Climate Change: The Move to Action
(AOSS 605 (480) // NRE 501.076)

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LECTURE NUMBER 2
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Class News

- There is a ctools site (AOSS 480 001 W07)
- Plan for a "community" web site to support the class with RSS link and infrastructure to support our class as a community
  - Want to start a wiki book
- First Readings: Spencer Weart's *The Discovery of Global Warming* http://www.aip.org/history/climate/index.html
  - And in particular two subsections
    - Carbon dioxide greenhouse effect: http://www.aip.org/history/climate/co2.htm
    - Simple climate models http://www.aip.org/history/climate/simple.htm
- Other references:
  - Glossary of climate and weather jargon (overkill, but might be useful) http://www.wrcc.dri.edu/ams/glossary.html
  - Link to the United States Climate Prediction Center (this is NOT climate change, but demonstrates the type of real problems people worry about impacting people) http://www.cpc.ncep.noaa.gov/


Outline of lecture

- Course Description
- Layout of the problem: The motivators
- Science-Mitigation-Adaptation Framework
- Discussion

From Course Description

- Identify the important elements of science, policy, economics, public health, etc.
  - Where should we pay attention?
  - What do we know versus what do we believe?
- Identify and map the interactions between these elements and connections to other external elements
  - How big is the problem?
- How is all of this changing?

Approximate Course Outline

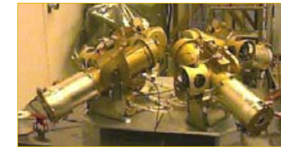
- Week 1: Description of course and course goals. Scientific investigation of climate – how is it done? What is climate variability? What are the fundamental balances of energy and how might these change? (Conservation principle.) What's the relation between weather and climate?
- Week 2: What are the elements of the climate system? What are the roles of these elements? Where can we expect the unexpected? Incremental versus abrupt climate change.
- Week 3: How is the climate variability measured? What are the sources of observations and how reliable are these observations? How do we build modern climate data records from weather data?

Approximate Course Outline

- Week 4: What are the components of modern climate models? How well do these models represent the fundamental balances and the observed variability? Why are the model predictions controversial? What do the models tell us about the observations, and what do the observations tell us about the model? How do we determine cause and effect, the attribution of observed signals to specific mechanisms?
- Week 5: Coherent and Convergent Evidence of Climate Change. What are the signals of climate change and how do these stack up against theory and predictions? Physical climate, ecosystems, coastal societies.
- Week 6: Social and Ethical Considerations: What are the potential social issues and ethical ramifications for mitigation and adaptation associated, primarily, with changes in energy sources, production, and use? Climate change in wealthy countries versus not so wealthy countries.

Approximate Course Outline

- Week 7: Global/International Policy Response: What are the strategy, role, impact and future direction of Global and International Multi/Bi/Unilateral and Sectoral Climate Regimes? How does the United States play in the international arean?
- Week 8: Sub-National Policy Response: What are the strategy, role and impact of, Sub-National Climate Regimes? Are bottom-up approaches more promising than top-down? What are U.S. states and communities doing? Will it impact federal policy?
- Week 9: Impact of Climate Change on Public Health: Are there health risks (advantages) associated with climate change? Emerging diseases. Heat waves. Air quality and climate change.



Approximate Course Outline

- Week 10: Private Sector Perception and Response: What issues are seen by the business community? How does this change from sector to sector? What is the role of liability risk? Business and policy: the need for national policy. Opportunity, competitiveness, risk.
- Week 11: Economics, Markets, and Trading: How is the value of the climate integrated into our economies? Carbon market and carbon trading, is this the strategy for controlling emissions through cost? What is the role of taxes and incentives?
- Week 12-13: Adapting to Climate Change: Vulnerability, resilience and adaptive capacity. When do societies adapt to climate change? Who pays? What is the best scale for measuring, implementing and monitoring adaptation options? Who gains, who loses? What are the strategies for integrating and mainstreaming climate change into the fabric and practices of society (planning, management and policy making)?   What is the role of geo-engineering? Finally, how does the prospect of abrupt climate change influence these questions?
- Week 14: Project presentations.

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Course Project

- Reflective of workplace …
  - “Complex Problems with no Known Solutions.”
- Groups of individuals with varied expertise
- Responsive to “news”
  - Relationship of news to science
- Project will provide recommendations, a strategy for addressing the complex problem.
  - What are first steps?
  - What do we need to look out for as these steps are taken?
- Monitor progress // briefing during the course
  - Use of community web page
  - Development of wiki book
  - Possible publication on widely accessed web site.
- Presentation at end of course
  - Nomination for student prize

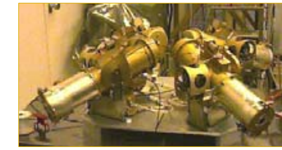
What are the pieces which we must consider? (scientific investigation)

SCIENTIFIC INVESTIGATION OF CLIMATE CHANGE

What does science bring to the problem?

