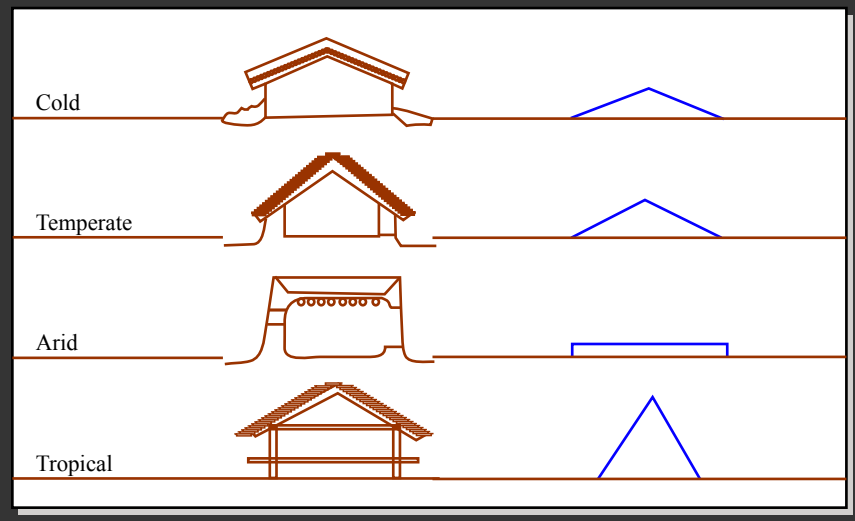
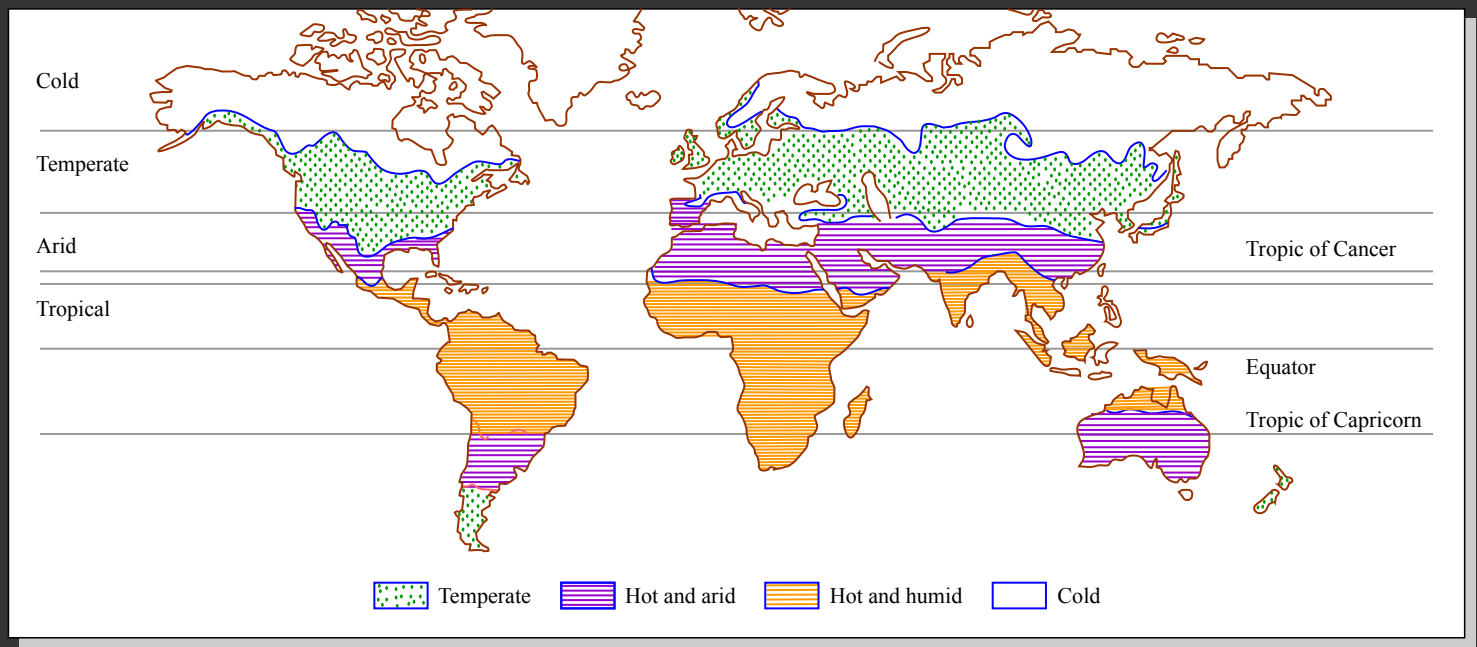
Climate-responsive building design

