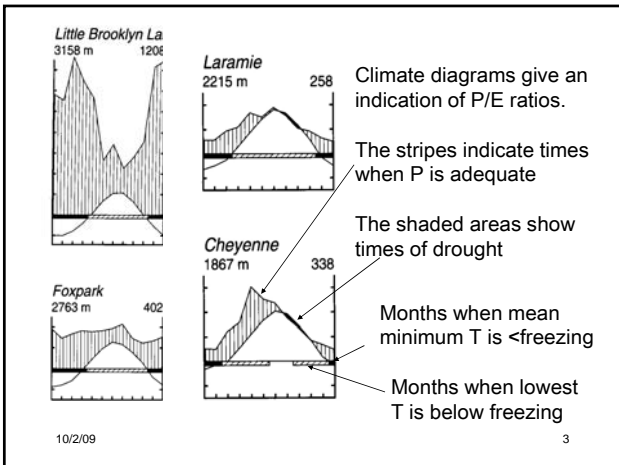


What aspects of climate affect plant distributions?

- **Climate:** long-term distribution of weather in an area (average and variability) affects vegetation distributions
- **Weather:** short-term conditions affect plant function, growth, survival, reproduction

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2



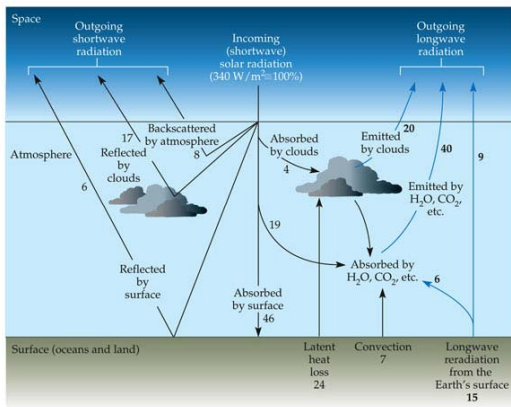
Radiation balance is a key to understanding climate patterns and local conditions

- Solar (mainly shortwave) radiation is absorbed by surfaces and re-radiated as heat (longwave or infrared)
- Amount of heating determined by angle of insolation and atmospheric conditions
- Global temperature patterns show effects of ocean in S. Hemisphere: water has higher specific heat than land so buffers temperature

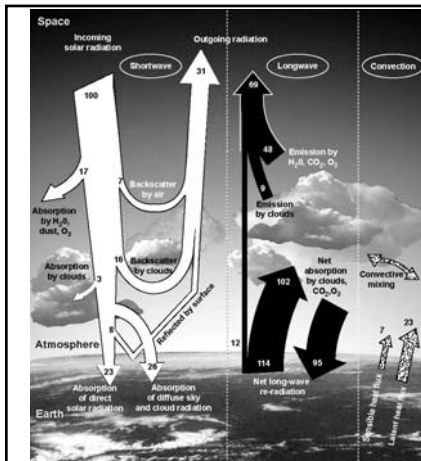
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4

Earth's radiation balance



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Another view of the energy balance

This one shows absorption and emission from the atmosphere better

6

Energy in = Energy out

Incoming Outgoing

Top of Atmosphere

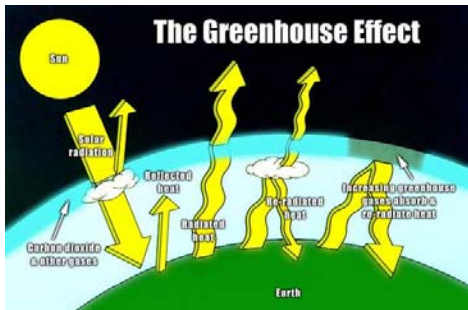
Within Atmosphere

At Surface

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7

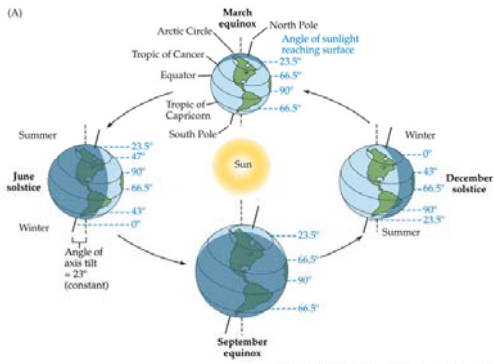
The "greenhouse effect" makes Earth habitable



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8

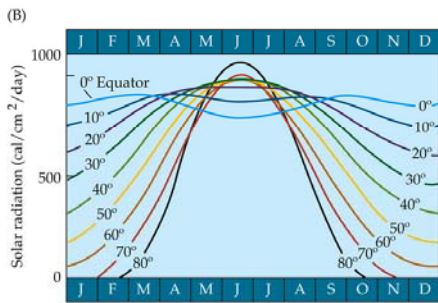
Axial tilt governs distribution of radiation over Earth's surface



10.

