

# *Kids' Crossing* in the CLASSROOM



Teaching Earth and Atmospheric Science  
with the *Kids' Crossing* Web Site

*A Guide for Educators*

National Center for Atmospheric Research  
Boulder, Colorado

[www.eo.ucar.edu/kids](http://www.eo.ucar.edu/kids)

## Teaching Earth and Atmospheric Science with the *Kids' Crossing* Web Site *A Guide for Educators*

*Welcome to Kids' Crossing, a Web space for you and your students to learn about the Earth and atmospheric sciences! We have collected our favorite upper elementary and middle school activities for hands-on science exploration and linked them to science content on our Kids' Crossing Web site. Together, these resources help students hone both literacy and scientific reasoning skills. We hope you enjoy this collection!*

### **Contents:**

- 1 Introduction
- 1 About Us
- 2 Using the *Kids' Crossing* Web Site with Students: Navigating the Site
- 3 Making Unique Web Activity Plans
- 3 Additional Science Education Resources from NCAR and UCAR
- 4 Introduction to *Kids' Crossing* Hands-on Activities
- 5 Hold Rivers and Lakes in Your Hand
- 6 Make a Mini-Glacier
- 7 Create a Portable Cloud
- 8 When Saltwater Meets Freshwater
- 9 Make an Aquifer
- 10 Looking Into Surface Albedo
- 11 Plants, Animals, and Carbon Dioxide
- 12 Travelling Nitrogen
- 13 Blue Skies and Red Sunsets
- 14 Convection Currents
- 15 How Far Is that Storm?
- 16 Tornado In a Jar
- 17 Make a Tornado Model
- 18 Make a Storm Surge Model
- 19 Catching Snowflakes
- 20 Make Lightning

*Questions about Kids' Crossing or this Educators' Guide?  
Contact Lisa Gardiner at UCAR Education and Outreach ([egardine@ucar.edu](mailto:egardine@ucar.edu)).*

## Introduction

It is our hope that *Kids' Crossing* conveys atmospheric and Earth science content and activities in a way that is useful for upper elementary and middle school audiences. The purpose of this guide is to facilitate their use within and beyond the classroom.

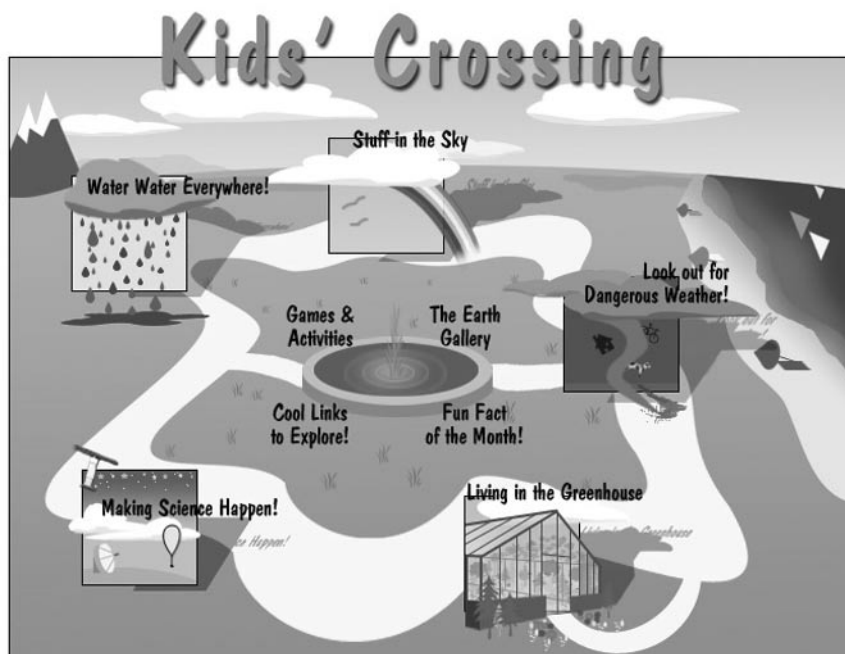
## About Us

The *Kids' Crossing* Web site was produced by the UCAR Office of Education and Outreach to explain the science of the National Center for Atmospheric Research (NCAR).

NCAR's parent organization, University Corporation for Atmospheric Research (UCAR), is a non-profit organization dedicated to basic research in the atmospheric and Earth sciences. UCAR is a group of 66 universities throughout North America that each grant doctoral degrees in the atmospheric and related sciences, plus an increasing number of academic and international affiliates and corporate partners.

NCAR is a research organization, established in Boulder, Colorado in 1960, to better understand our atmosphere and how weather and climate affect the Earth. Over 300 Ph.D. researchers and visiting scientists conduct interdisciplinary studies with state of the art technology. They have discovered much about the Earth system including how the Sun influences the Earth, how past and future climate can change, and how we can better forecast the weather. NCAR researchers also study how weather and climate affect people and environments around the globe. NCAR is operated by UCAR under a cooperative agreement with the National Science Foundation (NSF), our primary sponsor.

Development of the Kids' Crossing Web site and this Educators' Guide was funded by NCAR's Education and Outreach Strategic Initiative.



## Using the Kids' Crossing Web Site with Students Navigating the Site

<http://www.eo.ucar.edu/kids>

After a section of the site is accessed from the main page ([www.eo.ucar.edu/kids](http://www.eo.ucar.edu/kids)), navigate through the section using the graphic navigation bar at the top of the page. The example at the right shows the *Groundwater* content from the *Water, Water Everywhere* section. Links to individual groundwater pages are in the blue bar below the graphic.



Use the bar (shown at left) at the bottom of each *Kids' Crossing* page to navigate to other *Kids' Crossing* sections.

*Kids' Crossing* covers a range of Earth and atmospheric science content including the following major topics:

Science Content	<i>Kids' Crossing</i> Section
The Water Cycle	<i>Water, Water Everywhere</i>
Weather	<i>Look Out for Dangerous Weather</i>
Weather Safety/Decision-Making Skills	<i>Look Out for Dangerous Weather</i>
Climate and Global Change	<i>Living in the Greenhouse</i>
Cycles of the Earth System	<i>Living in the Greenhouse</i>
Atmosphere	<i>Stuff in the Sky</i>
<i>Careers in Science (coming soon!)</i>	<i>Making Science Happen</i>

Additionally, *Kids' Crossing* contains:

- *Links* to UCAR/NCAR educational resources and other recommended online resources
- An *Earth Gallery* providing links to useful Earth science images
- *Activities* written for students to try on their own

## **Making Unique Web Activity Plans Using *Kids' Crossing***

The Internet can be an excellent tool to promote inquiry, however, Internet-based lessons should be carefully structured to avoid overwhelming students. It is useful for such lessons to have a very concrete purpose. Within the Educators' Guide (p.4-20), we provide examples of how Kids' Crossing can be used successfully in upper elementary and middle school classrooms in conjunction with hands-on activities. Additionally, a number of helpful resources exist on the Internet to assist you in developing your own Web-based lessons that guide students with questions or challenges. A number of these resources are listed below.

