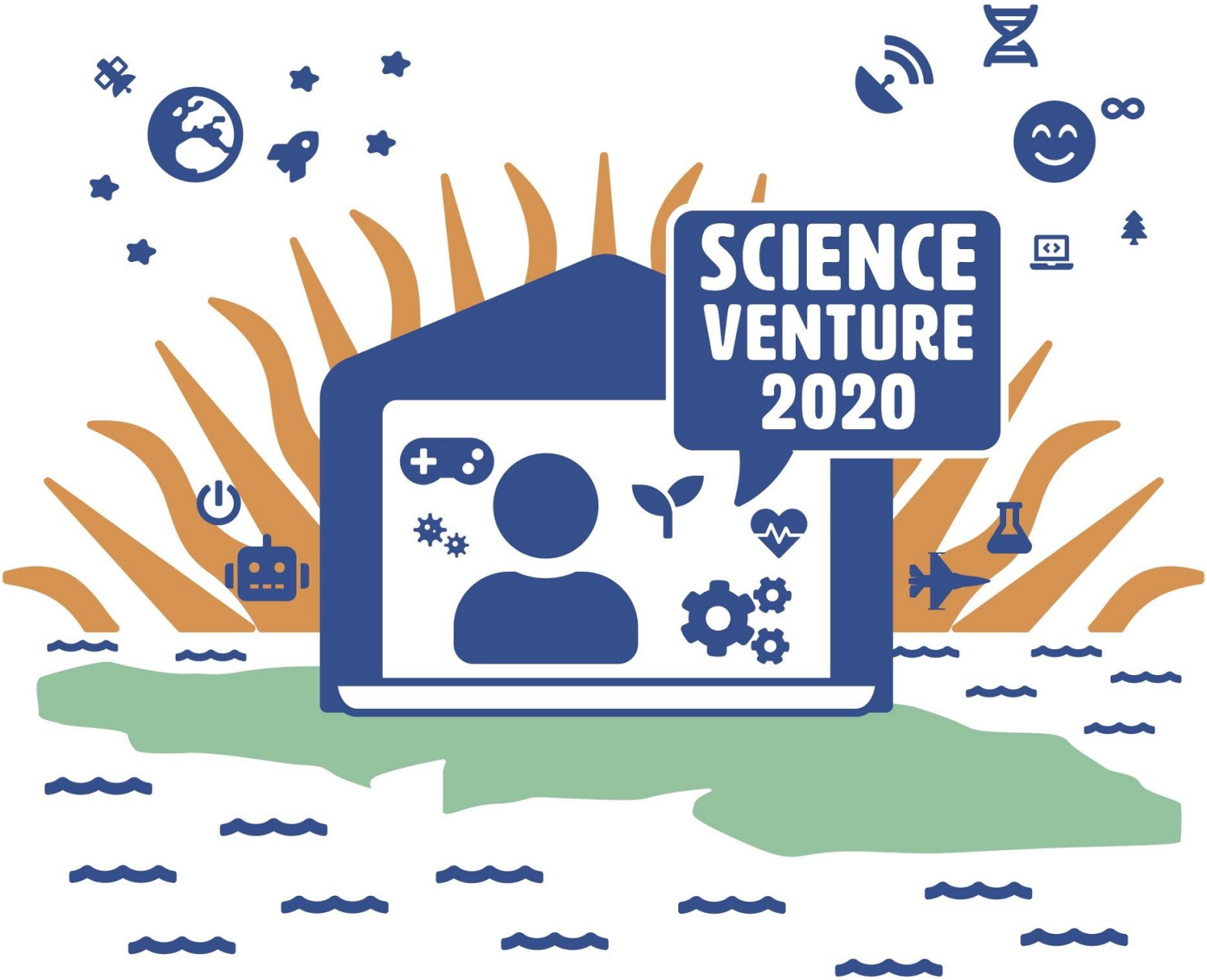



# Oceanography

# Ocean Motion

**By simulating ocean movements and motions with waves, students will recreate the motion of the ocean and the role of wind on our coasts. Students will create rheoscopic fluid so the currents and water motions will be easily observable, and will track waves, marine debris and convection currents.**

## Safety Considerations

- Students should be gentle when handling the mica powder

## Materials

- Mica powder
- Pan or container
- Play doh or clay
- Fan/hair dryer
- Food coloring
- Marine debris
  - Beads
  - Plastic
  - Toys
- Oil
- Sand
- Ice cubes and ice cube tray
- A4 map of the world (printed or drawn)

