Grade 5 - Earth Science
Weather

Standards:
 Differentiates between weather and climate
 Distinguishes among the various forms of precipitation
 Explains how air temperature, moisture, wind, precipitation, and global patterns influence weather

Teacher background

The following are demonstrations and labs to complement your teaching on weather and climate. Students will need to research and read about weather, but the demonstrations and labs will help them understand how the things they have been reading about work.

Weather is a combination of air moisture, movement and temperature. Climate is the same thing, but over a much longer period of time. Weather is right now. Climate is the weather for the past 10, 100 or 1000 years.

In order to teach weather, this unit should include some information on air pressure and how high and low air masses interact to create weather, thus there are some air pressure demonstrations included here.

All weather originates with the Sun. It is the engine that drives our weather system. In general, air is heated over land and cooled over ice or oceans. When the air is heated, it rises, causing it to pile up and form high-pressure air masses. Where there is only a little air, it is said to be a low-pressure system. When a low-pressure air mass meets a high-pressure air mass, the air moves from the big pile of air (high-pressure) to the small pile of air (low-pressure). This is the cause of wind.

When air travels over water, it picks up moisture from evaporation. This makes the air heavy and it does not pile up very high. Low-pressure systems produce low clouds and precipitation, (i.e. storms) while high-pressure is generally bright (though high-pressure can be humid).

Precipitation is caused when low-pressure and high-pressure air masses meet. The air moves from high to low pressure, creates wind and friction, which causes water vapor (clouds) to meet and condense, eventually leading to precipitation.
Web resources


Convection current demonstration- http://www.ucmp.berkeley.edu/education/dynamic/session1/sess1_act2.html
Try this, I think it is a good demonstration.

Requirements for different forms of precipitation

Sleet formation http://www.geography.hunter.cuny.edu/~tbw/wc.notes/5.cond.precip/precipitation/sleetformation.jpg

Rain formation http://www.geography.hunter.cuny.edu/~tbw/wc.notes/5.cond.precip/precipitation/precip.types.rain.jpg

Snow formation http://www.geography.hunter.cuny.edu/~tbw/wc.notes/5.cond.precip/precipitation/precip.types.snow.jpg

This also involves convection currents.

What causes the Jet Stream and what is it? Short slide show http://www.pbs.org/wgbh/nova/vanished/jetstream.htm


Ocean currents can be viewed here http://www.physicalgeography.net/fundamentals/8q_1.html .
The ocean current circulations in the North Atlantic and North Pacific create the general flow of weather systems from west to east. This also shows convection currents. Warm water = red, cold water= blue
Surface water temperature effects air temperature. England is much farther north than New England, yet is a milder climate due to the warm water Gulf Stream. (thus the pilgrims shock at our cold winters)

Use a blank world map, like this http://www.worldatlas.com/atlas/moutline.htm or http://alabamamaps.ua.edu/contemporarymaps/world/world/index.html
Have students color in the location of rain forests(green on this map http://upload.wikimedia.org/wikipedia/commons/8/8d/Rain_forest_location_map.png )
and deserts (brown like this map http://www.enchantedlearning.com/label/geography.shtml) on the land masses. Then using blue, color in the path of the ocean currents. Rain forests must get rain from wet air that has traveled over the ocean and deserts have air that has no water is traveling over land. This will not give you a complete pattern, but it will give you the beginning of a global weather pattern. By combining the map of rainforest, deserts and ocean currents, students will see how currents effect global weather patterns.

Climate http://www.cgrove417.org/fry/Science/Climate/climatezones.html
General climate zones

Cloud formation - A demonstration using a soda bottle and smoke from a match (is this allowed?)
http://www.wikihow.com/Make-a-Cloud-in-a-Bottle
Lesson 1 - Climate and Weather

Objective: Learn the difference between climate and weather

Materials: Map of global climate zones (web resources)

Procedure:
1. Place students in small groups and assign a climate zone and location to research the weather. (i.e. East coast of US, Caribbean islands, Greenland etc.)
   a. Tropical
   b. Temperate
   c. Polar

2. Students should find out the following for their zone.
   a. Average temperature
   b. High and Low yearly temperature
   c. Average precipitation
   d. Type and Length of seasons
   e. General wind direction or jet stream (east to west, west to east, SE to NW etc.)

