Atmospheric Absorption Spectra
(How well gases in the atmosphere absorb different wavelengths of radiation)
Notes: Components of the Atmosphere
Not Shown in the Figure

• Gases
  o $\text{N}_2$ (nitrogen): 78% of dry air
    • Absorbs no radiation (of any wavelength)
  o $\text{Ar}$ (argon): 1% of dry air
    • Absorbs no radiation (of any wavelength)

• Clouds
  o Made of tiny droplets of liquid water or ice crystals
  o Absorb all wavelengths of longwave infrared radiation well
  o Reflect most solar radiation well
Notes on Absorption Spectra

• Absorption by ozone ($O_3$) and oxygen ($O_2$)
  o Ozone:
    • absorbs a little LWIR radiation
    • absorbs most of the UV radiation from the sun
  o Oxygen:
    • absorbs a little UV (but nothing else)
Notes on Absorption Spectra
(cont’d)

• Atmospheric window:
  o Wavelengths of longwave infrared radiation that no gases absorb well
    • Without clouds, these wavelengths emitted by the earth’s surface escape to space, while most other wavelengths are absorbed
    • However, clouds do absorb these wavelengths (and all other LWIR radiation emitted by the earth’s surface)
Clearance: Scattering

• Scattering redirects radiation
  o Air scatters mostly just UV and visible light (especially blue light) from the sun
  o Some scattered radiation is redirected back to space (contributes to total solar radiation reflected away by the earth)
  o The rest reaches the earth’s surface (but not from the same direction as direct rays from the sun)
    • As a result, the sky looks blue (scattered blue light comes from all directions that we look)
    • and the sun (direct rays) looks yellow (scattering redirects blue out of the direct rays from the sun, and the result looks yellow)