

Lab 1

This lab involved selecting a cache at <http://www.geocaching.com/map/beta/default.aspx>. We selected the *Uzamaki meshiagaru* cache near the Smoothie King on College Street (ID: GC48DJN).



Figure 1: Finding the Geocache

1. Note the reported coordinates of the GPS device and cache and plot on a Google Maps image. Comment on the apparent accuracy of the plot.

Solution:

The following coordinates were either provided by the geocache or phone:

$$\begin{aligned}x_{cache} &= \begin{bmatrix} 32.579967 & -85.495583 \end{bmatrix} \\x_{andrew} &= \begin{bmatrix} 32.579981 & -85.495618 \end{bmatrix} \\x_{daniel} &= \begin{bmatrix} 32.579988 & -85.495579 \end{bmatrix}\end{aligned}$$

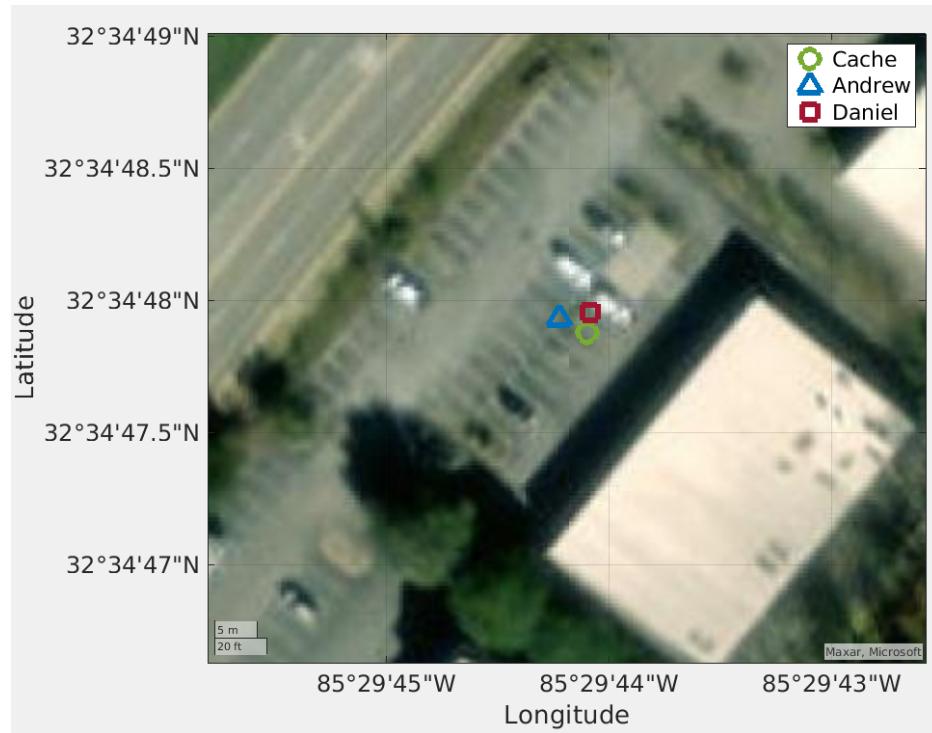


Figure 2: Geoplot of Cache and Students

Looking at the plot, there is only a few meters of error, which is relatively accurate for a phone GPS receiver. However, a significant portion of the error can be accounted for by the fact the measurements were taken about a meter away from the cache. If you take the RSME of the two measurements, it comes out to an error magnitude of 2.171 meters.

2. Note the terrain, such as any tall buildings, foliage, open sky, etc.

Solution:

The following figures display the terrain at the cache location.



Figure 3: Terrain at Cache

The terrain around the cache was relatively open, as it was in a parking lot. There were no tall buildings or thick foliage nearby. The tallest object was the lightpost hiding the cache and a few vehicles were nearby. It is unlikely that these interfered with the GPS signal. The most significant environmental factor was that it was very cloudy and overcast day which could yield poor satellite visibility.

3. Note the time and day of the finding.

Solution:

The cache was found and measured at 11:21:27 am central time on January 31, 2023.

4. Either sketch or photograph the current satellites used by the receiver.

Solution:

The following figure shows the GNSS satellites in view and their relative signal strength.

