Global Winds
AOSC 200

Tim Canty

Class Web Site: http://www.atmos.umd.edu/~tcanty/aosc200

Topics for today:

Global Wind Patterns
Deserts
Jet Stream
Monsoons
Ocean transport
Ocean cycles

Lecture 18
Oct 29 2019

https://twistedsifter.com/videos/cloudburst-over-lake-millstatt-austria/

http://www.military.com/video/aircraft/military-aircraft/strong-winds-toss-af-planes-like-toys/3652093668001/

Global Temperatures

What region of the planet is warmest?

Global Surface Temperatures: January

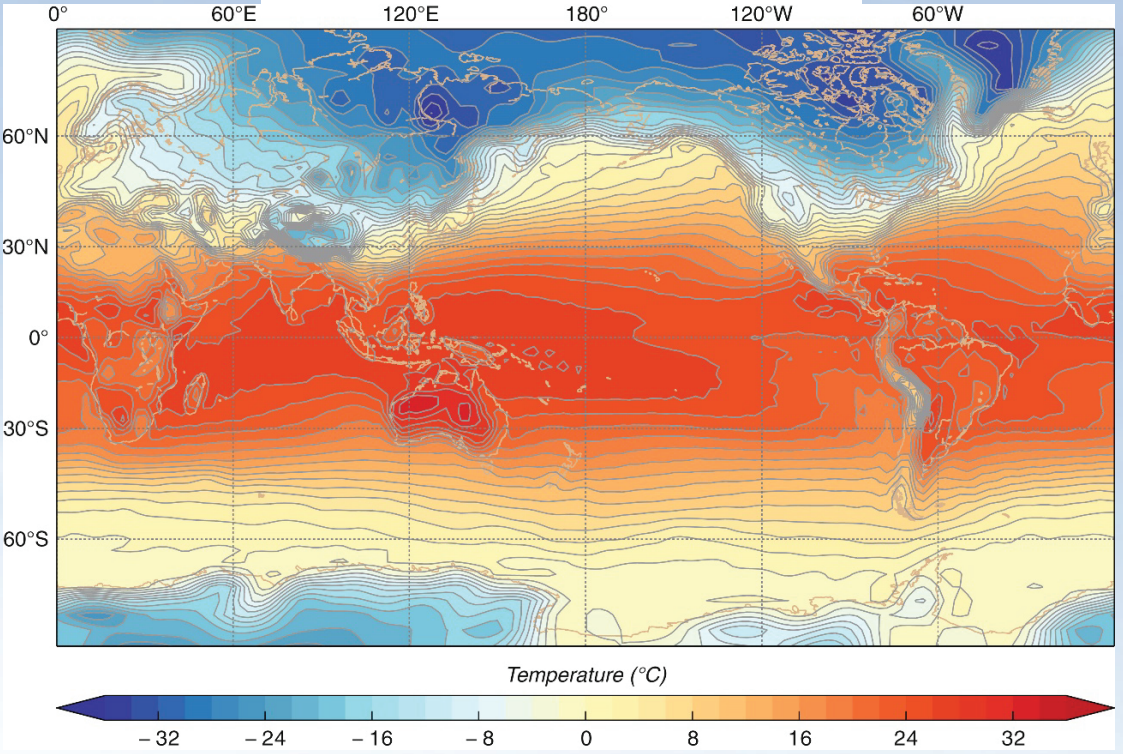


Fig 9.1a *Weather: A Concise Introduction*

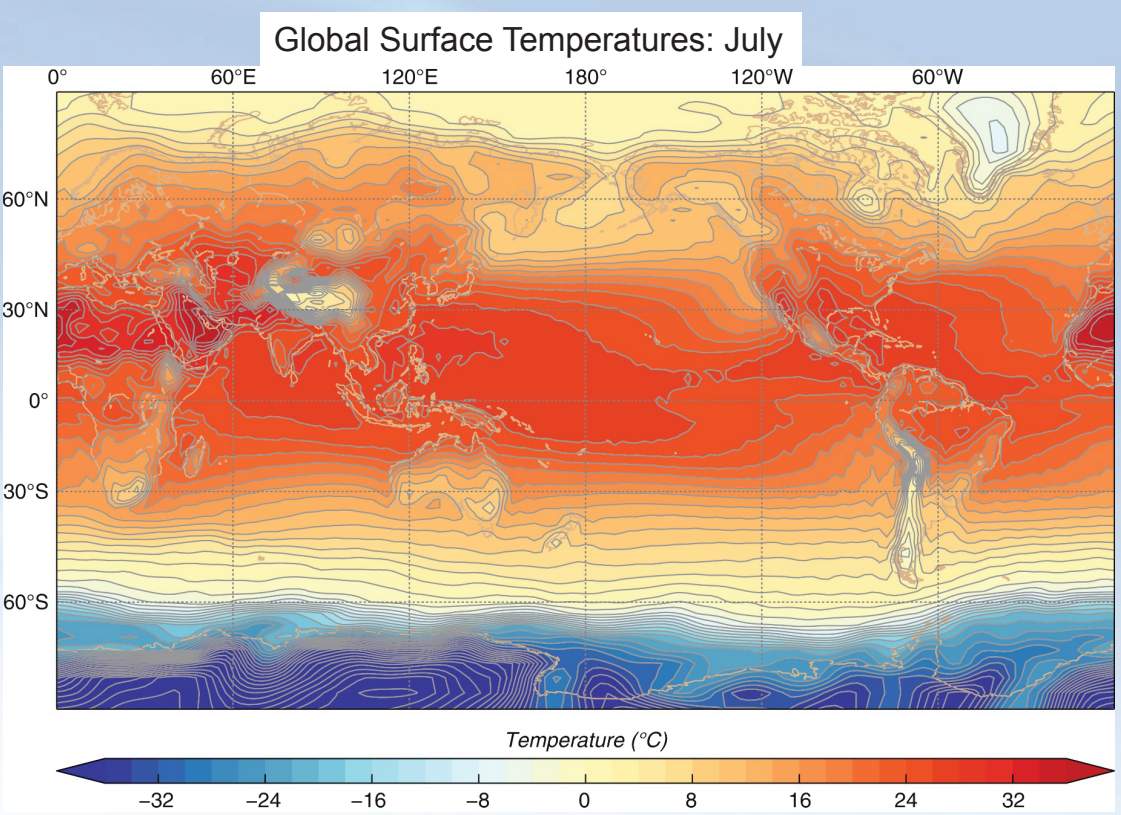
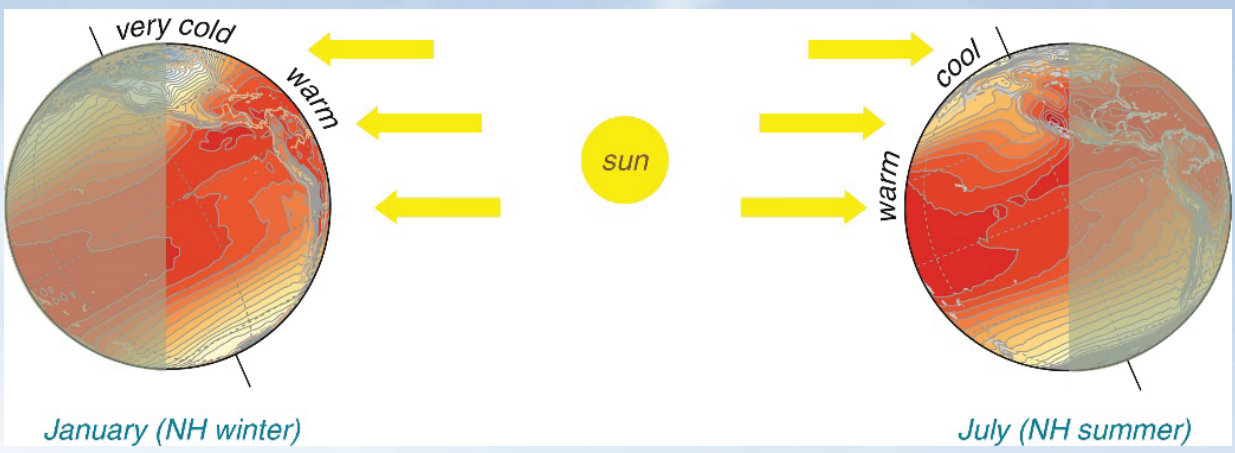


Fig 9.1b *Weather: A Concise Introduction*



The region exposed to the most sunlight shifts North and South over the course of the year.

The temperature contrast between tropics and the poles maximizes in winter.

Fig 9.2 *Weather: A Concise Introduction*

Regions of the World

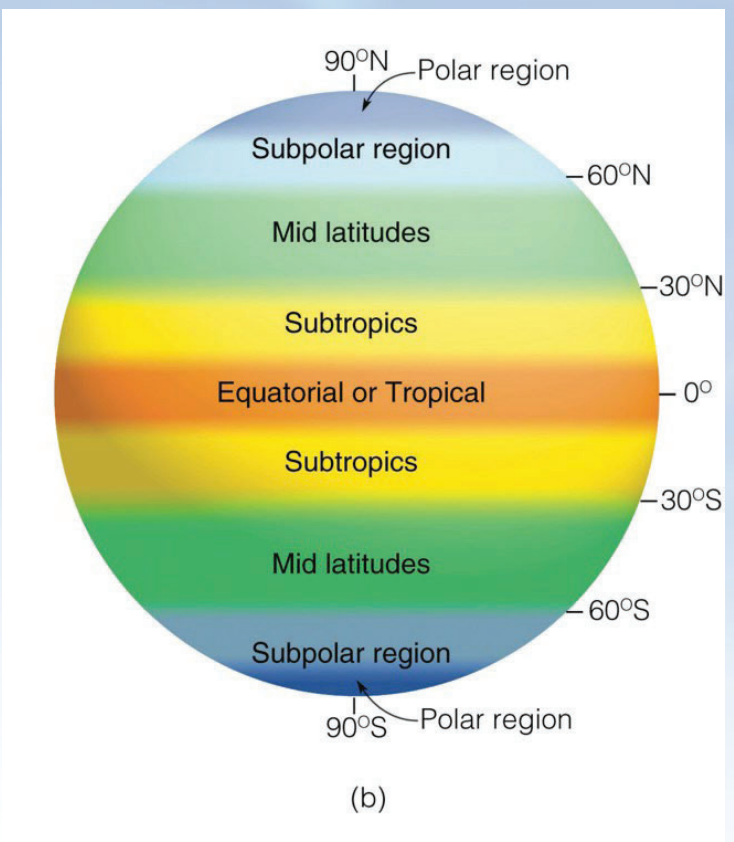
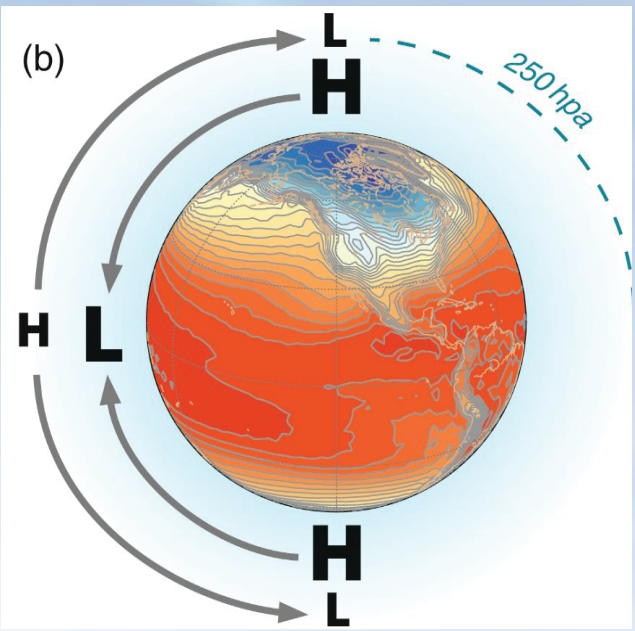


