

How El Niño Works

(A demonstration activity for primary grades)

Background:

The Pacific is the largest ocean basin on Earth. The weather and climate condition known as *El Niño* is caused by changes in wind patterns over the equatorial Pacific. This change leads to changes in how the Pacific distributes heat to other parts of Earth, and to changes in weather and climate. One of the changes in weather caused by an El Niño is a redistribution of rainfall around the Pacific.

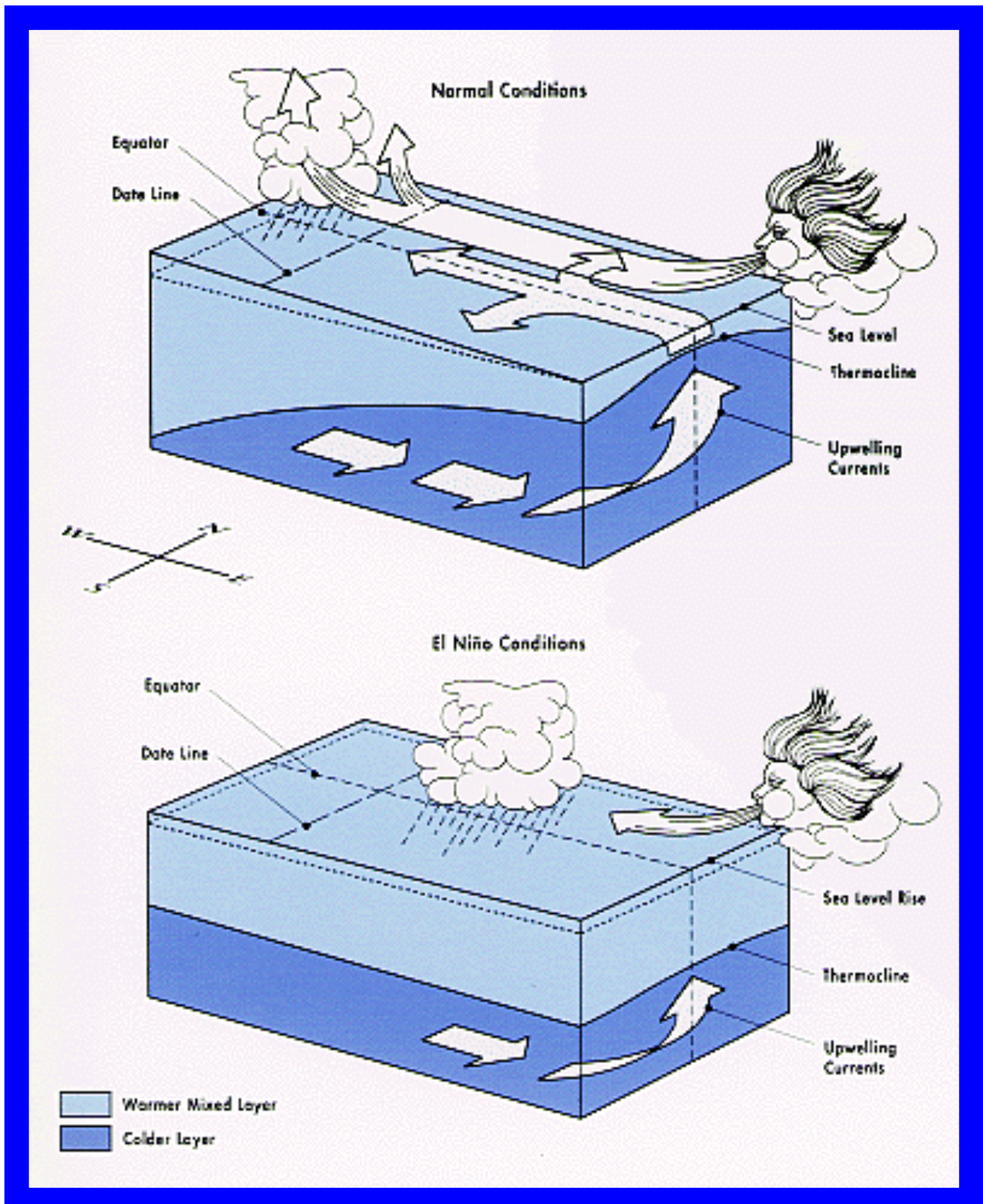
The term El Niño was actually first used long ago by Peruvian fisherman, who noticed that every year around Christmastime, the waters where they normally fished, began to warm up, and fish began to be scarce. They referred to this condition as “El Niño”, which in English means, “The Little Boy”, in reference to the Christ child.

