

SIO 15 (FQ 2024) – Homework #8 Due November 26, 2024 5 pm

Maximum score: 20 points + 0.5 bonus

NO LATE SUBMISSION BEYOND TUESDAY MIDNIGHT POSSIBLE

-2 point penalty for late submission (more than 30 min past due date), regardless of the reason.

Divide by 4 for contribution to total cumulative

- 1) Watch the homework 8 video on the class website!
- 2) Add your full name (your family/last name first) to the top on each page.
- 3) Provide only answers (not the questions!) in the document you submit.
- 4) Label each of your answers (1a, 1b, 1c etc.), starting a new line for each of your answers.
- 5) Provide short answers. Shorter is better! No full sentences required. Definitely no long answers. Points may be subtracted for answers that are too long/answers given that are not relevant to the question (including cut-and-paste jobs of entire sections from the class website).
- 6) include appropriate units where needed (not just numbers)
- 7) Hand-written ok as long as the handwriting is easily readable.
- 8) Submit a single pdf to Gradescope. Only submit a high-quality pdf. Cell phone photo scans are not ok! Instead, use a professional app, such as Turboscan.
- 9) Important!!!!!! After you uploaded your pdf but before hitting the submit button, please identify on which page each of your answers to problems 1 - 10 are. Only when this is completed, hit the submit button.

Topics 20 - 22

- 1) Arctic Sea Ice decline. Click on the image in the lecture notes and follow the link to Wikipedia. Scroll down To the graph in question.
 - a) What was the sea ice volume in April and September in 1980? (include units!) (0.5 pt)
 - b) What was the volume for the two months in 2000 (include units!) (0.5 pt)
 - c) Taking the 1980 values as baseline, by how much, in percent, did sea ice decline for the 2 months between 1980 and 2000? (0.5 pt)
 - d) Now do the same as in b) and c) but for the year 2017 instead of 2000. (0.5 pt)(2 points total)

- 2) Work with the same chart as discussed in #1
- Make a table with three columns. Place the name of the categories in the top row: year, volume April in 1000 km³, volume September in 1000 km³ (0.25 pt)
 - Tabulate the data for the following years: 1980, 1990, 2000, 2010, 2017, 2020 (0.75 pt)
 - Access the PIOMAS website of University of Washington at <https://psc.apl.uw.edu/research/projects/arctic-sea-ice-volume-anomaly/>
- Work with Figure 2. The graphed values are supposed to be from an updated study. Add a line in your table and log the values for 2017 for April and September. (0.5 pt)
- Discuss the difference in the values for both months in 2017 between what you get here and what you have in problem #1. (0.5 pt)
 - Using both Figure 2 and Figure 4, compare the April and September values for 2017 with those of 2024. It is recommended that you add a line in your table and log the 2024 as you have done for previous years. For which month has sea ice recovered, for which did it diminish going from 2017 to 2024? (0.5 pt)
- (2.5 points total)
- 3) Work with Google Earth hw8-arctic-ice.kmz file. This kmz file comes from the U.S. National Ice Center. You will have to turn on and off some of the entries on in the 'Places' tab when comparing ice cover on September 16 for the years 2017 and 2024. The kmz file shows the sea ice extent with various stages, where red colors indicate the thickest, most stable pack ice (over 80% ice) and blue colors mean no ice (< 10% ice).
- Find Prudhoe Bay, Alaska. With having the 2024 cover checked under 'Places', how far from there was the nearest marginal ice? How far was the nearest full-cover/thickest pack ice? (error margin: 70km) 0.5 pt
 - What are the values for 2017 (uncheck the year 2014 under the 'Places' tab. (error margin: 70 km) 0.5 pt
 - Find Svalbard and use the bottom of that placemark. How far from there was the nearest marginal ice (green) in 2017? How far was it in 2024? (error margin: 20 km) 0.5 pt
 - Now find Prince of Wales Island, Nunavut, Canada. Zoom out, if necessary, until you see Steffanson Island to the northwest. In 2024, what was the color/fraction of ice cover in the bay between the two islands? What was it in 2017? 0.5 pt
- (2 points total)
- 4) a) Apart from water vapor, which two gases contribute most to Earth's greenhouse? What is their relative contribution? (0.5 pt)
- Which gas is third? Where does it come from? (0.5 pt)
 - In one sentence, explain what radiative forcing is? (0.5 pt)
 - Explain the radiative forcing of ozone in the troposphere and stratosphere. (0.5 pt)
- (2 points)

