

# Using Mathematics to Understand Environmental Change

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Mathematics and the Climate Workshop  
Trinity University

# Mathematics in Climate Research

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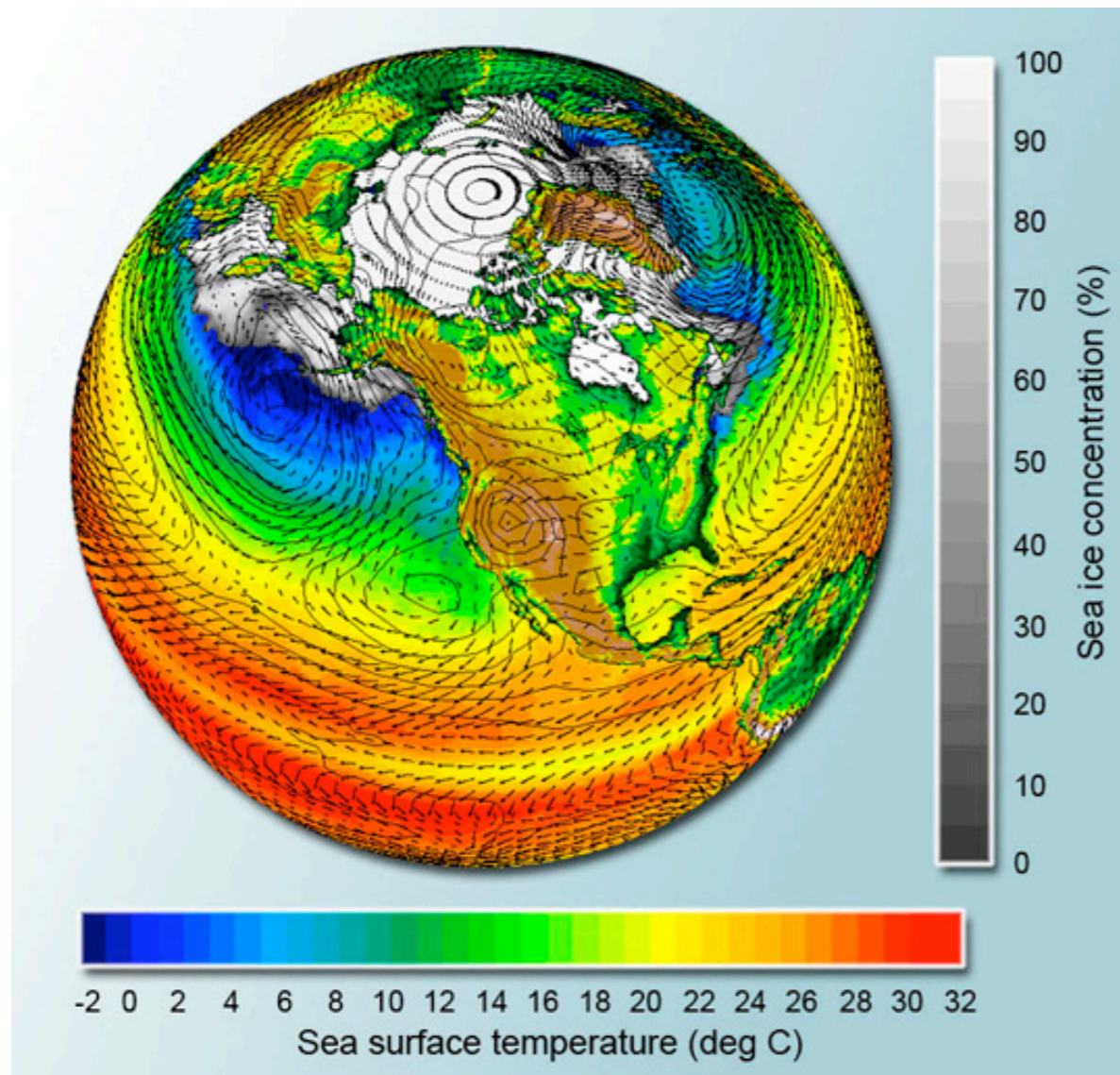
- Assessing Effects of Global Warming
- Creating Models
- Understanding Complexity of Our Climate
- Quantifying Climate Change

