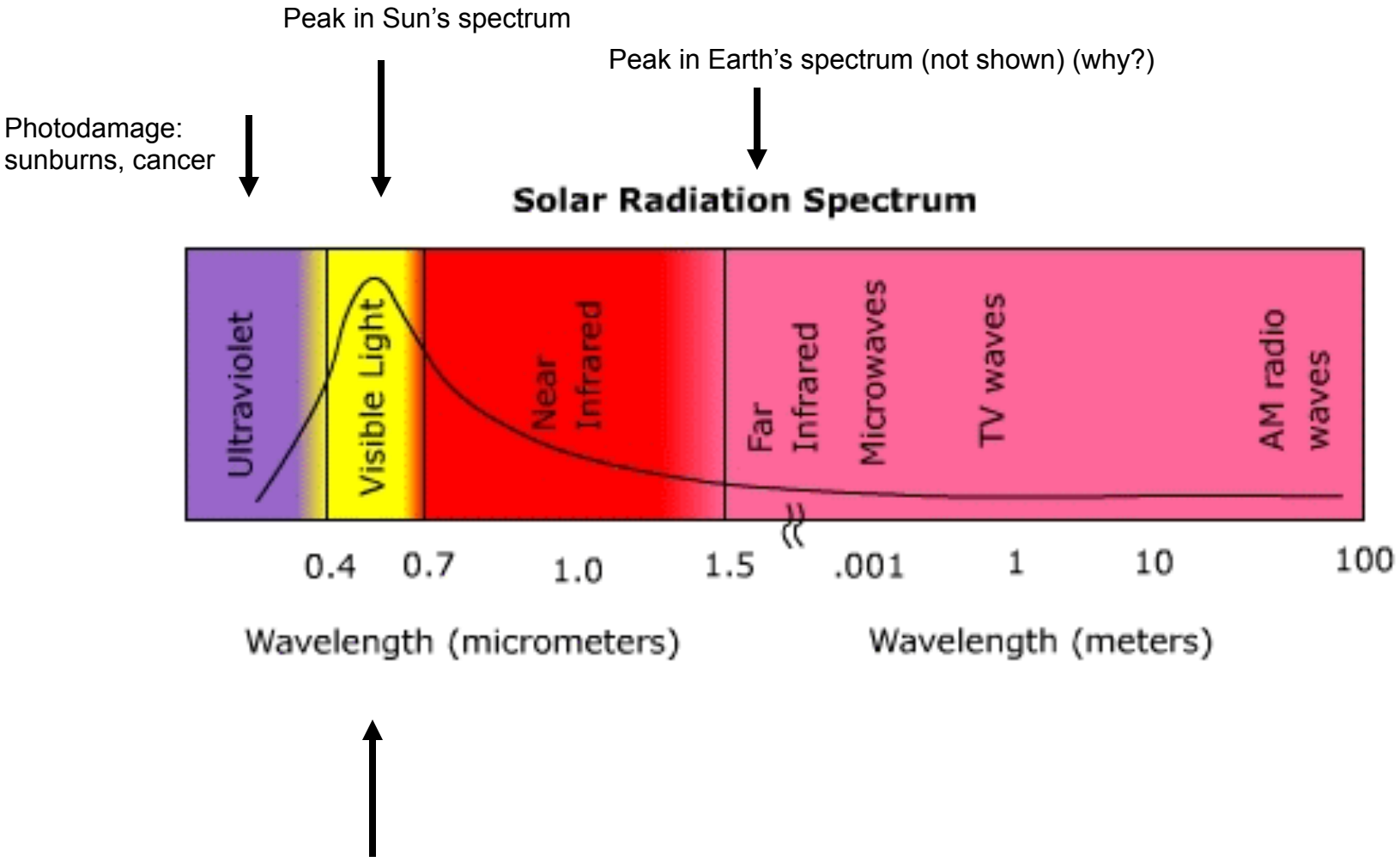
Physical geography and the functioning of the Earth



www.uwsp.edu/geo/faculty/ritter/geog101/uwsp_lectures/lecture_radiation_energy_concepts.html

Physical geography and the functioning of the Earth

Solar/UV radiation as a function of elevation/altitude

For every 1000 m increase in elevation, 1-2% increase in total solar radiation

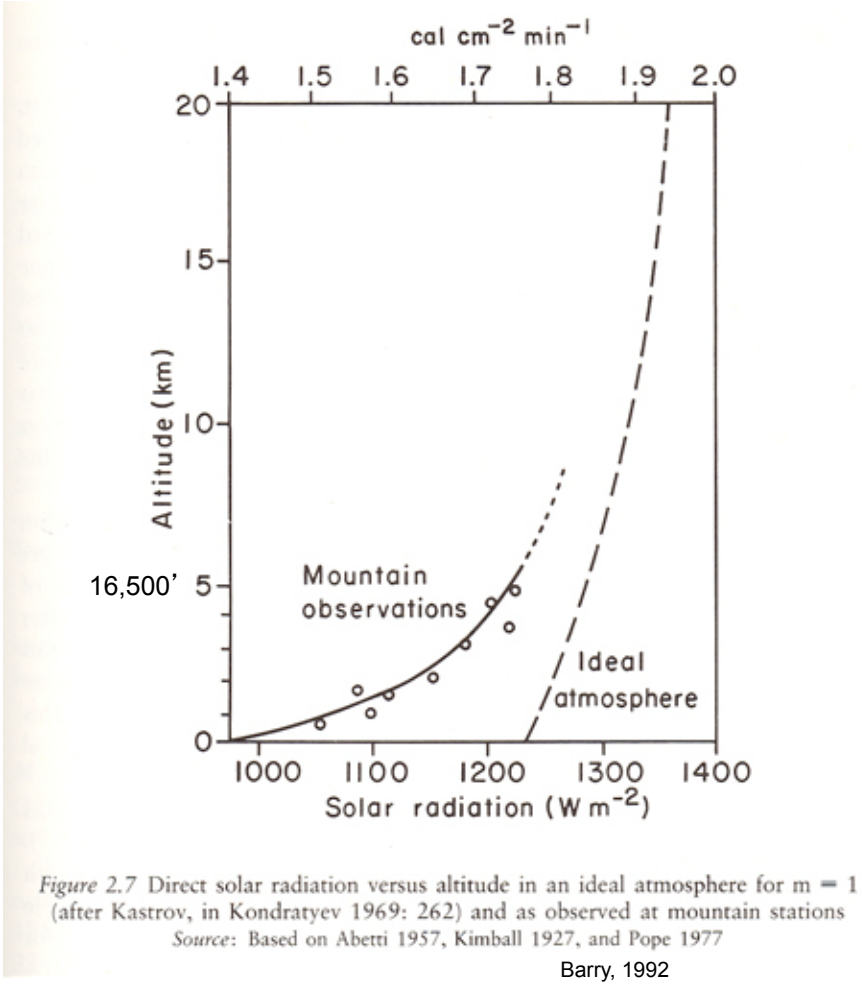
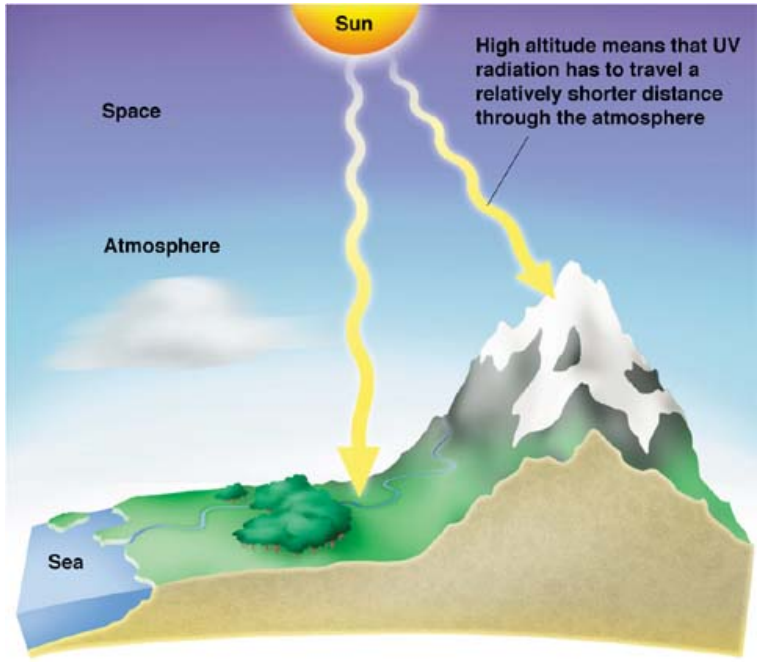


Figure 2.7 Direct solar radiation versus altitude in an ideal atmosphere for m = 1 (after Kastrov, in Kondratyev 1969: 262) and as observed at mountain stations
Source: Based on Abetti 1957, Kimball 1927, and Pope 1977