- WebQuest  
(Includes articles about, and links to, WebQuests, Internet-based inquiry activities)  
<http://webquest.org/>
- WebQuest 101- Putting Discovery into the Classroom  
(Useful for making your own WebQuests)  
<http://www.teachersfirst.com/summer/webquest/quest-a.shtml>
- Some Thoughts on the Use of the Internet in Schools  
(Article from the Franklin Institute Online)  
<http://www.fi.edu/fellows/fellow3/oct98/>
- How to Weave the Web Into K-8 Science, a book by David R Wetzel, NSTA Press, 2004  
(Techniques and online resources to integrate Internet into the classroom)  
<http://www.nsta.org>

## **More Science Education Resources from NCAR/UCAR**

- Windows to the Universe  
<http://www.windows.ucar.edu>
- NCAR, UCAR and UOP Education and Outreach  
<http://www.eo.ucar.edu>
- The Educators' Bridge  
<http://www.eo.ucar.edu/educators/index.html>
- Digital Library for Earth System Education (DLESE)  
<http://www.dlese.org>
- National Science Digital Library (NSDL)  
<http://nsdl.org>
- The GLOBE Program  
<http://www.globe.gov>
- Project LEARN  
<http://www.ucar.edu/learn>
- Web Weather for Kids  
[http://www.ucar.edu/educ\\_outreach/webweather/](http://www.ucar.edu/educ_outreach/webweather/)

## Introduction to *Kids' Crossing* Hands-on Activities

The *Kids' Crossing* site allows upper elementary and middle school educators to connect the science content on *Kids' Crossing* with hands-on inquiry. Students build literacy skills while also building scientific knowledge and science investigation skills such as forming hypotheses, making observations, and thinking critically.

Each activity includes reading from one or more pages of the *Kids' Crossing* Web site. Ideally, access to a computer lab would allow students to read the pages online. Alternatively, pages can be printed and copied for student use. Additionally, several of the activities in this suite include worksheets that can be accessed online and include student directions.

The table below lists activities according to the section of *Kids' Crossing* that they complement. Page numbers refer to location within this Educators' Guide.

<b><i>Kids' Crossing</i> Section</b>	<b>Classroom Activity</b>	<b>Page</b>
<i>Water, Water Everywhere</i>	Hold Rivers and Lakes in Your Hand	5
	Make a Mini-Glacier	6
	Create a Portable Cloud	7
	When Saltwater Meets Freshwater	8
	Make an Aquifer!*	9
<i>Living in the Greenhouse</i>	Looking into Surface Albedo	10
	Plants, Animals, and Carbon Dioxide*	11
	Travelling Nitrogen*	12
<i>Stuff in the Sky</i>	Blue Skies and Red Sunsets	13
	Create a Portable Cloud	7
	Make Convection Currents	14
<i>Look Out for Dangerous Weather!</i>	How Far Is That Storm?	15
	Tornado in a Jar	16
	Make a Tornado Model!*	17
	Make Convection Currents	14
	Make a Storm Surge Model	18
	Catching Snowflakes	19
	Make Lightning	20

\*Activities marked with an asterix are more appropriate at middle grades. All others can be applied from upper elementary through middle school.

The activities in this collection are favorites of the staff at the UCAR Office of Education and Outreach for use at the upper elementary and middle school levels. Many of these activities originated within our other educational resources such as *Web Weather for Kids* ([www.ucar.edu/educ\\_outreach/webweather/](http://www.ucar.edu/educ_outreach/webweather/)), *Windows to the Universe* ([www.windows.ucar.edu](http://www.windows.ucar.edu)), and *Project LEARN* ([www.ucar.edu/learn](http://www.ucar.edu/learn)). Explore these other resources for additional educational content and activity tie-ins for classroom use.

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students learn that the shape of the land will determine the locations of rivers and lakes within a watershed.
- Students learn that rivers that do not come in contact with each other are in different watersheds.

## Time

- 20-30 minutes

## Materials

For each student:

- A piece of paper
- A blue marker/pen

For the class:

- Several spray bottles
- Computers with Internet access or printouts of the Web site sections listed above.

## National Standards

- A: Science as Inquiry
- D: Earth Science

## Source

- *Adapted from the CMC Youth Education Program and the Keystone Science School*

# Hold Rivers and Lakes in Your Hand!

*Students make and describe a model of a watershed!*

## Related Kids' Crossing Web Pages for Students

- *Water, Water Everywhere! Rivers Section*  
<http://www.eo.ucar.edu/kids/wwe/river1.htm>
- *Water, Water Everywhere! Lakes Section*  
<http://www.eo.ucar.edu/kids/wwe/lake1.htm>
- Student Version of Activity  
<http://www.eo.ucar.edu/kids/wwe/lake4.htm>

## Directions

1. Have students read the *Water, Water Everywhere! Rivers and Lakes Sections* (URLs above). Ask students how water gets into and out of rivers and lakes.
2. Provide each student with two pieces of paper and a blue marker.
3. Instruct students to crumple one piece of paper into a ball. Then, gently open it but don't smooth it out entirely. Explain to students that, in this activity, the paper represents the land surface. Its wrinkles show the shape of the land (topography). The highest points are mountains and the lowest points are valleys.
4. Ask students how water typically travels on the Earth's surface. (In general, it will only travel downhill. If there is no slope, then it will stop or move slowly, forming a lake.) Consider showing aerial photographs of river drainages to familiarize students with the ways that rivers form in valleys, follow the shape of the land, and merge with other rivers on their way downhill.
5. Have students draw where they think rivers and lakes will form on their paper landscapes.
6. Spray student sheets of paper to see if the water flows in the pattern that students predicted.
7. Rivers that merge together are part of the same watershed. In this second part of the activity, students will indicate all the rivers of a watershed. Have students crumple and then uncrumple the second piece of paper and make an 'X' in the lowest point in their second paper landscape to represent a town.
8. Instruct students to follow the river that flows through the 'X' uphill (upstream) marking its path with the marker.
9. Eventually students will get to a point where the river splits into two. They should draw in both upstream to uncover the town's watershed

## Background Information

A *watershed* is the area where rivers and lakes are connected. In a watershed, all streams and rivers come together into one body of water like a larger river, lake, reservoir, or ocean. Mountains or other high ridges may separate some rivers. If time permits, have students draw in the boundaries of a watershed by following the high points that surround the watershed drawn in the second part of the activity.

## Extension

Find out more about your watershed using regional maps.

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students learn that glaciers contain ice, rocks, soil, and other debris.
- Students learn how glaciers shape the land surface as they move.

## Time

- Day 1: 20-30 minutes
- Day 2: 20 minutes

## Materials

For each student:

- A paper or plastic cup with a relatively flat bottom
- Dirt, sand, and/or gravel
- Blue food coloring
- Water

For the class:

- A freezer
- Cooking oil spray
- Flour
- A baking sheet for each group of four
- Computers with Internet access or printouts of the Web site sections listed above.

## National Standards

- A: Science as Inquiry
- D: Earth Science

## Source

- *Modified from PBS Teacher's Resources' Glacier Maker activity*

# Make a Mini-Glacier!

*Students make a model of a glacier that changes the shape of a model landscape as it moves.*

## Related Kids' Crossing Web Pages for Students

- *Water, Water Everywhere! Glaciers and Snowfields Section*  
<http://www.eo.ucar.edu/kids/www/ice1.htm>
- Student Version of Activity  
<http://www.eo.ucar.edu/kids/www/ice4.htm>

## Directions

### Day 1

1. Have students read the *Water, Water Everywhere! Glaciers and Snowfields Section* (URL above). Ask students: *What's a glacier? What materials make up a glacier?* (Ice, snow on top, dirt and rocks) Tell students that in this activity they will make models of glaciers.
2. Provide each student with a cup and have them fill the cup with some dirt, gravel and blue-colored water. Label cups with student names and place in a freezer until the next day (at least).

