

Ulysses' Position Angle During the Winter 2007 and Winter 2008 Extended Earth/SOHO-Sun-Ulysses Quadratures and

Locations of STEREO –Ahead(A) and –Behind(B) Relative to Earth

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If you don't need all the background information, then you can just refer to Figures 4, 5, 6 and the Appendices.

1. The Ulysses Orbit

Ulysses is in a solar polar orbit of inclination 80.2° , perihelion 1.34 AU, aphelion 5.4 AU, and period 6.2 years (Fig. 1). Fig. 2 contains a plot of the orbital radius and heliographic latitude, along with a plot of the sunspot number since launch.

The orbit is highly elliptic. Considering the time between north and south polar passages, Ulysses spends about five times as long in the aphelion portion of the orbit than in the perihelion portion of the orbit. For this reason, the south-to-north passage containing the perihelion is called the 'fast latitude scan,' while the north-to-south passage containing the aphelion is called the 'slow latitude scan.' The slow latitude scan takes ~ 5.4 years and the fast latitude scan (FLS) takes ~ 1 year. In Fig. 2, the three Ulysses' orbits and the three fast latitude scans are labeled (O-I, -II, -III; FLS I, II, III).

2. Earth/SOHO-Sun-Ulysses Quadratures

Fig. 1 also shows the orbit of the Earth. For all practical purposes, SOHO is at the same location as Earth on this scale, so they will be treated so from here on. Earth/SOHO are in 'quadrature' with respect to Ulysses and the Sun when the Earth-Sun-Ulysses included angle is 90° . Inspecting this figure indicates that quadratures will generally occur twice each year as Earth revolves around the Sun. This is especially true during the slow latitude scan because Ulysses is moving very slowly relative to the motion of Earth around the Sun and therefore is approximately fixed in longitude over a few week interval.

Fig. 3 shows the Earth-Sun-Ulysses included angle (IA) from 1 January 2001 to 1 January 2009. The general occurrence of quadratures twice per year is illustrated here. Earth moves around the Sun about $1^\circ/\text{day}$. Therefore, Ulysses is within $\pm 7^\circ$ of the limb for a period of two weeks centered on the quadrature date and time. 7° is close enough to the limb to expect that Ulysses will usually sample activity occurring on the limb. Feature tracking of phenomena rotating past the limb can be used to refine the relationship between activity and phenomena near the limb and what is detected at Ulysses. It is important to

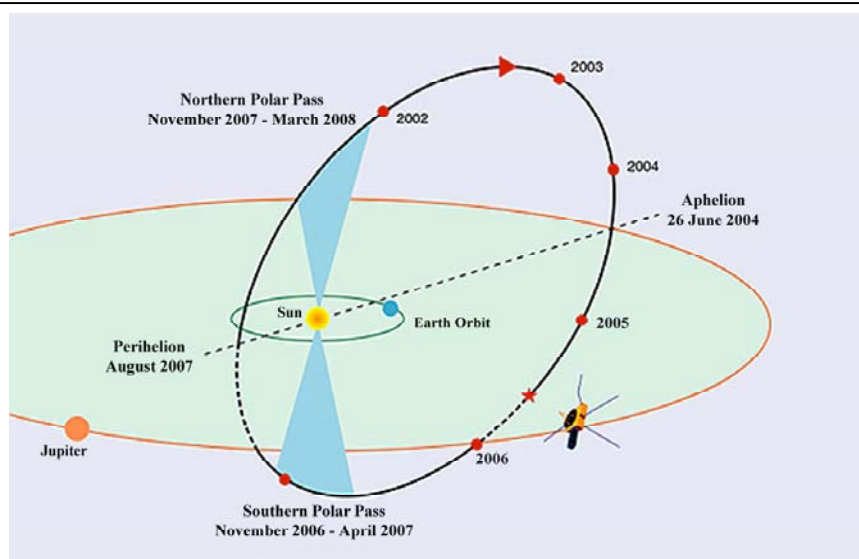


Figure 1. Ulysses' orbit, 2002-2008.

realize that the Sun is rotating during a two week interval. Over this time, the Sun will rotate through $\sim 180^\circ$.

There are two times in Fig. 3 when quadratures do not occur twice per year. The first in 2001 when the second quadrature never actually quite occurred because the IA never reached 90° . The second is in 2006-2007 and 2007-2008. In these cases, two quadratures effectively merge. The IA lingers near 90° for extended intervals. The first of these unusual times was in FLS II and the second and third are in FLS III. FLSs are when Ulysses can no longer be considered to be moving slowly, causing the unusual behavior in the IA. The 2001 case worked against quadrature observations. The 2006-2008 cases work in favor of quadrature observations.

3. The Winter 2007 & Winter 2008 Extended Quadratures

The first of these two quadratures (referred to from here on as the W2007 and W2008) starts as Ulysses is at 74.4° S and approaching its maximum southern latitude and continues until Ulysses moves back down to $\sim 52.8^\circ$ S off the west limb. The dates are 19 December 2006 to 19 May 2007. The distance to Ulysses begins as 2.72 AU and decreases to 1.72 AU. Typically, it will take one to two weeks for the solar wind to reach Ulysses at these distances. This lag must be taken in to account when comparing solar phenomena to Ulysses data. Ulysses will be within $\pm 5^\circ$ of the limb over this entire interval.

W2008 is much the same as W2007, except that it occurs after Ulysses has passed its perihelion and has begun moving back away from the Sun over the north pole. W2008 begins on 2 December 2007 and lasts until 28 May 2008, while Ulysses moves from 69.8° N to its maximum northern latitude and then back down to 56.8° N. The distance to Ulysses varies from 1.79 AU out to 2.96 AU. Conditions are not quite so ideal during W2008, with Ulysses only being within $\pm 10^\circ$ of the limb over this interval.

