

<b>Level</b>	<h1>Weather Predicting</h1>	
Middle School		
<b>Time Required</b>	<b>Lesson Summary</b>	
three and a half– 50 minute class periods (175 min.)	During this lesson, students will learn how satellites are used to predict weather. Then the class will investigate pictures from the weather satellites to determine when thunderstorms are possible.	
<b>Standards</b>		
<p>NGSS</p> <p>MS-PS4-3 Waves and their Applications in Technologies for Information Transfer. Integrate qualitative scientific signals are a more reliable way to encode and transmit information than analog signals.</p> <p>MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.</p>		
<b>Vocabulary</b>	<b>Objectives</b>	
Condensation Water vapor Convection Severe thunderstorm watch Severe thunderstorm warning	<ul style="list-style-type: none"> <li>• Students will understand the role of weather satellites in predicting weather.</li> <li>• Students will be able to use data from weather satellites to identify when thunderstorms are probable.</li> </ul>	
<b>Materials</b>		
<ul style="list-style-type: none"> <li>• Individual computers</li> </ul>		
<b>Pre-Requisites</b>		
Students should understand what radio waves are and how they can be used.		

<b>Safety Considerations</b>	
None	
<b>Pacing Notes</b>	
<p>Day 1: Bell ringer, video or presentation by visitor, reading,  Day 2: Group research and start creating infographics  Day 3: finish infographics and presentations  Day 4: (half a day) Predicting weather activity</p>	
<b>Before the Lesson</b>	
<ol style="list-style-type: none"> <li>1. Either make sure the video works or make arrangements for a visit by a meteorologist</li> <li>2. In the weeks (or possibly months) before you use this lesson you will need to visit this webpage <a href="https://www.star.nesdis.noaa.gov/GOES/">https://www.star.nesdis.noaa.gov/GOES/</a> (last accessed June 12, 2023). Select your region and inspect the Band 8 images. These pictures will show warm and cold air masses. You need to take screen captures in the days before thunderstorms are predicted in your area. You also need to take screen captures from those pictures when thunderstorms are not predicted in your area. You will use these images during class. You can use another area instead of yours if necessary but students will relate to it more if it highlights where they live. You will also need corresponding radar pictures from your area on those same days.</li> </ol>	
<b>Assessments</b>	<b>Classroom Instructions</b>
Pre-Activity Assessments	<b>Introduction</b>
	<p>While you are completing administrative tasks students should be responding to this prompt.</p> <p>How is the weather predicted?</p>
Activity Embedded Assessments	<b>Activities</b>
	<b>Day One</b>

Walk around listening to students. If they cannot answer these questions. Stop, go back and reteach.

Walk around and observe students.

Ask: Why are you doing that?

Ask: What do those lines going to or from the satellite represent?

1. Discuss introduction activity  
Ask students to share their answers. Make sure your classroom is a safe place where students don't have to be afraid to share their thoughts.  
**Say:** Satellites are very important to weather forecasting so next we are going to learn how these devices work.
2. What are satellites and how do they work?
  - a. Project the Satellite Presentation for your class  
  
Students should take notes during the presentation. Be sure to pause periodically for student questions.
  - b. After page 4 and the video stop and have students discuss the following with the person sitting next to them for 3-4 min. Then ask for volunteers to share their answers with the whole class.  
  
What is the electromagnetic spectrum?  
What do we use the spectrum for?  
What are radio waves?  
Why are radio waves important?
  - c. After page 8 pause and **Ask:** Who can summarize what the JPSS does?
3. Satellite communication activity
  - a. Hand out the student sheets and direct the students to this webpage, <https://spaceplace.nasa.gov/dsn-game/en/> (last accessed 5/13/23)
  - b. You can either allow students to work with a partner or have them work alone.
4. Video or visit from a local meteorologist (virtual or in person)
  - a. If you are using the video hand out the student page, Satellites 101: How They Work & The Importance to Weather Forecasting. Have students read through the questions and address any misunderstandings before playing the video. [https://www.youtube.com/watch?v=ry34hK3R\\_yg](https://www.youtube.com/watch?v=ry34hK3R_yg) (last accessed 8/1/23) Start the video at the 45 second mark.

The student sheets will be collected and graded.

Create a rubric for presentations and hand out to students when they get their research pages.

During the research circulate and make sure students are on

Be sure to stop the video when it is talking about sending data to and from the Earth. Ensure that students understand that those signals are using radio frequencies. Review the electromagnetic spectrum and radio frequencies if necessary.

- b. If you have a meteorologist visit your classroom create a list of questions for them to address.

5. Reading – What causes thunderstorms

- a. This reading can be skipped if a meteorologist visits the classroom and discusses this topic. Otherwise have students go to the following webpage to read the article. If time is short print the article and send it with students as homework.

<https://www.nssl.noaa.gov/education/svrwx101/thunderstorms/>  
(last accessed 8/1/23)

6. Conclusion of day one: Discussion

- a. Finish the first day by having a discussion that summarizes all students have learned. Consider using the questions below as well as your own in the discussion. Please allow students to ask their own questions and allow their peers to respond if possible.

What weather-related information do satellites collect?

How does information from a satellite reach Earth?

How does a thunderstorm form?

Have you ever experienced a really scary thunderstorm?