Barry, 1992

For every 1000 m increase in elevation, 12% increase in UV radiation



/www.familydoctor.co.uk/htdocs/SKINSUN/SKINSUN_specimen.html

Physical geography and the functioning of the Earth

Global climate

Control on temperature: elevation

TABLE 3.1 *The influence of elevation on climate*

Site	Elevation (m)	Temperature (°C)				Mean annual precipitation (cm)
		Mean January	Mean July	Lowest	Highest	
Tuscon, Arizona	745	10.8	30.7	–9.4	46.1	27.3
Mt. Lemmon, Arizona	2791	2.3	17.8	–21.7	32.8	70.0
Salem, Oregon	60	3.2	19.2	–24.4	40.0	104.3

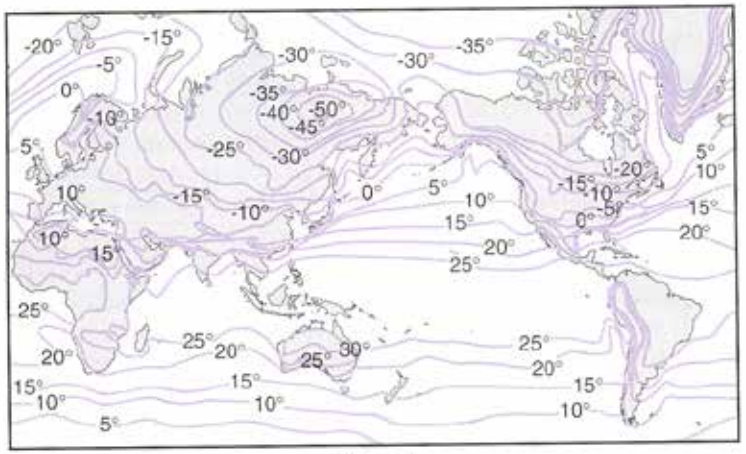
Source: Data from U.S. Weather Bureau.

Note: Two of the sites are near one another in Arizona; the third site is in Oregon. Note that the climate of the high-elevation site in Arizona, Mt. Lemmon, is much more similar to that of Salem, Oregon, 1700 km to the north, than to that of Tucson, only 25 km away but 2000 m lower in elevation.

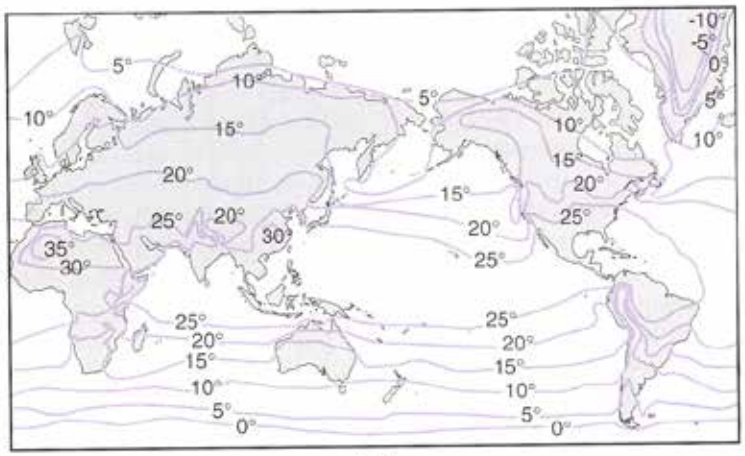
Lomolino et al., 2006

Physical geography and the functioning of the Earth

Global temperature patterns



January



July

FIGURE 2.6 Average monthly temperatures (°C) at the surface of the earth in January and July (after Strahler and Strahler, 1997).

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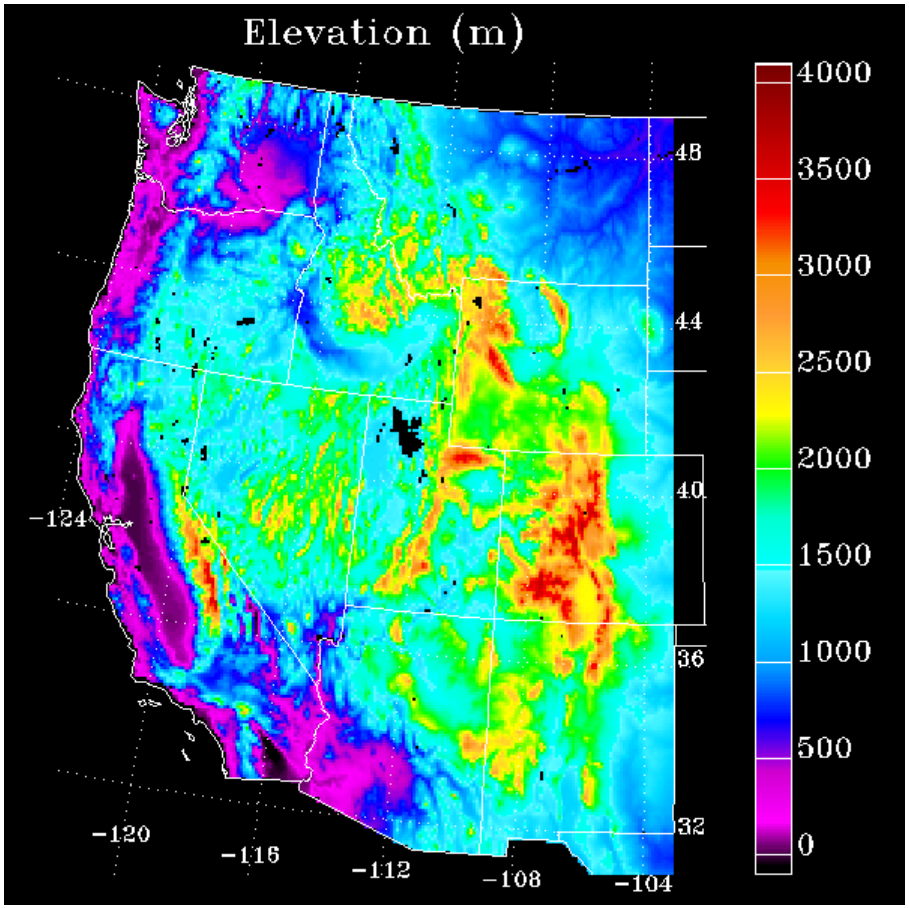
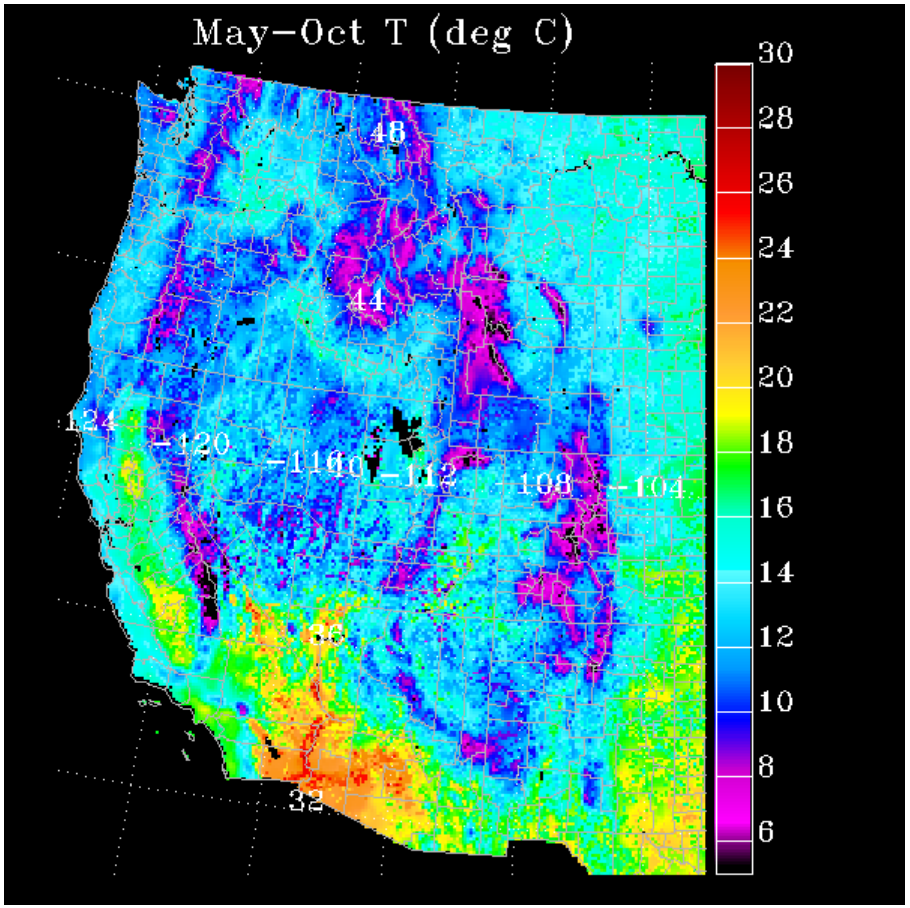
Orographic influences on temperature





