



## **Exploring the Antarctic Ozone Hole**

Grade(s): 7th

Lesson Duration: Class: 3 Class Periods

Course Name(s): 7<sup>th</sup> Grade Science

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### **BIG IDEAS**

Understanding how the ozone layer's depletion impacts Earth's atmosphere and contributes to

climate change, and how scientific investigation and engineering practices can be applied to study and address these environmental issues. Help students understand that atmospheric processes do influence the different other spheres and that one sphere impacts others.

## EDUCATION STANDARDS

<p>Science Performance Expectations (or state Science standard):</p> <p>NGSS Performance Expectation:</p> <p>MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century</p>		
<b>Science and Engineering Practices:</b>	<b>Disciplinary Core Ideas:</b>	<b>Crosscutting Concepts:</b>
<p>Analyzing and Interpreting Data</p> <p>Asking Questions and Defining Problems</p> <p>Communicating Information</p>	<p>ESS3.C: Human Impacts on Earth Systems</p>	<p>Cause and Effect</p> <p>Stability and Change</p>

**Common Core State Standards:**

ELA: Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest

(CCSS.ELA-LITERACY.SL.8.5).

**Math:**

Summarize numerical data sets in relation to their context, such as analyzing patterns in satellite data related to the ozone hole.

(CCSS.MATH.CONTENT.6.SP.B.5)

**ITEEA Standards:**

STEL Standard 1: Nature and Characteristics of Technology and Engineering

Benchmark 1N: Explain how the world around them guides technological development and engineering design.

**Other Standards: N/A**

**MEASURABLE STUDENT LEARNING OBJECTIVES**

Students will be able to analyze and interpret authentic NASA data on the Antarctic ozone hole.

Students will be able to explain the causes and consequences of ozone depletion.

Students will be able to develop solutions and strategies for mitigating the impacts of ozone layer depletion.

## MATERIALS NEEDED

My NASA Data animations and satellite images

NASA Ozone Watch animations and satellite images

Videos from NASA Earth Observatory YouTube channel

NASA EO Kids “Ozone Hole” resource

Computers or tablets with internet access

Poster materials or digital presentation tools

Assessment rubrics and quiz sheets

## ENGAGING CONTEXT/PHENOMENON

Introduce the lesson with a short animation showing the annual changes in the Antarctic ozone hole, sourced from NASA’s Ozone Watch. Pose the question, “Why is the ozone layer important, and how does its depletion impact life on Earth?” Facilitate a brief discussion to activate prior knowledge and gather student responses. Teaching the atmosphere as a separate sphere helps students focus on its specific properties before linking it to the broader context of Earth systems.

## DATA INTEGRATION

Students will analyze NASA data showing the size of the Antarctic ozone hole over the past 20 years and interpret seasonal changes. They will also use multimedia resources to understand the science behind ozone depletion and recovery. This focused approach to the atmosphere sets the stage for understanding its role before exploring connections with other spheres. Using up-to-date satellite data and multimedia differs from traditional Earth science teaching methods, which relied more on static, textbook-based learning. Past practices often presented Earth science as a

series of facts without interactive, real-time data, limiting student engagement and understanding.

### TEACHER BACKGROUND KNOWLEDGE

The teacher is going to be familiar with basic atmospheric science concepts, like the structure of the atmosphere, the role of the ozone layer, and the chemical reactions that lead to its depletion. Resources such as NASA's Ozone Watch and EO Kids "Ozone Hole" provide comprehensive background information.

### DIFFERENTIATION OF INSTRUCTION

Provide scaffolding by breaking down data analysis into manageable steps. Offer alternative formats, like video summaries, for students who benefit from visual learning.

Pair ELL students with peers for collaborative work.

### REAL-WORLD CONNECTIONS FOR STUDENTS

Discuss the implications of ozone layer depletion for global health, such as increased UV radiation exposure and its effects on ecosystems.

Connect these ideas to local issues like sun safety and climate change awareness.