### Day 2

1. Discuss how glaciers move over time. Show students the picture of the U-shaped valley carved by a glacier. (Click on the small version on the page <http://www.eo.ucar.edu/kids/www/ice1.htm> to see the large image.) Ask students to brainstorm ways that glaciers are able to carve the land. In this part of the activity, students will make a model to show how moving glaciers transform the land surface.
2. Have students collect their glaciers from the freezer and divide into groups of four.
3. Supply each group with a baking sheet sprayed with cooking spray and approximately 2 c. flour (representing the surface of the land).
4. Students sprinkle the flour over the baking sheet to create a relatively uniform land surface.
5. At this point the glaciers have had a few minutes to melt, making it easier for students to extract them from the plastic cups. Briefly discuss why the glaciers might be full of gravel and dirt.
6. Have students line up the glaciers on one end of the baking sheet landscape and push them across. Remove the glaciers (as if they melted and are no longer there) and discuss the tracks left in the flour (which represents soil and gravels). *Where have the glaciers removed material? Where have the glaciers deposited material?*
7. Have students draw a picture of what the glacier paths look like and label places where material was removed and deposited.

## Background Information

Glaciers scour the surface of the land. In the model, the main path of the glacier is like a *U-shaped valley*. Smaller scrapes in bedrock made by individual rocks are called *striations*. The mound of flour that the model glacier has snow plowed ahead of it is called a *moraine*. Mounds of flour on the sides of the model glacier's path are called *lateral moraines*. For more information, visit *All About Glaciers* from NSIDC (<http://nsidc.org/glaciers/>).

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students experiment, observe, and articulate results.
- Students learn the conditions necessary for cloud formation.

## Time

- 30 minutes

## Materials

For each group of 4:

- Gallon jar
- Cold water (100 ml)
- Hot water (100 ml)
- Rubber glove
- Food color (optional)
- Matches
- Rubberband
- Lamp (gooseneck or similar style)
- Paper and pencil to record observations
- Internet access or printed copies of the student directions (at URL above) for each student group

## National Standards

- A: Science as Inquiry
- B: Physical Science
- D: Earth Science

## Source

- *This activity has been adapted from NCAR's Web Weather for Kids.*

# Create a Portable Cloud!

*The purpose of this experiment is to observe how moisture, cooling temperature, and condensation nuclei play a role in cloud formation.*

## Related Kids' Crossing Web Pages for Students

- *Water, Water Everywhere: Atmosphere*  
<http://www.ncar.ucar.edu/eo/kids/wwe/air1.htm>
- *Stuff in the Sky*  
<http://www.eo.ucar.edu/kids/stuffsky/index.htm>
- Student Version of Activity: NCAR's *Web Weather for Kids*  
[http://www.ucar.edu/educ\\_outreach/webweather/cloudact2.html](http://www.ucar.edu/educ_outreach/webweather/cloudact2.html)

## Directions

1. Discuss the composition of clouds. Brainstorm what is needed for clouds to form. Tell students that in this experiment they will explore some of their ideas.
2. Instruct students to pour the cold water into the jar, add food coloring, and swirl for one minute to allow some water to evaporate.
3. Stretch the open end of a rubber glove over the mouth of the jar with the glove fingers hanging down into the jar. Affix a rubber band to the mouth to secure the glove (or a partner can hold it in place).
4. Turn on the lamp so it shines through the jar. After 2 minutes, instruct students to insert a hand into the glove and pull quickly outward without disturbing the jar's seal.
5. Instruct students to record what they observe inside the jar, push the glove back down into the jar, and record observations again.
6. Tell students about particles in the atmosphere. *Would more or fewer clouds form with particles in the jar?* Develop hypothesis.
7. Instruct students to remove the glove from the jar, while you drop a lit match into the jar. Students should quickly seal the jar with the rubber glove as before (containing the smoke particles within the jar) then repeat procedure to test the hypothesis made in Step 6.
8. Discuss the process of evaporation. *Does the temperature of the water make a difference?* Develop hypothesis.
9. Pass out hot tap water and have groups repeat the procedure using hot water to test the hypothesis developed in Step 8 above.
10. Discussion: *What helps a cloud form?* (Cooling air, condensation nuclei, and evaporation)

## Background Information

*Evaporation:* There must be water vapor in the air to build a cloud. Vapor is created as water evaporates either by heating under the lamp, swirling the water, or using hot water.

*Cooling air:* As air temperature decreases, vapor condenses. When you pull the glove out of the jar, the air pressure lowers inside the jar. The jar contains the same number of air molecules, but they occupy more space and slow down, causing the air temperature to drop.

*Condensation nuclei:* Tiny particles, such as dust, dirt, and pollutants, provide surfaces for water molecules to gather upon and condense into water droplets. The smoke provides tiny nuclei on which water condenses when the air temperature cools.

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students observe phenomena, record with pictures, and base conclusions on observations.
- Students learn about relative densities of saltwater and freshwater and why water can be layered at a delta or estuary.

## Time

- 50 min. (or 10 min. without analysis and assessment)

## Materials

For each group of four:

- Empty tennisball container
- 1 cup of Morton's water softening pellets
- Golf ball
- Enough water to fill container 2/3 full
- An extra cup of water with a drop of food coloring
- Paper and pencils

## National Standards

- A: Science as Inquiry
- B: Physical Science
- D: Earth Science

## Source

- *This activity has been adapted from teacher Dave Mastie, Ann Arbor, MI*

# When Saltwater Meets Freshwater

*In this activity students explore what happens when salt and freshwater come together in a river delta or an estuary.*

## Related Kids' Crossing Web Pages for Students

- *Water, Water Everywhere!*  
<http://www.eo.ucar.edu/kids/wwe/index.htm>
- Student Version of Activity  
<http://www.eo.ucar.edu/kids/wwe/ocean4.htm>

## Directions

1. Have students read the *Rivers* and *Oceans* sections of *Water, Water Everywhere* (URL listed above, navigate via the top graphic).
2. Discuss the reading as a class including: how rivers and oceans are similar and different, how water moves through the water cycle, and why oceans are salty but rivers are not. Ask students to hypothesize what they think might happen when freshwater from rivers and saltwater from oceans meet.
3. Divide students into groups of four. Have groups read the Student Version of this activity (URL above).
4. Assign each student group a cup of salt pellets, a container 2/3 full of freshwater, and a golf ball. Have students draw a side-view picture of the container. Ask students to take turns shaking the container to help the salt dissolve. (Remind students to keep a hand on the lid!)
5. After five to ten minutes, ask students to set the container upright on the table and make a second sideview drawing. *Has there been any change in the location of the golf ball within the container?* Discuss relative density. The ball sinks in freshwater but floats in saltwater, so it is more dense than freshwater but less dense than saltwater.
6. Have student groups SLOWLY pour their cup of freshwater into the container. To ensure that the waters do not mix too much, have students pour the freshwater on top of the golf ball (and/or use a funnel). Tell students to observe and make a third drawing.
7. Apply this physical principle to the natural world by discussing examples where freshwater meets saltwater such as the Chesapeake Bay Estuary or the Mississippi Delta.

## Background Information

The saltwater on the bottom of the container has a higher density than the freshwater above. Because of this density difference, the layers don't mix unless disturbed (which is a fun end to the lesson).