Physical geography and the functioning of the Earth

frontal precipitation

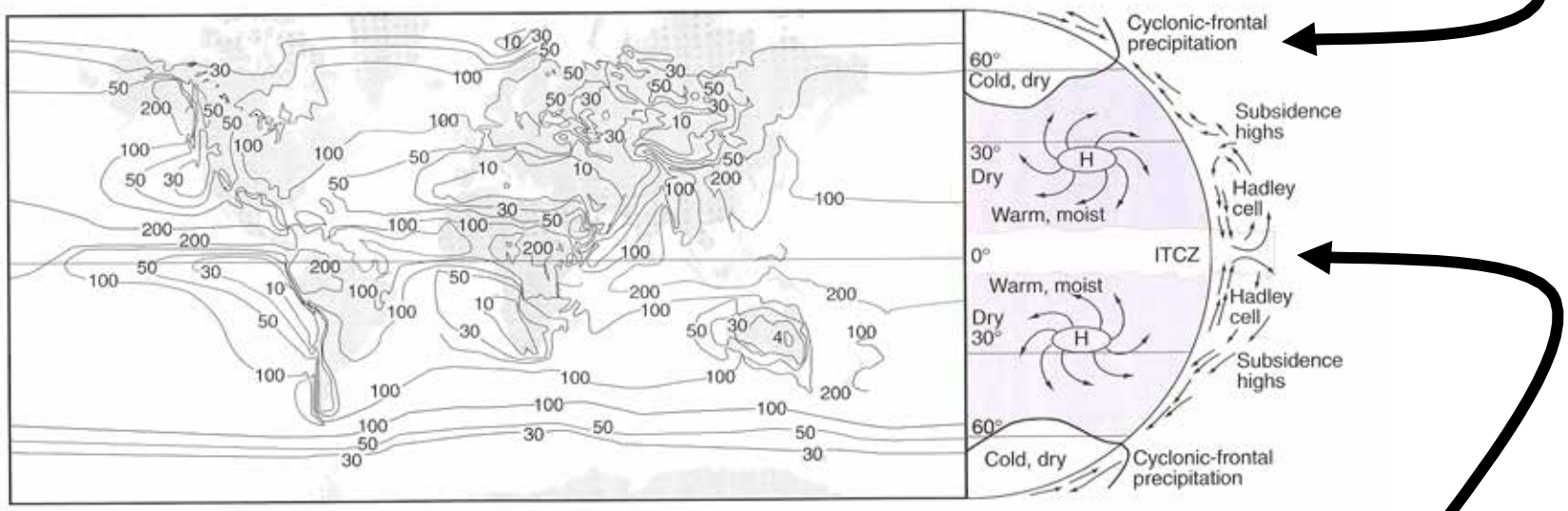


FIGURE 2.7 General circulation of the atmosphere and average annual precipitation (after Strahler and Strahler, 1997).

precipitation due to convergence: ITCZ

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Global climate

Orographic influences on precipitation

Enhancement on windward side

"Rain shadow" on leeward side

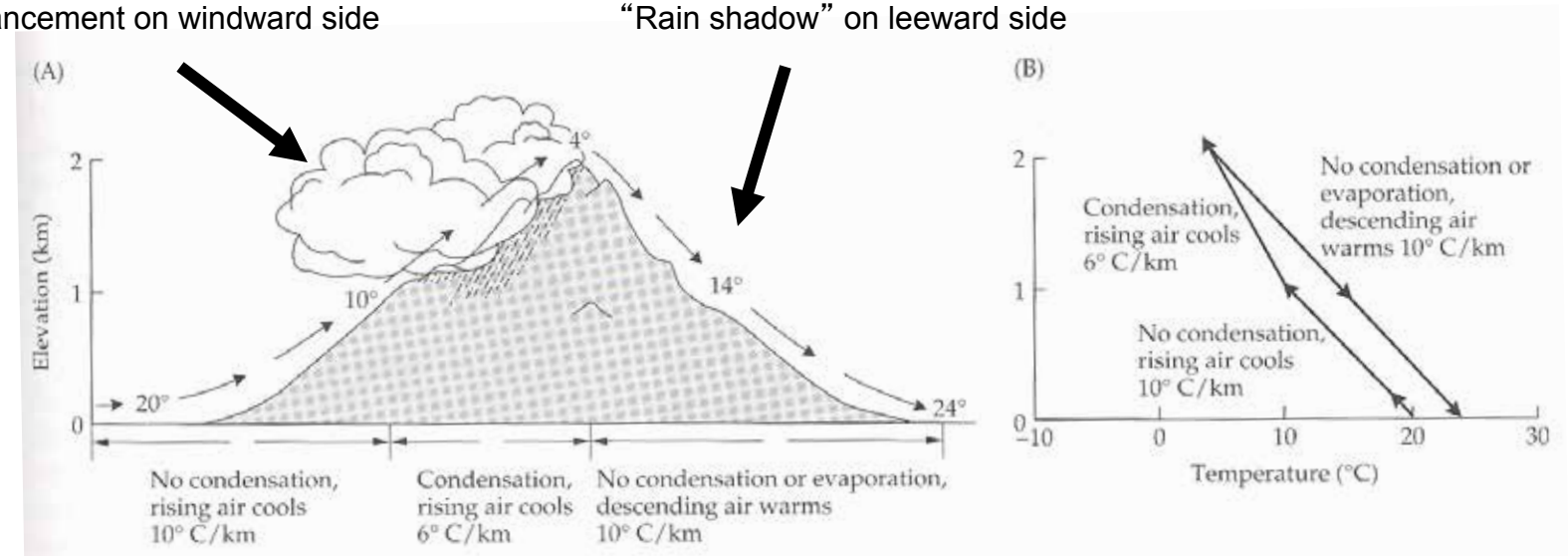

FIGURE 3.6 Factors causing rain shadow deserts. (A) Air blowing over a mountain cools as it rises, water vapor condenses, and the air loses much of its moisture as rain on the windward side, so that the leeward side experiences warm, dry winds. (B) The rate of change in air temperature with elevation is greater for drier air, resulting in warmer, drier conditions on the leeward side than at the same elevation on the windward side. (After Flohn 1969.)

Lomolino et al., 2006

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Global climate

Precipitation (cm per year)

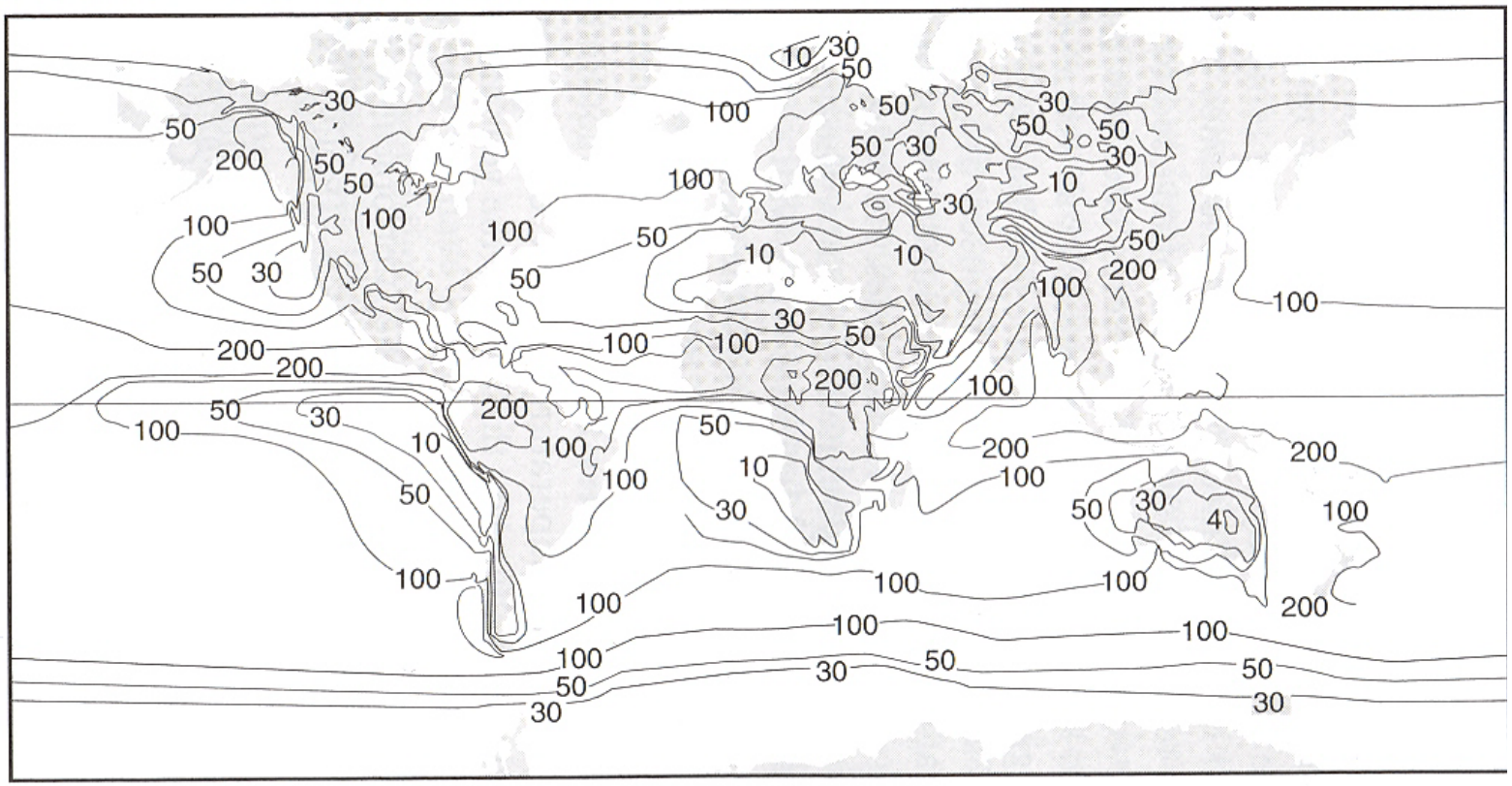

FIGURE 2.7 General circulation of the atmosphere and average annual precipitation (after Strahl