Fig 7.24: ***Essentials of Meteorology***

Thermal Wind



The air that moves poleward eventually sinks and creates high pressure at the surface

A pressure gradient at the surface completes the circuit and the surface air heads back to the equator

Fig 9.2 *Weather: A Concise Introduction*

Hadley Cell

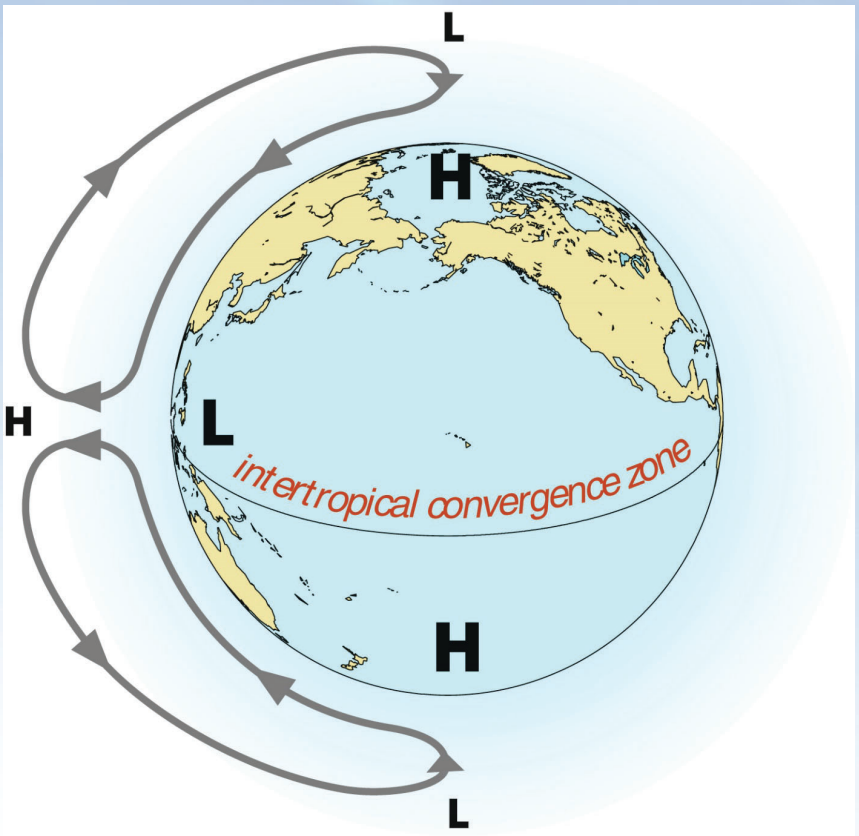


Fig 9.8 *Weather: A Concise Introduction*

Hadley Cell

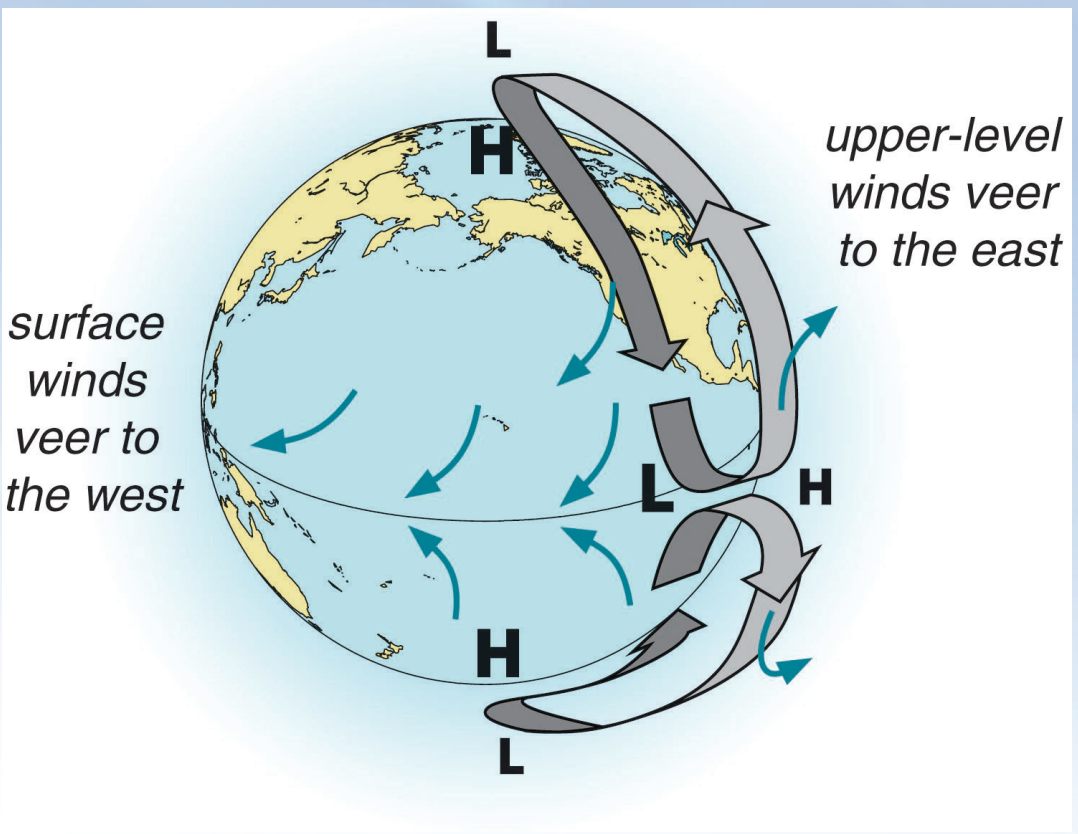
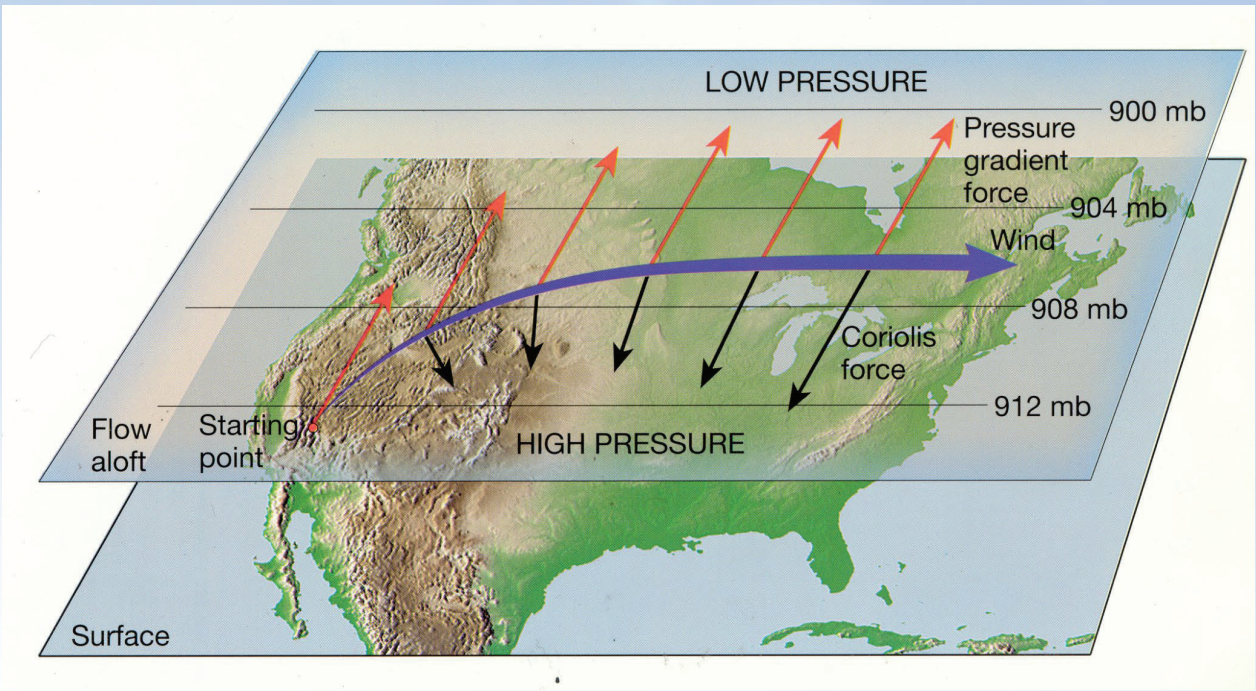


