Healthy Oceans

Math and Computational Challenges

Name:____ **Date:**____________________

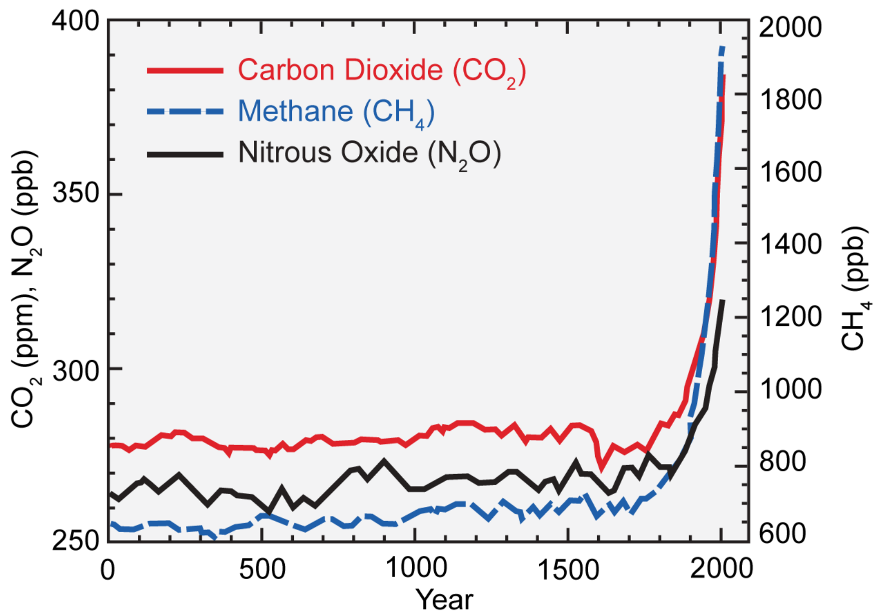
Healthy Oceans: Coral Reefs and Climate Change

Math and Computational Challenges

How has the amount of carbon dioxide in the atmosphere changed over time? Why do we attribute the most recent (since the 19th century) increase in CO_2 to human activities?

1. Look at the graph[1] below from the 2014 U.S. National Climate Assessment. Calculate the average rate of change of carbon dioxide (CO_2) in the atmosphere between the following time periods:

(a) 1000-1650
(b) 1650-1750
(c) 1750-1800
(d) 1800-1900
(e) 1900-2000



2. Compare the rates between the different time periods—are they similar or different? Why do you think this is? What kinds of things have happened in the world during these different time periods that could explain any differences?

[1] Forster, P., V. Ramaswamy, P. Artaxo, T. Berntsen, R. Betts, D. W. Fahey, J. Haywood, J. Lean, D. C. Lowe, G. Myhre, J. Nganga, R. Prinn, G. Raga, M. Schulz, and R. Van Dorland, 2007: Ch. 2: Changes in atmospheric constituents and in radiative forcing. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller, Eds., Cambridge University Press.

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Healthy Oceans: Sustainable Seafood

Math and Computational Challenges

1. Imagine that a clam accumulates one unit of mercury in its body from the water it lives in. How many units of mercury would a stingray accumulate if it eats 50 clams a day for 10 years, assuming no mercury is lost between the clams and stingray?

2. (a) How much mercury would a shark accumulate in a year if it eats 5 of the stingrays from the previous problem every month?

(b) What about a human that consumes an entire 15-year old shark?

(c) Is the build-up of mercury through this food chain linear? Why or why not?

3. Mercury is toxic to humans. Using what you learned from this problem, explain why people might want to 'eat lower on the food chain.'

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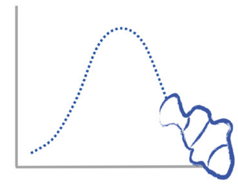
Healthy Oceans: Preventing Plastic Pollution

Math and Computational Challenges



1. Using the information given in the video about the Japanese teenager's soccer ball, write an equation to calculate the average speed of the ocean current(s) that transported the ball across the Pacific Ocean. Then, solve the equation!

2. Using the information given in the video about how much plastic gets into the ocean every year, create a graph of plastic in the ocean over time. Use 1930 as the year of 'zero' plastic in the ocean (*this was the decade when mass production of plastic began*). Then, use this graph to predict how much plastic will be in the oceans by the year 2050 if plastic pollution continues at this rate.

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Healthy Oceans: Preventing Plastic Pollution

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3. Calculate the surface area of a rectangular plastic container lid 60 cm x 30 cm x 2 cm. Now, imagine that this plastic lid gets carried into the ocean by a wave and slowly photodegrades into 100 equally-sized pieces. What is the total surface area of all of these 100 pieces?