

The greenhouse effect on Earth

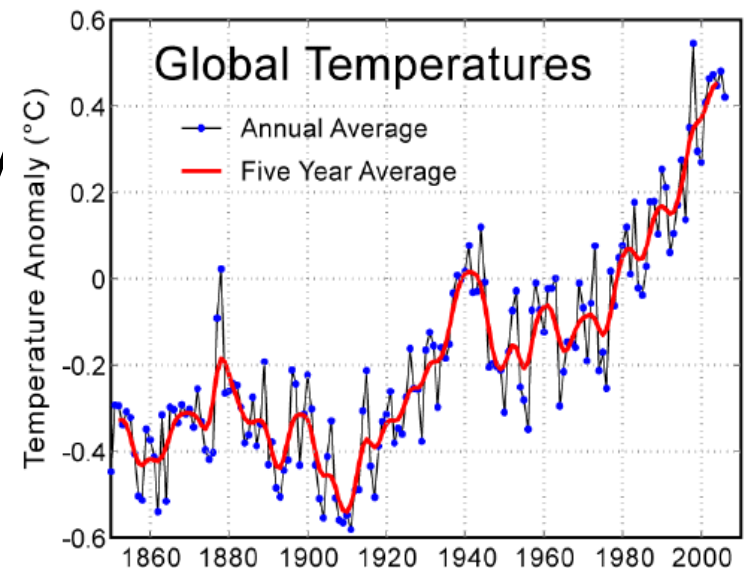
- Venus is MUCH warmer than expected based on a simple heat balance without taking the greenhouse effect of its atmosphere into account
- Earth is also warmer, by about 30 degrees C, than expected: the greenhouse effect plays a role on Earth too
 - The effect is not so strong because Earth's atmosphere is primarily made of nitrogen and oxygen, which don't trap infrared light
 - The main greenhouse gas on Earth is carbon dioxide (just like Venus), although there are other greenhouse gases as well

Climate change on Earth

- There is little debate that the greenhouse effect is a real thing: Venus provides a dramatic example
- Many human activities, especially the burning of fossil fuels (oil, gas, coal) produce carbon dioxide and other greenhouse gases
- There is a reasonable concern that man-made production of carbon dioxide could increase the concentration of CO₂ in the atmosphere enough to cause Earth to become noticeably warmer

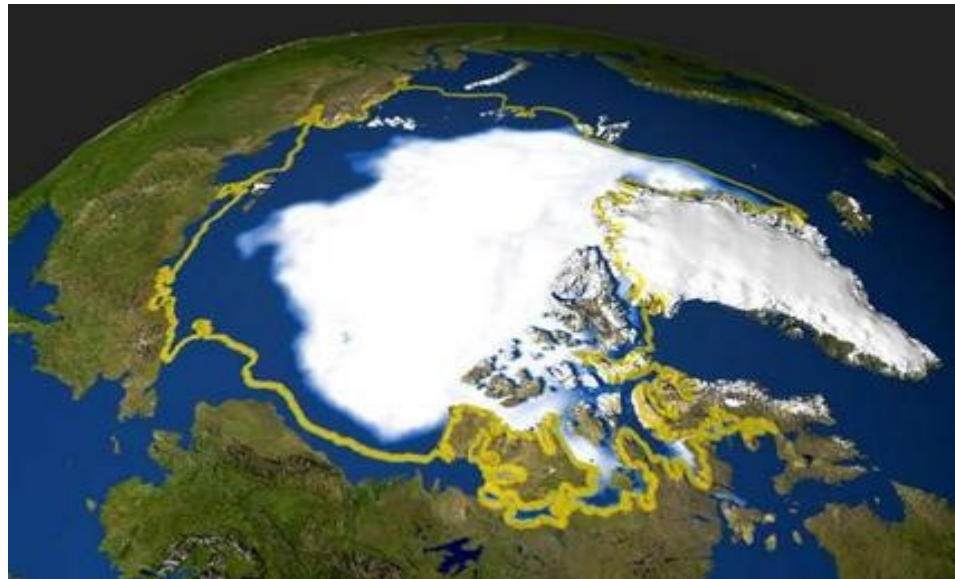
Is the Earth warming up?

