Natural Changes in Climate

Long Term and Short Term Changes in Climate

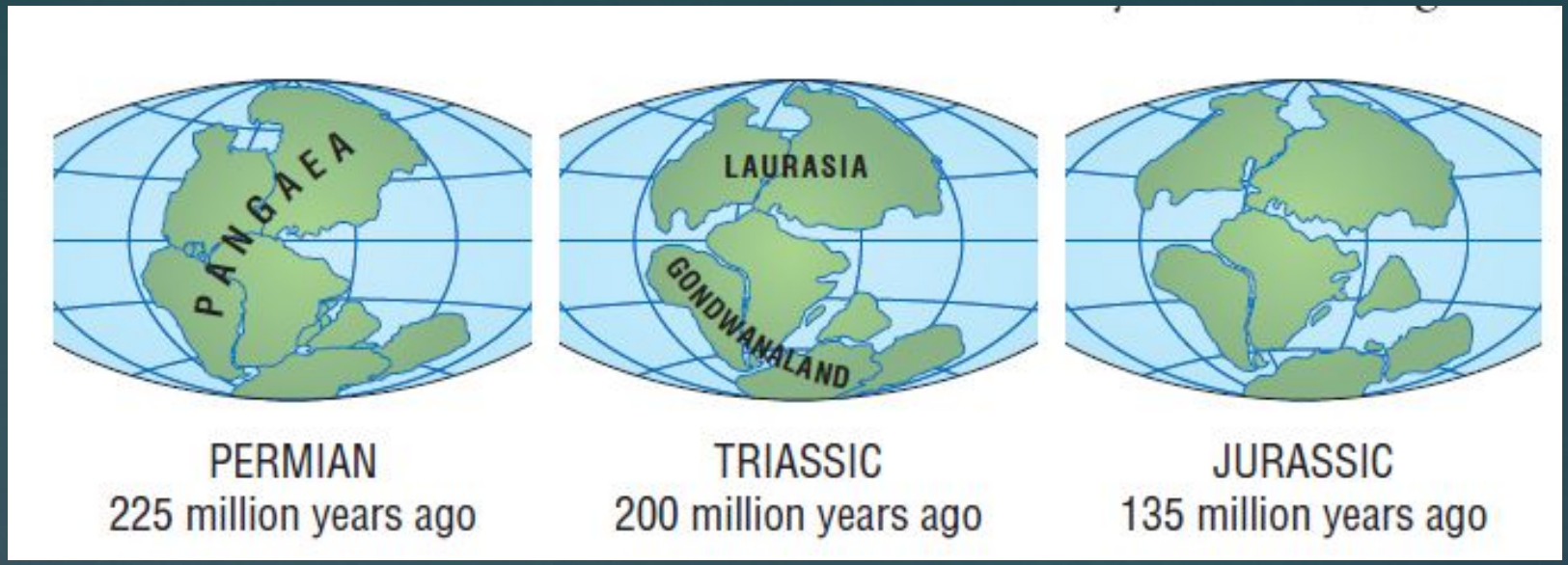
- The Earth's climate is not static and goes through natural cyclic changes (ex: Ice Age 20000 years ago)

- Changes in climate are triggered by changes in Earth's energy balance (ie: if the Sun's energy is absorbed differently, climate changes)

Long Term Changes

- Continental Drift
  - When continents move, ocean currents and wind patterns change causing changes in climate

Figure 2 Continental drift affects climate because it changes the distribution of land around the globe.



