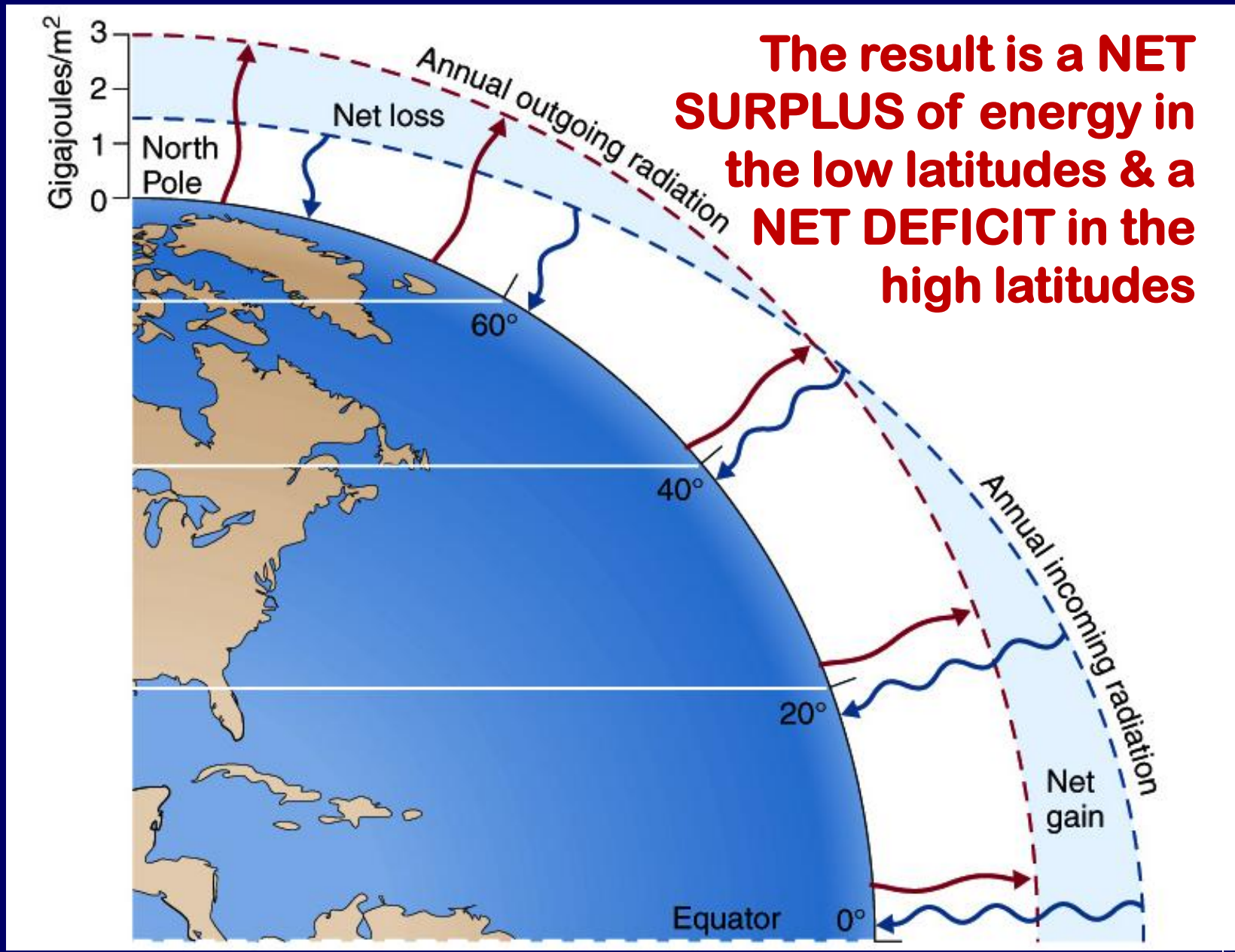
Topic # 11
HOW CLIMATE WORKS – PART III

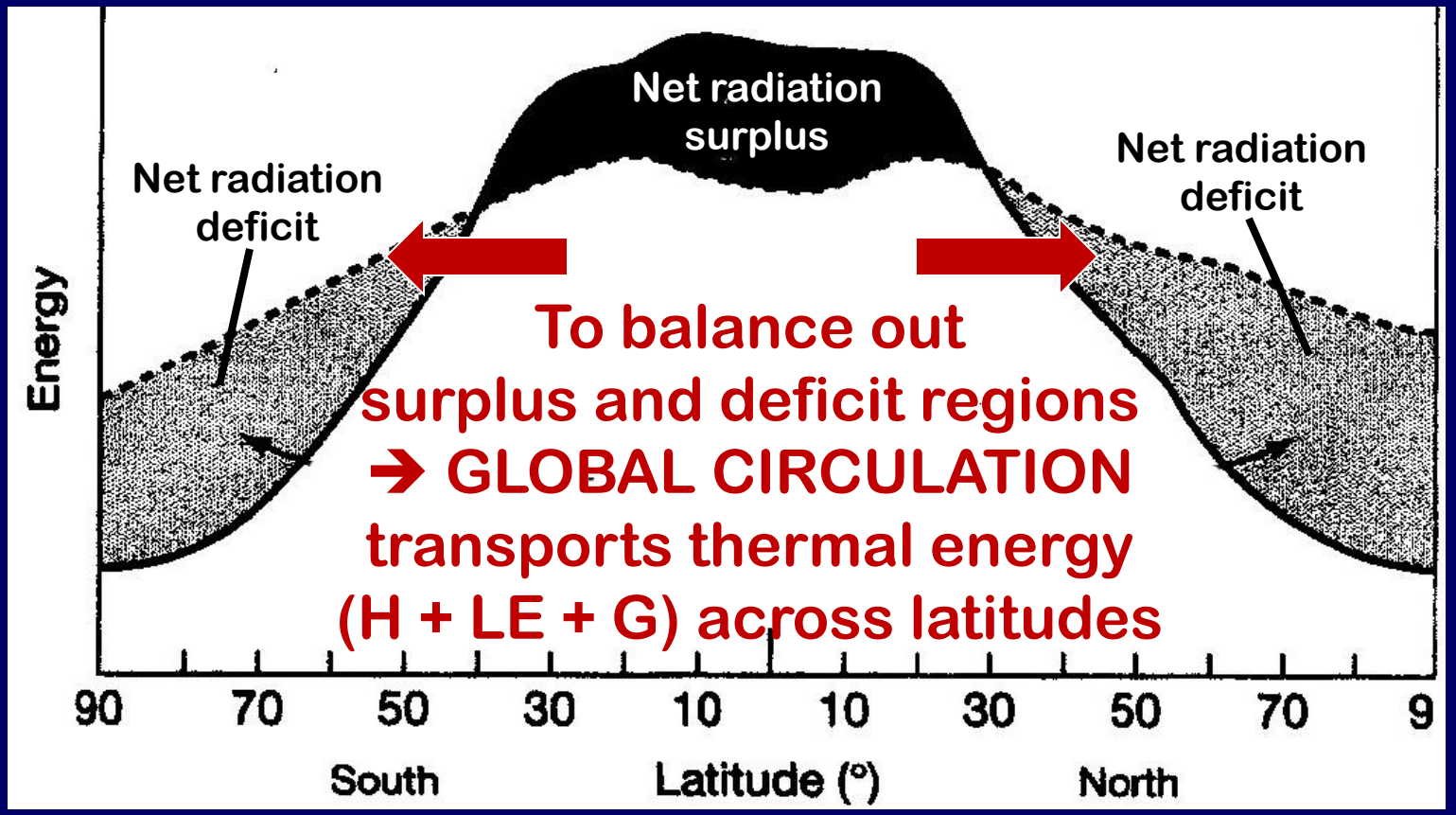
THE ROLE OF THE OCEANS

pp 64-65 in Class Notes

but first a review . . . .



The result is a NET SURPLUS of energy in the low latitudes & a NET DEFICIT in the high latitudes



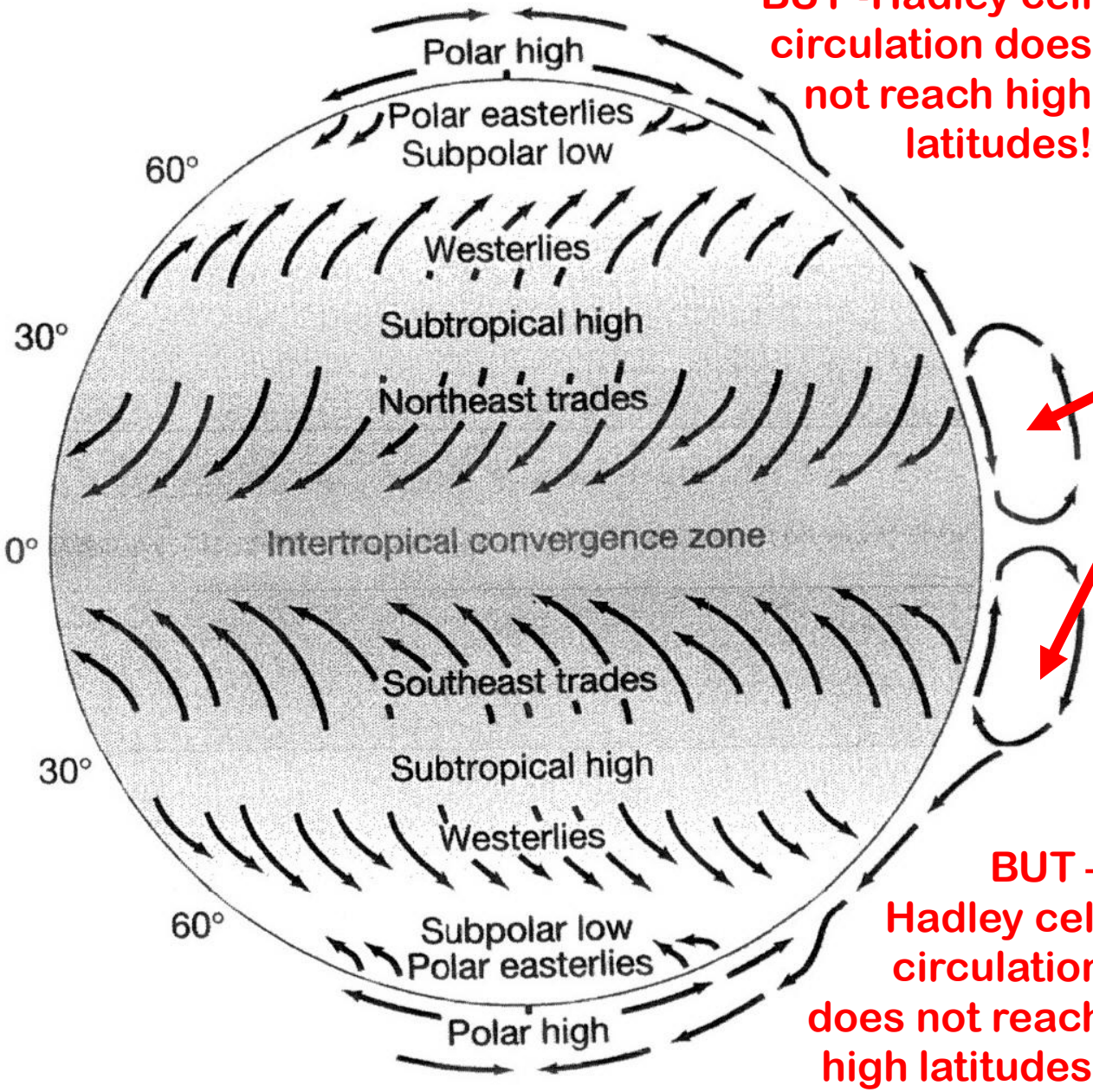
Absorbed solar energy

SW + SW - SW

Emitted infrared energy

(at top of atmosphere)

- LW



BUT -Hadley cell circulation does not reach high latitudes!