3. Students present their weather information about their climate to the class.
4. Extensions:
   a. How do people live here?
   b. Write a story about life here
   c. Map the locations on a classroom size map with labels.
Lesson 2 - Global Climate patterns

Objective: For students to understand how Global wind patterns influence world climate

Materials: Blank world map
http://www.bristolstories.org/site_images/big_world_map.jpg

Procedure:
2. Color in the location of deserts brown all over the world’s continents. Sahara, Western Australia (Outback), Gobi, Sonoran/Mojave
3. Next, draw in the prevailing wind patterns on the globe over the oceans. See this map. http://www.physicalgeography.net/fundamentals/8q_1.html View at 15%.

Questions:
1. What is the ocean wind pattern near deserts? (wind blows away from them after it travels over land)
2. What is the ocean wind pattern near rain forests? (wind blows over the ocean toward the land)
3. Where does the water that rains on the Amazon come from? (Atlantic ocean)
4. How do global wind patterns produce rain forests? (Wind blows across the ocean picks up moisture and rains on the land to make rain forests.)
5. How do global wind patterns produce deserts? (wind blows across the land and cannot pick up enough water to rain on the deserts) or (wind blows away from the deserts across the water)

This will not give you a complete pattern, but it will give you the beginning of a global weather pattern.
Lesson 3 - Precipitation

Objective: to learn about water vapor, condensation and precipitation

Materials: Soda bottle match warm water

Procedure:

2. Explain that the water vapor in the air from the warm water below condensed around the smoke pieces in the air and formed bigger drops, called a cloud.

3. Clouds form when water vapor condenses. Usually this is due to decreased temperatures. If the condensation continues, the water drops will become too big to stay in the air.

Questions:
1. Where did the water vapor in the bottle come from? (the warm water below)
2. Why did the cloud form? (when the squeeze is released, the pressure dropped and the water droplets condense on the smoke particles)
3. How does a real cloud form? (water vapor rises, enters colder and lower pressure air and condenses)

Lesson/Demonstration 4 - Air Masses and Air Pressure
(this could be several lessons)

Teacher Background: Air and water are fluids and act the same. This lesson will look at the cause of air pressure and will give students a better understanding of why weather occurs.

Objective: Understand principles of air pressure

Materials: 2 liter soda bottle with 3 holes at on one side at different depths
2 liter soda bottle with 3 holes on different sides at the same depth
water
dishpan or tub to catch water that drip out of the bottle (or a sink)
optional: food coloring

Procedure:
1. Have students copy the following principles in their notebook.
   Principles of Air pressure (they are the same for water)
   1. Air distributes forces (pressure) equally in all directions.
2. Air pressure increases with depth
3. High air pressure pushes more than low air pressure
4. Air flows from areas of high pressure to areas of low pressure

2. Pressure and depth
Use soda bottle with three holes punched down the length of it. Make the holes with a thumb tack. Use a strip of tape to cover the holes. Keep the cap screwed on and remove the tape.

A. Ask students to predict what will happen and why when you remove the cap. Remove the cap and the water at the top hole does not flow out as far as the water from the bottom holes. Ask students to explain what happened using the principles listed above. (#2. pressure increases with depth)

B. Ask students to predict what will happen and why when you put the cap back on. (#4. Air flows from high pressure to low pressure. The air holds the water back because it is more powerful, more pressure outside of the bottle than inside)

3. Direction of pressure
Use a soda bottle with holes punched in three different directions all at the same depth. Cover with tape and place the cap on the bottle. Remove the tape.

A. Ask students again to predict what will happen when the tape and cap is removed, using the principles in their notebook. (1. air distributes forces (pressure) in all directions equally)

B. Ask students to predict what will happen when you put the cap back on (4. Air flows from areas of high pressure to areas of low pressure)(In this case, High pressure is outside the bottle and low pressure is inside the bottle, so much so that the water is held back by the outside air)

C. With the cap on and no water coming out, ask the students to predict what will happen if you push on the bottle above one of the holes. Have them explain based on the four principles (1. Air distributes forces (pressure) equally in all directions. Water comes out equally in all directions. Be careful you don’t get wet!) You can repeat this by pushing in many different spots.