Fig 9.10 *Weather: A Concise Introduction*

Geostrophic Flow



Hadley Cell

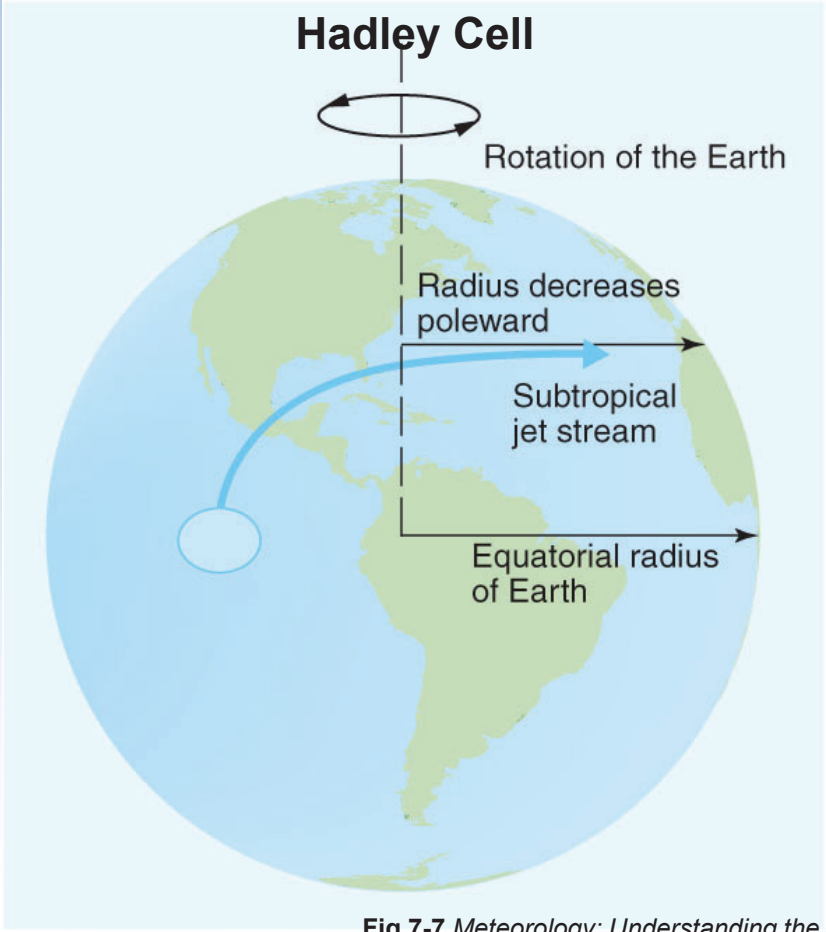


Fig 7-7 *Meteorology: Understanding the Atmosphere*

The PGF and Coriolis force lead to fast upper level winds

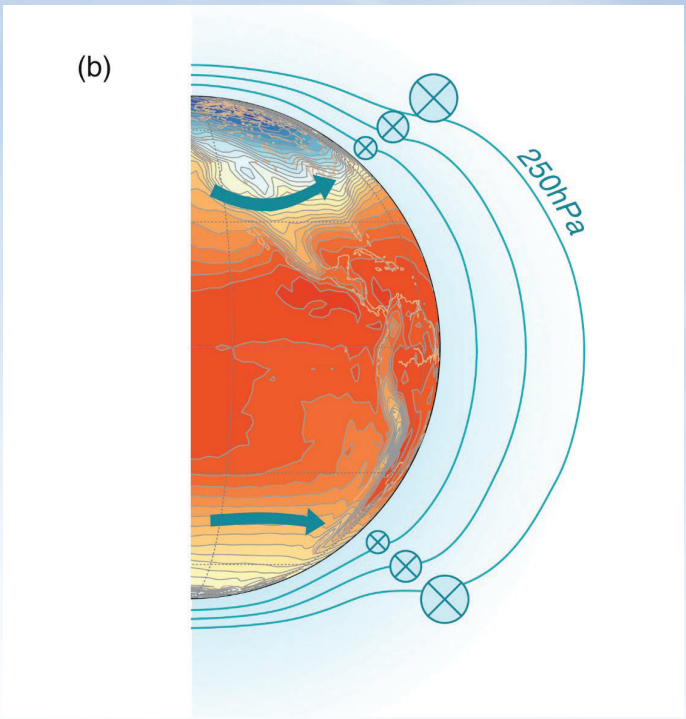


Fig 9.4 *Weather: A Concise Introduction*

The PGF and Coriolis force lead to fast upper level winds

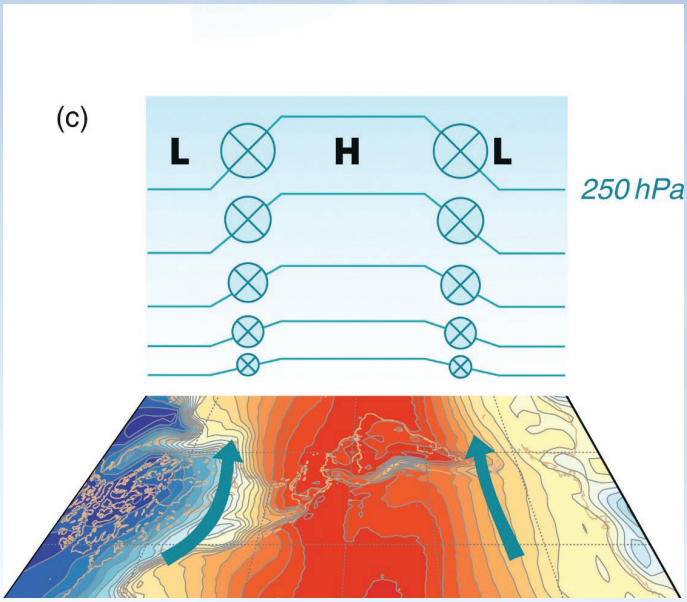


Fig 9.4 *Weather: A Concise Introduction*

The PGF and Coriolis force lead to fast upper level winds

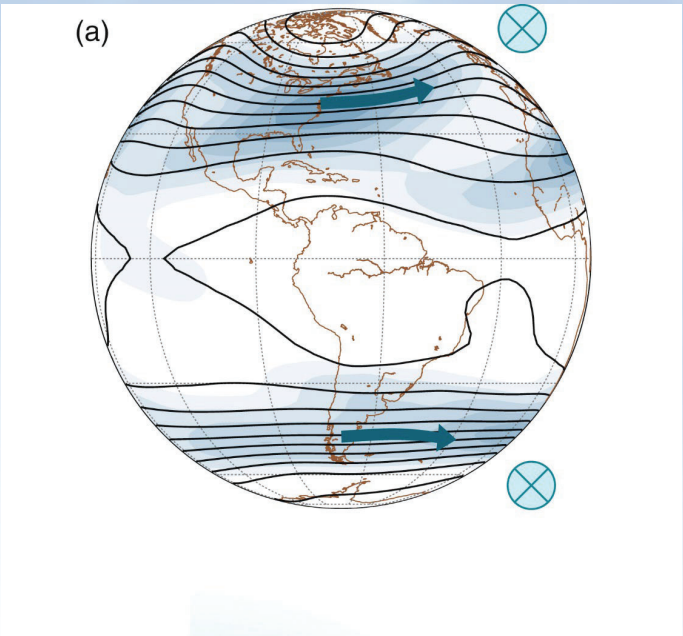
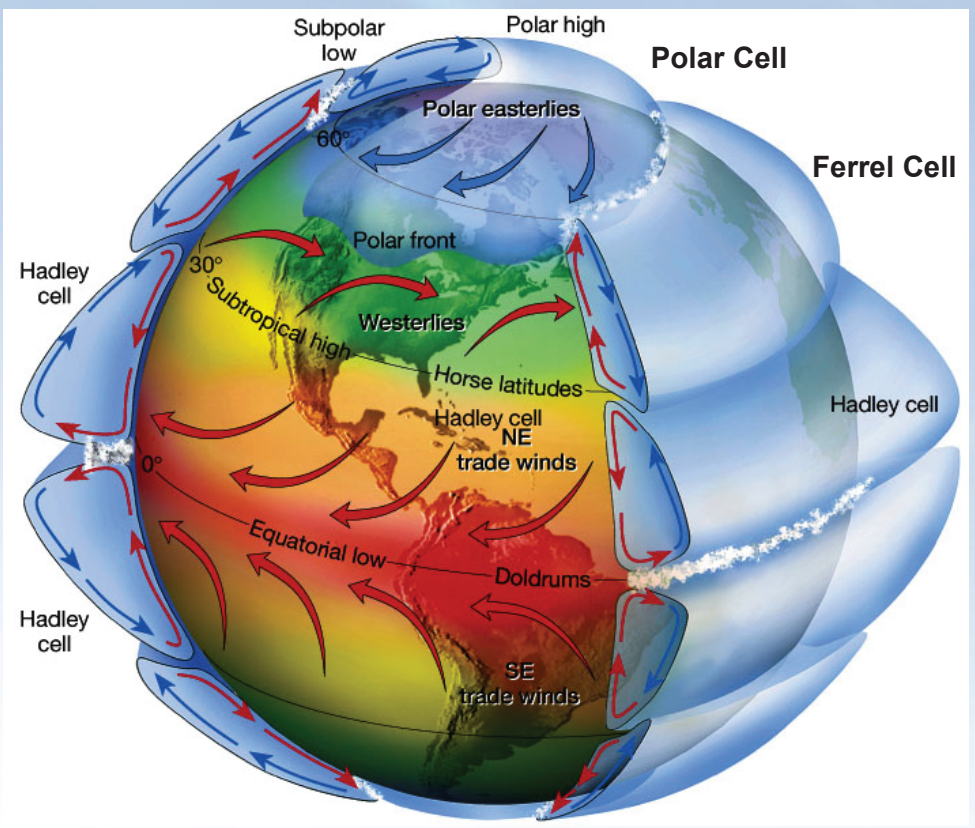