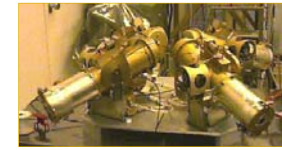
- We have predictions that the climate will warm significantly and quickly.

- How do we evaluate this information, how do we use it?



What is science, the scientific method?

- Elements of the scientific method
  - Observations of some phenomenon.
  - Identification of patterns, relationships and the generation of suppositions, hypotheses.
  - In principle, hypotheses are testable:
    - Experiments: cause and effect
    - Prediction instead of experiments?
  - Development of constructs, theory, which follow from successful hypothesis.
    - Predict behavior, what does the next observation might look like?
  - Development of tests, experiments that challenge the hypotheses and predictions.
    - Validate or refute theory and elements from which the theory is constructed.



What is science, the scientific method?

- Elements of the scientific method (continued)
  - Other independent investigators must be able to test, and verify, the hypotheses and predictions
  - Repeat with different, more stringent tests, and new observations to see if the phenomenon converge to some consistent picture, or whether there are phenomena that defy explanation by the hypotheses.

Goals and attributes of scientific investigation

- Objective, unprejudiced generation of knowledge.
  - Do you believe that the information is unprejudiced?
- Some attributes of the knowledge generated by science:
  - The knowledge is transient.
    - Evolution of “facts”
    - Qualification of “facts”
  - Search for cause and effect
    - Often only approximately determined.
  - Based on observations, experiments or predictions, and validation of those experiments or prediction
  - Management of complexity; in the case of climate the quantitative description of the climate system is a vast simplification of nature.