- Significant effort has been made to measure the Earth's temperature, both on the surface and in the atmosphere
 - It is not easy because, obviously there is a lot of variation of temperature with location and from year to year
- There is a substantial body of data that suggests the average temperature is increasing
 - 5 warmest years on record have been in last 8 years (NASA)



Warming can be seen visually

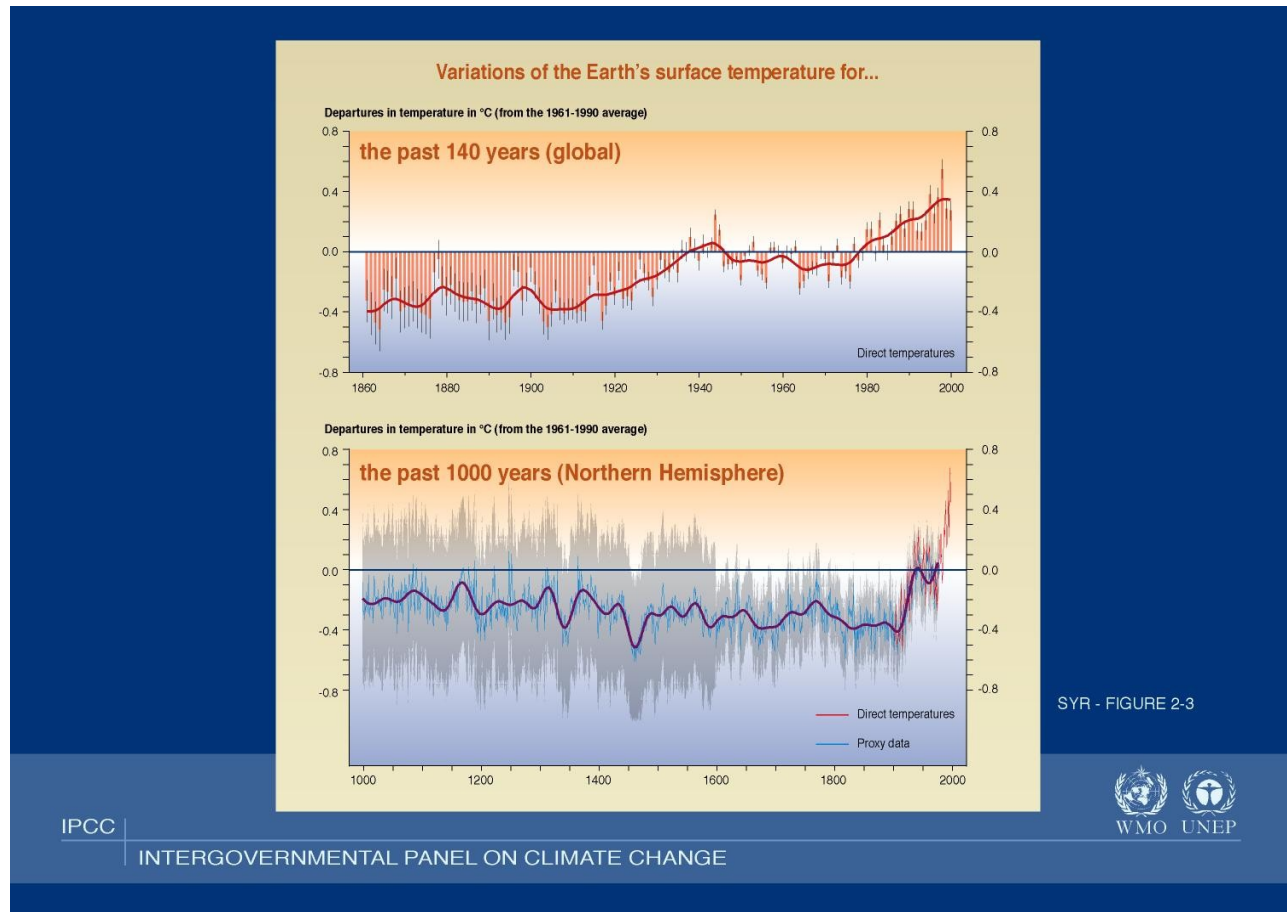
- Although mean temperature change hasn't been huge so far, visible effects are detectable
- Arctic ice cap
 - photo is a satellite photo taken in Sep 2005
 - Yellow line shows extent of ice cap in Sep 1979