It is a little difficult to visualize the motion of Ulysses in W2007 and W2008. To help, views of the Ulysses orbit in a frame of reference fixed in the Earth(SOHO)-Sun frame of reference are shown in Fig. 4. The left panel shows the orbit viewed from east of the Earth-Sun line, the center panel is the view from behind Earth looking towards the Sun, and the third panel is the view from heliographic north. The red star is just a marker for the near-radial alignment of Ulysses with near-Earth spacecraft as it passes the plane of the ecliptic in summer 2007. This is of interest for energetic particle transport studies. In these three panels, the arrow shows the motion of Ulysses, the maroon portion shows W2007, and the green portion shows W2008. The axes are in AU.

4. Ulysses' Position Angle (PA) During the Winter 2007 and Winter 2008 Quadratures

The PA is computed as the angle, moving counter-clockwise, from heliographic north. Its variation throughout W2007

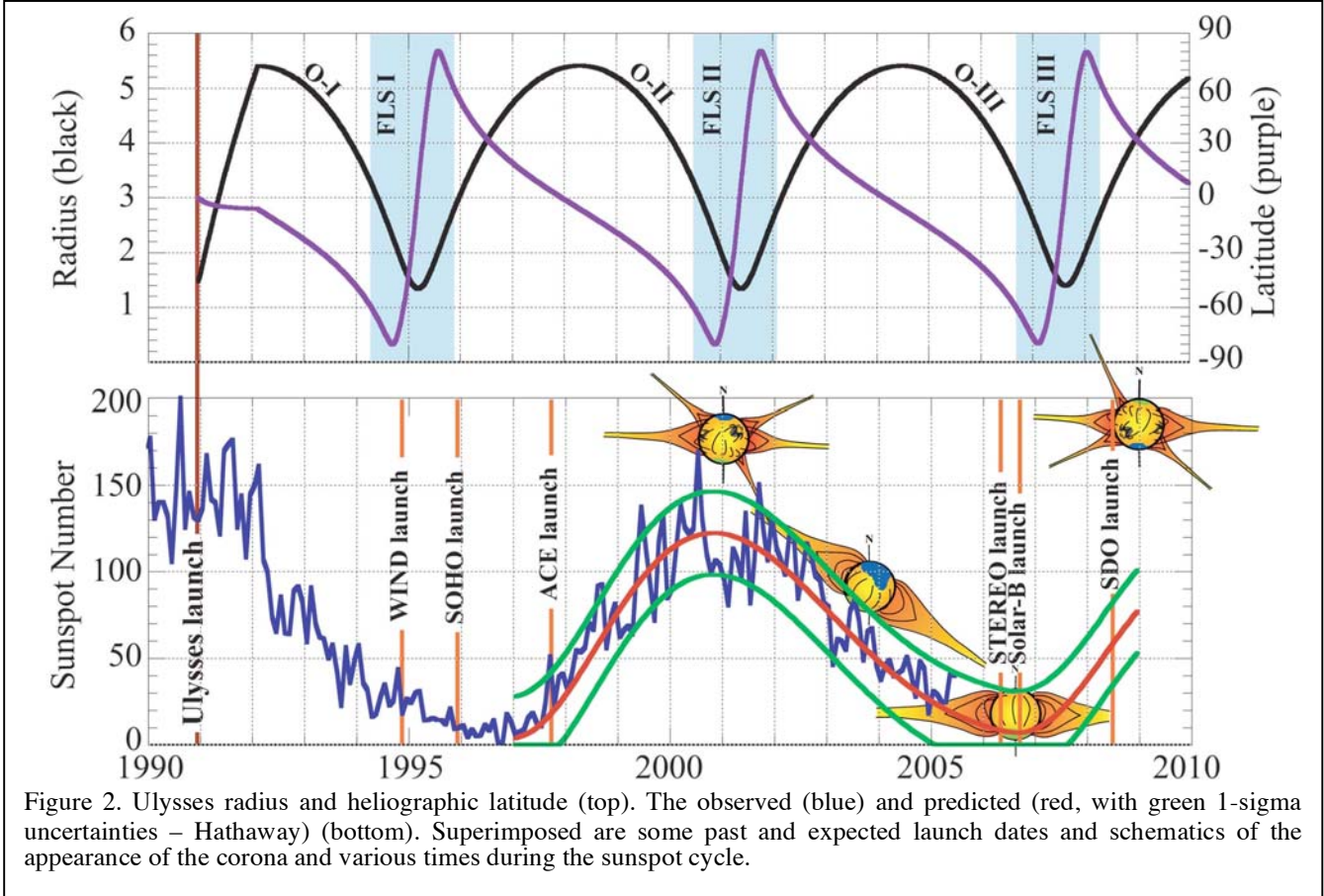
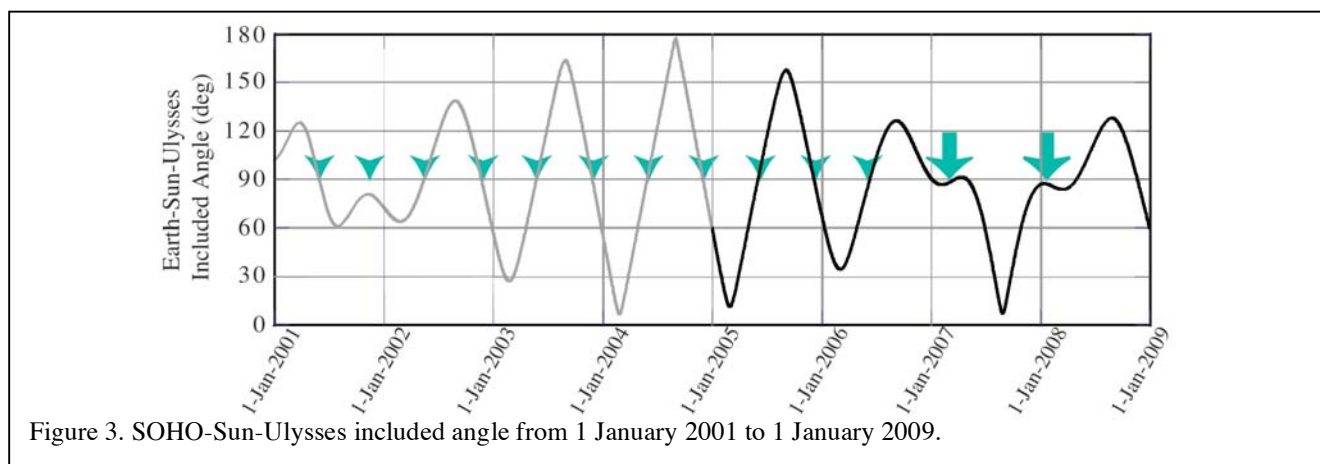


