Assorted notes on Investigating Variations

- To find relative extrema use *scipy.signal.find_peaks(x=[array of values],distance=minimum distance between peaks)*. Import: *from scipy.signal import find_peaks*
    - This seems like the best way to find relative maximums, and I couldn't find a similarly good function for finding relative minimums. The way to get around this is to find relative maximums on two arrays: one on the normal array of mags (this will return "fake" maximums, because their values are peaks, but their brightnessess are minimums due to the nature of the magnitude system) and find the indices for peaks in the magnitude array multiplied by a negative number (so the true minimums show up as maximums). You can combine the two resulting arrays with the numpy function *np.concatenate((array1,array2))*.
    - Note: The output of *find_peaks()* is sort of weird, so a good way to get an array of peak indices is to do this: *array_name, _ = find_peaks(x,width=)*

- A good way to smooth a one dimensional array (i.e. the method I've currently settled with) is the scipy implementation of a Savitzky–Golay filter: *smoothed_data = scipy.solgov(x=[unsmoothed array], window_length=odd integer,polyorder=integer)*. Import: *from scipy.signal import savgol_filter*
    - What is the window you might ask? The window parameter specifies how many data points will be used to fit a polynomial regression function for each point (that's why I presume it must be odd, because the median number in the window will be the data point in question).
    - *polyorder* must be less than *window_length* (note that for *N* points, a polynomial of the *N-1*th degree *should* fit the points perfectly).

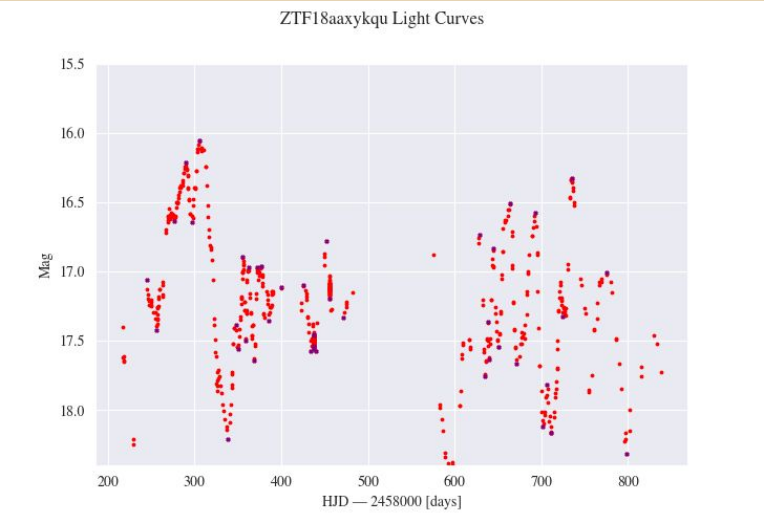

Fig. 1: Red band lc with relative extrema highlighted in purple. I calculated the relative extrema on smoothed array of the mag values, specifically a savgol filter with a window size of 3 and a second order polynomial.

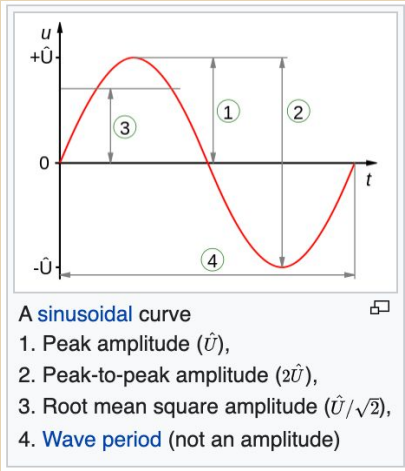

Fig. 2: Possible variation measures. Maybe we can measure the variations with a histograms of p-p amplitudes and another histogram of periods (which could be calculated as the time in days between indices of successive minima/maxima, depending on preference)?

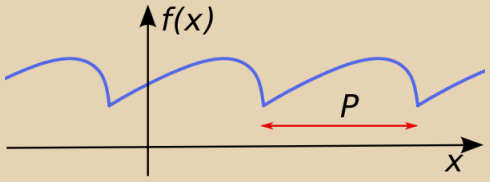

Fig. 3: Simple demonstration of periodicity.

