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ATLAS-2 AND UARS CORRELATIVE MEASUREMENT OPPORTUNITIES DURING SPACE SHUTTLE MISSION ON APRIL 8-17, 1993

by

Edwin F. Harrison*, Fred M. Denn†, and Gary G. Gibson†

SUMMARY

The second ATmospheric Laboratory for Applications and Science (ATLAS-2) mission was flown aboard the Space Shuttle Discovery from April 8 to April 17, 1993. The nighttime launch at 0529 Greenwich Mean Time provided maximum solar occultation sunrise coverage of the northern latitudes by the Atmospheric Trace Molecule Spectroscopy (ATMOS) instrument. The ATLAS-2 Earth-viewing instruments provided a large number of measurements which were nearly coincident with observations from experiments on the Upper Atmosphere Research Satellite (UARS). During the ATLAS-2 mission, simulations were performed to predict when and where correlative measurements between ATLAS-2 and UARS instruments would occur. These predictions were used to develop instrument operation schedules to maximize the correlative opportunities between experiments on the two satellites. In this report, ATLAS-2 instrument measurements are simulated for the time periods of sensor operation. ATLAS-2 and UARS measurements are compared to determine correlative measurement opportunities between various instruments on the two spacecraft. The number of correlative opportunities ranges from 30 to 600 for the various instrument combinations.

INTRODUCTION

A major goal of the ATLAS program (Torr and Sullivan, 1992) is to achieve underflights of the UARS to obtain correlative measurements between the two missions (Harrison et al., 1992). In addition, high-latitude sunrise coverage of the Northern Hemisphere by the ATMOS experiment was a primary objective of the ATLAS-2 mission. The UARS (Reber, 1990; Reber et al., 1993), launched on September 12, 1991, carries a variety of scientific instrumentation for studying the composition and dynamics of the atmosphere. Several UARS instruments are making global measurements of the vertical distributions of ozone, methane, water vapor, and several minor species involved in the chemistry of the ozone layer. The ATLAS is a Space Shuttle mission designed to be flown about once per year during an 11-year solar cycle to obtain extensive observations of the Sun and the Earth's atmosphere. The combination of the results from the UARS and the complementary atmospheric measurements from ATLAS experiments will greatly advance the understanding of the chemistry of the upper atmosphere. Maximum use of the two satellite data sets will be provided when near-coincident (correlative) measurements are obtained.

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*Atmospheric Sciences Division, NASA Langley Research Center, Hampton, VA 23681-0001
†Lockheed Engineering and Sciences Company, Hampton, VA 23666

ORBITAL AND INSTRUMENT SIMULATIONS

Computer simulations of satellite orbital characteristics and sensor techniques were developed to determine time and space coverage capabilities for the various experiments on the two satellites (Harrison and Gibson, 1981). First-order orbital perturbations were included to take into account Earth's nonsymmetrical gravitational field and the motion of the Earth with respect to the Sun. Coincident measurement opportunities between sensors on the two spacecraft are determined by comparing the coverage of pairs of instruments (Harrison et al., 1990).

UPPER ATMOSPHERE RESEARCH SATELLITE (UARS)

The UARS orbital elements are given in Table 1. Two UARS instruments are simulated: the Halogen Occultation Experiment (HALOE; Russell et al., 1993) and the Microwave Limb Sounder (MLS; Barath et al., 1993). The HALOE is a solar occultation instrument. The MLS is a limb scanner mounted at a fixed azimuth (90°) on the spacecraft. The UARS flight direction (backward or forward) determines which way the MLS views with respect to the velocity vector. It always looks toward the dark side of the spacecraft. A summary of instrument viewing characteristics used in the simulations is given in Table 2.

To aid in visualizing the coverage of the various UARS instruments, Figure 1 shows a latitudinal history of HALOE coverage for the ATLAS-2 Space Shuttle mission time frame. Figure 2 gives similar data for the MLS instrument. All data are for a tangent height of 30 km. The UARS instruments were assumed to be operating continuously during the ATLAS-2 Shuttle mission.

ATMOSPHERIC LABORATORY FOR APPLICATIONS AND SCIENCE (ATLAS-2)

The ATLAS-2 orbital elements are given in Table 1. The ATLAS-2 orbit elements were updated three times during the mission, and the ATLAS-UARS correlative measurement predictions revised as appropriate. Three ATLAS-2 instruments are simulated: Atmospheric Trace Molecule Spectroscopy (ATMOS), Millimeter-wave Atmospheric Sounder (MAS), and Shuttle Solar Backscatter UltraViolet (SSBUV). The ATMOS is a solar occultation instrument. The MAS views at an azimuth 90° to the left of the spacecraft. Because of the Space Shuttle yaw angle, the MAS looks at four azimuth angles relative to the velocity vector of the spacecraft: -50°, 90°, -81°, and -90° (positive azimuths are to the right of the velocity vector). Figure 3 shows the relationship between the velocity vector and the MAS pointing azimuth for the Space Shuttle orientations during the mission. Finally, the SSBUV is simulated as nadir viewing with a restriction that solar zenith angle be between 0° and 90°. A summary of instrument viewing characteristics used in the simulations is given in Table 2. ATLAS-2 time-line data (Robinson and Selmarten, 1993) were used to determine the periods during which each instrument was operating. The Shuttle attitude summary (Selmarten, 1993) is shown in Figure 4.

Figure 5 shows the latitudinal history of ATLAS ATMOS occultation tangent points with separate symbols for sunrise and sunset. Figures 6 and 7 show similar plots for MAS and the nadir-viewing SSBUV, respectively. All limb-viewing data are for a tangent height of 30 km.

ATLAS-UARS CORRELATIVE MEASUREMENTS

Each ATLAS measurement point for a given instrument was compared with all measurement points of a selected UARS sensor that occurred within a specified time interval. For each UARS orbit pass, the closest point meeting both time and distance constraints is determined. For the simulations in this report, the operating schedule for each ATLAS instrument was taken from the mission time-line data.

Correlative opportunities were determined for the various instrument combinations on the two satellites. A miss time of 7.0 hours was used for the two occultation cases (ATMOS vs. HALOE) and a miss time of 3.5 hours was used for all other cases. Miss distance was 2000 km for the two occultation instruments, 1000 km for an occultation instrument vs. either a limb scanner or nadir-viewing sensor, and 200 km for correlative measurements between non-occultation instruments. Figure 8 presents a plot of latitude vs. time for the 79 correlative measurements opportunities between the ATMOS and HALOE instruments. These correlative measurements are all for sunrises for both ATMOS and HALOE. ATMOS and MLS correlative measurements are shown in Figure 9. These 75 opportunities occur for ATMOS sunset measurements. Coincident measurements between the HALOE and SSBUV (30 points), and HALOE and MAS (51 points) are shown in Figures 10 and 11, respectively. The HALOE vs. MAS correlative points are generally for HALOE sunset measurements, but there are several sunrise opportunities above 60° north latitude during the last half of the Shuttle mission. HALOE vs. SSBUV correlative measurements are all for HALOE sunset data. Figure 12 presents the 600 correlative opportunities between the MAS and MLS; correlative opportunities between the SSBUV and MLS (208 points) are shown in Figure 13. The number of correlative measurement opportunities for each instrument combination along with the time and distance constraints is summarized in Table 3.

Tabular data were generated to fully describe the correlative measurement opportunities. The tabular output includes (for each satellite) the Greenwich Mean Time (GMT), mission elapsed time, satellite latitude and longitude, viewing angles with respect to the spacecraft velocity vector, geographical location of the measurement point, time and distance between the measurement points of the two instruments, and, in some cases, the solar zenith angle at the viewed point. Tabular data are given in Table 4 for the correlative measurements between ATMOS and HALOE, and in Table 5 for ATMOS and MLS. Tables 6 and 7 show the near-coincident measurement results for HALOE compared with SSBUV and MAS, respectively. Table 8 displays the correlative measurement opportunities between MAS and MLS; Table 9 shows results for SSBUV compared with MLS.

CONCLUDING REMARKS

Data are presented to show the correlative measurement opportunities between various experiments on ATLAS-2 and UARS. Results are based on the actual ATLAS-2 instrument operation schedule and the Space Shuttle attitude summary for the mission. The number of correlative measurement opportunities ranged from 30 for ATMOS vs. HALOE to 600 for MLS vs. MAS. The data in this report should be useful to scientists in assessing the correlative data available for analysis.

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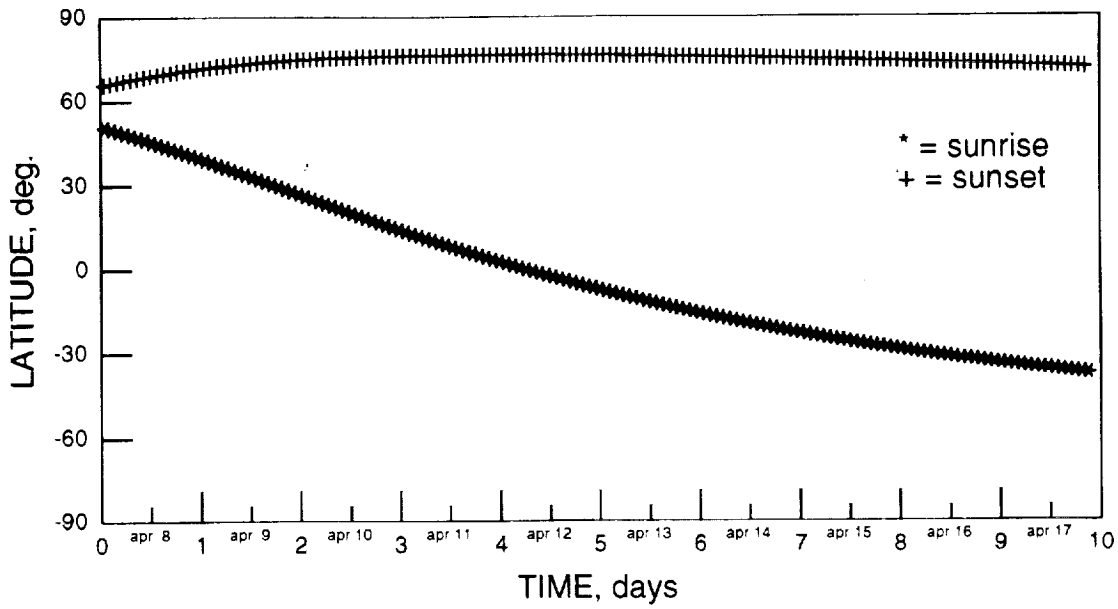


Figure 1. Latitudinal history of UARS HALOE coverage.

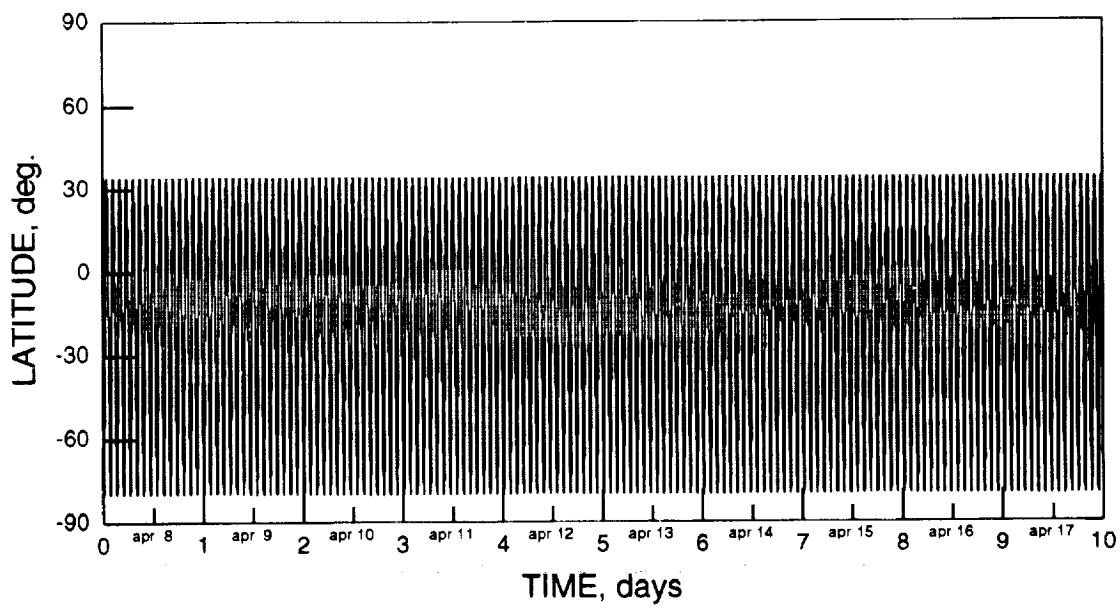


Figure 2. Latitudinal history of UARS MLS coverage

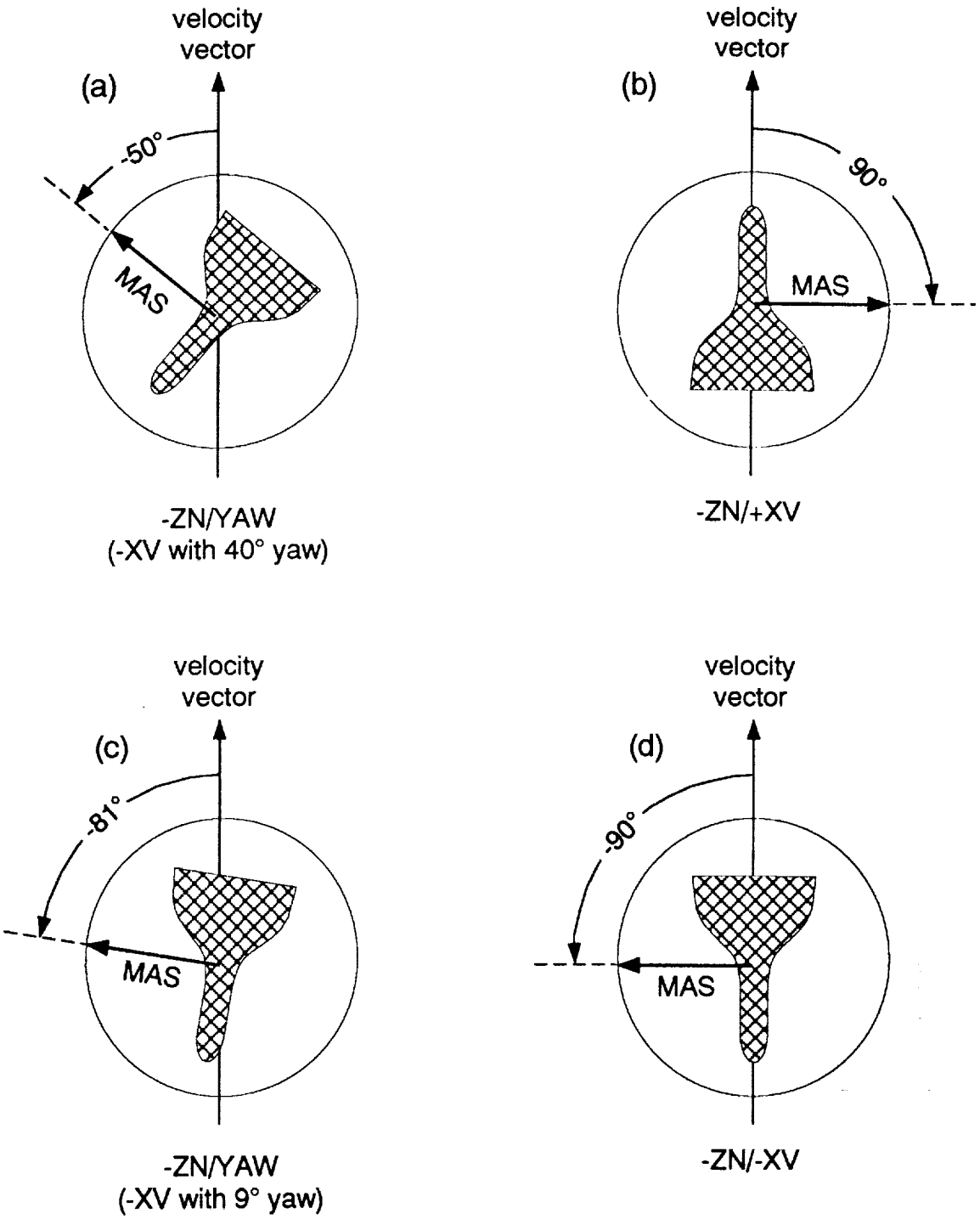
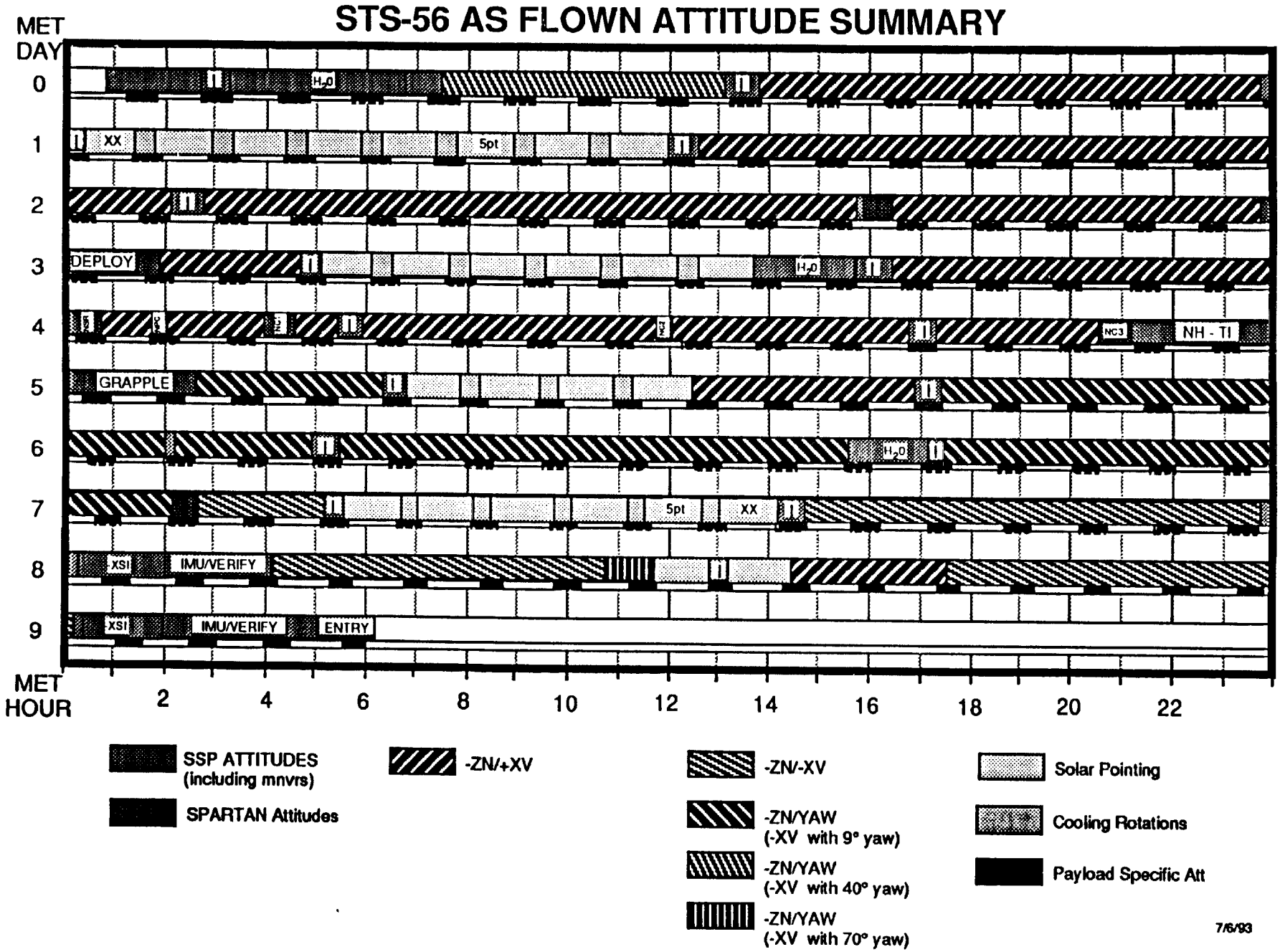


Figure 3. Four viewing azimuths used by MAS. The view shows the belly of the shuttle, with the Earth in the background. The open cargo bay points down toward the Earth (-ZN). The Shuttle pointing into the velocity vector is +XV, flying tail first is -XV. (a) viewing azimuth of -50°, (b) viewing azimuth 90°, (c) viewing azimuth -81°, and (d) viewing azimuth -90°.

Figure 4. Space Shuttle attitude angle summary.



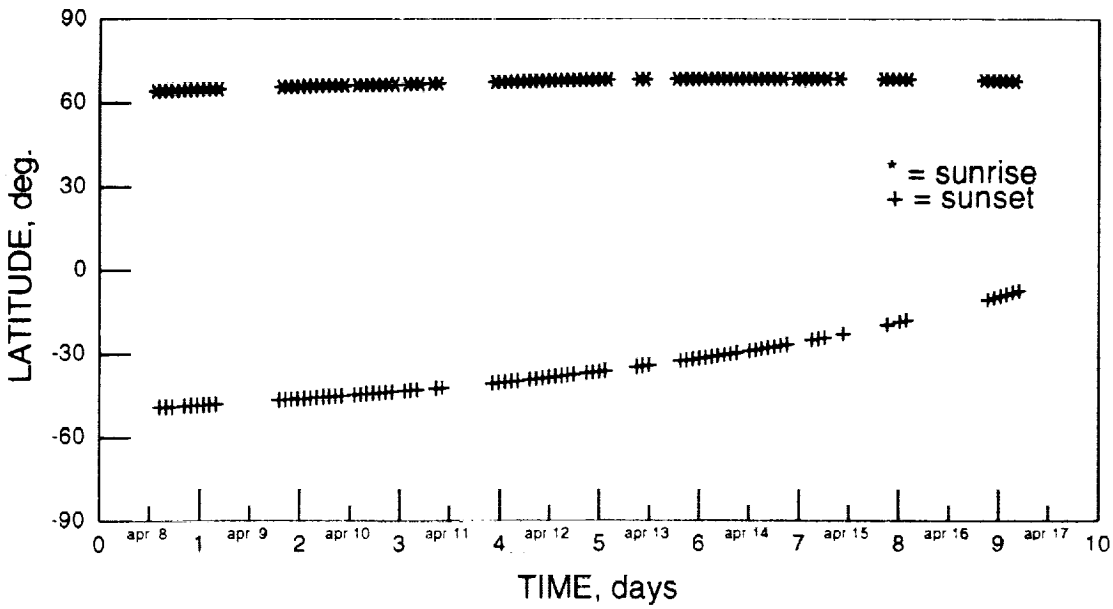


Figure 5. Latitudinal history of occultation coverage for ATLAS ATMOS.

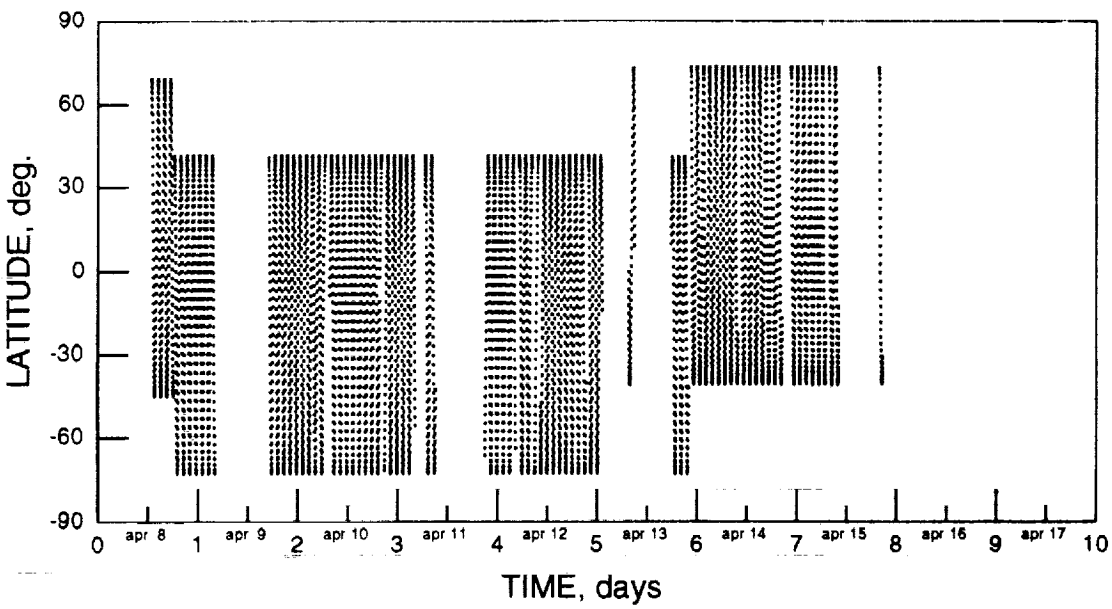


Figure 6. Latitudinal history of scanner coverage for ATLAS MAS.

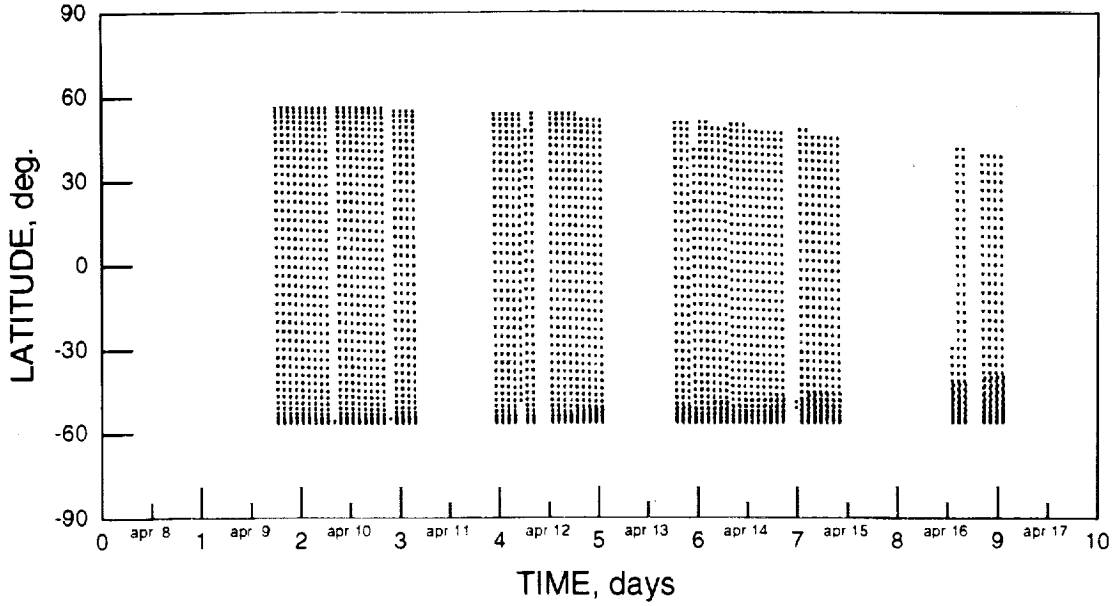


Figure 7. Latitudinal coverage history for ATLAS SSBUV.

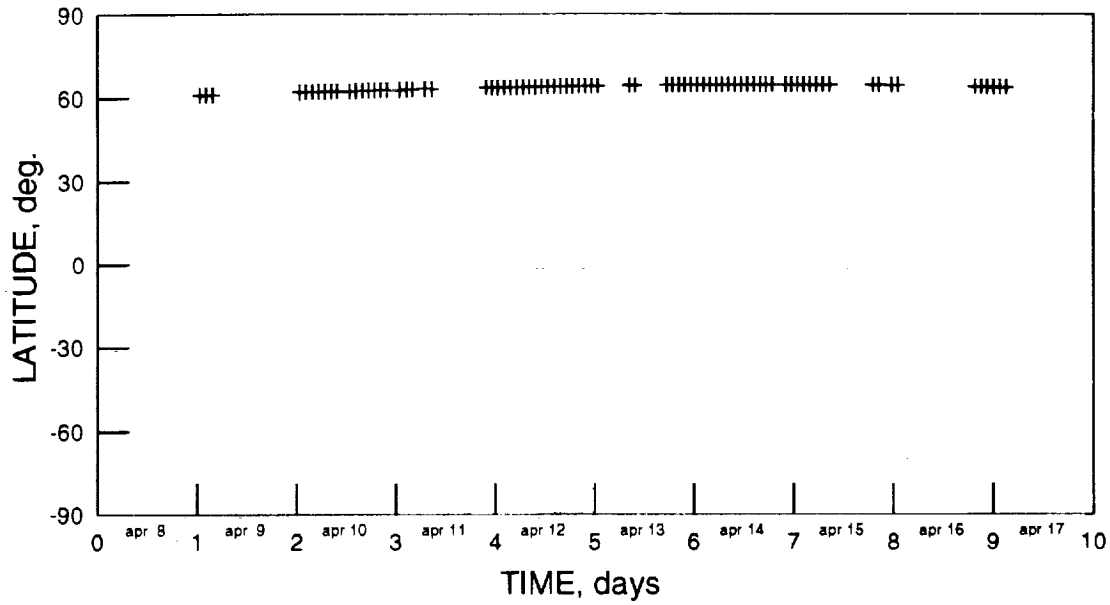


Figure 8. Latitudinal distribution of correlative measurement points between UARS HALOE and ATLAS ATMOS. The plotted points are the ATMOS measurements.

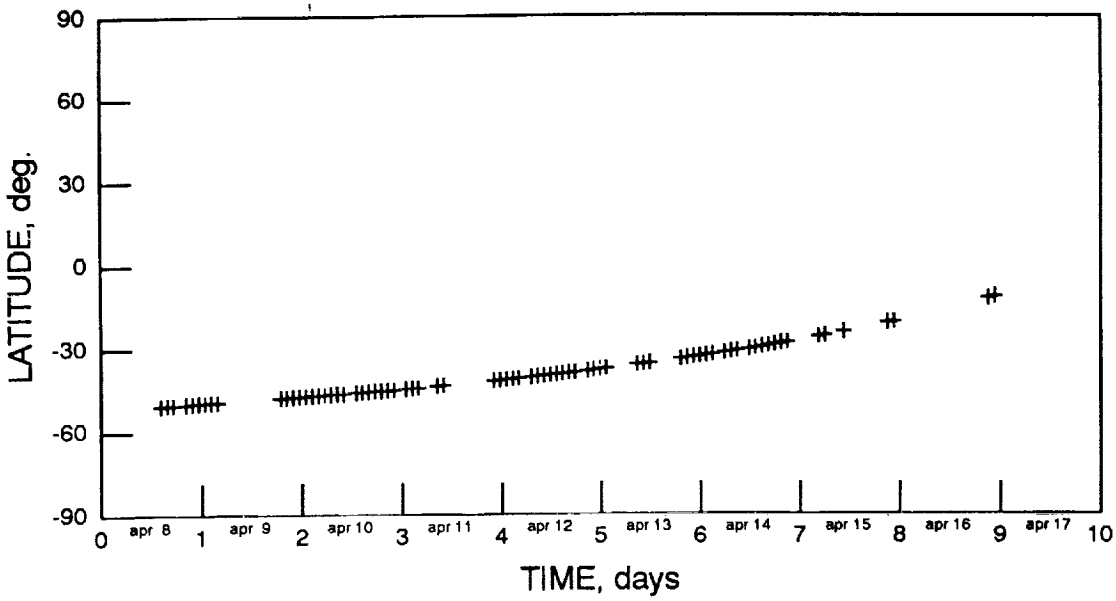


Figure 9. Latitudinal distribution of correlative measurement points between ATLAS ATMOS and UARS MLS. The plotted points are the ATMOS measurements.

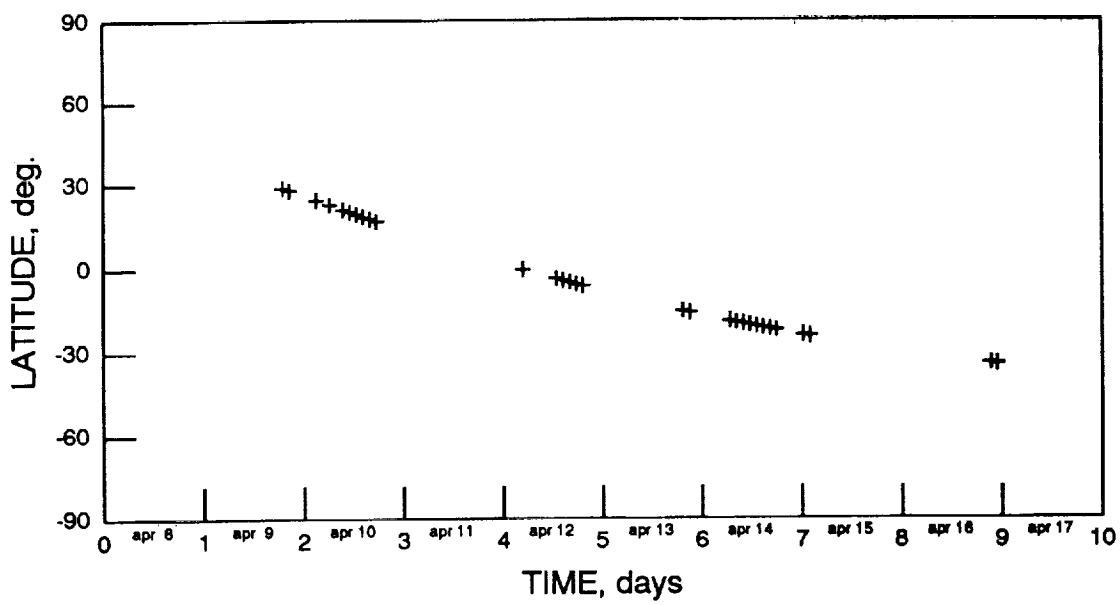


Figure 10. Latitudinal distribution of correlative measurement points between UARS HALOE and ATLAS SSBUV. The plotted points are the HALOE measurements.

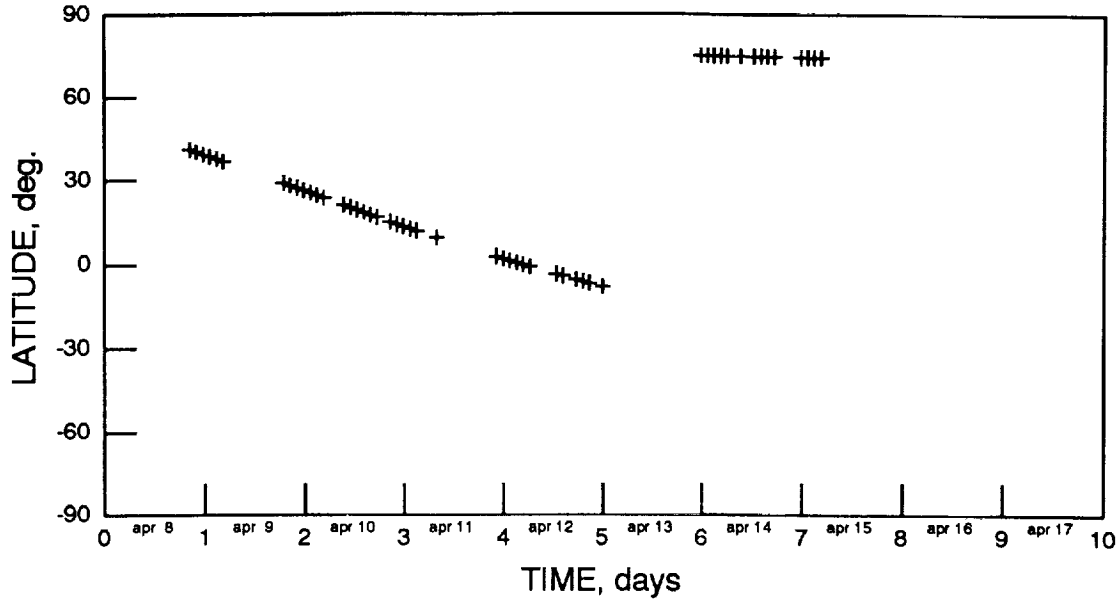


Figure 11. Latitudinal distribution of correlative measurement points between UARS HALOE and ATLAS MAS. The plotted points are the HALOE measurements.

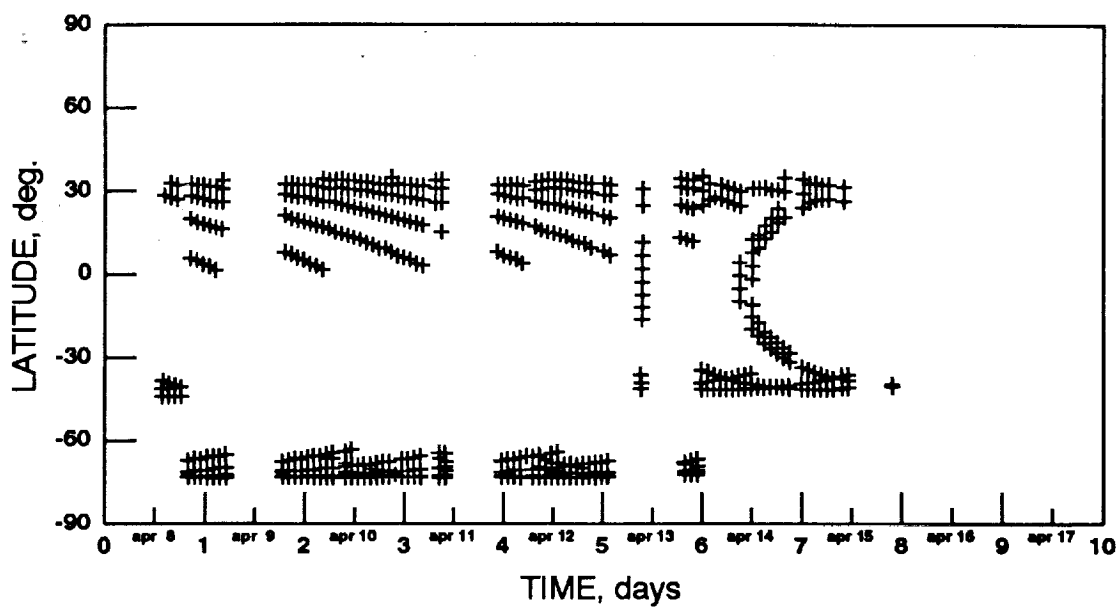


Figure 12. Latitudinal distribution of correlative measurement points between ATLAS MAS and UARS MLS. The plotted points are the MLS measurements.

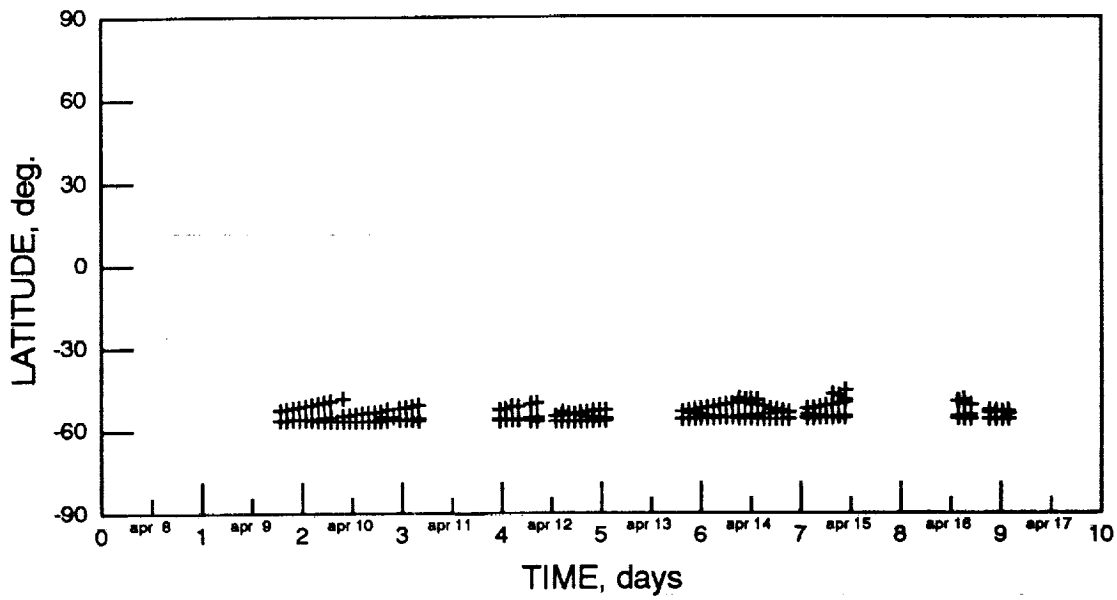


Figure 13. Latitudinal distribution of correlative measurement points between ATLAS SSBUV and UARS MLS. The plotted points are MLS measurements.

Table 1. UARS and ATLAS orbital elements.

		ORBITAL PARAMETERS	
		TIME OF STATE VECTOR DATE (yr, mo, day) GMT (hr, min, sec)	ORBIT ELEMENTS[3] SEMI-MAJOR AXIS (km) INCLINATION (deg) RIGHT ASCENSION (deg) ORBIT ANGLE[4] (deg)
SATELLITE	**UARS**[1]	93-04-08 12:00:00	6955.33 56.98 100.82 80.17
	ATLAS-2[2] (INITIAL)	93-04-08 12:58:58	6673.09 57.00 177.49 7.07
	ATLAS-2 (UPDATE 1)	93-04-09 12:58:58	6672.99 57.002 172.865 342.408
	ATLAS-2 (UPDATE 2)	93-04-12 13:43:59	6670.19 57.00 158.82 84.36
	ATLAS-2 (UPDATE 3)	93-04-14 15:44:00	6671.84 57.00 149.17 156.37

[1]UARS was launched on September 12, 1991 at 23:11:04 GMT.
[2]ATLAS was launched on April 8, 1993 at 05:29:00 GMT.
[3]All orbital elements have been adjusted to a common time of 00:00 GMT on April 8, 1993. This is done to facilitate the coincident measurement simulations and to evaluate orbital variations during the mission.
[4]Orbit Angle is the orbit central angle between the ascending node and the satellite.

Table 2. UARS and ATLAS-2 instruments viewing constraints.

SATELLITE	INSTRUMENT	VIEWING AZIMUTH DEG	CONSTRAINTS
UARS	MLS	+90°, -90°	VIEWS TOWARD DARK SIDE OF EARTH ONLY
	HALOE	VARIABLE	VIEWS TOWARD SUN SIDE OF SPACECRAFT
ATLAS	MAS	-90°, -81° -50°, 90°	VIEWS 90°. TO LEFT OF SPACECRAFT
	SSBUV	NADIR VIEWING	SOLAR ZENITH ANGLE 0° TO 90°
	ATMOS	VARIABLE	VIEWS TOWARD SUN SIDE OF SPACECRAFT

NOTES: MLS and MAS are limb-viewing sensors; HALOE and ATMOS look at the sun at sunrise and sunset of the spacecraft; SSBUV is a nadir viewing sensor. For MLS the viewing azimuth with respect to the velocity vector depends on whether the spacecraft is flying in a forward or backward orientation. The azimuth (either +90° or -90°) is such that the view is toward the dark side of the spacecraft. MAS views out the left side of the spacecraft. The viewing azimuth relative to the velocity vector depends on the orientation of the spacecraft (see Figure 3).

Table 3. Summary of the number of correlative measurement opportunities for each instrument combination. Time and distance constraints are as indicated.