Figure 2. Ulysses radius and heliographic latitude (top). The observed (blue) and predicted (red, with green 1-sigma uncertainties – Hathaway) (bottom). Superimposed are some past and expected launch dates and schematics of the appearance of the corona and various times during the sunspot cycle.



and W2008 is shown in Fig. 5, along with IA and the heliocentric distance to Ulysses. In this plot, the date is given across the bottom and the fractional day of year (DoY) is shown across the top. The dates are for 12:00:00 on each day. The DoY is shown to four decimal places and is accurate to this value. It is probably more accurate than using the dates across the bottom. The dates can be a little off because of the plotting software (Kaleidagraph).

A tabular listing of the PA, along with date (centered on noon), fractional day of year, IA, and radius to Ulysses is in the Appendix. These are given at 4-day intervals. A simple linear extrapolation between these values gives more accuracy than generally required for extrapolations to Ulysses.

5. Locations of STEREOs –Ahead (A) and –Behind (B) Relative to Earth

STEREOs A and B were launched late in 2006. After using the Moon for a gravitational assist, STEREO-A (-B) began moving ahead of (behind) the Earth. As they separate from the Earth, they provide an improving perspective for 3-dimensional viewing of mass ejections. This is especially true in W2008. The locations of STEREOs A and B relative to Earth are shown in Figure 6. Appendix II gives their locations in tabular form at the same 4-day interval done for the Ulysses PA. The orbital locations of STEREO A/B were taken from the GSFC web site:

<http://cohoweb.gsfc.nasa.gov/helios/heli.html>

If you need help with figuring out when the plasma should reach Ulysses, we will be glad to help. Probably it is best to contact:

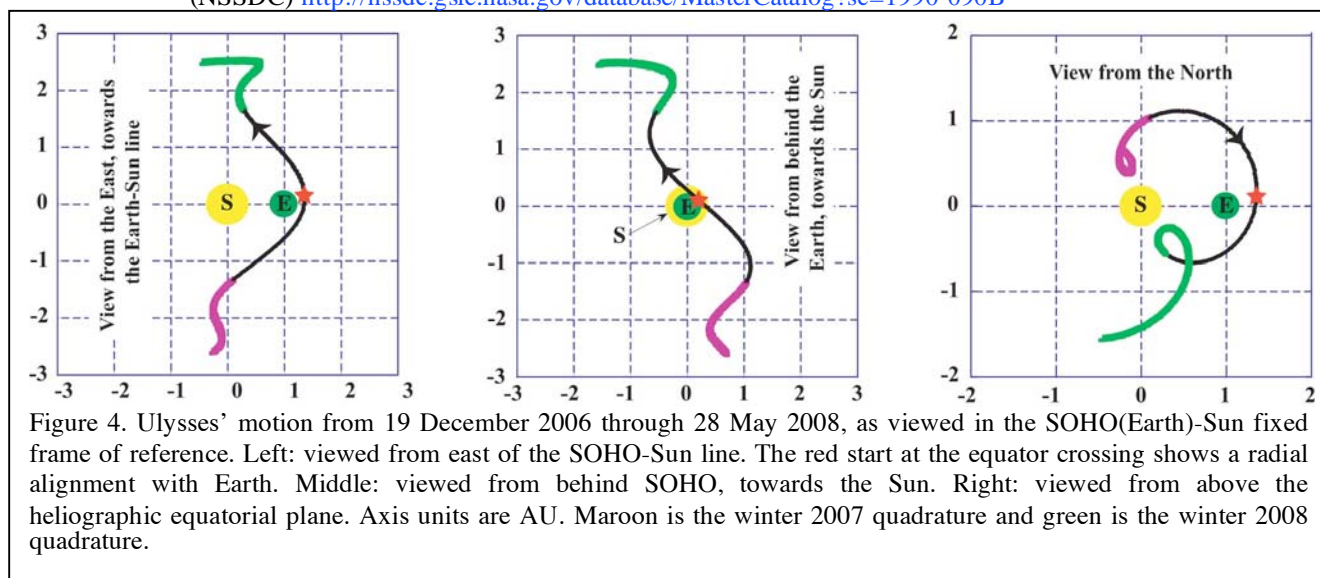
Steve Suess: ph. +1 256 961-7611, fax +1 256-961-7216, email: steven.t.suess@nasa.gov