Freshwater meets saltwater wherever a river meets an ocean. This happens at estuaries and deltas. In these places the freshwater often stays above the saltwater until mixed by waves and currents.

## Extension

Research the types of animals that live in an estuary or delta.

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students learn that good aquifers are made from large sediments and are lined with impervious material.
- Students hypothesize, experiment, record and present results.

## Time

- 50 minutes

## Materials

For each group of four:

- Approx. 1 c. of sand
- Approx. 1 c. of gravel
- Approx. 1 c. of clay
- Approx. 1 c. of dirt
- A plastic cup that has holes poked in the bottom
- A bowl that is slightly larger than the cup with holes
- A measuring cup or other container with scale
- Water
- A watch with a second hand for timing
- Computers with Internet access or printouts of the web pages listed above.

## National Standards

- A: Science as Inquiry
- D: Earth Science

## Source

- *Adapted from the CMC Youth Education Program*

# Make an Aquifer!

*Students figure out which sedimentary materials hold water the best!*

## Related Kids' Crossing Web Pages for Students

- *Water, Water Everywhere! Groundwater Section*  
<http://www.eo.ucar.edu/kids/wwe/ground1.htm>
- Student Version of Activity  
<http://www.eo.ucar.edu/kids/wwe/ground4.htm>

## Directions

1. Have students read the *Water, Water Everywhere! Groundwater Section* (URL above). Ask students how water gets into and out of the ground and where water is stored underground. Explain that an area where water is trapped underground is called an aquifer. In this activity the class will investigate what types of underground conditions make the best aquifer.
2. Divide students into groups of four, provide each group with materials, and have groups read the directions in the student version of the activity (URL above).
3. Have student groups choose one type of sediment, fill the cup with it (to the top), and pour water into the top to see roughly how long it takes for water to come out the holes in the bottom. Have groups try this with each material individually. (This first part of the activity will familiarize students with the different types of sediments and their relative water trapping abilities.)
4. Discuss as a class. *Which material let the water flow through most easily? Which didn't let the water through much at all? What about the others?* Lead students to understand that the material that let the most water flow through, has the most spaces between grains, and the ability to hold the most water.
5. Have student groups write a hypothesis about what combination of sediment layers hold the most water in an aquifer.
6. Students test their hypotheses by layering sediments in the plastic cup, filling their measuring cup with a set amount of water and seeing how much water they can pour into the cup without any escaping out the holes (an aquifer design competition).
7. Ask student groups to make posters stating (a) their hypothesis, (b) their results, and (c) a conclusion. Hang posters around the room and discuss all results as a class.

## Background Information

This inquiry activity allows students to discover for themselves what makes a good *aquifer*. They hopefully figure out that sediments with large grains (like gravel) will have the most space between them to hold water. But they also need to discover that there must be a layer below that doesn't let water go through, otherwise it will escape. Elementary students may need the inquiry to be conducted in a more guided fashion.

## Extension

Find out where your city or town gets its water. Well water means that you rely on an aquifer!

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students explore how the color of materials at the Earth's surface affects warming.
- Students collect and interpret data.

## Time

- 20-30 minutes

## Materials

For each group of four:

- 2 thermometers (or more)
- *Land and Glacier* Picture (print from URL above)
- Tape
- Watch or stopwatch
- Outdoor sunshine or desk lamp with a 150 W bulb

For each student:

- A worksheet (print from URL above)

For the class:

- Computers with Internet access or printouts of the Web page listed above.

## National Standards

- A: Science as Inquiry
- D: Earth Science

## Source

- *This activity was adapted from Project LEARN*  
[www.ucar.edu/learn](http://www.ucar.edu/learn)

# Looking into Surface Albedo

*This activity will demonstrate how the color of materials that cover the Earth affects the amount of sunlight absorbed.*

## Related Kids' Crossing Web Pages for Students

- *When the Sun's Energy Gets into the Atmosphere*  
<http://www.eo.ucar.edu/kids/green/warming3.htm>
- *Land and Glaciers* Satellite Picture  
[http://www.eo.ucar.edu/educators/activities/Land\\_glaciers2.pdf](http://www.eo.ucar.edu/educators/activities/Land_glaciers2.pdf)
- *Looking into Surface Albedo* Worksheet  
[http://www.eo.ucar.edu/educators/activities/albedo\\_worksheet.pdf](http://www.eo.ucar.edu/educators/activities/albedo_worksheet.pdf)

## Directions

1. Have students read *When the Sun's Energy Gets into the Atmosphere* (URL above). Ask students if they have noticed feeling warmer when wearing black cloths on a sunny day. *Why is this so?*
2. Have each group look at the *Land and Glaciers* picture. The dark red parts of the picture are land (rocks). The white sections are ice and snow in glaciers. Lakes have formed from the glaciers' melt water.
3. Ask students to make a hypothesis about which areas would absorb the most solar energy and write it at the top of the worksheet.
4. Instruct students to fix thermometers to the back of the picture. One thermometer bulb should be under a section of light colored ice and the other under a section of dark red land. Place thermometers so that, when you lay the picture down, they are readable.
5. Place the light (not turned on) about a foot above the picture.
6. Ask groups to choose a data recorder, an ice thermometer reader, a land thermometer reader, and a timekeeper for the group.
7. Instruct groups to read their thermometers before the light is turned on and give the numbers to the data collector.
8. Instruct groups to turn on their light and begin timing. Temperature readings will be taken every two minutes (for 6 or 8 min).
9. Discuss results. Point out how this model is different than the real world (the differences based on the color of the surface but does not take into account the type of material). Explain that glacial ice is melting because of warming. *How would less ice affect the system?*

## Background Information

The amount of energy retained by the Earth is strongly dependant on the *albedo* of Earth surfaces. Just as some clouds reflect solar energy into space, so do light-colored land surfaces. Scientists use the term *albedo* to define the percentage of solar energy reflected back by a surface. Forests, grasslands, ocean surfaces, ice caps, deserts, and cities all absorb, reflect, and radiate solar energy differently. Sunlight falling on a white glacier surface reflects strongly back into space, resulting in minimal heating of the surface and lower atmosphere. Sunlight falling on dark soil or rock is strongly absorbed, and contributes to significant heating of the Earth's surface and lower atmosphere.

## Extensions

Try more climate activities from Project LEARN ([www.ucar.edu/learn](http://www.ucar.edu/learn)).

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students use a chemical indicator to test for the presence of carbon dioxide.
- Students learn about the role of CO<sub>2</sub> in the atmosphere.
- Students learn that plant and animal respiration is a source of CO<sub>2</sub>
- Students learn that plants are an important sink for CO<sub>2</sub>.

