

# Climate

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# What is Climate?

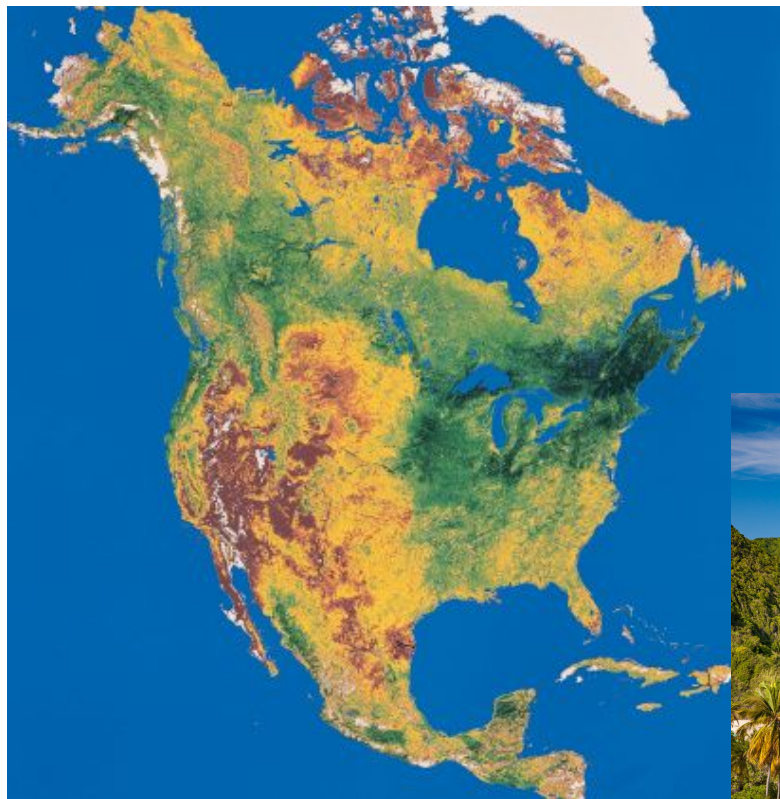
In short, climate is the description of the long-term pattern of weather in a particular area. Some scientists define climate as the average weather for a particular region and time period, usually taken over 30-years. It's really an average pattern of weather for a particular region

# **What Factors Influence Climate?**

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The six factors that affect or influence the temperature are:

**elevation** (altitude), **latitude**, proximity of large bodies of water (**humidity**), **ocean currents**, proximity of mountain ranges (**topography**), **prevailing and seasonal winds**.



# **Natural Causes of Climate Change?**

# Natural Causes of Climate Change?

Volcanic eruptions, meteor impacts, El Nino, ocean currents, and Earth's orbital changes

# Volcanic Eruptions

The main effect volcanoes have on the climate is ***short-term cooling***. Volcanic eruptions pump out clouds of dust and ash, which block out some sunlight. But volcanic debris also includes sulfur dioxide. This gas combines with water vapor and dust in the atmosphere to form sulfate aerosols, which reflect sunlight away from the Earth's surface. These aerosols are lighter than ash particles and can remain in the atmosphere for a year or more.



