

12.215 Homework #2 Solution

Due Monday, November 6, 2006

Latitude and Longitude determination.

- (a) Find the time and the value of the maximum angle between the sun and its reflection using the data given below
- (b) Find the mean index error of the sextant (data below) (5 points)
- (c) Using the mean index error for distance objects, compute the elevation angle to the Sun at its maximum (5 points)
- (d) Compute the approximate atmospheric bending contribution to this measured elevation to the sun (15 points)
- (e) Given the declination of the Sun and the in vacuum estimate of the elevation angle to the Sun, compute the latitude of the Green building. (25 points)
- (f) Given Greenwich hour angle at the Greenwich meridian crossing, compute the longitude of the Green building (25 points)

Index errors (minutes of arc)

TH	-6.2
Dawn	-7.5
Roxane	-7.8

Data is contained in file *Sextant_061025.txt*. The columns are
hrs min sec Angle (deg) Angle (min) where Angle is observed twice elevation angle of sun.

This solution is also discussed in lecture notes

Solution

- (a) The matlab code [HW02_Sextant_06.m](#) implements this solution using polyfit. The results are
Max Time 12.470 hrs EDT Val 70.87 deg, RMS 3.3 min
- (b) Mean index error
Mean Index Error -7.2 mins RMS 0.9 mins
- (c) Elevation angle of sun at maximum: $(70.87 + 7.2/60)/2 = 35.495$
- (d) Atmospheric bending
Refraction 1.3 min
Max elev: 35.47 deg index error and atm corrected
- (e and f) Results: Declination of Sun: -12.21, Use time of max to computer Greenwich Hour Angle of Sun (from tables or in code by fitting polynomial to table data).

RESULTS

Max Time 12.470 Val 70.87 deg, RMS 3.3 min

Index Error -7.2 min, Refraction 1.3 min

Sextant Longitude 71.036 deg Latitude 42.316 deg

GPS Longitude 71.089 deg Latitude 42.360 deg
Diff Longitude -3.2 min Latitude -2.6 min, Distance 4.6 km

Figures:

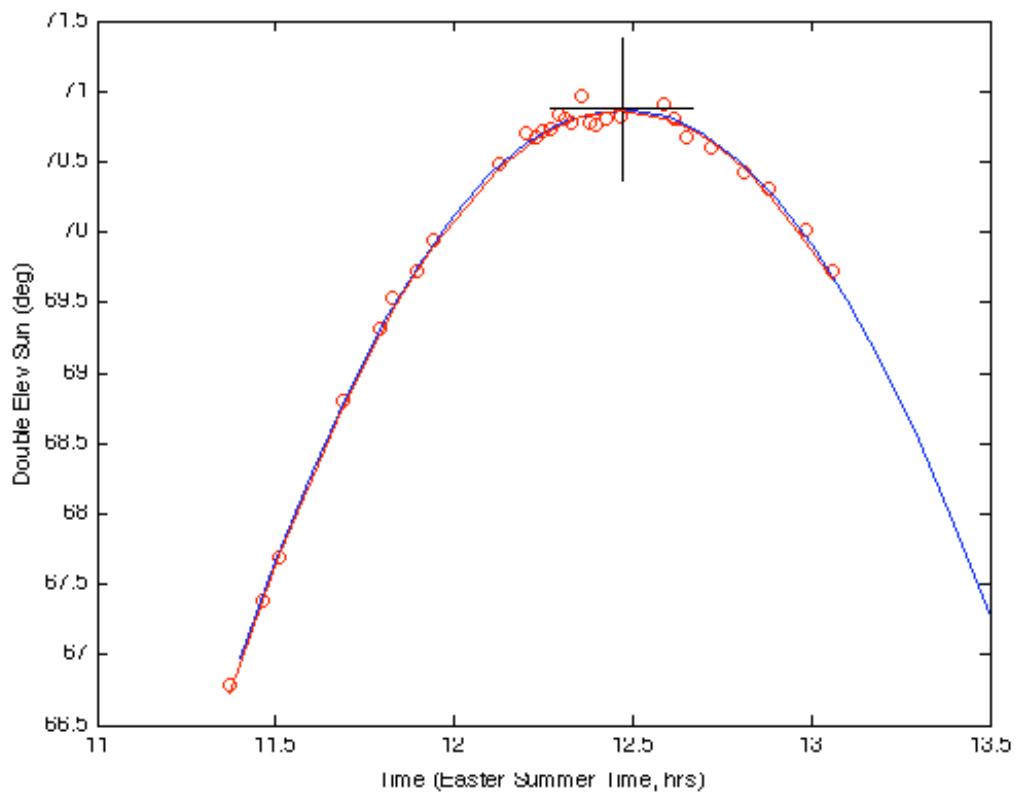


Figure 1: Raw data plot with theoretical model and polynomial maximum.

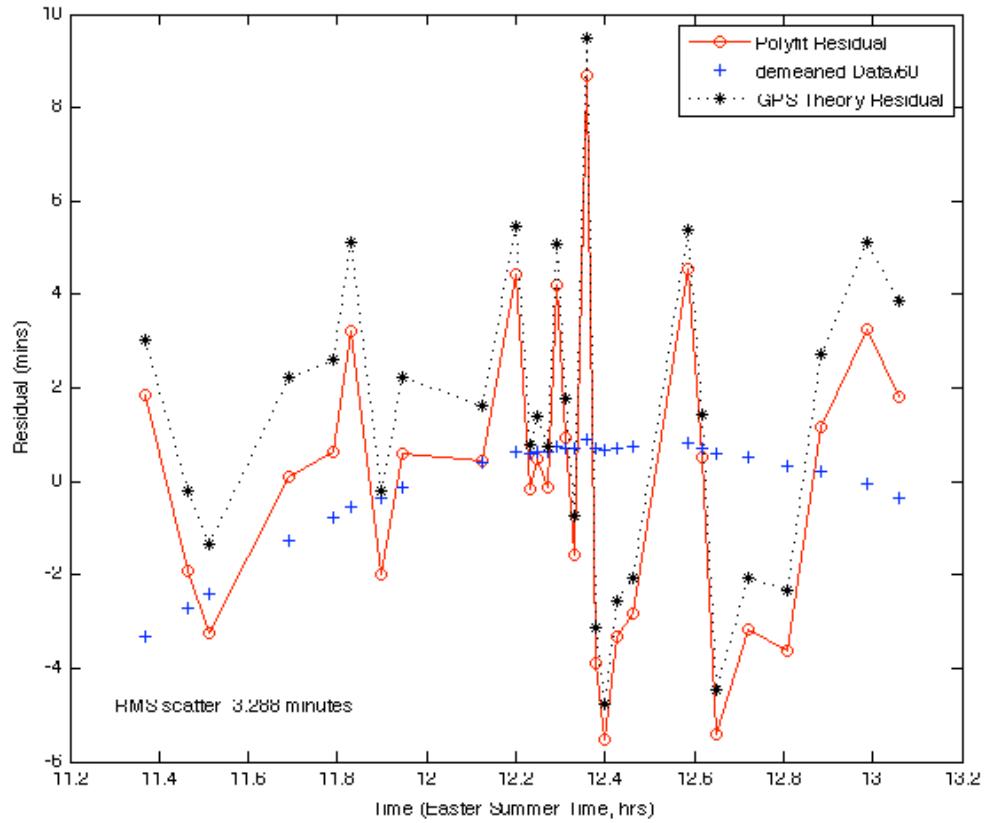


Figure 2: Residual to fit and scaled version of data.