## Time

- 30 minutes, plus 15 minutes during the next day's class

## Materials

For each group of four:

- Test tube rack
- Six test tubes
- 8 cotton balls
- Bottle of BTB solution
- Straws
- Two sprig of *Elodea* (available in pet stores)

## National Standards

- D: Earth Science

## Source

- *This activity has been adapted from UCAR's Project LEARN Curriculum.*

# Plants, Animals, & Carbon Dioxide

*Students will test whether plants and animals are sources or sinks of carbon dioxide using the chemical indicator (BTB).*

## Related Kids' Crossing Web Pages for Students

- *Living in the Greenhouse: The Carbon Cycle* (1 page)  
<http://www.eo.ucar.edu/kids/green/cycles6.htm>
- *Living in the Greenhouse: The Warming Greenhouse* (5 pages)  
<http://www.eo.ucar.edu/kids/green/warming1.htm>

## Directions

1. Have students read the pages listed above.
2. Discuss how carbon dioxide (CO<sub>2</sub>) and other greenhouse gases affect the planet. *What puts CO<sub>2</sub> into the atmosphere ("sources"), and what takes it out ("sinks")*.
3. Divide students into groups of four and provide each group with the materials listed at the left. Introduce students to the chemical indicator BTB (bromothymol blue). (It is non-toxic, but consumption is not advised.) BTB is blue in color but will turn green/yellow in the presence of carbon dioxide. In this lesson students will use BTB to identify sources and sinks of CO<sub>2</sub>.
4. **Part A Question:** *Are plants a source or a sink of CO<sub>2</sub>?* To test, have groups place *Elodea* into two test tubes and fill each tube with BTB. Cover one test tube with foil (to simulate night) and leave one exposed to light (day). The class will need to come back to this part of the activity the next day, unwrap the foil-covered test tube and see that the BTB is yellow, while in the exposed test tube it is blue. Ask students for their explanations. Explain that plants release CO<sub>2</sub> during the night and take it up during the day.
5. **Part B Question:** *Are animals a source or sink for CO<sub>2</sub>?* To test, have each student take a test tube of blue BTB and place a straw in it. Explain that they are NOT going to drink the BTB, rather they are going to blow, making bubbles in the BTB. If their exhaled breath contains CO<sub>2</sub>, then the BTB should turn yellow. If it does not, then it should stay blue. Advise students to place cotton balls in the mouth of the tube to prevent splashing and blow very slowly. The BTB should turn yellow indicating that they are a source of CO<sub>2</sub>, just like all respiring plants and animals.

## Background Information

*About BTB:* When dissolved in water, CO<sub>2</sub> forms a weak acid called carbonic acid. BTB indicates the presence of this acid by turning from dark blue to green or yellow depending on the CO<sub>2</sub> concentration.

Carbon dioxide is one of the greenhouse gases, which keep Earth's temperature warm and habitable by trapping infrared energy, warming the atmosphere. However, in the last 150 years the amount of CO<sub>2</sub> in the atmosphere has increased rapidly causing global warming. In the big picture, exhaling CO<sub>2</sub> does not cause global warming. However, increased clearcutting of trees (less sinks) and burning fossil fuels (a large source) contribute to increased CO<sub>2</sub> levels in the atmosphere. **11**

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students learn that nitrogen cycles indefinitely through the Earth system.
- Students understand that nitrogen is essential for living things.
- Students learn the cycle is complex and nonlinear, traveling between organisms and the physical environment.

## Time

- 30-40 minutes

## Materials

- *Nitrogen Passport Worksheets* (URL above)
- 11 dice
- Dice Codes (print URL)
- 11 large signs with reservoir names
- 11 small rubber stamps
- 11 ink pads
- Paper and markers
- Computers with Internet access or printouts of the online reading listed above.

## National Standards

- A: Science as Inquiry
- D: Earth Science

## Source

- *This activity is from Windows to the Universe, another great resource from UCAR!*

# Travelling Nitrogen

*Students role play nitrogen atoms traveling through the nitrogen cycle.*

## Related Kids' Crossing (and UCAR!) Web Pages

- *Living in the Greenhouse: The Nitrogen Cycle*  
<http://www.eo.ucar.edu/kids/green/cycles7.htm>
- *Nitrogen Passport Worksheet* (pdf)  
[http://www.windows.ucar.edu/teacher\\_resources/nitrogen\\_worksheet.pdf](http://www.windows.ucar.edu/teacher_resources/nitrogen_worksheet.pdf)
- *Dice Codes* (pdf)  
[http://www.windows.ucar.edu/teacher\\_resources/n\\_dicecode.pdf](http://www.windows.ucar.edu/teacher_resources/n_dicecode.pdf)

## Directions

1. Set-up: Hang nitrogen reservoir signs around the room and place a die, stamp, ink pad, and appropriate dice codes at each station.
2. Have students read *Living in the Greenhouse: The Nitrogen Cycle* (URL above). Ask students: *Who needs nitrogen? Where is nitrogen found on Earth?* Explain that the places that nitrogen is stored are called *reservoirs*. Point out the nitrogen reservoir signs. Explain that in this activity, students will each be an atom of nitrogen travelling from reservoir to reservoir in the nitrogen cycle.
3. Handout *Nitrogen Passport Worksheets* and explain directions.
4. Spread students between reservoir stations and allow them to start traveling with their passport worksheet. For added excitement, have students try to complete their worksheet as quickly as possible.
5. When all have completed ten stops, have students draw diagrams (flow charts) of their route through the cycle. Post flow charts around the room so that everyone can have a look at them.
6. Discuss results: *Will your journey ever end? Was everyone's journey the same? Why not?* With student input, construct a large nitrogen cycle diagram that includes all potential routes.

## Background Information

Nitrogen is an element. It is found in living things like plants and animals. It is also an important part of non-living things like air and dirt. Atoms of nitrogen move slowly between living things, dead things, the air, soil and water. These movements are called the *nitrogen cycle*.

Most of the nitrogen on Earth is in the atmosphere. Approximately 80% of the molecules in Earth's atmosphere are made of two nitrogen atoms bonded together (N<sub>2</sub>). All plants and animals need nitrogen, but the nitrogen in the atmosphere is not in a form that they can use. Atmospheric nitrogen becomes usable for living things when broken apart during lightning strikes, fires, or by bacteria.

Most plants get the nitrogen they need to grow from the soils or water in which they live. Animals get nitrogen by eating plants or other animals. Dead organisms decompose bringing nitrogen into soil on land or into ocean water. Bacteria alter the nitrogen into a form that plants are able to use. Other types of bacteria are able to change nitrogen dissolved in waterways into a form that allows it to return to the atmosphere.

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
www.eo.ucar.edu

## Student Learning Objectives

- Students explore how light is scattered in Earth's atmosphere making the sky look blue and orange at sunset/sunrise.
- Students observe and describe observations.

## Time

- 15 minutes

## Materials

For each group of four:

- Tall clear drinking glass or clear soda bottle
- Water
- Whole milk (about a cup or a small carton)
- Drinking straws
- Flashlight
- Writing paper and pencil
- *Optional: Paint samples of various blue/orange/red colors to compare with the color of the scattered light*

## National Standards

- A: Science as Inquiry
- B: Physical Science
- D: Earth Science

## Source

- *A classic classroom activity and a favorite of the Education and Outreach staff at NCAR/UCAR!*

# Blue Skies and Red Sunsets

*Find out how some wavelengths of light are scattered more than others producing blue skies and red sunsets.*

## Directions

1. Darken the room by closing shades and turning off the lights. Have student groups shine a flashlight at the top of a tall glass of water.
2. Ask students to describe in writing the color of the light coming from the flashlight, the color of light as it travels through the glass, and the color of the liquid at the bottom of the glass. (Put a sheet of white paper on the far side to avoid seeing colors through the glass.)
3. Turn on the classroom lights and instruct student groups to fill their straw with about an inch of milk, add it to the glass of water, and mix. (If you are using a soda bottle, you will need to use more milk.)
4. Turn off the lights and again instruct student groups to shine a flashlight at the top of the glass of water.
5. Ask students to describe in writing the color of the light coming from the flashlight, the color of light as it travels through the glass, and the color of the liquid from the far side of the glass.
6. If your students can't see any change in color, instruct them to add a few more drops of milk to the mixture and try again. The light will look blue where it has travelled through milky water. At the other end of the container, where the light has traveled through most of the milky water, the light appears yellow, orange, or red.