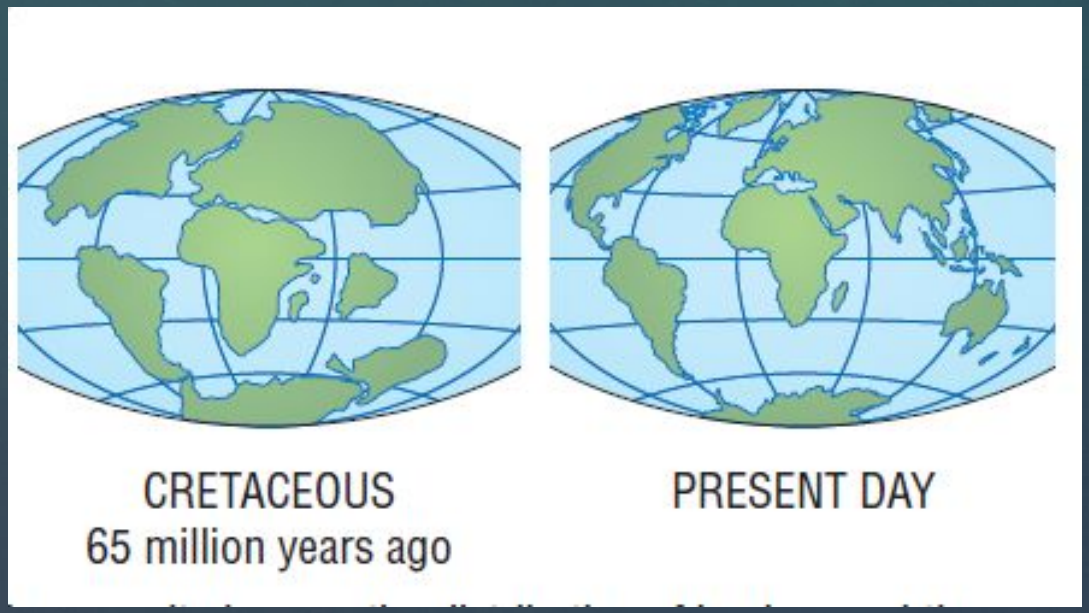
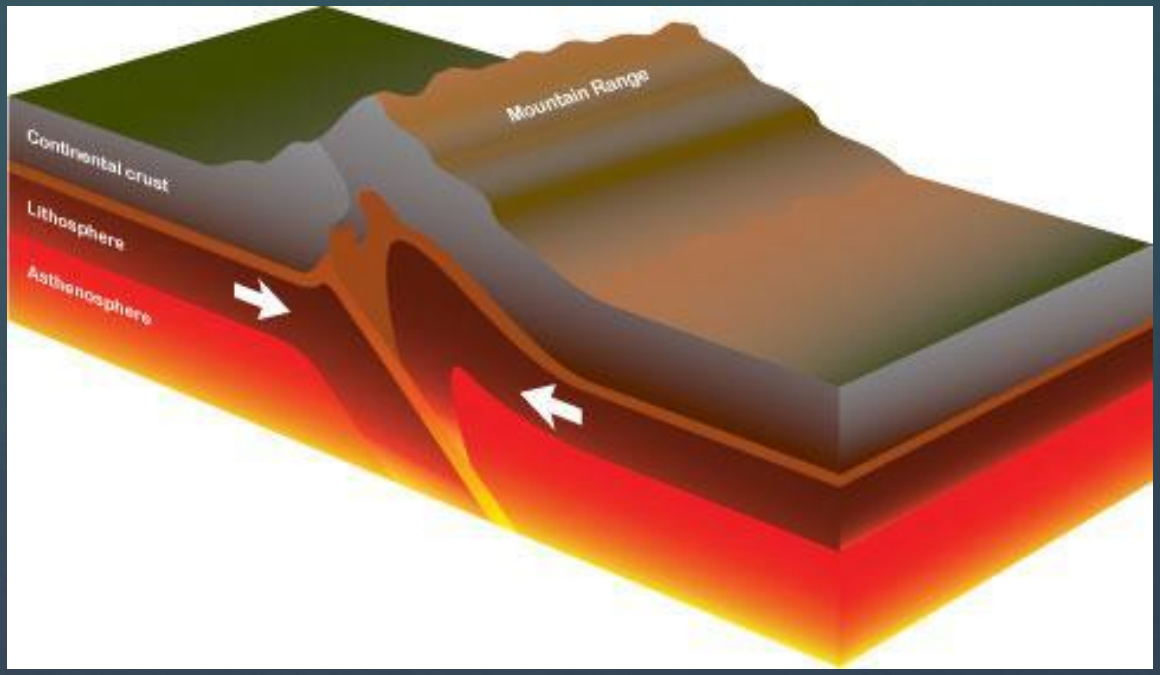


Figure 2 Continental drift affects climate because it changes the distribution of land around the globe.