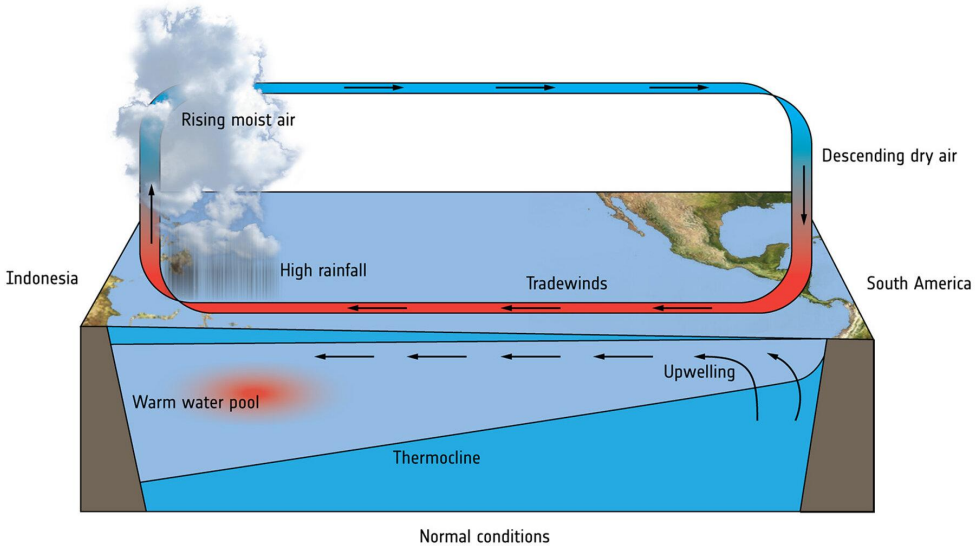
## Background

### El Niño

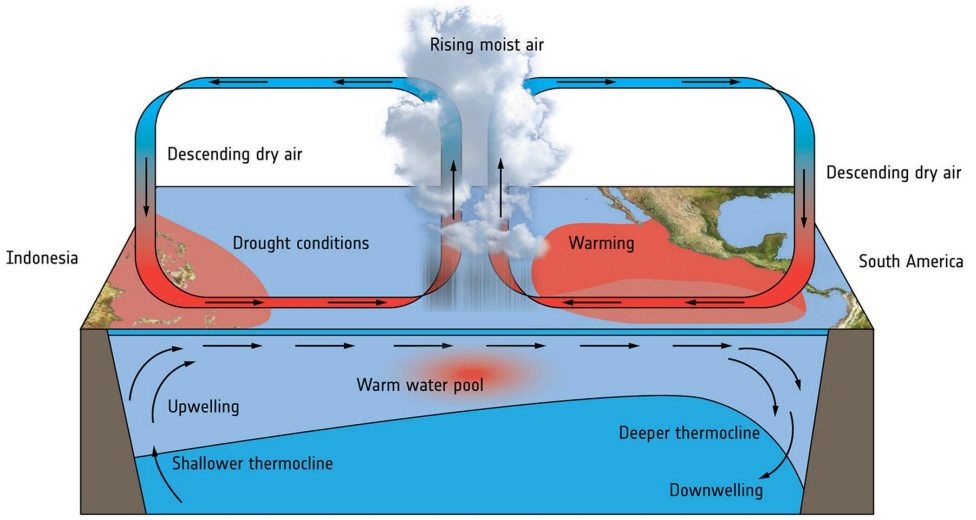
- An ocean-atmospheric climate interaction where surface sea temperatures rise across the the east-central equatorial pacific
  - El Ninos usually occur over North America leading up to the winter season
- Usually, strong trade winds blow towards the west, which pushes warm surface water towards the **western** pacific, near Asia and Australia
- However i an El Niño, these westward blowing trade winds are weaker along the equator, which causes the water to move **eastward** towards South America
  - This brings rain to South America, and droughts to Indonesia and Australia, which has many consequences for the country, as well as the people and animals that live there

# Ocean Motion

## Background Information




Normal conditions




El Niño conditions

### Trade winds

- Trade winds blow towards the equator from the northeast in the northern hemisphere, or from the southeast in the Southern Hemisphere. These two directions of winds circle around the earth and blow from high-pressure to low-pressure belts.