- cold
- temperate
- hot-dry (arid)
- warm-humid (tropical)



Images by MIT OCW.



Climate-responsive building design

- Cold climates
  - minimize surface / volume
  - good insulation
  - massive if continuous use

Climate-responsive building design

- Cold climates
- Temperate climates
  - cold winters
  - solar gains and daylight

Climate-responsive building design

- Cold climates
- Temperate climates
- Hot-dry cimates
  - high thermal mass
  - light colors
  - shaded courtyards
  - ventilation

Climate-responsive building design

- Cold climates
- Temperate climates
- Hot-dry cimates
- Warm-humid climates
  - lightweight construction
  - insulated roof
  - no E/W windows
  - cooling by air movement

Climate-responsive building design

- Climate vs. comfort

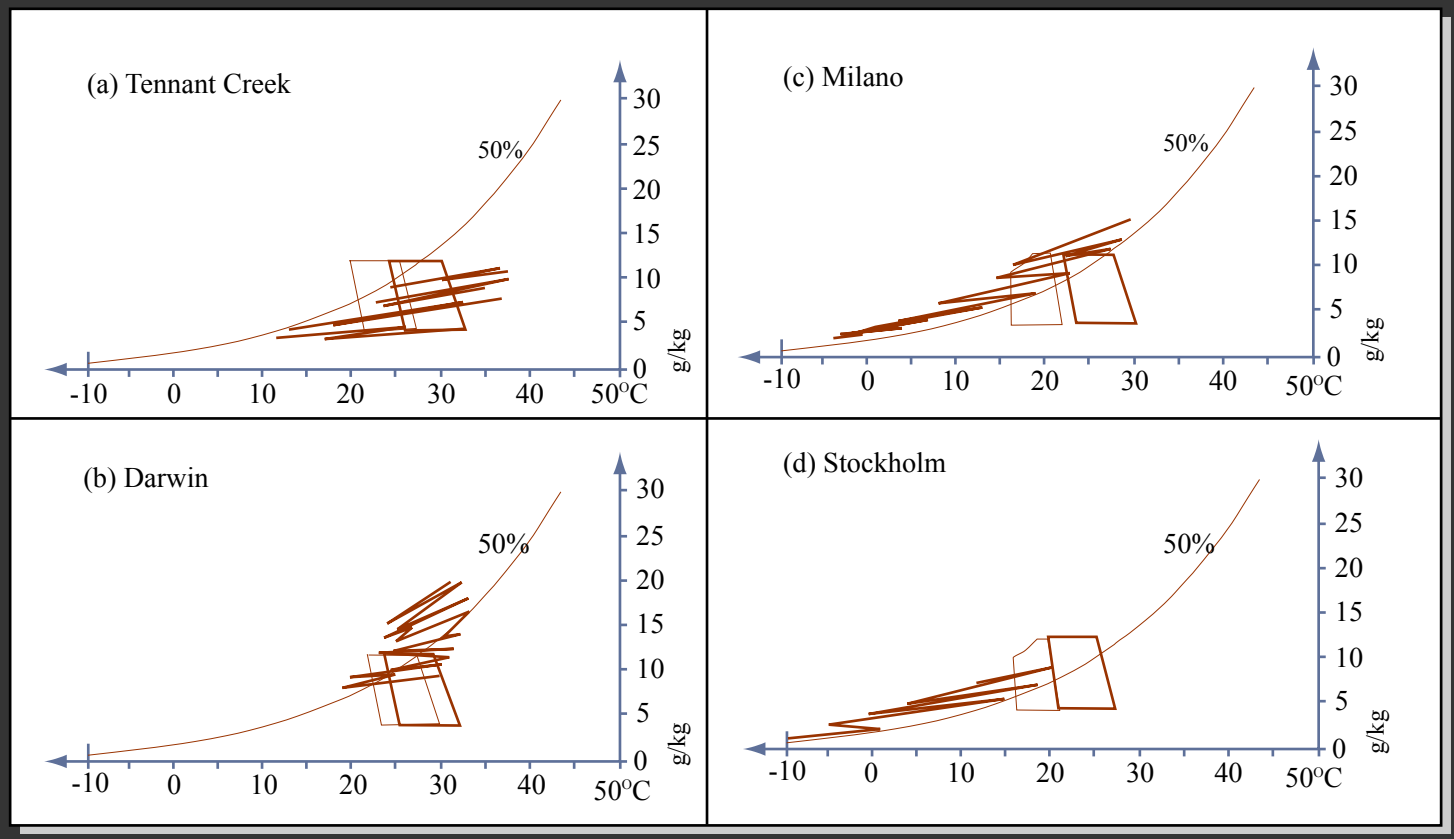
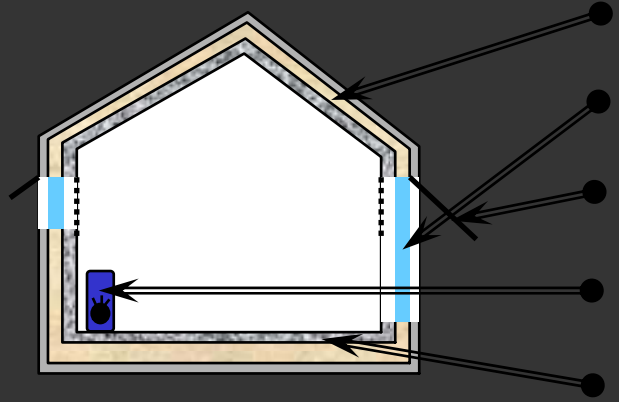


