

Homework 9, Part 4 (Observing Component)

Re-Tracking the Daily Motion of the Sun

Due 5pm on Wednesday, November 29, together with the rest of Homework #9

A sheet of paper with your name and answers to the observing questions should be handed in to my box outside Merrill 213 or scanned and submitted to Moodle. The sun tracking hemisphere with your observations and name should be handed in to the cardboard box outside Merrill 213. All of your observations should be recorded on the INSIDE of the hemisphere to reduce smudging.

This week, you will once again map the sun's path across the sky throughout the day and will compare the path of the sun to your prior observations two months ago.

As before, each observation is short, however you need to complete it *from the same location* each time and that location needs to be somewhere where you can see the Eastern and Western horizons without obscuration (mountains/trees are ok, but buildings are not).

For complete points, you need to complete an observation of the sun:

- 1) Within 2 hours of sunrise (right at sunrise, which happens around 6:30am, is best if you can manage)
- 2) Sometime mid-morning (9:30-10:30am)
- 3) Within 5 min of noon
- 4) Sometime mid-afternoon (1-2:30pm)
- 5) Right at or just before sunset (around 4:30 pm)

Keep in mind that sunrise will happen a little later and sunset a little later if there are mountains on the horizon.

You can make your measurements any day between now and November 29, however keep in mind that if it's very cloudy, you'll have trouble, so don't leave it until the last day.

Instructions for individual measurements are below. New tips and/or things that you need to do differently relative to last time are underlined.

- 1) Line up the "True North" label from your original observation with your best guess as to where North lies. If you were very far off in your guess as to the location of North the first time you did the observation, estimate it more carefully this time using a compass or map. ***You must be consistent between observations which is why you need to complete them from the same place each time. Find a marker on the ground that you can come back to as a location to set your hemisphere and a precise marker on the horizon (or an orientation relative to your marker on the ground) to remember precisely where to set North every time. Do not use a compass app on your phone to align the hemisphere each time. You can use it to estimate North the FIRST time, however these apps are notoriously unreliable so you need to use or place a marker on the ground for alignment each subsequent time.*** Even if you decide later on that North is actually a different direction, you should still orient your paper and hemisphere in the original direction that you thought was North.
- 2) Place the "Hemisphere Base Diagram" on the ground underneath the Planisphere with the letter "N" pointing the same way as the N on your planisphere. Line up the dome part of the plastic circle with the shaded circle on the Hemisphere Base Diagram.

- 3) Hold your grease pen just above the surface of the planisphere and move it around until the shadow of the tip lines up precisely with the intersection of the cardinal directions at the very center of the Hemisphere Base Diagram. Make a mark on the outside of your hemisphere.
- 4) Make a mark at the same spot on the INSIDE of your hemisphere (where it's less likely to get smudged) and label it with the time and date in red grease pen.

When you've completed all the observations, answer the following questions on a separate sheet of paper (with your name on it), to be handed in with your sun tracking hemisphere and the rest of Homework 9 by 5pm on November 29.

Hemisphere observations: 10 points

1. BEFORE DOING YOUR OBSERVATIONS, make a prediction for the path of the sun using a dashed red line and describe in words why you are making that prediction. Describe in particular how you expect the location of the sun at rising, setting and at noon to be different from your original observation and why. (4 points)
2. Describe in detail where you did your observations and how you made sure your paper was lined up the same way each time. If you made any modifications to your procedure based on feedback from the first time you did sun tracking, describe them. (3 points)
3. Connect your new observations (there should be 5 of them) with a solid line that extends all the way to the base of the hemisphere. How far off was the path you predicted in class relative to the actual path of the sun that you observed? Describe how they were different in terms of rising and setting location along the horizon and the height of the sun on the meridian at noon. Was your prediction better this time than last time? (3 points)
Note: Once again, if your observations don't lie along a straight line, it means something went wrong in your observing strategy. Don't panic, and don't modify your observations. Draw your best guess for the actual path of the sun from your observations and make sure to speculate about what the sources of error may have been.
4. Discuss the difference in the rising and setting location of the sun relative to your original observation. How many degrees from due E/W did the sun rise/set, and in which direction (north or south)? Note that the number of degrees from E/W should be the same. If they are not the same, use the fact that the sun reaches its southernmost point in the sky at noon to relabel your cardinal directions. Specify in your answer how you estimated the number of degrees. (4 points)
5. Discuss the differences in the height of the sun at noon between your original observation and this new one. Estimate the distance in degrees from the meridian in each case, and specify how you made that estimate. (3 points)
6. Summarize in words how AND WHY the path of the sun was different between this observation and your last one. Describe one thing you found surprising about the new path. (3 points)

For extra credit (5 points):

If you are traveling for Thanksgiving, do an additional observation at noon from this new location. Discuss whether the sun's location at noon was different than in Amherst and why (or why not) you think that is.

MAKE SURE YOUR NAME IS ON THE HEMISPHERE AND ALL OBSERVATIONS ARE MARKED ON THE INTERIOR OF THE HEMISPHERE BEFORE YOU HAND IT IN.