Module 4
Earth's Dynamics

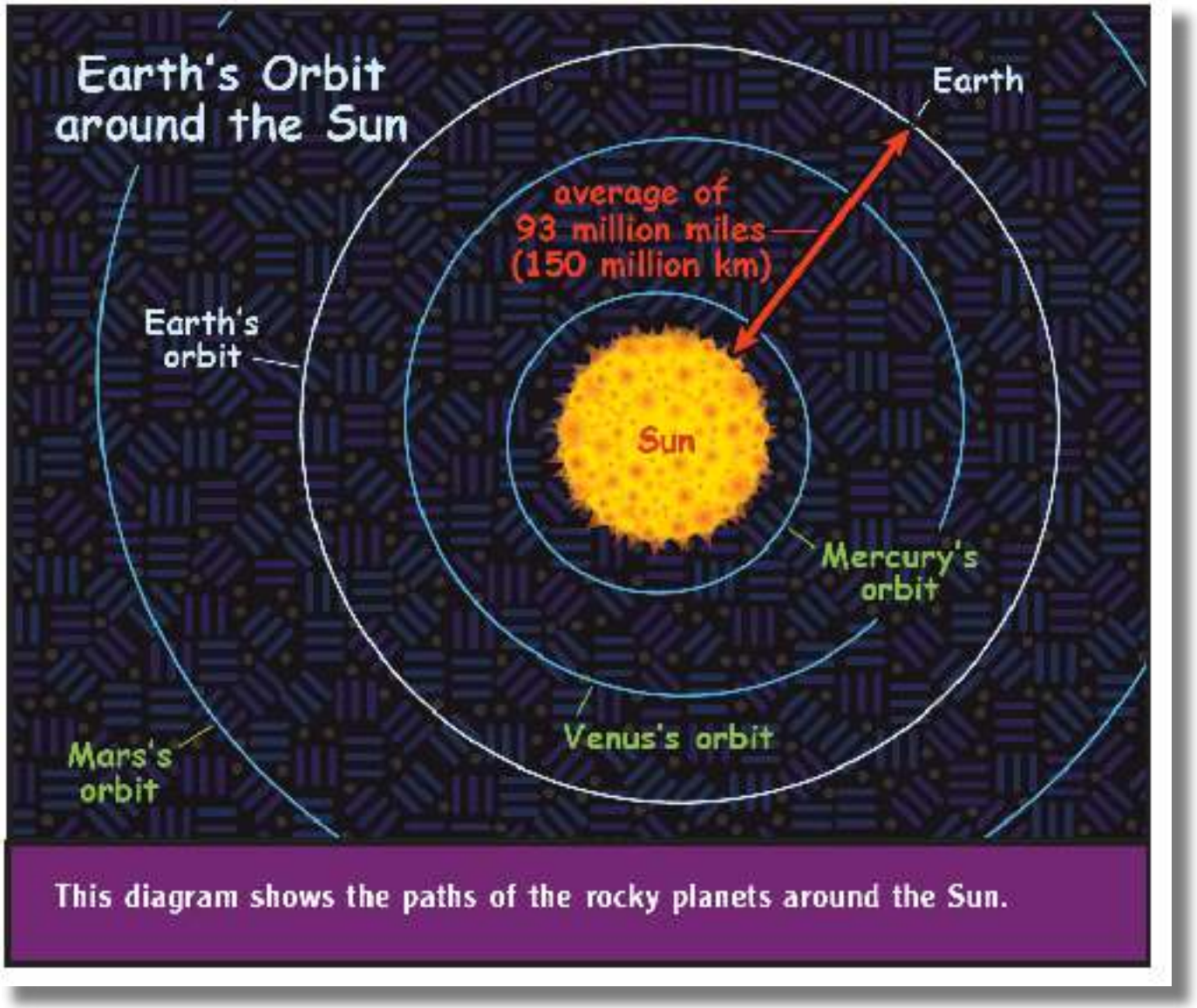
BUMI DALAM TATASURYA

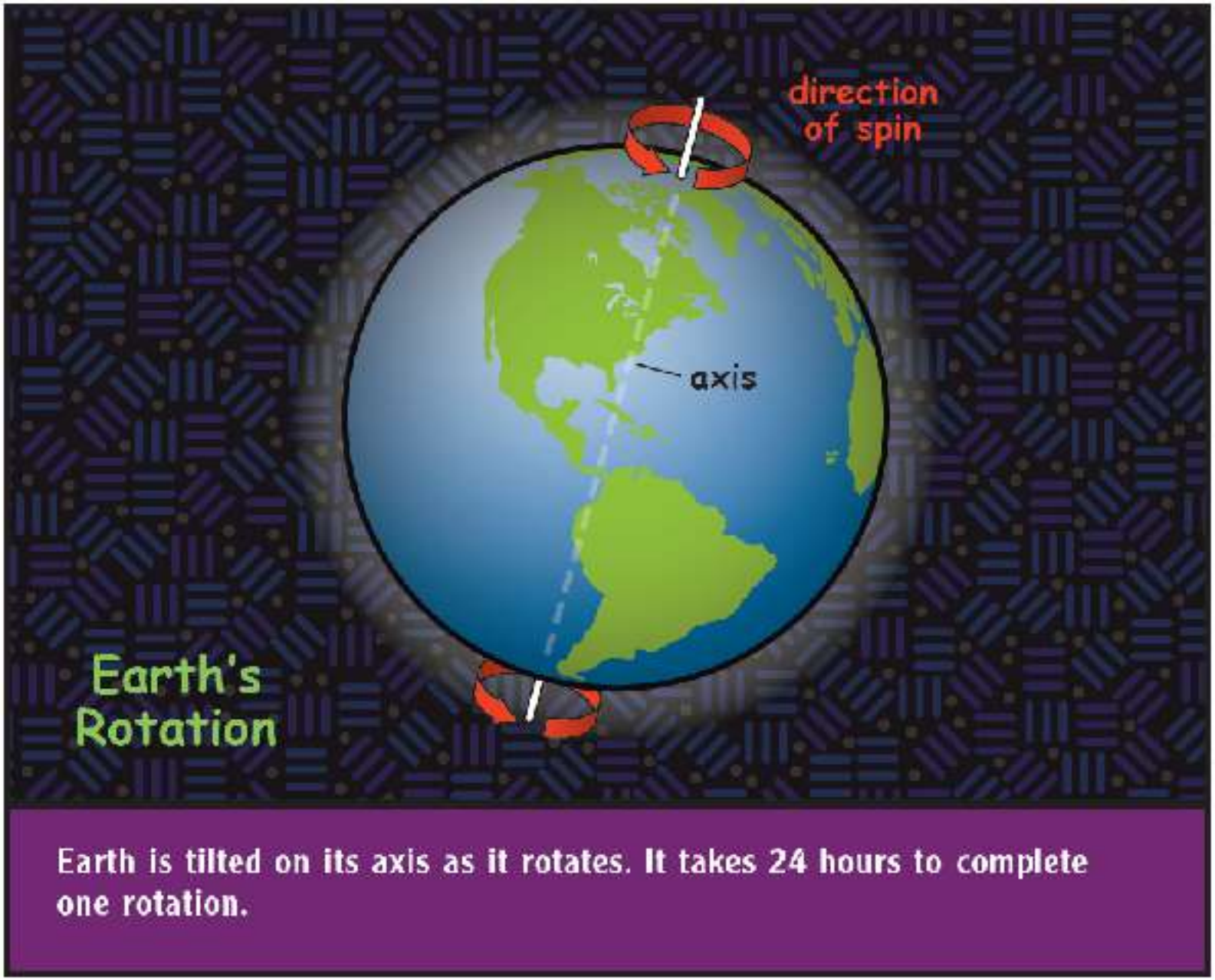
- Matahari dan planet-planetnya
- Anatomi bumi
- **Dinamika bumi**

EARTH DYNAMICS

- Rotation and revolution of planets
- Heat (from solar and Earth's mantle)
- Gravity force
- Electro-magnet

