



People and Climate

Activity from *The Science of Global Atmospheric Change Teacher's Guide*
and for *Mr. Slaptail's Curious Contraption*

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BioEdSM

Teacher Resources from the
Center for Educational Outreach at
Baylor College of Medicine

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Third edition. First edition published 1998.
Printed in the United States of America

ISBN: 978-1-888997-75-0

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The activities described in this book are intended for school-age children under direct supervision of adults. The authors and Baylor College of Medicine cannot be responsible for any accidents or injuries that may result from conduct of the activities, from not specifically following directions, or from ignoring cautions contained in the text.

Development of this unit was supported, in part, by grant numbers R25 ES06932 and R25 ES010698 from the National Institute of Environmental Health Sciences (NIEHS) of the National Institutes of Health (NIH). The opinions, findings and conclusions expressed in this publication are solely those of the authors and do not necessarily reflect the official views of Baylor College of Medicine, NIEHS or NIH.

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ACKNOWLEDGMENTS

The Science of Global Atmospheric Change educational materials, first developed as part of the My Health My World® project at Baylor College of Medicine, have benefited from the vision and expertise of scientists and educators representing a wide range of specialties. Our heartfelt appreciation goes to Michael Lieberman, M.D., Ph.D., William A. Thomson, Ph.D., and Carlos Vallbona, M.D., who have lent their support and expertise to the project.

Special acknowledgment is due to our original partners in this project, the Texas Medical Association and the American Physiological Society (APS). We especially thank Marsha Lakes Matyas, Ph.D., of APS, for her direction of field test activities and ongoing collaboration.

Several colleagues provided valuable assistance during the development of this guide. In particular, we would like to thank Cassius Bordelon, Ph.D., Ronald Sass, Ph.D., Sandra Saunders, M.A., Lief Sigren, Ph.D., and Ellison Wittels, M.D.

Special thanks go to the National Institute of Environmental Health Sciences, Allen Dearth, Ph.D., Frederick Tyson, Ph.D., and Liam O’Fallon for their support of the My Health My World project and the related Environment as a Context for Opportunities in Schools (ECOS) project.

We are especially grateful to the many classroom teachers in Washington, D.C., and Houston and Austin, Texas, who participated in the field tests of these materials and provided invaluable feedback.

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CENTER FOR DISEASE CONTROL AND PREVENTION

cdc.gov/climatechange

KOEN VAN GORP - ASTRONOMY AND PHOTOGRAPHY

www.koenvangorp.be/events/eclipse_2006.html

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

ipcc.ch

NASA EARTH OBSERVATORY

earthobservatory.nasa.gov

NASA’S EYES ON THE EARTH

climate.nasa.gov

NATIONAL ACADEMIES OF SCIENCES

dels.nas.edu/Climate/Climate-Change/Reports-Academies-Findings

NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

niehs.nih.gov/about/od/programs/climatechange

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, CLIMATE SERVICES

climate.gov/#education

NATIONAL PARK SERVICE, CLIMATE CHANGE RESPONSE PROGRAM

nature.nps.gov/climatechange

DAVID SHAND

www.flickr.com/photos/14508691@N08/with/5187817955/

TAU’OLUNGA

http://en.wikipedia.org/wiki/File:North_season.jpg

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

sis.nlm.nih.gov/enviro/climatechange.html

U.S. GEOLOGICAL SURVEY, OFFICE OF GLOBAL CHANGE

usgs.gov/global_change

U.S. GLOBAL CHANGE RESEARCH PROGRAM

globalchange.gov

GRAY WATSON

http://en.wikipedia.org/wiki/File:Solar_panels_on_house_roof.jpg

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<http://www.bath.ac.uk/bio-sci/research/profiles/wheals-a.html>

WORLD HEALTH ORGANIZATION

who.int/global-change/environment



People and Climate Changes

Environment and Health Basics

WHAT IS THE GREENHOUSE EFFECT?



