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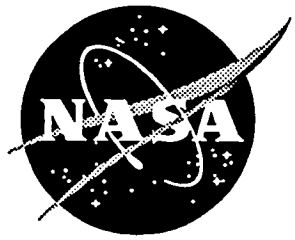

ATLAS-3 Correlative Measurement Opportunities With UARS and Surface Observations

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ATLAS-3 CORRELATIVE MEASUREMENT OPPORTUNITIES WITH UARS AND SURFACE OBSERVATIONS

by

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SUMMARY

The third ATmospheric Laboratory for Applications and Science (ATLAS-3) mission was flown aboard the Space Transportation System (STS) mission 66. The launch took place at 16:59:43 Greenwich Mean Time (GMT) on November 3, 1994; the mission length was approximately 10 days and 22 hours. The ATLAS-3 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-3 mission, simulations were performed to predict when and where correlative measurements between ATLAS-3 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-3 instrument measurements are simulated for the time periods of sensor operation. ATLAS-3 and UARS measurements are compared to determine correlative measurement opportunities between various instruments on the two spacecraft. The number of correlative opportunities ranges from 2 to 963 for the various instrument combinations. Overflight data are also included for each of the ATLAS-3 instruments for a selected set of ground sites.

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). 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. In addition, correlative measurement opportunities between ATLAS-3 instruments and data taken at selected surface sites offer a unique opportunity for scientific investigations.

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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 asymmetrical 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-3 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-3 Shuttle mission.

ATMOSPHERIC LABORATORY FOR APPLICATIONS AND SCIENCE (ATLAS-3)

The ATLAS-3 orbital elements are given in Table 1. The ATLAS-3 orbit elements were updated three times during the mission, and the ATLAS-UARS correlative measurement predictions revised as appropriate. Five ATLAS-3 instruments are simulated: Atmospheric Trace Molecule Spectroscopy (ATMOS) , CRyogenic Infrared Spectrometers and Telescope for the Atmosphere (CRISTA), Middle Atmosphere High Resolution Spectrograph Investigation (MAHRSI), Millimeter-wave Atmospheric Sounder (MAS), and Shuttle Solar Backscatter UltraViolet (SSBUV). The ATMOS is a solar occultation instrument; its latitudinal coverage history is shown in Figure 3. The CRISTA and MAHRSI were flown on the Shuttle Pallet Satellite (SPAS) which flew 0.66° behind the Shuttle (Bittner and Offermann, 1994). CRISTA is a limb viewing instrument with viewing azimuths of 144°, 162°, and 180° to the left of the velocity vector (hereafter referred to as CRISTA-144, CRISTA-162, and CRISTA-180). Latitudinal coverage histories for the three CRISTAs are shown in Figures 4, 5, and 6. The MAHRSI, a limb viewing device which views 162° to the left of the velocity vector, has the same coverage as CRISTA-162 and is also shown in Figure 5. In the simulations, CRISTA and MAHRSI are restricted to view no closer than within 36° of the Sun. The MAS (Figure 7) views at an azimuth 90° to the left of the velocity vector. The MAS instrument failed at 19 hours and 11 minutes into the mission. Finally, the SSBUV (Figure 8) 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-3 time-line data (Selmarten, 1994) were used to determine the periods during which each instrument was operating. All data are for a tangent height of 30 km above the Earth's surface.

SELECTED GROUND SITES

Overflight data are calculated for each of the ATLAS-3 instruments for 18 ground sites which were selected by investigators prior to the ATLAS-3 launch. Table 3 presents for each site the name, the latitude and longitude, and the number of times the site was seen by each of the ATLAS-3 instruments. The location of each of the sites is shown on the map in Figure 9.

ATLAS-UARS CORRELATIVE MEASUREMENTS

Each ATLAS-3 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 was determined. For the simulations in this report, the operating schedule for each ATLAS-3 instrument was taken from the mission time-line data.

Correlative opportunities were determined for the various instrument combinations on the two satellites. The number of correlative measurement opportunities for each instrument combination along with the time and distance constraints, number of the figure which displays the data, and the number of the appendix which lists the tabular data are summarized in Table 4. 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. Note that the MAHRSI results are the same as for CRISTA-162.

A plot of latitude vs. time is presented for each instrument combination. Tabular data were generated to fully describe the correlative measurement opportunities. The tabular output includes (for each satellite) the 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.

The 43 correlative measurement opportunities between the ATMOS and HALOE instruments are presented in Figure 10 and Appendix 1. The 88 correlative opportunities obtained for ATMOS and MLS are presented in Figure 11 and Appendix 2. Approximately 160 measurements are obtained between each of the 3 CRISTAs (144, 162, and 180) and HALOE (Figures 12, 13, and 14; and Appendices 3, 4, and 5, respectively). Approximately 960 measurements were obtained between each CRISTA and the MLS (Figures 15, 16, and 17). The tabular data for the first 10 measurements are presented in Appendices 6, 7, and 8. The full data set is to large to be included here, but either a hard copy or a computer file of these data may be obtained from the authors. Two coincident measurements were obtained between MAS and HALOE (Figure 18, and Appendix 9). The 47 points obtained between MAS and MLS are presented in Figure 19, and Appendix 10. The 49 coincident measurements obtained between SSBUV and HALOE are presented in Figure 20 and Appendix 11. Finally, the 178 measurements obtained between SSBUV and MLS are shown in Figure 21 and Appendix 12.

ATLAS-3 OVERFLIGHTS OF SELECTED GROUND SITES

Overflight times were determined for each of the ATLAS-3 instruments. The overflight data can be used in ground truth studies. Tabular data were generated which fully describe each measurement opportunity. The tabular output includes (for each instrument) the 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 point and the ground site, and the solar zenith angle at the viewed point. These data are presented in Appendix 13.

CONCLUDING REMARKS

Data are presented to show the correlative measurement opportunities between various experiments on ATLAS-3 and UARS. Results are based on the actual ATLAS-3 instrument operation schedule and the Space Shuttle attitude summary for the mission. The number of correlative measurement opportunities ranged from 2 for MAS vs. HALOE to 963 for CRISTA-162 vs. MLS. The data in this report should be useful to scientists in assessing the correlative data available for analysis. Computer files of correlative measurement opportunities are available on request from Mr. Fred Denn (e-mail: f.m.denn@larc.nasa.gov).

REFERENCES

Barath, F. T., M. C. Chavez, R. E. Cofield, D. A. Flower, M. A. Frerking, M. B. Gram, W. M. Harris, J. R. Holden, R. F. Jarnot, W. G. Kloezeman, G. J. Klose, G. K. Lau, M. S. Loo, B. J. Maddison, R. J. Mattauch, R. P. McKinney, G. E. Peckham, H. M. Pickett, G. Siebes, F. S. Soltis, R. A. Suttie, J. A. Tarsala, J. W. Waters, and W. J. Wilson: The Upper Atmosphere Research Satellite Microwave Limb Sounder Instrument. Journal of Geophysical Research, 98, 10751-10762, 1993.

Bittner, M. and D. Offermann: CRISTA/MAHRSI - Campaign Handbook. University of Wuppertal, Germany, June 1994.

Harrison, Edwin F. and Gary G. Gibson: Orbital Analysis for the Upper Atmosphere Research Satellite Missions. Journal of Spacecraft and Rockets, 18, 138-140, 1981.

Harrison, Edwin F., Fred M. Denn, and Gary G. Gibson: Correlative Measurement Opportunities Between ATLAS-1 and UARS Experiments. NASA Technical Memorandum 107630, May 1992.

Harrison, Edwin F., Fred M. Denn, and Gary G. Gibson: Mission Analysis for Coincident Measurements of the Upper Atmosphere Research Satellite and Space Shuttle Experiments. AIAA/AAS Astrodynamics Conference, AIAA-90-2870, Portland, OR, August 20-22, 1990.

Reber, Carl A.: The Upper Atmosphere Research Satellite. Eos Transactions, American Geophysical Union, 71, 1867, 1990.

Reber, Carl A., Charles E. Trevathan, Robert J. McNeal, and Michael R. Luther: The Upper Atmosphere Research Satellite (UARS) Mission. Journal of Geophysical Research, 98, 10643-10647, 1993.

Russell, J. M. III, Larry L. Gordley, Jae H. Park, S. Roland Drayson, W. Donald Hesketh, Ralph J. Cicerone, Adrian F. Tuck, John E. Frederick, John E. Harries, and Paul J. Crutzen: The Halogen Occultation Experiment. Journal of Geophysical Research, 98, 10777-10797, 1993.

Selmarten, John: Atmospheric Laboratory for Applications and Science (ATLAS-3) As-Flown Timeline. Teledyne Brown Engineering, Report 410RPT0617, December 1994.

Torr, Marsha R. and Kathryn D. Sullivan: The ATLAS-1 Shuttle Mission. Eos Transactions, American Geophysical Union, 73, 105, 1992.

Table 1. UARS and ATLAS orbital elements.

SATELLITE	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)
UARS[1]	94-11-03 12:00:00	6956.27 56.98 322.81 37.49
ATLAS-3[2] (INITIAL)	94-11-04 06:00:15	6681.25 56.99 201.11 280.29
ATLAS-3 (UPDATE 1)	94-11-07 06:00:15	6676.98 56.991 201.14 264.90
ATLAS-3 (UPDATE 2)	94-11-08 14:35:38	6675.72 56.99 201.15 256.45
ATLAS-3 (UPDATE 3)	94-11-10 19:20:00	6672.64 56.99 201.20 230.39

[1]UARS was launched on September 12, 1991 at 23:11:04 GMT.
[2]ATLAS-3 was launched on November 3, 1994 at 16:59:43 GMT.
[3]All orbital elements have been adjusted to a common time of 00:00 GMT on November 3, 1994. 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-3 instrument 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-3	MAS	90	VIEWS TOWARD DARK SIDE OF EARTH ONLY
	SSBUV	NADIR VIEWING	SOLAR ZENITH ANGLE 0 TO 90 deg.
	CRISTA-144	144	MUST LOOK MORE THAN 36° FROM SUN
	CRISTA-162	162	MUST LOOK MORE THAN 36° FROM SUN
	CRISTA-180	180	MUST LOOK MORE THAN 36° FROM SUN
	MAHRSI	162	MUST LOOK MORE THAN 36° FROM SUN
	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 toward the dark side of the spacecraft. The CRISTA-144 and CRISTA-162 instruments view to the left of the velocity vector. The MAHRSI viewing geometery is the same as CRISTA-162. The CRISTA-180 view is opposite to the velocity vector.

Table 3. Number of times each ground site is observed by each ATLAS-3 instrument.

