

National Aeronautics and  
Space Administration

Educational Product

Teachers

Grades K-4

# OUR MISSION TO PLANET EARTH



## A Guide to Teaching Earth System Science



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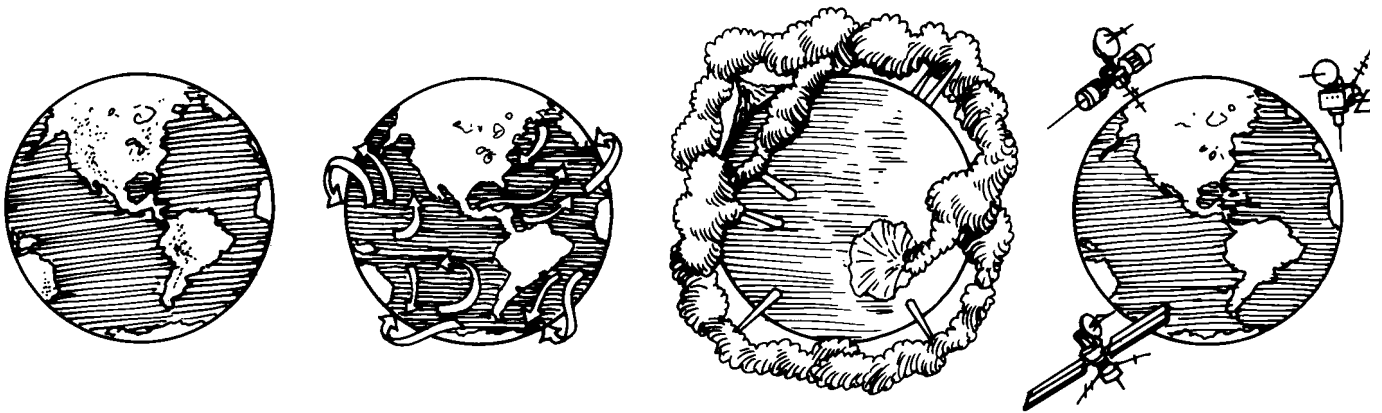
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## A Guide to Teaching Earth System Science

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National Aeronautics and Space Administration  
Office of Mission to Planet Earth  
Office of Human Resources and Education  
Education Division

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# Acknowledgments

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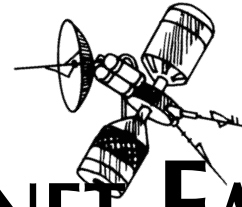
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# Table of Contents

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<b>Introduction</b>	A Guide to Teaching Earth System Science .....	1
<b>Unit 1 Earth From Space</b>	Demonstrating the View from Space.....	5
	Energy .....	6
	Creating an Earth System Model .....	7
	Systems .....	8
<b>Unit 2 Forces of Change</b>	Cycles: How Earth's Components Interact within the System .....	11
	Water Cycle.....	12
	Water Cycle Changes .....	14
<b>Unit 3 Global Change</b>	Global Environmental Impacts.....	17
	Land-use Changes: Deserts .....	18
	Greenhouse Effect: Global Warming.....	19
	Global Cooling.....	21
<b>Unit 4 Mission to Planet Earth</b>	Satellites: Observing the Whole Earth .....	23
	Satellites .....	26
	Instruments .....	26
	Satellite Design.....	26
	Data .....	27
	Modeling.....	27
	Careers .....	30
<b>NASA Resources for Educators</b>	.....	33



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### **Introduction**

Volcanic eruptions, hurricanes, floods, and El Niño are naturally occurring events over which humans have no control. But can human activities cause additional environmental change? Can scientists predict the global impacts of increased levels of pollutants in the atmosphere? Will the planet warm because increased levels of greenhouse gases, produced by the burning of fossil fuels, trap heat and prevent it from being radiated back into space? Will the polar ice caps melt, causing massive coastal flooding? Have humans initiated wholesale climatic change?