		UARS	
		HALOE	MLS
ATLAS-2	ATMOS	79 Δ time = 7 hours Δ dist = 2000 km	75 Δ time = 3.5 hours Δ dist = 1000 km
	MAS	51 Δ time = 3.5 hours Δ dist = 1000 km	600 Δ time = 3.5 hours Δ dist = 200 km
	SSBUV	30 Δ time = 3.5 hours Δ dist = 1000 km	208 Δ time = 3.5 hours Δ dist = 200 km

Table 4. Correlative measurements between ATLAS ATMOS and UARS HALOE.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS	93	4	9	1	21	50	0	19	52	50	55.3	26.9	-24.0	-16.2	63.3	54.7	1829	6	57	80.9
UARS	HALOE	93	4	8	18	24	10	573	19	13	7	55.0	54.6	-104.0	-22.9	70.6	16.0				98.1
ATLAS	ATMOS	93	4	9	2	52	14	0	21	23	14	55.3	4.1	-24.3	-16.2	63.4	32.0	1860	6	51	80.9
UARS	HALOE	93	4	8	20	0	30	573	20	49	27	55.1	31.0	-104.1	-22.9	70.9	352.4				98.0
ATLAS	ATMOS	93	4	9	4	22	38	0	22	53	38	55.4	341.4	-24.7	-16.2	63.5	9.3	1891	6	45	80.9
UARS	HALOE	93	4	8	21	36	49	573	22	25	46	55.3	7.4	-104.2	-22.9	71.2	328.8				97.9
ATLAS	ATMOS	93	4	10	1	28	15	1	19	59	15	55.9	23.4	-29.1	-16.2	64.4	51.5	1565	6	59	81.0
UARS	HALOE	93	4	9	18	28	43	574	19	17	41	56.5	59.7	-106.3	-22.9	74.2	22.0				96.8
ATLAS	ATMOS	93	4	10	2	58	39	1	21	29	39	55.9	0.7	-29.4	-16.2	64.4	28.8	1592	6	53	81.0
UARS	HALOE	93	4	9	20	5	0	574	20	53	56	56.6	36.0	-106.5	-22.9	74.4	358.4				96.8
ATLAS	ATMOS	93	4	10	4	29	3	1	23	0	3	55.9	338.0	-29.8	-16.2	64.5	6.1	1619	6	47	81.0
UARS	HALOE	93	4	9	21	41	17	574	22	30	15	56.6	12.2	-106.7	-22.9	74.5	334.8				96.7
ATLAS	ATMOS	93	4	10	5	59	27	2	0	30	27	56.0	315.3	-30.1	-16.2	64.6	343.4	1646	6	41	81.0
UARS	HALOE	93	4	9	23	17	33	575	0	6	30	56.7	348.4	-106.9	-22.9	74.7	311.1				96.7
ATLAS	ATMOS	93	4	10	7	29	51	2	2	0	51	56.0	292.6	-30.4	-16.2	64.6	320.7	1672	6	36	81.0
UARS	HALOE	93	4	10	0	53	50	575	1	42	44	56.7	324.6	-107.1	-22.9	74.8	287.4				96.6
ATLAS	ATMOS	93	4	10	9	0	16	2	3	31	16	56.0	269.9	-30.7	-16.2	64.7	298.0	1698	6	30	81.0
UARS	HALOE	93	4	10	2	30	6	575	3	19	4	56.7	300.8	-107.3	-22.9	74.9	263.8				96.6
ATLAS	ATMOS	93	4	10	10	30	40	2	5	1	40	56.1	247.2	-31.0	-16.2	64.7	275.3	1723	6	24	81.0
UARS	HALOE	93	4	10	4	6	23	575	4	55	18	56.8	277.0	-107.5	-22.9	75.1	240.1				96.6
ATLAS	ATMOS	93	4	10	13	31	28	2	8	2	28	56.1	201.7	-31.7	-16.2	64.8	229.9	1774	6	12	81.0
UARS	HALOE	93	4	10	7	18	55	575	8	7	52	56.8	229.3	-107.9	-22.9	75.3	192.7				96.5
ATLAS	ATMOS	93	4	10	15	1	52	2	9	32	52	56.2	179.0	-32.0	-16.2	64.9	207.2	1799	6	6	81.0
UARS	HALOE	93	4	10	8	55	11	575	9	44	7	56.9	205.5	-108.2	-22.9	75.4	169.0				96.5
ATLAS	ATMOS	93	4	10	16	32	16	2	11	3	16	56.2	156.3	-32.3	-16.2	65.0	184.5	1824	6	0	81.0
UARS	HALOE	93	4	10	10	31	27	575	11	20	21	56.9	181.6	-108.4	-22.9	75.5	145.3				96.4
ATLAS	ATMOS	93	4	10	18	2	40	2	12	33	40	56.2	133.6	-32.6	-16.2	65.0	161.8	1849	5	54	81.0
UARS	HALOE	93	4	10	12	7	43	575	12	56	41	56.9	157.7	-108.6	-22.9	75.6	121.6				96.4
ATLAS	ATMOS	93	4	10	19	33	4	2	14	4	4	56.2	110.9	-32.9	-16.2	65.1	139.0	1873	5	49	81.0
UARS	HALOE	93	4	10	13	43	59	575	14	32	55	56.9	133.9	-108.8	-22.9	75.6	97.9				96.4
ATLAS	ATMOS	93	4	10	21	3	28	2	15	34	28	56.3	88.2	-33.2	-16.2	65.1	116.3	1898	5	43	81.0
UARS	HALOE	93	4	10	15	20	15	575	16	9	10	56.9	110.0	-109.1	-22.9	75.7	74.1				96.4
ATLAS	ATMOS	93	4	10	22	33	52	2	17	4	52	56.3	65.5	-33.6	-16.2	65.2	93.6	1923	5	37	81.0
UARS	HALOE	93	4	10	16	56	30	575	17	45	24	56.9	86.1	-109.3	-22.9	75.8	50.4				96.3
ATLAS	ATMOS	93	4	11	1	34	41	2	20	5	41	56.3	20.1	-34.2	-16.2	65.3	48.2	1973	5	25	81.0
UARS	HALOE	93	4	10	20	9	1	575	20	57	58	57.0	38.3	-109.8	-22.9	75.9	2.9				96.3
ATLAS	ATMOS	93	4	11	3	5	5	2	21	36	5	56.4	357.4	-34.5	-16.2	65.3	25.5	1426	6	56	81.0
UARS	HALOE	93	4	10	20	9	1	575	20	57	58	57.0	38.3	-109.8	-22.9	75.9	2.9				96.3
ATLAS	ATMOS	93	4	11	4	35	29	2	23	6	29	56.4	334.7	-34.8	-16.2	65.4	2.8	1446	6	50	81.0
UARS	HALOE	93	4	10	21	45	17	575	22	34	13	57.0	14.4	-110.0	-22.9	76.0	339.1				96.3
ATLAS	ATMOS	93	4	11	7	36	17	3	2	7	17	56.4	289.3	-35.5	-16.2	65.5	317.4	1489	6	38	81.0
UARS	HALOE	93	4	11	0	57	47	576	1	46	41	57.0	326.5	-110.5	-22.9	76.1	291.5				96.3
ATLAS	ATMOS	93	4	11	9	6	41	3	3	37	41	56.5	266.6	-35.8	-16.2	65.5	294.7	1510	6	32	81.0
UARS	HALOE	93	4	11	2	34	3	576	3	23	1	57.0	302.6	-110.7	-22.9	76.1	267.7				96.3

Table 4. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat	sub satellite lon	viewing angle beta	viewing angle alpha	observed point lat	observed point lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	ATMOS	93 4 11 22 40 18	3 17 11 18	56.7	62.3	-38.6	-16.2	65.9	90.4	1713	5 39	81.1
UARS	HALOE	93 4 11 17 0 19	576 17 49 16	56.9	87.0	-112.9	-22.9	76.4	53.4			96.3
ATLAS	ATMOS	93 4 12 0 10 42	3 18 41 42	56.7	39.6	-38.9	-16.2	66.0	67.7	1738	5 34	81.1
UARS	HALOE	93 4 11 18 36 33	576 19 25 31	56.9	63.0	-113.2	-22.9	76.4	29.5			96.3
ATLAS	ATMOS	93 4 12 1 41 7	3 20 12 7	56.7	16.9	-39.2	-16.2	66.0	45.0	1765	5 28	81.1
UARS	HALOE	93 4 11 20 12 48	576 21 1 45	56.9	39.0	-113.5	-22.9	76.4	5.6			96.3
ATLAS	ATMOS	93 4 12 3 11 31	3 21 42 31	56.7	354.2	-39.6	-16.2	66.1	22.3	1283	6 58	81.1
UARS	HALOE	93 4 11 20 12 48	576 21 1 45	56.9	39.0	-113.5	-22.9	76.4	5.6			96.3
ATLAS	ATMOS	93 4 12 4 41 55	3 23 12 55	56.7	331.5	-39.9	-16.2	66.1	359.6	1299	6 52	81.1
UARS	HALOE	93 4 11 21 49 3	576 22 37 59	56.9	15.0	-113.7	-22.9	76.4	341.7			96.3
ATLAS	ATMOS	93 4 12 6 12 19	4 0 43 19	56.8	308.8	-40.2	-16.2	66.1	336.9	1315	6 47	81.1
UARS	HALOE	93 4 11 23 25 17	577 0 14 14	56.9	351.0	-114.0	-22.9	76.4	317.7			96.3
ATLAS	ATMOS	93 4 12 7 42 43	4 2 13 43	56.8	286.1	-40.5	-16.2	66.2	314.2	1333	6 41	81.1
UARS	HALOE	93 4 12 1 1 31	577 1 50 28	56.8	326.9	-114.3	-22.9	76.4	293.8			96.4
ATLAS	ATMOS	93 4 12 9 13 7	4 3 44 7	56.8	263.4	-40.8	-16.2	66.2	291.5	1350	6 35	81.1
UARS	HALOE	93 4 12 2 37 46	577 3 26 43	56.8	302.9	-114.5	-22.9	76.4	269.9			96.4
ATLAS	ATMOS	93 4 12 10 43 31	4 5 14 31	56.8	240.7	-41.1	-16.2	66.3	268.8	1370	6 29	81.1
UARS	HALOE	93 4 12 4 14 0	577 5 2 57	56.8	278.9	-114.8	-22.9	76.4	245.9			96.4
ATLAS	ATMOS	93 4 12 12 13 56	4 6 44 56	56.8	218.0	-41.4	-16.2	66.3	246.1	1390	6 23	81.1
UARS	HALOE	93 4 12 5 50 15	577 6 39 11	56.8	254.8	-115.1	-22.9	76.4	222.0			96.4
ATLAS	ATMOS	93 4 12 13 44 20	4 8 15 20	56.8	195.3	-41.8	-16.2	66.3	223.4	1412	6 17	81.0
UARS	HALOE	93 4 12 7 26 29	577 8 15 26	56.8	230.8	-115.3	-22.9	76.4	198.0			96.4
ATLAS	ATMOS	93 4 12 15 14 44	4 9 45 44	56.8	172.6	-42.1	-16.2	66.4	200.7	1434	6 12	81.0
UARS	HALOE	93 4 12 9 2 43	577 9 51 40	56.7	206.8	-115.6	-22.9	76.3	174.0			96.4
ATLAS	ATMOS	93 4 12 16 45 8	4 11 16 8	56.9	150.0	-42.4	-16.2	66.4	178.0	1457	6 6	81.0
UARS	HALOE	93 4 12 10 38 58	577 11 27 55	56.7	182.7	-115.9	-22.9	76.3	150.1			96.4
ATLAS	ATMOS	93 4 12 18 15 32	4 12 46 32	56.9	127.3	-42.7	-16.2	66.4	155.3	1481	6 0	81.0
UARS	HALOE	93 4 12 12 15 12	577 13 4 9	56.7	158.7	-116.1	-22.9	76.3	126.1			96.5
ATLAS	ATMOS	93 4 12 19 45 57	4 14 16 57	56.9	104.6	-43.0	-16.2	66.5	132.6	1506	5 54	81.0
UARS	HALOE	93 4 12 13 51 26	577 14 40 24	56.7	134.6	-116.4	-22.9	76.3	102.1			96.5
ATLAS	ATMOS	93 4 12 21 16 21	4 15 47 21	56.9	81.9	-43.3	-16.2	66.5	109.9	1532	5 48	81.0
UARS	HALOE	93 4 12 15 27 40	577 16 16 38	56.6	110.5	-116.7	-22.9	76.3	78.1			96.5
ATLAS	ATMOS	93 4 12 22 46 45	4 17 17 45	56.9	59.2	-43.6	-16.2	66.5	87.2	1559	5 42	81.0
UARS	HALOE	93 4 12 17 3 54	577 17 52 52	56.6	86.5	-116.9	-22.9	76.3	54.1			96.5
ATLAS	ATMOS	93 4 13 0 17 9	4 18 48 9	56.9	36.5	-43.9	-16.2	66.6	64.5	1586	5 37	81.0
UARS	HALOE	93 4 12 18 40 9	577 19 29 7	56.6	62.4	-117.2	-22.9	76.2	30.1			96.6
ATLAS	ATMOS	93 4 13 1 47 33	4 20 18 33	56.9	13.8	-44.3	-16.2	66.6	41.8	1614	5 31	81.0
UARS	HALOE	93 4 12 20 16 23	577 21 5 21	56.6	38.4	-117.5	-22.9	76.2	6.1			96.6
ATLAS	ATMOS	93 4 13 9 19 35	5 3 50 35	57.0	260.4	-45.8	-16.2	66.7	288.3	1218	6 38	81.0
UARS	HALOE	93 4 13 2 41 19	578 3 30 14	56.5	302.1	-118.6	-22.9	76.1	270.0			96.7
ATLAS	ATMOS	93 4 13 10 49 59	5 5 20 59	57.0	237.8	-46.1	-16.2	66.8	265.6	1237	6 32	81.0
UARS	HALOE	93 4 13 4 17 33	578 5 6 28	56.4	278.0	-118.9	-22.9	76.1	245.9			96.7
ATLAS	ATMOS	93 4 13 18 22 0	5 12 53 0	57.0	124.4	-47.7	-16.2	66.9	152.2	1354	6 3	81.0
UARS	HALOE	93 4 13 12 18 43	578 13 7 40	56.3	157.5	-120.3	-22.9	75.9	125.6			96.9

Table 4. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS	93	4	13	19	52	25	5	14	23	25	57.0	101.7	-48.0	-16.2	66.9	129.5	1381	5	57	80.9
UARS	HALOE	93	4	13	13	54	56	578	14	43	54	56.2	133.4	-120.6	-22.9	75.9	101.6				96.9
ATLAS	ATMOS	93	4	13	21	22	49	5	15	53	49	57.0	79.1	-48.3	-16.2	66.9	106.8	1410	5	51	80.9
UARS	HALOE	93	4	13	15	31	10	578	16	20	9	56.2	109.3	-120.8	-22.9	75.8	77.5				96.9
ATLAS	ATMOS	93	4	13	22	53	13	5	17	24	13	57.0	56.4	-48.6	-16.2	66.9	84.1	1440	5	45	80.9
UARS	HALOE	93	4	13	17	7	24	578	17	56	18	56.2	85.2	-121.1	-22.9	75.8	53.4				97.0
ATLAS	ATMOS	93	4	14	0	23	38	5	18	54	38	57.0	33.7	-48.9	-16.2	67.0	61.4	1471	5	39	80.9
UARS	HALOE	93	4	13	18	43	38	578	19	32	32	56.1	61.1	-121.4	-22.9	75.8	29.3				97.0
ATLAS	ATMOS	93	4	14	1	54	2	5	20	25	2	57.0	11.1	-49.2	-16.2	67.0	38.8	1502	5	34	80.9
UARS	HALOE	93	4	13	20	19	52	578	21	8	47	56.1	37.0	-121.7	-22.9	75.7	5.2				97.0
ATLAS	ATMOS	93	4	14	3	24	26	5	21	55	26	57.0	348.4	-49.5	-16.2	67.0	16.1	1535	5	28	80.9
UARS	HALOE	93	4	13	21	56	5	578	22	45	1	56.1	12.9	-122.0	-22.9	75.7	341.2				97.1
ATLAS	ATMOS	93	4	14	4	54	51	5	23	25	51	57.0	325.7	-49.8	-16.2	67.0	353.4	1052	6	58	80.9
UARS	HALOE	93	4	13	21	56	5	578	22	45	1	56.1	12.9	-122.0	-22.9	75.7	341.2				97.1
ATLAS	ATMOS	93	4	14	6	25	15	6	0	56	15	57.0	303.1	-50.1	-16.2	67.0	330.7	1067	6	52	80.9
UARS	HALOE	93	4	13	23	32	19	579	0	21	16	56.0	348.8	-122.3	-22.9	75.6	317.1				97.1
ATLAS	ATMOS	93	4	14	7	55	40	6	2	26	40	57.0	280.4	-50.5	-16.2	67.0	308.0	1084	6	47	80.9
UARS	HALOE	93	4	14	1	8	33	579	1	57	30	56.0	324.7	-122.5	-22.9	75.6	293.0				97.2
ATLAS	ATMOS	93	4	14	9	26	4	6	3	57	4	57.0	257.7	-50.8	-16.2	67.1	285.3	1103	6	41	80.8
UARS	HALOE	93	4	14	2	44	47	579	3	33	45	56.0	300.6	-122.8	-22.9	75.5	268.9				97.2
ATLAS	ATMOS	93	4	14	10	56	28	6	5	27	28	57.0	235.1	-51.1	-16.2	67.1	262.7	1124	6	35	80.8
UARS	HALOE	93	4	14	4	21	0	579	5	9	59	55.9	276.4	-123.1	-22.9	75.5	244.8				97.2
ATLAS	ATMOS	93	4	14	12	26	53	6	6	57	53	57.0	212.4	-51.4	-16.2	67.1	240.0	1148	6	29	80.8
UARS	HALOE	93	4	14	5	57	14	579	6	46	8	55.9	252.3	-123.4	-22.9	75.4	220.7				97.3
ATLAS	ATMOS	93	4	14	13	57	17	6	8	28	17	57.0	189.8	-51.7	-16.2	67.1	217.3	1173	6	23	80.8
UARS	HALOE	93	4	14	7	33	28	579	8	22	22	55.9	228.2	-123.7	-22.9	75.4	196.6				97.3
ATLAS	ATMOS	93	4	14	15	27	42	6	9	58	42	57.0	167.1	-52.0	-16.2	67.1	194.6	1199	6	18	80.8
UARS	HALOE	93	4	14	9	9	42	579	9	58	37	55.8	204.1	-124.0	-22.9	75.3	172.4				97.4
ATLAS	ATMOS	93	4	14	16	58	6	6	11	29	6	57.0	144.5	-52.3	-16.2	67.1	172.0	1228	6	12	80.8
UARS	HALOE	93	4	14	10	45	55	579	11	34	51	55.8	180.0	-124.3	-22.9	75.3	148.3				97.4
ATLAS	ATMOS	93	4	14	18	28	31	6	12	59	31	57.0	121.8	-52.6	-16.2	67.1	149.3	1258	6	6	80.7
UARS	HALOE	93	4	14	12	22	9	579	13	11	6	55.8	155.8	-124.5	-22.9	75.2	124.2				97.4
ATLAS	ATMOS	93	4	14	19	58	55	6	14	29	55	57.0	99.2	-52.9	-16.2	67.1	126.6	1290	6	0	80.7
UARS	HALOE	93	4	14	13	58	23	579	14	47	20	55.7	131.7	-124.8	-22.9	75.2	100.1				97.5
ATLAS	ATMOS	93	4	14	22	59	44	6	17	30	44	56.9	53.9	-53.5	-16.2	67.1	81.3	1357	5	48	80.7
UARS	HALOE	93	4	14	17	10	50	579	17	59	44	55.6	83.5	-125.4	-22.9	75.1	51.9				97.6
ATLAS	ATMOS	93	4	15	0	30	9	6	19	1	9	56.9	31.3	-53.8	-16.2	67.1	58.6	1393	5	43	80.7
UARS	HALOE	93	4	14	18	47	4	579	19	35	58	55.6	59.3	-125.7	-22.9	75.0	27.7				97.6
ATLAS	ATMOS	93	4	15	2	0	34	6	20	31	34	56.9	8.6	-54.1	-16.2	67.1	36.0	1430	5	37	80.6
UARS	HALOE	93	4	14	20	23	17	579	21	12	13	55.6	35.2	-126.0	-22.9	75.0	3.6				97.7
ATLAS	ATMOS	93	4	15	3	30	58	6	22	1	58	56.9	346.0	-54.4	-16.2	67.1	13.3	1468	5	31	80.6
UARS	HALOE	93	4	14	21	59	31	579	22	48	27	55.5	11.1	-126.3	-22.9	74.9	339.5				97.7
ATLAS	ATMOS	93	4	15	5	1	23	6	23	32	23	56.9	323.3	-54.7	-16.2	67.1	350.6	1507	5	25	80.6
UARS	HALOE	93	4	14	23	35	44	580	0	24	41	55.5	346.9	-126.6	-22.9	74.8	315.3				97.8

Table 4. Concluded.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS	93	4	15	6	31	47	7	1	2	47	56.9	300.7	-55.0	-16.2	67.1	328.0	971	6	56	80.6
UARS	HALOE	93	4	14	23	35	44	580	0	24	41	55.5	346.9	-126.6	-22.9	74.8	315.3				97.8
ATLAS	ATMOS	93	4	15	8	2	12	7	2	33	12	56.9	278.1	-55.3	-16.2	67.1	305.3	992	6	50	80.5
UARS	HALOE	93	4	15	1	11	58	580	2	0	56	55.4	322.8	-126.9	-22.9	74.8	291.2				97.8
ATLAS	ATMOS	93	4	15	9	32	37	7	4	3	37	56.8	255.4	-55.6	-16.2	67.1	282.6	1015	6	44	80.5
UARS	HALOE	93	4	15	2	48	12	580	3	37	10	55.4	298.6	-127.1	-22.9	74.7	267.1				97.9
ATLAS	ATMOS	93	4	15	20	5	30	7	14	36	30	56.7	97.1	-57.7	-16.2	67.0	124.1	1240	6	3	80.3
UARS	HALOE	93	4	15	14	1	47	580	14	50	41	55.1	129.6	-129.2	-22.9	74.3	98.0				98.2
ATLAS	ATMOS	93	4	15	21	35	55	7	16	6	55	56.7	74.5	-58.0	-16.2	67.0	101.5	1279	5	57	80.3
UARS	HALOE	93	4	15	15	38	0	580	16	26	55	55.0	105.5	-129.5	-22.9	74.2	73.9				98.3
ATLAS	ATMOS	93	4	16	0	36	45	7	19	7	45	56.6	29.3	-58.6	-16.2	66.9	56.2	1362	5	46	80.2
UARS	HALOE	93	4	15	18	50	27	580	19	39	24	55.0	57.2	-130.1	-22.9	74.1	25.6				98.4
ATLAS	ATMOS	93	4	16	2	7	10	7	20	38	10	56.6	6.6	-58.9	-16.2	66.9	33.5	1406	5	40	80.2
UARS	HALOE	93	4	15	20	26	41	580	21	15	38	54.9	33.0	-130.4	-22.9	74.0	1.4				98.4
ATLAS	ATMOS	93	4	16	20	12	12	8	14	43	12	56.1	95.6	-62.4	-16.2	66.4	122.1	1247	6	7	79.6
UARS	HALOE	93	4	16	14	5	9	581	14	54	6	54.4	127.3	-133.6	-22.9	73.2	95.7				99.1
ATLAS	ATMOS	93	4	16	21	42	37	8	16	13	37	56.1	73.1	-62.6	-16.2	66.4	99.5	1296	6	1	79.5
UARS	HALOE	93	4	16	15	41	23	581	16	30	21	54.3	103.1	-133.9	-22.9	73.1	71.5				99.1
ATLAS	ATMOS	93	4	16	23	13	2	8	17	44	2	56.0	50.5	-62.9	-16.2	66.3	76.9	1345	5	55	79.4
UARS	HALOE	93	4	16	17	17	36	581	18	6	30	54.3	79.0	-134.2	-22.9	73.1	47.3				99.2
ATLAS	ATMOS	93	4	17	0	43	28	8	19	14	28	56.0	27.9	-63.2	-16.2	66.3	54.3	1396	5	49	79.4
UARS	HALOE	93	4	16	18	53	49	581	19	42	44	54.2	54.8	-134.5	-22.9	73.0	23.2				99.3
ATLAS	ATMOS	93	4	17	2	13	53	8	20	44	53	55.9	5.4	-63.5	-16.2	66.2	31.8	1449	5	43	79.3
UARS	HALOE	93	4	16	20	30	3	581	21	18	59	54.2	30.7	-134.7	-22.9	72.9	359.0				99.3
ATLAS	ATMOS	93	4	17	3	44	19	8	22	15	19	55.9	342.9	-63.8	-16.2	66.1	9.2	1503	5	38	79.2
UARS	HALOE	93	4	16	22	6	16	581	22	55	13	54.1	6.5	-135.0	-22.9	72.8	334.8				99.4

Table 5. Correlative measurements between ATLAS ATMOS and UARS MLS.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat	sub satellite lon	viewing angle beta	viewing angle alpha	observed point lat	observed point lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	ATMOS	93 4 8 14 10 32	0 8 41 32	-51.0	74.5	-158.3	-16.2	-50.5	48.8	558	0 28	105.8
UARS	MLS	93 4 8 14 39 4	573 15 28 2	-35.9	15.6	90.0	-22.9	-48.8	41.5			67.3
ATLAS	ATMOS	93 4 8 15 40 59	0 10 11 59	-50.9	51.9	-158.0	-16.2	-50.4	26.2	676	0 34	105.9
UARS	MLS	93 4 8 16 15 18	573 17 4 16	-35.9	351.3	90.0	-22.9	-48.7	17.2			67.1
ATLAS	ATMOS	93 4 8 17 11 25	0 11 42 25	-50.8	29.2	-157.7	-16.2	-50.3	3.6	795	0 40	106.0
UARS	MLS	93 4 8 17 51 47	573 18 40 41	-35.0	327.8	90.0	-22.9	-47.8	353.4			67.1
ATLAS	ATMOS	93 4 8 20 12 19	0 14 43 19	-50.5	343.8	-157.0	-16.2	-50.0	318.4	597	0 45	106.3
UARS	MLS	93 4 8 19 26 24	573 20 15 21	-39.3	298.8	90.0	-22.9	-52.7	325.8			65.7
ATLAS	ATMOS	93 4 8 21 42 46	0 16 13 46	-50.4	321.2	-156.7	-16.2	-49.9	295.8	490	0 39	106.4
UARS	MLS	93 4 8 21 2 53	573 21 51 51	-38.5	275.3	90.0	-22.9	-51.8	302.1			65.7
ATLAS	ATMOS	93 4 8 23 13 13	0 17 44 13	-50.3	298.5	-156.4	-16.2	-49.8	273.2	384	0 33	106.6
UARS	MLS	93 4 8 22 39 22	573 23 28 21	-37.7	251.8	90.0	-22.9	-50.8	278.3			65.7
ATLAS	ATMOS	93 4 9 0 43 40	0 19 14 40	-50.2	275.8	-156.1	-16.2	-49.6	250.6	273	0 28	106.7
UARS	MLS	93 4 9 0 15 36	574 1 4 30	-37.6	227.6	90.0	-22.9	-50.7	254.0			65.5
ATLAS	ATMOS	93 4 9 2 14 6	0 20 45 6	-50.1	253.2	-155.8	-16.2	-49.5	228.0	165	0 22	106.8
UARS	MLS	93 4 9 1 52 5	574 2 41 0	-36.8	204.1	90.0	-22.9	-49.8	230.2			65.5
ATLAS	ATMOS	93 4 9 3 44 33	0 22 15 33	-50.0	230.5	-155.5	-16.2	-49.4	205.4	52	0 16	107.0
UARS	MLS	93 4 9 3 28 18	574 4 17 15	-36.7	179.8	90.0	-22.9	-49.7	205.9			65.3
ATLAS	ATMOS	93 4 9 18 49 3	1 13 20 3	-48.7	3.8	-152.3	-16.2	-48.0	339.4	555	0 55	108.5
UARS	MLS	93 4 9 17 53 45	574 18 42 42	-37.4	319.6	90.0	-22.9	-50.5	346.0			63.4
ATLAS	ATMOS	93 4 9 20 19 30	1 14 50 30	-48.6	341.1	-151.9	-16.2	-47.8	316.8	441	0 49	108.7
UARS	MLS	93 4 9 19 30 14	574 20 19 13	-36.6	296.1	90.0	-22.9	-49.5	322.2			63.3
ATLAS	ATMOS	93 4 9 21 49 58	1 16 20 58	-48.4	318.5	-151.6	-16.2	-47.7	294.2	330	0 43	108.9
UARS	MLS	93 4 9 21 6 44	574 21 55 38	-35.7	272.6	90.0	-22.9	-48.6	298.4			63.3
ATLAS	ATMOS	93 4 9 23 20 25	1 17 51 25	-48.3	295.8	-151.3	-16.2	-47.5	271.6	214	0 37	109.0
UARS	MLS	93 4 9 22 42 57	574 23 31 52	-35.6	248.3	90.0	-22.9	-48.5	274.1			63.1
ATLAS	ATMOS	93 4 10 0 50 52	1 19 21 52	-48.1	273.1	-151.0	-16.2	-47.4	249.0	98	0 31	109.2
UARS	MLS	93 4 10 0 19 26	575 1 8 22	-34.8	224.8	90.0	-22.9	-47.5	250.3			63.1
ATLAS	ATMOS	93 4 10 2 21 19	1 20 52 19	-48.0	250.5	-150.7	-16.2	-47.2	226.4	42	0 25	109.4
UARS	MLS	93 4 10 1 55 40	575 2 44 37	-34.7	200.5	90.0	-22.9	-47.4	225.9			62.9
ATLAS	ATMOS	93 4 10 3 51 46	1 22 22 46	-47.8	227.8	-150.4	-16.2	-47.0	203.8	141	0 19	109.6
UARS	MLS	93 4 10 3 32 9	575 4 21 7	-33.9	176.9	90.0	-22.9	-46.5	202.1			62.8
ATLAS	ATMOS	93 4 10 5 22 14	1 23 53 14	-47.7	205.1	-150.0	-16.2	-46.9	181.2	265	0 13	109.7
UARS	MLS	93 4 10 5 8 22	575 5 57 16	-33.8	152.6	90.0	-22.9	-46.4	177.8			62.6
ATLAS	ATMOS	93 4 10 6 52 41	2 1 23 41	-47.6	182.5	-149.7	-16.2	-46.7	158.6	385	0 7	109.9
UARS	MLS	93 4 10 6 44 51	575 7 33 46	-32.9	129.0	90.0	-22.9	-45.5	153.9			62.6
ATLAS	ATMOS	93 4 10 8 23 8	2 2 54 8	-47.4	159.8	-149.4	-16.2	-46.6	136.0	511	0 2	110.1
UARS	MLS	93 4 10 8 21 5	575 9 10 1	-32.8	104.7	90.0	-22.9	-45.4	129.6			62.4
ATLAS	ATMOS	93 4 10 9 53 36	2 4 24 36	-47.3	137.1	-149.1	-16.2	-46.4	113.4	636	0 3	110.3
UARS	MLS	93 4 10 9 57 34	575 10 46 31	-32.0	81.1	90.0	-22.9	-44.4	105.8			62.4
ATLAS	ATMOS	93 4 10 12 54 30	2 7 25 30	-46.9	91.8	-148.5	-16.2	-46.1	68.2	850	1 22	110.7
UARS	MLS	93 4 10 11 32 11	575 12 21 5	-36.4	52.5	90.0	-22.9	-49.3	78.5			61.4
ATLAS	ATMOS	93 4 10 14 24 58	2 8 55 58	-46.8	69.1	-148.1	-16.2	-45.9	45.6	739	1 16	110.9
UARS	MLS	93 4 10 13 8 40	575 13 57 35	-35.6	28.9	90.0	-22.9	-48.4	54.7			61.3

Table 5. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS	93	4	10	15	55	25	2	10	26	25	-46.6	46.5	-147.8	-16.2	-45.7	23.0	625	1	10	111.1
UARS	MLS	93	4	10	14	44	53	575	15	33	50	-35.5	4.7	90.0	-22.9	-48.3	30.4				61.1
ATLAS	ATMOS	93	4	10	17	25	53	2	11	56	53	-46.5	23.8	-147.5	-16.2	-45.6	0.4	509	1	4	111.3
UARS	MLS	93	4	10	16	21	23	575	17	10	20	-34.6	341.1	90.0	-22.9	-47.4	6.5				61.0
ATLAS	ATMOS	93	4	10	18	56	20	2	13	27	20	-46.3	1.2	-147.2	-16.2	-45.4	337.9	394	0	58	111.5
UARS	MLS	93	4	10	17	57	52	575	18	46	50	-33.8	317.5	90.0	-22.9	-46.4	342.7				60.9
ATLAS	ATMOS	93	4	10	20	26	48	2	14	57	48	-46.1	338.5	-146.9	-16.2	-45.2	315.3	273	0	52	111.7
UARS	MLS	93	4	10	19	34	5	575	20	22	59	-33.7	293.2	90.0	-22.9	-46.3	318.4				60.8
ATLAS	ATMOS	93	4	10	21	57	15	2	16	28	15	-46.0	315.8	-146.6	-16.2	-45.0	292.7	152	0	46	111.9
UARS	MLS	93	4	10	21	10	34	575	21	59	30	-32.9	269.7	90.0	-22.9	-45.4	294.5				60.7
ATLAS	ATMOS	93	4	11	0	58	11	2	19	29	11	-45.6	270.5	-145.9	-16.2	-44.7	247.5	95	0	34	112.3
UARS	MLS	93	4	11	0	23	17	576	1	12	14	-31.9	221.8	90.0	-22.9	-44.3	246.4				60.4
ATLAS	ATMOS	93	4	11	2	28	38	2	20	59	38	-45.5	247.8	-145.6	-16.2	-44.5	224.9	226	0	28	112.5
UARS	MLS	93	4	11	1	59	46	576	2	48	45	-31.1	198.2	90.0	-22.9	-43.4	222.5				60.3
ATLAS	ATMOS	93	4	11	3	59	6	2	22	30	6	-45.3	225.2	-145.3	-16.2	-44.3	202.3	349	0	23	112.8
UARS	MLS	93	4	11	3	35	59	576	4	24	54	-31.0	173.9	90.0	-22.9	-43.3	198.2				60.1
ATLAS	ATMOS	93	4	11	8	30	29	3	3	1	29	-44.8	157.2	-144.3	-16.2	-43.7	134.6	742	0	5	113.4
UARS	MLS	93	4	11	8	25	11	576	9	14	9	-29.1	102.3	90.0	-22.9	-41.3	126.1				59.7
ATLAS	ATMOS	93	4	11	10	0	57	3	4	31	57	-44.6	134.5	-144.0	-16.2	-43.5	112.0	875	0	0	113.7
UARS	MLS	93	4	11	10	1	24	576	10	50	23	-29.0	78.0	90.0	-22.9	-41.2	101.8				59.5
ATLAS	ATMOS	93	4	11	22	4	41	3	16	35	41	-43.0	313.2	-141.5	-16.2	-41.8	291.3	59	0	49	115.7
UARS	MLS	93	4	11	21	14	41	576	22	3	37	-29.1	267.2	90.0	-22.9	-41.3	291.0				57.9
ATLAS	ATMOS	93	4	11	23	35	9	3	18	6	9	-42.8	290.6	-141.2	-16.2	-41.6	268.7	172	0	44	116.0
UARS	MLS	93	4	11	22	50	54	576	23	39	52	-29.1	242.9	90.0	-22.9	-41.2	266.7				57.7
ATLAS	ATMOS	93	4	12	1	5	37	3	19	36	37	-42.6	267.9	-140.9	-16.2	-41.4	246.1	304	0	38	116.2
UARS	MLS	93	4	12	0	27	23	577	1	16	17	-28.2	219.2	90.0	-22.9	-40.3	242.8				57.5
ATLAS	ATMOS	93	4	12	2	36	5	3	21	7	5	-42.4	245.3	-140.6	-16.2	-41.2	223.5	440	0	32	116.5
UARS	MLS	93	4	12	2	3	37	577	2	52	31	-28.1	194.9	90.0	-22.9	-40.2	218.5				57.3
ATLAS	ATMOS	93	4	12	4	6	34	3	22	37	34	-42.2	222.6	-140.2	-16.2	-41.0	201.0	574	0	26	116.8
UARS	MLS	93	4	12	3	40	6	577	4	29	1	-27.2	171.2	90.0	-22.9	-39.3	194.6				57.2
ATLAS	ATMOS	93	4	12	7	7	30	4	1	38	30	-41.8	177.3	-139.6	-16.2	-40.5	155.8	850	0	14	117.4
UARS	MLS	93	4	12	6	52	48	577	7	41	46	-26.2	123.2	90.0	-22.9	-38.2	146.4				56.8
ATLAS	ATMOS	93	4	12	8	37	59	4	3	8	59	-41.5	154.6	-139.3	-16.2	-40.3	133.2	930	1	47	117.7
UARS	MLS	93	4	12	6	50	56	577	7	39	50	-31.7	118.7	90.0	-22.9	-44.1	143.3				56.4
ATLAS	ATMOS	93	4	12	10	8	27	4	4	39	27	-41.3	132.0	-139.0	-16.2	-40.0	110.6	806	1	41	118.0
UARS	MLS	93	4	12	8	27	25	577	9	16	20	-30.8	95.1	90.0	-22.9	-43.2	119.4				56.2
ATLAS	ATMOS	93	4	12	11	38	55	4	6	9	55	-41.1	109.3	-138.7	-16.2	-39.8	88.1	681	1	35	118.3
UARS	MLS	93	4	12	10	3	55	577	10	52	51	-30.0	71.5	90.0	-22.9	-42.2	95.5				56.1
ATLAS	ATMOS	93	4	12	13	9	24	4	7	40	24	-40.9	86.7	-138.4	-16.2	-39.5	65.5	555	1	28	118.6
UARS	MLS	93	4	12	11	40	24	577	12	29	21	-29.1	47.8	90.0	-22.9	-41.3	71.6				55.9
ATLAS	ATMOS	93	4	12	14	40	20	4	9	11	20	-40.7	63.8	-138.1	-16.1	-39.4	42.8	435	1	23	118.8
UARS	MLS	93	4	12	13	16	47	577	14	5	46	-28.4	24.0	90.0	-22.9	-40.6	47.6				55.7
ATLAS	ATMOS	93	4	12	16	10	45	4	10	41	45	-40.5	41.2	-137.8	-16.1	-39.1	20.2	303	1	17	119.2
UARS	MLS	93	4	12	14	53	1	577	15	41	55	-28.3	359.7	90.0	-22.9	-40.5	23.3				55.5

Table 5. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat	sub satellite lon	viewing angle beta	viewing angle alpha	observed point lat	observed point lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	ATMOS	93 4 12 17 41 10	4 12 12 10	-40.2	18.5	-137.4	-16.1	-38.9	357.6	168	1 11	119.5
UARS	MLS	93 4 12 16 29 30	577 17 18 25	-27.4	336.0	90.0	-22.9	-39.5	359.4			55.3
ATLAS	ATMOS	93 4 12 20 42 0	4 15 13 0	-39.7	333.2	-136.8	-16.1	-38.4	312.5	113	0 59	120.2
UARS	MLS	93 4 12 19 42 28	577 20 31 26	-25.7	288.6	90.0	-22.9	-37.6	311.6			55.0
ATLAS	ATMOS	93 4 12 22 12 25	4 16 43 25	-39.5	310.6	-136.5	-16.1	-38.1	290.0	243	0 53	120.5
UARS	MLS	93 4 12 21 18 41	577 22 7 35	-25.6	264.3	90.0	-22.9	-37.5	287.3			54.8
ATLAS	ATMOS	93 4 12 23 42 51	4 18 13 51	-39.2	288.0	-136.2	-16.1	-37.8	267.4	382	0 47	120.9
UARS	MLS	93 4 12 22 55 10	577 23 44 5	-24.7	240.6	90.0	-22.9	-36.6	263.4			54.6
ATLAS	ATMOS	93 4 13 1 13 16	4 19 44 16	-39.0	265.3	-135.9	-16.1	-37.6	244.8	524	0 41	121.2
UARS	MLS	93 4 13 0 31 40	578 1 20 35	-23.8	216.9	90.0	-22.9	-35.7	239.5			54.5
ATLAS	ATMOS	93 4 13 8 45 24	5 3 16 24	-37.7	152.2	-134.3	-16.1	-36.2	132.0	789	1 50	123.1
UARS	MLS	93 4 13 6 55 12	578 7 44 9	-27.4	116.6	90.0	-22.9	-39.4	140.0			53.4
ATLAS	ATMOS	93 4 13 10 15 49	5 4 46 49	-37.4	129.5	-134.0	-16.1	-35.9	109.5	655	1 44	123.5
UARS	MLS	93 4 13 8 31 41	578 9 20 39	-26.5	92.9	90.0	-22.9	-38.5	116.1			53.2
ATLAS	ATMOS	93 4 13 11 46 15	5 6 17 15	-37.1	106.9	-133.7	-16.1	-35.6	86.9	520	1 38	123.9
UARS	MLS	93 4 13 10 8 10	578 10 57 9	-25.6	69.2	90.0	-22.9	-37.6	92.2			53.0
ATLAS	ATMOS	93 4 13 19 18 25	5 13 49 25	-35.7	353.7	-132.1	-16.1	-34.1	334.2	183	1 8	126.0
UARS	MLS	93 4 13 18 10 20	578 18 59 14	-21.9	310.0	90.0	-22.9	-33.7	332.2			52.0
ATLAS	ATMOS	93 4 13 20 48 51	5 15 19 51	-35.4	331.1	-131.8	-16.1	-33.8	311.6	326	1 2	126.5
UARS	MLS	93 4 13 19 46 49	578 20 35 44	-21.0	286.3	90.0	-22.9	-32.8	308.3			51.8
ATLAS	ATMOS	93 4 13 22 19 17	5 16 50 17	-35.1	308.5	-131.5	-16.1	-33.5	289.0	473	0 55	127.0
UARS	MLS	93 4 13 21 23 19	578 22 12 14	-20.1	262.5	90.0	-22.9	-31.9	284.4			51.7
ATLAS	ATMOS	93 4 13 23 49 43	5 18 20 43	-34.8	285.8	-131.2	-16.1	-33.1	266.5	622	0 49	127.4
UARS	MLS	93 4 13 22 59 48	578 23 48 45	-19.2	238.7	90.0	-22.9	-30.9	260.4			51.5
ATLAS	ATMOS	93 4 14 1 20 9	5 19 51 9	-34.4	263.2	-130.9	-16.1	-32.8	243.9	772	0 43	127.9
UARS	MLS	93 4 14 0 36 17	579 1 25 15	-18.2	215.0	90.0	-22.9	-30.0	236.5			51.4
ATLAS	ATMOS	93 4 14 2 50 36	5 21 21 36	-34.1	240.6	-130.6	-16.1	-32.5	221.4	924	0 38	128.4
UARS	MLS	93 4 14 2 12 30	579 3 1 24	-18.1	190.6	90.0	-22.9	-29.9	212.2			51.1
ATLAS	ATMOS	93 4 14 5 51 30	6 0 22 30	-33.4	195.4	-130.0	-16.1	-31.8	176.3	908	2 4	129.5
UARS	MLS	93 4 14 3 47 7	579 4 36 3	-22.9	163.0	90.0	-22.9	-34.8	185.4			50.5
ATLAS	ATMOS	93 4 14 7 21 56	6 1 52 56	-33.1	172.8	-129.7	-16.1	-31.4	153.8	770	1 58	130.0
UARS	MLS	93 4 14 5 23 36	579 6 12 34	-22.0	139.3	90.0	-22.9	-33.9	161.5			50.3
ATLAS	ATMOS	93 4 14 8 52 23	6 3 23 23	-32.8	150.1	-129.4	-16.1	-31.0	131.2	631	1 52	130.5
UARS	MLS	93 4 14 7 0 5	579 7 49 4	-21.1	115.5	90.0	-22.9	-32.9	137.6			50.1
ATLAS	ATMOS	93 4 14 11 53 17	6 6 24 17	-32.1	104.9	-128.7	-16.1	-30.3	86.1	346	1 40	131.6
UARS	MLS	93 4 14 10 12 48	579 11 1 43	-20.1	67.4	90.0	-22.9	-31.9	89.3			49.6
ATLAS	ATMOS	93 4 14 13 23 43	6 7 54 43	-31.7	82.3	-128.4	-16.1	-30.0	63.6	202	1 34	132.2
UARS	MLS	93 4 14 11 49 17	579 12 38 13	-19.2	43.7	90.0	-22.9	-31.0	65.4			49.5
ATLAS	ATMOS	93 4 14 14 55 7	6 9 26 7	-31.4	59.4	-128.1	-16.1	-29.6	40.8	89	1 29	132.7
UARS	MLS	93 4 14 13 25 59	579 14 14 54	-17.7	20.2	90.0	-22.9	-29.5	41.7			49.3
ATLAS	ATMOS	93 4 14 16 25 36	6 10 56 36	-31.0	36.8	-127.8	-16.1	-29.2	18.2	85	1 23	133.3
UARS	MLS	93 4 14 15 2 12	579 15 51 9	-17.6	355.9	90.0	-22.9	-29.4	17.4			49.1
ATLAS	ATMOS	93 4 14 17 56 5	6 12 27 5	-30.6	14.2	-127.5	-16.1	-28.8	355.7	223	1 17	133.8
UARS	MLS	93 4 14 16 38 41	579 17 27 39	-16.7	332.1	90.0	-22.9	-28.4	353.4			48.9

Table 5. Concluded.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	ATMOS	93	4	14	19	26	34	6	13	57	34	-30.3	351.6	-127.2	-16.1	-28.4	333.1	370	1	11	134.4
UARS	MLS	93	4	14	18	15	10	579	19	4	4	-15.8	308.3	90.0	-22.9	-27.5	329.5				48.7
ATLAS	ATMOS	93	4	14	20	57	3	6	15	28	3	-29.9	328.9	-126.9	-16.1	-28.1	310.6	521	1	5	135.0
UARS	MLS	93	4	14	19	51	39	579	20	40	34	-14.8	284.5	90.0	-22.9	-26.6	305.6				48.6
ATLAS	ATMOS	93	4	15	4	29	31	6	23	0	31	-27.9	215.8	-125.4	-16.1	-26.0	197.8	951	2	14	138.2
UARS	MLS	93	4	15	2	15	28	580	3	4	23	-17.7	185.2	90.0	-22.9	-29.5	206.6				47.3
ATLAS	ATMOS	93	4	15	6	0	1	7	0	31	1	-27.5	193.2	-125.1	-16.1	-25.6	175.3	807	2	8	138.9
UARS	MLS	93	4	15	3	51	57	580	4	40	53	-16.8	161.4	90.0	-22.9	-28.6	182.7				47.1
ATLAS	ATMOS	93	4	15	10	31	30	7	5	2	30	-26.3	125.4	-124.2	-16.1	-24.3	107.6	370	1	50	140.9
UARS	MLS	93	4	15	8	41	24	580	9	30	19	-14.0	90.0	90.0	-22.9	-25.8	110.9				46.5
ATLAS	ATMOS	93	4	15	21	5	5	7	15	36	5	-23.0	327.2	-122.1	-16.2	-20.9	309.9	693	1	8	146.2
UARS	MLS	93	4	15	19	57	4	580	20	46	1	-6.7	283.7	90.0	-22.9	-18.6	303.7				45.9
ATLAS	ATMOS	93	4	15	22	35	36	7	17	6	36	-22.6	304.6	-121.8	-16.2	-20.4	287.3	848	1	1	146.9
UARS	MLS	93	4	15	21	33	50	580	22	22	47	-4.9	260.4	90.0	-22.9	-16.9	280.2				46.1
ATLAS	ATMOS	93	4	16	21	13	34	8	15	44	35	-14.5	325.7	-117.4	-16.2	-12.1	309.3	773	1	10	157.8
UARS	MLS	93	4	16	20	3	17	581	20	52	15	4.1	284.1	90.0	-22.9	-8.4	303.3				45.0
ATLAS	ATMOS	93	4	16	22	44	7	8	17	15	7	-13.9	303.2	-117.2	-16.2	-11.4	286.8	918	1	4	158.4
UARS	MLS	93	4	16	21	39	47	581	22	28	40	5.0	260.3	90.0	-22.9	-7.5	279.4				45.1