SITE	LOCATION LATITUDE	LOCATION LONGITUDE	ATMOS	CRISTA 144	MAHRSI & CRISTA 162	CRISTA 180	MAS	SSBUV
Dumont D'Urville	-67	140	29	-	-	-	-	-
Fritz Peak	39.91	-105.5	10	6	8	10	-	3
Heiss Island	81	58	-	-	-	-	-	-
Jungfraujock	47	8	7	8	9	10	-	2
Kislovodsk	42.80	42.44	6	9	10	7	-	2
Kitt Peak	32	-111	7	8	8	8	-	3
Lake Issyk-Kul	43	76	8	5	10	10	-	5
Luader	-45	170	-	23	12	11	-	4
Mauna Loa	20	-155	2	5	6	6	1	2
Moscow	55.45	37.35	3	11	15	20	-	9
Ny Alesund	79	12	-	-	-	-	-	-
Reunion Island	-22	56	-	5	5	6	-	2
Table Mountain	34	-118	10	7	9	8	-	3
Thule	76	-69	-	-	-	-	-	-
Tomsk	56.5	85.1	4	11	17	17	-	11
Volgograd	48.44	44.2	5	9	8	12	1	5
Yakutsk	62	130	4	20	20	-	1	-
Zvenigorod	56	37	3	10	15	19	-	8

Table 4. Summary of the number of correlative measurement opportunities for each instrument combination. Time and distance constraints are as indicated. Figure and appendix numbers for each data set are shown.

		UARS	
		HALOE	MLS
ATLAS-3	ATMOS	43 Δ time = 7 hours Δ dist = 2000 km Figure 10, Appendix 1	88 Δ time = 3.5 hours Δ dist = 1000 km Figure 11, Appendix 2
	CRISTA-144	159 Δ time = 3.5 hours Δ dist = 1000 km Figure 12, Appendix 3	951 Δ time = 3.5 hours Δ dist = 200 km Figure 15, Appendix 6
	CRISTA-162 & MAHRSI	163 Δ time = 3.5 hours Δ dist = 1000 km Figure 13, Appendix 4	963 Δ time = 3.5 hours Δ dist = 200 km Figure 16, Appendix 7
	CRISTA-180	164 Δ time = 3.5 hours Δ dist = 1000 km Figure 14, Appendix 5	962 Δ time = 3.5 hours Δ dist = 200 km Figure 17, Appendix 8
	MAS	2 Δ time = 3.5 hours Δ dist = 1000 km Figure 18, Appendix 9	47 Δ time = 3.5 hours Δ dist = 200 km Figure 19, Appendix 10
	SSBUV	49 Δ time = 3.5 hours Δ dist = 1000 km Figure 20, Appendix 11	178 Δ time = 3.5 hours Δ dist = 200 km Figure 21, Appendix 12

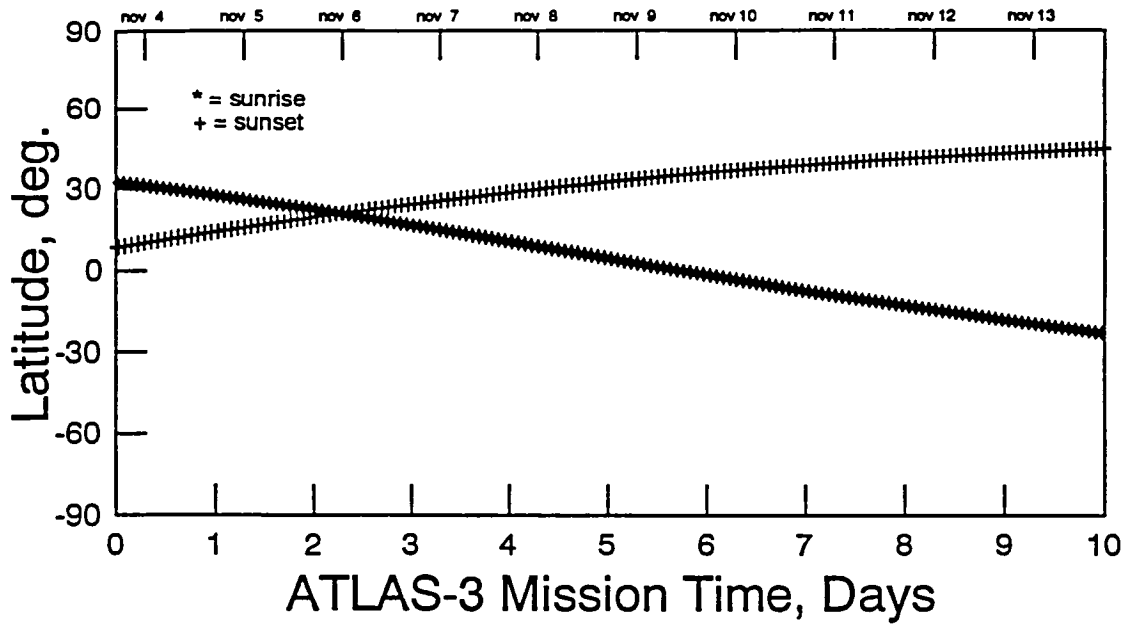

Figure 1. Latitudinal coverage history of HALOE on UARS.

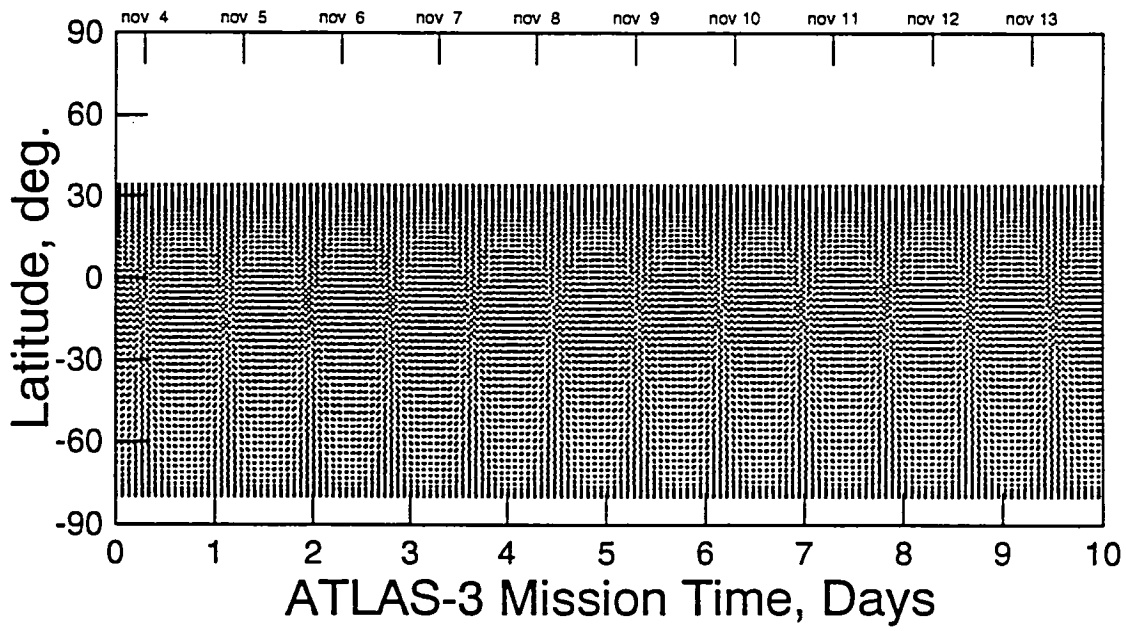

Figure 2. Latitudinal coverage history of MLS on UARS.

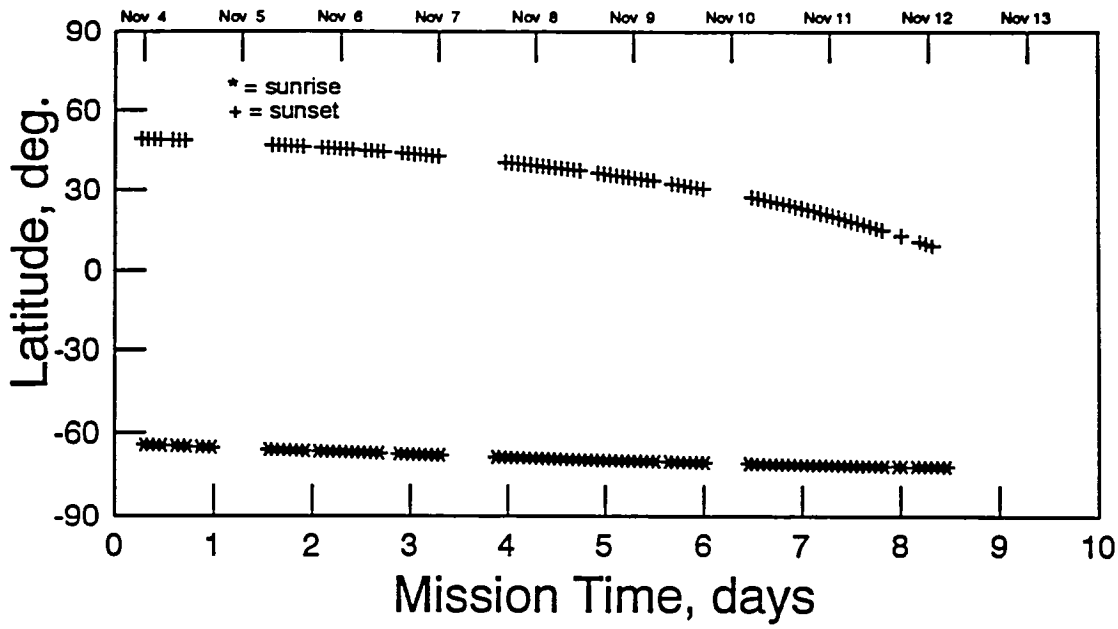

Figure 3. Latitudinal coverage history of ATMOS on ATLAS-3.

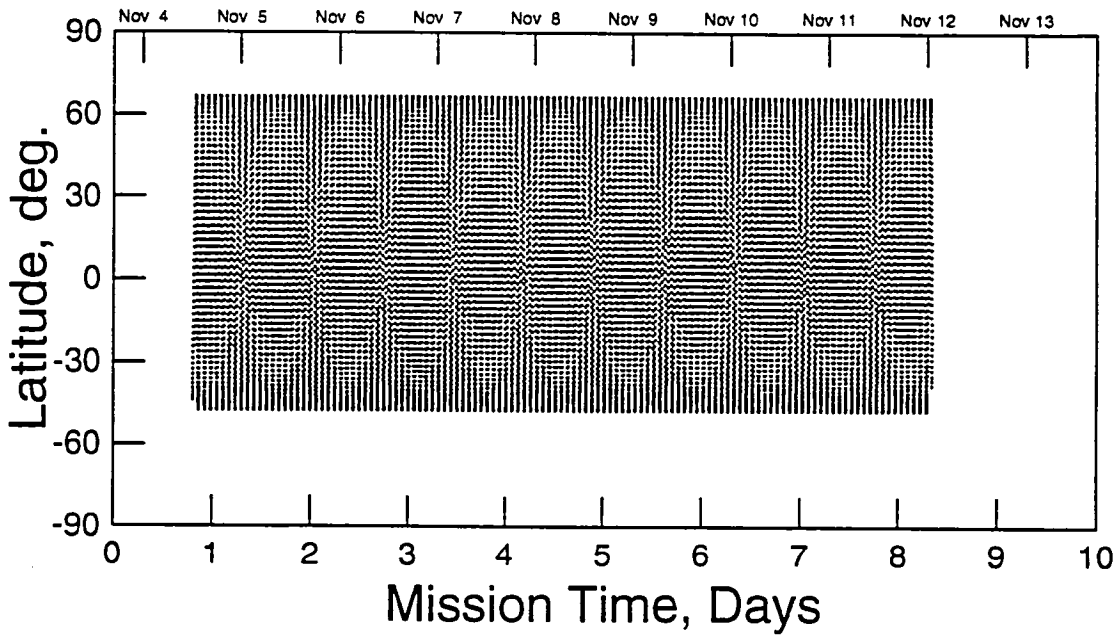

Figure 4. Latitudinal coverage history of CRISTA-144 on ATLAS-3.