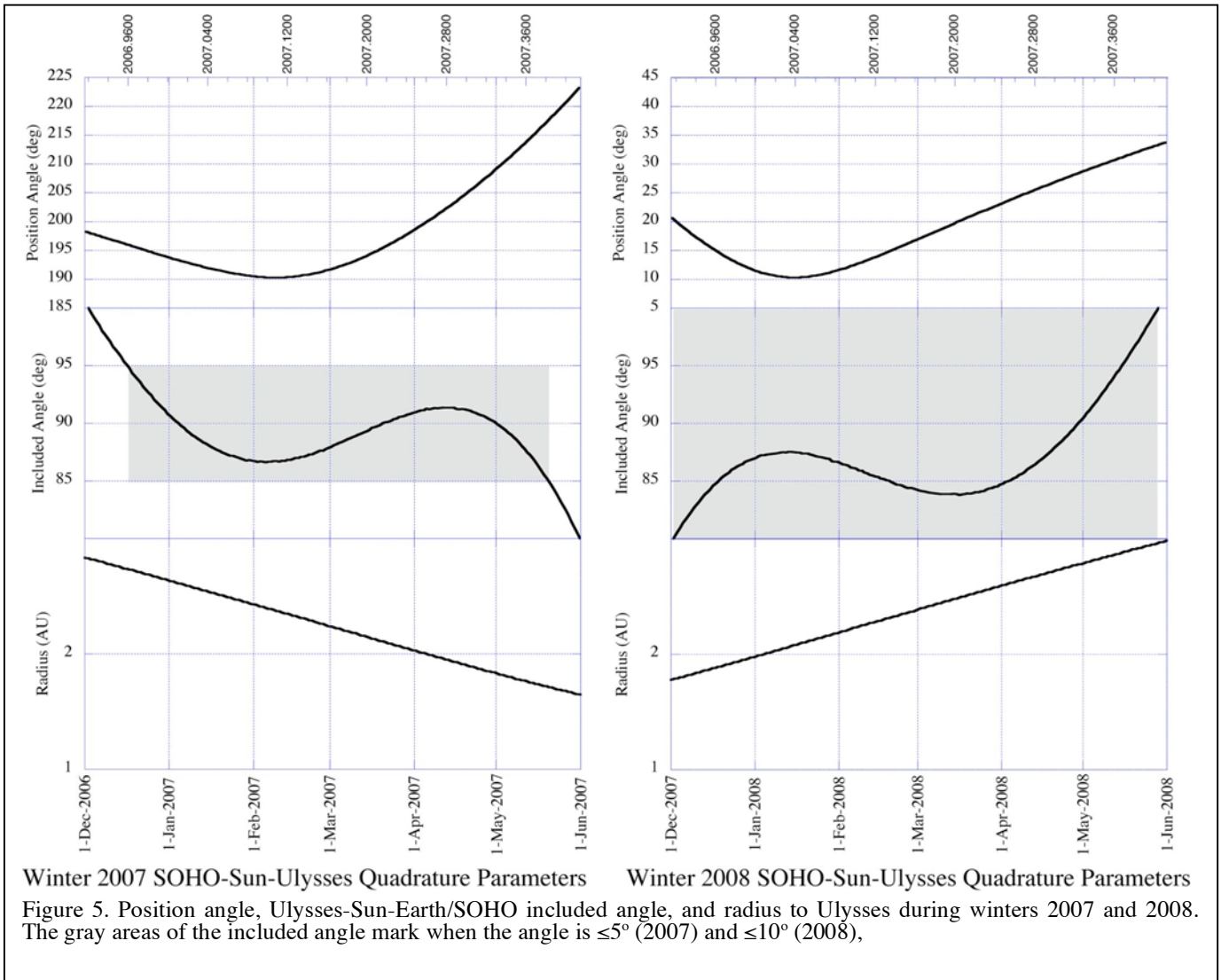
Ulysses data is easily accessed at NSSDC and through the Ulysses Data System (UDS). Web sites are:

(UDS) http://helio.esa.int/ulysses/data_archive.html

(UDS mirror) http://ulysses-ops.jpl.esa.int/ulysses/data_archive.html

(NSSDC) <http://nssdc.gsfc.nasa.gov/database/MasterCatalog?sc=1990-090B>





Typical solar wind parameters that are available from the SWOOPS instrument include solar wind proton and electron densities, flow speeds, and temperatures. The vector magnetic field is available at a higher cadence than the plasma. Solar wind composition and ionization state data is available from the SWICS instrument. There is a large amount of energetic particle and radio data.

The figures in this pdf manuscript are almost all jpegs because that seemed to work best with Word. However, if you want an eps file of any figure so that you can scale it (except figure 1, for which there is only a jpeg), then let us know and we'll send it to you.

A final note: Ulysses is presently scheduled for shut-off on 1 April 2008, before the end of W2008. An extension is under consideration to keep the mission running at least through the end of May 2008. - SS

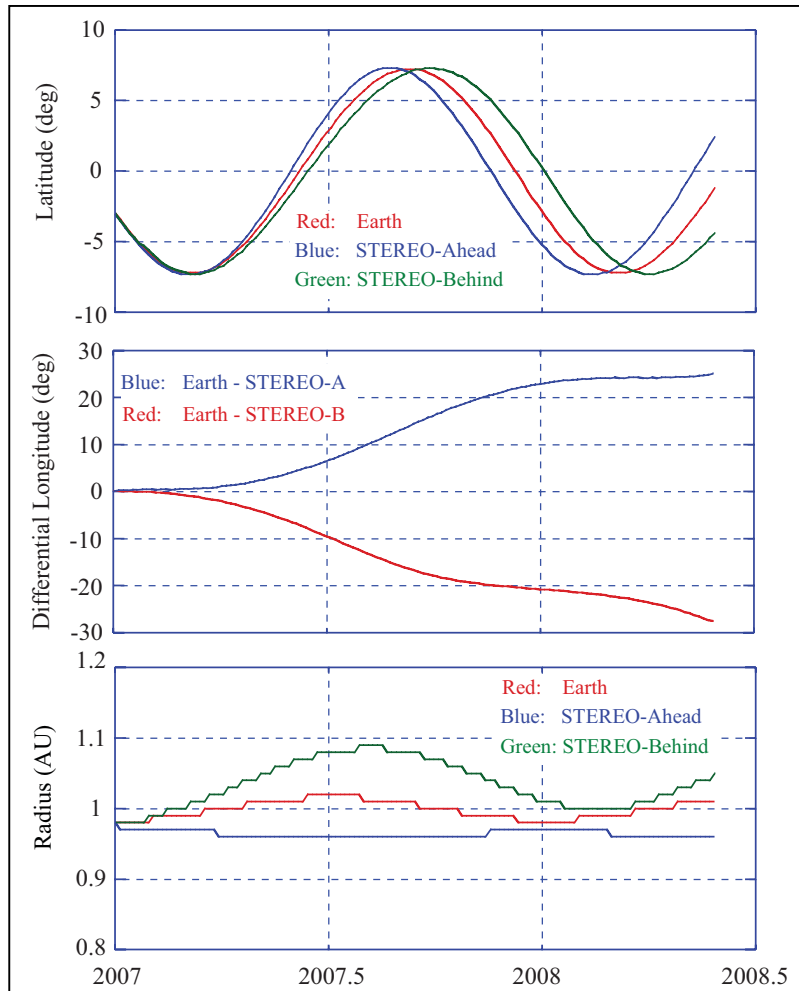


Figure 6. Relative positions of Earth, STEREO A, and STEREO B. The longitudes and latitudes are in heliographic coordinates. The plots run from 1 January 2007 through 30 May 2008. The Radius plots appears 'jagged' because the radius value is only given to two significant figures after the decimal at the GSFC web site I used: <http://cohoweb.gsfc.nasa.gov/helios/heli.html>