Table 6. Correlative measurements between ATLAS SSBUV and UARS HALOE.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat	sub satellite lon	viewing angle beta	viewing angle alpha	observed point lat	observed point lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	SSBUV	93 4 9 21 10 9	1 15 41 9	33.7	170.0	0.0	-90.0	33.7	170.0			55.0
UARS	HALOE	93 4 9 18 46 45	574 19 35 42	23.6	139.5	-73.7	-22.9	29.4	164.3	719	2 23	54.9
ATLAS	SSBUV	93 4 9 22 40 34	1 17 11 34	33.6	147.1	0.0	-90.0	33.6	147.1			55.2
UARS	HALOE	93 4 9 20 23 12	574 21 12 7	22.8	115.7	-73.5	-22.9	28.5	140.3	857	2 17	53.7
ATLAS	SSBUV	93 4 10 6 15 57	2 0 46 57	22.9	41.1	0.0	-90.0	22.9	41.1			45.9
UARS	HALOE	93 4 10 2 48 58	575 3 37 52	19.7	20.3	-72.7	-22.9	25.0	44.4	411	3 26	49.0
ATLAS	SSBUV	93 4 10 9 16 47	2 3 47 47	22.7	355.4	0.0	-90.0	22.7	355.4			46.3
UARS	HALOE	93 4 10 6 1 51	575 6 50 48	18.1	332.6	-72.2	-22.9	23.3	356.4	130	3 14	46.5
ATLAS	SSBUV	93 4 10 12 17 38	2 6 48 38	22.5	309.6	0.0	-90.0	22.5	309.6			46.7
UARS	HALOE	93 4 10 9 14 44	575 10 3 37	16.5	284.8	-71.8	-22.9	21.6	308.5	153	3 2	43.9
ATLAS	SSBUV	93 4 10 13 48 3	2 8 19 3	22.4	286.7	0.0	-90.0	22.4	286.7			46.9
UARS	HALOE	93 4 10 10 51 10	575 11 40 8	15.8	260.9	-71.6	-22.9	20.7	284.5	295	2 56	42.7
ATLAS	SSBUV	93 4 10 15 18 29	2 9 49 29	22.3	263.9	0.0	-90.0	22.3	263.8			47.2
UARS	HALOE	93 4 10 12 27 36	575 13 16 33	15.0	237.1	-71.4	-22.9	19.9	260.5	437	2 50	41.4
ATLAS	SSBUV	93 4 10 16 48 54	2 11 19 54	22.2	241.0	0.0	-90.0	22.2	241.0			47.4
UARS	HALOE	93 4 10 14 4 3	575 14 52 58	14.2	213.2	-71.1	-22.9	19.0	236.5	580	2 44	40.1
ATLAS	SSBUV	93 4 10 18 19 19	2 12 50 19	22.1	218.1	0.0	-90.0	22.1	218.1			47.6
UARS	HALOE	93 4 10 15 40 29	575 16 29 23	13.5	189.2	-70.9	-22.9	18.2	212.5	723	2 38	38.8
ATLAS	SSBUV	93 4 10 19 49 45	2 14 20 45	22.0	195.2	0.0	-90.0	22.0	195.2			47.8
UARS	HALOE	93 4 10 17 16 54	575 18 5 53	12.7	165.3	-70.7	-22.9	17.4	188.5	867	2 32	37.5
ATLAS	SSBUV	93 4 12 8 5 54	4 2 36 54	-0.5	18.2	0.0	-90.0	-0.5	18.2			41.4
UARS	HALOE	93 4 12 4 38 1	577 5 26 57	-2.9	358.0	-65.1	-22.9	0.5	20.7	296	3 27	25.5
ATLAS	SSBUV	93 4 12 15 38 1	4 10 9 1	-1.0	263.7	0.0	-90.0	-1.0	263.7			43.0
UARS	HALOE	93 4 12 12 39 57	577 13 28 51	-6.1	237.9	-63.8	-22.9	-2.9	260.7	400	2 58	28.0
ATLAS	SSBUV	93 4 12 17 8 26	4 11 39 26	-1.1	240.8	0.0	-90.0	-1.1	240.8			43.3
UARS	HALOE	93 4 12 14 16 20	577 15 5 16	-6.7	213.9	-63.5	-22.9	-3.6	236.7	536	2 52	28.6
ATLAS	SSBUV	93 4 12 18 38 52	4 13 9 52	-1.2	217.9	0.0	-90.0	-1.2	217.9			43.6
UARS	HALOE	93 4 12 15 52 43	577 16 41 41	-7.3	189.9	-63.2	-22.9	-4.2	212.7	673	2 46	29.2
ATLAS	SSBUV	93 4 12 20 9 17	4 14 40 17	-1.3	195.1	0.0	-90.0	-1.3	195.0			43.9
UARS	HALOE	93 4 12 17 29 6	577 18 18 1	-7.9	165.9	-63.0	-22.9	-4.9	188.7	809	2 40	29.8
ATLAS	SSBUV	93 4 12 21 39 42	4 16 10 42	-1.4	172.2	0.0	-90.0	-1.4	172.2			44.2
UARS	HALOE	93 4 12 19 5 29	577 19 54 26	-8.5	141.8	-62.7	-22.9	-5.5	164.7	945	2 34	30.5
ATLAS	SSBUV	93 4 13 21 48 47	5 16 19 47	-10.7	170.5	0.0	-90.0	-10.7	170.3			46.8
UARS	HALOE	93 4 13 19 10 56	578 19 59 52	-16.8	141.2	-58.5	-22.9	-14.2	164.8	723	2 37	39.6
ATLAS	SSBUV	93 4 13 23 19 11	5 17 50 11	-10.8	147.6	0.0	-90.0	-10.8	147.5			47.1
UARS	HALOE	93 4 13 20 47 17	578 21 36 12	-17.3	117.1	-58.2	-22.9	-14.7	140.8	849	2 31	40.1
ATLAS	SSBUV	93 4 14 9 54 45	6 4 25 45	-20.6	353.2	0.0	-90.0	-20.6	353.1			48.2
UARS	HALOE	93 4 14 6 25 21	579 7 14 16	-20.2	332.7	-56.5	-22.9	-17.8	356.8	499	3 29	43.0
ATLAS	SSBUV	93 4 14 11 24 54	6 5 55 54	-19.9	329.8	0.0	-90.0	-19.9	329.7			48.5
UARS	HALOE	93 4 14 8 1 42	579 8 50 35	-20.6	308.7	-56.2	-22.9	-18.3	332.8	376	3 23	43.5
ATLAS	SSBUV	93 4 14 12 55 17	6 7 26 17	-20.0	306.9	0.0	-90.0	-20.0	306.8			48.8
UARS	HALOE	93 4 14 9 38 2	579 10 27 0	-21.1	284.6	-55.9	-22.9	-18.7	308.8	253	3 17	43.9
ATLAS	SSBUV	93 4 14 14 25 41	6 8 56 41	-20.1	284.1	0.0	-90.0	-20.1	283.9			49.0
UARS	HALOE	93 4 14 11 14 22	579 12 3 20	-21.5	260.5	-55.6	-22.9	-19.2	284.8	135	3 11	44.3
ATLAS	SSBUV	93 4 14 15 55 50	6 10 26 50	-19.4	260.6	0.0	-90.0	-19.4	260.5			49.4
UARS	HALOE	93 4 14 12 50 42	579 13 39 40	-22.0	236.5	-55.3	-22.9	-19.7	260.8	51	3 5	44.7

Table 6. Concluded

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	SSBUV	93	4	14	17	26	14	6	11	57	14	-19.5	237.8	0.0	-90.0	-19.5	237.6				49.7
UARS	HALOE	93	4	14	14	27	2	579	15	15	59	-22.4	212.4	-55.1	-22.9	-20.1	236.9	110	2	59	45.2
ATLAS	SSBUV	93	4	14	18	56	38	6	13	27	38	-19.6	214.9	0.0	-90.0	-19.6	214.7				49.9
UARS	HALOE	93	4	14	16	3	22	579	16	52	19	-22.9	188.3	-54.8	-22.9	-20.6	212.9	228	2	53	45.6
ATLAS	SSBUV	93	4	14	20	27	2	6	14	58	2	-19.7	192.0	0.0	-90.0	-19.7	191.9				50.2
UARS	HALOE	93	4	14	17	39	42	579	18	28	39	-23.3	164.3	-54.5	-22.9	-21.1	188.9	348	2	47	45.9
ATLAS	SSBUV	93	4	15	2	28	23	6	20	59	23	-19.3	100.0	0.0	-90.0	-19.3	99.8				51.4
UARS	HALOE	93	4	15	0	5	1	580	0	53	57	-25.0	68.0	-53.3	-22.9	-22.8	92.9	818	2	23	47.4
ATLAS	SSBUV	93	4	15	3	58	32	6	22	29	32	-18.5	76.6	0.0	-90.0	-18.5	76.4				51.8
UARS	HALOE	93	4	15	1	41	20	580	2	30	17	-25.4	43.9	-53.0	-22.9	-23.2	68.9	935	2	17	47.8
ATLAS	SSBUV	93	4	16	23	43	37	8	18	14	37	-32.6	142.0	0.0	-90.0	-32.6	141.8				58.9
UARS	HALOE	93	4	16	21	1	39	581	21	50	37	-34.9	113.8	-45.1	-22.9	-33.0	141.4	65	2	41	54.7
ATLAS	SSBUV	93	4	17	1	14	1	8	19	45	1	-32.7	119.2	0.0	-90.0	-32.7	119.0				59.1
UARS	HALOE	93	4	16	22	37	56	581	23	26	51	-35.2	89.7	-44.8	-22.9	-33.3	117.4	165	2	36	54.9

Table 7. Correlative measurements between ATLAS MAS and UARS HALOE.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	8	19	21	25	0	13	52	25	57.0	139.7	90.0	-16.2	40.8	139.4				94.6
UARS	HALOE	93	4	8	20	16	33	573	21	5	26	34.0	112.2	-75.9	-22.9	41.5	139.7	78	0	55	67.7
ATLAS	MAS	93	4	8	20	51	35	0	15	22	35	57.0	115.2	90.0	-16.2	40.8	115.4				95.6
UARS	HALOE	93	4	8	21	52	59	573	22	41	57	33.3	88.5	-75.8	-22.9	40.6	115.7	33	1	1	67.0
ATLAS	MAS	93	4	8	22	21	45	0	16	52	45	57.0	90.7	90.0	-16.2	40.8	91.4				96.5
UARS	HALOE	93	4	8	23	29	26	574	0	18	22	32.6	64.7	-75.7	-22.9	39.8	91.8	115	1	7	66.2
ATLAS	MAS	93	4	9	1	27	22	0	19	58	22	52.9	76.7	90.0	-16.2	37.9	68.0				79.1
UARS	HALOE	93	4	9	1	5	52	574	1	54	47	31.9	41.0	-75.5	-22.9	39.0	67.9	117	0	21	65.4
ATLAS	MAS	93	4	9	2	57	33	0	21	28	33	53.3	52.5	90.0	-16.2	38.2	44.0				80.1
UARS	HALOE	93	4	9	2	42	18	574	3	31	17	31.2	17.3	-75.4	-22.9	38.1	43.9	14	0	15	64.6
ATLAS	MAS	93	4	9	4	27	43	0	22	58	43	53.6	28.2	90.0	-16.2	38.4	20.1				81.1
UARS	HALOE	93	4	9	4	18	45	574	5	7	42	30.4	353.5	-75.2	-22.9	37.2	19.9	132	0	8	63.7
ATLAS	MAS	93	4	9	19	35	27	1	14	6	27	45.7	178.0	90.0	-16.2	32.3	166.1				69.5
UARS	HALOE	93	4	9	18	46	45	574	19	35	42	23.6	139.5	-73.7	-22.9	29.4	164.3	368	0	48	54.9
ATLAS	MAS	93	4	9	21	5	53	1	15	36	53	45.6	155.2	90.0	-16.2	32.3	143.2				69.6
UARS	HALOE	93	4	9	20	23	12	574	21	12	7	22.8	115.7	-73.5	-22.9	28.5	140.3	502	0	42	53.7
ATLAS	MAS	93	4	9	22	36	3	1	17	7	3	46.1	131.3	90.0	-16.2	32.7	119.5				70.6
UARS	HALOE	93	4	9	21	59	38	574	22	48	32	22.0	91.9	-73.3	-22.9	27.7	116.3	638	0	36	52.6
ATLAS	MAS	93	4	10	1	41	10	1	20	12	10	34.1	100.7	90.0	-16.2	22.8	87.5				56.3
UARS	HALOE	93	4	9	23	36	5	575	0	25	2	21.2	68.0	-73.1	-22.9	26.8	92.4	663	2	5	51.4
ATLAS	MAS	93	4	10	3	11	35	1	21	42	35	34.1	77.8	90.0	-16.2	22.7	64.6				56.5
UARS	HALOE	93	4	10	1	12	32	575	2	1	27	20.4	44.2	-72.9	-22.9	25.9	68.4	522	1	59	50.2
ATLAS	MAS	93	4	10	4	42	0	1	23	13	0	34.0	55.0	90.0	-16.2	22.6	41.8				56.7
UARS	HALOE	93	4	10	2	48	58	575	3	37	52	19.7	20.3	-72.7	-22.9	25.0	44.4	380	1	53	49.0
ATLAS	MAS	93	4	10	6	12	26	2	0	43	26	33.9	32.1	90.0	-16.2	22.5	18.9				56.8
UARS	HALOE	93	4	10	4	25	25	575	5	14	23	18.9	356.5	-72.5	-22.9	24.2	20.4	239	1	47	47.8
ATLAS	MAS	93	4	10	10	43	27	2	5	14	27	34.3	322.8	90.0	-16.2	22.9	309.6				58.1
UARS	HALOE	93	4	10	9	14	44	575	10	3	37	16.5	284.8	-71.8	-22.9	21.6	308.5	191	1	28	43.9
ATLAS	MAS	93	4	10	12	13	52	2	6	44	52	34.2	299.9	90.0	-16.2	22.9	286.8				58.3
UARS	HALOE	93	4	10	10	51	10	575	11	40	8	15.8	260.9	-71.6	-22.9	20.7	284.5	332	1	22	42.7
ATLAS	MAS	93	4	10	13	44	17	2	8	15	17	34.1	277.1	90.0	-16.2	22.8	263.9				58.5
UARS	HALOE	93	4	10	12	27	36	575	13	16	33	15.0	237.1	-71.4	-22.9	19.9	260.5	476	1	16	41.4
ATLAS	MAS	93	4	10	15	14	28	2	9	45	28	34.8	253.5	90.0	-16.2	23.3	240.3				59.4
UARS	HALOE	93	4	10	14	4	3	575	14	52	58	14.2	213.2	-71.1	-22.9	19.0	236.5	620	1	10	40.1
ATLAS	MAS	93	4	10	16	44	53	2	11	15	53	34.7	230.6	90.0	-16.2	23.3	217.5				59.6
UARS	HALOE	93	4	10	15	40	29	575	16	29	23	13.5	189.2	-70.9	-22.9	18.2	212.5	762	1	4	38.8
ATLAS	MAS	93	4	10	18	15	18	2	12	46	18	34.6	207.8	90.0	-16.2	23.2	194.6				59.8
UARS	HALOE	93	4	10	17	16	54	575	18	5	53	12.7	165.3	-70.7	-22.9	17.4	188.5	905	0	58	37.5
ATLAS	MAS	93	4	10	22	50	20	2	17	21	20	22.6	148.9	90.0	-16.2	12.5	135.5				49.0
UARS	HALOE	93	4	10	20	29	46	575	21	18	43	11.2	117.5	-70.2	-22.9	15.7	140.6	647	2	20	35.0
ATLAS	MAS	93	4	11	0	20	46	2	18	51	46	22.5	126.0	90.0	-16.2	12.4	112.7				49.2
UARS	HALOE	93	4	10	22	6	12	575	22	55	8	10.4	93.6	-70.0	-22.9	14.9	116.6	502	2	14	33.8

Table 7. Continued

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	11	1	51	11	2	20	22	11	22.4	103.1	90.0	-16.2	12.3	89.8				49.4
UARS	HALOE	93	4	10	23	42	38	576	0	31	33	9.7	69.6	-69.7	-22.9	14.1	92.6	358	2	8	32.7
ATLAS	MAS	93	4	11	3	21	36	2	21	52	36	22.3	80.3	90.0	-16.2	12.2	66.9				49.6
UARS	HALOE	93	4	11	1	19	3	576	2	7	58	8.9	45.7	-69.5	-22.9	13.3	68.6	214	2	2	31.5
ATLAS	MAS	93	4	11	4	52	2	2	23	23	2	22.2	57.4	90.0	-16.2	12.1	44.0				49.9
UARS	HALOE	93	4	11	2	55	29	576	3	44	23	8.2	21.7	-69.2	-22.9	12.4	44.6	69	1	56	30.5
ATLAS	MAS	93	4	11	9	23	18	3	3	54	18	21.9	348.7	90.0	-16.2	11.9	335.4				50.5
UARS	HALOE	93	4	11	7	44	44	576	8	33	37	6.0	309.9	-68.5	-22.9	10.1	332.6	363	1	38	27.7
ATLAS	MAS	93	4	12	0	30	47	3	19	1	47	10.1	126.8	90.0	-16.2	1.0	113.3				45.1
UARS	HALOE	93	4	11	22	12	25	576	23	1	22	-0.3	94.0	-66.2	-22.9	3.3	116.6	451	2	18	24.5
ATLAS	MAS	93	4	12	2	1	12	3	20	32	12	10.0	103.9	90.0	-16.2	0.9	90.4				45.4
UARS	HALOE	93	4	11	23	48	49	577	0	37	47	-1.0	70.0	-65.9	-22.9	2.6	92.6	311	2	12	24.6
ATLAS	MAS	93	4	12	3	31	38	3	22	2	38	9.9	81.0	90.0	-16.2	0.8	67.6				45.7
UARS	HALOE	93	4	12	1	25	13	577	2	14	7	-1.6	46.0	-65.7	-22.9	1.9	68.6	174	2	6	24.8
ATLAS	MAS	93	4	12	5	2	3	3	23	33	3	9.8	58.1	90.0	-16.2	0.7	44.7				46.0
UARS	HALOE	93	4	12	3	1	37	577	3	50	32	-2.3	22.0	-65.4	-22.9	1.2	44.7	55	2	0	25.1
ATLAS	MAS	93	4	12	6	32	13	4	1	3	13	10.5	34.7	90.0	-16.2	1.4	21.3				46.8
UARS	HALOE	93	4	12	4	38	1	577	5	26	57	-2.9	358.0	-65.1	-22.9	0.5	20.7	120	1	54	25.5
ATLAS	MAS	93	4	12	8	2	39	4	2	33	39	10.4	11.8	90.0	-16.2	1.3	358.4				47.0
UARS	HALOE	93	4	12	6	14	24	577	7	3	22	-3.6	334.0	-64.9	-22.9	-0.2	356.7	253	1	48	25.9
ATLAS	MAS	93	4	12	14	4	20	4	8	35	20	10.0	280.3	90.0	-16.2	0.9	266.8				48.1
UARS	HALOE	93	4	12	12	39	57	577	13	28	51	-6.1	237.9	-63.8	-22.9	-2.9	260.7	804	1	24	28.0
ATLAS	MAS	93	4	12	15	34	45	4	10	5	45	9.9	257.4	90.0	-16.2	0.8	244.0				48.4
UARS	HALOE	93	4	12	14	16	20	577	15	5	16	-6.7	213.9	-63.5	-22.9	-3.6	236.7	941	1	18	28.6
ATLAS	MAS	93	4	12	20	9	2	4	14	40	2	-0.5	194.6	90.0	-16.2	-9.2	180.9				44.2
UARS	HALOE	93	4	12	17	29	6	577	18	18	1	-7.9	165.9	-63.0	-22.9	-4.9	188.7	990	2	39	29.8
ATLAS	MAS	93	4	12	21	39	27	4	16	10	27	-0.6	171.7	90.0	-16.2	-9.3	158.0				44.5
UARS	HALOE	93	4	12	19	5	29	577	19	54	26	-8.5	141.8	-62.7	-22.9	-5.5	164.7	854	2	33	30.5
ATLAS	MAS	93	4	12	23	9	53	4	17	40	53	-0.7	148.8	90.0	-16.2	-9.4	135.1				44.8
UARS	HALOE	93	4	12	20	41	51	577	21	30	45	-9.1	117.8	-62.4	-22.9	-6.1	140.7	719	2	28	31.1
ATLAS	MAS	93	4	13	2	10	43	4	20	41	43	-0.9	103.0	90.0	-16.2	-9.6	89.3				45.4
UARS	HALOE	93	4	12	23	54	36	578	0	43	30	-10.3	69.7	-61.9	-22.9	-7.4	92.7	452	2	16	32.4
ATLAS	MAS	93	4	14	1	50	21	5	20	21	21	54.1	346.1	-81.0	-16.2	69.6	335.9				115.5
UARS	HALOE	93	4	13	23	32	19	579	0	21	16	56.0	348.8	-122.3	-22.9	75.6	317.1	904	2	18	97.1
ATLAS	MAS	93	4	14	3	20	30	5	21	51	30	53.8	321.8	-81.0	-16.2	69.2	310.9				116.0
UARS	HALOE	93	4	14	1	8	33	579	1	57	30	56.0	324.7	-122.5	-22.9	75.6	293.0	924	2	11	97.2
ATLAS	MAS	93	4	14	4	50	54	5	23	21	54	53.9	299.0	-81.0	-16.2	69.3	288.3				116.0
UARS	HALOE	93	4	14	2	44	47	579	3	33	45	56.0	300.6	-122.8	-22.9	75.5	268.9	946	2	6	97.2
ATLAS	MAS	93	4	14	6	21	3	6	0	52	3	53.5	274.8	-81.0	-16.2	68.8	263.4				116.5
UARS	HALOE	93	4	14	4	21	0	579	5	9	59	55.9	276.4	-123.1	-22.9	75.5	244.8	969	2	0	97.2
ATLAS	MAS	93	4	14	9	23	6	6	3	54	6	55.3	237.1	-81.0	-16.2	71.2	230.2				113.5
UARS	HALOE	93	4	14	5	57	14	579	6	46	8	55.9	252.3	-123.4	-22.9	75.4	220.7	556	3	25	97.3

Table 7. Concluded

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	14	12	23	39	6	6	54	39	55.1	190.0	-81.0	-16.2	70.9	182.3				114.0
UARS	HALOE	93	4	14	9	9	42	579	9	58	37	55.8	204.1	-124.0	-22.9	75.3	172.4	582	3	13	97.4
ATLAS	MAS	93	4	14	15	24	12	6	9	55	12	54.9	142.9	-81.0	-16.2	70.6	134.5				114.5
UARS	HALOE	93	4	14	12	22	9	579	13	11	6	55.8	155.8	-124.5	-22.9	75.2	124.2	610	3	2	97.4
ATLAS	MAS	93	4	14	16	54	21	6	11	25	21	54.6	118.6	-81.0	-16.2	70.2	109.4				115.0
UARS	HALOE	93	4	14	13	58	23	579	14	47	20	55.7	131.7	-124.8	-22.9	75.2	100.1	627	2	55	97.5
ATLAS	MAS	93	4	14	18	24	45	6	12	55	45	54.6	95.8	-81.0	-16.2	70.3	86.8				115.0
UARS	HALOE	93	4	14	15	34	36	579	16	23	35	55.7	107.6	-125.1	-22.9	75.1	76.0	642	2	50	97.5
ATLAS	MAS	93	4	14	19	55	9	6	14	26	9	54.7	73.1	-81.0	-16.2	70.4	64.1				114.9
UARS	HALOE	93	4	14	17	10	50	579	17	59	44	55.6	83.5	-125.4	-22.9	75.1	51.9	660	2	44	97.6
ATLAS	MAS	93	4	15	1	56	14	6	20	27	14	54.1	339.0	-81.0	-16.2	69.7	328.8				115.8
UARS	HALOE	93	4	14	23	35	44	580	0	24	41	55.5	346.9	-126.6	-22.9	74.8	315.3	732	2	20	97.8
ATLAS	MAS	93	4	15	3	26	38	6	21	57	38	54.2	316.2	-81.0	-16.2	69.7	306.1				115.7
UARS	HALOE	93	4	15	1	11	58	580	2	0	56	55.4	322.8	-126.9	-22.9	74.8	291.2	754	2	14	97.8
ATLAS	MAS	93	4	15	4	56	47	6	23	27	47	53.9	292.0	-81.0	-16.2	69.3	281.2				116.2
UARS	HALOE	93	4	15	2	48	12	580	3	37	10	55.4	298.6	-127.1	-22.9	74.7	267.1	773	2	8	97.9
ATLAS	MAS	93	4	15	6	27	11	7	0	58	11	53.9	269.2	-81.0	-16.2	69.3	258.5				116.1
UARS	HALOE	93	4	15	4	24	25	580	5	13	19	55.3	274.5	-127.4	-22.9	74.7	242.9	794	2	2	97.9

Table 8. Correlative measurements between ATLAS MAS and UARS MLS.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	8	13	58	11	0	8	29	11	-48.3	357.7	-50.0	-16.2	-42.0	18.9	164	2	18	60.4
UARS	MLS	93	4	8	16	17	10	573	17	6	7	-30.5	356.3	90.0	-22.9	-42.9	20.6				68.9
ATLAS	MAS	93	4	8	14	2	42	0	8	33	42	-55.9	23.3	-50.0	-16.2	-44.6	41.8	163	0	37	77.0
UARS	MLS	93	4	8	14	40	9	573	15	29	5	-32.9	18.6	90.0	-22.9	-45.5	43.5				68.3
ATLAS	MAS	93	4	8	14	8	28	0	8	39	28	-54.5	62.7	-50.0	-16.2	-39.0	69.7	137	1	2	98.5
UARS	MLS	93	4	8	13	5	48	573	13	54	41	-27.6	47.5	90.0	-22.9	-39.7	71.0				70.5
ATLAS	MAS	93	4	8	14	31	20	0	9	2	20	12.5	130.7	-50.0	-16.2	28.0	125.7	191	0	59	156.9
UARS	MLS	93	4	8	13	32	15	573	14	21	9	49.7	110.7	90.0	-22.9	29.4	124.6				110.0
ATLAS	MAS	93	4	8	14	31	20	0	9	2	20	12.5	130.7	-50.0	-16.2	28.0	125.7	106	2	26	156.9
UARS	MLS	93	4	8	16	58	20	573	17	47	15	48.5	141.2	90.0	-22.9	28.6	126.6				116.1
ATLAS	MAS	93	4	8	15	28	21	0	9	59	21	-47.8	333.7	-50.0	-16.2	-41.7	355.0	144	2	25	59.5
UARS	MLS	93	4	8	17	53	39	573	18	42	37	-29.7	332.7	90.0	-22.9	-41.9	356.7				69.0
ATLAS	MAS	93	4	8	15	32	52	0	10	3	52	-55.7	358.9	-50.0	-16.2	-44.7	17.7	140	0	43	76.1
UARS	MLS	93	4	8	16	16	22	573	17	5	19	-32.9	354.3	90.0	-22.9	-45.4	19.2				68.1
ATLAS	MAS	93	4	8	15	38	24	0	10	9	24	-55.1	36.8	-50.0	-16.2	-39.8	44.7	147	0	56	96.6
UARS	MLS	93	4	8	14	41	45	573	15	30	40	-28.3	22.6	90.0	-22.9	-40.4	46.2				70.0
ATLAS	MAS	93	4	8	16	1	30	0	10	32	30	11.8	107.3	-50.0	-16.2	27.2	102.3	127	2	33	157.1
UARS	MLS	93	4	8	18	34	49	573	19	23	45	47.8	118.1	90.0	-22.9	28.1	103.2				116.1
ATLAS	MAS	93	4	8	16	3	1	0	10	34	1	16.7	110.4	-50.0	-16.2	32.3	105.4	106	0	52	154.2
UARS	MLS	93	4	8	15	10	5	573	15	59	3	52.7	94.5	90.0	-22.9	31.4	105.9				111.6
ATLAS	MAS	93	4	8	16	3	1	0	10	34	1	16.7	110.4	-50.0	-16.2	32.3	105.4	185	0	49	154.2
UARS	MLS	93	4	8	16	52	27	573	17	41	22	56.7	108.6	90.0	-22.9	33.9	105.2				115.9
ATLAS	MAS	93	4	8	16	58	31	0	11	29	31	-47.3	309.8	-50.0	-16.2	-41.4	331.0	121	2	31	58.6
UARS	MLS	93	4	8	19	29	52	573	20	18	46	-29.6	308.4	90.0	-22.9	-41.8	332.4				68.8
ATLAS	MAS	93	4	8	17	3	3	0	11	34	3	-55.5	334.6	-50.0	-16.2	-44.7	353.6	119	0	49	75.1
UARS	MLS	93	4	8	17	52	35	573	18	41	29	-32.8	330.0	90.0	-22.9	-45.3	354.8				67.9
ATLAS	MAS	93	4	8	17	8	19	0	11	39	19	-55.6	10.8	-50.0	-16.2	-40.5	19.7	164	0	50	94.7
UARS	MLS	93	4	8	16	17	42	573	17	6	39	-29.0	357.6	90.0	-22.9	-41.2	21.5				69.5
ATLAS	MAS	93	4	8	17	31	41	0	12	2	41	11.0	84.0	-50.0	-16.2	26.5	78.9	149	2	39	157.2
UARS	MLS	93	4	8	20	11	18	573	21	0	15	47.2	95.0	90.0	-22.9	27.6	79.8				116.1
ATLAS	MAS	93	4	8	17	33	11	0	12	4	11	16.0	87.0	-50.0	-16.2	31.5	82.0	34	0	46	154.6
UARS	MLS	93	4	8	16	46	18	573	17	35	12	52.8	70.3	90.0	-22.9	31.4	81.7				111.5
ATLAS	MAS	93	4	8	18	28	42	0	12	59	42	-46.7	285.8	-50.0	-16.2	-41.1	307.0	106	2	37	57.8
UARS	MLS	93	4	8	21	6	6	573	21	55	1	-29.5	284.1	90.0	-22.9	-41.7	308.0				68.5
ATLAS	MAS	93	4	8	18	33	13	0	13	4	13	-55.2	310.2	-50.0	-16.2	-44.6	329.5	99	0	55	74.2
UARS	MLS	93	4	8	19	28	48	573	20	17	43	-32.7	305.7	90.0	-22.9	-45.2	330.5				67.7
ATLAS	MAS	93	4	8	20	2	6	0	14	33	6	-53.1	278.4	90.0	-16.2	-66.9	261.0	84	2	31	68.8
UARS	MLS	93	4	8	22	34	2	573	23	22	59	-50.4	231.5	90.0	-22.9	-67.2	262.8				63.3
ATLAS	MAS	93	4	8	20	4	7	0	14	35	7	-55.8	290.9	90.0	-16.2	-71.1	278.7	52	0	52	76.1
UARS	MLS	93	4	8	20	56	28	573	21	45	26	-52.9	248.9	90.0	-22.9	-71.2	280.1				63.3
ATLAS	MAS	93	4	8	20	5	37	0	14	36	37	-56.8	301.2	90.0	-16.2	-72.9	296.1	102	0	46	81.7
UARS	MLS	93	4	8	19	19	27	573	20	8	24	-54.1	268.7	90.0	-22.9	-73.4	298.8				63.4

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	8	20	7	38	0	14	38	38	-56.7	315.3	90.0	-16.2	-72.7	321.8	93	2	24	89.1
UARS	MLS	93	4	8	17	43	14	573	18	32	10	-54.2	292.9	90.0	-22.9	-73.5	322.9				63.5
ATLAS	MAS	93	4	8	20	33	45	0	15	4	45	15.5	40.8	90.0	-16.2	6.0	54.2	160	2	59	154.5
UARS	MLS	93	4	8	23	33	6	574	0	22	3	21.4	73.6	90.0	-22.9	7.1	55.1				108.7
ATLAS	MAS	93	4	8	20	38	47	0	15	9	47	31.5	52.7	90.0	-16.2	20.5	65.9	59	1	12	141.0
UARS	MLS	93	4	8	21	51	16	573	22	40	11	37.7	84.0	90.0	-22.9	20.6	66.5				114.2
ATLAS	MAS	93	4	8	20	42	2	0	15	13	2	41.1	62.8	90.0	-16.2	28.6	75.5	100	0	31	130.1
UARS	MLS	93	4	8	20	10	14	573	20	59	12	49.5	90.3	90.0	-22.9	29.2	76.3				116.5
ATLAS	MAS	93	4	8	20	44	3	0	15	15	3	46.3	70.7	90.0	-16.2	32.9	82.5	108	2	14	123.0
UARS	MLS	93	4	8	18	29	12	573	19	18	8	56.4	87.8	90.0	-22.9	33.7	83.0				116.1
ATLAS	MAS	93	4	8	21	32	17	0	16	3	17	-52.7	254.2	90.0	-16.2	-66.4	236.5	123	2	37	67.9
UARS	MLS	93	4	9	0	10	15	574	0	59	9	-50.4	207.2	90.0	-22.9	-67.1	238.6				63.2
ATLAS	MAS	93	4	8	21	34	17	0	16	5	17	-55.6	266.5	90.0	-16.2	-70.8	253.5	96	0	58	75.2
UARS	MLS	93	4	8	22	32	42	573	23	21	35	-52.8	224.7	90.0	-22.9	-71.1	255.9				63.3
ATLAS	MAS	93	4	8	21	36	3	0	16	7	3	-56.8	278.5	90.0	-16.2	-72.9	273.6	56	0	40	81.6
UARS	MLS	93	4	8	20	55	40	573	21	44	38	-54.1	244.5	90.0	-22.9	-73.3	274.7				63.4
ATLAS	MAS	93	4	8	21	37	33	0	16	8	33	-56.9	289.1	90.0	-16.2	-73.0	293.0	165	2	18	87.2
UARS	MLS	93	4	8	19	19	11	573	20	8	8	-54.5	267.2	90.0	-22.9	-74.1	296.7				63.4
ATLAS	MAS	93	4	8	22	3	55	0	16	34	55	14.7	17.4	90.0	-16.2	5.3	30.8	120	3	5	154.8
UARS	MLS	93	4	9	1	9	51	574	1	58	49	19.6	50.4	90.0	-22.9	5.6	31.8				108.3
ATLAS	MAS	93	4	8	22	8	42	0	16	39	42	30.1	28.4	90.0	-16.2	19.2	41.7	147	1	19	142.5
UARS	MLS	93	4	8	23	27	45	574	0	16	41	36.9	60.5	90.0	-22.9	20.0	42.9				114.2
ATLAS	MAS	93	4	8	22	12	13	0	16	43	13	40.5	39.1	90.0	-16.2	28.1	51.9	120	0	25	130.9
UARS	MLS	93	4	8	21	46	27	573	22	35	21	49.4	66.1	90.0	-22.9	29.2	52.0				116.6
ATLAS	MAS	93	4	8	22	14	13	0	16	45	13	45.8	46.8	90.0	-16.2	32.4	58.7	142	2	8	123.9
UARS	MLS	93	4	8	20	5	25	573	20	54	22	56.3	63.7	90.0	-22.9	33.7	58.7				116.1
ATLAS	MAS	93	4	8	23	2	42	0	17	33	42	-52.8	231.5	90.0	-16.2	-66.5	213.8	69	2	43	67.9
UARS	MLS	93	4	9	1	46	28	574	2	35	23	-50.3	183.0	90.0	-22.9	-67.0	214.3				63.1
ATLAS	MAS	93	4	8	23	4	27	0	17	35	27	-55.3	242.2	90.0	-16.2	-70.4	228.3	142	1	4	74.3
UARS	MLS	93	4	9	0	8	55	574	0	57	49	-52.8	200.5	90.0	-22.9	-71.0	231.7				63.2
ATLAS	MAS	93	4	8	23	6	13	0	17	37	13	-56.8	254.0	90.0	-16.2	-72.8	247.9	100	0	34	80.7
UARS	MLS	93	4	8	22	31	53	573	23	20	48	-54.0	220.3	90.0	-22.9	-73.2	250.5				63.3
ATLAS	MAS	93	4	8	23	7	58	0	17	38	58	-56.9	266.4	90.0	-16.2	-73.0	270.4	129	2	12	87.1
UARS	MLS	93	4	8	20	55	24	573	21	44	23	-54.4	243.0	90.0	-22.9	-74.0	272.5				63.4
ATLAS	MAS	93	4	8	23	33	51	0	18	4	51	13.2	353.5	90.0	-16.2	3.9	6.9	165	3	12	155.4
UARS	MLS	93	4	9	2	46	20	574	3	35	14	18.7	26.7	90.0	-22.9	4.8	8.0				108.2
ATLAS	MAS	93	4	8	23	38	52	0	18	9	52	29.4	4.9	90.0	-16.2	18.6	18.2	136	1	25	143.1
UARS	MLS	93	4	9	1	4	14	574	1	53	12	36.1	37.0	90.0	-22.9	19.3	19.3				114.2
ATLAS	MAS	93	4	8	23	42	23	0	18	13	23	39.8	15.4	90.0	-16.2	27.6	28.2	134	0	19	131.7
UARS	MLS	93	4	8	23	22	56	574	0	11	51	48.8	43.1	90.0	-22.9	28.8	28.6				116.6
ATLAS	MAS	93	4	8	23	44	39	0	18	15	39	45.8	24.0	90.0	-16.2	32.5	35.9	121	2	2	123.8
UARS	MLS	93	4	8	21	42	11	573	22	31	8	55.9	42.9	90.0	-22.9	33.4	36.5				116.3

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	9	0	32	52	0	19	3	52	-52.4	207.3	90.0	-16.2	-65.9	189.4	88	2	50	67.0
UARS	MLS	93	4	9	3	22	57	574	4	11	53	-49.7	160.0	90.0	-22.9	-66.2	191.2				63.1
ATLAS	MAS	93	4	9	0	34	53	0	19	5	53	-55.4	219.4	90.0	-16.2	-70.4	205.7	85	1	10	74.2
UARS	MLS	93	4	9	1	45	8	574	2	34	4	-52.7	176.3	90.0	-22.9	-70.9	207.5				63.1
ATLAS	MAS	93	4	9	0	36	38	0	19	7	38	-56.8	231.3	90.0	-16.2	-72.8	225.3	52	0	28	80.7
UARS	MLS	93	4	9	0	8	7	574	0	57	2	-54.0	196.1	90.0	-22.9	-73.2	226.4				63.3
ATLAS	MAS	93	4	9	0	38	9	0	19	9	9	-57.0	241.9	90.0	-16.2	-73.1	244.7	149	2	6	86.2
UARS	MLS	93	4	8	22	31	37	573	23	20	32	-54.4	218.8	90.0	-22.9	-73.9	248.4				63.4
ATLAS	MAS	93	4	9	1	4	1	0	19	35	1	12.5	330.1	90.0	-16.2	3.2	343.5	122	3	18	155.5
UARS	MLS	93	4	9	4	22	50	574	5	11	44	17.8	2.9	90.0	-22.9	4.0	344.2				108.1
ATLAS	MAS	93	4	9	1	9	2	0	19	40	2	28.7	341.4	90.0	-16.2	18.0	354.7	124	1	31	143.7
UARS	MLS	93	4	9	2	40	44	574	3	29	42	35.3	13.4	90.0	-22.9	18.7	355.6				114.1
ATLAS	MAS	93	4	9	1	12	33	0	19	43	33	39.2	351.7	90.0	-16.2	27.1	4.6	151	0	13	132.5
UARS	MLS	93	4	9	0	59	26	574	1	48	22	48.1	20.0	90.0	-22.9	28.3	5.2				116.6
ATLAS	MAS	93	4	9	1	14	49	0	19	45	49	45.3	0.1	90.0	-16.2	32.0	12.1	152	1	56	124.7
UARS	MLS	93	4	8	23	18	24	574	0	7	17	55.9	18.7	90.0	-22.9	33.4	12.3				116.3
ATLAS	MAS	93	4	9	2	3	2	0	20	34	2	-52.0	183.1	90.0	-16.2	-65.3	165.0	122	2	56	66.1
UARS	MLS	93	4	9	4	59	11	574	5	48	8	-49.7	135.8	90.0	-22.9	-66.1	167.0				63.0
ATLAS	MAS	93	4	9	2	5	3	0	20	36	3	-55.1	195.0	90.0	-16.2	-70.0	180.6	134	1	16	73.3
UARS	MLS	93	4	9	3	21	21	574	4	10	18	-52.7	152.1	90.0	-22.9	-70.8	183.4				63.1
ATLAS	MAS	93	4	9	2	6	48	0	20	37	48	-56.7	206.8	90.0	-16.2	-72.6	199.7	98	0	22	79.7
UARS	MLS	93	4	9	1	44	20	574	2	33	16	-53.9	171.9	90.0	-22.9	-73.1	202.2				63.2
ATLAS	MAS	93	4	9	2	8	19	0	20	39	19	-57.0	217.4	90.0	-16.2	-73.2	218.9	179	2	0	85.2
UARS	MLS	93	4	9	0	7	35	574	0	56	30	-54.7	193.0	90.0	-22.9	-74.5	222.1				63.4
ATLAS	MAS	93	4	9	2	33	56	0	21	4	56	10.9	306.2	90.0	-16.2	1.7	319.6	164	3	25	155.8
UARS	MLS	93	4	9	5	59	35	574	6	48	30	16.1	339.6	90.0	-22.9	2.5	320.9				107.7
ATLAS	MAS	93	4	9	2	39	13	0	21	10	13	28.0	317.9	90.0	-16.2	17.4	331.2	110	1	38	144.3
UARS	MLS	93	4	9	4	17	13	574	5	6	7	34.4	349.9	90.0	-22.9	18.0	332.0				114.1
ATLAS	MAS	93	4	9	2	42	44	0	21	13	44	38.6	328.0	90.0	-16.2	26.6	340.9	167	0	6	133.2
UARS	MLS	93	4	9	2	35	55	574	3	24	52	47.5	356.9	90.0	-22.9	27.9	341.8				116.7
ATLAS	MAS	93	4	9	2	45	14	0	21	16	14	45.4	337.3	90.0	-16.2	32.1	349.3	127	1	50	124.6
UARS	MLS	93	4	9	0	55	9	574	1	44	3	55.3	357.8	90.0	-22.9	33.1	350.0				116.5
ATLAS	MAS	93	4	9	3	33	28	0	22	4	28	-52.1	160.3	90.0	-16.2	-65.4	142.2	65	3	1	66.1
UARS	MLS	93	4	9	6	35	24	574	7	24	22	-49.6	111.6	90.0	-22.9	-66.0	142.7				62.9
ATLAS	MAS	93	4	9	3	35	13	0	22	6	13	-54.8	170.7	90.0	-16.2	-69.6	155.7	182	1	22	72.4
UARS	MLS	93	4	9	4	57	34	574	5	46	33	-52.6	127.9	90.0	-22.9	-70.7	159.2				63.0
ATLAS	MAS	93	4	9	3	36	59	0	22	7	59	-56.5	182.3	90.0	-16.2	-72.4	174.1	148	0	16	78.8
UARS	MLS	93	4	9	3	20	33	574	4	9	31	-53.9	147.7	90.0	-22.9	-73.0	178.1				63.2
ATLAS	MAS	93	4	9	3	38	44	0	22	9	44	-57.0	194.7	90.0	-16.2	-73.2	196.3	138	1	54	85.2
UARS	MLS	93	4	9	1	44	4	574	2	33	1	-54.3	170.4	90.0	-22.9	-73.8	200.2				63.3
ATLAS	MAS	93	4	9	4	9	23	0	22	40	23	27.3	294.4	90.0	-16.2	16.8	307.7	93	1	44	144.9
UARS	MLS	93	4	9	5	53	42	574	6	42	37	33.6	326.3	90.0	-22.9	17.3	308.4				114.1