## Background Information

Sunlight, or visible light, is composed of the rainbow colors: red, orange, yellow, green, blue, and violet. Visible light is a part of the electromagnetic spectrum and carries energy in waves. Colors towards the red end of the spectrum have longer wavelengths and colors near the violet end of the spectrum have shorter wavelengths. Light waves can transfer energy when they interact with matter.

The molecules and other particles in Earth's atmosphere scatter (re-emit) some wavelengths of light more easily than others. The shorter wavelengths, such as violet and blue are the most likely to be scattered. The sky is blue because our eyes are not very sensitive to violet light.

When the Sun is low in the sky, sunlight travels through a much greater thickness of atmosphere than it does when it is overhead. Over this greater distance, more wavelengths of light are scattered including longer wavelengths like green, yellow and orange. Only the red light comes through to your eyes; so, the setting Sun often looks red.

In this activity, the suspended particles of milk scatter light like molecules and other particles in Earth's atmosphere. Where the light has only traveled through the top layer of water, it appears light blue. Where it has traveled through most of the water, it appears yellow, orange, or red. If you add too much milk to the water, the glass will have a yellowish hue just like the atmosphere on a smoggy day.

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students experiment, records observations, and draw conclusions.
- Students learn how convection currents form and apply this knowledge to understand how thunderstorms form.

## Time

- 30 minutes

## Materials

- A clear plastic shoebox-sized container for each group
- Red food coloring
- Ice cubes made with blue food coloring and water
- Colored pencils (red and blue)
- Index cards or paper
- Internet access or printed copies of the student version (URL above)

## National Standards

- A: Science as Inquiry
- D: Earth Science

## Source

- *This activity is from Web Weather for Kids, another great educational project of NCAR/UCAR!*

# Make Convection Currents!

*In this activity students learn how warm and cool fluids create convection currents.*

## Related Kids' Crossing Web Pages for Students

- *How Do Thunderstorms Form?*  
<http://www.ncar.ucar.edu/eo/kids/dangerwx/tstorm4.htm>
- Student Version of Activity from *Web Weather for Kids*  
[http://www.ucar.edu/educ\\_outreach/webweather/tornact2.html](http://www.ucar.edu/educ_outreach/webweather/tornact2.html)

## Directions

1. Divide students into groups of four. Have groups read the article *How Do Thunderstorms Form?* and the Student Version of this activity (URLs listed above).
2. Discuss the reading as a class including discussion of what thunderstorms need to form and the role of convection. Explain that in this activity students will observe how convection works using water. Air masses move in the same ways.
3. Provide each group with a plastic container 2/3 full of room temperature water. Instruct students not to move the container or the table so that the water becomes completely still.
4. Provide each student group with a blue ice cube to put at one end of their container. (Alternatively, use a drop of blue coloring on ice.)
5. Put two drops of red food coloring at the other end of each container. (For dramatic effect, heat the red coloring bottle in warm water.)
6. Have students observe the long sides of the container to see where the blue and red food coloring travel. Ask each student to draw a picture that describes his/her observations and hang it on the wall. Ask students to look at the pictures of other groups.
7. Class discussion: *Did similar things happen to the food coloring for each group?* (Hopefully, yes.) *What happened to the blue?* (It sunk.) *And the red?* (It stayed above the blue.) *What was the difference between the blue and red water?* (Temperature) *That's convection! How is convection needed to form a thunderstorm?*

## Background Information

Convection is the transfer of heat by the movement or flow of a substance from one position to another. A thunderstorm is caused when a body of warm air is forced to rise by an approaching cold front. This rising air is called an updraft. The warm air is typically moist and when it rises, meeting cold air above, the water in it condenses, becoming a cumulus cloud. The condensation releases latent heat which helps fuel the thunderstorm.

## Extensions

Read and discuss: *A Close Encounter with Lightning* (<http://www.eo.ucar.edu/kids/dangerwx/tstorm9.htm>) and *Thunderstorm Safety* (<http://www.eo.ucar.edu/kids/dangerwx/tstorm7.htm>).

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students collect, analyze data and present results.
- Students learn that lightning and thunder happen at the same time but light is seen first because light travels faster than sound.

## Time

- 50 minutes (or 10 minutes without data analysis)

## Materials

- A nearby thunderstorm (or simulate one! See *Extensions* section at right)
- Stopwatches (or the ability to count “one-Mississippi, two-Mississippi...)
- Paper and pencil for data recording
- Classroom clock
- Craft paper and markers
- Internet access or printed copies of the student version printed from Kids' Crossing (URL above)

## National Standards

- A: Science as Inquiry
- B: Physical Science
- D: Earth Science

## Source

- *This classic activity is from Web Weather for Kids*

# How Far Is That Storm?

*In this activity students figure out how far they are from a storm by watching lightning and listening for thunder.*

## Related Kids' Crossing Web Pages for Students

- *Watch Out for Dangerous Weather!*  
<http://www.eo.ucar.edu/kids/dangerwx/index.htm>
- Student Version of Activity  
<http://www.eo.ucar.edu/kids/dangerwx/tstorm6.htm>

## Directions

1. Divide students into groups of four. Have groups read the Student Version of this activity (URL listed above) for instructions.
2. Discuss the reading as a class including how light and sound travel at different speeds, and the directions for the activity.
3. Assign student groups stopwatches, paper and pencil and a safe space near a window from which to witness lightning and thunder.
4. Instruct students to time the number of seconds between the flash of lighting and the rumble of thunder. Have them write down the both the time that the measurement was taken and number of seconds. If the weather allows, have groups take several measurements over 15 minutes or more, noting the time of each measurement. (This will allow students to assess whether the storm is moving towards the school or away.)
5. Have student groups calculate the distance of the storm from the measurements using these instructions: *For every 5 seconds the storm is one mile away. Divide the number of seconds you count by 5 to get the number of miles.* If student groups made several measurements, have them perform the calculation for each measurement to try to answer the following: *Was the storm moving towards school, away from school, or not moving either direction?*
6. Assessment: Have student groups create a poster from a sheet of craft paper that displays their data both in a table and visually (with a graph or map) to present their analysis to the class. Hang posters around the room and discuss all results.

## Background Information

A bolt of lightning heats the air along its path causing it to expand rapidly. Thunder is the sound caused by the rapidly expanding atmosphere. The light and sound actually happen at the same time, but the light of the lightning flash travels faster than the grumbling sound of the thunder. The time between the flash of light and thunder will tell you how far you are from where the lightning struck.

## Extensions

Read and discuss: *A Close Encounter with Lightning* (<http://www.eo.ucar.edu/kids/dangerwx/tstorm9.htm>) and discuss safety.

If you don't have a nearby thunderstorm, have students practice the calculations to gage the distance of the imaginary storm by counting seconds between “lightning” (flash room lights) and “thunder” (clash symbols)

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students learn that a tornado is a vortex and how a vortex can form in fluids.

