Earth System Science

How does the Earth on which we live function as a whole?

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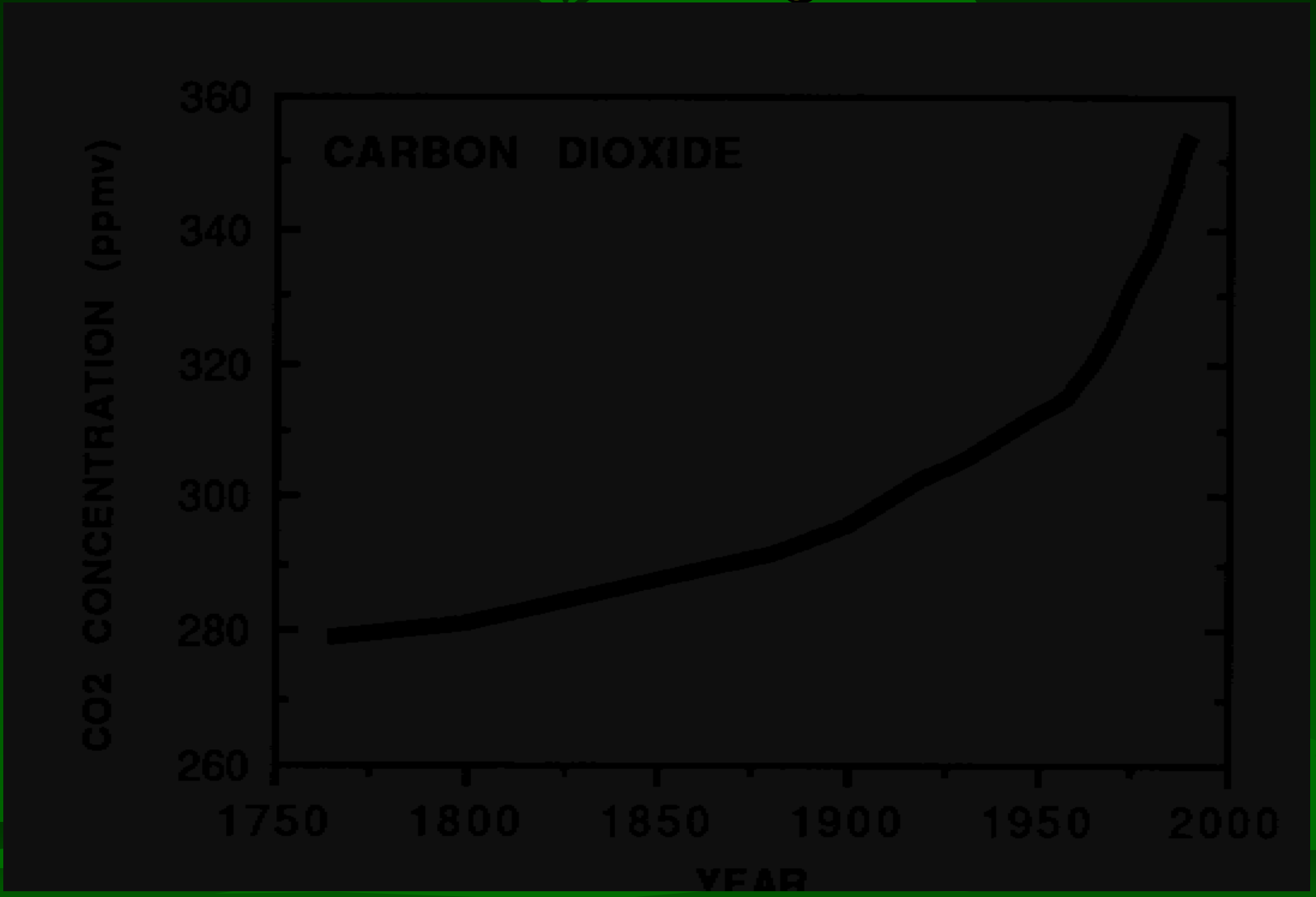
Key Points

- Human activities are affecting the environment on global scale
- The impacts on human societies are potentially substantial but largely unknown
- We need a basic scientific understanding of how the Earth functions as an interacting system