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	9	4	13	9	0	22	44	9	38.7	305.2	90.0	-16.2	26.6	318.1	87	0	0	133.1
UARS	MLS	93	4	9	4	12	24	574	5	1	22	46.8	333.7	90.0	-22.9	27.4	318.4				116.7
ATLAS	MAS	93	4	9	4	15	9	0	22	46	9	44.2	312.4	90.0	-16.2	31.1	324.7	165	3	26	126.3
UARS	MLS	93	4	9	0	48	28	574	1	37	22	54.6	315.2	90.0	-22.9	32.6	324.3				112.0
ATLAS	MAS	93	4	9	4	16	40	0	22	47	40	47.9	318.9	90.0	-16.2	34.1	330.2	54	3	26	121.1
UARS	MLS	93	4	9	0	50	4	574	1	39	3	56.2	325.0	90.0	-22.9	33.6	330.4				113.5
ATLAS	MAS	93	4	9	5	3	38	0	23	34	38	-51.7	136.2	90.0	-16.2	-64.8	117.9	80	3	8	65.2
UARS	MLS	93	4	9	8	11	53	574	9	0	47	-49.0	88.6	90.0	-22.9	-65.1	119.5				62.8
ATLAS	MAS	93	4	9	5	5	39	0	23	36	39	-54.9	148.0	90.0	-16.2	-69.6	133.0	132	1	28	72.4
UARS	MLS	93	4	9	6	33	48	574	7	22	42	-52.6	103.7	90.0	-22.9	-70.6	135.0				62.9
ATLAS	MAS	93	4	9	5	7	9	0	23	38	9	-56.4	157.9	90.0	-16.2	-72.1	148.6	196	0	10	77.8
UARS	MLS	93	4	9	4	56	30	574	5	45	24	-54.2	122.0	90.0	-22.9	-73.6	151.9				63.2
ATLAS	MAS	93	4	9	5	8	55	0	23	39	55	-57.0	170.2	90.0	-16.2	-73.2	170.5	165	1	48	84.2
UARS	MLS	93	4	9	3	20	1	574	4	8	59	-54.6	144.7	90.0	-22.9	-74.4	173.9				63.3
ATLAS	MAS	93	4	9	18	38	11	1	13	9	11	-53.5	295.5	90.0	-16.2	-67.5	278.4	105	2	22	67.9
UARS	MLS	93	4	9	21	0	19	574	21	49	13	-51.1	248.4	90.0	-22.9	-68.3	279.9				62.2
ATLAS	MAS	93	4	9	18	39	57	1	13	10	57	-55.8	306.5	90.0	-16.2	-71.1	294.1	142	0	42	74.1
UARS	MLS	93	4	9	19	22	45	574	20	11	39	-53.4	265.7	90.0	-22.9	-72.1	296.5				62.7
ATLAS	MAS	93	4	9	18	41	27	1	13	12	27	-56.8	316.8	90.0	-16.2	-72.9	311.5	185	0	55	79.4
UARS	MLS	93	4	9	17	45	44	574	18	34	43	-54.6	285.4	90.0	-22.9	-74.3	314.6				63.1
ATLAS	MAS	93	4	9	18	43	28	1	13	14	28	-56.7	330.9	90.0	-16.2	-72.7	337.2	160	2	33	86.6
UARS	MLS	93	4	9	16	9	47	574	16	58	44	-54.3	311.1	90.0	-22.9	-73.7	340.9				63.0
ATLAS	MAS	93	4	9	18	44	58	1	13	15	58	-55.6	341.1	90.0	-16.2	-70.7	354.2	181	2	33	91.9
UARS	MLS	93	4	9	16	11	7	574	17	0	3	-52.2	318.4	90.0	-22.9	-70.1	349.8				62.6
ATLAS	MAS	93	4	9	19	10	20	1	13	41	20	17.9	58.1	90.0	-16.2	8.2	71.5	128	2	48	150.5
UARS	MLS	93	4	9	21	59	7	574	22	48	1	23.2	91.0	90.0	-22.9	8.7	72.5				113.3
ATLAS	MAS	93	4	9	19	15	7	1	13	46	7	33.0	69.7	90.0	-16.2	21.8	82.9	54	1	2	139.2
UARS	MLS	93	4	9	20	17	17	574	21	6	14	39.4	100.7	90.0	-22.9	21.9	83.4				117.3
ATLAS	MAS	93	4	9	19	18	7	1	13	49	7	41.7	79.4	90.0	-16.2	29.1	92.0	132	0	41	129.9
UARS	MLS	93	4	9	18	36	15	574	19	25	9	50.7	106.1	90.0	-22.9	30.1	92.8				117.7
ATLAS	MAS	93	4	9	19	19	53	1	13	50	53	46.2	86.3	90.0	-16.2	32.8	98.1	133	2	24	124.1
UARS	MLS	93	4	9	16	54	57	574	17	43	54	56.8	100.8	90.0	-22.9	34.0	98.2				115.2
ATLAS	MAS	93	4	9	20	8	22	1	14	39	22	-53.1	271.3	90.0	-16.2	-66.9	253.9	138	2	28	67.0
UARS	MLS	93	4	9	22	36	48	574	23	25	43	-50.5	225.5	90.0	-22.9	-67.4	256.9				62.1
ATLAS	MAS	93	4	9	20	10	7	1	14	41	7	-55.6	282.1	90.0	-16.2	-70.7	268.9	190	0	48	73.2
UARS	MLS	93	4	9	20	58	59	574	21	47	54	-53.4	241.5	90.0	-22.9	-72.0	272.4				62.7
ATLAS	MAS	93	4	9	20	11	52	1	14	42	52	-56.8	294.1	90.0	-16.2	-72.9	289.0	137	0	49	79.4
UARS	MLS	93	4	9	19	22	13	574	20	11	7	-54.2	262.7	90.0	-22.9	-73.5	292.7				62.9
ATLAS	MAS	93	4	9	20	13	38	1	14	44	38	-56.8	306.4	90.0	-16.2	-72.9	311.5	183	2	27	85.6
UARS	MLS	93	4	9	17	45	44	574	18	34	43	-54.6	285.4	90.0	-22.9	-74.3	314.6				63.1
ATLAS	MAS	93	4	9	20	40	31	1	15	11	31	17.1	34.7	90.0	-16.2	7.5	48.1	88	2	55	150.7
UARS	MLS	93	4	9	23	35	36	575	0	24	31	22.3	67.2	90.0	-22.9	7.9	48.7				113.3

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	9	20	45	2	1	15	16	2	31.5	45.5	90.0	-16.2	20.5	58.7	149	1	8	140.5
UARS	MLS	93	4	9	21	53	46	574	22	42	44	38.6	77.3	90.0	-22.9	21.3	59.9				117.3
ATLAS	MAS	93	4	9	20	48	18	1	15	19	18	41.1	55.6	90.0	-16.2	28.6	68.3	157	0	35	130.6
UARS	MLS	93	4	9	20	12	28	574	21	1	24	50.6	81.9	90.0	-22.9	30.0	68.5				117.8
ATLAS	MAS	93	4	9	20	50	18	1	15	21	18	46.3	63.5	90.0	-16.2	32.9	75.3	121	2	18	124.1
UARS	MLS	93	4	9	18	31	26	574	19	20	25	56.7	78.3	90.0	-22.9	33.9	75.0				115.4
ATLAS	MAS	93	4	9	21	38	32	1	16	9	32	-52.8	247.1	90.0	-16.2	-66.4	229.4	174	2	34	66.2
UARS	MLS	93	4	10	0	13	1	575	1	1	57	-50.5	201.3	90.0	-22.9	-67.3	232.6				62.0
ATLAS	MAS	93	4	9	21	40	32	1	16	11	32	-55.6	259.4	90.0	-16.2	-70.8	246.3	138	0	54	73.2
UARS	MLS	93	4	9	22	35	28	574	23	24	24	-52.9	218.7	90.0	-22.9	-71.2	249.9				62.5
ATLAS	MAS	93	4	9	21	42	3	1	16	13	3	-56.7	269.6	90.0	-16.2	-72.7	263.3	183	0	43	78.5
UARS	MLS	93	4	9	20	58	11	574	21	47	6	-54.5	237.0	90.0	-22.9	-74.1	266.4				63.0
ATLAS	MAS	93	4	9	21	44	3	1	16	15	3	-56.8	283.7	90.0	-16.2	-72.9	289.0	139	2	21	85.6
UARS	MLS	93	4	9	19	22	13	574	20	11	7	-54.2	262.7	90.0	-22.9	-73.5	292.7				62.9
ATLAS	MAS	93	4	9	22	10	26	1	16	41	26	15.6	10.7	90.0	-16.2	6.1	24.1	150	3	1	151.1
UARS	MLS	93	4	10	1	12	6	575	2	1	1	21.4	43.5	90.0	-22.9	7.2	25.0				113.3
ATLAS	MAS	93	4	9	22	15	12	1	16	46	12	30.9	21.9	90.0	-16.2	19.9	35.2	142	1	15	141.0
UARS	MLS	93	4	9	23	30	16	575	0	19	9	37.8	53.8	90.0	-22.9	20.7	36.3				117.4
ATLAS	MAS	93	4	9	22	18	28	1	16	49	28	40.5	31.9	90.0	-16.2	28.1	44.7	175	0	29	131.4
UARS	MLS	93	4	9	21	48	58	574	22	37	54	50.0	58.9	90.0	-22.9	29.6	45.2				117.9
ATLAS	MAS	93	4	9	22	20	29	1	16	51	29	45.8	39.6	90.0	-16.2	32.4	51.5	157	2	12	124.9
UARS	MLS	93	4	9	20	7	56	574	20	56	50	56.5	55.9	90.0	-22.9	33.8	51.8				115.6
ATLAS	MAS	93	4	9	23	8	57	1	17	39	57	-52.8	224.3	90.0	-16.2	-66.5	206.6	110	2	40	66.2
UARS	MLS	93	4	10	1	49	15	575	2	38	12	-50.4	177.1	90.0	-22.9	-67.2	208.4				61.9
ATLAS	MAS	93	4	9	23	10	58	1	17	41	58	-55.6	236.6	90.0	-16.2	-70.8	223.7	80	1	0	73.2
UARS	MLS	93	4	10	0	11	41	575	1	0	38	-52.8	194.5	90.0	-22.9	-71.1	225.7				62.4
ATLAS	MAS	93	4	9	23	12	28	1	17	43	28	-56.8	246.8	90.0	-16.2	-72.8	240.7	136	0	37	78.4
UARS	MLS	93	4	9	22	34	40	574	23	23	36	-54.1	214.3	90.0	-22.9	-73.4	244.4				62.9
ATLAS	MAS	93	4	9	23	14	14	1	17	45	14	-56.9	259.2	90.0	-16.2	-73.0	263.3	159	2	16	84.6
UARS	MLS	93	4	9	20	58	11	574	21	47	6	-54.5	237.0	90.0	-22.9	-74.1	266.4				63.0
ATLAS	MAS	93	4	9	23	40	36	1	18	11	36	14.9	347.3	90.0	-16.2	5.4	0.7	111	3	8	151.2
UARS	MLS	93	4	10	2	48	51	575	3	37	47	19.7	20.3	90.0	-22.9	5.7	1.7				112.9
ATLAS	MAS	93	4	9	23	45	22	1	18	16	22	30.2	358.4	90.0	-16.2	19.3	11.7	134	1	21	141.6
UARS	MLS	93	4	10	1	6	45	575	1	55	39	37.0	30.3	90.0	-22.9	20.0	12.7				117.4
ATLAS	MAS	93	4	9	23	48	53	1	18	19	53	40.6	9.1	90.0	-16.2	28.2	21.8	112	0	23	131.3
UARS	MLS	93	4	9	23	25	43	575	0	14	40	48.9	37.1	90.0	-22.9	28.8	22.7				118.1
ATLAS	MAS	93	4	9	23	50	54	1	18	21	54	45.9	16.8	90.0	-16.2	32.5	28.7	136	2	6	124.8
UARS	MLS	93	4	9	21	44	25	574	22	33	20	56.3	33.4	90.0	-22.9	33.7	28.6				115.8
ATLAS	MAS	93	4	10	0	39	7	1	19	10	7	-52.4	200.1	90.0	-16.2	-65.9	182.2	146	2	46	65.4
UARS	MLS	93	4	10	3	25	44	575	4	14	42	-49.8	154.1	90.0	-22.9	-66.3	185.3				61.8
ATLAS	MAS	93	4	10	0	41	8	1	19	12	8	-55.4	212.2	90.0	-16.2	-70.4	198.5	127	1	6	72.3
UARS	MLS	93	4	10	1	47	54	575	2	36	53	-52.8	170.3	90.0	-22.9	-71.0	201.5				62.4

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	MAS	93 4 10 0 42 38	1 19 13 38	-56.7 222.4	90.0 -16.2	-72.6 215.1	183	0 32	77.5
UARS	MLS	93 4 10 0 10 37	575 0 59 35	-54.4 188.6	90.0 -22.9	-74.0 218.2			63.0
ATLAS	MAS	93 4 10 0 44 39	1 19 15 39	-56.9 236.5	90.0 -16.2	-73.0 240.7	125	2 9	84.6
UARS	MLS	93 4 9 22 34 40	574 23 23 36	-54.1 214.3	90.0 -22.9	-73.4 244.4			62.9
ATLAS	MAS	93 4 10 1 10 31	1 19 41 31	13.3 323.4	90.0 -16.2	4.0 336.8	155	3 14	151.4
UARS	MLS	93 4 10 4 25 20	575 5 14 17	18.8 356.5	90.0 -22.9	4.9 337.9			112.9
ATLAS	MAS	93 4 10 1 15 33	1 19 46 33	29.5 334.9	90.0 -16.2	18.7 348.1	124	1 27	142.1
UARS	MLS	93 4 10 2 43 14	575 3 32 10	36.2 6.8	90.0 -22.9	19.4 349.1			117.5
ATLAS	MAS	93 4 10 1 19 4	1 19 50 4	39.9 345.4	90.0 -16.2	27.7 358.2	125	0 17	132.0
UARS	MLS	93 4 10 1 1 56	575 1 50 55	48.8 12.9	90.0 -22.9	28.8 358.4			118.2
ATLAS	MAS	93 4 10 1 21 19	1 19 52 19	45.9 354.0	90.0 -16.2	32.6 5.9	108	2 0	124.7
UARS	MLS	93 4 9 23 21 10	575 0 10 6	55.9 12.6	90.0 -22.9	33.4 6.3			116.2
ATLAS	MAS	93 4 10 2 9 18	1 20 40 18	-52.0 175.9	90.0 -16.2	-65.3 157.8	176	2 52	64.5
UARS	MLS	93 4 10 5 1 57	575 5 50 51	-49.8 129.9	90.0 -22.9	-66.2 161.0			61.7
ATLAS	MAS	93 4 10 2 11 33	1 20 42 33	-55.4 189.5	90.0 -16.2	-70.5 175.9	72	1 12	72.3
UARS	MLS	93 4 10 3 24 8	575 4 13 2	-52.7 146.1	90.0 -22.9	-70.9 177.3			62.3
ATLAS	MAS	93 4 10 2 13 4	1 20 44 4	-56.7 199.6	90.0 -16.2	-72.6 192.5	134	0 25	77.5
UARS	MLS	93 4 10 1 47 6	575 2 36 0	-54.0 165.9	90.0 -22.9	-73.2 196.1			62.8
ATLAS	MAS	93 4 10 2 14 49	1 20 45 49	-56.9 212.0	90.0 -16.2	-73.1 215.0	140	2 4	83.7
UARS	MLS	93 4 10 0 10 37	575 0 59 35	-54.4 188.6	90.0 -22.9	-74.0 218.2			63.0
ATLAS	MAS	93 4 10 2 40 41	1 21 11 41	12.6 300.0	90.0 -16.2	3.3 313.4	112	3 21	151.3
UARS	MLS	93 4 10 6 1 49	575 6 50 48	17.5 332.7	90.0 -22.9	4.1 314.1			112.8
ATLAS	MAS	93 4 10 2 45 43	1 21 16 43	28.8 311.3	90.0 -16.2	18.1 324.6	112	1 34	142.5
UARS	MLS	93 4 10 4 19 43	575 5 6 40	33.3 343.3	90.0 -22.9	18.7 325.5			117.5
ATLAS	MAS	93 4 10 2 49 14	1 21 20 14	39.3 321.7	90.0 -16.2	27.2 334.5	140	0 10	132.6
UARS	MLS	93 4 10 2 38 25	575 3 27 20	48.2 349.8	90.0 -22.9	28.3 335.0			118.3
ATLAS	MAS	93 4 10 2 51 29	1 21 22 29	45.4 330.1	90.0 -16.2	32.1 342.1	144	1 54	125.5
UARS	MLS	93 4 10 0 57 24	575 1 46 20	55.9 348.5	90.0 -22.9	33.4 342.1			116.2
ATLAS	MAS	93 4 10 3 39 43	1 22 10 43	-52.1 153.2	90.0 -16.2	-65.4 135.0	110	2 58	64.5
UARS	MLS	93 4 10 6 38 10	575 7 27 5	-49.7 105.6	90.0 -22.9	-66.1 136.8			61.6
ATLAS	MAS	93 4 10 3 41 44	1 22 12 44	-55.2 165.1	90.0 -16.2	-70.1 150.8	121	1 18	71.4
UARS	MLS	93 4 10 5 0 21	575 5 49 16	-52.7 121.9	90.0 -22.9	-70.8 153.1			62.3
ATLAS	MAS	93 4 10 3 43 29	1 22 14 29	-56.7 176.9	90.0 -16.2	-72.6 170.0	84	0 20	77.5
UARS	MLS	93 4 10 3 23 20	575 4 12 14	-54.0 141.7	90.0 -22.9	-73.1 172.0			62.7
ATLAS	MAS	93 4 10 3 45 15	1 22 16 15	-56.9 189.3	90.0 -16.2	-73.1 192.4	103	1 58	83.6
UARS	MLS	93 4 10 1 46 50	575 2 35 44	-54.4 164.4	90.0 -22.9	-73.9 194.1			62.9
ATLAS	MAS	93 4 10 4 10 37	1 22 41 37	11.0 276.1	90.0 -16.2	1.8 289.5	155	3 27	151.4
UARS	MLS	93 4 10 7 38 35	575 8 27 28	16.1 309.5	90.0 -22.9	2.5 290.8			112.5
ATLAS	MAS	93 4 10 4 15 53	1 22 46 53	28.1 287.8	90.0 -16.2	17.5 301.1	98	1 40	143.0
UARS	MLS	93 4 10 5 56 13	575 6 45 10	34.5 319.7	90.0 -22.9	18.0 301.9			117.6
ATLAS	MAS	93 4 10 4 19 24	1 22 50 24	38.7 298.0	90.0 -16.2	26.7 310.9	155	0 4	133.3
UARS	MLS	93 4 10 4 14 55	575 5 3 50	47.5 326.7	90.0 -22.9	27.9 311.6			118.5

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	10	5	9	53	1	23	40	53	-51.7	129.0	90.0	-16.2	-64.9	110.7	141	3	4	63.7
UARS	MLS	93	4	10	8	14	40	575	9	3	36	-49.1	82.6	90.0	-22.9	-65.2	113.6				61.4
ATLAS	MAS	93	4	10	5	11	54	1	23	42	54	-54.9	140.8	90.0	-16.2	-69.6	125.9	170	1	24	70.5
UARS	MLS	93	4	10	6	36	34	575	7	25	31	-52.6	97.7	90.0	-22.9	-70.8	128.9				62.2
ATLAS	MAS	93	4	10	5	13	39	1	23	44	39	-56.6	152.4	90.0	-16.2	-72.4	144.4	133	0	14	76.6
UARS	MLS	93	4	10	4	59	33	575	5	48	29	-53.9	117.5	90.0	-22.9	-73.0	147.8				62.7
ATLAS	MAS	93	4	10	5	15	25	1	23	46	25	-57.0	164.8	90.0	-16.2	-73.2	166.7	126	1	52	82.7
UARS	MLS	93	4	10	3	23	4	575	4	11	58	-54.3	140.2	90.0	-22.9	-73.8	169.9				62.9
ATLAS	MAS	93	4	10	5	46	3	2	0	17	3	27.4	264.3	90.0	-16.2	16.9	277.6	81	1	46	143.4
UARS	MLS	93	4	10	7	32	42	575	8	21	40	33.6	296.2	90.0	-22.9	17.4	278.2				117.6
ATLAS	MAS	93	4	10	5	49	49	2	0	20	49	38.8	275.1	90.0	-16.2	26.7	288.0	78	0	1	133.2
UARS	MLS	93	4	10	5	51	24	575	6	40	20	46.9	303.6	90.0	-22.9	27.4	288.2				118.6
ATLAS	MAS	93	4	10	5	51	50	2	0	22	50	44.3	282.4	90.0	-16.2	31.2	294.7	160	3	24	127.0
UARS	MLS	93	4	10	2	27	28	575	3	16	26	54.5	285.0	90.0	-22.9	32.6	294.1				109.7
ATLAS	MAS	93	4	10	5	53	20	2	0	24	20	48.0	288.9	90.0	-16.2	34.2	300.2	60	3	24	122.1
UARS	MLS	93	4	10	2	29	4	575	3	18	1	56.2	294.8	90.0	-22.9	33.6	300.2				111.8
ATLAS	MAS	93	4	10	6	40	4	2	1	11	4	-51.2	104.9	90.0	-16.2	-64.3	86.4	168	3	10	62.9
UARS	MLS	93	4	10	9	50	53	575	10	39	50	-49.0	58.4	90.0	-22.9	-65.1	89.3				61.3
ATLAS	MAS	93	4	10	6	42	19	2	1	13	19	-54.9	118.0	90.0	-16.2	-69.7	103.2	119	1	30	70.5
UARS	MLS	93	4	10	8	13	3	575	9	2	1	-52.1	74.9	90.0	-22.9	-69.9	106.3				62.0
ATLAS	MAS	93	4	10	6	44	5	2	1	15	5	-56.6	129.7	90.0	-16.2	-72.5	121.8	82	0	8	76.6
UARS	MLS	93	4	10	6	35	46	575	7	24	43	-53.9	93.3	90.0	-22.9	-72.9	123.7				62.7
ATLAS	MAS	93	4	10	6	45	35	2	1	16	35	-57.0	140.3	90.0	-16.2	-73.2	140.9	159	1	46	81.8
UARS	MLS	93	4	10	4	59	1	575	5	47	57	-54.6	114.5	90.0	-22.9	-74.4	143.6				63.0
ATLAS	MAS	93	4	10	6	48	36	2	1	19	36	-55.0	160.8	90.0	-16.2	-69.8	175.5	137	3	24	92.3
UARS	MLS	93	4	10	3	24	24	575	4	13	18	-52.3	147.5	90.0	-22.9	-70.2	178.9				62.2
ATLAS	MAS	93	4	10	6	50	6	2	1	21	6	-52.7	169.8	90.0	-16.2	-66.4	187.5	99	3	24	97.5
UARS	MLS	93	4	10	3	25	44	575	4	14	42	-49.8	154.1	90.0	-22.9	-66.3	185.3				61.8
ATLAS	MAS	93	4	10	7	15	59	2	1	46	59	26.0	240.2	90.0	-16.2	15.6	253.5	166	1	53	144.4
UARS	MLS	93	4	10	9	9	11	575	9	58	5	32.8	272.6	90.0	-22.9	16.7	254.6				117.7
ATLAS	MAS	93	4	10	7	20	0	2	1	51	0	38.2	251.5	90.0	-16.2	26.2	264.4	88	0	7	133.8
UARS	MLS	93	4	10	7	27	53	575	8	16	50	46.2	280.4	90.0	-22.9	26.9	264.8				118.8
ATLAS	MAS	93	4	10	7	22	15	2	1	53	15	44.4	259.6	90.0	-16.2	31.3	271.8	191	3	18	126.9
UARS	MLS	93	4	10	5	46	19	575	6	35	14	55.5	277.6	90.0	-22.9	33.2	270.3				116.4
ATLAS	MAS	93	4	10	7	23	46	2	1	54	46	48.0	266.1	90.0	-16.2	34.2	277.3	63	3	18	122.1
UARS	MLS	93	4	10	4	5	33	575	4	54	31	56.4	272.3	90.0	-22.9	33.7	277.0				112.0
ATLAS	MAS	93	4	10	8	46	9	2	3	17	9	25.3	216.7	90.0	-16.2	14.9	230.1	148	1	59	144.7
UARS	MLS	93	4	10	10	45	40	575	11	34	35	31.9	249.0	90.0	-22.9	16.0	230.9				117.7
ATLAS	MAS	93	4	10	8	50	10	2	3	21	10	37.5	227.8	90.0	-16.2	25.7	240.8	99	0	14	134.5
UARS	MLS	93	4	10	9	4	22	575	9	53	20	45.5	257.2	90.0	-22.9	26.4	241.3				118.9
ATLAS	MAS	93	4	10	8	52	41	2	3	23	41	44.4	236.8	90.0	-16.2	31.4	249.0	139	1	29	126.8
UARS	MLS	93	4	10	7	23	21	575	8	12	16	54.6	258.2	90.0	-22.9	32.6	249.1				117.0

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	10	8	54	11	2	3	25	11	48.1	243.3	90.0	-16.2	34.3	254.5	44	3	11	122.0
UARS	MLS	93	4	10	5	42	19	575	6	31	17	56.7	251.6	90.0	-22.9	33.9	254.8				112.6
ATLAS	MAS	93	4	10	9	40	39	2	4	11	39	-50.9	58.0	90.0	-16.2	-63.7	39.4	122	3	22	62.1
UARS	MLS	93	4	10	13	3	35	575	13	52	30	-48.3	11.1	90.0	-22.9	-64.1	41.8				61.1
ATLAS	MAS	93	4	10	9	42	55	2	4	13	55	-54.7	71.0	90.0	-16.2	-69.3	55.6	98	1	42	69.7
UARS	MLS	93	4	10	11	25	30	575	12	14	24	-52.0	26.4	90.0	-22.9	-69.7	57.8				61.9
ATLAS	MAS	93	4	10	9	44	40	2	4	15	40	-56.5	82.5	90.0	-16.2	-72.2	73.7	81	0	3	75.7
UARS	MLS	93	4	10	9	48	12	575	10	37	7	-53.8	44.9	90.0	-22.9	-72.8	75.4				62.6
ATLAS	MAS	93	4	10	9	46	11	2	4	17	11	-57.0	93.0	90.0	-16.2	-73.2	92.5	146	1	34	80.9
UARS	MLS	93	4	10	8	11	27	575	9	0	21	-54.6	66.1	90.0	-22.9	-74.2	95.4				63.0
ATLAS	MAS	93	4	10	9	48	41	2	4	19	41	-55.8	110.4	90.0	-16.2	-71.1	122.8	162	3	12	89.5
UARS	MLS	93	4	10	6	36	2	575	7	24	59	-53.5	94.8	90.0	-22.9	-72.2	125.6				62.5
ATLAS	MAS	93	4	10	9	50	12	2	4	21	12	-53.9	119.9	90.0	-16.2	-68.0	136.5	93	3	12	94.8
UARS	MLS	93	4	10	6	37	38	575	7	26	34	-50.7	103.1	90.0	-22.9	-67.7	134.5				61.8
ATLAS	MAS	93	4	10	10	16	19	2	4	47	19	24.6	193.3	90.0	-16.2	14.3	206.6	128	2	5	145.0
UARS	MLS	93	4	10	12	22	10	575	13	11	6	31.1	225.4	90.0	-22.9	15.3	207.2				117.8
ATLAS	MAS	93	4	10	10	20	20	2	4	51	20	36.9	204.2	90.0	-16.2	25.1	217.2	110	0	20	135.1
UARS	MLS	93	4	10	10	40	52	575	11	29	45	44.8	234.0	90.0	-22.9	25.9	217.9				119.0
ATLAS	MAS	93	4	10	10	22	51	2	4	53	51	43.9	213.0	90.0	-16.2	30.9	225.3	170	1	23	127.6
UARS	MLS	93	4	10	8	59	50	575	9	48	46	54.2	235.5	90.0	-22.9	32.4	225.8				117.2
ATLAS	MAS	93	4	10	10	24	21	2	4	55	21	47.6	219.3	90.0	-16.2	33.9	230.7	20	3	5	122.8
UARS	MLS	93	4	10	7	18	32	575	8	7	26	56.7	227.4	90.0	-22.9	33.9	230.5				112.5
ATLAS	MAS	93	4	10	11	10	49	2	5	41	49	-50.4	33.9	90.0	-16.2	-63.1	15.2	150	3	28	61.3
UARS	MLS	93	4	10	14	39	49	575	15	28	44	-48.2	346.8	90.0	-22.9	-64.0	17.5				61.0
ATLAS	MAS	93	4	10	11	13	5	2	5	44	5	-54.4	46.7	90.0	-16.2	-68.9	30.8	143	1	48	68.8
UARS	MLS	93	4	10	13	1	43	575	13	50	39	-52.0	2.2	90.0	-22.9	-69.6	33.6				61.8
ATLAS	MAS	93	4	10	11	14	50	2	5	45	50	-56.3	58.1	90.0	-16.2	-72.0	48.2	129	0	9	74.8
UARS	MLS	93	4	10	11	24	26	575	12	13	21	-53.7	20.7	90.0	-22.9	-72.7	51.2				62.5
ATLAS	MAS	93	4	10	11	16	36	2	5	47	36	-57.0	70.3	90.0	-16.2	-73.2	70.0	113	1	28	80.8
UARS	MLS	93	4	10	9	47	56	575	10	36	51	-54.2	43.4	90.0	-22.9	-73.5	73.4				62.8
ATLAS	MAS	93	4	10	11	18	52	2	5	49	52	-56.0	86.0	90.0	-16.2	-71.4	97.5	157	3	6	88.6
UARS	MLS	93	4	10	8	12	15	575	9	1	13	-53.4	70.6	90.0	-22.9	-72.1	101.4				62.5
ATLAS	MAS	93	4	10	11	20	22	2	5	51	22	-54.2	95.6	90.0	-16.2	-68.5	111.8	115	3	6	93.8
UARS	MLS	93	4	10	8	13	35	575	9	2	32	-51.2	77.6	90.0	-22.9	-68.4	109.0				61.8
ATLAS	MAS	93	4	10	11	46	29	2	6	17	29	23.9	169.8	90.0	-16.2	13.7	183.1	109	2	12	145.3
UARS	MLS	93	4	10	13	58	39	575	14	47	36	30.2	201.7	90.0	-22.9	14.6	183.5				117.8
ATLAS	MAS	93	4	10	11	50	30	2	6	21	30	36.3	180.5	90.0	-16.2	24.6	193.6	120	0	26	135.6
UARS	MLS	93	4	10	12	17	21	575	13	6	16	44.0	210.7	90.0	-22.9	25.4	194.4				119.2
ATLAS	MAS	93	4	10	11	53	16	2	6	24	16	43.9	190.1	90.0	-16.2	31.0	202.4	125	1	16	127.5
UARS	MLS	93	4	10	10	36	19	575	11	25	16	53.8	212.8	90.0	-22.9	32.1	202.5				117.4
ATLAS	MAS	93	4	10	11	54	47	2	6	25	47	47.7	196.5	90.0	-16.2	33.9	207.9	43	2	59	122.7
UARS	MLS	93	4	10	8	55	17	575	9	44	12	56.9	206.7	90.0	-22.9	34.1	208.3				113.1

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	MAS	93 4 10 12 43 30	2 7 14 30	-54.4 23.9	90.0 -16.2	-68.9 8.1	87	1 54	68.9
UARS	MLS	93 4 10 14 37 56	575 15 26 53	-51.9 338.0	90.0 -22.9	-69.5 9.4			61.8
ATLAS	MAS	93 4 10 12 45 16	2 7 16 16	-56.3 35.3	90.0 -16.2	-72.0 25.6	81	0 15	74.8
UARS	MLS	93 4 10 13 0 39	575 13 49 35	-53.7 356.5	90.0 -22.9	-72.6 27.1			62.5
ATLAS	MAS	93 4 10 12 46 46	2 7 17 46	-57.0 45.8	90.0 -16.2	-73.2 44.2	137	1 22	79.9
UARS	MLS	93 4 10 11 23 54	575 12 12 49	-54.5 17.7	90.0 -22.9	-74.1 47.2			62.9
ATLAS	MAS	93 4 10 12 49 2	2 7 20 2	-56.2 61.6	90.0 -16.2	-71.7 72.2	158	3 0	87.7
UARS	MLS	93 4 10 9 48 12	575 10 37 7	-53.8 44.9	90.0 -22.9	-72.8 75.4			62.6
ATLAS	MAS	93 4 10 12 50 32	2 7 21 32	-54.5 71.3	90.0 -16.2	-69.0 87.0	121	3 0	92.9
UARS	MLS	93 4 10 9 49 49	575 10 38 47	-51.1 53.3	90.0 -22.9	-68.3 84.8			61.7
ATLAS	MAS	93 4 10 13 16 40	2 7 47 40	23.2 146.3	90.0 -16.2	13.0 159.7	88	2 18	145.6
UARS	MLS	93 4 10 15 35 24	575 16 24 22	28.5 178.7	90.0 -22.9	13.2 160.5			117.7
ATLAS	MAS	93 4 10 13 20 41	2 7 51 41	35.6 156.9	90.0 -16.2	24.0 170.0	128	0 33	136.2
UARS	MLS	93 4 10 13 53 50	575 14 42 46	43.3 187.4	90.0 -22.9	24.8 170.9			119.3
ATLAS	MAS	93 4 10 13 23 27	2 7 54 27	43.4 166.3	90.0 -16.2	30.5 178.7	153	1 10	128.2
UARS	MLS	93 4 10 12 12 48	575 13 1 47	53.3 190.1	90.0 -22.9	31.8 179.2			117.7
ATLAS	MAS	93 4 10 13 24 57	2 7 55 57	47.2 172.6	90.0 -16.2	33.5 184.1	60	2 53	123.5
UARS	MLS	93 4 10 10 31 30	575 11 20 26	56.9 182.6	90.0 -22.9	34.1 184.1			113.0
ATLAS	MAS	93 4 10 14 13 41	2 8 44 41	-54.1 359.6	90.0 -16.2	-68.4 343.3	135	2 0	68.0
UARS	MLS	93 4 10 16 14 26	575 17 3 23	-51.4 315.1	90.0 -22.9	-68.7 346.6			61.6
ATLAS	MAS	93 4 10 14 15 26	2 8 46 26	-56.2 10.9	90.0 -16.2	-71.7 0.2	128	0 21	73.9
UARS	MLS	93 4 10 14 36 52	575 15 25 50	-53.6 332.3	90.0 -22.9	-72.5 2.9			62.5
ATLAS	MAS	93 4 10 14 17 12	2 8 48 12	-57.0 23.1	90.0 -16.2	-73.2 21.7	101	1 17	79.9
UARS	MLS	93 4 10 13 0 7	575 13 49 4	-54.4 353.5	90.0 -22.9	-74.0 23.0			62.9
ATLAS	MAS	93 4 10 14 19 27	2 8 50 27	-56.1 38.8	90.0 -16.2	-71.7 49.6	124	2 55	87.6
UARS	MLS	93 4 10 11 24 26	575 12 13 21	-53.7 20.7	90.0 -22.9	-72.7 51.2			62.5
ATLAS	MAS	93 4 10 14 46 35	2 9 17 35	21.6 122.3	90.0 -16.2	11.7 135.6	149	2 25	146.2
UARS	MLS	93 4 10 17 11 54	575 18 0 47	27.7 155.1	90.0 -22.9	12.5 136.7			117.7
ATLAS	MAS	93 4 10 14 50 51	2 9 21 51	35.0 133.3	90.0 -16.2	23.5 146.4	134	0 39	136.8
UARS	MLS	93 4 10 15 30 20	575 16 19 16	42.5 164.1	90.0 -22.9	24.3 147.4			119.5
ATLAS	MAS	93 4 10 14 53 52	2 9 24 52	43.5 143.5	90.0 -16.2	30.6 155.9	102	1 4	128.1
UARS	MLS	93 4 10 13 49 18	575 14 38 12	52.8 167.3	90.0 -22.9	31.5 155.9			117.9
ATLAS	MAS	93 4 10 14 55 22	2 9 26 22	47.2 149.8	90.0 -16.2	33.6 161.3	68	2 47	123.4
UARS	MLS	93 4 10 12 8 0	575 12 56 57	57.0 160.2	90.0 -22.9	34.1 160.9			113.3
ATLAS	MAS	93 4 10 15 44 6	2 10 15 6	-54.2 336.9	90.0 -16.2	-68.5 320.6	71	2 6	68.0
UARS	MLS	93 4 10 17 50 39	575 18 39 33	-51.3 290.9	90.0 -22.9	-68.6 322.3			61.5
ATLAS	MAS	93 4 10 15 45 51	2 10 16 51	-56.2 348.2	90.0 -16.2	-71.8 337.6	83	0 27	73.9
UARS	MLS	93 4 10 16 13 5	575 17 1 59	-53.6 308.1	90.0 -22.9	-72.4 338.8			62.4
ATLAS	MAS	93 4 10 15 47 22	2 10 18 22	-57.0 358.6	90.0 -16.2	-73.1 355.9	130	1 11	79.0
UARS	MLS	93 4 10 14 36 20	575 15 25 18	-54.4 329.3	90.0 -22.9	-73.9 358.9			62.8
ATLAS	MAS	93 4 10 15 49 22	2 10 20 22	-56.5 12.7	90.0 -16.2	-72.3 21.3	169	2 48	85.9
UARS	MLS	93 4 10 13 0 23	575 13 49 20	-54.1 355.0	90.0 -22.9	-73.3 25.1			62.7

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat	sub satellite lon	viewing angle beta	viewing angle alpha	observed point lat	observed point lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	MAS	93 4 10 15 50 53	2 10 21 53	-55.1	22.7	90.0	-16.2	-69.9	37.2	140	2 49	91.0
UARS	MLS	93 4 10 13 1 43	575 13 50 39	-52.0	2.2	90.0	-22.9	-69.6	33.6			61.8
ATLAS	MAS	93 4 10 16 16 45	2 10 47 45	20.9	98.9	90.0	-16.2	11.0	112.2	119	2 31	146.4
UARS	MLS	93 4 10 18 48 23	575 19 37 17	26.8	131.4	90.0	-22.9	11.7	113.0			117.8
ATLAS	MAS	93 4 10 16 21 1	2 10 52 1	34.3	109.7	90.0	-16.2	22.9	122.8	138	0 45	137.3
UARS	MLS	93 4 10 17 6 49	575 17 55 46	41.8	140.8	90.0	-22.9	23.7	123.9			119.6
ATLAS	MAS	93 4 10 16 24 2	2 10 55 2	42.9	119.7	90.0	-16.2	30.1	132.2	127	0 58	128.8
UARS	MLS	93 4 10 15 25 47	575 16 14 42	52.3	144.5	90.0	-22.9	31.2	132.6			118.1
ATLAS	MAS	93 4 10 16 25 33	2 10 56 33	46.7	125.8	90.0	-16.2	33.2	137.5	104	2 41	124.1
UARS	MLS	93 4 10 13 44 29	575 14 33 27	57.0	137.8	90.0	-22.9	34.1	137.7			113.5
ATLAS	MAS	93 4 10 17 14 16	2 11 45 16	-53.8	312.6	90.0	-16.2	-68.0	295.9	106	2 12	67.2
UARS	MLS	93 4 10 19 26 52	575 20 15 47	-51.3	266.7	90.0	-22.9	-68.5	298.1			61.4
ATLAS	MAS	93 4 10 17 16 2	2 11 47 2	-56.0	323.7	90.0	-16.2	-71.4	312.2	129	0 33	73.1
UARS	MLS	93 4 10 17 49 19	575 18 38 13	-53.5	283.9	90.0	-22.9	-72.3	314.6			62.4
ATLAS	MAS	93 4 10 17 17 47	2 11 48 47	-57.0	335.9	90.0	-16.2	-73.1	333.3	91	1 5	79.0
UARS	MLS	93 4 10 16 12 33	575 17 1 27	-54.3	305.1	90.0	-22.9	-73.8	334.8			62.8
ATLAS	MAS	93 4 10 17 19 33	2 11 50 33	-56.6	348.2	90.0	-16.2	-72.5	355.7	185	2 43	85.0
UARS	MLS	93 4 10 14 36 20	575 15 25 18	-54.4	329.3	90.0	-22.9	-73.9	358.9			62.8
ATLAS	MAS	93 4 10 17 21 3	2 11 52 3	-55.3	358.3	90.0	-16.2	-70.3	12.2	136	2 43	90.1
UARS	MLS	93 4 10 14 37 56	575 15 26 53	-51.9	338.0	90.0	-22.9	-69.5	9.4			61.8
ATLAS	MAS	93 4 10 17 46 40	2 12 17 40	19.4	74.9	90.0	-16.2	9.6	88.2	190	2 38	146.8
UARS	MLS	93 4 10 20 24 52	575 21 13 47	25.9	107.7	90.0	-22.9	11.0	89.3			117.8
ATLAS	MAS	93 4 10 17 51 12	2 12 22 12	33.6	86.1	90.0	-16.2	22.3	99.3	141	0 52	137.8
UARS	MLS	93 4 10 18 43 18	575 19 32 17	41.0	117.4	90.0	-22.9	23.1	100.4			119.8
ATLAS	MAS	93 4 10 17 54 12	2 12 25 12	42.3	95.9	90.0	-16.2	29.6	108.5	156	0 51	129.4
UARS	MLS	93 4 10 17 2 16	575 17 51 12	51.8	121.7	90.0	-22.9	30.8	109.3			118.3
ATLAS	MAS	93 4 10 17 55 43	2 12 26 43	46.2	101.9	90.0	-16.2	32.7	113.8	153	2 35	124.9
UARS	MLS	93 4 10 15 20 42	575 16 9 36	57.0	113.6	90.0	-22.9	34.1	113.4			113.5
ATLAS	MAS	93 4 10 18 44 26	2 13 15 26	-53.5	288.3	90.0	-16.2	-67.5	271.3	150	2 18	66.4
UARS	MLS	93 4 10 21 3 5	575 21 52 1	-51.2	242.5	90.0	-22.9	-68.4	273.9			61.4
ATLAS	MAS	93 4 10 18 46 12	2 13 17 12	-55.8	299.3	90.0	-16.2	-71.1	287.0	177	0 39	72.2
UARS	MLS	93 4 10 19 25 32	575 20 14 28	-53.5	259.7	90.0	-22.9	-72.3	290.5			62.3
ATLAS	MAS	93 4 10 18 47 57	2 13 18 57	-56.9	311.4	90.0	-16.2	-73.0	307.6	126	0 59	78.1
UARS	MLS	93 4 10 17 48 47	575 18 37 42	-54.3	280.9	90.0	-22.9	-73.7	310.7			62.8
ATLAS	MAS	93 4 10 18 49 58	2 13 20 58	-56.6	325.5	90.0	-16.2	-72.5	333.1	141	2 37	84.9
UARS	MLS	93 4 10 16 12 49	575 17 1 43	-54.0	306.6	90.0	-22.9	-73.1	336.9			62.6
ATLAS	MAS	93 4 10 19 17 6	2 13 48 6	19.5	52.0	90.0	-16.2	9.7	65.3	60	2 44	146.6
UARS	MLS	93 4 10 22 1 21	575 22 50 18	25.0	84.0	90.0	-22.9	10.2	65.5			117.8
ATLAS	MAS	93 4 10 19 21 22	2 13 52 22	33.6	62.5	90.0	-16.2	21.8	75.7	141	0 58	138.2
UARS	MLS	93 4 10 20 19 47	575 21 8 42	40.2	94.0	90.0	-22.9	22.5	76.8			119.9
ATLAS	MAS	93 4 10 19 24 23	2 13 55 23	41.7	72.2	90.0	-16.2	29.1	84.8	185	0 45	130.1
UARS	MLS	93 4 10 18 38 29	575 19 27 27	51.8	97.5	90.0	-22.9	30.8	85.1			118.4