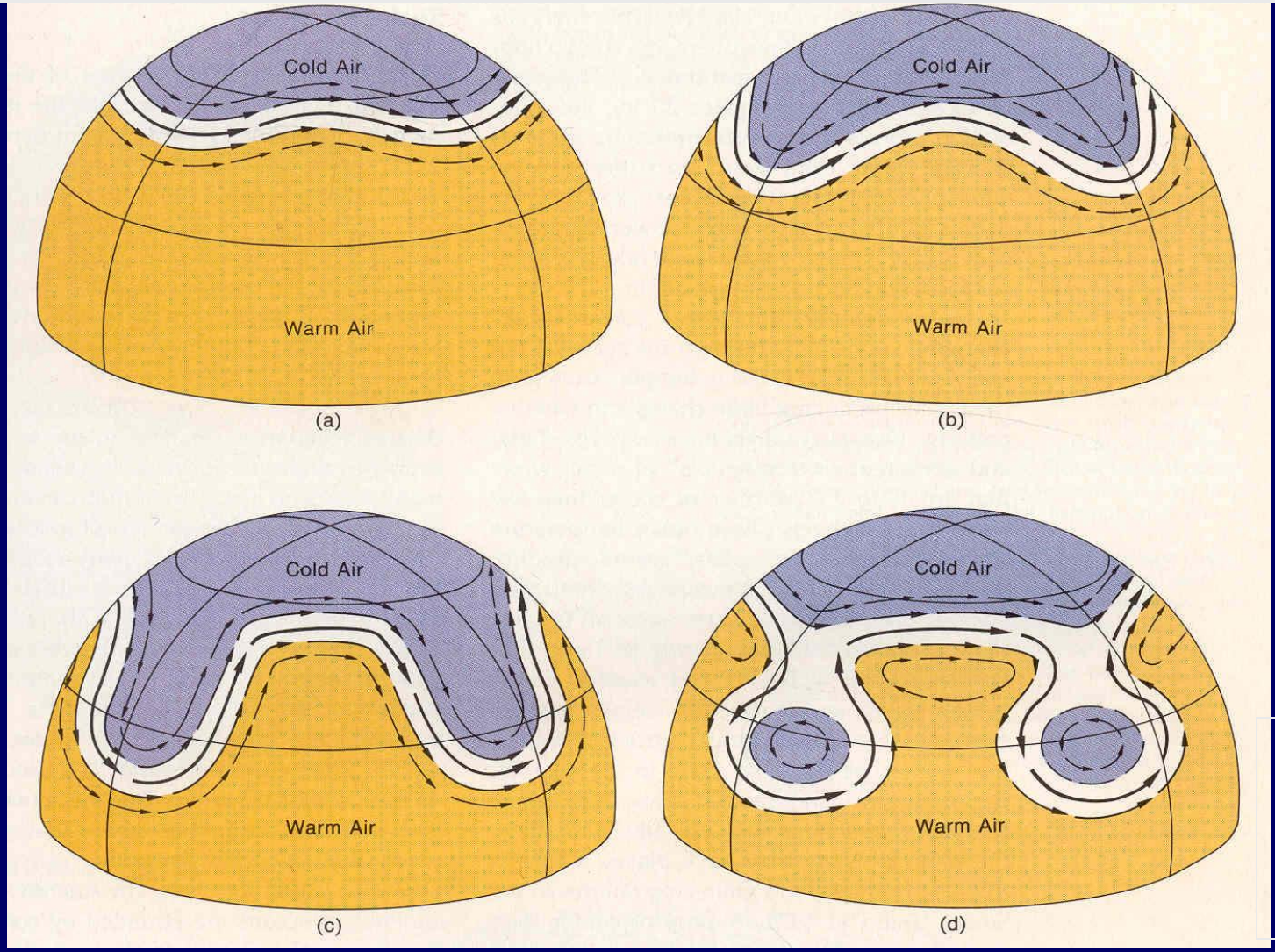
BUT – Hadley cell circulation does not reach high latitudes!

Hadley Cells transport warm air poleward as SENSIBLE HEAT

HADLEY CELLS = key drivers!

Convection cell transfer of thermal energy from low latitude area of energy SURPLUS to higher latitude area of energy DEFICIT

UPPER LEVEL "ROSSBY WAVE" CIRCUMPOLAR WINDS !



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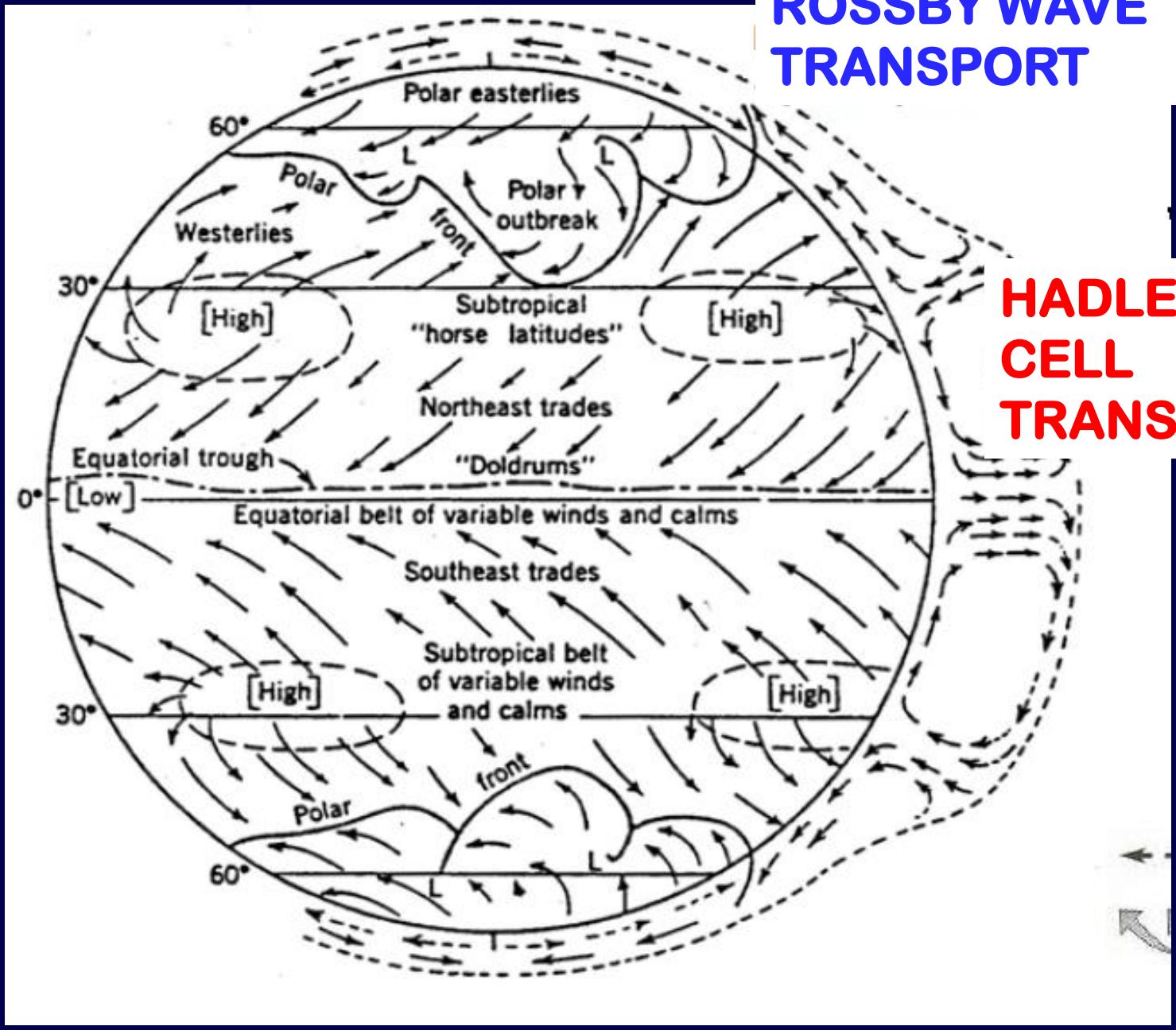
"Wave" transport of SENSIBLE HEAT (in lobes of warm air) instead of Hadley cell transport!

