

Surface Temperature

- When solar radiation strikes the ground:
 - shortwave radiation absorbed by ground surface and warms surface
 - Longwave radiation emitted
 - Sensible heat flows by conduction from warm objects to cooler objects
 - Latent heat transfer: water evaporates, taking away latent heat, or condenses, releasing latent heat
 - Convection redistributes heat by mixing

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- ### Processes of creating heat
- Radiation
 - Conduction
 - Convection
 - Advection
 - Latent heat of condensation

Radiation

- The process by which incoming electromagnetic radiation is transferred from the sun to the Earth
- The more energy absorbed by the Earth, the more heat the Earth will generate
- This heats up our atmosphere

Conduction

- The molecule to molecule transfer of energy
- Heat flows from warm to cool areas
 - Can work inversely
- Only affects areas close to Earth's surface

Convection

- The transfer of energy by a strong vertical movement
- When air heats up it becomes lighter
 - Light air rises
- As the air rises, it cools and becomes denser
 - Denser air falls

Advection

- The transfer of energy by horizontal movements
 - Winds
 - Ocean Currents

Latent heat of condensation


Helps warm the atmosphere

Surface and Air Temperature


Environmental Contrasts: Urban and Rural Temperatures

Surface materials influence temperature strongly

Transpiration: the process by which plants lose water to the atmosphere by evaporation through leaf pores



Evapotranspiration: the combined water flow to the atmosphere by evaporation from soil and transpiration from plants

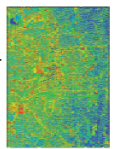
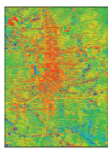


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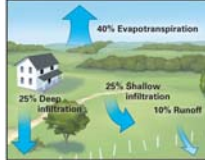
Surface and Air Temperature

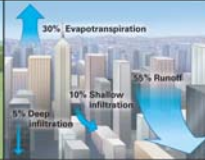
The Urban Heat Island

City centers tend to be several degrees warmer than surrounding suburbs and countryside.

Urban Heat Island: area at the center of a city that has a higher temperature than surrounding regions






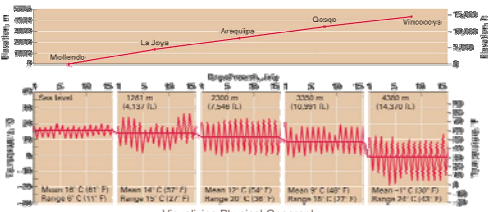
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Surface and Air Temperature

High-Mountain Environments

- Reduced air pressure → reduced oxygen to lungs
- Fewer air molecules → sun's rays stronger
- Less CO₂ and water vapor → reduced greenhouse effect





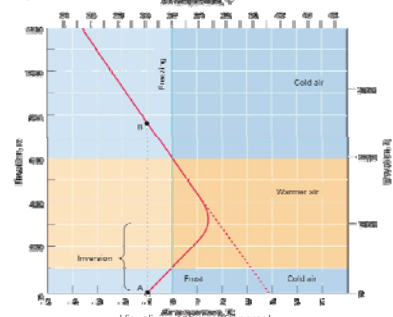
Peak	Elevation (m)	Mean 16° C (61° F)	Mean 14° C (57° F)	Mean 12° C (54° F)	Mean 9° C (48° F)	Mean -1° C (30° F)
Monte Lema	1391 m (4,563 ft)	Range 19° C (64° F)	Range 17° C (63° F)	Range 15° C (59° F)	Range 13° C (55° F)	Range 11° C (52° F)
La Joya	2248 m (7,391 ft)	Range 19° C (64° F)	Range 17° C (63° F)	Range 15° C (59° F)	Range 13° C (55° F)	Range 11° C (52° F)
Arreccion	3261 m (10,697 ft)	Range 19° C (64° F)	Range 17° C (63° F)	Range 15° C (59° F)	Range 13° C (55° F)	Range 11° C (52° F)
Goose	4362 m (14,310 ft)	Range 19° C (64° F)	Range 17° C (63° F)	Range 15° C (59° F)	Range 13° C (55° F)	Range 11° C (52° F)
Winobooks	4362 m (14,310 ft)	Range 19° C (64° F)	Range 17° C (63° F)	Range 15° C (59° F)	Range 13° C (55° F)	Range 11° C (52° F)

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Surface and Air Temperature

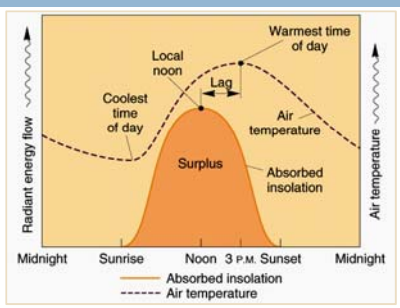
Temperature Inversion

reversal of normal temperature pattern so that air temperature increases with altitude

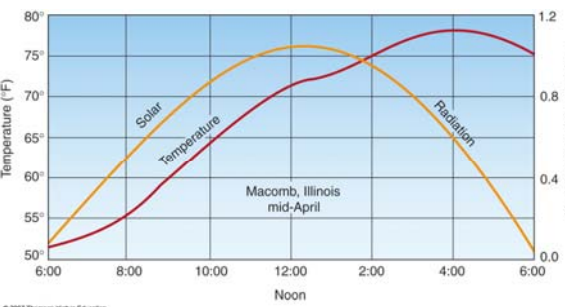


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Total idealized insolation during 24 hours (daily radiation curve)



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Fig. 4-14, p. 100

Daily and Annual Cycles of Air Temperature

The Daily Cycle of Air Temperature

- Insolation varies by season
 - Daylength longest at summer solstice
 - Daylength shortest at winter solstice
- Net radiation varies daily
 - Positive after sunrise
 - Peaks at noon
 - Decreases to negative by sunset
- Air temperature varies daily
 - Minimum just after sunrise
 - Rises to a peak in mid-afternoon

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Daily and Annual Cycles of Air Temperature

Land and Water Contrasts

Maritime temperatures:
Coastal regions have smaller daily and annual temperature ranges

Continental temperatures:
Inland regions have greater daily and annual temperature ranges

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Daily and Annual Cycles of Air Temperature

Land and Water Contrasts

Inland climates have more temperature extremes than coastal climates:

1. Solar rays heat land surface, but are distributed deeper in water
2. Water has higher heat capacity than rock and soil
3. Water mixes
4. Water evaporates, removing latent heat

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Daily and Annual Cycles of Air Temperature

Annual Net Radiation and Temperature Cycles

Annual cycle of daily insolation affects → net radiation, which affects → monthly mean air temperature

Place	Lat	Annual avg W/m ²
Yakutsk	62°N	42
Moscow	54°N	47
Algon	24°N	87
Mannix	3°S	86

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Effect of Cloud cover

- Clouds tend to reflect incoming radiation back to space
- BUT can also trap reradiated heat from the Earth
- Cloudy regions tend to have minimal **diurnal** temperature ranges
- Cloudless regions have high diurnal temperature ranges

(a) Day

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