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- 5) a) During the last ice age, how was sea level different from today? Also add a number with unit. (0.5 pt)
b) How do scientists infer past climates from ice cores in Greenland and Antarctica, i.e. which part of the ice core is analyzed for which chemical compound? (0.5 pt)
c) Compare the duration of cooling going into an ice age vs warming at the end of an ice age. (0.5 pt)
d) Explain the cause for this difference. (0.5 pt)
(2 points total)
- 6) a) What are the main three NATURAL causes for a temperature increase in the last 150 years? Provide the causes and the possible temperature increase. Do not list anthropogenic contributions, including it will result in a reduction in points! (0.5 pt)
b) What is a possible natural cause for a drop between 1940 and 1970? (0.5 pt)
c) What is a possible cause for a drop in the early 1970s? (0.5 pt)
d) What is a possible natural cause for an increase since 1976? (0.5 pt)
(2 points total)
- 7) a) By how much has global sea level risen in the last 100 years? (0.5 pt)
b) What are the four main contributions to global sea level rise? Also provide the amount of contribution for each. (0.5 pt)
c) How does the melting of sea ice contribute to global sea level rise? (0.5 pt)
d) What is the realistic range of predicted sea level rise for the next 100 years? (0.5 pt)
(2 points total)
- 8) the Keeling Curve:
go to <https://www.esrl.noaa.gov/gmd/ccgg/trends/>
choose “trends in CO₂”, then Mauna Loa, then go to the interactive plots tab
- a) Make sure to distinguish between the actual CO₂ value (red) and the trend (blue) value.
Working first with the trend values, log the measurement for March 1958 and October 2024? (include units) (0.5 pt)
b) Compute the difference. Include units (0.25 pt)
c) Using the value for 1958 as the base, by how much is percent has the CO₂ level increased? (0.5 pt)
d) Zoom in so that you see seasonal variations better. Log the values for October 2011 and May 2012 and determine the difference. Include units. (0.5 pt)
e) How does the difference under c) (seasonal variations) compare with the difference under b) (overall increase in the last 66 year)? (0.25 pt)
(2 points total)

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- 9) Use the same webpage as in 8). Choose trends in CH₄
- a) What was the value in July 2024? include units (0.25 pt)
 - b) Estimate the value for 1984. include units. (0.25 pt)
 - c) Using the 1984 value as baseline, determine the percentage increase for the 2024 value under a). (0.25 pt)
 - d) From the panel on the left, estimate the range of seasonal variations. For most consistency, use summer 2022 and the following winter in 2023. Include units. Careful here! To make an accurate estimate, you have to take into account the strong overall increase! (0.5 pt)
 - e) CH₄ did not increase steadily. Which year between 1984 and 2024 has seen the biggest year-to-year drop in CH₄? (0.25 pt)
 - f) Go to Wikipedia and search for atmospheric methane. Find that cause for the drop in methane under d). (0.5 pt)
- (2 points total)
- 10) Go to <https://earth.nullschool.net>. Upon first opening, you will see the current global winds. Choose the date 11/19/24 14:00 PST/22:00 UTC
- a) There is a large/strong storm approaching the Pacific Northwest. Log the coordinates of the center of the storm. (0.5 pt)
 - b) Where relative to the center do we find the strongest winds? Log the highest wind speed? include units (0.5 pt)
 - c) Choosing the ocean mode and wave height (HTSGW) as overlay, what is the wave height in that area? include units (0.5 pt)
 - d) The storm has a strong advancing front. Given temperatures at an altitude corresponding to 850 hPa, what kind of front is this? (0.5 pt)
- (2 points total)