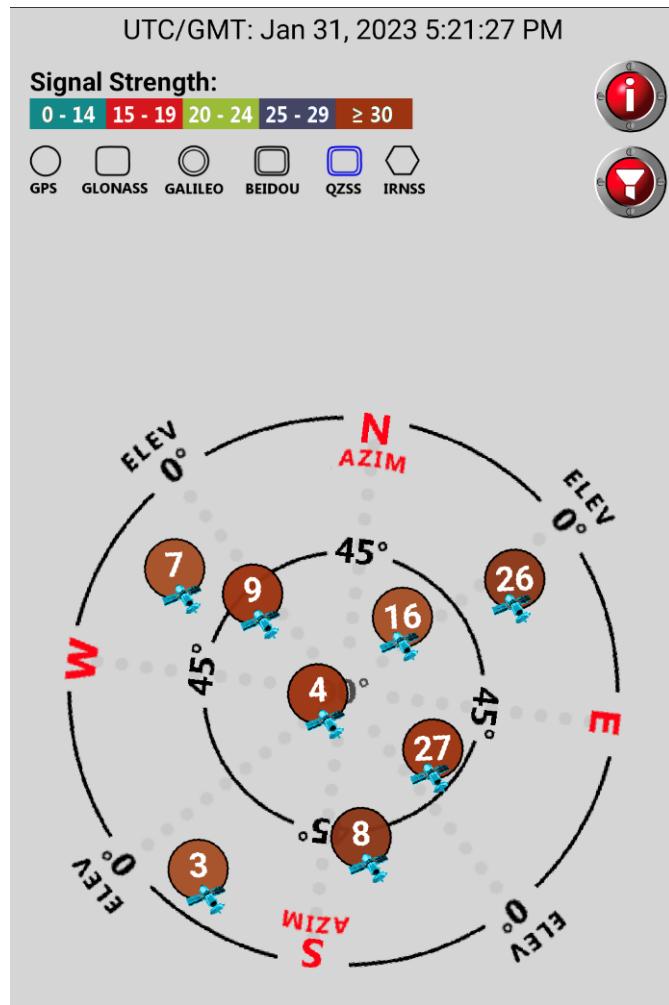


Figure 4: Phone Satellites in Use.

As shown, each of the 8 satellites in use have high signal strength.

5. Using your location and time, compare the satellite positions to the receivers satellite positions using <https://www.gnssplanning.com> or <http://gnssmissionplanning.com>.

Solution:

Using both websites, the satellite locations at the geocache were as follows:

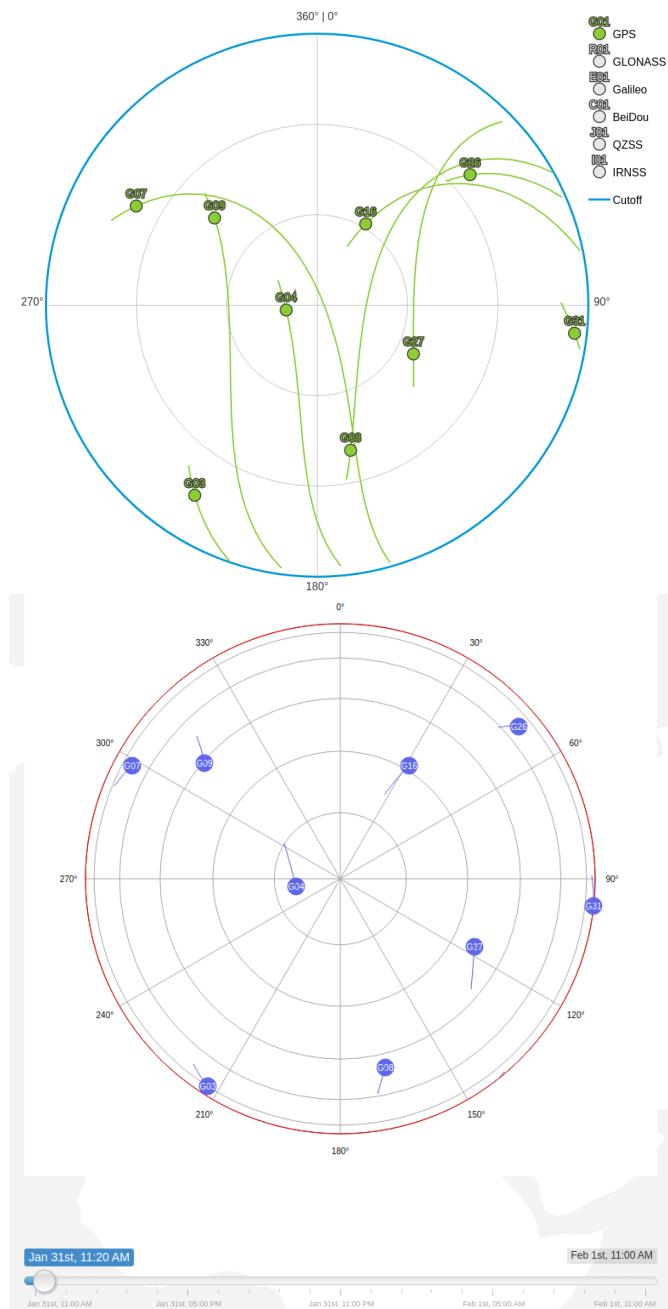


Figure 5: Skyplot at 11:20 am (a) Trimble (b) Mission

Both skyplots are nearly identical and include 9 satellites at a 0 degree elevation cutoff.

