

**Math 1901
Freshman Seminar
Mathematical Climate Models**

Fall 2024
1:00 - 2:15 Mondays and Wednesdays
Vincent Hall 213

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course website
<https://www-users.cse.umn.edu/~mcgehee/Course/Math1901/>

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they didn't see it coming. /

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Greenhouse Effect

Gary Stix, *Scientific American* September 2006, pp.46-49

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The Greenhouse Effect

Greenhouse gases (CO_2 , H_2O , CH_4) are transparent to visible light, but opaque to infrared light. The energy from the sun passes through the atmosphere and heats the surface. The surface radiates energy at a lower temperature (infrared), which is absorbed by the atmosphere.

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Who discovered the greenhouse effect?

1. A meteorologist
2. A physicist
3. A chemist
4. A mathematician
5. Al Gore

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Who discovered the greenhouse effect?

A mathematician!

Joseph Fourier (1827), Mémoire sur les Températures du Globe Terrestre et des Espaces Planétaires, *Mémoires de l'Académie Royale des Sciences*, t. vii., p. 569.






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The Greenhouse Effect!

Joseph Fourier, *Mémoires de l'Académie des Sciences de l'Institut de France*, t. vii. 1827.



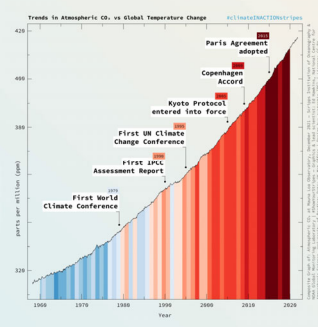


Svante Arrhenius, "On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground," *Philosophical Magazine and Journal of Science (Fifth Series)* 41, pp. 237-276, 1896.

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1896
Svante Arrhenius analyzes the Greenhouse Effect
CO₂: 280 ppm
GMT anomaly: 0.0

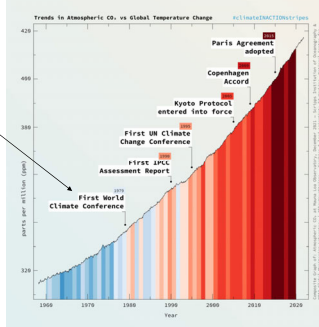


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1896
Svante Arrhenius analyzes the Greenhouse Effect
CO₂: 280 ppm
GMT anomaly: 0.0

1898
James Hansen testifies before US Congress
CO₂: 354 ppm
GMT anomaly: 0.70


1979
First World Climate Conference, Geneva, Switzerland
CO₂: 340 ppm
GMT anomaly: 0.62


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James Hansen






James Hansen arrested at a demonstration outside the White House, August 29, 2011



Hansen giving testimony before the United States Congress in 1988.

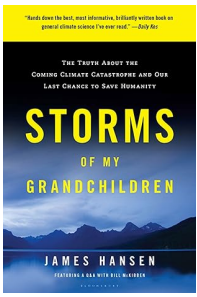
https://en.wikipedia.org/wiki/James_Hansen


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James Hansen



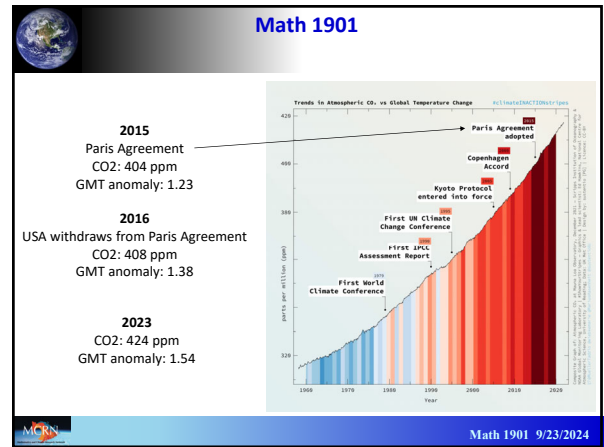
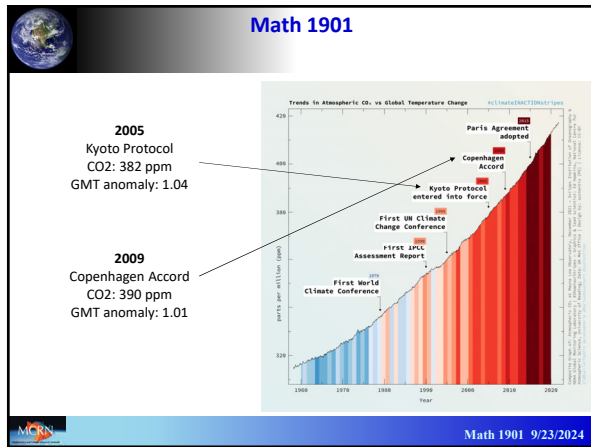
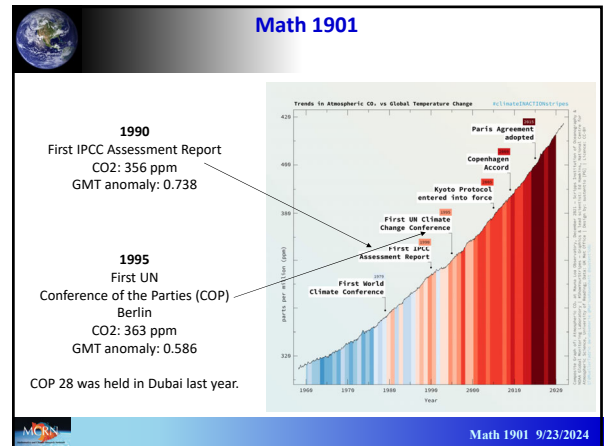
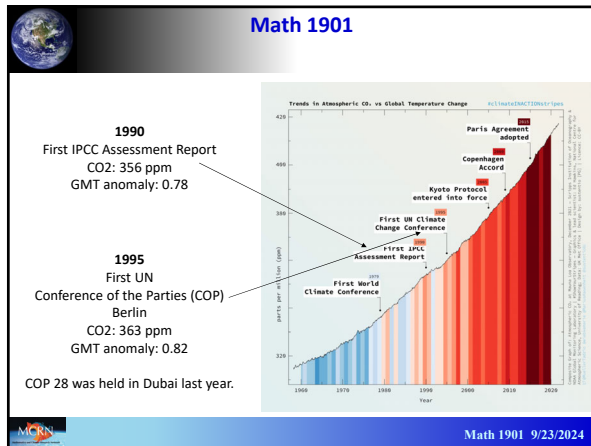
STORMS OF MY GRANDCHILDREN
JAMES HANSEN
FEATURING A Q&A WITH BILL BLASSER



Hansen giving testimony before the United States Congress in 1988.

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What is temperature?

What is energy?

What is heat?

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