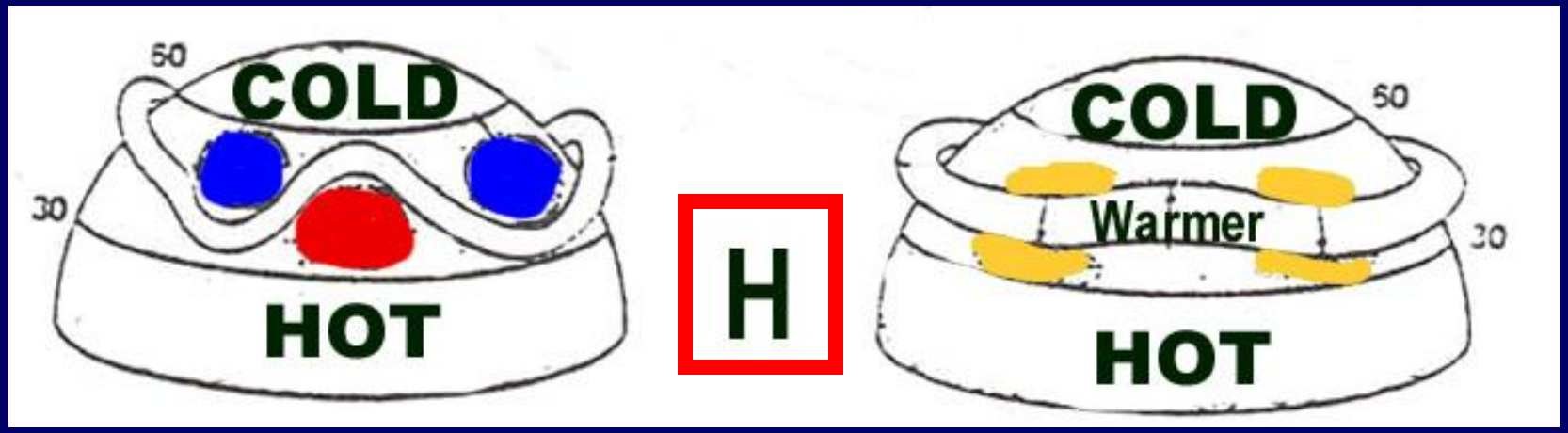
ROSSBY WAVE TRANSPORT



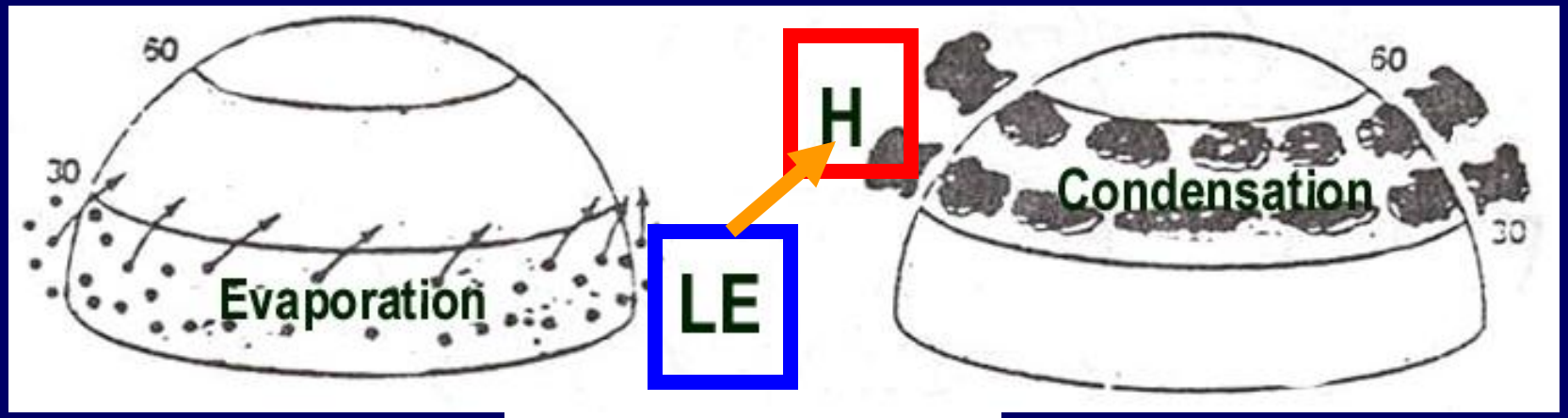
HADLEY CELL TRANSPORT

Energy is transported from areas of surplus to deficit via:

H (sensible heat)



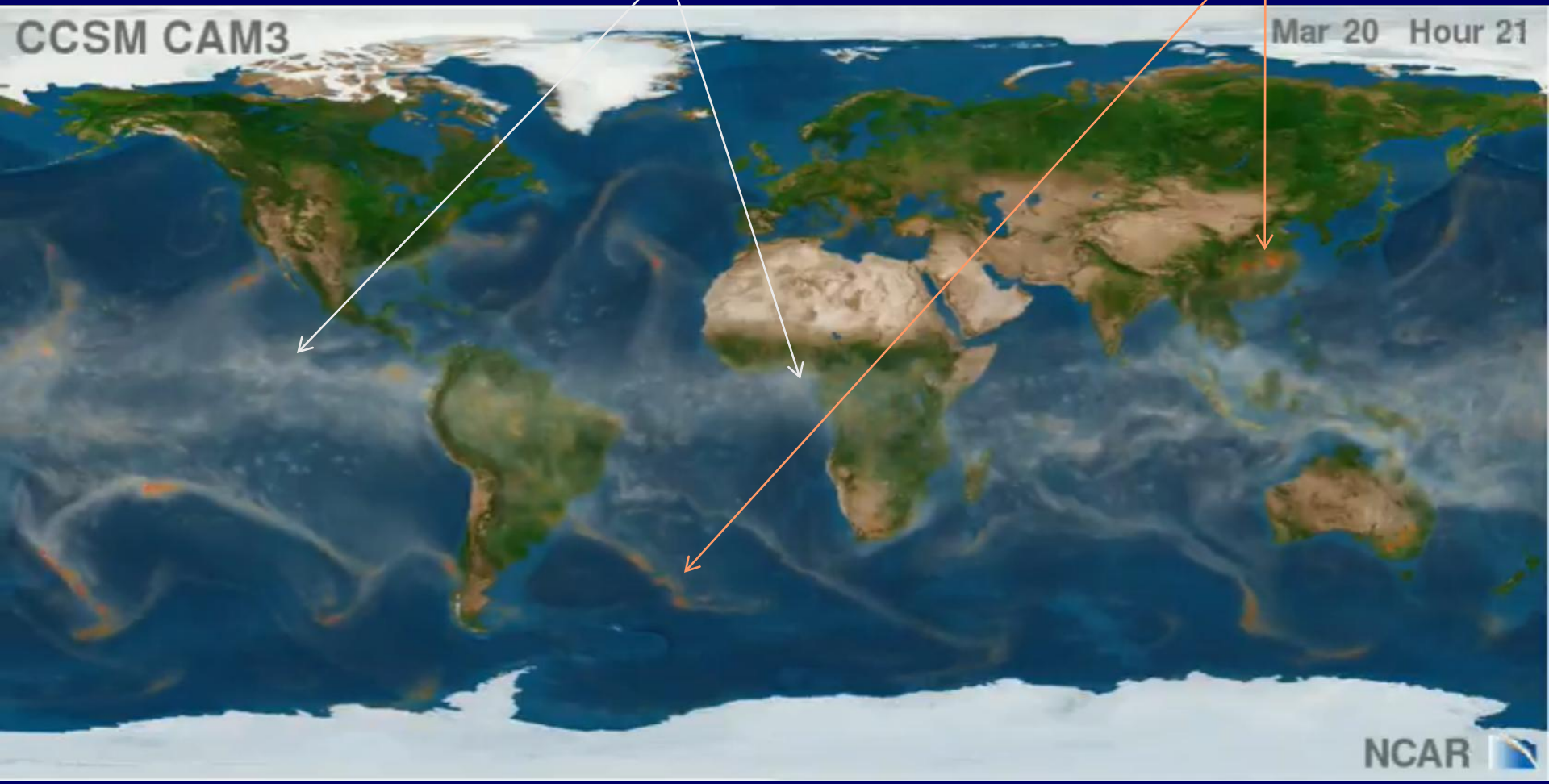
& LE (Latent Energy)



H + LE

The **Community Climate System Model** (CCSM)
is a coupled climate model for simulating Earth's climate system.
It simulates the earth's atmosphere, ocean, land surface and sea-ice

water vapor = WHITE precipitation rate = ORANGE.