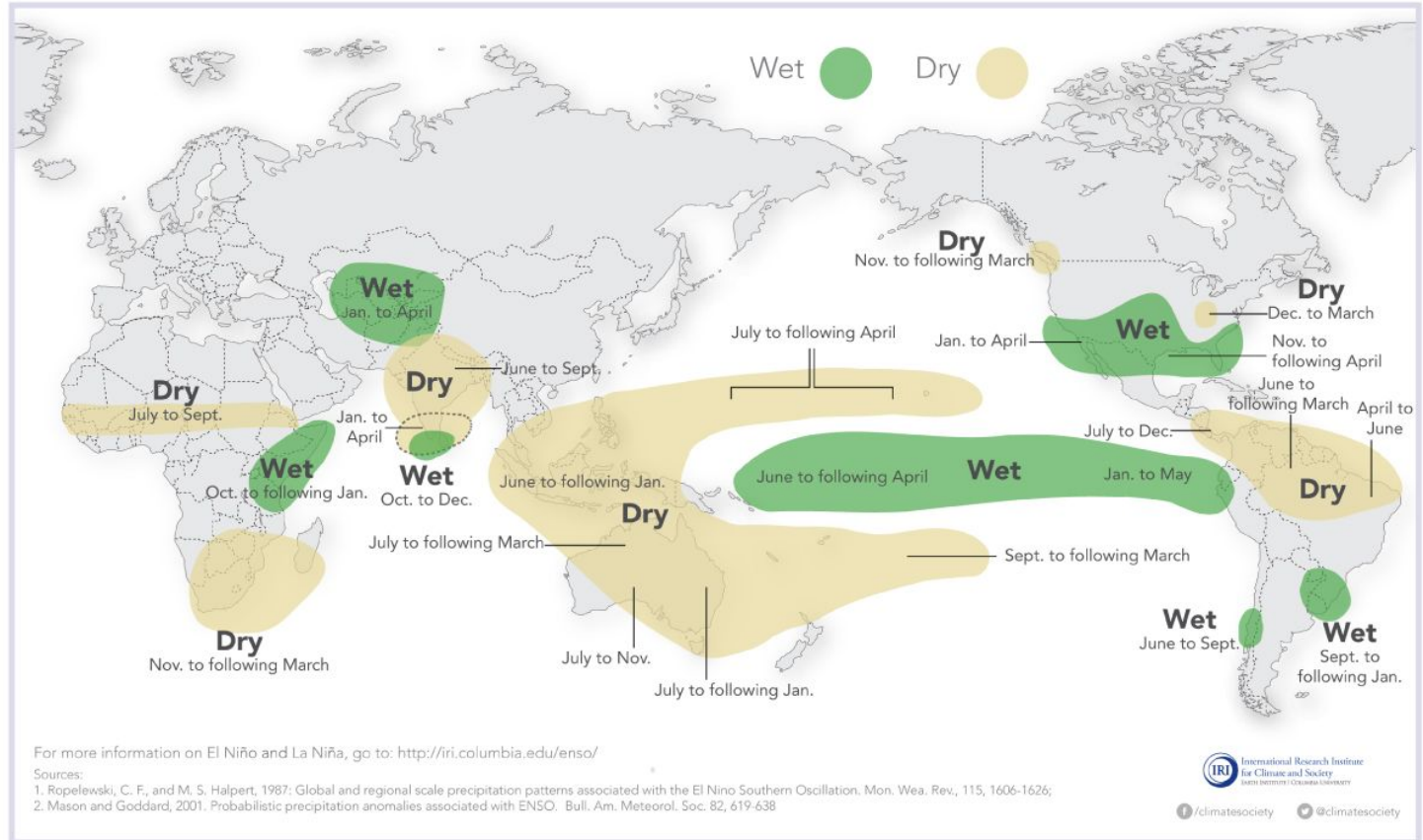


# El Niño–La Niña

The El Niño–La Niña cycle causes temporary warming and cooling due to positive feedback loops. Both phenomena affect atmospheric circulation patterns and influence global climate. While El Niño increases global temperature, La Niña decreases it. This cycle repeats itself on a timescale of about five years. But these changes are short-term, only lasting a few years.

