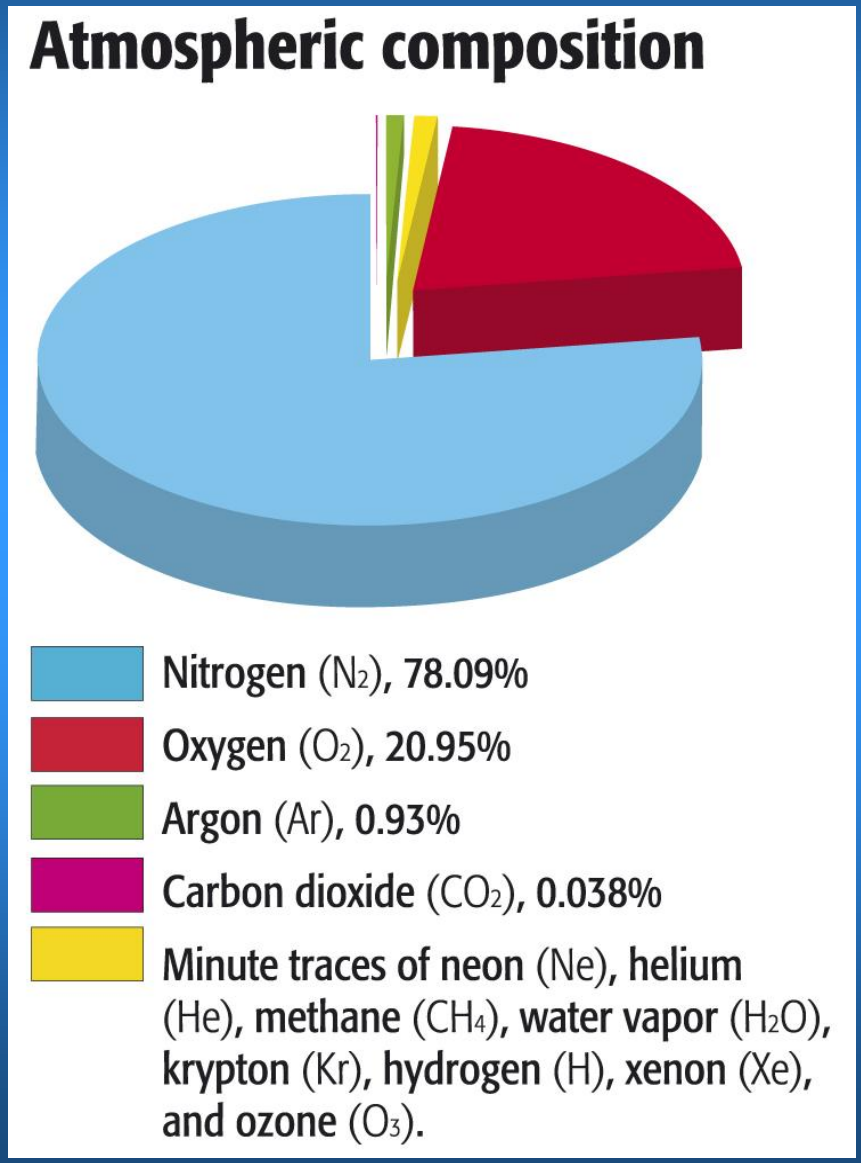
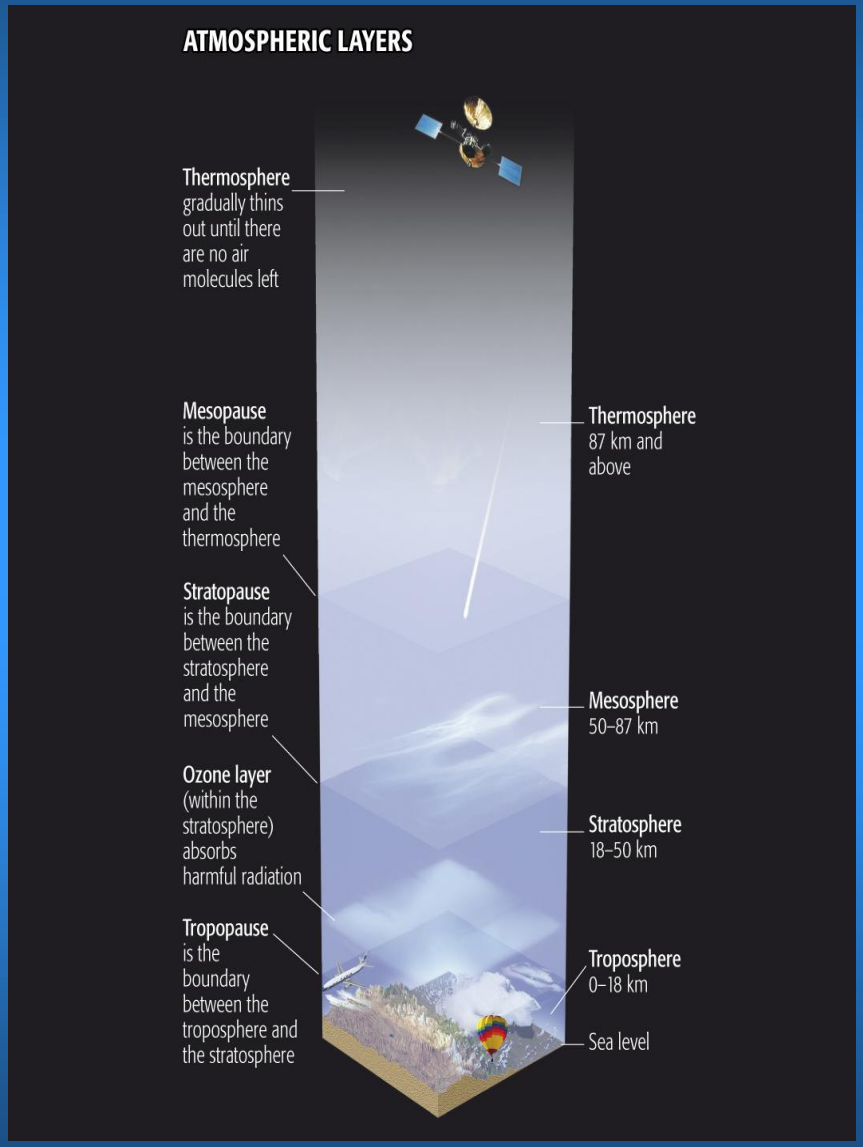
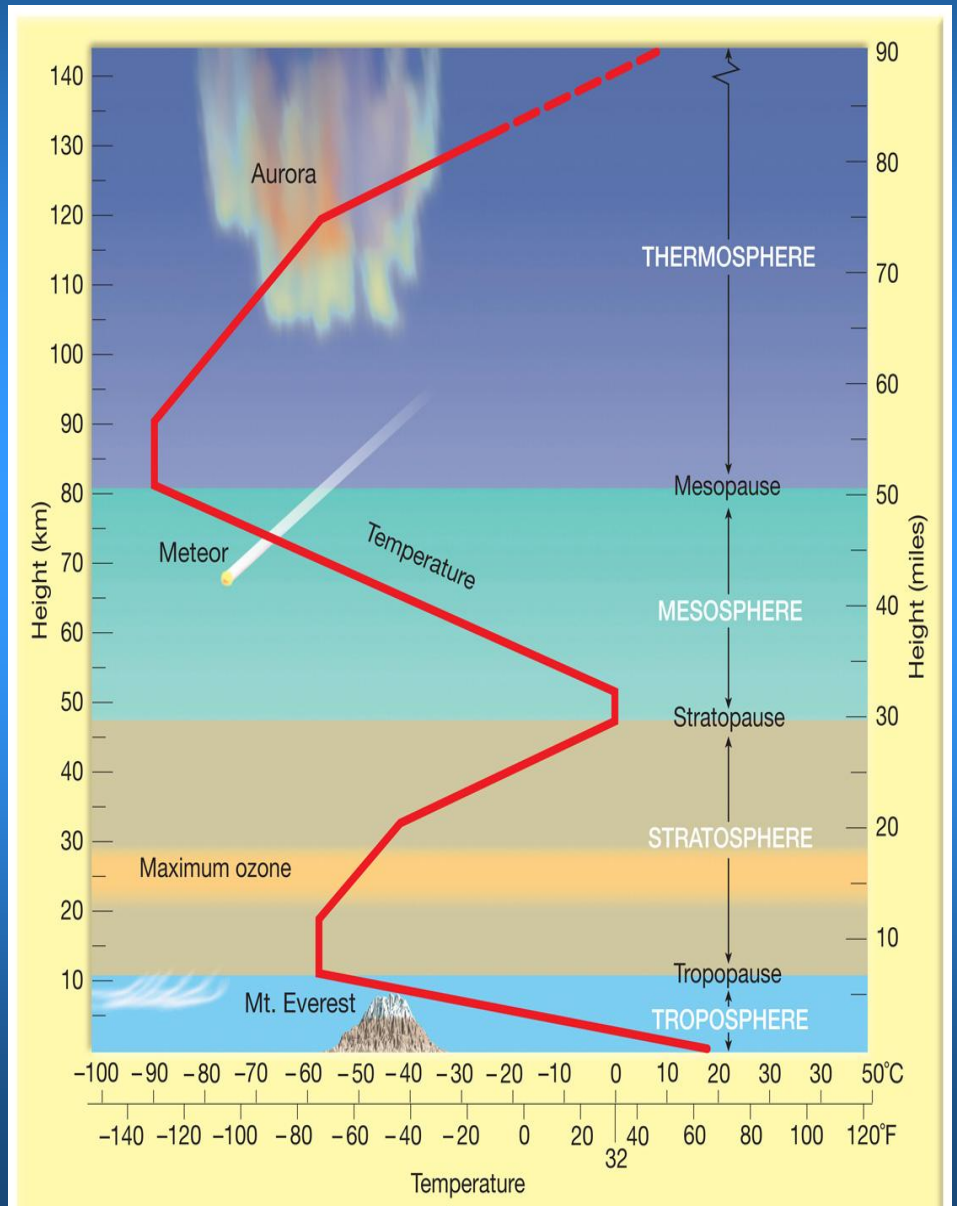
Climate and Atmosphere