6. Appendix I: Ulysses' orbital parameters during the winter 2007 and winter 2008 extended quadratures.

Winter 2007						Winter 2008					
Frac. Year	Date	Radius	Latitude	Incl.Ang.	PositionAngle	Frac. Year	Date	Radius	Latitude	Incl.Ang.	PositionAngle
2006.9164	01-Dec-2006	2.8300	-71.800	100.29	198.20	2007.9164	01-Dec-2007	1.7800	69.400	79.860	20.600
2006.9247	04-Dec-2006	2.8200	-72.200	99.166	197.80	2007.9274	05-Dec-2007	1.8000	71.000	81.383	19.000
2006.9274	05-Dec-2006	2.8100	-72.400	98.815	197.60	2007.9384	09-Dec-2007	1.8300	72.400	82.644	17.600
2006.9384	09-Dec-2006	2.7800	-73.000	97.373	197.00	2007.9493	13-Dec-2007	1.8600	73.800	83.809	16.200
2006.9493	13-Dec-2006	2.7600	-73.500	96.080	196.50	2007.9603	17-Dec-2007	1.8800	75.000	84.766	15.000
2006.9603	17-Dec-2006	2.7300	-74.100	94.801	195.90	2007.9712	21-Dec-2007	1.9100	76.200	85.603	13.800
2006.9712	21-Dec-2006	2.7100	-74.700	93.554	195.30	2007.9822	25-Dec-2007	1.9300	77.200	86.266	12.800
2006.9822	25-Dec-2006	2.6800	-75.300	92.436	194.70	2007.9932	29-Dec-2007	1.9600	78.000	86.753	12.000
2006.9932	29-Dec-2006	2.6500	-75.900	91.370	194.10	2008.0042	02-Jan-2008	1.9900	78.700	87.163	11.300
2007.0042	02-Jan-2007	2.6300	-76.500	90.399	193.50	2008.0150	06-Jan-2008	2.0100	79.200	87.319	10.800
2007.0150	06-Jan-2007	2.6000	-77.000	89.617	193.00	2008.0260	10-Jan-2008	2.0400	79.500	87.473	10.500
2007.0260	10-Jan-2007	2.5700	-77.500	88.839	192.50	2008.0369	14-Jan-2008	2.0700	79.700	87.516	10.300
2007.0370	14-Jan-2007	2.5500	-78.000	88.230	192.00	2008.0479	18-Jan-2008	2.1000	79.600	87.376	10.400
2007.0480	18-Jan-2007	2.5200	-78.400	87.709	191.60	2008.0587	22-Jan-2008	2.1200	79.400	87.242	10.600
2007.0590	22-Jan-2007	2.4900	-78.800	87.266	191.20	2008.0697	26-Jan-2008	2.1500	79.100	87.010	10.900
2007.0698	26-Jan-2007	2.4700	-79.100	87.032	190.90	2008.0806	30-Jan-2008	2.1800	78.600	86.676	11.400
2007.0808	30-Jan-2007	2.4400	-79.400	86.826	190.60	2008.0916	03-Feb-2008	2.2000	78.100	86.415	11.900
2007.0918	03-Feb-2007	2.4100	-79.600	86.706	190.40	2008.1024	07-Feb-2008	2.2300	77.400	86.068	12.600
2007.1028	07-Feb-2007	2.3900	-79.700	86.657	190.30	2008.1134	11-Feb-2008	2.2600	76.700	85.679	13.300
2007.1136	11-Feb-2007	2.3600	-79.700	86.765	190.30	2008.1243	15-Feb-2008	2.2900	76.000	85.358	14.000
2007.1246	15-Feb-2007	2.3300	-79.600	86.906	190.40	2008.1353	19-Feb-2008	2.3100	75.200	85.037	14.800
2007.1356	19-Feb-2007	2.3100	-79.300	87.110	190.70	2008.1461	23-Feb-2008	2.3400	74.400	84.683	15.600
2007.1466	23-Feb-2007	2.2800	-79.000	87.408	191.00	2008.1571	27-Feb-2008	2.3700	73.600	84.407	16.400
2007.1576	27-Feb-2007	2.2500	-78.500	87.770	191.50	2008.1626	29-Feb-2008	2.3800	73.200	84.261	16.800
2007.1685	03-Mar-2007	2.2200	-78.000	88.175	192.00	2008.1708	03-Mar-2008	2.4000	72.600	84.091	17.400
2007.1794	07-Mar-2007	2.2000	-77.300	88.610	192.70	2008.1816	07-Mar-2008	2.4300	71.800	83.932	18.200
2007.1904	11-Mar-2007	2.1700	-76.600	89.015	193.40	2008.1926	11-Mar-2008	2.4600	71.000	83.876	19.000
2007.2014	15-Mar-2007	2.1400	-75.700	89.416	194.30	2008.2035	15-Mar-2008	2.4800	70.100	83.869	19.900
2007.2123	19-Mar-2007	2.1100	-74.800	89.841	195.20	2008.2145	19-Mar-2008	2.5100	69.300	83.938	20.700
2007.2233	23-Mar-2007	2.0900	-73.800	90.225	196.20	2008.2255	23-Mar-2008	2.5400	68.500	84.023	21.500
2007.2343	27-Mar-2007	2.0600	-72.800	90.603	197.20	2008.2363	27-Mar-2008	2.5600	67.800	84.345	22.200
2007.2452	31-Mar-2007	2.0300	-71.600	90.915	198.40	2008.2473	31-Mar-2008	2.5900	67.000	84.700	23.000
2007.2561	04-Apr-2007	2.0100	-70.400	91.138	199.60	2008.2582	04-Apr-2008	2.6200	66.200	85.064	23.800
2007.2671	08-Apr-2007	1.9800	-69.200	91.327	200.80	2008.2692	08-Apr-2008	2.6400	65.400	85.621	24.600
2007.2781	12-Apr-2007	1.9500	-67.800	91.344	202.20	2008.2800	12-Apr-2008	2.6700	64.700	86.304	25.300
2007.2891	16-Apr-2007	1.9300	-66.500	91.254	203.50	2008.2910	16-Apr-2008	2.6900	63.900	87.010	26.100
2007.3000	20-Apr-2007	1.9000	-65.000	91.168	205.00	2008.3019	20-Apr-2008	2.7200	63.200	87.889	26.800
2007.3109	24-Apr-2007	1.8700	-63.500	90.786	206.50	2008.3129	24-Apr-2008	2.7500	62.500	88.771	27.500
2007.3219	28-Apr-2007	1.8500	-62.000	90.364	208.00	2008.3237	28-Apr-2008	2.7700	61.800	89.791	28.200
2007.3329	02-May-2007	1.8200	-60.300	89.745	209.70	2008.3347	02-May-2008	2.8000	61.100	90.900	28.900
2007.3439	06-May-2007	1.8000	-58.700	89.016	211.30	2008.3456	06-May-2008	2.8200	60.400	92.044	29.600
2007.3547	10-May-2007	1.7700	-56.900	88.000	213.10	2008.3566	10-May-2008	2.8500	59.700	93.368	30.300
2007.3657	14-May-2007	1.7500	-55.100	86.960	214.90	2008.3674	14-May-2008	2.8700	59.000	94.631	31.000
2007.3767	18-May-2007	1.7200	-53.300	85.566	216.70	2008.3784	18-May-2008	2.9000	58.400	96.093	31.600
2007.3877	22-May-2007	1.7000	-51.400	84.151	218.60	2008.3894	22-May-2008	2.9200	57.700	97.539	32.300
2007.3987	26-May-2007	1.6800	-49.400	82.507	220.60	2008.4003	26-May-2008	2.9500	57.100	99.109	32.900
2007.4095	30-May-2007	1.6500	-47.300	80.616	222.70	2008.4113	30-May-2008	2.9700	56.400	100.66	33.600