ESSENTIAL OF PLANTS, Second Edition, Figure 11.2 (Part 1) © 2008 Sinauer Associates, Inc.

Temperature variations across the globe drive climate, weather and vegetation distributions

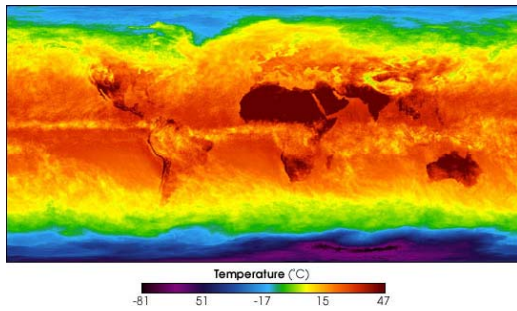


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10

Average global temperatures

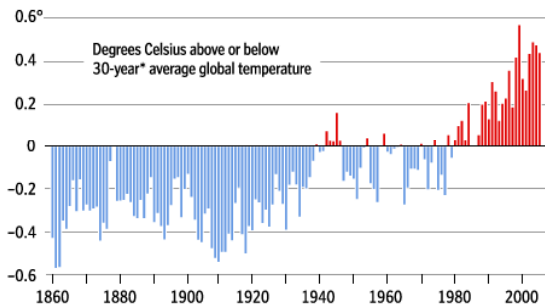


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Source: www.earthobservatory.nasa.gov

11

...are rising!



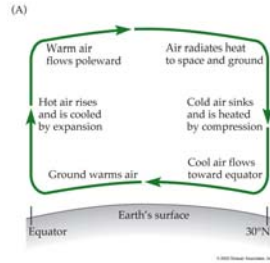
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SOURCE: National Center for Atmospheric Research | *30-year period: 1961-1990 | The Washington Post 10/13/05

12

Atmospheric circulation: driven by temperature contrasts

- Huge, 3-D conveyor belts of air transport energy (heat) and moisture toward poles (Fig. 17.7)
- Warm air holds more vapor than cold air
- Heating at the equator causes air to rise
- As it cools, vapor condenses and rains



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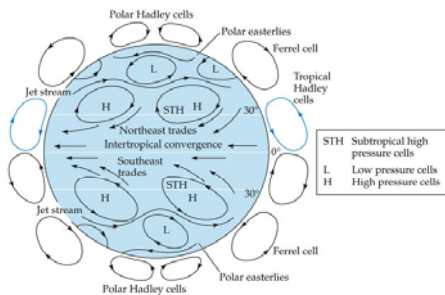
Atmospheric circulation and deserts

- Some of the air moves poleward in Hadley circulation
- Air eventually cools enough to sink, around 30° latitude
 - Sinking air has lost most of its vapor; sinking also causes the air to heat, increasing its capacity for vapor
- This causes deserts to form at subtropical latitudes

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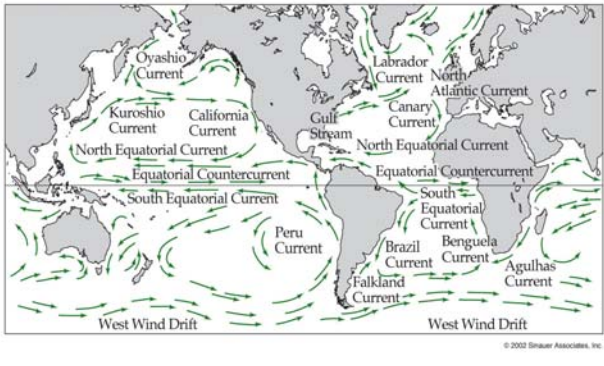
Atmospheric circulation and the ITCZ