- Glaciers on several continents are noticeably smaller, or have disappeared, compared with photos taken several decades ago

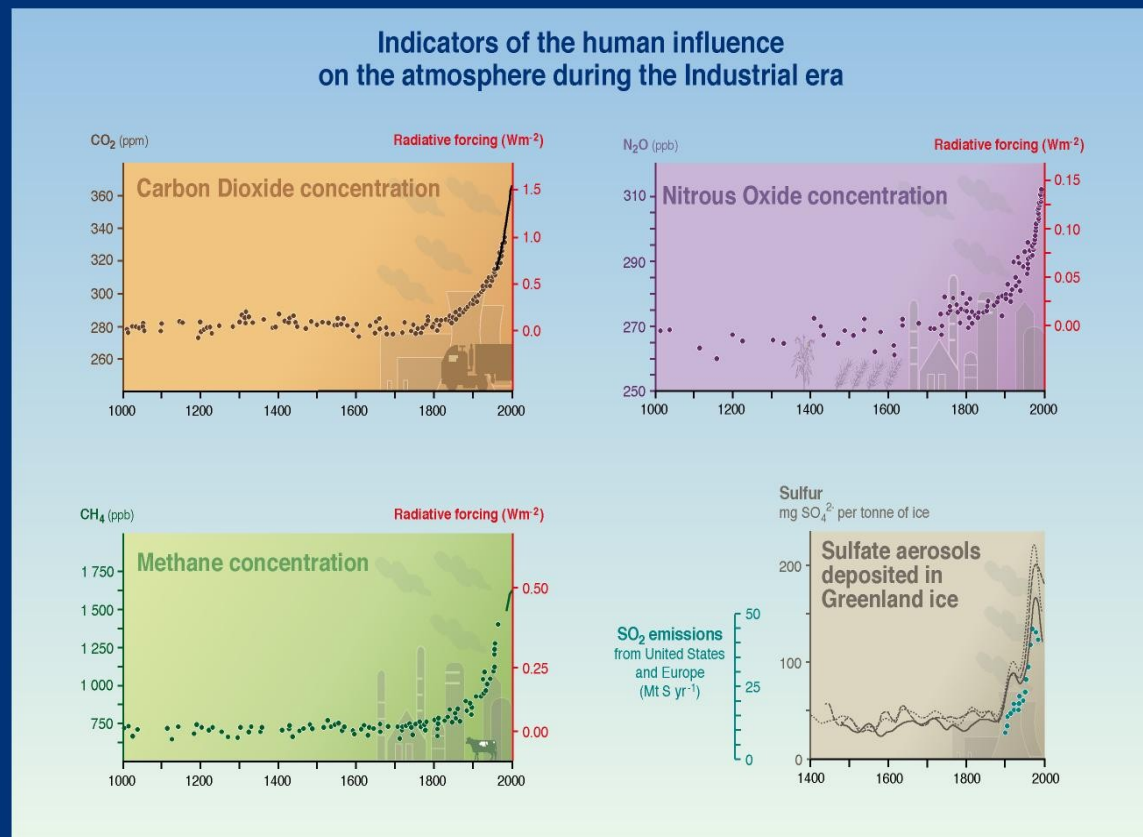
Is the warming caused by human activity?

- Global temperatures have certainly varied in the past
- Current rate of change, however, is larger than previously seen



