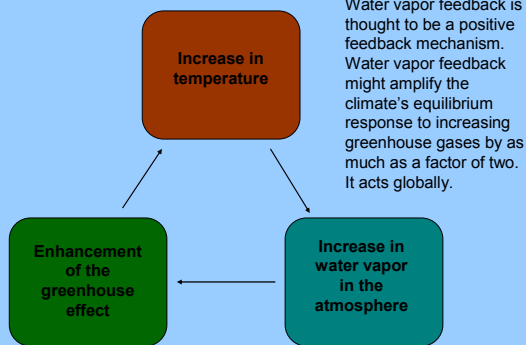


CLIMATE FEEDBACKS

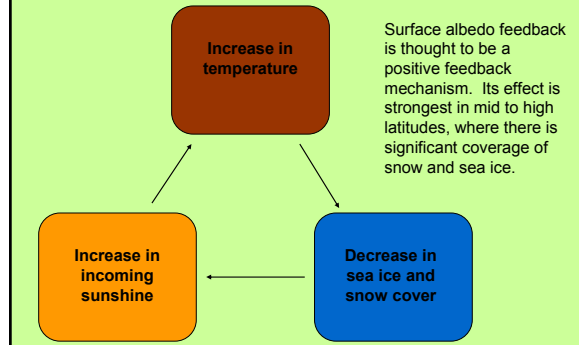
If the climate's response to an increase in greenhouse gases were simply to increase its temperature to compensate for the increase in greenhouse trapping of infrared radiation, the climate change problem would be quite simple. Unfortunately, there are climate feedbacks that come into play, influencing the climate's response. The main climate feedbacks are:

- (1) Water vapor feedback
- (2) Surface albedo feedback
- (3) Cloud feedback

WATER VAPOR FEEDBACK



SURFACE ALBEDO FEEDBACK

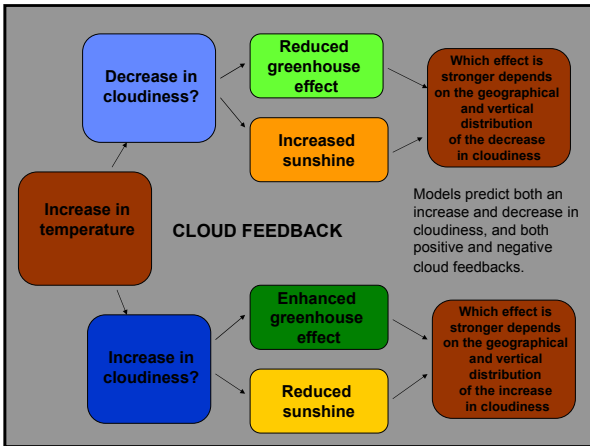


To understand how cloud feedback might work, you have to understand some facts about clouds:

- (1) Clouds absorb radiation in the infrared, and therefore have a greenhouse effect on the climate. If you put a cloud high in the atmosphere, it will have a stronger greenhouse effect than if you put it low in the atmosphere.
- (2) Clouds reflect sunshine back to space. So more clouds means less sunshine for earth. If you put a cloud high in the atmosphere, it will reflect about the same amount of sunshine as if you put a cloud low in the atmosphere.