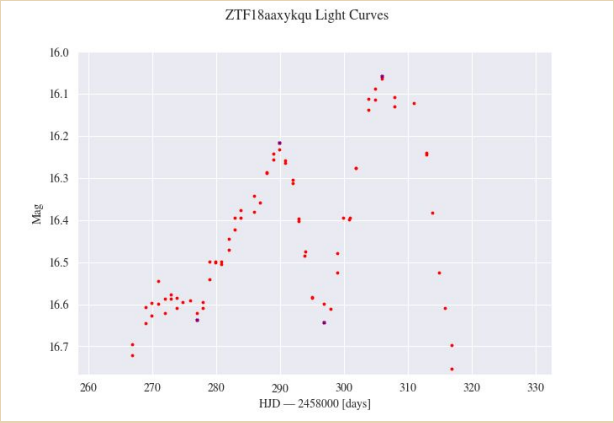

Fig. 4: A good sub-interval in the data.

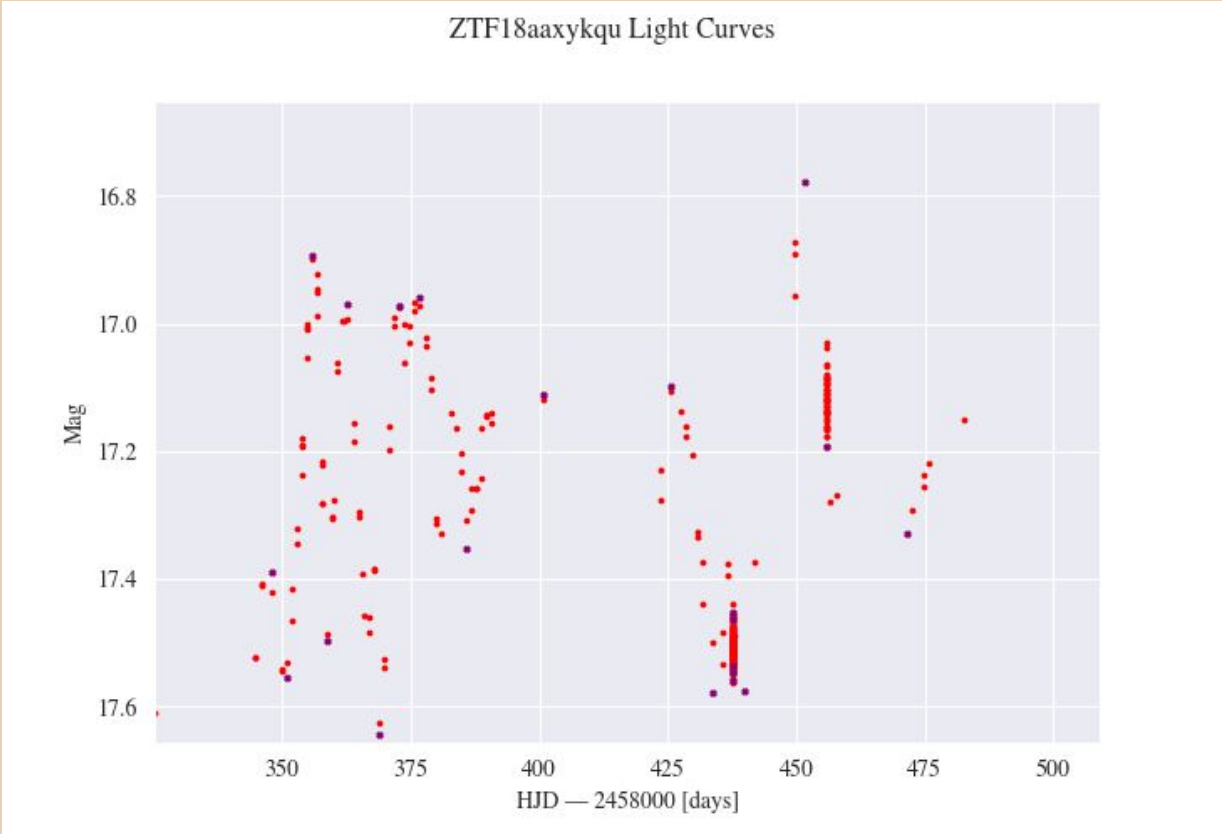

Fig. 5: Another sub-interval in the data. Note the weird clumping in the data—this is something that requires attention. Note the situation going on around HJD 2458375: it appears that due to their windowing/smoothing, there is a missing relative minimum around HJD ~+375. That would greatly increase the period between the minimum at ~368 and the minimum between +375 and +400. Should we continue and ignore the ~0.1 Mag variation around HJD +375?