These are difficult questions, with grave implications. Predicting global change and understanding the relationships among Earth's components have become a priority for the nation. The National Aeronautics and Space Administration (NASA), along with many other government agencies, has initiated long-term studies of Earth's atmosphere, oceans, and land masses using observations from satellite-, balloon-, and aircraft-borne instruments. NASA calls its research program Mission to Planet Earth. Because NASA can place scientific instruments far above Earth's surface, the program allows scientists to explore Earth's components and their interactions on a global scale.

### **Earth as a System**

Although this program will never answer all the questions, NASA realizes that understanding the planet will not happen by examining pieces one at a time; it will take teams of biologists, physicists, chemists, and geologists working together to fully understand Earth as a system. Earth Science, in short, must be an interdisciplinary challenge. The scope of Earth Science is sometimes limited to the study of geology and some closely allied fields, such as oceanography. The Mission to Planet Earth calls for an interdisciplinary approach including biology, chemistry, and physics.

This leads to why NASA initiated the development of “Our Mission to Planet Earth: A Guide to Teaching Earth System Science.” The children in your classrooms today could become the scientists of tomorrow who will analyze the data streaming back to Earth via satellite communications. NASA will look to their generation for talent. Consequently, children’s exposure to the concept of Earth as a system cannot begin too early. Even if your students do not pursue careers in Earth Science, they must understand Earth System Science. They could face the challenge of trying to adapt to global climate change.

## Cycles and Change

This teacher’s guide is not meant to replace the existing curricula of your local school jurisdiction, but rather to augment it. The primary goal is for children to become familiar with the concept of cycles, defined as a process that repeats itself in the same order, and to learn that some human activities can cause changes in their environment.

It is assumed in this guide that children are already studying the basics of Earth Science. They have learned about the planet’s primary components—its land, air, and water, and understand the role of the Sun in providing us with energy. Although the guide addresses Earth’s components, it does so from the perspective of space to show the planet as a large system, with interacting parts. To demonstrate on a much smaller scale how these parts work together, children are asked to build their own Earth system, a terrarium, which will be used for experimentation throughout the guide. For instance, your students observe how water evaporates due to the Sun’s radiation and eventually condenses to form clouds. They are exposed to the relationship between land and water, and the topographical changes due to erosion. Through experimentation with the terrarium, they learn about the impact of global change on the system.

After completing these lessons, they learn how scientists use satellite technology to examine the entire planet as a whole to study global climate—the basics of NASA’s Mission to Planet Earth program. They create their own models of instruments and satellites and learn about careers in Earth System Science. Although some younger children may understand these concepts, the activities are geared primarily to second and third graders. For kindergarten and first grade teachers, however, this should not preclude you from incorporating some of the activities into your lessons.

## **Tomorrow's Scientists, Engineers, and Technicians**

“Our Mission to Planet Earth” is designed to reinforce basic skills. Through hands-on activities, experiments, and discussions, students practice how to identify, classify, organize, and recall information. They become familiar with new vocabulary. You are encouraged to create any type of scenario—pretending, for instance, that students are Earth scientists—to make the lessons come to life. Above all, the program is aimed at allowing younger people to recognize themselves as part of the Earth system.

For NASA, the challenge has been to develop a package that makes integrated Earth Science compelling, understandable, and interesting to young minds. NASA has a vested interest. The agency, after all, is depending on your students to become the engineers, scientists, and technicians of tomorrow, those who will build the next generation of satellites or interpret the data and inform leaders of responsible environmental policies. While many of your students will pursue other roles in society, an understanding of the Earth system is still important. They could face the more daunting, long-term challenge of trying to control or adapt to global climate change.

Our Mission to Planet Earth includes a teacher's guide and a set of seven lithographs designed to illustrate key lessons in the package. Although NASA has recommended specific lithographs for each unit (see “Visuals” selection of each unit), you may use other visuals to augment the lessons. Photographs found in magazines, newspapers and other sources work well, as do posters and slides.