7. Appendix II: The locations of Earth, STEREO-Ahead, and STEREO-Behind from 1 January 2007 through 30 May 2008, in heliographic inertial coordinates.

Fractional Year	Radius Earth	Latitude Earth	Radius STEREOA	Latitude STEREOA	D-Long. Earth-A	Radius STEREOB	Latitude STEREOB	D-Long. Earth-B
2007.001370	0.98000	-3.0000	0.98000	-3.1000	0.20000	0.98000	-3.0000	0.20000
2007.012329	0.98000	-3.4000	0.97000	-3.5000	0.20000	0.98000	-3.5000	0.099998
2007.023288	0.98000	-3.9000	0.97000	-4.0000	0.30000	0.98000	-3.9000	0.099998
2007.034247	0.98000	-4.3000	0.97000	-4.4000	0.30000	0.98000	-4.4000	0.10000
2007.045205	0.98000	-4.7000	0.97000	-4.8000	0.30000	0.98000	-4.7000	0.0000
2007.056164	0.98000	-5.1000	0.97000	-5.2000	0.40000	0.98000	-5.1000	0.0000
2007.067123	0.98000	-5.4000	0.97000	-5.6000	0.40000	0.98000	-5.3000	-0.099998
2007.078082	0.98000	-5.8000	0.97000	-5.9000	0.40000	0.99000	-5.6000	-0.099998
2007.089041	0.99000	-6.1000	0.97000	-6.2000	0.40000	0.99000	-5.9000	-0.10000
2007.100000	0.99000	-6.3000	0.97000	-6.5000	0.60000	0.99000	-6.2000	0.0000
2007.110959	0.99000	-6.6000	0.97000	-6.7000	0.60000	0.99000	-6.5000	-0.10001
2007.121918	0.99000	-6.8000	0.97000	-6.9000	0.70000	1.0000	-6.7000	-0.099998
2007.132877	0.99000	-6.9000	0.97000	-7.1000	0.80000	1.0000	-6.9000	0.0000
2007.143836	0.99000	-7.1000	0.97000	-7.2000	0.90000	1.0000	-7.0000	-0.099998
2007.154795	0.99000	-7.2000	0.97000	-7.3000	1.0000	1.0000	-7.1000	-0.20000
2007.165753	0.99000	-7.2000	0.97000	-7.3000	1.1000	1.0000	-7.2000	-0.20000
2007.176712	0.99000	-7.2000	0.97000	-7.3000	1.3000	1.0100	-7.3000	-0.20000
2007.187671	0.99000	-7.2000	0.97000	-7.3000	1.4000	1.0100	-7.3000	-0.30000
2007.198630	0.99000	-7.2000	0.97000	-7.2000	1.5000	1.0100	-7.3000	-0.30000
2007.209589	1.0000	-7.1000	0.97000	-7.1000	1.7000	1.0100	-7.2000	-0.39999
2007.220548	1.0000	-7.0000	0.97000	-7.0000	1.9000	1.0200	-7.1000	-0.39999
2007.231507	1.0000	-6.8000	0.97000	-6.8000	2.1000	1.0200	-7.0000	-0.50000
2007.242466	1.0000	-6.7000	0.96000	-6.6000	2.2000	1.0200	-6.8000	-0.60000
2007.253425	1.0000	-6.4000	0.96000	-6.3000	2.4000	1.0200	-6.7000	-0.80000
2007.264384	1.0000	-6.2000	0.96000	-6.1000	2.7000	1.0300	-6.4000	-0.90000
2007.275342	1.0000	-5.9000	0.96000	-5.7000	2.9000	1.0300	-6.2000	-1.0000
2007.286301	1.0000	-5.6000	0.96000	-5.4000	3.1000	1.0300	-5.9000	-1.1000
2007.297260	1.0000	-5.3000	0.96000	-5.0000	3.4000	1.0400	-5.7000	-1.3000
2007.308219	1.0100	-5.0000	0.96000	-4.6000	3.7000	1.0400	-5.3000	-1.4000
2007.319178	1.0100	-4.6000	0.96000	-4.2000	3.9000	1.0400	-5.0000	-1.6000
2007.330137	1.0100	-4.2000	0.96000	-3.7000	4.2000	1.0400	-4.7000	-1.8000
2007.341096	1.0100	-3.8000	0.96000	-3.3000	4.5000	1.0500	-4.3000	-2.1000
2007.352055	1.0100	-3.4000	0.96000	-2.8000	4.8000	1.0500	-3.9000	-2.2000
2007.363014	1.0100	-2.9000	0.96000	-2.3000	5.1000	1.0500	-3.5000	-2.5000
2007.373973	1.0100	-2.5000	0.96000	-1.8000	5.5000	1.0600	-3.1000	-2.7000
2007.384932	1.0100	-2.0000	0.96000	-1.2000	5.8000	1.0600	-2.7000	-2.9000
2007.395890	1.0100	-1.6000	0.96000	-0.70000	6.2000	1.0600	-2.2000	-3.1000
2007.406849	1.0100	-1.1000	0.96000	-0.20000	6.5000	1.0600	-1.8000	-3.5000
2007.417808	1.0100	-0.6000	0.96000	0.40000	6.9000	1.0700	-1.4000	-3.8000
2007.428767	1.0100	-0.1000	0.96000	0.90000	7.2000	1.0700	-0.90000	-4.1000
2007.439726	1.0100	0.40000	0.96000	1.4000	7.6000	1.0700	-0.50000	-4.4000
2007.450685	1.0200	0.80000	0.96000	2.0000	8.0000	1.0700	0.0000	-4.7000
2007.461644	1.0200	1.3000	0.96000	2.5000	8.5000	1.0700	0.40000	-4.9000
2007.472603	1.0200	1.8000	0.96000	3.0000	8.9000	1.0800	0.80000	-5.3000
2007.483562	1.0200	2.3000	0.96000	3.4000	9.3000	1.0800	1.3000	-5.6000
2007.494521	1.0200	2.7000	0.96000	3.9000	9.7000	1.0800	1.7000	-6.0000
2007.505479	1.0200	3.1000	0.96000	4.4000	10.100	1.0800	2.1000	-6.4000
2007.516438	1.0200	3.6000	0.96000	4.8000	10.500	1.0800	2.5000	-6.7000
2007.527397	1.0200	4.0000	0.96000	5.2000	10.900	1.0800	3.0000	-7.1000
2007.538356	1.0200	4.4000	0.96000	5.5000	11.400	1.0800	3.3000	-7.5000
2007.549315	1.0200	4.7000	0.96000	5.9000	11.800	1.0800	3.7000	-7.9000
2007.560274	1.0200	5.1000	0.96000	6.2000	12.200	1.0800	4.1000	-8.3000