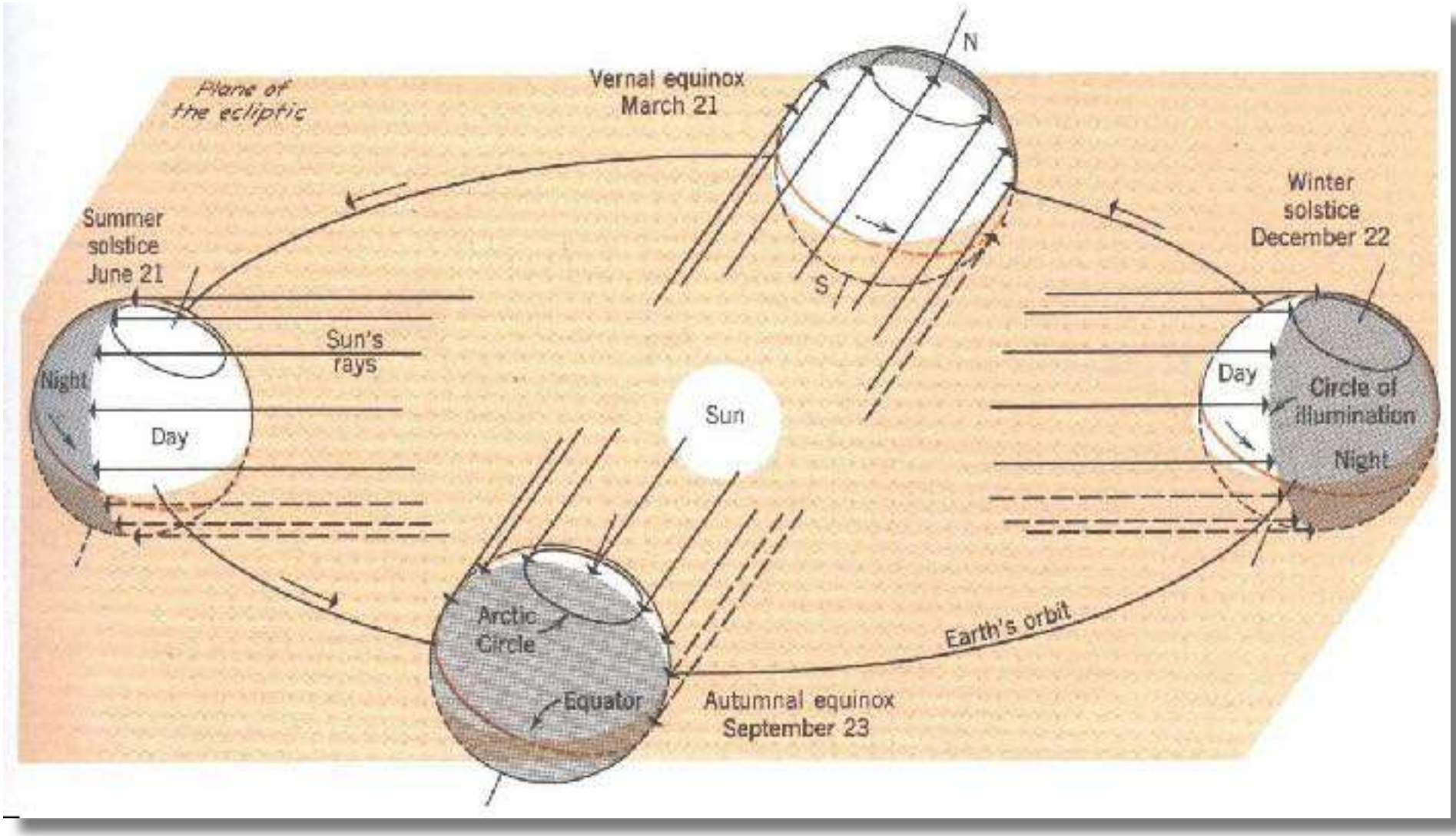
EARTH'S orbit around the Sun





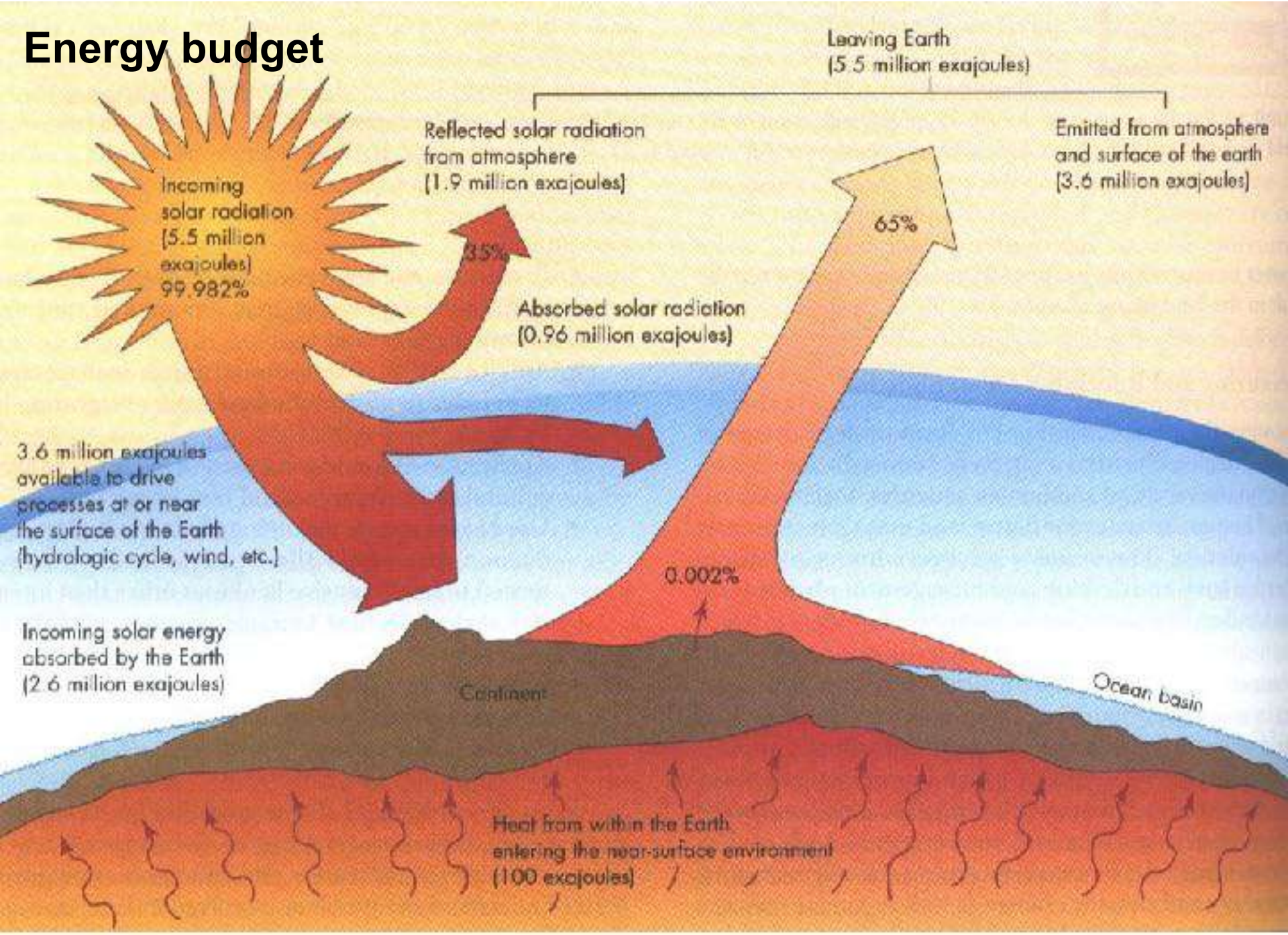
Earth is tilted on its axis as it rotates. It takes 24 hours to complete one rotation.