# Assessing Effects of Climate Change

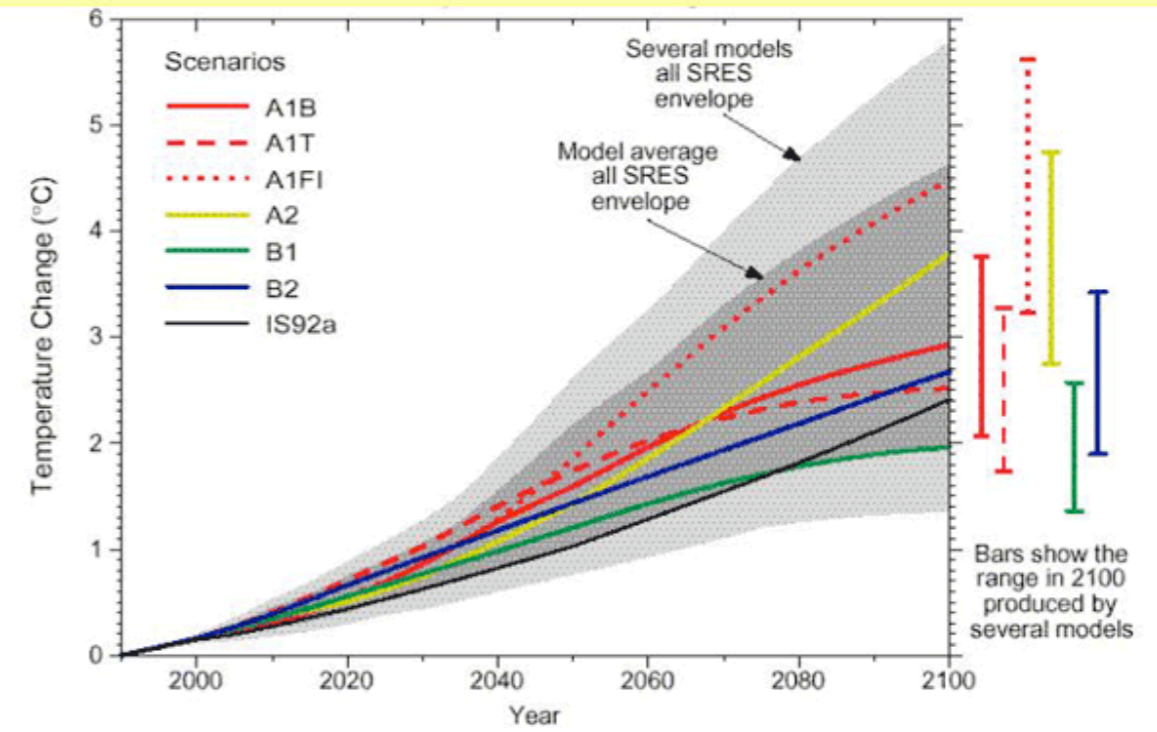
