

LS 2X03 - Lecture 4 – Climate Change and the Future

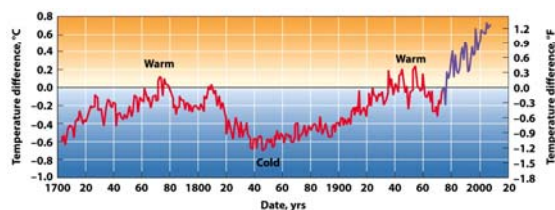
1. The Last 2,000 Years
2. Warming and Cooling
3. Anthropogenic Causes
4. Projections
5. Health Outcomes

Key Concepts

- Identify natural sources of climate variations
- Identify anthropogenic sources of GHG
- Scenarios of temperature change and GHG emissions
- Which health outcomes are going to be the most affected according to the IPCC

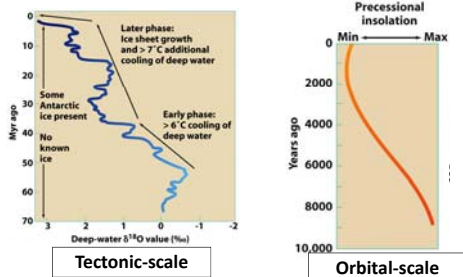
The Last 2,000 Years

- Only anthropogenic forcing of climate can explain:



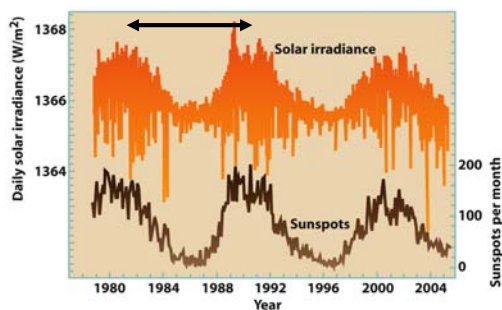
Natural Variations

- Changes that occur over long timescales:



Solar Radiation & Sunspots

- Because of short duration means:



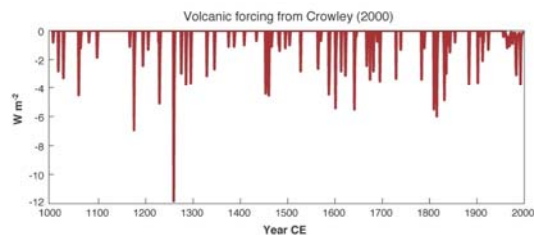
Volcanic Explosions

- Highly explosive eruptions can reach 20-30 km into stratosphere:



Volcanic Activity

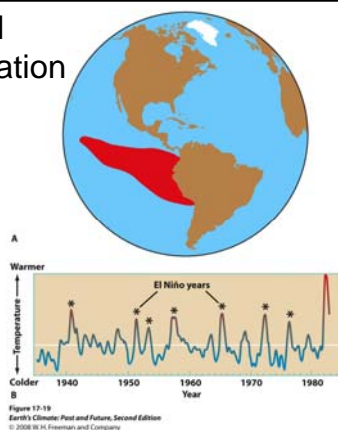
- Increased variability observed during:



Mann ME, 2007.
Annu. Rev. Earth Planet. Sci. 35:111–36

El Niño and Southern Oscillation

- Short length of some records leaves possibility that:



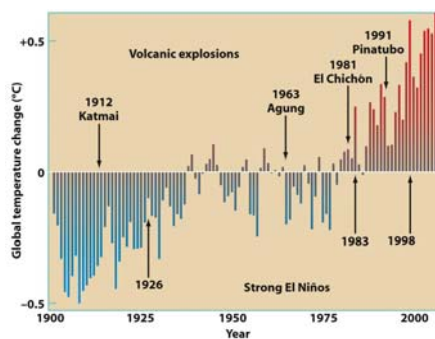
- ENSO:

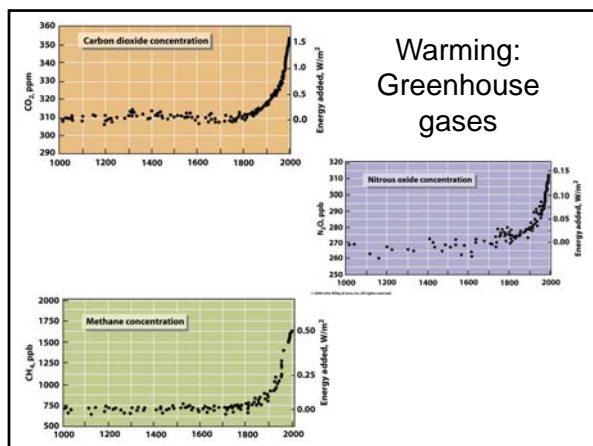
El Niños and Volcanic Eruptions

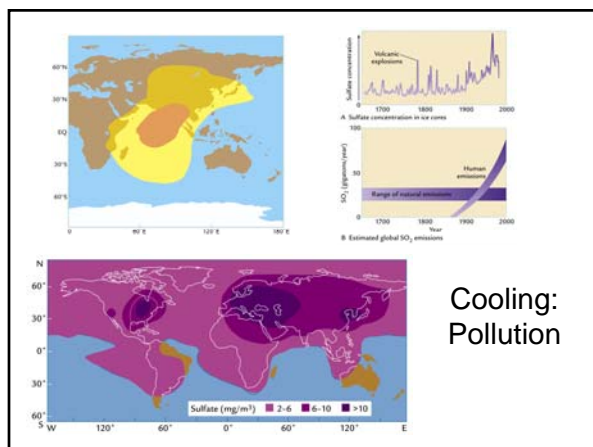
- El Niños:

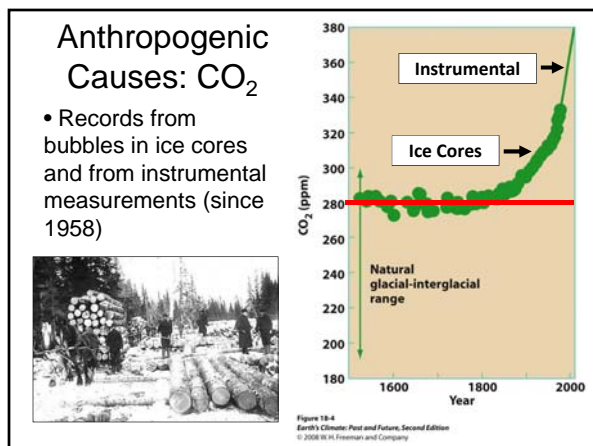
- Eruptions:

- Both:



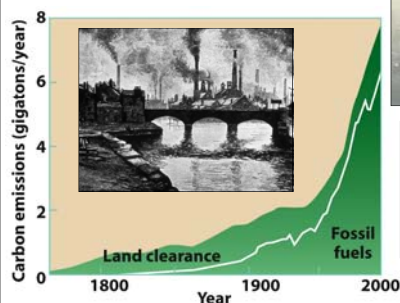






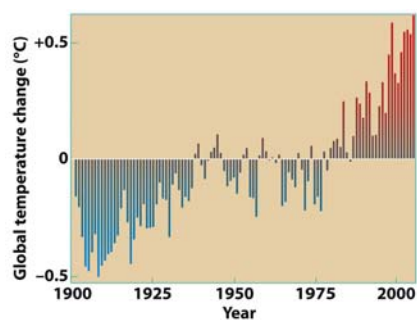
Human Production of CO₂

- Industrial carbon emissions:



- While short-term variations may have played some role:

In the
End...



Projected Carbon Emissions

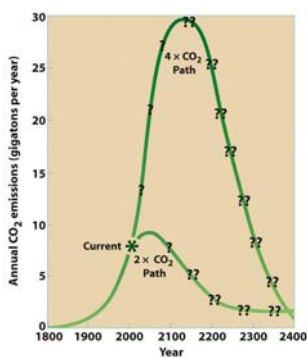
- Range of possible scenarios by IPCC

1) $2 \times \text{CO}_2$: peak in CO_2 near 2040

- Assumes:

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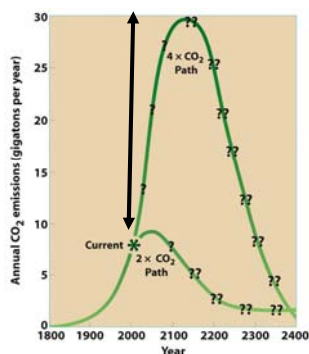
Projected Carbon Emissions (2)