Distributian of day and night; and climate along year

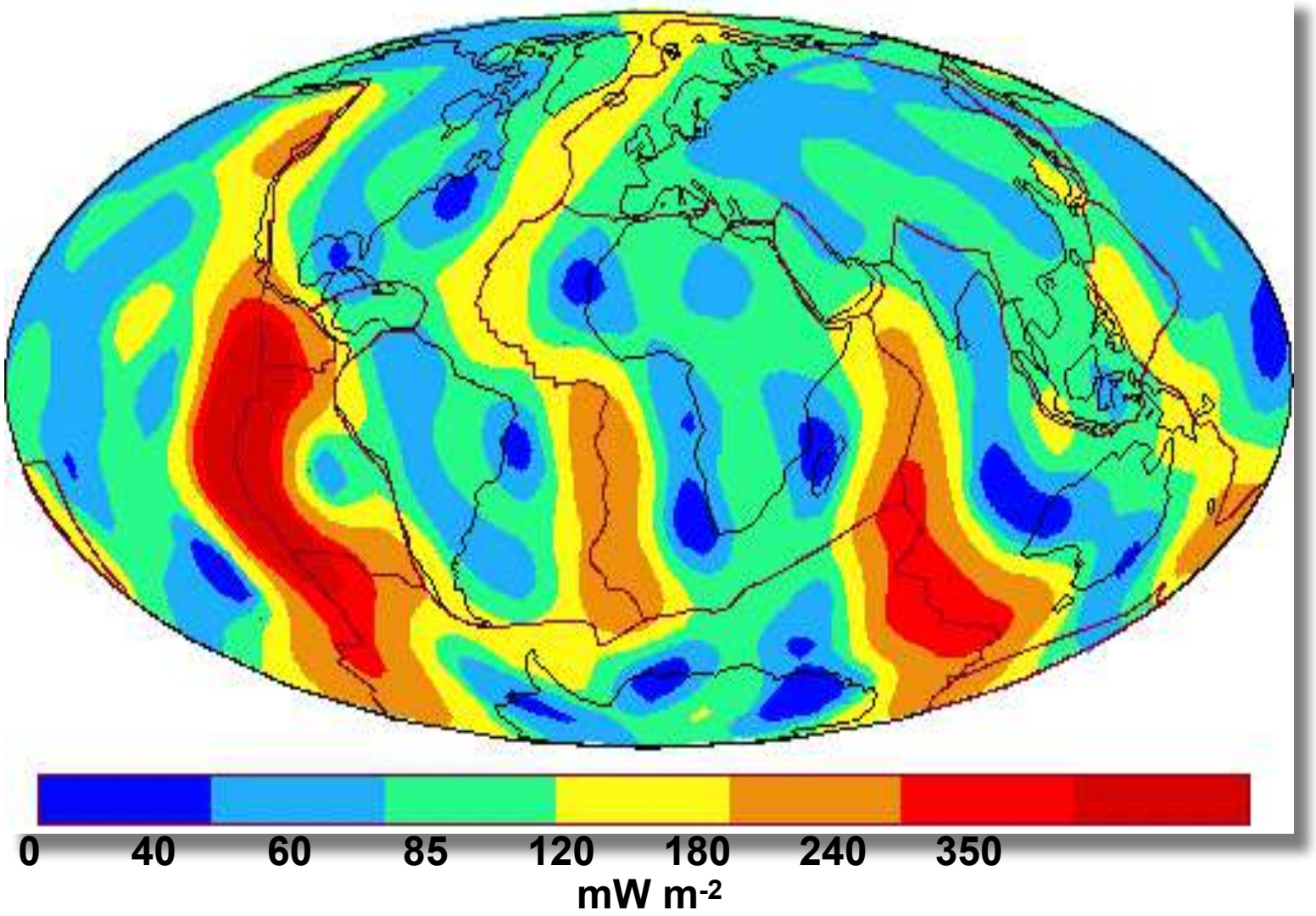


Solstice: Titik balik matahari
Equinox: Waktu siang dan malam sama lama

Energy budget

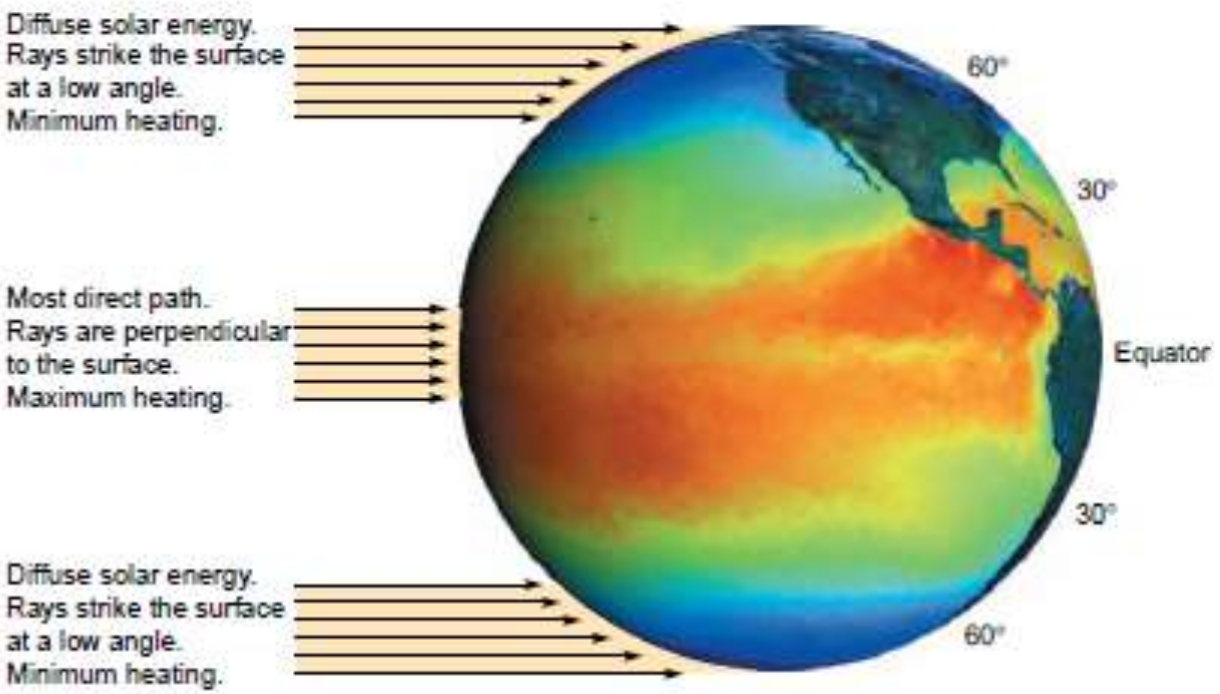


Heat Flow (Internal Source)



