ACTIVITY GUIDE

LOCKED ON EARTH

AT A GLANCE

GRADE LEVEL

- Grade 3-5, 6-8, 9-12

TIME REQUIRED

- 10-20 minutes prep time
- 10-20 minutes classtime

FORMAT

- Large group demonstration
- Small group exploration

MATERIALS

- 3 student volunteers
- Volunteer name tags:Earth, GEO 1, and GEO 2
- Weather tags: Hurricane, Thunderstorm, Lightning, Wildfire
- Safety pins, tape and/or Velcro for tags
- Pencils and science journal (or related materials to record observations)

THE SCIENCE EXPLAINED

Geostationary satellites, such as NOAA's Geostationary Operational Environmental Satellites (GOES)–R Series and Geostationary Extended Observations (GeoXO), orbit 22,236 miles above Earth's equator, at speeds equal to the Earth's rotation. This allows them to maintain their positions over specific geographic regions so they can provide continuous coverage of that area over time.

LESSON SUMMARY

Explore how geostationary satellites orbit Earth and observe weather phenomena in an interactive demonstration.

OBJECTIVES

The learner will:

- Model the orbital mechanics of a geostationary satellite to understand how it moves and what it observes.
- Explain the benefits that geostationary satellites provide meteorologists, forecasters and emergency teams on Earth.

PROCEDURE

Step One

In groups of three, assign students' roles as Earth, GEO 1 and GEO 2 and give students the appropriate name tags to wear (can be attached with safety pins, tape or Velcro).

Step Two

Place Earth in the center with two Weather Tags on each arm. GEO 1 will stand facing the right arm and walk backwards three steps away; GEO 2 will do the same next to the left arm.

Step Three

Earth will rotate or spin slowly in place counter-clockwise, and GEO 1 and 2 will need to revolve (circle around) Earth at the same speed. The challenge will be for GEO 1 and 2 to match their orbital speed to match Earth's rotation so they always see the same weather tags.

Step Four

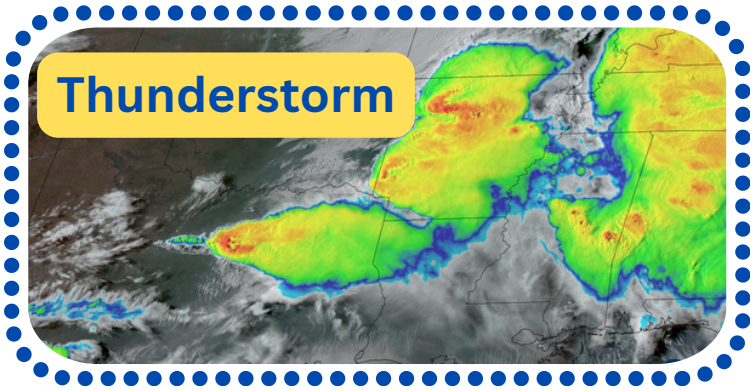
Students will observe what happens and record their observations and answers to the journal prompts in their science journals.

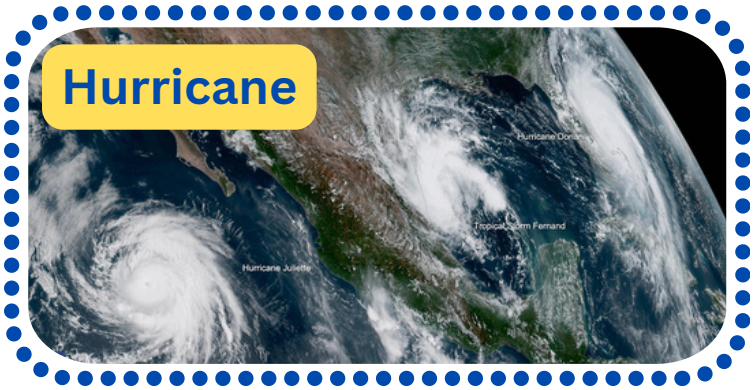
LOCKED ON EARTH MATERIALS: WEATHER AND NAME TAGS

EARTH

GEO 1

GEO 2





LOCKED ON EARTH AND NOAA GEOSTATIONARY SATELLITES

CONNECTIONS

NOAA's Geostationary Extended Observations (GeoXO) satellite system will be its next generation of geostationary satellites, replacing the current GOES-R Series. The information GeoXO supplies will improve short-term forecasting and warning of severe weather and environmental hazards such as wildfires, smoke, dust, fog and volcanic ash.

GeoXO will help us anticipate, respond to, and recover from extreme weather and events that threaten the security and well-being of everyone in the Western Hemisphere. NOAA is planning a two-satellite operational GeoXO constellation, plus two replacement satellites. The first GeoXO satellite is scheduled for launch in 2032.

Did you know ...

GeoXO is a collaborative mission between NOAA and NASA. NASA will manage the development of the satellites for NOAA, which will oversee operation of the satellites and distribution of their data worldwide. NOAA and NASA are working with commercial partners to design and build the GeoXO spacecraft and instruments.

KEY RESOURCES

Learn more about satellites with NESDIS Education!

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

NESDIS Education - Why Do Satellites Have Different Orbits?

THINKING OUTSIDE THE BOX

Discussion Prompts and Extension Activities

DISCUSSION AND JOURNAL PROMPTS

- For GEO 1 and 2: How difficult was it to match the rate of rotation of Earth in this activity? Explain what you experienced during the activity: How long did it take you to match the rate of rotation? Which weather phenomena did you observe? Did you ever see the other satellite's weather tags? Why do you think that happened?
- For Earth: Why was it important for GEO 1 and 2 to "stare" at the same arm as you rotated?
- For all: What are the benefits for geostationary satellites to stare at the same region of Earth continuously? List 2-3 reason why.

SUGGESTED EXTENSION ACTIVITIES

Repeat the exercise and have students:

- ·Use stopwatches or timers to track how long it takes GEO 1 and 2 to match the rate of rotation
- ·Count the number of "successful" revolutions where the satellites locked onto their respective places on Earth and matched the rate of rotation.