, reproduce, and administer the quiz that can be found in the "Related Materials" section of the DE video Enviro-Tacklebox: Module 02: Decisions Based on Science: Extreme Weather.
    c. Ask students to write a review or summary of the virtual field trip they took to the National Weather Center.
    d. Ask students to write a narrative that incorporates some aspect of weather and that includes details that indicate a basic knowledge of different types of severe weather, weather forecasting, instruments for measuring weather, and weather safety.
    e. Direct students to Storm Chasers Extras, for any or all of the following quizzes: Tornado Forecasting Quiz, Tornado Basics Quiz, Meteorology Quiz, and Storm Watcher Quiz.

Wrap Up

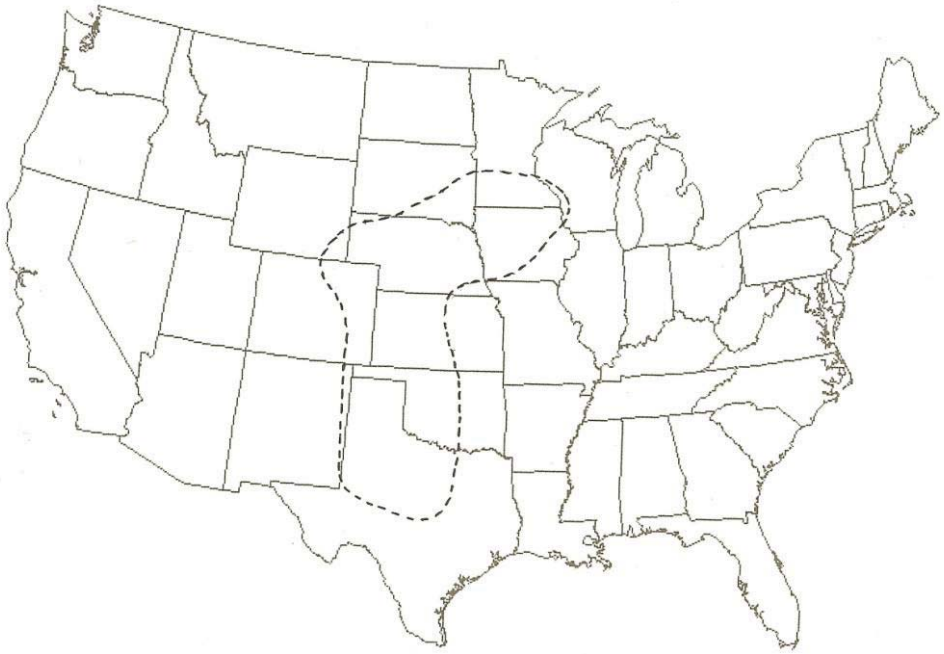
Play the song Teacher and the Rockbots: How's the Weather for students; movement or dancing while listening is teacher's discretion.

Weather Chart **Name**_____

Day of Week	Clouds	Wind	Precipitation	Temperature	
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					

Tornadoes – Where and When? **Name** _____

Directions: Color in Tornado Alley, the area inside the dashed line. Then make a bar graph on the back of this sheet showing the number of tornadoes occurring each month of the year.



U.S. Tornadoes by Month 2003-2005

Month	Number of Tornadoes
January	10
February	10
March	50
April	130
May	400
June	300
July	150
August	120
September	170
October	50
November	100
December	10

Student Resource Page 2