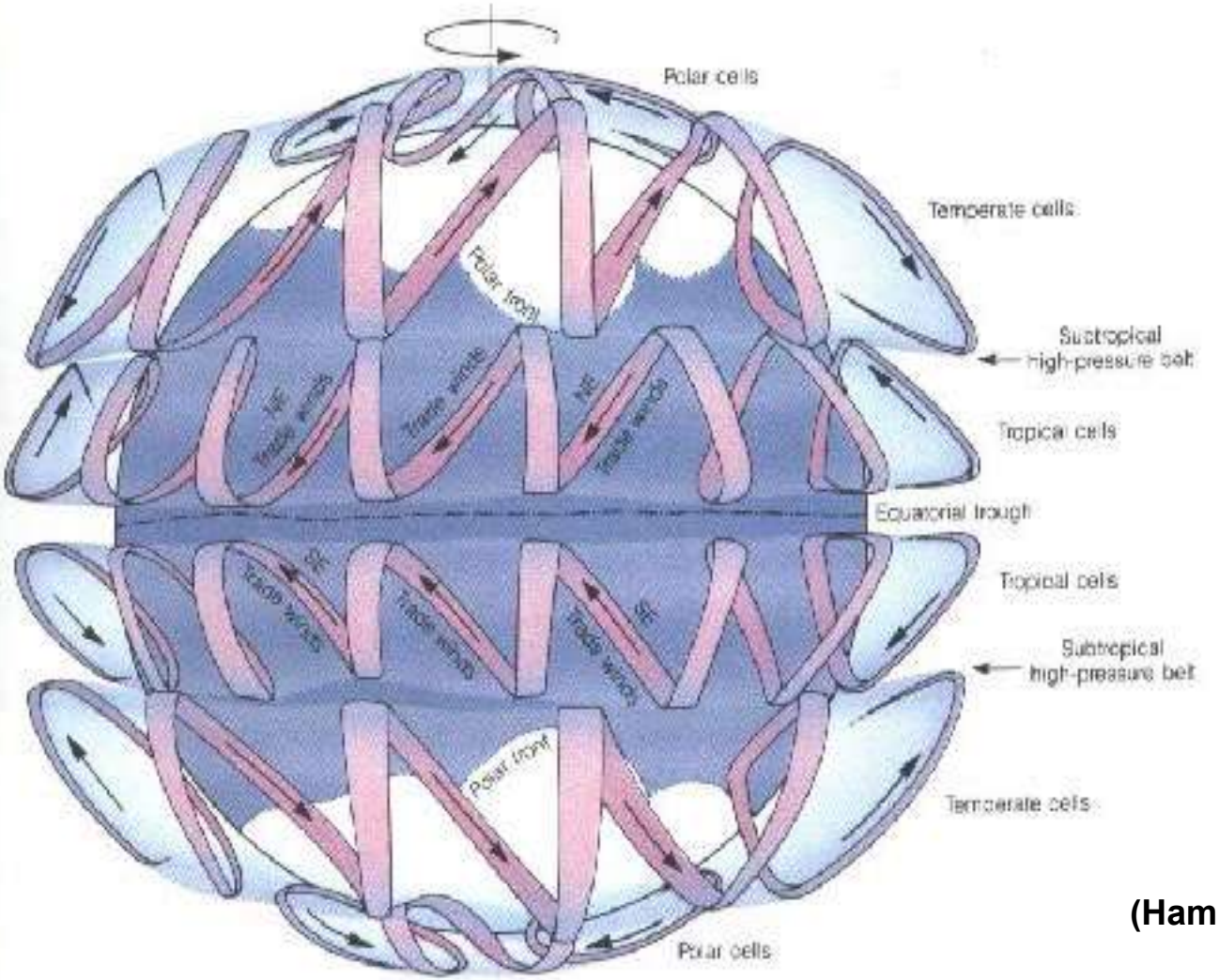
The Sun's energy on Earth

FIGURE 9.7 The Sun's energy is unevenly distributed across the surface of the nearly spherical Earth. The amount of solar energy per unit area varies with the angle at which the Sun's rays strike Earth's surface. At low latitudes, near the equator, the Sun's rays are nearly perpendicular and much more heat is received per unit area. At higher latitudes, where the angle is smaller, the same amount of energy is spread over a larger elliptical area and warms the surface less. Moreover, sunlight must travel through a much greater thickness of atmosphere near the poles than at the equator. This greater thickness also diminishes the amount of heat that reaches the surface.



(Hamblin & Christiansen, 2009)

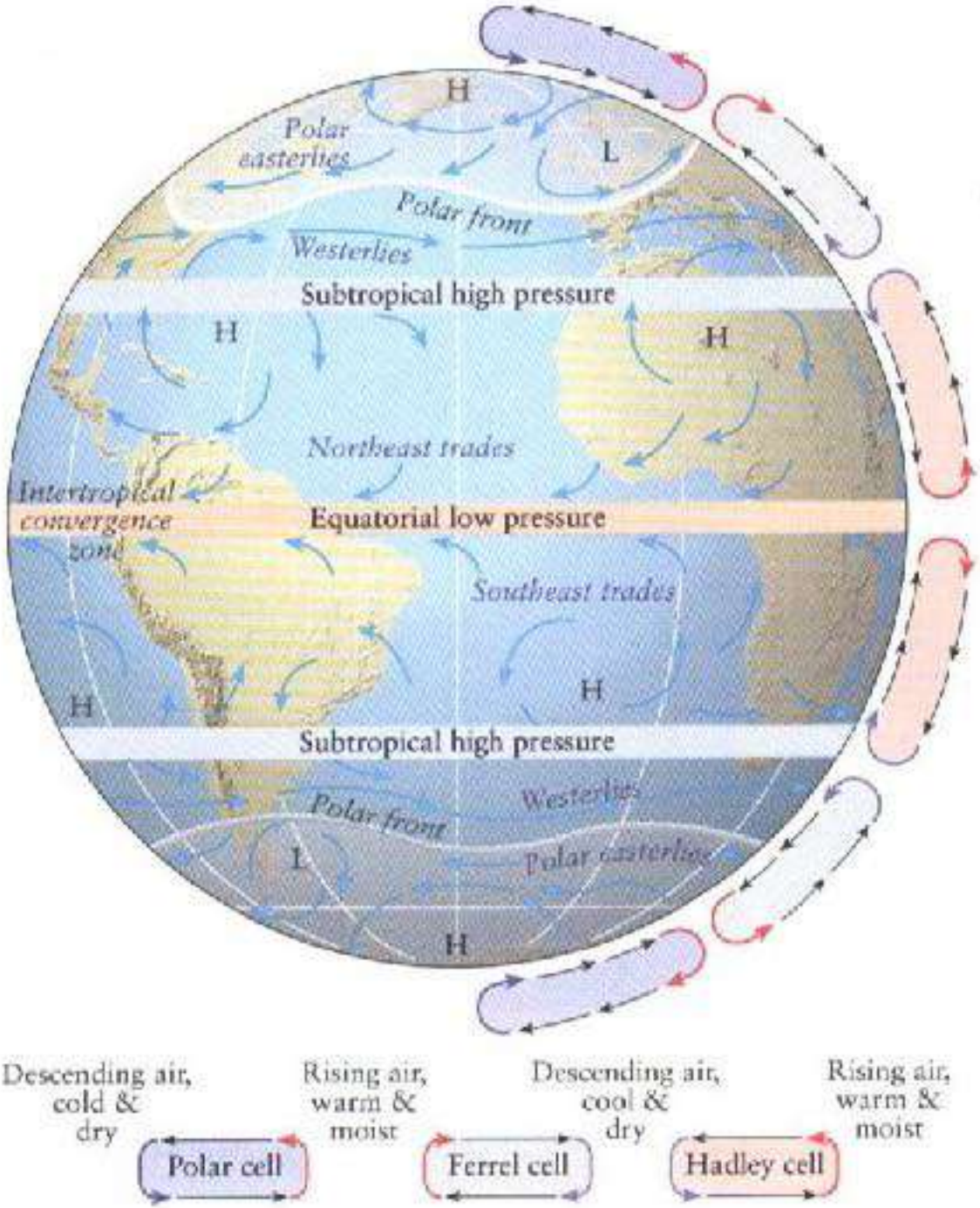
Winds circulation



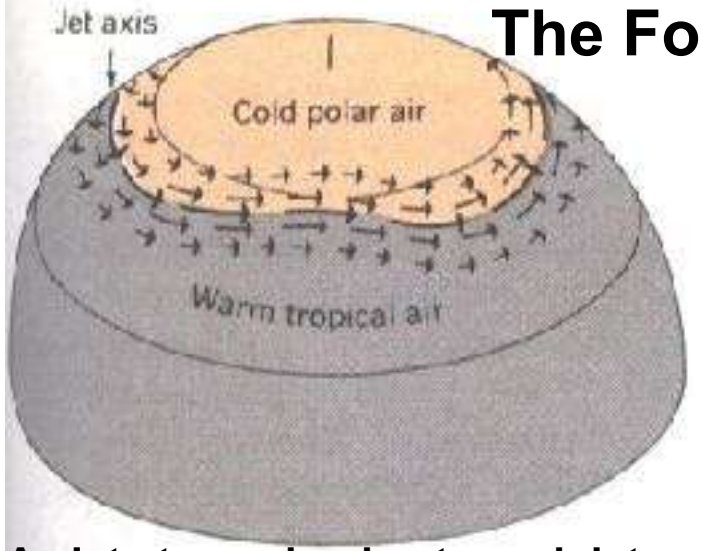
(Hamblin & Christiansen, 2009)

FIGURE 9.8 **Atmospheric circulation** and prevailing wind patterns are generated by the uneven distribution of solar radiation in combination with Earth's rotation. In the equatorial regions, air is intensely heated; the heating reduces its density, and the air rises. At higher altitudes, this air cools, becomes denser, and descends, forming the subtropical high-pressure belts (deserts) on either side of the equator. Near the surface, this air then moves back toward the equator to complete the cycle, causing trade winds. In the Northern Hemisphere, this air is deflected by Earth's rotation to flow southwestward. (In the Southern Hemisphere, flow is northwestward.) Temperate cells form a complementary spiral, creating strong west-to-east winds. Cold polar air tends to wedge itself toward the lower latitudes and forms polar fronts.

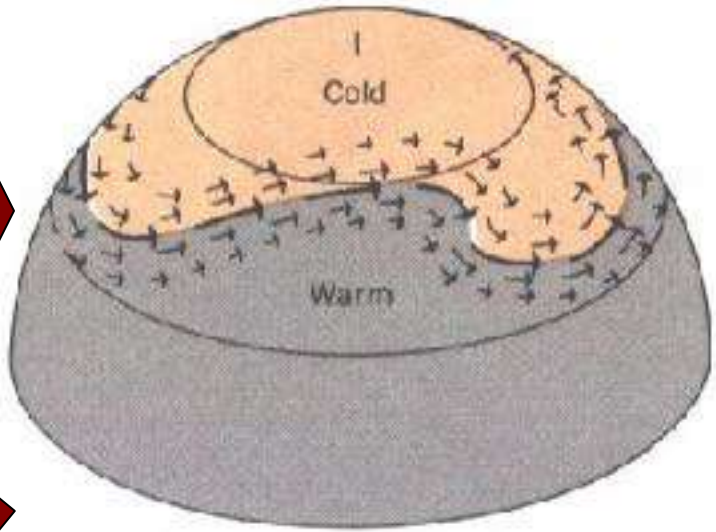
Winds circulation



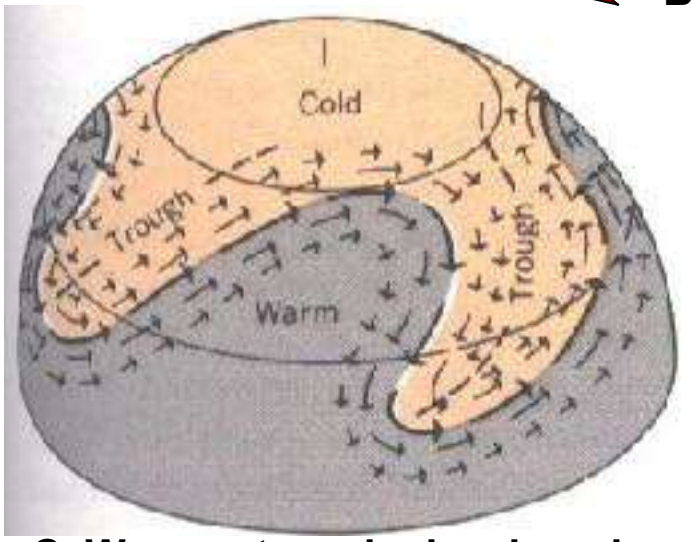
The Formation of Syclones dan anticyclones