Image by MIT OCW.

Passive use of solar radiation

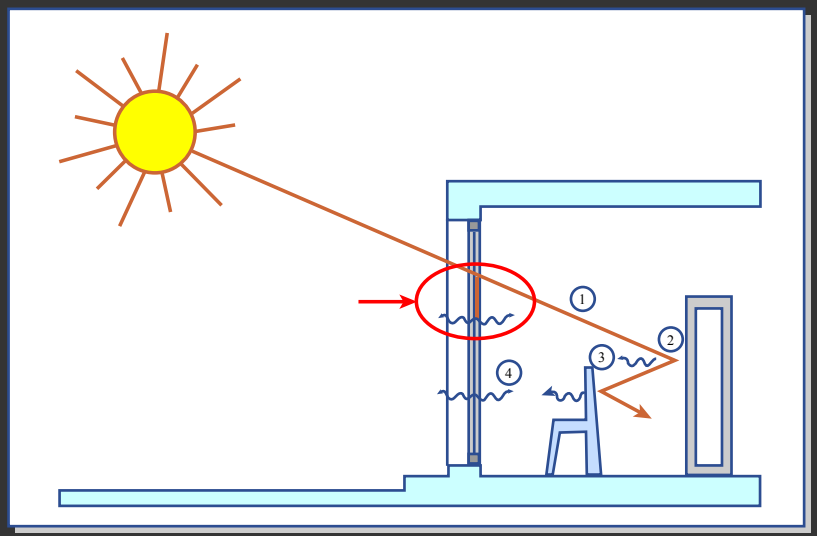
Building type	Heating needs	Lighting needs	Overheat risks	Internal gains	Period of use
Housing	high	medium	low	low	high
Office	medium	high	high	medium	limited
School	medium	high	medium	medium	limited
Hospital	high	medium	medium	low	high
Retail	low	variable	high	high	medium
Industry	low	medium	variable	variable	limited