Composition of atmosphere



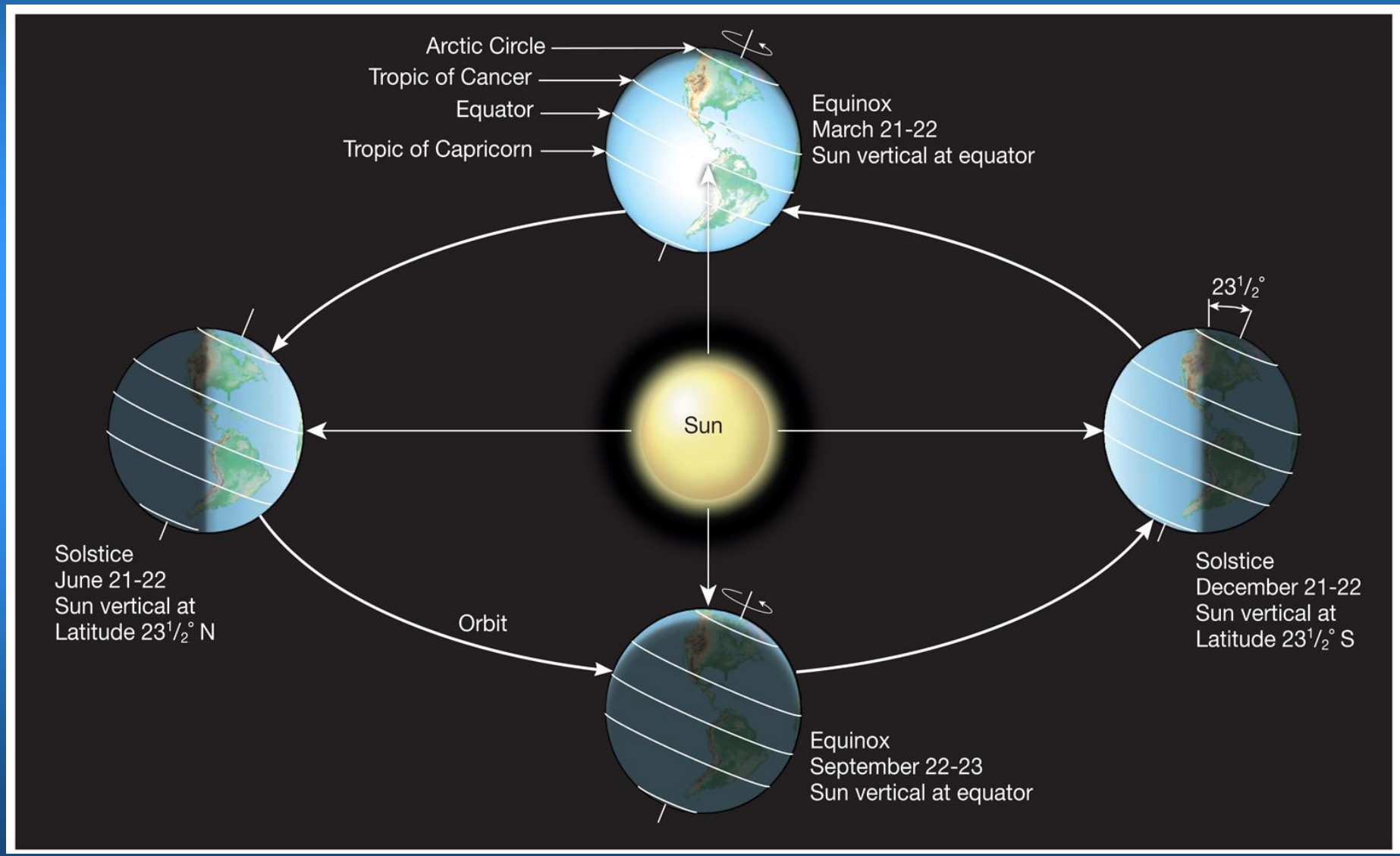
Vertical structure of atmosphere

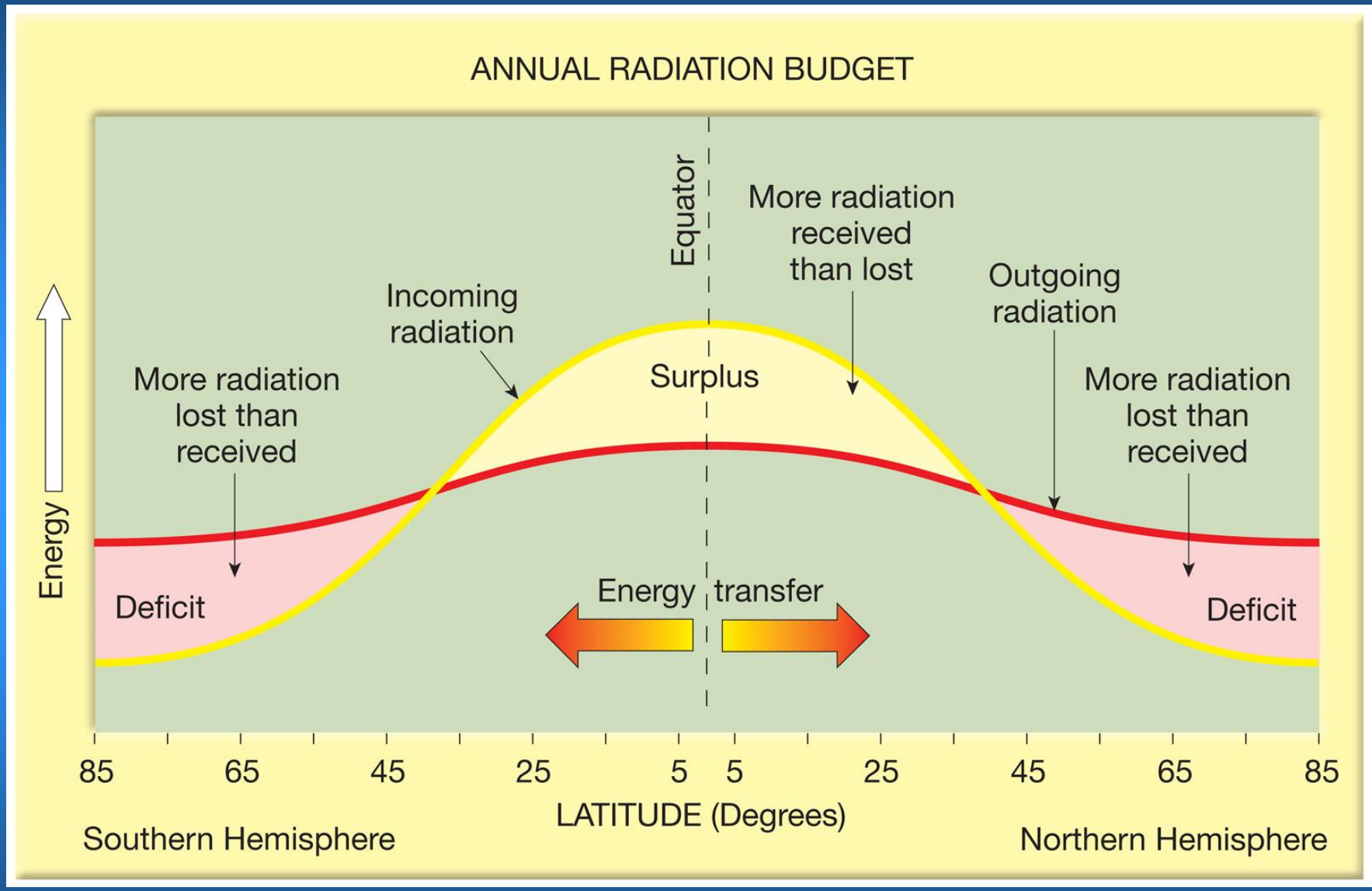




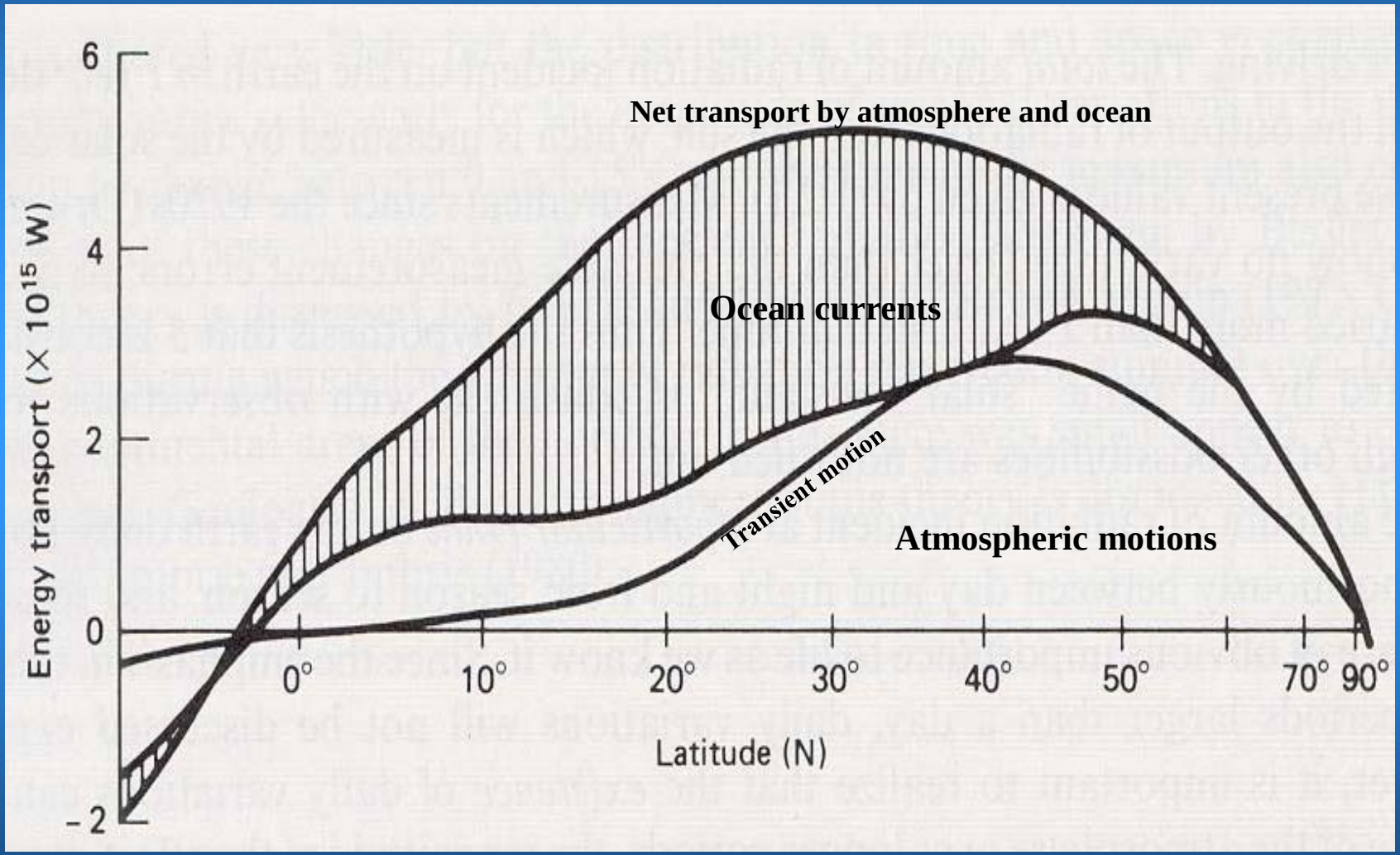
What drives atmospheric motions?

Earth-Sun relationship



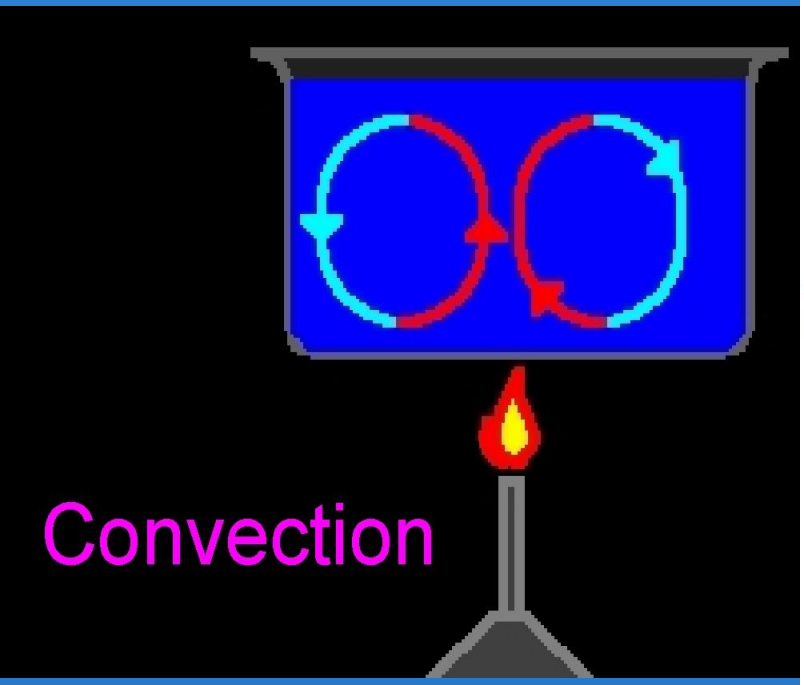

ANNUAL RADIATION BUDGET
Equator
More radiation received than lost
Outgoing radiation
Incoming radiation
Surplus
More radiation lost than received
More radiation lost than received
Energy
Deficit
Energy transfer
Deficit
85
65
45
25
5
5
25
45
65
85
LATITUDE (Degrees)
Southern Hemisphere
Northern Hemisphere