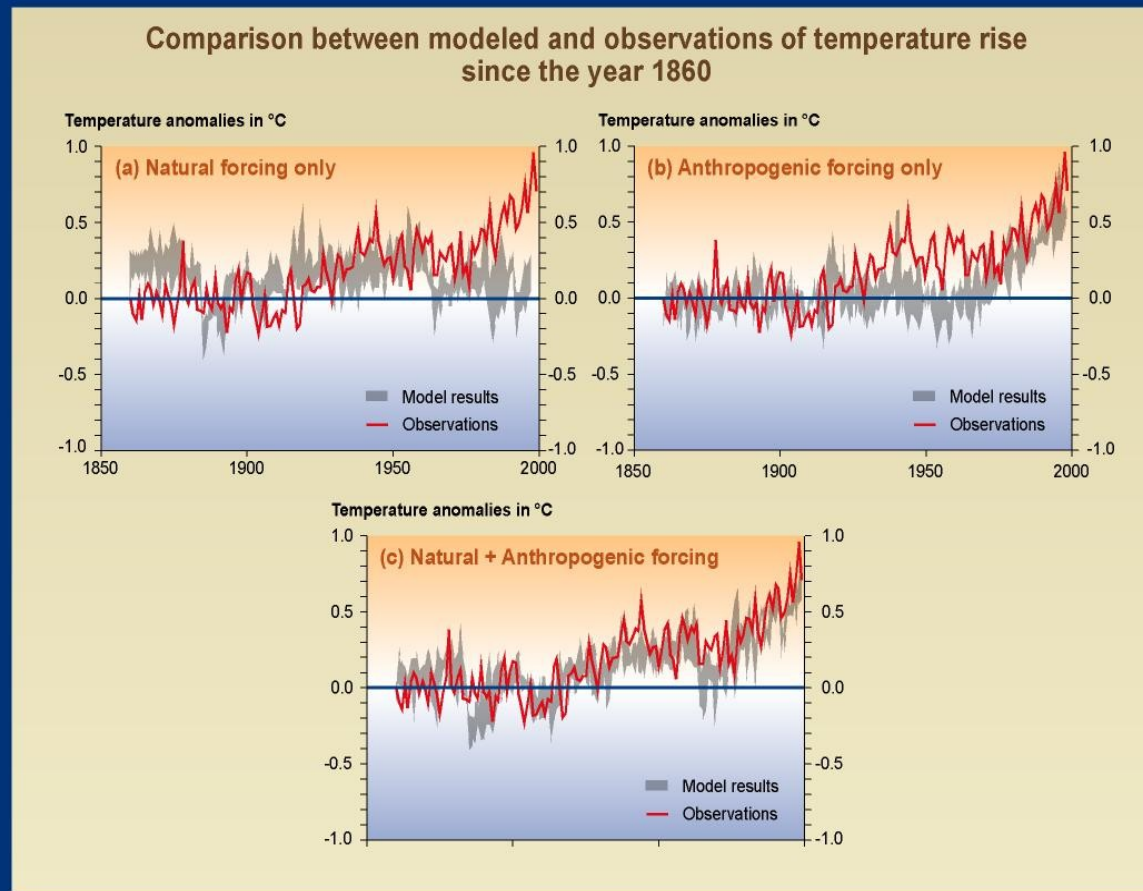
Is warming caused by human activity?

- Increased greenhouse gases have been measured in the atmosphere



SYR - FIGURE 2-1
WG1 FIGURE SPM-2

- Climate models strongly suggest that increased greenhouse gases are responsible for temperature increase



SYR - FIGURE 2-4

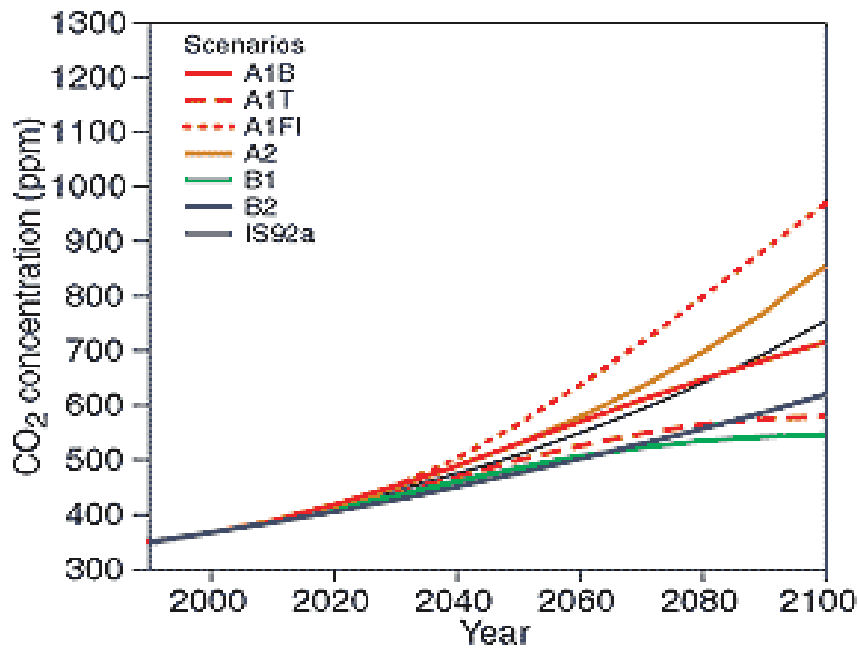
What about other theories for warming?