Long Term Changes

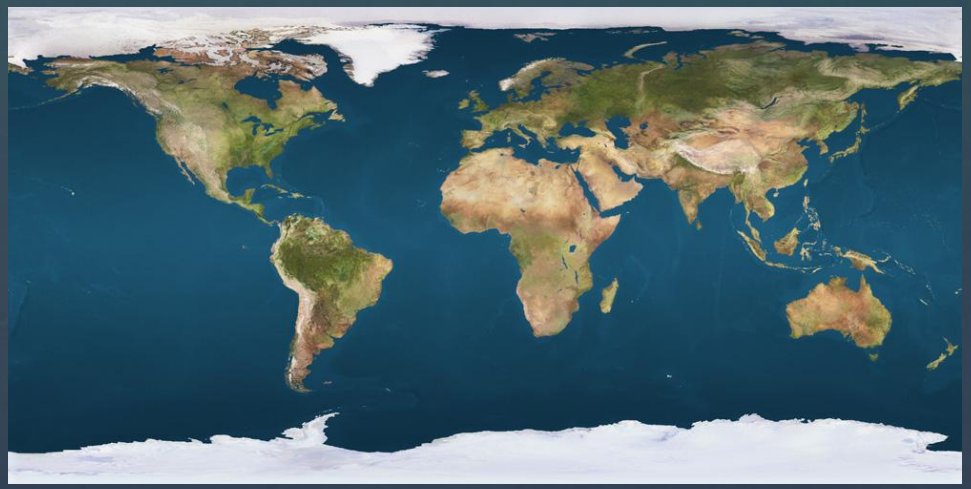
- As mountain ranges form, regional climates change



Long Term Changes

- When surrounded by more larger bodies of water, you get more moderate climates (ie: Southern Hemisphere)

- When you have fewer, large bodies of water you get harsher winters and hotter summers (ie: Northern Hemisphere)