Human activities are affecting the environment on a global scale

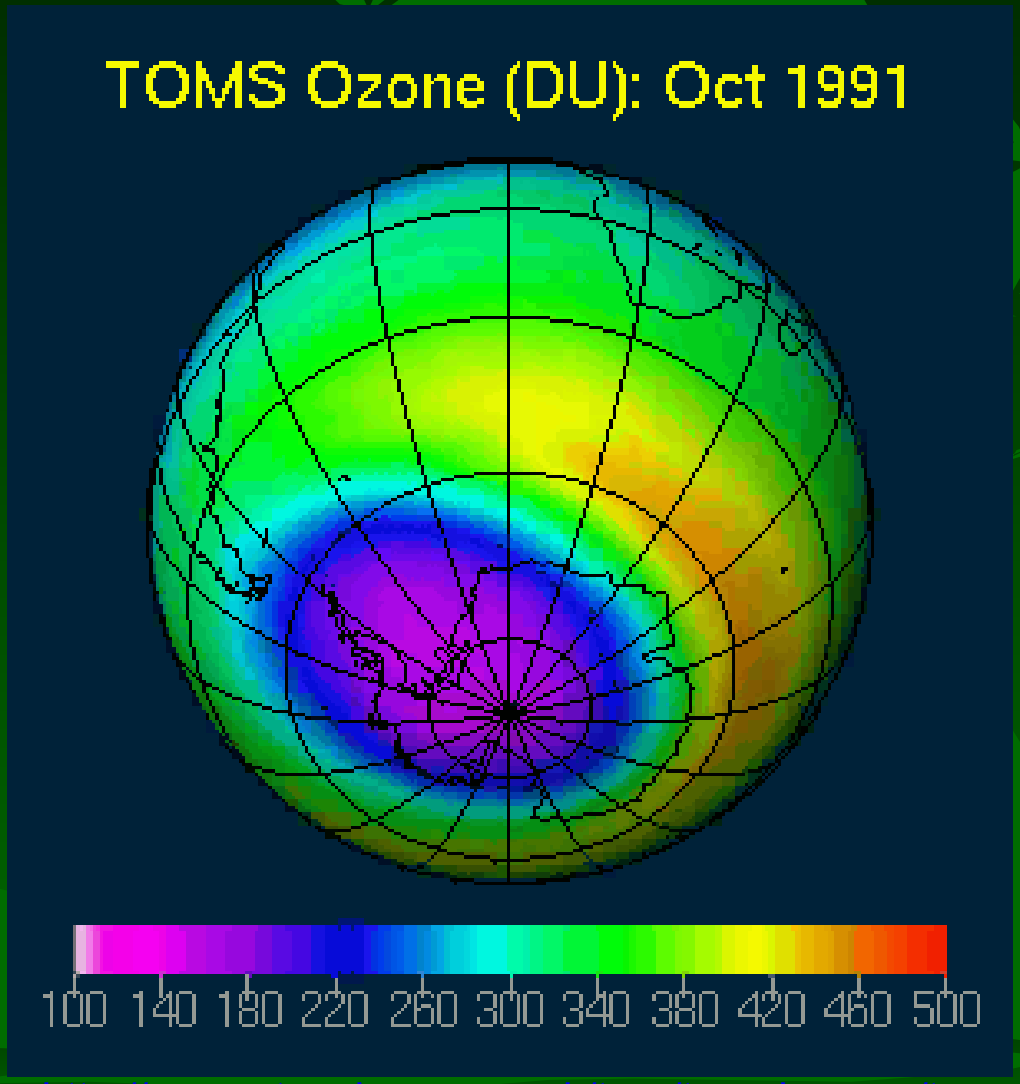
- Burning fossil fuel is causing global warming and rising sea-level
- Emission of CFCs has caused the depletion of stratospheric ozone
- Soil erosion is reducing agricultural productivity
- Deforestation and habitat destruction threaten species diversity
- Pesticides, fertilizers are polluting water resources
- Sulfate and nitrogen oxide emissions cause acid rain