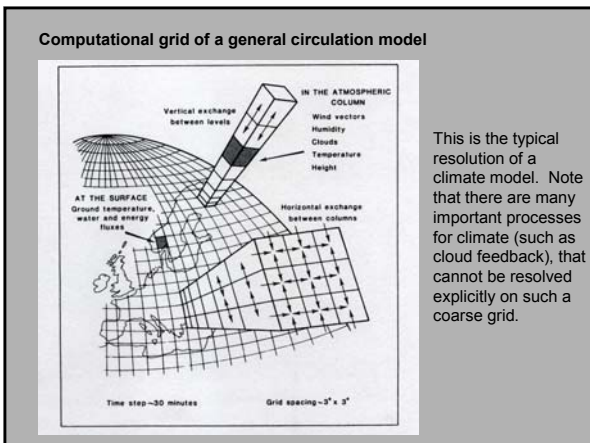
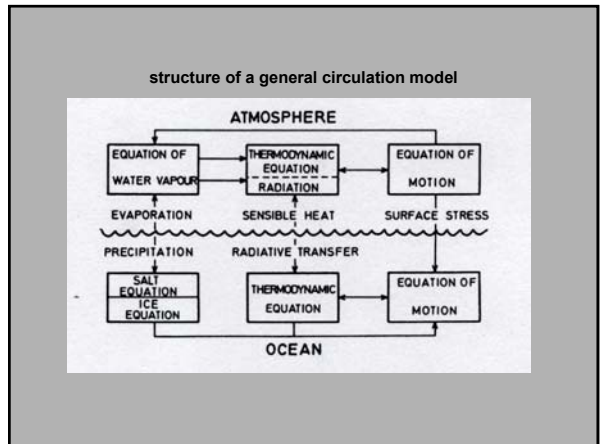
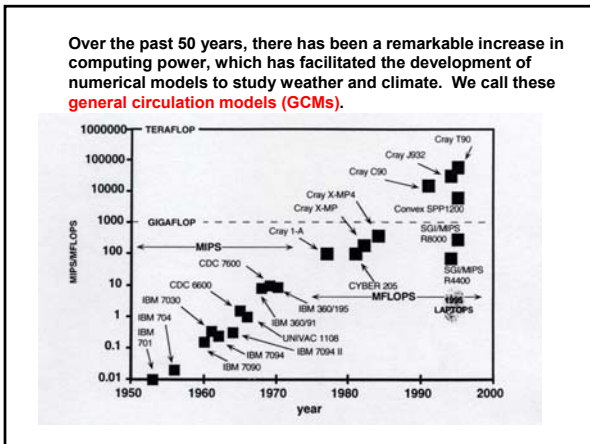
Photo taken in Los Angeles
August 2003





Lewis Richardson (1881-1953)

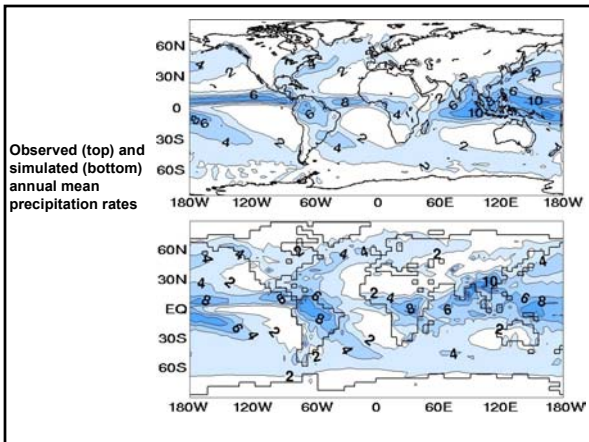
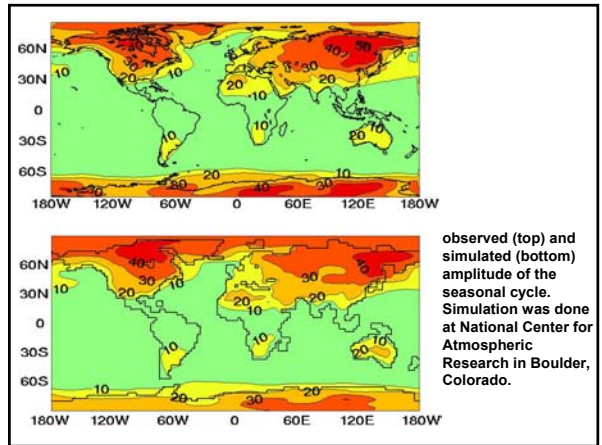
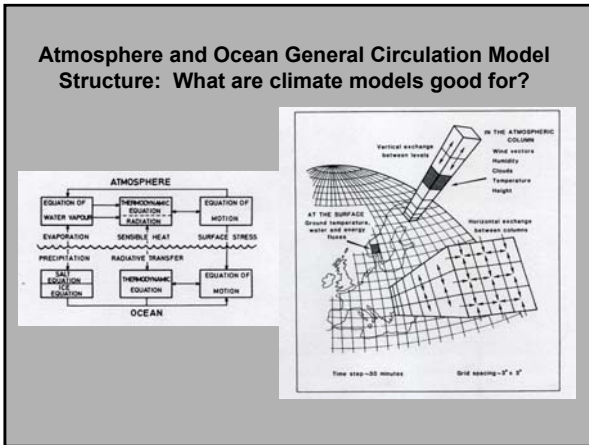
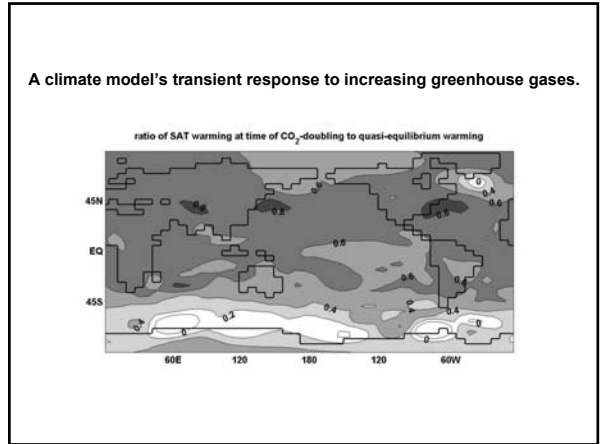
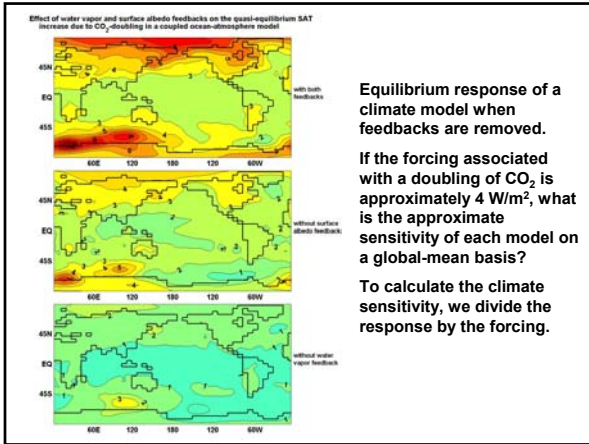
In the 1920s, he proposed solving the weather prediction equations using numerical methods. Worked for six weeks to do a six-hour "hindcast" by hand. Proposed a wild scheme to predict the weather in real time. His scheme was totally impractical because of the lack of computing power.