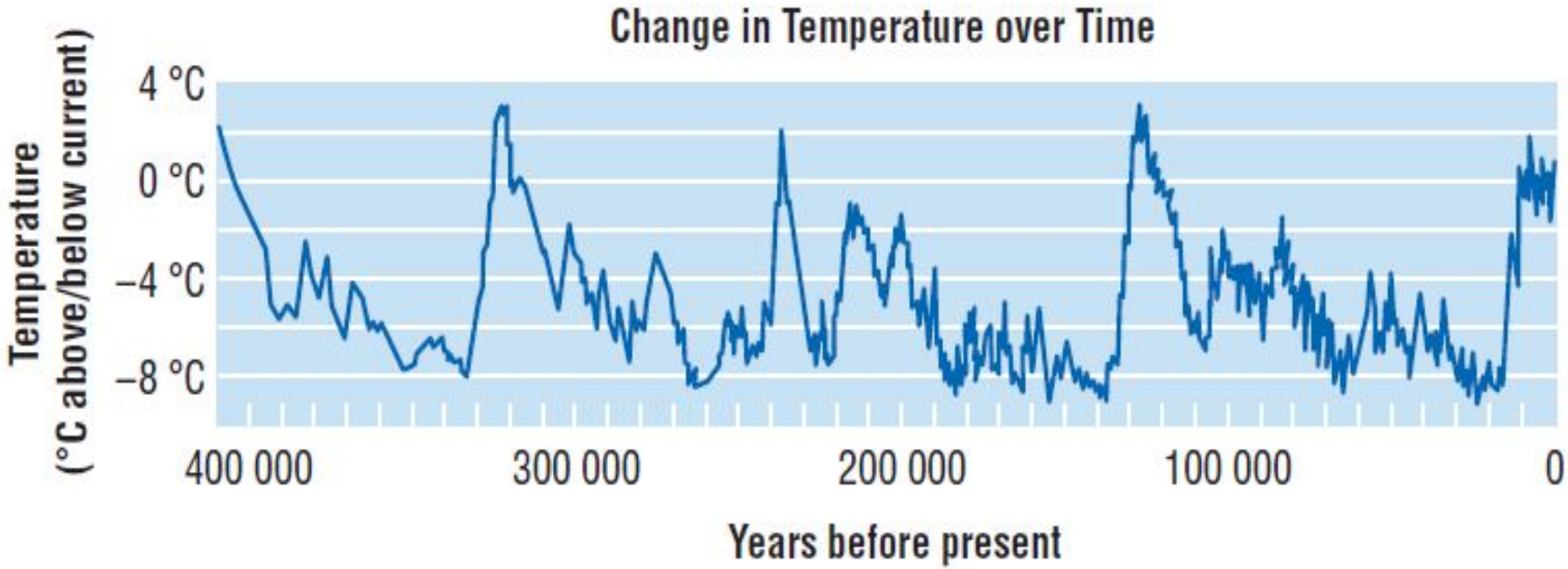
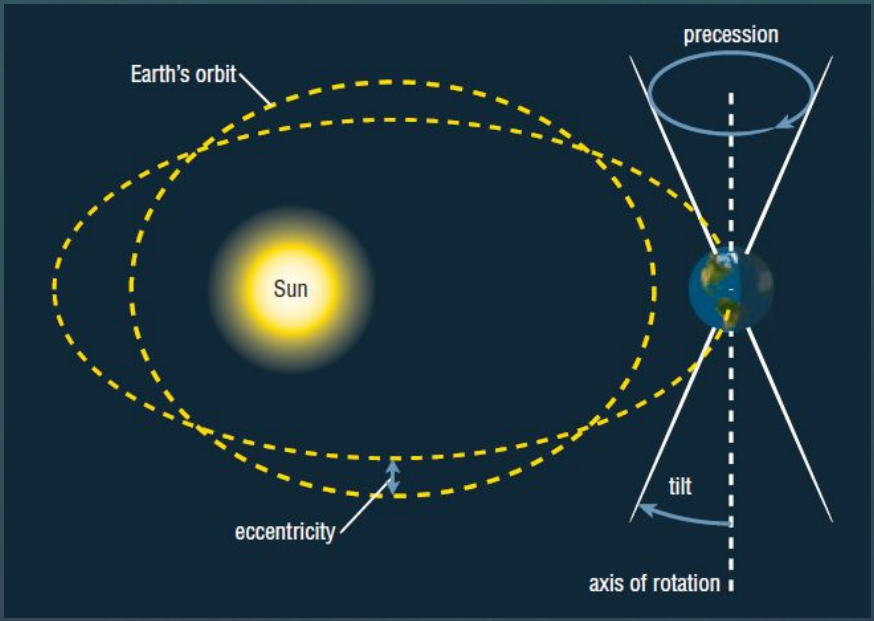


Figure 4 Graph of changes in Earth's average temperature over the past 400 000 years. The values on the *y*-axis represent deviations from Earth's average temperature today. Notice that major changes in temperature happen in regular cycles. Warm interglacial periods occur about every 100 000 years.

Why do Interglacial Periods and Ice Ages Happen?

