

SIO 15 (FQ 2024) – Homework #6 Due November 12, 2024

Maximum score: 20 points + 1 bonus point

- 2 penalty points for late submission (more than 30 min past due date)

Divide by 4 for contribution to total cumulative

- 1) Watch the homework 6 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 17 – 18

- 1) a) Watch the lecture 17 podcast for 2023 (see Canvas announcement for canceled lecture on 11/4/24): Explain why the day/night temperature on Venus is so high (e.g. higher than on Mercury even though Mercury is closer to the sun). (0.5 pt)
 - b) In the 1995 Chicago heat wave, the urban heat island effect was one of several human-caused factors that enhanced the misery. Name three other human-caused factors that are not related to the urban heat island. (0.5 pt)
 - c) In October 2023, of all U.S. states which one experienced the most severe drought? What was the drought level (provide D level and description). (0.5 pt)
 - d) In the time since 1900, when was the worst drought/heatwave event in the U.S.? Provide year(s) and name of the event. (0.5 pt)
- (2 points total)

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- 2) go to droughtmonitor.unl.edu.
 - a) For the current map (valid Oct 29, 2024), which state currently has the largest area in an exceptional drought? (0.5 pt)
 - b) Which two neighboring states (one in the Midwest, one in the Northeast) have smaller areas with a D4-level drought? (0.5 pt)
 - c) Choose the map for October 31, 2023. What was the highest drought level in California? (0.5 pt)
 - d) In the map for December 6, 2022, what was the highest drought level in California? (0.5 pt)
 - e) Under the 'data' tab, we now look at time series. Choose "state" and area type and "California" as are. Since 2000, from when to when did California's most prolonged and intense drought last? For dates, consider only the D4 level. (0.5 pt)

(2.5 points total)

- 3) Heat index. For the following, use the chart in the book, lecture slides or the class website. The following questions are best summarized in a table. Properly label the categories in the table (i.e. provide a header row that lists the categories). After setting up the columns for a) add rows for each of b) – c)
 - a) Given an air temperature of 80°F, what is the heat index for the following 4 values for relative humidity: 5%, 20%, 40%, 80% (0.5 pt)
 - b) Give the corresponding values for an air temperature of 90°F and for 100°F. (0.5 pt).
 - c) Given an air temperature of 80°F, for which relative humidity does the air feel warmer than it really is? Work only with the data in your table. (0.25 pt)
 - d) Given an air temperature of 100°F, for which relative humidity does the air feel warmer than it really is? Work only with the data in your table. (0.25 pt)
 - e) Given a relative humidity of 80%, discuss the difference in heat index effect for an air temperature of 80°F with that of 100°F. Here, do not just give numbers but discuss the impact of the effect. (0.5 pt)

(2 points total)

- 4) Wind chill factor, use the chart given in the lecture slides. For b) and c) make a similar table as for 2b)-c).
 - a) Why does wind speed have an effect on felt temperature? (0.25 pt)
 - b) Given an air temperature of 30°F, what is the wind chill for the following wind speeds: 5 mph, 15 mph, 25 mph, 35 mph (0.5 pt)
 - c) Give the corresponding values for an air temperature of 0°F (0.25 pt)
 - d) Given a temperature of -15°F and 10 mph winds, how long does it take to develop frost bites? (0.5 pt)
 - e) How about -15°F and 20 mph winds? (0.5 pt)

(2 points total)

- 5) Air masses and fronts.
 - a) What happens when a cold air mass advances on a warm air mass? Include answers to: which air is moving where, which air mass ends up at the bottom, which on the top? (0.5 pt)
 - b) What kind of front is forming? (0.5 pt).
 - c) Where and what kind of weather is typically associated with this kind of front? (0.5 pt)
 - d) In a wave cyclone, which front moves faster, the cold front or the warm front? (0.5 pt)

(2 points total)

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- 6) a) What are the three principal ways for thunderstorms to form? (0.5 pt)
b) Where in the U.S. do we have the highest occurrence of thunderstorms? (0.5 pt)
c) Why is standing under a tree during a thunderstorm not a good idea? (0.5 pt)
d) Where in the world do we find the highest occurrence of lightning flashes? (0.5 pt)
(2 points total)
- 7) a) What is a supercell thunderstorm? (0.5 pt)
b) Which fraction of supercell thunderstorms spawn tornadoes? (0.5 pt)
c) Why is a microburst dangerous to aviation? (0.5 pt)
d) In Tornado Alley, when do the majority of tornadoes occur? When do most fatalities from tornadoes occur? (0.5 pt)
(2 points total)
- 8) News clip November 01, 2024:
a) Unusually balmy weather left which two states vulnerable to hundreds of wildfires? (0.5 pt)
b) Are these the same two states found in problem 2b)? (0.25 pt)
c) For both states, how many fires burn currently, compared to a normal year? (0.5 pt)
d) What is the usual cause of wildfires? (0.25 pt)
e) Which fires elsewhere have prepared emergency workers in the Northeast with what to expect? (0.5 pt)
(2 points total)
- 9) Go to earth.nullschool.net. Choose the date 11/4/24 12:00 local (PST) or 20:00 UTC.
a) Provide the coordinates of the center of the storm along the Aleutian islands? (0.5 pt)
b) To the southeast of this storm, and separated approximately by the 40°N latitude, there are two systems with rotating winds. Which one is a low-pressure, which a high-pressure system? (0.5 pt)
c) Coming from the Pacific ocean, over which state(s) in the U.S. does the jet stream come on land? (0.5 pt)
d) What is the approximate maximum wind speed in that area? Provide the altitude you chose, one of only two alternatives according to the homework video, and the maximum wind speed. (include units for both)
Both are needed for full points. (0.5 pt)
(2 points total)
- 10) Go to water.noaa.gov. This site shows current flood levels at river gauges in the U.S.
The Mississippi River currently experiences water levels below the low water threshold between New Madrid, MO and Vicksburg, MS. Find the river gauge along the Mississippi River at Vicksburg, MS.
a) What is the latest observation (water level and discharge)? Include units. Also log the date/time of your observation. (0.5 pt)
b) click on “full information”. Scroll down to the crest data. When and at which height did the highest historic crest occur? Include units. (0.5 pt)
c) When and at which height was the most recent crest? (0.25 pt)
d) Is this most recent crest among the top 5 historic crests? (0.25 pt)
e) Now repeat a)-d) for the river gauge at St. Louis, MO. (1 pt)
(2.5 points total)