Scientists now use the term to refer to a larger ocean-atmosphere interaction, which occurs every 3-7 years in the equatorial Pacific. During a normal year, strong, easterly surface winds (winds blowing from the east to the west) along the equator, cause upwelling of cold, nutrient rich water along the coast of South America. This keeps the waters of the central Pacific relatively cool. Because the Pacific is so big, a large El Niño can also alter the weather in places far from the Pacific.

Warmer waters are pushed westward along the equator and they form a warm water pool in the tropical western Pacific. Just as warm water in the bathtub causes moisture to accumulate in the air, warm seawater creates a lot of moisture in the air above, so during normal conditions, countries in the western Pacific, such as Indonesia, normally have very high rainfall.

When, for an as yet, unknown reason, the easterly surface winds weaken, or reverse, the warm pool moves from the western Pacific to the central and eastern Pacific. This situation is known as an El Niño, and when this happens, heavy rainfall occurs along the western coasts of Peru, Mexico and California instead. The warm water also acts as a cap that prevents cold water from upwelling along the eastern edge of the Pacific. No upwelling; no fish.

Because water expands when heated, radar altimeters like those on the Topex/Jason series of oceanography spacecraft, can measure the changes in sea surface height associated with the warm water of an El Niño. It was the Topex/Poseidon satellite which first captured an El Niño from space during the significant 1992-93 El Niño, and then the even larger 1997-98 event.



Purpose: This skit is intended to show primary grade students how the ocean-atmosphere condition known as El Niño happens. The activity will use a minimum of from 5 to 7 students:

Setup:

From left to right from the perspective of the audience, place the students like this:

1. Coasts of Indonesia and Australia (1 or 2 students facing right. If two students they should be side by side, one upstage, one downstage);
2. Warm water with cloud overhead (1 student facing Indonesia and Australia. You can simulate clouds with a mass of cotton balls or some other white fluffy material);
3. Easterly surface wind (1 student facing Indonesia and Australia);
4. Upwelling cold water (1 student facing Indonesia and Australia but standing closer to the South and North American Coastlines);
5. South and North American coastlines (1 or 2 students facing Indonesia and Australia).

Prop List:

Warm Water “Cloak”	Water Hose
Rain Gear	Firefighter Hats
Fishing Poles	Empty Canteen
Cold Water “Fish” covered “Cloak”	Surfboard
Halo of Clouds	

Prop Use:

In the normal condition, the student(s) representing the coasts of Indonesia and Australia can have rain gear on. In the El Niño condition, these students will be fighting fires and dying of thirst.

The warm water student should have a halo of “clouds”.

The “cold water” student can have a garment covered with fish (fake of course) to represent the upwelling nutrient rich water that attracts fish and fishermen.

In the normal condition, the student(s) representing the coast of South America can have fishing poles and can pretend to be catching a bumper crop of fish. In the El Niño condition the North and South American Coast students will have on rain gear and can have oars to pretend they are rowing through floodwaters. In addition, someone can pretend to be surfing extra high waves in Southern California. Mention that the fish that were off the South American coast during normal conditions may have now moved further north (North America even as far as Alaska) seeking the nutrient rich cold water.

The Performance:

The teacher can give the class or audience background information on El Niño. The teacher or a student will then tell the audience that they are about to see a demonstration of what happens to worldwide weather patterns when we have the condition known as El Niño. After the students are set up, the teacher gives the cue by stating “During normal conditions, an easterly wind is blowing very hard across the Pacific.

The easterly wind student then blows, gyrates, and moves their hands in the direction of the cold and warm water students.

The teacher continues: This pushes the warm water across the Pacific toward Indonesia and Australia. Just like the warm water in your bathtub produces clouds of steam in the bathroom, the warm water in the Pacific carries with it, its rain clouds.

The warm water student moves across the stage toward Indonesia

Teacher: As the warm water moves west, the nutrient rich cold water can come up along the coast of South America. This is called upwelling. Because fish follow this source of food, upwelling means lots of fish for the fishermen. This makes the fishermen happy.

The fish covered student can begin to move around, and the South American coast fishermen can go into action.

Teacher: But during El Niño conditions, the wind gets very lazy and doesn’t blow nearly as hard. Sometimes it just stops altogether.

The easterly wind acts accordingly.

Teacher: When this happens, the warm water stays closer to the South American Coast, the cold water can’t upwell, so the fish don’t have anything to eat. Instead, there is a lot of warm water piled up against the coasts of South and North America. Since the warm water always has its halo of clouds, there is heavy rain all along these coasts. When the rain is confined to the eastern side of the Pacific, western Pacific countries like Indonesia and Australia experience drought.

The Indonesia and Australia coast students pant, and gag from thirst, and use their fire hoses to put out the brush fires.

Teacher: “So, as shown by our wonderful cast of actors, we can see that the El Niño condition can create dramatic changes in climate all over the world.”

Repeat the skit a few times to reinforce the actions and aid in understanding.