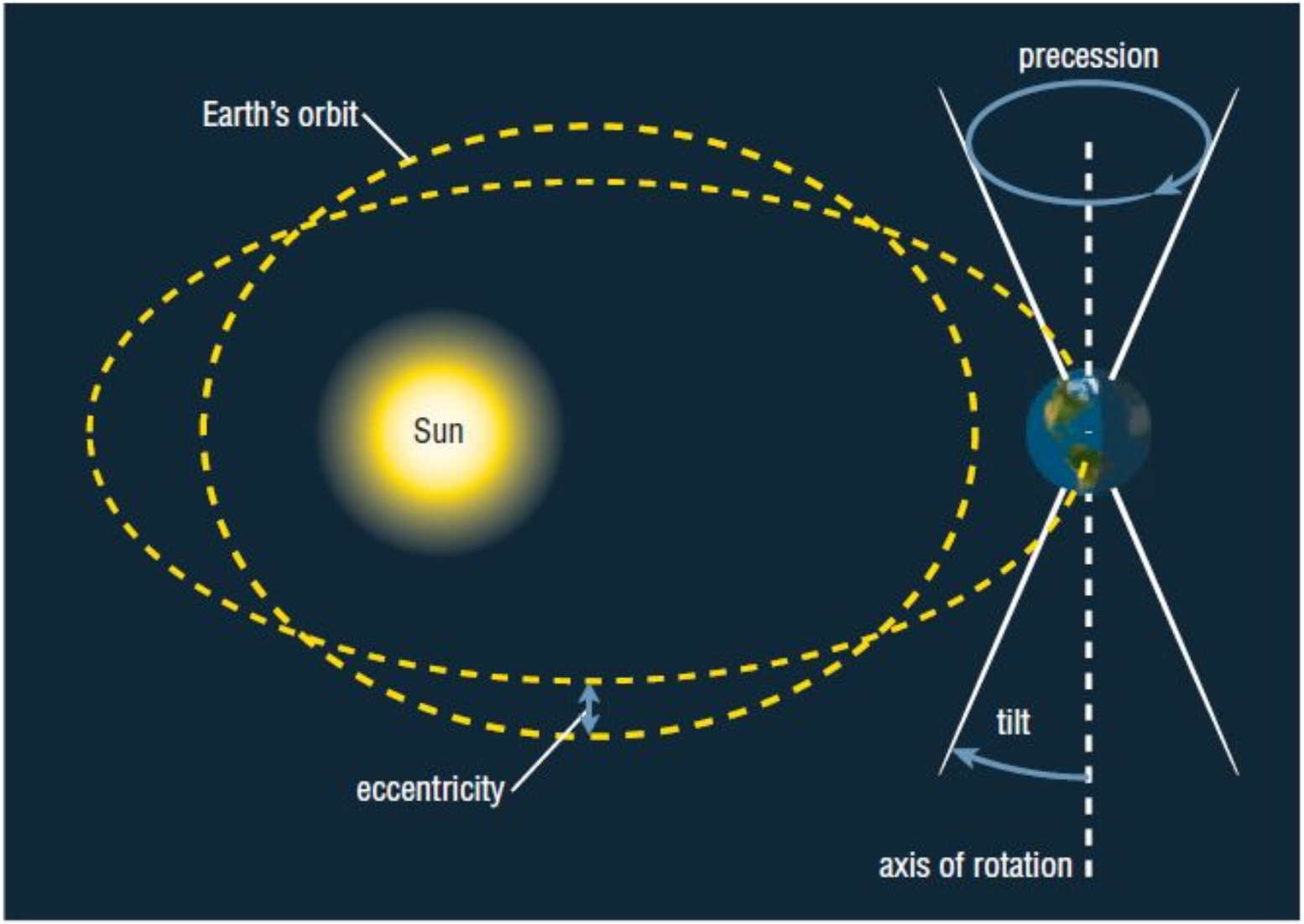
- Earth's orbit around the sun changes due to eccentricity, tilt and its wobble



Why do Interglacial Periods and Ice Ages Happening?