The Probable Cause of Global Warming



- IPPC 1990 page xvi

The Antarctic Ozone Hole



- http://www.atm.ch.cam.ac.uk/tour/tour_images/toms1091.gif

Acid Rain

- http://odin.dep.no/md/publ/acid/Erodes.html

Water Resources

- http://www.oroville-city.com/lakeview.html

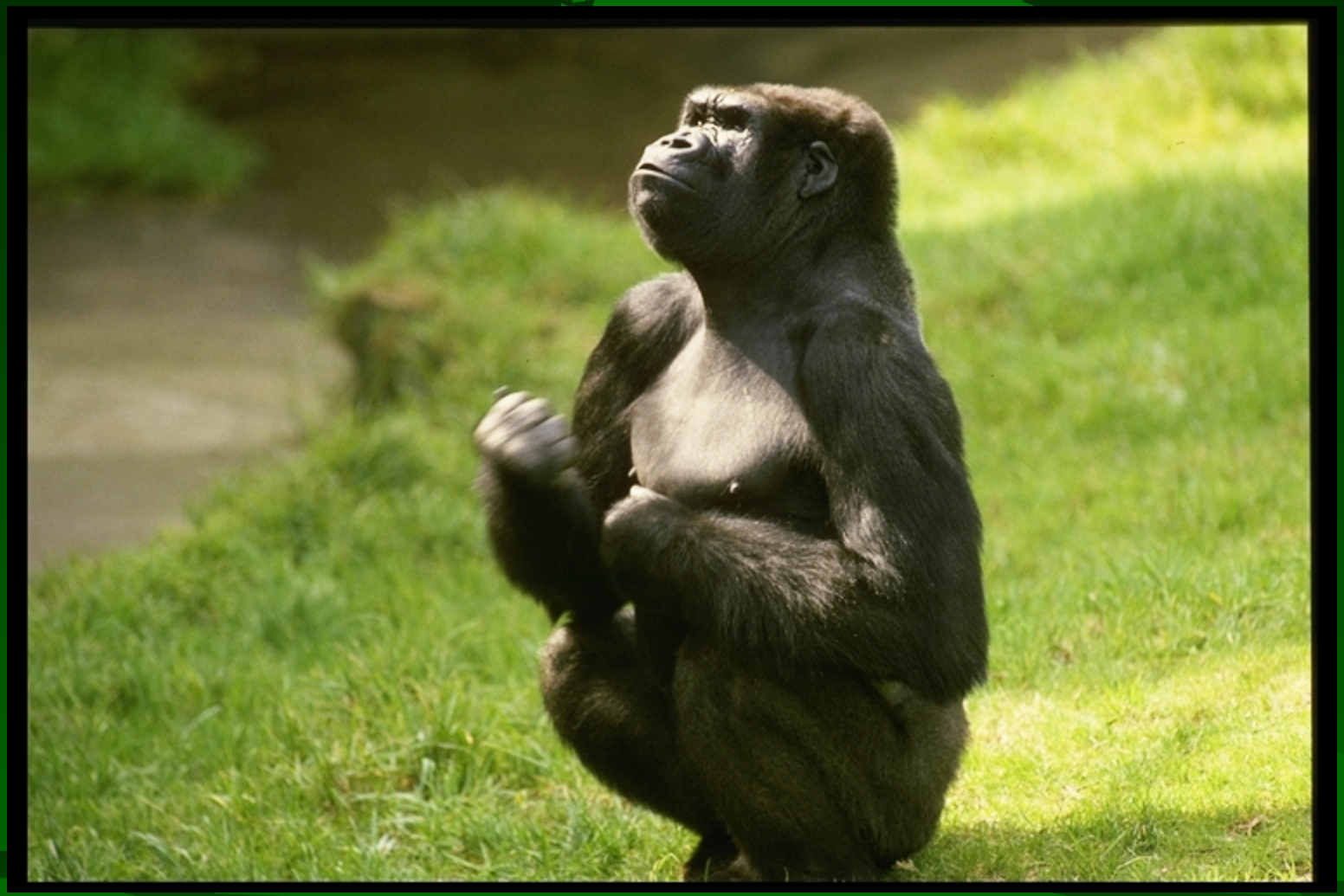
Soil Degradation

- National Geographic Society

Habitat Destruction

- http://www.panda.org/multimedia/photogallery/photogallery.htm

A Mountain Gorilla



- Corel Professional Photos CD-ROM Sampler #200051

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Impacts on human societies potentially substantial but largely unknown

- Fundamental values and lifestyles may be questioned
- It may be decades before the effects become apparent
- Remedial actions have indirect consequences