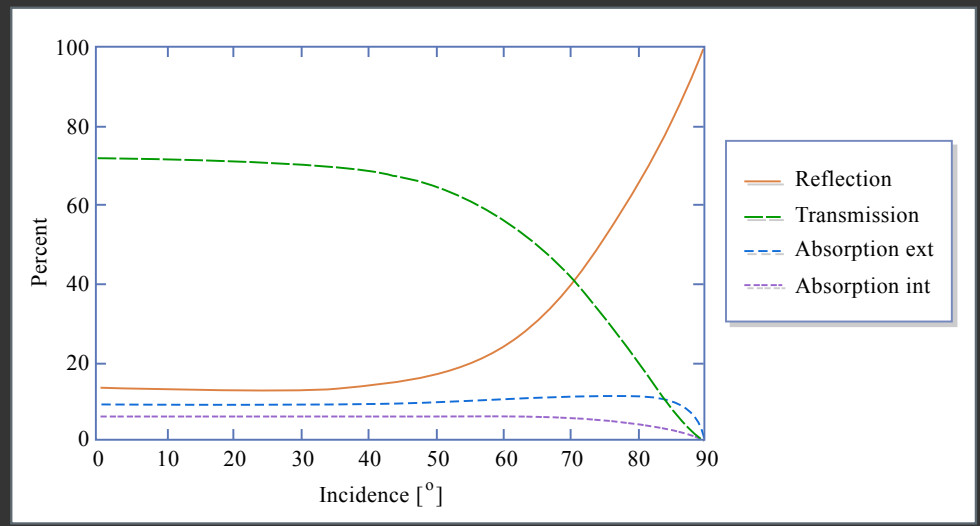


- Good thermal insulation
- Large solar radiation collecting surfaces at proper orientation
- Efficient solar protections
- Appropriate heating system
- Sufficient thermal inertia

Passive use of solar radiation

- Control of sunlight penetration
  - Glare
  - Solar gains
    - Greenhouse effect
    - Incident angle

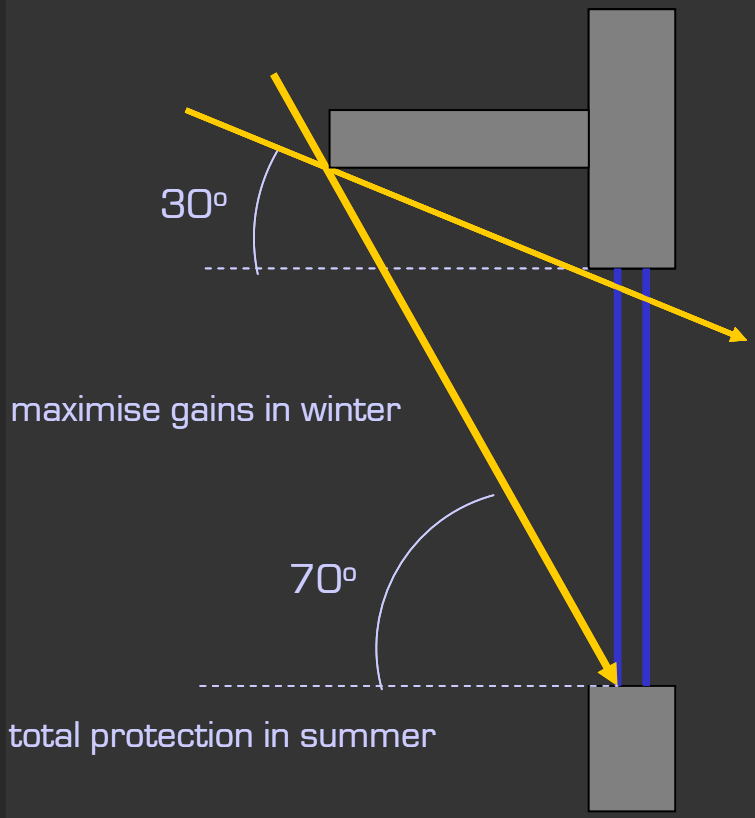




Images by MIT OCW.