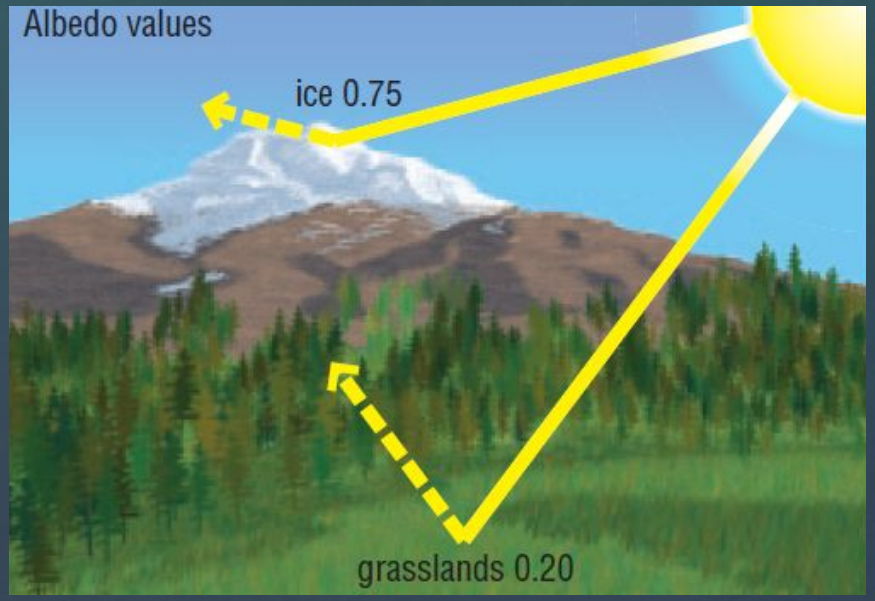
- A decrease in the energy from the Sun causes lower temperatures (ice age) and an increase will cause higher temperatures (interglacial)

- http://www.youtube.com/watch?v=6lbJrvtxWNE


precession
Earth's orbit
Sun
tilt
eccentricity
axis of rotation

Albedo

- Albedo: a measure of how much of the Sun's radiation is reflected by a surface. (related to percent of radiation reflected)
  - ice and snow have high albedo (therefore it's cold)
  - grass and trees have a low albedo (therefore it's warm)