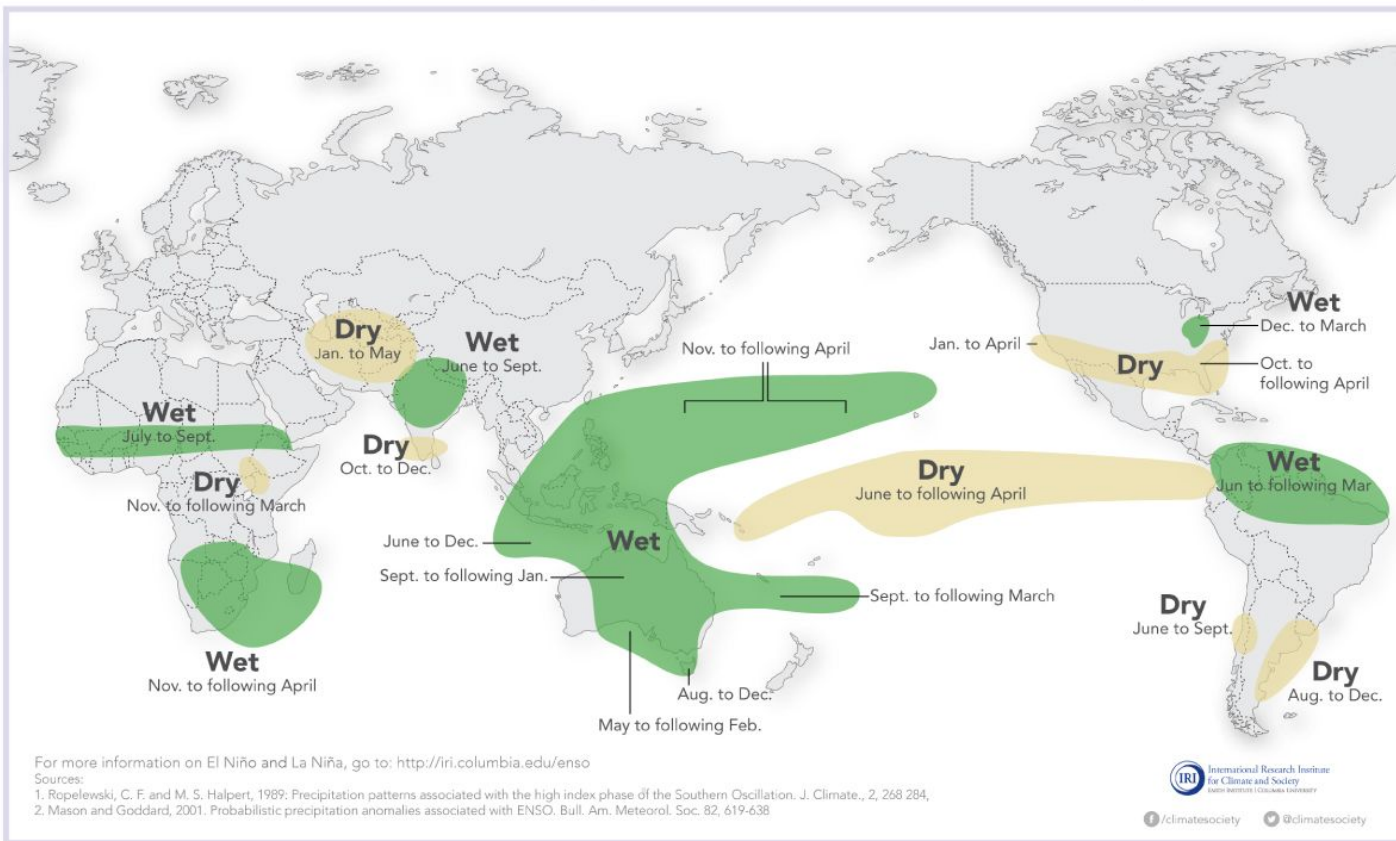
# El Niño and Rainfall

El Niño conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. Although they vary somewhat from one El Niño to the next, the strongest shifts remain fairly consistent in the regions and seasons shown on the map below.



# La Niña and Rainfall

La Niña conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. Although they vary somewhat from one La Niña to the next, the strongest shifts remain fairly consistent in the regions and seasons shown on the map below.