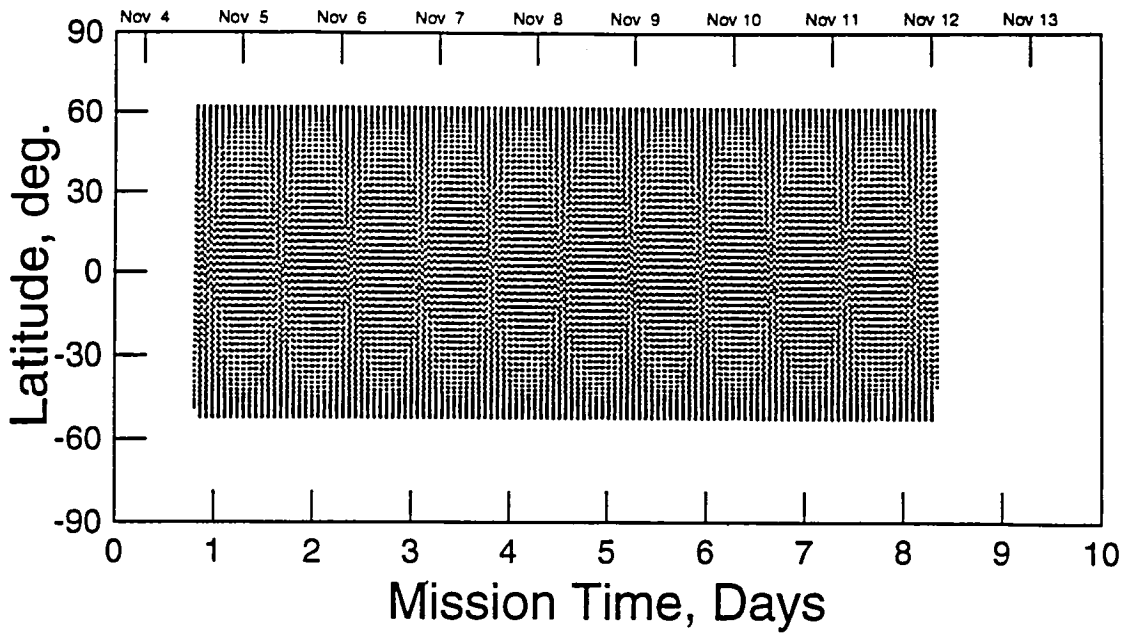

Figure 5. Latitudinal coverage history of CRISTA-162 and MAHRSI on ATLAS-3.

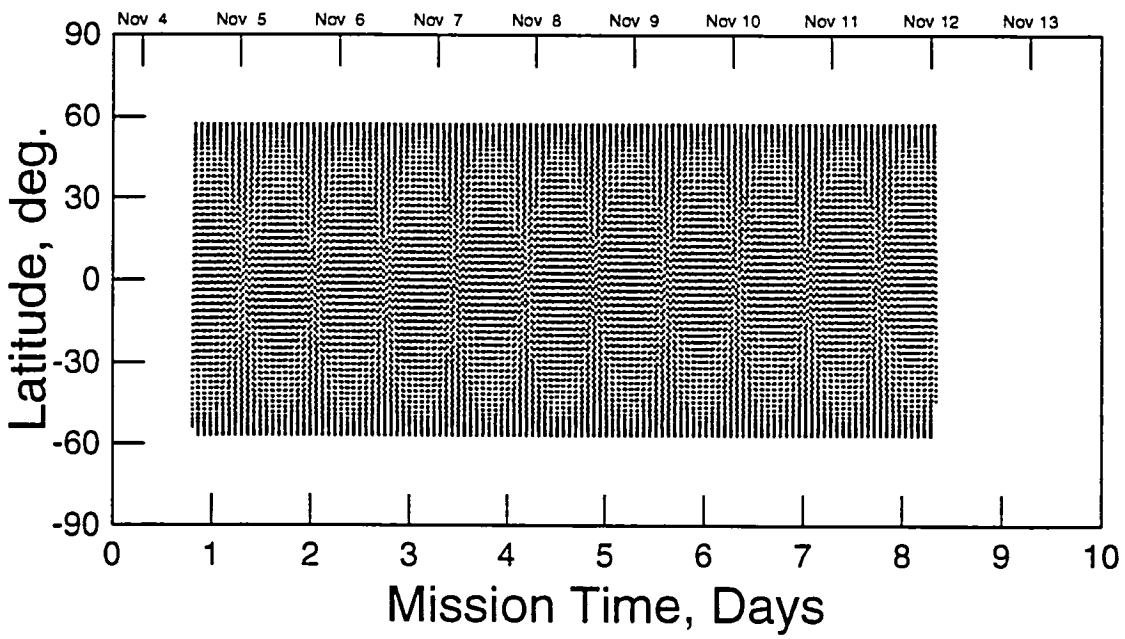

Figure 6. Latitudinal coverage history of CRISTA-180 on ATLAS-3.

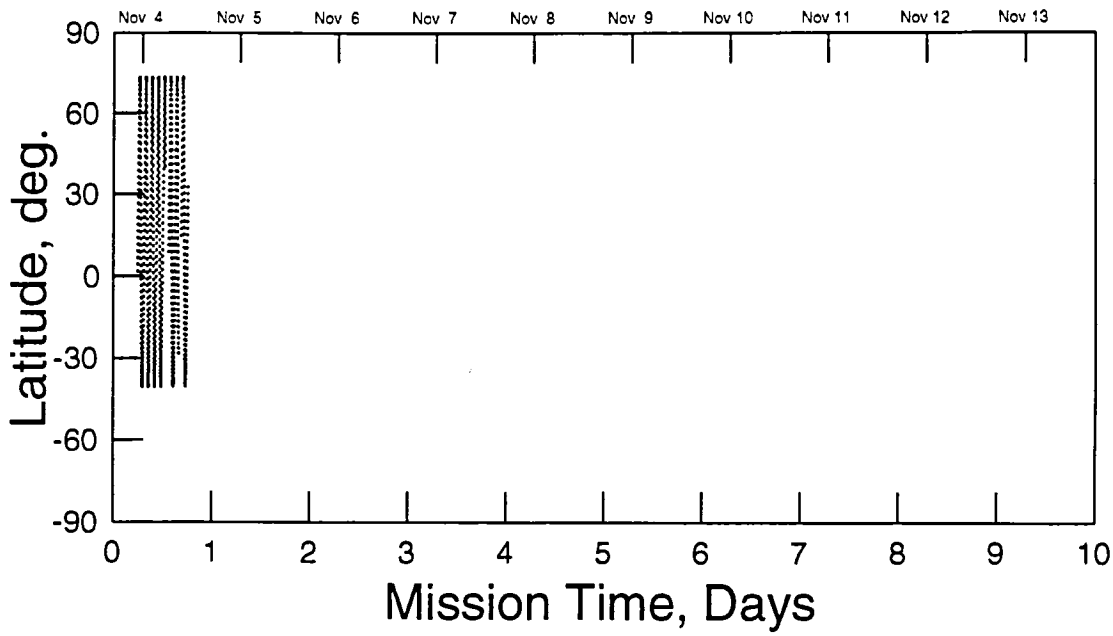

Figure 7. Latitudinal coverage history of MAS on ATLAS-3.

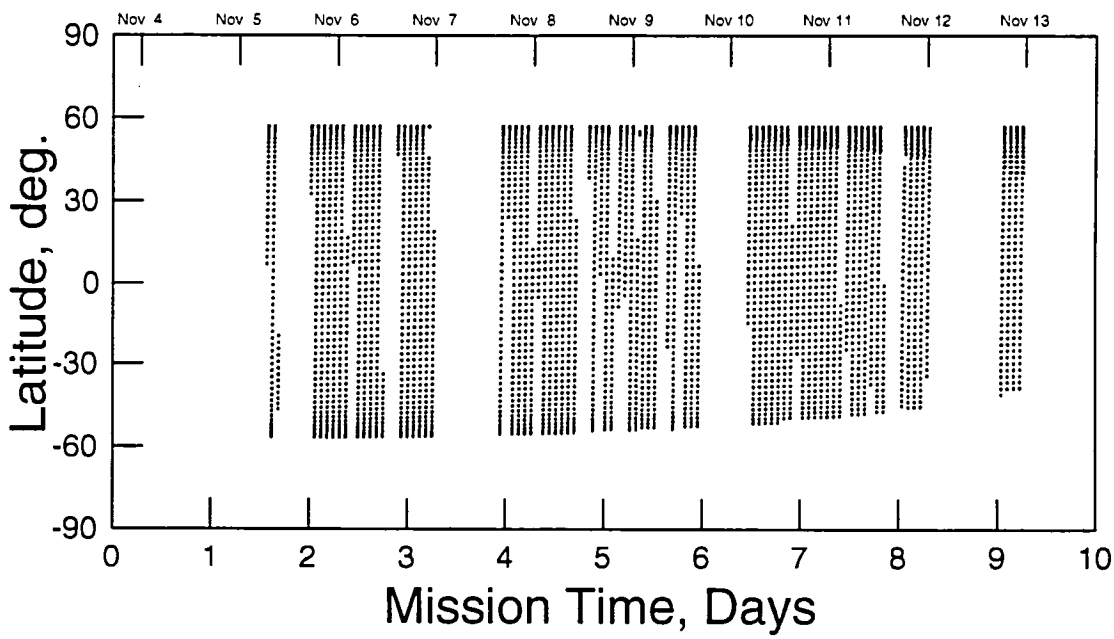

Figure 8. Latitudinal coverage history of SSBUV on ATLAS-3.