Fig 9.4 *Weather: A Concise Introduction*

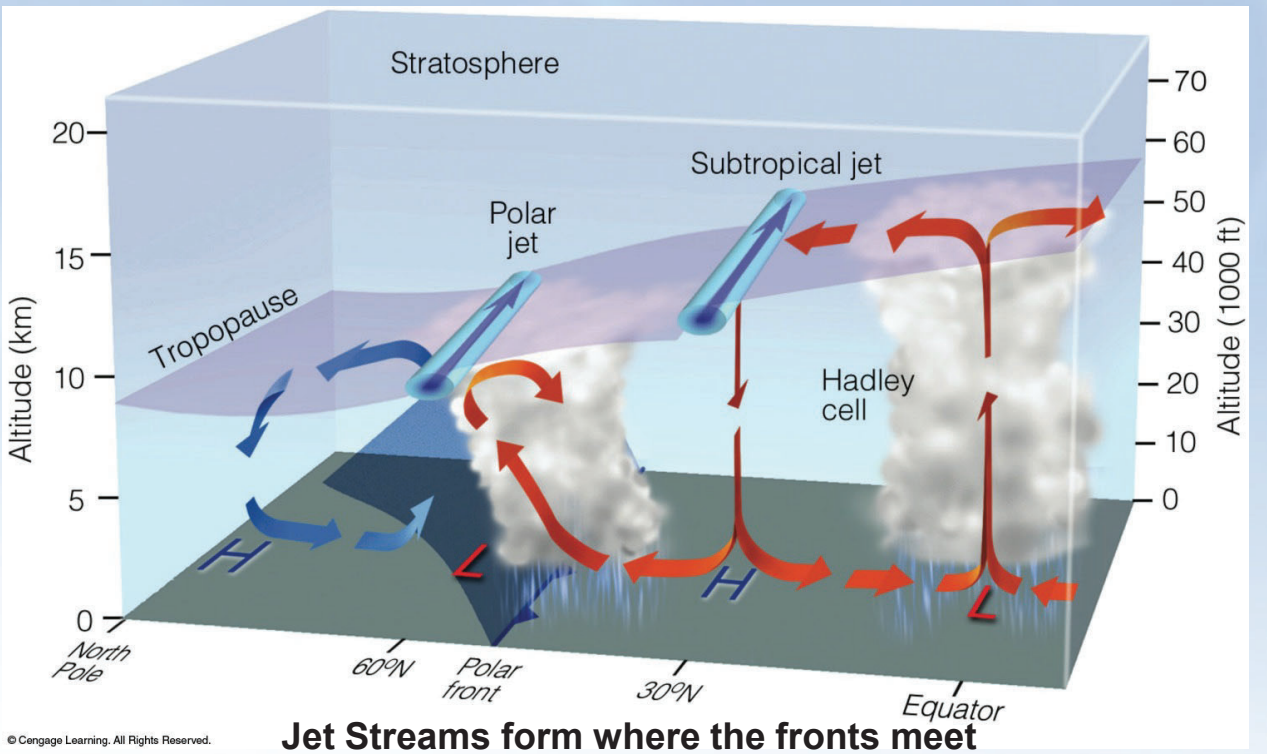
Conceptual Model



http://www.ux1.eiu.edu/~cfjps/1400/circulation.html

The Jet Streams

Tropopause height decreases as you move toward Pole

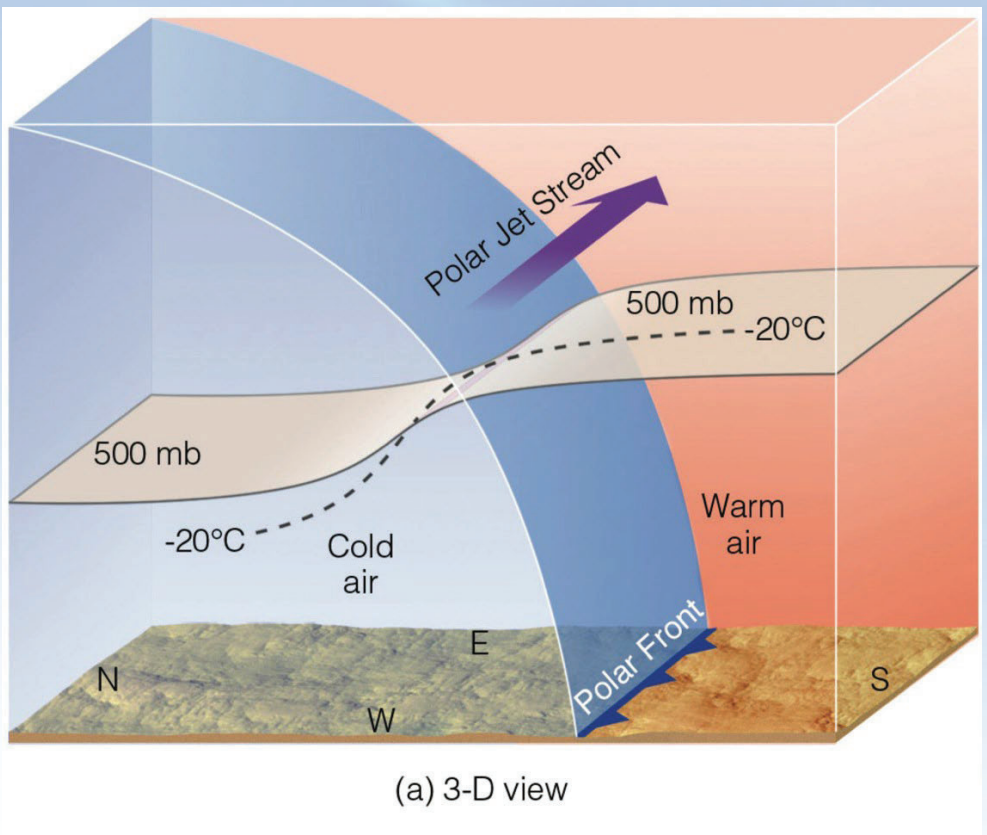


Jet Streams form where the fronts meet

Wind speeds greater than 100 mph

Notice: the fronts are slanted toward the N. Pole

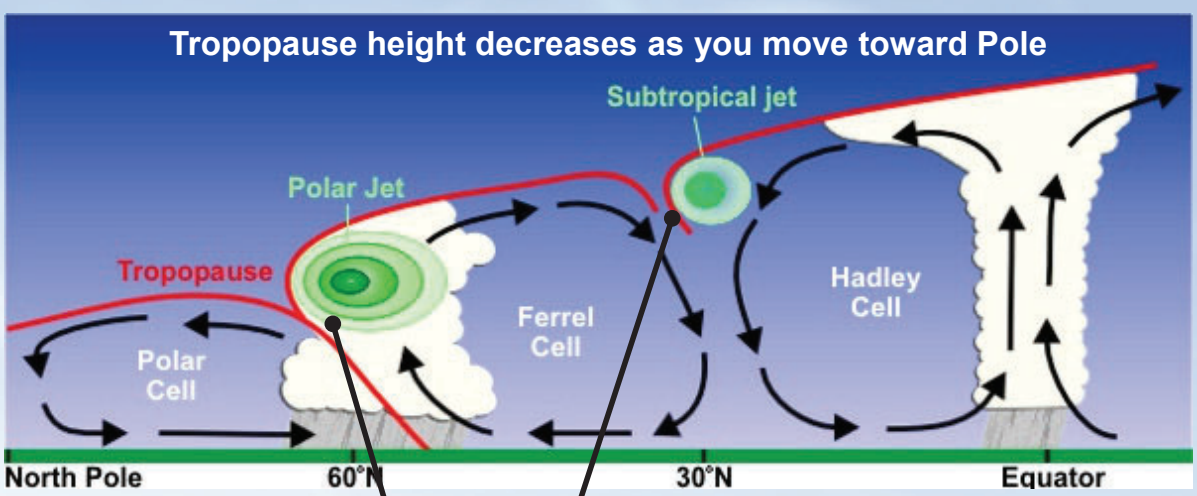
The Polar Jet Streams



(a) 3-D view

Fig 7.35: ***Essentials of Meteorology***

The Jet Streams



Pressure Gradient Force will push the air from south to north, Coriolis forces will move it to the right in the N. Hemisphere.

The Jet Streams (strong upper level Westerlies)

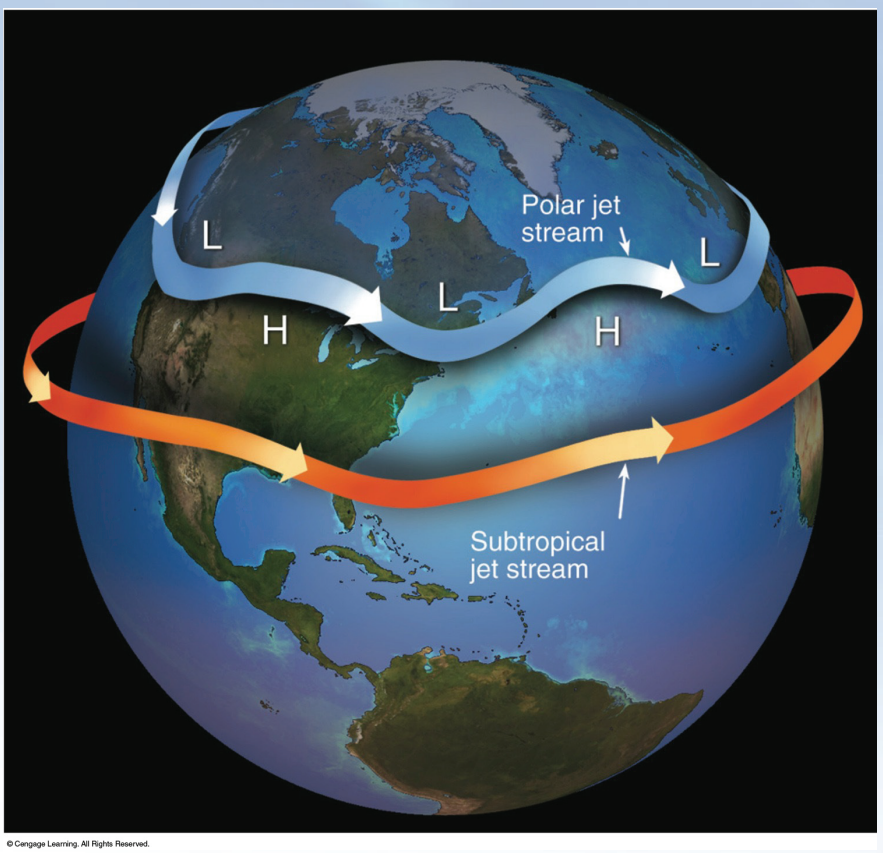
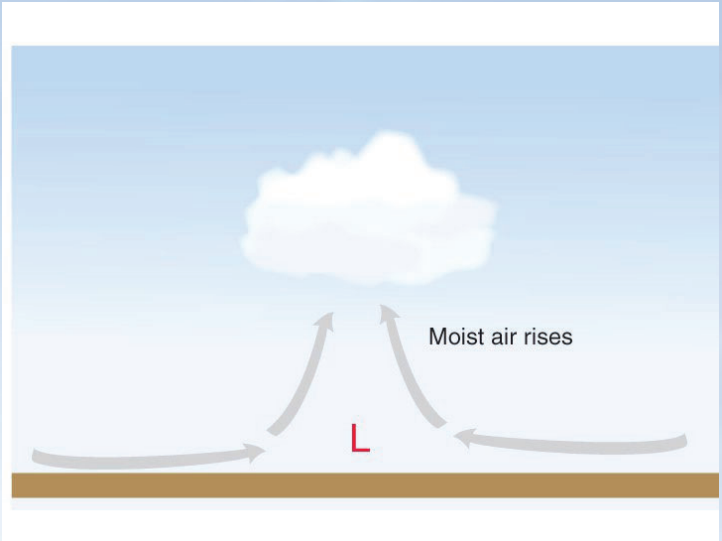


Fig 7.33: ***Essentials of Meteorology***

Convection

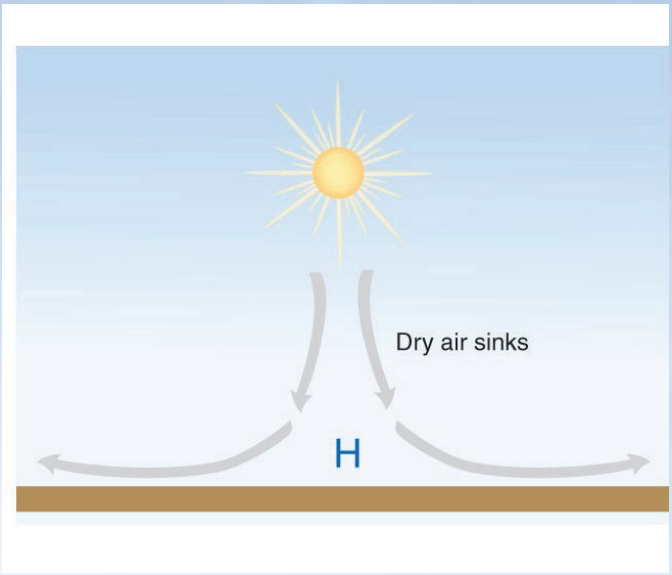


When air converges at a surface low pressure system, it can get pushed up and condense

What happens when air sinks toward a surface high pressure system?

