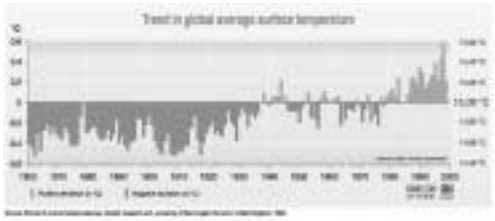
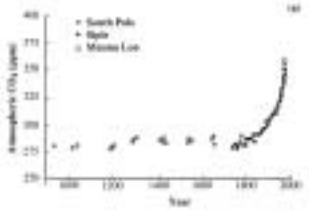
Lecture 12: Global Warming



- Points Of Agreement
- Main Point of Contention
- Prediction Of the Future Warming

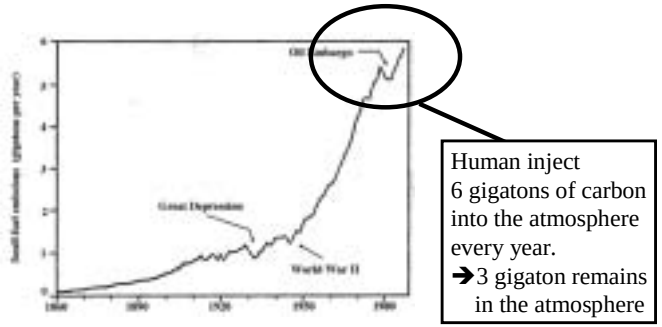
Points of Agreement



(from *"Is The Temperature Rising?")*

- Global climate change, including global warming, are inevitable should the atmospheric concentration of greenhouse gases rise continually. (They disagree about the timing and magnitude of the warming).
- The atmospheric concentration of greenhouse gases is rising.

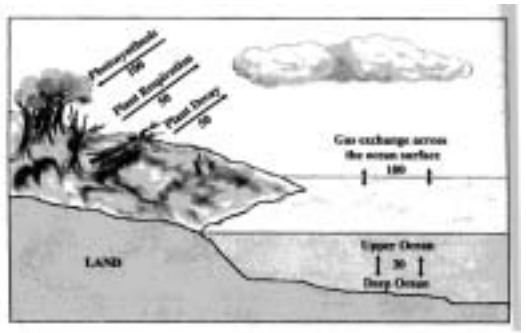
Human Injection of Carbon



Human inject
6 gigatons of carbon into the atmosphere every year.
➔3 gigaton remains in the atmosphere

(from *Philander's "Is The Temperature Rising?"*)

Global Carbon Cycle



(from *"Is The Temperature Rising?")*

The Missing Carbon Sink

Human Inject 6 Gigaton of Carbon Into the Atmosphere (per year)

3 Gigaton Remains in the Atmosphere

1.5 Gigaton Is Absorbed By the Ocean

?

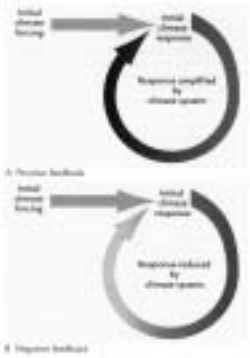
Where Is he Missing 1.5 Gigaton (Sink)?

(Is this missing sink going to be saturated soon?)

Main Point of Contention

- The debate about global warming is primarily about the degree to which different feedbacks will influence the Earth's climate in the future.
- Many of those feedbacks involve water in one form or another.

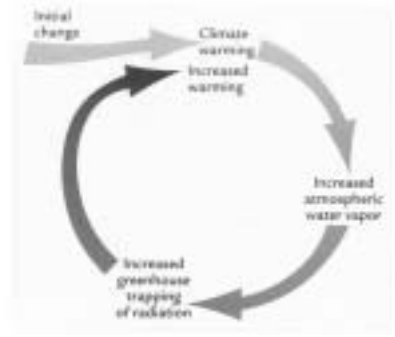
Major Climate Feedback Processes



- **Water Vapor Feedback** - Positive
- **Snow/Ice Albedo Feedback** - Positive
- **Longwave Radiation Feedback** - Negative
- **Vegetation-Climate Feedback** - Positive
- **Cloud Feedback** - Uncertain

(from *Earth's Climate: Past and Future*)

Water Vapor Feedback

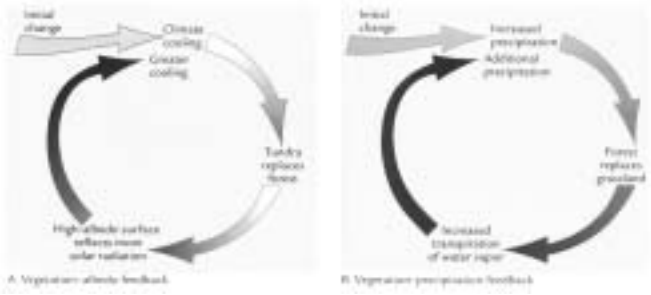


(from *Earth's Climate: Past and Future*)

Snow/Ice Albedo Feedback

(from *Earth's Climate: Past and Future*)

Vegetation-Climate Feedbacks



(from *Earth' Climate: Past and Future*)

Is Global Warming Evident Yet?

- The global warming observed in the past 100 years can be a result of natural variability and anthropogenically induced.
- Since our understanding of the natural variability is limited, it is difficult for us to decide whether or not the human-induced global warming already shows up.
- The detection of the current anthropogenically induced signal will be difficult until it is very large.

Prediction of Future Warming

- If the atmospheric level of greenhouse gases continue to rise at the present rate, climate models predicts:
- ***Very Probable***

✓ Global surface temperature will warm up 0.5-2°C over the period 1990 to 2050.
✓ Global sea level will rise by 5 to 40 cm by 2050.
✓ Global precipitation will increase
✓ Arctic land areas will experience wintertime warming

Prediction of Future Warming

- ***Probable***

✓ Rainfall will increase over the high latitude of the northern hemisphere, but will decrease in the midlatitude of northern hemisphere continents.

- ***Uncertain***

✓ We are not sure how climate will change in small regions
✓ We are not sure how the frequency of El Nino will change
✓ We are not sure how hurricane, flood, and drought will respond to global warming