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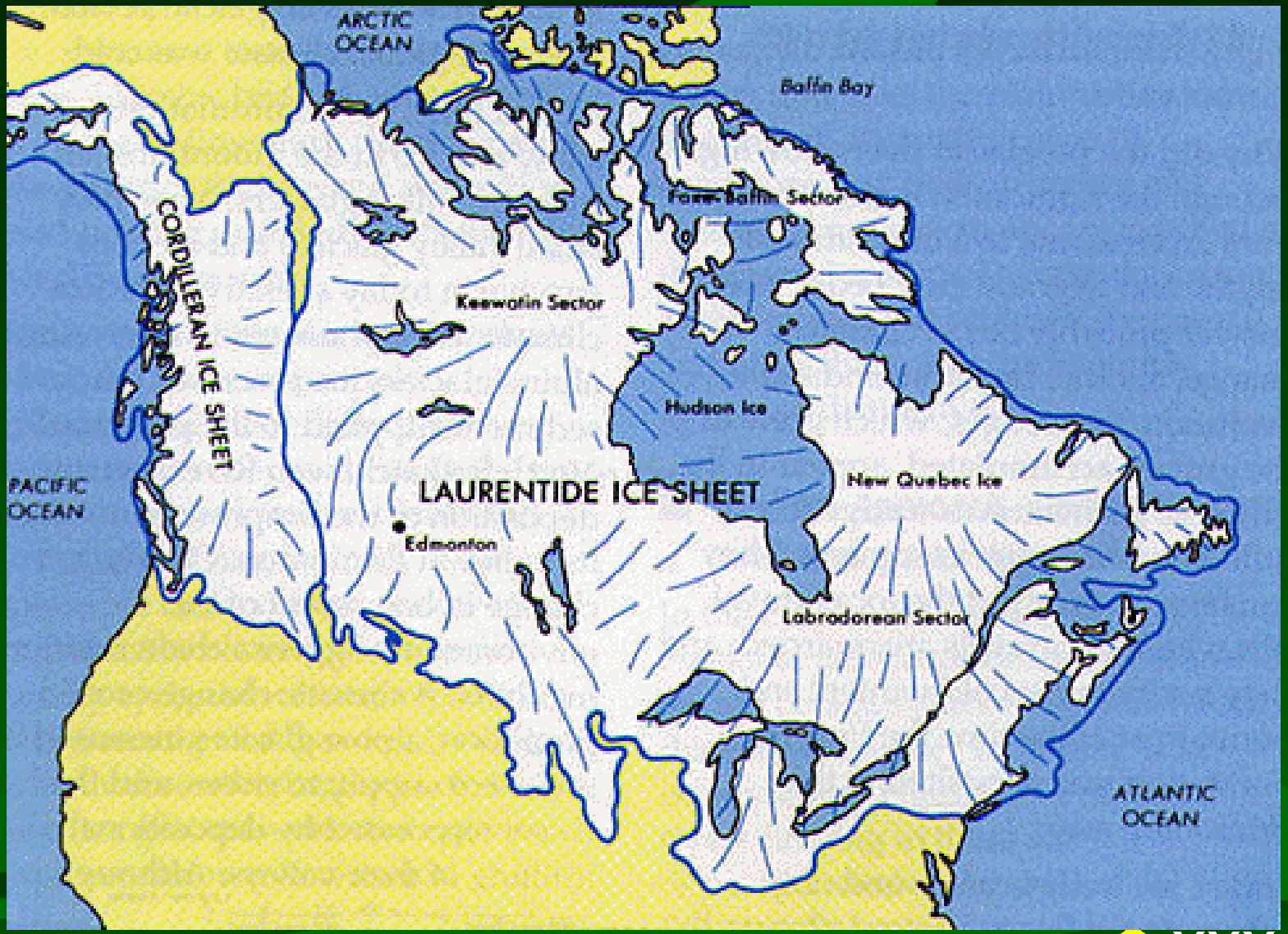
- Understand and distinguish natural variability in climate and ecosystems
- Include the interactions between the atmosphere, oceans, land surface, ice, and biosphere
- Examine the evidence from the past
- Document the effects of human activities
- Simulate future changes and assess their probable consequences