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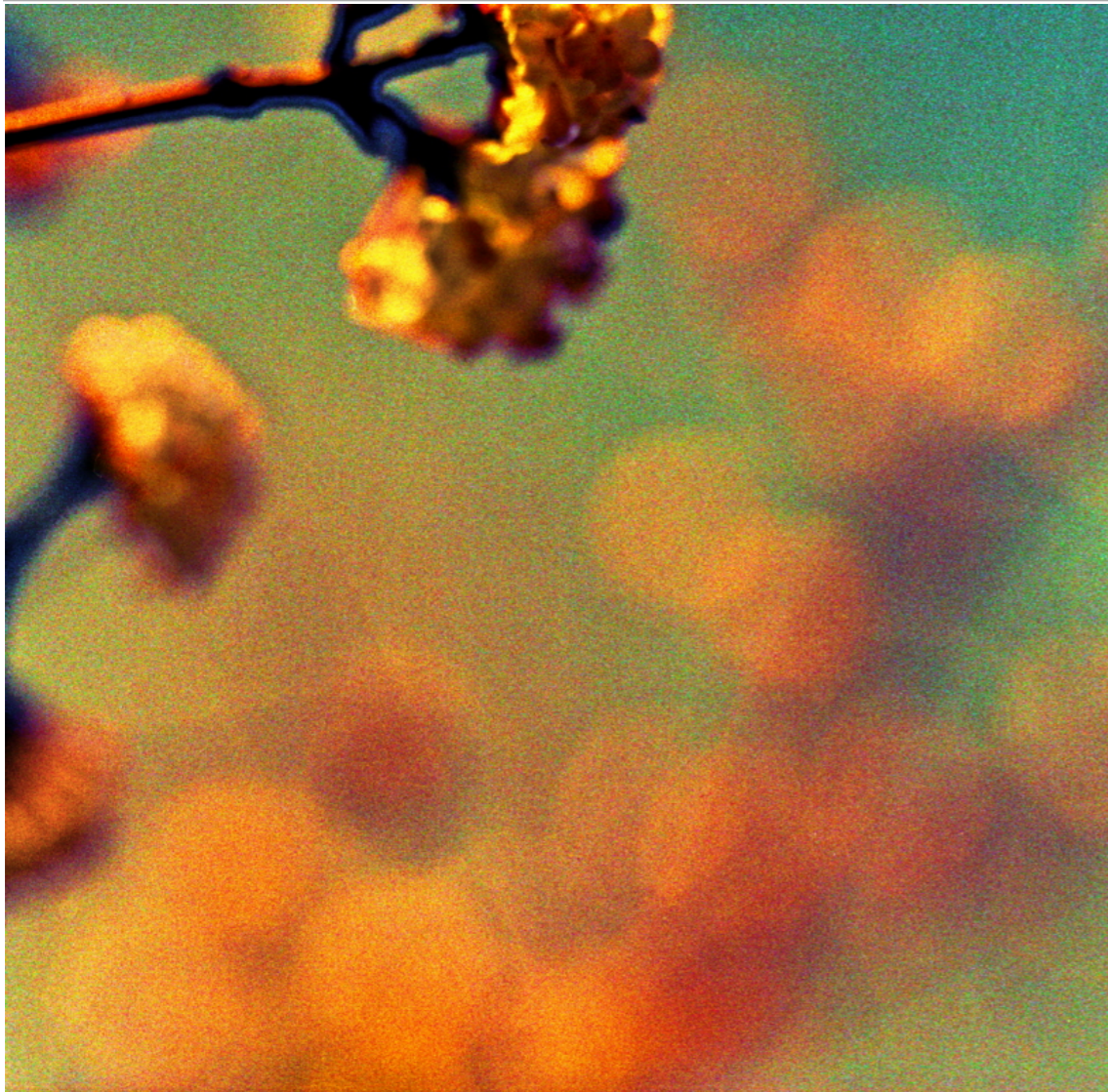
# Creating Models