Comparing to the phone skyplot, the only difference is that the phone only has 8 satellites in use whereas there should have been 9 satellites available (according to the online skyplots). This is most likely due to an elevation mask removing low elevation satellites from the solution.

6. Record the SV positions and DOP from the mission planning website for time of the cache.

Solution:

The following charts proved the world plot with satellite locations at 11:20 am central time followed by the DOP charts starting 11:00 am central time. Only the satellites that were in view at the time of measurement are included.

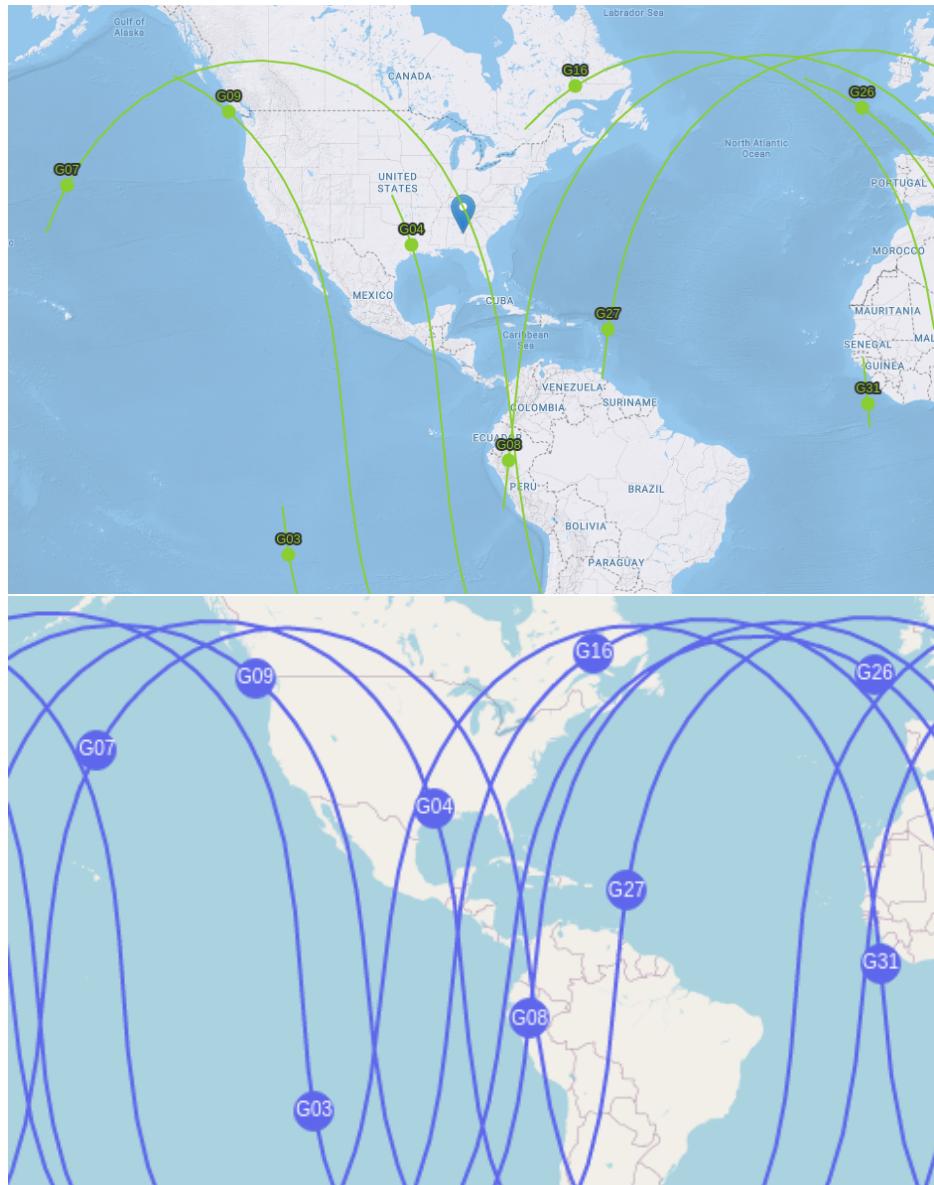


Figure 6: World View (a) Trimble (b) Mission



Figure 7: DOP (a) Trimble (b) Mission