# Ocean Currents

The global conveyor belt includes both surface and deep ocean currents that circulate the globe in a 1,000-year cycle. This circulation is the result of ***two simultaneous processes***: warm surface currents carrying less dense water away from the Equator toward the poles, and cold deep ocean currents carrying denser water away from the poles toward the Equator. The ocean's global circulation system plays a key role in distributing heat energy, regulating weather and climate, and cycling vital nutrients and gases.



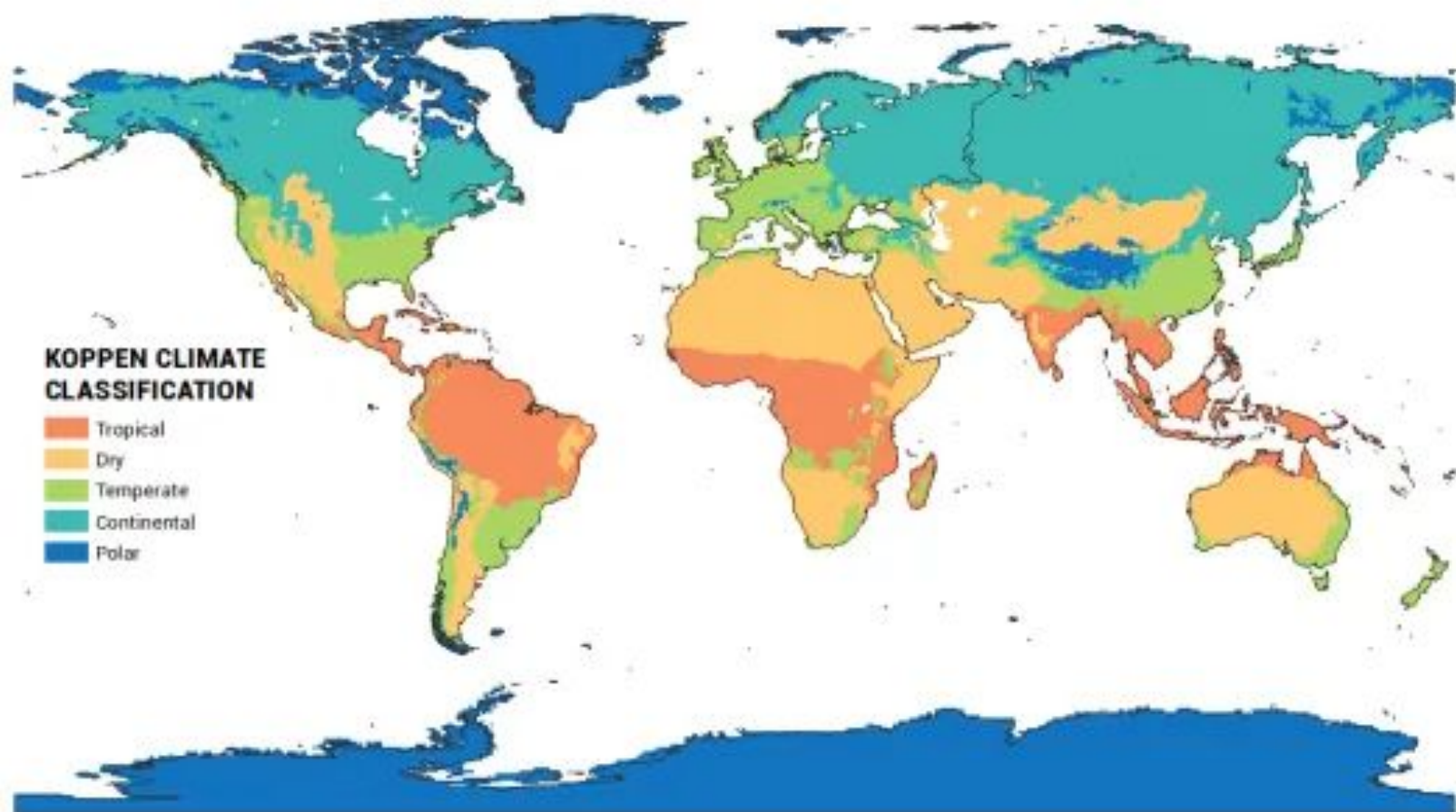


**Ocean Currents:**

- Warm currents