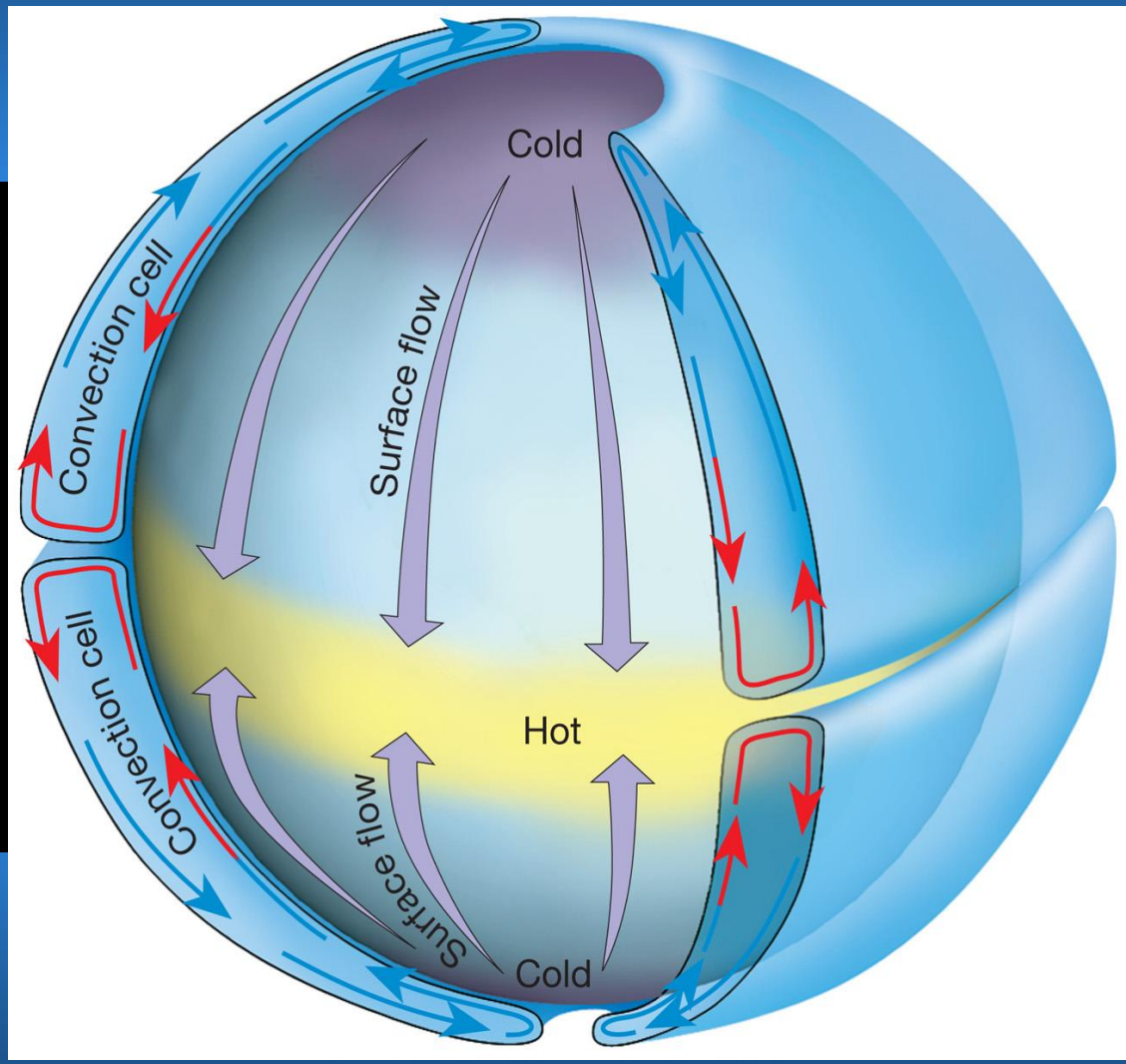
Transport by atmospheric motion and ocean currents



Global circulation

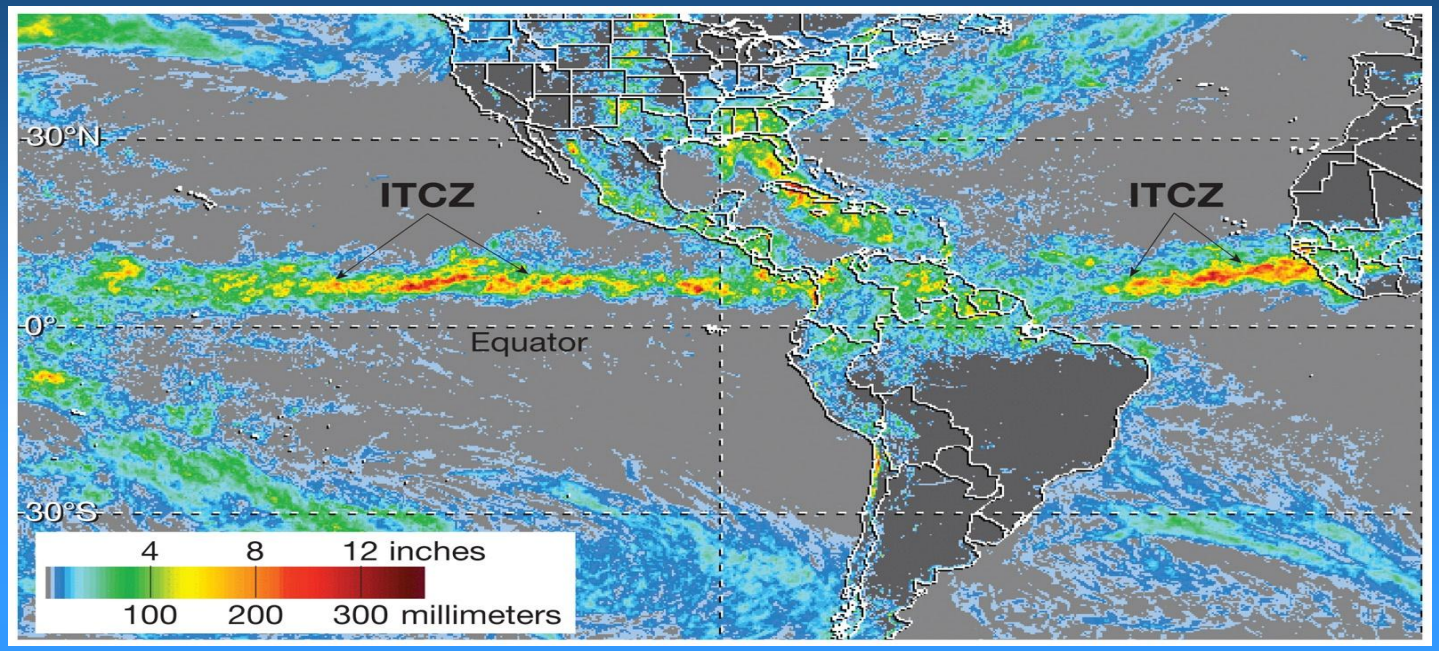
Single-cell Model

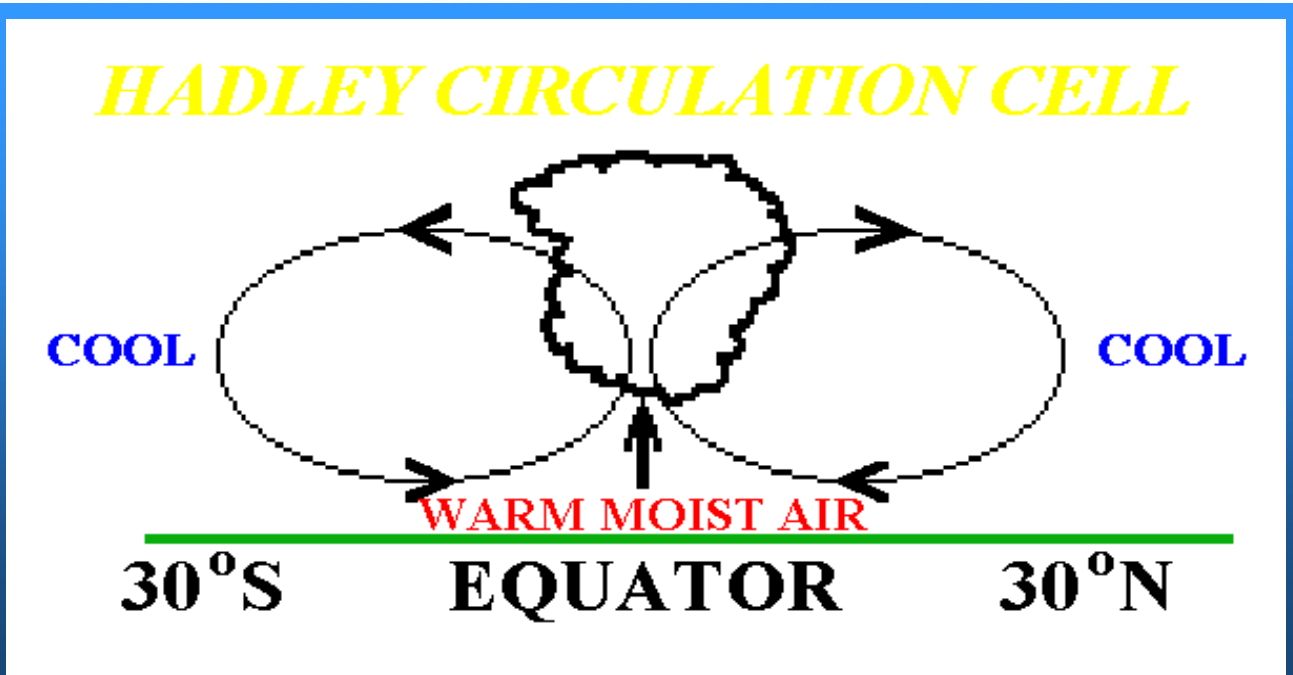




Thermally driven circulation (direct circulation)

ITCZ: Intertropical Convergence Zone





Coriolis Effect

North to South

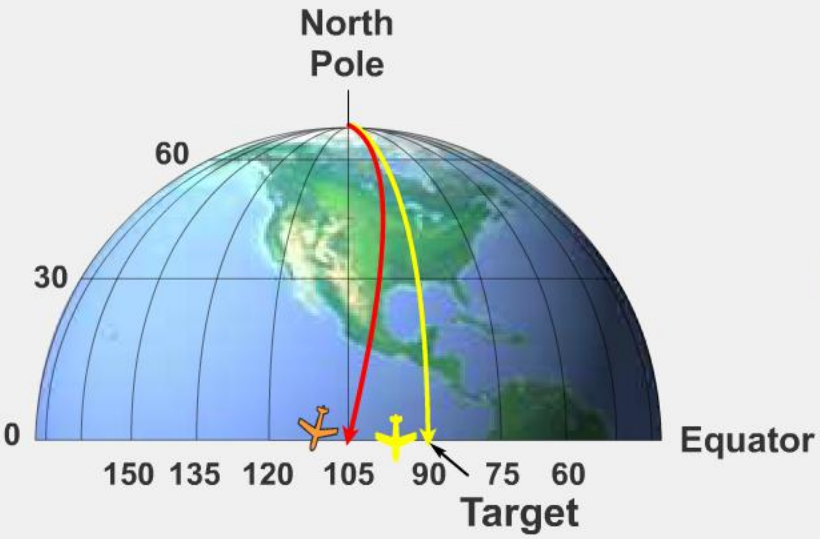
On a nonrotating earth, the plane would travel straight to its target.

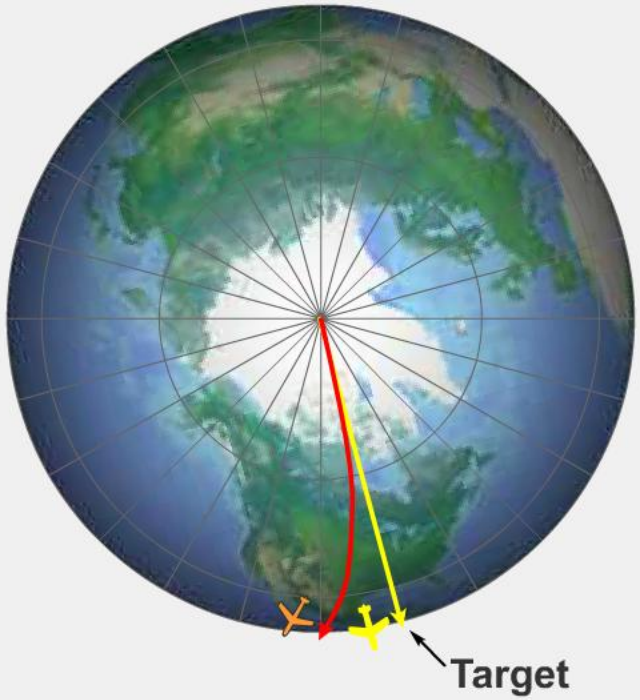
The Coriolis effect illustrated using the flight of a plane travelling from the North Pole to a location on the Equator.