### POSSIBLE PRIOR or MISCONCEPTIONS

Students may think that ozone depletion and climate change are the same phenomena.

Teacher must clarify that while they are related, they have distinct causes and impacts.

## LESSON PROCEDURE

5E	Details of 5E Lesson Implementation
<p><b><u>Engage</u></b></p> <p>Show the NASA animation of the Antarctic ozone hole changes.</p> <p>Facilitate a discussion with the question: “Why is the ozone layer important?”</p> <p>“What are the five Earth Systems?”</p>	<p><b>Lesson Objective:</b> Understand the significance of the ozone layer.</p> <p>I will use NASA resources, including animations and images from <a href="#">My NASA Data</a>, <a href="#">NASA Ozone Watch</a>, and related <a href="#">NASA media</a> to spark curiosity. A brief overview of the ozone layer and the Antarctic ozone hole will be provided by NASA "<a href="#">EO Kids - Ozone Hole</a>", which explains the importance of the ozone layer as Earth's natural sunscreen and how it protects against harmful UV rays. I will help students understand that Earth is also made up of five major parts or subsystems: the Atmosphere, Hydrosphere, Biosphere, Cryosphere, and Geosphere.</p> <p>I will introduce how one sphere impact others. For example, how volcanic eruptions impact the atmosphere and biosphere.</p> <p><b>Standards Addressed:</b> MS-ESS3-5, SEP: Asking Questions; CCC: Cause and Effect.</p> <p><b>Materials &amp; Resources:</b> <a href="#">My NASA Data</a>, <a href="#">NASA Ozone Watch</a>, <a href="#">NASA media</a> NASA "<a href="#">EO Kids - Ozone Hole</a>, computers or tablets with internet access.</p> <p><b>Procedure:</b> Show NASA animations and resources and facilitate a brief discussion.</p>

	<p><b>Formative/Summative Assessments:</b> MS-ESS3-5, SEP: Asking Questions</p> <p><b>Modifications:</b> Visual aids, peer collaboration for ELLs.</p>
<p><b><u>Explore</u></b></p> <p>In groups, students analyze satellite data from NASA’s Ozone Watch.</p> <p><b>Guiding questions:</b></p> <p>“During what months does the ozone hole reach its peak size?”</p> <p>“Why do scientists primarily discuss the "Antarctic</p>	<p><b>Lesson Objective:</b> Students will work in groups and use the video provided by NASA Earth Observatory YouTube channel <a href="#">NASA Earth Observatory - Ozone Hole 2013</a>, animation link <a href="#">NASA Ozone Movies</a> to explore seasonal changes in the ozone hole during the last 20 years. They will answer guiding questions.</p> <p><b>Standards Addressed:</b> SEP: Analyzing and Interpreting Data, CCC: Cause and Effect.</p> <p><b>Materials &amp; Resources:</b> <a href="#">NASA Earth Observatory - Ozone Hole 2013</a>, animation link <a href="#">NASA Ozone Movies</a>, computers or tablets, data analysis worksheets.</p> <p><b>Procedure:</b> Students work in groups to analyze and discuss satellite data from NASA’s Ozone Watch. They answer guiding questions and document their findings collaboratively. Analyzing atmospheric data in isolation aids in developing a clear understanding before connecting it to data from other Earth spheres.</p>

<p>ozone hole" rather than an "Arctic ozone hole"?"</p> <p>“How long does the ozone hole typically last?”</p>	<p><b>Formative/Summative Assessments:</b> Monitor group discussions and review worksheets for understanding.</p> <p><b>Modifications:</b> Provide guided templates and assigned group roles based on strengths, ELL support.</p>
<p><b><u>Explain</u></b></p> <p>Lead a class discussion on the causes of ozone depletion using NASA’s multimedia resources.</p>	<p><b>Lesson Objective:</b> Explain the chemical and environmental causes of ozone depletion. Guide students through a discussion on the causes and effects of ozone depletion, supported by <a href="#">NASA multimedia resources and data</a>. Cover how stratospheric temperatures, chlorine compounds, and sunlight interact to deplete ozone. The <a href="#">Ozone Watch</a> data will be analyzed to understand the environmental implications and the science behind the ozone hole's formation and recovery. Explain that past practices often presented Earth science as a series of facts without interactive, real-time data, limiting student understanding.</p> <p><b>Standards Addressed:</b> DCI: ESS3.C, CCC: Stability and Change.</p> <p><b>Materials &amp; Resources:</b> NASA multimedia resources (videos, animations), whiteboard or digital presentation tool, student notebooks.</p>