- Cool currents

**Global Winds:**

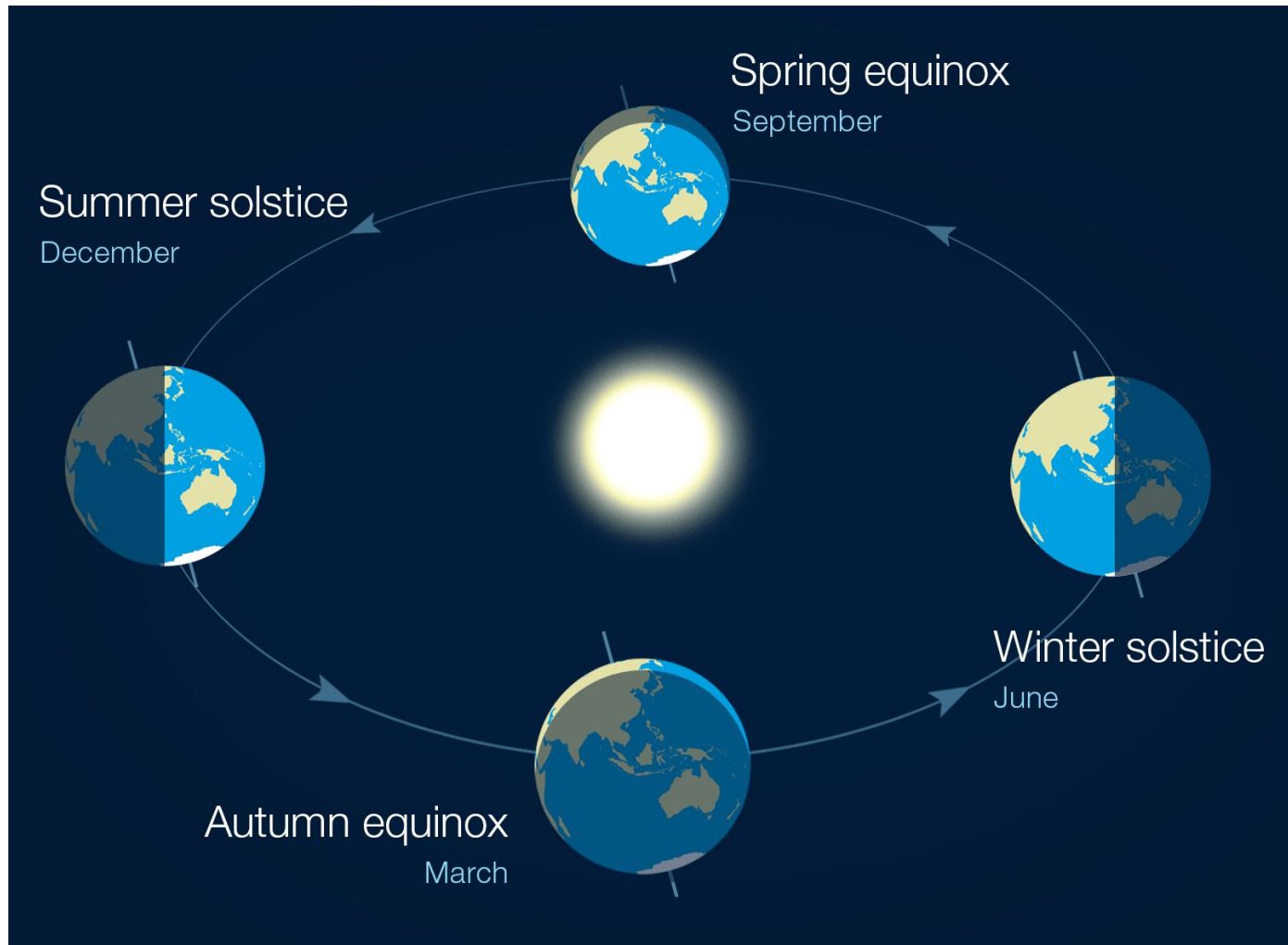




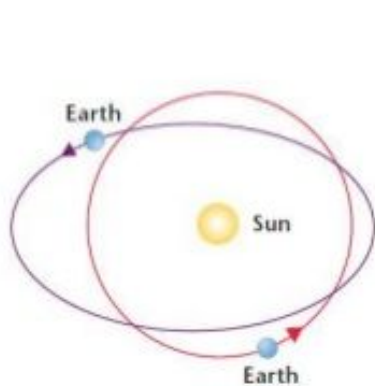
# Earth's Orbital Changes

Shifts and wobbles in the Earth's orbit can trigger changes in climate such as the beginning and end of ice ages. The last ice age ended about 12,000 years ago and the next cooling cycle may begin in about 30,000 years. Changes in the tilt of the earth can lead to small but climatically important changes in the strength of the seasons, more tilt means warmer summers and colder winters; less tilt means cooler summers and milder winters.