West to East

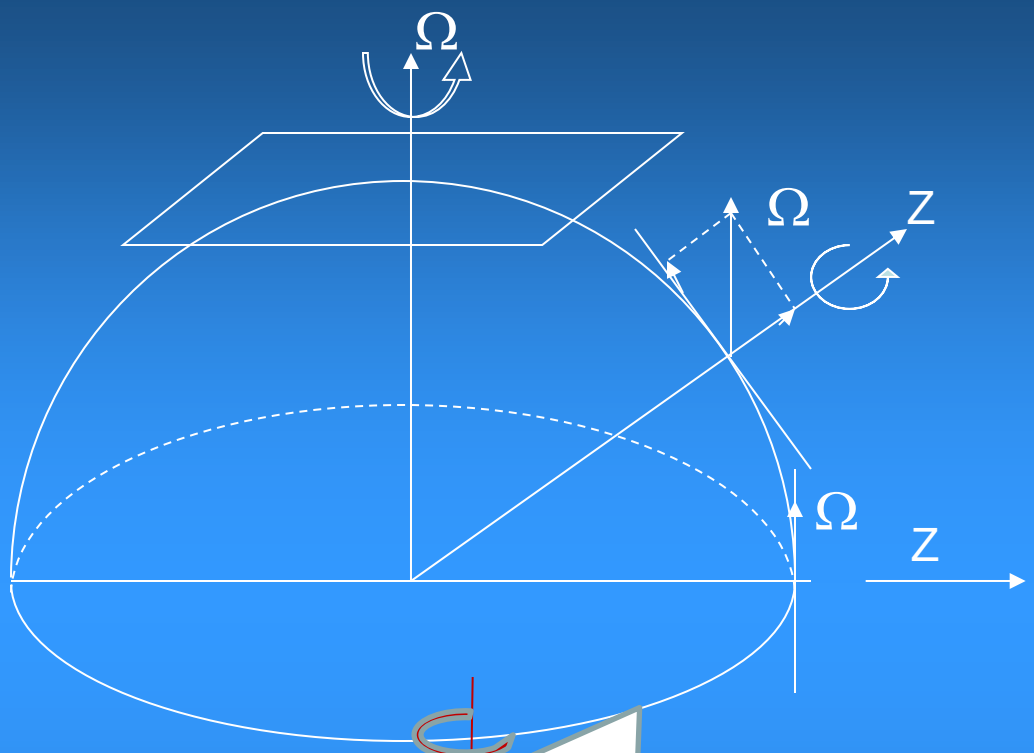
On a nonrotating earth, the plane would travel straight to its target.

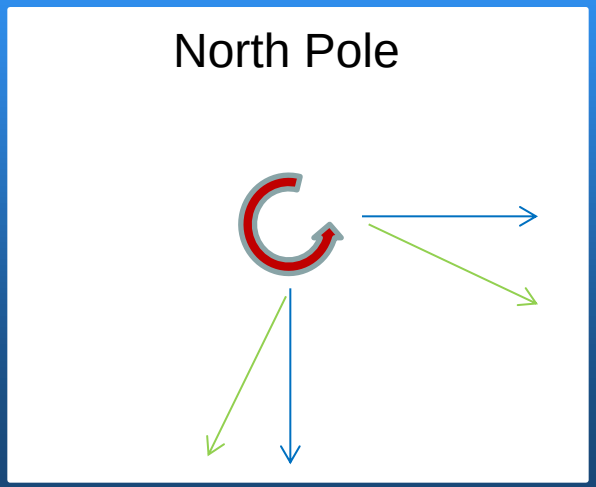
The Coriolis effect illustrated using the flight of a plane travelling from San Francisco to New York.

