

Problems Week 1

Due Friday, January 10, 2014

1. Garrison, Ch. 8, Thinking Critically Question 1: What factors contribute to the uneven heat of Earth by the sun?
2. Garrison, Ch. 8, Thinking Critically Question 3: Why doesn't the ocean boil away at the equator and freeze solid near the poles?
3. Take a close look at the *Nature Geosciences* article by Stephens et al (2012), entitled "An update on Earth's energy balance in light of the latest global observations", which has been posted to Ted for you, and use it as a starting point to answer the following questions.
 - a. Overall, in the Earth's energy balance, what is the current estimate of the surface imbalance (and in what units is it measured)? How is the imbalance inferred?
 - b. Given this imbalance, suppose that the entire energy impabalance went towards heating the atmosphere. How much would atmospheric temperatures rise in a year?
 - c. Alternatiely, if over oceanic regions, all of this energy imbalance went towards heating the top 1000 m of the ocean, how rapidly would the ocean warm? Keep in mind the following factors:
 - The heat capacity of the ocean is $c_p = 4000 \text{ J kg}^{-1} \text{ }^\circ\text{C}^{-1}$
 - $1 \text{ W} = 1 \text{ J s}^{-1}$.
 - The density of water $\rho \approx 1000 \text{ kg m}^{-3}$.