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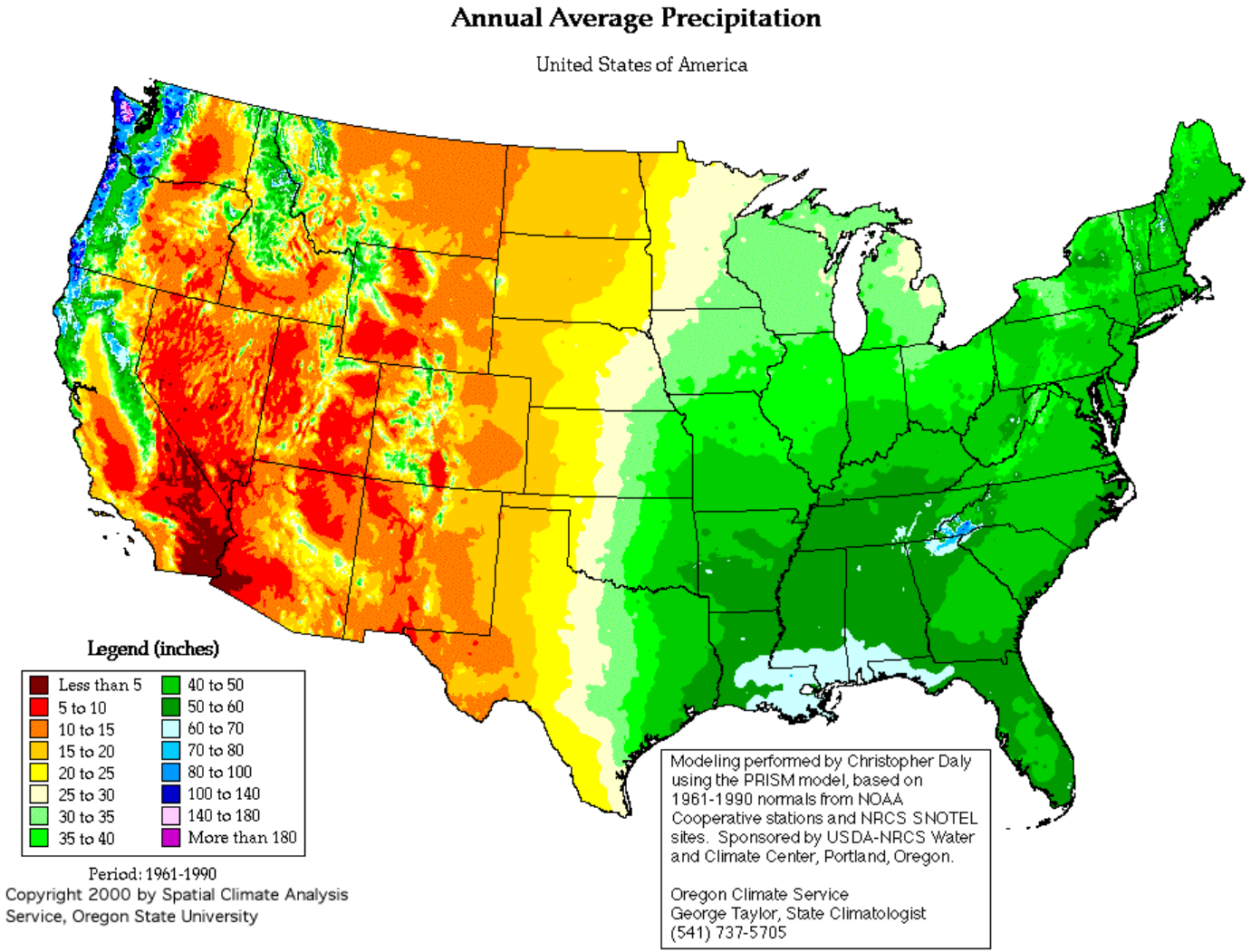

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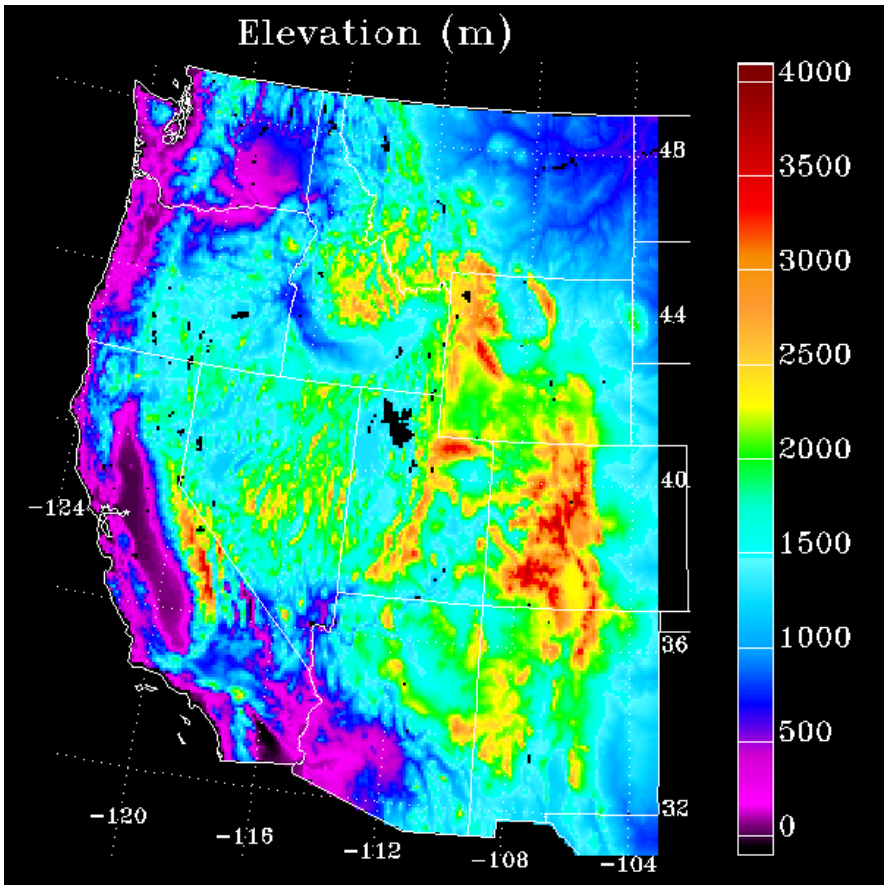
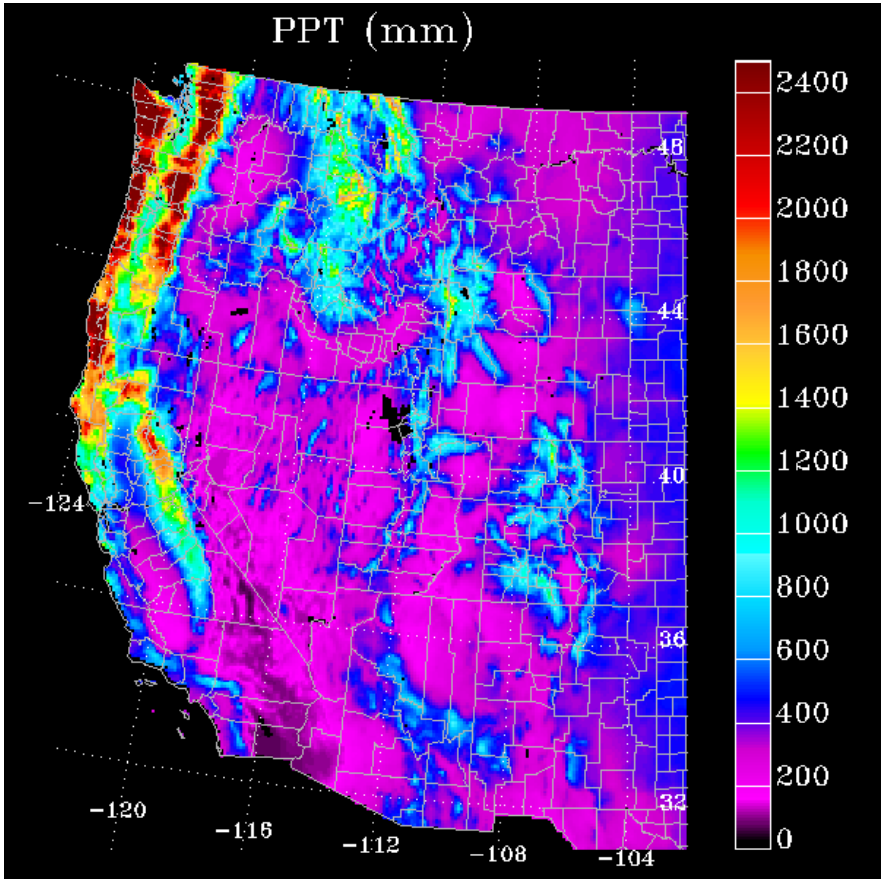
Orographic influences on precipitation