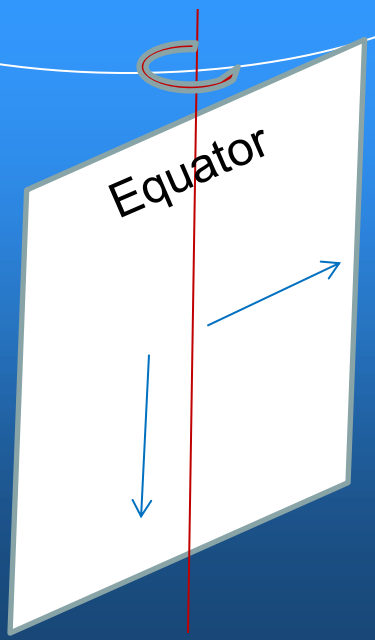


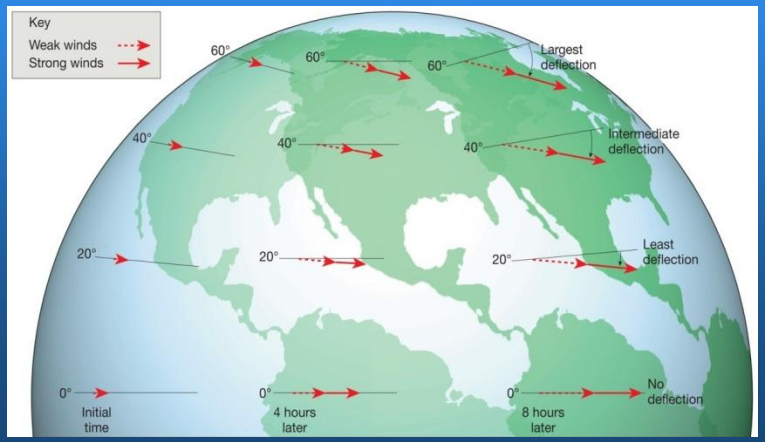


Coriolis Deflection Depends on Latitude







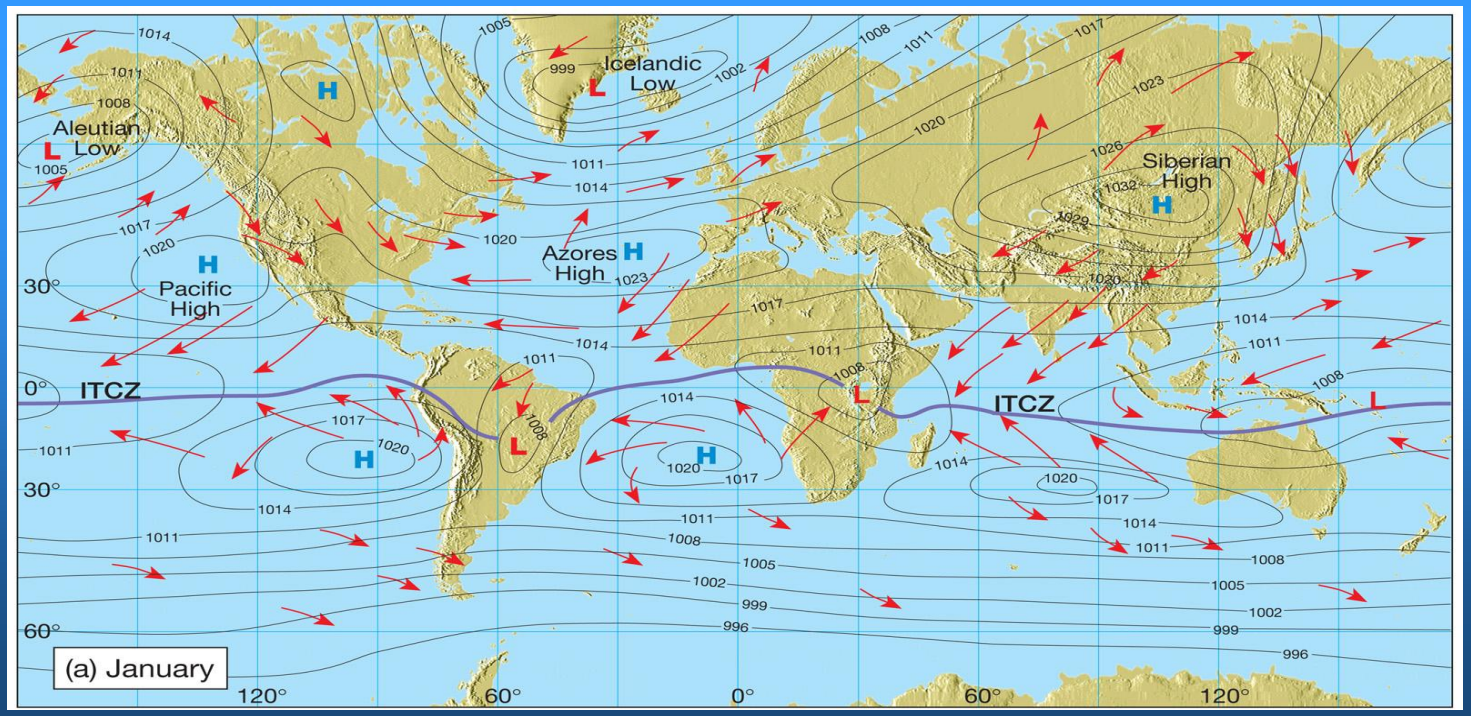


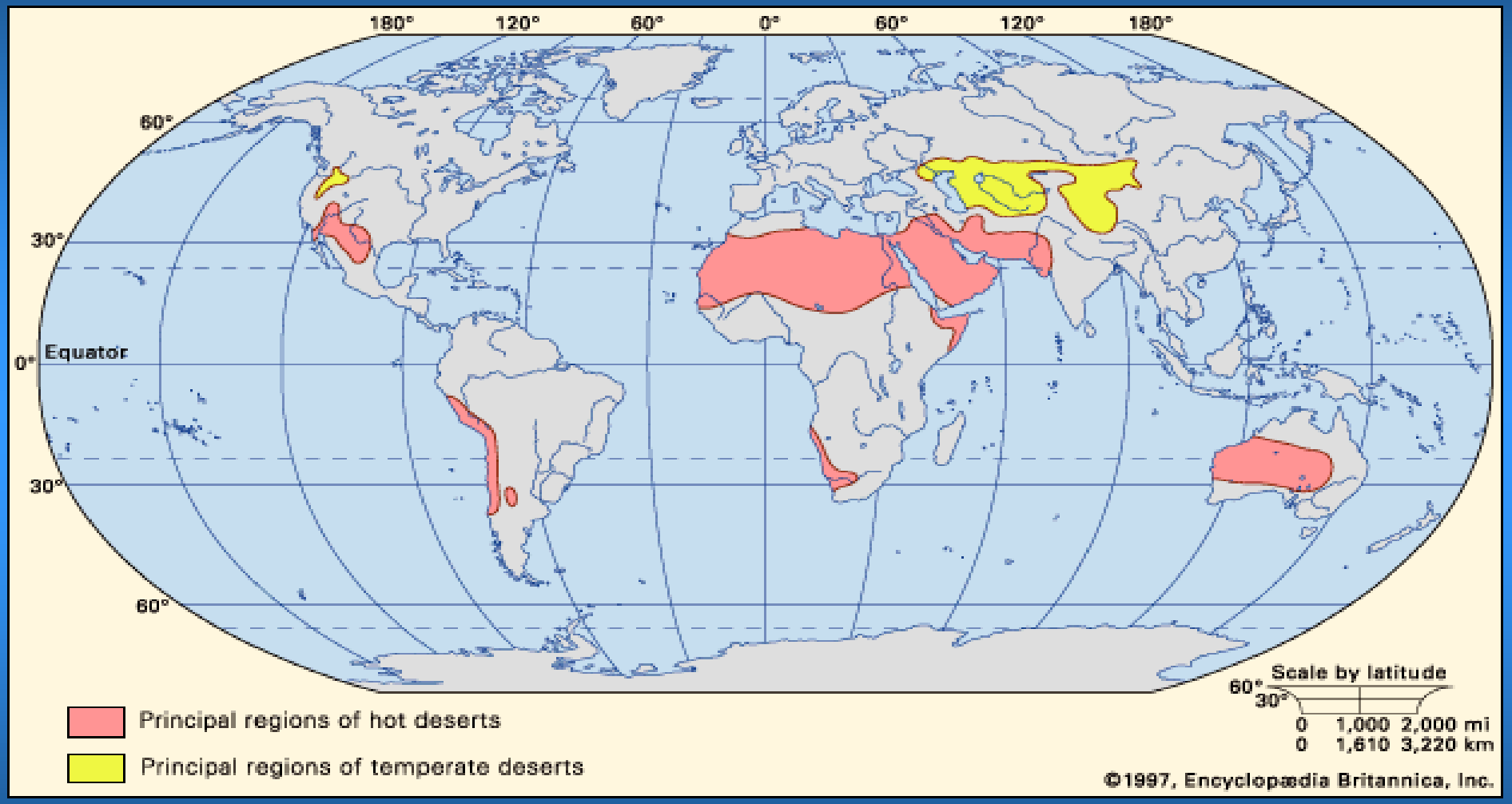
General circulations of the atmosphere

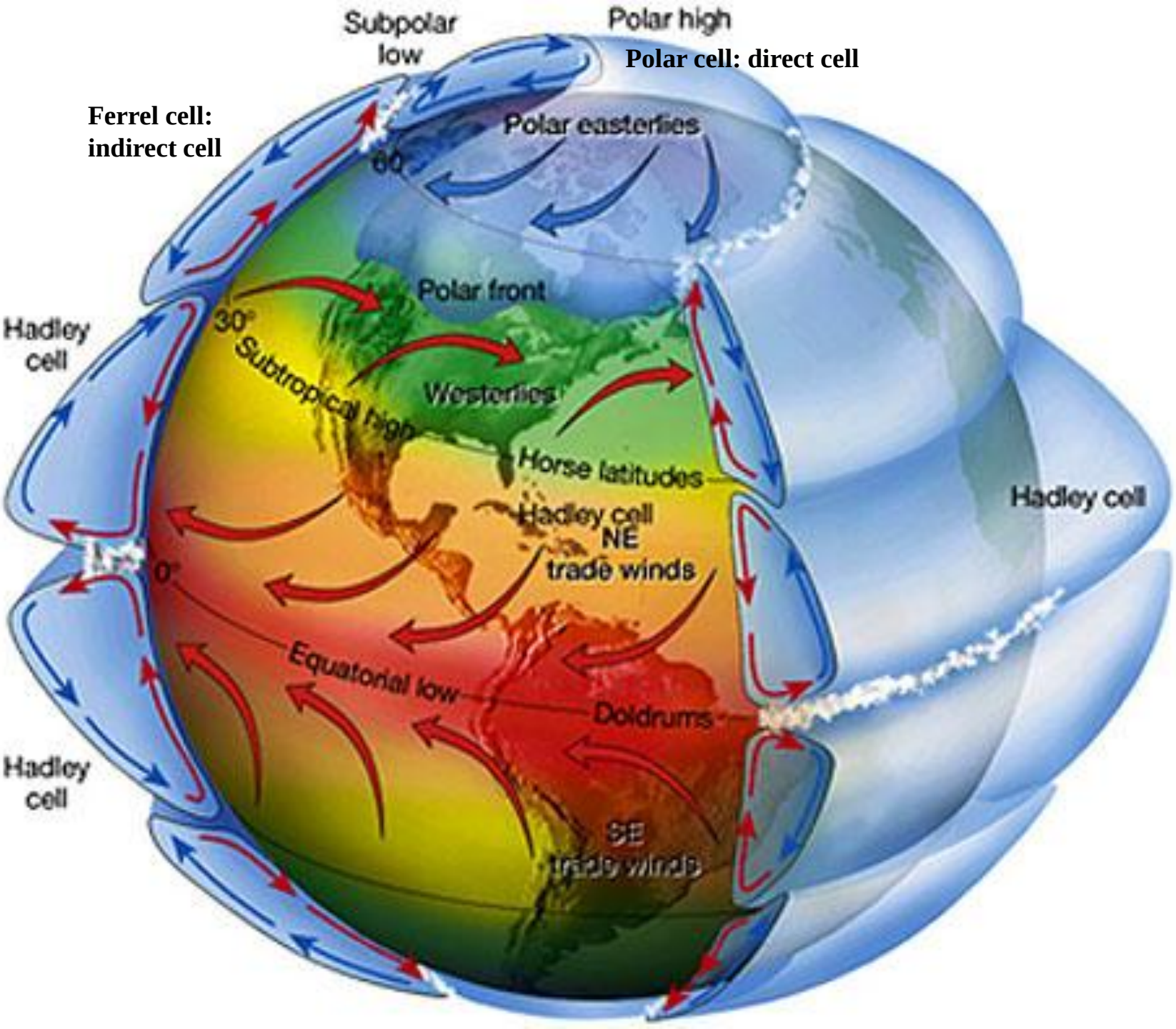
North

30 degree

ITCZ




180°
120°
60°
0°
60°
120°
180°
60°
30°
0°
Equator
30°
60°
Principal regions of hot deserts
Principal regions of temperate deserts
Scale by latitude
60°
30°
0 1,000 2,000 mi
0 1,610 3,220 km
©1997, Encyclopædia Britannica, Inc.


Subpolar low
Polar high
Polar cell: direct cell
Ferrel cell: indirect cell
Polar easterlies
60°
Polar front
30°
Subtropical high
Westerlies
Hadley cell
Horse latitudes
Hadley cell
NE trade winds
0°
Equatorial low
Doldrums
Hadley cell
Hadley cell
SE trade winds

