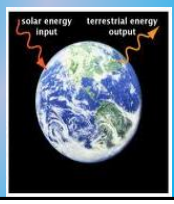
THE EARTH'S CLIMATE SYSTEM

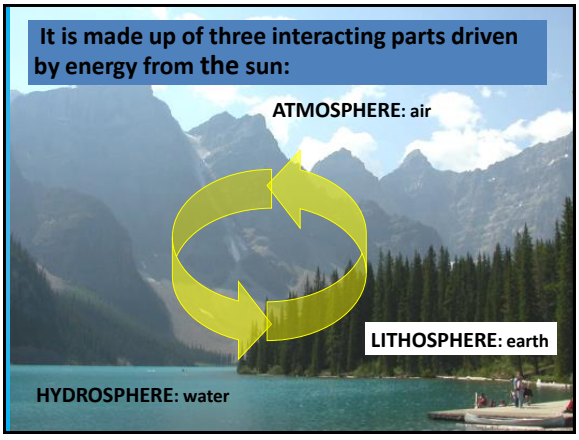
Earth's Climate System is driven by interactions between the parts of our biosphere

So….what is the Biosphere?

- a relatively thin layer of Earth that has conditions suitable for supporting life.
- It includes all the living things on earth and the physical environment that supports them.
- It is a **closed system**
  = only Energy can cross, not matter

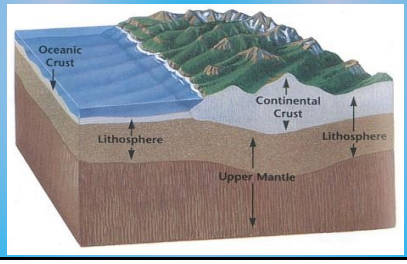


It is made up of three interacting parts driven by energy from the sun:



The Lithosphere

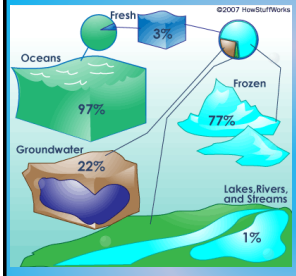
- Includes the crust and the uppermost mantle, which constitute the hard and rigid outer layer of the Earth.
- Varies in thickness from 100 km – 200 km
- Life exists several km below earth's surface.



The Hydrosphere

- Is water on or near Earth's surface

- includes water in oceans, rivers, lakes, streams, underground reservoirs, and in the atmosphere.

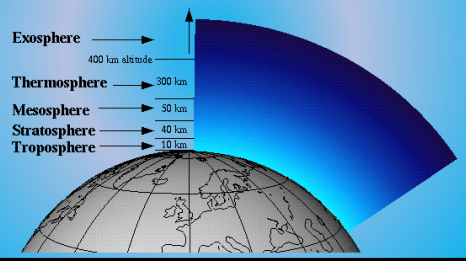


- 97% is marine saltwater
- 3% freshwater, most is frozen
- **Cryosphere** = glaciers, continental ice sheets, permafrost

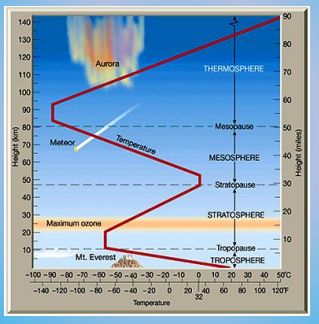
- The amount of water on Earth always remains the same. No water is ever lost or destroyed.
- It is a **closed system**

The Atmosphere

- A mixture of gases extending 500 km above the Earth's surface
  - 78% = Nitrogen
  - 21% = Oxygen
  - 1% = Other gases including carbon dioxide
  - Also contains dust particles and pollutants



The atmosphere is divided into definite layers or **strata** based on their temperature profiles



Layers of the Atmosphere:

Exosphere
- outer space (not a true layer)

Thermosphere (500 km +)
- Gets really hot
- lower part consists of a layer of charged particles which allows radio and satellite communications = **ionosphere**
- region of **Aurora Borealis** (magnetic field)

Mesosphere (50 to 100 km)
- thin atmosphere creates enough air friction to cause most meteors to burn up in this strata

Stratosphere (10 to 50 km)
- Temperature increases as you go up in this layer due to the presence of the **ozone layer**
- absorbs solar radiation making life on earth possible

Troposphere (0 to 10 km)
- strata in contact with Earth
- temperatures decrease with height (ave. 15°C)
- contains 80% of all atmospheric gases
- Nearly all life contained in this layer

The Sun Melts The Earth.