Last Glacial Maximum



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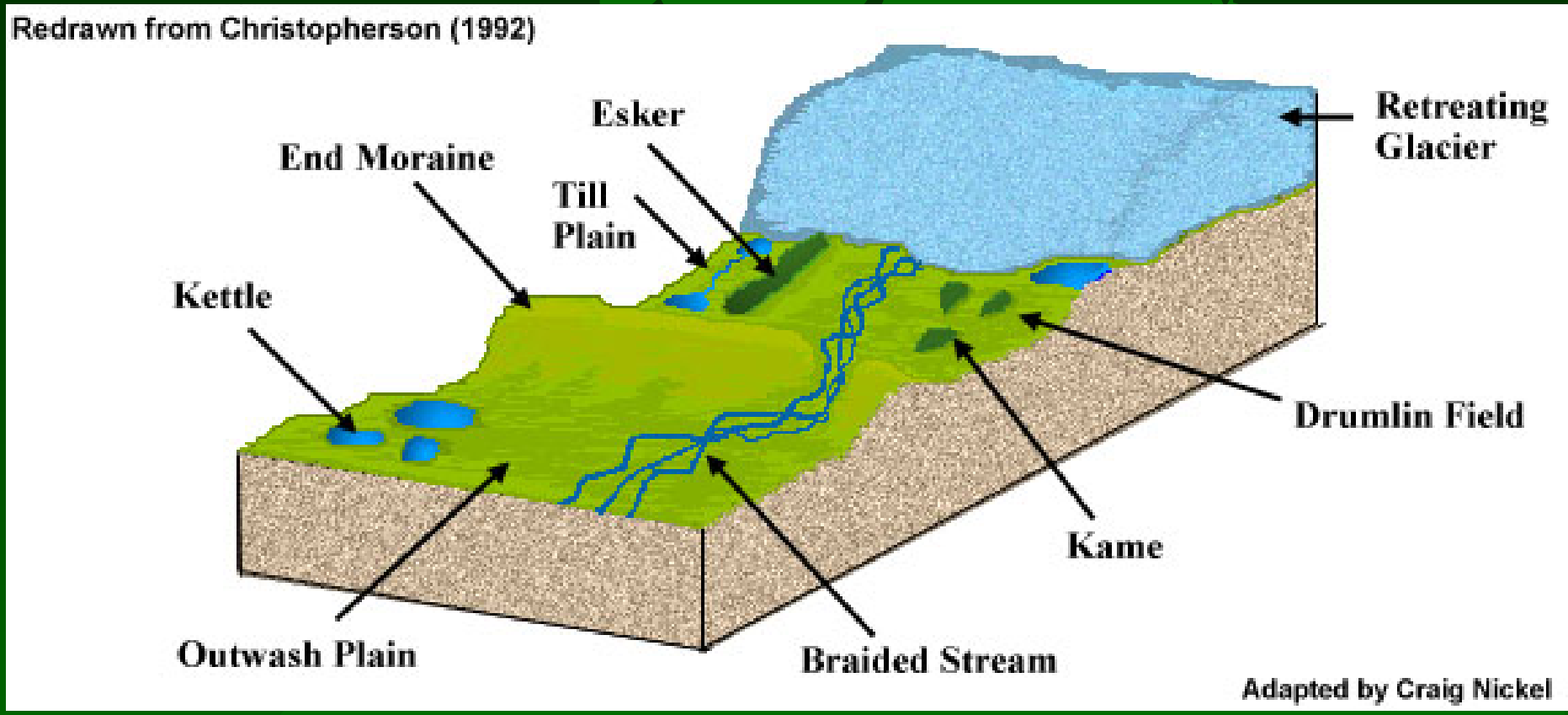
Signs of Past Glaciation



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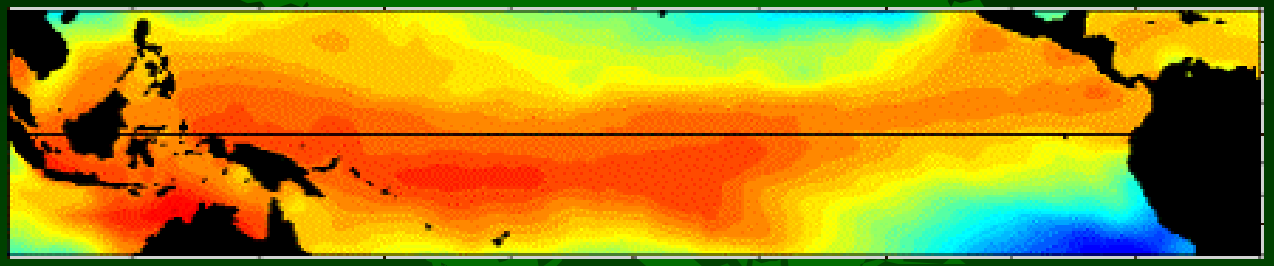
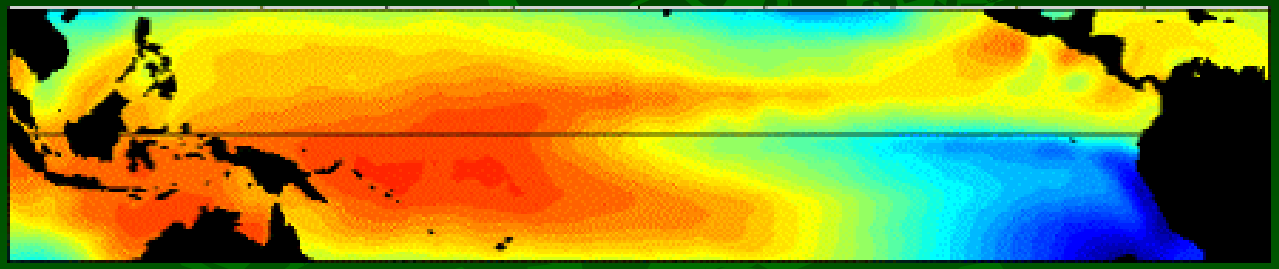
Equatorial Pacific Sea SurfaceTemperature

