Unit 11: Climate Change

Lecture 5

Objectives:

E5.4f - Describe geological evidence that implies climates were significantly colder at times in the geologic record (e.g., geomorphology, striations, and fossils).

E5.r4j - Predict the global temperature increase by 2100, given data on the annual trends of CO_2 concentration increase.

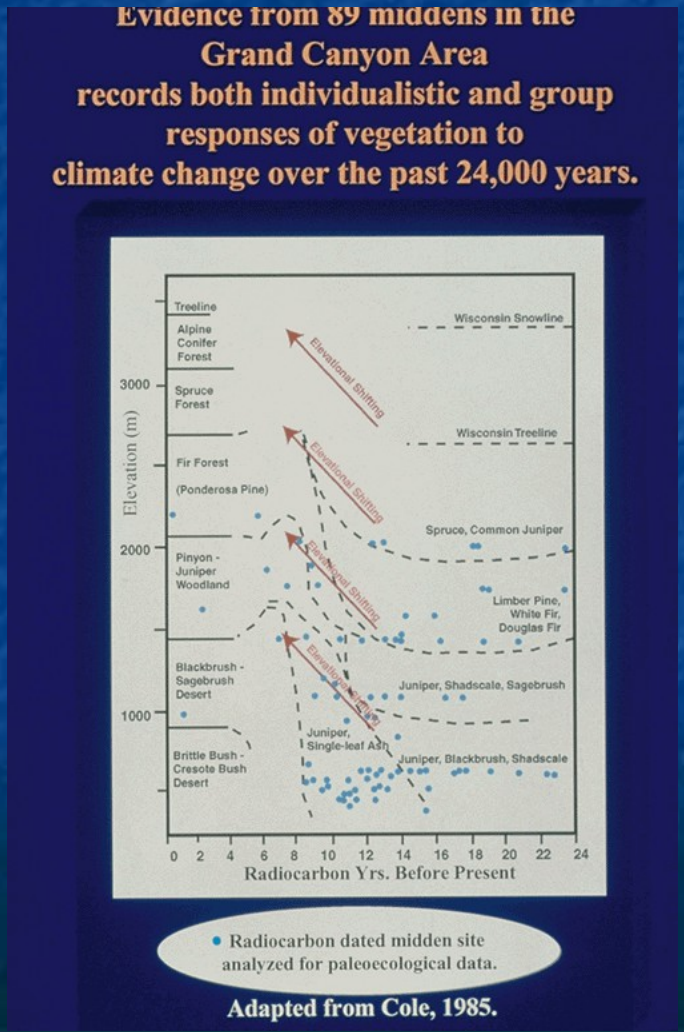
Paleo-Climates

- Climates have changed greatly in the past 4.6 BY.
- Earth Has been both warmer and colder then it is today.

Fossil Evidence

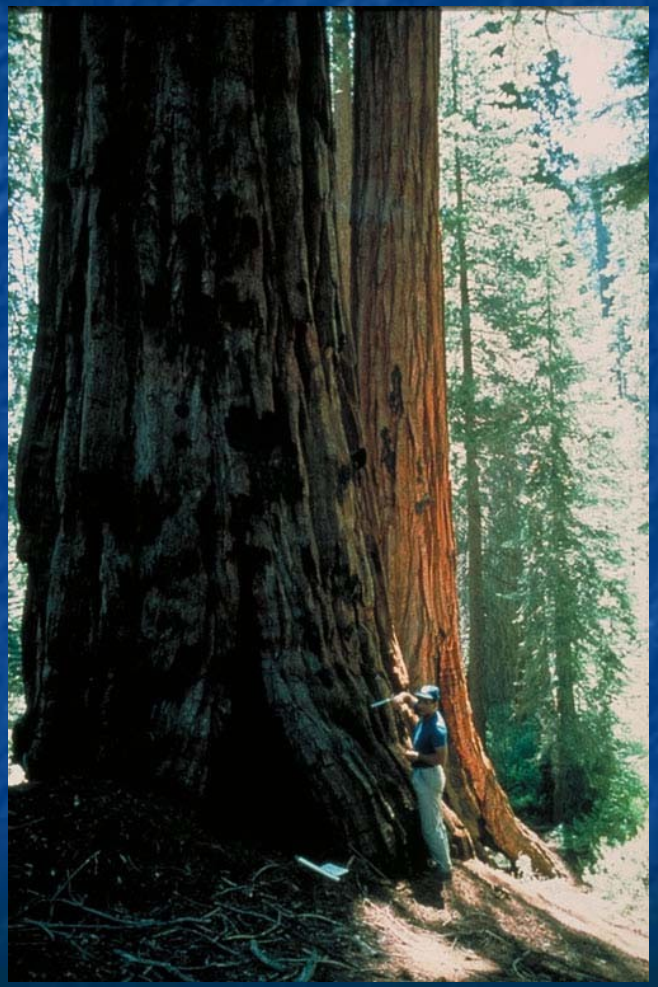
- In 1960, lack of knowledge about former plant distributions in North American deserts was reversed by the discovery of plant-rich deposits or middens in caves and rock shelters in the arid interior of North America. These so-called middens, an amalgamation of plant and animal remains encased in crystallized packrat urine, were noted by military and scientific expeditions across the West as early as 1849. But, it was not until 1960 that paleoecologists fully recognized their potential for reconstructing past environmental change.