### Upwelling

- The movement of nutrient rich waters from deep in the colder ocean water up to the surface of the ocean through the thermocline, as a result of the trade winds moving water and creating currents as warm water moves across the ocean from East to West.
- El Niño's prevent upwelling to occur because of this unusual warm layer of warm water that is moving differently.
- Without upwelling, the coastal ecosystems change and fish populations and die or migrate

# Ocean Motion

## Procedure

1) Create rheoscopic fluid with mica powder
   a) Fill your container with water (1 liter or however much water it can fit)
   b) Add a teaspoon of mica powder, or however much is directed on the bottle
   c) Color the liquid with food coloring (blue for water ~ or any other color you want your ocean to be)

2) Rheoscopic fluid allows you to see the motion of the water and turbulence in the fluid. This will help you visualize the fluid dynamics better!

3) In a pan or container, create land masses and a sea floor with play doh or clay, or sand. Create a 'coastline' in your container, so that a portion is land (like a beach).

4) Using a fan or hairdryer, create different currents and observe what happens from different directions

5) The hairdryer will act as the **trade winds**. These **trade winds** blow towards the equator from the northeast in the northern hemisphere, or from the southeast in the Southern Hemisphere. These two directions of winds circle around the earth and blow from high-pressure to low-pressure belts.

6) Can you create waves in your container? How are you doing this?

7) What does the role of the coastline play? What does the role of the ocean floor that you created play in waves and water movement?
   a) Move around your sea floor design by recreating the play doh and creating new structures. What does shallow water look like vs deep water? Does it move in the same way?

8) Map the movement of sea creatures
   a) Place some marine debris in the water and watch which way they move with the currents you are creating

# Ocean Motion

## Extension

1) Create convection currents with hot water and cold water
    a) First, make a tray of ice cubes and color them with a lot of food coloring so they are very dark in color (very dark blue, or very dark red).
    b) Next, add them to your container filled with rheoscopic fluid. Because they are a different color, you should be able to see what's happening from above
    c) Using your hairdryer or fan, can you move the ice cubes around? What is this doing?
        i) Leave the hairdryer on in the same place in the container, what starts to happen? What currents are created?

2) Next, you will add another color of rheoscopic fluid to your container and examine and manipulate the currents
    a) To do this, first create another liter of rheoscopic fluid
        i) This time, use food coloring to color it red, and use hot water!
    b) In your already existing liter of rheoscopic fluid, add ice cubes to it so that it becomes colder.
        i) Also, make sure it is a different color to your new batch!
    c) Slowly add the new fluid into your container. Where does it go? Do the colors blend or do they stay together?

# Ocean Motion

3) Create an El Niño
   a) Print out a map of the earth on an A4 piece of paper, or sketch an outline of the earth on one. Make sure you put North, South, East and West on it. Place this underneath your container so you can see which direction is which underneath your container.
   b) Add some sand to your play doh or clay sea floor.
   c) Next, make more. Rheoscopic fluid and place it in your container. Fill it so that it's 1.5 inches from the top, not quite full. This fluid will represent the cold water deeper down in the ocean.
   d) Then, add a layer of oil on top, so that it is almost filled to the top. The oil will represent the warm layer of surface water that is heated from the sun in the ocean.
   e) Next, turn on the hairdryer. This will be the trade winds. Direct the winds over the surface of the oil-topped water from East to West.
      i) What is happening to the water when the wind blows in this way?
      ii) This is mimicking an El Niño! The warm water moves across the ocean from West to East. The warm waters is the effect of the El Niño as it moves across the North Pacific Ocean.
   f) What do you notice about your sand sediment on the seafloor? Repeat using the hairdryer and watch what happens.
      i) The sediment may move upward towards the surface at the East end. This is called **upwelling**, which in brings nutrient rich waters from the bottom of the ocean to the top of the ocean for sea creatures to eat and feed on. These areas tend to be richer in sea life because there is more food for everyone.
      ii) What would happen if there were no trade winds, or trade winds in the wrong direction?
         (1) No trade winds, or trade winds in the wrong direction means no upwelling, so no nutrient rich pockets emerge for fish to thrive on. If there is only a thick layer of warm oil, this cuts off nutrient-rich cold water from upwelling to the top.

#SVatHome

Want to share your project or results with us?

Email or tag us @ScienceVenture

Have a question?

Reach us at svcamp@engr.uvic.ca