2) $4 \times \text{CO}_2$: peak in CO_2 near 2100-2200

• Assumes:

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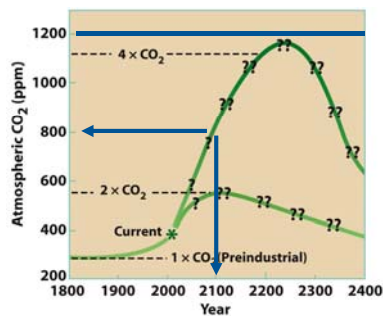


Future CO₂ concentrations

• Depend on interplay between emissions and removal

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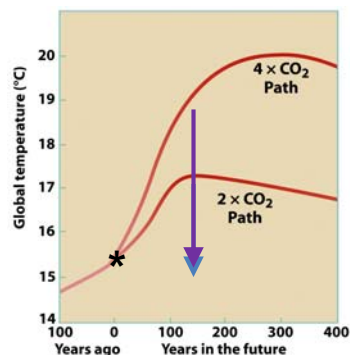
• Assumes that CO_2 dominates



Projected Temperature Increases

• $2 \times \text{CO}_2$ and $4 \times \text{CO}_2$ span the range of possible CO_2 increases

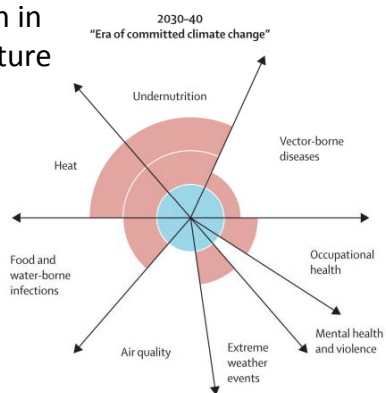
• Best estimates of future changes are for:



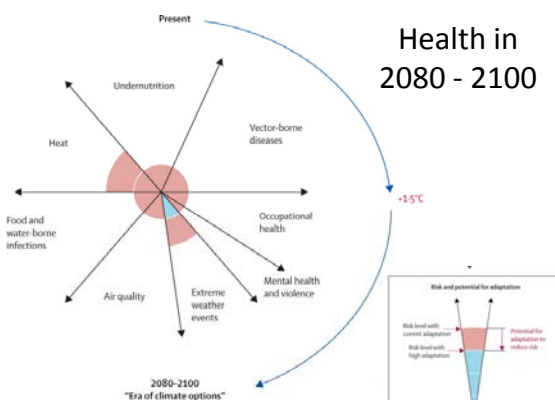
5. Health Outcomes in the Future

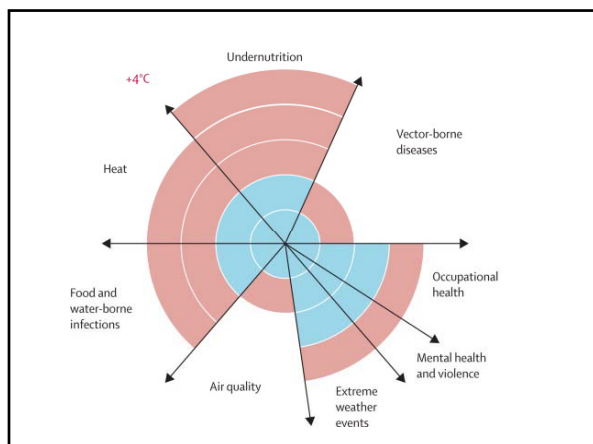
- The Intergovernmental Panel on Climate Change (IPCC) released its 5th Assessment in 2014.
- Climate change opposes health gains achieved by social development and that it might hold back progress in the poorest countries

Health in the Future



Health in 2080 - 2100





End of Lecture Question

1. As discussed by Woodward et al. (Article 2 on A2L), the IPPC in its 5th Assessment identifies strategies which would help to mitigate climate impacts, and have at the same time health-benefits.

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TO DO!

1. For next Lecture: read Article 3
2. Tutorials start next week: Outline of Term Paper + Group Discussion
 - Bring Term Paper Outline Review Grid (will be posted on A2L)
 - Bring Discussion Worksheet (will be posted on A2L)