License Credits

Clear all animations

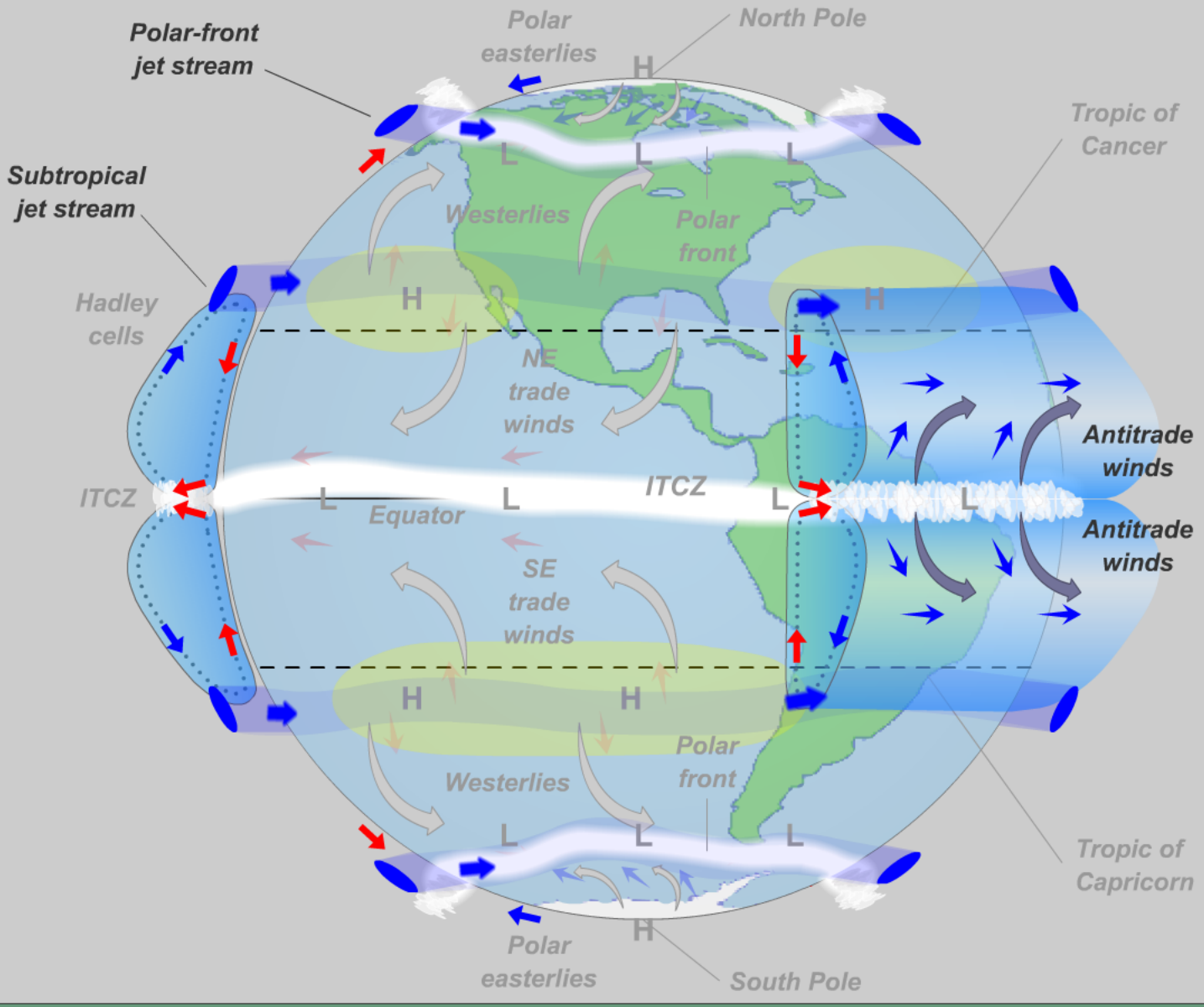
Idealized Hadley Cell Circulation

Develop Tropical and Midlatitude Components

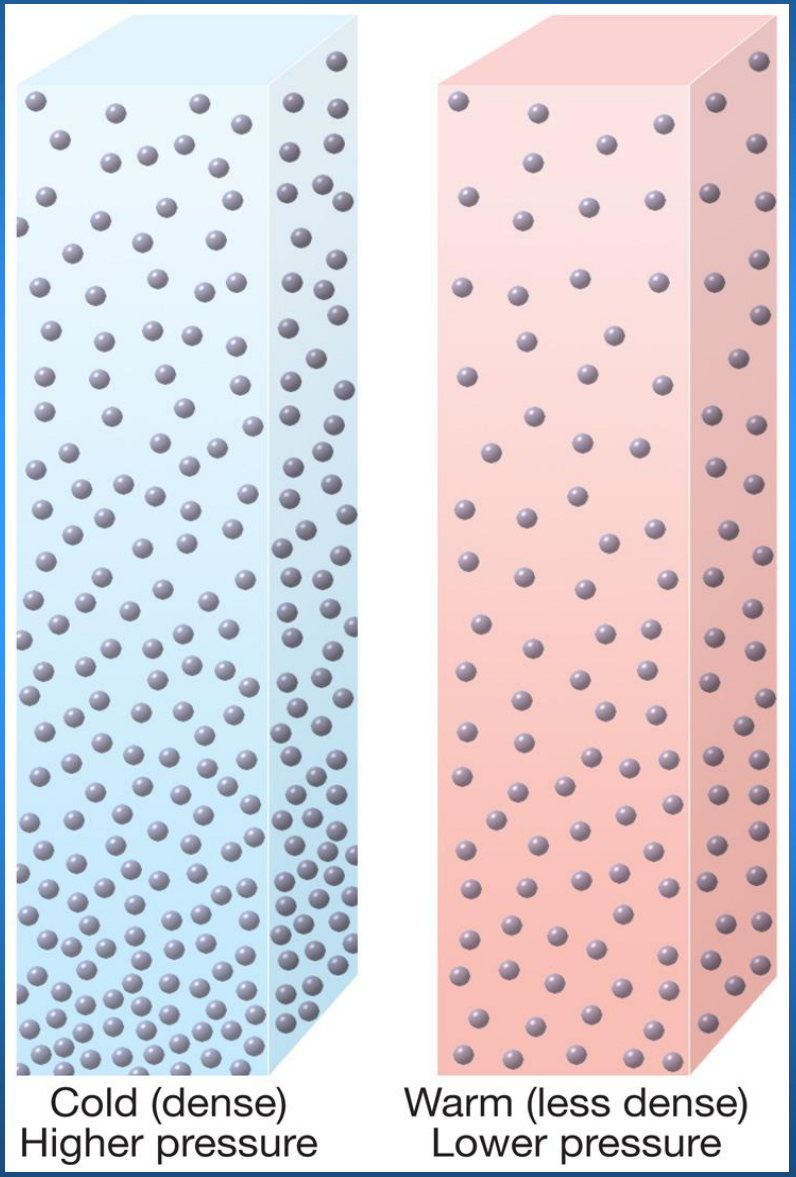
Develop High Latitude Components

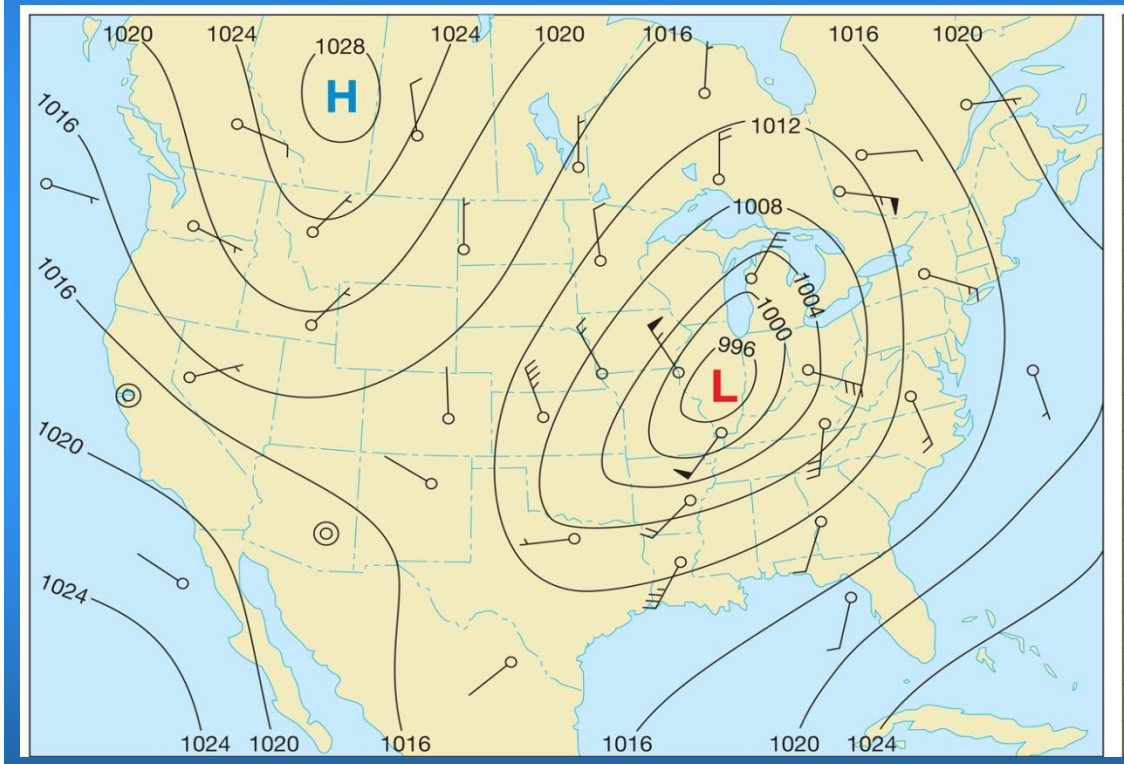
Develop Upper Atmosphere Flow

Labels Off



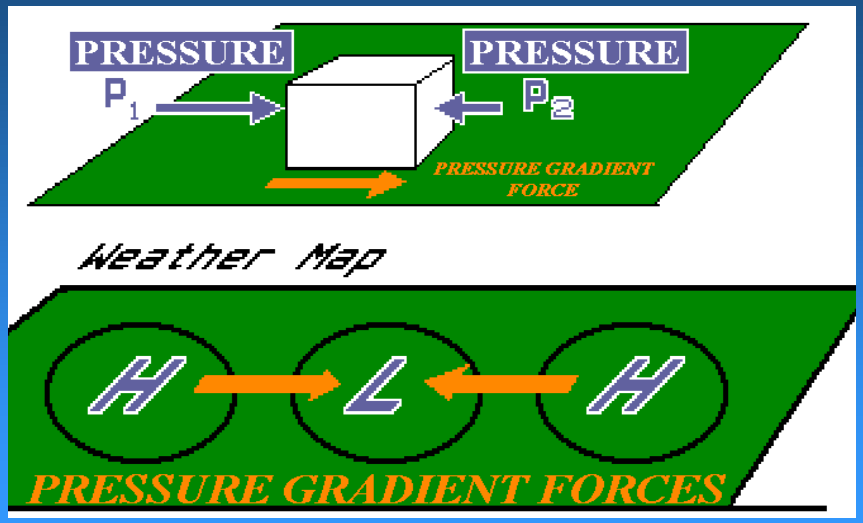
Atmospheric Pressure

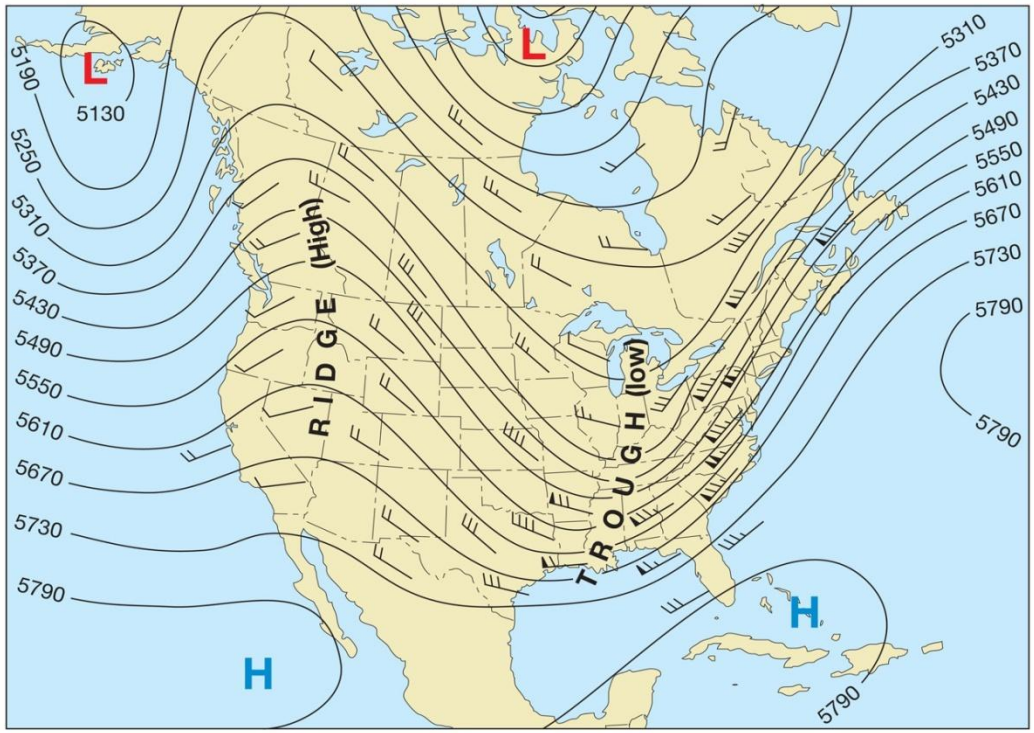




Force and Winds

Horizontal pressure gradient force



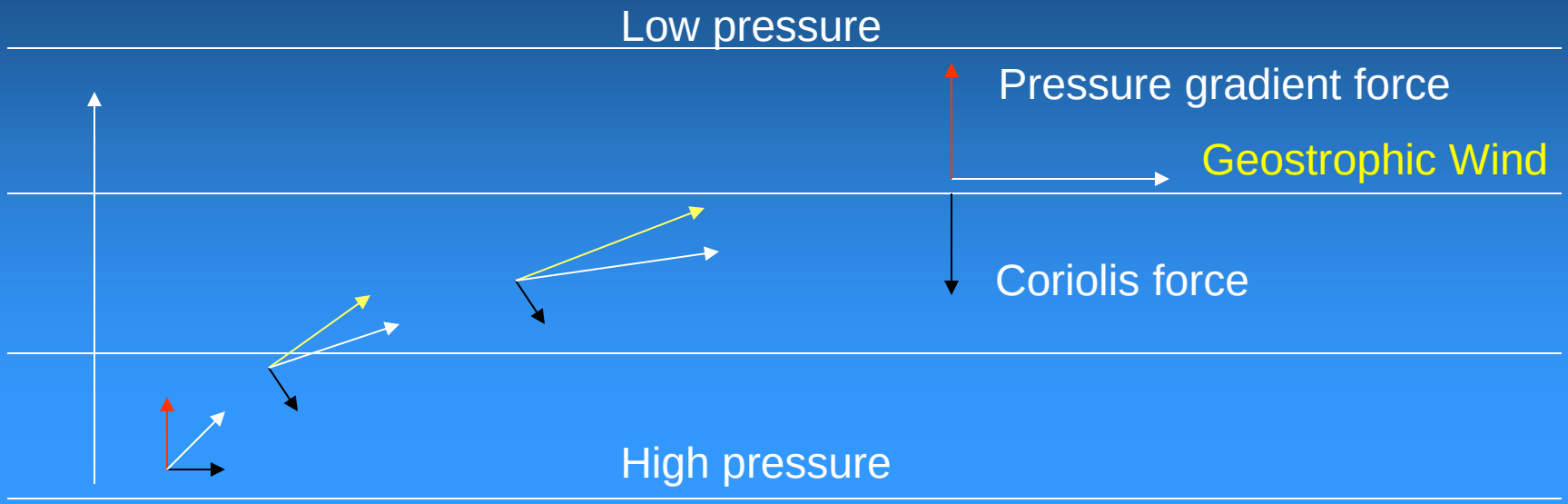


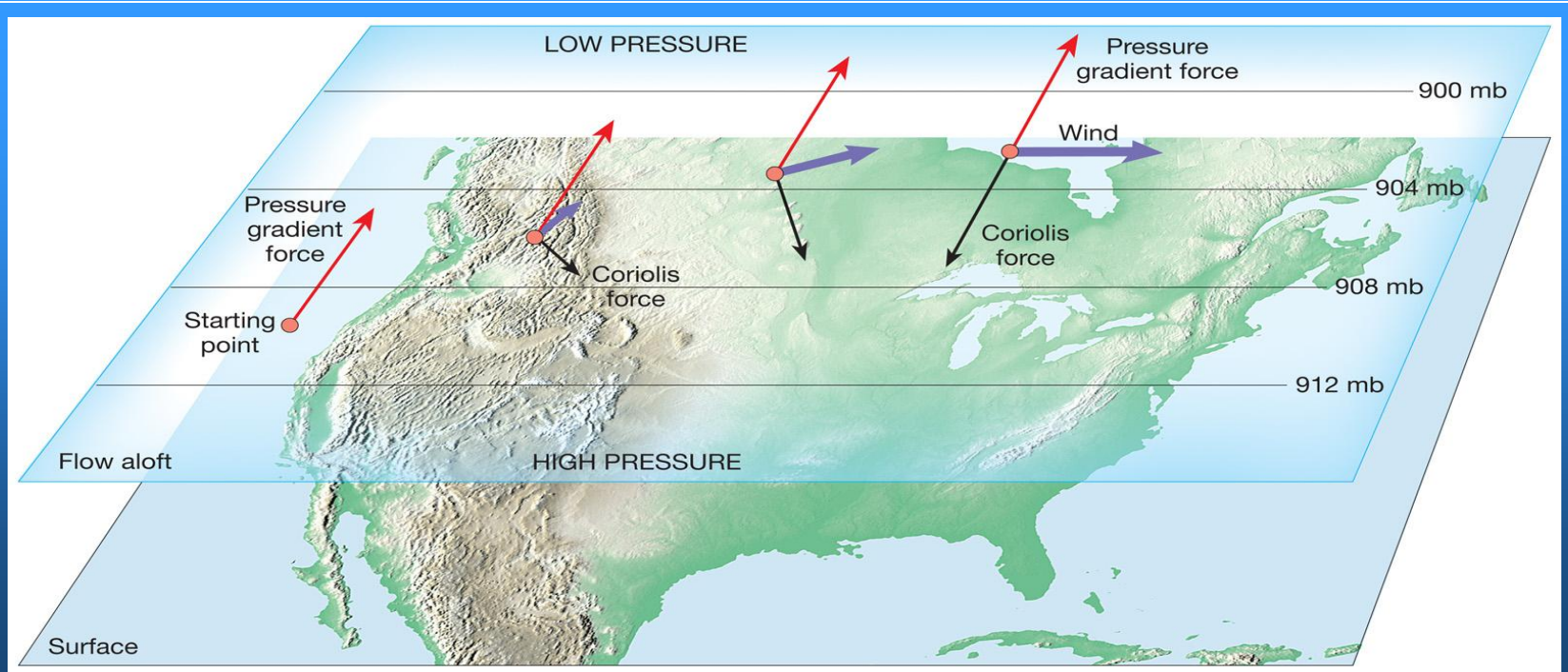
(a) Upper-level weather chart

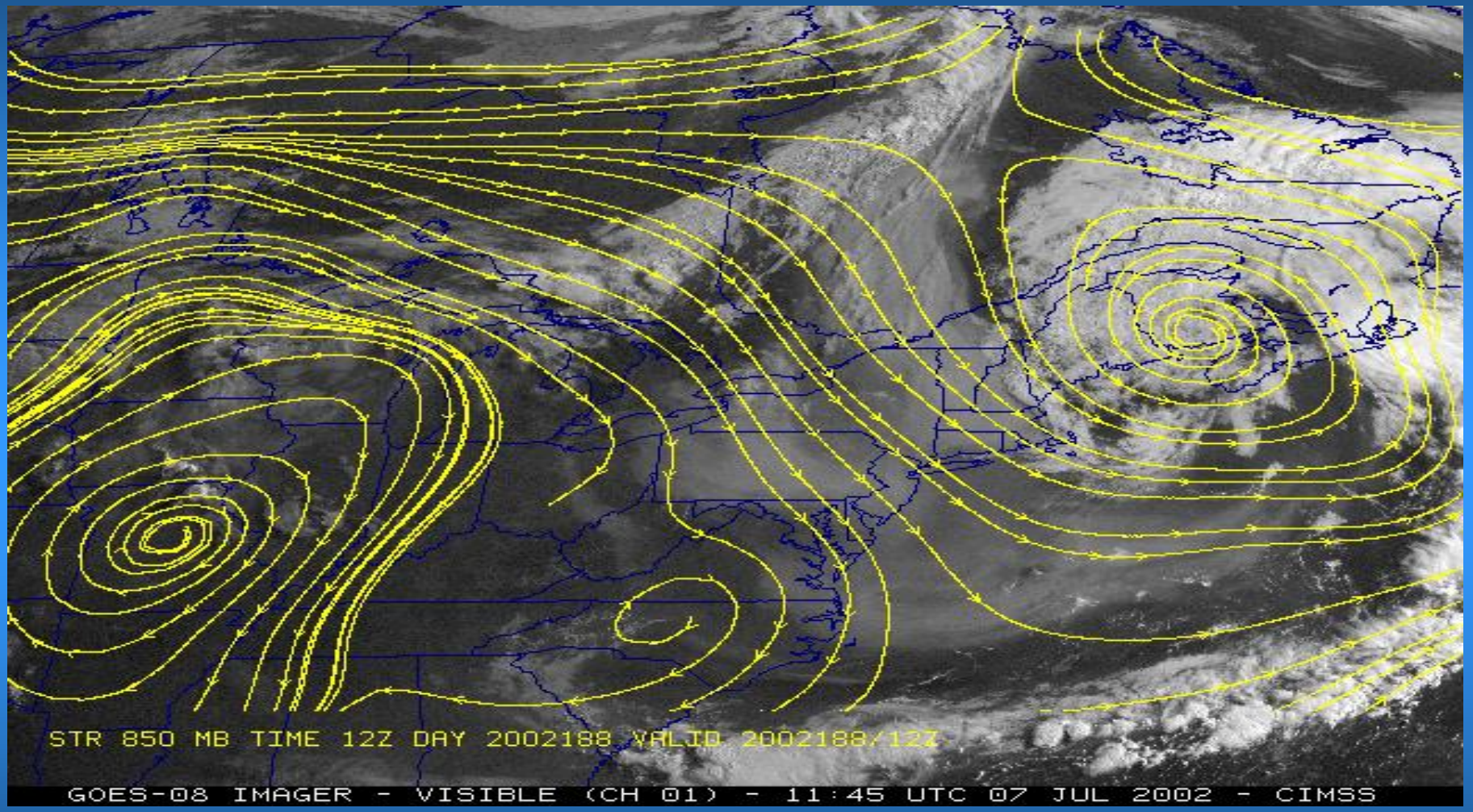
ff	Miles per hour