Transient vs Equilibrium climate response

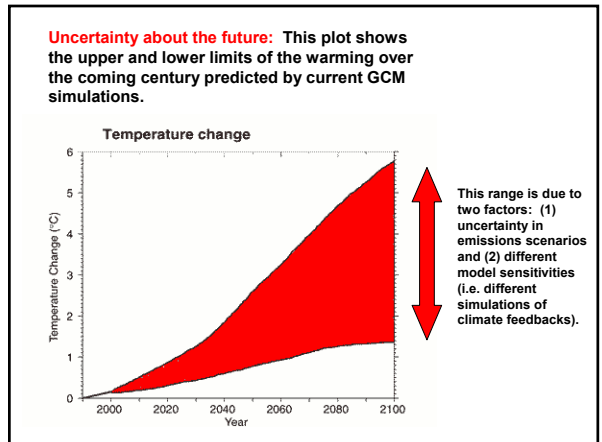
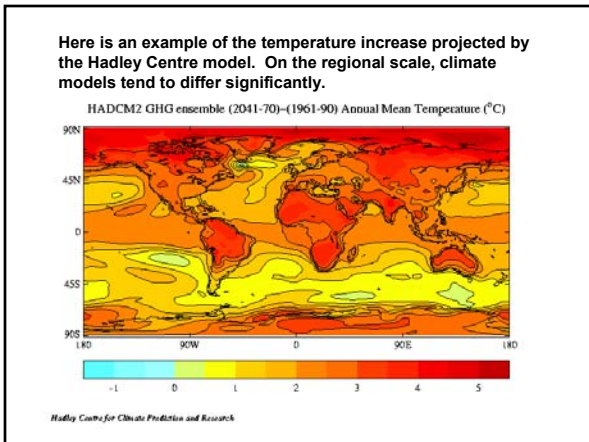
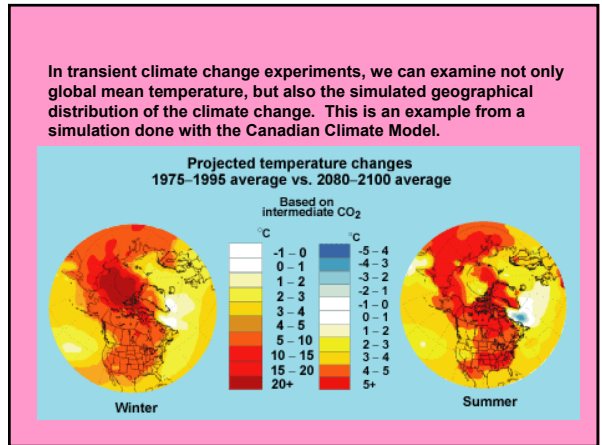
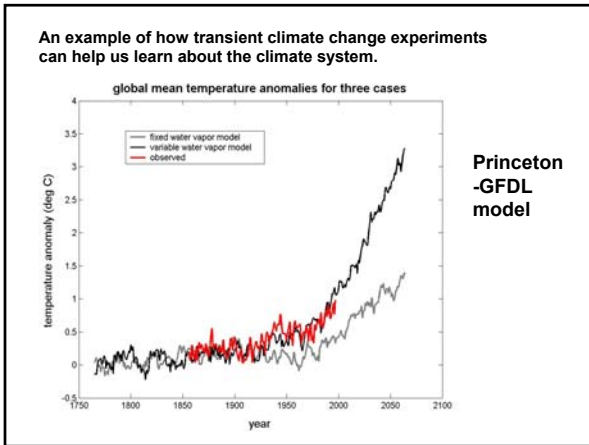
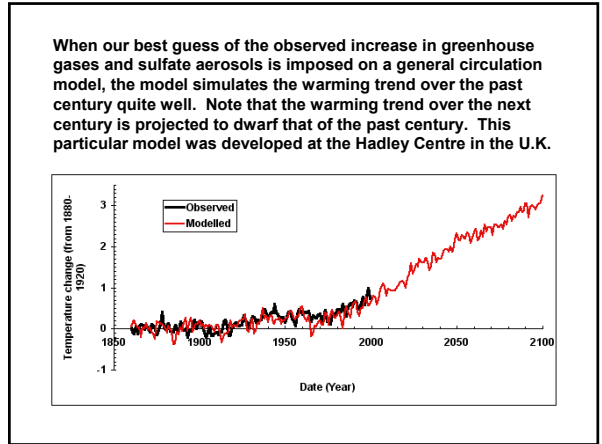
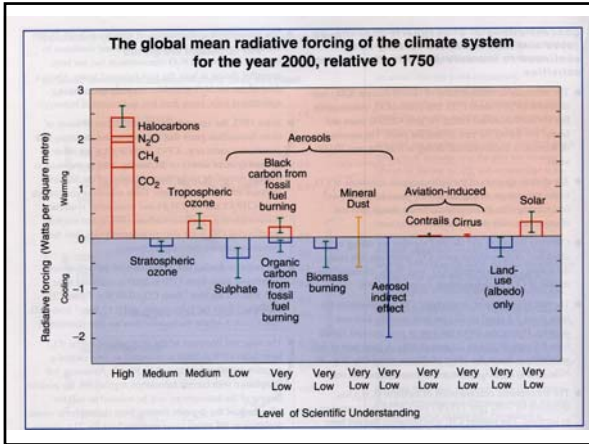
Transient response refers to the evolution of the climate system as it responds to external forcing, such as an increase in greenhouse gases.

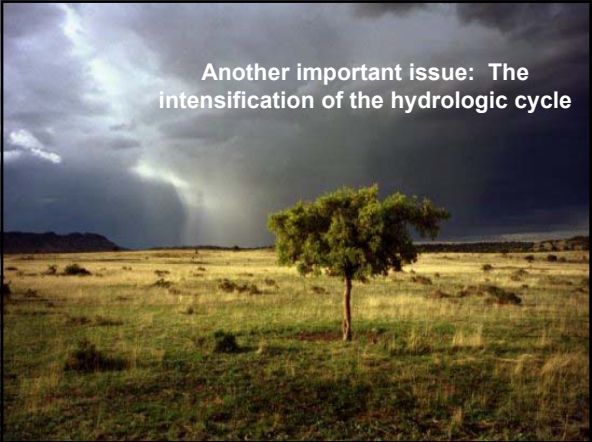
Equilibrium response refers to the final state of the climate system after it has adjusted to the external forcing. The magnitude of the equilibrium response compared to the magnitude of the forcing is referred to as the **climate sensitivity**.



A key idea in climate change research is the concept of **RADIATIVE FORCING**

This allows us to quantify the importance of the various factors that have potential to change climate. It is defined as the radiation change in W/m² at the tropopause due to the forcing agent (e.g. increase in greenhouse gases)





Another important issue: The intensification of the hydrologic cycle

Key Concepts

Transient response

Equilibrium response

Climate sensitivity

Water vapor feedback

Surface albedo feedback

Cloud feedback