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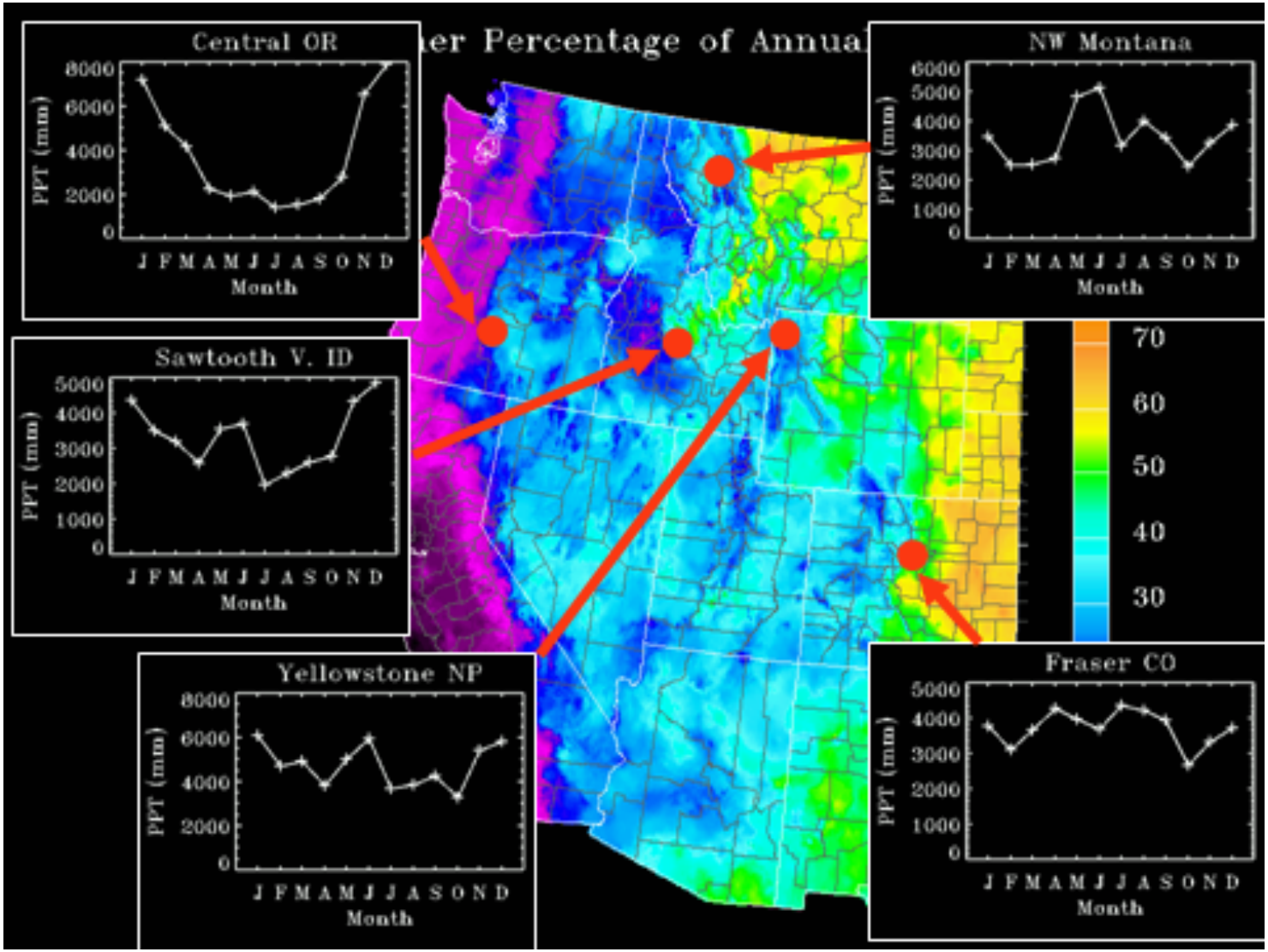
Seasonal distribution of precipitation: % summer precip



Physical geography and the functioning of the Earth

Global climate

Climate classifications: Köppen

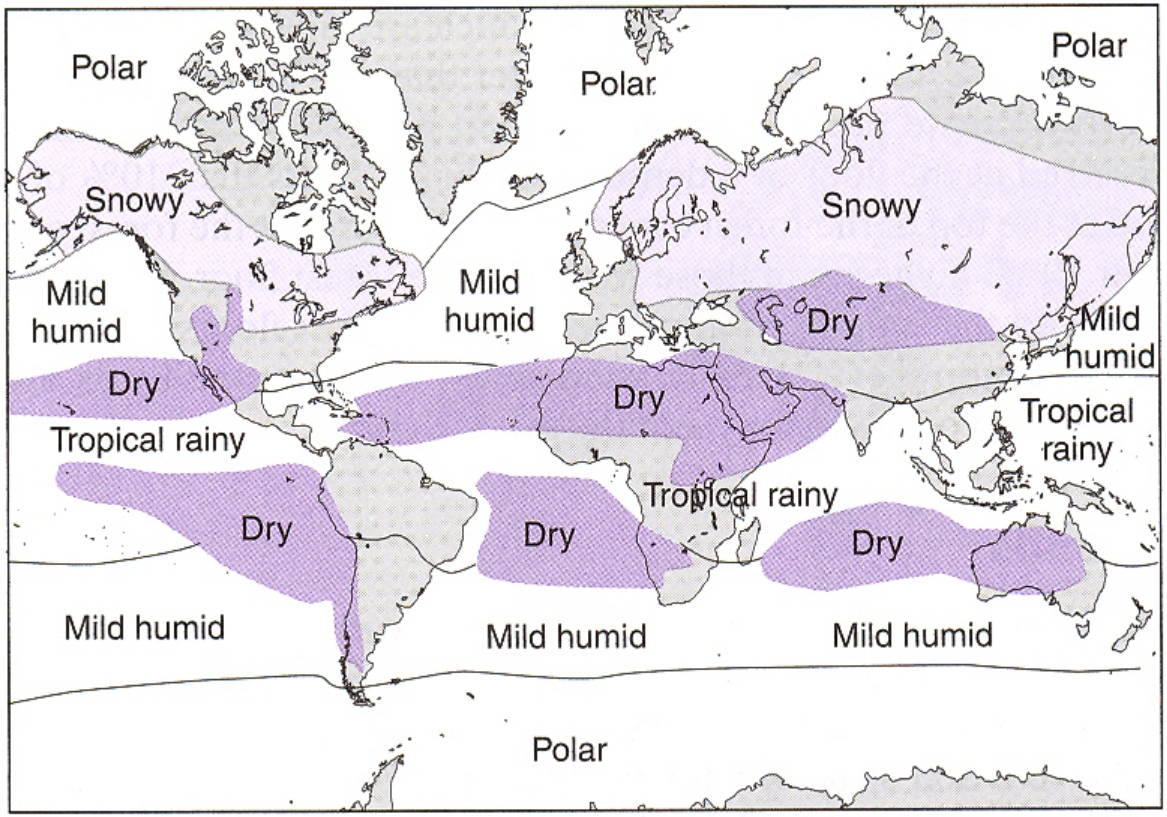


FIGURE 2.8 Simplified Köppen climate classification (after Strahler and Strahler, 1997).

Physical geography and the functioning of the Earth

Microclimate

Aspect

West of Denver, CO

Physical geography and the functioning of the Earth

Microclimate

Slope

Drainage: Boreal bog

http://www.chem.ucla.edu/~alice/explorations/churchill/landscapes.htm

Disturbance

http://xpda.com/junkmail/junk154/PICT1778.jpg

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Microclimate

Vegetation

pinker.wjh.harvard.edu/photos/new_zealand/pages/meadow%20S%20Alps.htm

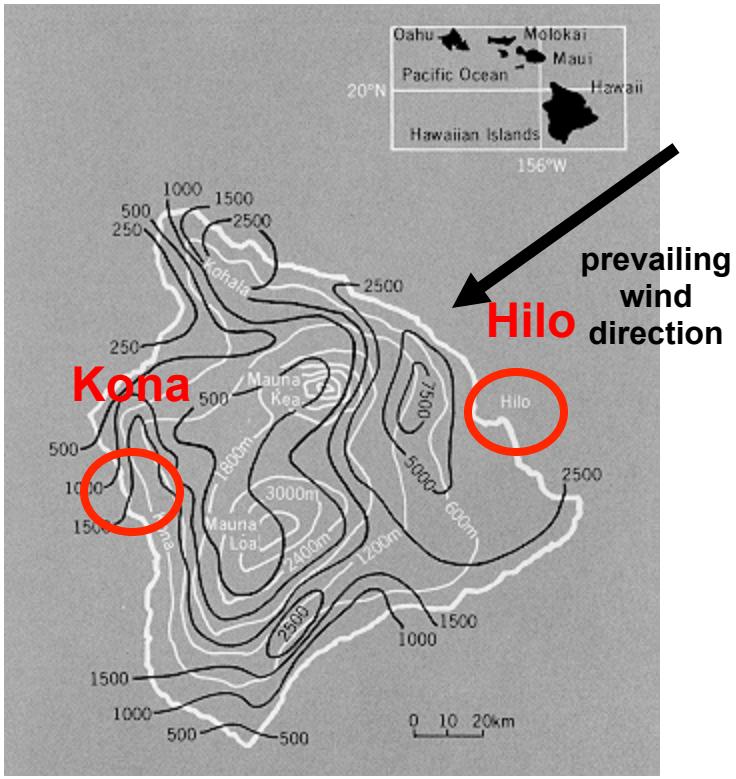
http://photos.jibble.org/Longleat/Forest_canopy_at_Longleat