Fig 6-24 *Meteorology: Understanding the Atmosphere*

Subsidence

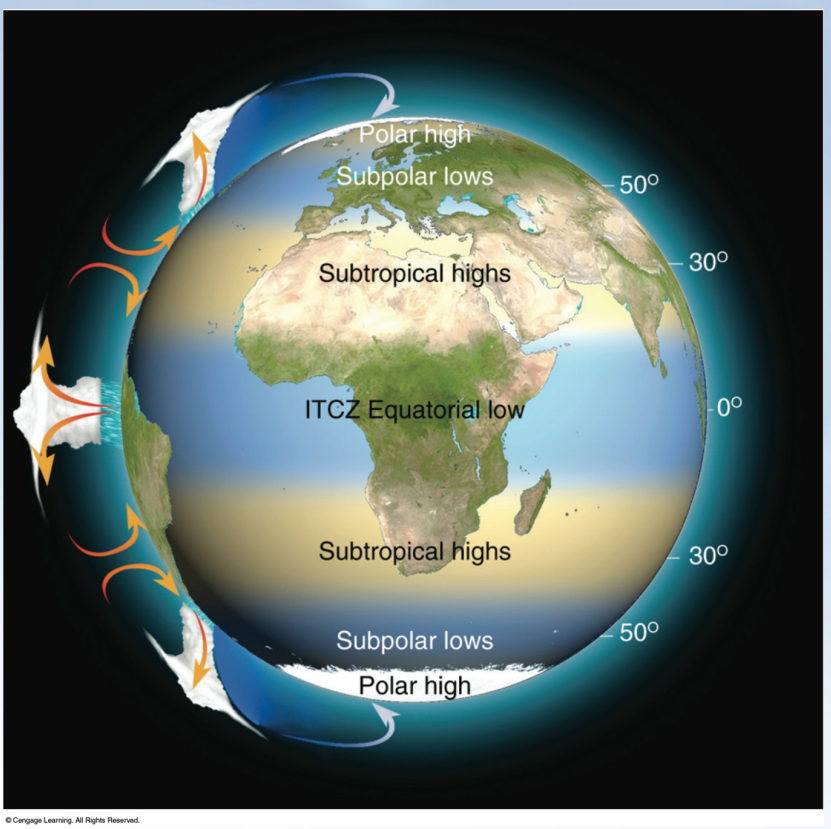


The air will warm as it sinks and gets drier

This sinking air will also inhibit convection

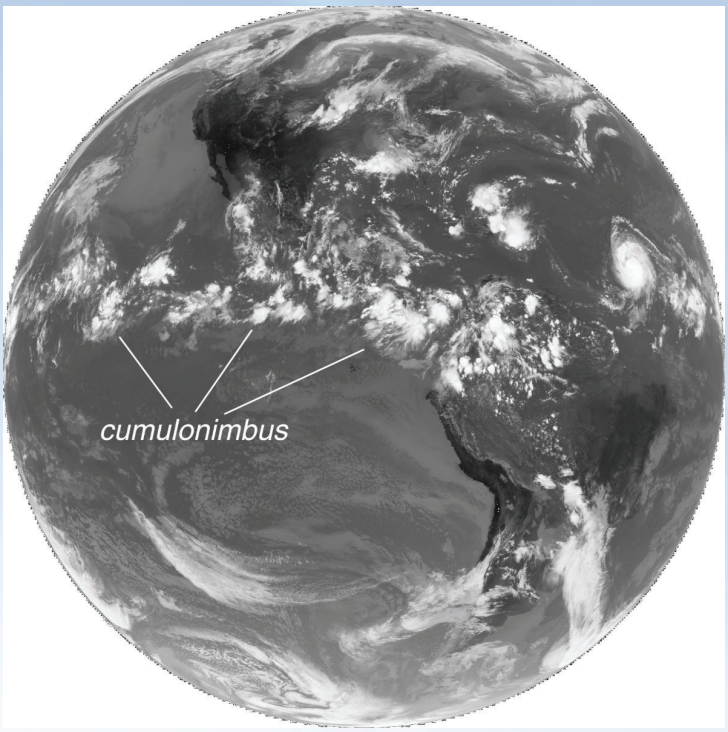
Fig 6-24 *Meteorology: Understanding the Atmosphere*

Conceptual Model



http://www.ux1.eiu.edu/~cfjps/1400/circulation.html

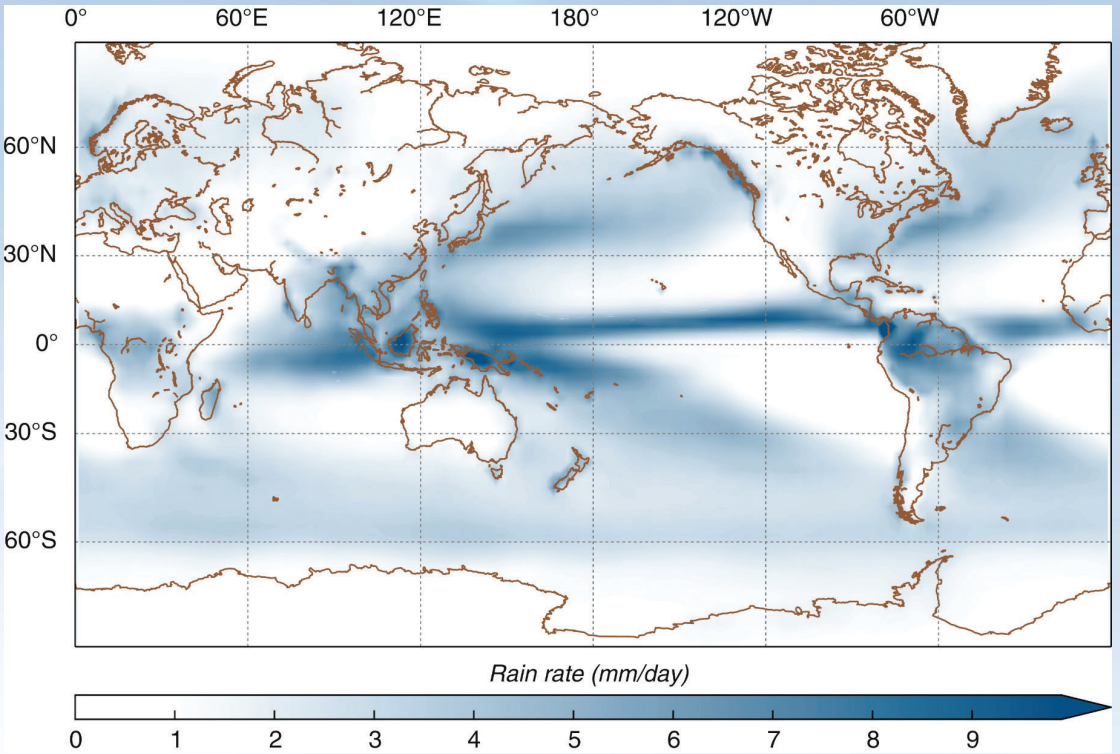
ITCZ



The region where the trade winds meet, near the Equator is called the Intertropical Convergence Zone (ITCZ)

Fig 9.9 *Weather: A Concise Introduction*

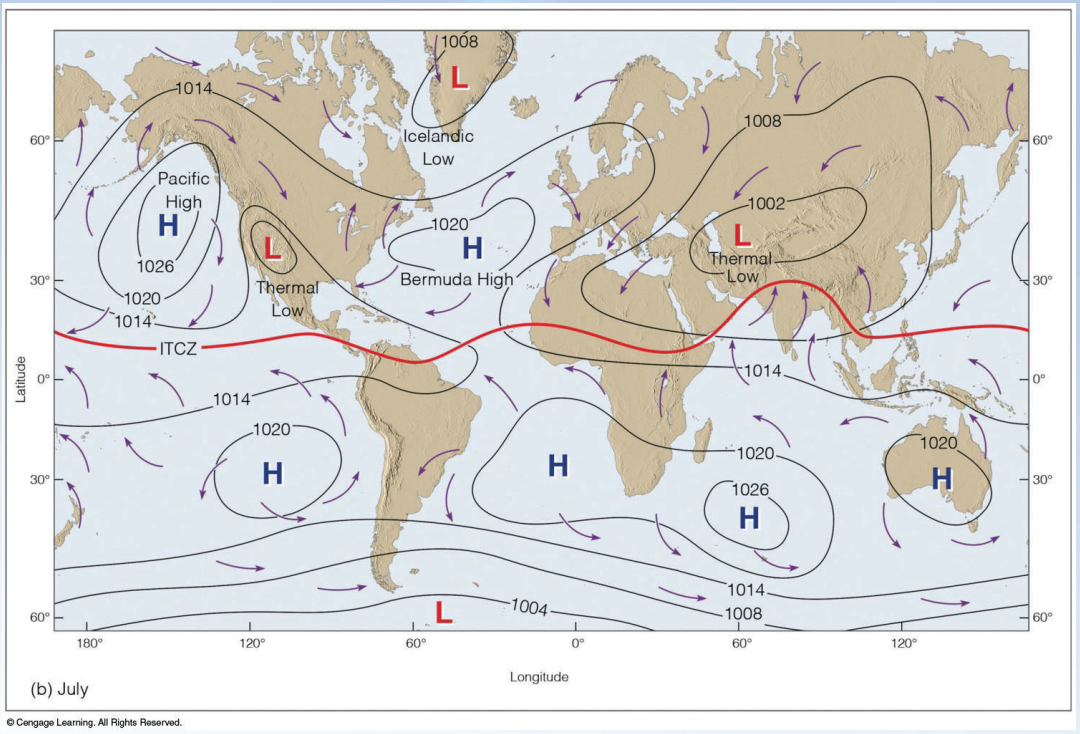
ITCZ



The region where the trade winds meet, near the Equator is called the Intertropical Convergence Zone (ITCZ)

Fig 9.6 *Weather: A Concise Introduction*

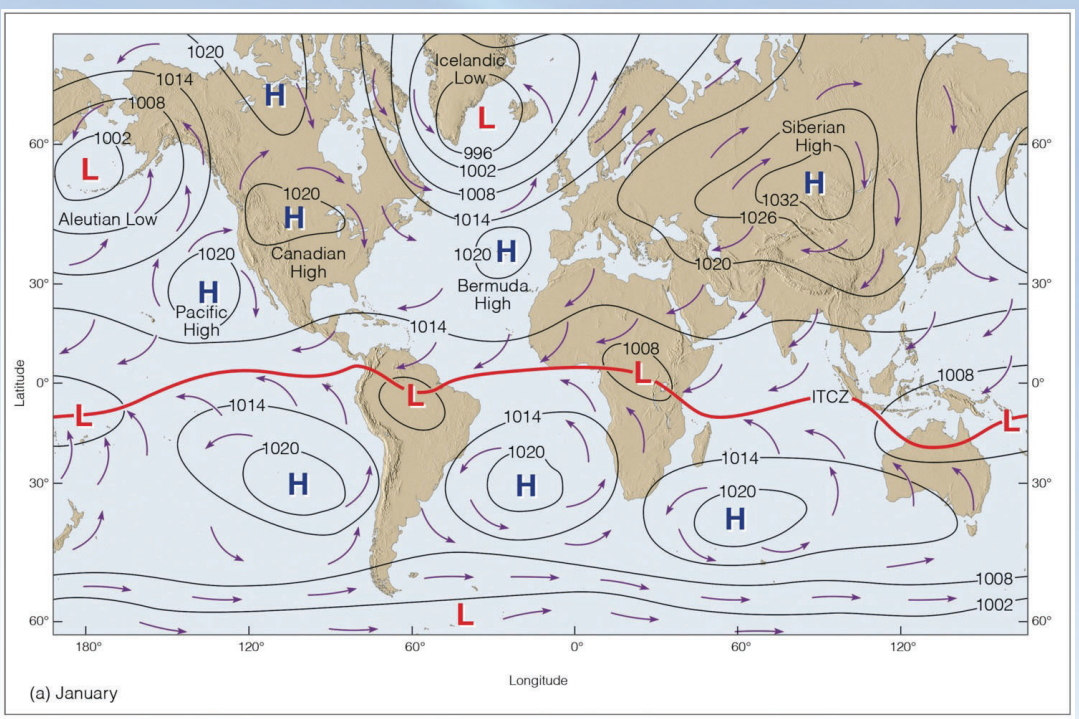
Sea-level pressure in Summer



Low pressure systems form over land in N.H. summer: Thermal Lows
ITCZ has moved northward
Similar pattern develops in S.H during summer