2007.571233	1.0200	5.4000	0.96000	6.5000	12.600	1.0900	4.4000	-8.8000
2007.582192	1.0100	5.7000	0.96000	6.7000	13.000	1.0900	4.8000	-9.2000
2007.593151	1.0100	6.0000	0.96000	6.9000	13.500	1.0900	5.1000	-9.6000
2007.604110	1.0100	6.3000	0.96000	7.1000	13.800	1.0900	5.4000	-10.100
2007.615068	1.0100	6.5000	0.96000	7.2000	14.300	1.0900	5.7000	-10.400
2007.626027	1.0100	6.7000	0.96000	7.3000	14.600	1.0900	5.9000	-10.900
2007.636986	1.0100	6.9000	0.96000	7.3000	15.000	1.0800	6.2000	-11.400
2007.647945	1.0100	7.0000	0.96000	7.3000	15.400	1.0800	6.4000	-11.800
2007.658904	1.0100	7.1000	0.96000	7.3000	15.800	1.0800	6.6000	-12.200
2007.669863	1.0100	7.2000	0.96000	7.2000	16.100	1.0800	6.8000	-12.700
2007.680822	1.0100	7.2000	0.96000	7.1000	16.500	1.0800	6.9000	-13.100
2007.691781	1.0100	7.2000	0.96000	7.0000	16.800	1.0800	7.1000	-13.500
2007.702740	1.0100	7.2000	0.96000	6.8000	17.000	1.0800	7.2000	-14.100
2007.713699	1.0000	7.2000	0.96000	6.5000	17.400	1.0800	7.2000	-14.500
2007.724658	1.0000	7.1000	0.96000	6.3000	17.700	1.0700	7.3000	-14.900
2007.735616	1.0000	6.9000	0.96000	6.0000	17.900	1.0700	7.3000	-15.400
2007.746575	1.0000	6.8000	0.96000	5.7000	18.200	1.0700	7.3000	-15.700
2007.757534	1.0000	6.6000	0.96000	5.3000	18.400	1.0700	7.2000	-16.200
2007.768493	1.0000	6.4000	0.96000	4.9000	18.700	1.0700	7.2000	-16.500
2007.779452	1.0000	6.1000	0.96000	4.5000	18.800	1.0600	7.1000	-17.000
2007.790411	1.0000	5.8000	0.96000	4.1000	19.000	1.0600	7.0000	-17.400
2007.801370	1.0000	5.5000	0.96000	3.6000	19.200	1.0600	6.8000	-17.700
2007.812329	0.99000	5.2000	0.96000	3.2000	19.400	1.0600	6.7000	-18.100
2007.823288	0.99000	4.8000	0.96000	2.7000	19.500	1.0500	6.5000	-18.400
2007.834247	0.99000	4.4000	0.96000	2.2000	19.700	1.0500	6.2000	-18.800
2007.845205	0.99000	4.0000	0.96000	1.7000	19.800	1.0500	6.0000	-19.100
2007.856164	0.99000	3.6000	0.96000	1.1000	19.900	1.0500	5.7000	-19.500
2007.867123	0.99000	3.1000	0.96000	0.60000	20.100	1.0400	5.4000	-19.800
2007.878082	0.99000	2.7000	0.97000	0.10000	20.200	1.0400	5.1000	-20.100
2007.889041	0.99000	2.2000	0.97000	-0.40000	20.300	1.0400	4.7000	-20.300
2007.900000	0.99000	1.7000	0.97000	-1.0000	20.400	1.0300	4.3000	-20.600
2007.910959	0.99000	1.2000	0.97000	-1.5000	20.500	1.0300	3.9000	-20.800
2007.921918	0.99000	0.70000	0.97000	-2.0000	20.500	1.0300	3.5000	-21.200
2007.932877	0.99000	0.20000	0.97000	-2.5000	20.600	1.0300	3.1000	-21.400
2007.943836	0.98000	-0.3000	0.97000	-3.0000	20.800	1.0200	2.7000	-21.600
2007.954795	0.98000	-0.8000	0.97000	-3.5000	20.800	1.0200	2.2000	-21.900
2007.965753	0.98000	-1.4000	0.97000	-3.9000	20.900	1.0200	1.7000	-22.000
2007.976712	0.98000	-1.9000	0.97000	-4.4000	21.000	1.0200	1.2000	-22.200
2007.987671	0.98000	-2.3000	0.97000	-4.8000	21.000	1.0100	0.80000	-22.400
2007.998630	0.98000	-2.8000	0.97000	-5.2000	21.200	1.0100	0.30000	-22.500
2008.009563	0.98000	-3.3000	0.97000	-5.5000	21.200	1.0100	-0.20000	-22.700
2008.020492	0.98000	-3.7000	0.97000	-5.9000	21.200	1.0100	-0.70000	-22.900
2008.031421	0.98000	-4.2000	0.97000	-6.2000	21.400	1.0100	-1.2000	-23.000
2008.042350	0.98000	-4.6000	0.97000	-6.4000	21.400	1.0100	-1.7000	-23.100
2008.053279	0.98000	-5.0000	0.97000	-6.7000	21.500	1.0000	-2.2000	-23.300
2008.064208	0.98000	-5.3000	0.97000	-6.9000	21.600	1.0000	-2.7000	-23.300
2008.075137	0.98000	-5.7000	0.97000	-7.0000	21.700	1.0000	-3.2000	-23.400
2008.086066	0.99000	-6.0000	0.97000	-7.2000	21.800	1.0000	-3.6000	-23.500
2008.096995	0.99000	-6.2000	0.97000	-7.3000	21.800	1.0000	-4.0000	-23.600
2008.107923	0.99000	-6.5000	0.97000	-7.3000	22.000	1.0000	-4.5000	-23.600
2008.118852	0.99000	-6.7000	0.97000	-7.3000	22.100	1.0000	-4.9000	-23.700
2008.129781	0.99000	-6.9000	0.97000	-7.3000	22.200	1.0000	-5.2000	-23.800
2008.140710	0.99000	-7.0000	0.97000	-7.2000	22.300	1.0000	-5.6000	-23.800
2008.151639	0.99000	-7.1000	0.97000	-7.2000	22.400	1.0000	-5.9000	-23.800
2008.162568	0.99000	-7.2000	0.96000	-7.0000	22.600	1.0000	-6.2000	-23.800
2008.173497	0.99000	-7.2000	0.96000	-6.8000	22.700	1.0000	-6.4000	-23.900
2008.184426	0.99000	-7.2000	0.96000	-6.6000	22.900	1.0000	-6.7000	-23.800
2008.195355	0.99000	-7.2000	0.96000	-6.4000	23.000	1.0000	-6.8000	-23.800
2008.206284	0.99000	-7.1000	0.96000	-6.1000	23.100	1.0000	-7.0000	-23.900