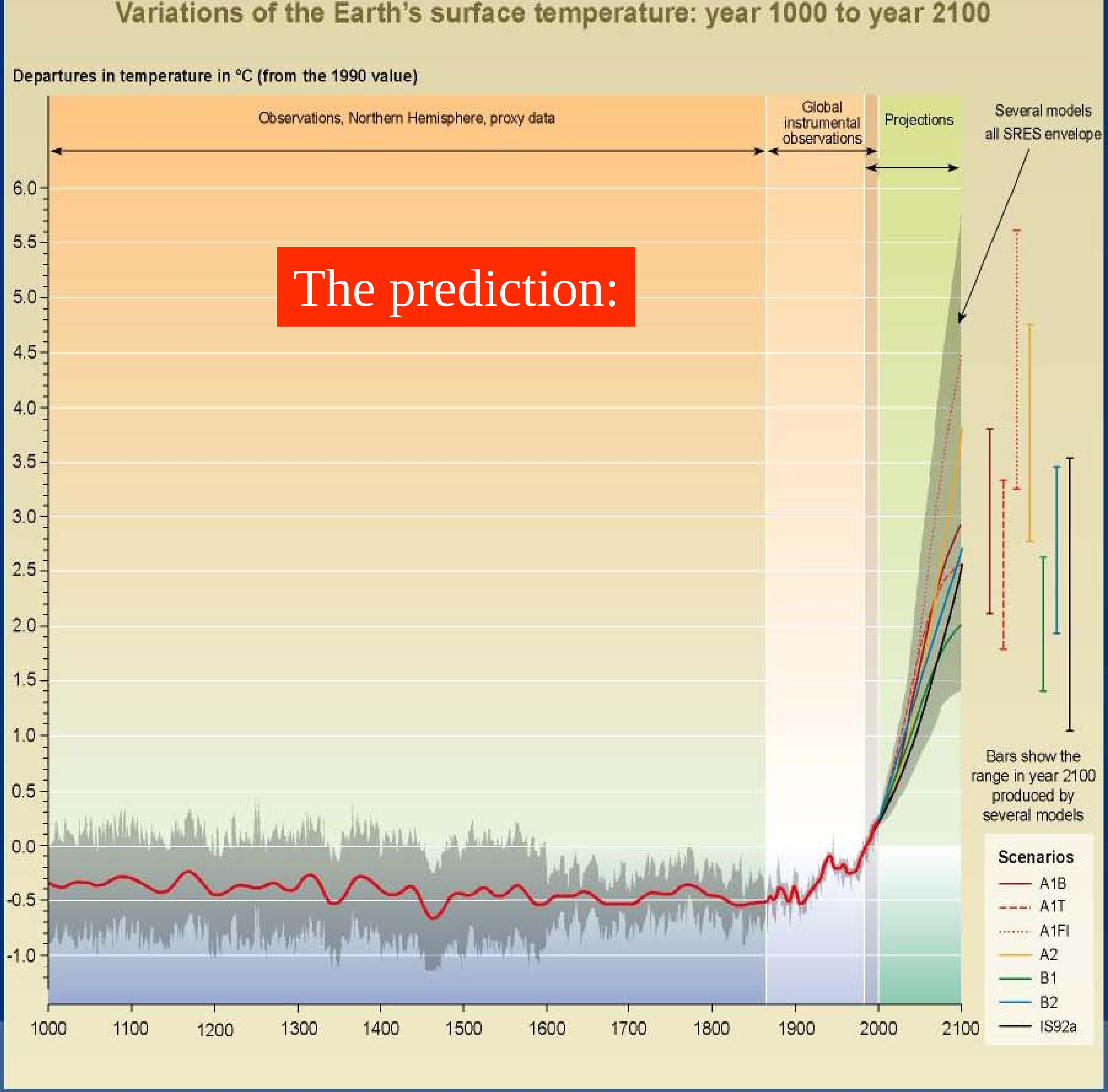
Types of predictions

- Deterministic prediction: A prediction that states specifically what is expected to happen at a particular place at a particular time.

- Probabilistic prediction: What is likely to happen over the course of time in some average sense → global, continental, regional, in your congressional district.

What do predictions tell us?

Basic physics of temperature increase is very simple, non-controversial.

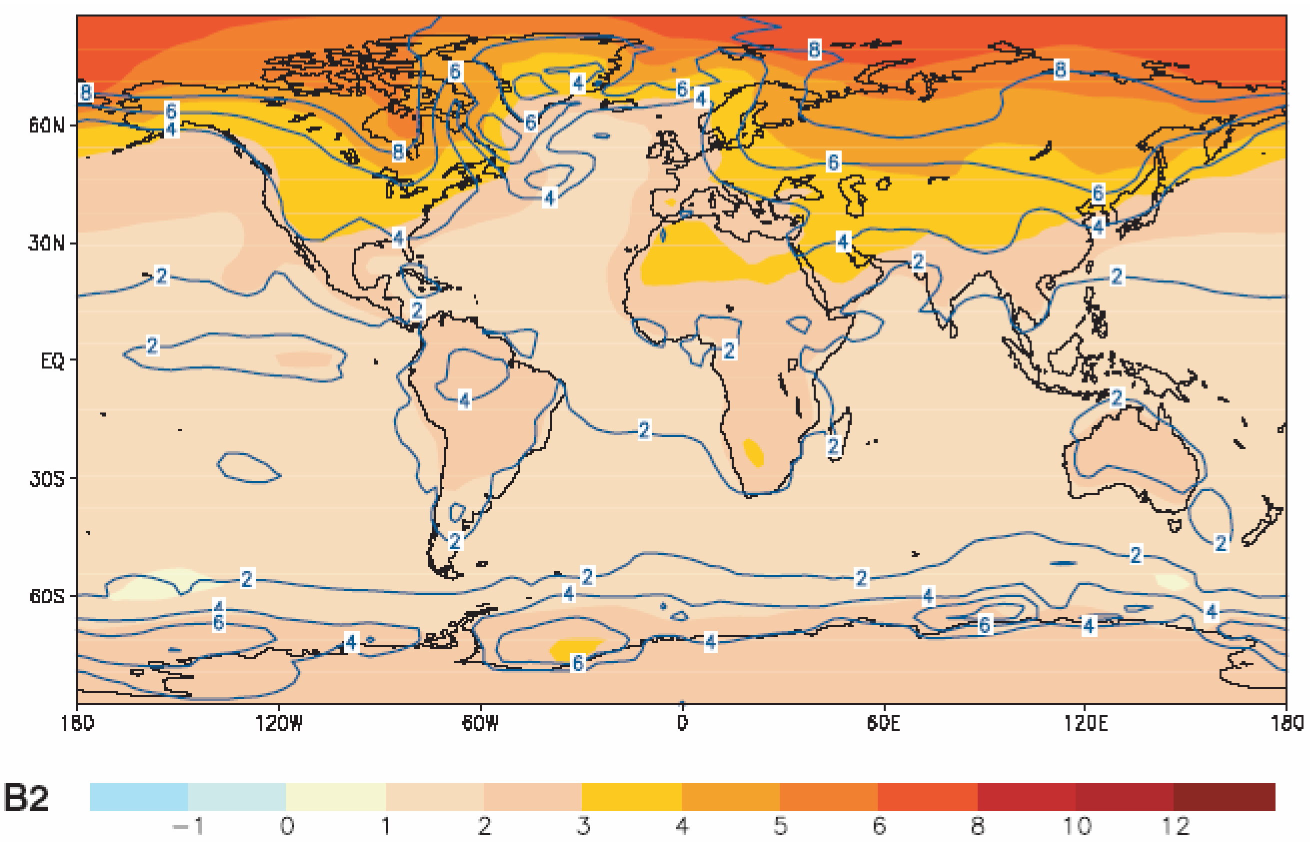


Note: There is consistency from many models, many scenarios, that there will be warming. (1.5 – 5.5 C)

Also, it's still going up in 2100!