Fig 7.28: ***Essentials of Meteorology***

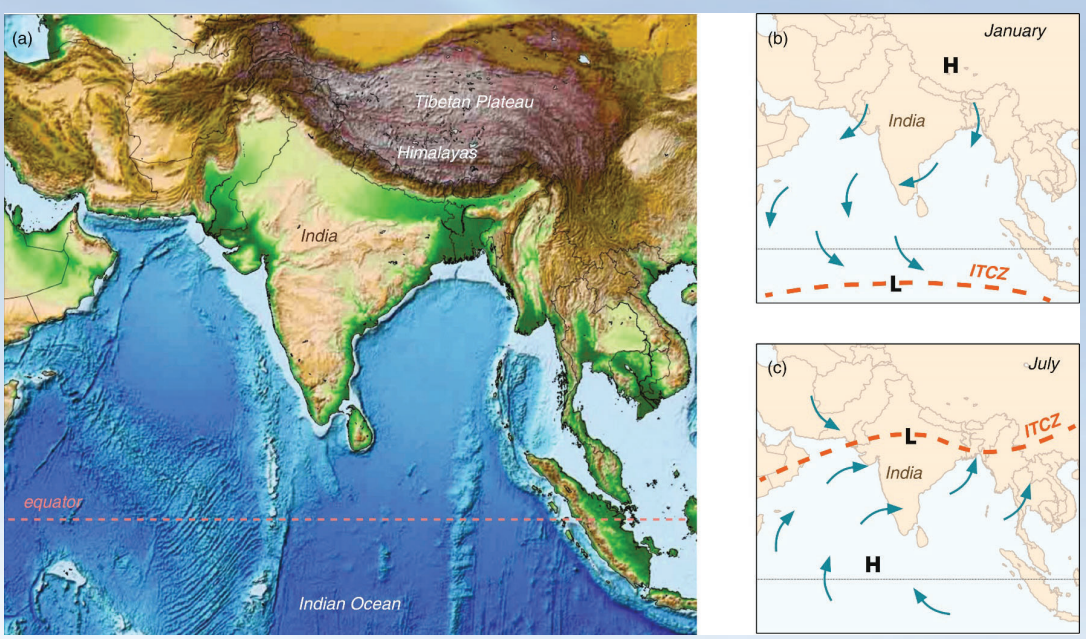
Sea-level pressure in Winter



Low pressure systems form over land in N.H. summer: Thermal Lows
ITCZ has moved northward
Similar pattern develops in S.H during summer

Fig 7.28: ***Essentials of Meteorology***

Monsoon



ITCZ shifts northward
Land heats up and pressure gradient forms, wind blows from ocean to land
Wind brings moist air from ocean, which condenses and rains out over land
Himalayas force air up leading to additional rainfall

Fig 9.17 *Weather: A Concise Introduction*

Monsoon

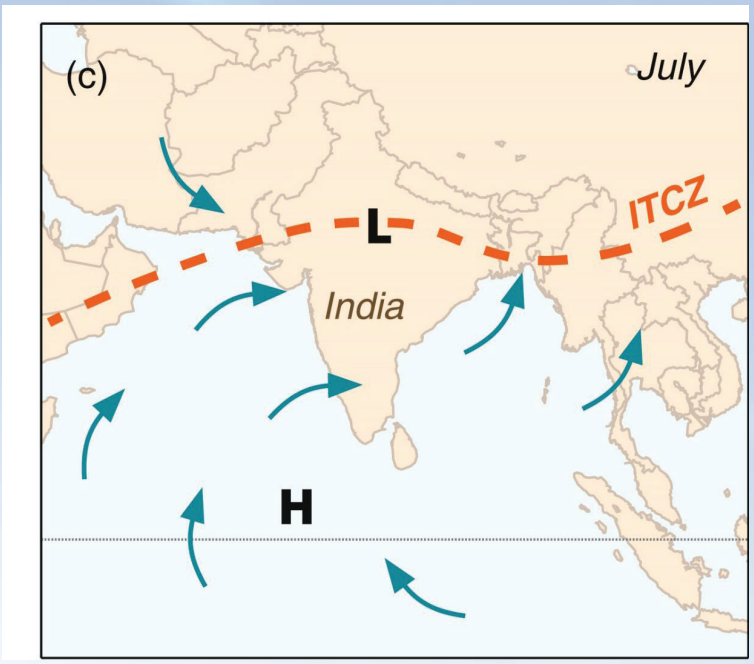


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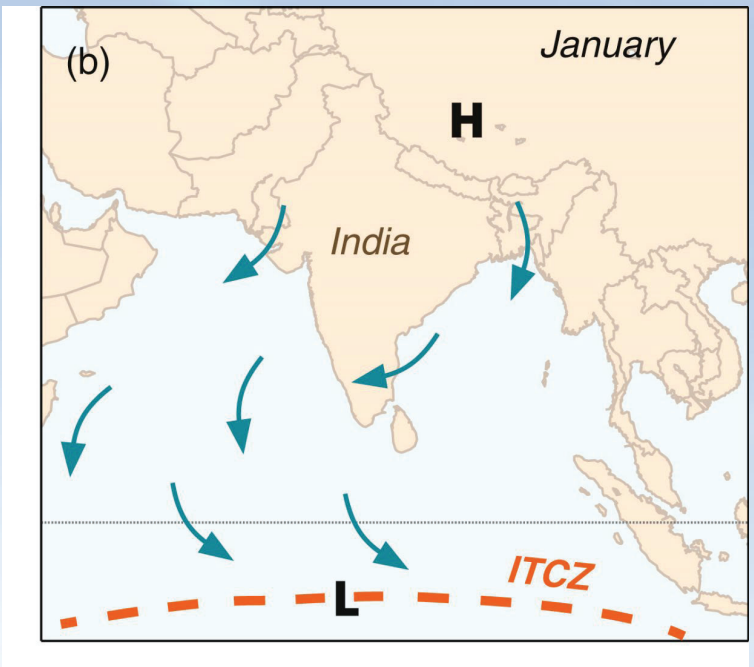
Fig 9.17 *Weather: A Concise Introduction*

Monsoon

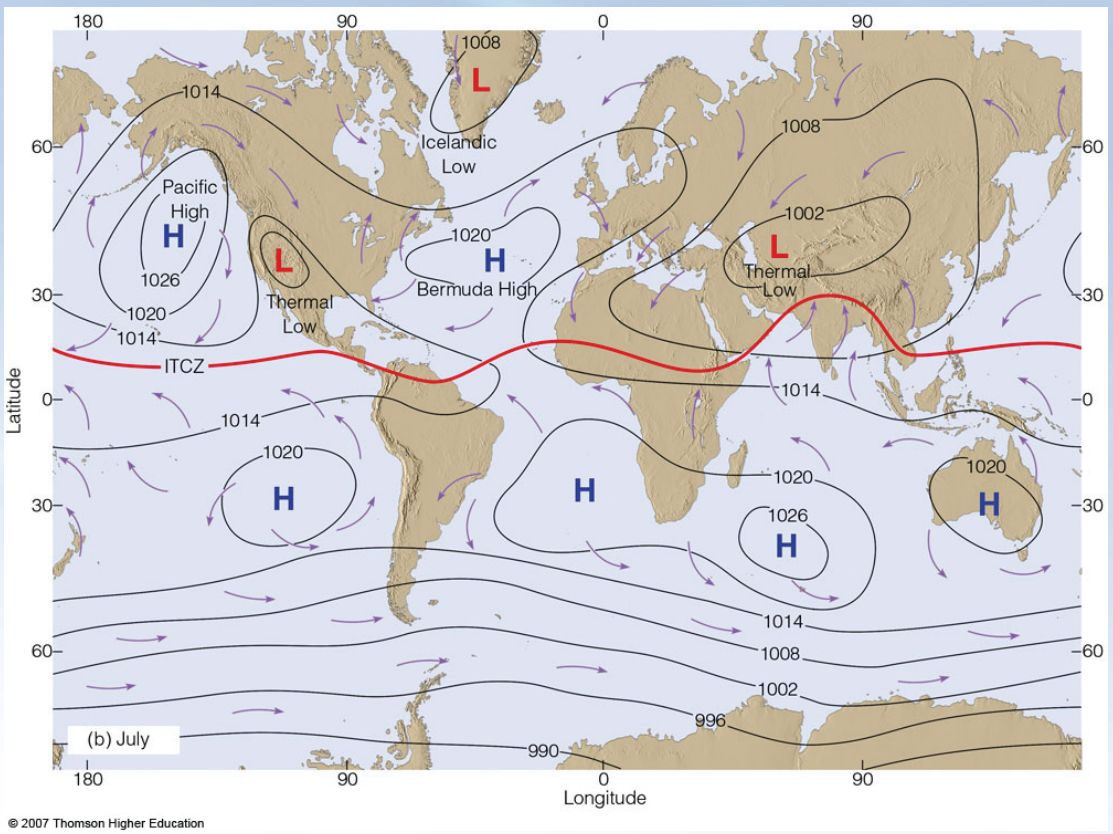


Aloft air descends over water, picks up more moisture, completes cycle.