Physical geography and the functioning of the Earth

Microclimate: *Windward, leeward*

	Hilo - East - Windward		Kona - West - Leeward	
	day/night (F)	Rain (" / month)	day/night (F)	Rain (" / month)
Jan-Mar	79 / 62	11	80 / 62	4
Apr-Jun	80 / 62	15	81 / 65	2
Jul-Sep	82 / 70	10	82 / 68	0
Oct-Dec	80 / 65	15	81 / 63	1

http://www.hawaii.islands-holiday.com/weather.html



www.mlo.noaa.gov

Physical geography and the functioning of the Earth

Microclimate: *Shelter*

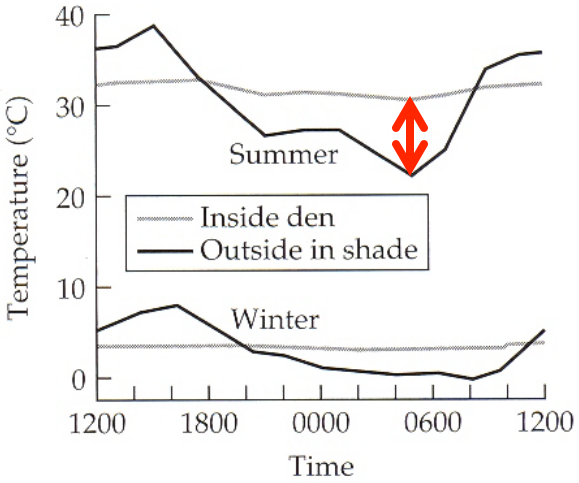


FIGURE 3.18 Temperatures inside and outside the den of a bushy-tailed woodrat (*Neotoma cinerea*) and a deep crack between large boulders in the high desert of southeastern Utah during midsummer and midwinter. Because the den (where the animal spends most of its time) experiences much less variation than the macroclimate outside, it affords vital protection from stressfully high and low temperatures in summer and winter, respectively. (After Brown 1968.)

