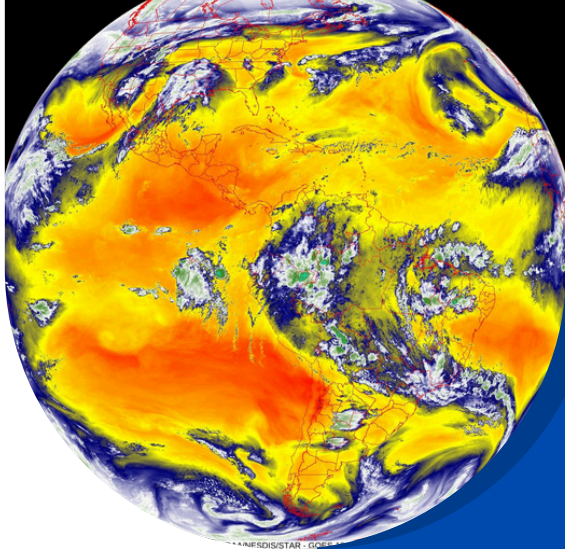




SEEING BEYOND THE VISIBLE

AT A GLANCE

GRADE LEVEL

- Grade 6-8, 9-12

TIME REQUIRED

- 5-10 minutes prep time
- 20-30 minutes classtime

FORMAT

- Individual exploration
- Small group

MATERIALS

- 1 Infrared camera (e.g. FLIR camera)
- 1 clear plastic container (shoebox sized)
- Red food coloring
- Ice cubes made with blue food coloring
- Paper towels
- Pencils and science journal (or related materials to record observations)

THE SCIENCE EXPLAINED

The cold water sinks while the warm water rises. This happens because of convection. A thunderstorm is caused by unstable air and convection plays an important part. Warmer air surrounded by cooler air will rise, supporting the formation of thunderstorms. Satellites detect infrared energy, allowing forecasters to locate relatively warm regions that are more supportive of storms. Infrared light lies between the visible and microwave portions of the electromagnetic spectrum and shows us how hot or cold things are, like layers of the atmosphere.

LESSON SUMMARY

Explore how thunderstorms form, using direct visual observation and an IR camera, in this hands-on activity that demonstrates hot and cold air convection.

OBJECTIVES

The learner will:

- Describe the basic process of convection by observing the movement of warm and cold water in the container.
- Use scientific tools and models by interpreting IR camera images to investigate otherwise invisible temperature patterns.

PROCEDURE

Step One

Fill the plastic container two-thirds full with lukewarm water. Let the water sit for one minute.

Step Two

Have one student stand in front of the Thunderstorm Container with the IR camera and record the temperature of the water before, during and after the ice cubes are added.

Step Three

Ask students to place 6-10 blue ice cubes at one end of the plastic container. Note: the number of ice cubes depends on the size of container.

Step Four

Add three drops of red food coloring to the water at the other end of the plastic container.

Step Five

Have students observe what happens using direct visual observation and the IR camera, and record observations in their science journals.

SEEING BEYOND THE VISIBLE AND NOAA GEOSTATIONARY SATELLITES



CONNECTIONS

NOAA's next generation of weather satellites will improve short-term severe weather forecasting.

The GeoXO Sounder (GXS) will provide real-time information about the vertical distribution of atmospheric moisture, winds, and temperature. The camera-like instrument will provide real-time Infrared data of the troposphere, the lowest level of the atmosphere where weather occurs.

GXS will detect and track air masses capable of producing the most dangerous severe weather, helping forecasters give longer lead-time to residents.

Did you know ...

GXS will increase full atmosphere sensing over the United States by ten times compared to existing low-Earth-orbiting satellites, improving storm tracking and storm strength monitoring, and forecasting of fire behavior and smoke transport.

KEY RESOURCES

Learn more about thunderstorms with NESDIS Education!

Select the link or scan the QR code to visit the page:

[NESDIS Education - What Causes a Thunderstorm?](#)





THINKING OUTSIDE THE BOX

Discussion Prompts and Extension Activities

DISCUSSION AND JOURNAL PROMPTS

- Describe your observations of how the hot and cold water moved in the container via visual observation and the IR camera.
- Explain the cause and effect relationship between the hot and cold water in the container as observed through the IR camera and apply it to how thunderstorms form (teacher note: relationship between rising air masses and moisture).
- Summarize the convection processes that drive the development of thunderstorms and other weather phenomena in Earth's atmosphere, and use your observations from today's demonstration to support your points.

SUGGESTED EXTENSION ACTIVITIES

- Create a variable in the experiment: use warm water of varying temperatures to see whether the changing temperatures affect the convection cycles. Connect this to seasonal weather changes, hurricanes forming over cool versus warm water and other weather phenomena.
- Observe the movement of the food coloring and describe its movement. Why does this happen?
- Further explore infrared light in the activity ["Understanding Infrared Light"](#).