In fall and winter, ITCZ moves south
Wind flow is reversed, winter monsoon is dry

Fig 9.17 *Weather: A Concise Introduction*

Sea-level pressure in Summer



N.H. summer: thermal lows over land, high pressure over ocean

Ocean Currents

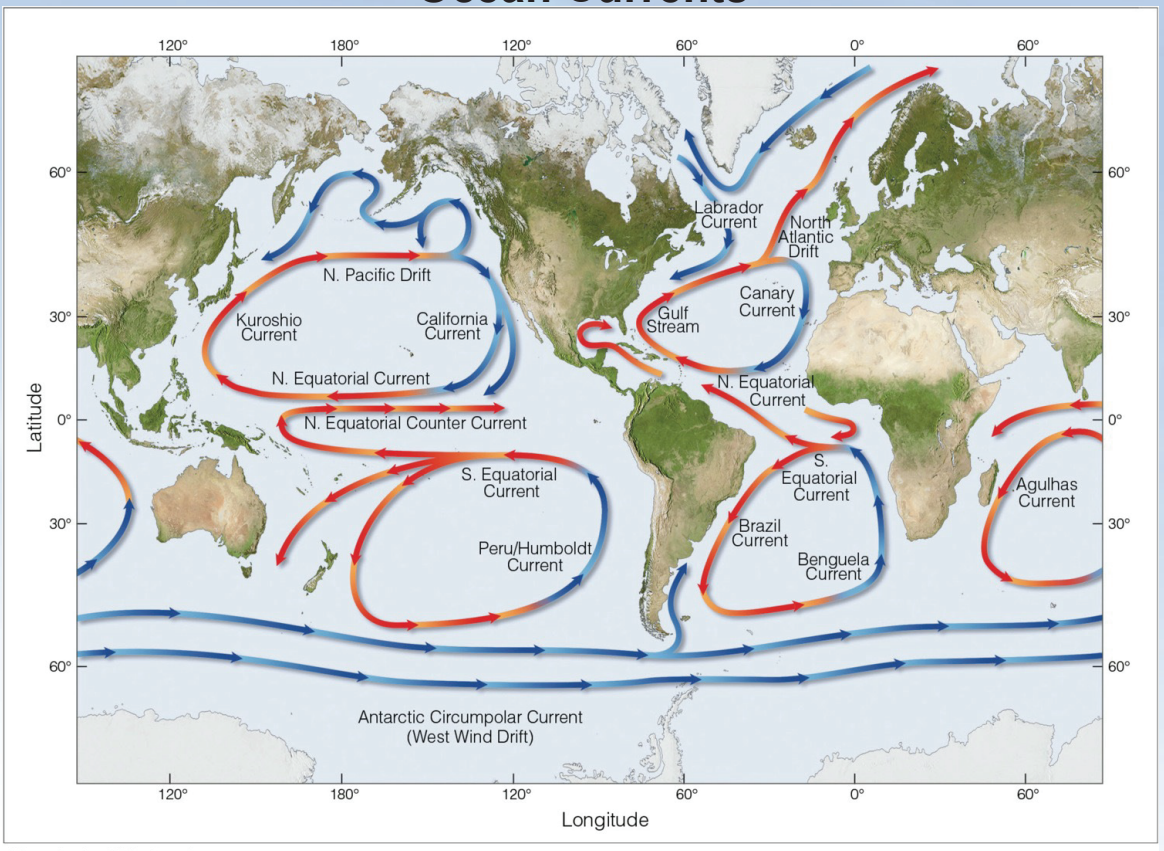


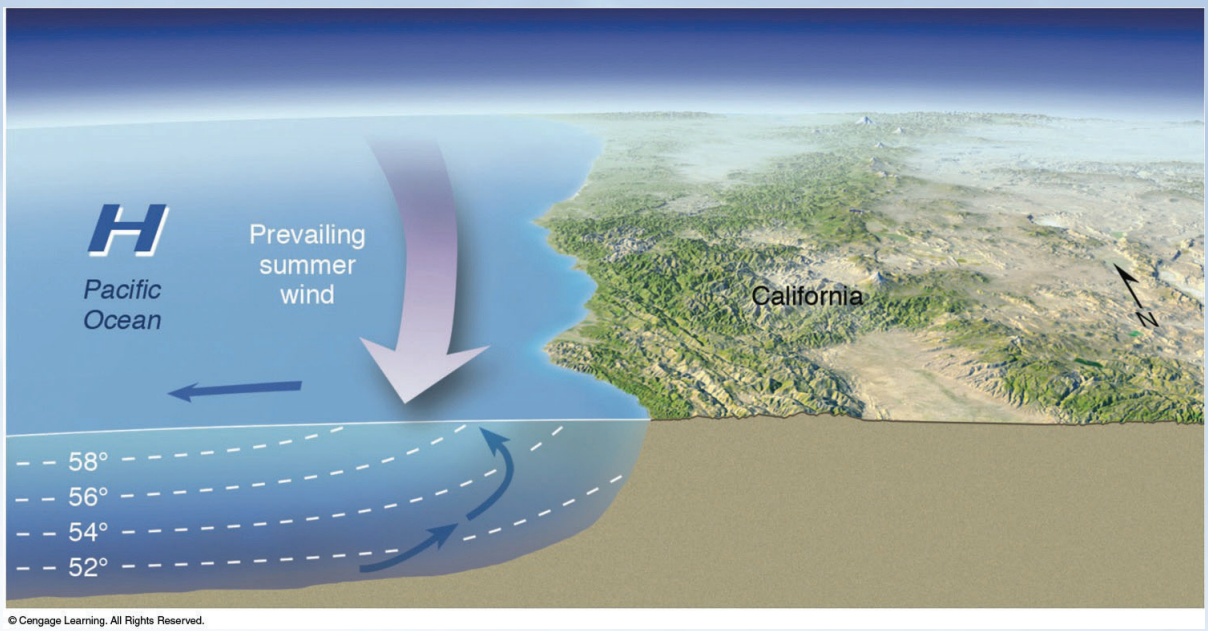
Fig 8-6 *Meteorology: Understanding the Atmosphere*

Ocean Currents

North Atlantic Gyre driven by trade winds and Westerlies

Fig 8-8 *Meteorology: Understanding the Atmosphere*

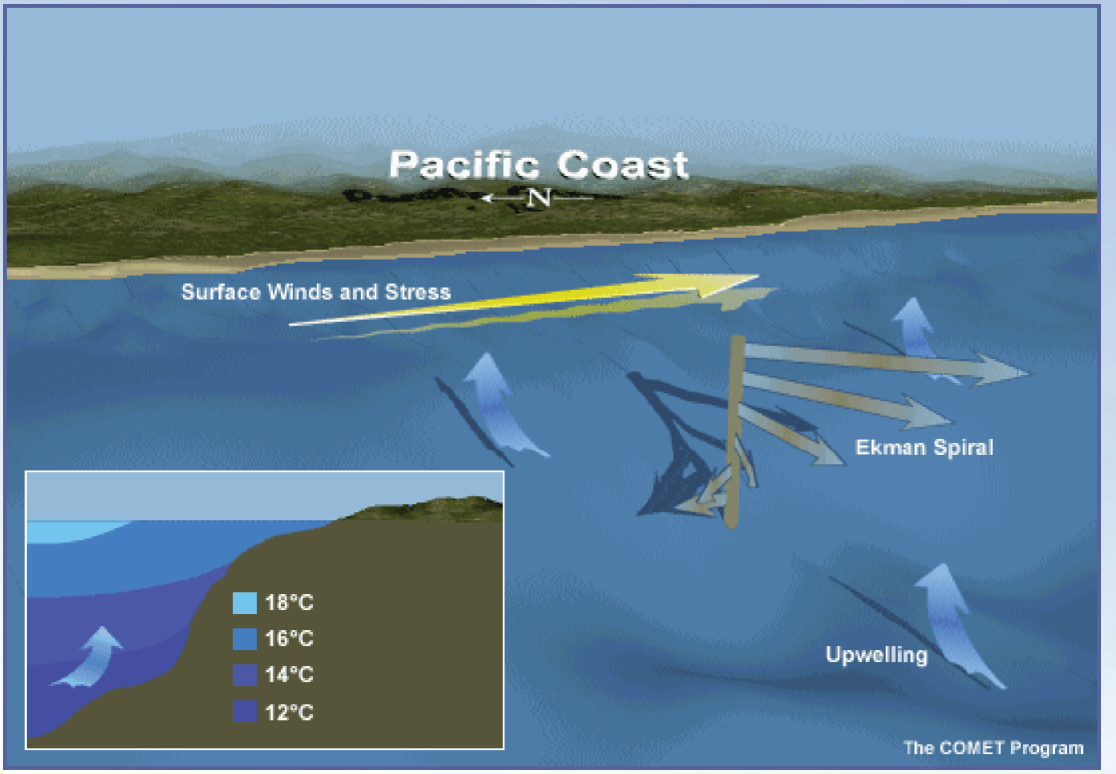
Ekman Transport



Ocean water pushed by wind but is also affect by Coriolis forces

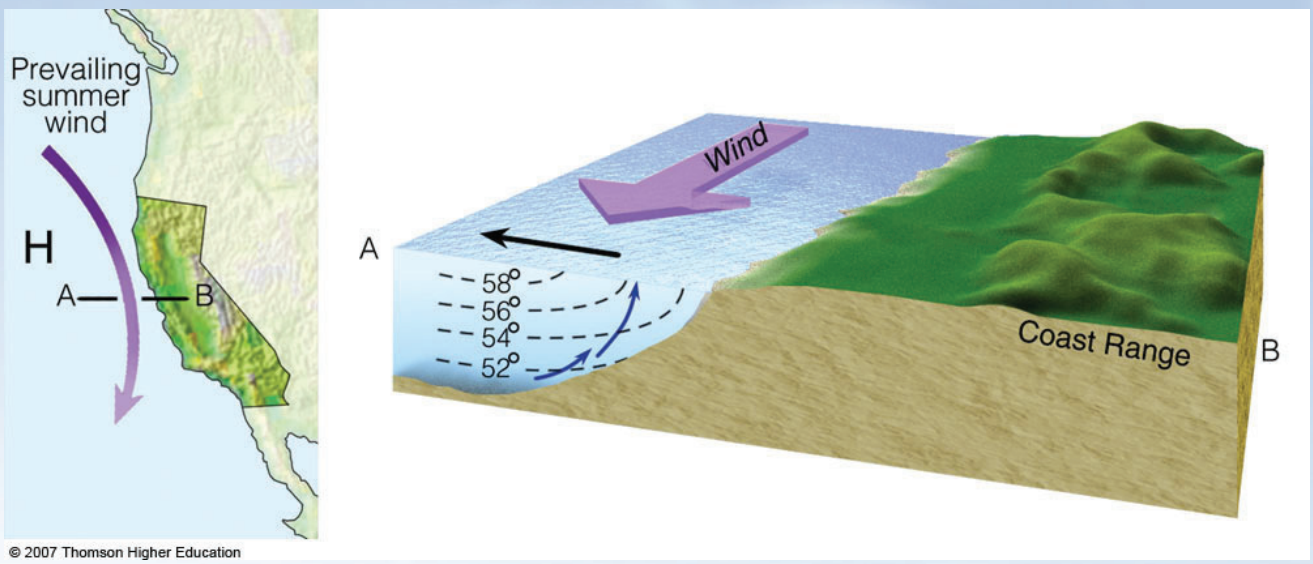
Fig 7.39: ***Essentials of Meteorology***

Ekman Spiral and Ekman Transport



http://www.meted.ucar.edu/fogstrat/ic31/ic313/graphics/comet/ekman.gif

Ekman Spiral and Ekman Transport



Water off the coast of Southern California is cold and teeming with life
Great for fishing!!!!