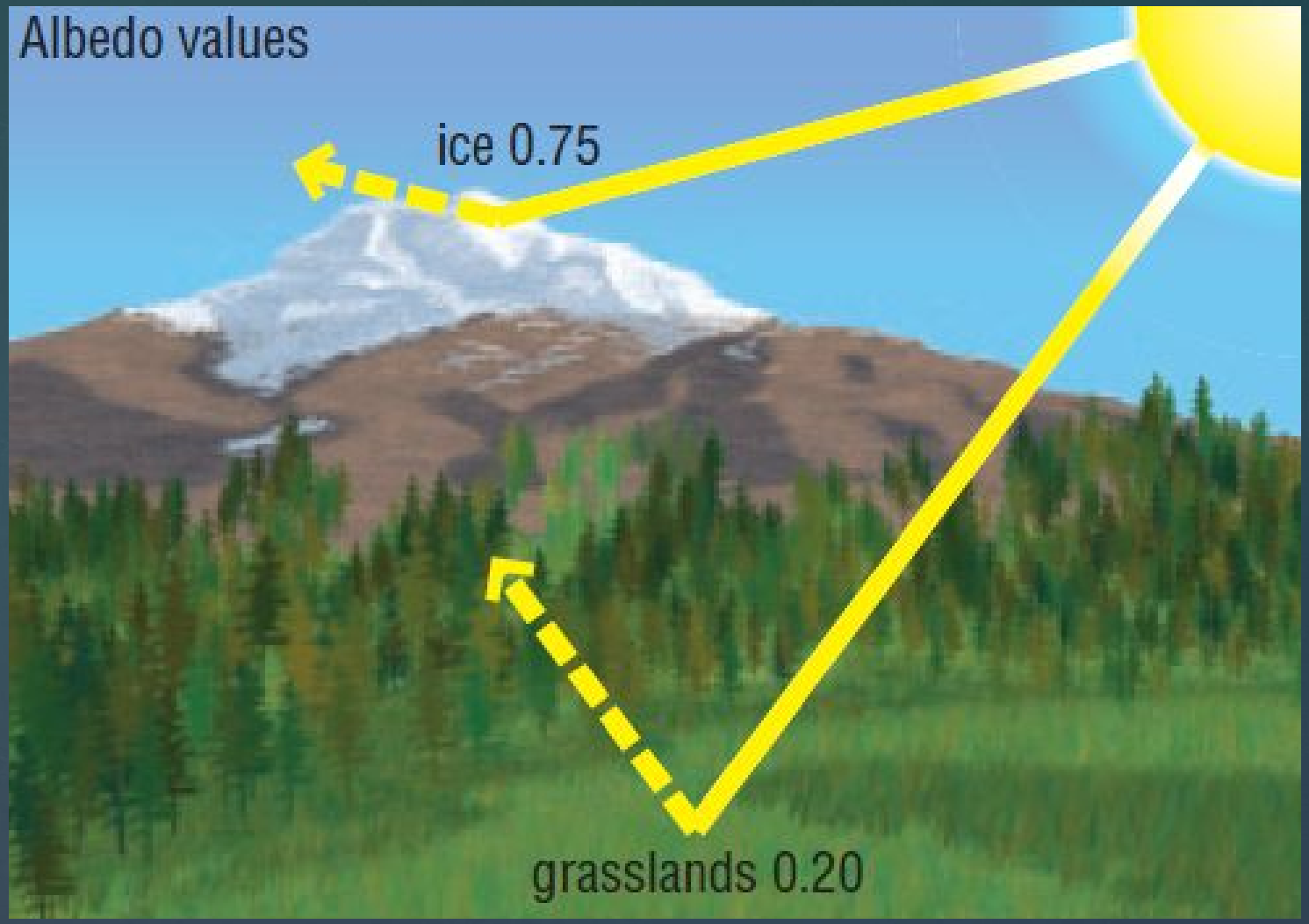


Figure 2 Ice reflects about 75 % of the Sun's radiation; its albedo is 0.75. Grass reflects about 20 % of the Sun's radiation; its albedo is 0.20.

Albedo Effect

- an increase in the Earth's temperature causes ice to melt, so more radiation is absorbed by Earth's surface, leading to further increases in temperature

Albedo Effect

- Is the albedo effect a positive or a negative feedback loop?

It is a positive loop!

Short-Term Variations In Climate

- Small term variations occur over 10s of years to 100s of years

Short-Term Variations In Climate

- Volcanic Eruptions
  - More dust in the air inhibits Sun's energy from reaching that area causing a temporary cool down

Volcanic Eruptions

- Mount Pinatubo in the Phillipines erupted in June 1991
  - There was so much lava and ash in the stratosphere that the amount of sunlight reaching earth's surface reduced by 10%
  - Global temperatures lower an average of 0.5°

Short Term Variations in Climate

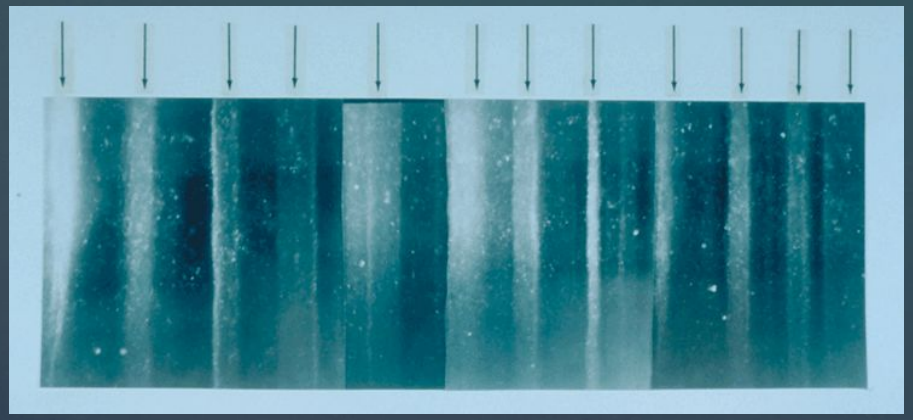
- Air and Ocean Currents
  - Changes in the circulation of these currents can result in climate changes
  - If the salinity of the water changes, it can have an effect on the thermohaline circulation
  - El-Nino effect occurs every 3-7 years. It involves a change in prevailing winds that causes changes in climate
  - http://www.youtube.com/watch?v=7FVZrw7bk1w

How do we study climate change?