Lomolino et al. 2006

Nurse trees

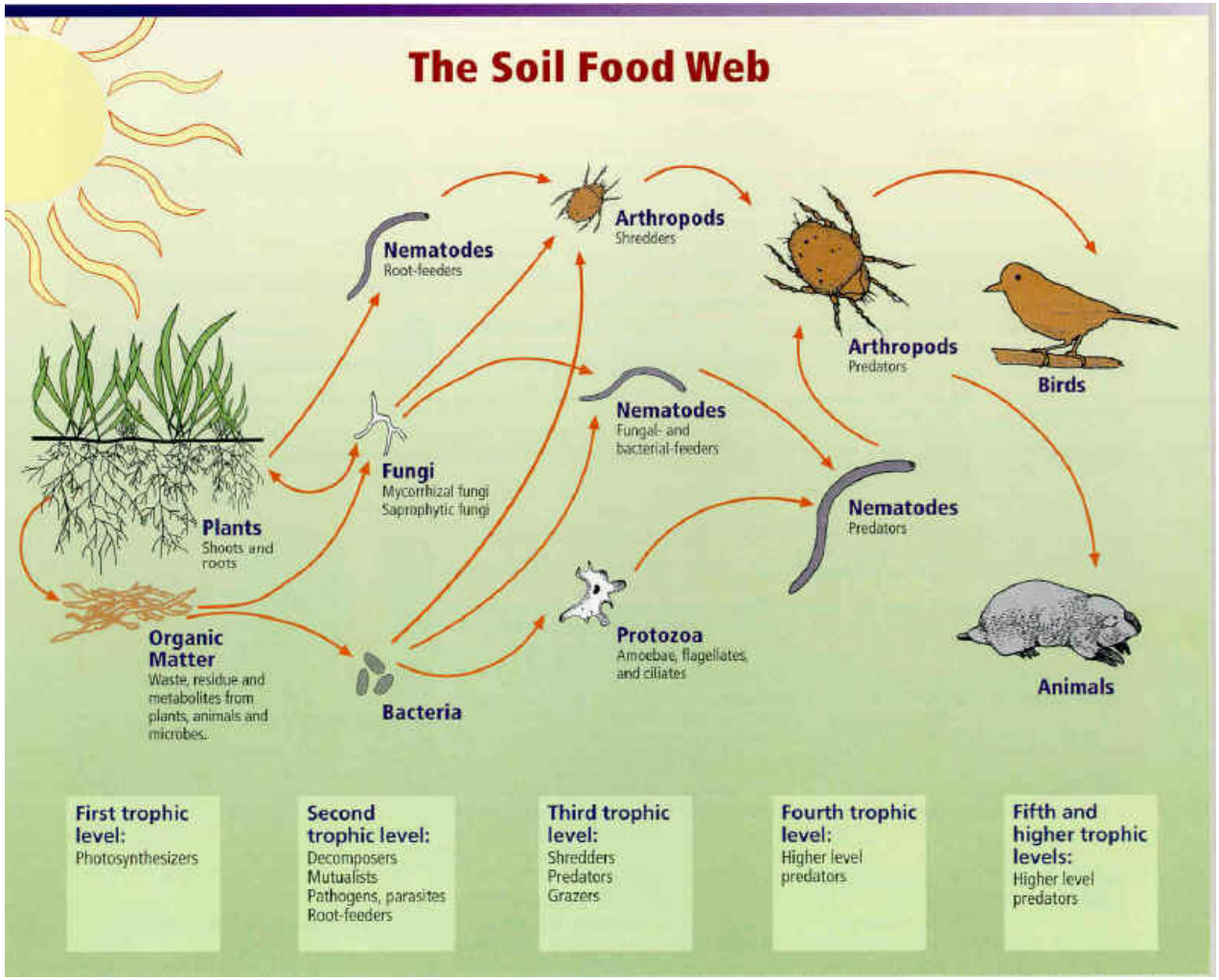
Saguaro in shade of limber bush

Subalpine fir in shade of whitebark pine

helios.bto.ed.ac.uk/bto/desbiome/nursery.htm

Physical geography and the functioning of the Earth

Soil provides habitat for a variety of organisms



soils.usda.gov

Physical geography and the functioning of the Earth

Soil classification

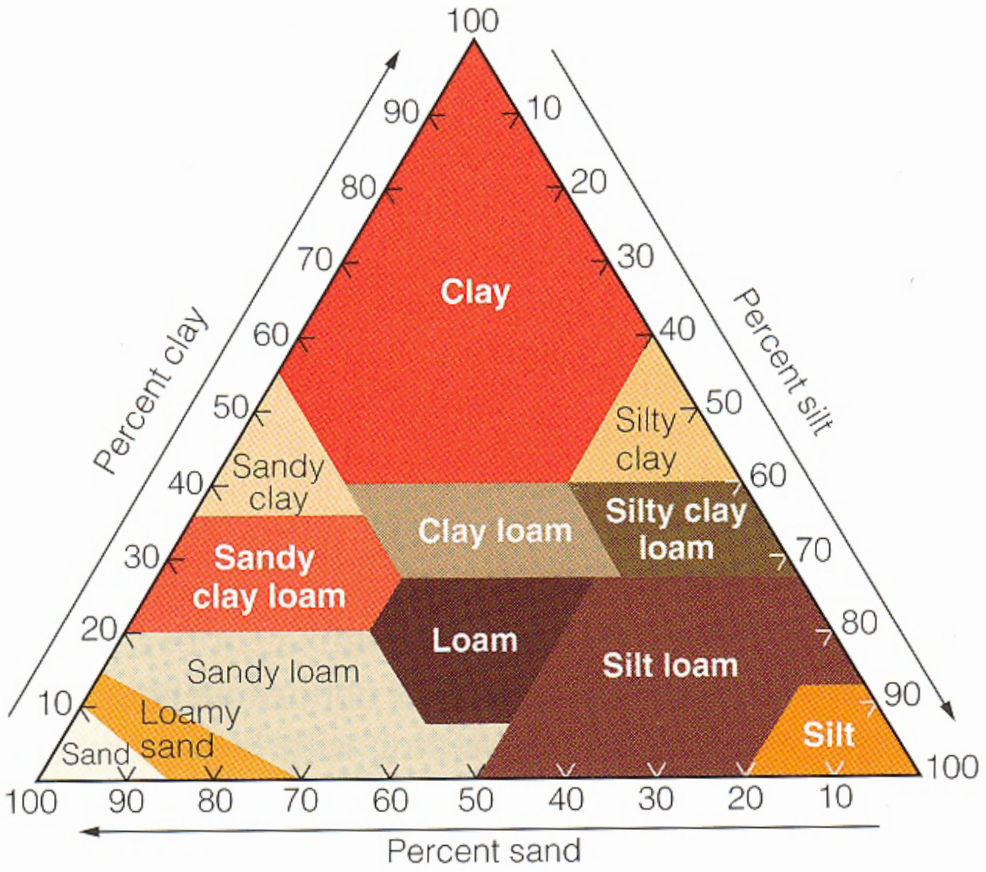
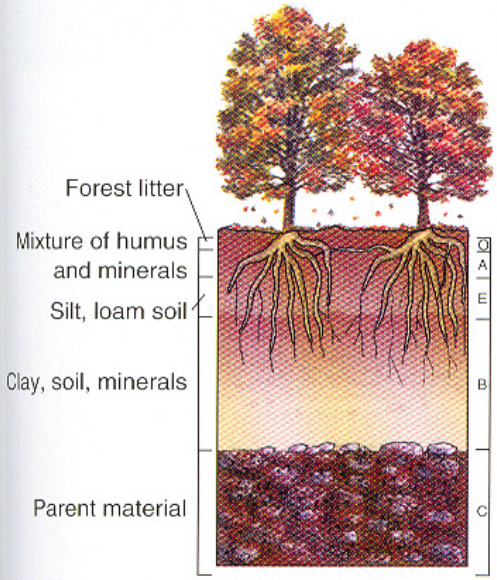
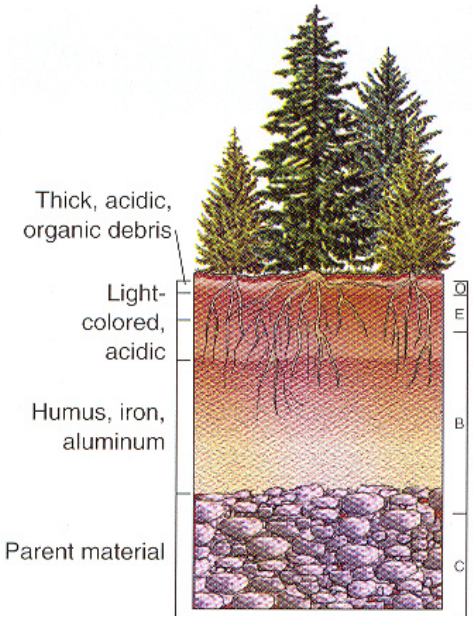


Figure 5.7 | A soil texture chart, which shows the percentages of clay (below 0.002 mm), silt (0.002–0.05 mm), and sand (0.05–2.0 mm) in the basic soil texture classes. For example, a soil with 60 percent sand, 30 percent silt, and 10 percent clay would be classified as a sandy loam.

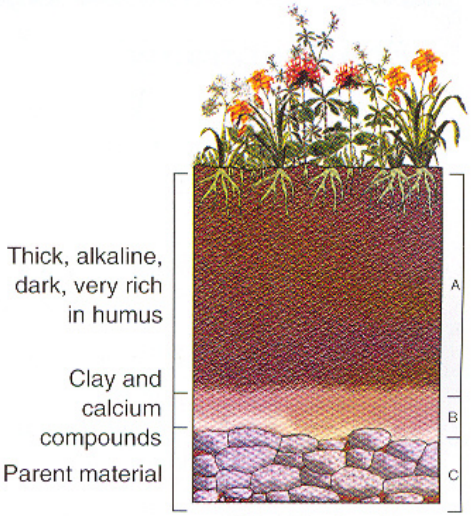
Smith and Smith, 2006



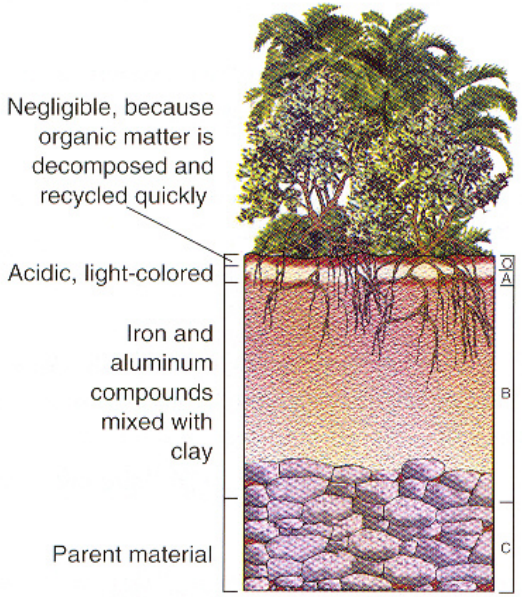
Temperate broadleaf



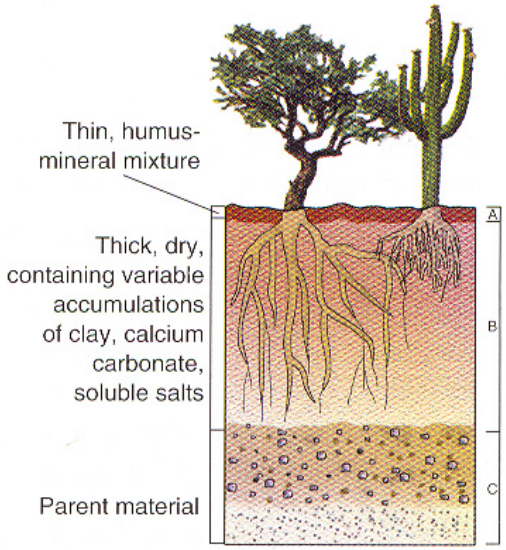
Temperate needleleaf



Grassland



Tropical broadleaf



Desert

Physical geography and the functioning of the Earth

Physical Environment of Oceans

State variables

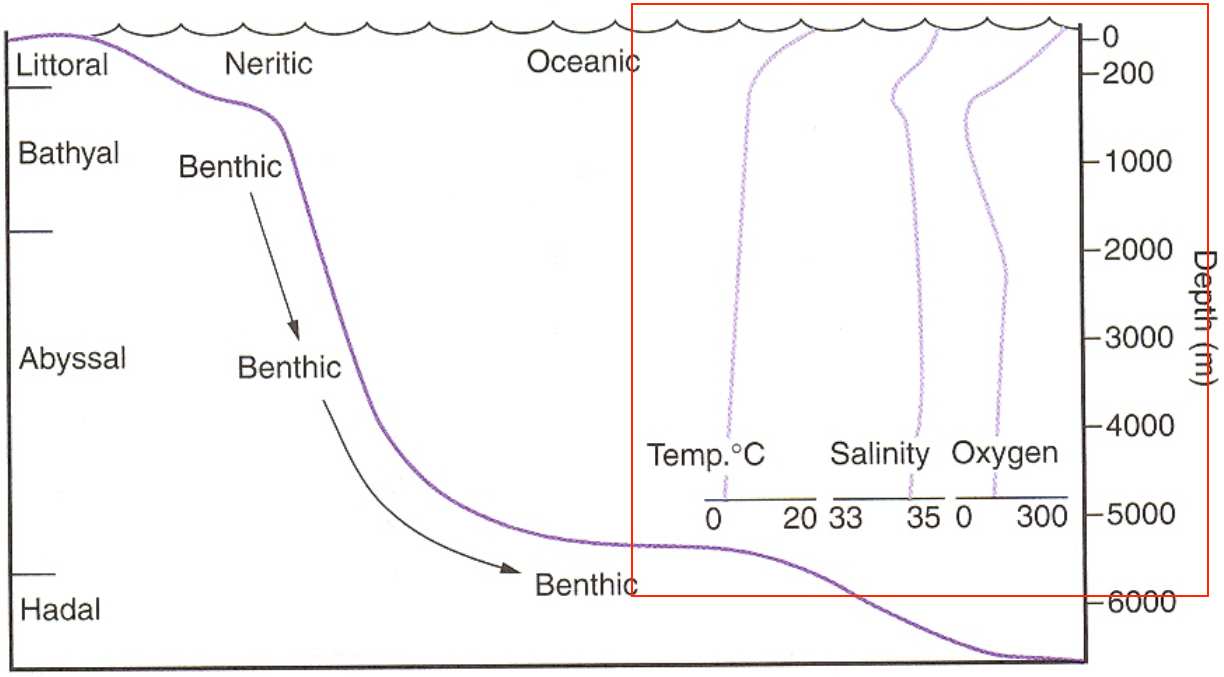


FIGURE 2.11 Marine life zones, salinity, temperature, and oxygen distibutions in the ocean.

Pattern of what other state important variable?