Ocean Currents

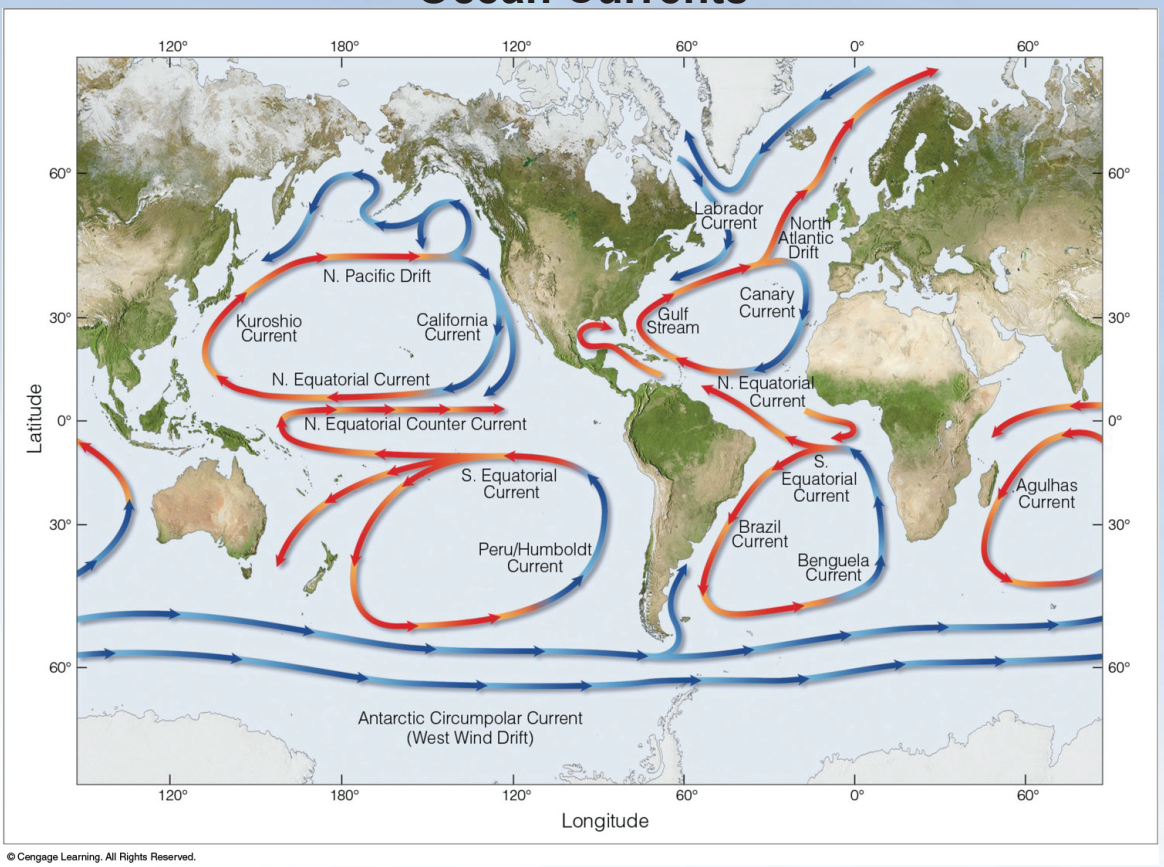
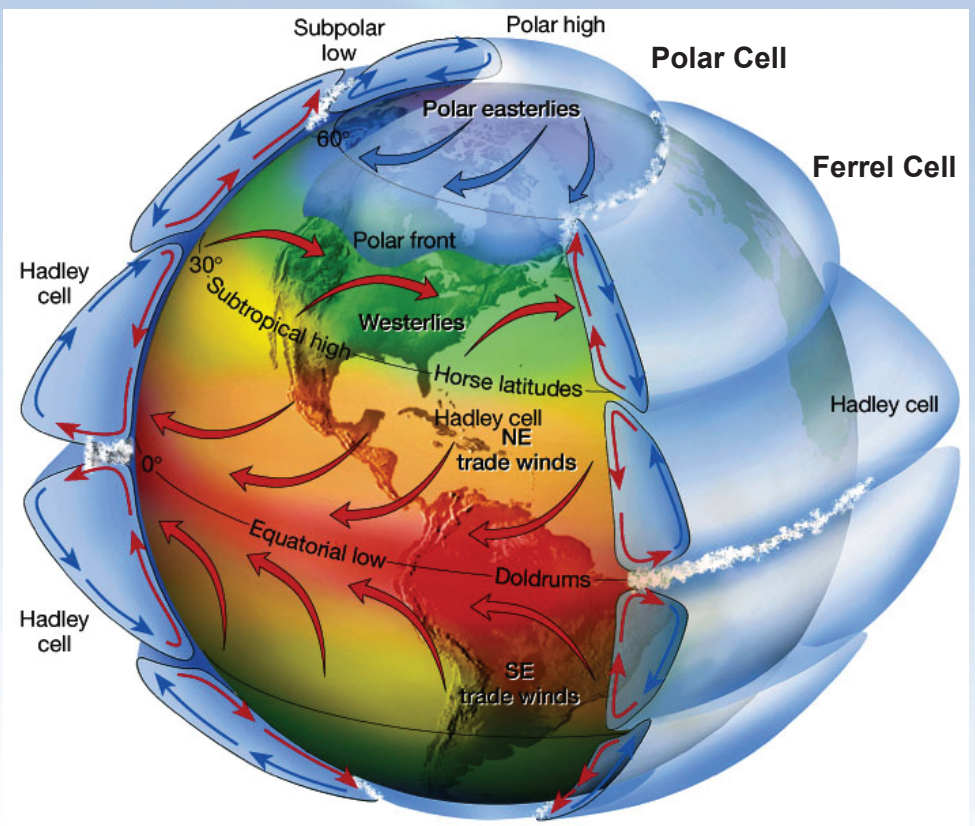


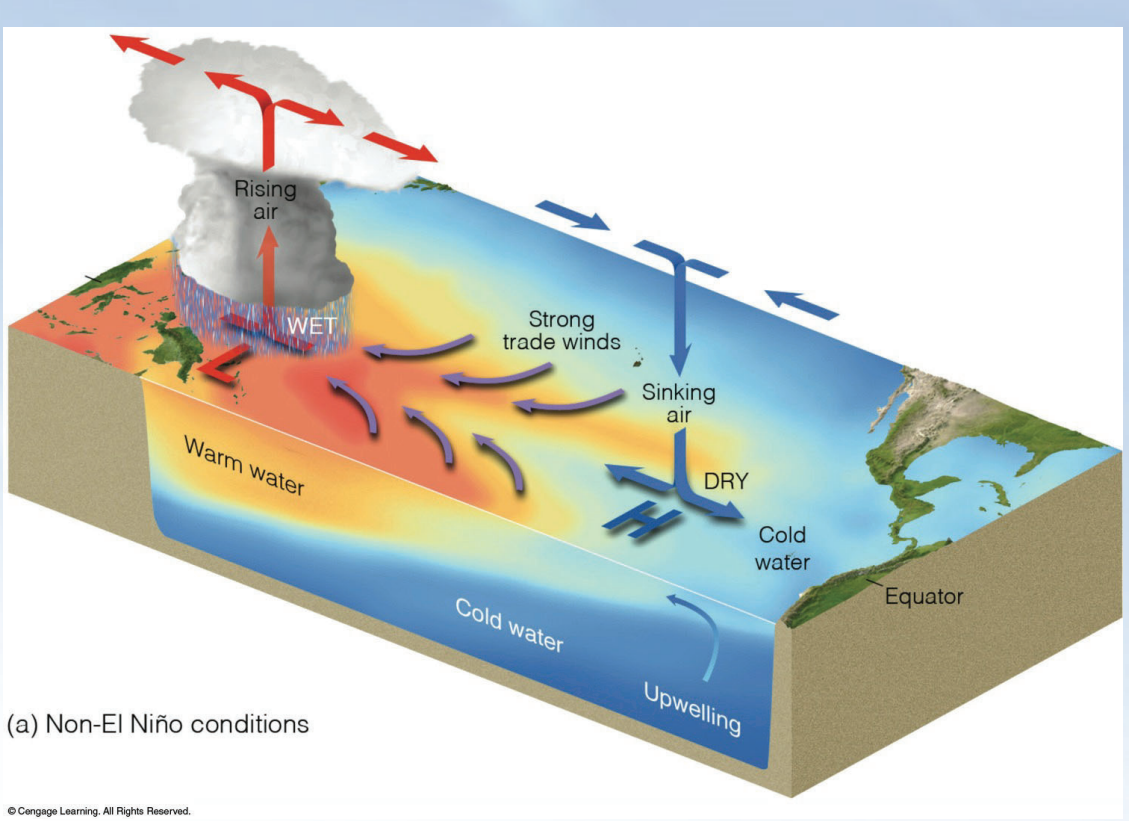
Fig 8-6 *Meteorology: Understanding the Atmosphere*

Conceptual Model

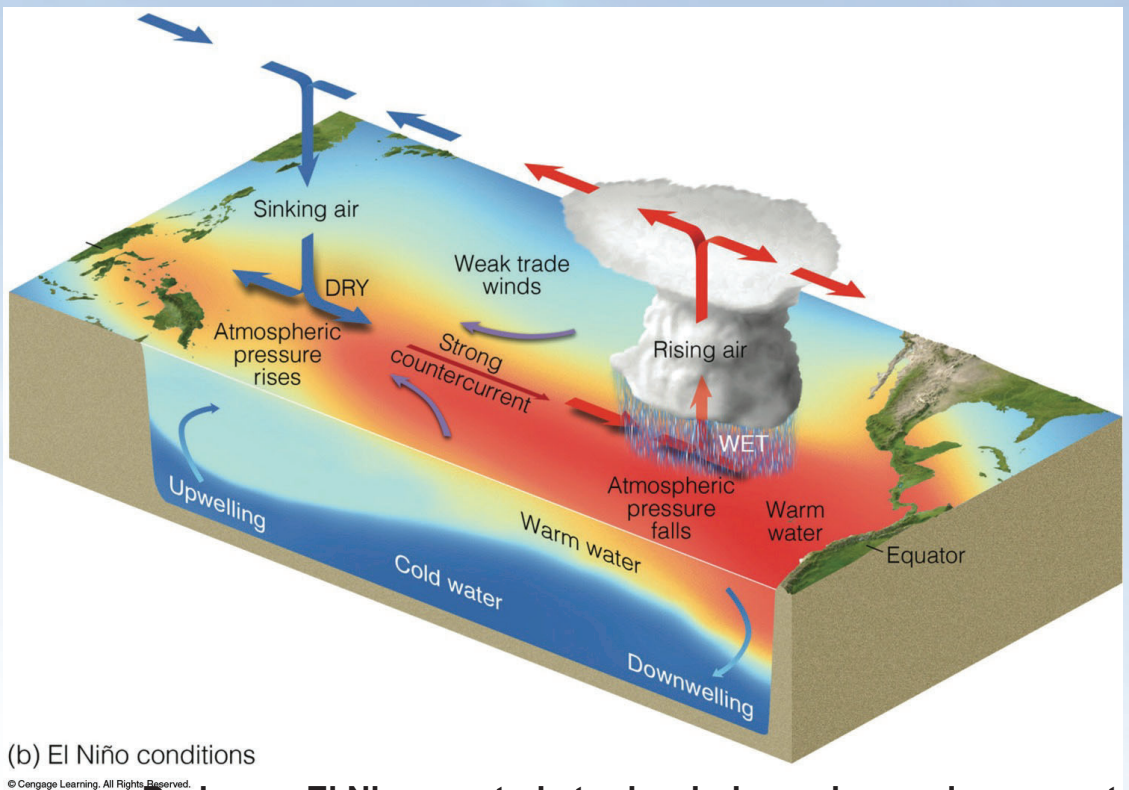


http://www.ux1.eiu.edu/~cfjps/1400/circulation.html

Normal Conditions



El Niño: warm water sloshes to the east



During an El Nino, easterly trade winds weaken and warm water is transported from western pacific to eastern pacific