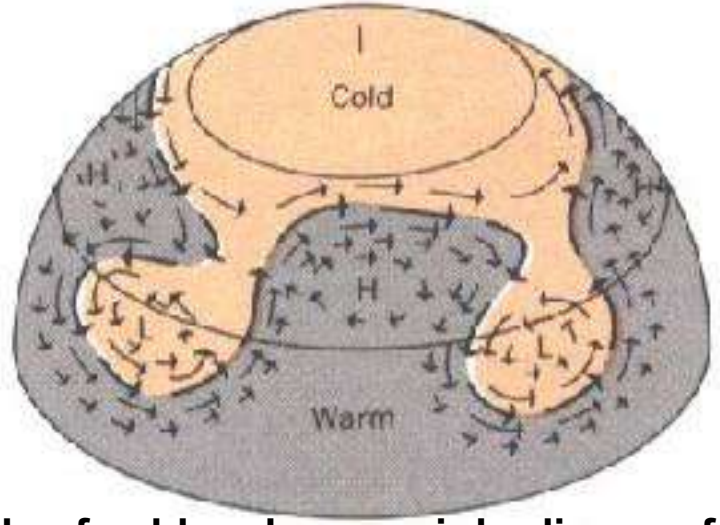
A. Jet stream begins to undulate



B. Rossby waves begin to form



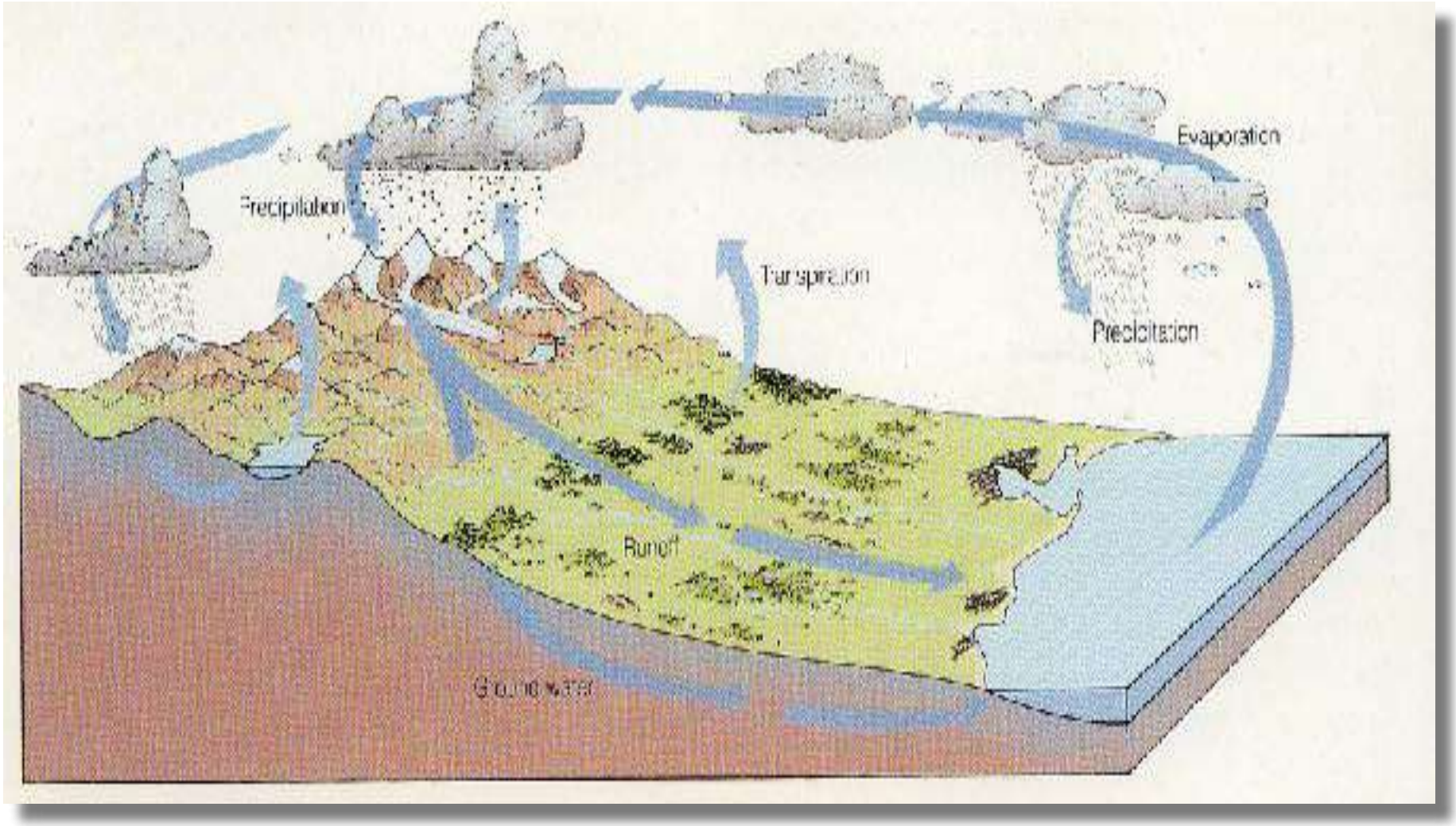
C. Waves strongly developed



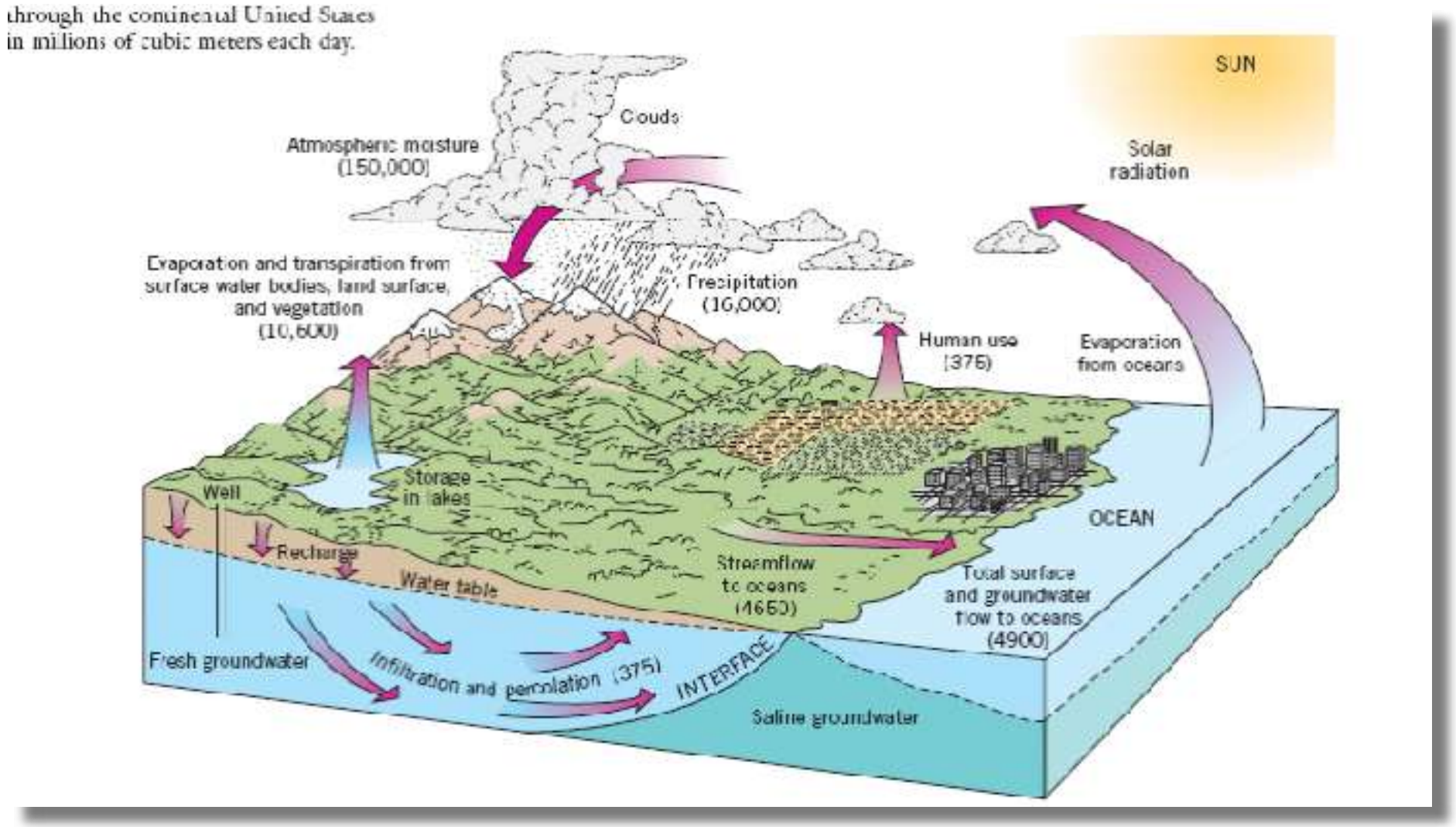
D. Cells of cold and warm air bodies are formed