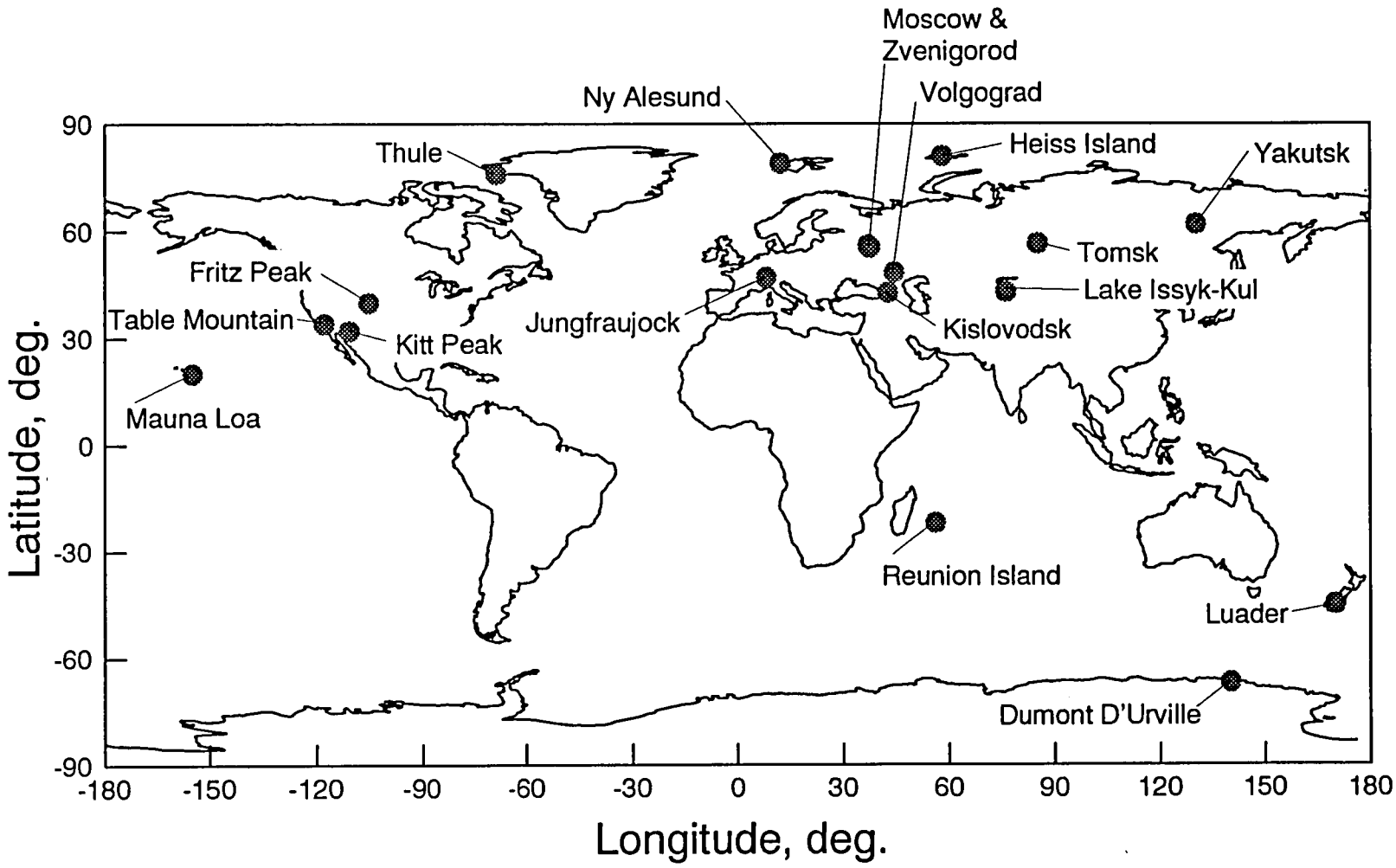

Figure 9. Surface sites for correlative measurements with ATLAS-3 instruments.

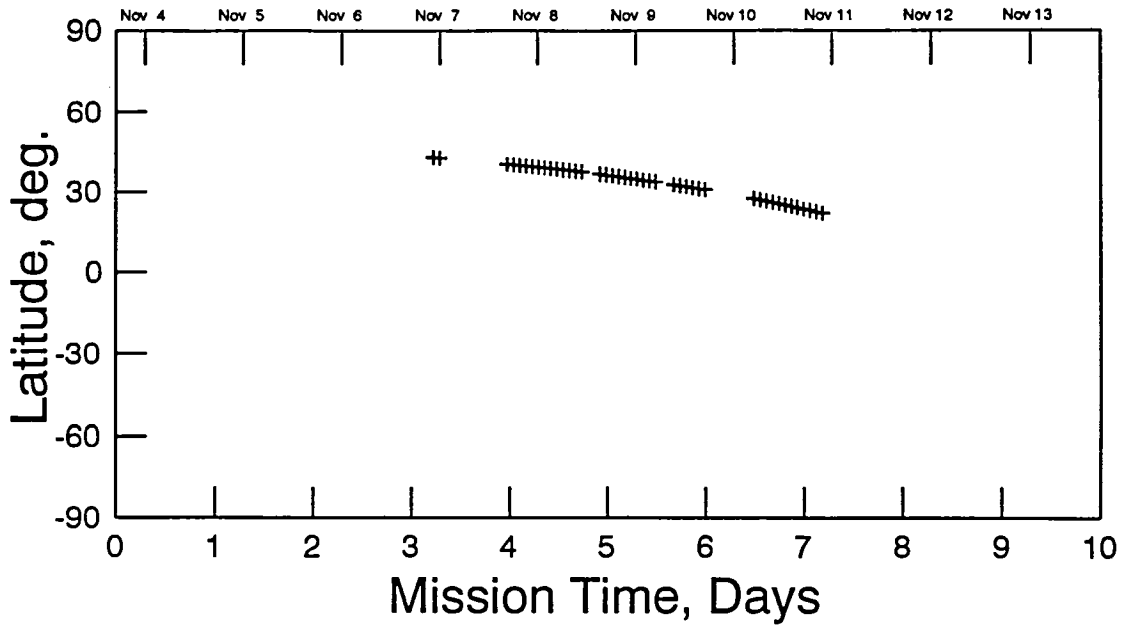

Figure 10. Correlative measurement opportunities between ATLAS-3 (ATMOS) and UARS (HALOE).

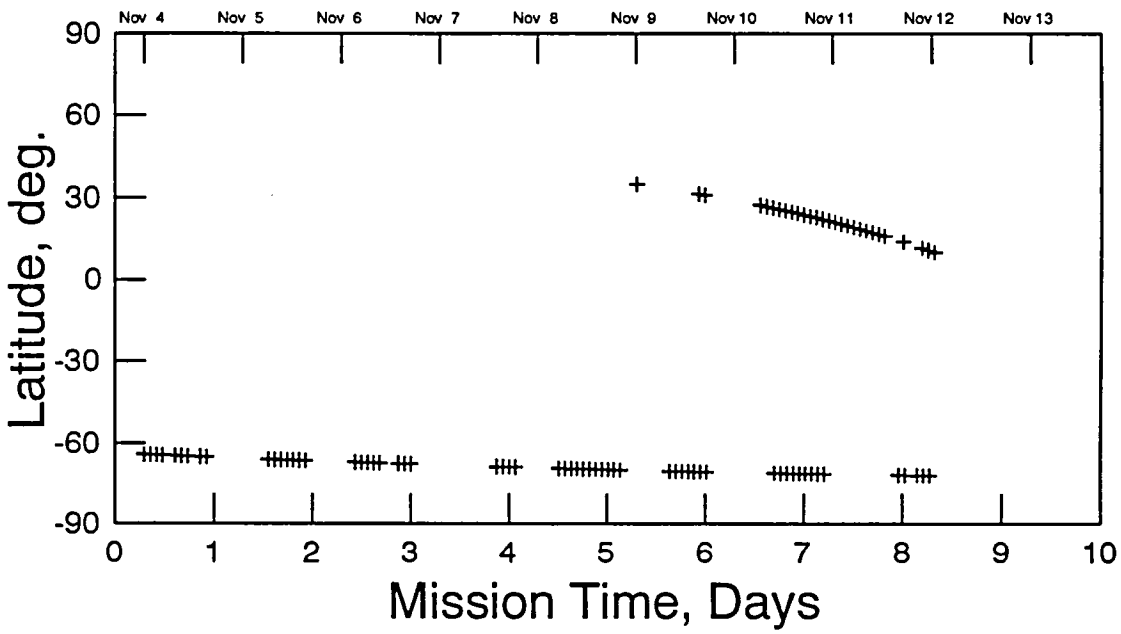

Figure 11. Correlative measurement opportunities between ATLAS-3 (ATMOS) and UARS (MLS).

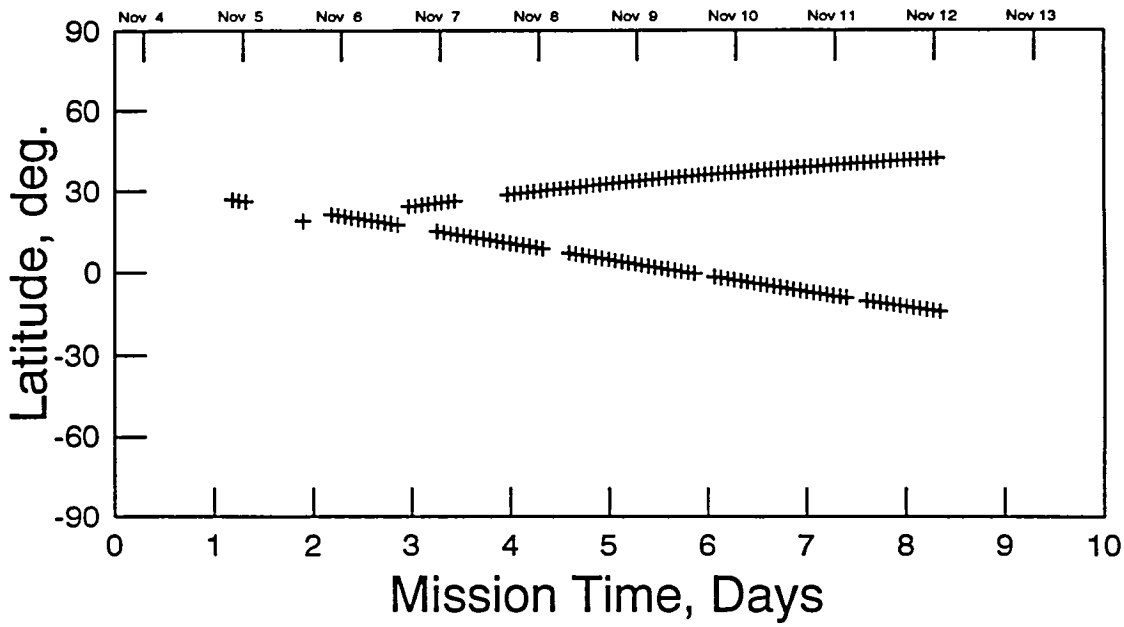

Figure 12. Correlative measurement opportunities between ATLAS-3 (CRISTA-144) and UARS (HALOE).