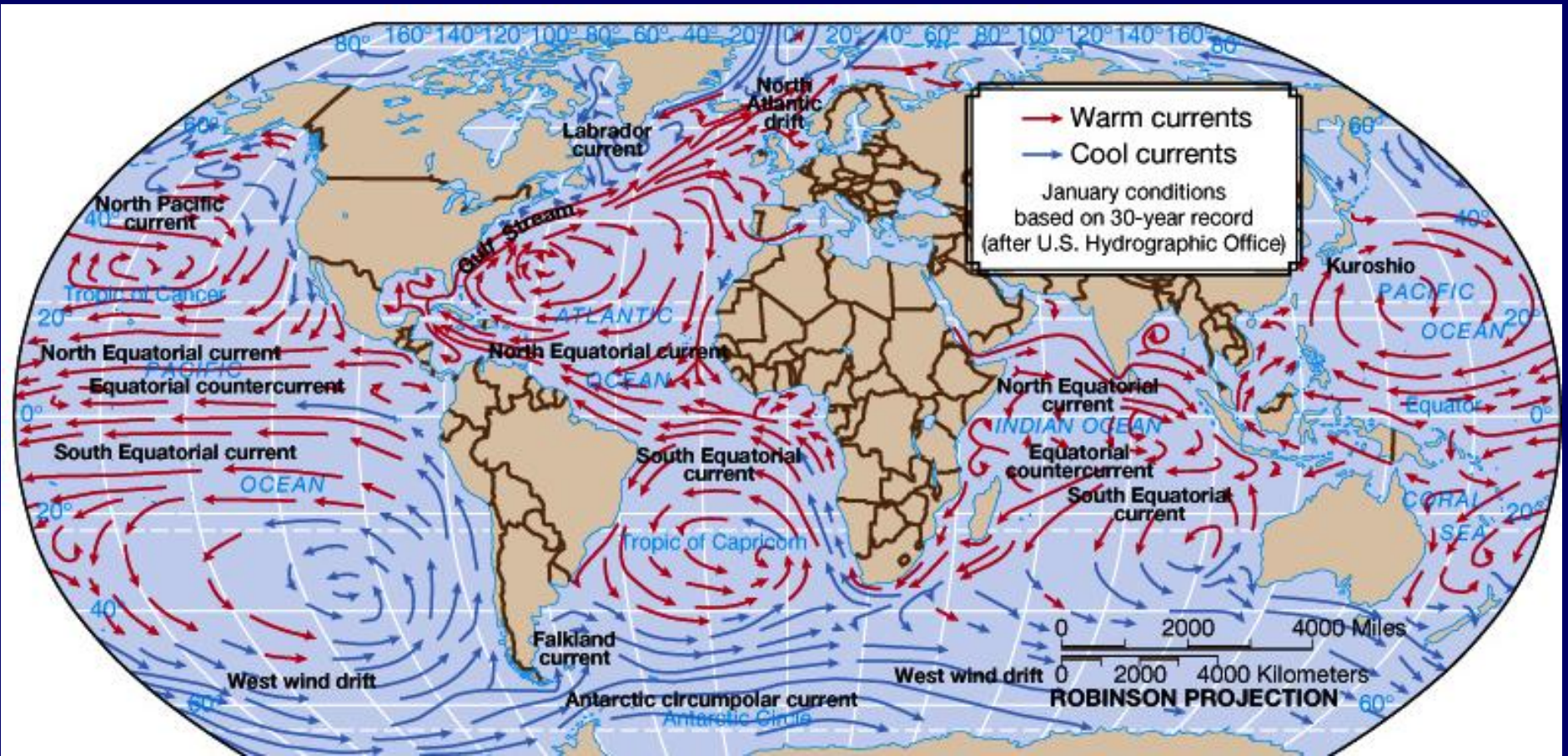


http://www.vets.ucar.edu/vg/T341/index.shtml

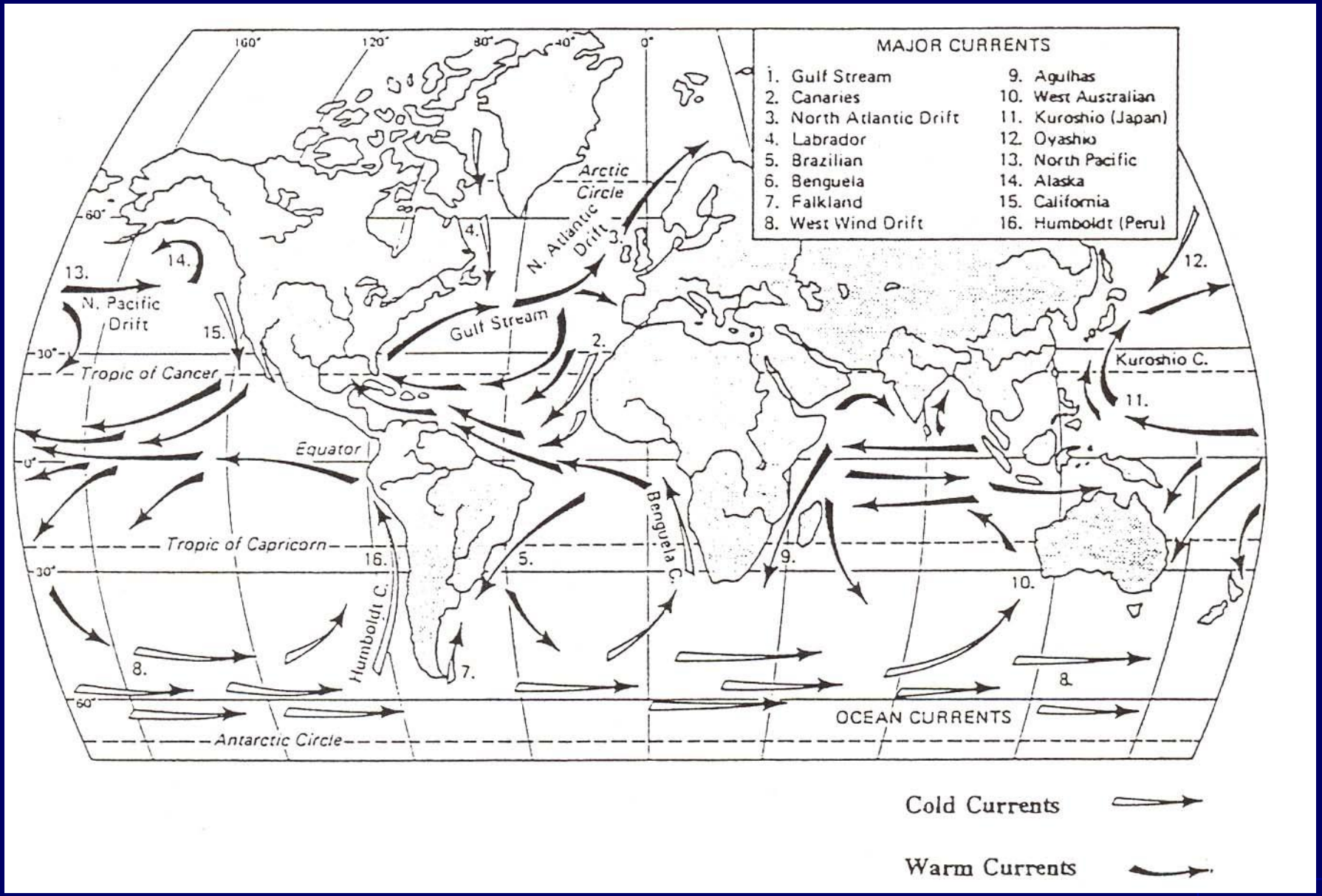
H + LE + G

BUT WHAT ABOUT G ?

G is a **STORAGE** component, not a transfer component BUT energy stored in the OCEAN, can later be transported via ocean currents as **H** !

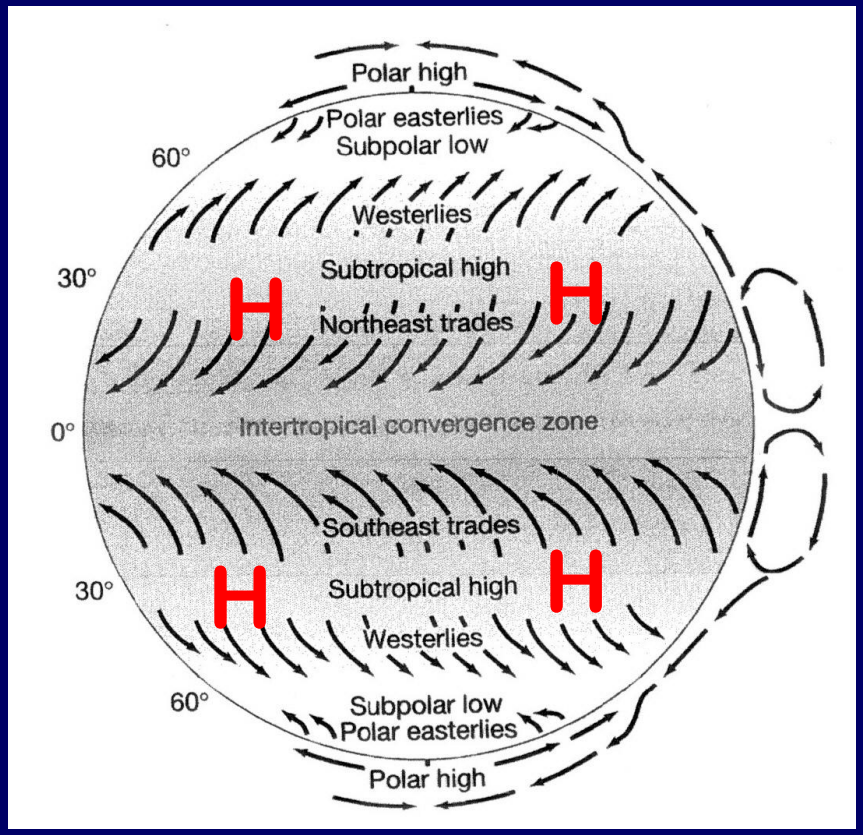


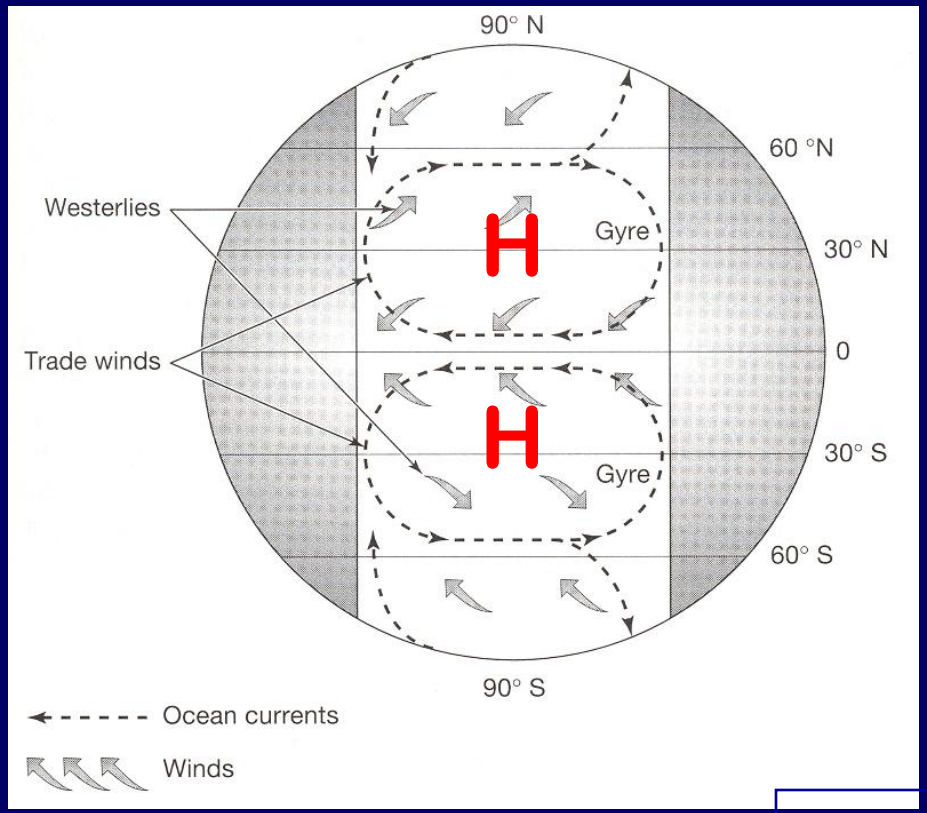
WARM & COLD SURFACE OCEAN CURRENTS:



➔ Large OCEAN GYRES -- driven by Trade Winds & Westerlies in Oceanic Subtropical HIGH PRESSURE CELLS (STH)

Leads to SURFACE ocean currents





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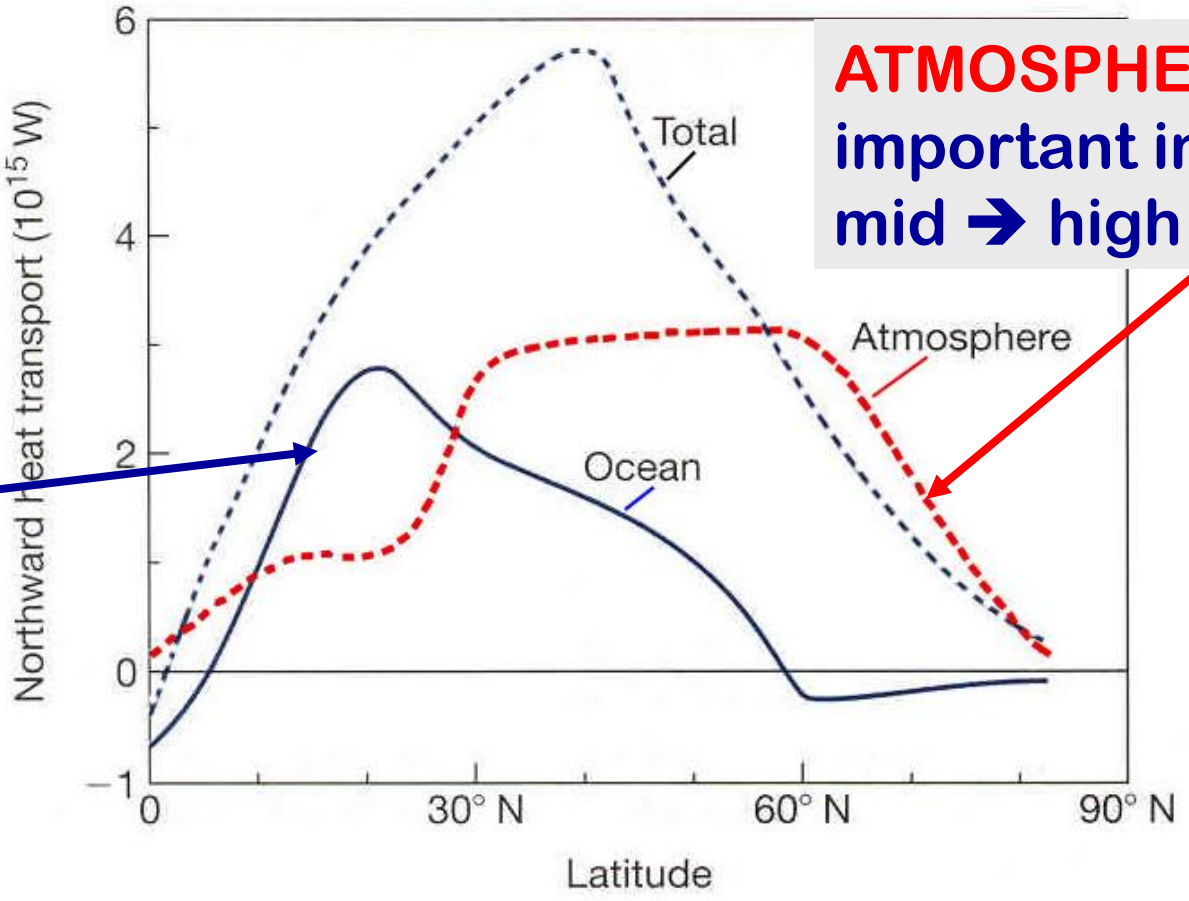
Both ATMOSPHERE & OCEAN play important roles in BALANCING OUT ENERGY SURPLUS & DEFICIT AREAS:

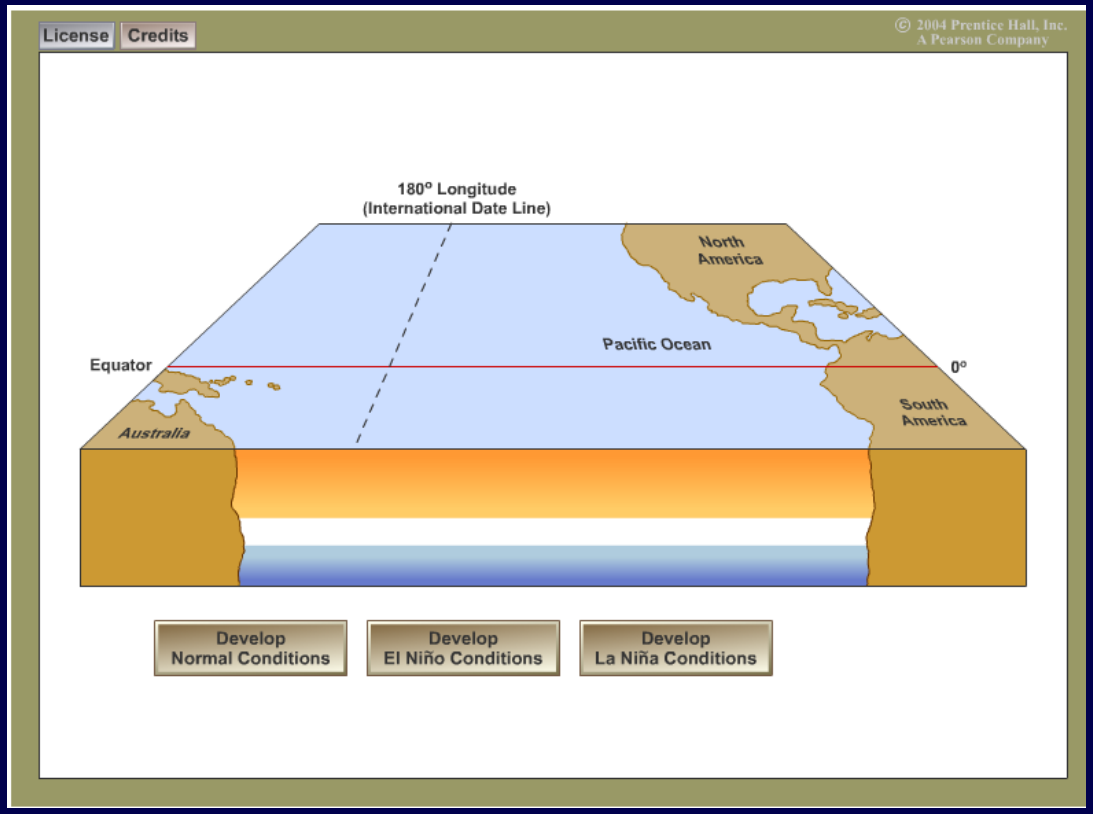


ATMOSPHERE more important in mid ➔ high latitudes

OCEAN transports MOST of the energy in LOW ➔ subtropical latitudes

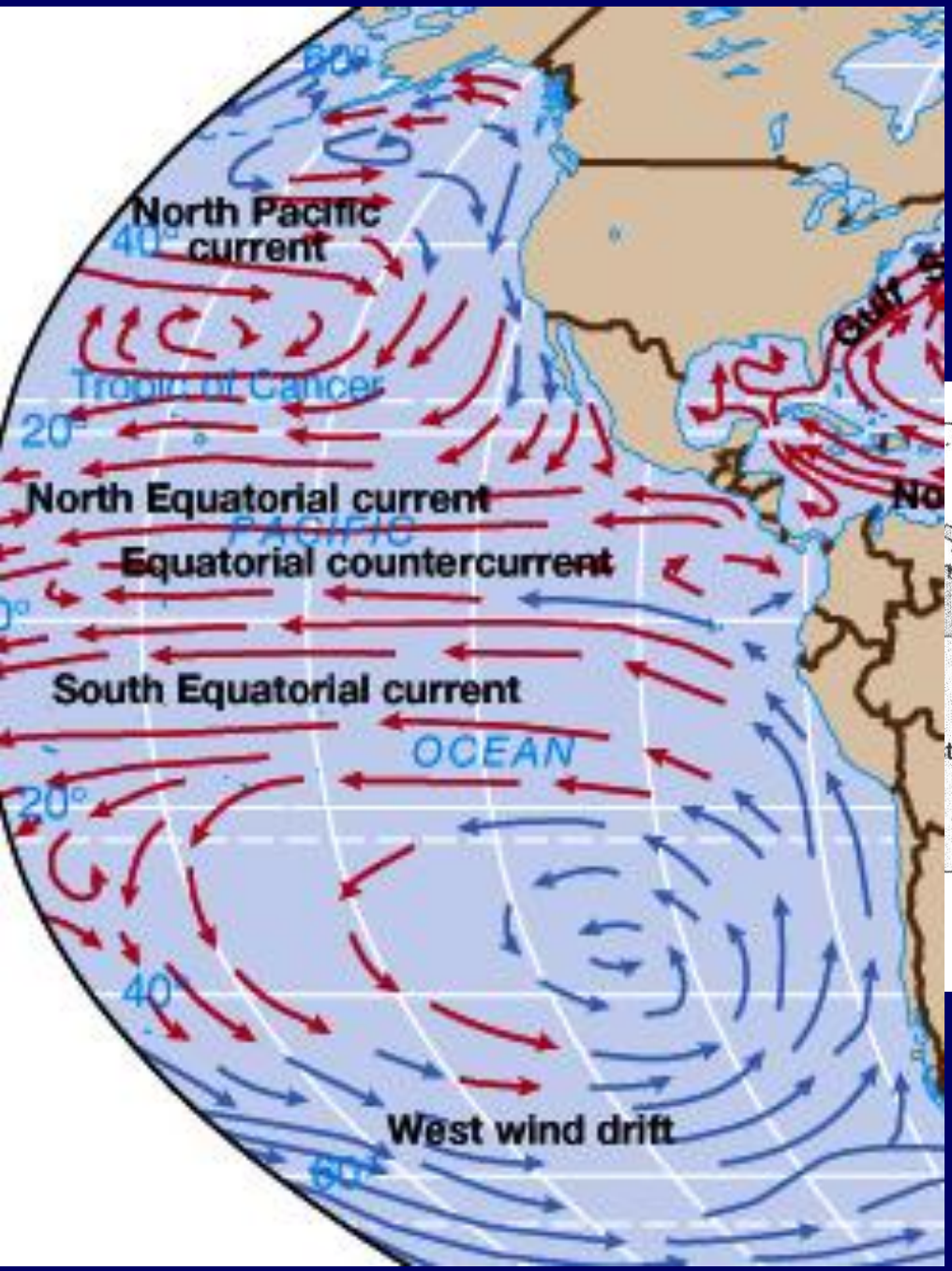
Poleward transport of energy in N.H.

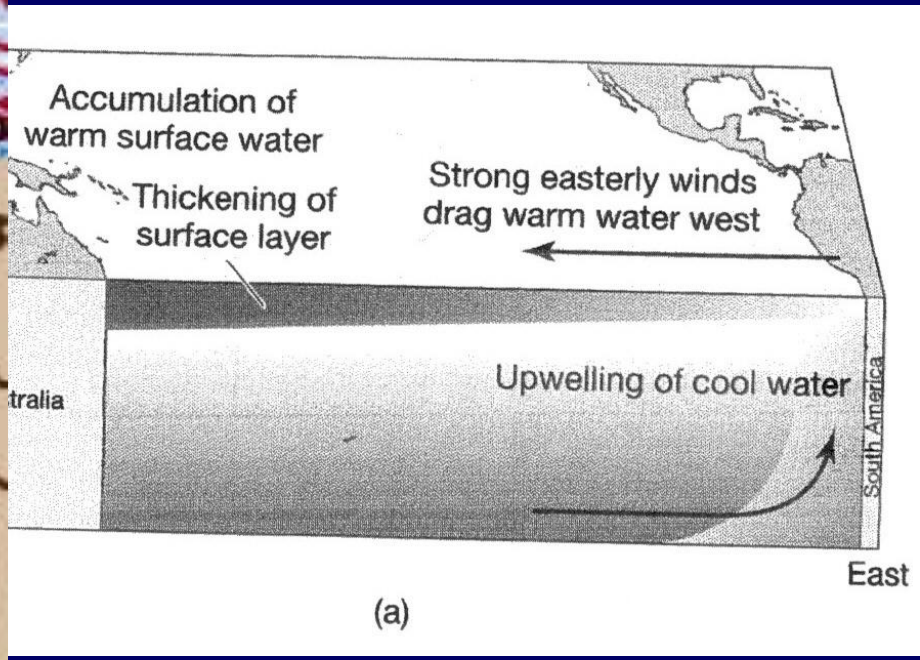
A KEY ATMOPSHERE-OCEAN INTERACTION : El Niño / La Niña ENSO (El Niño – Southern Oscillation)