2008.217213	1.0000	-7.0000	0.96000	-5.8000	23.300	1.0100	-7.1000	-23.900
2008.228142	1.0000	-6.9000	0.96000	-5.5000	23.500	1.0100	-7.2000	-23.900
2008.239071	1.0000	-6.7000	0.96000	-5.1000	23.700	1.0100	-7.3000	-23.800
2008.250000	1.0000	-6.5000	0.96000	-4.7000	23.900	1.0100	-7.3000	-23.800
2008.260929	1.0000	-6.3000	0.96000	-4.3000	24.100	1.0100	-7.3000	-23.900
2008.271858	1.0000	-6.0000	0.96000	-3.8000	24.300	1.0200	-7.2000	-23.800
2008.282787	1.0000	-5.7000	0.96000	-3.3000	24.500	1.0200	-7.1000	-23.900
2008.293716	1.0000	-5.4000	0.96000	-2.9000	24.800	1.0200	-7.0000	-23.900
2008.304645	1.0000	-5.1000	0.96000	-2.4000	25.100	1.0200	-6.9000	-23.900
2008.315574	1.0100	-4.7000	0.96000	-1.9000	25.300	1.0300	-6.7000	-24.000
2008.326503	1.0100	-4.3000	0.96000	-1.3000	25.600	1.0300	-6.5000	-24.000
2008.337432	1.0100	-3.9000	0.96000	-0.80000	26.000	1.0300	-6.3000	-24.000
2008.348361	1.0100	-3.5000	0.96000	-0.30000	26.200	1.0300	-6.0000	-24.100
2008.359290	1.0100	-3.1000	0.96000	0.30000	26.600	1.0400	-5.7000	-24.100
2008.370219	1.0100	-2.6000	0.96000	0.80000	26.900	1.0400	-5.4000	-24.300
2008.381148	1.0100	-2.2000	0.96000	1.3000	27.300	1.0400	-5.1000	-24.400
2008.392077	1.0100	-1.7000	0.96000	1.9000	27.700	1.0400	-4.7000	-24.500
2008.403005	1.0100	-1.2000	0.96000	2.4000	27.900	1.0500	-4.4000	-24.700