- El Nino



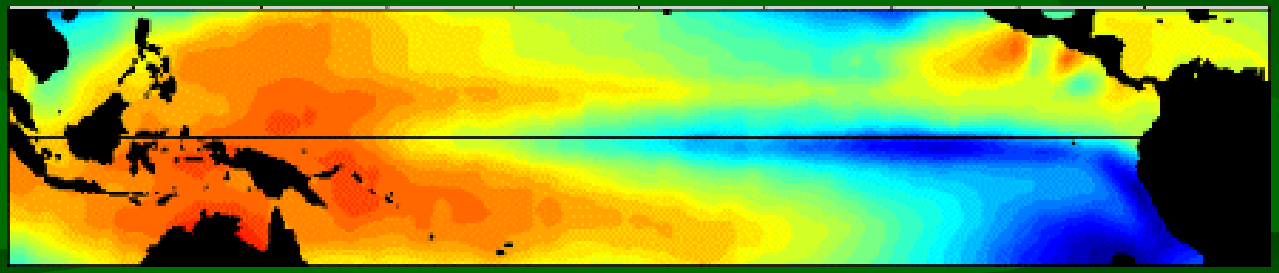
Dec 97

- Normal



Dec 90

- La Nina



- NOAA/PMEL

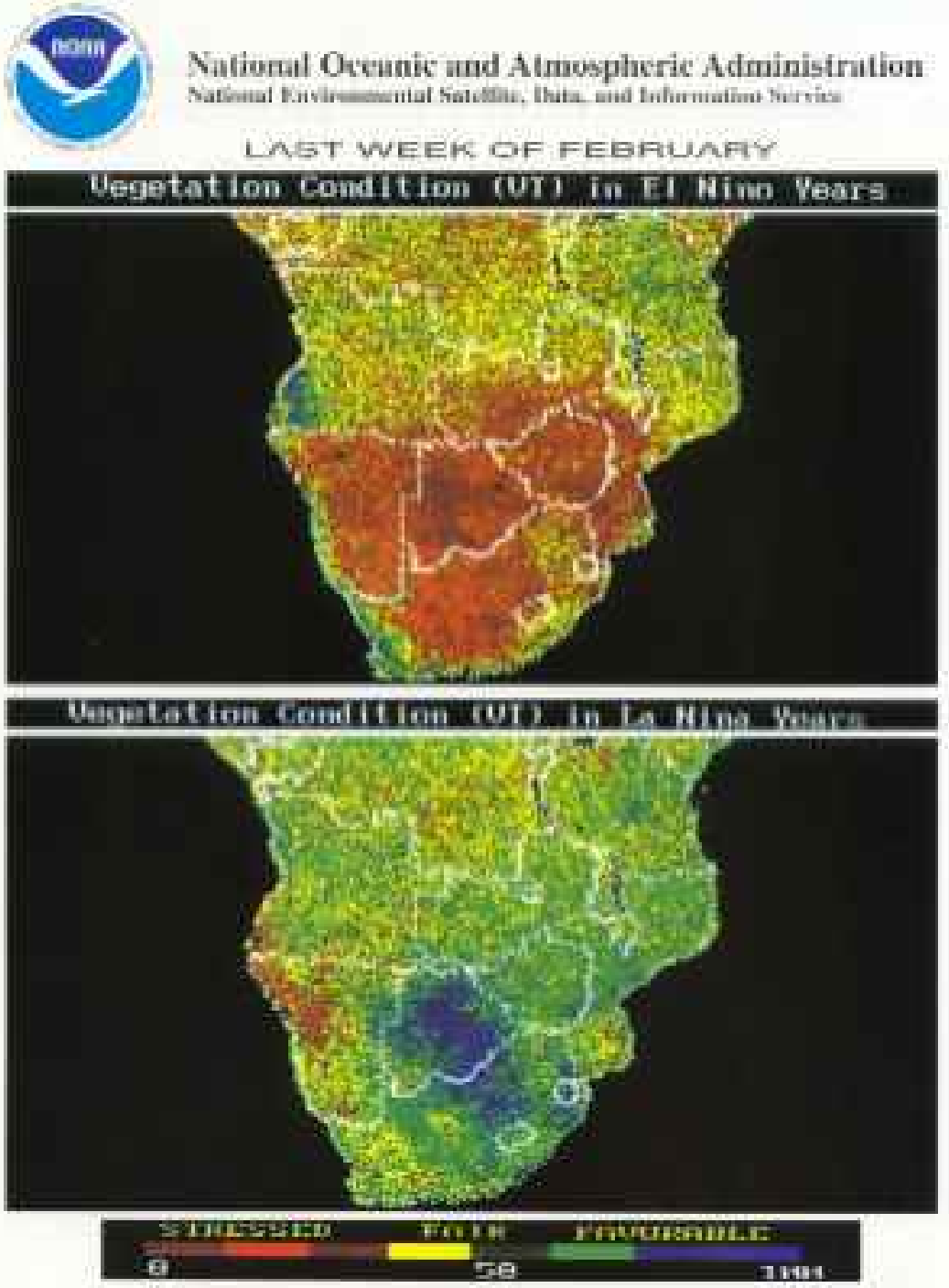
Dec 88

Measuring Ocean Winds and Temperature

- National Oceanic and Atmospheric Administration

Vegetation Stress

- El Nino (top)
- La Nina (bottom)



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Drilling Ice Cores in Peru

- Annual layers in the Quelccaya Ice Cap

- Distant view of ice cap

Lonnie Thompson

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Pipeline in British Columbia