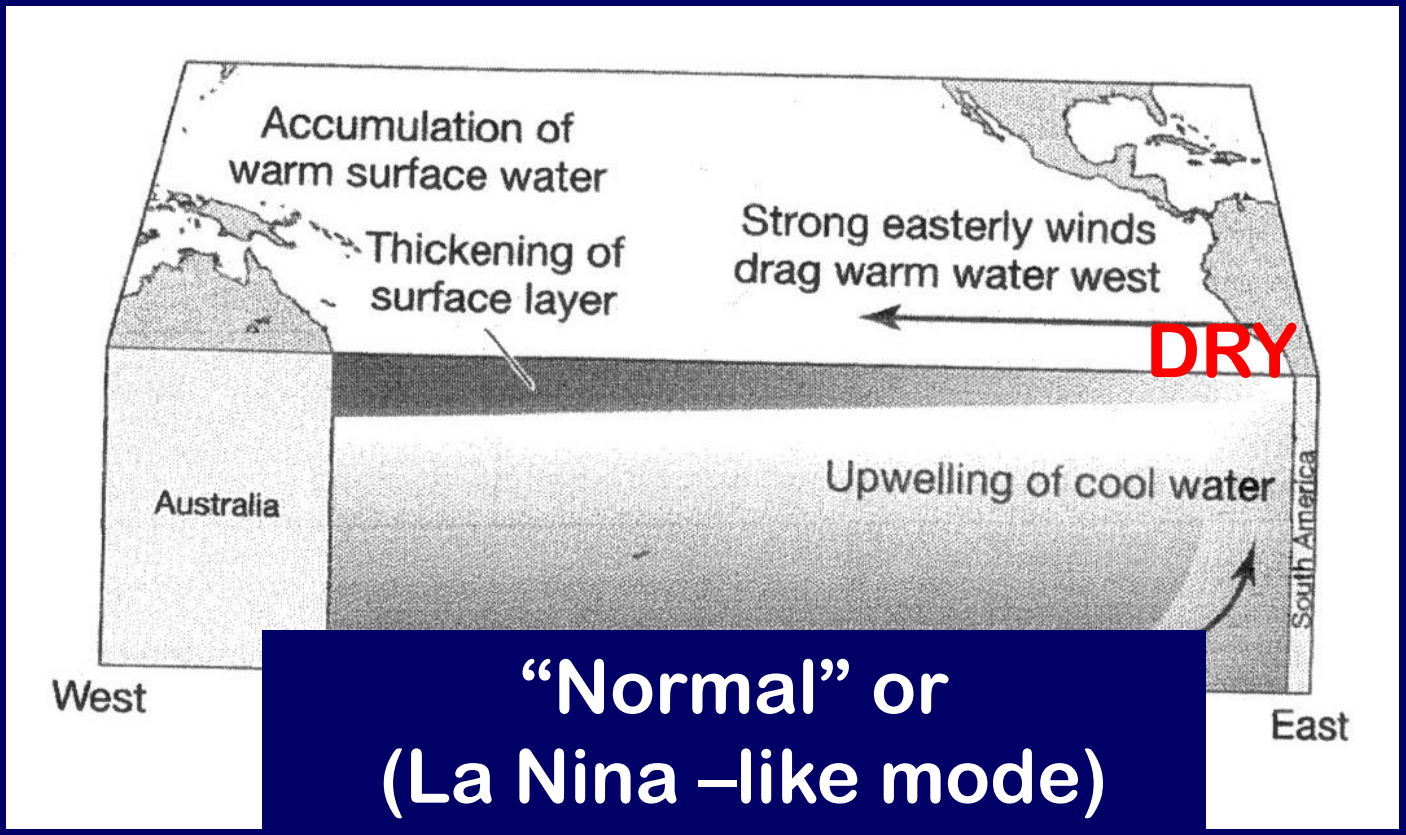
http://esminfo.prenhall.com/science/geoanimations/animations/26_NinoNina.html

EL Nino & La Nina Ocean circulation shifts

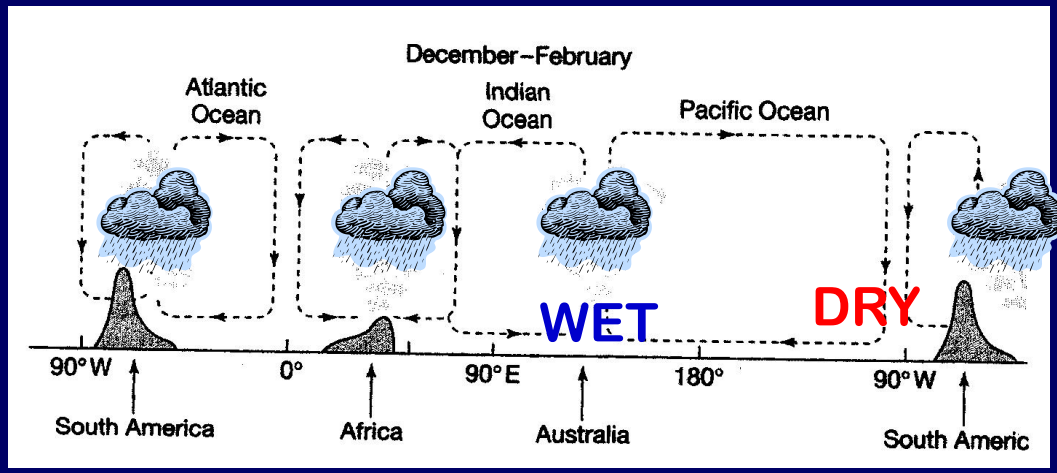




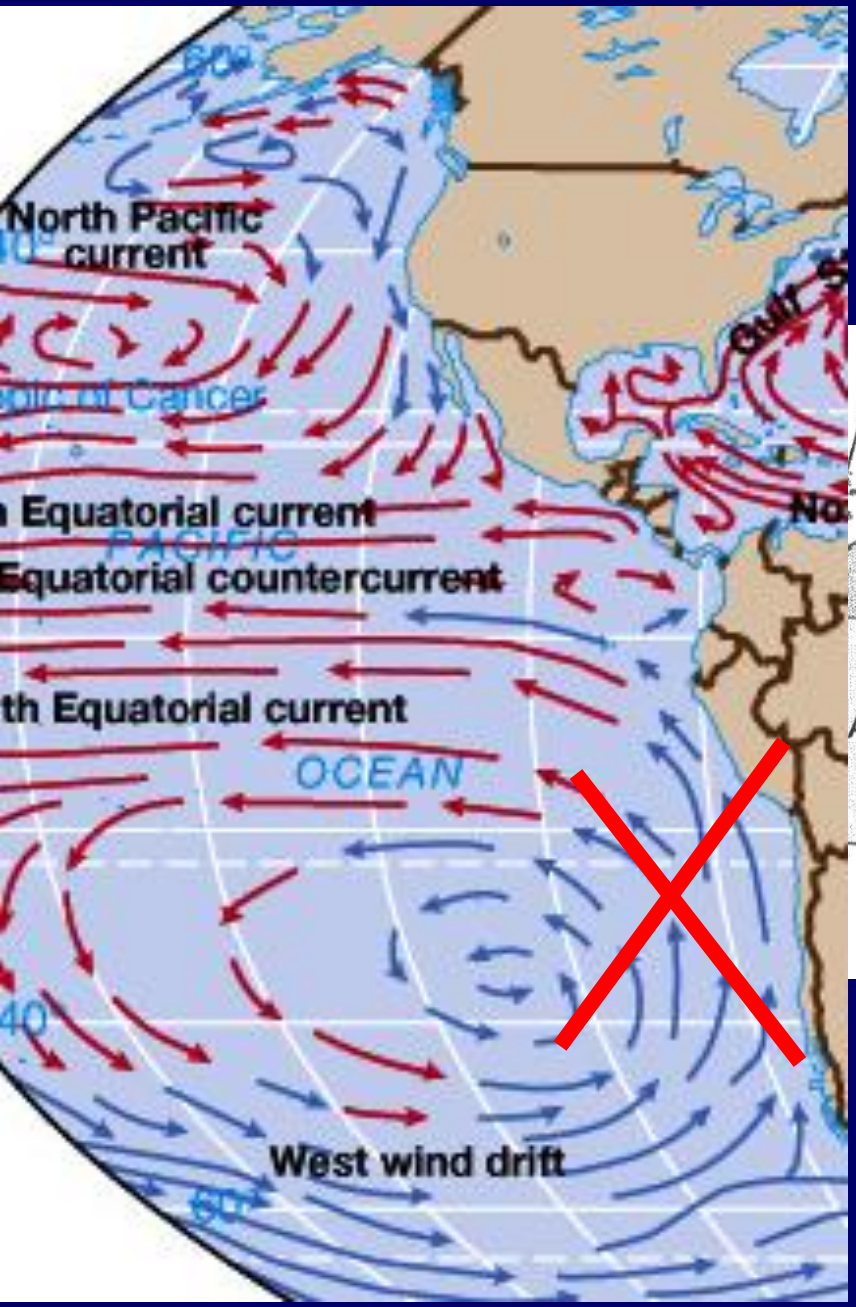
"Normal" situation (La Nina –like)

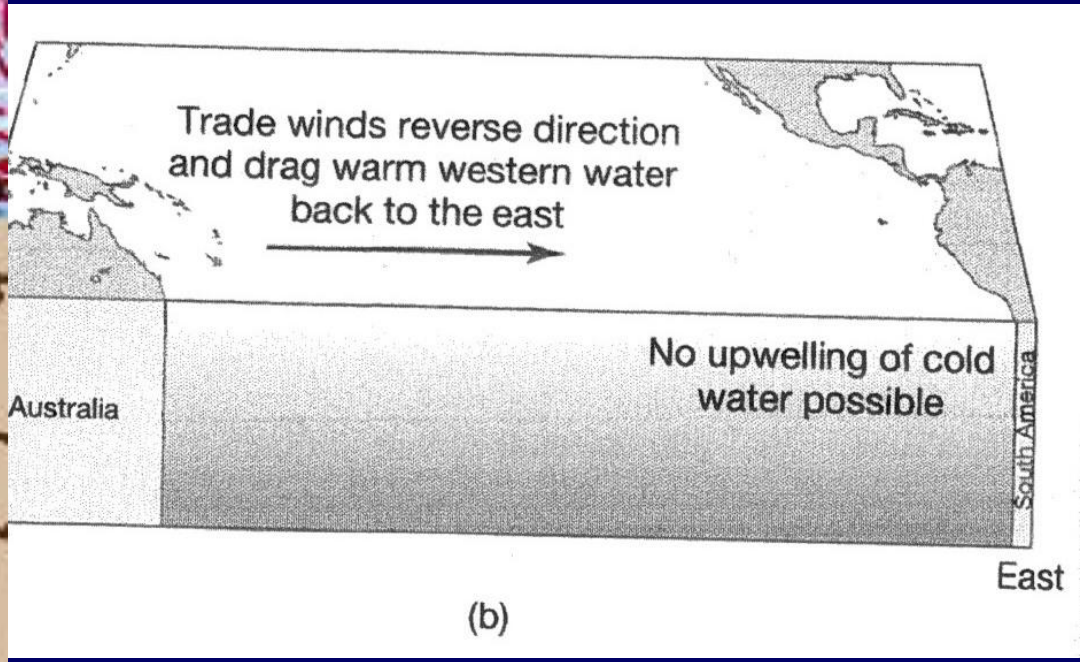


"Normal" or (La Nina –like mode)