4. Air Flow- (practice this first) Place a notecard over a small cup of water and tip it upside down. Hold the card against the cup while it is upside down. A little water should escape. The card will stay on the cup and the water will not spill out because the air pressure is stronger than the water pressure. Ask students to explain. Air moves from high pressure areas to low pressure areas, thus holding up the water and the card.

How all this relates to weather…

1. High pressure air is caused by large piles of air overhead, thus we are deep under the air.
2. Air pressure decreases as you go higher into the atmosphere, thus the weather changes.
3. Wind is caused by air flowing from areas of High pressure to areas of Low pressure. The greater the difference, the greater the wind speed. The movement of air creates friction, static electricity can build up in clouds and storms can form.
4. Water is more likely to evaporate under low pressure than high pressure, thus low pressure systems often have more moisture than high pressure systems.

Lesson 5 - Analyzing Today’s Weather

Objective: To be able to explain the mechanisms of today’s weather using the terms pressure, front, jet stream and precipitation.

Materials: A current weather map www.weather.com

Procedure:
1. Students should already know the symbols for a warm and cold front along with High and Low pressure symbols.
2. Have students look at a map of the US and explain why we are having the weather we have today.
3. Choose a different location for each student.
4. Add wind direction to a map and ask students to predict the weather tomorrow or next week.
Earth Science – Grade 5
Soil Property Activities

Standards:
 Explain and give examples of ways in which soil is formed
 Recognize and discuss the different properties of soil, including color, texture, the ability to retain water and the ability to support the growth of plants.

Teacher background
Soil is made from the weathering of rocks. Big rocks become little rocks through a variety of processes (water, freezing, animal and plant action, glaciers etc.) The little rocks are mixed with dead organic matter (humus) and clay. These three main elements and how they are mixed determine the properties of soil.

Sand – large particles, produce big pores in the soil, provide minerals for plants. Different kinds of sand are different colors.
Silt – smaller particles, produces smaller pores which hold water better
Clay – tiny pieces which makes very tiny pores, holds water very well, but may also prevent water from getting through the soil. Clay also provides minerals for plants.
Humus - Organic matter – dead leaves, insects, etc. provides minerals to plants

1. Weathering and Erosion

Weathering is the breaking down of big rocks to small rocks.
Erosion is picking up, carrying and dropping off small rocks.

Weathering and Erosion Videos
Animated video
http://www.youtube.com/watch?v=lvKkPFoRiaw
Bill Nye video
http://www.youtube.com/watch?v=IR6evrt7els&feature=related

Water erosion
http://www.youtube.com/watch?v=MFpCJsc_k64&feature=related

Weathering and Erosion evidence at each school – tour school

2. Soil model – http://www.wtamu.edu/~crobinson/DrDirt/soil_air.html
Built with golf balls, marbles, beads and water. Questions may be too complex for your students, but the model works well.

3. Texture (size of particles) and Color

Background Information for teachers:
Particle Sizes
Soil particles are classified by particle sizes:
• Clay: less than 0.002 mm
• Silt: 0.002-0.05 mm
• Sand: 0.05-2 mm
  o 0.05-0.1 mm-very fine
  o 0.1-0.25 mm-fine
  o 0.25-0.5 mm-medium
  o 0.5-1.0 mm-coarse
  o 1.0-2 mm-very coarse
• Gravels: 2-75 mm
• Cobbles:75-250 mm
• Stones: 250-600 mm
• Boulders: >600 mm

This can be reduced to 3 main categories: Sand, silt and clay.

**Humus (Organic matter)** – provides small and large air spaces (pores) and nutrients.


   This link uses a sponge to demonstrate various traits of soil. Easy to understand and demonstrate. “Dry” soil link goes well with Lab # 3

**Teacher Demonstrations:**

1. **Making Good Soil**

   Quick soil composition test to see if it is good for plants.