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	10	19	26	8	2	13	57	8	46.3	79.1	90.0	-16.2	32.8	90.9	141	2	28	124.8
UARS	MLS	93	4	10	16	57	28	575	17	46	22	56.9	93.0	90.0	-22.9	34.1	91.2				114.1
ATLAS	MAS	93	4	10	20	14	52	2	14	45	52	-53.5	265.6	90.0	-16.2	-67.6	248.5	95	2	24	66.4
UARS	MLS	93	4	10	22	39	19	575	23	28	16	-51.1	218.3	90.0	-22.9	-68.3	249.7				61.3
ATLAS	MAS	93	4	10	20	16	37	2	14	47	37	-55.8	276.6	90.0	-16.2	-71.1	264.3	131	0	45	72.2
UARS	MLS	93	4	10	21	1	45	575	21	50	42	-53.4	235.5	90.0	-22.9	-72.2	266.3				62.3
ATLAS	MAS	93	4	10	20	18	23	2	14	49	23	-56.9	288.6	90.0	-16.2	-73.1	285.0	83	0	53	78.1
UARS	MLS	93	4	10	19	25	0	575	20	13	56	-54.3	256.7	90.0	-22.9	-73.7	286.6				62.8
ATLAS	MAS	93	4	10	20	20	8	2	14	51	8	-56.7	301.0	90.0	-16.2	-72.7	307.5	154	2	31	84.0
UARS	MLS	93	4	10	17	48	47	575	18	37	42	-54.3	280.9	90.0	-22.9	-73.7	310.7				62.8
ATLAS	MAS	93	4	10	20	21	39	2	14	52	39	-55.5	311.2	90.0	-16.2	-70.7	324.4	191	2	31	89.1
UARS	MLS	93	4	10	17	50	7	575	18	39	1	-52.3	288.2	90.0	-22.9	-70.1	319.6				61.8
ATLAS	MAS	93	4	10	20	47	1	2	15	18	1	18.0	28.0	90.0	-16.2	8.3	41.4	118	2	51	146.9
UARS	MLS	93	4	10	23	38	7	576	0	27	4	23.3	60.8	90.0	-22.9	8.8	42.4				117.7
ATLAS	MAS	93	4	10	20	51	32	2	15	22	32	32.3	39.0	90.0	-16.2	21.2	52.2	140	1	4	138.7
UARS	MLS	93	4	10	21	56	17	575	22	45	12	39.4	70.6	90.0	-22.9	21.9	53.3				120.0
ATLAS	MAS	93	4	10	20	54	48	2	15	25	48	41.8	49.4	90.0	-16.2	29.2	61.9	119	0	39	130.0
UARS	MLS	93	4	10	20	15	15	575	21	4	13	50.7	75.9	90.0	-22.9	30.1	62.6				118.7
ATLAS	MAS	93	4	10	20	56	18	2	15	27	18	45.7	55.2	90.0	-16.2	32.4	67.2	186	2	22	125.5
UARS	MLS	93	4	10	18	33	41	575	19	22	37	56.9	68.8	90.0	-22.9	34.1	67.0				114.1
ATLAS	MAS	93	4	10	20	57	49	2	15	28	49	49.3	62.0	90.0	-16.2	35.1	72.9	178	2	22	120.8
UARS	MLS	93	4	10	18	35	1	575	19	23	56	56.2	77.5	90.0	-22.9	33.6	72.2				115.5
ATLAS	MAS	93	4	10	21	51	4	2	16	22	4	-56.4	281.7	90.0	-16.2	-72.1	291.0	20	2	25	85.7
UARS	MLS	93	4	10	19	25	32	575	20	14	28	-53.5	259.7	90.0	-22.9	-72.3	290.5				62.3
ATLAS	MAS	93	4	10	22	16	56	2	16	47	56	16.4	4.1	90.0	-16.2	6.9	17.4	177	2	57	147.1
UARS	MLS	93	4	11	1	14	36	576	2	3	34	22.4	37.1	90.0	-22.9	8.0	18.6				117.7
ATLAS	MAS	93	4	10	22	21	42	2	16	52	42	31.6	15.4	90.0	-16.2	20.6	28.6	136	1	11	139.1
UARS	MLS	93	4	10	23	32	46	576	0	21	42	38.7	47.1	90.0	-22.9	21.3	29.7				120.2
ATLAS	MAS	93	4	10	22	24	58	2	16	55	58	41.2	25.6	90.0	-16.2	28.7	38.3	146	0	33	130.6
UARS	MLS	93	4	10	21	51	44	575	22	40	38	50.1	52.9	90.0	-22.9	29.7	39.3				119.0
ATLAS	MAS	93	4	10	22	26	59	2	16	57	59	46.4	33.5	90.0	-16.2	32.9	45.3	115	2	16	124.7
UARS	MLS	93	4	10	20	10	42	575	20	59	38	56.6	49.9	90.0	-22.9	33.8	45.8				114.9
ATLAS	MAS	93	4	10	23	15	12	2	17	46	12	-52.8	217.1	90.0	-16.2	-66.5	199.5	161	2	36	64.8
UARS	MLS	93	4	11	1	52	1	576	2	40	55	-50.5	171.1	90.0	-22.9	-67.3	202.4				61.0
ATLAS	MAS	93	4	10	23	17	13	2	17	48	13	-55.6	229.4	90.0	-16.2	-70.8	216.5	123	0	57	71.4
UARS	MLS	93	4	11	0	14	28	576	1	3	22	-52.9	188.5	90.0	-22.9	-71.3	219.7				62.0
ATLAS	MAS	93	4	10	23	18	58	2	17	49	58	-56.9	241.4	90.0	-16.2	-73.0	236.7	78	0	41	77.2
UARS	MLS	93	4	10	22	37	26	575	23	26	20	-54.2	208.3	90.0	-22.9	-73.5	238.3				62.7
ATLAS	MAS	93	4	10	23	20	44	2	17	51	44	-56.8	253.8	90.0	-16.2	-72.9	259.3	129	2	19	83.1
UARS	MLS	93	4	10	21	1	13	575	21	50	11	-54.2	232.5	90.0	-22.9	-73.6	262.4				62.7
ATLAS	MAS	93	4	10	23	47	6	2	18	18	6	15.7	340.7	90.0	-16.2	6.2	354.0	140	3	3	147.0
UARS	MLS	93	4	11	2	51	5	576	3	39	59	21.5	13.4	90.0	-22.9	7.2	354.8				117.7

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	10	23	51	53	2	18	22	53	31.0	351.9	90.0	-16.2	20.0	5.1	130	1	17	139.5
UARS	MLS	93	4	11	1	9	15	576	1	58	12	37.8	23.7	90.0	-22.9	20.7	6.1				120.3
ATLAS	MAS	93	4	10	23	55	8	2	18	26	8	40.6	1.9	90.0	-16.2	28.2	14.6	165	0	27	131.2
UARS	MLS	93	4	10	23	27	57	576	0	16	52	50.1	28.7	90.0	-22.9	29.7	15.0				119.1
ATLAS	MAS	93	4	10	23	57	9	2	18	28	9	45.9	9.6	90.0	-16.2	32.5	21.5	148	2	10	125.3
UARS	MLS	93	4	10	21	46	55	575	22	35	53	56.5	25.7	90.0	-22.9	33.8	21.6				114.9
ATLAS	MAS	93	4	11	0	45	38	2	19	16	38	-52.9	194.3	90.0	-16.2	-66.6	176.7	99	2	42	64.9
UARS	MLS	93	4	11	3	28	14	576	4	17	10	-50.4	146.9	90.0	-22.9	-67.2	178.2				60.9
ATLAS	MAS	93	4	11	0	47	38	2	19	18	38	-55.7	206.7	90.0	-16.2	-70.9	193.9	65	1	3	71.4
UARS	MLS	93	4	11	1	50	41	576	2	39	36	-52.9	164.3	90.0	-22.9	-71.2	195.5				62.0
ATLAS	MAS	93	4	11	0	49	9	2	19	20	9	-56.8	216.9	90.0	-16.2	-72.8	211.0	121	0	35	76.3
UARS	MLS	93	4	11	0	13	40	576	1	2	34	-54.1	184.1	90.0	-22.9	-73.4	214.2				62.7
ATLAS	MAS	93	4	11	0	50	54	2	19	21	54	-56.9	229.3	90.0	-16.2	-73.0	233.6	155	2	13	82.2
UARS	MLS	93	4	10	22	37	10	575	23	26	4	-54.5	206.8	90.0	-22.9	-74.2	236.1				62.9
ATLAS	MAS	93	4	11	1	17	16	2	19	48	16	15.0	317.3	90.0	-16.2	5.5	330.6	102	3	10	146.9
UARS	MLS	93	4	11	4	27	51	576	5	16	45	19.8	350.2	90.0	-22.9	5.7	331.5				117.5
ATLAS	MAS	93	4	11	1	22	3	2	19	53	3	30.3	328.3	90.0	-16.2	19.4	341.6	122	1	23	139.9
UARS	MLS	93	4	11	2	45	44	576	3	34	43	37.0	0.2	90.0	-22.9	20.1	342.5				120.5
ATLAS	MAS	93	4	11	1	25	34	2	19	56	34	40.7	339.0	90.0	-16.2	28.3	351.8	99	0	20	131.1
UARS	MLS	93	4	11	1	4	43	576	1	53	38	48.9	6.9	90.0	-22.9	28.9	352.5				119.4
ATLAS	MAS	93	4	11	1	27	34	2	19	58	34	46.0	346.8	90.0	-16.2	32.6	358.7	131	2	4	125.3
UARS	MLS	93	4	10	23	23	25	576	0	12	23	56.4	3.2	90.0	-22.9	33.7	358.4				115.2
ATLAS	MAS	93	4	11	2	15	48	2	20	46	48	-52.5	170.2	90.0	-16.2	-66.0	152.3	132	2	48	64.1
UARS	MLS	93	4	11	5	4	44	576	5	53	40	-49.9	123.9	90.0	-22.9	-66.4	155.1				60.7
ATLAS	MAS	93	4	11	2	17	48	2	20	48	48	-55.4	182.3	90.0	-16.2	-70.5	168.7	113	1	9	70.5
UARS	MLS	93	4	11	3	26	54	576	4	15	50	-52.8	140.1	90.0	-22.9	-71.1	171.3				61.9
ATLAS	MAS	93	4	11	2	19	34	2	20	50	34	-56.8	194.2	90.0	-16.2	-72.8	188.5	75	0	29	76.3
UARS	MLS	93	4	11	1	49	53	576	2	38	49	-54.1	159.9	90.0	-22.9	-73.3	190.0				62.6
ATLAS	MAS	93	4	11	2	21	19	2	20	52	19	-56.9	206.6	90.0	-16.2	-73.0	211.0	111	2	7	82.2
UARS	MLS	93	4	11	0	13	40	576	1	2	34	-54.1	184.1	90.0	-22.9	-73.4	214.2				62.7
ATLAS	MAS	93	4	11	2	47	12	2	21	18	12	13.4	293.3	90.0	-16.2	4.1	306.7	145	3	17	146.9
UARS	MLS	93	4	11	6	4	20	576	6	53	15	18.8	326.4	90.0	-22.9	4.9	307.7				117.5
ATLAS	MAS	93	4	11	2	52	13	2	21	23	13	29.6	304.8	90.0	-16.2	18.8	318.1	112	1	30	140.3
UARS	MLS	93	4	11	4	22	14	576	5	11	7	36.2	336.7	90.0	-22.9	19.4	318.9				120.6
ATLAS	MAS	93	4	11	2	55	44	2	21	26	44	40.0	315.3	90.0	-16.2	27.8	328.1	116	0	14	131.7
UARS	MLS	93	4	11	2	40	56	576	3	29	52	48.9	342.7	90.0	-22.9	28.8	328.3				119.5
ATLAS	MAS	93	4	11	2	57	45	2	21	28	45	45.4	322.9	90.0	-16.2	32.1	334.9	163	1	57	125.9
UARS	MLS	93	4	11	0	59	54	576	1	48	48	56.1	340.8	90.0	-22.9	33.6	335.1				115.5
ATLAS	MAS	93	4	11	3	45	58	2	22	16	58	-52.1	146.0	90.0	-16.2	-65.4	127.9	163	2	54	63.3
UARS	MLS	93	4	11	6	40	57	576	7	29	54	-49.8	99.7	90.0	-22.9	-66.3	130.8				60.6
ATLAS	MAS	93	4	11	3	47	59	2	22	18	59	-55.2	158.0	90.0	-16.2	-70.1	143.7	161	1	15	69.7
UARS	MLS	93	4	11	5	3	7	576	5	52	5	-52.8	115.9	90.0	-22.9	-71.0	147.1				61.9

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	MAS	93 4 11 3 49 44	2 22 20 44	-56.7 169.7	90.0 -16.2	-72.6 162.8	120	0 23	75.5
UARS	MLS	93 4 11 3 26 6	576 4 15 3	-54.0 135.7	90.0 -22.9	-73.2 165.9			62.6
ATLAS	MAS	93 4 11 3 51 30	2 22 22 30	-56.9 182.1	90.0 -16.2	-73.1 185.3	132	2 1	81.3
UARS	MLS	93 4 11 1 49 37	576 2 38 33	-54.4 158.4	90.0 -22.9	-74.0 187.9			62.9
ATLAS	MAS	93 4 11 4 17 22	2 22 48 22	12.7 269.9	90.0 -16.2	3.4 283.3	102	3 23	146.7
UARS	MLS	93 4 11 7 40 49	576 8 29 45	17.9 302.6	90.0 -22.9	4.1 283.9			117.5
ATLAS	MAS	93 4 11 4 22 23	2 22 53 23	28.9 281.3	90.0 -16.2	18.2 294.6	100	1 36	140.6
UARS	MLS	93 4 11 5 58 43	576 6 47 38	35.4 313.1	90.0 -22.9	18.8 295.3			120.7
ATLAS	MAS	93 4 11 4 25 54	2 22 56 54	35.4 291.6	90.0 -16.2	27.3 304.5	129	0 8	132.2
UARS	MLS	93 4 11 4 17 25	576 5 6 23	48.2 319.6	90.0 -22.9	28.4 304.9			119.7
ATLAS	MAS	93 4 11 4 28 10	2 22 59 10	45.5 300.1	90.0 -16.2	32.2 312.1	138	1 51	125.9
UARS	MLS	93 4 11 2 36 23	576 3 25 18	55.9 318.3	90.0 -22.9	33.4 311.9			115.8
ATLAS	MAS	93 4 11 7 26 15	3 1 57 15	38.2 244.3	90.0 -16.2	26.2 257.2	159	0 4	133.3
UARS	MLS	93 4 11 7 30 24	576 8 19 18	46.9 273.4	90.0 -22.9	27.4 258.0			120.2
ATLAS	MAS	93 4 11 7 28 31	3 1 59 31	44.4 252.4	90.0 -16.2	31.3 264.6	155	3 22	127.1
UARS	MLS	93 4 11 4 6 28	576 4 55 24	54.5 254.8	90.0 -22.9	32.6 263.9			107.2
ATLAS	MAS	93 4 11 7 30 1	3 2 1 1	48.1 258.9	90.0 -16.2	34.2 270.2	69	3 21	122.7
UARS	MLS	93 4 11 4 8 4	576 4 56 58	56.2 264.6	90.0 -22.9	33.6 270.0			109.8
ATLAS	MAS	93 4 11 8 16 44	3 2 47 44	-51.3 74.9	90.0 -16.2	-64.4 56.5	155	3 13	61.9
UARS	MLS	93 4 11 11 29 53	576 12 18 48	-49.0 28.2	90.0 -22.9	-65.2 59.1			60.2
ATLAS	MAS	93 4 11 8 19 0	3 2 50 0	-55.0 88.1	90.0 -16.2	-69.8 73.4	104	1 33	68.9
UARS	MLS	93 4 11 9 52 3	576 10 40 59	-52.2 44.7	90.0 -22.9	-70.0 76.0			61.5
ATLAS	MAS	93 4 11 8 20 45	3 2 51 45	-56.6 99.8	90.0 -16.2	-72.5 92.1	71	0 5	74.6
UARS	MLS	93 4 11 8 14 46	576 9 3 41	-53.9 63.1	90.0 -22.9	-73.0 93.5			62.5
ATLAS	MAS	93 4 11 8 22 31	3 2 53 31	-57.0 112.1	90.0 -16.2	-73.1 114.4	78	1 44	80.3
UARS	MLS	93 4 11 6 38 16	576 7 27 11	-54.3 85.8	90.0 -22.9	-73.8 115.6			62.8
ATLAS	MAS	93 4 11 8 25 16	3 2 56 16	-54.9 130.8	90.0 -16.2	-69.7 145.6	128	3 21	89.4
UARS	MLS	93 4 11 5 3 23	576 5 52 21	-52.3 117.3	90.0 -22.9	-70.2 148.7			61.6
ATLAS	MAS	93 4 11 8 26 47	3 2 57 47	-52.7 139.9	90.0 -16.2	-66.3 157.6	101	3 21	94.4
UARS	MLS	93 4 11 5 5 0	576 5 53 56	-49.3 125.1	90.0 -22.9	-65.6 156.2			60.5
ATLAS	MAS	93 4 11 8 52 39	3 3 23 39	26.1 210.2	90.0 -16.2	15.7 223.5	155	1 55	141.8
UARS	MLS	93 4 11 10 48 11	576 11 37 8	32.8 242.4	90.0 -22.9	16.7 224.4			121.1
ATLAS	MAS	93 4 11 8 56 40	3 3 27 40	38.3 221.4	90.0 -16.2	26.3 234.4	77	0 10	133.1
UARS	MLS	93 4 11 9 6 53	576 9 55 48	46.2 250.2	90.0 -22.9	27.0 234.6			120.4
ATLAS	MAS	93 4 11 8 58 56	3 3 29 56	44.4 229.6	90.0 -16.2	31.4 241.8	181	3 15	127.0
UARS	MLS	93 4 11 7 25 19	576 8 14 17	55.5 247.4	90.0 -22.9	33.2 240.2			116.1
ATLAS	MAS	93 4 11 9 0 26	3 3 31 26	48.1 236.1	90.0 -16.2	34.3 247.3	66	3 15	122.7
UARS	MLS	93 4 11 5 44 49	576 6 33 45	56.5 243.8	90.0 -22.9	33.8 247.8			110.5
ATLAS	MAS	93 4 11 9 47 9	3 4 18 9	-51.4 52.2	90.0 -16.2	-64.4 33.7	89	3 18	61.9
UARS	MLS	93 4 11 13 6 6	576 13 55 2	-49.0 4.0	90.0 -22.9	-65.1 34.9			60.1
ATLAS	MAS	93 4 11 9 49 10	3 4 20 10	-54.7 63.8	90.0 -16.2	-69.3 48.4	144	1 39	68.2
UARS	MLS	93 4 11 11 28 16	576 12 17 13	-52.1 20.5	90.0 -22.9	-69.9 51.8			61.4

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	11	9	50	55	3	4	21	55	-56.5	75.3	90.0	-16.2	-72.3	66.5	117	0	0	73.8
UARS	MLS	93	4	11	9	50	59	576	10	39	55	-53.9	38.9	90.0	-22.9	-72.9	69.3				62.5
ATLAS	MAS	93	4	11	9	52	26	3	4	23	26	-57.0	85.9	90.0	-16.2	-73.2	85.4	176	1	38	78.7
UARS	MLS	93	4	11	8	14	14	576	9	3	9	-54.6	60.1	90.0	-22.9	-74.4	89.2				63.0
ATLAS	MAS	93	4	11	9	55	12	3	4	26	12	-55.5	104.9	90.0	-16.2	-70.6	118.2	158	3	16	87.7
UARS	MLS	93	4	11	6	39	5	576	7	27	58	-53.1	90.3	90.0	-22.9	-71.6	121.3				62.0
ATLAS	MAS	93	4	11	9	56	42	3	4	27	42	-53.5	114.2	90.0	-16.2	-67.4	131.3	78	3	16	92.7
UARS	MLS	93	4	11	6	40	41	576	7	29	38	-50.3	98.4	90.0	-22.9	-67.1	129.7				60.8
ATLAS	MAS	93	4	11	22	23	41	3	16	54	41	16.1	357.9	90.0	-16.2	8.4	11.3	108	2	53	142.7
UARS	MLS	93	4	12	1	17	6	577	2	6	2	23.3	30.7	90.0	-22.9	8.8	12.2				121.8
ATLAS	MAS	93	4	11	22	28	13	3	16	59	13	32.4	8.9	90.0	-16.2	21.3	22.1	127	1	7	136.8
UARS	MLS	93	4	11	23	35	16	577	0	24	10	39.5	40.4	90.0	-22.9	22.0	23.1				122.5
ATLAS	MAS	93	4	11	22	31	29	3	17	2	29	41.9	19.3	90.0	-16.2	29.3	31.9	106	0	37	129.5
UARS	MLS	93	4	11	21	54	14	576	22	43	11	50.8	45.7	90.0	-22.9	30.1	32.5				119.4
ATLAS	MAS	93	4	11	22	32	59	3	17	3	59	45.8	25.2	90.0	-16.2	32.5	37.1	180	2	20	125.5
UARS	MLS	93	4	11	20	12	40	576	21	1	34	56.9	38.6	90.0	-22.9	34.1	36.8				112.8
ATLAS	MAS	93	4	11	23	21	43	3	17	52	43	-53.2	211.4	90.0	-16.2	-67.1	194.1	110	2	33	64.5
UARS	MLS	93	4	12	1	54	48	577	2	43	44	-50.6	165.1	90.0	-22.9	-67.5	196.5				60.4
ATLAS	MAS	93	4	11	23	23	43	3	17	54	43	-55.9	223.9	90.0	-16.2	-71.3	212.0	61	0	53	70.6
UARS	MLS	93	4	12	0	17	14	577	1	6	10	-53.0	182.6	90.0	-22.9	-71.4	213.6				61.9
ATLAS	MAS	93	4	11	23	25	14	3	17	56	14	-56.9	234.3	90.0	-16.2	-73.0	229.6	111	0	45	75.2
UARS	MLS	93	4	11	22	40	13	576	23	29	9	-54.2	202.3	90.0	-22.9	-73.6	232.2				62.8
ATLAS	MAS	93	4	11	23	27	14	3	17	58	14	-56.7	248.4	90.0	-16.2	-72.6	255.3	109	2	22	81.5
UARS	MLS	93	4	11	21	4	16	576	21	53	10	-53.9	228.0	90.0	-22.9	-73.0	258.3				62.6
ATLAS	MAS	93	4	11	23	53	37	3	18	24	37	16.6	334.0	90.0	-16.2	7.0	347.4	166	2	59	142.7
UARS	MLS	93	4	12	2	53	36	577	3	42	32	22.4	7.0	90.0	-22.9	8.0	348.4				121.9
ATLAS	MAS	93	4	11	23	58	23	3	18	29	23	31.8	345.4	90.0	-16.2	20.7	358.6	123	1	13	137.1
UARS	MLS	93	4	12	1	11	46	577	2	0	40	38.7	17.0	90.0	-22.9	21.4	359.5				122.8
ATLAS	MAS	93	4	12	0	1	39	3	18	32	39	41.3	355.6	90.0	-16.2	28.8	8.2	133	0	30	130.0
UARS	MLS	93	4	11	23	30	44	577	0	19	41	50.2	22.8	90.0	-22.9	29.7	9.1				119.8
ATLAS	MAS	93	4	12	0	3	24	3	18	34	24	45.9	2.4	90.0	-16.2	32.5	14.3	160	2	13	125.4
UARS	MLS	93	4	11	21	49	26	576	22	38	20	56.7	17.9	90.0	-22.9	33.9	14.6				113.6
ATLAS	MAS	93	4	12	0	51	53	3	19	22	53	-52.9	187.2	90.0	-16.2	-66.6	169.6	147	2	39	63.8
UARS	MLS	93	4	12	3	31	1	577	4	19	58	-50.5	140.9	90.0	-22.9	-67.4	172.2				60.3
ATLAS	MAS	93	4	12	0	53	53	3	19	24	53	-55.7	199.5	90.0	-16.2	-70.9	186.7	107	0	59	69.8
UARS	MLS	93	4	12	1	53	27	577	2	42	25	-53.0	158.3	90.0	-22.9	-71.3	189.4				61.8
ATLAS	MAS	93	4	12	0	55	39	3	19	26	39	-56.9	211.5	90.0	-16.2	-73.0	207.0	71	0	39	75.2
UARS	MLS	93	4	12	0	16	26	577	1	5	23	-54.2	178.1	90.0	-22.9	-73.5	208.0				62.8
ATLAS	MAS	93	4	12	0	57	9	3	19	28	9	-56.9	222.1	90.0	-16.2	-73.0	226.4	184	2	17	79.9
UARS	MLS	93	4	11	22	39	57	576	23	28	53	-54.6	200.8	90.0	-22.9	-74.3	230.0				63.2
ATLAS	MAS	93	4	12	0	58	40	3	19	29	40	-55.9	232.5	90.0	-16.2	-71.4	244.2	185	2	17	84.7
UARS	MLS	93	4	11	22	41	17	576	23	30	12	-52.6	208.2	90.0	-22.9	-70.7	239.4				61.6

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	MAS	93 4 12 1 23 47	3 19 54 47	15.8 310.6	90.0 -16.2	6.3 324.0	130	3 6	142.5
UARS	MLS	93 4 12 4 30 5	577 5 19 2	21.5 343.2	90.0 -22.9	7.3 324.7			122.0
ATLAS	MAS	93 4 12 1 28 33	3 19 59 33	31.1 321.8	90.0 -16.2	20.1 335.1	118	1 19	137.3
UARS	MLS	93 4 12 2 48 15	577 3 37 10	37.9 353.5	90.0 -22.9	20.7 336.0			123.0
ATLAS	MAS	93 4 12 1 31 49	3 20 2 49	40.7 331.9	90.0 -16.2	28.3 344.6	156	0 24	130.4
UARS	MLS	93 4 12 1 6 57	577 1 55 55	50.1 358.5	90.0 -22.9	29.7 344.8			119.8
ATLAS	MAS	93 4 12 1 33 50	3 20 4 50	46.0 339.6	90.0 -16.2	32.6 351.5	140	2 7	125.3
UARS	MLS	93 4 11 23 25 55	577 0 14 51	56.6 355.5	90.0 -22.9	33.8 351.4			113.9
ATLAS	MAS	93 4 12 2 22 18	3 20 53 18	-52.9 164.4	90.0 -16.2	-66.7 146.8	87	2 44	63.8
UARS	MLS	93 4 12 5 7 14	577 5 56 7	-50.5 116.7	90.0 -22.9	-67.3 148.0			60.3
ATLAS	MAS	93 4 12 2 24 4	3 20 55 4	-55.4 175.1	90.0 -16.2	-70.5 161.6	155	1 5	69.1
UARS	MLS	93 4 12 3 29 41	577 4 18 34	-52.9 134.1	90.0 -22.9	-71.2 165.3			61.8
ATLAS	MAS	93 4 12 2 25 49	3 20 56 49	-56.8 187.0	90.0 -16.2	-72.8 181.3	108	0 33	74.4
UARS	MLS	93 4 12 1 52 39	577 2 41 37	-54.1 153.9	90.0 -22.9	-73.5 183.9			62.8
ATLAS	MAS	93 4 12 2 27 50	3 20 58 50	-56.8 201.2	90.0 -16.2	-72.8 207.0	88	2 11	80.7
UARS	MLS	93 4 12 0 16 26	577 1 5 23	-54.2 178.1	90.0 -22.9	-73.5 208.0			62.8
ATLAS	MAS	93 4 12 2 53 57	3 21 24 57	15.1 287.2	90.0 -16.2	5.7 300.6	94	3 12	142.3
UARS	MLS	93 4 12 6 6 50	577 6 55 48	19.8 320.0	90.0 -22.9	5.8 301.4			121.9
ATLAS	MAS	93 4 12 2 58 43	3 21 29 43	30.4 298.3	90.0 -16.2	19.5 311.5	110	1 26	137.6
UARS	MLS	93 4 12 4 24 44	577 5 13 40	37.1 330.0	90.0 -22.9	20.1 312.4			123.2
ATLAS	MAS	93 4 12 3 1 59	3 21 32 59	40.1 308.1	90.0 -16.2	27.8 320.9	173	0 18	130.9
UARS	MLS	93 4 12 2 43 26	577 3 32 20	49.5 335.5	90.0 -22.9	29.3 321.5			120.1
ATLAS	MAS	93 4 12 3 4 15	3 21 35 15	46.0 316.8	90.0 -16.2	32.6 328.6	120	2 1	125.3
UARS	MLS	93 4 12 1 2 40	577 1 51 37	56.2 334.7	90.0 -22.9	33.6 329.2			114.7
ATLAS	MAS	93 4 12 3 52 28	3 22 23 28	-52.6 140.2	90.0 -16.2	-66.1 122.4	119	2 51	63.1
UARS	MLS	93 4 12 6 43 43	577 7 32 38	-49.9 93.7	90.0 -22.9	-66.4 124.9			59.9
ATLAS	MAS	93 4 12 3 54 29	3 22 25 29	-55.5 152.4	90.0 -16.2	-70.6 138.9	99	1 11	69.1
UARS	MLS	93 4 12 5 5 54	577 5 54 48	-52.9 109.9	90.0 -22.9	-71.1 141.1			61.8
ATLAS	MAS	93 4 12 3 56 15	3 22 27 14	-56.8 164.3	90.0 -16.2	-72.9 158.8	66	0 27	74.4
UARS	MLS	93 4 12 3 28 52	577 4 17 46	-54.1 129.7	90.0 -22.9	-73.4 159.8			62.8
ATLAS	MAS	93 4 12 3 57 45	3 22 28 45	-56.9 174.9	90.0 -16.2	-73.1 178.2	164	2 5	79.1
UARS	MLS	93 4 12 1 52 23	577 2 41 22	-54.5 152.4	90.0 -22.9	-74.1 181.8			63.1
ATLAS	MAS	93 4 12 4 23 52	3 22 54 52	13.6 263.3	90.0 -16.2	4.2 276.6	135	3 19	142.0
UARS	MLS	93 4 12 7 43 19	577 8 32 13	18.9 296.2	90.0 -22.9	5.0 277.6			121.9
ATLAS	MAS	93 4 12 4 28 54	3 22 59 54	29.7 274.7	90.0 -16.2	18.9 288.0	100	1 32	137.8
UARS	MLS	93 4 12 6 1 13	577 6 50 11	36.3 306.5	90.0 -22.9	19.4 288.8			123.4
ATLAS	MAS	93 4 12 4 32 25	3 23 3 25	40.2 285.3	90.0 -16.2	27.9 298.1	109	0 12	130.8
UARS	MLS	93 4 12 4 19 55	577 5 8 50	48.9 312.5	90.0 -22.9	28.8 298.1			120.5
ATLAS	MAS	93 4 12 4 34 25	3 23 5 25	45.5 292.9	90.0 -16.2	32.2 304.9	154	1 55	125.8
UARS	MLS	93 4 12 2 38 54	577 3 27 51	56.2 310.5	90.0 -22.9	33.6 305.0			114.7
ATLAS	MAS	93 4 12 5 22 39	3 23 53 39	-52.2 116.0	90.0 -16.2	-65.5 98.0	150	2 57	62.5
UARS	MLS	93 4 12 8 19 56	577 9 8 52	-49.8 69.5	90.0 -22.9	-66.3 100.7			59.9

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	12	6	53	4	4	1	24	4	-52.2	93.3	90.0	-16.2	-65.6	75.2	86	3	3	62.5
UARS	MLS	93	4	12	9	56	10	577	10	45	7	-49.8	45.3	90.0	-22.9	-66.2	76.4				59.8
ATLAS	MAS	93	4	12	6	55	5	4	1	26	5	-55.3	105.3	90.0	-16.2	-70.2	91.2	97	1	23	68.3
UARS	MLS	93	4	12	8	18	20	577	9	7	17	-52.7	61.5	90.0	-22.9	-70.9	92.7				61.7
ATLAS	MAS	93	4	12	6	56	35	4	1	27	35	-56.6	115.4	90.0	-16.2	-72.5	107.5	154	0	15	72.9
UARS	MLS	93	4	12	6	41	19	577	7	30	15	-54.0	81.3	90.0	-22.9	-73.2	111.5				62.7
ATLAS	MAS	93	4	12	6	58	21	4	1	29	21	-57.0	127.7	90.0	-16.2	-73.1	129.8	149	1	53	78.2
UARS	MLS	93	4	12	5	4	50	577	5	53	45	-54.4	104.0	90.0	-22.9	-74.0	133.5				63.1
ATLAS	MAS	93	4	12	7	29	14	4	2	0	14	28.4	227.7	90.0	-16.2	17.7	241.0	74	1	44	138.1
UARS	MLS	93	4	12	9	14	12	577	10	3	6	34.6	259.4	90.0	-22.9	18.1	241.5				123.9
ATLAS	MAS	93	4	12	7	32	45	4	2	3	45	38.9	237.9	90.0	-16.2	26.8	250.8	133	0	0	131.6
UARS	MLS	93	4	12	7	32	54	577	8	21	51	47.6	266.4	90.0	-22.9	27.9	251.3				121.1
ATLAS	MAS	93	4	12	7	34	31	4	2	5	31	43.7	244.2	90.0	-16.2	30.8	256.6	149	3	25	127.5
UARS	MLS	93	4	12	4	8	42	577	4	57	35	53.7	245.8	90.0	-22.9	32.1	256.0				103.7
ATLAS	MAS	93	4	12	7	36	1	4	2	7	1	47.5	250.6	90.0	-16.2	33.8	262.0	53	3	25	123.7
UARS	MLS	93	4	12	4	10	18	577	4	59	16	55.7	255.2	90.0	-22.9	33.3	262.0				106.7
ATLAS	MAS	93	4	12	7	36	1	4	2	7	1	47.5	250.6	90.0	-16.2	33.8	262.0	126	1	43	123.7
UARS	MLS	93	4	12	5	52	40	577	6	41	34	54.7	270.3	90.0	-22.9	32.7	261.5				116.5
ATLAS	MAS	93	4	12	8	23	14	4	2	54	14	-51.8	69.1	90.0	-16.2	-65.0	50.9	115	3	9	61.9
UARS	MLS	93	4	12	11	32	39	577	12	21	37	-49.1	22.2	90.0	-22.9	-65.3	53.2				59.4
ATLAS	MAS	93	4	12	8	25	15	4	2	56	15	-55.0	80.9	90.0	-16.2	-69.8	66.2	146	1	29	67.6
UARS	MLS	93	4	12	9	54	33	577	10	43	32	-52.7	37.3	90.0	-22.9	-70.9	68.5				61.6
ATLAS	MAS	93	4	12	8	27	0	4	2	58	0	-56.6	92.6	90.0	-16.2	-72.5	84.9	105	0	9	72.8
UARS	MLS	93	4	12	8	17	32	577	9	6	30	-54.0	57.1	90.0	-22.9	-73.1	87.4				62.7
ATLAS	MAS	93	4	12	8	28	31	4	2	59	31	-57.0	103.2	90.0	-16.2	-73.2	104.0	181	1	47	77.4
UARS	MLS	93	4	12	6	40	47	577	7	29	44	-54.7	78.2	90.0	-22.9	-74.6	107.2				63.4
ATLAS	MAS	93	4	12	8	31	47	4	3	2	47	-54.6	125.2	90.0	-16.2	-69.2	140.7	141	3	25	87.5
UARS	MLS	93	4	12	5	6	26	577	5	55	20	-52.0	112.7	90.0	-22.9	-69.6	144.1				61.1
ATLAS	MAS	93	4	12	8	33	17	4	3	4	17	-52.2	134.1	90.0	-16.2	-65.6	152.1	85	3	25	92.2
UARS	MLS	93	4	12	5	8	2	577	5	57	0	-48.9	120.4	90.0	-22.9	-64.9	151.3				59.5
ATLAS	MAS	93	4	12	8	59	9	4	3	30	9	26.9	203.6	90.0	-16.2	16.4	216.9	160	1	51	138.5
UARS	MLS	93	4	12	10	50	41	577	11	39	36	33.7	235.9	90.0	-22.9	17.5	217.9				124.1
ATLAS	MAS	93	4	12	9	2	55	4	3	33	55	38.3	214.2	90.0	-16.2	26.3	227.2	147	0	6	132.0
UARS	MLS	93	4	12	9	9	23	577	9	58	21	46.9	243.2	90.0	-22.9	27.5	227.9				121.4
ATLAS	MAS	93	4	12	9	4	56	4	3	35	56	43.8	221.4	90.0	-16.2	30.9	233.7	187	3	19	127.4
UARS	MLS	93	4	12	5	45	11	577	6	34	6	54.1	223.1	90.0	-22.9	32.3	232.8				104.0
ATLAS	MAS	93	4	12	9	6	26	4	3	37	26	47.6	227.8	90.0	-16.2	33.8	239.2	54	3	19	123.6
UARS	MLS	93	4	12	5	46	47	577	6	35	46	55.9	232.7	90.0	-22.9	33.5	238.8				107.0
ATLAS	MAS	93	4	12	9	6	26	4	3	37	26	47.6	227.8	90.0	-16.2	33.8	239.2	174	1	37	123.6
UARS	MLS	93	4	12	7	29	9	577	8	18	4	54.4	247.7	90.0	-22.9	32.5	238.3				116.9
ATLAS	MAS	93	4	12	9	59	11	4	4	30	11	-57.0	82.2	90.0	-16.2	-73.1	84.8	78	1	41	78.1
UARS	MLS	93	4	12	8	17	16	577	9	6	14	-54.3	55.6	90.0	-22.9	-73.8	85.3				63.1

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	12	10	1	42	4	4	32	42	-55.2	99.3	90.0	-16.2	-70.1	113.5	160	3	19	85.9
UARS	MLS	93	4	12	6	42	7	577	7	31	3	-52.8	85.7	90.0	-22.9	-71.0	116.9				61.7
ATLAS	MAS	93	4	12	10	3	12	4	4	34	12	-53.0	108.5	90.0	-16.2	-66.8	126.0	62	3	19	90.5
UARS	MLS	93	4	12	6	43	43	577	7	32	38	-49.9	93.7	90.0	-22.9	-66.4	124.9				59.9
ATLAS	MAS	93	4	12	10	29	20	4	5	0	20	26.2	180.1	90.0	-16.2	15.8	193.4	143	1	57	138.6
UARS	MLS	93	4	12	12	27	10	577	13	16	6	32.9	212.3	90.0	-22.9	16.8	194.3				124.3
ATLAS	MAS	93	4	12	10	33	6	4	5	4	6	37.7	190.6	90.0	-16.2	25.8	203.6	161	0	12	132.4
UARS	MLS	93	4	12	10	45	53	577	11	34	46	46.3	220.1	90.0	-22.9	27.0	204.4				121.8
ATLAS	MAS	93	4	12	10	35	36	4	5	6	36	44.5	199.6	90.0	-16.2	31.4	211.8	173	3	13	126.7
UARS	MLS	93	4	12	9	4	19	577	9	53	15	55.6	217.1	90.0	-22.9	33.2	210.0				115.4
ATLAS	MAS	93	4	12	10	37	7	4	5	8	7	48.2	206.1	90.0	-16.2	34.3	217.3	64	3	13	122.8
UARS	MLS	93	4	12	7	23	49	577	8	12	42	56.5	213.6	90.0	-22.9	33.8	217.6				108.4
ATLAS	MAS	93	4	12	11	23	50	4	5	54	50	-51.4	22.2	90.0	-16.2	-64.5	3.8	79	3	21	61.3
UARS	MLS	93	4	12	14	45	5	577	15	34	0	-49.0	333.8	90.0	-22.9	-65.1	4.7				59.3
ATLAS	MAS	93	4	12	11	25	50	4	5	56	50	-54.7	33.9	90.0	-16.2	-69.4	18.6	130	1	41	66.9
UARS	MLS	93	4	12	13	7	16	577	13	56	11	-52.1	350.3	90.0	-22.9	-69.9	21.6				61.2
ATLAS	MAS	93	4	12	11	27	36	4	5	58	36	-56.5	45.4	90.0	-16.2	-72.3	36.8	104	0	2	72.1
UARS	MLS	93	4	12	11	29	59	577	12	18	53	-53.9	8.7	90.0	-22.9	-73.0	39.1				62.7
ATLAS	MAS	93	4	12	11	29	6	4	6	0	6	-57.0	56.0	90.0	-16.2	-73.2	55.7	168	1	35	76.6
UARS	MLS	93	4	12	9	53	13	577	10	42	7	-54.6	29.9	90.0	-22.9	-74.4	59.0				63.4
ATLAS	MAS	93	4	12	11	31	37	4	6	2	37	-55.7	73.3	90.0	-16.2	-71.0	85.9	197	3	13	84.2
UARS	MLS	93	4	12	8	17	48	577	9	6	46	-53.6	58.6	90.0	-22.9	-72.4	89.3				62.4
ATLAS	MAS	93	4	12	11	33	8	4	6	4	8	-53.8	82.8	90.0	-16.2	-67.9	99.5	48	3	13	88.9
UARS	MLS	93	4	12	8	19	24	577	9	8	20	-50.9	67.0	90.0	-22.9	-67.9	98.3				60.4
ATLAS	MAS	93	4	12	11	59	30	4	6	30	30	25.5	156.6	90.0	-16.2	15.2	169.9	126	2	4	138.7
UARS	MLS	93	4	12	14	3	40	577	14	52	37	32.0	188.7	90.0	-22.9	16.1	170.6				124.5
ATLAS	MAS	93	4	12	12	3	31	4	6	34	31	37.7	167.7	90.0	-16.2	25.8	180.7	76	0	18	132.2
UARS	MLS	93	4	12	12	22	22	577	13	11	16	45.6	196.9	90.0	-22.9	26.5	181.0				122.1
ATLAS	MAS	93	4	12	12	6	2	4	6	37	2	44.6	176.8	90.0	-16.2	31.5	188.9	126	1	24	126.6
UARS	MLS	93	4	12	10	41	20	577	11	30	17	54.6	197.8	90.0	-22.9	32.6	188.7				116.6
ATLAS	MAS	93	4	12	12	7	32	4	6	38	32	48.3	183.3	90.0	-16.2	34.4	194.5	53	3	7	122.7
UARS	MLS	93	4	12	9	0	18	577	9	49	13	56.7	191.1	90.0	-22.9	33.9	194.4				108.8
ATLAS	MAS	93	4	12	12	54	0	4	7	25	0	-51.0	358.1	90.0	-16.2	-63.9	339.5	97	3	27	60.6
UARS	MLS	93	4	12	16	21	35	577	17	10	31	-48.4	310.7	90.0	-22.9	-64.2	341.4				58.9
ATLAS	MAS	93	4	12	12	56	16	4	7	27	16	-54.8	11.1	90.0	-16.2	-69.5	356.0	69	1	47	67.0
UARS	MLS	93	4	12	14	43	29	577	15	32	25	-52.1	326.1	90.0	-22.9	-69.8	357.4				61.2
ATLAS	MAS	93	4	12	12	57	46	4	7	28	46	-56.3	21.0	90.0	-16.2	-72.0	11.3	152	0	8	71.3
UARS	MLS	93	4	12	13	6	12	577	13	55	8	-53.8	344.5	90.0	-22.9	-72.9	14.9				62.6
ATLAS	MAS	93	4	12	12	59	32	4	7	30	32	-57.0	33.3	90.0	-16.2	-73.2	33.2	132	1	29	76.6
UARS	MLS	93	4	12	11	29	43	577	12	18	37	-54.2	7.2	90.0	-22.9	-73.7	37.0				63.0
ATLAS	MAS	93	4	12	13	2	2	4	7	33	2	-55.7	50.6	90.0	-16.2	-70.9	63.2	148	3	7	84.2
UARS	MLS	93	4	12	9	54	17	577	10	43	16	-53.1	35.9	90.0	-22.9	-71.6	66.9				62.0

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	12	13	3	33	4	7	34	33	-53.7	60.0	90.0	-16.2	-67.9	76.8	113	3	7	88.8
UARS	MLS	93	4	12	9	55	38	577	10	44	35	-50.8	42.7	90.0	-22.9	-67.8	74.1				60.4
ATLAS	MAS	93	4	12	13	29	40	4	8	0	40	24.8	133.1	90.0	-16.2	14.5	146.4	107	2	10	138.7
UARS	MLS	93	4	12	15	40	9	577	16	29	7	31.2	165.1	90.0	-22.9	15.4	146.9				124.7
ATLAS	MAS	93	4	12	13	33	41	4	8	4	41	37.1	144.1	90.0	-16.2	25.3	157.1	85	0	25	132.6
UARS	MLS	93	4	12	13	58	51	577	14	47	46	44.8	173.6	90.0	-22.9	26.0	157.5				122.4
ATLAS	MAS	93	4	12	13	36	12	4	8	7	12	44.1	153.0	90.0	-16.2	31.1	165.2	150	1	18	127.0
UARS	MLS	93	4	12	12	17	49	577	13	6	47	54.2	175.1	90.0	-22.9	32.4	165.5				117.0
ATLAS	MAS	93	4	12	13	37	42	4	8	8	42	47.8	159.3	90.0	-16.2	34.0	170.7	46	3	0	123.3
UARS	MLS	93	4	12	10	36	47	577	11	25	43	56.8	168.7	90.0	-22.9	34.0	171.2				109.2
ATLAS	MAS	93	4	12	14	26	26	4	8	57	26	-54.5	346.8	90.0	-16.2	-69.0	331.1	116	1	53	66.3
UARS	MLS	93	4	12	16	19	42	577	17	8	40	-52.0	301.8	90.0	-22.9	-69.7	333.2				61.1
ATLAS	MAS	93	4	12	14	28	12	4	8	59	12	-56.4	358.3	90.0	-16.2	-72.1	348.7	104	0	14	71.3
UARS	MLS	93	4	12	14	42	25	577	15	31	22	-53.8	320.3	90.0	-22.9	-72.8	350.8				62.6
ATLAS	MAS	93	4	12	14	29	42	4	9	0	42	-57.0	8.8	90.0	-16.2	-73.2	7.4	159	1	24	75.8
UARS	MLS	93	4	12	13	5	40	577	13	54	36	-54.6	341.5	90.0	-22.9	-74.3	10.8				63.4
ATLAS	MAS	93	4	12	14	32	13	4	9	3	13	-55.9	26.2	90.0	-16.2	-71.3	38.0	146	3	1	83.4
UARS	MLS	93	4	12	11	30	15	577	12	19	9	-53.5	10.2	90.0	-22.9	-72.2	40.9				62.3
ATLAS	MAS	93	4	12	14	33	43	4	9	4	43	-54.1	35.8	90.0	-16.2	-68.4	52.1	118	3	1	88.0
UARS	MLS	93	4	12	11	31	51	577	12	20	49	-50.7	18.5	90.0	-22.9	-67.7	49.9				60.3
ATLAS	MAS	93	4	12	14	59	50	4	9	30	50	24.1	109.7	90.0	-16.2	13.9	123.0	90	2	16	138.7
UARS	MLS	93	4	12	17	16	38	577	18	5	32	30.3	141.5	90.0	-22.9	14.7	123.2				124.9
ATLAS	MAS	93	4	12	15	3	52	4	9	34	52	36.5	120.4	90.0	-16.2	24.8	133.5	94	0	31	132.9
UARS	MLS	93	4	12	15	35	20	577	16	24	17	44.1	150.4	90.0	-22.9	25.4	134.1				122.8
ATLAS	MAS	93	4	12	15	6	37	4	9	37	37	44.1	130.1	90.0	-16.2	31.1	142.4	112	1	12	126.9
UARS	MLS	93	4	12	13	54	18	577	14	43	12	53.8	152.4	90.0	-22.9	32.1	142.2				117.4
ATLAS	MAS	93	4	12	15	8	8	4	9	39	8	47.9	136.5	90.0	-16.2	34.1	147.9	11	2	54	123.2
UARS	MLS	93	4	12	12	13	17	577	13	2	13	56.9	146.3	90.0	-22.9	34.1	148.0				109.7
ATLAS	MAS	93	4	12	15	56	36	4	10	27	36	-54.2	322.5	90.0	-16.2	-68.5	306.3	165	1	59	65.6
UARS	MLS	93	4	12	17	55	56	577	18	44	54	-52.0	277.6	90.0	-22.9	-69.6	309.0				61.1
ATLAS	MAS	93	4	12	15	58	22	4	10	29	22	-56.2	333.8	90.0	-16.2	-71.8	323.3	151	0	20	70.6
UARS	MLS	93	4	12	16	18	38	577	17	7	37	-53.7	296.1	90.0	-22.9	-72.7	326.6				62.6
ATLAS	MAS	93	4	12	16	0	7	4	10	31	7	-57.0	346.0	90.0	-16.2	-73.2	344.8	123	1	18	75.8
UARS	MLS	93	4	12	14	41	53	577	15	30	50	-54.5	317.3	90.0	-22.9	-74.2	346.6				63.4
ATLAS	MAS	93	4	12	16	2	38	4	10	33	38	-55.9	3.4	90.0	-16.2	-71.2	15.4	111	2	56	83.3
UARS	MLS	93	4	12	13	6	28	577	13	55	24	-53.4	346.0	90.0	-22.9	-72.2	16.8				62.3
ATLAS	MAS	93	4	12	16	4	8	4	10	35	8	-54.0	13.0	90.0	-16.2	-68.3	29.4	174	2	56	87.9
UARS	MLS	93	4	12	13	8	4	577	13	56	58	-50.7	354.3	90.0	-22.9	-67.6	25.6				60.3
ATLAS	MAS	93	4	12	16	29	46	4	11	0	46	22.6	85.6	90.0	-16.2	12.5	98.9	157	2	23	138.8
UARS	MLS	93	4	12	18	53	24	577	19	42	18	28.7	118.5	90.0	-22.9	13.3	100.2				125.1
ATLAS	MAS	93	4	12	16	34	2	4	11	5	2	35.8	96.8	90.0	-16.2	24.2	109.9	102	0	37	133.2
UARS	MLS	93	4	12	17	11	50	577	18	0	47	43.4	127.1	90.0	-22.9	24.9	110.6				123.1