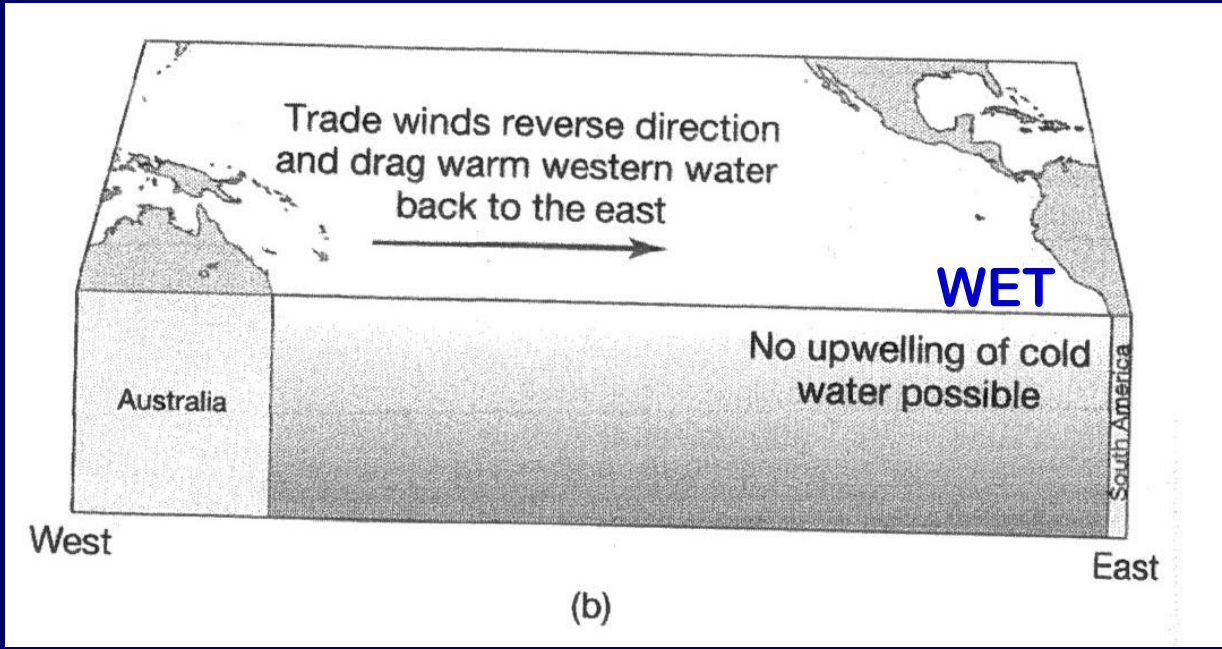
EL Nino & La Nina short-term ocean circulation shifts

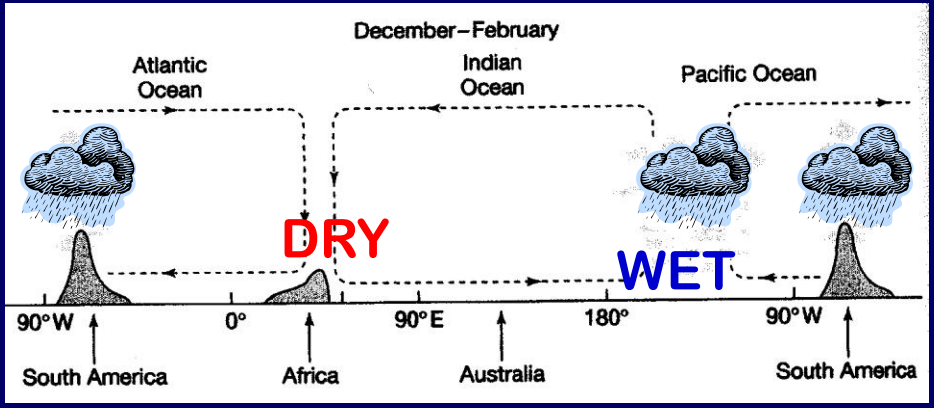




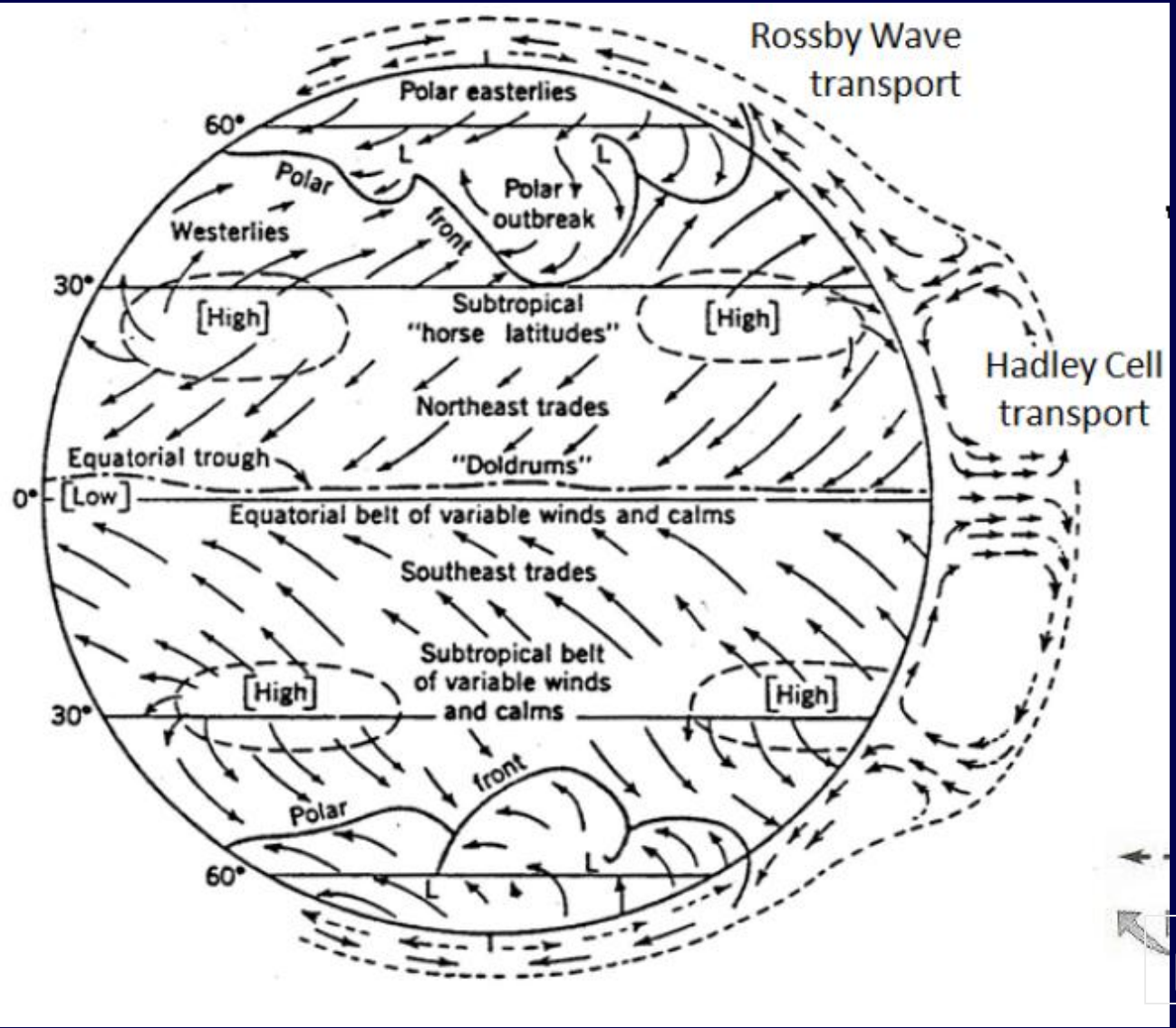
"El Nino" situation: Upwelling fails

EL Nino mode


Trade winds reverse direction
and drag warm western water
back to the east
WET
No upwelling of cold
water possible
Australia
South America
West
East
(b)


December–February
Atlantic
Ocean
Indian
Ocean
Pacific Ocean
DRY
WET
90°W
0°
90°E
180°
90°W
South America
Africa
Australia
South America

GLOBAL CLIMATE PATTERNS – BRIEF OVERVIEW



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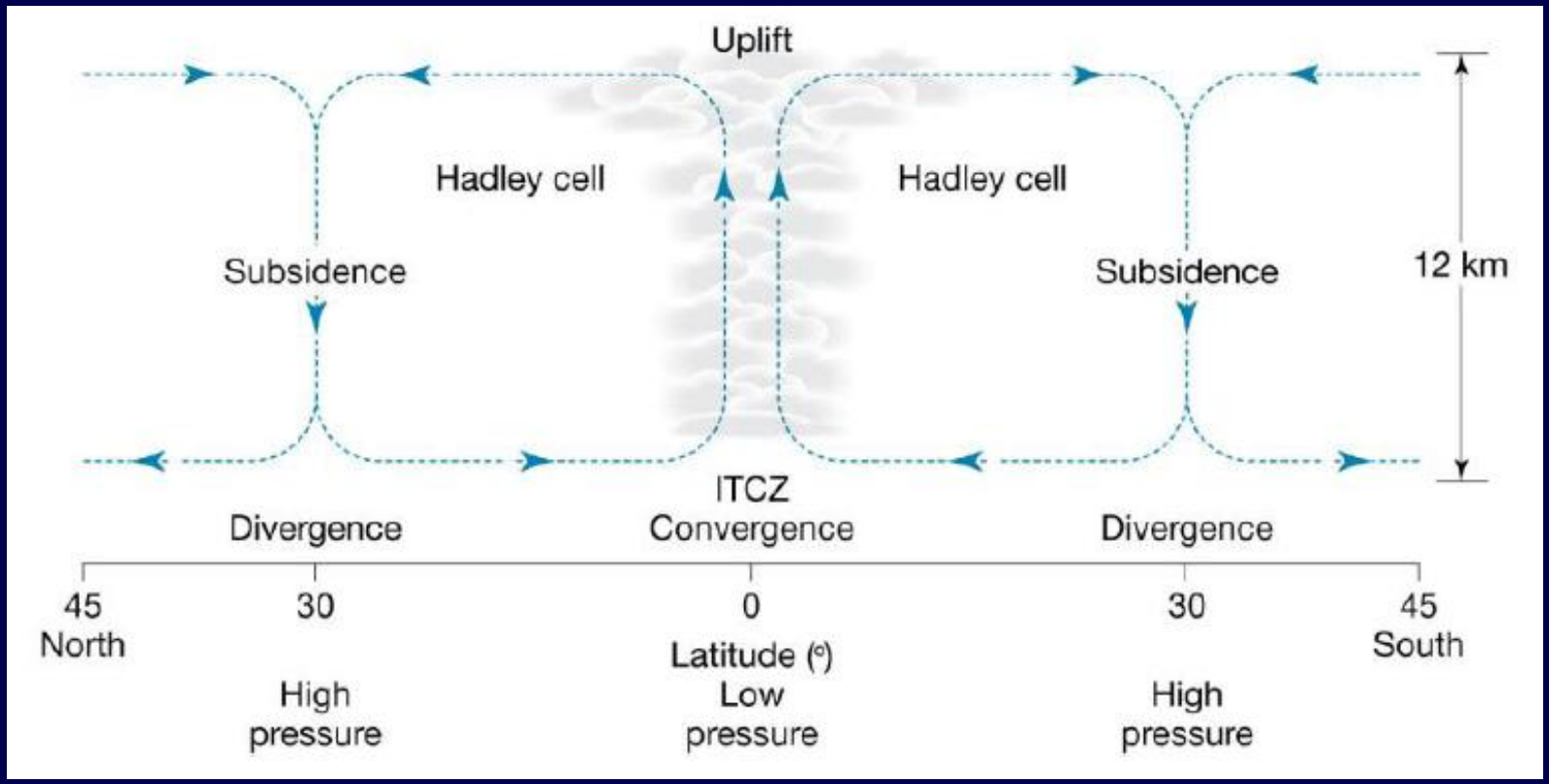
UPLIFT vs SUBSIDENCE