Climate Change



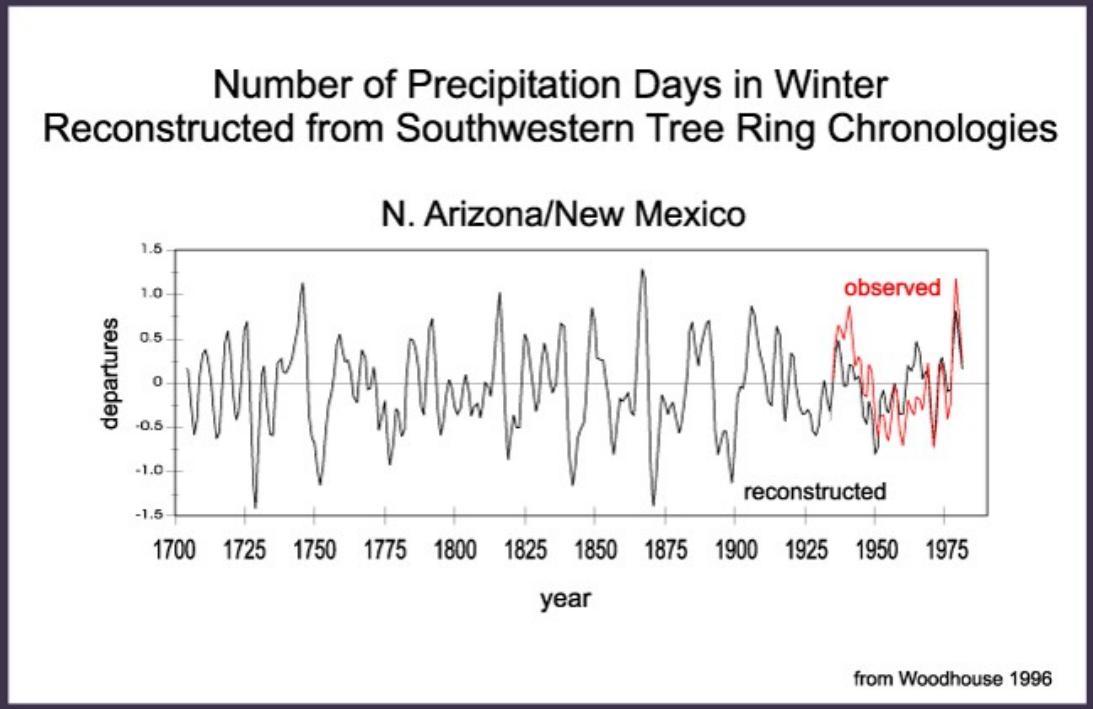
- Vegetation zonation with elevation has shifted over the last 40,000 years in the Grand Canyon. Evidence from 89 middens (the elevation and radiocarbon ages of which are shown as data points) depicts a clear pattern of individualistic species response to climate change.

Tree Rings



- Tree rings record the fluctuation of environmental factors that influence tree growth during the life of the tree. In many cases, trees grow to be hundreds or even thousands of years old and thus are an important source of information about environmental change. Instrumental records of climate or other types of environmental variations exist for less than 100 years in most parts of the world.