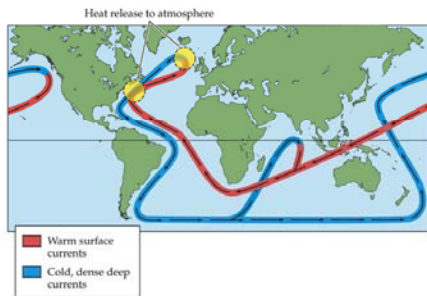
Subsiding cool air flows back toward the equator, but is deflected to west by coriolis effect; this creates the Intertropical Convergence Zone (ITCZ)

5

Atmospheric circulation also drives oceanic circulation patterns



Thermohaline circulation, plus atmospheric Hadley cells, transport equatorial heat poleward



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REPLY OF PLANTS, Second Edition, Figure 11.10 © 2002 Sinauer Associates, Inc.

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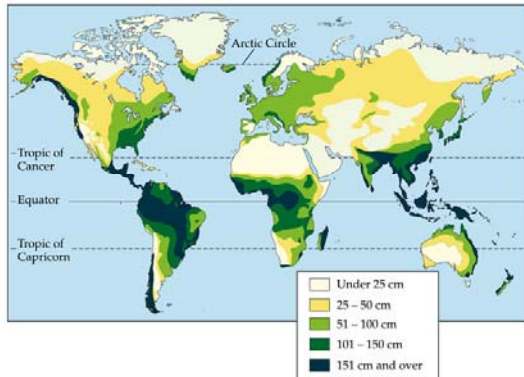
Precipitation patterns

- Determined by atmospheric circulation, topography and water-holding capacity of air
- At continental scales proximity to oceans, ocean temp, and mountain ranges affect precipitation patterns
- Seasonality of precipitation determined partly by seasonal changes in circulation (Asian monsoon)

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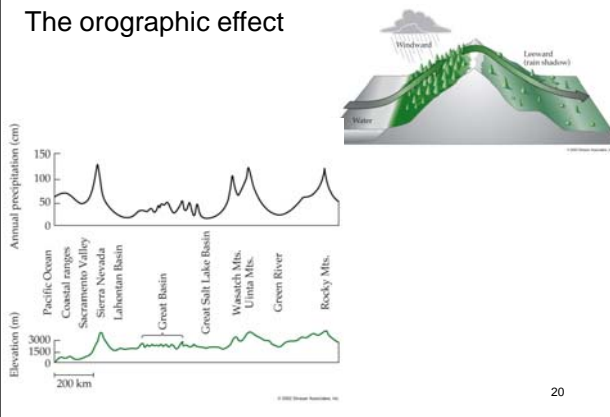
18

Global precipitation patterns



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The orographic effect



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Seasonality of Climate

- **Mediterranean** climate only has winter precipitation, with mild temperatures year round; western edges of continents
- **Continental** climates have precip distributed through the year; seasonal changes in temperature are more important; centers of continents
- **Maritime** climates have uniform precipitation distribution, milder temperatures than continental; eastern edges of continents
- **Tropical** climates may be continually rainy, or may have distinct dry season(s)

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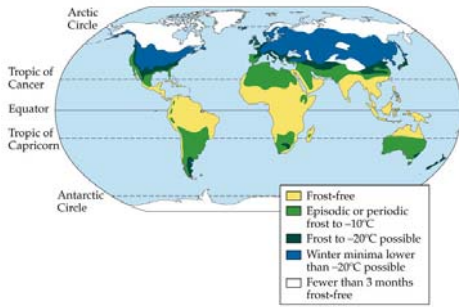
Movement of air masses determines climatic seasonality



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Growing season length is an aspect of climatic seasonality



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Extreme events may be critical to vegetation establishment and survival

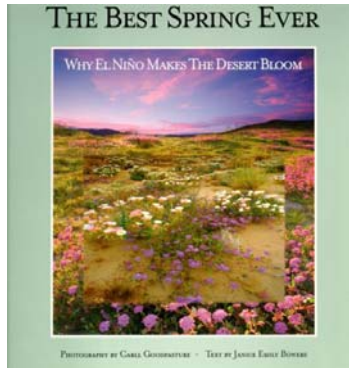
- Droughts
- Floods
- Early/late frosts
- Heat waves
- Consider the regeneration niche

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El Nino Southern Oscillation

- Ocean-atmosphere interaction creates precipitation anomalies in different regions around the world
- Teleconnections
- See pages 407-411 in GSF



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