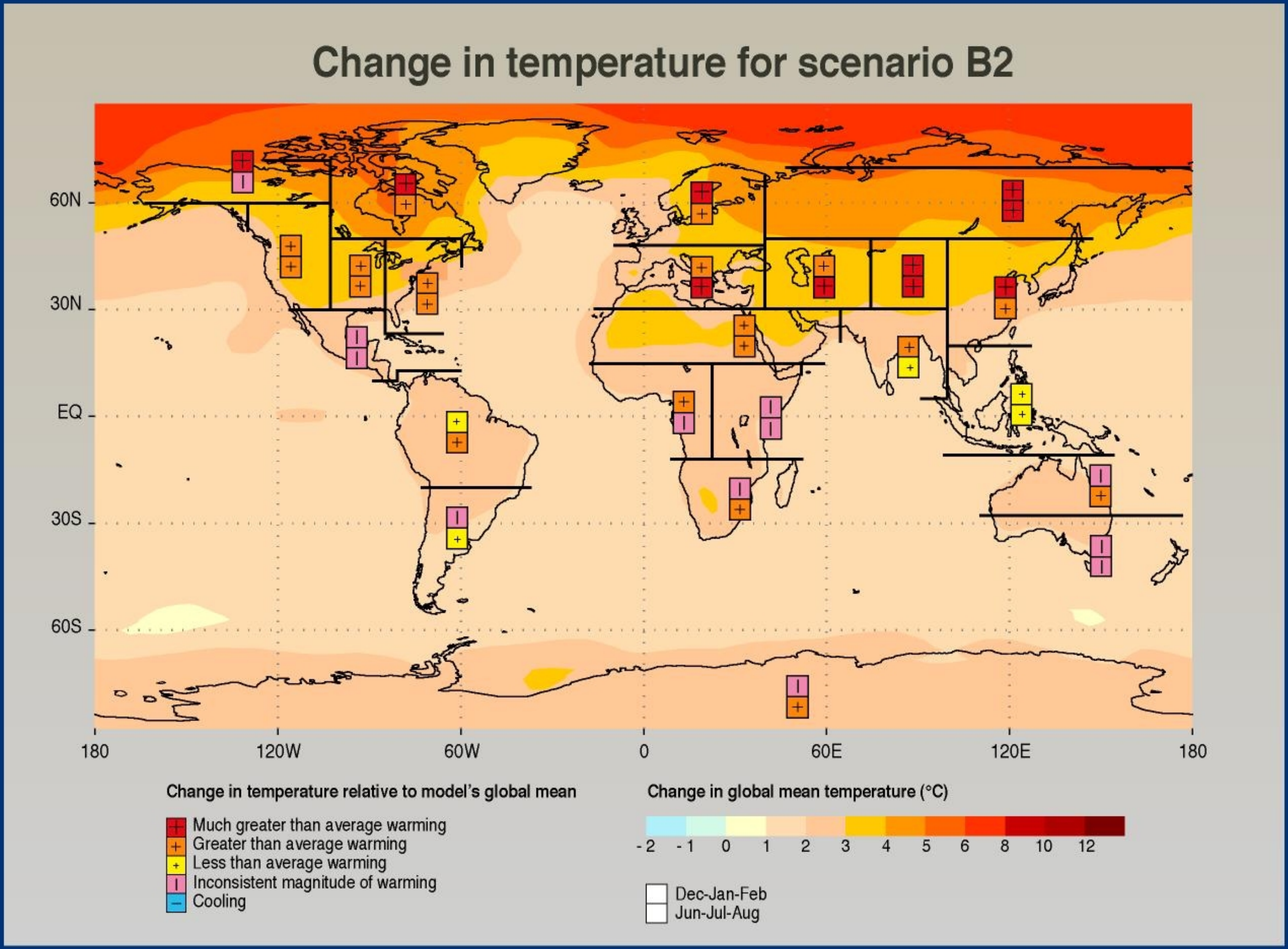
SYR - FIGURE 9-1b

Projected Global Temperature Trends



2071-2100 temperatures relative to 1961-1990.
Special Report on Emissions Scenarios Storyline B2 (middle of the road warming).

IPCC '01



SYR - FIGURE 3-2 b

Systematic Temperature Changes

- Global Temperature increase 1.5 – 4.5 C
- Poles warm more faster than globe, especially the North Pole.
- Land warms faster than ocean.
- Night warms faster than day
- Spring starts earlier
- Autumn starts later

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