- Proxy Records
  - Stores of information in tree rings, ice cores, and fossils that can be measured to give clues to what the climate was like in the past

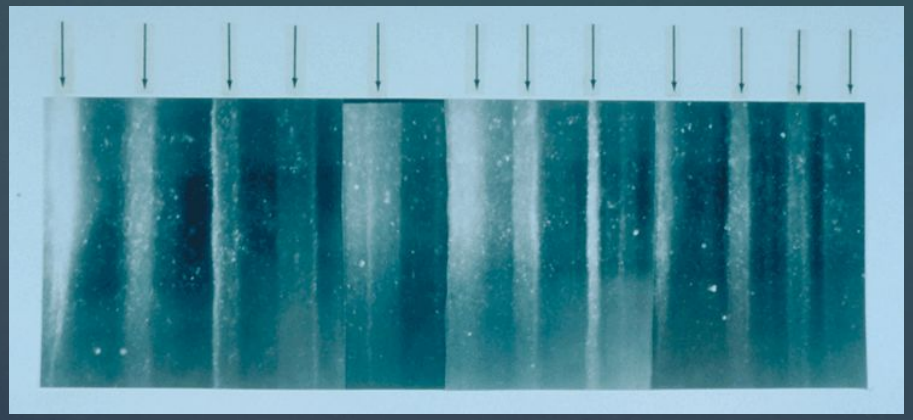
Ice Cores

- Ice has tiny air bubbles that have been trapped for thousands of centuries and can be tested for various gases



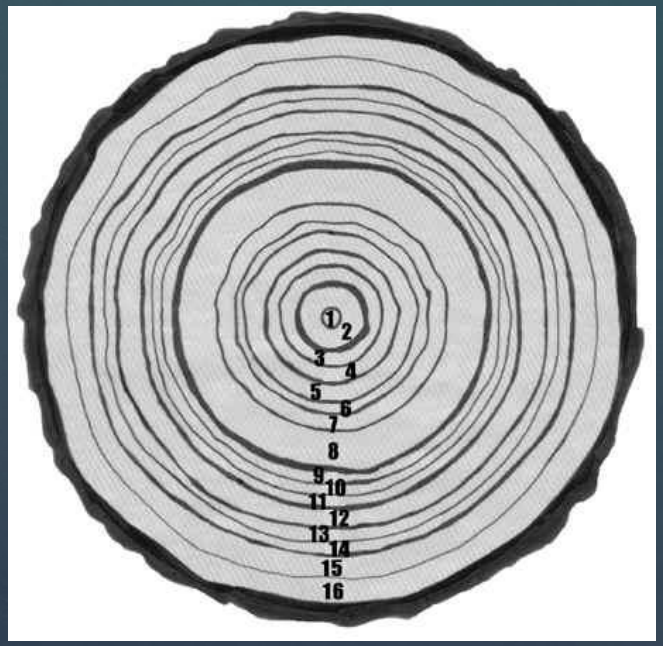
Ice Cores

- http://www.youtube.com/watch?v=JS2PhRd_5NA



Tree Rings

- The thickness of a tree ring indicates the growing conditions
  - Warm, wet year will produce a thick ring
  - Cold, dry year will produce a thin ring



Coral Reefs

- Corals have layers of growth each season and give clues about the temperature of the ocean

Rocks & Fossils

- Scientists can look at rocks and layers of soil for clues like plant pollen or fossils that would give us an idea about what the climate was like

- In the ocean floor, scientists can find fossils of marine plants and animals that may not have been there previously suggesting a change in climate