

Global Change: Humans in the Earth System

Matthew H. Hitchman



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PREFACE

Ever since I was young, I have felt drawn to the beauty, complexity, and fundamental wholeness of nature. Humans are an incredibly interesting component of our earth system. This textbook is an attempt to integrate scientific understanding of the earth system with our understanding of ourselves as humans and as a global society. This is a humble product of teaching and learning from others, primarily the result of my experience in teaching the course Global Change: Atmospheric Issues and Problems at the University of Wisconsin – Madison for the past thirty years. It is intended for use as a first course on global change. Topics are developed starting from a good background in high school science and a general awareness of culture and literature. This book includes detailed scientific descriptions and the author's analysis of global change issues. This book tries to address the question of why humans are changing the earth system, delving into aspects of value systems and human psychology.

The first section develops fundamental concepts, including an overview of the climate system, aspects of paleoclimate, and climate dynamics. The second section explores specific global change topics, including the stratospheric ozone layer, tropospheric pollution, the hydrologic cycle, vegetation, the carbon cycle, and biodiversity. The third section explores human issues, including consideration of our personal footprint, environmental chemicals, the health of the biosphere, geoengineering, and genetically modified organisms.

This attempt to interweave environmental change issues with human issues is incomplete. The world is changing every year, new aspects are being discovered about the science of global change, and our ideas of what to do about them are also evolving.

I finished this book while on sabbatical in Japan, where I was fortunate enough to be able to offer this class at Kyoto University. I also teach geophysical fluid dynamics, and sometimes I try to convey a different perspective of how storms rotate, by imagining an earth that is transparent.

What if The World Were Made of Glass?

When thinking about the Coriolis effect
it is nice to use a clear globe
to see through the earth
and thereby disrobe
preconceptions of old.

The way that cyclones spin at the top
is the same way that they spin at the bottom;
this idea even works
in the spring and the autumn.

Brief Table of Contents

Part I: The Natural Climate System

- Chapter 1. Introduction to the Earth System and Global Change
- Chapter 2. Building Blocks of the Climate System
- Chapter 3. The General Circulation of the Atmosphere and Ocean
- Chapter 4. Paleoclimate and Climate Dynamics

Part II. Anthropogenic Global Change Issues

- Chapter 5. The Stratospheric Ozone Layer and the Ozone Hole
- Chapter 6. Tropospheric Pollution
- Chapter 7. The Hydrologic Cycle
- Chapter 8. Vegetation and Climate
- Chapter 9. The Carbon Cycle and Future Scenarios
- Chapter 10. Biodiversity

Part III. Human Issues

- Chapter 11. Our Human Footprint
- Chapter 12. Value Systems and Strategies

Table of Contents

Part I: The Natural Climate System

1. Introduction to the Earth System and Global Change
 - 1.1. Spheres of the Earth system
 - 1.2. Examples of global change
 - 1.3. Changes in atmospheric composition
 - 1.4. Evolution of the Earth system and natural climate control

2. Building Blocks of the Climate System
 - 2.1. Important constituents
 - 2.2. Temperature
 - 2.3. The electromagnetic spectrum
 - 2.4. Vertical temperature structure
 - 2.5. Pressure and density
 - 2.6. Atmospheric charts
 - 2.7. Radiative balance for the Earth
 - 2.8. The atmospheric greenhouse effect

3. The General Circulation of the Atmosphere and Ocean
 - 3.1. Motivation from radiative considerations
 - 3.2. Atmospheric and oceanic heat transport
 - 3.3. A puzzle concerning land and sea
 - 3.4. Monsoon circulations
 - 3.5. Sea level pressure and wind patterns
 - 3.6. Midlatitude westerlies and subtropical easterlies
 - 3.7. Ocean gyres
 - 3.8. Thermohaline Circulation
 - 3.9. El Nino Southern Oscillation
 - 3.10. The NAM, the SAM, and the QBO

4. Paleoclimate and Climate Dynamics
 - 4.1. Introduction
 - 4.2. Evidence of past change
 - 4.3. The paleoclimatic record
 - 4.4. Climate theory and the ice age / interglacial cycles
 - 4.5. Strong climate oscillations during the Ice Ages
 - 4.6. Millennial variations during the Holocene
 - 4.7. Volcanoes and Climate

Part II. Anthropogenic Global Change Issues

5. The Stratospheric Ozone Layer and the Ozone Hole
 - 5.1. History of discovery
 - 5.2. Distribution of ozone
 - 5.3. Gas phase chemistry
 - 5.4. Of PSCs, CFCs, and the ozone hole
 - 5.5. Volcanic eruptions and ozone
 - 5.6. A comparison of ozone holes
 - 5.7. Ozone in the summer stratosphere
 - 5.8. Ozone depletion in the Arctic spring
 - 5.9. Effects of ozone loss and prospect for the future
 - 5.10. Summary

6. Tropospheric Pollution
 - 6.1. Burning fossil fuels
 - 6.2. Tropospheric ozone chemistry
 - 6.3. Tropospheric sulfate aerosol
 - 6.4. Acid precipitation
 - 6.5. NASA flight campaign: Pollution from Asia
 - 6.6. Geophysical box model: Sulfur over the Eastern U.S.
 - 6.7. Chemical transport models

7. The Hydrologic Cycle
 - 7.1. Geophysical box model: water over the globe
 - 7.2. Human influence on the hydrologic cycle
 - 7.3. Desertification
 - 7.4. Coral bleaching
 - 7.5. Factors affecting the global oceans

8. Vegetation and Climate
 - 8.1. Biomes
 - 8.2. Plant physiology
 - 8.3. Plant migration
 - 8.4. "CO₂ fertilization", O₃, and the future

9. The Carbon Cycle and Climate
 - 9.1. Role of carbon in the earth system
 - 9.2. Components of the carbon budget
 - 9.3. Current carbon dioxide budget
 - 9.4. Current methane budget
 - 9.5. Future scenarios

10. Biodiversity
 - 10.1. Biodiversity and climate stability
 - 10.2. Phytoplankton, DMS, and clouds
 - 10.3. Reductions in biodiversity
 - 10.4. Viruses
 - 10.5. Genetic engineering
 - 10.6. Perspectives on the value of biodiversity

Part III. Human Issues

11. Our Human Footprint
 - 11.1. Water, land, food, and energy
 - 11.2. Limits to human habitation
 - 11.3. Energy use
 - 11.4. Renewable energy
 - 11.5. Chemical hazards
12. Value Systems and Strategies
 - 12.1. Perspectives on the human condition
 - 12.2. Geoengineering
 - 12.3. What can we do?