1. Sunlight passes through the clear atmosphere and warms the Earth's surface.
2. The warm surface reflects heat back into the atmosphere.
3. Greenhouse gases and water vapor trap some of the heat and send it back toward the Earth.

CFSs AND OZONE

The release of chemicals known as CFCs (chlorofluorocarbons) is contributing to changes in the atmosphere that will affect climate and human health and well-being. Freon and other CFCs are greenhouse gases that increase the amount of heat trapped near the surface of Earth. In addition, chlorine molecules released by these chemicals in the stratosphere break apart the ozone molecules responsible for shielding Earth from ultraviolet radiation.

Over the last decade, the amount of ozone in the stratosphere has decreased (especially in the polar regions)—leading to greater risks of skin cancer for people and also damaging vital populations of plants, animals and marine life.

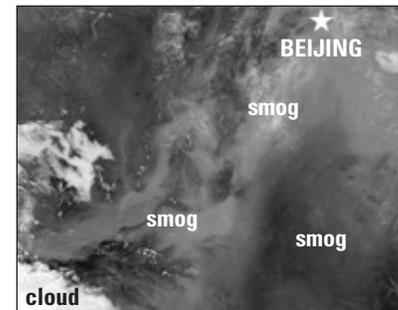
Life on Earth has been possible because of the very special characteristics of our atmosphere. The planet is warm enough to support life, thanks to the presence of certain gases in the lower atmosphere. The atmosphere also absorbs almost all of the potentially damaging radiation produced by the sun before it reaches the surface. Our atmosphere contains elements necessary for life—nitrogen, carbon and oxygen—as well as abundant water vapor to maintain the water cycle.

Human actions, particularly during the last several decades, are changing the composition of Earth's atmosphere. Since the industrial revolution, people have been removing stored carbon from Earth in the forms of coal, crude oil and natural gas, and burning it to make heat. In the process, water vapor, carbon dioxide and small amounts of other substances are produced. Other activities, such as clearing land (by burning) for agriculture, also have added CO₂ to the atmosphere. As a result, levels of carbon dioxide in the lower atmosphere have increased from around 260 parts per million (ppm) by weight to more than 350 ppm.

Carbon dioxide is one of the gases responsible for trapping heat near Earth's surface and lower atmosphere. Many scientists believe that increases in the amounts of CO₂ and other greenhouse gases, such as methane (CH₄), will lead to warmer temperatures on Earth. Even minor increases in the surface temperature of the planet could have far-reaching effects. Major climatic patterns of winds, temperature and rainfall could change drastically. This would impact water resources, coastlines, agriculture, forests, energy production and patterns of disease.

Climate, the characteristics of weather in a particular region over long periods of time, determines which kinds of plant and animal life are present, which crops can be grown, how people construct their houses and, to a great extent, people's clothing and diet. The climate of any given region depends on its distance from the equator, altitude and rainfall patterns.

Even slight changes in the world's climate affect human health and well-being in countless ways.



The dense smog over China in the above image likely results from pollution held in place by a temperature inversion. Air high in the atmosphere is usually cooler than the air near the ground. As warm air rises through the atmosphere, it disperses its pollutants, but when cold air is trapped under a layer of warm air, it cannot rise.

Winter temperature inversions are not uncommon as residents rely on coal for electricity and heat. These conditions lead to frequent build-ups of smog.

Photo courtesy of NASA Earth Observatory.





People and Climate

Environment and Health

CONCEPTS

- Major climate zones are determined by distance from the equator and angle of light received from the sun.
- Rainfall also is an important part of climate.
- Climate affects all aspects of human life.

OVERVIEW

Students will learn about Earth's major climate types and how they affect people's lifestyles.

SCIENCE, HEALTH & MATH SKILLS

- Observing
- Modeling
- Inferring
- Using maps
- Drawing conclusions

TIME

Preparation: 10 minutes

Class: Two or more sessions of 30–60 minutes

MATERIALS

- Flashlight
- Flashlight batteries
- Globe, large inflated balloon or ball

Each group will need:

- Large sheet of paper or poster board
- Several sheets of construction paper, asst. colors, 9 in. x 12 in.
- Glue sticks or paste
- One or more copies of "Global Climate Map" student sheet

We don't often think about it, but many aspects of life are determined by climate, the characteristics of the weather in a particular region over long periods of time. Climate determines which kinds of plant and animal life are present, which crops can be grown, how people build their houses and, to a great extent, people's clothing and diet.