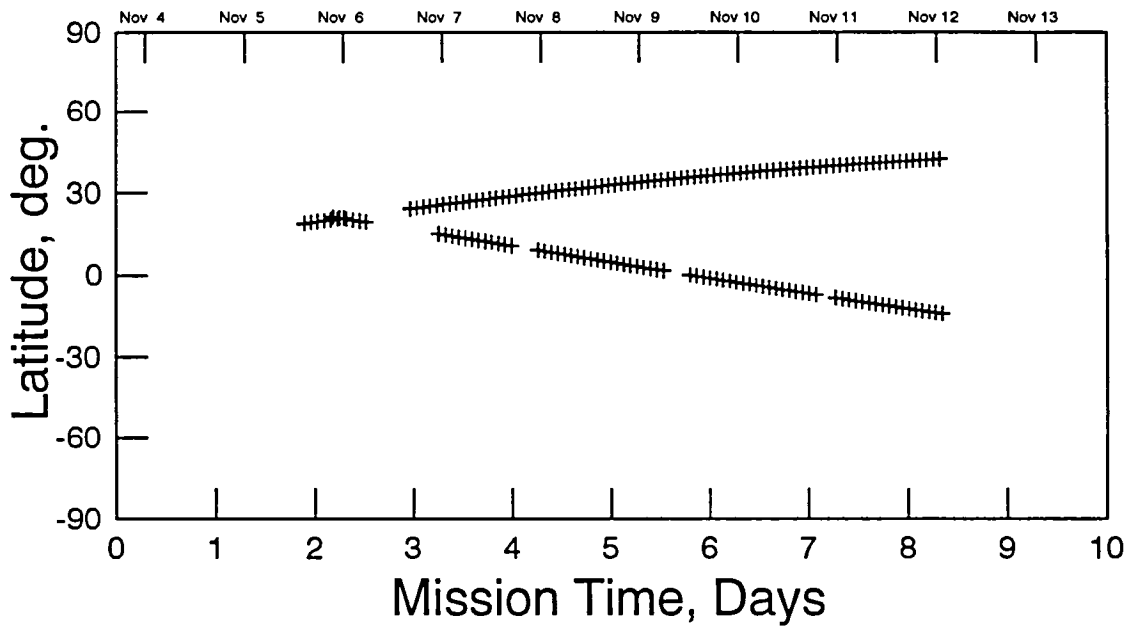

Figure 13. Correlative measurement opportunities between ATLAS-3 (CRISTA-162 or MAHRSI) and UARS (HALOE).

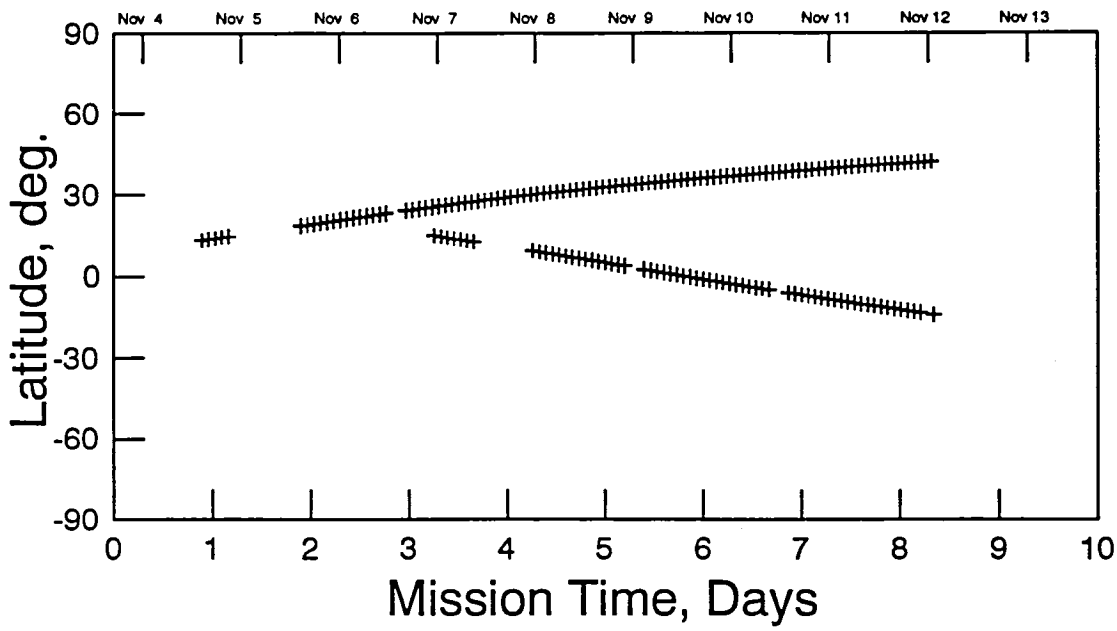

Figure 14. Correlative measurement opportunities between ATLAS-3 (CRISTA-180) and UARS (HALOE).

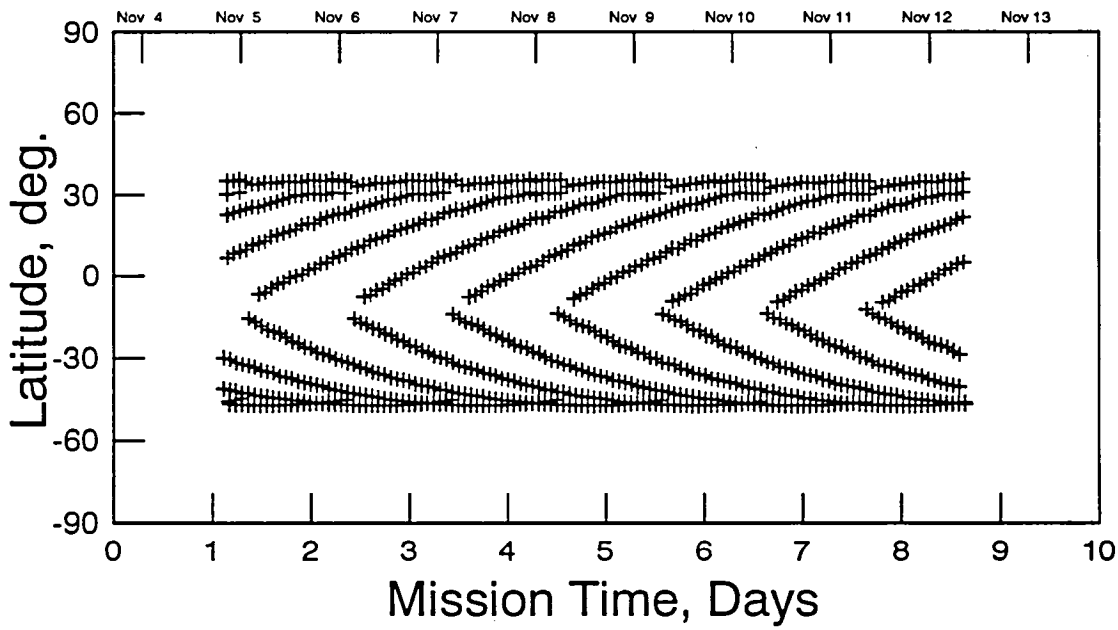

Figure 15. Correlative measurement opportunities between ATLAS-3 (CRISTA-144) and UARS (MLS).

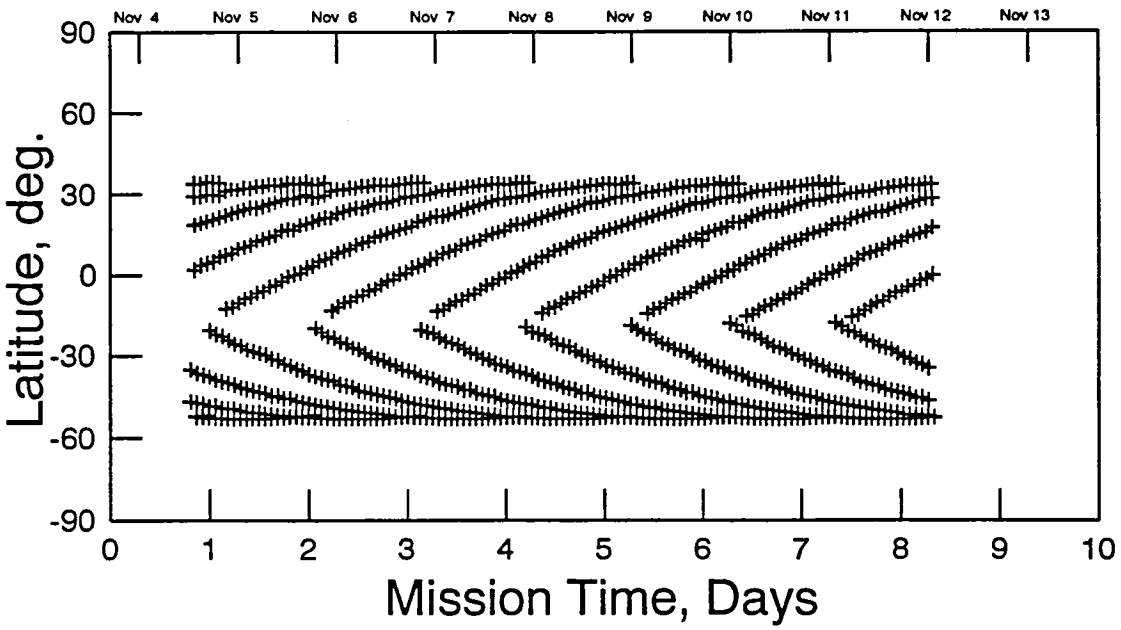

Figure 16. Correlative measurement opportunities between ATLAS-3 (CRISTA-162 and MAHRSI) and UARS (MLS).

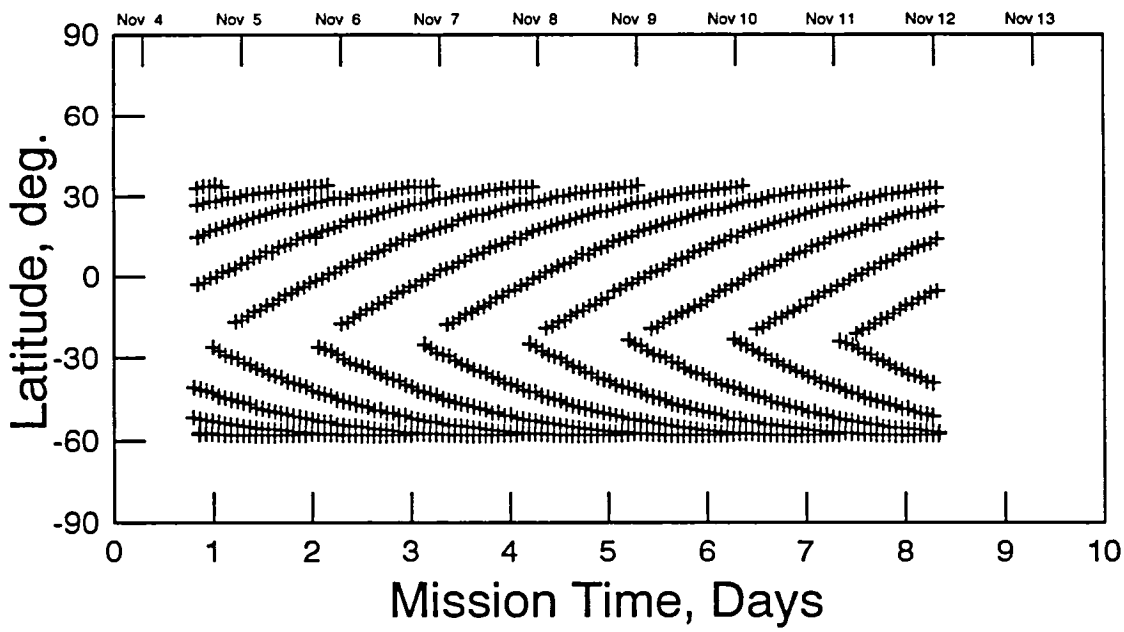

Figure 17. Correlative measurement opportunities between ATLAS-3 (CRISTA-180) and UARS (MLS).