- Certainly, other theories have been proposed for the cause of warming. This is good: it is how science works
- this is a science experiment that may have significant consequences, so we have to make our best judgment on what, if anything, to do: sometimes you have to make choices without being sure; in any case, science is never sure!
- There are significant vested interests in the issue, which is a challenge to impartial science
 - Important to consider sources of information

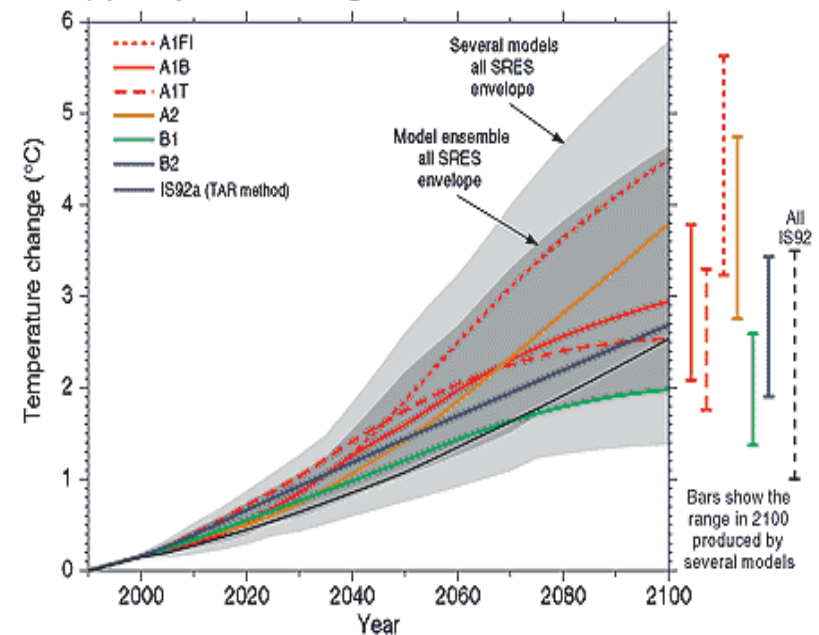
What might the consequences of warming be?

- Predictions for warming from increased concentrations of greenhouse gases can be made from climate models
 - Different scenarios are for different choices for reduction (or lack thereof) of greenhouse gas production

