Elementary Cloud Science

Lisa Gardiner
K-12 Education Manager
UCAR Center for Science Education

Friday, March 13 12:30 PM - 1:30 PM, McCormick Place, S502b
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- We develop innovative K-12 educational resources for teaching about climate, weather, and earth science.
- We provide informal learning experiences at the NCAR Mesa Lab in Boulder, CO including field trip programs and exhibits.
- We offer teacher professional development from short workshops to year-long courses.
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Clouds, A Teaching Box

Clouds are both universal and mysterious. The science of clouds helps students feel closer to the sky and in awe of nature as they learn elementary concepts of physics, the water cycle, and atmospheric science. Explore the educational resources in this teaching box and bring cloud science to your elementary students.

Teaching Boxes are collections of classroom-ready and standards-aligned activities, content, and multimedia that build student understanding of science, technology, engineering, and math.

Overview

The UCAR Center for Science Education Teaching Boxes are themed collections of classroom-ready educational resources to build student understanding of science, technology, engineering, and math (STEM). Resources highlighted within teaching boxes are from various science education programs and all have been vetted by the the Center's education team.

- Topic: Clouds
- Level: Upper elementary
- How to use this resource: Each tab correlates with a part of the scope and sequence for this topic and includes links to hands-on activities, background content, and multimedia resources. Select resources within each tab that are best suited for your students to meet the learning goals. (There are often more resources linked within each section than you will need.)
- Printable version of this overview (PDF)
What is a teaching box?

- Themed collections of classroom-ready educational resources to build student understanding of science, technology, engineering, and math (STEM).
- Resources highlighted within teaching boxes are from various science education programs and all have been vetted by the our educators.
Clouds Teaching Box: How Clouds Form

Goal: Students learn about the ingredients needed to make a cloud, and the role that air pressure and temperature play in cloud formation.
What does it take to make a cloud?

Explore cloud formation with simple models.

Portable cloud

• What you’ll need:
  – Gallon jar
  – Rubber glove
  – Warm water
  – Matches
Explore cloud formation with simple models.

Cloud in a Bottle

• What you’ll need:
  – Bike pump
  – Clear plastic bottle
  – Rubber stopper
  – Warm water or alcohol
  – Safety glasses

Brian Jones at CSU’s Little Shop of Physics makes a cloud!
Clouds are made of water droplets or ice crystals that are so small and light they are able to stay in the air. But how does the water and ice that makes up clouds get into the sky? And why do different types of clouds form?

The water or ice that make up clouds travels into the sky within air as water vapor, the gas form of water. Water vapor gets into air mainly by evaporation – some of the liquid water from the ocean, lakes, and rivers turns into water vapor and travels in the air. When air rises in the atmosphere it gets cooler and is under less pressure. When air cools, it’s not able to hold all of the water vapor it once was. Air also can’t hold as much water when air pressure drops. The vapor becomes small water droplets or ice crystals and a cloud is formed.

It’s easier for water vapor to condense into water droplets when it has a particle to condense upon. These particles, such as dust and pollen, are called condensation nuclei. Eventually, enough water vapor condenses upon pieces of dust, pollen or other condensation nuclei to form a cloud.

Some clouds form as air warms up near the ground and rises. Heated by sunshine, the ground heats the air just above it. That warmed air rises until it cools, condenses, and forms a cloud. This warm front is the source of the air that makes up some clouds.
How Clouds Form

Clouds are made up of tiny water droplets and ice crystals that are so small they can float in the air. If the droplets become large enough, you will be able to see them as cloud or fog. If they become even larger, they can fall as rain (or snow).

The water in a glass, like the one shown below, might not look like it is moving at all, but the molecules that make up the water are always moving. When the water is warm, the molecules move faster. When the water is cool, the molecules move more slowly. Some of the molecules are moving fast enough that they escape into the air. When water molecules move from the glass into the air, the water is evaporating. If we heat the water, more water molecules evaporate becoming water vapor. If the air cools, then water vapor molecules slow down and some can not remain a vapor. They cluster in the air to form tiny liquid droplets. This is called condensation. In clouds, the liquid droplets formed by condensation are small and light enough that they stay in the air. If they grow large enough, they will fall to the ground as precipitation.
The story of convective cloud formation
The story of convective cloud formation
The story of convective cloud formation
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Clouds Teaching Box: Observing Clouds

Goal: Students learn how to observe and describe clouds.
Goal: Students learn to observe & describe clouds.
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<table>
<thead>
<tr>
<th>Cloud Height</th>
<th>Cloud Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Cirrus</td>
</tr>
<tr>
<td></td>
<td>Cirrostratus</td>
</tr>
<tr>
<td></td>
<td>Cirrocumulus</td>
</tr>
<tr>
<td>Medium</td>
<td>Altostratus</td>
</tr>
<tr>
<td></td>
<td>Altocumulus</td>
</tr>
<tr>
<td>Low</td>
<td>Cumulus</td>
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<tr>
<td></td>
<td>Stratus</td>
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<tr>
<td></td>
<td>Stratocumulus</td>
</tr>
<tr>
<td></td>
<td>Cumulonimbus</td>
</tr>
<tr>
<td></td>
<td>Nimbostratus</td>
</tr>
</tbody>
</table>
Goal: Students learn to observe & describe clouds.

High-level Clouds are white and thin-looking. At sunrise or sunset, they can be very colorful. They are most often made of ice crystals.

Mid-level Clouds are made mostly of water droplets. When temperatures are very low, the water droplets can turn to ice crystals.

How are clouds classified? Scientists classify clouds by how high they are in the sky (low, medium or high), and by whether they are flat (stratus), puffy (cumulus), rain-filled (nimbus), or a combination of these characteristics.

How does the Cloud Viewer work? Cut along the dashed line in the center of the page. Look through the opening in the Cloud Viewer at the sky above you. What types of clouds do you see today? Use the Cloud Viewer to help you classify the clouds outside.

Low-level Clouds are made of water droplets. Cumulonimbus clouds (9) can rise rapidly causing water droplets to turn to ice.

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Goal: Students learn to observe & describe clouds.
Goal: Students learn to observe & describe clouds.

The Art of Clouds

Can you guess which clouds the artist painted?
Title: Weymouth Bay
Artist: John Constable, a 19th century British artist
Cumulus clouds
Tomorrow’s workshop:

Climate Is Elementary
Saturday, March 14
9:30 AM - 10:30 AM
McCormick Place, S502a
Get the workshop handouts at: SciEd.ucar.edu/workshops

Lisa Gardiner
lisagard@ucar.edu