Passive use of solar radiation

- Control of sunlight penetration



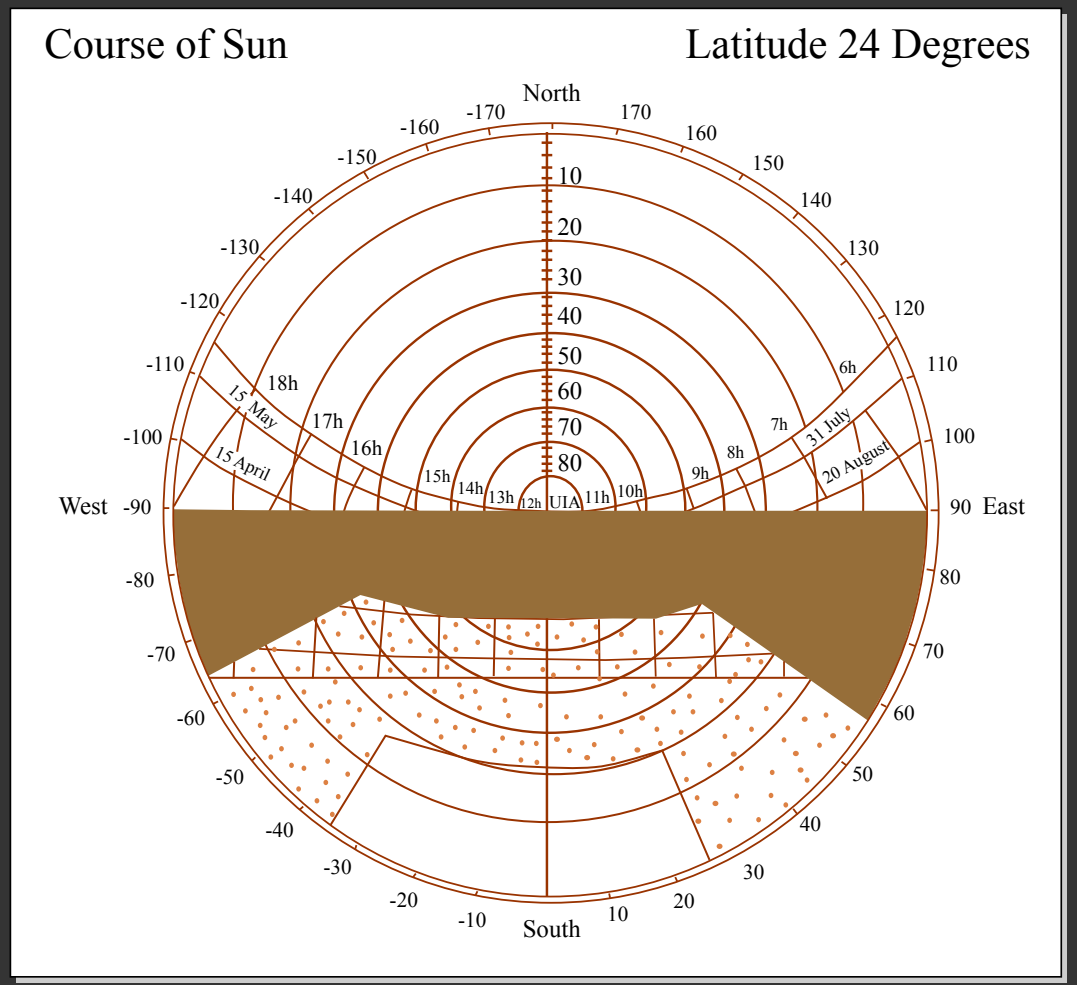


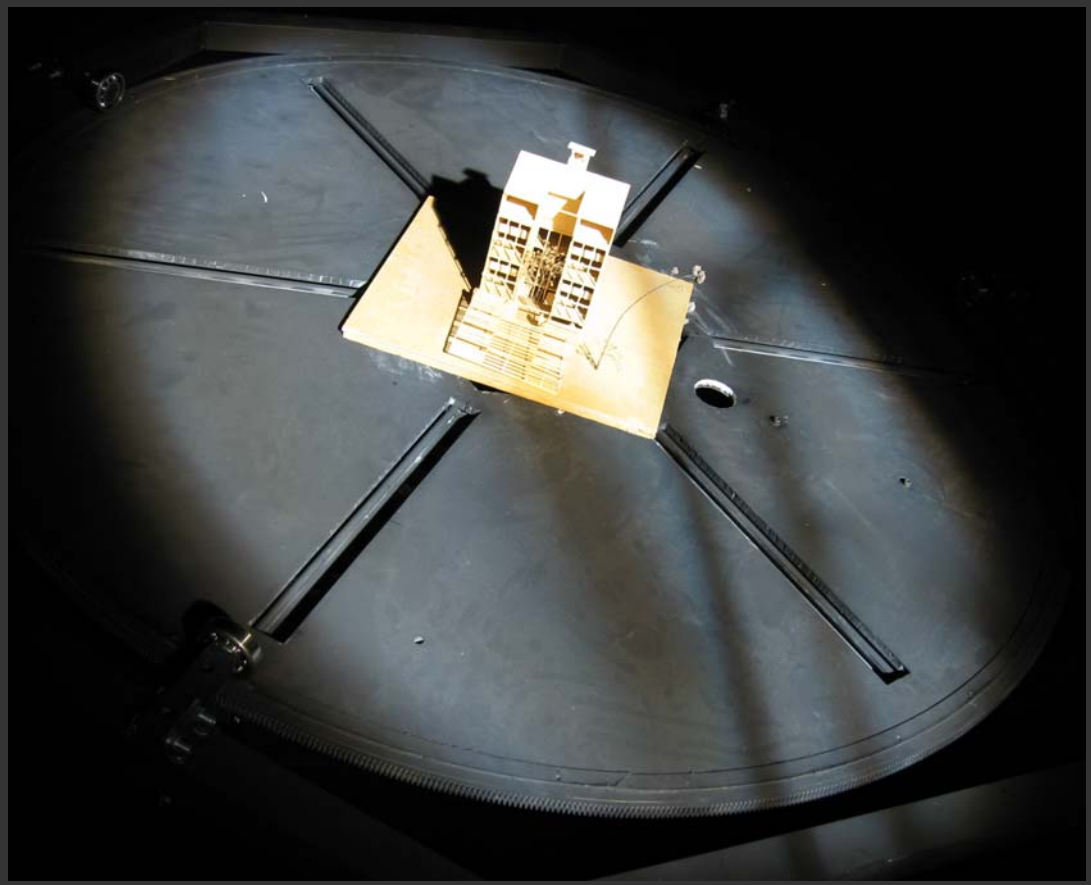
Image by MIT OCW.

Passive use of solar radiation

- Control of sunlight penetration
  - Bad design example in Singapore (equatorial region)
    - S & W façades have the same protections
    - Upper part of windows are unprotected

Passive use of solar radiation

- Control of sunlight penetration
  - Heliodons and sundials at MIT



Climate-responsive design

- Reading assignment from Textbook:
  - “Introduction to Architectural Science” by Szokolay: § 1.5.3 + § 1.5.5
- Additional readings relevant to lecture topics:
  - "Heating Cooling Lighting" by Lechner: Chaps 1 + 5 + § 6.14 - 6.18
  - “The Technology of Ecological Building“ by Daniels: Chaps 1 + 3
  - “Solar Power“ by Behling: Chap on “Responsive Solar Buildings"