There are three major climate zones on the planet, determined by distance from the equator. The zone nearest the equator—the tropical zone—is warmest because it receives the most direct radiation from the sun. The zones closest to each pole—the polar zones—are the coldest, because they receive the least direct radiation. The broad areas between the tropical and polar zones—known as the temperate zones—generally have snow or rain during cool or very cold winters. The temperate zones lie between 30° and 60° latitude in both hemispheres.

Factors other than latitude also affect climate. Nearness to an ocean usually keeps temperatures cooler in summer and warmer in winter. Altitude also influences temperature; mountainous areas are colder than sea-level regions at the same latitude. In addition, rainfall varies from region to region depending on wind patterns and characteristics of the land. Some parts of the world receive little or no rainfall. Most of these desert areas are located near or within the tropical zone. Other parts of the tropical zone receive large amounts of rain during certain seasons.

Most scientists are concerned that human activities are modifying Earth's climate. The addition of greenhouse gases, such as carbon dioxide, may lead to increases in global temperatures (global warming). This could cause changes in rainfall and temperature patterns in many parts of the planet, with enormous consequences for ecosystems, cities and agriculture.

The release of chemicals known as CFCs (chlorofluorocarbons) also is contributing to atmospheric changes that affect climate and human health. Freon and other CFCs are greenhouse gases that contribute to the trapping of heat near Earth's surface. In addition, chlorine molecules released by these chemicals in the stratosphere break apart the ozone molecules that shield Earth from ultraviolet radiation. Over the last decade, the amount of ozone in the stratosphere has decreased (especially in the polar regions)—leading to greater risks of skin cancer for people and also damaging vital populations of plants, animals and marine life.



Unit Links

Mr. Slaptail's Curious Contraption
Science boxes,
pp. 27–29

Explorations
Cover; What is Climate?
p. 2





This activity is designed to raise students' awareness of how climate influences all aspects of people's lives.

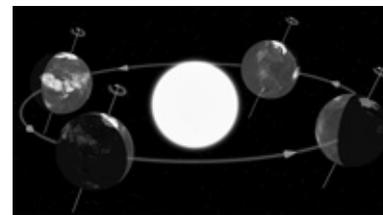
SETUP

Begin the activity with a whole-class discussion, and then have students work in groups of four.

PROCEDURE

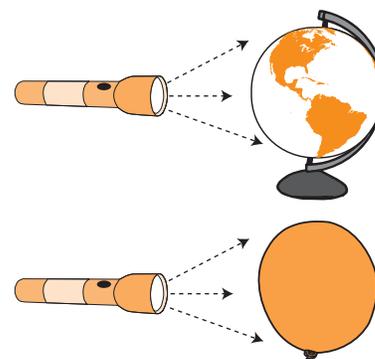
1. Darken the room and shine a flashlight at the center of a globe (or balloon, or large ball). Ask, *If the globe represents Earth and the flashlight represents the sun, which part of Earth receives the most direct light and heat from the sun?* Help students understand that the central part of the planet (near the equator) receives light at the most direct angle from the sun. Follow by asking, *Which part of Earth do you think might be warmest? Coldest? Why?*
2. Distribute copies of the "Global Climate Map" page to each student or group of students. Help students find the equator and relate it to the central portion of the balloon or ball used for your demonstration. Help students identify the polar and temperate regions.
3. Ask, *Is temperature the only important part of climate?* Lead students to understand that rainfall also is an important part of weather and climate. If students are not familiar with these concepts, introduce them at this point. *We use the term "weather" to describe conditions in the atmosphere at a given time or place. We usually measure several variables to describe weather, including temperature, rainfall, wind speed and humidity. The normal weather in a region over long periods of time is called climate. What is our climate like?* Lead a discussion of the climate characteristics in your location (winter conditions, amounts of rainfall, temperatures in summer, etc.).
4. Point out that regions with very little rainfall (deserts) also are shown on the "Global Climate Map" sheet.
5. Assign a climate zone and geographic area from the student page to each group of students. Examples might include: temperate zone of North America; tropical zone of South America; tropical desert zone of Africa; and so forth. Give more explicit geographic locations (by country or region) to older students, and have them use outside resources to gather additional information about their assigned regions. Explain that students should think about how people might live in the given climate type. Have each group discuss and decide the types of clothing that people might wear in summer and winter (or during rainy and dry seasons), what the houses might look like, and what foods people might eat. Refer students to the cover of the *Explorations* magazine accompanying this unit for ideas. Older students may