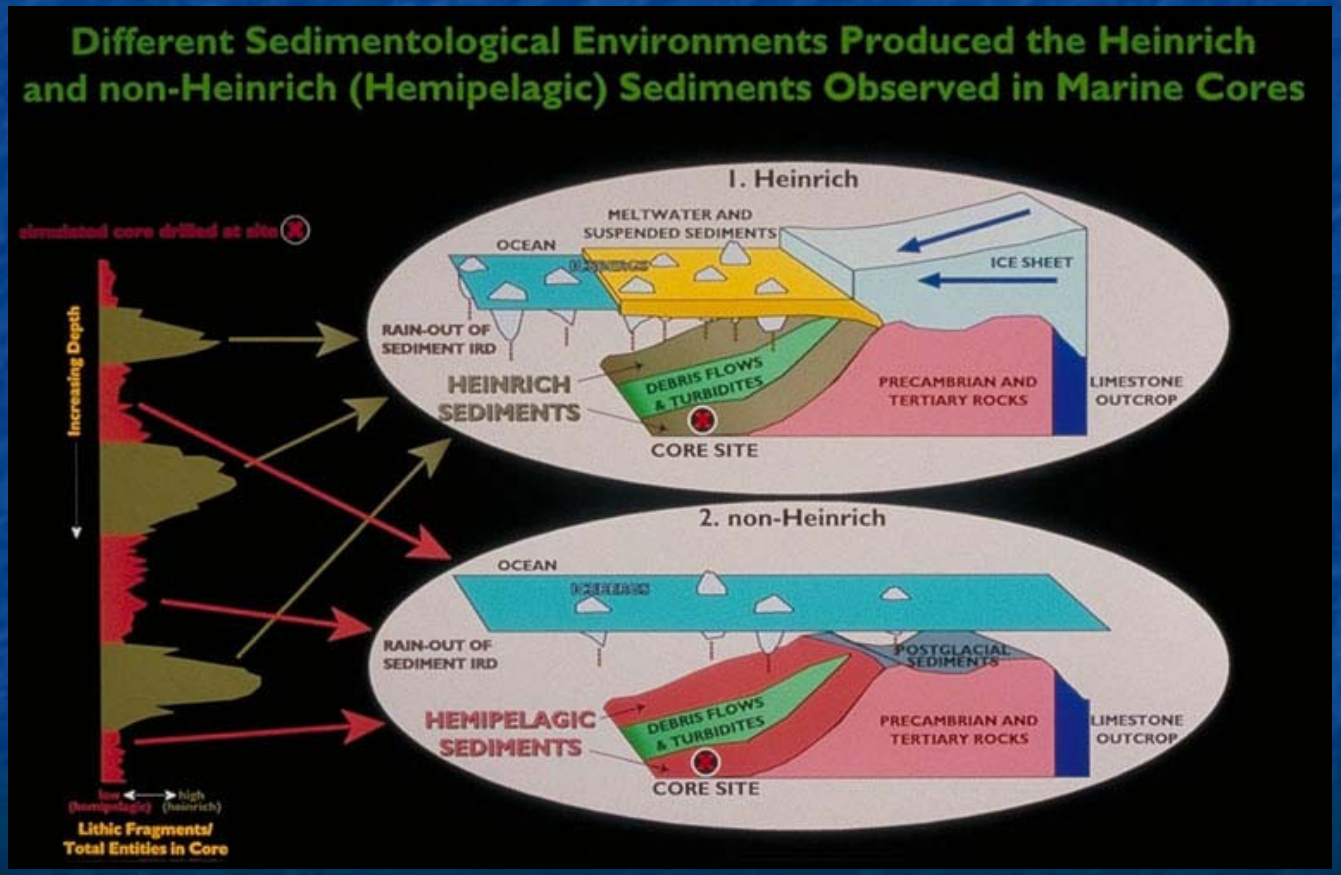
Climate Change



Varves and Cores

- High resolution marine sediment records that have provided a long and detailed history of changes in North Atlantic.