What made it so frightening?

### Day Two

I. Investigate weather satellites

- a. Create groups. There are six groups of NOAA weather satellites. If possible divide the students into six groups. However, be careful to not have more than four students in a group. If the groups are too large divide them in half and two groups can investigate the same satellite group.
- b. Hand out the research page and make sure students understand everyone is expected to help with the research.
- c. Put a timer on the board to keep everyone working quickly.

task. Answer any questions they have.

Walk around while students are working on their presentations. Answer any questions they may have about the application.

Use the rubric you created to grade the project.

2. Introduction to Digital Design App
  - a. It is important that the teacher has made an example of this project for themselves so they can confidently demonstrate how to use the app for the class. The Canva website ([www.canva.com](http://www.canva.com)) is completely free for educators and students, integrates with classroom software, and will allow multiple students to collaborate on the same project if needed. Adobe Spark works similarly.
  - b. When the class has completed their research they can decide how they will present their research. Infographics are a great way for students to quickly and easily communicate multiple points in an easy to read one-pager. Students may also like a social media-style presentation or video.
  - c. Demonstrate how the students can choose a template based on how much data they are presenting. The presentation will need a title and the name of the author(s) apparent for their audience. Images from their research can be copied and pasted into their digital design. Existing images in their template will need adjusting, or deleting. Students should resize the finished project so that it appears attractive and complete. Finally, show students where to add their works cited. Citations do not have to be visible on the main page of the presentation.
  - d. Encourage students to try a creative way to present their project. It is common for students to ask to use a more familiar software, such as PowerPoint, but remind those students that they are at school to learn many skills, including design. The new app may prove useful for other interests and projects, so it is a good experience for them.

### Day Three

1. Introduction
  - a. Give students five minutes to finish their research.
2. Presentation Creation
  - a. Students should use what they learned about infographics to create their presentation.
  - b. Encourage students to pick a template quickly.

<p>Walk around and ask the following questions:</p> <p>Why did you make that decision?</p> <p>What additional information would be helpful?</p>	<p>3. Conclusions: Presentations</p> <p>a. Students should use their best presentation skills: speaking loudly and clearly when it is their turn and being quiet and attentive when it is not their turn.</p> <p style="text-align: center;"><b>Day Four</b></p> <p>I. Using weather data to make predictions</p> <p>a. Use the image from this PDF to explain to students how to recognize the formation of a thunderstorm from weather satellite data.  <a href="https://www.star.nesdis.noaa.gov/GOES/documents/QuickGuide_GOESR_AirMassRGB_final.pdf">https://www.star.nesdis.noaa.gov/GOES/documents/QuickGuide_GOESR_AirMassRGB_final.pdf</a> (last accessed 8/1/23)</p> <p>b. In the weeks and months prior to doing this lesson in your classroom collect images from <a href="https://www.star.nesdis.noaa.gov/GOES/">https://www.star.nesdis.noaa.gov/GOES/</a> (last accessed 8/1/23) Band 8. Be sure to do so when thunderstorms are predicted as well as when they are not predicted. On those same days take screenshots of your local weather station radar.</p> <p>c. Hand out color copies of the GOES images to each pair of students. (Hint: laminate the copies so they will last all day) Hand out the Predicting Thunderstorms page and have students complete in pairs.</p> <p>d. When all students are finished. Project the radar images on the screen. For each GOES image project the radar image and lead a discussion about what the students thought would happen and what really did happen.</p>
<p>Post Activity Assessments</p>	<p><b>Closure</b></p>
<p>By collecting the exit tickets you will learn what you need to review or cover in more</p>	<p>Exit ticket</p> <p>One thing you learned about weather and one thing you still have questions about.</p>

depth in future lessons.

### Culturally Inclusive/Responsive Components

Some students struggle to get information from videos or readings. Pair them up with a buddy who can help them if they get stuck.

### Educator Resources

[https://www.star.nesdis.noaa.gov/GOES/documents/QuickGuide\\_GOESR\\_AirMassRGB\\_final.pdf](https://www.star.nesdis.noaa.gov/GOES/documents/QuickGuide_GOESR_AirMassRGB_final.pdf) (last accessed 8/1/23)

<https://www.nesdis.noaa.gov/current-satellite-missions/currently-flying> (last accessed 8/1/23)

<https://www.canva.com/learn/how-to-make-an-infographic/> (last accessed 9/9/23)

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Below is a list of the lesson titles included in the series. All lessons can be accessed from this web page, <https://superknova.org/educational-resources/>.

#### Middle School

Introduction to Satellites

Weather Predicting

Introduction to Radio Wave Communication

The Importance of Radio Astronomy

Cubesat Model Building

Understanding FM Radio

Radio Frequency Technology

Who Decides if You Get 5G?

#### High School

The Uses of Radio Waves and Frequency Allocation

Is Radio Technology Safe?

Diffraction of Radio Waves

Measuring Sea Surface Temperatures with Satellites

Marine Animal Tracking and Bathymetry

How to Design Your Own Crystal Radio

How Radio Waves Changed the World

Simple Wireless Communication

Seeing and Hearing the Invisible  
Local Wireless Radio Frequency Communication  
Investigating the Internet Connection  
The Geometry of Radio Astronomy

**Informal**

Modeling Radio Astronomy