Spiral clouds

Water Cycle

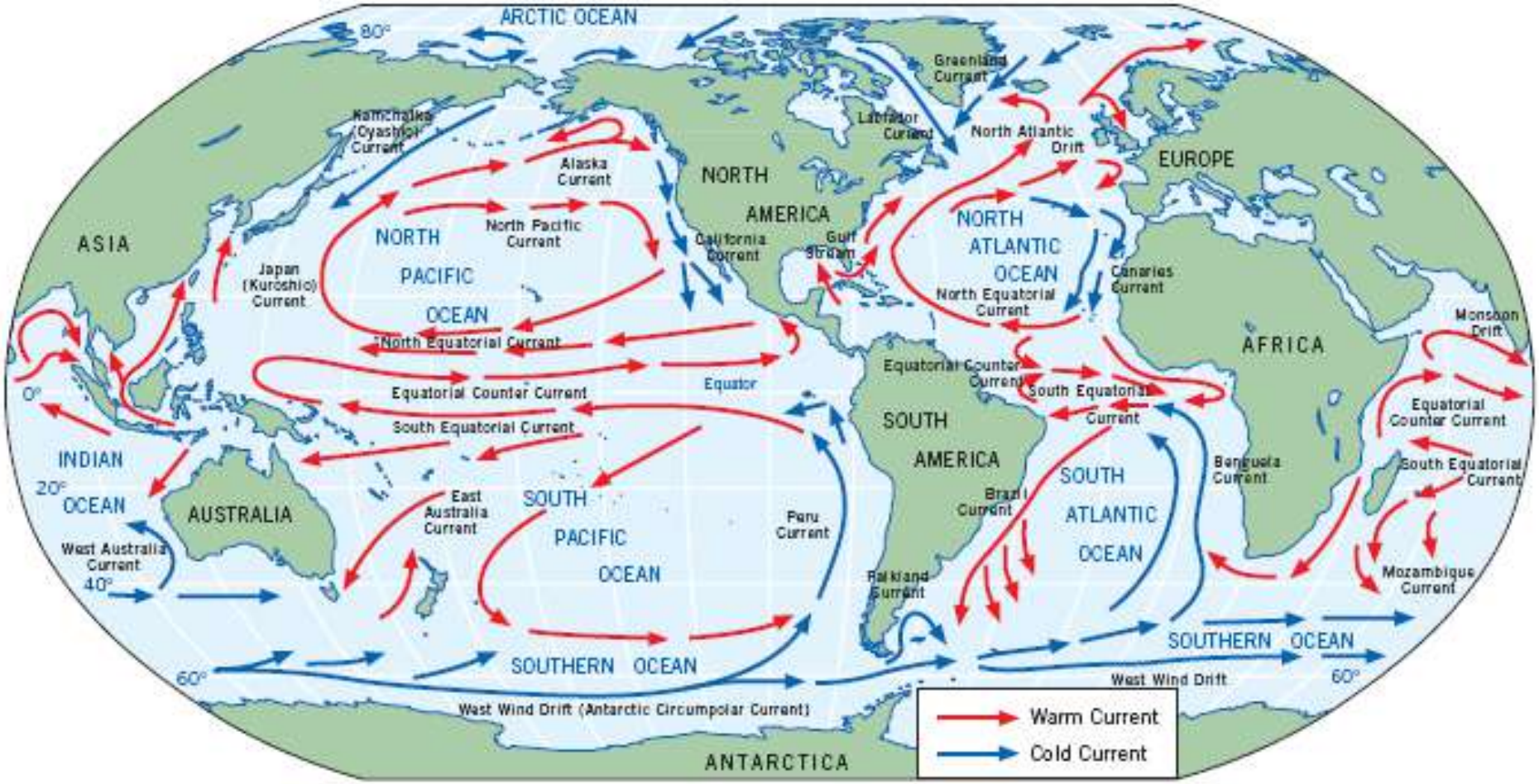

Evaporation
Precipitation
Transpiration
Precipitation
Runoff

How does water move among reservoirs?



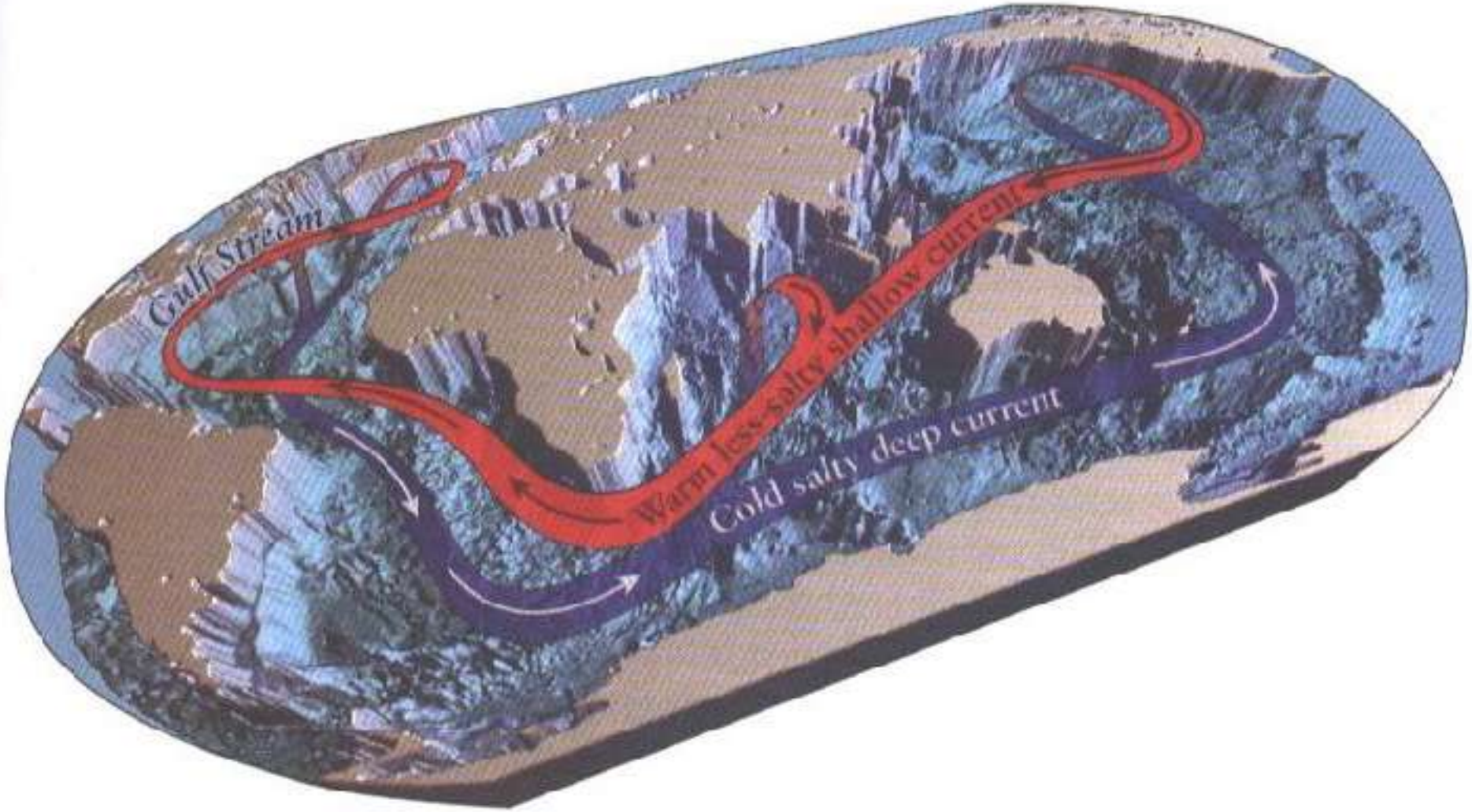
Ocean Currents

- Redistribute heat across planet



(Hamblin & Christiansen, 2009)