	<p><b>Procedure:</b> Lead the class discussion on ozone depletion, highlighting chemical reactions and environmental impacts using NASA resources. Engage students with questions.</p> <p><b>Formative/Summative Assessments:</b> Monitor participation and use formative questions; review student notes.</p> <p><b>Modifications:</b> Provide discussion prompts, visual aids, simplified explanations, and visual summaries for ELL students.</p>
<p><b><u>Elaborate</u></b></p> <p>Students create posters or digital presentations detailing the science behind the ozone hole and possible recovery strategies.</p>	<p><b>Lesson Objective:</b> Connect scientific concepts to real-world solutions. guide students through a discussion on the causes and effects of ozone depletion, supported by <a href="#">NASA multimedia resources and data</a>. The session will cover how stratospheric temperatures, chlorine compounds, and sunlight interact to deplete ozone. The <a href="#">Ozone Watch</a> data will be analyzed to understand the environmental implications and the science behind the ozone hole's formation and recovery</p> <p><b>Standards Addressed:</b> CCC: Stability and Change, SEP: Communicating Information.</p> <p><b>Materials &amp; Resources:</b> <a href="#">NASA multimedia resources and data</a>, <a href="#">Ozone</a></p>

	<p><u>Watch.</u> poster materials or digital tools, access to NASA resources, and previous student notes.</p> <p><b>Procedure:</b> Guide students to create detailed posters or digital presentations summarizing the science behind ozone depletion and potential recovery strategies. Encourage them to use data and visuals from NASA resources.</p> <p><b>Formative/Summative Assessments:</b> Evaluate presentations with a rubric and use peer feedback.</p> <p><b>Modifications:</b> Provide poster templates, allow group work, and use bilingual resources for ELL students.</p>
<p><b><u>Evaluate</u></b></p> <p>Students present their projects to the class and receive feedback.</p> <p>A quiz with questions on ozone depletion and its impacts</p>	<p><b>Lesson Objective:</b> Demonstrate understanding of ozone depletion and mitigation strategies. Students will present their projects to the class for peer feedback, followed by a reflective discussion. A quiz and a set of questions will assess their understanding of the topic, such as why ozone depletion is significant and how it has changed over time. The "EO Kids - Ozone Hole" document can be used as a reference for key facts and data visualization examples to support their understanding</p> <p><b>Standards Addressed:</b> MS-ESS3-5, SEP: Communicating Information, CCC: Stability and Change.</p>

<p>assesses individual understanding.</p>	<p><b>Materials &amp; Resources:</b> Completed student projects, rubric for presentation evaluation, quiz sheets.</p> <p><b>Procedure:</b> Students present their projects, receive peer feedback, and take a quiz on ozone depletion. The teacher facilitates feedback and clarifies questions.</p> <p><b>Formative/Summative Assessments:</b> Use presentation rubrics and quiz scores.</p> <p><b>Modifications:</b> Allow alternative formats (e.g., video), extra time, and simplified quiz language for ELL students.</p>
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## FUTURE LESSONS AND USE OF NASA RESOURCES

Follow-up lesson exploring how changes in the atmosphere affect the biosphere. Use NASA's GLOBE Observer or data on vegetation impact studies to link atmospheric science to biological changes, reinforcing connections between spheres.

### Example Materials:

- [GLOBE Observer app](#) for field data.
- [NASA's Earth Science Data](#) for vegetation impact studies.

### REFERENCES

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