SEASONS



Earth is tilted as it revolves around the sun. When the Northern Hemisphere is tilted toward the sun, that half of the Earth has summer and the Southern Hemisphere has winter.

Illustration courtesy of Tau'olunga, Wikipedia Commons.



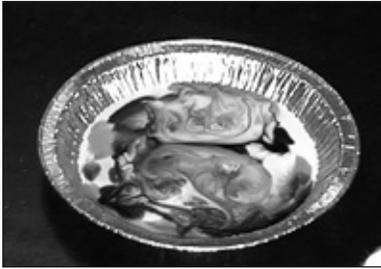
The center of the globe (or balloon) receives the most direct light.

TEMPERATURE AT HIGH ALTITUDES

Air temperatures are colder at higher altitudes because most heat on the planet is held near ground level. In fact, some mountains near the equator have snow at the top all year long.



VISUALIZATION ACTIVITY



As a supplemental activity to encourage students to think about the effects of air and water currents on the distribution of pollutants, have students conduct the “Swirled World” experiment found on page 4 of this unit’s *Explorations* mini-magazine.

Photo by M.S. Young, Baylor College of Medicine

GLOBAL ATMOSPHERIC CHANGE RESOURCES

Intergovernmental Panel on Climate Change

ipcc.ch

NASA Earth Observatory

earthobservatory.nasa.gov

NASA’S Eyes on the Earth

climate.nasa.gov

National Oceanic and Atmospheric Administration, Climate Services

climate.gov/#education

National Park Service

nature.nps.gov/climatechange

U.S. EPA

epa.gov/climatechange

U.S. Geological Survey, Office of Global Change

usgs.gov/global_change

U.S. Global Change Research Program

globalchange.gov

want to use resources in the library or on the Internet to find additional information.

6. Have each group write a description of the climate in its region and a description of how people live in this region and climate. Have students illustrate their descriptions. Consider having students follow a format such as the one shown below.

Climate Zone _____
Geographic Area _____
DESCRIBE:
The Seasons _____
Major Crops _____
Major Foods _____
Types of Clothes _____
Types of Houses _____
Other Important Factors _____

7. Display each group’s descriptions and pictures around the classroom.

VARIATIONS

- The distribution of plants and animals on Earth is determined largely by climate. Have students research and learn about the principal plant and animal communities in their assigned climate zones and regions.
- On a large sheet of paper or poster board, have each group create a “torn paper art” picture of people and houses for their climate. To create “torn paper art,” students should use only pieces of construction paper torn to any size, pasted onto a background.

