

SMS-204: Integrative marine sciences. Assignment #4

1. Annual cycle of temperature in the Gulf of Maine in 2014 :

Go to the website http://www.neracoos.org/datatools/historical/graphing_download/.

- A) Under the Data Types tab select Air Temperatures, specify Daily Average, unit Degrees Centigrade. Click “Add Data Type”. Then select Water Temperature, specify Daily Average, units Degrees Centigrade. Click “Add Data Type”.
- B) Under the Time Periods tab scroll down and click the Custom Time button, then choose from 2014 1/1 00 hours to 2014 12/31 23 hours. Click “add selection”.
- C) Under the Locations tab click Penobscot Bay (F01) and check only the 2 m box. Click Update Selection. (See map at <http://gyre.umeoce.maine.edu/buoyhome.php>)
- D) Under the Report tab choose one of the Text File buttons and then the View Report Now button.

2. Plot the air and 2m water temperature as function of date. Plot both temperatures on the same graph with date on the x axis. (20pt)

3. Note the maximum and minimum air and water temperatures and their dates (10pt). Explain the observation with regards to the annual cycle of the sun radiation in

4. Compare the observations to the annual cycle of solar radiation in Maine. Is the warmest day the longest (June 21)? Is the coldest day the shortest (Dec 21)? If the answer is no, why do you think it is not?(10pt)

5. How does the variability of air temperature compare to the variability of water temperature? Explain why there are (or are not) differences between the two? (10pt)

Unit conversion (MKS stands for meter, kilogram, second) (30 points):

6. How many ml's are there in 0.2m^3 ? How many liters? How many cm^3 ?
7. A river is flowing at 1000m/day . What is the speed in cm/s ?
8. An organism weighing 0.2kg has a velocity of 15cm/s as it sinks through water. What is its kinetic energy in MKS units? (Kinetic energy = $\frac{1}{2} m v^2$).
9. What are the mass and volume fluxes in MKS units of a stream (density 1g cm^{-3}) flowing at an average speed 0.3m/s with a 300cm width and $4,000\text{mm}$ depth?
10. How many kilometers do tuna swimming at 0.5m s^{-1} swim in a day?
11. What is, approximately, the density of pure water in g/ml , g/cm^3 and kg/m^3 ?

12. Movie analysis (20 pts):

Now that you have watched the four part movie series on drag, explain two of the three strange phenomena seen in the first movie (use the concepts of Reynolds number and boundary layer in your answers).

13. Extra credit, 10pts: a Hershey kiss has 26 Calories (= 26,000 calories). Some claim if we could convert this energy to mechanical energy without loss, it could lift an SUV (see: <http://www.npr.org/templates/story/story.php?storyId=6700905&sc=emaf>).

The energy required to lift an object equals the potential energy of the raised mass = mgh . Given that 1 calorie = 4.186 joules calculate how high you could lift a 5000lb SUV.

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