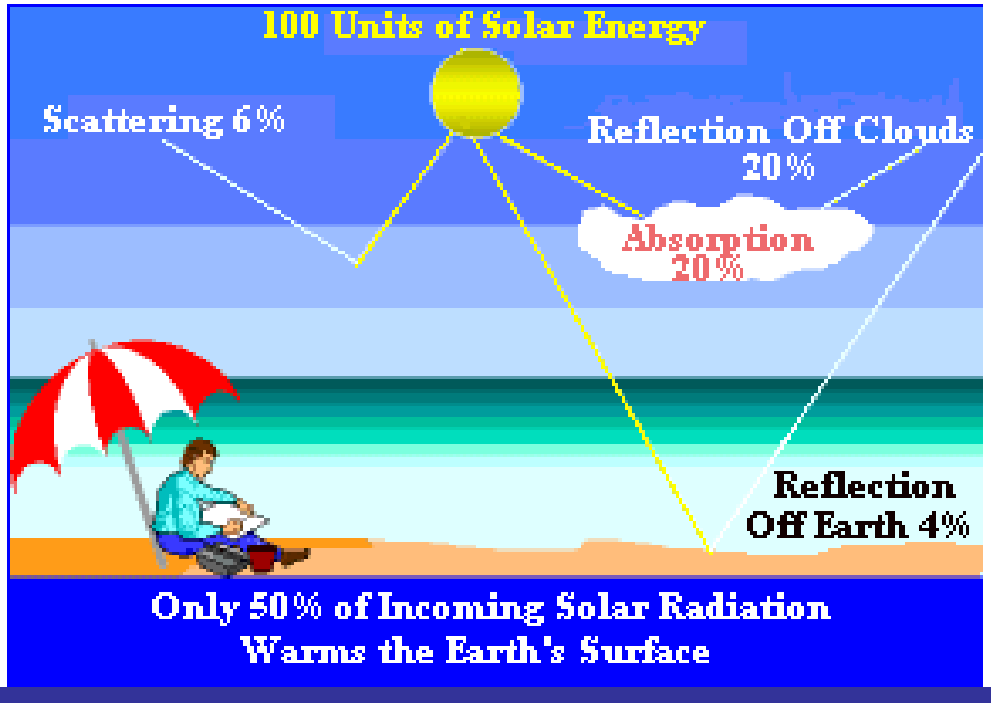
Unit Four: Weather Systems

SCIENCE 1206

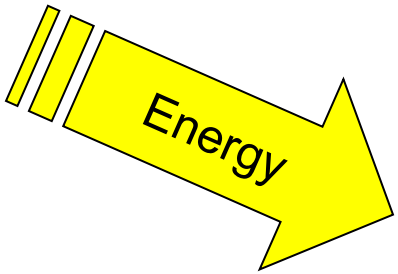
- **Topic 10:**

  Energy Transfer



What causes weather?

- Energy transfer from the sun to the earth.



The sun is our primary source of energy and this energy is transferred to air, land and water.

The sun is the ultimate cause of changing weather systems

Kinetic Molecular Theory

All matter is made up of particles that are in constant motion because they possess kinetic energy (energy of motion)

The speed at which the particles of a substance move as well as the distance between the particles determine the physical state of the substance ie. both factors increase going from solids to liquids to gases

Temperature is a measure of the average kinetic energy of the particles of a substance or how “hot” or “cold” something is

- *The greater the temperature, the greater the average kinetic energy and thus the faster the particles move*

Heat (Thermal Energy) is the total kinetic energy of all particles of a substance and is transferred from a warm object to a cooler one due to a difference in temperature

Transfer of Energy

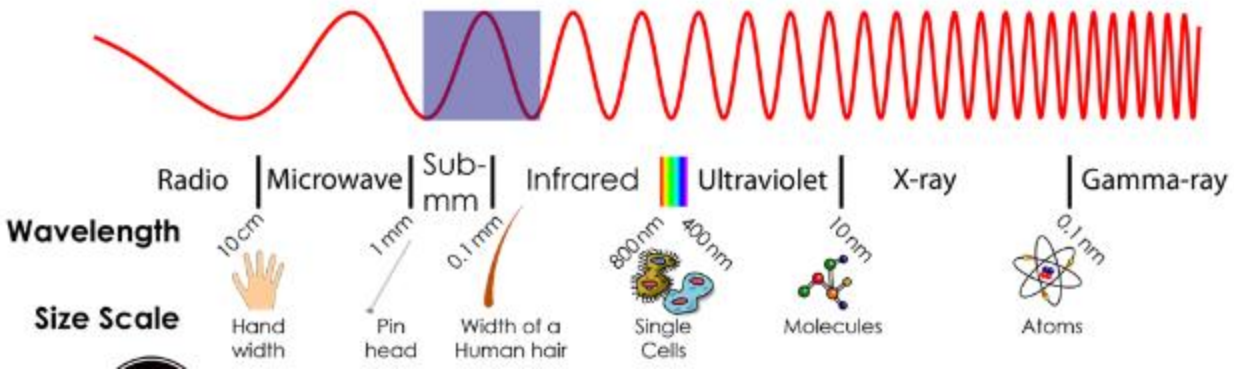
Energy can be transferred from one place to another by the following four methods.

1. Radiation
2. Conduction
3. Convection
4. Advection

These four methods of heat transfer are contribute to earth's weather

1. Radiation

Radiation is the transfer of energy by means of waves that do not require a medium



Visible light is one form of radiation that reaches us from the sun via empty space.

Visible light is only one member of the electromagnetic spectrum. Some other waves from this spectrum are: microwaves, X-rays, infrared waves, etc

2. Conduction

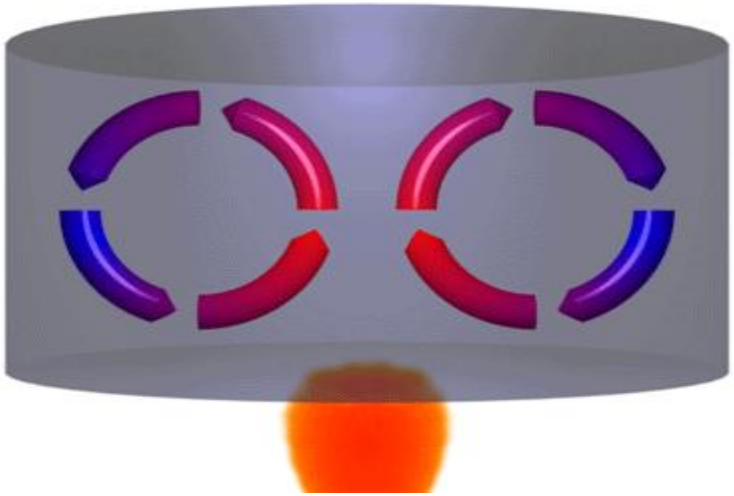
- **Conduction** is the transfer of energy through the collision of particles..

A frying pan on a stove element heats up by conduction.

Some materials are better conductors of heat than others. Metals are generally better conductors than some materials such as rock, sand, sand, etc

3. Convection

Convection: is the transfer of energy vertically by movement of particles in a fluid (water or atmosphere

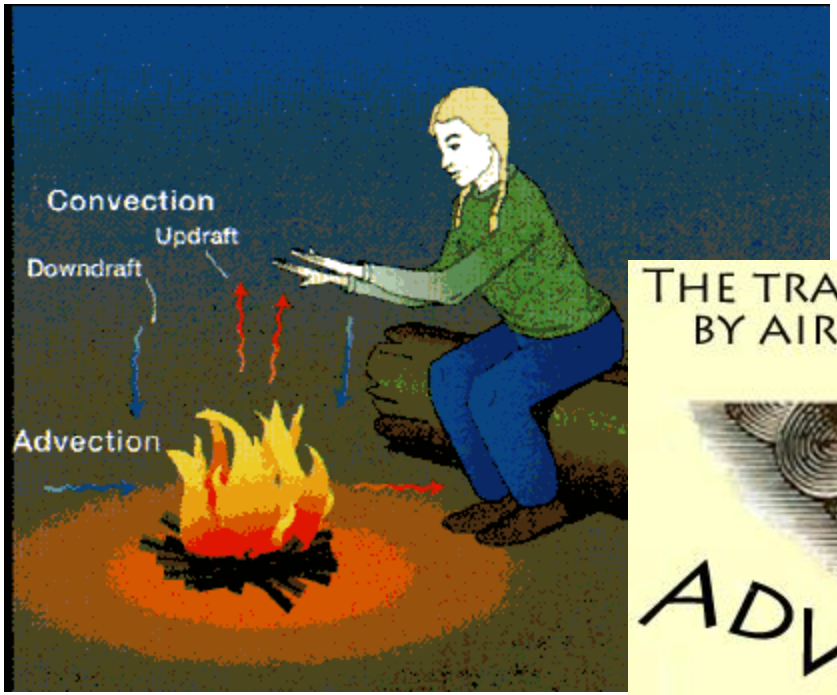


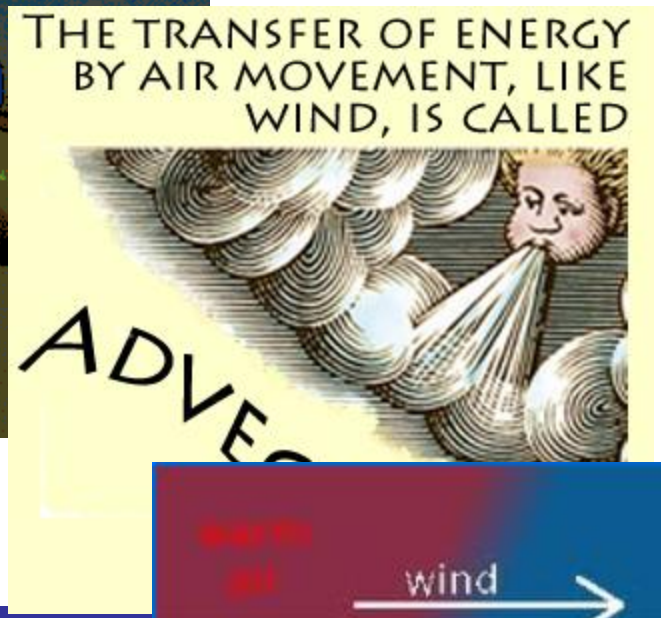
3. Convection

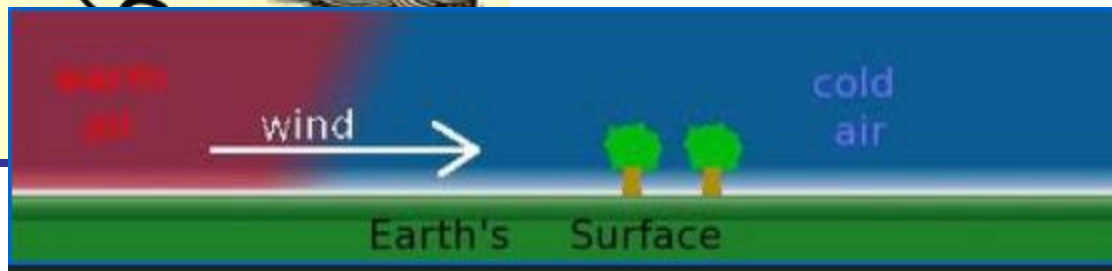
Convection is the transfer of energy *vertically* by movement of particles in a fluid (water or atmosphere).

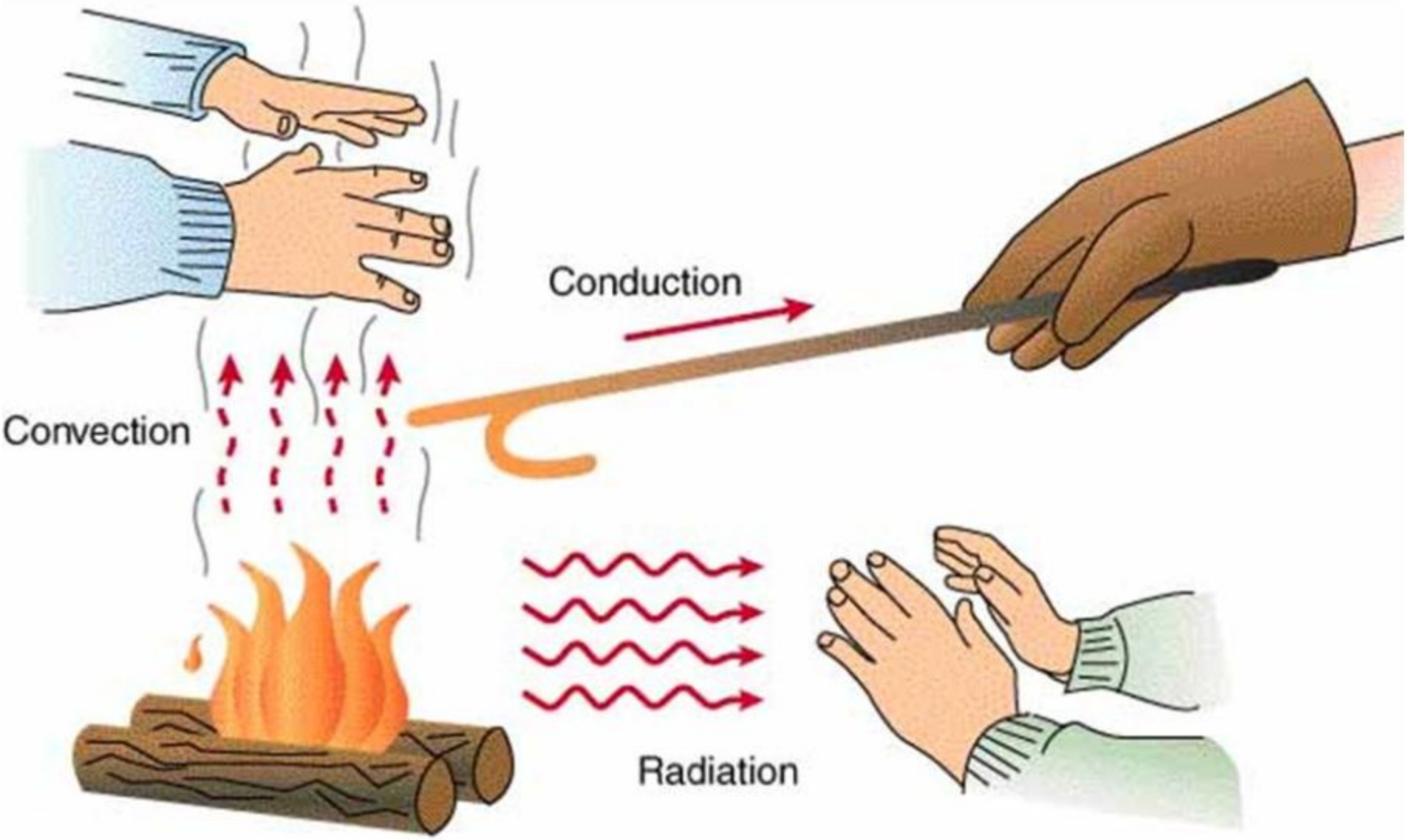
4. **Advection**

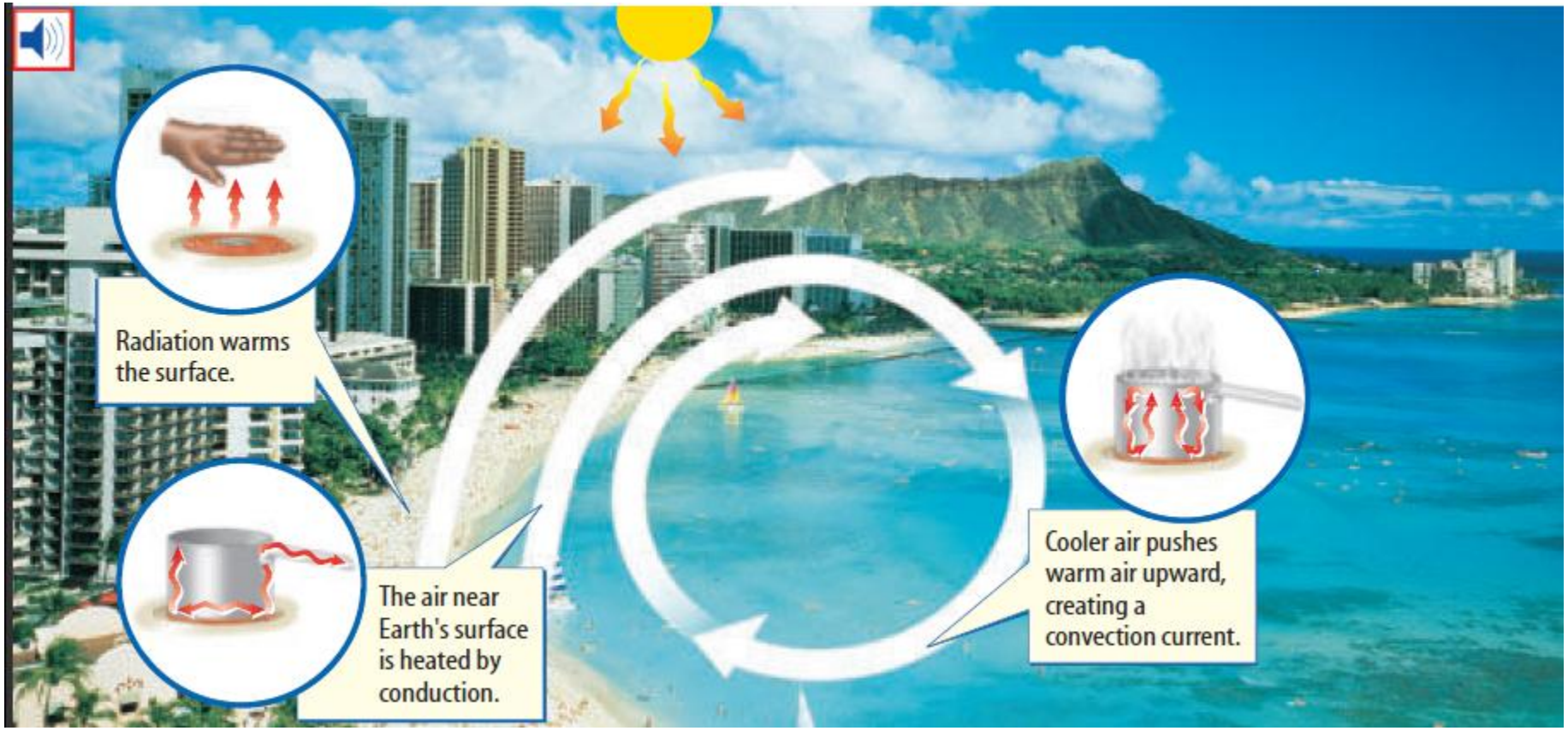
- **Advection** is the transfer of energy *horizontally* by movement of particles in a fluid (water or atmosphere).





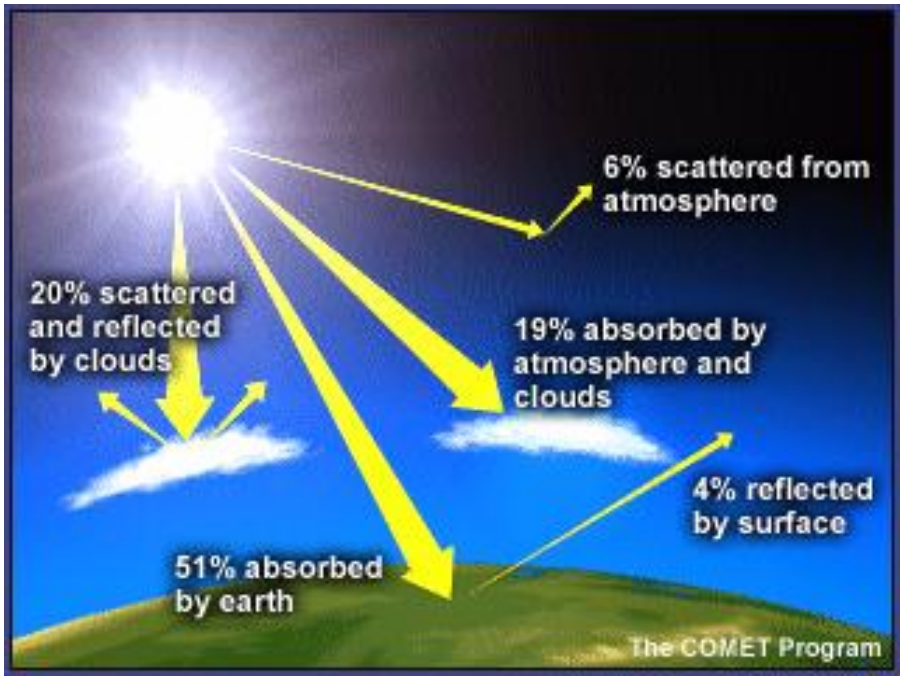



Conduction
Convection
Radiation


Radiation warms the surface.
The air near Earth's surface is heated by conduction.
Cooler air pushes warm air upward, creating a convection current.

The Energy of the Sun

The solar energy that reaches the Earth is either reflected or absorbed:



30% is reflected : 27% by clouds and particles in the atmosphere
3% by Earth`s Surface

70% is absorbed : 20% by clouds
50% by water, land and ice

Reflection of Radiant Energy

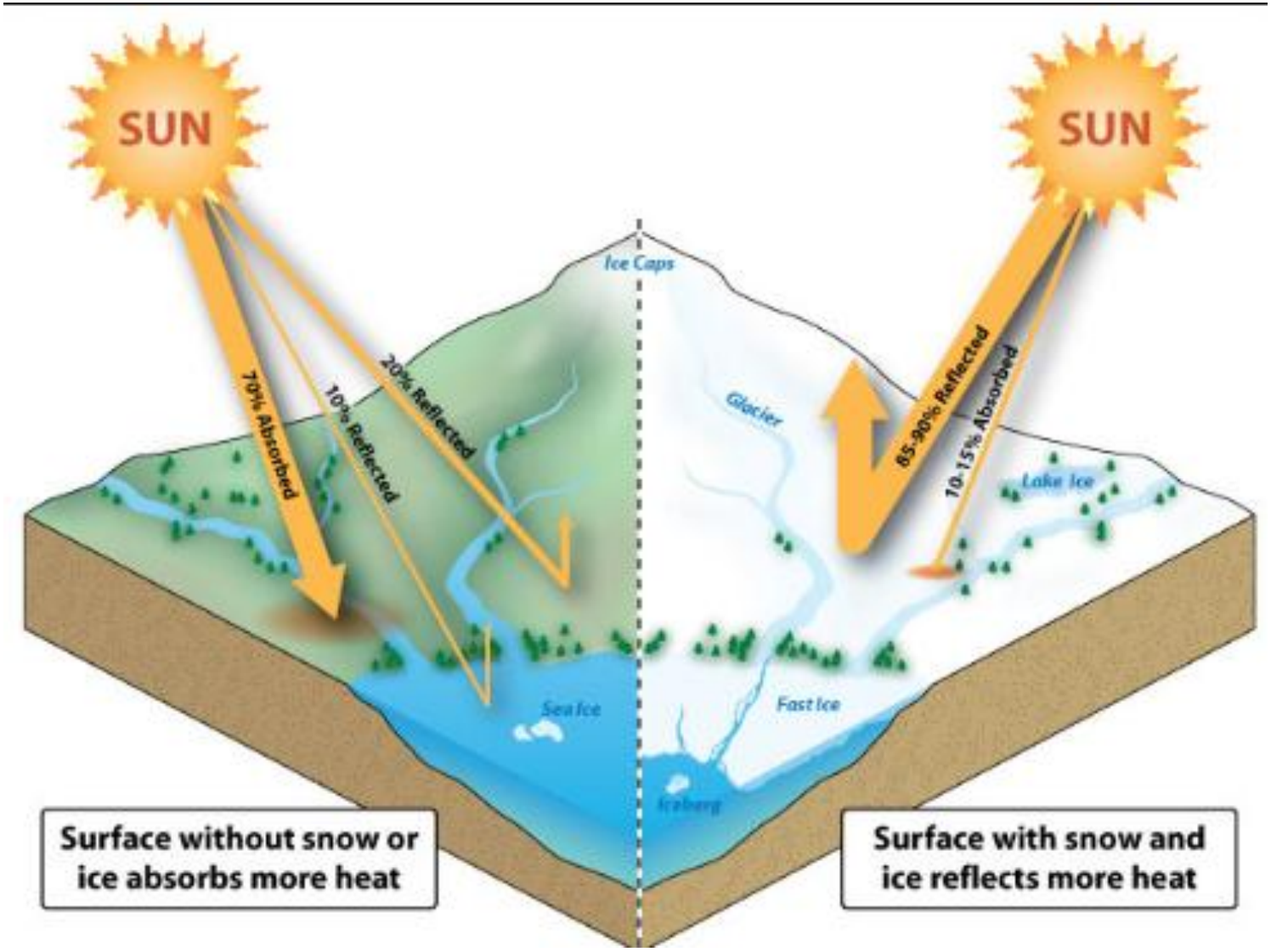
- **Albedo** is a measure of the percentage of light an object reflects

High Albedo

- Object that reflect a lot of light
- snow, clouds and light coloured areas (sand, pale rocks and deforested areas

Low Albedo

- Object that absorb more light than they reflect.
- Dark surfaces such as asphalt and dark soil


SUN
SUN
Ice Caps
70% Absorbed
10% Reflected
20% Reflected
Glacier
85-90% Reflected
10-15% Absorbed
Lake Ice
Sea Ice
Fast Ice
Iceberg
Surface without snow or ice absorbs more heat
Surface with snow and ice reflects more heat

sCieNCe DemANds ANsWerS

Absorption of Radiant Energy

- **Heat Sink** refers to any material that absorbs energy and becomes warmer.

Water and air are the Earth's major heat sinks since they can hold a lot of heat .

Eg. The oceans absorbs solar energy which causes water to move and transfer energy to the ocean depths

Soil and rocks are poor heat sinks because heat is transferred slowly

Heat Source: **any warm body such as water or land in contact with colder air.**

Recall that heat is transferred from a warm object to a cooler object.

Heat Capacity is a measure of how much heat is required to increase the temperature of a substance or how much heat is released as the temperature decreases.

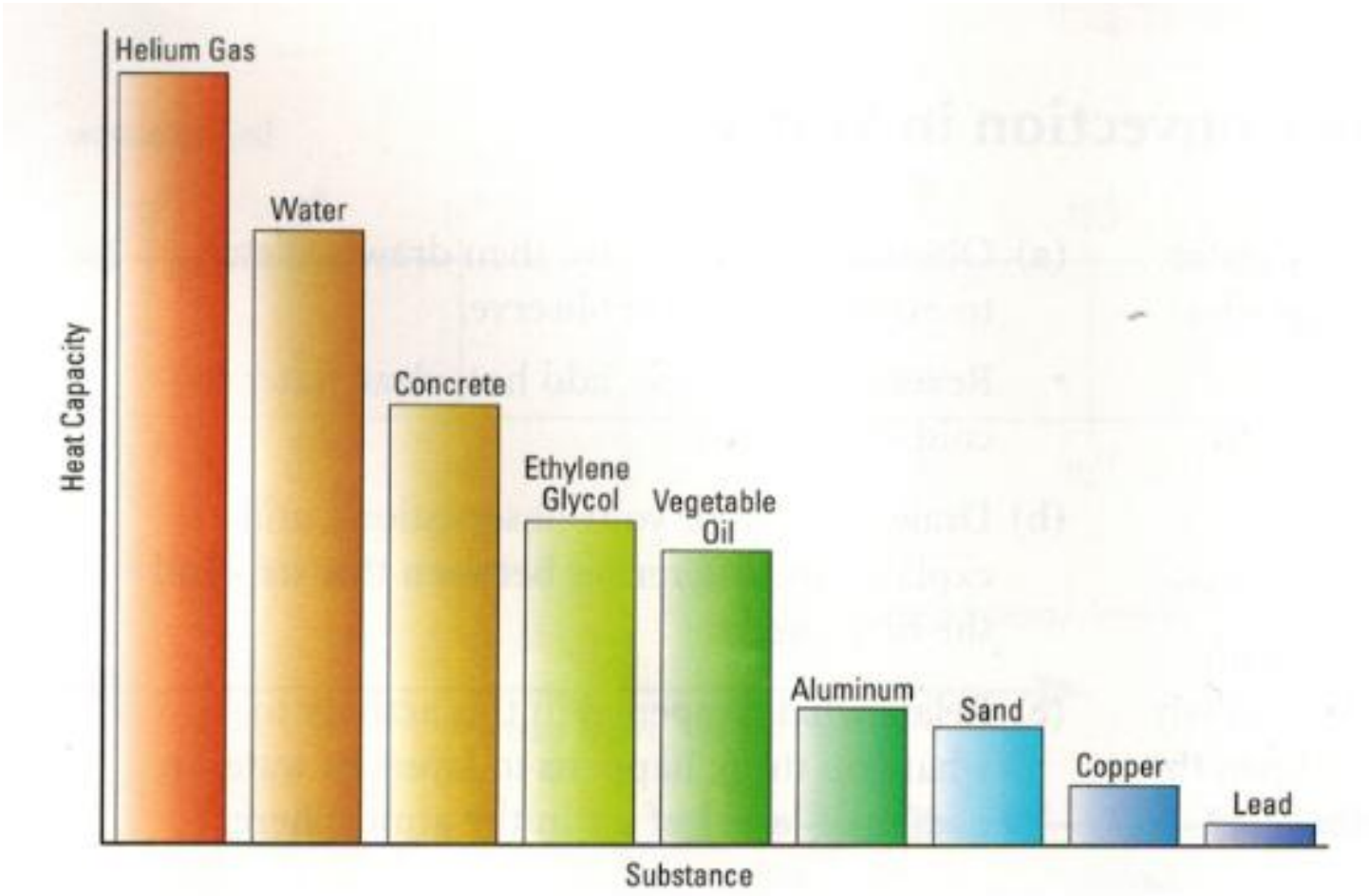
Water and air have a high heat capacity since they are good heat sinks

Soil and rocks have a low heat capacity since they are poor heat sink

This difference in heat capacity explains why a lake takes longer to heat up during the day than does land(Takes more energy to increase the temperature of the water).

However, the lake takes longer to cool off in the evening than does land because the water releases the energy more slowly.

Heat Capacity of Some Common Substances



Latent Heat

Latent Heat is a measure of the attraction between particles in a substance. ‘Latent’ means ‘hidden’.

Eg. When changing state from a solid to a liquid to a gas attractions must be overcome

Latent heat of vaporization (evaporation) refers to the amount of energy that must be absorbed by substance to change from a liquid to a gas.

Latent heat of fusion (melting) refers to the amount of energy needed to change a substance from a solid to a liquid.

Types of Heat

- **Latent heat of fusion**
  - *The amount of heat needed to change a unit* mass of a substance from a solid to a liquid.

- **Latent heat of vaporization**
  - *The amount of heat needed to change a unit mass of a substance from a liquid to a gas.*

- '**Latent**' means 'hidden'. When a substance changes state, the substance either absorbs or releases energy without changing temperature.

Look at lab; see apendix a

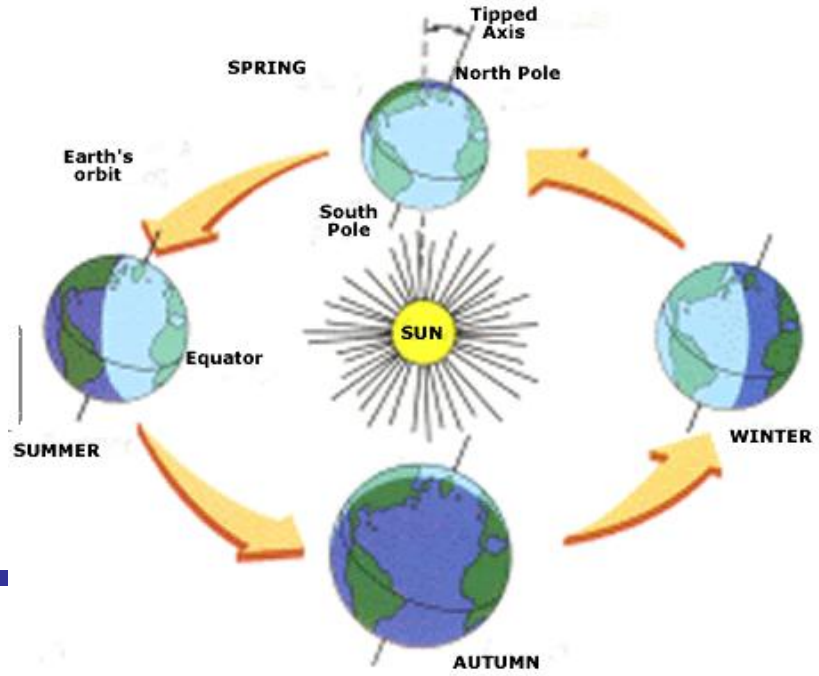
SCIENCE 1206

- **Topic 11:**

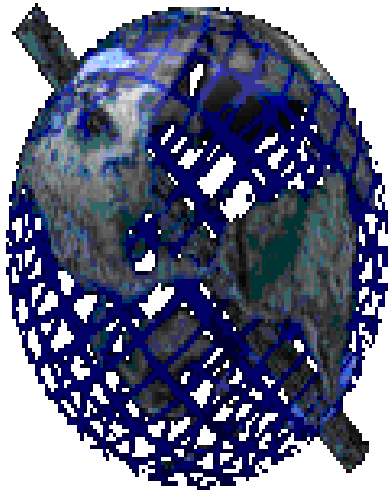
  Seasons

  and

  Angle of Sun



Much of the Earth's weather, especially our changing seasons are caused by:

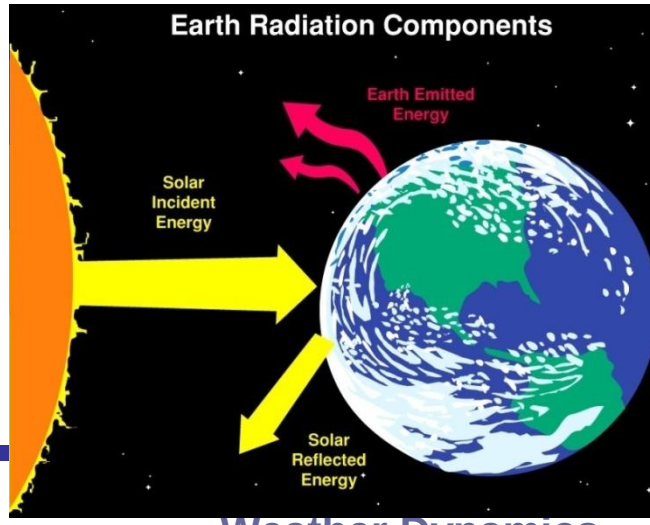


1) Tilt of the Earth

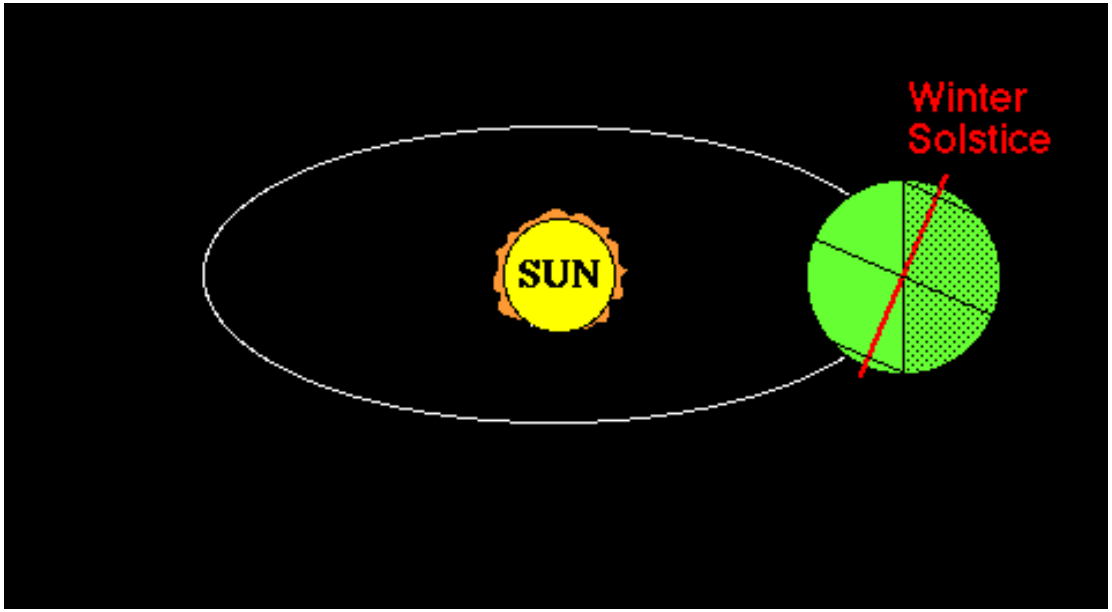
Earth is tilted at 23.5 degrees on its axis

Every 24 hours, the Earth rotates once on its axis. This rotation is what caused night and day.

This rotation is what caused day and night

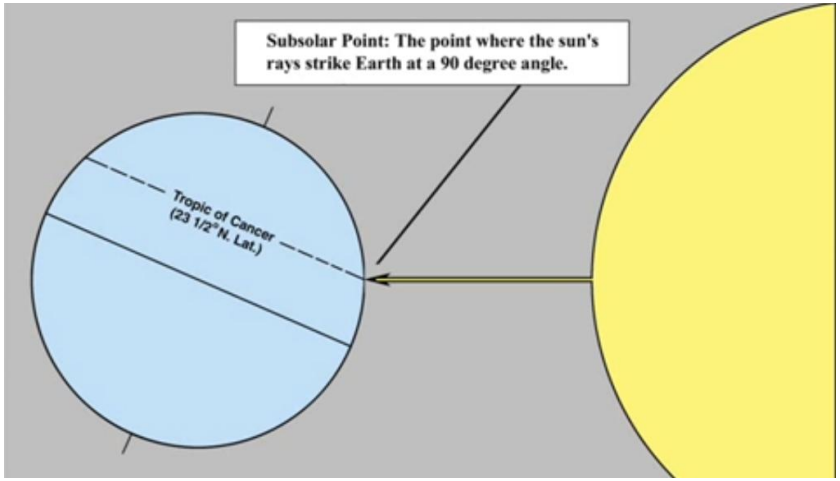


2) Earth's revolution around the sun



Planet Earth also revolves around the sun. It takes 365.25 days for the Earth to make a complete revolution around the sun.

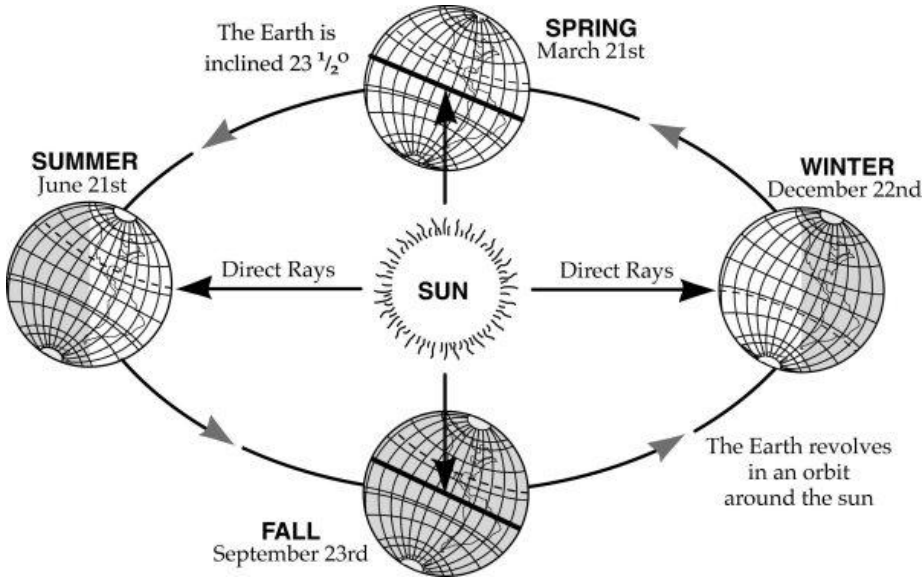
Sub-solar point the point where the sun's rays strike the earth at a 90 degree angle. The Sun would appear to be located directly over head).



Here, the sunlight is generally able to penetrate water to its greates depth or to heat the land. As a result more energy is absorbed rather than reflected. As one moves away from the sub-solar point, the Sun's rays strike the Earth's surface at a lower angle, and less energy is absorbed. This is one reason why it generally becomes cooler as one moves away from the sub-solar point, toward the poles of the Earth.

The interaction between the rotation of the Earth around its axis, and revolution of the Earth around the Sun means that the sub-solar point is constantly changing position on the surface of the Earth. This has a major effect on the seasonal changes in climate and weather.

The following important dates are for the northern hemisphere (opposite occurs for the southern hemisphere.



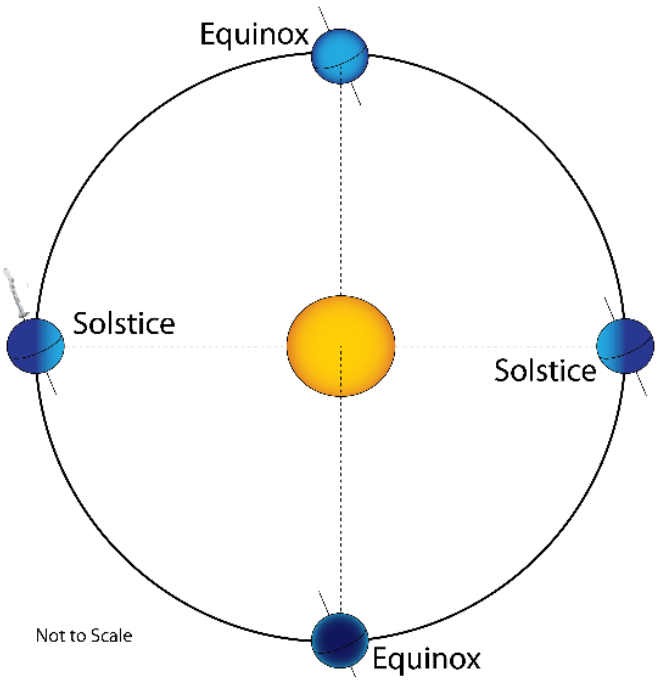
The beginning of each season is marked by:

1) Solstice : Sun stands still (does not move any further North or South)

Summer: day of **maximum** daylight hours
Winter: day of **minimum** daylight hours

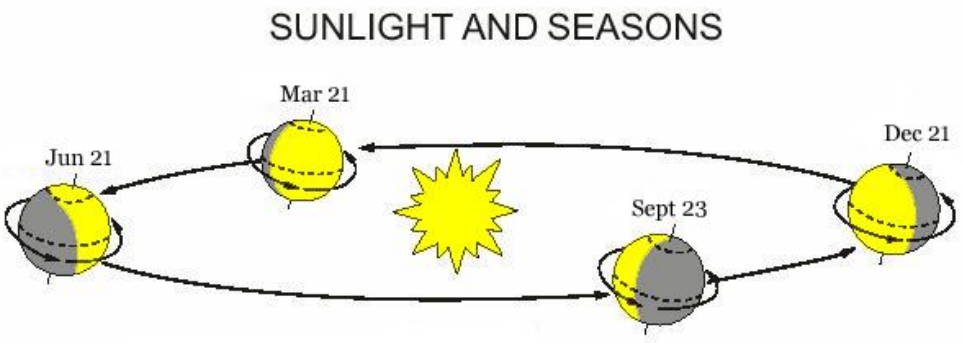
2) Equinox

Day and night are equal length



The following important dates on the next slides are for the Northern Hemisphere (the opposite occurs in Southern Hemisphere)

Summer Solstice



- June 21, the first day of summe
- Northern Hemisphere is at its maximum tilt toward the sun
- It is the maximum daylight period
- Sun is over the Tropic of Cancer (Northern Hemisphere)
- So the sun's ray are hitting the Northern Hemisphere most directly .
- Sun's rays have their maximum intensity since they are concentrated over a smaller surface

Autumnal Equinox

- September 23, the first day of fall
- Sun in directly over the equator
- The sun is above the horizon for 12 hours and below the horizon for 12 hours

Winter Solstice

•occurs December 21 => the first day of winter

•Northern Hemisphere is at its maximum tilt away from the sun

•Minimum daylight period (Short day or long night)

•Sun is over the Tropic of Capricorn (southern Hemisphere). So the sun's ray are hitting the Northern Hemisphere at a steep angle.

• Sun's rays have their minimum intensity since they are spread over a larger surface

.

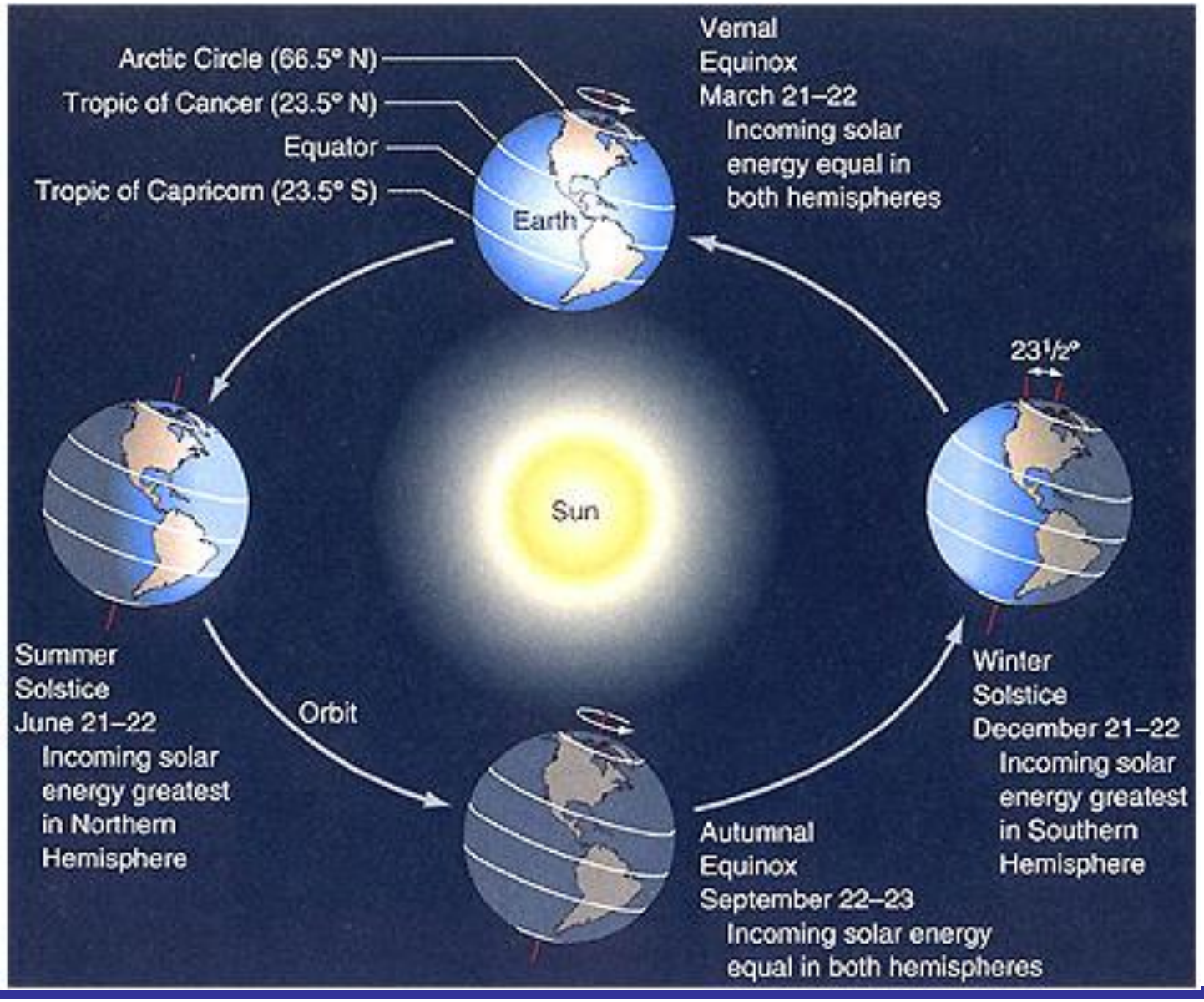
Vernal Equinox

•occurs on March 21.

• On this day the solar point is directly over the equator.

•All parts of the earth will have a 12 hour day and a 12 hour night. It is Spring in the northern hemisphere.

Do you know what season it is in the southern hemisphere? Fall


Arctic Circle (66.5° N)
Tropic of Cancer (23.5° N)
Equator
Tropic of Capricorn (23.5° S)
Earth
Vernal
Equinox
March 21–22
Incoming solar
energy equal in
both hemispheres
23½°
Sun
Summer
Solstice
June 21–22
Incoming solar
energy greatest
in Northern
Hemisphere
Orbit
Winter
Solstice
December 21–22
Incoming solar
energy greatest
in Southern
Hemisphere
Autumnal
Equinox
September 22–23
Incoming solar energy
equal in both hemispheres

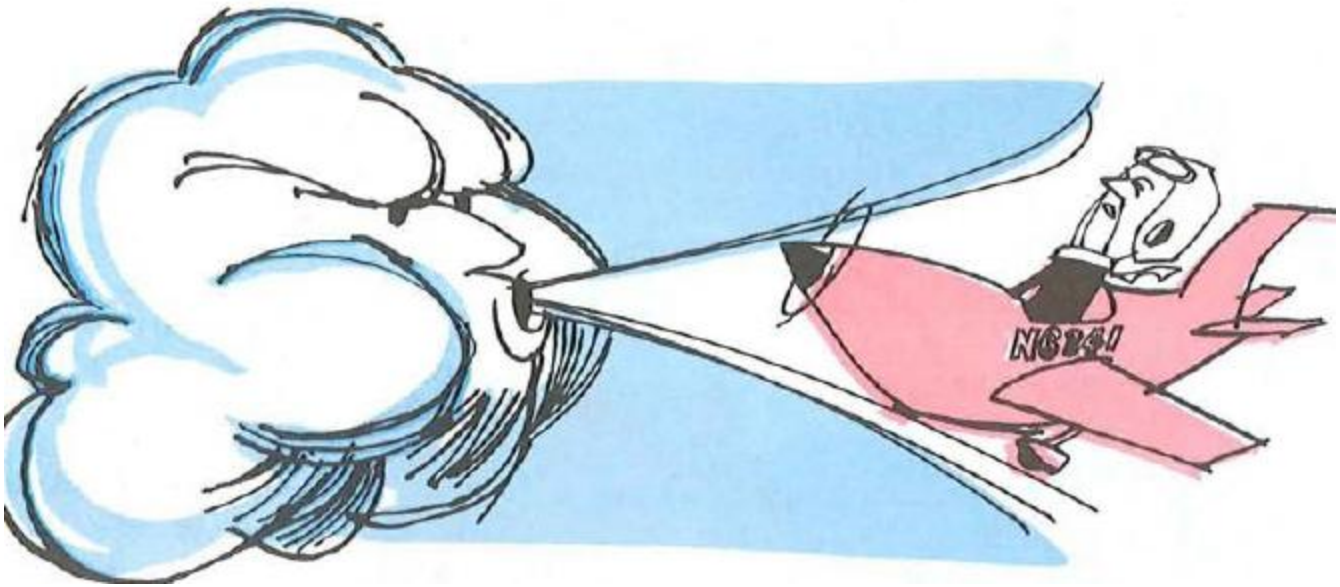
Activity 1:
Read 13.3 "Investigation: Seasons and the Angle of Sunlight" on pages 508-509 of Nelson: Science 10. Answer questions 1-4 from "Understanding Concepts" on page 509.

Activity 2:
Using a flashlight (representing the sun) and a globe or ball (representing Earth), describe and illustrate the relationship between light source position and density of radiant incident to the surface of the globe/ball at various locations in terms of both daily and seasonal changes.

SCIENCE 1206

- **Topic 12:**

  Movement of Air



What is Wind ?

Atmosphere is the blanket of air and moisture that surrounds the earth.

Air refers to the invisible gaseous substance surrounding the earth, a mixture mainly of oxygen and nitrogen

Wind refers to the movement of air in the atmosphere

Air moves because of pressure systems - it travels from areas of high pressure to areas of low pressure.

Winds may be classified as

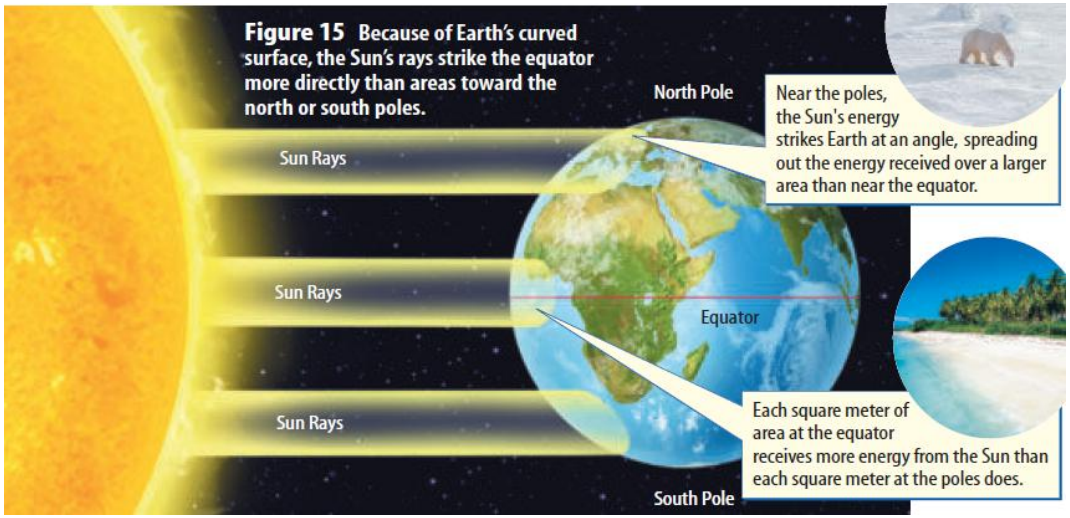
Prevailing winds : are major wind patterns that affect large regions. Also know as the **trade winds** due to their importance to trade by sailing ship back in the time of the great explorers.

Local or regional winds: occurs fairly small areas and are the result of geographical features of the land (mountains, large bodies of water)

These winds include:

thermals, sea breezes (or offshore winds), land breezes (or on-shore winds), and *Chinook* winds

The prevailing winds are mainly the result from the transfer of heat energy from the land and oceans to the atmosphere.



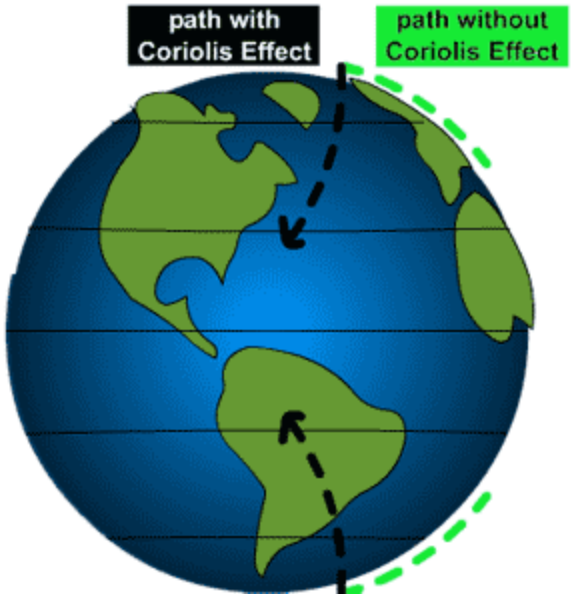
Areas of the earth receive different amount of radiation from the sun because Earth is curved. The diagram above illustrates why equator receives more radiation than the north and South Poles

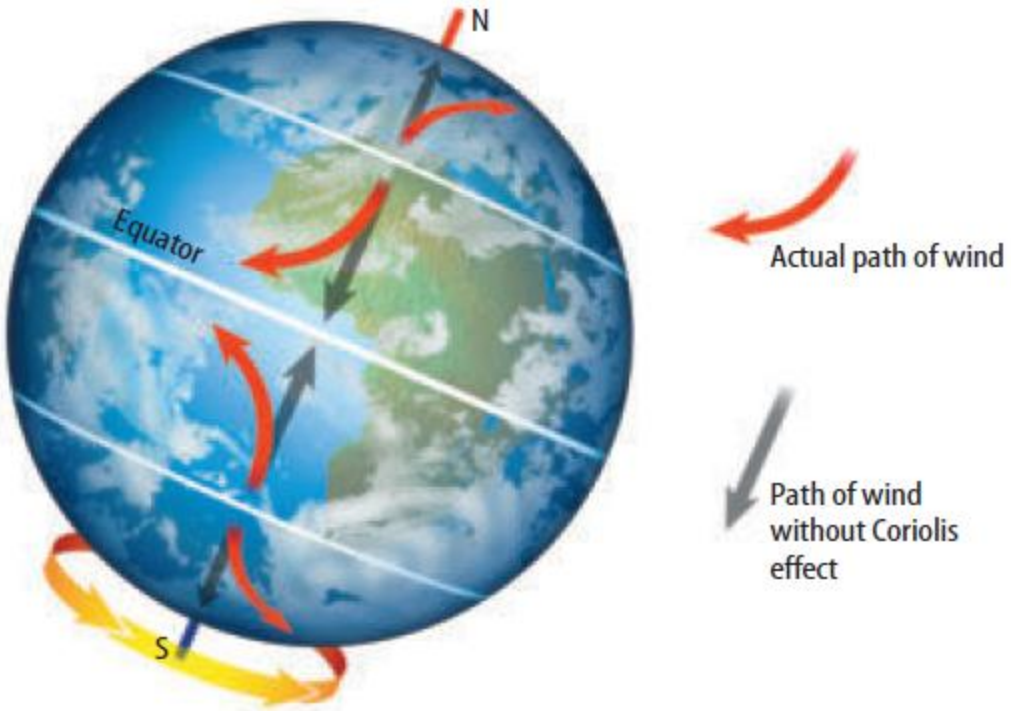
The heated air at the equator is less dense (Low Pressure), so it is displaced by denser, cold air (High Pressure) from the poles creating convection currents

The Coriolis Effect

- **Coriolis Effect** refers to the apparent change in the direction of a moving object within a rotating coordinate

The earth's rotation creates an apparent force that defects moving air to the right of initial direction in the northern hemisphere and to the left of the initial direction in the southern hemisphere.





The Coriolis effect causes moving air to turn to the right in the Northern Hemisphere and to the left in the Southern Hemisphere

Major wind patterns and how they are formed:

They are due to a combination of convection current and the earth's rotation:

The trade winds:

Occurs between the equator and 30 ^{o} latitude

The sun heats up the air at the equator causing hot air to rise, leaving behind an area of low pressure.

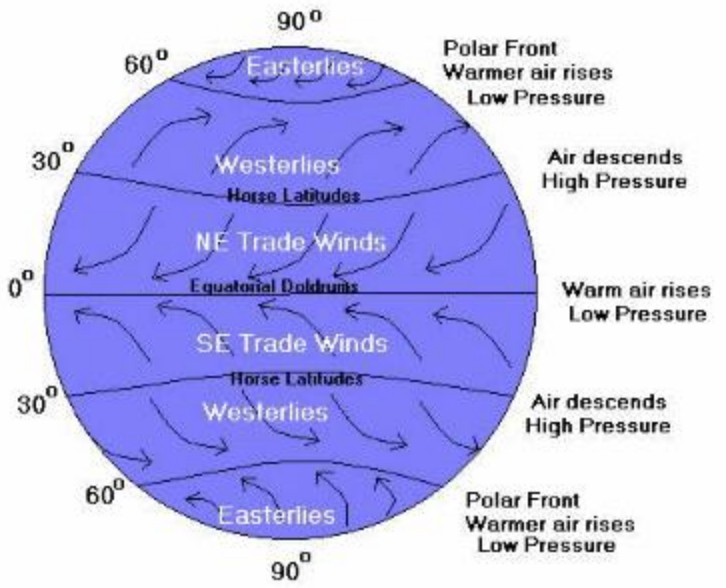
This rising air moves northward, cools, becomes more dense and falls around 30 ^{o} latitude

This air moves back towards the equator (low pressure) producing the trade winds.

This air movement twists to the right in the N. H to form northeast trade winds and left in the S. H to form the southeast trade winds

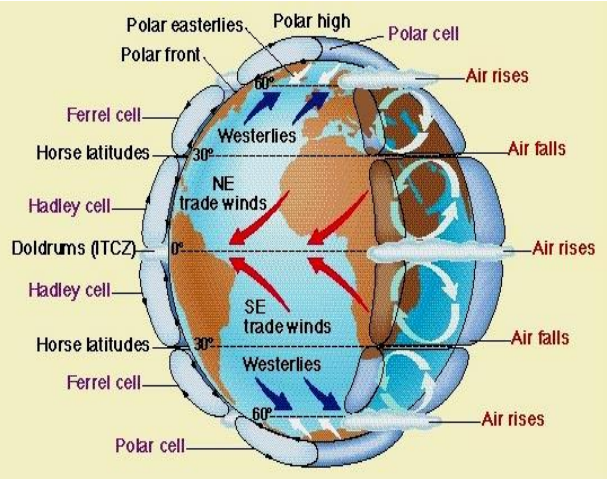
Mid – latitude Westerlies

- occurs between 30^{o} and 60^{o} latitude
- At 30 ^{o} some of the warm air from the equatorial convection currents meets cold polar air, creating low pressure around 60^{o}. The surface air moving north twist to the right in the Northern hemisphere (Left in SH)



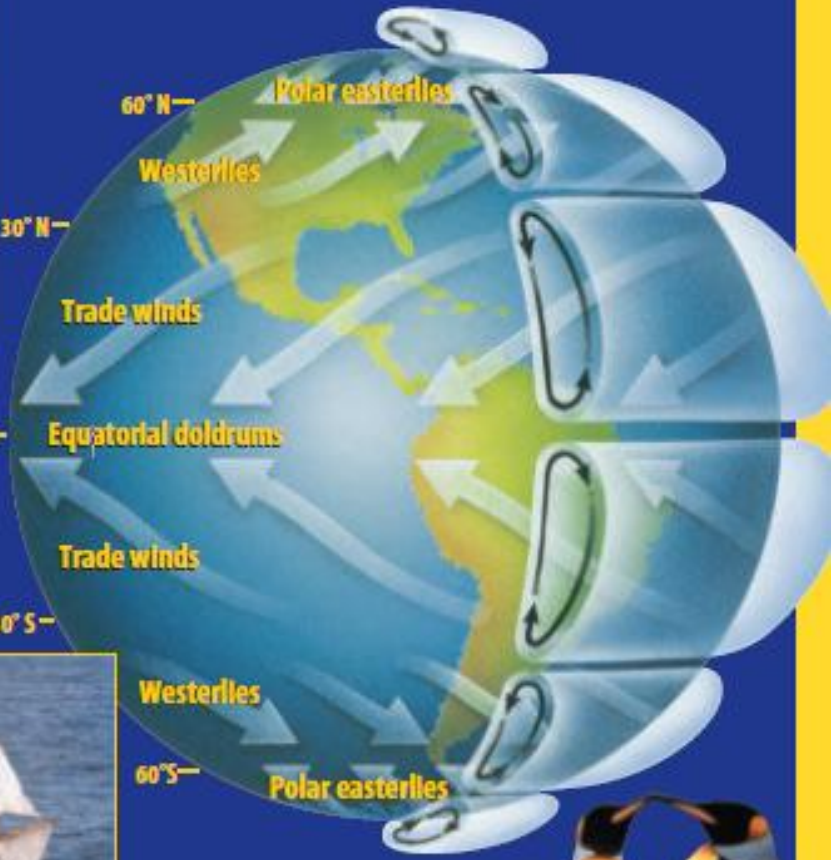
Polar Easterlies

- occurs between 60º latitude and the poles
- Near the poles the air is cold and dense. This sinks and moves toward the equator. The earth's rotation cause this air mass to twist to the right in in the Northern Hemisphere (Left in the south)



A WESTERLIES Near 30° north and south latitude, Earth's rotation deflects air from west to east as air moves toward the polar regions. In the United States, the westerlies move weather systems, such as this one along the Oklahoma-Texas border, from west to east.

B DOLDRUMS Along the equator, heating causes air to expand, creating a zone of low pressure. Cloudy, rainy weather, as shown here, develops almost every afternoon.



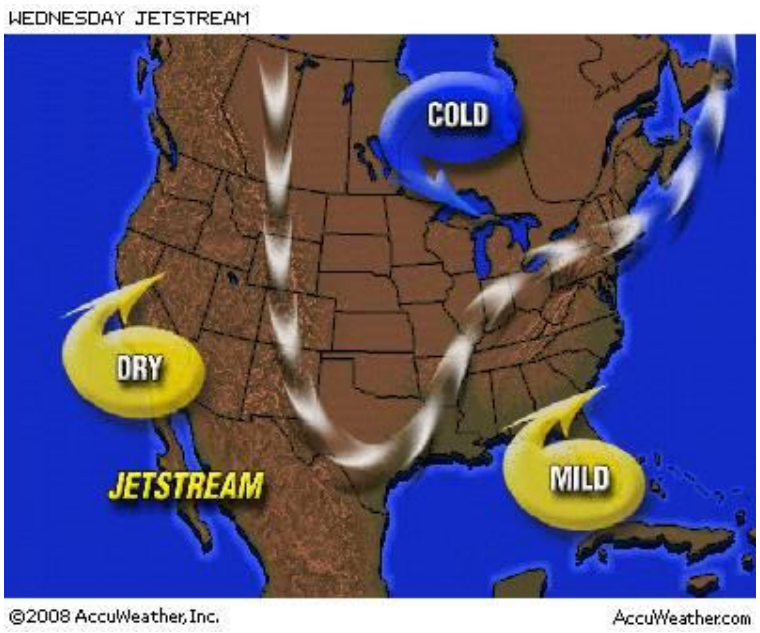
C TRADE WINDS Air warmed near the equator travels toward the poles but gradually cools and sinks. As the air flows back toward the low pressure of the doldrums, the Coriolis effect deflects the surface wind to the west. Early sailors, in ships like the one above, relied on these winds to navigate global trade routes.

D POLAR EASTERLIES In the polar regions, cold, dense air sinks and moves away from the poles. Earth's rotation deflects this wind from east to west.

Jet Stream

- High altitude, fast moving, winds in the troposphere that gradually flows from west to the east over the mid latitudes.

- The jet stream separate cold polar air to its north from warmer air to the south



Air moves at speeds of 160 -300 km/hr

2) Local Air Movements

Local convection currents set up during the day

- **1) Thermals = thermal updrafts**

Steps:

On a clear, sunny day, solar energy warms the land

Land absorbs the energy and converts it into heat, which warms the nearby air

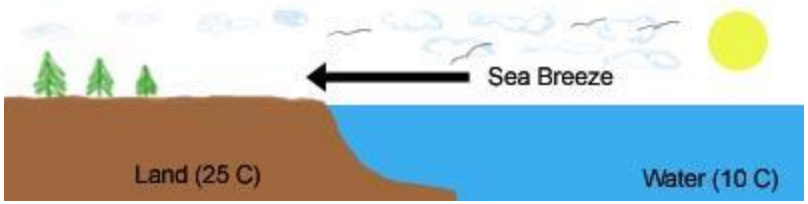
Warm air expands and becomes less dense and rises

Rising warm air is replaced by cooler, denser air

Geothermal activity clearly displays the action of rising convection air currents.

2. Sea Breeze:

A convectional thermal that flows from a large body of water towards the land



Steps:

In early morning, solar energy warms the land faster than the water

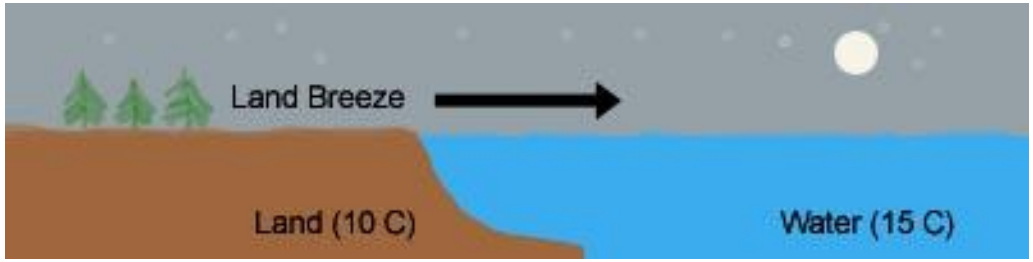
Warm air above the land rises and moves out over the water

Warm air replaced by cooler air from above the water

Sets up convection current

3. Land Breeze:

A convectional thermal that flows from the land towards a large body of water



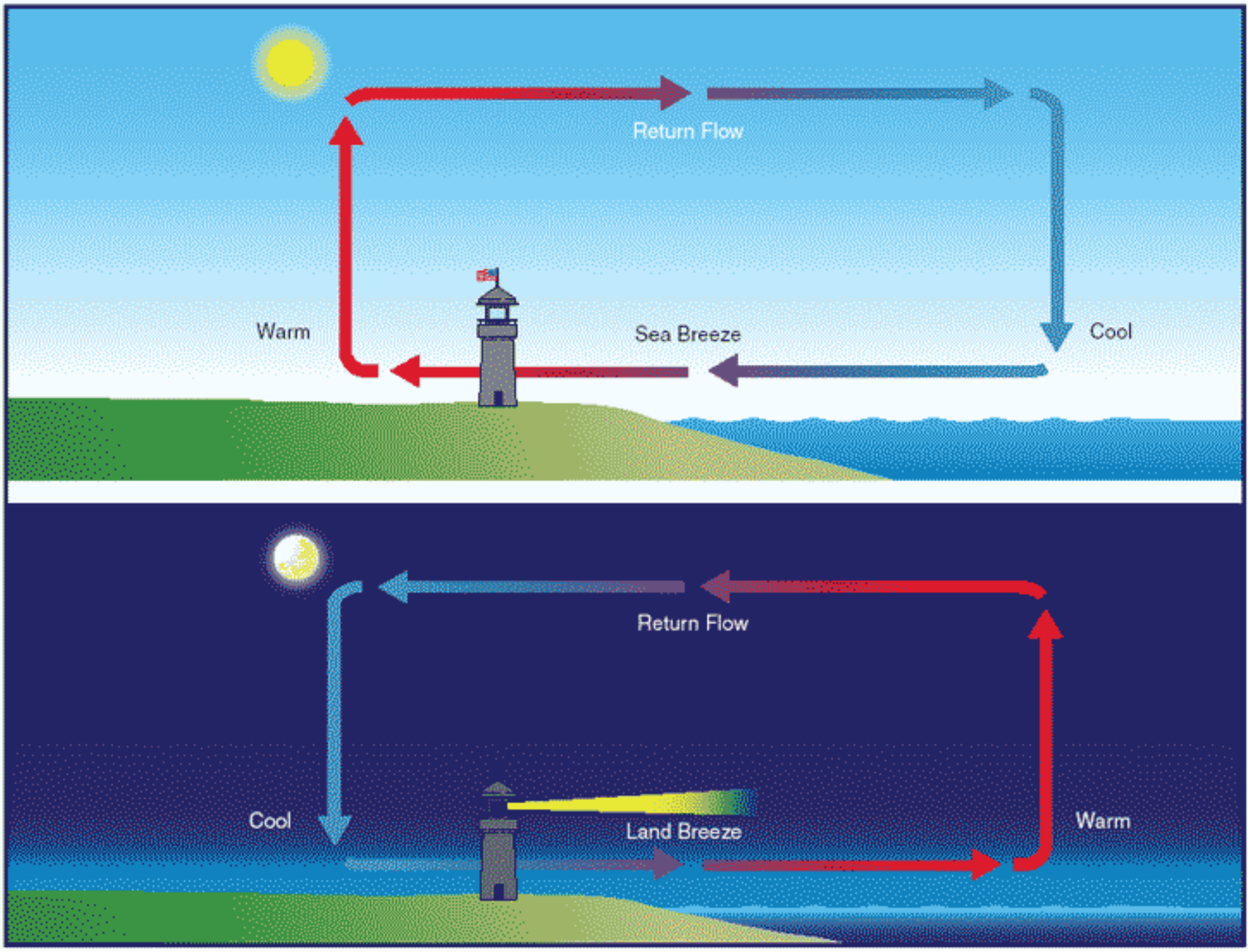
Steps:

As sun sets, the land cools down faster than the water

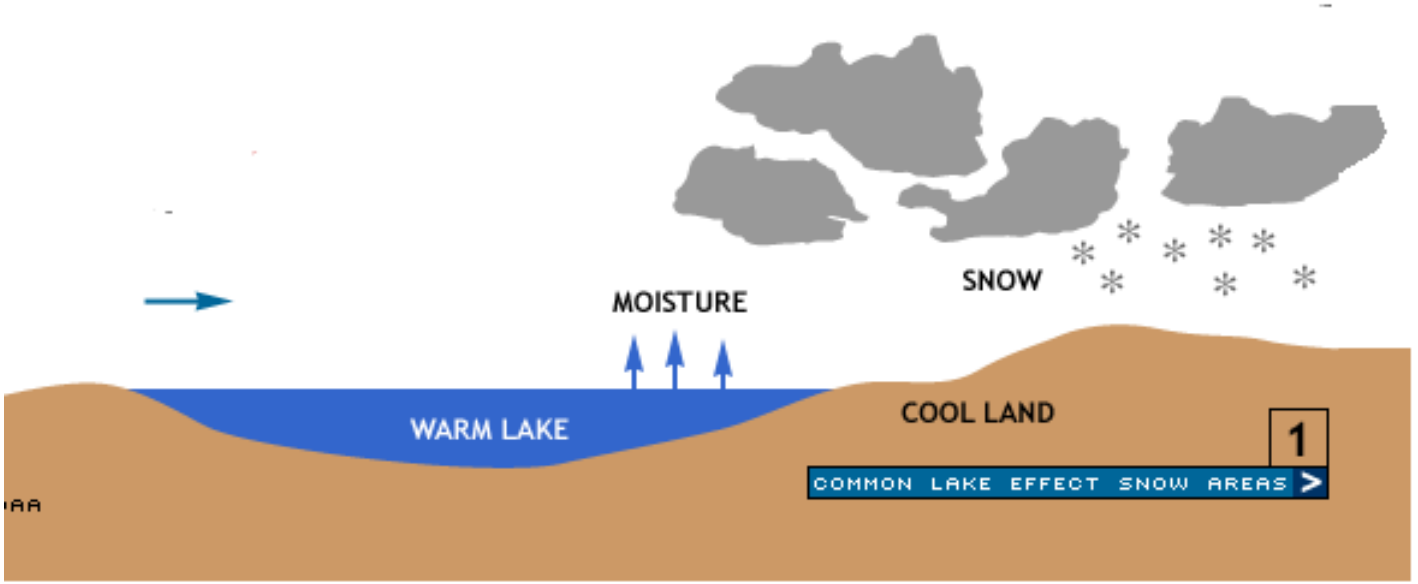
Warm air above the water rises and moves in over the land

Warm air replaced by cooler air from above the land

Sets up convection current


Return Flow
Warm
Sea Breeze
Cool
Return Flow
Cool
Land Breeze
Warm

4. Lake Snow Effect:

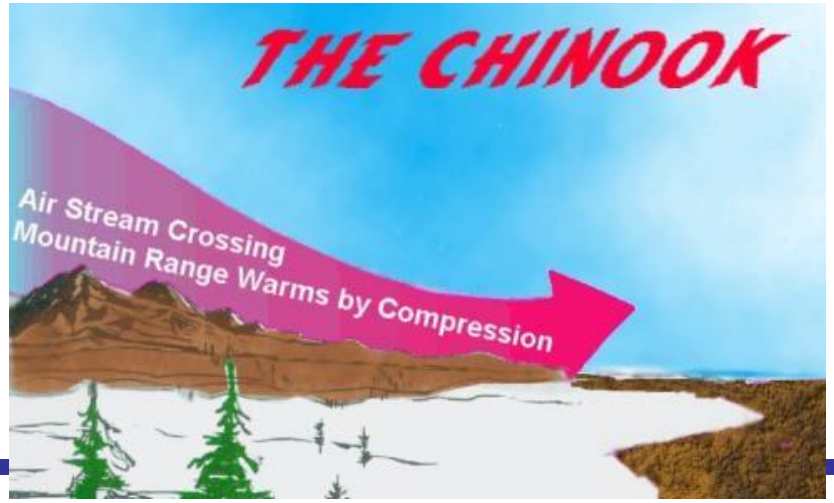


When an air mass moves across a large body of water it picks up moisture. In winter the air above the land is colder than the air above the water. Therefore, when air blows onshore the colder temperature causes the moisture to change to snow.

5. Chinook Winds

On the west side of the Rockies orographic lifting causes water vapor in the air to condense into clouds, snow and rain. A lot of energy is release during this phase change so that the air is warmed.

The air that sinks on the east side is warm and dry producing the warm, dry Chinooks.



SCIENCE 1206

- **Topic 13:**

  Major Ocean Currents

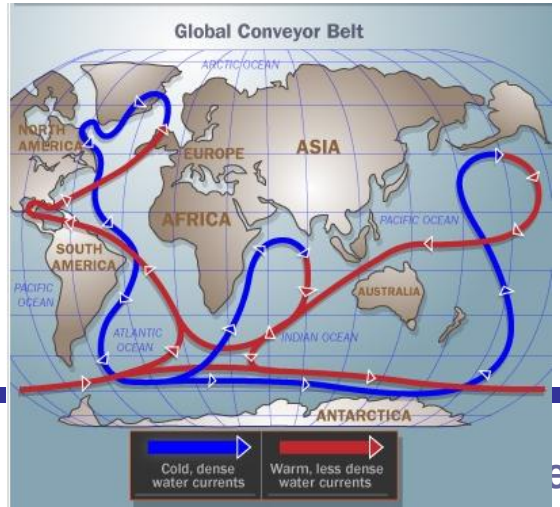
Major Ocean Currents

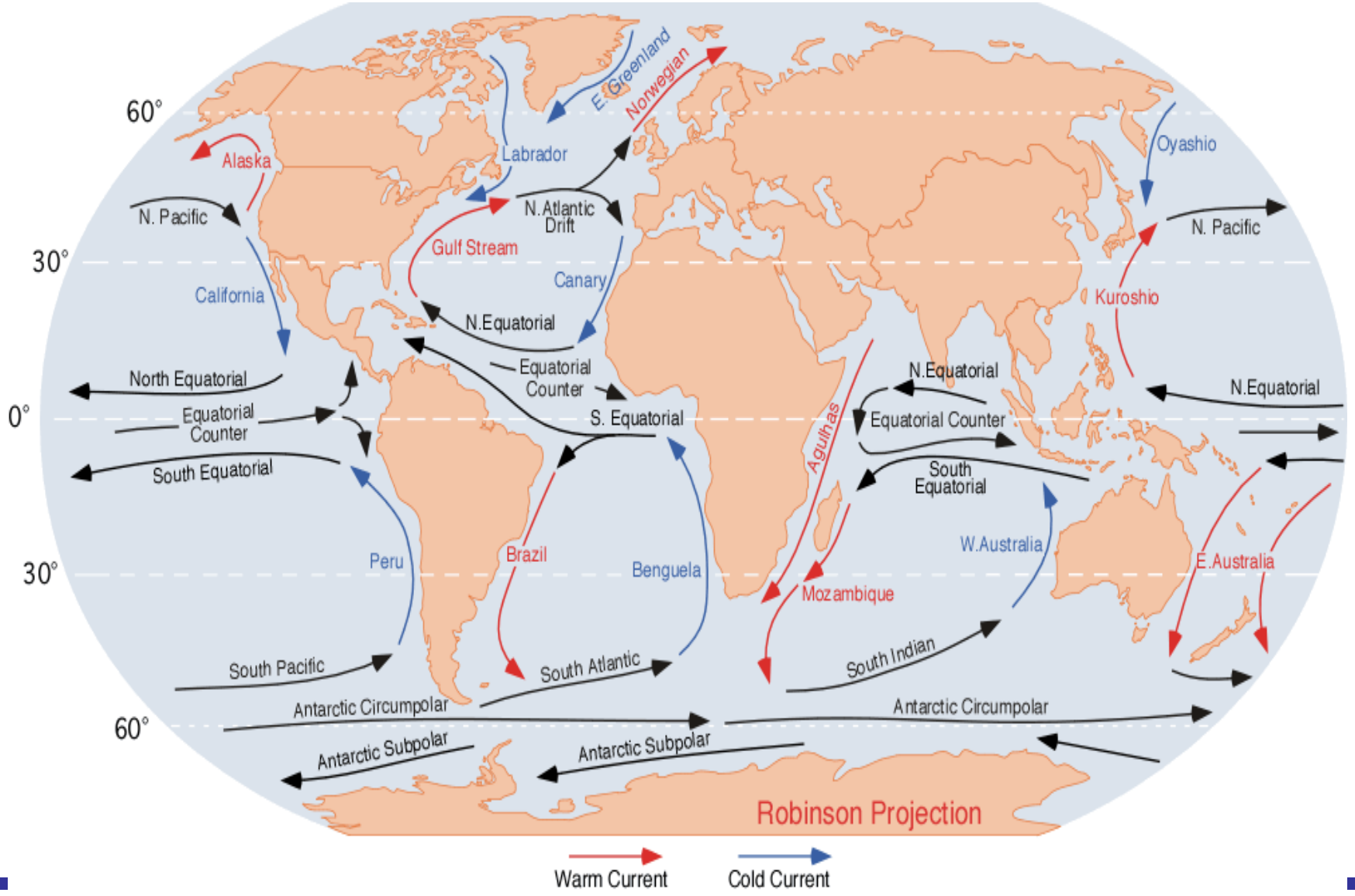
Ocean current refers to the steady flow of surface ocean water in a prevailing direction

The oceans have an important effect on weather dynamics.

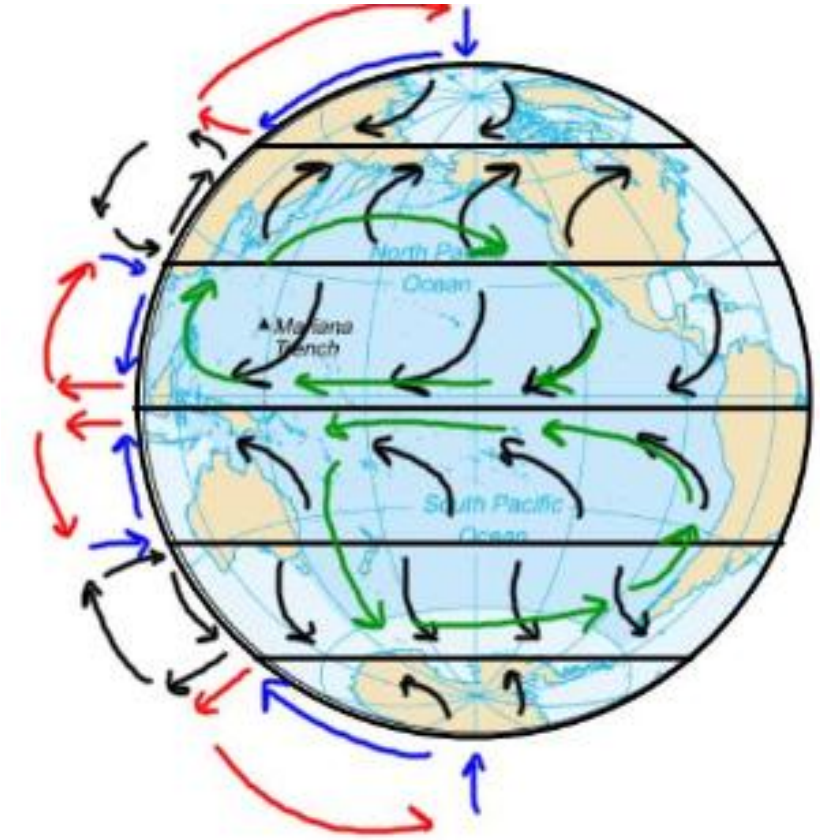
1)Oceans occupy a large portion of the Earth's surface. Water's high heat capacity will affect temperature changes in a given area.

2)There is a large vast of water at the equator, where the sun is most direct, ocean currents act as conveyer belts to transport energy around the world

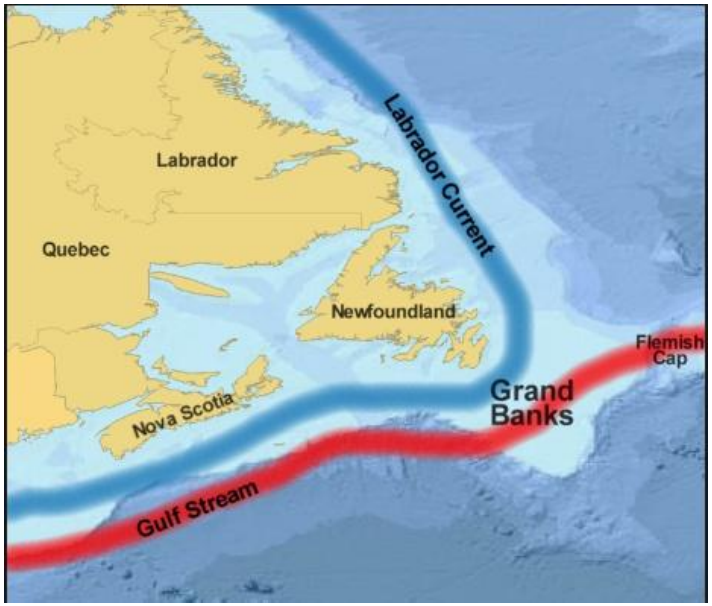



60°
30°
0°
30°
60°
Alaska
N. Pacific
California
Labrador
E. Greenland
Norwegian
N.Atlantic Drift
Gulf Stream
Canary
N.Equatorial
North Equatorial
Equatorial Counter
South Equatorial
Equatorial Counter
S. Equatorial
Peru
Brazil
Benguela
South Pacific
South Atlantic
Antarctic Circumpolar
Antarctic Subpolar
Oyashio
N. Pacific
Kuroshio
N.Equatorial
N.Equatorial
Equatorial Counter
South Equatorial
Aguilhas
W.Australia
E.Australia
Mozambique
South Indian
Antarctic Circumpolar
Antarctic Subpolar
Robinson Projection
Warm Current
Cold Current

- Wind and ocean current flow in the same direction.



Our weather patterns are rapidly changing due to the interaction of the Labrador Current and the Gulf Stream.



Warm surface currents transfer tropical heat to the atmosphere and colder currents remove heat from the atmosphere.

•When the warm, moist air above the Gulf Stream blows over the colder water of the Labrador Current, it cools and condenses, producing fog.

Causes of Ocean Currents

1. Convection currents:

- Water at the equator absorbs the intense, directed rays of the sun and becomes heated.
    - This warm water is less dense than cold water and moves away from the equator towards the poles. The warm water is replaced by cold water from below (originating from the polar regions).

2. Prevailing winds and the Coriolis Effect

Ocean currents tend to follow the prevailing winds blowing at the surface

3. Earth's Rotation

Because of Earth's eastward rotation currents on the west sides of the oceans tend to be narrow and fast moving and those on the east sides of oceans are wide and slow moving

4. Shapes of the Continents

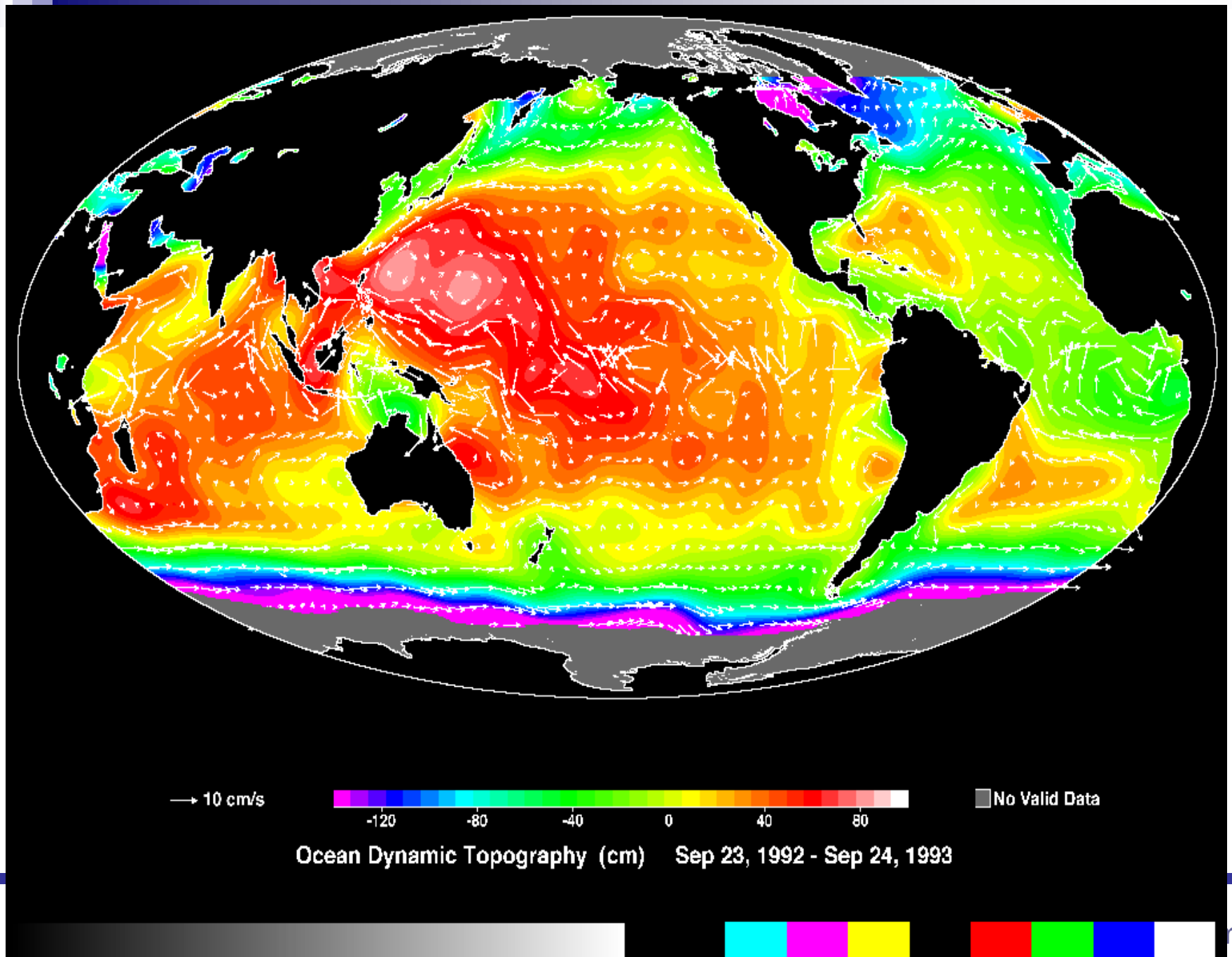
Where currents encounter a landmass they are deflected away the path produced by the prevailing winds

5. Heat Capacity of water

Oceans acts as huge heat sinks so they heat up slowly and, once heated,

6. Amount of Salt

When sea salt evaporates, the salt left behind makes the remaining water more dense. This dense seawater sinks and creates a deep water current.


10 cm/s
-120
-80
-40
0
40
80
No Valid Data
Ocean Dynamic Topography (cm) Sep 23, 1992 - Sep 24, 1993

nics

Effects of Ocean Currents

1. Creation of rain forest

- Warm Currents heat the air above them which increases the air's ability to carry moisture

•Creates rain forest on the east side of continents

Eg. Brazilian rain forest of eastern South America

2. Creation of Deserts

- Cool current cools the air above them which decreases the ability of the air to hold moisture

- Creates deserts on the west side of continents

Eg. Desert area in Peru of western south America

3. Moderation of Temperature

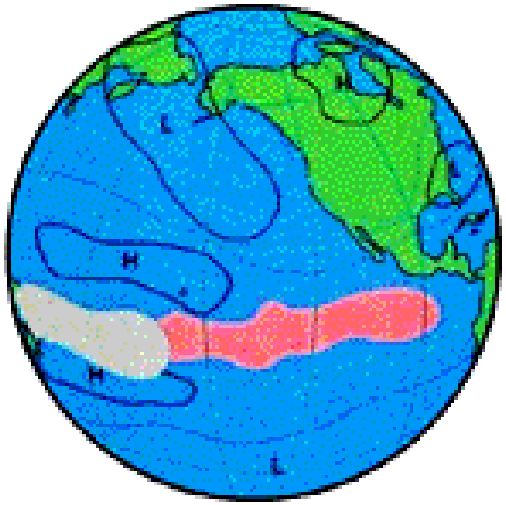
A coastal area will tend to have cooler summers and milder winters than an inland location at the same latitude due to the moderating affect of a large body if water. (it prevents extremes in temperature)

Eg. St. John's is warmer in winter than Ottawa because of the warm moist air brought northward by the Gulf Stream

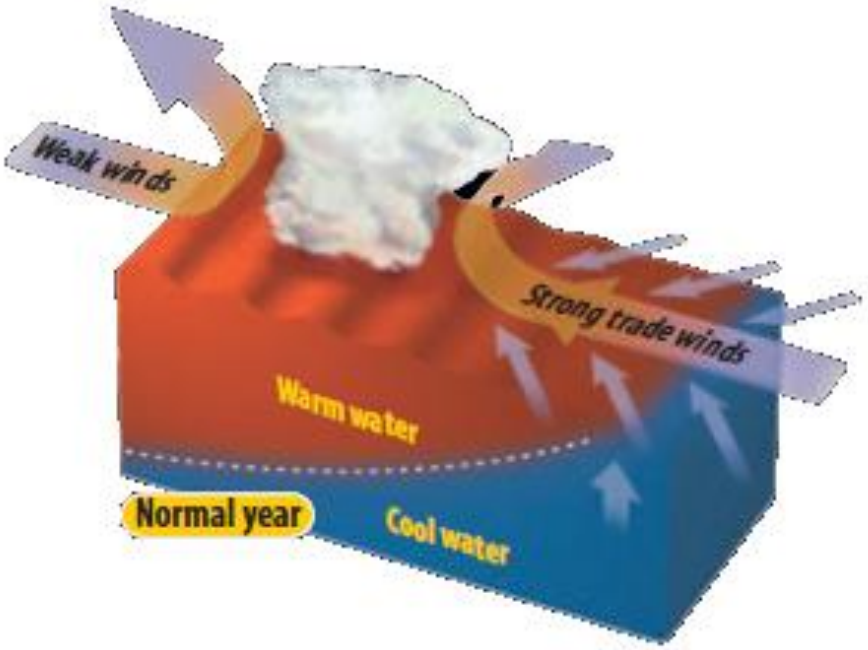
El Nino and La Nina (p. 612 – 615)

Weather in Canada can be affected by changes that occur thousands kilometers away.

El Nino and La Nina refers to a phenomena in the middle of the Pacific Ocean, the periodic warming and cooling of a hugh mass of seawater



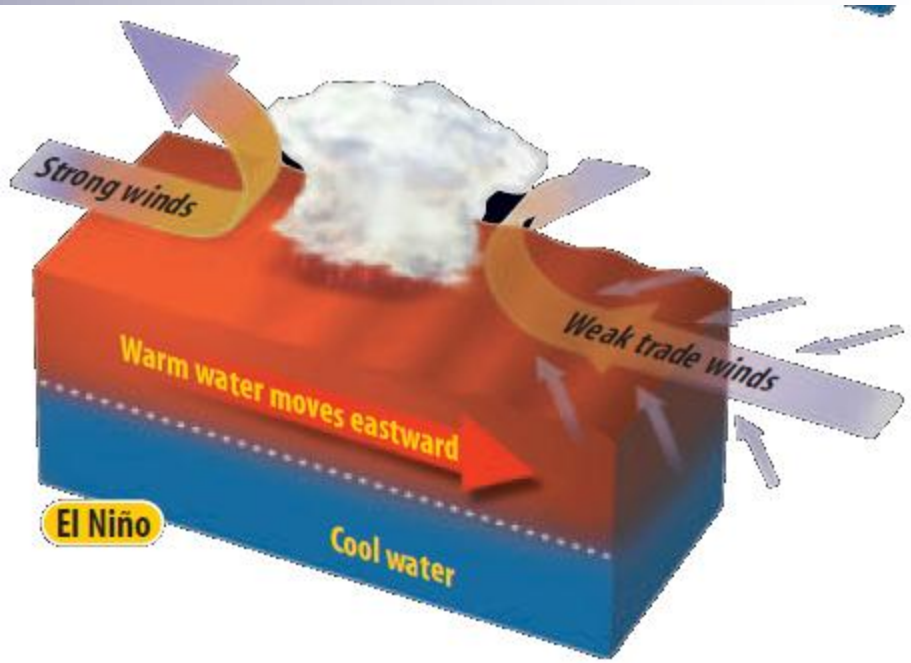
During Normal years, when either El Nino and La Nina is in effect, strong winds tend to keep warm surface waters contained in the western pacific while cooler water wells up to the surface in the eastern pacific.



El Niño...

Spanish for little Boy

Occurs every 3-7 years



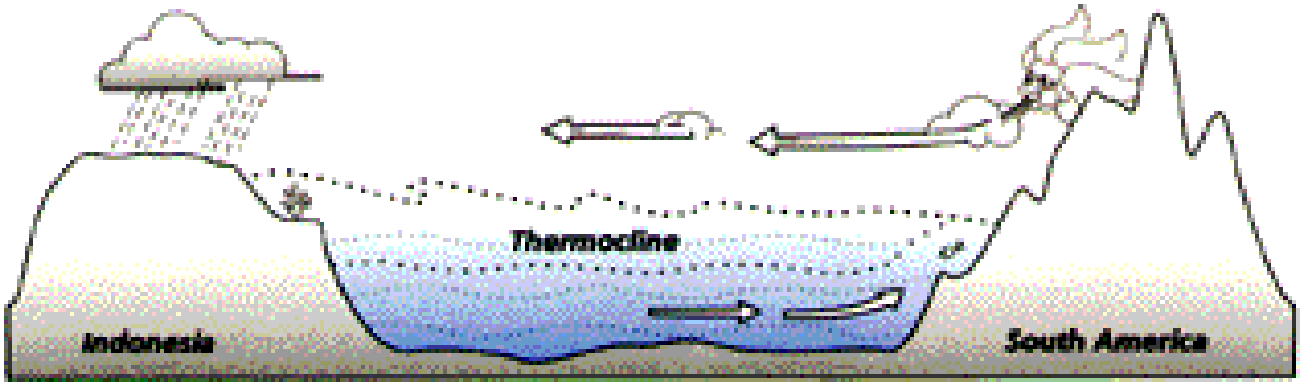
During El Nino years, the winds weaken and sometimes reverse

The change in Winds allow warm tropical water in the upper layers of the Pacific to flow back eastward to South America

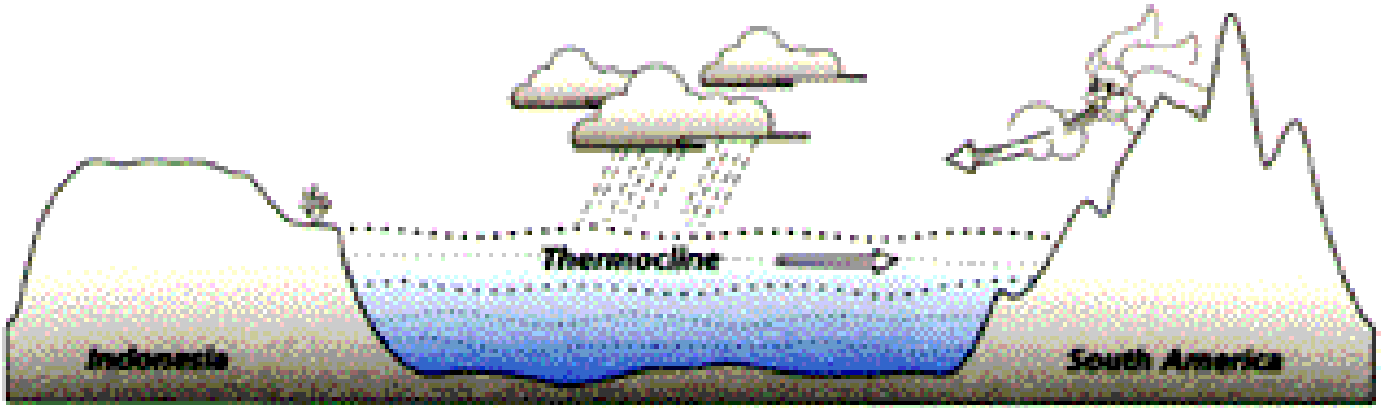
Cold deep water is no longer forced below

Ocean temperatures increase by 1 oC to 7 oC off the coast of Peru

Under Normal Conditions



El-Nino Conditions



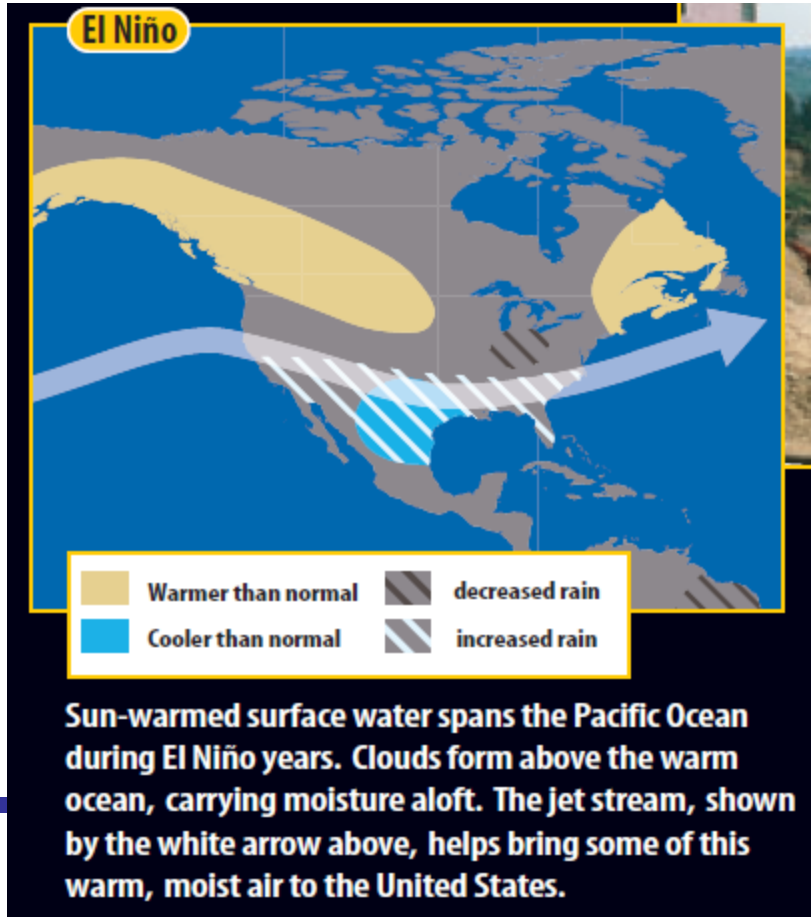
Effect of El Niño...

It can alter the position and strength of the jet stream

Changes wind and precipitation patterns around the world

Cause droughts in Australia and Africa

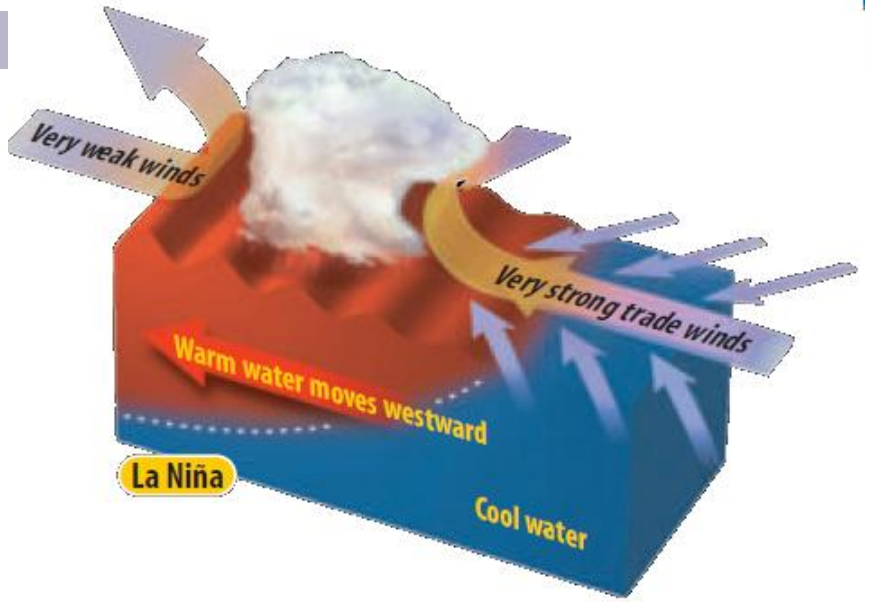
Cause storms and flooding in Peru, Chile and North America



La Niña...

Spanish for little girl

The opposite of El Niño



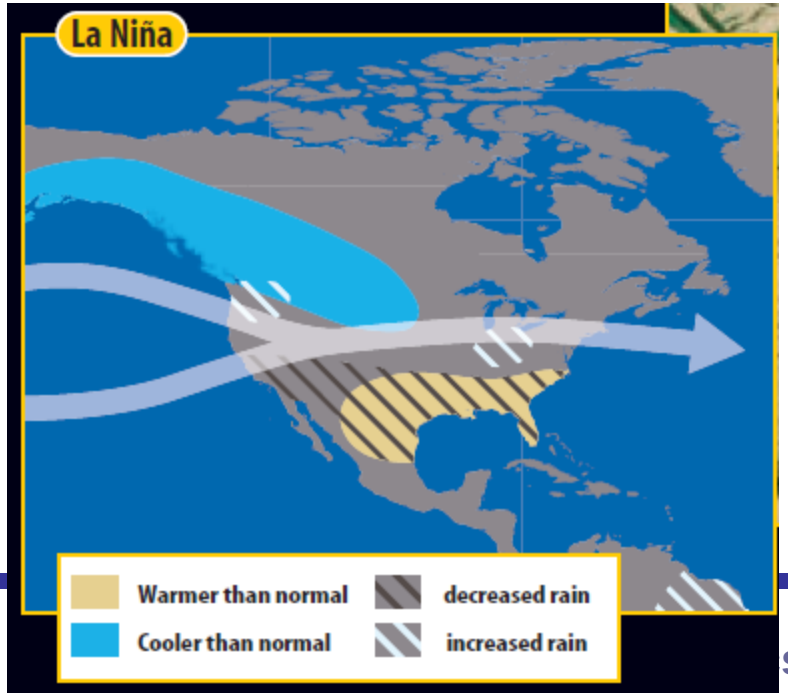
The winds blowing across the Pacific are stronger than normal causing warm water to accumulate in the western Pacific.

The water in eastern Pacific near Peru is cooler than Normal

Effects of La Niña...

Warm ocean waters, clouds, and moisture are pushed away from North America

A weaker Jet stream often brings cooler weather to the northern parts of the continent and hot and drier weather to southern parts.



In-class Assignment

- Newfoundland and Labrador Climate

SCIENCE 1206

- **Topic 14:**

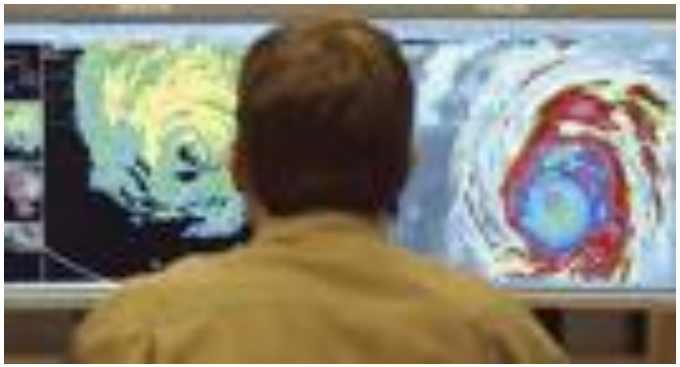
  Weather Forecasting

Weather Forecasting

Weather forecasting is a prediction of what the weather will be like in an hour, tomorrow, or next week

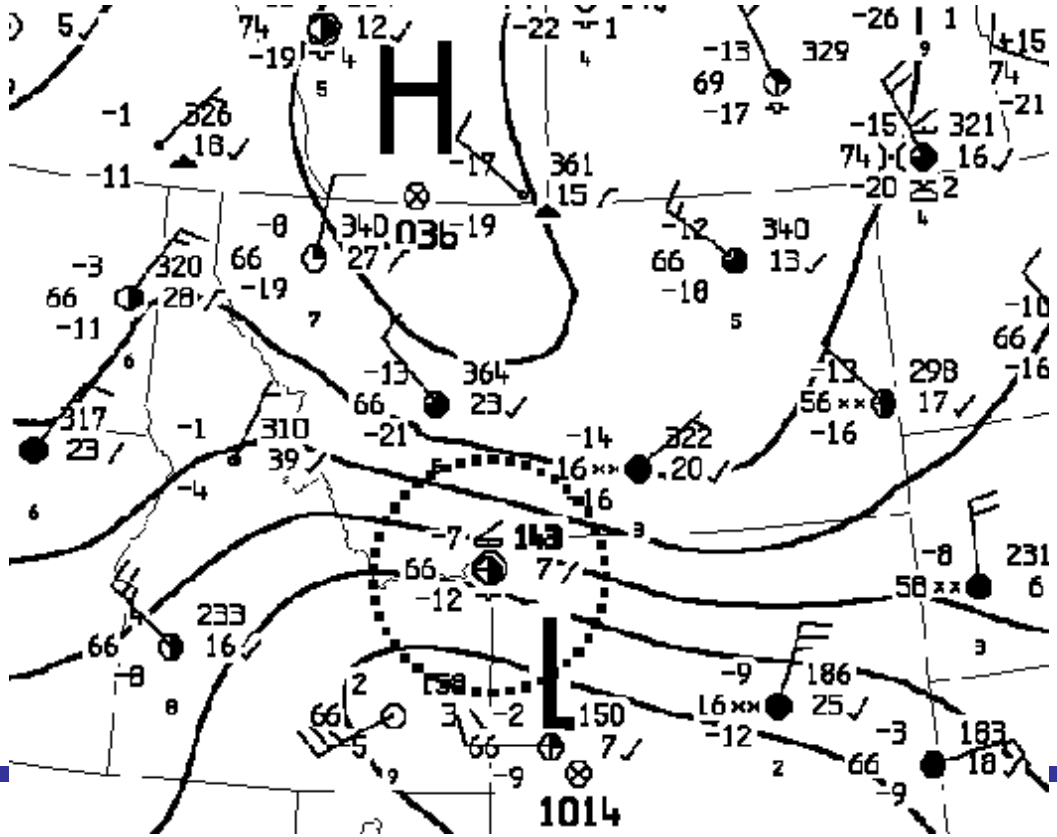
Meteorology: The study of the atmosphere and weather forecasting.

Meteorologists refers to a person who studies weather and make weather forecasts



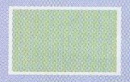
Weather Maps and Symbols

weather map displays various meteorological features across a particular area at a particular point in time and has various symbols which all have specific meanings.[



Weather Symbols

Weather symbols are used on my weather maps as shorthand for the conditions at weather observing stations.

Weather	Symbol	Associated Weather
Precipitation		Rain, snow, fog, or other forms of precipitation
Cold front		Cooler temperatures, possible precipitation
Warm front		Warmer temperatures, possible precipitation
Low pressure		Cloudy skies, possible precipitation
High pressure		Clear skies
Hurricane		Damaging winds, rain, possible flooding
Tornado watch		Area where tornadoes may occur, possible severe thunderstorms
Tropical storm		Very strong winds and heavy rains

L Low Pressure Center in Millibars...typically brings clouds and precipitation

H High Pressure Center in Millibars...typically brings fair skies

Unshaded areas indicate cloud-free or fair skies

Grey shaded areas indicate cloudy areas

Green shaded areas indicate areas that have the best chanc for precipitati

Black lines are lines of constant pressure or isobars

Rain

Moderate Rain

Heavy Rain

Rain and Drizzle

Drizzle

Rain and Snow

Flurries

Snow

Moderate Snow

Heavy Snow

Smoke

Thunderstorms

Fog

Dense Fog

Rain and Fog

Drizzle and Fog

Rain, Drizzle, & Fog

Snow and Fog

Rain, Snow, & Fog

Freezing Rain

Freezing Drizzle

Blowing Snow

Thunderstorms w/ Hail

Rain Showers

Snow Showers

Rain & Snow Showers

Snow or Ice Pellets

Cold Front...boundary between approaching cold air and warmer a

Warm Front... boundary between approachin warm air ar cooler air

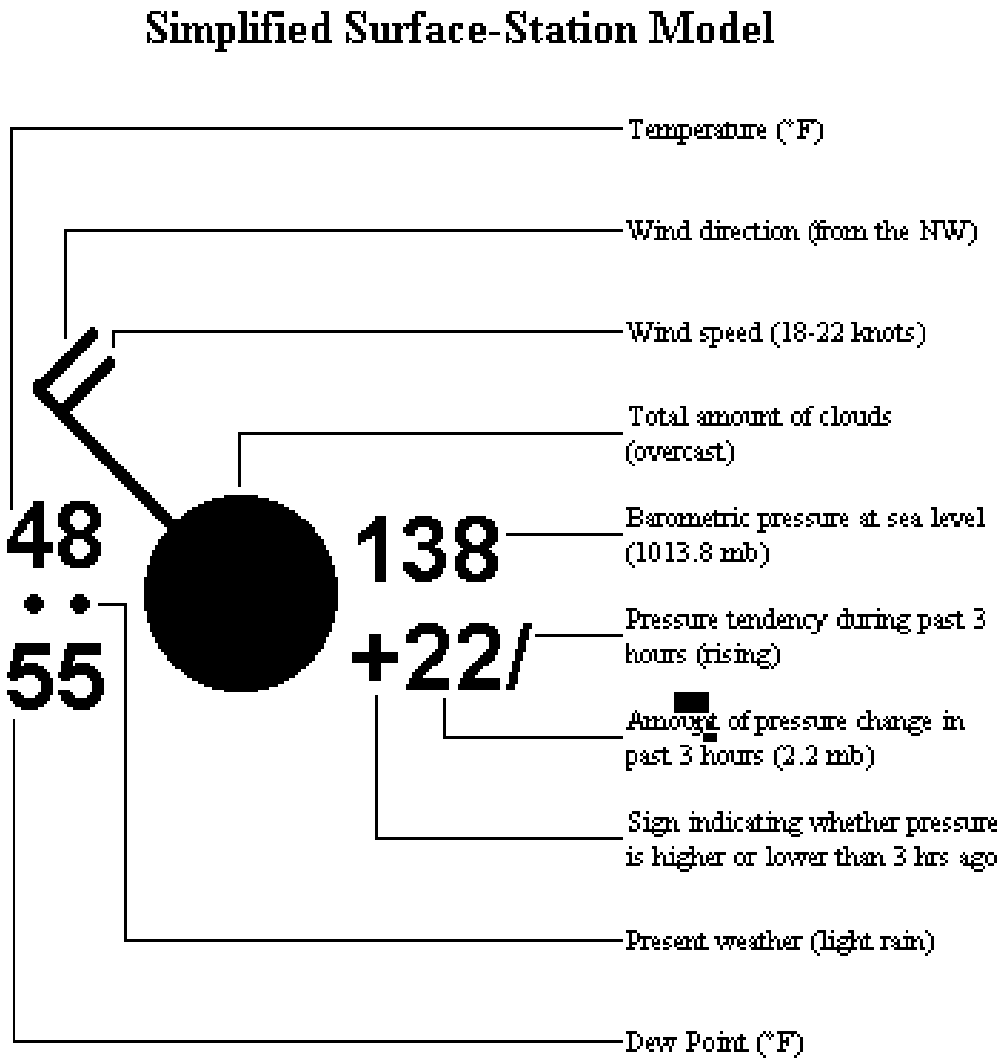
Occluded Front... cold air over tak warm air or vice versa

Trough...boundary of low pressure

Stationary Front... ...dary between warm ar... old air has little or no m...vement

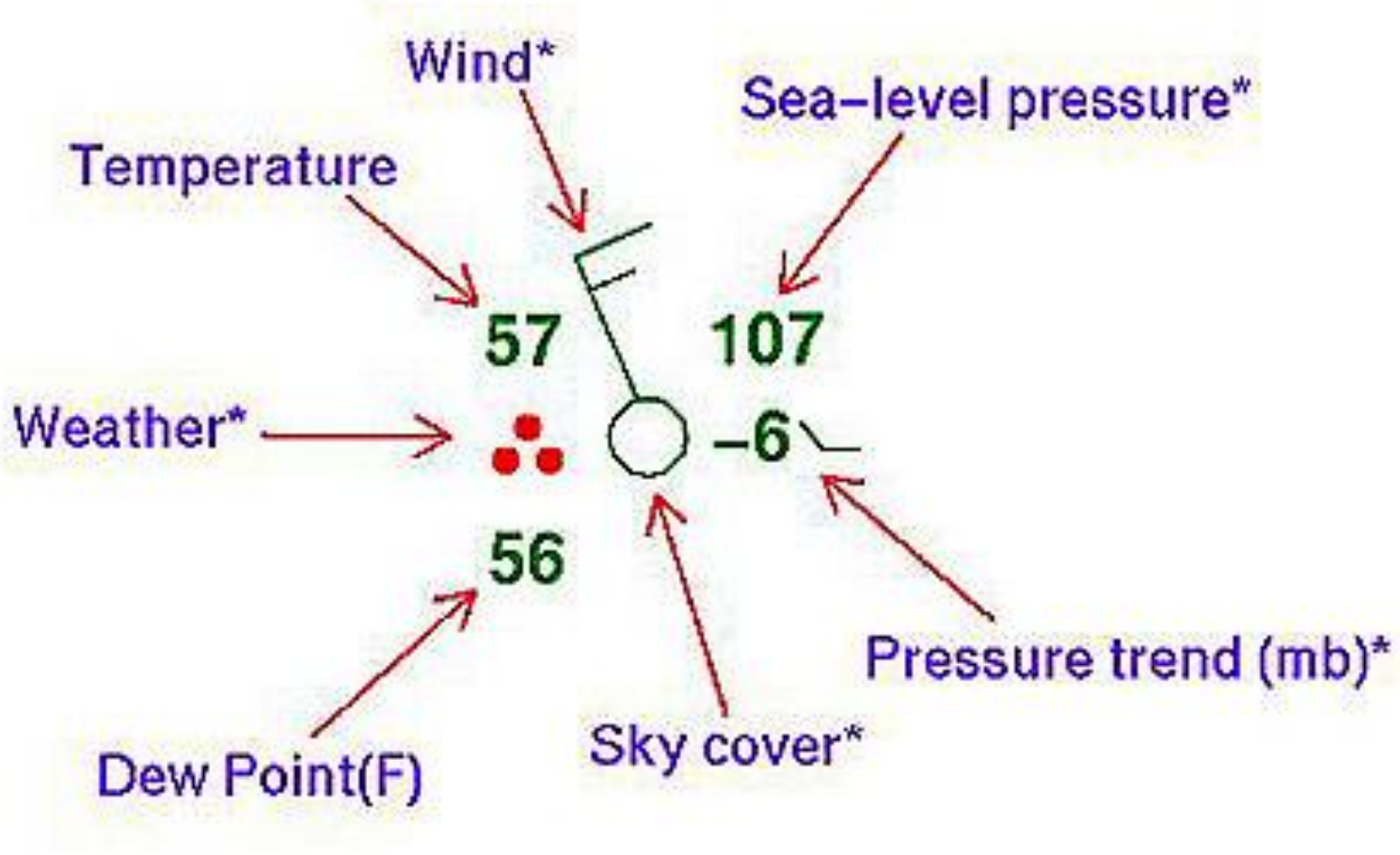
MENU

Weather Station (not on the TV)
Weather conditions at specific location



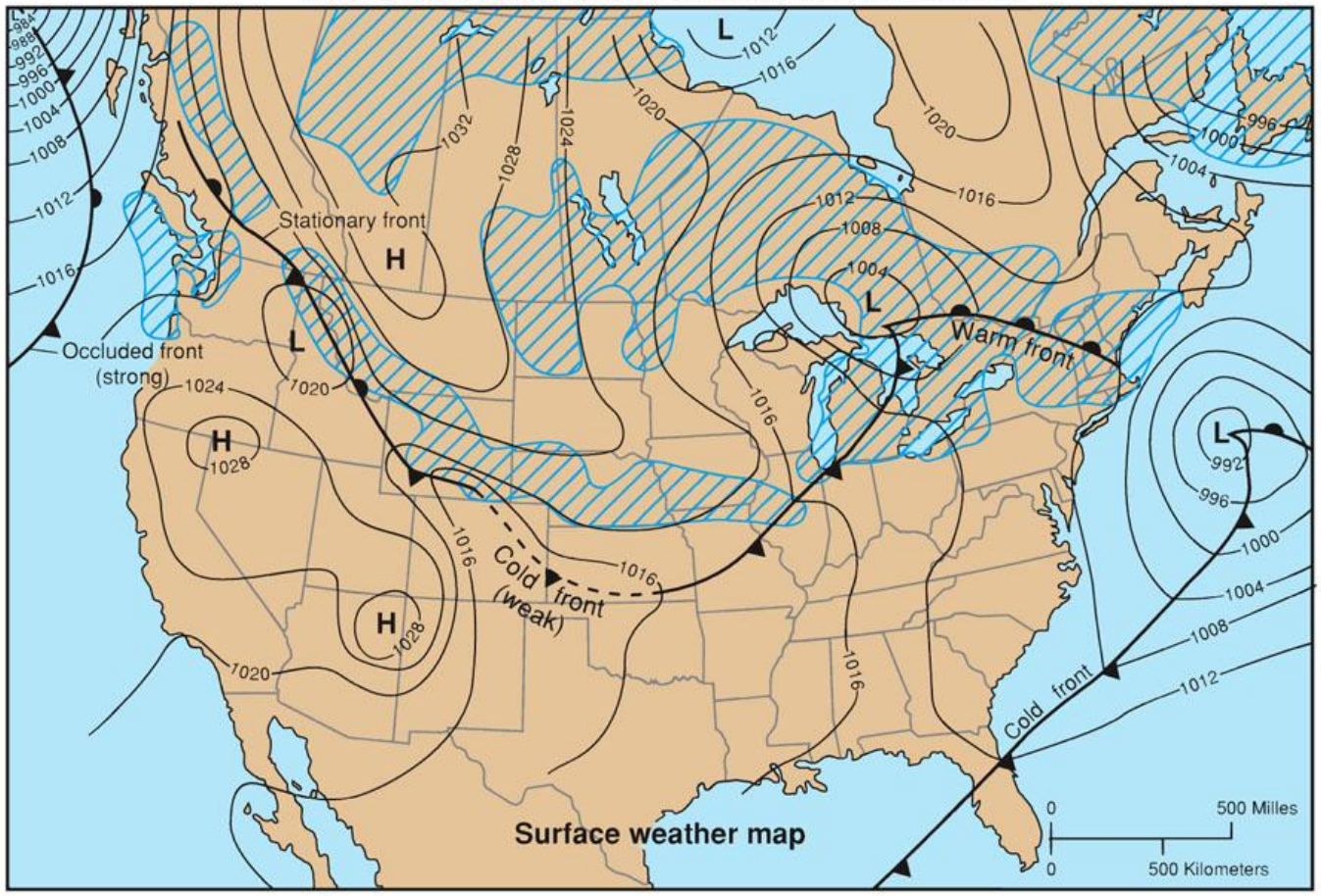
Current Conditions!!

