

Energy & the Environment Spring 2009

HWK #6 Ch. 16 : 21, 22, 27 } 70 pts.
 Ch. 17 : 31, 34, 36, 38 } total

16.21

The change in net radiation is

$$4 \text{ W/m}^2 / 100 \text{ W/m}^2 = 4\% \text{. Using}$$

black body radiation to estimate ΔT

$$\Delta T = 287 \text{ K} * (1.04)^{1/4} - 287 \text{ K}$$

$$\Delta T = 2.83 \text{ K} = 2.83 \text{ }^\circ\text{C}$$

This seems significant

16.22

thermo haline

↓

heat

↓ salt

Warm relatively salty waters carry heat from the equator towards the poles.

This warms regions like Europe.

16-27 Studying Mars & Venus allows us to look @ how changes in atmosphere affect climate on a scale of change that is much broader than possible when only the earth is examined.

17.31

1850 - 2000, temp increase = $0.6 \pm 0.2^\circ\text{C}$ (p. 362) = $\frac{0.04^\circ\text{C}}{\text{decade}}$

1950 - 2000 temp increase $\approx 0.4^\circ\text{C}$ (Fig. 17.9) = $\frac{0.08^\circ\text{C}}{\text{decade}}$

twice as much

17.34

From Fig. 17.4

$\Delta \text{EMISSIONS, } 1950 - 2000 = \frac{6700 - 1500 \times 10^6 \text{ tons}}{50 \text{ years}} = 5200 \times 10^6 \text{ tons increase}$

Increase due to more people using more CO₂/person, increases in transportation, electrification

1900 - 1950 = $\frac{1500 - 500 \times 10^6 \text{ tons}}{50 \text{ years}}$

1900 - 1950 = $\frac{1000 \times 10^6 \text{ tons increase}}{50 \text{ years}}$

5x earlier change

17.36

From book, p. 355, change in global albedo of 0.01 changes temp by 2°C . Assuming linearity, an increase of $5.8/2.0 * 0.01 = 0.029$. This is $0.029/0.30 = 9.7\%$ of the total albedo, which is significant, but not huge.

17.38

Trees sequester $7.5 + \text{CO}_2$
ha·yr

Human Emissions = $6700 \times 10^6 + \frac{\text{CO}_2}{\text{yr}}$

Fig 17.4

$$\frac{6700 \times 10^6 + \text{CO}_2/\text{yr}}{7.5 + \frac{\text{CO}_2}{\text{yr}}} = 8.93 \times 10^8 \text{ ha}$$

$$1 \text{ ha} = 0.01 \text{ km}^2$$

$$8.93 \times 10^8 \text{ ha} = 8.93 \times 10^6 \text{ (km)}^2$$