# CORIOLIS EFFECT ACTIVITY—INSTRUCTOR'S NOTES

*GEOLOGICAL OCEANOGRAPHY—PROF. LAURA WETZEL*

*Progress through this activity with the professor at the overhead projector, with the Northern and Southern Hemisphere maps and a thumb tack through the center to allow rotation. Stick a pencil with eraser or plastitack into the thumb tack to simulate the set-up for students. The students don't need these instructions. They only need a double-sided copy with the Northern and Southern hemispheres.*

The Coriolis Effect is the deflection of moving objects when they are viewed in a rotating reference frame. In oceanography, we are most interested in how the Coriolis Effect moves winds and ocean currents on the rotating Earth.

To better understand the Coriolis Effect, follow these instructions to demonstrate the Coriolis Effect for yourself.

First, let's explore the perspective of an object moving from the North Pole towards the Equator:

1) On the map of the Northern Hemisphere below, label the U.S. East Coast with an E and the West Coast with a W.
2) Draw an arrow from the W to the E, indicating the direction of rotation for the Earth. (The sun rises in the east and sets in the west.)
3) Draw an arrow in the same direction around the North Pole. Which direction is the arrow pointing? *Clockwise* ***Counterclockwise***
4) Use a pencil or pen to make a hole in the paper at the North Pole.

Work with a neighbor for the next steps:

5) One person holds the pencil or pen straight up on the table through the hole in the North Pole. The paper should be flat on the table. Practice rotating the paper in the direction of the arrow to simulate the rotation of the Earth.
6) The other person takes their finger and places it near the North Pole. Pick a spot in the room, like one of the doors. As one person rotates the paper, the other drags their finger from the North Pole towards the door.
7) After you have practiced this a few times, use a pencil or pen instead of your finger. Draw a line as one person rotates the paper and you move your pencil or pen towards the door. Which direction does the line curve? ***Right*** *Left*
8) Repeat this on the map of the Northern Hemisphere on the other person's paper, swapping jobs so now the person who rotated the page has a chance to draw the line.

Next, let's explore the perspective of an object moving from the South Pole towards the Equator:

1) On the map of the Southern Hemisphere, label the East and West coast of South America. (W in Ecuador, and E in Brazil.)
2) Draw an arrow from W to E.
3) Draw an arrow in the same direction around the South Pole. Which direction is the arrow pointing? ***Clockwise*** *Counterclockwise*
4) As you did with the Northern Hemisphere, work with a partner to rotate the map and draw a line extending away from the South Pole. Which direction does the line curve?
   *Right* ***Left***

Now that we understand how objects are deflected as they move from the poles towards the equator, let's explore the Coriolis Effect from the perspective of an object moving from the Equator towards the poles.

Let's return to the map of the Northern Hemisphere.

1) Trace the circle representing the line of latitude closest to the North Pole, placing an X in Greenland. Someone at that X will travel around that circle in one day.
2) Trace the circle representing the Equator, placing a W on the west coast of South America in northern Ecuador. Someone at W will travel around the equator in one day.
3) Which person has to travel faster? *Greenland* ***Ecuador***
   (Because the person in Ecuador travels farther in the same amount of time—one day.)
4) Suppose we shoot a cannon ball north from the W in Ecuador. Draw an arrow north from the W in Ecuador to Miami.
5) Because the Earth rotates, it won't follow this straight path. Draw an arrow along the Equator through South America, from west to east, to show how the Earth rotates.
6) When an object moves from the Equator to the north, it retains the velocity it had as it was rotating around the equator. So, a cannon ball that is fired due north, towards Miami, will also be moving through the air to the east, as if it were still at the equator. Meanwhile, the Earth is also moving under the cannon ball, but the Earth's rotation is slower as you move north. To simulate this combination of effects, draw a curved arrow from the W in Ecuador through Panama to Puerto Rico.
7) Which direction does the line curve? ***Right*** *Left*
8) Is this the same direction—right or left—as the arrow you drew from the North Pole?
   ***Yes*** *No*

Now let's explore the Southern Hemisphere.

1) Find Ecuador along the equator, again. You've already written a W there.
2) Draw a straight arrow due south from the W in Ecuador into the ocean.
3) Consider a cannon ball fired due south. The cannon ball retains the velocity of Earth's rotation at the equator and flies over the Earth, which is rotating under the cannon ball. To simulate this combination of effects, draw a curved arrow from the W in Ecuador to Chile. (Where in Chile isn't important, as we aren't making exact calculations.)
4) Which direction does the line curve? *Right* ***Left***
5) Is this the same direction—right or left—as the arrow you drew from the South Pole?
   ***Yes*** *No*

Let's summarize:

- The Coriolis Effect is the deflection of objects moving in a rotating reference frame.
- Earth rotates from west to east, which is counterclockwise around the North Pole and clockwise around the South Pole.
- The rotation causes winds, currents, and other objects to move to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

*Created by LRW on January 13, 2017.*