(b) CO₂ concentrations

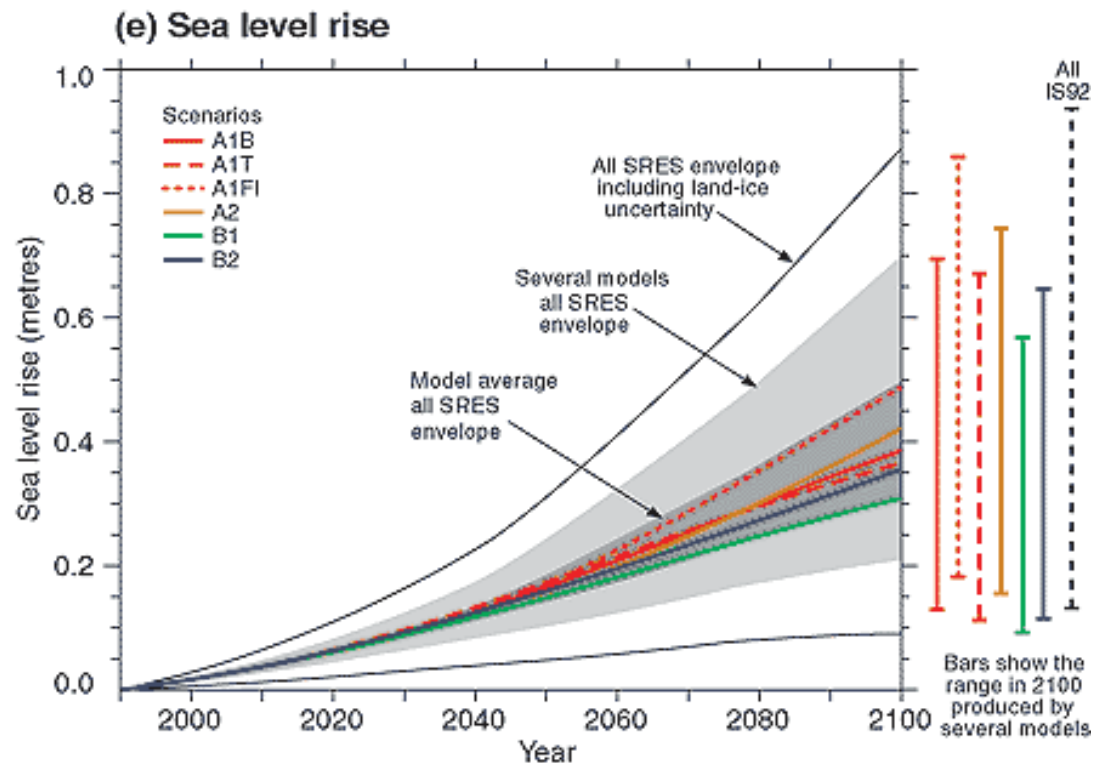


(d) Temperature change



Consequences

- Simplest consequence is rising sea level from increase in water density at higher temperatures, and especially, in melting of ice currently on land (Antarctica and Greenland)



- Significant implications for populations living in many coastal areas (e.g. Florida). Increased potential for storm damage

Consequences

- Climate models suggest possibilities for increased storm strength, more extended drought in some areas
 - Potential impact in NM: decreased snowpack in southern Rockies, with significant water/agriculture implications
 - With current global economy, changes in other locations might have more direct implications on you than you might imagine
- Impact on other species has been documented and could be extreme
 - Indirect impact on people is unknown, but not necessarily negligible: diseases, medicines, etc.
 - Loss of biodiversity already rivals previous mass extinctions
- Timescale of potential consequences is in your lifetime

Should we do something?

- How reliable are predictions?
 - Weather is hard to predict!
 - But potential consequences are significant
- For some things, we eventually need to change regardless:
 - Fossil fuel supply is not an unlimited resource!
- Is the cost of doing something too large?
 - Is the cost of not doing something too large?
 - Is it even a cost to do something? Maybe not! Maybe depends on how you define cost.

What can we do?

- Be informed: whatever you believe, we may be living in a critical time, and you might as well at least pay attention!
- Talk about the issues with friends and family. My personal suggestions:
 - Avoid too much overexcitement: if it turns people off or makes them despair, it doesn't help
 - Talk about real **data** on the issue: talk about how science works: disagreements are normal and don't necessarily mean that you can't believe *anything*
 - Talk about real possibilities for the future and how they might affect you personally, as well as the world as a whole
 - Avoid too much politics directly

What can we do, more specifically?

- Action by individuals, while important, is not likely to dramatically change the situation: we all must act together, as well as individually
 - Government is probably best suited to play this role
 - Contact elected officials, and candidates to state your views on the issue
 - When it comes to getting elected, politicians listen, especially when they are contacted by LOTS of people
 - Ask officials to specifically tell you how important this issue is to them, relative to other issues
 - Ask officials to specifically tell you what they propose to do, and how they will verify that their proposals are effective
 - Vote with this issue in mind as a key issue

What can we do, personally?

- Some immediate, win-win actions
 - Convert to florescent light bulbs, save \$\$s and energy!
 - Say something when you are cold inside when it is hot outside, and when you are hot inside when it is cold outside!
- Actions with only mild personal impact
 - Make energy efficiency a top priority in future purchases
 - Automobile
 - Appliances
 - Schedule/group activities to minimize travel; travel with others: be social!
 - Attempt to eat foods produced closer to home: pay attention to seasonal differences in availability. Transportation of food is a significant energy consumer
- Actions with larger personal/financial impact
 - Use mass transit, or human powered transit (bicycle, walk)
 - Invest in alternative energy production