

**Investigating Earth's Spheres: Teaching Earth Science Through an Interconnected
Lens**

Stefano Cascapera

Hommocks Middel School, NY

Eyes on Earth: Teaching Earth Science from Space (Fall 2024)

Missy Holzer, PhD

11/24/2024

Investigating Earth's Spheres: Teaching Earth Science Through an Interconnected Lens

Introduction

I chose to write the "Investigating Earth's Spheres" paper because it reflects how much I've learned in this course. It gives me a chance to think critically about how my teaching has evolved, particularly in using real-world data to create lessons that connect with my students' lives. Before this course, I relied heavily on general online resources and everyday observations to find relatable topics for my students. Now, I feel much more confident integrating NASA resources to explore local, global, and even space phenomena, transforming how I approach lesson planning. This paper also ties directly to a grant project I'm working on with my colleagues to bring a meteorological station to our school. The station will provide real-time and historical data that all teachers can use to make lessons more engaging and relevant. As I reflect on my practice in this paper, I aim to connect Earth's spheres in meaningful ways that help my students grasp the big picture of what's happening in the world around them. Writing this paper is an opportunity to consolidate everything I've learned in this course and apply it to benefit both my teaching and my students.

Why We Teach Each Sphere Separately

Teaching Earth's spheres separately helps students focus on the unique processes and features of each system—Lithosphere, Hydrosphere, Atmosphere, and Biosphere—before exploring how they connect. For example, the Lithosphere deals with things like rocks and tectonic activity, while the Atmosphere focuses on weather and climate. By learning about these systems one at a time, students build a solid foundation and avoid feeling overwhelmed.

NASA's "Connect the Spheres" lesson highlights this approach by supporting systems thinking (*Connect the Spheres: Earth Systems Interactions | Precipitation Education*, n.d.). Instructional modules like this "may support systems thinking as articulated in the Earth Systems Perspective Framework, through defining an appropriate overarching goal and by moving back and forth between contextual examples and global-scale interactions among the spheres" (Scherer et al., 2017). For instance, students can explore how rain (Atmosphere) impacts rivers (Hydrosphere) and plant growth (Biosphere).

In my lessons, I will use real-time data from our school's meteorological station. For example, students look at local weather patterns and answer questions like, "How does today's weather compare to historical trends?" and "What patterns can you identify in this data?" Once they understand these patterns, we connect them to other spheres, like how rainfall affects local ecosystems or water systems. This step-by-step method makes it easier for students to understand how Earth's systems are both separate and connected. Learning about the spheres individually also helped me and the students appreciate their distinct roles, making their connections easier to conceptualize later.

Comparing and Complementing Past Practices

Prior to this course, my lessons focused on isolated phenomena like hurricanes or erosion, drawing on general resources or everyday observations. While relatable, these methods lacked depth. Incorporating NASA's "Eyes on Earth" (*NASA's Eyes: Eyes on the Earth*, n.d.) has revolutionized my teaching. This tool allows students to investigate Earth's spheres through an interconnected lens.

For instance, in a meteorological lesson, students analyze precipitation data from the Atmosphere and discuss its effects on the Hydrosphere (flooding) and Biosphere (plant health). This integrative approach contrasts with my earlier lessons, which treated weather as

an isolated topic. I now encourage students to explore systemic relationships, enhancing their critical thinking and appreciation for Earth as a dynamic system.

By comparing these approaches, it's clear that leveraging advanced resources like NASA's Earth System Data Explorer (*Earth System Data Explorer*, n.d.) results in more engaging, impactful lessons. This transformation underscores the importance of evolving teaching methods to inspire curiosity and foster deeper learning.

Student Challenges and Learning Supports

Some spheres are harder for students to understand than others. For example, the Atmosphere can be tricky because it involves abstract ideas like air pressure and wind patterns. To make it easier, I use tools like weather maps, real-time data, and NASA's GLOBE Observer simulations (*GLOBE Observer*, 2019). These resources help students connect what they are learning to real-world examples.

The Lithosphere is also challenging because it focuses on processes that happen over a long time, like the formation of rocks. To make it more relatable, I include hands-on activities, like studying local rocks or soil. These activities help students see the concepts in action.

I also encourage group discussions and data analysis activities. This way, students can share ideas and work through challenging material together. By breaking down the lessons into manageable parts and using engaging resources, students can better understand Earth's spheres.

Using NASA Materials to Highlight Sphere Connections

NASA's resources are invaluable for teaching the interconnections among Earth's spheres. Tools like the Earth System Data Explorer (*Earth System Data Explorer*, n.d.) allow students to visualize the relationships between atmospheric precipitation, river flow (Hydrosphere), and vegetation health (Biosphere). For example, in a lesson linking urban

forestry initiatives to climate, students examine how tree planting improves air quality (Atmosphere) while supporting biodiversity (Biosphere). By integrating local projects, such as our school's tree-planting initiative, with global data, students see the tangible impacts of environmental science on their communities. NASA tools not only highlight these connections but also facilitate discussions on equity and sustainability, providing a holistic view of Earth's systems.

Conclusion

Writing this paper has allowed me to reflect on the transformation of my teaching practices. Integrating NASA resources has deepened my understanding of Earth's systems and enabled me to present these concepts more effectively. Teaching spheres separately before connecting them ensures students grasp the fundamentals while NASA tools make lessons engaging and relevant. Through initiatives like the meteorological station project, I hope to inspire curiosity, critical thinking, and a sense of environmental responsibility in my students.

References

Connect the Spheres: Earth Systems Interactions | Precipitation Education. (n.d.).

Gpm.nasa.gov. <https://gpm.nasa.gov/education/lesson-plans/connect-spheres-earth-systems-interactions>

Earth System Data Explorer. (n.d.). Larc-Mynasadata-2df7cce0.Projects.earthengine.app.

<https://larc-mynasadata-2df7cce0.projects.earthengine.app/view/earth-system-data-explorer>

NASA's Eyes: Eyes on the Earth. (n.d.). Eyes.nasa.gov. <https://eyes.nasa.gov/apps/earth/#/>

Scherer, H. H., Holder, L., & Herbert, B. (2017). Student Learning of Complex Earth

Systems: Conceptual Frameworks of Earth Systems and Instructional Design. *Journal of Geoscience Education*, 65(4), 473–489.