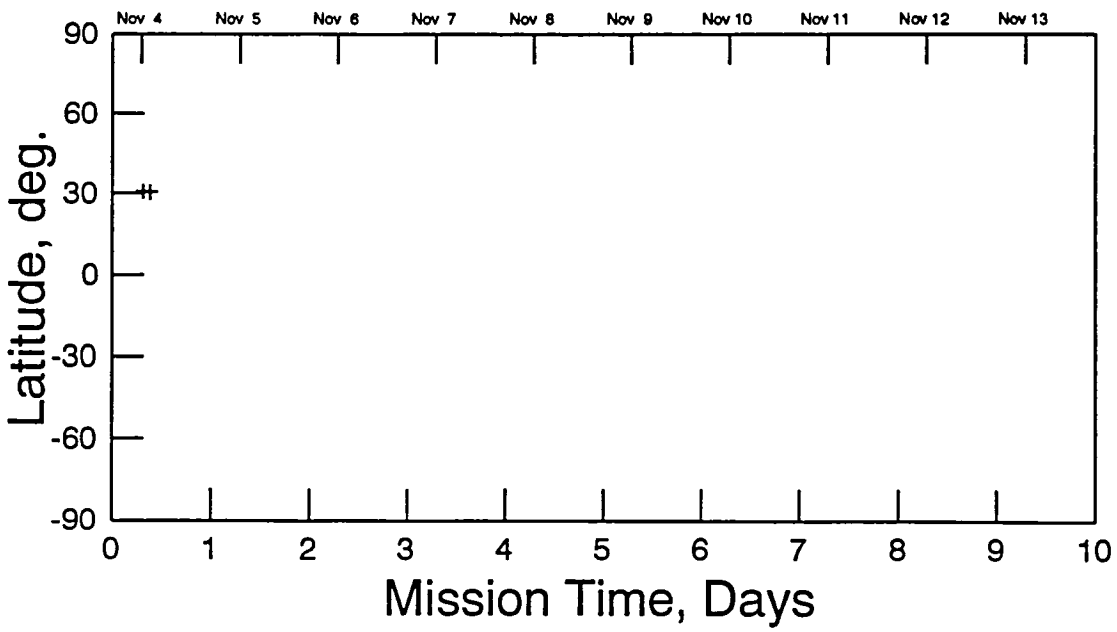

Figure 18. Correlative measurement opportunities between ATLAS-3 (MAS) and UARS (HALOE).

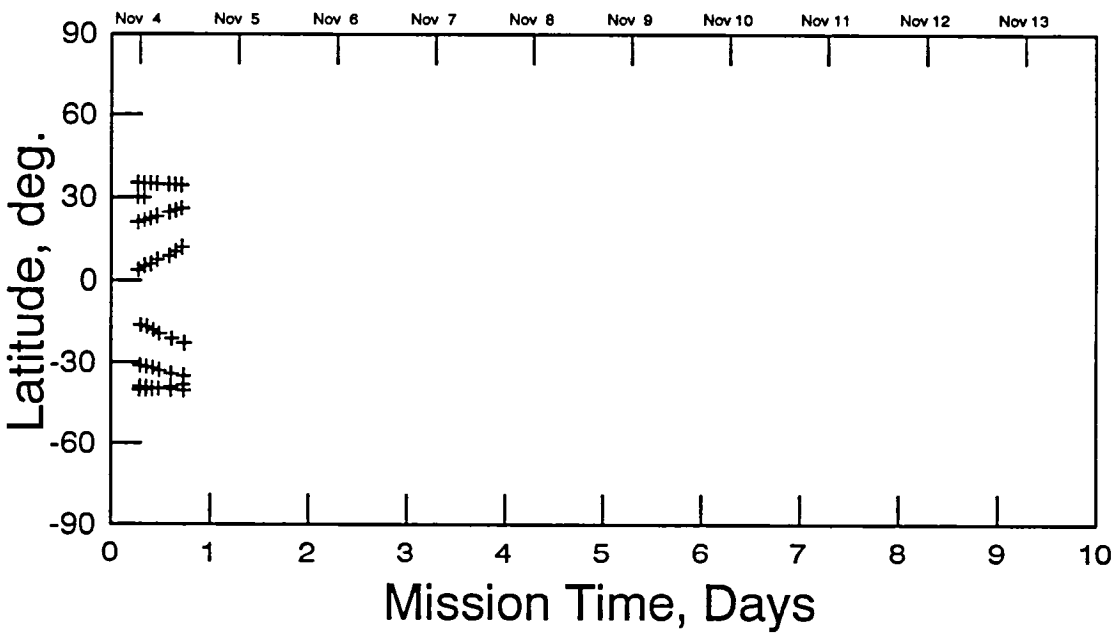

Figure 19. Correlative measurement opportunities between ATLAS-3 (MAS) and UARS (MLS).

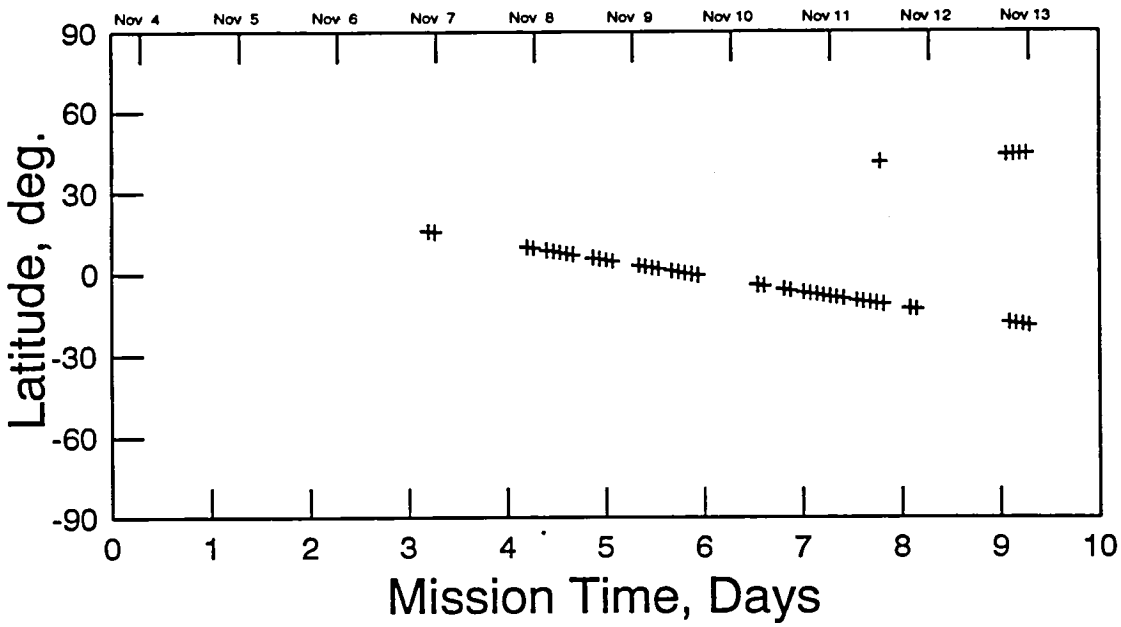

Figure 20. Correlative measurement opportunities between ATLAS-3 (SSBUV) and UARS (HALOE).

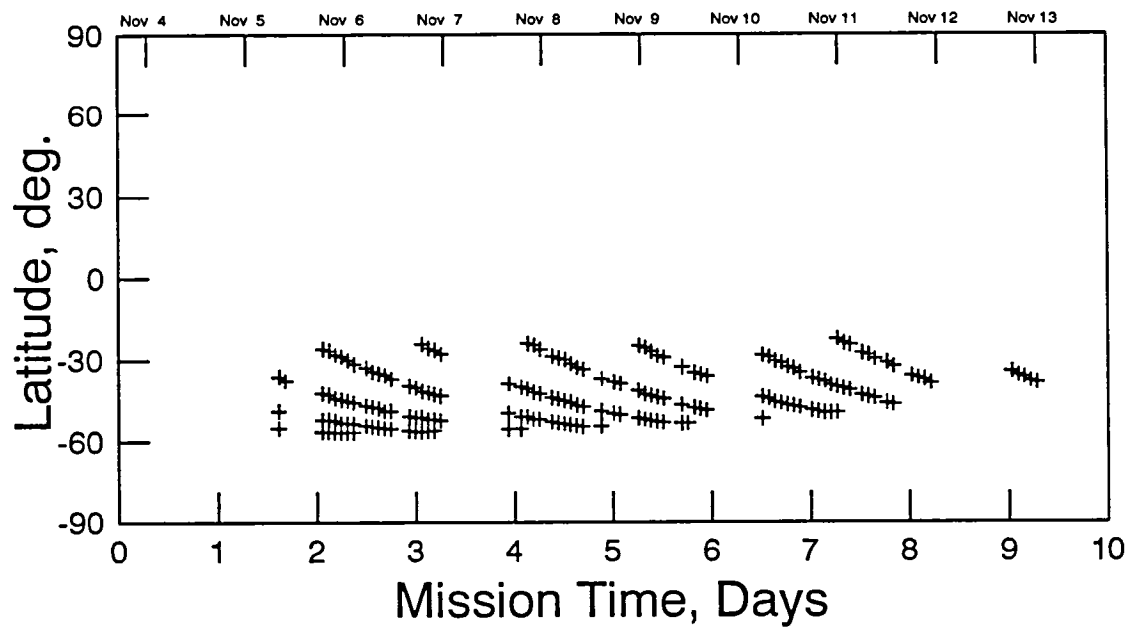

Figure 21. Correlative measurement opportunities between ATLAS-3 (SSBUV) and UARS (MLS).