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	12	16	36	48	4	11	7	48	43.6	106.3	90.0	-16.2	30.7	118.6	132	1	5	127.4
UARS	MLS	93	4	12	15	30	48	577	16	19	43	53.4	129.7	90.0	-22.9	31.8	118.9				117.8
ATLAS	MAS	93	4	12	16	38	18	4	11	9	18	47.3	112.6	90.0	-16.2	33.7	124.1	54	2	48	123.8
UARS	MLS	93	4	12	13	49	30	577	14	38	28	56.9	122.1	90.0	-22.9	34.1	123.7				109.6
ATLAS	MAS	93	4	12	17	27	2	4	11	58	2	-54.2	299.7	90.0	-16.2	-68.6	283.6	106	2	5	65.6
UARS	MLS	93	4	12	19	32	25	577	20	21	19	-51.4	254.8	90.0	-22.9	-68.8	286.2				60.7
ATLAS	MAS	93	4	12	17	28	47	4	11	59	47	-56.2	311.1	90.0	-16.2	-71.8	300.7	105	0	26	70.6
UARS	MLS	93	4	12	17	54	52	577	18	43	46	-53.7	271.9	90.0	-22.9	-72.6	302.5				62.6
ATLAS	MAS	93	4	12	17	30	18	4	12	1	18	-57.0	321.5	90.0	-16.2	-73.1	319.1	152	1	12	75.0
UARS	MLS	93	4	12	16	18	6	577	17	7	0	-54.5	293.1	90.0	-22.9	-74.1	322.5				63.4
ATLAS	MAS	93	4	12	17	32	33	4	12	3	33	-56.3	337.3	90.0	-16.2	-71.9	347.3	150	2	50	81.7
UARS	MLS	93	4	12	14	42	25	577	15	31	22	-53.8	320.3	90.0	-22.9	-72.8	350.8				62.6
ATLAS	MAS	93	4	12	17	34	4	4	12	5	4	-54.7	347.2	90.0	-16.2	-69.3	2.5	146	2	50	86.3
UARS	MLS	93	4	12	14	43	45	577	15	32	41	-51.6	327.4	90.0	-22.9	-69.1	358.8				60.8
ATLAS	MAS	93	4	12	17	59	56	4	12	30	56	21.9	62.2	90.0	-16.2	11.9	75.5	127	2	29	138.7
UARS	MLS	93	4	12	20	29	53	577	21	18	48	27.8	94.8	90.0	-22.9	12.6	76.4				125.2
ATLAS	MAS	93	4	12	18	4	12	4	12	35	12	35.2	73.2	90.0	-16.2	23.7	86.3	108	0	44	133.4
UARS	MLS	93	4	12	18	48	19	577	19	37	17	42.6	103.8	90.0	-22.9	24.3	87.1				123.4
ATLAS	MAS	93	4	12	18	6	58	4	12	37	58	43.0	82.5	90.0	-16.2	30.2	94.9	161	0	59	127.8
UARS	MLS	93	4	12	17	7	17	577	17	56	13	52.9	106.9	90.0	-22.9	31.5	95.6				118.2
ATLAS	MAS	93	4	12	18	8	28	4	12	39	28	46.8	88.7	90.0	-16.2	33.3	100.3	95	2	42	124.3
UARS	MLS	93	4	12	15	25	59	577	16	14	52	57.0	99.7	90.0	-22.9	34.1	100.5				110.0
ATLAS	MAS	93	4	12	18	57	12	4	13	28	12	-53.9	275.5	90.0	-16.2	-68.1	258.9	142	2	11	64.9
UARS	MLS	93	4	12	21	8	38	577	21	57	34	-51.4	230.5	90.0	-22.9	-68.7	261.9				60.7
ATLAS	MAS	93	4	12	18	58	57	4	13	29	57	-56.0	286.7	90.0	-16.2	-71.5	275.3	152	0	32	69.9
UARS	MLS	93	4	12	19	31	5	577	20	20	0	-53.6	247.7	90.0	-22.9	-72.5	278.3				62.5
ATLAS	MAS	93	4	12	19	0	43	4	13	31	43	-57.0	298.8	90.0	-16.2	-73.1	296.5	113	1	6	75.0
UARS	MLS	93	4	12	17	54	19	577	18	43	14	-54.4	268.9	90.0	-22.9	-74.0	298.4				63.4
ATLAS	MAS	93	4	12	19	2	43	4	13	33	43	-56.4	312.9	90.0	-16.2	-72.2	321.8	161	2	44	80.9
UARS	MLS	93	4	12	16	18	22	577	17	7	21	-54.1	294.6	90.0	-22.9	-73.4	324.7				63.0
ATLAS	MAS	93	4	12	19	4	14	4	13	35	14	-55.0	322.8	90.0	-16.2	-69.8	337.6	145	2	44	85.4
UARS	MLS	93	4	12	16	19	58	577	17	8	56	-51.6	303.2	90.0	-22.9	-69.0	334.6				60.8
ATLAS	MAS	93	4	12	19	30	6	4	14	1	6	21.2	38.7	90.0	-16.2	11.2	52.1	97	2	36	138.6
UARS	MLS	93	4	12	22	6	22	577	22	55	18	26.9	71.1	90.0	-22.9	11.8	52.7				125.4
ATLAS	MAS	93	4	12	19	34	22	4	14	5	22	34.5	49.6	90.0	-16.2	23.1	62.7	113	0	50	133.7
UARS	MLS	93	4	12	20	24	48	577	21	13	42	41.9	80.4	90.0	-22.9	23.8	63.6				123.7
ATLAS	MAS	93	4	12	19	37	23	4	14	8	23	43.1	59.7	90.0	-16.2	30.3	72.1	107	0	53	127.7
UARS	MLS	93	4	12	18	43	46	577	19	32	43	52.4	84.1	90.0	-22.9	31.2	72.3				118.6
ATLAS	MAS	93	4	12	19	38	54	4	14	9	54	46.9	65.9	90.0	-16.2	33.3	77.5	89	2	36	124.2
UARS	MLS	93	4	12	17	2	28	577	17	51	23	57.0	77.3	90.0	-22.9	34.1	77.3				110.4

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat	sub satellite lon	viewing angle beta	viewing angle alpha	observed point lat	observed point lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	MAS	93 4 12 20 27 37	4 14 58 37	-54.0	252.7	90.0	-16.2	-68.2	236.2	79	2 17	65.0
UARS	MLS	93 4 12 22 44 51	577 23 33 48	-51.3	206.3	90.0	-22.9	-68.6	237.7			60.6
ATLAS	MAS	93 4 12 20 29 23	4 15 0 23	-56.1	263.9	90.0	-16.2	-71.6	252.7	109	0 37	69.9
UARS	MLS	93 4 12 21 7 18	577 21 56 15	-53.6	223.5	90.0	-22.9	-72.4	254.2			62.5
ATLAS	MAS	93 4 12 20 30 53	4 15 1 53	-56.9	274.3	90.0	-16.2	-73.1	270.7	147	1 0	74.2
UARS	MLS	93 4 12 19 30 33	577 20 19 28	-54.4	244.7	90.0	-22.9	-73.9	274.3			63.3
ATLAS	MAS	93 4 12 20 33 9	4 15 4 9	-56.4	290.1	90.0	-16.2	-72.2	299.2	118	2 38	80.9
UARS	MLS	93 4 12 17 54 52	577 18 43 46	-53.7	271.9	90.0	-22.9	-72.6	302.5			62.6
ATLAS	MAS	93 4 12 21 0 1	4 15 31 1	19.6	14.7	90.0	-16.2	9.8	28.1	169	2 42	138.6
UARS	MLS	93 4 12 23 42 51	578 0 31 48	26.0	47.4	90.0	-22.9	11.1	29.0			125.6
ATLAS	MAS	93 4 12 21 4 33	4 15 35 33	33.9	26.0	90.0	-16.2	22.5	39.2	115	0 56	133.9
UARS	MLS	93 4 12 22 1 17	577 22 50 12	41.1	57.1	90.0	-22.9	23.2	40.0			124.0
ATLAS	MAS	93 4 12 21 7 33	4 15 38 33	42.5	35.9	90.0	-16.2	29.8	48.4	132	0 47	128.1
UARS	MLS	93 4 12 20 20 16	577 21 9 13	51.9	61.3	90.0	-22.9	30.9	49.0			119.0
ATLAS	MAS	93 4 12 21 9 4	4 15 40 4	46.4	41.9	90.0	-16.2	32.9	53.7	138	2 30	124.7
UARS	MLS	93 4 12 18 38 58	577 19 27 53	57.0	54.9	90.0	-22.9	34.1	54.1			110.9
ATLAS	MAS	93 4 12 21 57 48	4 16 28 48	-53.6	228.4	90.0	-16.2	-67.7	211.5	125	2 23	64.3
UARS	MLS	93 4 13 0 21 5	578 1 10 2	-51.3	182.1	90.0	-22.9	-68.5	213.5			60.6
ATLAS	MAS	93 4 12 21 59 33	4 16 30 33	-55.9	239.5	90.0	-16.2	-71.2	227.4	154	0 43	69.2
UARS	MLS	93 4 12 22 43 31	577 23 32 29	-53.5	199.3	90.0	-22.9	-72.3	230.0			62.5
ATLAS	MAS	93 4 12 22 1 19	4 16 32 19	-56.9	251.6	90.0	-16.2	-73.1	248.2	106	0 54	74.2
UARS	MLS	93 4 12 21 6 46	577 21 55 43	-54.3	220.5	90.0	-22.9	-73.8	250.2			63.3
ATLAS	MAS	93 4 12 22 3 4	4 16 34 4	-56.7	263.9	90.0	-16.2	-72.7	270.7	181	2 32	79.3
UARS	MLS	93 4 12 19 30 33	577 20 19 28	-54.4	244.7	90.0	-22.9	-73.9	274.3			63.3
ATLAS	MAS	93 4 12 23 28 13	4 17 59 13	-53.7	205.7	90.0	-16.2	-67.7	188.8	73	2 29	64.4
UARS	MLS	93 4 13 1 57 34	578 2 46 27	-50.7	159.2	90.0	-22.9	-67.6	190.5			60.1
ATLAS	MAS	93 4 12 23 29 58	4 18 0 58	-55.9	216.8	90.0	-16.2	-71.3	204.8	102	0 50	69.2
UARS	MLS	93 4 13 0 20 0	578 1 8 54	-53.1	176.6	90.0	-22.9	-71.5	207.6			62.1
ATLAS	MAS	93 4 12 23 31 29	4 18 2 29	-56.9	227.1	90.0	-16.2	-73.0	222.5	145	0 48	73.5
UARS	MLS	93 4 12 22 42 59	577 23 31 57	-54.3	196.3	90.0	-22.9	-73.8	226.0			63.3
ATLAS	MAS	93 4 12 23 33 44	4 18 4 44	-56.5	242.9	90.0	-16.2	-72.4	251.1	91	2 26	80.0
UARS	MLS	93 4 12 21 7 2	577 21 55 59	-54.0	222.0	90.0	-22.9	-73.1	252.2			62.9
ATLAS	MAS	93 4 13 0 0 22	4 18 31 22	18.2	327.9	90.0	-16.2	8.5	341.2	99	2 55	138.2
UARS	MLS	93 4 13 2 56 6	578 3 45 0	23.4	0.6	90.0	-22.9	8.9	342.1			125.8
ATLAS	MAS	93 4 13 0 4 53	4 18 35 53	32.5	338.9	90.0	-16.2	21.4	352.1	114	1 9	134.3
UARS	MLS	93 4 13 1 14 16	578 2 3 13	39.5	10.3	90.0	-22.9	22.0	352.9			124.7
ATLAS	MAS	93 4 13 0 7 54	4 18 38 54	41.3	348.4	90.0	-16.2	28.8	1.0	187	0 34	128.9
UARS	MLS	93 4 12 23 32 58	578 0 21 53	51.3	14.2	90.0	-22.9	30.5	1.4			119.4
ATLAS	MAS	93 4 13 0 9 55	4 18 40 55	46.5	356.3	90.0	-16.2	33.0	8.0	116	2 17	124.5
UARS	MLS	93 4 12 21 51 56	577 22 40 53	56.8	10.1	90.0	-22.9	34.0	7.7			111.8
ATLAS	MAS	93 4 13 0 58 23	4 19 29 23	-53.3	181.4	90.0	-16.2	-67.2	164.2	96	2 35	63.7
UARS	MLS	93 4 13 3 33 47	578 4 22 42	-50.6	135.0	90.0	-22.9	-67.5	166.3			60.1

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	MAS	93 4 13 1 0 24	4 19 31 24	-55.9 194.0	90.0 -16.2	-71.3 182.2	45	0 55	69.2
UARS	MLS	93 4 13 1 56 14	578 2 45 8	-53.0 152.4	90.0 -22.9	-71.4 183.4			62.0
ATLAS	MAS	93 4 13 1 1 54	4 19 32 54	-56.9 204.4	90.0 -16.2	-73.0 199.9	100	0 42	73.5
UARS	MLS	93 4 13 0 19 12	578 1 8 6	-54.3 172.1	90.0 -22.9	-73.7 201.9			63.3
ATLAS	MAS	93 4 13 1 3 40	4 19 34 40	-56.8 216.7	90.0 -16.2	-72.8 222.5	155	2 20	78.5
UARS	MLS	93 4 12 22 42 59	577 23 31 57	-54.3 196.3	90.0 -22.9	-73.8 226.0			63.3
ATLAS	MAS	93 4 13 1 30 17	4 20 1 17	16.7 303.9	90.0 -16.2	7.1 317.3	156	3 2	137.9
UARS	MLS	93 4 13 4 32 35	578 5 21 30	22.5 336.8	90.0 -22.9	8.1 318.3			126.0
ATLAS	MAS	93 4 13 1 35 3	4 20 6 3	31.9 315.3	90.0 -16.2	20.8 328.5	111	1 15	134.4
UARS	MLS	93 4 13 2 50 45	578 3 39 43	38.7 346.8	90.0 -22.9	21.4 329.4			125.0
ATLAS	MAS	93 4 13 1 38 19	4 20 9 19	41.4 325.6	90.0 -16.2	28.9 338.2	120	0 28	128.8
UARS	MLS	93 4 13 1 9 43	578 1 58 39	50.2 352.6	90.0 -22.9	29.7 338.9			120.2
ATLAS	MAS	93 4 13 1 40 5	4 20 11 5	46.0 332.4	90.0 -16.2	32.6 344.3	151	2 11	125.0
UARS	MLS	93 4 12 23 28 25	578 0 17 24	56.7 347.7	90.0 -22.9	33.9 344.5			112.2
ATLAS	MAS	93 4 13 8 28 0	5 2 59 0	-48.1 53.2	-81.0 -16.2	-35.6 66.9	157	3 16	57.2
UARS	MLS	93 4 13 11 44 47	578 12 33 45	-24.5 45.7	90.0 -22.9	-36.4 68.4			52.8
ATLAS	MAS	93 4 13 8 33 2	5 3 4 2	-56.3 82.1	-81.0 -16.2	-40.8 89.3	104	1 33	70.0
UARS	MLS	93 4 13 10 6 57	578 10 55 55	-29.3 66.3	90.0 -22.9	-41.5 90.1			53.0
ATLAS	MAS	93 4 13 8 38 18	5 3 9 18	-54.6 118.2	-81.0 -16.2	-38.6 114.2	149	0 6	84.8
UARS	MLS	93 4 13 8 31 32	578 9 20 28	-27.1 92.5	90.0 -22.9	-39.1 115.8			53.1
ATLAS	MAS	93 4 13 8 48 51	5 3 19 51	-28.2 161.1	-81.0 -16.2	-15.9 149.6	191	1 46	114.5
UARS	MLS	93 4 13 7 2 32	578 7 51 26	-5.0 131.2	90.0 -22.9	-17.0 151.0			58.2
ATLAS	MAS	93 4 13 8 50 21	5 3 21 21	-23.5 164.7	-81.0 -16.2	-11.6 153.1	82	1 46	118.4
UARS	MLS	93 4 13 7 4 8	578 7 53 6	0.0 134.1	90.0 -22.9	-12.2 153.5			60.3
ATLAS	MAS	93 4 13 8 51 52	5 3 22 52	-18.6 168.1	-81.0 -16.2	-7.0 156.3	36	1 45	122.0
UARS	MLS	93 4 13 7 6 0	578 7 54 57	5.9 137.4	90.0 -22.9	-6.7 156.5			63.2
ATLAS	MAS	93 4 13 8 53 22	5 3 24 22	-13.6 171.3	-81.0 -16.2	-2.4 159.4	36	1 45	125.3
UARS	MLS	93 4 13 7 7 37	578 7 56 32	10.9 140.3	90.0 -22.9	-2.2 159.2			65.9
ATLAS	MAS	93 4 13 8 54 52	5 3 25 52	-8.6 174.3	-81.0 -16.2	2.4 162.3	27	1 45	128.4
UARS	MLS	93 4 13 7 9 13	578 7 58 7	15.9 143.4	90.0 -22.9	2.3 162.0			68.9
ATLAS	MAS	93 4 13 8 56 23	5 3 27 23	-3.6 177.2	-81.0 -16.2	7.2 165.1	65	1 45	131.1
UARS	MLS	93 4 13 7 10 49	578 7 59 47	20.8 146.6	90.0 -22.9	6.6 165.1			72.0
ATLAS	MAS	93 4 13 8 57 53	5 3 28 53	1.4 180.1	-81.0 -16.2	12.1 167.8	154	1 45	133.3
UARS	MLS	93 4 13 7 12 41	578 8 1 38	26.4 150.7	90.0 -22.9	11.4 169.0			75.9
ATLAS	MAS	93 4 13 9 1 54	5 3 32 54	14.8 188.0	-81.0 -16.2	25.4 174.9	127	3 23	136.4
UARS	MLS	93 4 13 12 25 24	578 13 14 21	45.0 192.0	90.0 -22.9	26.1 175.9			123.4
ATLAS	MAS	93 4 13 9 3 40	5 3 34 40	20.5 191.8	-81.0 -16.2	31.3 178.2	117	0 3	136.4
UARS	MLS	93 4 13 9 0 24	578 9 49 18	54.2 168.7	90.0 -22.9	32.3 178.3			101.0
ATLAS	MAS	93 4 13 18 6 26	5 12 37 26	22.7 55.5	90.0 -16.2	12.6 68.9	146	2 25	134.6
UARS	MLS	93 4 13 20 32 23	578 21 21 21	28.7 88.3	90.0 -22.9	13.3 70.0			128.4
ATLAS	MAS	93 4 13 18 10 42	5 12 41 42	35.9 66.8	90.0 -16.2	24.3 79.8	89	0 40	130.8
UARS	MLS	93 4 13 18 50 49	578 19 39 45	43.4 96.9	90.0 -22.9	24.9 80.4			124.4

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	13	18	13	28	5	12	44	28	43.7	76.3	90.0	-16.2	30.7	88.6	124	1	3	126.2
UARS	MLS	93	4	13	17	9	47	578	17	58	46	53.4	99.5	90.0	-22.9	31.9	88.7				117.3
ATLAS	MAS	93	4	13	18	14	59	5	12	45	59	47.4	82.6	90.0	-16.2	33.7	94.1	59	2	46	123.2
UARS	MLS	93	4	13	15	28	29	578	16	17	25	56.9	91.9	90.0	-22.9	34.1	93.5				107.5
ATLAS	MAS	93	4	13	19	3	42	5	13	34	42	-54.3	269.8	90.0	-16.2	-68.7	253.7	91	2	7	64.9
UARS	MLS	93	4	13	21	11	25	578	22	0	22	-51.5	224.6	90.0	-22.9	-68.8	256.0				60.8
ATLAS	MAS	93	4	13	19	5	28	5	13	36	28	-56.3	281.2	90.0	-16.2	-71.9	270.9	97	0	28	69.3
UARS	MLS	93	4	13	19	33	51	578	20	22	49	-53.7	241.7	90.0	-22.9	-72.7	272.2				63.1
ATLAS	MAS	93	4	13	19	6	58	5	13	37	58	-57.0	291.6	90.0	-16.2	-73.1	289.4	142	1	9	73.3
UARS	MLS	93	4	13	17	57	6	578	18	46	3	-54.5	262.9	90.0	-22.9	-74.1	292.3				64.1
ATLAS	MAS	93	4	13	19	9	14	5	13	40	14	-56.3	307.4	90.0	-16.2	-71.9	317.5	145	2	47	79.4
UARS	MLS	93	4	13	16	21	25	578	17	10	20	-53.8	290.1	90.0	-22.9	-72.8	320.5				63.2
ATLAS	MAS	93	4	13	19	10	44	5	13	41	44	-54.6	317.2	90.0	-16.2	-69.2	332.6	147	2	47	83.6
UARS	MLS	93	4	13	16	23	1	578	17	11	55	-51.2	298.6	90.0	-22.9	-68.3	329.9				60.5
ATLAS	MAS	93	4	13	19	36	36	5	14	7	36	22.0	32.1	90.0	-16.2	12.0	45.4	117	2	32	134.4
UARS	MLS	93	4	13	22	8	53	578	22	57	46	27.8	64.6	90.0	-22.9	12.6	46.3				128.6
ATLAS	MAS	93	4	13	19	40	53	5	14	11	53	35.3	43.2	90.0	-16.2	23.8	56.3	96	0	46	130.9
UARS	MLS	93	4	13	20	27	19	578	21	16	15	42.7	73.6	90.0	-22.9	24.4	56.9				124.8
ATLAS	MAS	93	4	13	19	43	38	5	14	14	38	43.1	52.5	90.0	-16.2	30.3	64.9	150	0	57	126.6
UARS	MLS	93	4	13	18	46	17	578	19	35	11	52.9	76.7	90.0	-22.9	31.5	65.4				117.8
ATLAS	MAS	93	4	13	19	45	9	5	14	16	9	46.9	58.7	90.0	-16.2	33.3	70.3	85	2	40	123.6
UARS	MLS	93	4	13	17	4	59	578	17	53	56	57.0	69.5	90.0	-22.9	34.1	70.3				108.0
ATLAS	MAS	93	4	13	20	33	52	5	15	4	52	-54.0	245.5	90.0	-16.2	-68.2	229.0	128	2	13	64.3
UARS	MLS	93	4	13	22	47	38	578	23	36	31	-51.4	200.4	90.0	-22.9	-68.7	231.7				60.8
ATLAS	MAS	93	4	13	20	35	38	5	15	6	38	-56.1	256.7	90.0	-16.2	-71.6	245.6	140	0	34	68.7
UARS	MLS	93	4	13	21	10	4	578	21	58	58	-53.7	217.5	90.0	-22.9	-72.6	248.1				63.1
ATLAS	MAS	93	4	13	20	37	23	5	15	8	23	-57.0	268.9	90.0	-16.2	-73.2	266.8	108	1	4	73.3
UARS	MLS	93	4	13	19	33	19	578	20	22	17	-54.5	238.7	90.0	-22.9	-74.1	268.1				64.1
ATLAS	MAS	93	4	13	20	39	39	5	15	10	39	-56.2	284.7	90.0	-16.2	-71.8	295.0	110	2	42	79.4
UARS	MLS	93	4	13	17	57	38	578	18	46	34	-53.8	265.9	90.0	-22.9	-72.7	296.4				63.1
ATLAS	MAS	93	4	13	21	6	47	5	15	37	47	21.3	8.6	90.0	-16.2	11.3	22.0	86	2	38	134.2
UARS	MLS	93	4	13	23	45	22	579	0	34	16	26.9	41.0	90.0	-22.9	11.9	22.6				128.9
ATLAS	MAS	93	4	13	21	11	3	5	15	42	3	34.6	19.6	90.0	-16.2	23.2	32.7	100	0	52	131.1
UARS	MLS	93	4	13	22	3	48	578	22	52	45	41.9	50.3	90.0	-22.9	23.8	33.4				125.2
ATLAS	MAS	93	4	13	21	14	4	5	15	45	4	43.2	29.7	90.0	-16.2	30.3	42.1	98	0	51	126.4
UARS	MLS	93	4	13	20	22	46	578	21	11	41	52.4	53.9	90.0	-22.9	31.2	42.1				118.3
ATLAS	MAS	93	4	13	21	15	34	5	15	46	34	47.0	35.9	90.0	-16.2	33.4	47.4	85	2	34	123.5
UARS	MLS	93	4	13	18	41	28	578	19	30	26	57.0	47.1	90.0	-22.9	34.1	47.1				108.5
ATLAS	MAS	93	4	13	22	4	3	5	16	35	3	-53.6	221.3	90.0	-16.2	-67.7	204.3	171	2	19	63.8
UARS	MLS	93	4	14	0	23	51	579	1	12	46	-51.4	176.1	90.0	-22.9	-68.7	207.5				60.7
ATLAS	MAS	93	4	13	22	6	3	5	16	37	3	-56.1	234.0	90.0	-16.2	-71.6	223.0	97	0	40	68.7
UARS	MLS	93	4	13	22	46	34	578	23	35	28	-53.2	194.8	90.0	-22.9	-71.8	225.7				62.6

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat	sub satellite lon	viewing angle beta	viewing angle alpha	observed point lat	observed point lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	MAS	93 4 13 22 7 34	5 16 38 34	-56.9	244.4	90.0	-16.2	-73.1	241.1	136	0 58	72.6
UARS	MLS	93 4 13 21 9 32	578 21 58 26	-54.4	214.5	90.0	-22.9	-74.0	244.0			64.1
ATLAS	MAS	93 4 13 22 9 34	5 16 40 34	-56.6	258.5	90.0	-16.2	-72.4	266.6	160	2 35	77.9
UARS	MLS	93 4 13 19 33 35	578 20 22 33	-54.1	240.2	90.0	-22.9	-73.4	270.3			63.6
ATLAS	MAS	93 4 13 22 11 5	5 16 42 5	-55.2	268.5	90.0	-16.2	-70.1	282.7	157	2 36	82.0
UARS	MLS	93 4 13 19 34 55	578 20 23 52	-52.0	247.4	90.0	-22.9	-69.7	278.8			61.3
ATLAS	MAS	93 4 13 23 33 45	5 18 4 45	-52.4	194.3	-81.0	-16.2	-38.6	206.2	133	2 35	62.1
UARS	MLS	93 4 14 2 9 42	579 2 58 35	-26.8	184.5	90.0	-22.9	-38.8	207.7			50.8
ATLAS	MAS	93 4 13 23 38 47	5 18 9 46	-57.0	227.2	-81.0	-16.2	-40.9	229.9	95	0 53	74.6
UARS	MLS	93 4 14 0 32 40	579 1 21 39	-29.3	206.9	90.0	-22.9	-41.5	230.7			51.2
ATLAS	MAS	93 4 13 23 45 3	5 18 16 3	-49.0	265.7	-81.0	-16.2	-34.0	257.4	138	0 46	91.7
UARS	MLS	93 4 13 22 58 51	578 23 47 46	-22.2	236.7	90.0	-22.9	-34.0	258.9			51.2
ATLAS	MAS	93 4 14 0 5 39	5 18 36 39	15.0	318.7	-81.0	-16.2	25.6	305.6	190	0 43	133.4
UARS	MLS	93 4 13 23 21 51	579 0 10 48	46.1	288.7	90.0	-22.9	26.9	304.3			89.4
ATLAS	MAS	93 4 14 0 7 9	5 18 38 9	19.9	321.9	-81.0	-16.2	30.7	308.4	82	2 41	133.7
UARS	MLS	93 4 14 2 48 27	579 3 37 21	50.8	321.1	90.0	-22.9	30.1	307.9			119.8
ATLAS	MAS	93 4 14 0 8 39	5 18 39 39	24.8	325.4	-81.0	-16.2	35.7	311.4	181	0 57	133.3
UARS	MLS	93 4 14 1 6 37	579 1 55 34	57.0	312.2	90.0	-22.9	34.1	311.1			108.9
ATLAS	MAS	93 4 14 1 3 54	5 19 34 54	-52.0	170.2	-81.0	-16.2	-38.3	182.3	105	2 42	61.6
UARS	MLS	93 4 14 3 45 55	579 4 34 50	-26.7	160.2	90.0	-22.9	-38.7	183.4			50.6
ATLAS	MAS	93 4 14 1 8 40	5 19 39 40	-57.0	200.9	-81.0	-16.2	-41.0	204.6	153	1 0	73.3
UARS	MLS	93 4 14 2 8 54	579 2 57 48	-29.2	182.6	90.0	-22.9	-41.4	206.4			51.0
ATLAS	MAS	93 4 14 1 14 57	5 19 45 57	-50.0	240.4	-81.0	-16.2	-34.8	232.7	131	0 40	90.2
UARS	MLS	93 4 14 0 34 33	579 1 23 29	-23.7	211.2	90.0	-22.9	-35.6	233.7			50.9
ATLAS	MAS	93 4 14 1 36 33	5 20 7 33	16.7	296.9	-81.0	-16.2	27.4	283.6	133	0 37	133.3
UARS	MLS	93 4 14 0 59 8	579 1 48 6	48.6	268.9	90.0	-22.9	28.6	283.4			91.8
ATLAS	MAS	93 4 14 1 38 18	5 20 9 18	22.4	300.7	-81.0	-16.2	33.3	287.0	89	1 4	133.3
UARS	MLS	93 4 14 2 42 50	579 3 31 48	56.9	288.0	90.0	-22.9	34.1	286.9			108.8
ATLAS	MAS	93 4 14 2 33 48	5 21 4 48	-51.1	144.7	-81.0	-16.2	-37.7	157.3	184	2 48	60.5
UARS	MLS	93 4 14 5 22 8	579 6 11 4	-26.6	135.9	90.0	-22.9	-38.6	159.1			50.4
ATLAS	MAS	93 4 14 2 38 49	5 21 9 49	-57.0	176.4	-81.0	-16.2	-41.0	180.6	123	1 6	72.6
UARS	MLS	93 4 14 3 45 7	579 4 34 2	-29.1	158.3	90.0	-22.9	-41.3	182.1			50.8
ATLAS	MAS	93 4 14 2 44 51	5 21 15 51	-51.0	215.1	-81.0	-16.2	-35.6	207.8	129	0 34	88.7
UARS	MLS	93 4 14 2 10 30	579 2 59 28	-24.4	186.3	90.0	-22.9	-36.3	209.0			50.7
ATLAS	MAS	93 4 14 3 7 12	5 21 38 12	17.7	274.5	-81.0	-16.2	28.4	261.2	120	0 31	133.0
UARS	MLS	93 4 14 2 35 53	579 3 24 52	49.7	247.1	90.0	-22.9	29.4	260.9			92.9
ATLAS	MAS	93 4 14 3 7 12	5 21 38 12	17.7	274.5	-81.0	-16.2	28.4	261.2	101	2 54	133.0
UARS	MLS	93 4 14 6 1 42	579 6 50 37	49.0	276.4	90.0	-22.9	28.9	262.0			121.2
ATLAS	MAS	93 4 14 4 3 57	5 22 34 57	-50.7	120.6	-81.0	-16.2	-37.4	133.5	154	2 54	60.1
UARS	MLS	93 4 14 6 58 37	579 7 47 34	-25.7	112.2	90.0	-22.9	-37.7	135.2			50.1
ATLAS	MAS	93 4 14 4 8 43	5 22 39 43	-56.8	150.2	-81.0	-16.2	-41.0	155.4	190	1 12	71.3
UARS	MLS	93 4 14 5 21 4	579 6 10 1	-29.8	133.3	90.0	-22.9	-42.0	157.3			50.7

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	14	4	14	45	5	22	45	45	-51.9	189.6	-81.0	-16.2	-36.4	183.0	134	0	28	87.2
UARS	MLS	93	4	14	3	46	27	579	4	35	21	-25.1	161.4	90.0	-22.9	-37.1	184.2				50.5
ATLAS	MAS	93	4	14	4	37	21	5	23	8	21	16.9	251.1	-81.0	-16.2	27.6	237.9	123	3	0	132.7
UARS	MLS	93	4	14	7	38	11	579	8	27	7	48.4	253.3	90.0	-22.9	28.5	238.6				121.7
ATLAS	MAS	93	4	14	4	38	51	5	23	9	51	21.8	254.4	-81.0	-16.2	32.7	240.7	179	0	25	132.8
UARS	MLS	93	4	14	4	13	27	579	5	2	20	52.3	229.5	90.0	-22.9	31.1	241.3				95.9
ATLAS	MAS	93	4	14	4	38	51	5	23	9	51	21.8	254.4	-81.0	-16.2	32.7	240.7	149	1	16	132.8
UARS	MLS	93	4	14	5	55	49	579	6	44	44	56.8	243.2	90.0	-22.9	34.0	240.5				109.9
ATLAS	MAS	93	4	14	5	34	6	6	0	5	6	-50.2	96.6	-81.0	-16.2	-37.1	109.6	123	3	0	59.6
UARS	MLS	93	4	14	8	34	51	579	9	23	49	-25.6	87.9	90.0	-22.9	-37.6	110.8				49.9
ATLAS	MAS	93	4	14	5	38	52	6	0	9	52	-56.7	125.7	-81.0	-16.2	-41.0	131.4	163	1	18	70.7
UARS	MLS	93	4	14	6	57	17	579	7	46	15	-29.7	109.0	90.0	-22.9	-41.9	133.0				50.5
ATLAS	MAS	93	4	14	5	44	38	6	0	15	38	-52.7	164.1	-81.0	-16.2	-37.1	158.1	146	0	22	85.8
UARS	MLS	93	4	14	5	22	24	579	6	11	20	-25.8	136.5	90.0	-22.9	-37.8	159.5				50.3
ATLAS	MAS	93	4	14	6	7	29	6	0	38	29	16.2	227.7	-81.0	-16.2	26.9	214.5	146	3	7	132.3
UARS	MLS	93	4	14	9	14	40	579	10	3	37	47.8	230.2	90.0	-22.9	28.0	215.2				122.2
ATLAS	MAS	93	4	14	6	9	0	6	0	40	0	21.1	231.0	-81.0	-16.2	31.9	217.4	79	0	19	132.5
UARS	MLS	93	4	14	5	49	56	579	6	38	50	52.8	206.7	90.0	-22.9	31.5	218.0				96.4
ATLAS	MAS	93	4	14	7	4	14	6	1	35	14	-49.8	72.5	-81.0	-16.2	-36.8	85.7	106	3	6	59.2
UARS	MLS	93	4	14	10	11	4	579	10	59	58	-25.5	63.6	90.0	-22.9	-37.5	86.5				49.7
ATLAS	MAS	93	4	14	7	9	1	6	1	40	1	-56.6	101.2	-81.0	-16.2	-41.0	107.4	138	1	24	70.1
UARS	MLS	93	4	14	8	33	30	579	9	22	24	-29.6	84.7	90.0	-22.9	-41.8	108.7				50.3
ATLAS	MAS	93	4	14	7	14	32	6	1	45	32	-53.5	138.4	-81.0	-16.2	-37.7	133.2	163	0	16	84.3
UARS	MLS	93	4	14	6	58	21	579	7	47	18	-26.5	111.6	90.0	-22.9	-38.5	134.7				50.1
ATLAS	MAS	93	4	14	7	37	38	6	2	8	38	15.5	204.3	-81.0	-16.2	26.2	191.2	170	3	13	131.9
UARS	MLS	93	4	14	10	51	9	579	11	40	8	47.1	207.1	90.0	-22.9	27.6	191.8				122.7
ATLAS	MAS	93	4	14	7	39	9	6	2	10	9	20.4	207.5	-81.0	-16.2	31.2	194.0	40	0	12	132.3
UARS	MLS	93	4	14	7	26	9	579	8	15	5	52.8	182.4	90.0	-22.9	31.5	193.7				96.3
ATLAS	MAS	93	4	14	8	34	8	6	3	5	8	-48.7	47.3	-81.0	-16.2	-36.0	60.9	166	3	13	58.3
UARS	MLS	93	4	14	11	47	33	579	12	36	28	-24.6	39.9	90.0	-22.9	-36.6	62.6				49.4
ATLAS	MAS	93	4	14	8	39	10	6	3	10	10	-56.5	76.8	-81.0	-16.2	-40.9	83.4	113	1	30	69.4
UARS	MLS	93	4	14	10	10	0	579	10	58	54	-28.7	61.1	90.0	-22.9	-40.9	84.8				50.0
ATLAS	MAS	93	4	14	8	44	26	6	3	15	26	-54.2	112.7	-81.0	-16.2	-38.3	108.2	187	0	10	82.9
UARS	MLS	93	4	14	8	34	19	579	9	23	17	-27.2	86.7	90.0	-22.9	-39.3	110.0				50.0
ATLAS	MAS	93	4	14	8	56	59	6	3	27	59	-21.0	159.4	-81.0	-16.2	-9.3	147.6	160	1	49	115.1
UARS	MLS	93	4	14	7	7	43	579	7	56	37	2.4	129.7	90.0	-22.9	-10.0	148.9				56.5
ATLAS	MAS	93	4	14	8	58	30	6	3	29	30	-16.1	162.6	-81.0	-16.2	-4.7	150.8	108	1	49	118.4
UARS	MLS	93	4	14	7	9	19	579	7	58	12	7.4	132.6	90.0	-22.9	-5.3	151.5				59.1
ATLAS	MAS	93	4	14	9	0	0	6	3	31	0	-11.1	165.7	-81.0	-16.2	0.0	153.8	105	1	49	121.5
UARS	MLS	93	4	14	7	10	55	579	7	59	52	12.4	135.5	90.0	-22.9	-0.8	154.3				61.9
ATLAS	MAS	93	4	14	9	1	31	6	3	32	31	-6.1	168.7	-81.0	-16.2	4.8	156.6	136	1	48	124.3
UARS	MLS	93	4	14	7	12	47	579	8	1	43	18.2	139.2	90.0	-22.9	4.3	157.7				65.5

Table 8. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat	sub satellite lon	viewing angle beta	viewing angle alpha	observed point lat	observed point lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	MAS	93 4 14 9 7 47	6 3 38 47	14.8	180.9	-81.0	-16.2	25.4	167.8	193	3 19	131.5
UARS	MLS	93 4 14 12 27 39	579 13 16 33	46.4	184.0	90.0	-22.9	27.1	168.4			123.2
ATLAS	MAS	93 4 14 9 9 18	6 3 40 18	19.7	184.1	-81.0	-16.2	30.5	170.6	149	0 6	132.0
UARS	MLS	93 4 14 9 2 38	579 9 51 35	53.3	159.7	90.0	-22.9	31.8	170.4			96.8
ATLAS	MAS	93 4 14 10 4 17	6 4 35 17	-48.2	23.3	-81.0	-16.2	-35.7	37.0	140	3 19	57.9
UARS	MLS	93 4 14 13 23 46	579 14 12 42	-24.5	15.5	90.0	-22.9	-36.5	38.3			49.2
ATLAS	MAS	93 4 14 10 9 3	6 4 40 3	-56.1	50.7	-81.0	-16.2	-40.8	58.2	175	1 36	68.3
UARS	MLS	93 4 14 11 45 57	579 12 34 53	-29.4	36.1	90.0	-22.9	-41.6	60.0			49.9
ATLAS	MAS	93 4 14 10 14 35	6 4 45 35	-54.5	88.4	-81.0	-16.2	-38.6	84.3	134	0 4	82.2
UARS	MLS	93 4 14 10 10 32	579 10 59 26	-27.1	62.3	90.0	-22.9	-39.2	85.6			49.8
ATLAS	MAS	93 4 14 11 34 26	6 6 5 26	-47.7	359.4	-81.0	-16.2	-35.3	13.2	105	3 25	57.6
UARS	MLS	93 4 14 15 0 16	579 15 49 13	-23.6	351.8	90.0	-22.9	-35.5	14.3			48.9
ATLAS	MAS	93 4 14 11 39 12	6 6 10 12	-55.9	26.2	-81.0	-16.2	-40.7	34.2	152	1 42	67.7
UARS	MLS	93 4 14 13 22 10	579 14 11 7	-29.3	11.8	90.0	-22.9	-41.5	35.7			49.7
ATLAS	MAS	93 4 14 11 44 29	6 6 15 29	-55.1	62.5	-81.0	-16.2	-39.1	59.2	167	0 2	80.8
UARS	MLS	93 4 14 11 46 29	579 12 35 25	-27.8	37.4	90.0	-22.9	-39.9	60.9			49.7
ATLAS	MAS	93 4 14 11 54 16	6 6 25 16	-31.9	104.9	-81.0	-16.2	-19.2	93.6	172	1 37	106.3
UARS	MLS	93 4 14 10 16 41	579 11 5 35	-8.3	74.8	90.0	-22.9	-20.2	94.9			51.8
ATLAS	MAS	93 4 14 11 55 47	6 6 26 47	-27.2	108.9	-81.0	-16.2	-15.0	97.4	35	1 37	109.9
UARS	MLS	93 4 14 10 18 17	579 11 7 15	-3.3	77.7	90.0	-22.9	-15.3	97.4			53.5
ATLAS	MAS	93 4 14 11 57 17	6 6 28 17	-22.4	112.5	-81.0	-16.2	-10.6	100.8	105	1 37	113.5
UARS	MLS	93 4 14 10 19 53	579 11 8 50	1.8	80.5	90.0	-22.9	-10.6	99.8			55.6
ATLAS	MAS	93 4 14 12 0 18	6 6 31 18	-12.6	118.9	-81.0	-16.2	-1.4	107.0	176	1 36	120.0
UARS	MLS	93 4 14 10 23 22	579 11 12 16	12.6	86.9	90.0	-22.9	-0.6	105.6			61.4
ATLAS	MAS	93 4 14 12 1 48	6 6 32 48	-7.6	121.9	-81.0	-16.2	3.4	109.9	152	1 36	122.8
UARS	MLS	93 4 14 10 24 58	579 11 13 56	17.6	90.0	90.0	-22.9	3.8	108.6			64.5
ATLAS	MAS	93 4 14 12 3 19	6 6 34 19	-2.6	124.8	-81.0	-16.2	8.2	112.6	69	1 36	125.4
UARS	MLS	93 4 14 10 26 50	579 11 15 47	23.3	93.9	90.0	-22.9	8.7	112.3			68.4
ATLAS	MAS	93 4 14 12 4 49	6 6 35 49	2.5	127.7	-81.0	-16.2	13.2	115.3	59	1 36	127.5
UARS	MLS	93 4 14 10 28 26	579 11 17 22	28.0	97.5	90.0	-22.9	12.8	115.7			71.9
ATLAS	MAS	93 4 14 12 10 20	6 6 41 20	20.7	138.9	-81.0	-16.2	31.5	125.4	127	0 5	131.4
UARS	MLS	93 4 14 12 15 53	579 13 4 51	54.5	115.8	90.0	-22.9	32.6	124.9			98.5
ATLAS	MAS	93 4 14 12 10 20	6 6 41 20	20.7	138.9	-81.0	-16.2	31.5	125.4	191	1 48	131.4
UARS	MLS	93 4 14 13 58 31	579 14 47 25	55.6	132.5	90.0	-22.9	33.2	125.4			113.2
ATLAS	MAS	93 4 14 13 9 21	6 7 40 21	-55.7	1.9	-81.0	-16.2	-40.5	10.3	129	1 49	67.1
UARS	MLS	93 4 14 14 58 39	579 15 47 38	-28.4	348.2	90.0	-22.9	-40.5	11.8			49.4
ATLAS	MAS	93 4 14 13 14 38	6 7 45 38	-55.4	38.1	-81.0	-16.2	-39.3	35.3	120	0 8	80.1
UARS	MLS	93 4 14 13 22 42	579 14 11 39	-27.7	13.1	90.0	-22.9	-39.8	36.6			49.5
ATLAS	MAS	93 4 14 13 23 40	6 7 54 40	-34.8	79.2	-81.0	-16.2	-21.9	68.1	154	1 31	103.5
UARS	MLS	93 4 14 11 52 6	579 12 41 2	-10.7	49.0	90.0	-22.9	-22.5	69.4			50.8
ATLAS	MAS	93 4 14 13 25 25	6 7 56 25	-29.5	84.1	-81.0	-16.2	-17.1	72.7	53	1 31	107.9
UARS	MLS	93 4 14 11 53 58	579 12 42 53	-4.9	52.4	90.0	-22.9	-16.8	72.2			52.6