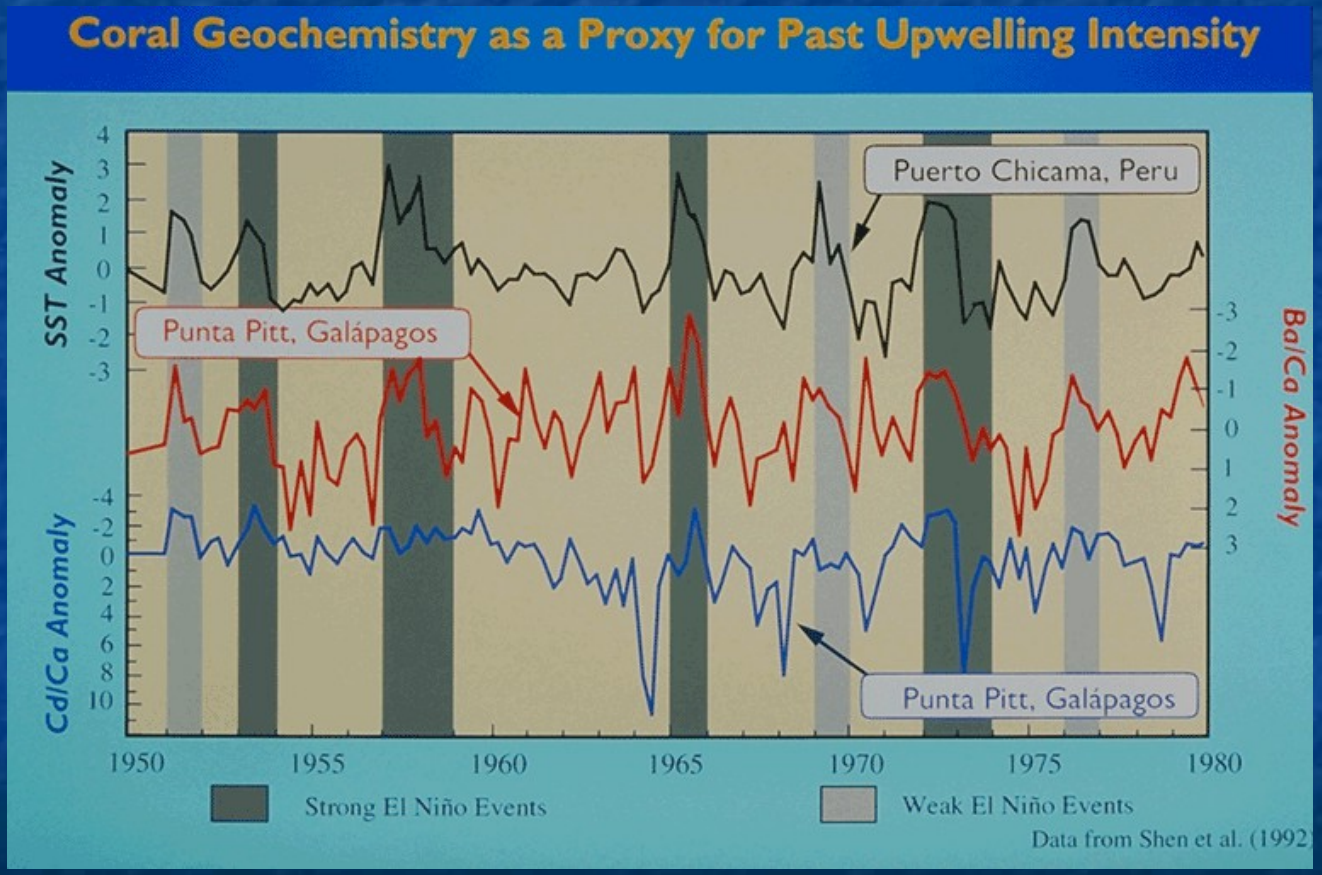
Climate Change



Coral Data

- Coral, like that of the Incas thousands of miles and hundreds of years from them, was tied to the variations of a climatic system whose mysteries scientists are only beginning to understand, the El Niño/Southern Oscillation (ENSO for short).

