

# Topography & Weather



**Recommended Grades:**

K-5



**Time Needed:**

15 minutes

## Description

- Students will learn how mountains affect weather conditions in surrounding areas
- Guiding Question/Concept: What role do mountains play in influencing winds and clouds in the atmosphere

## Learning Objectives

- Learn about and describe wind-atmosphere-mountain interactions
- Describe how mountains affect typical weather conditions

## Materials

- Sturdy boxes (not included with Kentucky Giant Map supplies)

## Preparation

- Have boxes available near the edge of the map

**Rules: (e.g., have students remove shoes before walking on map)**

## Directions

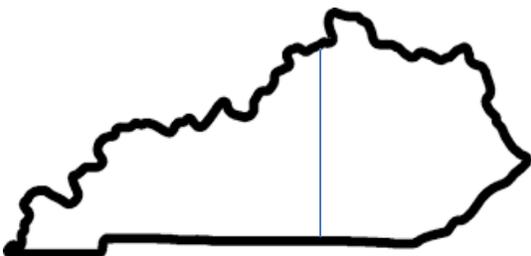
1. Introduce the concepts of leeward and windward sides of the mountain and ask students to identify which side is which on a diagram of a map (either draw one on a white board or on a big sheet of paper)
2. Introduce concept of saturation
  - a. Say to the students: Saturation occurs when air has reached its full capacity of water vapor- the air can no longer hold any more water vapor and precipitation starts to fall.

For example, when you are looking at the forecast and it says there is 100% humidity, the air is saturated.

- b. Pull up the forecast for the day/week and ask students if the air is saturated or not
3. Introduce the orographic effect
- a. Ask students if they think mountains affect weather, and if so, how
  - b. Say to the students: As air approaches a mountain, it is pushed up the windward side of a mountain, causing it to cool. Because the air is cooling, it becomes saturated from the water molecules that were already in the air. This forms clouds and precipitation as the air is on its way up the mountain. This leads to the areas on the windward side of the mountain to receive more precipitation than the areas on the leeward side. On the leeward side, the areas are typically drier than the windward side because the air that gets over the mountain is dry and it descends back down, warming up as it goes. This prevents the formation of clouds and precipitation and makes the leeward side significantly drier and warmer than the windward side.
4. Introduce the concept of a rain shadow
- a. Say to the students: A rain shadow is a patch of land that has been forced to become a desert because mountain ranges blocked all plant growing, rainy weather. An example in the United States is Death Valley- caused by the Sierra Nevada mountain range. An example in a different region of the world is the Tibetan Plateau which is due to the Himalayan mountain range.
5. Describe how winds/clouds/precipitation behavior differs between relatively flat landscape and elevated landscape
- a. Flat/relatively flat/low elevation landscape- travel is not hindered so the winds, clouds, storms, and precipitation can go about on their path and not be stopped or interfered with

**Activity** (directions if using boxes for mountains):

1. Lay out the traveling map and explain that the kids will represent the wind/clouds/ precipitation. Have them travel across the map. Explain that this represents the normal conditions of Kentucky.
2. Set out one row of boxes (1 box high) going north to south across the state of Kentucky (see picture below, line represents the row of boxes) and explain that the boxes are representing a



hypothetical/pretend mountain range that does not actually exist in Kentucky but exists for the purpose of this activity.

3. Have the kids go from west to east across the map. Have the kids step over the boxes, if they can.
  - a. Explain that this shows how winds that do not encounter an obstacle can flow more freely than those that encounter relatively low mountains because the kids could get across the map faster and easier before encountering the boxes than when they had to step over boxes. Explain that the winds and clouds and precipitation can still make it over the mountain, but it does not happen as easily or as fast as the unhindered wind.
4. Add a few more boxes on top of the line- to the point where some kids may be able to get partly across the barrier (have an arm/hand over the boxes) but not be able to completely cross over it.
5. Have the kids travel across the map again- do not let the kids climb over the boxes.
  - a. Explain that some mountains are between being able to fully block wind/clouds/precipitation from reaching the other side but that a little bit of each is sometimes able to make it over, represented by a few arms/hands getting over the boxes.
6. Add another row of boxes in height- to the point where kids cannot make it over and cannot get an arm, hand, or anything over the mountain. Explain that the kids are now all only representing precipitation and clouds.
7. Have the kids go across the map
  - a. Explain that some mountains like the Sierra Nevada's are able to completely block the precipitation and clouds from making it over the boxes. Ask them if they remember what happens to the weather on the other side of the mountain since no rain or clouds can make it over. (Answers do not have to specifically mention rain shadow, just something along the lines of that area being dry and warm)

**There are two options for the next steps:** 1. Teacher giving demonstration (steps 9-10) or 2. Students and teacher finishing the demonstration together (skip to step 11)

**Option 1:**

8. Have the kids stand on the side of the map so that way they can see you go across the map and get over the boxes
9. Explain what is going on as you traverse the map

- a. As you get close to the mountains, explain that as the air is rising, the air is cooling off (optional: put on a jacket and pretend to be getting cold/colder) and clouds are forming. As you are about to go over the boxes, explain that precipitation is now falling.
- b. Cross over the boxes and gradually squat down until you are sitting on the map. As you go down, explain that the air is descending and warming up (optional: take off jacket and pretend to be warming up)
- c. While sitting on the map, ask the students to explain what would happen to the eastern half of Kentucky if the hypothetical mountain range was real and to compare/contrast those conditions. Bonus if they mention rain shadow and describe it properly. Or ask if they remember what the term is to describe a desert caused by a mountain range.

**Option 2:**

10. Lower the boxes to where the students can get over them completely and explain that they now represent the tops of the highest mountains.
11. Explain that everyone just represents the wind/air now
12. Join the students in traveling across the map and explain what is happening as you go (see step 10 a-c)
13. Right after crossing the “mountains” have everyone sit down and explain that as everyone is sitting down that the air is warming up and sinking. After everyone is sitting down, ask the students what would happen to the eastern half of Kentucky if the hypothetical mountain ranges were real and to compare/contrast those conditions with the current conditions. Bonus if they mention rain shadow and describe it properly or you could ask if they remember the term to describe a desert caused by a mountain range.

**Key Vocabulary:**

- Leeward side (of a mountain): Is typically the eastern side of a mountain; it is the side that is protected from harsh winds and weather conditions
- Windward side (of a mountain): Is typically the western side of a mountain; it is exposed to harsh winds and weather conditions
- Saturation: Occurs when air has reached full capacity of water vapor- the air can no longer hold any more water vapor (example is when you are looking at the forecast and it says there is 100% humidity) and precipitation starts to fall
- Orographic effect: Air is pushed up the windward side of a mountain, causing it to cool and become saturated. This leads to the areas on the windward side of the mountain to receive more precipitation than the areas on the leeward side. On the leeward side, the areas are typically drier than the windward side because the air that gets over the mountain descends

back down, warming up as it goes. This prevents the formation of clouds and precipitation and makes the leeward side significantly drier and warmer than the windward side

- Rain shadow: A patch of land that has been forced to become a desert because mountain ranges blocked all plant growing, rainy weather. Some examples are Death Valley (caused by the Sierra Nevada mountain range), Tibetan Plateau (due to the Himalayan mountain range).

### **Note**

This lesson plan has the ability to be adapted to different grade levels by either simplifying or enhancing the activities and directions.

### **Connections to the Curriculum:**

- 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.
- 5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact