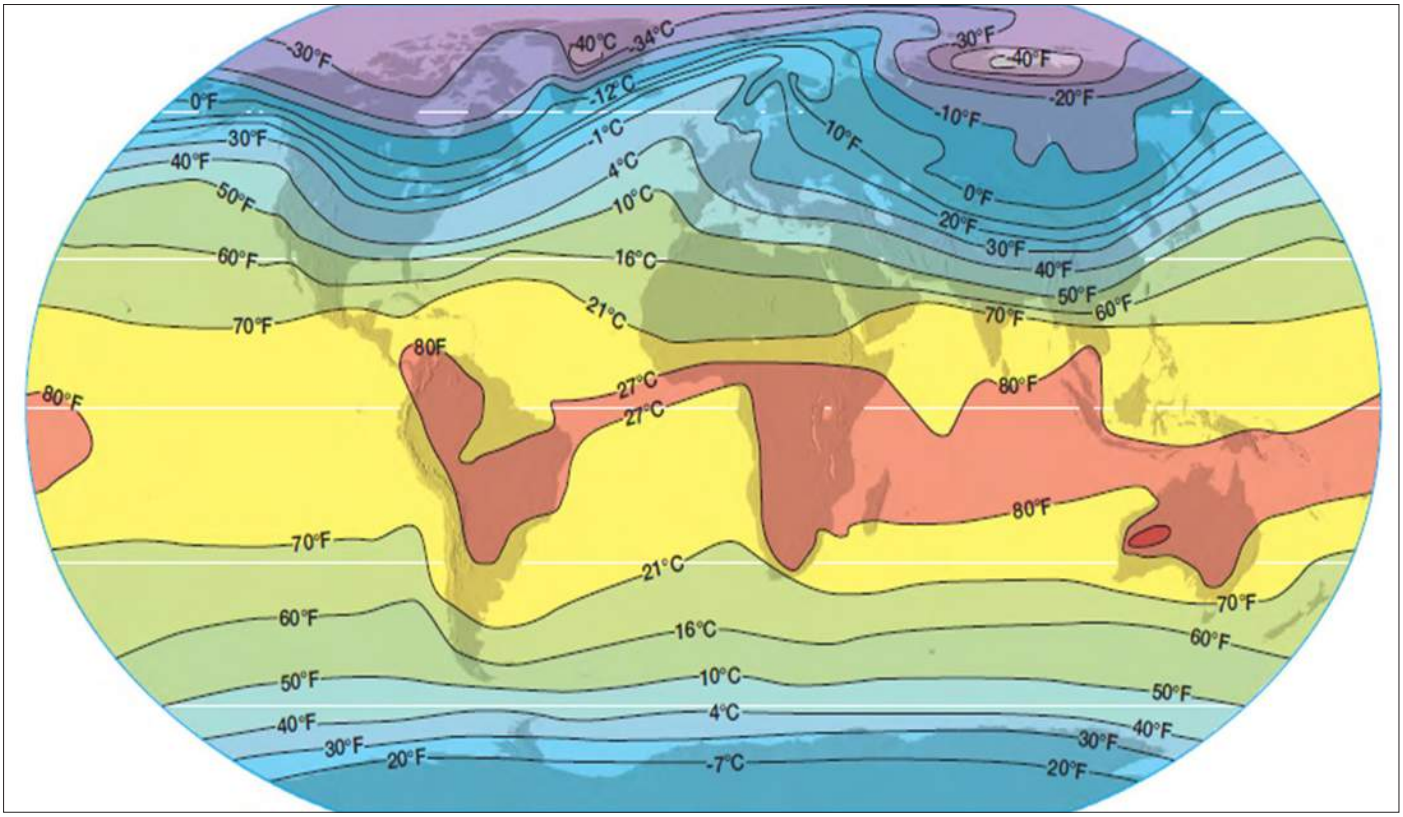
ATMOSPHERE

Heat Budget, Atmospheric Pressure & Winds

Global Mean Sea Level Temperature (Jan)

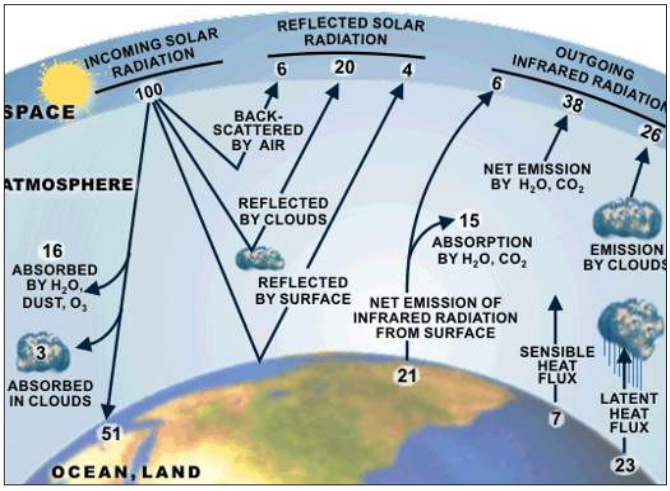


Heat Budget

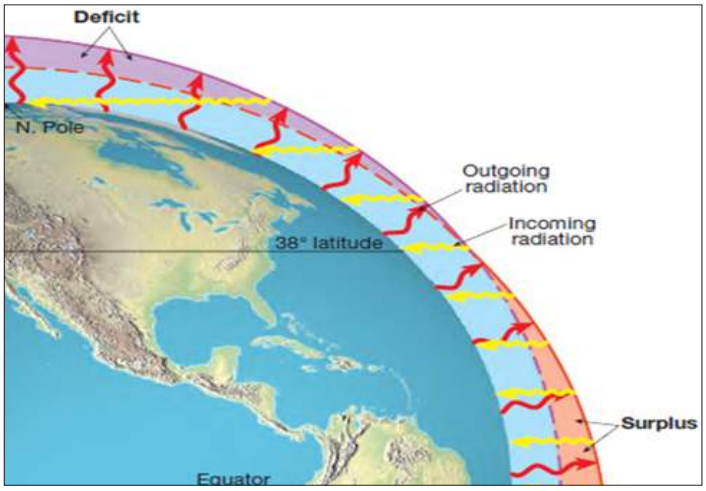
As scientists work to understand **why global temperatures are rising** and how carbon dioxide and other greenhouse gases are changing the climate system, they have been **auditing Earth's energy budget.**

Is more energy being absorbed by Earth than is being lost to space?

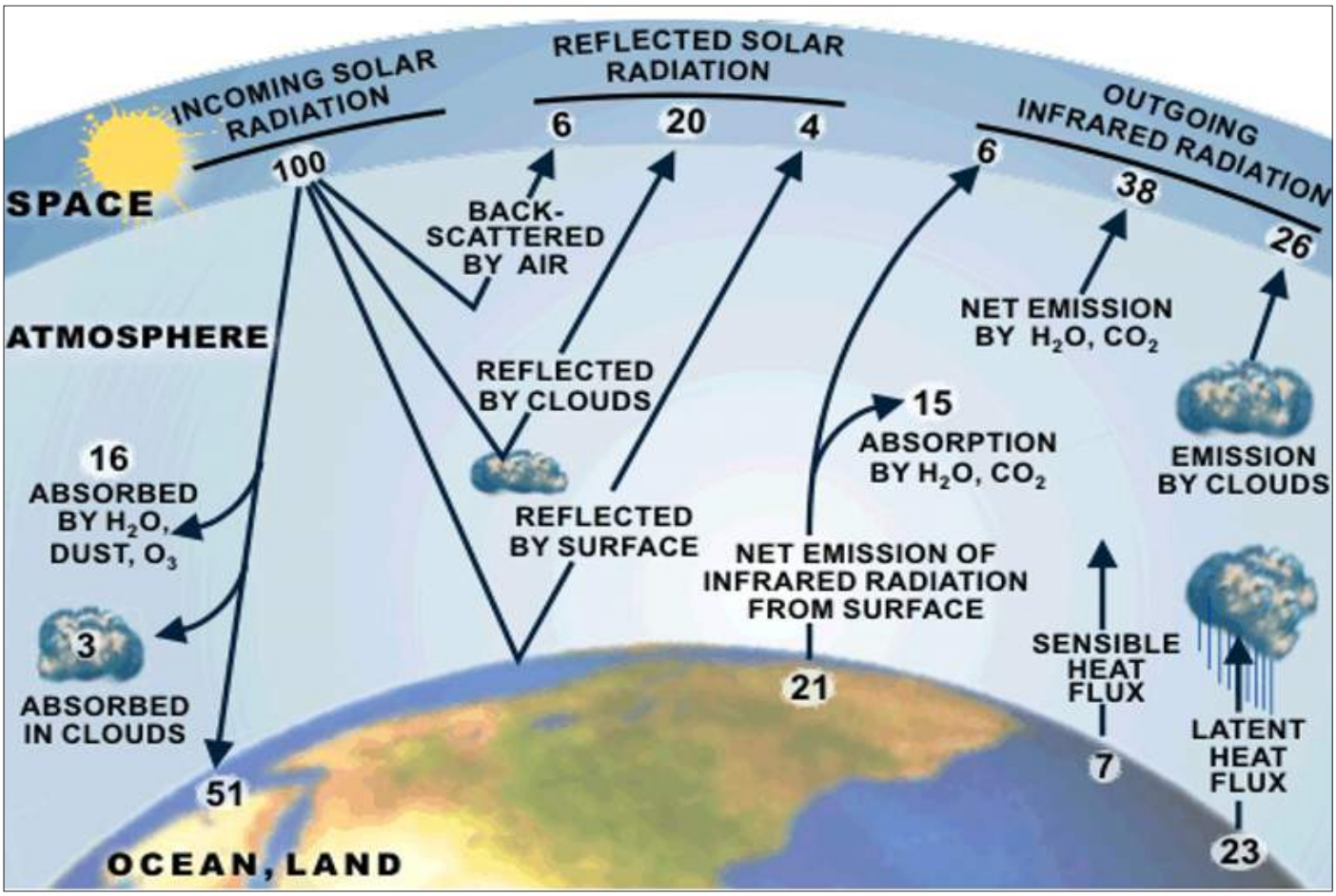
Planetary Heat Budget



Latitudinal Heat Budget

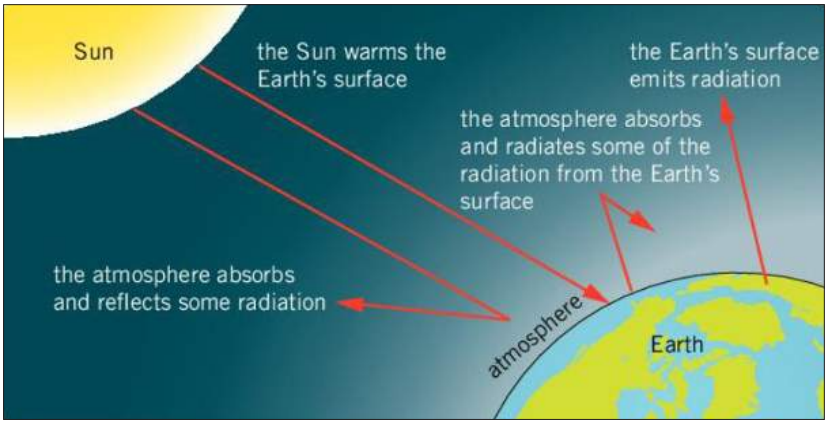


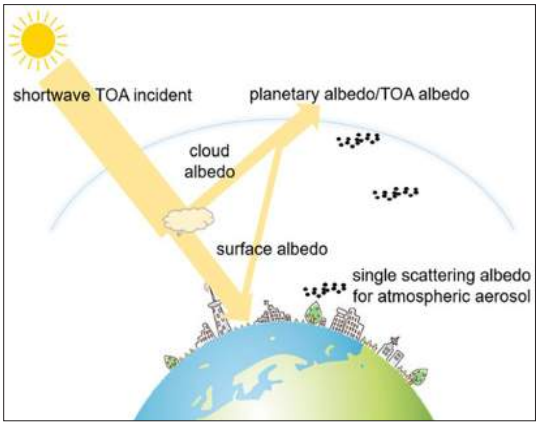
Planetary Heat Budget



Albedo

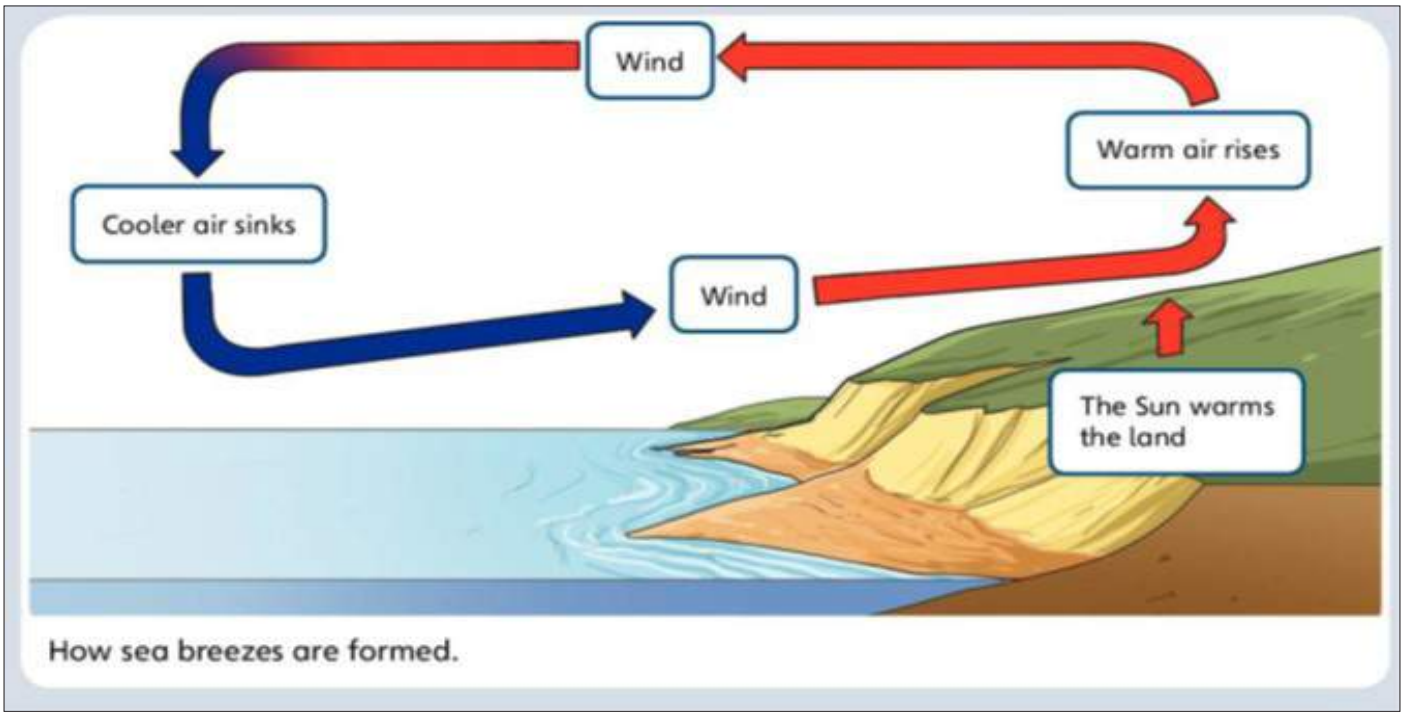
- Albedo is the **fraction of the incident sunlight that is reflected** from surface of an object.
- A **perfectly black surface** has an albedo of 0 (absorbs all radiations).
- A perfectly white surface has an albedo of 1.0 (absorbs all radiations)
- About one-third of that energy is reflected back into space!!!



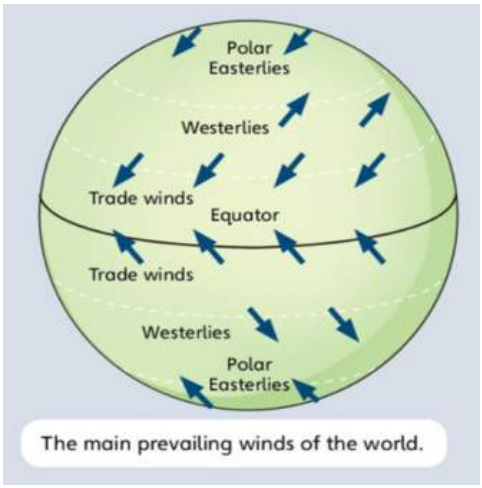


Pressure

- Pressure – meaning
- Variation with altitude
- High Vs Low pressure (Altitudinal and Horizontal)
- Pressure difference leads to movement of air i.e winds.
- PGF, perpendicular/radial.

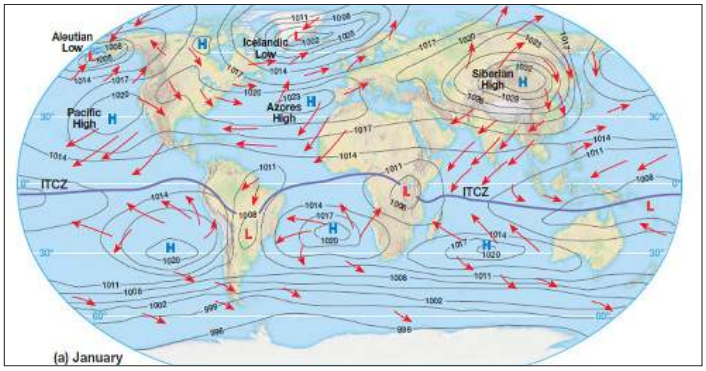


How sea breezes are formed.

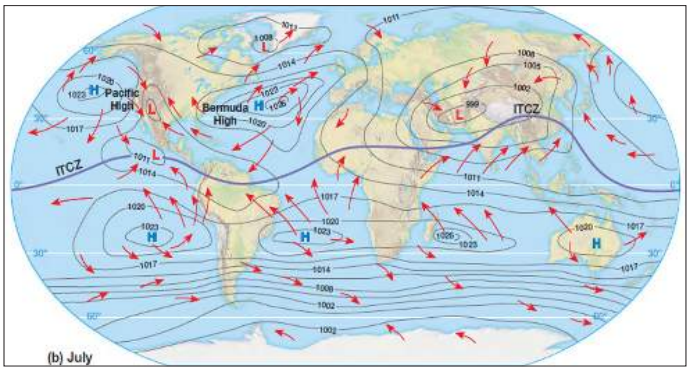


The main prevailing winds of the world.

Global Pressure Patterns and Winds (January)



Global Pressure Patterns and Winds (July)



HUMIDITY

Atmosphere **gains water vapour** mainly by:

- Evaporation
- Transpiration from plants

Atmosphere **looses water vapour** mainly in the form of precipitation (rain or snow).

Most important factor controlling the atmospheric moisture is **temperature**

1. **Absolute humidity:** Weight of the water vapour in grams per unit volume of air (grams/m^3)
2. **Specific Humidity:** Weight of the water vapour in grams per unit mass of air (grams/kg)
3. **Relative humidity:** Most important measurement it is the **ratio of the actual amount of water vapour in the air to the maximum amount that the air** could hold at that temperature.

RH = (Actual amount of water vapour/Holding Capacity)x100

Humidity & Precipitation

Change in RH : **Two ways**

i. By the change in water vapour content. i. e. if air receives more water by evapo transpiration or loose by precipitation

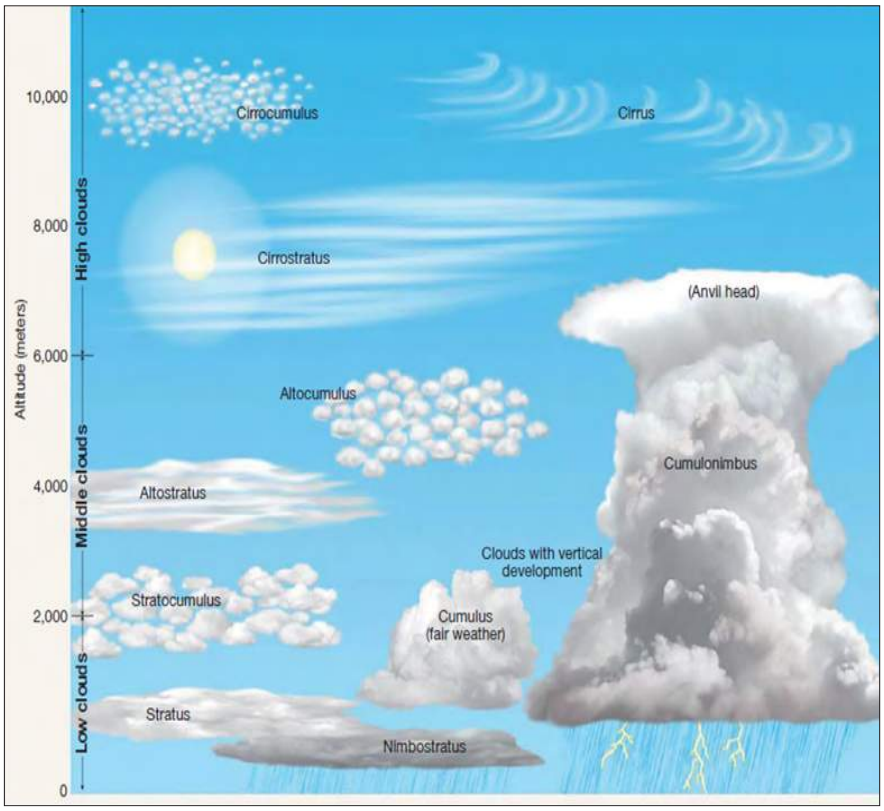
ii. Change in temperature

Dew Point: The critical temperature at which air, on cooling, becomes saturated with water vapour and below which continued cooling will cause **condensation of water droplets.**

Forms of Condensation

3 Types of Precipitation

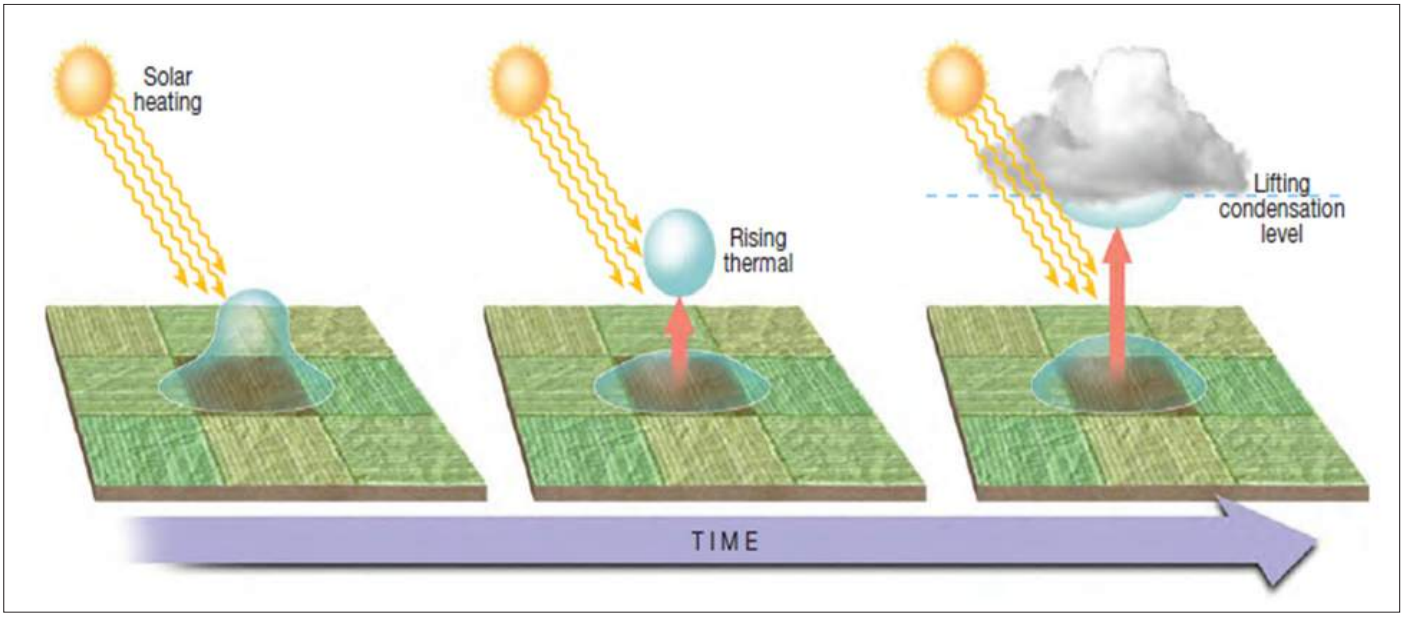
Type	Approximate Size	State of Water
Mist	0.005–0.05 mm	Liquid
Drizzle	<0.5 mm	Liquid
Rain	0.5–5 mm	Liquid
Sleet	0.5–5 mm	Solid
Freezing Rain (Glaze)	Layers 1 mm–2 cm thick	Solid
Rime	Variable accumulations	Solid
Snow	1 mm–2 cm	Solid
Hail	5–10 cm or larger	Solid
Graupel	2–5 mm	Solid



Processes That Lift Air

- Three mechanisms cause air to rise:

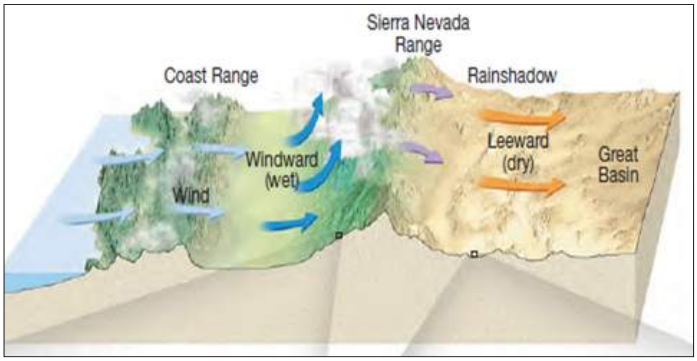
1. **Localized convective lifting,** in which unequal surface heating causes localized pockets of air to rise because of their buoyancy

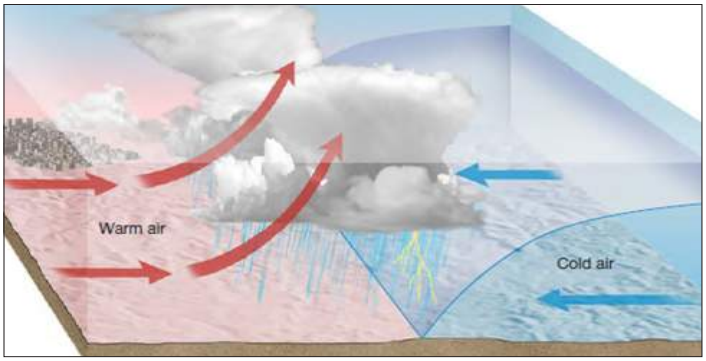


Processes That Lift Air

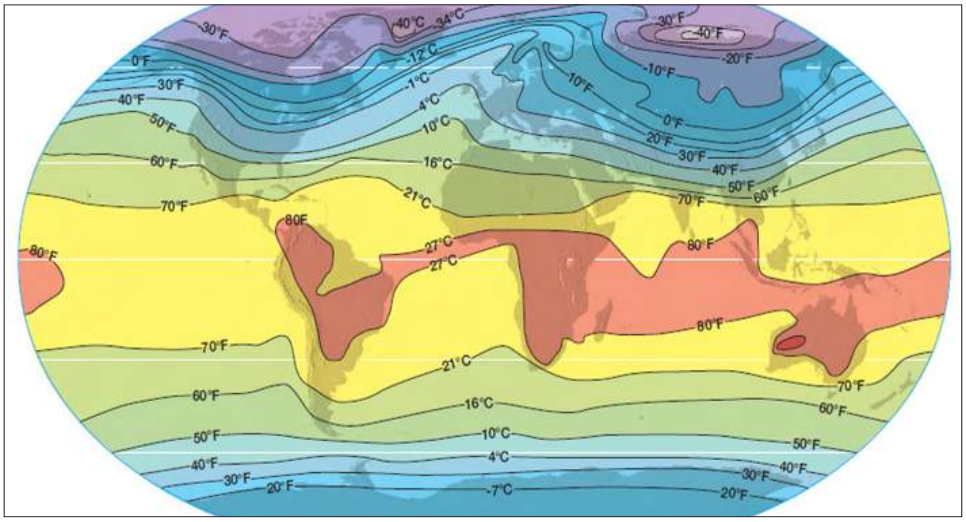
- Three mechanisms cause air to rise:

2. **Orographic lifting**
3. **Frontal Wedging,** in which warmer, less dense air is forced over cooler, denser air



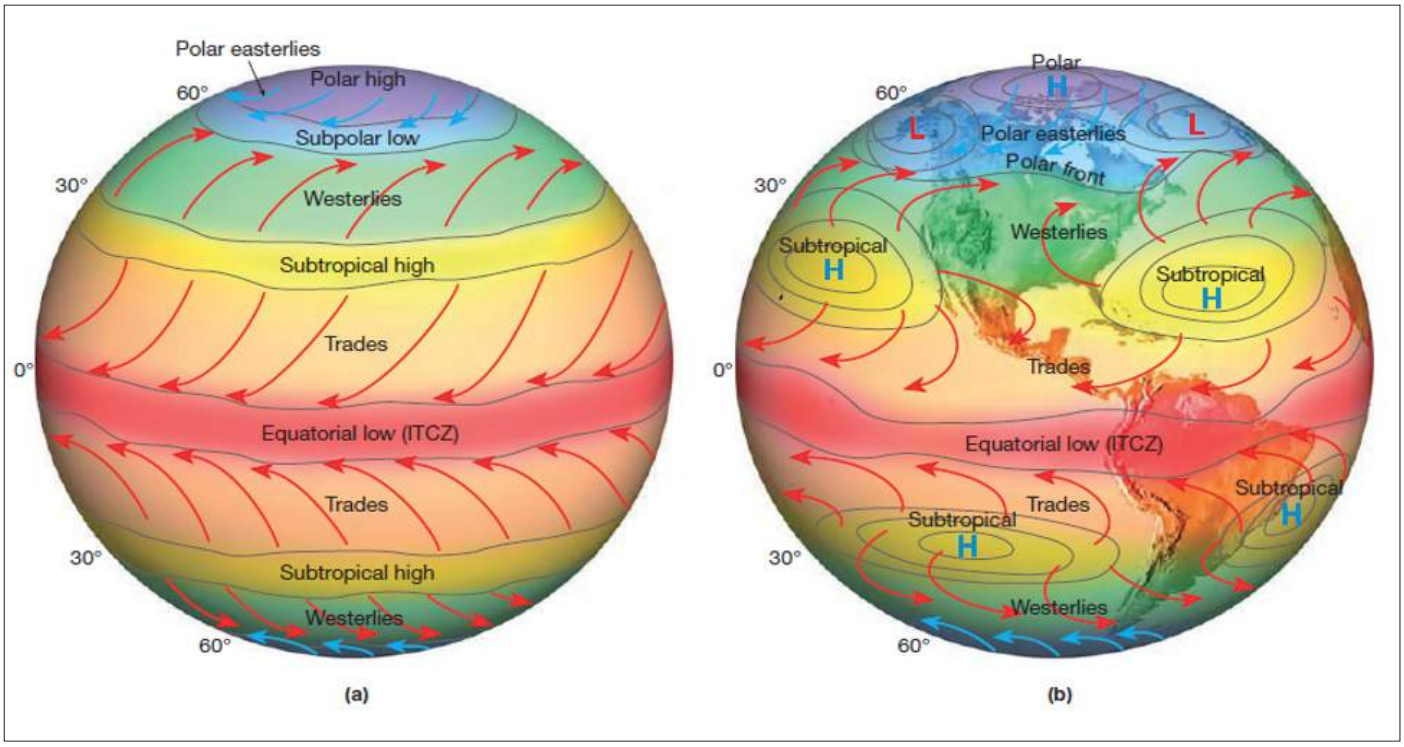


Global Mean Sea Level Temperature (Jan)



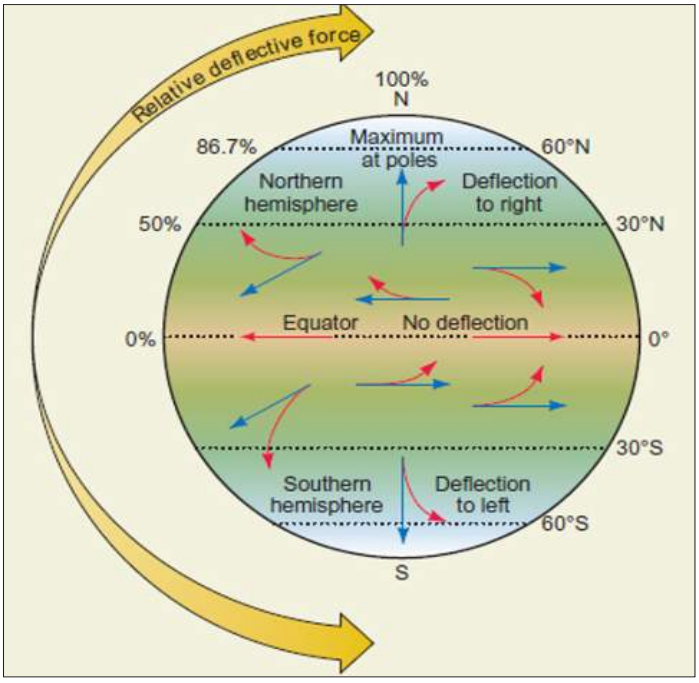
PRESSURE & WINDS

Idealized Zonal Pressure Belts

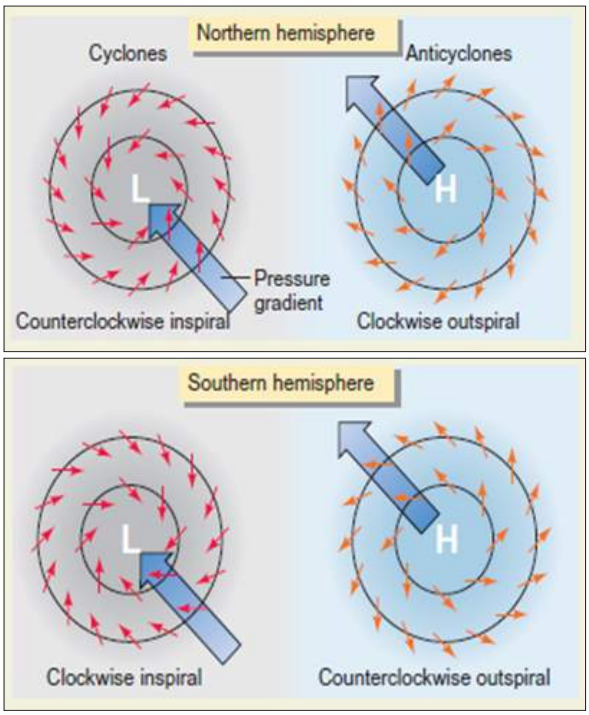


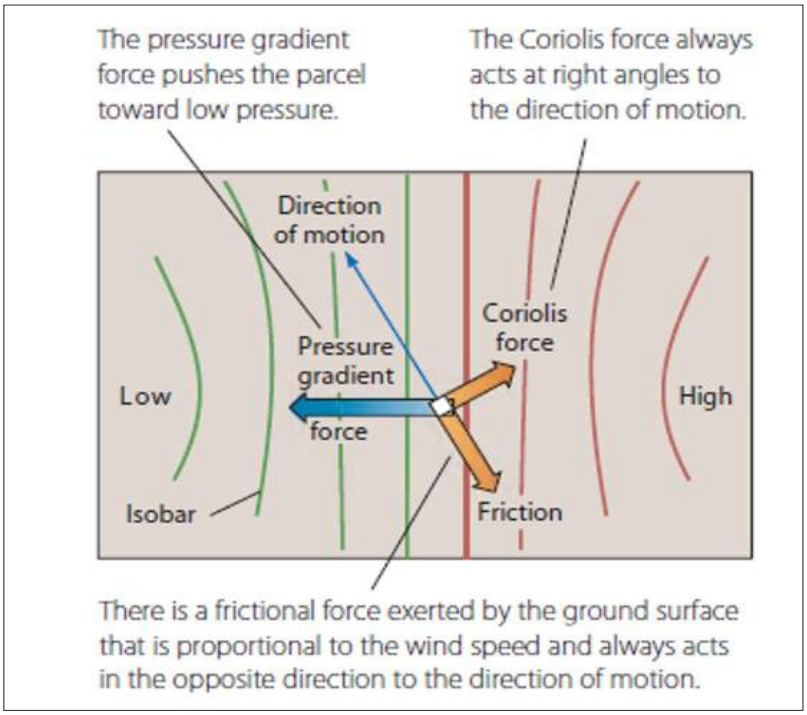
- There **are 7 pressure belts** across the surface of the globe.
- The reasons are different for each.
- Wind circulation across these belts constitutes the planetary wind circulation.

Coriolis Force



PGF Coriolis Force Frictional Force

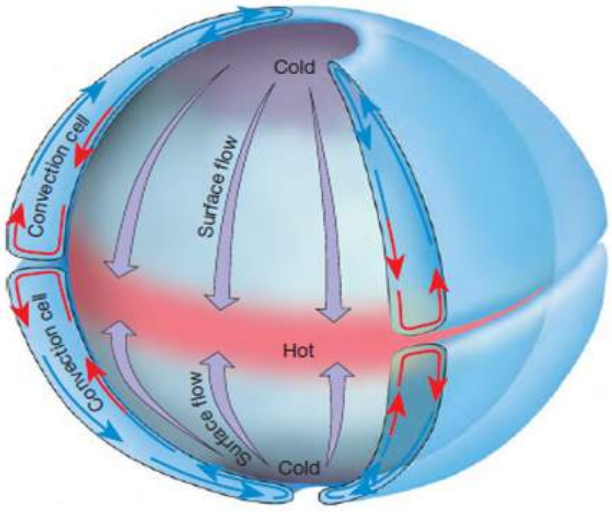




Global Circulation

- We **first** consider **the classical model of global circulation** that was developed largely from average worldwide pressure distribution.
- We will **then modify this idealized model** by adding **more recently discovered aspects** of the atmosphere's complex motions.
- One of the first contributions to the classical model of global circulation came from **George Hadley in 1735.**
- Well aware that **solar energy drives the winds,** Hadley proposed that the large temperature contrast between the poles and the equator creates **a large convection cell in both the Northern and Southern Hemispheres.**
- In Hadley's model, warm equatorial **air rises until it reaches the tropopause,** where it **spreads toward the poles.**

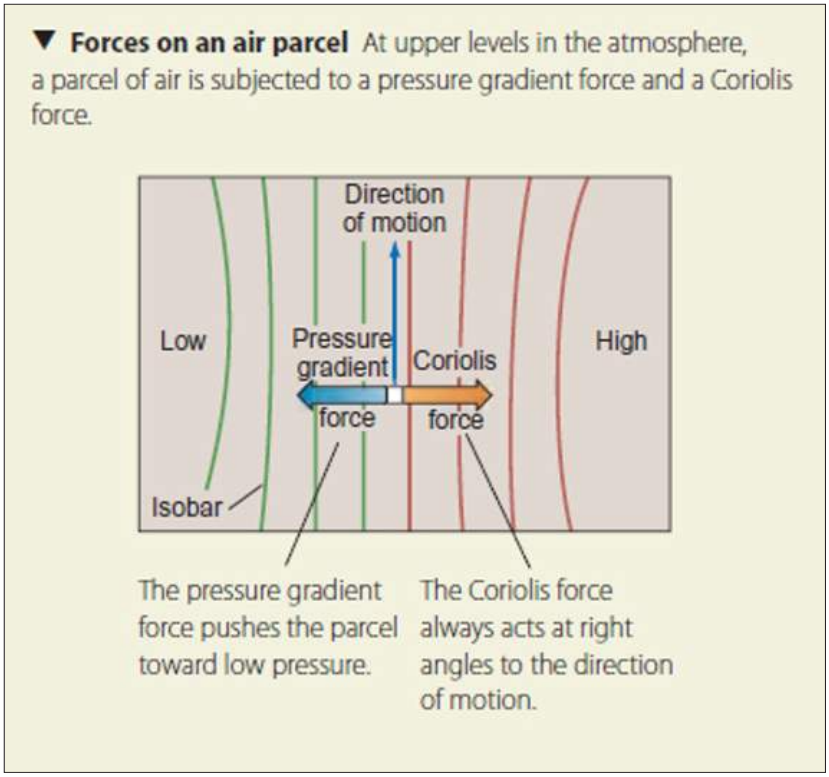
Single-Cell Circulation Model

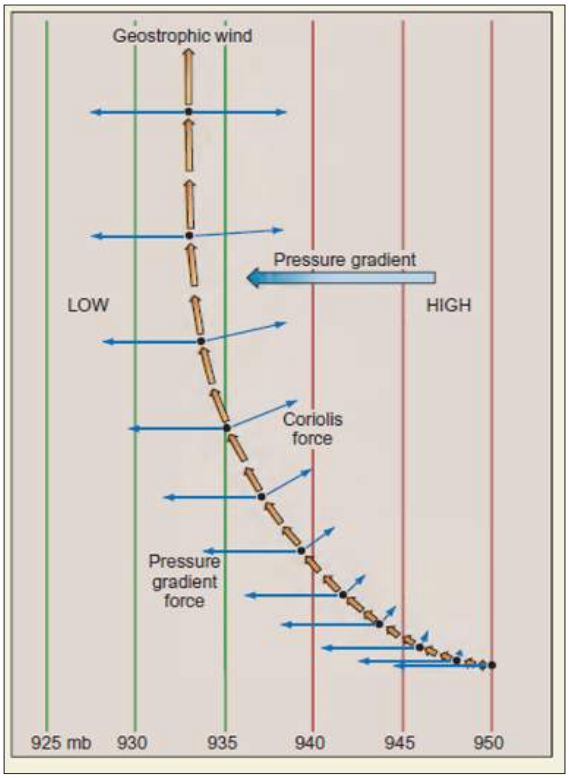


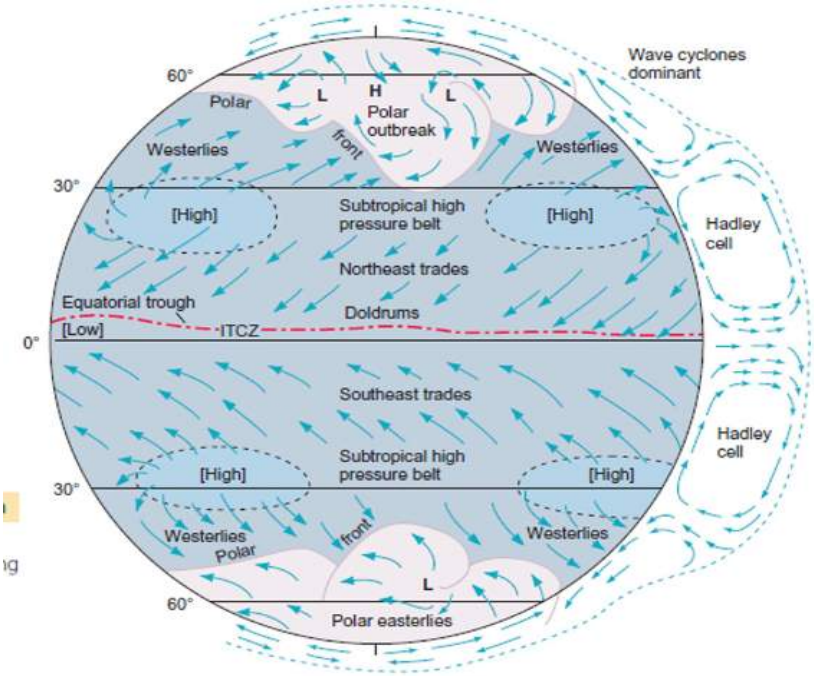
Pressure Belts And Winds

- Hadley has **upper-level air** flowing poleward and **surface air** moving equatorward.
- **Although correct in principle, hadley's model does not take into account earth's rotation.**
- Hadley's model would better approximate the **circulation of a nonrotating planet.**
- There are 7 pressure belts across the surface of the globe.
- The reason's are different for each.
- Wind circulation across these belts constitutes the planetary wind circulation.

Geostrophic Wind

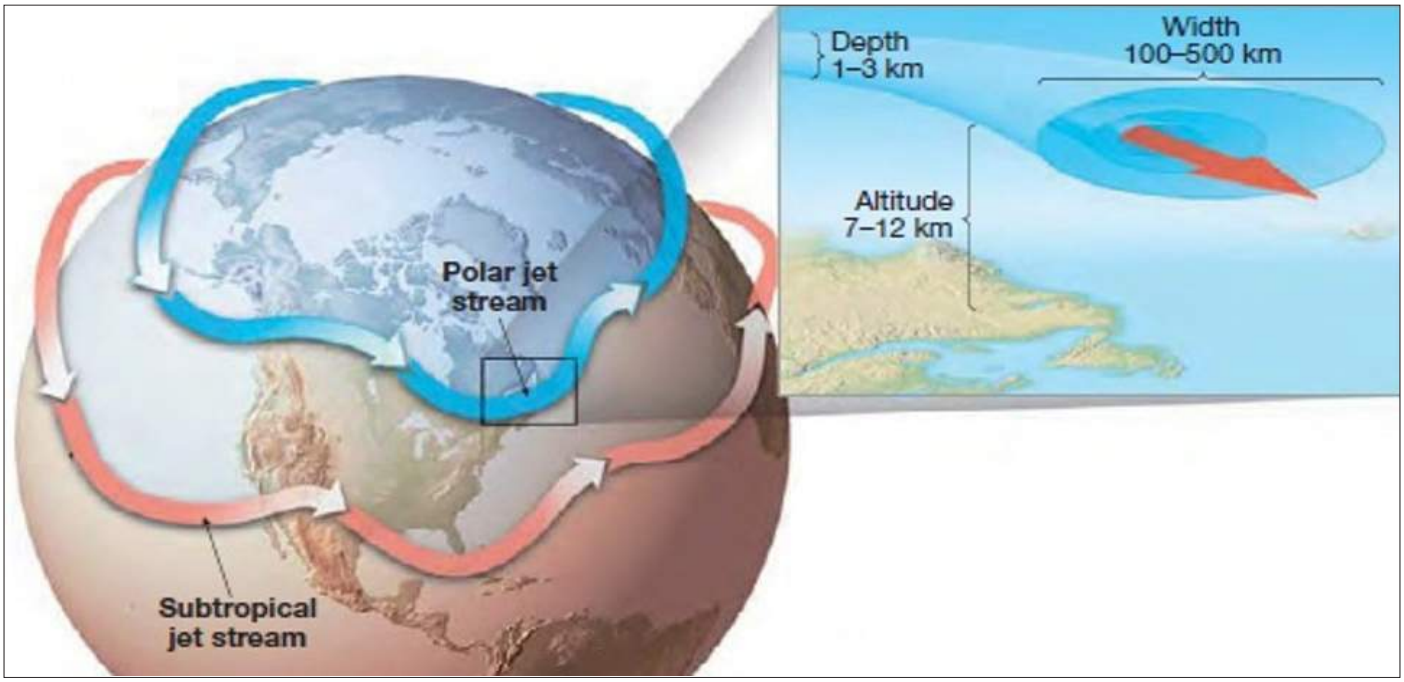


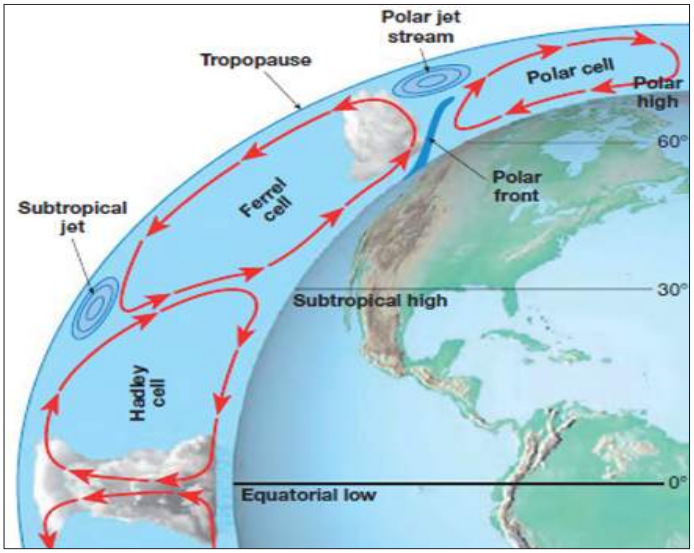


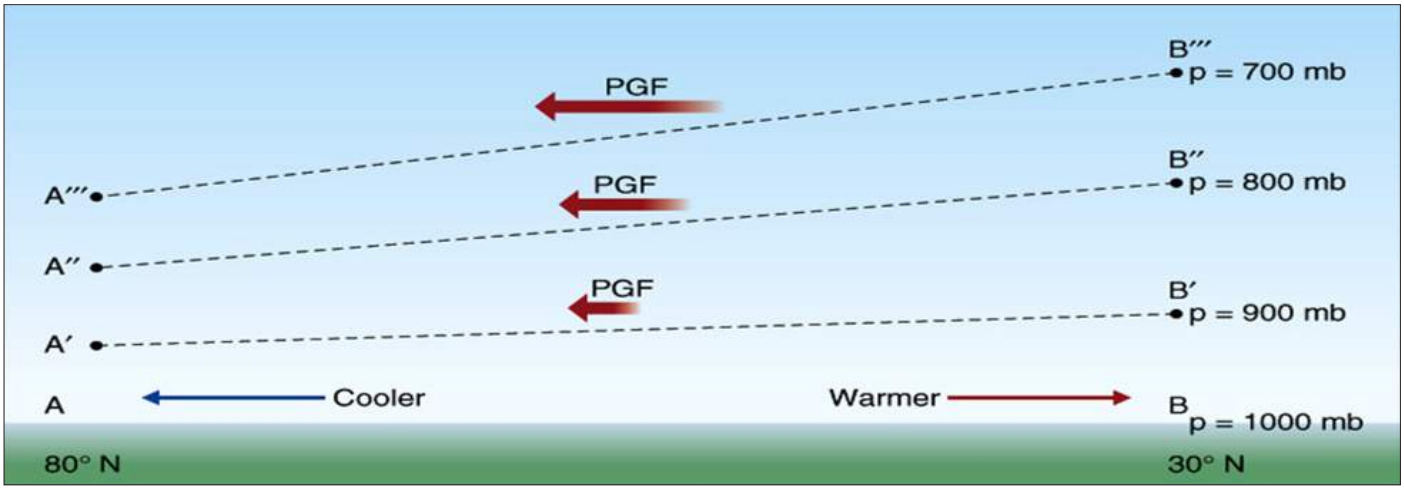


JET STREAM

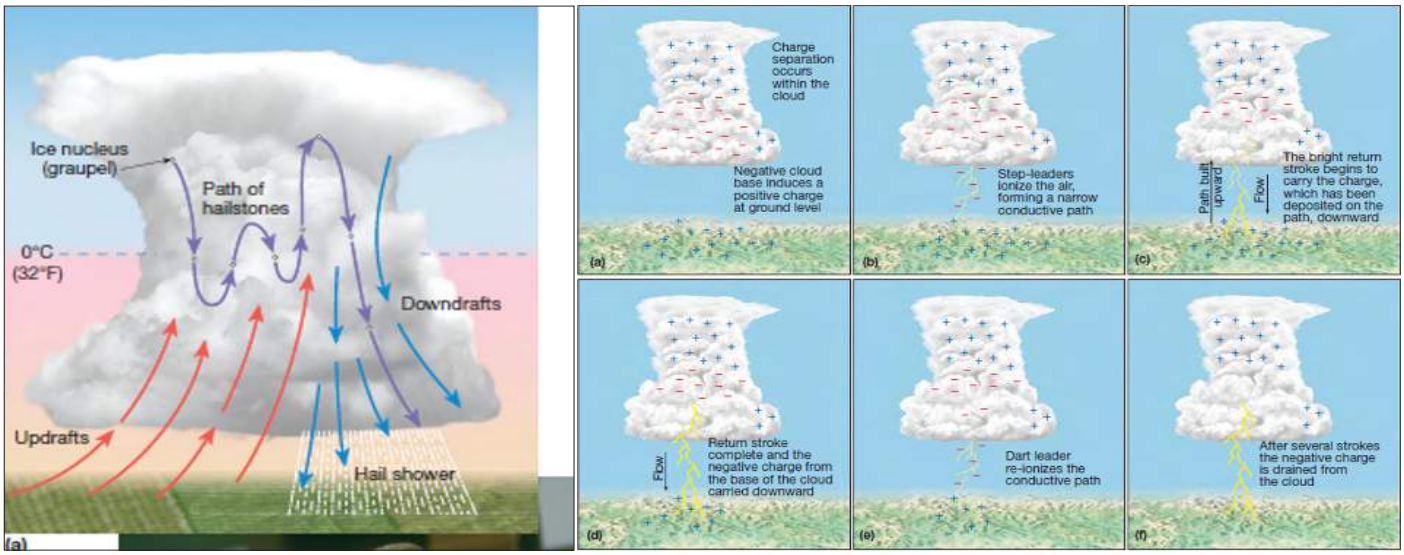
Permanent Jet Streams







Hail



PRACTICE QUESTIONS

Q 1. What causes wind to deflect toward left in the Southern hemisphere?

(a). Temperature

(b). Magnetic field

(c). Rotation of the earth.

(d). Pressure

Q 2. Consider the following Statements:

1. Wind patterns are clockwise in the northern hemisphere and anti-clockwise in the southern hemisphere.
2. The directions of wind patterns in the northern and the southern hemisphere are governed by the Coriolis effect.

Which of the statements given above is/are correct?

(a). 1 only

(b). 2 only

(c). Both 1 and 2

(d). Neither 1 nor 2