OR

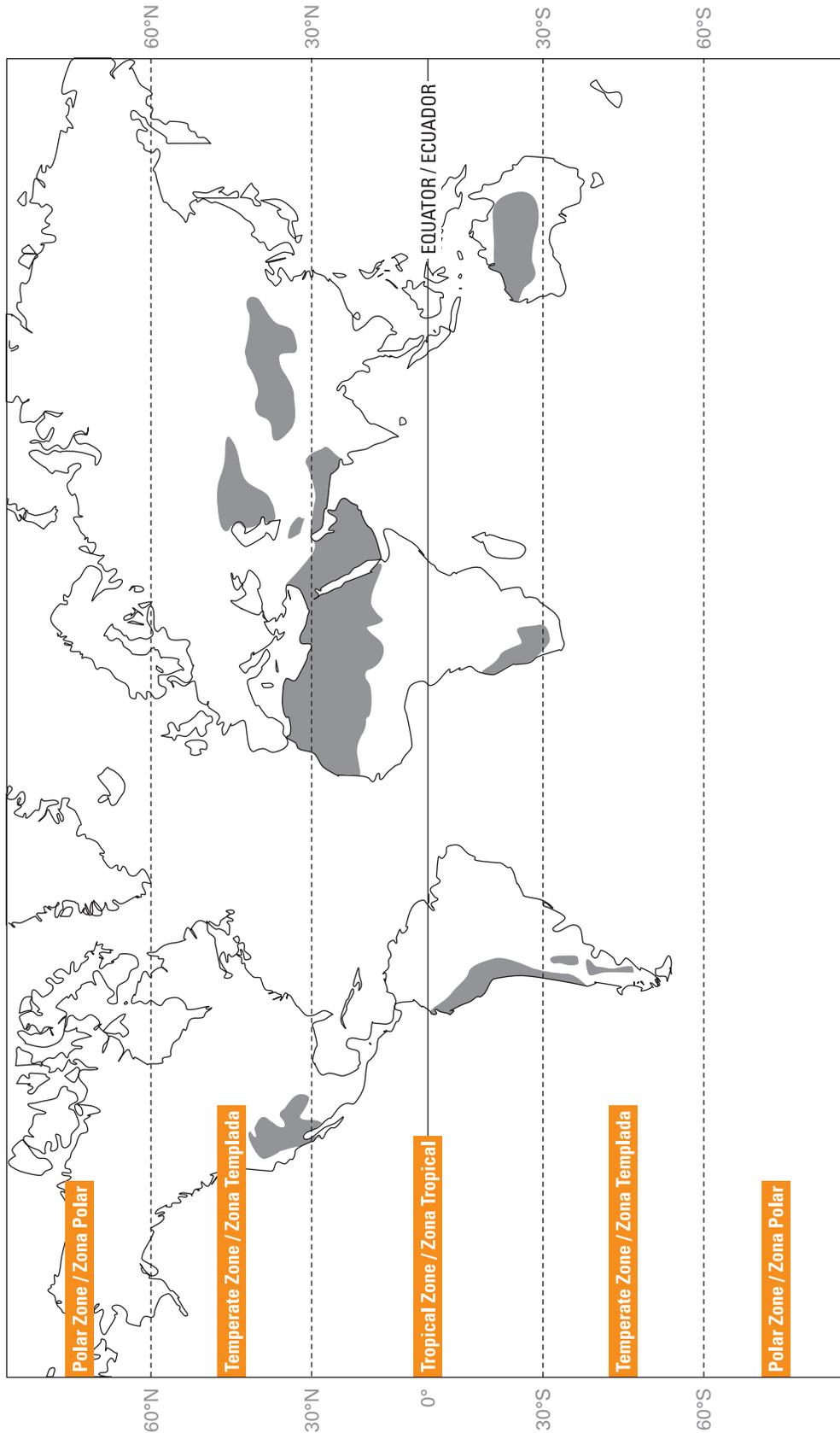
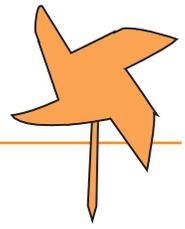
Instead of creating “torn paper art,” have each student group choose the medium for its presentation.

- Have each student group select a city, identify where the city would fall on a map, and conduct research on the climate and lifestyles of people living in that city.

QUESTIONS FOR STUDENTS TO THINK ABOUT

Ask students, *What kinds of lifestyle changes would people have to make if the predictions of global warming are accurate? Do you think something that affects the Earth’s atmosphere will impact everyone, or only certain regions?*

Global Climate Map / Mapa Mundial de Climas



Desert areas are shaded in gray. / Las áreas desérticas se señalan en gris.