◎	Calm
	1–2
	3–8
	9–14
	15–20
	21–25
	26–31
	32–37
	38–43
	44–49
	50–54
	55–60
	61–66
	67–71
	72–77
	78–83
	84–89
	119–123

Winds should blow from high to low pressure. But they are not. Why?

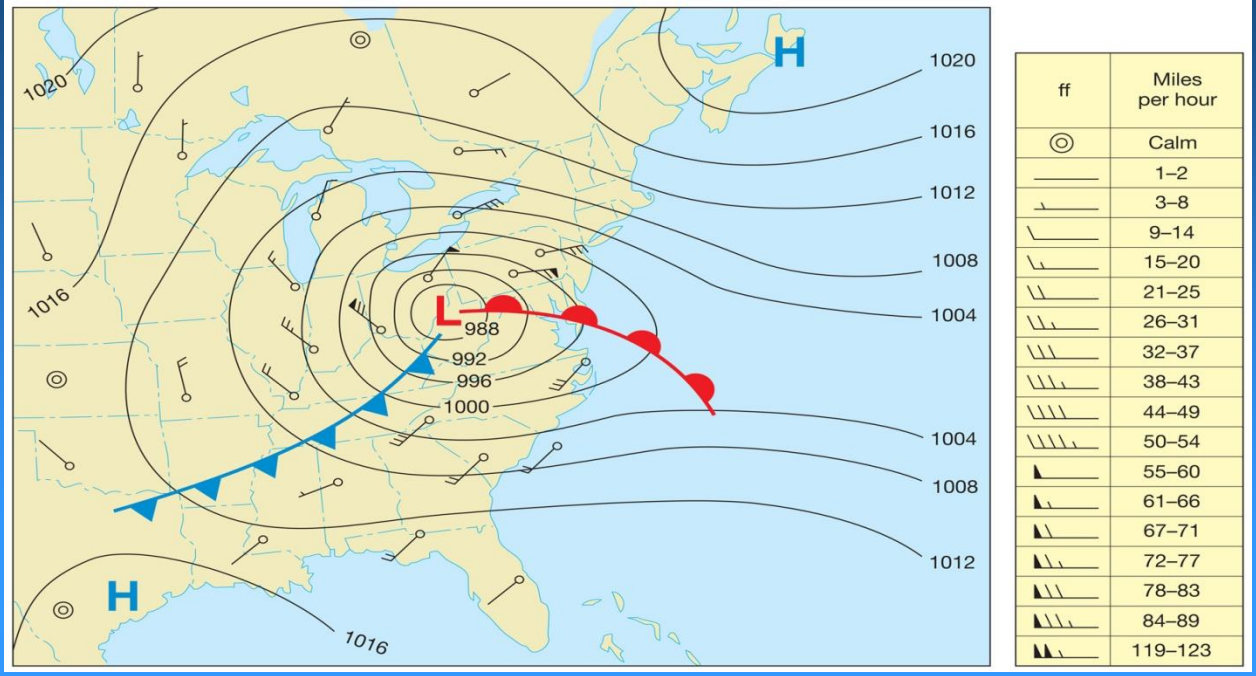
Geostrophic Balance

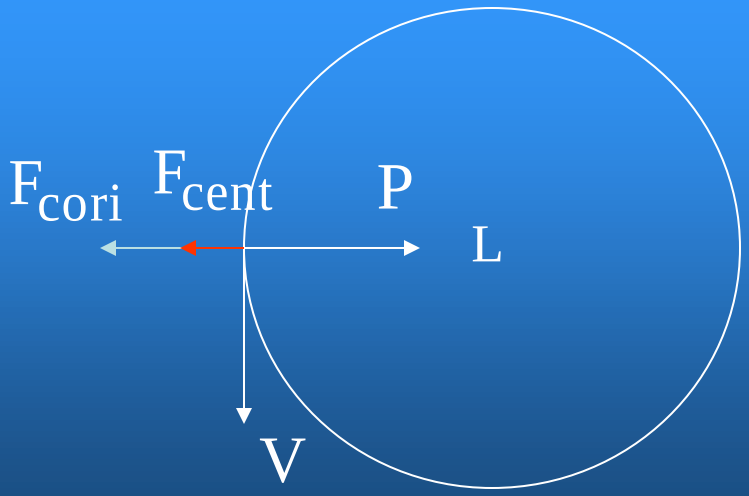




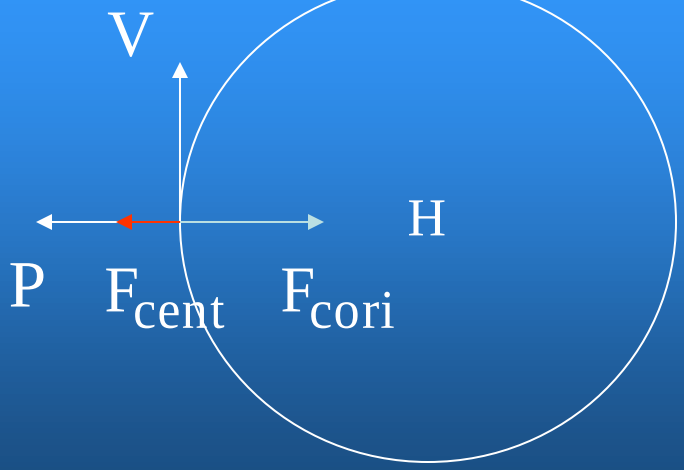

STR 850 MB TIME 12Z DAY 2002188 VALID 2002188/12Z
GOES-08 IMAGER - VISIBLE (CH 01) - 11:45 UTC 07 JUL 2002 - CIMSS

Curved flow and Gradient Wind



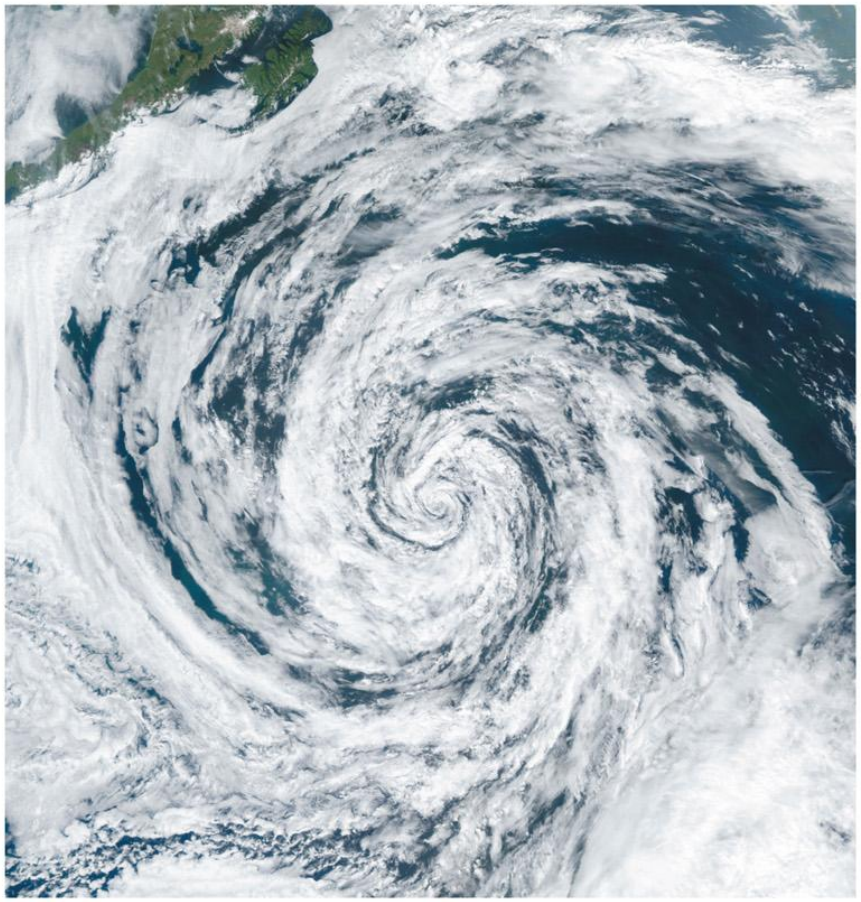


Anti-clockwise (cyclonic)

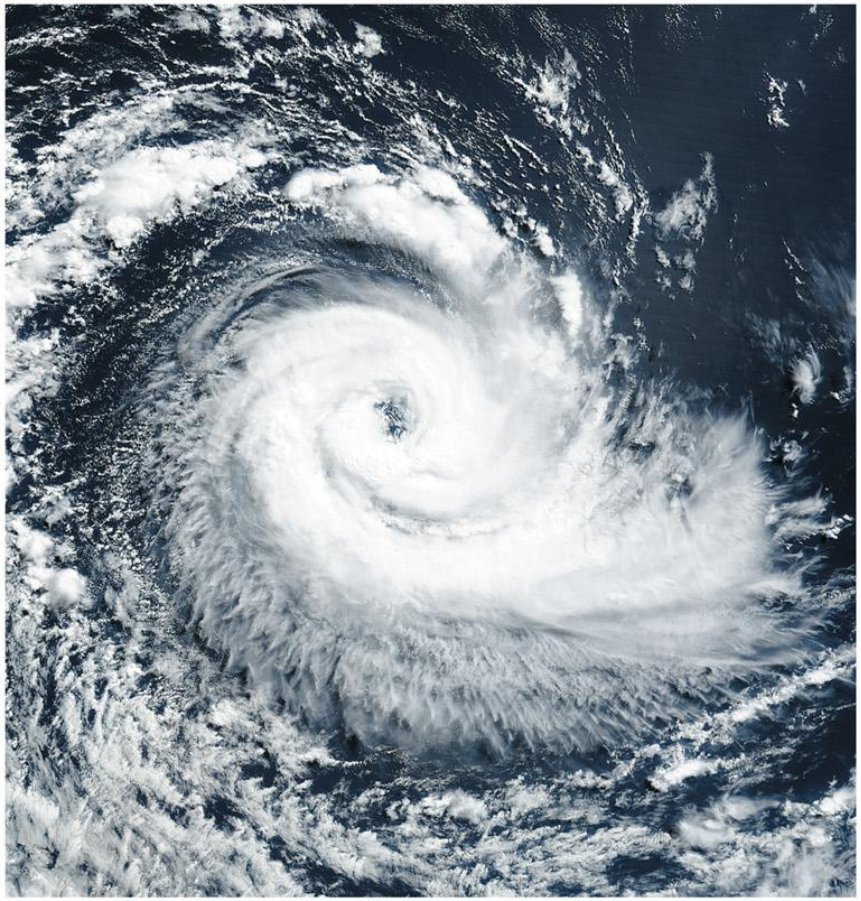


Clockwise (anti-cyclonic)

Hurricane



(a)