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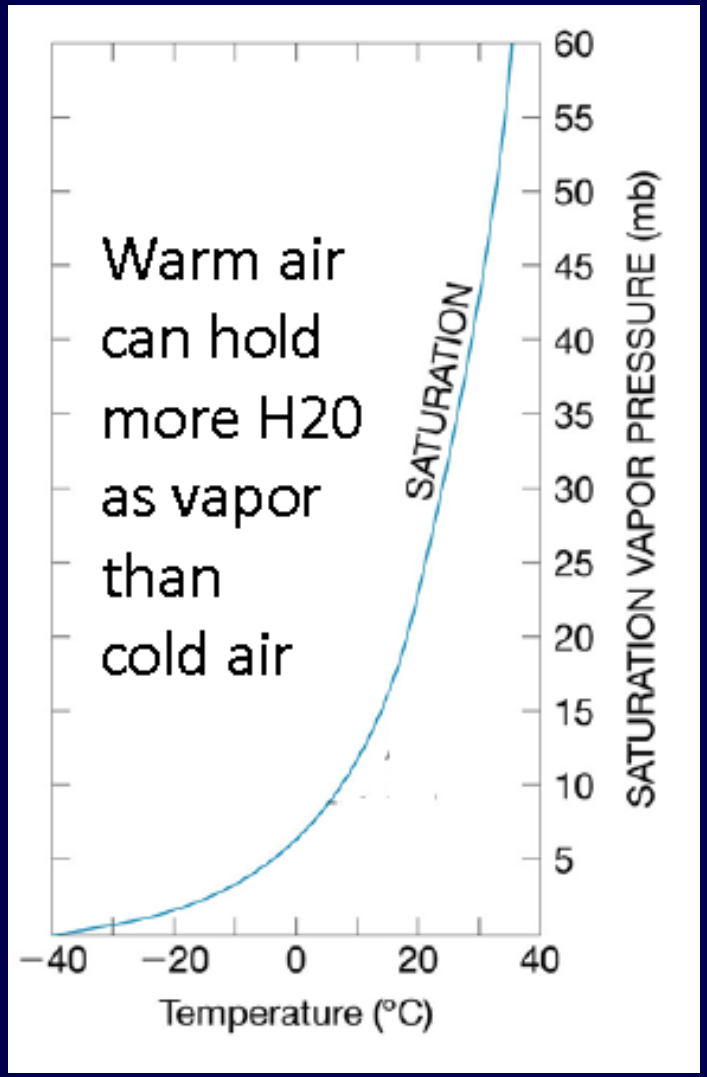
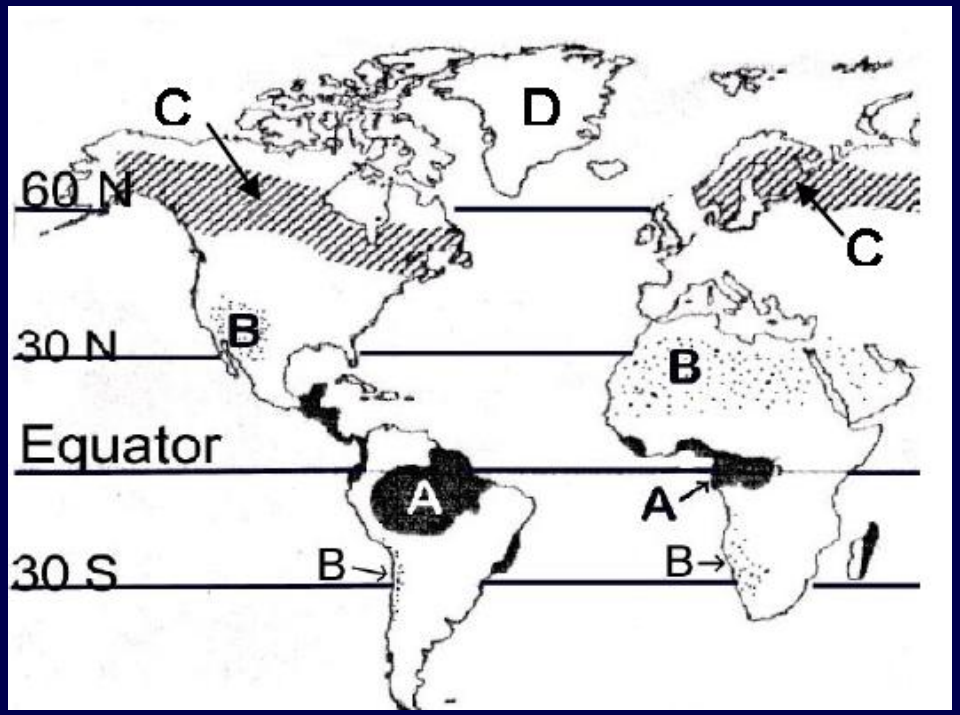


WARM REGIONS (Tropics) vs COLD REGIONS (Arctic/Antarctic & Poles)

Q's. What kind of climate and vegetation will you find in the areas marked A, B , C, & D ?



Q-1 AREA A?
Q-2 Area B?
Q-3 Area C?
Q-4 Area D?

1-Tropical Forest
2 -Conifer Forest
3- Warm Desert vegetation
4 -No vegetation: snow and ice

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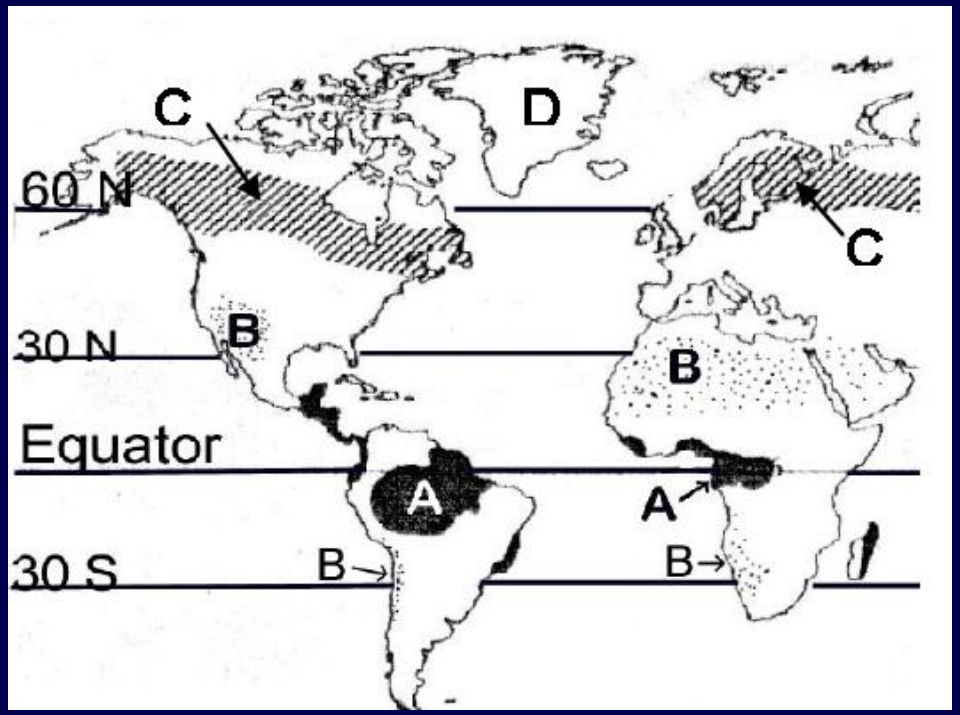
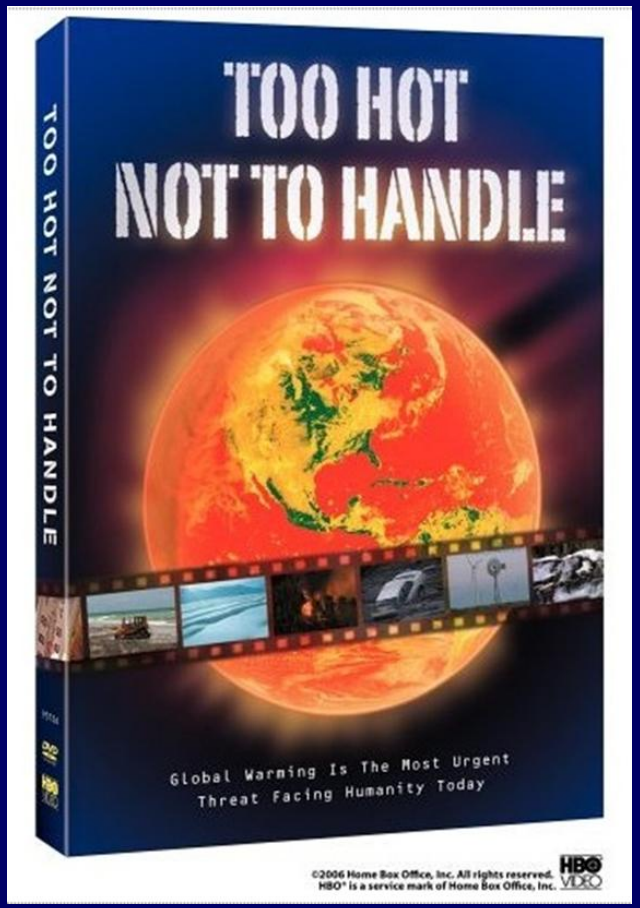
Q's. What kind of climate and vegetation will you find in the areas marked A, B , C, & D ?



ANSWERS:

Q-1 **AREA A**= 1
Q-2 **Area B** = 3
Q-3 **Area C** = 2
Q-4 **Area D** = 4

1-Tropical Forest
2 -Conifer Forest
3- Warm Desert vegetation
4 -No vegetation: snow and ice


TOO HOT NOT TO HANDLE
TOO HOT
NOT TO HANDLE
Global Warming Is The Most Urgent
Threat Facing Humanity Today
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