– © http://corbis.com 10585078.jpg

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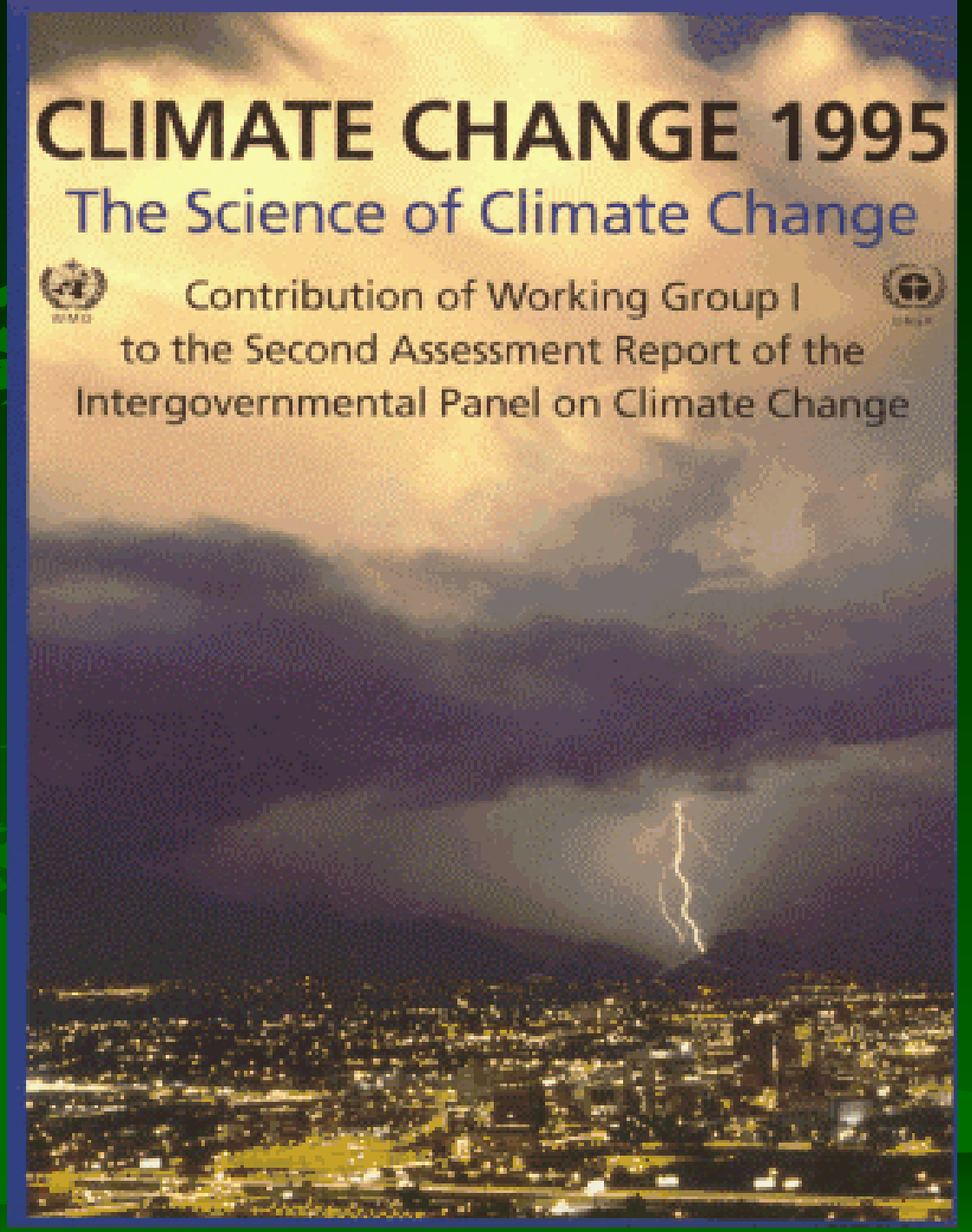
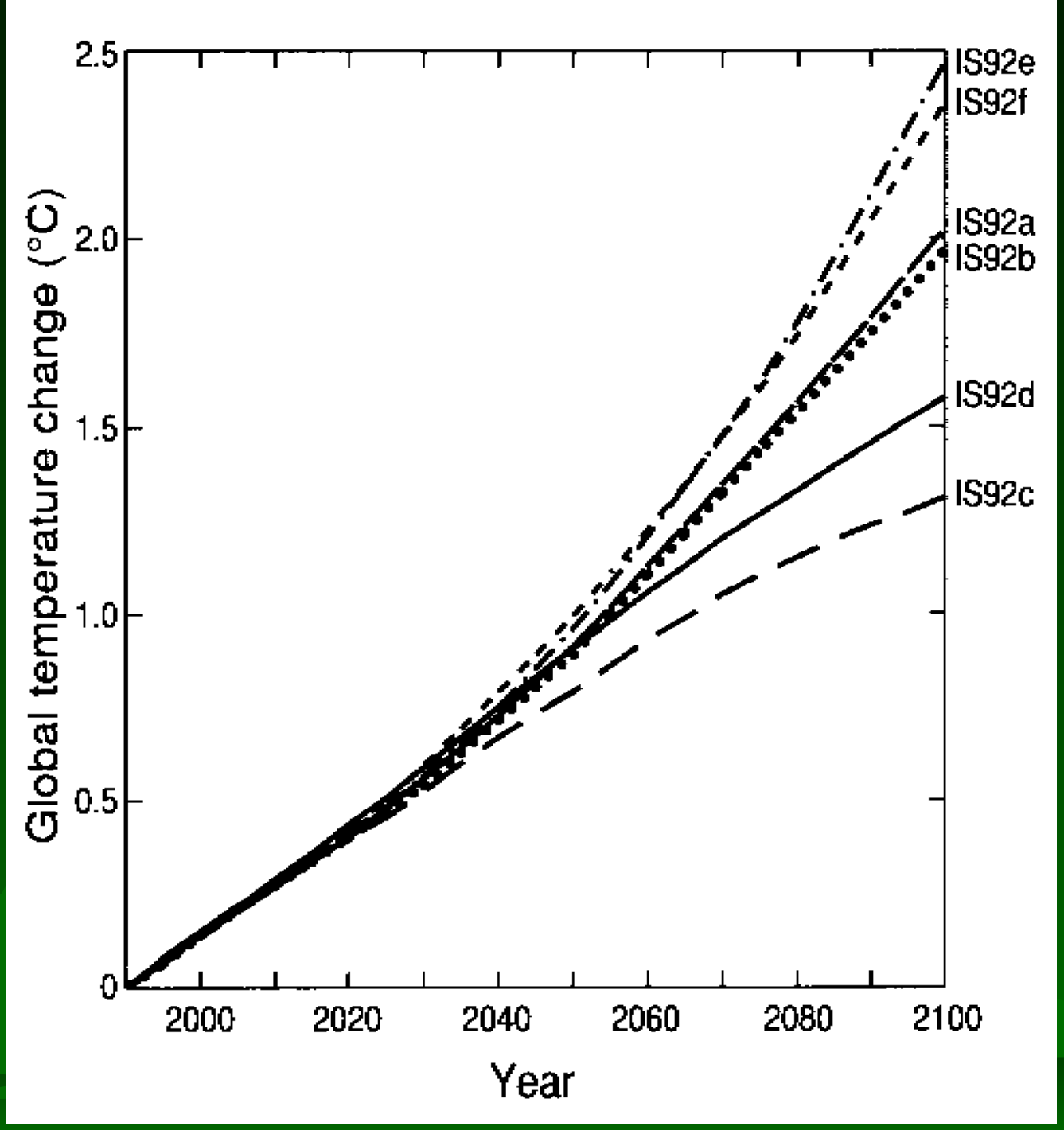
The Intergovernmental Panel on Climate Change



- IPPC 1995

Projected Future Warming

- For various emission scenarios
- For high or low climate feedback multiply by 1.8 or 0.6
- IPPC 1995



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Earth System Science
Sources of Information

- Earth System Science - Overview, NASA, 1986 (ESS)
- Climate Change 1995 , Intergovernmental Panel on Climate Change (IPPC)
- Referenced web sites