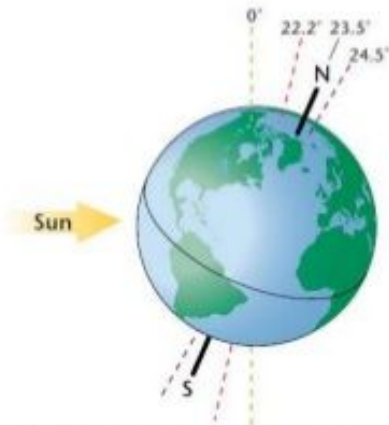




# Milankovitch Cycle



**Eccentricity** Earth encounters more variation in the energy that it receives from the sun when Earth's orbit is elongated than it does when Earth's orbit is more circular.

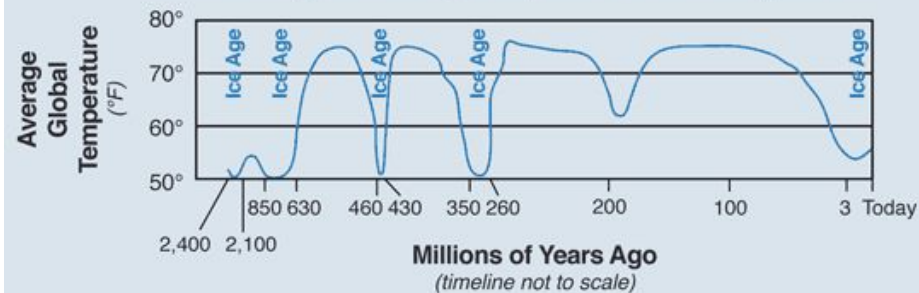


**Tilt** The tilt of Earth's axis varies between  $22.2^{\circ}$  and  $24.5^{\circ}$ . The greater the tilt angle is, the more solar energy the poles receive.

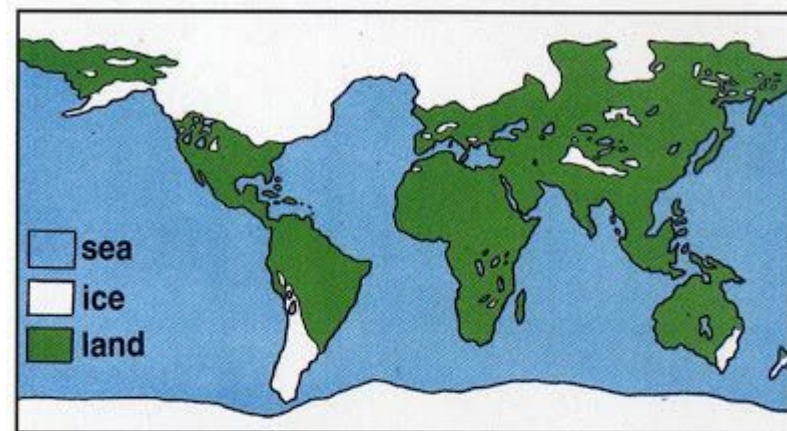


**Precession** A gradual change, or "wobble," in the orientation of Earth's axis affects the relationship between Earth's tilt and eccentricity.