Station Model

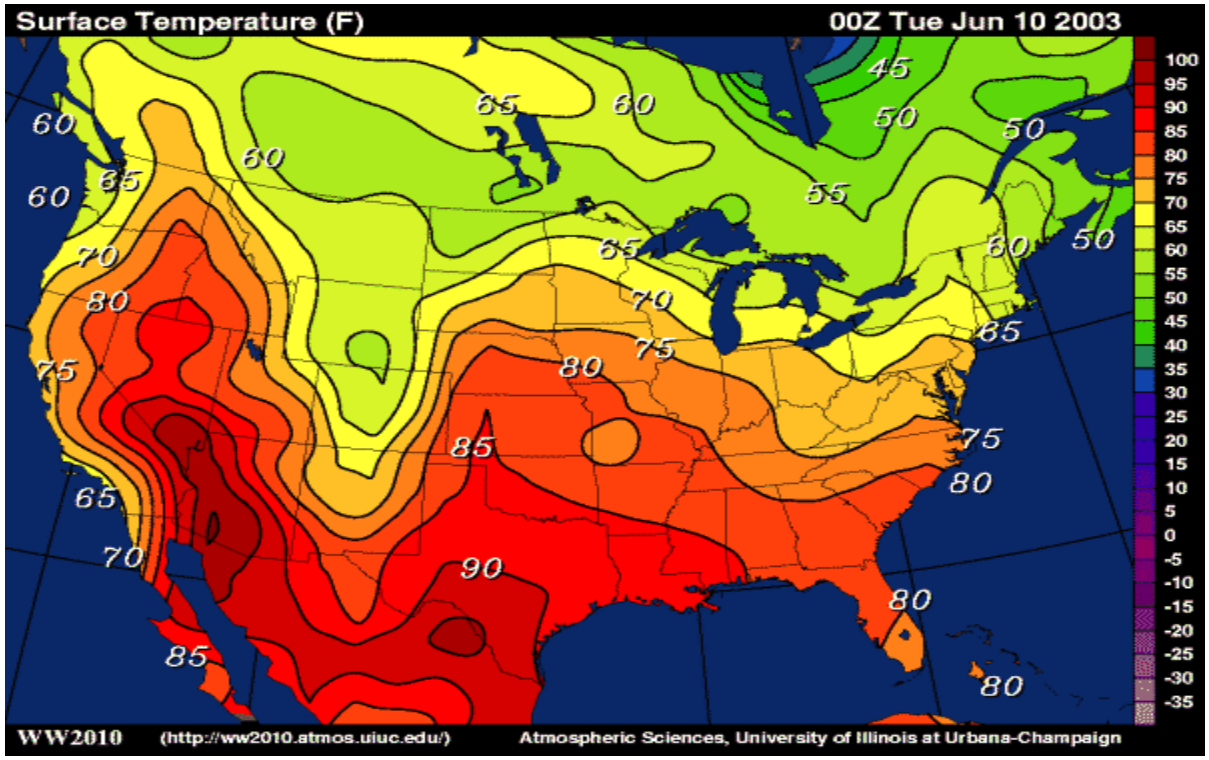


Reading a weather map

Isobar refers to a line connecting points of equal atmospheric pressure. The closer the isobar the stronger the winds



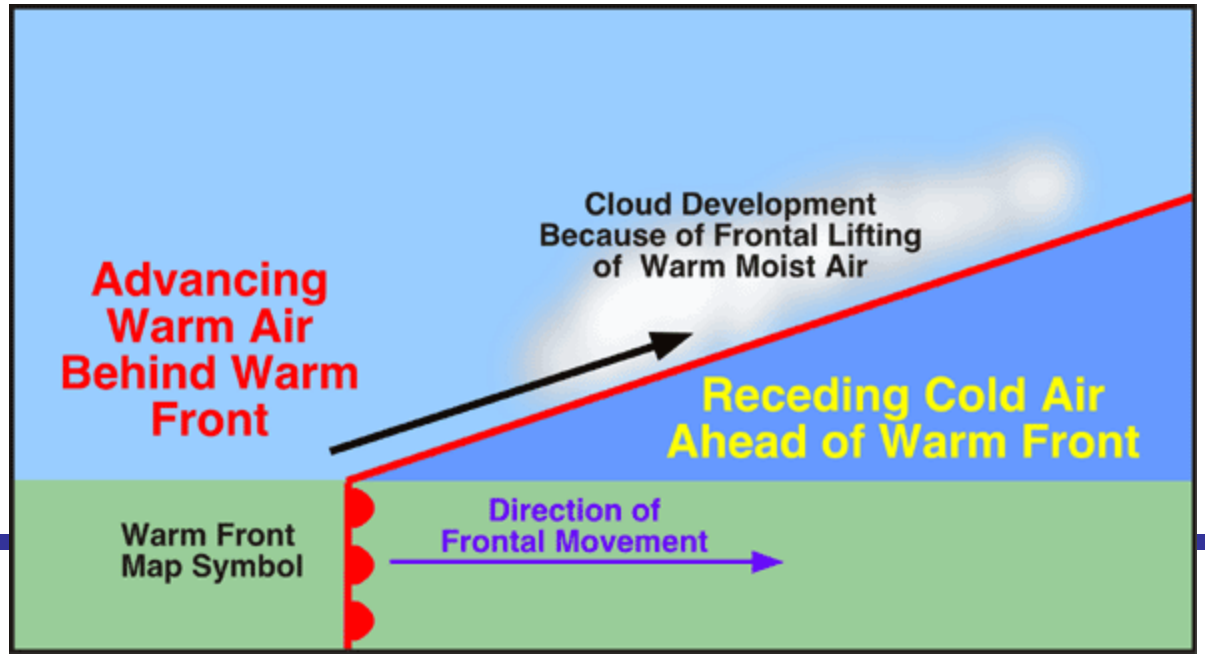
- **Isotherm:** Connects areas of equal temperature; therm means temperature



Fronts: the boundary between 2 air masses

- Warm Front: warm air slides over departing cold air- large bands of precipitation form

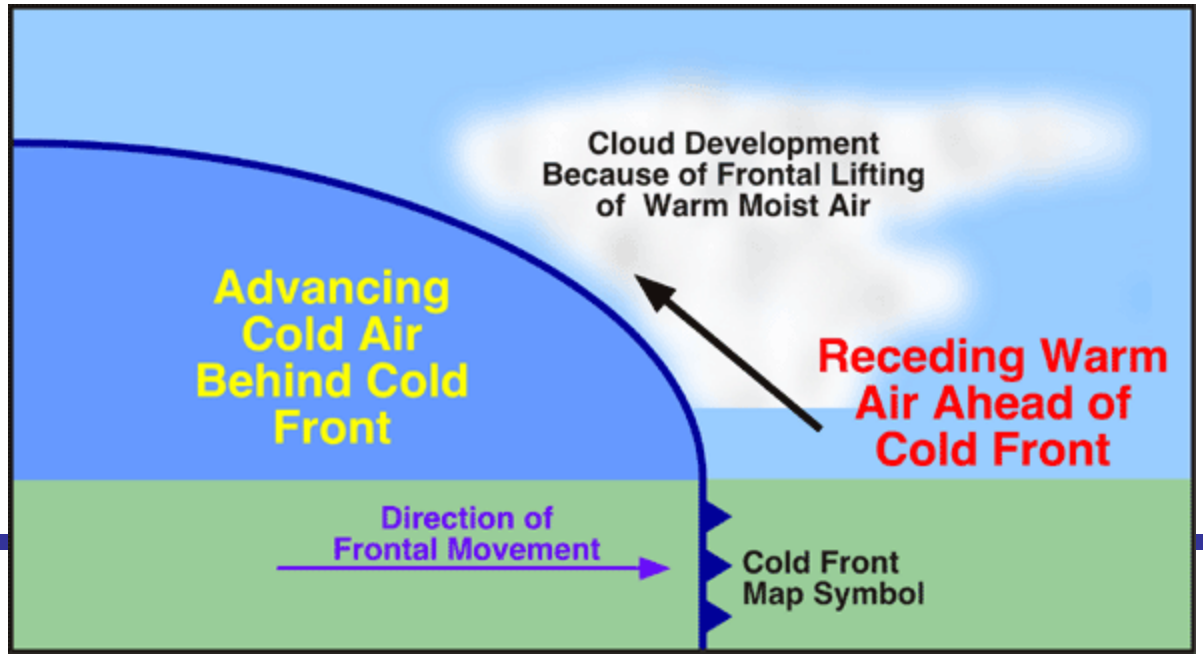
This is the symbol on a map for a warm front



This is the symbol for a cold front

Cold Fronts

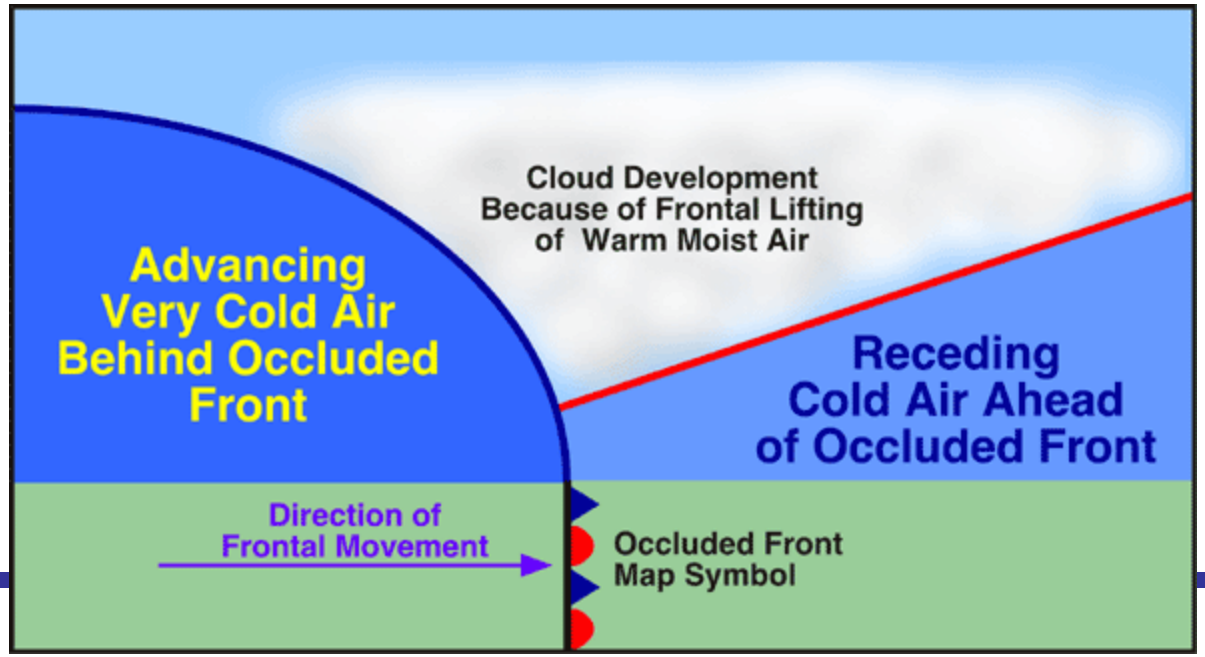
- Cold air pushes under a warm air mass. Warm air rises quickly=narrow bands of violent storms form



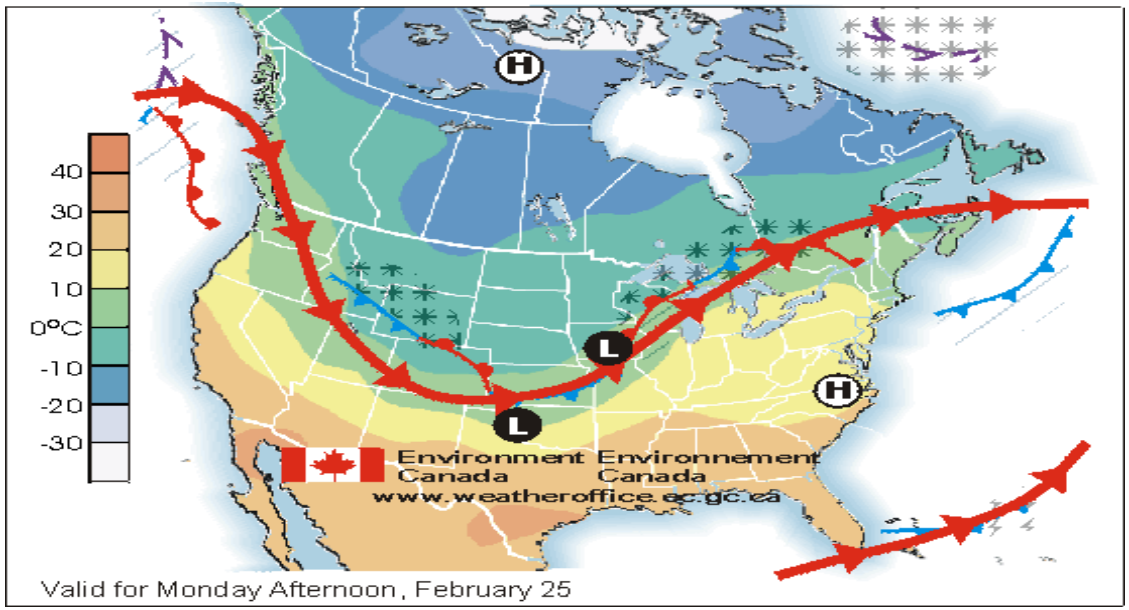
Occluded Front

This is the weather map symbol for an occluded front

- 2 air masses merge and force warm air between them to rise quickly. Strong winds and heavy precipitation will occur



- There are more than one type of weather map. Those found in newspapers and on television are generally simple versions of the professional map used by a meteorologist.



- The use of colour makes it is easy to determine the temperature in any region. The location of **high pressure** regions (H) and **low pressure** regions (L) are also easy to spot. There are also symbols that indicate the positions, and types of weather fronts.

Weather Forecasting Technology

Meteorologists of today have a great deal more technology at their disposal.

1. **Weather Satellite:** An orbiting spacecraft that regularly gathers weather related data and relays them to weather stations on the ground.

- High Orbit Satellites

Orbits about 36 000 km above the equator

Provides images that show cloud cover, earth's physical features and amount of infrared radiation from the atmosphere

-Low orbit Satellites

Orbit about 1000 km above the poles

Gather data that is used to detect changes in air temperature and water vapor at different levels of the atmosphere, as will as global wind patterns.

2. Weather Balloons

Helium –filled balloons that are launched 2 or more times per day from weather stations across North America

Carry instruments that collect data on temperature, pressure, humidity and ice crystals

Can also be used to determine speed and directions of Winds

As a result of such questions, man developed weather balloons to explore the atmosphere to an altitude up to about 30 km. Each balloon caries a small radio transmitter known as a **radiosonde**.

3. Ground Based Technology

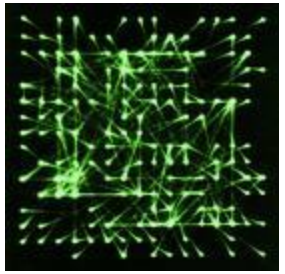
Instruments used at a weather station

Instrument	Weather Factor measured
Thermometer	Current Min & Max Temperature
Anemometer	Wind Speed and Direction
Aneriod Barometer	Atmospheric Pressure
Rain Gauge	Rain Fall
Hydrometer	Relative Humidity

4. Computer Technology

Data from satellites, weather balloons and ground based instruments are gathered, stored and analyzed by computer software

Computers linked to satellite communications systems allows info to be sent around the world



SCIENCE 1206

- **Topic 15:**

  Extreme Weather

Extreme Weather Conditions

Thunderstorm

A storm with lightning, thunder, heavy rain and sometimes hail

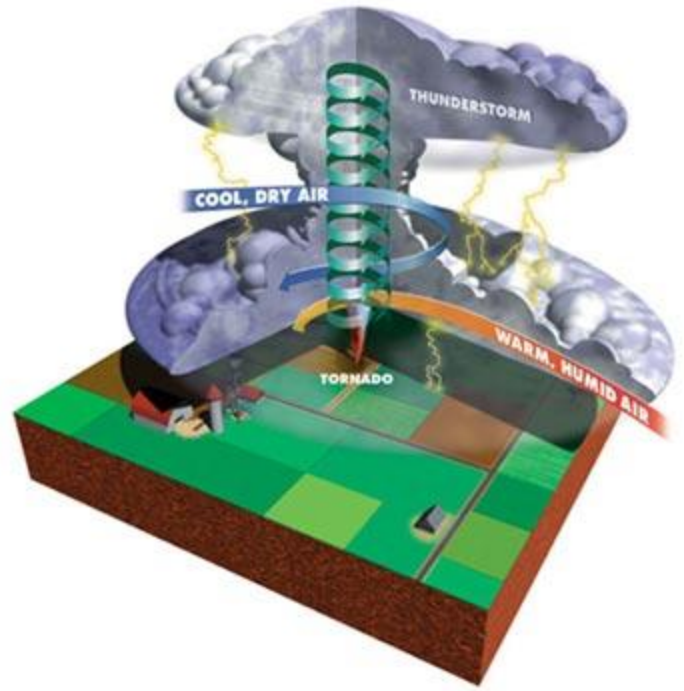
Results from the uplift of air and moisture high in the troposphere

Tornadoes

From in the most severe thunderstorms

Fast rising air begins spinning, forming a funnel of air and moisture. As it rises it turns to the right due to the Coriolis effect.

Travels at speeds of up to 100 km



Floods:

Excess of water from rain, rivers, or oceans that form over land and cannot soak up any more water.

1. **Broadside** – Cover a large land area: Seasonal, predictable floods

2. **Flash** –quick onset; difficult to predict (Badger, Nl)

Drought:

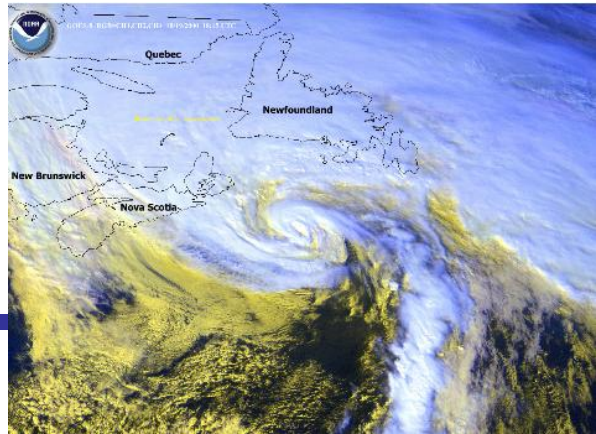
- occur whenever precipitation is very low over a long time period
- common in areas at or near 30o latitude (high pressure areas)
- eg. Dust Bowl of 1930's in the prairies

Hurricane, Typhoons and Tropical Cyclones (p. 594 – 597)

All are cyclones: massive high-energy low pressure systems which have resulted from the large amounts of energy from hot, tropical marine air masses spinning off of equatorial ocean areas.

The names are different due to the regions in which they are found.

- Hurricanes: eg. Atlantic Ocean
- Typhoons: eg. Pacific Ocean
- Tropical Cyclone: eg. Indian Ocean



Blizzards:

- Severe snow storms with strong winds (> 55 km/h) and low temperatures
- Can develop when a warm moisture-laden air mass moves northward and meets a cold Arctic air mass, under a strong jet stream.

Ice Storms:

- Freezing rain that lasts for several hours

- Can occur when a warm air mass meets a cold air mass and the cold air mass pushes the warm one upward.

- The moisture in the warm condenses into clouds and ice crystals. As ice crystals fall through air mass they melt to form rain.

- The raindrops fall through cold air mass, cool and then freeze instantly when they hit a cold object on the ground

Activity

Choose a severe weather event and analyze how it has affected the people both as individuals and as a community in terms of economic, social, and environmental conditions. You are encouraged to use a provincial example. This activity may be presented as a written account, a photo/visual image essay, or as a "news" report.

The following resources will help you complete this activity:
Read 15.1 "Weather Records and Events" on pages 580 - 581.
Read 15.8 "Surviving the 1998 Ice Storm" on pages 600 - 603.
Read 15.9 "Extreme Heat and Cold" on pages 604 - 607.
Read 15.10 "Explore an Issue: Winter Shelters for the Homeless" on page 608.
Read 16.9 "Case Study: Monsoons in Bangladesh" on pages 639 - 640.

Science 1206 - Movie

- **WEATHER WONDERS**