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	14	13	34	13	6	8	5	13	-0.8	102.9	-81.0	-16.2	10.0	90.6	148	1	30	125.8
UARS	MLS	93	4	14	12	3	51	579	12	52	49	25.8	71.3	90.0	-22.9	10.9	89.6				69.9
ATLAS	MAS	93	4	14	13	35	43	6	8	6	43	4.3	105.8	-81.0	-16.2	14.9	93.3	16	1	30	127.8
UARS	MLS	93	4	14	12	5	28	579	12	54	24	30.5	75.1	90.0	-22.9	14.8	93.2				73.5
ATLAS	MAS	93	4	14	13	40	44	6	8	11	44	20.8	116.1	-81.0	-16.2	31.6	102.5	155	0	11	131.1
UARS	MLS	93	4	14	15	34	44	579	16	23	40	55.5	108.4	90.0	-22.9	33.2	101.1				113.2
ATLAS	MAS	93	4	14	14	39	30	6	9	10	30	-55.5	337.5	-81.0	-16.2	-40.4	346.3	100	1	55	66.6
UARS	MLS	93	4	14	16	34	53	579	17	23	47	-28.3	323.9	90.0	-22.9	-40.4	347.5				49.2
ATLAS	MAS	93	4	14	14	44	31	6	9	15	31	-55.9	12.1	-81.0	-16.2	-39.8	10.2	160	0	14	78.7
UARS	MLS	93	4	14	14	58	39	579	15	47	38	-28.4	348.2	90.0	-22.9	-40.5	11.8				49.4
ATLAS	MAS	93	4	14	14	53	4	6	9	24	4	-37.7	53.3	-81.0	-16.2	-24.4	42.4	160	1	25	100.8
UARS	MLS	93	4	14	13	27	31	579	14	16	29	-13.1	23.2	90.0	-22.9	-24.9	43.9				50.0
ATLAS	MAS	93	4	14	14	54	34	6	9	25	34	-33.2	57.8	-81.0	-16.2	-20.4	46.6	60	1	25	104.6
UARS	MLS	93	4	14	13	29	7	579	14	18	4	-8.1	26.1	90.0	-22.9	-20.0	46.3				51.2
ATLAS	MAS	93	4	14	15	5	37	6	9	36	37	2.7	82.0	-81.0	-16.2	13.4	69.5	165	1	24	126.9
UARS	MLS	93	4	14	13	41	25	579	14	30	22	29.8	50.2	90.0	-22.9	14.2	68.3				72.7
ATLAS	MAS	93	4	14	15	7	7	6	9	38	7	7.7	84.9	-81.0	-16.2	18.3	72.2	41	1	24	128.6
UARS	MLS	93	4	14	13	43	1	579	14	31	57	34.4	54.3	90.0	-22.9	18.0	72.1				76.4
ATLAS	MAS	93	4	14	15	11	8	6	9	42	8	20.9	93.2	-81.0	-16.2	31.7	79.6	166	0	17	130.8
UARS	MLS	93	4	14	15	29	8	579	16	18	2	55.5	72.2	90.0	-22.9	33.2	79.4				100.3
ATLAS	MAS	93	4	14	15	11	8	6	9	42	8	20.9	93.2	-81.0	-16.2	31.7	79.6	101	2	0	130.8
UARS	MLS	93	4	14	17	11	46	579	18	0	42	54.6	89.0	90.0	-22.9	32.6	79.9				114.9
ATLAS	MAS	93	4	14	16	9	39	6	10	40	39	-55.2	313.1	-81.0	-16.2	-40.3	322.3	71	2	1	66.0
UARS	MLS	93	4	14	18	11	6	579	19	0	1	-28.2	259.6	90.0	-22.9	-40.3	323.1				49.0
ATLAS	MAS	93	4	14	16	14	40	6	10	45	40	-56.1	347.7	-81.0	-16.2	-40.0	346.2	117	0	20	78.0
UARS	MLS	93	4	14	16	34	53	579	17	23	47	-28.3	323.9	90.0	-22.9	-40.4	347.5				49.2
ATLAS	MAS	93	4	14	16	22	42	6	10	53	42	-39.8	27.9	-81.0	-16.2	-26.2	17.3	147	1	19	98.7
UARS	MLS	93	4	14	15	3	12	579	15	52	7	-14.6	357.8	90.0	-22.9	-26.4	18.8				49.4
ATLAS	MAS	93	4	14	16	24	13	6	10	55	13	-35.4	32.8	-81.0	-16.2	-22.4	21.7	96	1	19	102.5
UARS	MLS	93	4	14	15	4	32	579	15	53	26	-10.5	0.3	90.0	-22.9	-22.3	20.7				50.3
ATLAS	MAS	93	4	14	16	36	46	6	11	7	46	5.3	60.5	-81.0	-16.2	16.0	48.0	184	1	18	127.5
UARS	MLS	93	4	14	15	18	42	579	16	7	40	33.0	28.6	90.0	-22.9	16.8	46.5				74.9
ATLAS	MAS	93	4	14	16	38	16	6	11	9	16	10.3	63.5	-81.0	-16.2	20.9	50.7	63	1	17	129.0
UARS	MLS	93	4	14	15	20	18	579	16	9	15	37.4	33.1	90.0	-22.9	20.4	50.6				78.7
ATLAS	MAS	93	4	14	16	41	17	6	11	12	17	20.2	69.8	-81.0	-16.2	31.0	56.2	156	2	6	130.5
UARS	MLS	93	4	14	18	48	15	579	19	37	12	54.2	66.3	90.0	-22.9	32.4	56.6				115.4
ATLAS	MAS	93	4	14	17	39	33	6	12	10	33	-54.6	287.2	-81.0	-16.2	-39.9	297.2	144	2	7	65.0
UARS	MLS	93	4	14	19	47	19	579	20	36	16	-28.1	275.3	90.0	-22.9	-40.2	298.8				48.8
ATLAS	MAS	93	4	14	17	44	34	6	12	15	34	-56.5	321.5	-81.0	-16.2	-40.3	321.1	166	0	26	76.7
UARS	MLS	93	4	14	18	10	50	579	18	59	45	-29.0	298.9	90.0	-22.9	-41.2	322.7				49.1
ATLAS	MAS	93	4	14	17	52	21	6	12	23	21	-41.8	2.5	-81.0	-16.2	-27.9	352.1	148	1	13	96.6
UARS	MLS	93	4	14	16	38	37	579	17	27	34	-17.0	331.5	90.0	-22.9	-28.8	353.2				48.9

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	14	17	53	51	6	12	24	51	-37.5	7.6	-81.0	-16.2	-24.2	356.7	116	1	13	100.4
UARS	MLS	93	4	14	16	40	13	579	17	29	9	-12.1	335.0	90.0	-22.9	-23.9	355.6				49.6
ATLAS	MAS	93	4	14	18	8	10	6	12	39	10	8.8	39.6	-81.0	-16.2	19.4	26.9	133	1	11	128.3
UARS	MLS	93	4	14	16	56	32	579	17	45	29	37.5	8.8	90.0	-22.9	20.4	26.3				78.5
ATLAS	MAS	93	4	14	18	9	41	6	12	40	41	13.7	42.6	-81.0	-16.2	24.4	29.6	140	1	11	129.5
UARS	MLS	93	4	14	16	58	8	579	17	47	4	41.8	13.9	90.0	-22.9	23.7	30.7				82.4
ATLAS	MAS	93	4	14	18	11	41	6	12	42	41	20.3	46.9	-81.0	-16.2	31.1	33.3	110	2	13	130.3
UARS	MLS	93	4	14	20	24	44	579	21	13	42	53.8	43.6	90.0	-22.9	32.1	33.3				116.0
ATLAS	MAS	93	4	14	19	9	42	6	13	40	42	-54.3	262.9	-81.0	-16.2	-39.7	273.2	116	2	13	64.5
UARS	MLS	93	4	14	21	23	32	579	22	12	30	-28.0	251.0	90.0	-22.9	-40.1	274.5				48.6
ATLAS	MAS	93	4	14	19	14	43	6	13	45	43	-56.6	297.1	-81.0	-16.2	-40.4	297.1	126	0	32	76.1
UARS	MLS	93	4	14	19	47	3	579	20	36	0	-28.9	274.6	90.0	-22.9	-41.1	298.4				48.9
ATLAS	MAS	93	4	14	19	22	0	6	13	53	0	-43.7	336.8	-81.0	-16.2	-29.5	326.8	152	1	7	94.5
UARS	MLS	93	4	14	18	14	18	579	19	3	16	-18.6	306.5	90.0	-22.9	-30.3	328.1				48.5
ATLAS	MAS	93	4	14	19	23	30	6	13	54	30	-39.6	342.3	-81.0	-16.2	-26.0	331.6	131	1	7	98.4
UARS	MLS	93	4	14	18	15	55	579	19	4	51	-13.6	309.7	90.0	-22.9	-25.4	330.5				49.1
ATLAS	MAS	93	4	14	19	39	4	6	14	10	4	10.5	17.7	-81.0	-16.2	21.2	4.9	135	1	5	128.4
UARS	MLS	93	4	14	18	33	33	579	19	22	31	39.8	347.0	90.0	-22.9	22.2	4.2				80.3
ATLAS	MAS	93	4	14	19	41	50	6	14	12	50	19.6	23.5	-81.0	-16.2	30.4	10.0	160	2	19	129.9
UARS	MLS	93	4	14	22	1	14	579	22	50	7	53.3	20.9	90.0	-22.9	31.8	10.0				116.6
ATLAS	MAS	93	4	14	19	43	20	6	14	14	20	24.5	26.9	-81.0	-16.2	35.4	12.9	160	0	36	130.0
UARS	MLS	93	4	14	20	19	24	579	21	8	20	56.7	9.9	90.0	-22.9	34.0	12.8				103.9
ATLAS	MAS	93	4	14	20	39	50	6	15	10	50	-54.0	238.6	-81.0	-16.2	-39.6	249.2	93	2	19	64.0
UARS	MLS	93	4	14	22	59	46	579	23	48	39	-27.9	226.7	90.0	-22.9	-40.0	250.1				48.4
ATLAS	MAS	93	4	14	20	44	52	6	15	15	52	-56.7	272.6	-81.0	-16.2	-40.6	273.1	88	0	38	75.4
UARS	MLS	93	4	14	21	23	16	579	22	12	14	-28.8	250.3	90.0	-22.9	-41.0	274.0				48.7
ATLAS	MAS	93	4	14	20	51	38	6	15	22	38	-45.5	310.9	-81.0	-16.2	-31.1	301.4	170	1	1	92.5
UARS	MLS	93	4	14	19	49	59	579	20	38	54	-20.1	281.1	90.0	-22.9	-31.9	303.0				48.2
ATLAS	MAS	93	4	14	20	53	9	6	15	24	9	-41.6	316.8	-81.0	-16.2	-27.7	306.4	138	1	1	96.3
UARS	MLS	93	4	14	19	51	36	579	20	40	34	-15.2	284.3	90.0	-22.9	-26.9	305.4				48.5
ATLAS	MAS	93	4	14	23	39	53	6	18	10	53	-52.9	188.7	-81.0	-16.2	-38.9	200.2	145	2	32	62.6
UARS	MLS	93	4	15	2	12	28	580	3	1	24	-26.9	178.7	90.0	-22.9	-39.0	201.9				47.8
ATLAS	MAS	93	4	14	23	44	54	6	18	15	54	-57.0	221.9	-81.0	-16.2	-40.9	224.0	117	0	50	73.6
UARS	MLS	93	4	15	0	35	27	580	1	24	22	-29.4	201.1	90.0	-22.9	-41.6	224.9				48.5
ATLAS	MAS	93	4	14	23	51	26	6	18	22	26	-47.8	260.9	-81.0	-16.2	-33.0	252.2	128	0	49	89.7
UARS	MLS	93	4	14	23	1	54	579	23	50	51	-21.5	231.4	90.0	-22.9	-33.4	253.5				47.7
ATLAS	MAS	93	4	15	0	11	16	6	18	42	16	14.2	311.1	-81.0	-16.2	24.8	298.0	176	0	47	128.3
UARS	MLS	93	4	14	23	24	5	580	0	13	0	44.7	280.7	90.0	-22.9	25.9	296.7				84.3
ATLAS	MAS	93	4	15	0	12	47	6	18	43	47	19.1	314.3	-81.0	-16.2	29.8	300.8	76	2	38	129.0
UARS	MLS	93	4	15	2	50	57	580	3	39	54	51.4	313.8	90.0	-22.9	30.5	301.0				118.8
ATLAS	MAS	93	4	15	0	14	17	6	18	45	17	24.0	317.7	-81.0	-16.2	34.9	303.8	92	0	54	129.2
UARS	MLS	93	4	15	1	9	7	580	1	58	2	57.0	304.4	90.0	-22.9	34.1	304.2				106.2

Table 8. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	15	1	10	2	6	19	41	2	-52.5	164.5	-81.0	-16.2	-38.6	176.3	113	2	38	62.2
UARS	MLS	93	4	15	3	48	41	580	4	37	38	-26.9	154.4	90.0	-22.9	-38.9	177.6				47.6
ATLAS	MAS	93	4	15	1	14	48	6	19	45	48	-57.0	195.6	-81.0	-16.2	-41.0	198.8	165	0	56	72.4
UARS	MLS	93	4	15	2	11	40	580	3	0	36	-29.3	176.8	90.0	-22.9	-41.5	200.6				48.3
ATLAS	MAS	93	4	15	1	21	20	6	19	52	20	-48.9	235.8	-81.0	-16.2	-33.9	227.5	119	0	43	88.3
UARS	MLS	93	4	15	0	37	51	580	1	26	50	-22.2	206.5	90.0	-22.9	-34.1	228.8				47.5
ATLAS	MAS	93	4	15	1	42	10	6	20	13	10	15.9	289.3	-81.0	-16.2	26.6	276.1	127	0	40	128.3
UARS	MLS	93	4	15	1	1	22	580	1	50	18	47.3	260.7	90.0	-22.9	27.7	275.8				86.9
ATLAS	MAS	93	4	15	1	44	11	6	20	15	11	22.5	293.7	-81.0	-16.2	33.3	279.9	88	1	1	128.9
UARS	MLS	93	4	15	2	45	21	580	3	34	16	57.0	280.2	90.0	-22.9	34.1	279.9				106.2
ATLAS	MAS	93	4	15	2	40	11	6	21	11	11	-52.1	140.4	-81.0	-16.2	-38.3	152.4	88	2	44	61.8
UARS	MLS	93	4	15	5	24	55	580	6	13	53	-26.8	130.0	90.0	-22.9	-38.8	153.3				47.4
ATLAS	MAS	93	4	15	2	44	57	6	21	15	57	-57.0	171.1	-81.0	-16.2	-41.0	174.8	134	1	2	71.8
UARS	MLS	93	4	15	3	47	53	580	4	36	51	-29.2	152.5	90.0	-22.9	-41.4	176.3				48.1
ATLAS	MAS	93	4	15	2	51	14	6	21	22	14	-49.9	210.6	-81.0	-16.2	-34.8	202.7	117	0	37	86.9
UARS	MLS	93	4	15	2	13	48	580	3	2	43	-22.9	181.6	90.0	-22.9	-34.8	204.0				47.3
ATLAS	MAS	93	4	15	3	12	49	6	21	43	49	16.8	266.9	-81.0	-16.2	27.5	253.6	121	0	34	128.1
UARS	MLS	93	4	15	2	38	8	580	3	27	4	48.5	238.8	90.0	-22.9	28.6	253.3				88.1
ATLAS	MAS	93	4	15	3	14	35	6	21	45	35	22.6	270.8	-81.0	-16.2	33.4	257.0	80	1	7	128.6
UARS	MLS	93	4	15	4	21	50	580	5	10	46	57.0	257.8	90.0	-22.9	34.1	256.7				106.7
ATLAS	MAS	93	4	15	4	10	5	6	22	41	5	-51.2	114.9	-81.0	-16.2	-37.8	127.4	167	2	51	61.0
UARS	MLS	93	4	15	7	1	8	580	7	50	2	-26.7	105.7	90.0	-22.9	-38.7	128.9				47.2
ATLAS	MAS	93	4	15	4	15	6	6	22	46	6	-57.0	146.7	-81.0	-16.2	-41.0	150.8	104	1	9	71.2
UARS	MLS	93	4	15	5	24	6	580	6	13	0	-29.1	128.2	90.0	-22.9	-41.3	151.9				47.9
ATLAS	MAS	93	4	15	4	21	8	6	22	52	8	-50.9	185.2	-81.0	-16.2	-35.6	177.9	120	0	31	85.5
UARS	MLS	93	4	15	3	49	45	580	4	38	42	-23.7	156.8	90.0	-22.9	-35.6	179.3				47.2
ATLAS	MAS	93	4	15	4	43	13	6	23	14	13	17.0	244.0	-81.0	-16.2	27.6	230.8	174	0	28	127.8
UARS	MLS	93	4	15	4	14	37	580	5	3	34	49.1	215.7	90.0	-22.9	29.0	229.9				88.6
ATLAS	MAS	93	4	15	4	44	44	6	23	15	44	21.9	247.3	-81.0	-16.2	32.7	233.6	152	1	13	128.3
UARS	MLS	93	4	15	5	58	19	580	6	47	17	56.9	235.4	90.0	-22.9	34.0	233.5				107.3
ATLAS	MAS	93	4	15	5	40	14	7	0	11	14	-50.8	90.8	-81.0	-16.2	-37.5	103.6	133	2	57	60.6
UARS	MLS	93	4	15	8	37	37	580	9	26	32	-25.8	82.0	90.0	-22.9	-37.8	105.0				46.9
ATLAS	MAS	93	4	15	5	45	15	7	0	16	15	-56.9	122.2	-81.0	-16.2	-41.0	126.8	74	1	15	70.6
UARS	MLS	93	4	15	7	0	20	580	7	49	14	-29.0	103.9	90.0	-22.9	-41.2	127.6				47.8
ATLAS	MAS	93	4	15	5	51	1	7	0	22	1	-51.8	159.8	-81.0	-16.2	-36.3	153.1	126	0	25	84.2
UARS	MLS	93	4	15	5	25	27	580	6	14	24	-25.2	131.3	90.0	-22.9	-37.1	154.1				47.2
ATLAS	MAS	93	4	15	6	13	37	7	0	44	37	17.1	221.2	-81.0	-16.2	27.8	207.9	103	3	3	127.5
UARS	MLS	93	4	15	9	17	10	580	10	6	5	48.4	223.2	90.0	-22.9	28.5	208.5				121.7
ATLAS	MAS	93	4	15	6	15	8	7	0	46	8	22.0	224.5	-81.0	-16.2	32.8	210.8	190	0	22	128.1
UARS	MLS	93	4	15	5	52	26	580	6	41	23	52.3	199.3	90.0	-22.9	31.1	211.1				92.6
ATLAS	MAS	93	4	15	6	15	8	7	0	46	8	22.0	224.5	-81.0	-16.2	32.8	210.8	136	1	19	128.1
UARS	MLS	93	4	15	7	35	4	580	8	24	3	56.7	214.7	90.0	-22.9	33.9	211.3				108.6

Table 8. Concluded.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	MAS	93	4	15	7	10	22	7	1	41	22	-50.3	66.7	-81.0	-16.2	-37.1	79.7	106	3	3	60.3
UARS	MLS	93	4	15	10	13	50	580	11	2	46	-25.7	57.7	90.0	-22.9	-37.7	80.7				46.7
ATLAS	MAS	93	4	15	7	15	24	7	1	46	24	-56.8	97.7	-81.0	-16.2	-41.0	102.8	45	1	21	70.1
UARS	MLS	93	4	15	8	36	33	580	9	25	29	-28.9	79.6	90.0	-22.9	-41.1	103.3				47.6
ATLAS	MAS	93	4	15	7	20	55	7	1	51	55	-52.7	134.2	-81.0	-16.2	-37.0	128.2	137	0	19	82.9
UARS	MLS	93	4	15	7	1	24	580	7	50	18	-25.9	106.4	90.0	-22.9	-37.9	129.3				47.1
ATLAS	MAS	93	4	15	8	41	1	7	3	12	1	-50.9	45.2	-90.0	-16.2	-36.4	55.1	150	3	9	60.8
UARS	MLS	93	4	15	11	50	20	580	12	39	17	-24.8	34.0	90.0	-22.9	-36.7	56.8				46.3
ATLAS	MAS	93	4	15	8	46	3	7	3	17	3	-56.9	76.7	-90.0	-16.2	-40.8	77.9	94	1	26	70.6
UARS	MLS	93	4	15	10	12	46	580	11	1	43	-28.8	55.2	90.0	-22.9	-41.0	79.0				47.4
ATLAS	MAS	93	4	15	8	51	34	7	3	22	34	-52.2	112.9	-90.0	-16.2	-37.4	103.4	145	0	13	83.4
UARS	MLS	93	4	15	8	37	37	580	9	26	32	-25.8	82.0	90.0	-22.9	-37.8	105.0				46.9
ATLAS	MAS	93	4	15	9	14	40	7	3	45	40	18.1	175.9	-90.0	-16.2	26.7	161.0	117	3	15	127.1
UARS	MLS	93	4	15	12	30	9	580	13	19	6	47.1	176.9	90.0	-22.9	27.6	161.6				122.9
ATLAS	MAS	93	4	15	9	16	11	7	3	47	11	23.0	179.3	-90.0	-16.2	31.8	163.8	41	0	11	127.5
UARS	MLS	93	4	15	9	5	9	580	9	54	3	52.8	152.3	90.0	-22.9	31.5	163.6				93.0
ATLAS	MAS	93	4	15	10	11	10	7	4	42	10	-50.4	21.2	-90.0	-16.2	-36.1	31.3	120	3	15	60.5
UARS	MLS	93	4	15	13	26	33	580	14	15	31	-24.7	9.7	90.0	-22.9	-36.6	32.4				46.1
ATLAS	MAS	93	4	15	10	16	12	7	4	47	12	-56.9	52.2	-90.0	-16.2	-40.7	53.9	65	1	32	70.1
UARS	MLS	93	4	15	11	48	59	580	12	37	58	-28.7	30.9	90.0	-22.9	-40.9	54.6				47.2
ATLAS	MAS	93	4	15	10	21	28	7	4	52	28	-53.0	87.3	-90.0	-16.2	-38.0	78.5	166	0	7	82.1
UARS	MLS	93	4	15	10	13	34	580	11	2	31	-26.5	57.1	90.0	-22.9	-38.5	80.3				46.8
ATLAS	MAS	93	4	15	20	46	28	7	15	17	28	-55.0	236.2	-90.0	-16.2	-39.5	242.5	175	2	16	65.3
UARS	MLS	93	4	15	23	2	32	580	23	51	28	-28.1	220.8	90.0	-22.9	-40.2	244.3				45.9
ATLAS	MAS	93	4	15	20	51	30	7	15	22	30	-56.2	270.7	-90.0	-16.2	-40.3	266.3	185	0	34	75.3
UARS	MLS	93	4	15	21	26	3	580	22	14	58	-29.0	244.5	90.0	-22.9	-41.1	268.2				46.3

Table 9. Correlative measurements between ATLAS SSBUV and UARS MLS.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat	sub satellite lon	viewing angle beta	viewing angle alpha	observed point lat	observed point lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	SSBUV	93 4 9 18 37 56	1 13 8 56	-53.1	294.0	0.0	-90.0	-53.1	294.0	92	2 27	67.0
UARS	MLS	93 4 9 21 5 8	574 21 54 3	-40.1	267.7	90.0	-22.9	-53.6	295.1			62.5
ATLAS	SSBUV	93 4 9 18 41 12	1 13 12 12	-56.7	315.0	0.0	-90.0	-56.7	315.0	119	0 46	78.5
UARS	MLS	93 4 9 19 27 50	574 20 16 45	-42.9	288.4	90.0	-22.9	-57.0	316.9			62.4
ATLAS	SSBUV	93 4 9 20 8 6	1 14 39 6	-52.7	269.8	0.0	-90.0	-52.7	269.8	105	2 33	66.2
UARS	MLS	93 4 9 22 41 37	574 23 30 33	-39.3	244.3	90.0	-22.9	-52.7	271.4			62.5
ATLAS	SSBUV	93 4 9 20 11 22	1 14 42 22	-56.6	290.6	0.0	-90.0	-56.6	290.5	130	0 52	77.6
UARS	MLS	93 4 9 21 4 3	574 21 52 59	-42.8	264.1	90.0	-22.9	-56.9	292.6			62.2
ATLAS	SSBUV	93 4 9 21 38 17	1 16 9 17	-52.3	245.7	0.0	-90.0	-52.3	245.6	100	2 39	65.3
UARS	MLS	93 4 10 0 17 50	575 1 6 47	-39.2	220.0	90.0	-22.9	-52.6	247.1			62.3
ATLAS	SSBUV	93 4 9 21 41 33	1 16 12 33	-56.5	266.1	0.0	-90.0	-56.5	266.1	140	0 58	76.7
UARS	MLS	93 4 9 22 40 17	574 23 29 14	-42.7	239.9	90.0	-22.9	-56.8	268.3			62.1
ATLAS	SSBUV	93 4 9 21 45 4	1 16 16 4	-56.2	290.6	0.0	-90.0	-56.2	290.6	144	0 41	89.1
UARS	MLS	93 4 9 21 4 3	574 21 52 59	-42.8	264.1	90.0	-22.9	-56.9	292.6			62.2
ATLAS	SSBUV	93 4 9 23 8 27	1 17 39 27	-51.9	221.5	0.0	-90.0	-51.9	221.5	106	2 45	64.5
UARS	MLS	93 4 10 1 54 3	575 2 43 2	-39.1	195.8	90.0	-22.9	-52.5	222.8			62.1
ATLAS	SSBUV	93 4 9 23 11 43	1 17 42 43	-56.3	241.6	0.0	-90.0	-56.3	241.6	151	1 4	75.8
UARS	MLS	93 4 10 0 16 30	575 1 5 28	-42.6	215.6	90.0	-22.9	-56.7	244.0			61.9
ATLAS	SSBUV	93 4 9 23 15 14	1 17 46 14	-56.4	266.2	0.0	-90.0	-56.4	266.2	139	0 34	88.2
UARS	MLS	93 4 9 22 40 17	574 23 29 14	-42.7	239.9	90.0	-22.9	-56.8	268.3			62.1
ATLAS	SSBUV	93 4 10 0 38 37	1 19 9 37	-51.5	197.4	0.0	-90.0	-51.5	197.4	114	2 51	63.6
UARS	MLS	93 4 10 3 30 33	575 4 19 27	-38.3	172.3	90.0	-22.9	-51.5	199.0			62.1
ATLAS	SSBUV	93 4 10 0 41 53	1 19 12 53	-56.1	217.2	0.0	-90.0	-56.1	217.2	163	1 10	74.9
UARS	MLS	93 4 10 1 52 43	575 2 41 37	-42.6	191.3	90.0	-22.9	-56.6	219.7			61.8
ATLAS	SSBUV	93 4 10 0 45 24	1 19 16 24	-56.5	241.7	0.0	-90.0	-56.5	241.7	141	0 28	87.3
UARS	MLS	93 4 10 0 16 30	575 1 5 28	-42.6	215.6	90.0	-22.9	-56.7	244.0			61.9
ATLAS	SSBUV	93 4 10 2 8 47	1 20 39 47	-51.1	173.2	0.0	-90.0	-51.1	173.2	108	2 57	62.8
UARS	MLS	93 4 10 5 6 46	575 5 55 41	-38.2	148.0	90.0	-22.9	-51.4	174.7			61.9
ATLAS	SSBUV	93 4 10 2 12 18	1 20 43 18	-56.2	194.5	0.0	-90.0	-56.2	194.5	69	1 16	74.9
UARS	MLS	93 4 10 3 28 56	575 4 17 52	-42.5	167.1	90.0	-22.9	-56.5	195.4			61.6
ATLAS	SSBUV	93 4 10 2 15 34	1 20 46 34	-56.7	217.3	0.0	-90.0	-56.7	217.2	139	0 23	86.3
UARS	MLS	93 4 10 1 52 27	575 2 41 22	-43.2	190.4	90.0	-22.9	-57.5	219.0			61.7
ATLAS	SSBUV	93 4 10 3 38 58	1 22 9 58	-50.6	149.2	0.0	-90.0	-50.6	149.2	116	3 4	62.0
UARS	MLS	93 4 10 6 42 59	575 7 31 56	-38.1	123.7	90.0	-22.9	-51.3	150.4			61.7
ATLAS	SSBUV	93 4 10 3 42 29	1 22 13 29	-56.0	170.1	0.0	-90.0	-56.0	170.0	82	1 22	74.0
UARS	MLS	93 4 10 5 5 10	575 5 54 6	-42.4	142.8	90.0	-22.9	-56.4	171.1			61.5
ATLAS	SSBUV	93 4 10 3 45 45	1 22 16 45	-56.8	192.8	0.0	-90.0	-56.8	192.8	134	0 17	85.4
UARS	MLS	93 4 10 3 28 40	575 4 17 36	-43.2	166.1	90.0	-22.9	-57.4	194.7			61.6
ATLAS	SSBUV	93 4 10 5 9 8	1 23 40 8	-50.2	125.1	0.0	-90.0	-50.2	125.1	110	3 10	61.2
UARS	MLS	93 4 10 8 19 28	575 9 8 26	-37.3	100.3	90.0	-22.9	-50.4	126.6			61.6
ATLAS	SSBUV	93 4 10 5 12 39	1 23 43 39	-55.8	145.6	0.0	-90.0	-55.8	145.6	95	1 28	73.1
UARS	MLS	93 4 10 6 41 23	575 7 30 21	-42.3	118.5	90.0	-22.9	-56.3	146.8			61.3

Table 9. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	SSBUV	93	4	10	5	15	55	1	23	46	55	-56.9	168.3	0.0	-90.0	-56.9	168.3	136	0	11	84.5
UARS	MLS	93	4	10	5	4	54	575	5	53	50	-43.1	141.8	90.0	-22.9	-57.3	170.4				61.4
ATLAS	SSBUV	93	4	10	6	39	18	2	1	10	18	-49.7	101.1	0.0	-90.0	-49.7	101.0	110	3	16	60.4
UARS	MLS	93	4	10	9	55	42	575	10	44	40	-37.2	76.0	90.0	-22.9	-50.3	102.3				61.5
ATLAS	SSBUV	93	4	10	6	42	49	2	1	13	49	-55.5	121.3	0.0	-90.0	-55.5	121.2	109	1	34	72.3
UARS	MLS	93	4	10	8	17	36	575	9	6	30	-42.2	94.3	90.0	-22.9	-56.2	122.5				61.2
ATLAS	SSBUV	93	4	10	6	46	5	2	1	17	5	-56.9	143.8	0.0	-90.0	-56.9	143.8	143	0	4	83.5
UARS	MLS	93	4	10	6	41	7	575	7	30	5	-43.0	117.6	90.0	-22.9	-57.2	146.1				61.3
ATLAS	SSBUV	93	4	10	8	16	46	2	2	47	46	-56.8	122.8	0.0	-90.0	-56.8	122.8	65	0	0	84.4
UARS	MLS	93	4	10	8	17	20	575	9	6	14	-42.9	93.3	90.0	-22.9	-57.1	121.8				61.2
ATLAS	SSBUV	93	4	10	9	39	39	2	4	10	39	-48.7	53.0	0.0	-90.0	-48.7	53.0	101	3	28	58.8
UARS	MLS	93	4	10	13	8	24	575	13	57	20	-36.3	28.2	90.0	-22.9	-49.2	54.2				61.2
ATLAS	SSBUV	93	4	10	9	43	10	2	4	14	10	-55.0	72.5	0.0	-90.0	-55.0	72.5	127	1	47	70.5
UARS	MLS	93	4	10	11	30	19	575	12	19	14	-41.4	46.6	90.0	-22.9	-55.2	74.5				60.9
ATLAS	SSBUV	93	4	10	9	46	26	2	4	17	26	-57.0	94.8	0.0	-90.0	-57.0	94.8	150	0	6	81.7
UARS	MLS	93	4	10	9	53	17	575	10	42	13	-43.5	68.1	90.0	-22.9	-57.8	96.8				61.0
ATLAS	SSBUV	93	4	10	11	13	20	2	5	44	20	-54.7	48.2	0.0	-90.0	-54.7	48.2	134	1	53	69.7
UARS	MLS	93	4	10	13	6	32	575	13	55	29	-41.3	22.4	90.0	-22.9	-55.1	50.2				60.8
ATLAS	SSBUV	93	4	10	11	16	36	2	5	47	36	-57.0	70.3	0.0	-90.0	-57.0	70.3	154	0	12	80.8
UARS	MLS	93	4	10	11	29	30	575	12	18	27	-43.4	43.8	90.0	-22.9	-57.7	72.5				60.9
ATLAS	SSBUV	93	4	10	12	43	30	2	7	14	30	-54.4	23.9	0.0	-90.0	-54.4	23.9	143	1	59	68.9
UARS	MLS	93	4	10	14	42	45	575	15	31	43	-41.2	358.1	90.0	-22.9	-55.0	25.9				60.6
ATLAS	SSBUV	93	4	10	12	46	46	2	7	17	46	-57.0	45.8	0.0	-90.0	-57.0	45.8	160	0	18	79.9
UARS	MLS	93	4	10	13	5	44	575	13	54	41	-43.3	19.6	90.0	-22.9	-57.6	48.2				60.7
ATLAS	SSBUV	93	4	10	14	13	41	2	8	44	41	-54.1	359.6	0.0	-90.0	-54.1	359.6	154	2	5	68.0
UARS	MLS	93	4	10	16	18	58	575	17	7	52	-41.1	333.8	90.0	-22.9	-54.9	1.6				60.5
ATLAS	SSBUV	93	4	10	14	17	12	2	8	48	12	-57.0	23.1	0.0	-90.0	-57.0	23.1	75	0	24	79.9
UARS	MLS	93	4	10	14	41	57	575	15	30	50	-43.3	355.3	90.0	-22.9	-57.5	23.9				60.6
ATLAS	SSBUV	93	4	10	15	43	51	2	10	14	51	-53.8	335.3	0.0	-90.0	-53.8	335.3	169	2	11	67.2
UARS	MLS	93	4	10	17	55	12	575	18	44	7	-41.1	309.5	90.0	-22.9	-54.8	337.3				60.3
ATLAS	SSBUV	93	4	10	15	47	22	2	10	18	22	-57.0	358.6	0.0	-90.0	-57.0	358.6	79	0	30	79.0
UARS	MLS	93	4	10	16	18	10	575	17	7	5	-43.2	331.0	90.0	-22.9	-57.4	359.6				60.5
ATLAS	SSBUV	93	4	10	17	14	16	2	11	45	16	-53.8	312.6	0.0	-90.0	-53.8	312.6	67	2	17	67.2
UARS	MLS	93	4	10	19	31	41	575	20	20	37	-40.3	286.1	90.0	-22.9	-53.9	313.6				60.2
ATLAS	SSBUV	93	4	10	17	17	32	2	11	48	32	-56.9	334.1	0.0	-90.0	-56.9	334.1	86	0	36	78.1
UARS	MLS	93	4	10	17	54	23	575	18	43	19	-43.1	306.8	90.0	-22.9	-57.3	335.3				60.3
ATLAS	SSBUV	93	4	10	18	44	26	2	13	15	26	-53.5	288.3	0.0	-90.0	-53.5	288.3	69	2	23	66.4
UARS	MLS	93	4	10	21	7	54	575	21	56	51	-40.2	261.9	90.0	-22.9	-53.8	289.3				60.0
ATLAS	SSBUV	93	4	10	18	47	42	2	13	18	42	-56.8	309.6	0.0	-90.0	-56.8	309.6	95	0	42	77.3
UARS	MLS	93	4	10	19	30	37	575	20	19	34	-43.0	282.5	90.0	-22.9	-57.2	311.0				60.2
ATLAS	SSBUV	93	4	10	18	51	13	2	13	22	13	-55.6	333.9	0.0	-90.0	-55.6	333.9	162	0	56	89.2
UARS	MLS	93	4	10	17	54	39	575	18	43	35	-42.4	307.7	90.0	-22.9	-56.5	336.0				60.3

Table 9. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	SSBUV	93	4	10	20	14	22	2	14	45	22	-52.7	262.7	0.0	-90.0	-52.7	262.6	186	2	29	64.8
UARS	MLS	93	4	10	22	44	7	575	23	33	6	-40.1	237.6	90.0	-22.9	-53.7	265.0				59.9
ATLAS	SSBUV	93	4	10	20	17	53	2	14	48	53	-56.7	285.1	0.0	-90.0	-56.7	285.1	105	0	48	76.4
UARS	MLS	93	4	10	21	6	50	575	21	55	48	-42.9	258.2	90.0	-22.9	-57.1	286.7				60.0
ATLAS	SSBUV	93	4	10	20	21	24	2	14	52	24	-55.8	309.5	0.0	-90.0	-55.8	309.5	148	0	50	88.3
UARS	MLS	93	4	10	19	30	53	575	20	19	50	-42.3	283.4	90.0	-22.9	-56.4	311.7				60.2
ATLAS	SSBUV	93	4	10	21	52	4	2	16	23	4	-55.5	288.4	0.0	-90.0	-55.5	288.4	26	0	44	89.1
UARS	MLS	93	4	10	21	7	22	575	21	56	20	-41.6	260.1	90.0	-22.9	-55.4	288.0				60.0
ATLAS	SSBUV	93	4	10	23	14	57	2	17	45	57	-52.4	215.7	0.0	-90.0	-52.4	215.7	87	2	41	64.0
UARS	MLS	93	4	11	1	56	50	576	2	45	45	-39.2	189.9	90.0	-22.9	-52.6	216.9				59.6
ATLAS	SSBUV	93	4	10	23	18	13	2	17	49	13	-56.5	236.2	0.0	-90.0	-56.5	236.2	127	1	1	74.7
UARS	MLS	93	4	11	0	19	16	576	1	8	12	-42.8	209.7	90.0	-22.9	-56.9	238.1				59.8
ATLAS	SSBUV	93	4	10	23	21	44	2	17	52	44	-56.2	260.7	0.0	-90.0	-56.2	260.7	138	0	38	86.5
UARS	MLS	93	4	10	22	43	3	575	23	31	57	-42.9	234.0	90.0	-22.9	-57.0	262.4				59.9
ATLAS	SSBUV	93	4	11	0	45	7	2	19	16	7	-52.0	191.5	0.0	-90.0	-52.0	191.5	94	2	47	63.2
UARS	MLS	93	4	11	3	33	3	576	4	22	0	-39.1	165.6	90.0	-22.9	-52.5	192.6				59.4
ATLAS	SSBUV	93	4	11	0	48	23	2	19	19	23	-56.3	211.7	0.0	-90.0	-56.3	211.7	138	1	7	73.8
UARS	MLS	93	4	11	1	55	30	576	2	44	26	-42.7	185.4	90.0	-22.9	-56.8	213.8				59.6
ATLAS	SSBUV	93	4	11	0	51	54	2	19	22	54	-56.4	236.3	0.0	-90.0	-56.4	236.3	129	0	32	85.6
UARS	MLS	93	4	11	0	19	16	576	1	8	12	-42.8	209.7	90.0	-22.9	-56.9	238.1				59.8
ATLAS	SSBUV	93	4	11	2	15	18	2	20	46	18	-51.6	167.4	0.0	-90.0	-51.6	167.4	101	2	54	62.5
UARS	MLS	93	4	11	5	9	32	576	5	58	30	-38.3	142.1	90.0	-22.9	-51.6	168.9				59.2
ATLAS	SSBUV	93	4	11	2	18	34	2	20	49	34	-56.2	187.3	0.0	-90.0	-56.2	187.3	149	1	13	73.0
UARS	MLS	93	4	11	3	31	43	576	4	20	41	-42.6	161.2	90.0	-22.9	-56.7	189.5				59.5
ATLAS	SSBUV	93	4	11	2	22	5	2	20	53	5	-56.5	211.8	0.0	-90.0	-56.5	211.8	127	0	26	84.7
UARS	MLS	93	4	11	1	55	30	576	2	44	26	-42.7	185.4	90.0	-22.9	-56.8	213.8				59.6
ATLAS	SSBUV	93	4	11	3	45	28	2	22	16	28	-51.1	143.3	0.0	-90.0	-51.1	143.3	95	3	0	61.7
UARS	MLS	93	4	11	6	45	45	576	7	34	39	-38.3	117.9	90.0	-22.9	-51.5	144.5				59.1
ATLAS	SSBUV	93	4	11	3	48	44	2	22	19	44	-56.0	162.9	0.0	-90.0	-56.0	162.9	160	1	19	72.2
UARS	MLS	93	4	11	5	7	56	576	5	56	50	-42.5	136.9	90.0	-22.9	-56.6	165.2				59.4
ATLAS	SSBUV	93	4	11	3	52	15	2	22	23	15	-56.6	187.3	0.0	-90.0	-56.6	187.3	133	0	20	83.8
UARS	MLS	93	4	11	3	31	27	576	4	20	25	-43.3	160.2	90.0	-22.9	-57.5	188.9				59.5
ATLAS	SSBUV	93	4	11	23	21	28	3	17	52	28	-52.8	209.9	0.0	-90.0	-52.8	209.9	77	2	38	63.8
UARS	MLS	93	4	12	1	59	36	577	2	48	34	-39.4	184.0	90.0	-22.9	-52.8	211.1				57.2
ATLAS	SSBUV	93	4	11	23	24	43	3	17	55	43	-56.6	230.8	0.0	-90.0	-56.6	230.7	103	0	57	73.7
UARS	MLS	93	4	12	0	22	3	577	1	11	0	-42.9	203.8	90.0	-22.9	-57.0	232.3				57.9
ATLAS	SSBUV	93	4	11	23	28	14	3	17	59	14	-56.0	255.2	0.0	-90.0	-56.0	255.2	131	0	42	84.7
UARS	MLS	93	4	11	22	46	6	576	23	35	2	-42.3	229.0	90.0	-22.9	-56.3	257.2				57.9
ATLAS	SSBUV	93	4	12	0	51	38	3	19	22	38	-52.4	185.7	0.0	-90.0	-52.4	185.7	74	2	44	63.1
UARS	MLS	93	4	12	3	35	49	577	4	24	43	-39.3	159.7	90.0	-22.9	-52.7	186.8				57.1
ATLAS	SSBUV	93	4	12	0	54	54	3	19	25	54	-56.5	206.3	0.0	-90.0	-56.5	206.3	114	1	3	72.9
UARS	MLS	93	4	12	1	58	16	577	2	47	10	-42.8	179.5	90.0	-22.9	-56.9	208.0				57.8