Appendix 1. Correlative measurement opportunities between ATLAS-3 (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-3	ATMOS	94	11	6	22	23	2	3	5	23	19	47.1	297.0	136.8	-16.3	43.0	274.6	1991	0	13	139.9
UARS	HALOE	94	11	6	22	36	8	1150	23	25	1	30.3	304.4	-135.0	-22.9	25.5	279.0				164.8
ATLAS-3	ATMOS	94	11	6	23	53	35	3	6	53	52	46.9	274.4	136.5	-16.3	42.8	252.0	1911	0	18	140.2
UARS	HALOE	94	11	7	0	12	27	1151	1	1	20	30.6	280.2	-135.1	-22.9	25.8	254.8				164.4
ATLAS-3	ATMOS	94	11	7	16	29	41	3	23	29	58	44.6	25.5	132.9	-16.3	40.5	4.0	1538	0	14	144.2
UARS	HALOE	94	11	7	16	15	33	1151	17	4	27	33.5	39.0	-135.8	-22.9	28.7	12.8				161.0
ATLAS-3	ATMOS	94	11	7	18	0	15	4	1	0	32	44.4	2.9	132.6	-16.3	40.3	341.5	1414	0	8	144.6
UARS	HALOE	94	11	7	17	51	52	1151	18	40	46	33.8	14.9	-135.9	-22.9	29.0	348.6				160.7
ATLAS-3	ATMOS	94	11	7	19	30	48	4	2	31	5	44.2	340.3	132.2	-16.3	40.0	318.9	1298	0	2	145.0
UARS	HALOE	94	11	7	19	28	10	1151	20	17	6	34.1	350.8	-136.0	-22.9	29.3	324.4				160.4
ATLAS-3	ATMOS	94	11	7	21	1	22	4	4	1	39	43.9	317.7	131.9	-16.3	39.8	296.4	1193	0	3	145.4
UARS	HALOE	94	11	7	21	4	29	1151	21	53	26	34.3	326.7	-136.0	-22.9	29.6	300.2				160.1
ATLAS-3	ATMOS	94	11	7	22	32	1	4	5	32	18	43.7	295.0	131.6	-16.3	39.6	273.8	1107	0	8	145.8
UARS	HALOE	94	11	7	22	40	47	1151	23	29	45	34.6	302.6	-136.1	-22.9	29.8	276.0				159.7
ATLAS-3	ATMOS	94	11	8	0	2	34	4	7	2	51	43.5	272.4	131.2	-16.3	39.4	251.3	1032	0	14	146.2
UARS	HALOE	94	11	8	0	17	6	1152	1	6	5	34.9	278.4	-136.2	-22.9	30.1	251.8				159.4
ATLAS-3	ATMOS	94	11	8	1	33	6	4	8	33	23	43.2	249.8	130.9	-16.3	39.1	228.8	979	0	20	146.6
UARS	HALOE	94	11	8	1	53	24	1152	2	42	25	35.2	254.3	-136.3	-22.9	30.4	227.6				159.1
ATLAS-3	ATMOS	94	11	8	3	3	38	4	10	3	55	43.0	227.2	130.6	-16.3	38.9	206.3	952	0	26	147.0
UARS	HALOE	94	11	8	3	29	42	1152	4	18	34	35.4	230.2	-136.4	-22.9	30.6	203.4				158.8
ATLAS-3	ATMOS	94	11	8	4	34	11	4	11	34	28	42.7	204.6	130.3	-16.3	38.6	183.7	952	0	31	147.5
UARS	HALOE	94	11	8	5	6	0	1152	5	54	54	35.7	206.1	-136.5	-22.9	30.9	179.2				158.5
ATLAS-3	ATMOS	94	11	8	6	4	43	4	13	5	0	42.5	182.0	129.9	-16.3	38.4	161.2	979	0	37	147.9
UARS	HALOE	94	11	8	6	42	19	1152	7	31	13	36.0	182.0	-136.6	-22.9	31.2	155.0				158.2
ATLAS-3	ATMOS	94	11	8	7	35	16	4	14	35	33	42.2	159.4	129.6	-16.3	38.1	138.7	1031	0	43	148.3
UARS	HALOE	94	11	8	8	18	37	1152	9	7	33	36.2	157.9	-136.7	-22.9	31.4	130.8				157.9
ATLAS-3	ATMOS	94	11	8	9	5	48	4	16	6	5	42.0	136.7	129.3	-16.3	37.8	116.2	1106	0	49	148.8
UARS	HALOE	94	11	8	9	54	55	1152	10	43	53	36.5	133.8	-136.8	-22.9	31.7	106.6				157.6
ATLAS-3	ATMOS	94	11	8	10	36	21	4	17	36	38	41.7	114.1	128.9	-16.3	37.6	93.6	1199	0	54	149.2
UARS	HALOE	94	11	8	11	31	13	1152	12	20	12	36.8	109.7	-136.9	-22.9	31.9	82.4				157.3
ATLAS-3	ATMOS	94	11	8	15	8	0	4	22	8	17	40.8	46.4	127.9	-16.3	36.7	26.1	869	0	24	150.6
UARS	HALOE	94	11	8	14	43	49	1152	15	32	41	37.3	61.4	-137.2	-22.9	32.4	34.1				156.7
ATLAS-3	ATMOS	94	11	8	16	38	33	4	23	38	50	40.6	23.8	127.6	-16.3	36.4	3.6	708	0	18	151.1
UARS	HALOE	94	11	8	16	20	8	1152	17	9	1	37.5	37.3	-137.3	-22.9	32.7	9.9				156.4
ATLAS-3	ATMOS	94	11	8	18	9	6	5	1	9	23	40.3	1.2	127.3	-16.3	36.1	341.1	550	0	12	151.6
UARS	HALOE	94	11	8	17	56	25	1152	18	45	21	37.8	13.2	-137.4	-22.9	32.9	345.7				156.1
ATLAS-3	ATMOS	94	11	8	19	39	39	5	2	39	56	40.0	338.6	127.0	-16.3	35.8	318.6	396	0	6	152.1
UARS	HALOE	94	11	8	19	32	44	1152	20	21	40	38.0	349.1	-137.5	-22.9	33.2	321.5				155.9
ATLAS-3	ATMOS	94	11	8	21	10	12	5	4	10	29	39.7	316.0	126.6	-16.3	35.5	296.1	258	0	1	152.6
UARS	HALOE	94	11	8	21	9	2	1152	21	58	0	38.3	325.0	-137.6	-22.9	33.4	297.3				155.6
ATLAS-3	ATMOS	94	11	8	22	40	45	5	5	41	2	39.4	293.4	126.3	-16.3	35.2	273.5	176	0	4	153.1
UARS	HALOE	94	11	8	22	45	20	1152	23	34	20	38.5	300.9	-137.7	-22.9	33.7	273.1				155.3
ATLAS-3	ATMOS	94	11	9	0	11	19	5	7	11	36	39.0	270.8	126.0	-16.3	34.9	251.0	225	0	10	153.6
UARS	HALOE	94	11	9	0	21	38	1153	1	10	29	38.8	276.8	-137.9	-22.9	33.9	248.9				155.0

Appendix 1. 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-3	ATMOS	94	11	9	1	41	52	5	8	42	9	38.7	248.2	125.6	-16.3	34.6	228.5	355	0	16	154.1
UARS	HALOE	94	11	9	1	57	55	1153	2	46	48	39.0	252.7	-138.0	-22.9	34.1	224.7				154.8
ATLAS-3	ATMOS	94	11	9	3	12	26	5	10	12	43	38.4	225.6	125.3	-16.3	34.2	206.0	508	0	21	154.7
UARS	HALOE	94	11	9	3	34	13	1153	4	23	8	39.2	228.6	-138.1	-22.9	34.4	200.5				154.5
ATLAS-3	ATMOS	94	11	9	4	42	59	5	11	43	16	38.1	203.0	125.0	-16.3	33.9	183.5	668	0	27	155.2
UARS	HALOE	94	11	9	5	10	31	1153	5	59	28	39.5	204.5	-138.2	-22.9	34.6	176.3				154.2
ATLAS-3	ATMOS	94	11	9	9	14	41	5	16	14	58	37.0	135.3	124.0	-16.3	32.9	116.0	1124	0	51	156.8
UARS	HALOE	94	11	9	8	23	6	1153	9	12	7	39.9	156.3	-138.5	-22.9	35.1	127.9				153.7
ATLAS-3	ATMOS	94	11	9	10	45	15	5	17	45	32	36.7	112.7	123.6	-16.3	32.5	93.5	991	0	45	157.4
UARS	HALOE	94	11	9	9	59	24	1153	10	48	16	40.2	132.2	-138.6	-22.9	35.3	103.7				153.4
ATLAS-3	ATMOS	94	11	9	12	15	49	5	19	16	6	36.3	90.1	123.3	-16.3	32.2	71.0	870	0	40	158.0
UARS	HALOE	94	11	9	11	35	42	1153	12	24	36	40.4	108.1	-138.8	-22.9	35.5	79.5				153.2
ATLAS-3	ATMOS	94	11	9	13	46	23	5	20	46	40	35.9	67.5	123.0	-16.3	31.8	48.5	767	0	34	158.5
UARS	HALOE	94	11	9	13	12	0	1153	14	0	56	40.6	83.9	-138.9	-22.9	35.7	55.4				152.9
ATLAS-3	ATMOS	94	11	9	15	16	58	5	22	17	15	35.6	44.9	122.6	-16.3	31.4	26.0	692	0	28	159.1
UARS	HALOE	94	11	9	14	48	17	1153	15	37	15	40.8	59.8	-139.1	-22.9	35.9	31.2				152.7
ATLAS-3	ATMOS	94	11	9	16	47	32	5	23	47	49	35.2	22.4	122.3	-16.3	31.0	3.6	653	0	22	159.7
UARS	HALOE	94	11	9	16	24	35	1153	17	13	35	41.1	35.7	-139.2	-22.9	36.2	7.0				152.4
ATLAS-3	ATMOS	94	11	10	4	51	31	6	11	51	48	32.0	201.8	119.7	-16.2	27.8	183.8	1466	0	23	164.5
UARS	HALOE	94	11	10	5	14	55	1154	6	3	52	42.7	202.9	-140.4	-22.9	37.8	173.5				150.6
ATLAS-3	ATMOS	94	11	10	6	22	3	6	13	22	20	31.6	179.3	119.3	-16.2	27.4	161.3	1622	1	7	165.2
UARS	HALOE	94	11	10	5	14	55	1154	6	3	52	42.7	202.9	-140.4	-22.9	37.8	173.5				150.6
ATLAS-3	ATMOS	94	11	10	7	52	35	6	14	52	52	31.1	156.8	119.0	-16.2	26.9	138.9	1571	1	1	165.8
UARS	HALOE	94	11	10	6	51	12	1154	7	40	11	42.9	178.8	-140.6	-22.9	38.0	149.3				150.3
ATLAS-3	ATMOS	94	11	10	9	23	7	6	16	23	24	30.7	134.2	118.7	-16.2	26.5	116.4	1538	0	55	166.5
UARS	HALOE	94	11	10	8	27	29	1154	9	16	20	43.1	154.7	-140.7	-22.9	38.2	125.1				150.1
ATLAS-3	ATMOS	94	11	10	10	53	39	6	17	53	56	30.2	111.7	118.3	-16.2	26.0	93.9	1526	0	49	167.2
UARS	HALOE	94	11	10	10	3	47	1154	10	52	40	43.3	130.6	-140.9	-22.9	38.4	100.9				149.9
ATLAS-3	ATMOS	94	11	10	12	24	12	6	19	24	29	29.7	89.1	118.0	-16.2	25.5	71.5	1536	0	44	167.9
UARS	HALOE	94	11	10	11	40	4	1154	12	29	0	43.5	106.5	-141.0	-22.9	38.6	76.7				149.7
ATLAS-3	ATMOS	94	11	10	13	54	44	6	20	55	1	29.2	66.6	117.7	-16.2	25.0	49.0	1567	0	38	168.6
UARS	HALOE	94	11	10	13	16	21	1154	14	5	19	43.7	82.4	-141.2	-22.9	38.7	52.5				149.5
ATLAS-3	ATMOS	94	11	10	15	25	17	6	22	25	34	28.7	44.1	117.3	-16.2	24.5	26.6	1617	0	32	169.3
UARS	HALOE	94	11	10	14	52	38	1154	15	41	39	43.9	58.3	-141.4	-22.9	38.9	28.4				149.3
ATLAS-3	ATMOS	94	11	10	16	55	50	6	23	56	7	28.2	21.6	117.0	-16.2	24.0	4.1	1687	0	26	170.0
UARS	HALOE	94	11	10	16	28	56	1154	17	17	48	44.1	34.2	-141.5	-22.9	39.1	4.2				149.1
ATLAS-3	ATMOS	94	11	10	18	26	23	7	1	26	40	27.7	359.0	116.6	-16.2	23.4	341.7	1774	0	21	170.7
UARS	HALOE	94	11	10	18	5	13	1154	18	54	8	44.3	10.2	-141.7	-22.9	39.3	340.0				148.9
ATLAS-3	ATMOS	94	11	10	19	56	56	7	2	57	13	27.1	336.5	116.3	-16.2	22.9	319.2	1875	0	15	171.5
UARS	HALOE	94	11	10	19	41	30	1154	20	30	28	44.5	346.1	-141.9	-22.9	39.5	315.8				148.7
ATLAS-3	ATMOS	94	11	10	21	27	29	7	4	27	46	26.6	314.0	116.0	-16.2	22.3	296.8	1989	0	9	172.2
UARS	HALOE	94	11	10	21	17	47	1154	22	6	47	44.7	322.0	-142.1	-22.9	39.6	291.6				148.5