## Time

- 20 minutes

## Materials

- An 8 oz. jar with lid for each pair of students
- Water
- Vinegar
- Clear liquid dish soap
- Glitter
- Computers with Internet access or printouts of the Web site section (URL above)

## National Standards

- A: Science as Inquiry
- B: Physical Science
- D: Earth Science

## Source

- *This activity is adapted from Web Weather for Kids, another educational web resource from NCAR/UCAR!*

# Make a Tornado in a Jar!

*Students make a vortex that looks like a real tornado!*

## Related Kids' Crossing Web Pages for Students

- *Look Out For Dangerous Weather Tornado Section*  
<http://www.eo.ucar.edu/kids/dangerwx/tornado1.htm>
- *Student Version of Activity*  
<http://www.eo.ucar.edu/kids/dangerwx/tornado4.htm>

## Directions

1. Have students read the five pages of the *Look Out For Dangerous Weather Tornado Section* (URL above). Discuss the reading as a class. Ask students what area of the United States has the most tornadoes and whether the state where they live is at high risk. Ask students what conditions are necessary for a tornado to form.
2. Divide students into pairs and have each pair read the directions in the student version of the activity (URL above).
3. Provide each group with a glass jar to fill with water, a teaspoon of dish soap, a teaspoon of vinegar, and a pinch of glitter.
4. Instruct students to swirl or twist jar in one direction to form the vortex, then place the jar on the table and look at the side to watch the mini-tornado continue to spin.
5. Summary questions for class: *How is this model like a real tornado? How is it different?*

## Background Information

As you twist the jar, the water up against the glass is pulled along due to its friction against the glass walls. The fluid toward the inside takes longer to get moving. But eventually both the glass jar and the fluid are spinning as you rotate the bottle. When you stop rotating the jar, the fluid inside keeps spinning. A mini twister can be seen for just a few seconds when the outer fluid slows down and the inner fluids continue to spin rapidly.

### *How is this like a real tornado?*

Winds moving at different speeds likely start a real tornado spinning. Much in the same way, there is water in the jar moving at different speeds. Students may have difficulty understanding that what is happening in the water is analogous to what happens in the air. Consider taking a minute to explain that both air and water are fluids and behave in similar ways.

## Extensions

Make a more dramatic model of a tornado. Instructions provided on page 17 of this Educators Guide or at [http://www.eo.ucar.edu/educators/activities/KCactivity\\_maketornado.pdf](http://www.eo.ucar.edu/educators/activities/KCactivity_maketornado.pdf)

Read the story *Tornadoes on the Soccer Field*, by Nicole Gordon (<http://www.eo.ucar.edu/kids/dangerwx/tornado2.htm>) and discuss tornado safety.

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students learn how rotating air and an updraft can cause a tornado.

## Time

- 40-50 minutes

## Materials

For each group:

- 10" x 12" piece of wood or foam core board
- Two 9" x 10" clear acetate sheets (.010" thickness)
- Glue gun or tape
- Small hand fan
- Deli dish or cup
- 7" clear plastic plant saucer with a 2" diameter hole cut in the middle
- Water
- Dry ice (Find it at a grocery; only a teacher wearing gloves should handle it!)
- Gloves (for teacher)
- Internet access or printed copies of reading (URLs above)

## National Standards

- A: Science as Inquiry
- B: Physical Science
- D: Earth Science

## Source

- *This activity is from Web Weather for Kids!*

# Make a Tornado Model!

*In this activity students create and observe a vortex.*

## Related Kids' Crossing Web Pages for Students

- *Look Out for Dangerous Weather Tornado Section*  
<http://www.eo.ucar.edu/kids/dangerwx/tornado1.htm>
- *Student Version of Activity from Web Weather for Kids*  
[http://www.ucar.edu/educ\\_outreach/webweather/tornact3.html](http://www.ucar.edu/educ_outreach/webweather/tornact3.html)

## Directions

1. Have groups read the *Look Out for Dangerous Weather Tornado Section* (URL above) and discuss the reading as a class. Ask students what conditions are needed for a tornado to form (mainly rotating air and an updraft). Explain that in this activity students will make a model of those conditions to form a miniature tornado.
2. Divide students into groups of four or five and have each group read the student version of the activity (URL above). If possible, show students a completed version of the set-up so that they know what the product will look like. Provide groups with supplies (not dry ice yet).
3. Instruct student groups to use glue gun or tape to attach the cup in the center of wood or foam core board.
4. Point out the top view diagram (steps 2 and 3 on the Student Version) when students are gluing the acetate sheets. Glue one of the acetate sheets to one side of the cup. Then glue the rest of the sheet in a half circle around but not touching the cup. Glue the second sheet around the opposite side of the cup in a similar fashion. The two sheets must overlap, but not touch.
5. For each group, pour about half a cup of water into the deli dish and, using gloves, place a few small pieces of dry ice into the water.
6. Once dry ice and water are in the cup, instruct students to place the plant saucer upside down on top of the upright pieces of acetate and hold the fan over the hole in the saucer to draw the air up. Be patient, adjusting the fan until a vortex forms.

## Background Information

The whirling fan at the top creates a spinning "updraft" or vortex. This pulls air in at the bottom of the container (in the spaces between acetate sheets) and out through the hole in the plant saucer.

*About Dry Ice:* Dry ice is frozen carbon dioxide. It quickly turns to a gas as it warms. The gas cools the air, causing a cloud to form as water vapor condenses. The little cloud enters the updraft created by the fan, allowing us to see the shape of the vortex just like we might see the dust and debris that a tornado has picked up from the land. If dry ice is not available in your area, try using the KERI electric Mist Maker with higher vinyl walls and a larger dish to contain the water. (*We purchased ours in January 2005 for \$24 from mainlandmart@yahoo.com.*)

## Extensions

Read *Tornadoes on the Soccer Field* (<http://www.eo.ucar.edu/kids/dangerwx/tornado2.htm>) and discuss tornado safety.

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students learn how storm surge forms during a hurricane.
- Students learn how the shape of a coastline influences the amount of flooding caused by a hurricane's storm surge.

## Time

- 30-40 minutes

## Materials

For each group:

- A plastic plate with a line marked inside the rim with permanent marker
- Container of playdough
- Six sugar cubes
- One cup of water tinted with blue food coloring.
- Computers with Internet access or printouts of the pages at the URLs above.

For the class:

- Hair dryer
- A baking sheet or plastic garbage bag

## National Standards

- A: Science as Inquiry
- D: Earth Science

## Source

- *Developed by staff of the UCAR Office of Education and Outreach*

# Make a Model of Storm Surge!

*Students model conditions during a hurricane that produce storm surge and witness its impact on model coastlines.*

## Related Kids' Crossing Web Pages for Students

- *How Do Hurricanes Form?*  
<http://www.eo.ucar.edu/kids/dangerwx/hurricane3.htm>
- *Hurricanes Impact Our Lives*  
<http://www.eo.ucar.edu/kids/dangerwx/hurricane1.htm>
- Student Version of Activity  
<http://www.eo.ucar.edu/kids/dangerwx/hurricane4.htm>