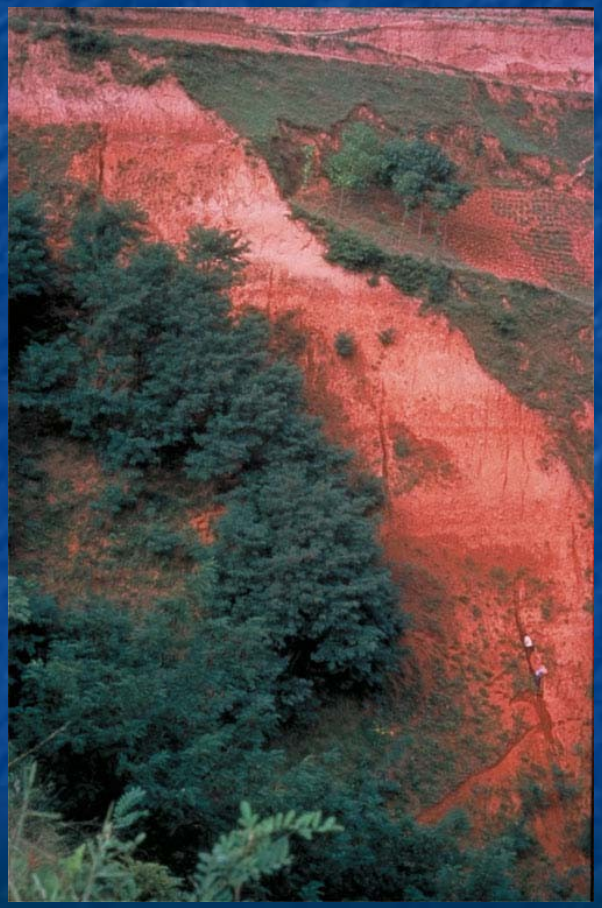
Climate Change



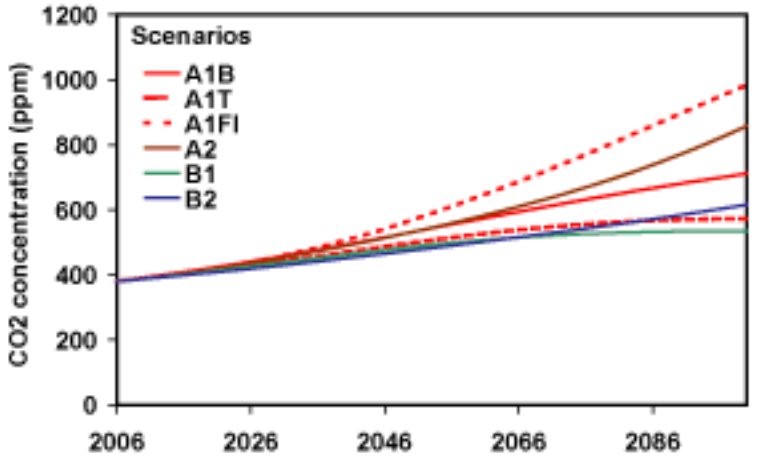
Striations

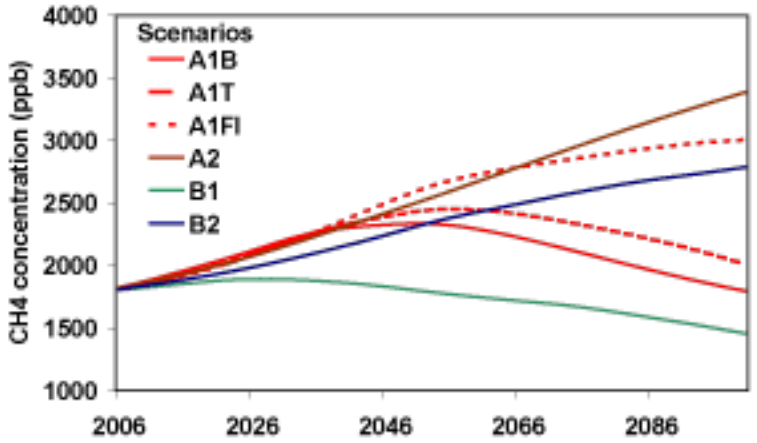
- Striations form when boulders trapped at the base of ice sheets scratch across bedrock, leaving deep scratch marks.

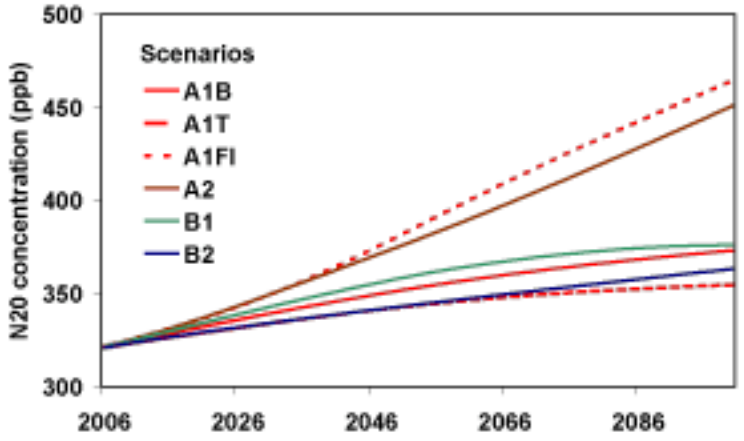
Geomorphology



- This slide shows the upper part of a section of loess near Baoji in southern China's Central Loess Plateau. These soils represent interglacial periods when climates were wet enough to sustain vegetation development. During glacial periods, climates were colder, drier, and windier, leading to sparse vegetation cover and extensive mineral dust (loess) accumulation in many parts of the world.