## Projected global warming



# Understanding Climate



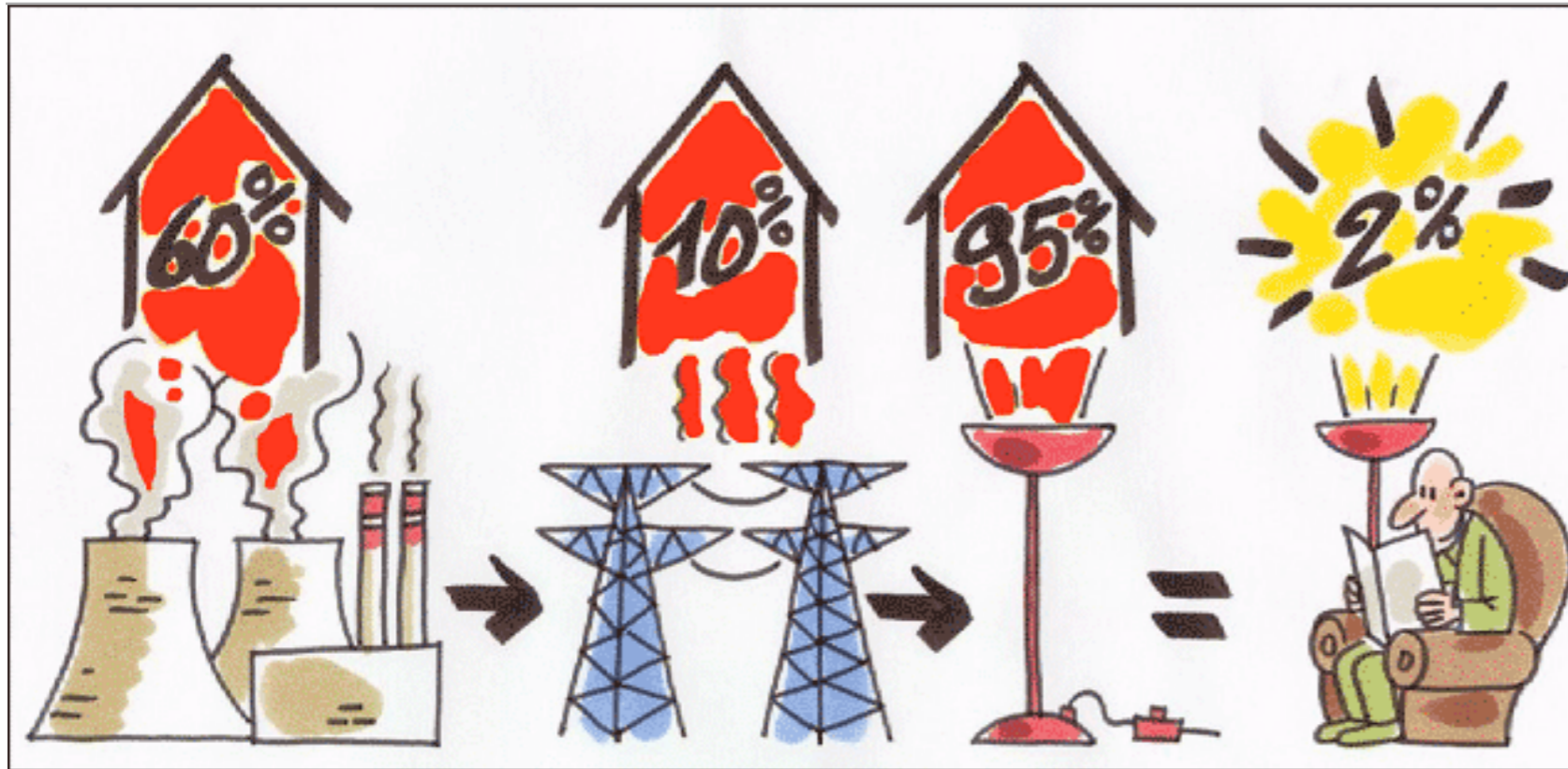
# Quantifying Climate Change

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- Deforestation
- Energy Consumption
- Economic Impacts



# Waste Heat



- Conventional coal or nuclear power
- Grid
- Halogen Torchiere
- Light

# Area-under-curves and Climate

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- The need to cut greenhouse gas emissions “by N% in Y years”
- Cut emissions to A% below today’s vs cut emissions to B% below 1990 levels.
- What percent cut per year?
- Is it enough to agree on N and Y?