## Directions

1. Have students read *How Do Hurricanes Form?* and *Hurricanes Impact Our Lives* (URLs above). Discuss the reading as a class. Ask students what storm surge is and what causes it. *What type of coastline will be impacted the most by flooding?* Show students photographs of different types of coasts (some are flat or have steep cliffs, and they may have river drainages). Describe how the ocean close to shore can slope gradually or steeply.
2. Divide students into groups and have each group read the student version of the activity (URL above). Set up the challenge with the class: *Based on your knowledge of what type of coastline will have the most flooding, can you make a model coastline that has one area that will get the worst flooding and one area that will not flood?*
3. Provide each group with a plastic plate, a container of play-dough to form the land, and six sugar cubes, which will represent houses along the coast. Tell groups that the blue line on the plate is the level of the ocean water under normal high-tide conditions.
4. Allow each student group to create their coastlines on one side of the plastic plate. Have students decide where to locate the sugar cube houses. Then have students fill the plastic plate with blue water up to the line.
5. Test student models one at a time. Gather the class around a model and allow the group to explain where they think there will be the most flooding and which areas will not flood. Aim the hair dryer so that wind blows across the "ocean" towards the "land". The water will have nowhere to go and will pile up on the shore. The sugar houses that have been flooded will be blue in color and may start to fall apart. (As water will likely splash out of the plate, you may wish to put the models in a baking pan or plastic garbage bag.)
6. Summary: *Did the models work as students predicted they would?*

## Background Information

In this model, the hair dryer is simulating the winds of a hurricane, which push water into a mound at the storm's center. As the hurricane approaches the coast, the mound of water is unable to escape anywhere but onto land. A hurricane will cause more storm surge in areas where the ocean floor and coastal areas slope gradually.

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students learn how snowflakes form and examine the variety of snowflake shapes.

## Time

- 30 minutes or less

## Materials

- Small or medium sized pieces of black construction paper
- Magnifying glasses
- Warm winter cloths
- Falling snow
- Clipboards, paper, and pencils for snowflake sketches
- Computers with Internet access or printouts of the pages at the URLs listed above.

## National Standards

- D: Earth Science

## Source

- *A classic!*

# Catching Snowflakes

*Students observe the varied shapes and sizes of snowflakes.*

## Related Kids' Crossing Web Pages for Students

- *How Do Blizzards Form? (Look Out for Dangerous Weather)*  
<http://www.eo.ucar.edu/kids/dangerwx/blizzard3.htm>
- Student Version of Activity  
<http://www.eo.ucar.edu/kids/dangerwx/blizzard4.html>

## Directions

1. Have students read *How Do Blizzards Form?* (URL above) and discuss the reading as a class. Ask students what conditions are needed for snowflakes to form.
2. Have students look at the Student Version of the activity (URL above) and discuss the two snowflakes that researcher Nancy Knight found that are virtually identical. Ask students if they think they could find snowflakes that look alike in the snow falling outside.
3. Dress warmly and head outside into the falling snow. Have each student take a black piece of paper and magnifying glass with them.
4. Instruct students to hold black paper flat so that snowflakes fall on it. Keep hands at the paper's edges to avoid melting the snowflakes.
5. Allow students to look for similar and different types of snowflakes through the magnifying glass. Have students sketch the shapes of the snowflakes they see with paper and pencil.
6. Hang students' snowflake sketches around the classroom and allow students to take a look at the variety of shapes. In some snowstorms, most flakes will look similar, and in others there will be a variety of shapes and sizes.

*Note: If you find it impractical to wait for a snowstorm, snowflakes can be preserved instead for future use. Catch them on glass microscope slides and spray lightly with Aqua-Net hairspray. The snowflake will melt but the shape will be preserved by the hairspray. Students will likely need a microscope to see them.*

## Background Information

Snowflakes form in clouds where the temperature is below freezing (0°C, or 32°F). The ice crystals form around tiny bits of dirt that have been carried up into the atmosphere by the wind. As the snow crystals grow, they become heavier and fall toward Earth. A snowflake is made of up to 200 ice crystals. Different types of snowflakes form in different conditions. Temperature determines if the crystals become a flat plate, a long column, or a prism shape. Snowflakes have a tendency to form a hexagon shape because that is how water molecules organize themselves as they freeze. If a flake spins as it falls, it may be perfectly symmetrical. But if it falls sideways, it will end up lopsided.

## Extensions

Play the *Winter Storms Are Different True-False Game* (<http://www.eo.ucar.edu/kids/dangerwx/blizzard1.htm>)

Read and discuss the story *Adventures in Snow*, by Colette LaForce (<http://www.eo.ucar.edu/kids/dangerwx/blizzard2.htm>).

# Kids' Crossing Hands-on ACTIVITIES

Resources for Educators from the  
National Center for Atmospheric Research  
[www.eo.ucar.edu](http://www.eo.ucar.edu)

## Student Learning Objectives

- Students learn that lightning forms because of the attraction of positive and negative charges.

## Time

- 30 minutes

## Materials

For each group of four:

- Styrofoam plate
- Thumbtack
- Pencil with new eraser
- Aluminum pie plate
- Small piece of wool fabric
- Internet access or printed copies of the reading and student version (Note: there are animations on the Web pages, so using computers rather than printouts is preferable.)

## National Standards

- A: Science as Inquiry
- B: Physical Science
- D: Earth Science

## Source

- *This activity is from the Web Weather for Kids web site, another great educational project of NCAR/UCAR!*

# Make Lightning!

*In this activity students observe lightning formation.*

## Related Kids' Crossing Web Pages for Students

- *What Gives Lightning its Zap?*  
<http://www.eo.ucar.edu/kids/dangerwx/tstorm5.htm>
- Student Version of Activity from *Web Weather for Kids*  
[http://www.ucar.edu/educ\\_outreach/webweather/lightningact.html](http://www.ucar.edu/educ_outreach/webweather/lightningact.html)

## Directions

1. Divide students into groups of four. Have groups read the article *What Gives Lightning its Zap?* and the Student Version (URLs listed above). Discuss the reading and directions as a class. Make sure students understand of the concept of negative and positive charges.
2. Distribute supplies and directions to each group. If possible, show students a completed version so they know what it should look like.
3. Instruct students to push the thumbtack through the center of the pie pan from the bottom and then push the eraser end of the pencil into the thumbtack. Students should only hold the pie plate by the pencil.
4. Following the directions in the students handout, complete the set-up by putting the Styrofoam plate upside-down on a table, rubbing the bottom of the plate vigorously with the wool for one minute, picking up the pie pan with its pencil handle and placing it on top of the styrofoam plate.
5. Instruct a student from each group to touch the edge of the pie plate with a finger. Ask if they felt a shock. Have groups repeat the process of rubbing the plate with the cloth and allow another member of the group to touch the pie plate. Students may be able to actually see the sparks if the classroom lights are turned off. (This experiment works best in low humidity.)
6. For extra excitement, get a Neon Gas Spectrum Tube (about \$20 from Edmund Scientific, among other places). Tell students that on the count of three you will turn off the room lights. That is when students should touch the end of the tube to the pie plate. They the tube touches the plate, they will see a spark - lightning!

## Background Information

When negative charges (electrons) in the bottom of a cloud are attracted to positive charges (protons) in the ground, and the protons rush up to meet the electrons, we see lightning. In this experiment, the finger is the cloud and the pie pan is the ground. Rubbing the Styrofoam plate with the wool cloth generates the positive charge as electrons are rubbed off of the plate. Students will likely be able to provide other examples of static electricity and attraction from daily life (e.g., shuffling across carpet, clothing stuck together, rubbing balloons against clothing).

## Extensions

Play the *Lightning Impacts Our Lives* True-False quiz (<http://www.eo.ucar.edu/kids/dangerwx/tstorm2.htm>). Read and discuss: *A Close Encounter with Lightning* (<http://www.eo.ucar.edu/kids/dangerwx/tstorm9>).