   Squeeze a sample of soil in your hands. If it:

   Crumbles = not enough clay
   Stays tightly together = too much clay

   Good soil is the right mix of clay, sand and humus (organic matter). The way to fix poor soil is to add more organic matter. In sandy soils, it helps fill the big pores and hold it together. In clay soils, it helps break up the clay and make larger pores. Practice adding missing pieces to create good soil.
2. Soil Model

http://www.wtamu.edu/~crobinson/DrDirt/soil_air.html

3. Water Retention in soil

Soils have different abilities to hold water based upon the size and number of holes (pores) that exist because of the size of the particles that make up the soil.

Have students act out water passing through the soil by having some students be sand, some silt, and some clay. Put them into a limited space, say standing on a carpet, and mix them up. Have them do the following to create space.

Sand – place their arms out horizontally

Silt – put their hands on their hips

Clay- cross their arms across their chest.

Then have a 4th group of students be water molecules and stand off of the carpet. They begin to gently walk toward the group of soil and try to get through to the other side (like rain going through soil). If the water is stopped, that is like a puddle and could cause plants to drown. If the water gets through too easily, (sandy soil) then the plants can’t get enough to drink.

Try changing the mix of sand, silt and clay to see the effect upon water being retained.

*Do this activity before or after you do the water retention lab.

4. Available water and soil for food production - A nice Math connection

The Apple as Planet Earth: A quick, simple illustration using an apple to help students understand the importance and limited nature of the soil resource. The earth is shared with about 6.8 billion people, who depend on soil to produce all the food, fiber and lumber to feed, clothe, and shelter them all, so that the populace does not end up hungry, naked and homeless.

You need an apple and a knife (sharp enough to easily cut the apple). The basic facts you need to complete the demonstration include:

Approximately 70% of the earth’s surface is covered with water (simplify it for cutting an apple to about 75%, three-fourths)

Half of the part that is not water is in polar ice caps and high mountain ranges (1/2 of 1/4 – note use of math skills, 1/8 remains)

Of the remaining 1/8, 3/4 of it is too hot, too cold, too steep, too shallow, too wet, too dry, or has some other problem so that it cannot be used to produce the food, fiber and lumber to help feed, clothe, and shelter the 6.8 billion people on the planet. This leaves 1/4 of 1/8, or 1/32 of the earth’s surface that is used in food, fiber and lumber production.
Actually, though, the soil is only the thin skin (peel a fraction of the remaining slice, so that the peel hangs down), the surface 1 to 2 meters, which is the part used to produce the food, fiber, and lumber.

Each year, the population grows, and the soil available for food, fiber, and lumber production decreases due to desertification, salinization (ruined by salt), sodification (lawns), urban sprawl and industrial development, etc. So, farmers around the world have to produce more and more food on less and less land every year.

5. Worm Farm

Keep a worm farm in the classroom to turn organic matter into usable soil for plants. Worm Farm Basics – http://www.css.cornell.edu/compost/worms/basics.html

Videos

- Soil organisms video – There are more organisms in a handful of soil than there are people on Earth. http://www.agron.iastate.edu/~loynachan/mov/

  Video game for students to explore soil, called soil safari

- http://school.discoveryeducation.com/schooladventures/soil/

6. Physical and Chemical Weathering

Physical weathering - Fill a plastic bottle (or better yet a glass bottle) with water, cap it and put it into the freezer overnight. Take it out the next day to show how powerful freezing water is. Use this to explain how potholes are formed in roads during the winter or rocks are broken into smaller rocks (freeze/thaw cycle).

Chemical weathering – Scratch a symbol or initials into a piece of chalk. Drip vinegar onto the chalk and the acid will etch into the chalk and dissolve some of the surface. (similar to acidic water weathering limestone) This could also be done as a lab. Have students wear safety glasses.
Lesson 1 – Dry Soil Samples

Note: Soil samples can be collected around the school by students or brought in from home.

**Objective:** Recognize and discuss the different properties of soil, including color and texture.

**Materials:**
- several soil samples
- white paper
- toothpick or pencil
- Magnifying glass

**Procedure:**
1. Take a teaspoon full of a dry soil sample and spread it around on a piece of white paper.
2. Record the overall color of the large soil sample in the bag.
3. Record the color of your small soil sample.
4. Spread out the soil sample on a white piece of paper.
5. Record the color and the different types of particles found in the soil. (sticks, sand, dirt, glass, etc)
Dry Soil Data Sheet

Sample # ______________

Overall color ______________

Color of small sample ______________

<table>
<thead>
<tr>
<th>Types of particles found</th>
<th>Color of particles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
<td>5.</td>
</tr>
</tbody>
</table>

Answer the following questions.