# Area-under-curves and Climate

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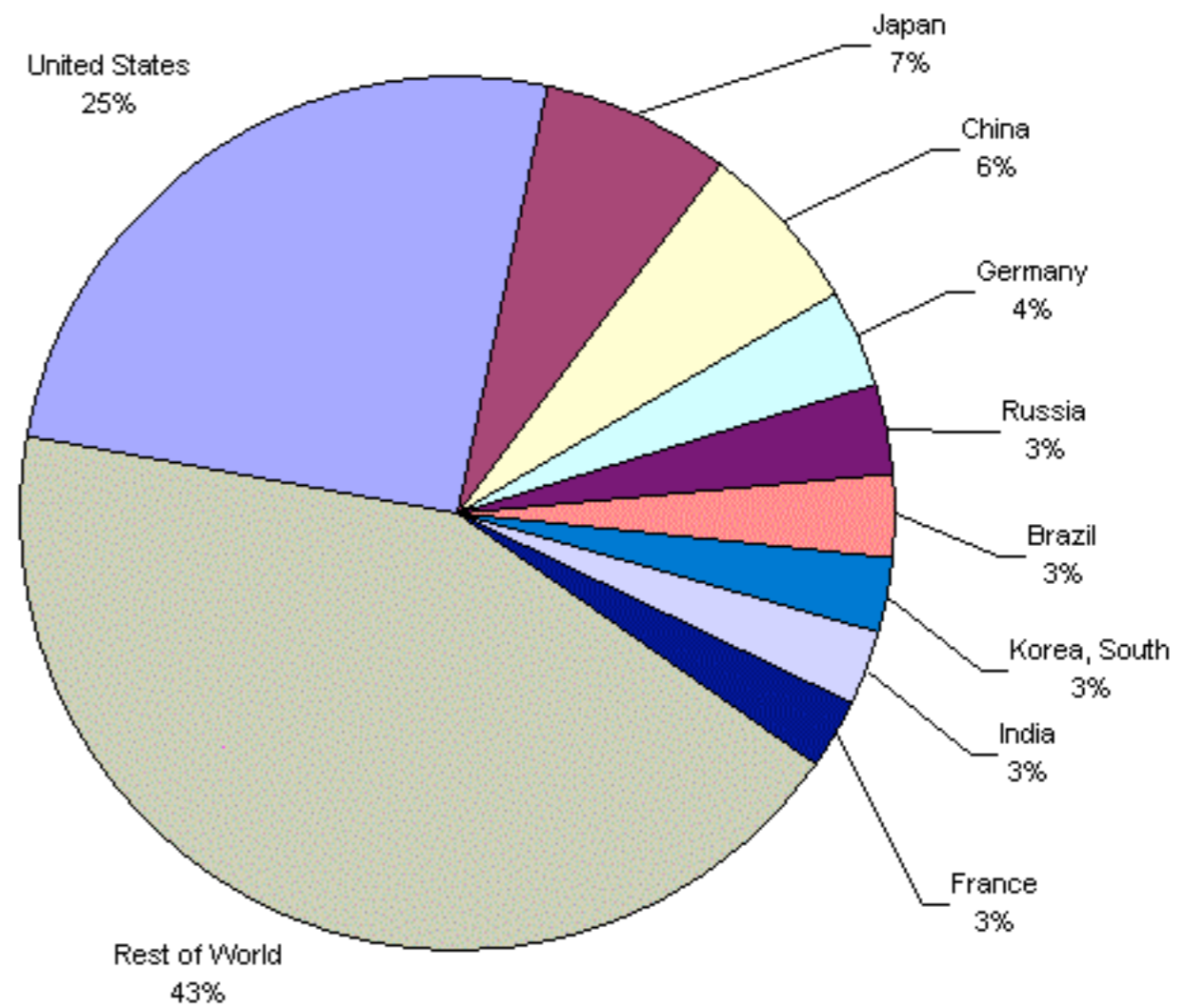
- George Monbiot, *The Guardian*, 10/31/2006

...almost everyone now agrees that we must act..If we're to have a high chance of preventing global temperatures from rising by 2C (3.6F) above preindustrial levels, we need, in the rich nations, a 90% reduction in greenhouse gas emissions by 2030. **The greater part of the cut has to be made at the beginning of this period.**

# Consumption Factor

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- Handout



# CO<sub>2</sub> emissions increasing exponentially

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- Marianne Bom, News Release, March 31, 2009

Measurements from the Mauna Loa Observatory in Hawaii show that the human produced CO<sub>2</sub> is growing exponentially in the atmosphere, reports Discovery News.

- Human contribution to greenhouse gas is growing at 2.3 percent since 1958
- CO<sub>2</sub> is doubling every 30 years.

# Summary

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- Reviewed uses of mathematics in climate research
- Examples using mathematics to understand environment issues

# Quote

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- What science can there be more noble, more excellent, more useful for men, more admirably high and demonstrative, than this of mathematics?  
- Benjamin Franklin

# Thank You

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- Problems provided by Harel Barzilai, Salisbury University