Physical geography and the functioning of the Earth

Physical Environment of Oceans

Life zones

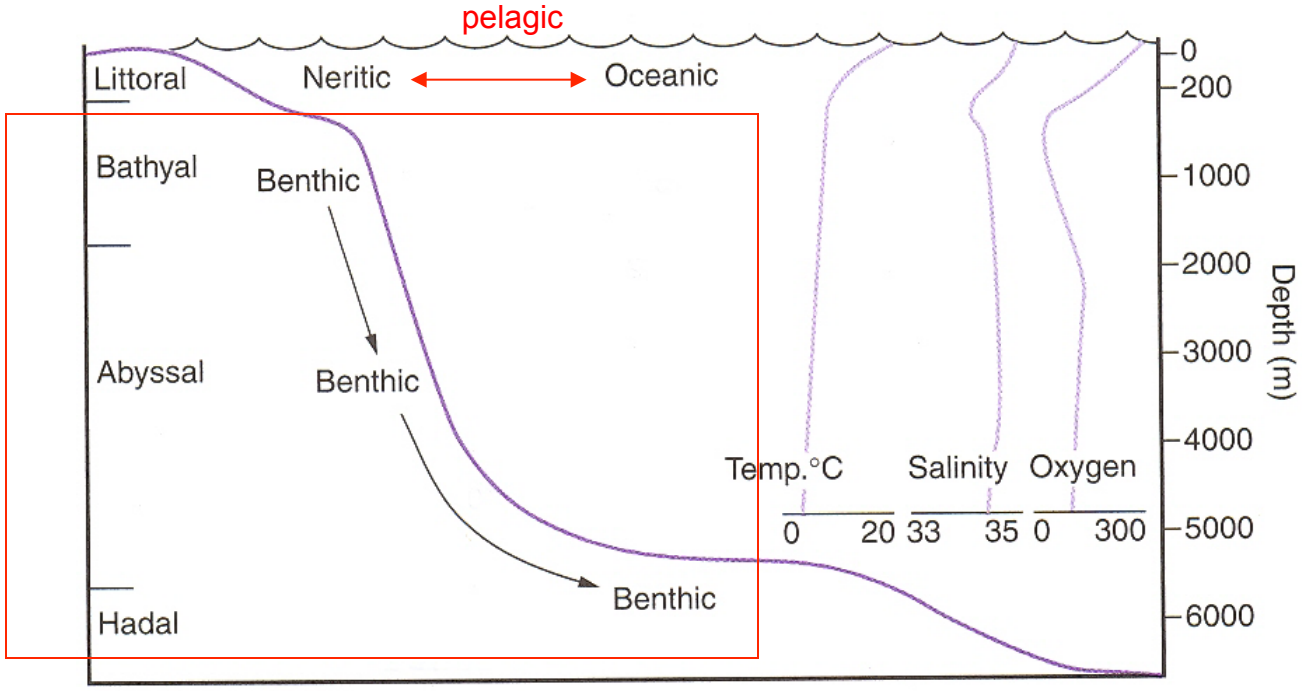


FIGURE 2.11 Marine life zones, salinity, temperature, and oxygen distibutions in the ocean.

Differences in benthic habitat near coast versus well away?

Physical geography and the functioning of the Earth

Ocean temperatures

Ocean salinities

Ocean circulation

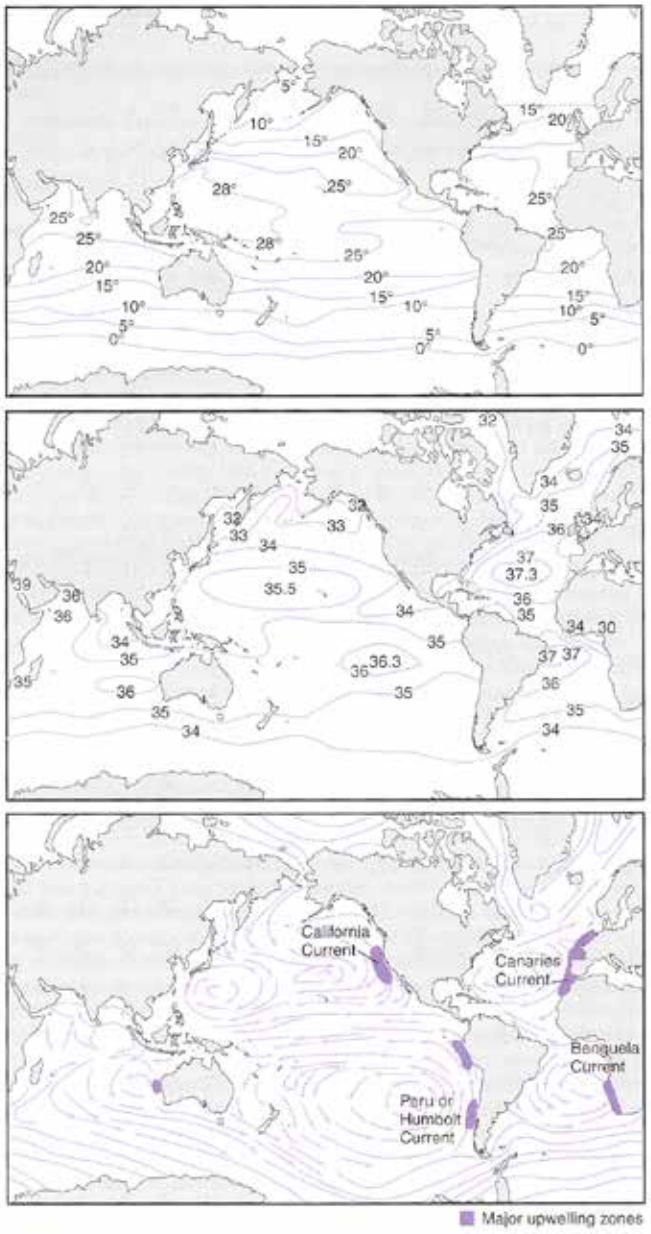


FIGURE 2.12 Ocean surface temperatures, salinity, currents, and major upwelling zones (from a number of sources including Lalli and Parsons, 1997; Ross, 1982; Thurman, 1990).

Physical geography and the functioning of the Earth

Studies of ocean circulation

- 1990: 80,000 Nike sneakers
- 1992: 29,000 bath toys, tracked 4000 km
- 1992: 28,800 plastic animals
- 2000: 10,224 Nike sandals

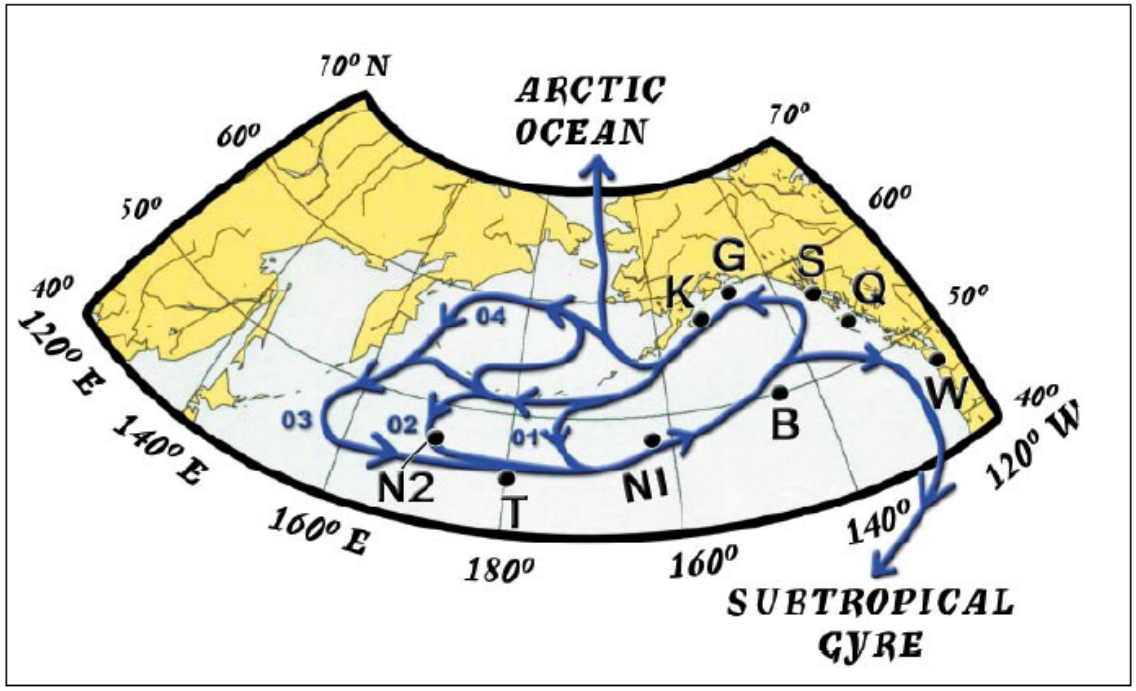


Fig. 1. Orbits of the Subarctic Gyre derived from the Ocean Surface Current Simulator (OSCURS) computer program. Toys exit into the Arctic Ocean and the Subtropical Gyre (as evidenced by toys found in Washington state). Legend: B, drifters released at Ocean Weather Station P; G, temperature and salinity measurements; K, sandals at Kodiak and Katmai eruption; N1, 1990 sneaker spill; N2, sandals spilled in 2000; O1–O4, orbits 1–4; Q, toys in the Queen Charlotte Islands; S, toys at Sitka; T, 1992 toy spill; and W, toys in Washington.

Ebbesmeyer et al., 2007