1. How many different colors did you find in your soil sample?

2. Are these colors different from the overall color of the soil?

3. What is the most common color in the soil sample?

4. Why does the soil color differ from the color of its parts?
Lesson 2 - Soil Separation

Objective: Recognize and discuss the different properties of soil, including color and texture (size of particles).

Materials: soil samples  graduated cylinder  water  paper towels

Procedure:
1. Take a large sample of soil (approximately ¼ cup).
2. Record the soil sample location.
3. Place all the soil in the graduated cylinder. Record the volume.
4. Add enough water so that it is 10 ml over the top of the soil.
5. Cover the top of the cylinder with your hand and thoroughly mix the water and soil together. (this may take 1 or 2 minutes)
6. Place the cylinder on the table for 15 minutes and let the contents settle. It is important not to touch it during this process. (another short lesson can be taught during this time)
7. After the soil is settled, draw the different layers you see using the diagram on your data sheet. Label the different layers, noting the size of the particles.
8. Record the amount of each layer by reading the side of the graduated cylinder.
Soil Separation Data Sheet

Draw what your soil looks like. Label the color, amount and soil particle name. (sand, silt, clay or humus)

Before settling

After settling

Questions

1. What is the most common particle in your soil?

2. What soil particle does your soil need more of in order to be more balanced?

3. Would your soil support plant growth well? Why or why not?
Lesson 3 - Water Retention
(Porosity, size of the pores (air spaces) in the soil)

Objective: Recognize and discuss the different properties of soil, including color and texture (size of particles), the ability to retain water and the ability to support the growth of plants. (Teacher note: This would be a good place to use the sponge example of dry soil)

Materials: plastic cups
soil samples (sandy, clay, mixed and unknown soil)
water
graduated cylinders
Plastic trays
paper towels

Procedure:
1. Place several small pencil holes in the bottom of a cup. Add _____________ soil from one sample to your cup.
2. Label the container with your name and soil sample. Answer question #1.
3. Place the cup into a plastic tray and pour 100 ml of water into the tray.
4. Leave the cup in the tray overnight and let the soil absorb the water in the tray.
5. The next day, lift the cup out of the tray and hold it over the water until it stops dripping from the bottom.
6. Place the cup on a paper towel.
7. Pour the water from the tray into a graduated cylinder to measure how much water is left in the tray. Record that amount below in the data section.
8. Record the amount of water held in the other samples by getting the data from that group.
## Water Retention Data Sheet

<table>
<thead>
<tr>
<th>Soil Sample Name: <strong>Sandy</strong></th>
<th>Soil Sample Name: <strong>Mixed</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of water added:</td>
<td>Amount of water added:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of water the soil absorbed:</td>
<td>Amount of water the soil absorbed:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Soil Sample Name: <strong>Clay</strong></th>
<th>Soil Sample Name: <strong>Unknown</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of water added:</td>
<td>Amount of water added:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of water the soil absorbed:</td>
<td>Amount of water the soil absorbed:</td>
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</tbody>
</table>

### Questions:

1. Predict how much water your soil can hold in ml? Look at the graduated cylinder to estimate.
2. Place the three soils in order of holding the most water to the least water. Explain why?
3. Compare the unknown soil to the others. What type of soil do you think it is? Why?
4. Which soil would be best for plants to grow in? Why?
Lesson 5 - Ability to Support Plant Growth

Objective: Recognize and discuss the different properties of soil, including color and texture (size of particles), the ability to retain water and the ability to support the growth of plants.

Materials: Soil samples  
seeds  
small containers  
journals for data

Procedure:
1. Create a soil by mixing sand, silt, clay and humus. Record the amount used of each.
2. Plant three seeds in this soil mix. Record the planting date.
3. Plant three seeds in a control cup. (sand only or silt only or clay only or humus only). Record the date.
4. Record the growth of the plant each week for at least 6 weeks using the information below.

Soil __________________________

Plant color -  
Plant width -  
Plant height -  
Number of leaves –