Deep ocean currents



(Hamblin & Christiansen, 2009)

Weather and Climate

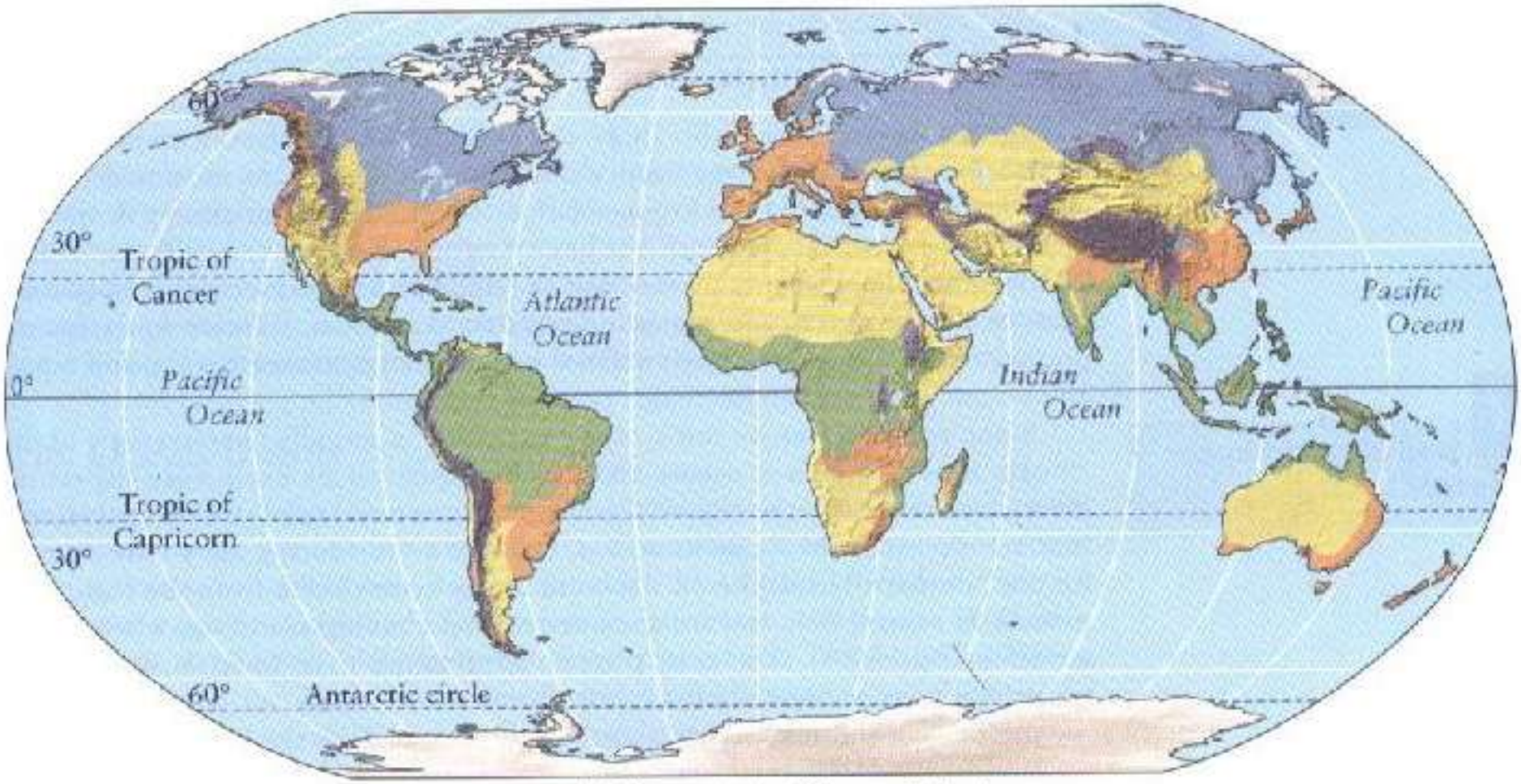
What is weather?

What is climate?

How do they differ?

- **Weather** is the short-term state of the atmosphere at a particular place at any given time
- **Climate** is a long-term composite of weather conditions at a particular place
- Short term versus long term---that is how they differ

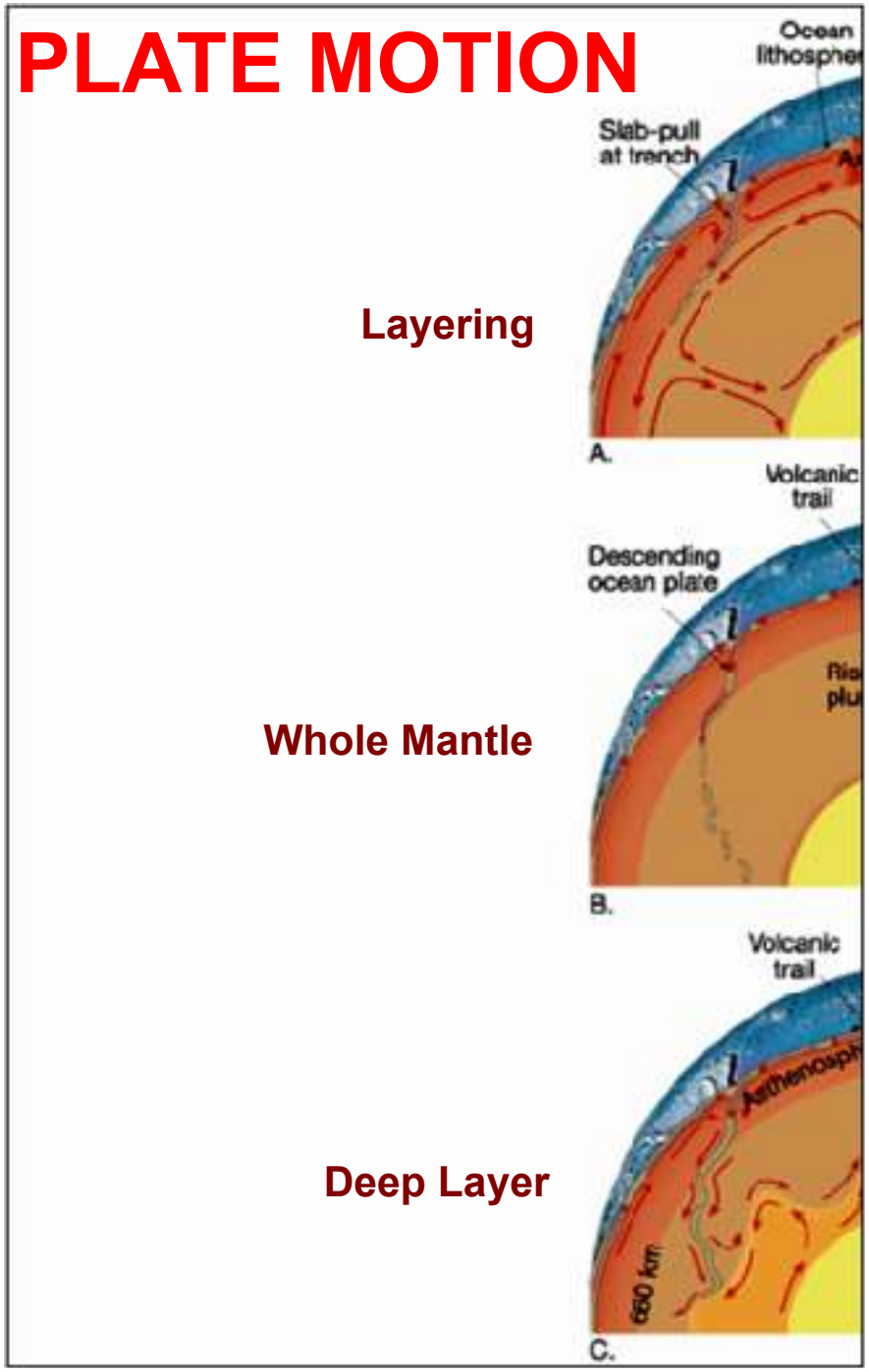
World Climate



World Climates (after Köppen-Geiger)

- Tropical climates
- Temperate-humid climates
- Dry climates
- Cold-humid climates
- Polar climates
- Highland climates

PLATE MOTION



Layering

Whole Mantle

Deep Layer

What drives plate motions?

