GRAD 590F 2008 - Homework 3

Assigned Thursday 20 March, due 1 week, Thursday 27 March

1_A1	40 22 38.54801	86 52 48.75744	165.64	20464.023981	13854.945463
2_A2	40 22 42.92589	86 54 27.36491	162.28	20301.924722	10173.878796
3_A4	40 25 15.09051	86 55 39.63017	155.42	12796.939537	7473.001389
4_A5	40 23 38.48719	86 54 48.46947	159.29	17560.973611	9382.028426
5_A6	40 23 51.29334	86 52 29.66068	166.14	16853.631389	14558.829167
6_A7	40 25 02.22420	86 52 31.92162	178.92	13340.979537	14460.787685
7_A8	40 25 09.83404	86 54 44.09534	150.75	13032.419537	9541.195463
8_A11	40 26 05.58922	86 55 14.72793	170.64	10279.438796	8391.764352
9_A12	40 26 23.11545	86 58 02.70066	181.87	9482.475833	2150.341389
10_A13	40 27 49.26738	86 57 29.04356	175.56	5189.928056	3400.896574
11_A14	40 28 01.14895	86 55 27.37389	179.32	4551.380278	7916.593981
12_A15	40 27 08.78274	86 52 50.16630	133.18	7085.572130	13780.662500
13_A17	40 28 51.29928	86 55 47.87123	173.85	2071.021019	7158.351389
14_T1	40 23 19.20079	86 48 40.78624	168.843	18314.562500	23137.812500
15_T2	40 24 54.58128	86 49 1.87407	165.685	13612.687500	22326.687500
16_T3	40 27 58.51065	86 48 38.50046	162.122	4504.812500	23169.937500
17_T4	40 27 44.95158	86 50 20.53733	148.931	5224.281250	19358.156250
18_T5	40 20 26.67458	86 56 18.25274	165.130	27113.031250	6044.906250
19_T6	40 20 33.28460	86 53 12.55869	164.014	26678.031250	12977.906250
20_T7	40 21 48.18954	86 48 31.74218	169.764	22805.290648	23495.265093

The above ground control list consists of point ID, lat (dms), lon (dms), h (ell), line, sample. Point coordinates determined by student GPS static survey. “A” points from Ikonos project, “T” points added later. (l,s) digits after the decimal point are not significant. Point uncertainties are in the 5-10 cm range, most uncertainty from target ID, GPS contributes only a few cm. Remember that longitude is minus in our hemisphere.

Make a matlab function (misc_l, misc_s) = QB(l,s,phi,lambda,h,eph,att,d) which evaluates the quicklbird condition equation (see page 18-9). Call this function for each of the ground control points and obtain the misclosure (pixel units - should be ~10-20 pixels) for line and sample. Report the results numerically, and plot (exaggerated scale) misclosure vectors in image space. (You may want to go in an image viewer to the (l,s) locations to see what features were selected as control points.

“d” is an 18x1 vector consisting of the low order polynomial correction coefficients. For now they will all be zero – but next assignment we will refine the solution by estimating some of these coefficients.
d=[dx0,dx1,dx2,dy0,dy1,dy2,dz0,dz1,dz2,dw0,dw1,dw2,dp0,dp1,dp2,dk0,dk1,dk2].

Submit your numerical results, graphical results, and matlab source code.

Suggested steps:

- From line, determine the time
- From time determine before/after ephemeris samples
- For this time interpolate XL,YL,ZL, qs,qi,qj,qk – use linear interpolation & normalize the new quaternion – you may also try other interpolation methods (lagrange, SLERP, …, but do linear for evaluation)
- Evaluate the condition equations (18-9)
- Other useful hints from the notes: 18-3, reading the eph, att data; 17-13,17-13 interpolating quaternions, 15-8, 14-3 condition equations, all of lecture 13, 8-2 from last semester (GRAD590D) on geographic to geocentric cartesian transformation