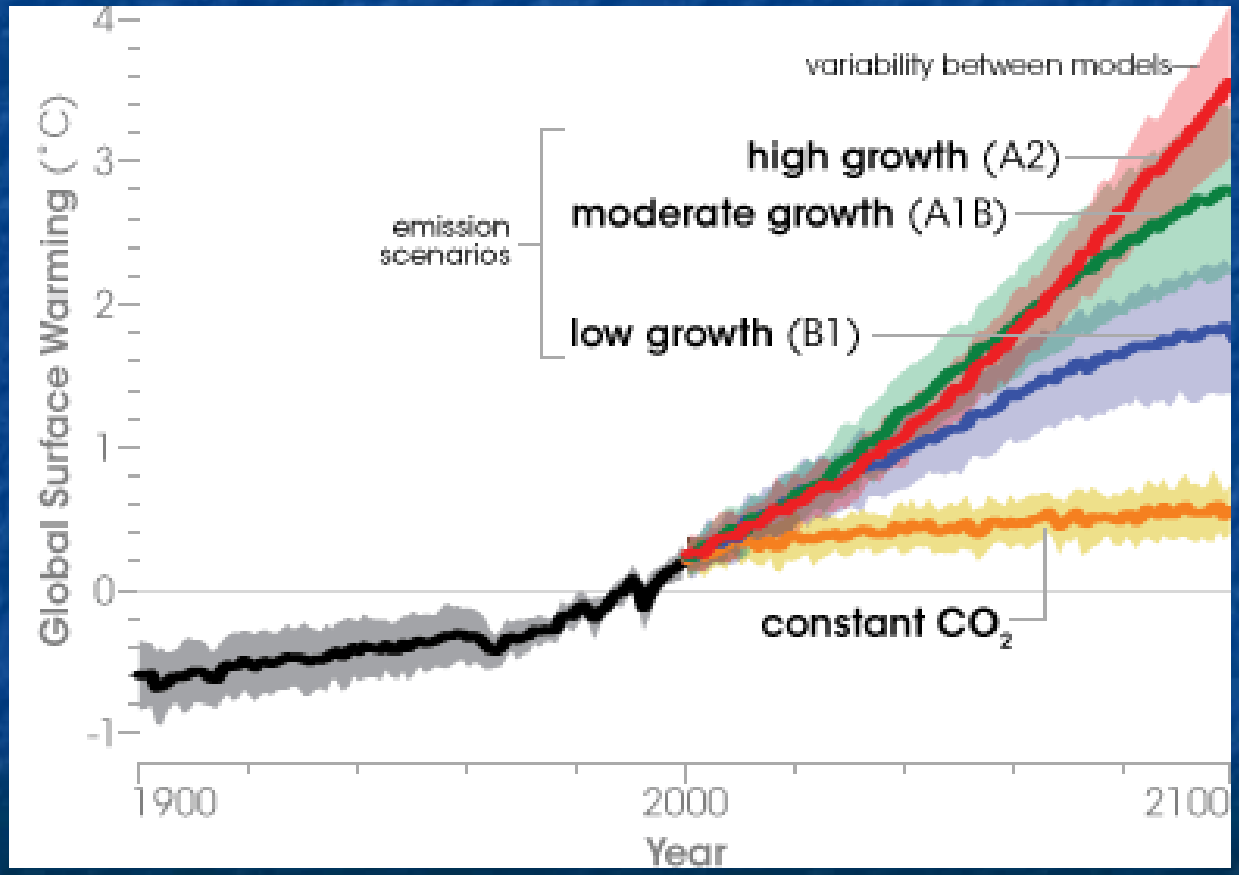




The Future

- Long term scenarios (through 2100) developed by the Intergovernmental Panel on Climate Change (IPCC), which cover a wide range of possible future characteristics, project changes in greenhouse gas and aerosol concentrations

The Future


variability between models
high growth (A2)
moderate growth (A1B)
emission scenarios
low growth (B1)
constant CO_2
Global Surface Warming (°C)
4
3
2
1
0
-1
1900
2000
2100
Year