Mantle convection provides the primary drive for plate tectonics

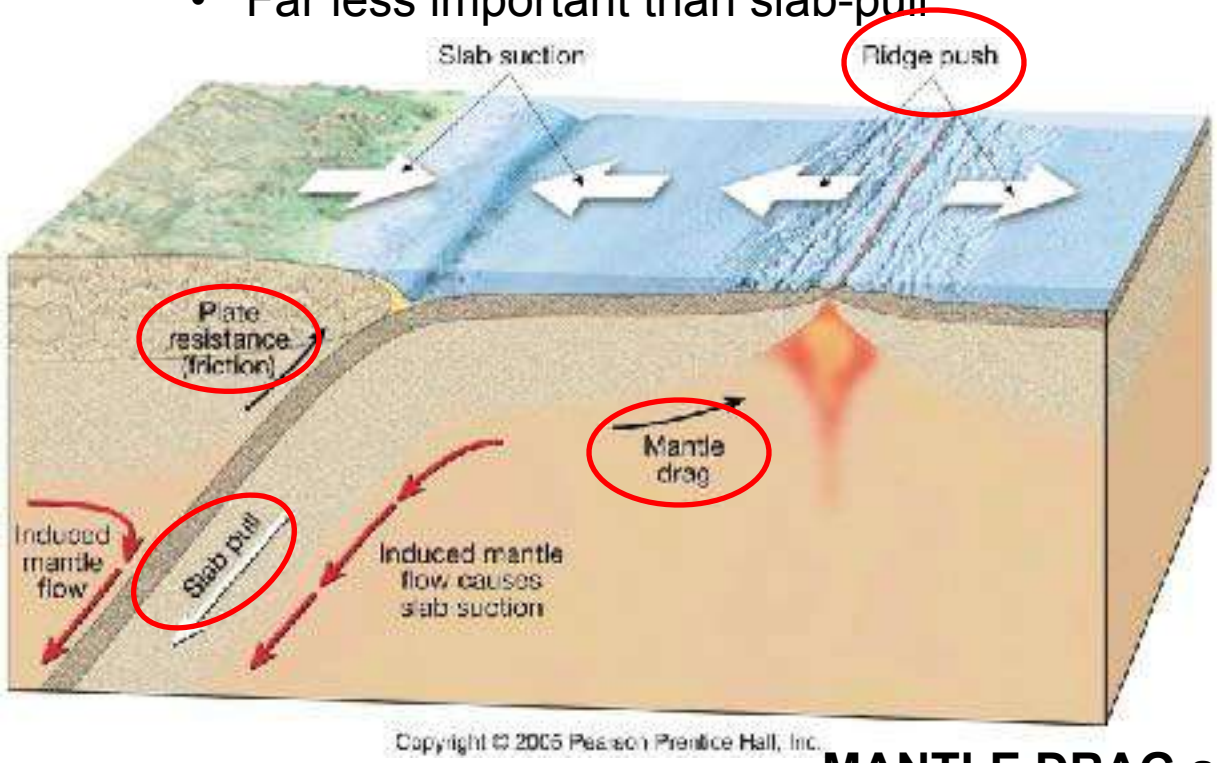
MODELS:

A. Layering at 660 kilometers Model
B. Whole Mantle Convection Model
C. Deep-layer Model

What drives plate motions

RIDGE-PUSH

- The higher elevation of spreading centers result in oceanic lithosphere wanting to move “downhill”, away from the ridge
- Far less important than slab-pull



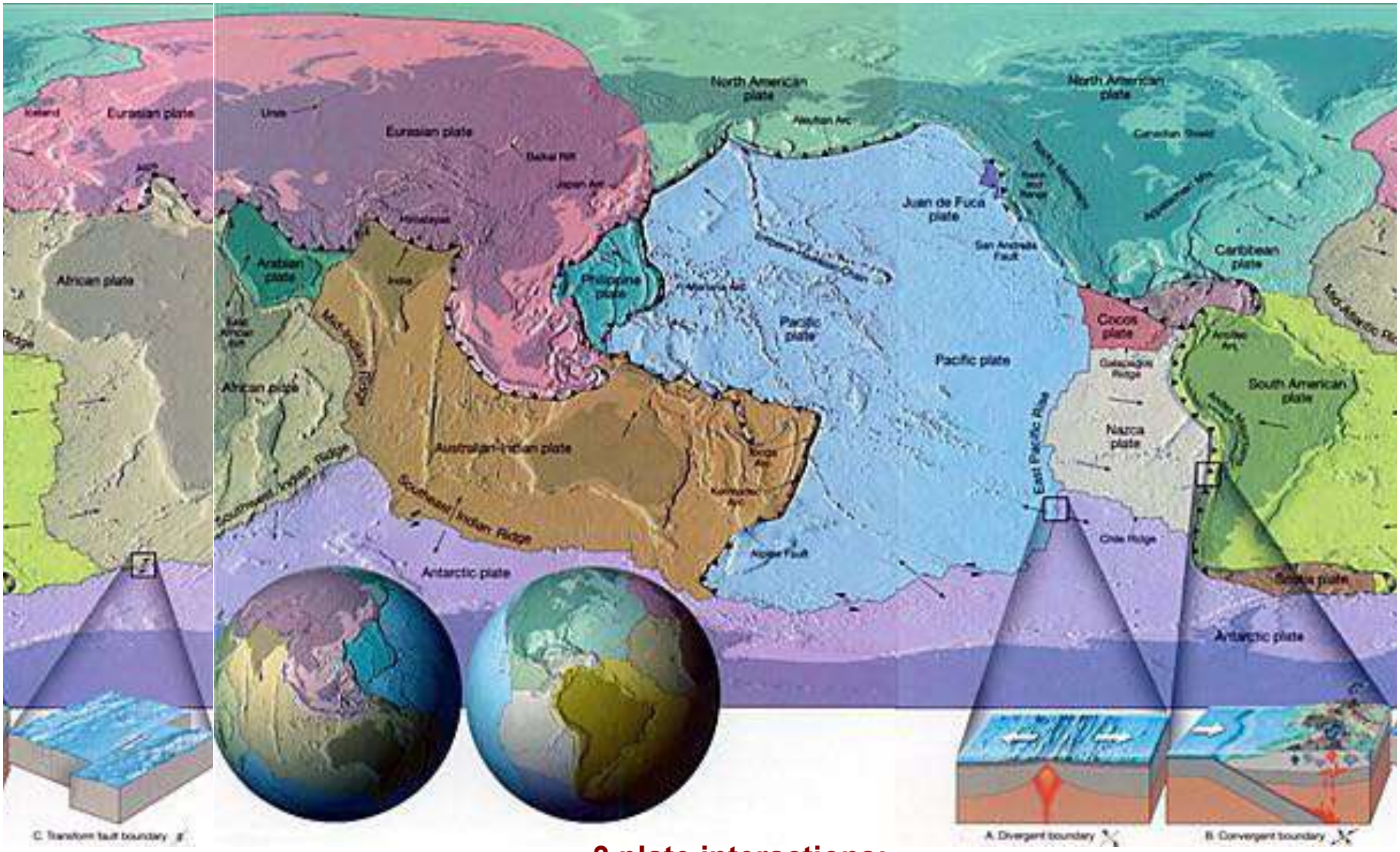
SLAB PULL

Cold, dense slabs of subducted oceanic lithosphere pull the plate towards the subduction zone

MANTLE DRAG and PLATE RESISTANCE

Can act to increase or decrease plate motion

- **Forces that drive plate motion**



3 plate interactions:

Divergent

Convergent

Transform

Morphology of the ocean (oceanic basins)

Landforms & Surface Processes

H.C. Berann (1915-1999)
Yosemite National Park, 1987

http://www.berann.com

- Glaciers
- Mass Wasting
- Streams
- Shorelines
- Deserts
- Groundwater