

Homework 3, Part 4 (Observing Component)

Tracking the Daily Motion of the Sun

Due 5pm on Monday, September 27th, together with the rest of Homework #3

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 map the sun's path across the sky throughout the day and will take advantage of our proximity to the autumnal equinox to locate the cardinal directions on the horizon. You will do the same observation a bit later in the semester.

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).

This week, 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 (2-4pm)
- 5) Right at or just before sunset (around 6:50pm)

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

Your measurements will be best if you complete them all on the same day, and I recommend doing them on the day of the equinox (September 21) if you can, however you can do them up to a couple of days apart without significantly impacting your measurement.

Instructions for individual measurements are below.

- 1) Line up the "N" on your planisphere with your best guess as to where North lies (use a compass on your phone or a map to get close). ***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.*** 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.

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 3 by 5pm on September 27.

1. Where did you do your observations and how did you make sure your paper was lined up the same way each time?
2. Connect your actual 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.
Note: 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.
3. Since we observed the sun within a few days of the equinox, we can assume that it rose due east and set due west. Label the points where the actual trajectory of the sun intersects the horizon with “TE” and “TW” for “True East” and “True West”. Do the same for True North and South (90 deg from TE and TW). How did you estimate where North was when you made your first observation and how accurate was your estimate? You should give the accuracy in degrees by estimating the distance in degrees between your new and old cardinal directions, keeping in mind that there are 360deg in a full circle.
4. Draw the meridian and label it by connecting True North and True South with a line that passes through the zenith of your hemisphere. Then answer the following questions:
 - a. Was the sun right on the meridian for your noon observation? Give your best explanation for why or why not.
 - b. How far from the zenith was the sun at noon on the day of your observation? Use the fact that there are 90deg between the horizon and zenith to make your estimate.
5. What was most difficult and/or surprising thing about your observation?

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