Table 9. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	SSBUV	93	4	12	0	58	25	3	19	29	25	-56.2	230.8	0.0	-90.0	-56.2	230.8	133	0	36	83.9
UARS	MLS	93	4	12	0	22	3	577	1	11	0	-42.9	203.8	90.0	-22.9	-57.0	232.3				57.9
ATLAS	SSBUV	93	4	12	2	21	33	3	20	52	33	-51.6	160.2	0.0	-90.0	-51.6	160.2	190	2	50	61.7
UARS	MLS	93	4	12	5	12	3	577	6	0	58	-39.2	135.4	90.0	-22.9	-52.6	162.5				56.9
ATLAS	SSBUV	93	4	12	2	25	4	3	20	56	4	-56.4	181.8	0.0	-90.0	-56.4	181.8	125	1	9	72.1
UARS	MLS	93	4	12	3	34	29	577	4	23	24	-42.7	155.3	90.0	-22.9	-56.8	183.7				57.6
ATLAS	SSBUV	93	4	12	2	28	35	3	20	59	35	-56.3	206.4	0.0	-90.0	-56.3	206.4	120	0	30	83.0
UARS	MLS	93	4	12	1	58	16	577	2	47	10	-42.8	179.5	90.0	-22.9	-56.9	208.0				57.8
ATLAS	SSBUV	93	4	12	3	51	58	3	22	22	58	-51.6	137.4	0.0	-90.0	-51.6	137.4	87	2	56	61.7
UARS	MLS	93	4	12	6	48	32	577	7	37	28	-38.4	112.0	90.0	-22.9	-51.6	138.7				56.7
ATLAS	SSBUV	93	4	12	3	55	14	3	22	26	14	-56.2	157.4	0.0	-90.0	-56.2	157.4	136	1	15	71.3
UARS	MLS	93	4	12	5	10	42	577	5	59	38	-42.7	131.0	90.0	-22.9	-56.7	159.4				57.5
ATLAS	SSBUV	93	4	12	3	58	45	3	22	29	45	-56.5	181.9	0.0	-90.0	-56.5	181.9	115	0	24	82.2
UARS	MLS	93	4	12	3	34	29	577	4	23	24	-42.7	155.3	90.0	-22.9	-56.8	183.7				57.6
ATLAS	SSBUV	93	4	12	6	52	19	4	1	23	19	-50.8	89.2	0.0	-90.0	-50.8	89.2	95	3	8	60.4
UARS	MLS	93	4	12	10	0	58	577	10	49	57	-38.2	63.4	90.0	-22.9	-51.4	90.1				56.4
ATLAS	SSBUV	93	4	12	6	55	35	4	1	26	35	-55.8	108.6	0.0	-90.0	-55.8	108.6	160	1	27	69.8
UARS	MLS	93	4	12	8	23	9	577	9	12	7	-42.5	82.5	90.0	-22.9	-56.5	110.8				57.3
ATLAS	SSBUV	93	4	12	6	59	6	4	1	30	6	-56.7	133.0	0.0	-90.0	-56.7	133.0	119	0	12	80.5
UARS	MLS	93	4	12	6	46	40	577	7	35	37	-43.2	105.8	90.0	-22.9	-57.5	134.4				57.5
ATLAS	SSBUV	93	4	12	8	22	29	4	2	53	29	-50.3	65.2	0.0	-90.0	-50.3	65.1	84	3	14	59.8
UARS	MLS	93	4	12	11	37	28	577	12	26	22	-37.4	39.9	90.0	-22.9	-50.5	66.3				56.1
ATLAS	SSBUV	93	4	12	8	25	45	4	2	56	45	-55.6	84.2	0.0	-90.0	-55.6	84.2	173	1	33	69.1
UARS	MLS	93	4	12	9	59	22	577	10	48	16	-42.4	58.2	90.0	-22.9	-56.4	86.5				57.1
ATLAS	SSBUV	93	4	12	8	29	16	4	3	0	16	-56.8	108.5	0.0	-90.0	-56.8	108.5	114	0	6	79.7
UARS	MLS	93	4	12	8	22	53	577	9	11	51	-43.2	81.5	90.0	-22.9	-57.4	110.1				57.4
ATLAS	SSBUV	93	4	12	12	56	31	4	7	27	31	-55.1	12.7	0.0	-90.0	-55.1	12.7	99	1	51	67.7
UARS	MLS	93	4	12	14	48	18	577	15	37	15	-41.5	346.3	90.0	-22.9	-55.3	14.2				56.6
ATLAS	SSBUV	93	4	12	12	59	47	4	7	30	47	-57.0	35.0	0.0	-90.0	-57.0	35.0	133	0	11	77.3
UARS	MLS	93	4	12	13	11	33	577	14	0	29	-42.9	8.7	90.0	-22.9	-57.1	37.2				57.0
ATLAS	SSBUV	93	4	12	14	26	41	4	8	57	41	-54.8	348.4	0.0	-90.0	-54.8	348.3	107	1	57	67.0
UARS	MLS	93	4	12	16	24	31	577	17	13	25	-41.4	322.0	90.0	-22.9	-55.2	349.9				56.4
ATLAS	SSBUV	93	4	12	14	29	57	4	9	0	57	-57.0	10.5	0.0	-90.0	-57.0	10.5	135	0	17	76.5
UARS	MLS	93	4	12	14	47	30	577	15	36	28	-43.5	343.5	90.0	-22.9	-57.8	12.2				57.1
ATLAS	SSBUV	93	4	12	14	33	58	4	9	4	58	-53.7	37.3	0.0	-90.0	-53.7	37.2	157	1	21	88.7
UARS	MLS	93	4	12	13	12	21	577	14	1	17	-40.9	11.5	90.0	-22.9	-54.6	39.1				56.5
ATLAS	SSBUV	93	4	12	15	56	51	4	10	27	51	-54.5	324.0	0.0	-90.0	-54.5	324.0	118	2	3	66.3
UARS	MLS	93	4	12	18	0	44	577	18	49	39	-41.3	297.8	90.0	-22.9	-55.1	325.6				56.3
ATLAS	SSBUV	93	4	12	16	0	7	4	10	31	7	-57.0	346.0	0.0	-90.0	-57.0	346.0	139	0	23	75.8
UARS	MLS	93	4	12	16	23	43	577	17	12	37	-43.4	319.2	90.0	-22.9	-57.7	347.9				57.0
ATLAS	SSBUV	93	4	12	16	4	8	4	10	35	8	-54.0	13.0	0.0	-90.0	-54.0	13.0	129	1	15	87.9
UARS	MLS	93	4	12	14	48	34	577	15	37	31	-40.8	347.2	90.0	-22.9	-54.5	14.8				56.4

Table 9. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	SSBUV	93	4	12	17	27	2	4	11	58	2	-54.2	299.7	0.0	-90.0	-54.2	299.7	132	2	9	65.6
UARS	MLS	93	4	12	19	36	58	577	20	25	53	-41.2	273.5	90.0	-22.9	-55.0	301.3				56.2
ATLAS	SSBUV	93	4	12	17	30	18	4	12	1	18	-57.0	321.5	0.0	-90.0	-57.0	321.5	145	0	29	75.0
UARS	MLS	93	4	12	17	59	56	577	18	48	52	-43.3	295.0	90.0	-22.9	-57.6	323.6				56.9
ATLAS	SSBUV	93	4	12	17	34	19	4	12	5	19	-54.3	348.7	0.0	-90.0	-54.3	348.7	118	1	9	87.0
UARS	MLS	93	4	12	16	24	47	577	17	13	46	-40.7	322.9	90.0	-22.9	-54.4	350.5				56.3
ATLAS	SSBUV	93	4	12	18	57	12	4	13	28	12	-53.9	275.5	0.0	-90.0	-53.9	275.4	141	2	16	64.9
UARS	MLS	93	4	12	21	13	27	577	22	2	24	-40.5	250.1	90.0	-22.9	-54.1	277.6				55.8
ATLAS	SSBUV	93	4	12	19	0	28	4	13	31	28	-56.9	297.0	0.0	-90.0	-56.9	297.0	153	0	35	74.2
UARS	MLS	93	4	12	19	36	9	577	20	25	6	-43.3	270.7	90.0	-22.9	-57.5	299.3				56.7
ATLAS	SSBUV	93	4	12	19	4	14	4	13	35	14	-55.0	322.8	0.0	-90.0	-55.0	322.8	172	1	3	85.4
UARS	MLS	93	4	12	18	0	28	577	18	49	23	-42.0	296.8	90.0	-22.9	-55.9	325.0				56.5
ATLAS	SSBUV	93	4	12	20	27	22	4	14	58	22	-53.6	251.2	0.0	-90.0	-53.6	251.2	144	2	22	64.3
UARS	MLS	93	4	12	22	49	40	577	23	38	38	-40.4	225.8	90.0	-22.9	-54.0	253.3				55.7
ATLAS	SSBUV	93	4	12	20	30	38	4	15	1	38	-56.8	272.5	0.0	-90.0	-56.8	272.5	163	0	41	73.5
UARS	MLS	93	4	12	21	12	23	577	22	1	20	-43.2	246.4	90.0	-22.9	-57.4	275.0				56.6
ATLAS	SSBUV	93	4	12	20	34	24	4	15	5	24	-55.2	298.5	0.0	-90.0	-55.2	298.5	153	0	57	84.6
UARS	MLS	93	4	12	19	36	42	577	20	25	38	-41.9	272.6	90.0	-22.9	-55.8	300.7				56.3
ATLAS	SSBUV	93	4	12	21	57	32	4	16	28	32	-53.2	227.0	0.0	-90.0	-53.2	227.0	151	2	28	63.7
UARS	MLS	93	4	13	0	25	53	578	1	14	47	-40.3	201.5	90.0	-22.9	-53.9	229.0				55.6
ATLAS	SSBUV	93	4	12	22	1	3	4	16	32	3	-56.9	249.8	0.0	-90.0	-56.9	249.8	74	0	47	73.5
UARS	MLS	93	4	12	22	48	36	577	23	37	30	-43.1	222.2	90.0	-22.9	-57.3	250.7				56.5
ATLAS	SSBUV	93	4	12	22	4	34	4	16	35	34	-55.5	274.1	0.0	-90.0	-55.5	274.1	144	0	51	83.8
UARS	MLS	93	4	12	21	12	55	577	22	1	52	-41.8	248.3	90.0	-22.9	-55.7	276.3				56.2
ATLAS	SSBUV	93	4	12	23	27	43	4	17	58	43	-52.8	202.8	0.0	-90.0	-52.8	202.7	163	2	34	63.0
UARS	MLS	93	4	13	2	2	7	578	2	51	2	-40.2	177.3	90.0	-22.9	-53.8	204.7				55.4
ATLAS	SSBUV	93	4	12	23	31	14	4	18	2	14	-56.8	225.3	0.0	-90.0	-56.8	225.3	82	0	53	72.8
UARS	MLS	93	4	13	0	24	49	578	1	13	44	-43.0	197.9	90.0	-22.9	-57.2	226.4				56.4
ATLAS	SSBUV	93	4	12	23	34	45	4	18	5	45	-55.7	249.7	0.0	-90.0	-55.7	249.7	133	0	45	83.0
UARS	MLS	93	4	12	22	48	52	577	23	37	51	-42.4	223.1	90.0	-22.9	-56.5	251.4				56.3
ATLAS	SSBUV	93	4	13	0	58	8	4	19	29	8	-52.9	180.0	0.0	-90.0	-52.9	180.0	64	2	40	63.1
UARS	MLS	93	4	13	3	38	36	578	4	27	32	-39.4	153.8	90.0	-22.9	-52.8	180.9				55.1
ATLAS	SSBUV	93	4	13	1	1	24	4	19	32	24	-56.7	200.8	0.0	-90.0	-56.7	200.8	92	0	59	72.0
UARS	MLS	93	4	13	2	1	2	578	2	49	58	-42.9	173.6	90.0	-22.9	-57.1	202.1				56.3
ATLAS	SSBUV	93	4	13	1	4	55	4	19	35	55	-55.9	225.3	0.0	-90.0	-55.9	225.3	120	0	39	82.2
UARS	MLS	93	4	13	0	25	5	578	1	14	0	-42.4	198.8	90.0	-22.9	-56.4	227.1				56.2
ATLAS	SSBUV	93	4	13	19	3	49	5	13	34	49	-54.3	270.0	0.0	-90.0	-54.3	269.8	118	2	12	64.9
UARS	MLS	93	4	13	21	15	57	578	22	4	51	-41.3	243.3	90.0	-22.9	-55.1	271.1				54.5
ATLAS	SSBUV	93	4	13	19	7	5	5	13	38	5	-57.0	291.8	0.0	-90.0	-57.0	291.7	131	0	31	73.3
UARS	MLS	93	4	13	19	38	56	578	20	27	49	-43.4	264.8	90.0	-22.9	-57.7	293.5				55.5
ATLAS	SSBUV	93	4	13	19	11	6	5	13	42	6	-54.3	318.9	0.0	-90.0	-54.3	318.8	101	1	7	84.3
UARS	MLS	93	4	13	18	3	47	578	18	52	44	-40.8	292.8	90.0	-22.9	-54.4	320.4				54.5

Table 9. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	SSBUV	93 4 13 20 33 58	5 15 4 58	-54.0 245.7	0.0 -90.0	-54.0 245.6	123	2 18	64.4
UARS	MLS	93 4 13 22 52 26	578 23 41 22	-40.5 219.5	90.0 -22.9	-54.1 247.4			54.1
ATLAS	SSBUV	93 4 13 20 37 13	5 15 8 13	-56.9 267.3	0.0 -90.0	-56.9 267.2	138	0 37	72.6
UARS	MLS	93 4 13 21 15 9	578 22 4 4	-43.3 240.5	90.0 -22.9	-57.5 269.2			55.4
ATLAS	SSBUV	93 4 13 20 41 14	5 15 12 14	-54.6 294.6	0.0 -90.0	-54.6 294.5	86	1 1	83.5
UARS	MLS	93 4 13 19 39 44	578 20 28 42	-41.4 267.6	90.0 -22.9	-55.2 295.4			54.6
ATLAS	SSBUV	93 4 13 22 4 6	5 16 35 6	-53.6 221.4	0.0 -90.0	-53.6 221.3	126	2 24	63.8
UARS	MLS	93 4 14 0 28 40	579 1 17 36	-40.4 195.7	90.0 -22.9	-54.0 223.1			54.0
ATLAS	SSBUV	93 4 13 22 7 22	5 16 38 22	-56.9 242.8	0.0 -90.0	-56.9 242.7	146	0 44	72.0
UARS	MLS	93 4 13 22 51 22	578 23 40 18	-43.2 216.3	90.0 -22.9	-57.4 244.9			55.3
ATLAS	SSBUV	93 4 13 22 11 8	5 16 42 8	-55.2 268.7	0.0 -90.0	-55.2 268.6	142	0 55	82.1
UARS	MLS	93 4 13 21 15 41	578 22 4 35	-42.0 242.4	90.0 -22.9	-55.9 270.5			54.8
ATLAS	SSBUV	93 4 13 23 34 15	5 18 5 15	-53.3 197.2	0.0 -90.0	-53.3 197.1	134	2 30	63.3
UARS	MLS	93 4 14 2 4 53	579 2 53 50	-40.3 171.4	90.0 -22.9	-53.9 198.8			53.9
ATLAS	SSBUV	93 4 13 23 37 31	5 18 8 31	-56.8 218.4	0.0 -90.0	-56.8 218.2	155	0 50	71.3
UARS	MLS	93 4 14 0 27 36	579 1 16 33	-43.2 192.0	90.0 -22.9	-57.3 220.6			55.2
ATLAS	SSBUV	93 4 13 23 41 17	5 18 12 17	-55.4 244.4	0.0 -90.0	-55.4 244.2	128	0 49	81.3
UARS	MLS	93 4 13 22 51 54	578 23 40 50	-41.9 218.1	90.0 -22.9	-55.8 246.2			54.7
ATLAS	SSBUV	93 4 14 1 4 24	5 19 35 24	-52.9 173.0	0.0 -90.0	-52.9 172.9	148	2 36	62.7
UARS	MLS	93 4 14 3 41 6	579 4 30 5	-40.3 147.1	90.0 -22.9	-53.8 174.5			53.7
ATLAS	SSBUV	93 4 14 1 7 40	5 19 38 40	-56.7 193.9	0.0 -90.0	-56.7 193.8	165	0 56	70.7
UARS	MLS	93 4 14 2 3 49	579 2 52 47	-43.1 167.7	90.0 -22.9	-57.2 196.3			55.1
ATLAS	SSBUV	93 4 14 1 11 26	5 19 42 26	-55.7 220.0	0.0 -90.0	-55.7 219.9	126	0 43	80.6
UARS	MLS	93 4 14 0 28 8	579 1 17 4	-41.8 193.9	90.0 -22.9	-55.7 221.9			54.6
ATLAS	SSBUV	93 4 14 2 34 33	5 21 5 33	-52.5 148.8	0.0 -90.0	-52.5 148.7	146	2 43	62.2
UARS	MLS	93 4 14 5 17 36	579 6 6 30	-39.5 123.7	90.0 -22.9	-52.9 150.8			53.3
ATLAS	SSBUV	93 4 14 2 38 4	5 21 9 4	-56.7 171.2	0.0 -90.0	-56.7 171.0	76	1 1	70.7
UARS	MLS	93 4 14 3 40 2	579 4 28 56	-43.0 143.5	90.0 -22.9	-57.1 172.0			55.0
ATLAS	SSBUV	93 4 14 2 41 20	5 21 12 20	-56.1 193.9	0.0 -90.0	-56.1 193.8	196	0 37	79.2
UARS	MLS	93 4 14 2 3 49	579 2 52 47	-43.1 167.7	90.0 -22.9	-57.2 196.3			55.1
ATLAS	SSBUV	93 4 14 4 4 42	5 22 35 42	-52.1 124.6	0.0 -90.0	-52.1 124.5	150	2 49	61.7
UARS	MLS	93 4 14 6 53 49	579 7 42 44	-39.4 99.4	90.0 -22.9	-52.8 126.5			53.2
ATLAS	SSBUV	93 4 14 4 8 13	5 22 39 13	-56.6 146.7	0.0 -90.0	-56.6 146.6	86	1 8	70.0
UARS	MLS	93 4 14 5 16 15	579 6 5 11	-42.9 119.2	90.0 -22.9	-57.0 147.7			54.9
ATLAS	SSBUV	93 4 14 4 11 44	5 22 42 44	-56.1 171.2	0.0 -90.0	-56.1 171.1	100	0 31	79.1
UARS	MLS	93 4 14 3 40 18	579 4 29 12	-42.3 144.4	90.0 -22.9	-56.3 172.6			54.7
ATLAS	SSBUV	93 4 14 5 34 51	6 0 5 51	-51.7 100.5	0.0 -90.0	-51.7 100.4	161	2 55	61.2
UARS	MLS	93 4 14 8 30 2	579 9 18 59	-39.3 75.1	90.0 -22.9	-52.7 102.2			53.0
ATLAS	SSBUV	93 4 14 5 38 22	6 0 9 22	-56.4 122.2	0.0 -90.0	-56.4 122.1	96	1 14	69.4
UARS	MLS	93 4 14 6 52 29	579 7 41 25	-42.8 94.9	90.0 -22.9	-56.9 123.4			54.8
ATLAS	SSBUV	93 4 14 5 41 53	6 0 12 53	-56.3 146.8	0.0 -90.0	-56.3 146.6	105	0 25	78.4
UARS	MLS	93 4 14 5 16 31	579 6 5 26	-42.2 120.1	90.0 -22.9	-56.2 148.3			54.5

Table 9. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	SSBUV	93	4	14	7	5	0	6	1	36	0	-51.3	76.4	0.0	-90.0	-51.3	76.3	156	3	1	60.8
UARS	MLS	93	4	14	10	6	31	579	10	55	29	-38.5	51.7	90.0	-22.9	-51.7	78.4				52.6
ATLAS	SSBUV	93	4	14	7	8	31	6	1	39	31	-56.3	97.8	0.0	-90.0	-56.3	97.7	107	1	20	68.8
UARS	MLS	93	4	14	8	28	42	579	9	17	39	-42.7	70.7	90.0	-22.9	-56.8	99.1				54.7
ATLAS	SSBUV	93	4	14	7	12	2	6	1	43	2	-56.4	122.3	0.0	-90.0	-56.4	122.2	91	0	19	77.7
UARS	MLS	93	4	14	6	52	29	579	7	41	25	-42.8	94.9	90.0	-22.9	-56.9	123.4				54.8
ATLAS	SSBUV	93	4	14	8	35	9	6	3	6	9	-50.9	52.3	0.0	-90.0	-50.9	52.2	159	3	7	60.3
UARS	MLS	93	4	14	11	42	44	579	12	31	38	-38.4	27.4	90.0	-22.9	-51.6	54.1				52.5
ATLAS	SSBUV	93	4	14	8	38	39	6	3	9	39	-56.1	73.4	0.0	-90.0	-56.1	73.3	119	1	26	68.2
UARS	MLS	93	4	14	10	4	55	579	10	53	49	-42.7	46.4	90.0	-22.9	-56.7	74.8				54.5
ATLAS	SSBUV	93	4	14	8	41	55	6	3	12	55	-56.7	96.1	0.0	-90.0	-56.7	96.0	179	0	13	76.4
UARS	MLS	93	4	14	8	28	26	579	9	17	24	-43.4	69.7	90.0	-22.9	-57.7	98.4				55.0
ATLAS	SSBUV	93	4	14	8	46	57	6	3	17	57	-49.7	126.5	0.0	-90.0	-49.7	126.4	144	1	52	89.6
UARS	MLS	93	4	14	6	54	37	579	7	43	32	-37.2	101.9	90.0	-22.9	-50.3	128.1				52.4
ATLAS	SSBUV	93	4	14	10	5	32	6	4	36	32	-50.9	29.5	0.0	-90.0	-50.9	29.4	70	3	13	60.4
UARS	MLS	93	4	14	13	19	14	579	14	8	8	-37.6	3.9	90.0	-22.9	-50.7	30.3				52.0
ATLAS	SSBUV	93	4	14	10	8	48	6	4	39	48	-55.9	49.0	0.0	-90.0	-55.9	48.8	131	1	32	67.7
UARS	MLS	93	4	14	11	41	8	579	12	30	3	-42.6	22.1	90.0	-22.9	-56.6	50.5				54.4
ATLAS	SSBUV	93	4	14	10	12	4	6	4	43	4	-56.8	71.7	0.0	-90.0	-56.8	71.5	176	0	7	75.7
UARS	MLS	93	4	14	10	4	39	579	10	53	33	-43.3	45.5	90.0	-22.9	-57.6	74.1				54.9
ATLAS	SSBUV	93	4	14	10	17	5	6	4	48	5	-50.1	102.5	0.0	-90.0	-50.1	102.3	106	1	46	88.8
UARS	MLS	93	4	14	8	30	50	579	9	19	46	-37.1	77.6	90.0	-22.9	-50.2	103.8				52.2
ATLAS	SSBUV	93	4	14	11	35	26	6	6	6	26	-50.0	4.2	0.0	-90.0	-50.0	4.0	157	3	20	59.5
UARS	MLS	93	4	14	14	55	27	579	15	44	23	-37.5	339.6	90.0	-22.9	-50.6	6.0				51.9
ATLAS	SSBUV	93	4	14	11	38	57	6	6	9	57	-55.7	24.6	0.0	-90.0	-55.7	24.4	145	1	38	67.1
UARS	MLS	93	4	14	13	17	21	579	14	6	17	-42.5	357.9	90.0	-22.9	-56.5	26.2				54.3
ATLAS	SSBUV	93	4	14	11	42	28	6	6	13	28	-56.8	49.0	0.0	-90.0	-56.8	48.8	96	0	1	75.6
UARS	MLS	93	4	14	11	40	52	579	12	29	47	-43.3	21.2	90.0	-22.9	-57.5	49.8				54.8
ATLAS	SSBUV	93	4	14	11	46	44	6	6	17	44	-51.6	75.8	0.0	-90.0	-51.6	75.6	188	1	40	86.7
UARS	MLS	93	4	14	10	6	15	579	10	55	13	-39.2	50.8	90.0	-22.9	-52.6	77.8				52.9
ATLAS	SSBUV	93	4	14	13	5	50	6	7	36	50	-50.0	341.4	0.0	-90.0	-50.0	341.3	61	3	25	59.6
UARS	MLS	93	4	14	16	31	40	579	17	20	37	-37.4	315.4	90.0	-22.9	-50.5	341.7				51.8
ATLAS	SSBUV	93	4	14	13	9	21	6	7	40	21	-55.7	1.9	0.0	-90.0	-55.7	1.7	50	1	44	67.1
UARS	MLS	93	4	14	14	53	51	579	15	42	48	-41.7	334.5	90.0	-22.9	-55.6	2.5				53.9
ATLAS	SSBUV	93	4	14	13	12	37	6	7	43	37	-56.9	24.5	0.0	-90.0	-56.9	24.3	89	0	4	75.0
UARS	MLS	93	4	14	13	17	5	579	14	6	2	-43.2	356.9	90.0	-22.9	-57.4	25.5				54.7
ATLAS	SSBUV	93	4	14	13	16	53	6	7	47	53	-52.0	51.6	0.0	-90.0	-52.0	51.5	148	1	34	85.9
UARS	MLS	93	4	14	11	42	28	579	12	31	22	-39.1	26.6	90.0	-22.9	-52.5	53.5				52.8
ATLAS	SSBUV	93	4	14	14	39	30	6	9	10	30	-55.5	337.5	0.0	-90.0	-55.5	337.3	55	1	50	66.6
UARS	MLS	93	4	14	16	30	4	579	17	19	2	-41.7	310.3	90.0	-22.9	-55.5	338.2				53.7
ATLAS	SSBUV	93	4	14	14	42	46	6	9	13	46	-56.9	360.0	0.0	-90.0	-56.9	359.8	89	0	10	74.3
UARS	MLS	93	4	14	14	53	19	579	15	42	16	-43.1	332.7	90.0	-22.9	-57.3	1.2				54.6

Table 9. Continued.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	SSBUV	93	4	14	14	47	2	6	9	18	2	-52.4	27.5	0.0	-90.0	-52.4	27.3	126	1	28	85.2
UARS	MLS	93	4	14	13	18	26	579	14	7	21	-39.7	1.4	90.0	-22.9	-53.2	28.6				53.0
ATLAS	SSBUV	93	4	14	16	9	39	6	10	40	39	-55.2	313.1	0.0	-90.0	-55.2	313.0	62	1	56	66.0
UARS	MLS	93	4	14	18	6	17	579	18	55	11	-41.6	286.0	90.0	-22.9	-55.4	313.9				53.6
ATLAS	SSBUV	93	4	14	16	12	55	6	10	43	55	-57.0	335.5	0.0	-90.0	-57.0	335.4	95	0	16	73.7
UARS	MLS	93	4	14	16	29	32	579	17	18	30	-43.0	308.4	90.0	-22.9	-57.2	336.9				54.5
ATLAS	SSBUV	93	4	14	16	16	56	6	10	47	56	-53.2	1.9	0.0	-90.0	-53.2	1.7	156	1	22	83.8
UARS	MLS	93	4	14	14	54	23	579	15	43	19	-40.4	336.3	90.0	-22.9	-54.0	3.7				53.2
ATLAS	SSBUV	93	4	14	17	39	48	6	12	10	48	-54.9	288.8	0.0	-90.0	-54.9	288.6	73	2	2	65.5
UARS	MLS	93	4	14	19	42	30	579	20	31	26	-41.5	261.7	90.0	-22.9	-55.3	289.6				53.5
ATLAS	SSBUV	93	4	14	17	43	4	6	12	14	4	-57.0	311.0	0.0	-90.0	-57.0	310.9	105	0	22	73.1
UARS	MLS	93	4	14	18	5	45	579	18	54	40	-42.9	284.1	90.0	-22.9	-57.1	312.6				54.4
ATLAS	SSBUV	93	4	14	17	47	5	6	12	18	5	-53.6	337.6	0.0	-90.0	-53.6	337.5	131	1	16	83.1
UARS	MLS	93	4	14	16	30	36	579	17	19	34	-40.3	312.0	90.0	-22.9	-53.8	339.4				53.0
ATLAS	SSBUV	93	4	14	19	9	57	6	13	40	57	-54.7	264.5	0.0	-90.0	-54.7	264.3	88	2	8	65.0
UARS	MLS	93	4	14	21	18	44	579	22	7	40	-41.4	237.4	90.0	-22.9	-55.2	265.3				53.4
ATLAS	SSBUV	93	4	14	19	13	12	6	13	44	12	-57.0	286.5	0.0	-90.0	-57.0	286.4	116	0	28	72.4
UARS	MLS	93	4	14	19	41	42	579	20	30	38	-43.5	258.9	90.0	-22.9	-57.8	287.6				54.7
ATLAS	SSBUV	93	4	14	19	17	14	6	13	48	14	-53.9	313.4	0.0	-90.0	-53.9	313.2	112	1	10	82.4
UARS	MLS	93	4	14	18	6	33	579	18	55	27	-40.9	286.9	90.0	-22.9	-54.6	314.5				53.3
ATLAS	SSBUV	93	4	14	20	40	6	6	15	11	6	-54.4	240.2	0.0	-90.0	-54.4	240.0	103	2	15	64.5
UARS	MLS	93	4	14	22	55	13	579	23	44	10	-40.6	214.1	90.0	-22.9	-54.3	241.6				52.9
ATLAS	SSBUV	93	4	14	20	43	21	6	15	14	21	-57.0	262.0	0.0	-90.0	-57.0	261.9	118	0	34	71.8
UARS	MLS	93	4	14	21	17	56	579	22	6	53	-43.4	234.6	90.0	-22.9	-57.7	263.3				54.6
ATLAS	SSBUV	93	4	14	20	47	7	6	15	18	7	-54.6	287.6	0.0	-90.0	-54.6	287.4	160	1	4	81.0
UARS	MLS	93	4	14	19	42	30	579	20	31	26	-41.5	261.7	90.0	-22.9	-55.3	289.6				53.5
ATLAS	SSBUV	93	4	15	1	10	32	6	19	41	32	-53.3	167.4	0.0	-90.0	-53.3	167.2	117	2	33	63.2
UARS	MLS	93	4	15	3	43	53	580	4	32	48	-40.4	141.2	90.0	-22.9	-54.0	168.7				52.6
ATLAS	SSBUV	93	4	15	1	13	48	6	19	44	48	-56.8	188.6	0.0	-90.0	-56.8	188.4	138	0	52	70.1
UARS	MLS	93	4	15	2	6	35	580	2	55	31	-43.2	161.8	90.0	-22.9	-57.4	190.4				54.3
ATLAS	SSBUV	93	4	15	1	17	34	6	19	48	34	-55.4	214.6	0.0	-90.0	-55.4	214.4	112	0	46	78.9
UARS	MLS	93	4	15	0	30	54	580	1	19	48	-41.9	188.0	90.0	-22.9	-55.8	216.0				53.6
ATLAS	SSBUV	93	4	15	2	40	41	6	21	11	41	-53.0	143.2	0.0	-90.0	-53.0	143.0	128	2	39	62.8
UARS	MLS	93	4	15	5	20	22	580	6	9	18	-39.6	117.8	90.0	-22.9	-53.0	144.9				52.1
ATLAS	SSBUV	93	4	15	2	43	57	6	21	14	57	-56.7	164.1	0.0	-90.0	-56.7	163.9	148	0	58	69.5
UARS	MLS	93	4	15	3	42	48	580	4	31	45	-43.1	137.6	90.0	-22.9	-57.3	166.1				54.2
ATLAS	SSBUV	93	4	15	2	47	43	6	21	18	43	-55.6	190.2	0.0	-90.0	-55.6	190.1	106	0	40	78.3
UARS	MLS	93	4	15	2	7	7	580	2	56	2	-41.8	163.7	90.0	-22.9	-55.7	191.7				53.5
ATLAS	SSBUV	93	4	15	4	10	50	6	22	41	50	-52.6	119.0	0.0	-90.0	-52.6	118.8	126	2	45	62.4
UARS	MLS	93	4	15	6	56	35	580	7	45	33	-39.5	93.5	90.0	-22.9	-52.9	120.6				51.9
ATLAS	SSBUV	93	4	15	4	14	6	6	22	45	6	-56.6	139.6	0.0	-90.0	-56.6	139.5	158	1	4	69.0
UARS	MLS	93	4	15	5	19	2	580	6	7	59	-43.0	113.3	90.0	-22.9	-57.2	141.8				54.1

Table 9. Continued.

sat.	instrument	gmt yr mo da hr mn sc	time into mission da hr mn sc	sub satellite lat lon	viewing angle beta alpha	observed point lat lon	miss dist km	miss time hr mn	solar zenith angle
ATLAS	SSBUV	93 4 15 4 17 52	6 22 48 52	-55.9 165.8	0.0 -90.0	-55.9 165.7	97	0 34	77.6
UARS	MLS	93 4 15 3 43 5	580 4 32 1	-42.4 138.5	90.0 -22.9	-56.5 166.8			53.8
ATLAS	SSBUV	93 4 15 5 40 59	7 0 11 59	-52.2 94.8	0.0 -90.0	-52.2 94.7	132	2 51	62.0
UARS	MLS	93 4 15 8 32 48	580 9 21 42	-39.4 69.3	90.0 -22.9	-52.8 96.3			51.8
ATLAS	SSBUV	93 4 15 5 44 15	7 0 15 15	-56.4 115.2	0.0 -90.0	-56.4 115.0	168	1 11	68.5
UARS	MLS	93 4 15 6 55 15	580 7 44 9	-43.0 89.0	90.0 -22.9	-57.1 117.5			54.0
ATLAS	SSBUV	93 4 15 5 47 46	7 0 18 46	-56.3 139.7	0.0 -90.0	-56.3 139.6	172	0 28	76.4
UARS	MLS	93 4 15 5 19 2	580 6 7 59	-43.0 113.3	90.0 -22.9	-57.2 141.8			54.1
ATLAS	SSBUV	93 4 15 7 11 8	7 1 42 8	-51.8 70.7	0.0 -90.0	-51.8 70.5	141	2 58	61.6
UARS	MLS	93 4 15 10 9 18	580 10 58 12	-38.6 45.8	90.0 -22.9	-51.9 72.6			51.3
ATLAS	SSBUV	93 4 15 7 14 39	7 1 45 39	-56.4 92.5	0.0 -90.0	-56.4 92.3	83	1 16	68.5
UARS	MLS	93 4 15 8 31 28	580 9 20 23	-42.9 64.8	90.0 -22.9	-57.0 93.2			53.9
ATLAS	SSBUV	93 4 15 7 17 54	7 1 48 54	-56.4 115.3	0.0 -90.0	-56.4 115.1	164	0 22	75.7
UARS	MLS	93 4 15 6 55 15	580 7 44 9	-43.0 89.0	90.0 -22.9	-57.1 117.5			54.0
ATLAS	SSBUV	93 4 15 7 23 11	7 1 54 11	-48.0 145.8	0.0 -90.0	-48.0 145.6	175	2 1	88.4
UARS	MLS	93 4 15 5 21 42	580 6 10 38	-36.0 121.8	90.0 -22.9	-48.9 147.7			50.3
ATLAS	SSBUV	93 4 15 8 41 16	7 3 12 16	-51.4 46.6	0.0 -90.0	-51.4 46.4	137	3 4	61.3
UARS	MLS	93 4 15 11 45 31	580 12 34 27	-38.5 21.5	90.0 -22.9	-51.8 48.3			51.2
ATLAS	SSBUV	93 4 15 8 44 47	7 3 15 47	-56.3 68.0	0.0 -90.0	-56.3 67.9	93	1 22	68.0
UARS	MLS	93 4 15 10 7 41	580 10 56 37	-42.8 40.5	90.0 -22.9	-56.9 68.9			53.8
ATLAS	SSBUV	93 4 15 8 48 18	7 3 19 18	-56.4 92.5	0.0 -90.0	-56.4 92.4	83	0 16	75.7
UARS	MLS	93 4 15 8 31 28	580 9 20 23	-42.9 64.8	90.0 -22.9	-57.0 93.2			53.9
ATLAS	SSBUV	93 4 15 8 53 20	7 3 24 20	-48.5 121.8	0.0 -90.0	-48.5 121.7	125	1 55	87.6
UARS	MLS	93 4 15 6 57 55	580 7 46 52	-35.9 97.6	90.0 -22.9	-48.8 123.3			50.1
ATLAS	SSBUV	93 4 15 10 11 25	7 4 42 25	-50.9 22.5	0.0 -90.0	-50.9 22.3	142	3 10	60.9
UARS	MLS	93 4 15 13 21 44	580 14 10 41	-38.5 357.2	90.0 -22.9	-51.7 23.9			51.1
ATLAS	SSBUV	93 4 15 10 14 56	7 4 45 56	-56.1 43.6	0.0 -90.0	-56.1 43.4	105	1 28	67.5
UARS	MLS	93 4 15 11 43 55	580 12 32 52	-42.7 16.2	90.0 -22.9	-56.8 44.6			53.7
ATLAS	SSBUV	93 4 15 10 18 27	7 4 49 27	-56.6 68.1	0.0 -90.0	-56.6 67.9	71	0 10	75.1
UARS	MLS	93 4 15 10 7 41	580 10 56 37	-42.8 40.5	90.0 -22.9	-56.9 68.9			53.8
ATLAS	SSBUV	93 4 15 10 22 58	7 4 53 58	-50.1 95.4	0.0 -90.0	-50.1 95.2	195	1 49	85.7
UARS	MLS	93 4 15 8 33 20	580 9 22 19	-38.0 70.9	90.0 -22.9	-51.2 97.4			51.1
ATLAS	SSBUV	93 4 15 10 24 29	7 4 55 29	-46.7 102.4	0.0 -90.0	-46.7 102.3	148	1 49	89.3
UARS	MLS	93 4 15 8 34 57	580 9 23 54	-33.5 75.5	90.0 -22.9	-46.1 100.5			49.1
ATLAS	SSBUV	93 4 16 13 17 51	8 7 48 51	-50.6 328.5	0.0 -90.0	-50.6 328.3	121	3 19	61.7
UARS	MLS	93 4 16 16 37 13	581 17 26 9	-37.7 303.6	90.0 -22.9	-50.8 330.0			49.5
ATLAS	SSBUV	93 4 16 13 21 22	8 7 52 22	-56.0 349.4	0.0 -90.0	-56.0 349.2	99	1 38	66.7
UARS	MLS	93 4 16 14 59 24	581 15 48 20	-42.0 322.7	90.0 -22.9	-55.9 350.8			52.7
ATLAS	SSBUV	93 4 16 13 24 38	8 7 55 38	-56.8 12.1	0.0 -90.0	-56.8 11.9	150	0 1	72.4
UARS	MLS	93 4 16 13 22 38	581 14 11 34	-43.4 345.1	90.0 -22.9	-57.7 13.8			53.9
ATLAS	SSBUV	93 4 16 13 29 24	8 8 0 24	-50.5 41.5	0.0 -90.0	-50.5 41.3	137	1 40	82.0
UARS	MLS	93 4 16 11 48 33	581 12 37 31	-38.0 16.5	90.0 -22.9	-51.1 43.0			49.8

Table 9. Concluded.

sat.	instrument	gmt yr	mo	da	hr	mn	sc	time into mission da	hr	mn	sc	sub satellite lat	lon	viewing angle beta	alpha	observed point lat	lon	miss dist km	time hr	mn	solar zenith angle
ATLAS	SSBUV	93	4	16	14	48	0	8	9	19	0	-50.1	304.5	0.0	-90.0	-50.1	304.3	120	3	25	61.6
UARS	MLS	93	4	16	18	13	26	581	19	2	24	-37.6	279.3	90.0	-22.9	-50.7	305.7				49.4
ATLAS	SSBUV	93	4	16	14	51	31	8	9	22	31	-55.7	325.0	0.0	-90.0	-55.7	324.8	106	1	44	66.3
UARS	MLS	93	4	16	16	35	37	581	17	24	34	-41.9	298.5	90.0	-22.9	-55.8	326.5				52.6
ATLAS	SSBUV	93	4	16	14	54	47	8	9	25	47	-56.9	347.6	0.0	-90.0	-56.9	347.5	146	0	4	71.9
UARS	MLS	93	4	16	14	58	52	581	15	47	48	-43.3	320.9	90.0	-22.9	-57.6	349.5				53.9
ATLAS	SSBUV	93	4	16	14	59	18	8	9	30	18	-51.4	16.1	0.0	-90.0	-51.4	15.9	159	1	34	80.8
UARS	MLS	93	4	16	13	24	31	581	14	13	25	-38.6	351.4	90.0	-22.9	-51.9	18.1				50.2
ATLAS	SSBUV	93	4	16	16	21	40	8	10	52	40	-55.5	300.6	0.0	-90.0	-55.5	300.4	113	1	50	66.0
UARS	MLS	93	4	16	18	11	50	581	19	0	49	-41.8	274.2	90.0	-22.9	-55.7	302.2				52.6
ATLAS	SSBUV	93	4	16	16	24	55	8	10	55	55	-56.9	323.2	0.0	-90.0	-56.9	323.0	146	0	10	71.4
UARS	MLS	93	4	16	16	35	5	581	17	24	3	-43.3	296.6	90.0	-22.9	-57.5	325.2				53.8
ATLAS	SSBUV	93	4	16	16	29	27	8	11	0	27	-51.8	352.0	0.0	-90.0	-51.8	351.8	128	1	28	80.2
UARS	MLS	93	4	16	15	0	28	581	15	49	23	-39.2	326.3	90.0	-22.9	-52.6	353.2				50.6
ATLAS	SSBUV	93	4	16	20	52	6	8	15	23	6	-54.7	227.6	0.0	-90.0	-54.7	227.4	144	2	8	65.1
UARS	MLS	93	4	16	23	0	30	581	23	49	27	-41.6	201.4	90.0	-22.9	-55.4	229.3				52.3
ATLAS	SSBUV	93	4	16	20	55	22	8	15	26	22	-57.0	249.7	0.0	-90.0	-57.0	249.5	168	0	28	70.1
UARS	MLS	93	4	16	21	23	28	581	22	12	25	-43.7	222.8	90.0	-22.9	-58.0	251.6				54.2
ATLAS	SSBUV	93	4	16	20	59	23	8	15	30	23	-53.8	276.5	0.0	-90.0	-53.8	276.3	177	1	11	77.4
UARS	MLS	93	4	16	19	48	19	581	20	37	14	-41.1	250.8	90.0	-22.9	-54.8	278.5				51.9
ATLAS	SSBUV	93	4	16	22	22	15	8	16	53	15	-54.4	203.3	0.0	-90.0	-54.4	203.1	157	2	14	64.8
UARS	MLS	93	4	17	0	36	43	582	1	25	41	-41.5	177.1	90.0	-22.9	-55.3	205.0				52.2
ATLAS	SSBUV	93	4	16	22	25	31	8	16	56	31	-57.0	225.2	0.0	-90.0	-57.0	225.0	172	0	34	69.7
UARS	MLS	93	4	16	22	59	42	581	23	48	39	-43.6	198.6	90.0	-22.9	-57.9	227.3				54.1
ATLAS	SSBUV	93	4	16	22	29	32	8	17	0	32	-54.2	252.3	0.0	-90.0	-54.2	252.1	151	1	4	76.8
UARS	MLS	93	4	16	21	24	33	581	22	13	28	-41.0	226.6	90.0	-22.9	-54.7	254.2				51.8
ATLAS	SSBUV	93	4	16	23	52	39	8	18	23	39	-54.5	180.5	0.0	-90.0	-54.5	180.3	61	2	20	64.9
UARS	MLS	93	4	17	2	13	12	582	3	2	6	-40.7	153.7	90.0	-22.9	-54.4	181.3				51.6
ATLAS	SSBUV	93	4	16	23	55	40	8	18	26	40	-56.9	200.7	0.0	-90.0	-56.9	200.5	178	0	40	69.2
UARS	MLS	93	4	17	0	35	55	582	1	24	48	-43.5	174.3	90.0	-22.9	-57.8	203.0				54.0
ATLAS	SSBUV	93	4	16	23	59	41	8	18	30	41	-54.5	228.0	0.0	-90.0	-54.5	227.8	138	0	58	76.3
UARS	MLS	93	4	16	23	0	46	581	23	49	43	-40.9	202.3	90.0	-22.9	-54.6	229.9				51.7
ATLAS	SSBUV	93	4	17	1	22	48	8	19	53	48	-54.1	156.3	0.0	-90.0	-54.1	156.1	62	2	26	64.6
UARS	MLS	93	4	17	3	49	25	582	4	38	20	-40.6	129.5	90.0	-22.9	-54.3	157.0				51.5
ATLAS	SSBUV	93	4	17	1	26	4	8	19	57	4	-57.0	178.0	0.0	-90.0	-57.0	177.8	96	0	46	69.3
UARS	MLS	93	4	17	2	12	24	582	3	1	19	-42.8	151.0	90.0	-22.9	-56.9	179.4				53.3
ATLAS	SSBUV	93	4	17	1	29	35	8	20	0	35	-55.1	202.1	0.0	-90.0	-55.1	201.9	194	0	53	75.3
UARS	MLS	93	4	17	0	36	27	582	1	25	25	-42.2	176.2	90.0	-22.9	-56.2	204.3				52.8

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Edwin F. Harrison, Fred M. Denn, and
Gary G. Gibson

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NASA Langley Research Center
Hampton, VA 23681-0001

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13. ABSTRACT *(Maximum 200 words)*

The second ATmospheric Laboratory for Applications and Science (ATLAS-2) mission was flown aboard the Space Shuttle Discovery from April 8 to April 17, 1993. The nighttime launch at 0529 Greenwich Mean Time provided maximum solar occultation sunrise coverage of the northern latitudes by the Atmospheric Trace Molecule Spectroscopy instrument. The ATLAS-2 Earth-viewing instruments provided a large number of measurements which were nearly coincident with observations from experiments on the Upper Atmosphere Research Satellite (UARS). Based on instrument operating schedules during the ATLAS-2 mission, simulations were performed to determine when and where correlative measurements between ATLAS and UARS instruments occurred. Results of these orbital and instrument simulations provide valuable information for the ATLAS and UARS scientists to compare measurements between various instruments on the two satellites.

14. SUBJECT TERMS

Correlative satellite measurements; orbital mechanics; atmospheric sciences experiments; ATLAS; UARS

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