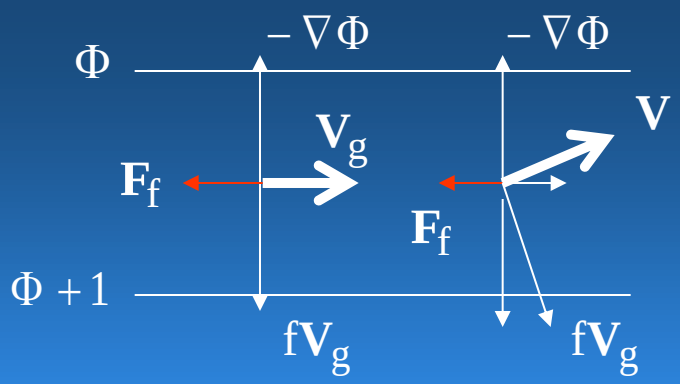


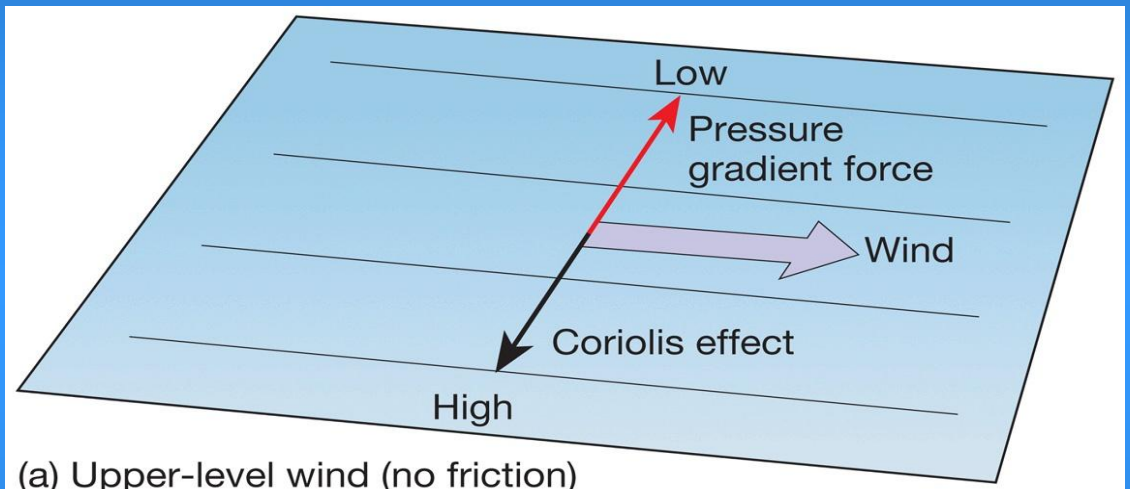
(b)

Northern hemisphere

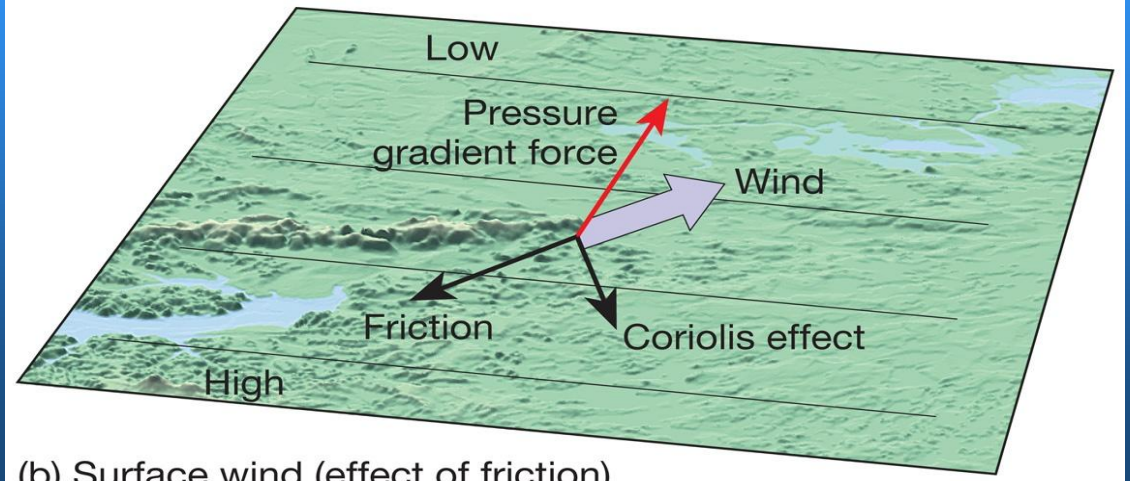
Southern hemisphere

Frictional force





(a) Upper-level wind (no friction)



(b) Surface wind (effect of friction)

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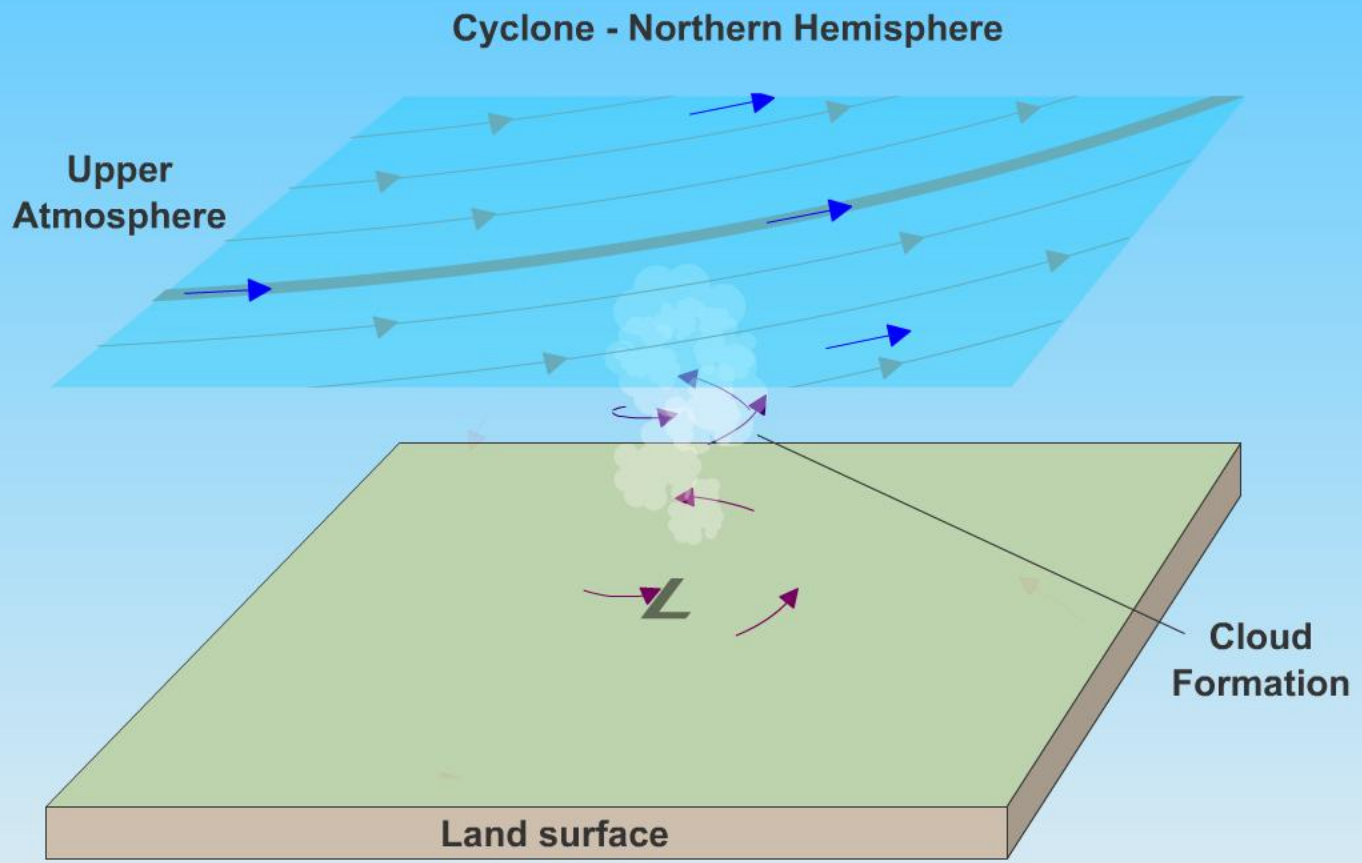

Cyclone Anticyclone Labels Off

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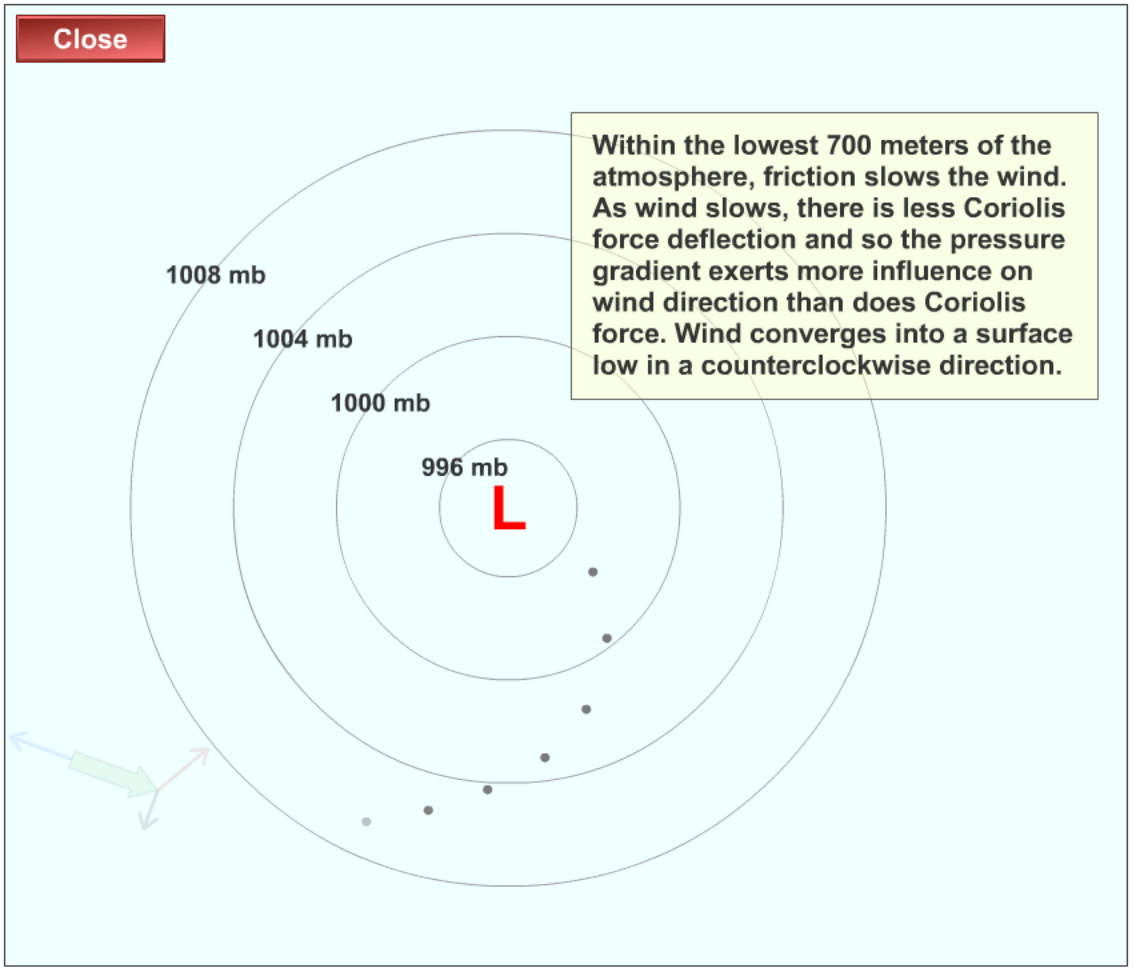
Map of Low Pressure Cell in Northern Hemisphere

Click below to see wind patterns

- Pressure Gradient Only (Hypothetical)
- Upper Atmosphere Wind Pattern
- *Surface Wind Pattern*

Close



Within the lowest 700 meters of the atmosphere, friction slows the wind. As wind slows, there is less Coriolis force deflection and so the pressure gradient exerts more influence on wind direction than does Coriolis force. Wind converges into a surface low in a counterclockwise direction.

Surface Wind Pattern

Legend

- *Wind*
- *Pressure gradient force*
- *Coriolis force*
- *Friction force*

Simple Pressure Gradient | High Pressure Cell | *Low Pressure Cell*