## Ice Ages during the past 2.4 billion years

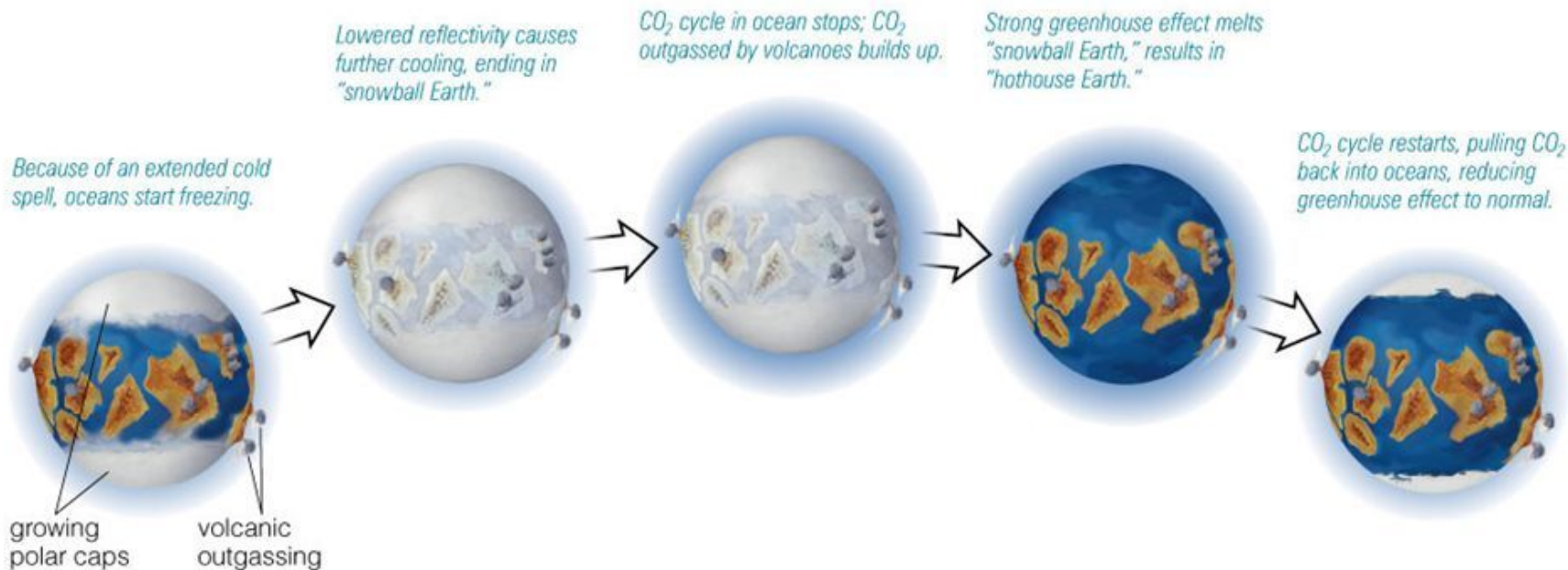


## Quaternary Ice Age 1.5 mya - 15,000 years ago



*This map shows which areas of the world were covered with ice during the Pleistocene Ice Age.*

# Snowball Earth



# Extraterrestrial Factors

Solar  
Output

Earth-Sun  
Geometry

Interstellar  
Dust

**Earth's  
Climate**

Volcanic  
Emissions

Atmospheric  
Chemistry

Mountain  
Building

Atmospheric  
Reflectivity

Continental  
Drift

Atmosphere/Ocean  
Heat Exchange

Surface  
Reflectivity

Ocean, Atmosphere, and Land Factors