So…Earth's climate occurs due to the interactions between:

Weather or Climate?

Which photo is about weather? Which is about climate?

WEATHER:
- condition of the atmosphere at a **particular place and time** (**short term**)
- includes temperature, precipitation, air pressure, cloud cover, humidity, etc

CLIMATE:
the **average** weather conditions of a **region** over a long time (at least 30 years).

Weather vs. Climate

"Climate is what we expect. Weather is what we get."

– Mark Twain

Which comment refers to Weather? Climate?

I can't believe it's snowing on May 11th!

Weather

My grandma says never to plant the garden til the May long weekend.

Climate

Don't put your tomatoes in the garden yet as we often get frost this time of year.

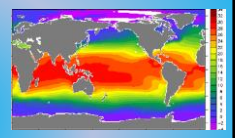
Climate

A tornado hit the golf course yesterday.

Weather

Weather vs. Climate

Most often, climate is similar across large regions of Earth.



Other times, climate can differ in small regions, creating unique microclimates.

What Causes Climate?

- **Temperature (cold or hot climate)**
  = Thermal Energy

Precipitation (dry or humid climate)
= Moisture

BUT climate is not that "cut and dried". There are many variations between these extremes.

Factors Affecting Temperature

- **Latitude**
- **Altitude**
- **Distance From Large Bodies of Water**
- **Ocean Currents**

Latitude

- the distance from the equator measured in degrees
- 3 Temperature Zones:

Polar Zones: cold climates

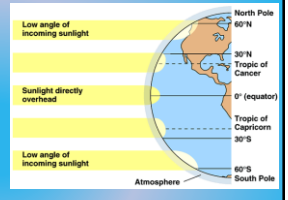
Temperate Zones: varying temperatures (warm in the summer/cold in the winter)

Tropical Zones: warm climates

- Impacts result because of the angle at which the sun strikes the Earth

Latitude

- The tropical zone is from 23.5 degrees N to S. It has a warm climate because it receives direct sunlight all year.
- The polar zones extend from 66.5 to 90 degree N/S. They have cold climates because the sun strikes at a low angle.



Altitude

- Is elevation above sea level
- Air temperature decreases as altitude increases

Higher altitudes
= cooler temperatures

Lower altitudes
= warmer temperatures

Distance From Large Bodies of Water

- **Marine Climates**
  = warmer winters and cooler summers
- **Continental Climates**
  = colder winters and warmer summers

Ocean Currents

- Many marine climates are influenced by ocean currents.

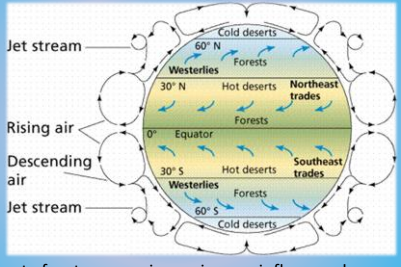
- **Ocean Currents**- streams of water within the ocean that move in regular patterns
- *3 examples*: Gulf Stream, North Atlantic Drift, California Current

Factors Affecting Precipitation

- **Prevailing Winds**
- **Topography**

Prevailing Winds

- movement of air masses caused by directional winds in a region



- The amount of water vapor in an air mass influences how much rain or snow will fall

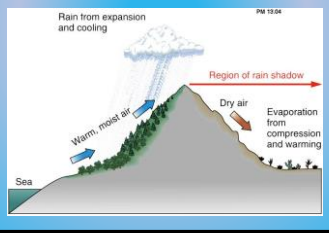
Topography

- Variations in the lay of the land will affect amounts of precipitation

Example: Mountain ranges will "trap" moisture on 1 side resulting in differences in precipitation on either side of the range

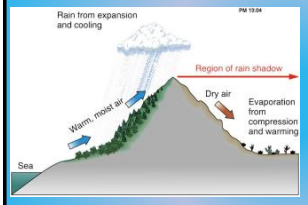
Topography

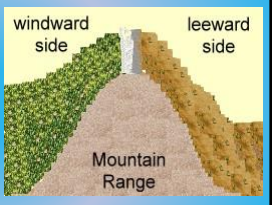
- Winds blowing inland from oceans carry moist air.
- When forced to rise over mountains, the rising warm air cools, water vapour condenses, and rain or snow then falls on the windward side of the mountain.



Topography

- The land on the leeward side receives little precipitation.





Conclusions

- Climate is the average weather conditions of a region over a long time (at least 30 years).
- Climate results from the interactions of many of Earth's "spheres".