Appendix 2. Correlative measurement opportunities between ATLAS-3 (ATMOS) 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-3	ATMOS	94	11	4	0	1	21	0	7	1	38	-52.1	29.7	28.1	-16.4	-64.2	51.3	991	2	31	71.6
UARS	MLS	94	11	4	2	33	18	1148	3	22	19	-46.2	99.7	90.0	-22.9	-61.3	69.8				44.2
ATLAS-3	ATMOS	94	11	4	1	31	57	0	8	32	14	-52.2	6.9	28.4	-16.4	-64.3	28.4	921	2	37	71.7
UARS	MLS	94	11	4	4	9	32	1148	4	58	28	-46.3	75.4	90.0	-22.9	-61.4	45.5				44.3
ATLAS-3	ATMOS	94	11	4	3	2	32	0	10	2	49	-52.2	344.1	28.7	-16.4	-64.4	5.6	851	2	43	71.8
UARS	MLS	94	11	4	5	45	47	1148	6	34	48	-46.4	51.2	90.0	-22.9	-61.5	21.2				44.5
ATLAS-3	ATMOS	94	11	4	4	33	7	0	11	33	24	-52.3	321.2	29.1	-16.4	-64.5	342.7	782	2	49	71.9
UARS	MLS	94	11	4	7	22	17	1148	8	11	18	-47.1	28.0	90.0	-22.9	-62.4	357.8				44.2
ATLAS-3	ATMOS	94	11	4	7	34	17	0	14	34	34	-52.4	275.6	29.7	-16.4	-64.7	297.0	645	3	0	72.1
UARS	MLS	94	11	4	10	34	46	1148	11	23	47	-47.2	339.5	90.0	-22.9	-62.6	309.2				44.5
ATLAS-3	ATMOS	94	11	4	9	4	53	0	16	5	10	-52.4	252.7	30.0	-16.4	-64.7	274.1	579	3	6	72.2
UARS	MLS	94	11	4	12	11	0	1148	12	59	56	-47.3	315.2	90.0	-22.9	-62.7	284.9				44.6
ATLAS-3	ATMOS	94	11	4	10	35	28	0	17	35	45	-52.5	229.9	30.4	-16.4	-64.8	251.2	514	3	11	72.3
UARS	MLS	94	11	4	13	47	15	1148	14	36	16	-47.4	291.0	90.0	-22.9	-62.8	260.7				44.8
ATLAS-3	ATMOS	94	11	4	13	36	38	0	20	36	55	-52.6	184.3	31.0	-16.4	-65.0	205.5	386	3	23	72.5
UARS	MLS	94	11	4	17	0	0	1148	17	48	55	-48.1	243.6	90.0	-22.9	-63.8	213.0				44.7
ATLAS-3	ATMOS	94	11	4	15	7	13	0	22	7	30	-52.6	161.4	31.3	-16.4	-65.1	182.6	323	3	29	72.6
UARS	MLS	94	11	4	18	36	14	1148	19	25	15	-48.1	219.4	90.0	-22.9	-63.9	188.8				44.8
ATLAS-3	ATMOS	94	11	5	6	13	5	1	13	13	22	-53.1	293.1	34.6	-16.4	-66.0	313.8	764	2	49	73.5
UARS	MLS	94	11	5	9	2	8	1149	9	51	9	-48.2	0.0	90.0	-22.9	-64.0	329.4				46.3
ATLAS-3	ATMOS	94	11	5	7	43	40	1	14	43	57	-53.2	270.3	34.9	-16.4	-66.0	290.9	700	2	54	73.6
UARS	MLS	94	11	5	10	38	22	1149	11	27	18	-48.3	335.8	90.0	-22.9	-64.1	305.1				46.4
ATLAS-3	ATMOS	94	11	5	9	14	15	1	16	14	32	-53.2	247.4	35.2	-16.4	-66.1	268.0	637	3	0	73.7
UARS	MLS	94	11	5	12	14	37	1149	13	3	37	-48.3	311.5	90.0	-22.9	-64.2	280.9				46.5
ATLAS-3	ATMOS	94	11	5	10	44	50	1	17	45	7	-53.2	224.6	35.5	-16.4	-66.2	245.1	575	3	6	73.8
UARS	MLS	94	11	5	13	50	51	1149	14	39	47	-48.4	287.3	90.0	-22.9	-64.3	256.6				46.6
ATLAS-3	ATMOS	94	11	5	12	15	25	1	19	15	42	-53.3	201.8	35.9	-16.4	-66.3	222.3	514	3	11	73.9
UARS	MLS	94	11	5	15	27	5	1149	16	16	6	-48.5	263.0	90.0	-22.9	-64.4	232.3				46.8
ATLAS-3	ATMOS	94	11	5	13	46	0	1	20	46	17	-53.3	178.9	36.2	-16.4	-66.4	199.4	455	3	17	74.0
UARS	MLS	94	11	5	17	3	20	1149	17	52	15	-48.5	238.8	90.0	-22.9	-64.5	208.1				46.9
ATLAS-3	ATMOS	94	11	5	15	16	35	1	22	16	52	-53.4	156.1	36.5	-16.4	-66.5	176.5	398	3	23	74.1
UARS	MLS	94	11	5	18	39	50	1149	19	28	46	-49.2	215.7	90.0	-22.9	-65.4	184.8				46.6
ATLAS-3	ATMOS	94	11	6	3	20	50	2	10	21	7	-53.8	333.7	39.1	-16.3	-67.0	353.6	929	2	32	74.8
UARS	MLS	94	11	6	5	52	59	1150	6	42	0	-48.5	43.6	90.0	-22.9	-64.4	13.0				48.3
ATLAS-3	ATMOS	94	11	6	4	51	20	2	11	51	37	-53.8	310.9	39.4	-16.3	-67.1	330.7	867	2	37	74.9
UARS	MLS	94	11	6	7	29	13	1150	8	18	9	-48.6	19.4	90.0	-22.9	-64.5	348.7				48.4
ATLAS-3	ATMOS	94	11	6	6	21	50	2	13	22	7	-53.8	288.1	39.7	-16.3	-67.2	307.8	805	2	43	75.0
UARS	MLS	94	11	6	9	5	28	1150	9	54	29	-48.6	355.2	90.0	-22.9	-64.6	324.4				48.6
ATLAS-3	ATMOS	94	11	6	7	52	20	2	14	52	37	-53.9	265.3	40.0	-16.3	-67.2	284.9	744	2	49	75.1
UARS	MLS	94	11	6	10	41	42	1150	11	30	38	-48.7	330.9	90.0	-22.9	-64.7	300.2				48.7
ATLAS-3	ATMOS	94	11	6	9	22	49	2	16	23	6	-53.9	242.5	40.4	-16.3	-67.3	262.0	685	2	55	75.2
UARS	MLS	94	11	6	12	17	57	1150	13	6	58	-48.8	306.7	90.0	-22.9	-64.8	275.9				48.8
ATLAS-3	ATMOS	94	11	6	13	54	19	2	20	54	36	-54.0	174.0	41.3	-16.3	-67.5	193.3	509	3	12	75.5
UARS	MLS	94	11	6	17	6	56	1150	17	55	57	-49.5	235.2	90.0	-22.9	-65.9	204.2				48.7

Appendix 2. 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-3	ATMOS	94	11	6	15	24	48	2	22	25	5	-54.1	151.2	41.7	-16.3	-67.6	170.5	452	3	18	75.5
UARS	MLS	94	11	6	18	43	10	1150	19	32	6	-49.6	210.9	90.0	-22.9	-66.0	179.9				48.8
ATLAS-3	ATMOS	94	11	6	16	55	18	2	23	55	35	-54.1	128.4	42.0	-16.3	-67.7	147.6	396	3	24	75.6
UARS	MLS	94	11	6	20	19	25	1150	21	8	26	-49.7	186.7	90.0	-22.9	-66.1	155.7				48.9
ATLAS-3	ATMOS	94	11	7	14	2	14	3	21	2	31	-54.6	168.9	46.6	-16.3	-68.7	186.8	580	3	8	77.0
UARS	MLS	94	11	7	17	10	16	1151	17	59	7	-50.0	230.4	90.0	-22.9	-66.5	199.3				50.9
ATLAS-3	ATMOS	94	11	7	15	32	44	3	22	33	1	-54.6	146.1	46.9	-16.3	-68.7	163.9	527	3	13	77.1
UARS	MLS	94	11	7	18	46	30	1151	19	35	26	-50.0	206.1	90.0	-22.9	-66.6	175.1				51.0
ATLAS-3	ATMOS	94	11	7	17	3	13	4	0	3	30	-54.7	123.2	47.2	-16.3	-68.8	141.0	475	3	19	77.2
UARS	MLS	94	11	7	20	22	45	1151	21	11	36	-50.1	181.9	90.0	-22.9	-66.7	150.8				51.1
ATLAS-3	ATMOS	94	11	7	18	33	43	4	1	34	0	-54.7	100.4	47.6	-16.3	-68.9	118.0	424	3	25	77.3
UARS	MLS	94	11	7	21	59	15	1151	22	48	16	-50.7	158.9	90.0	-22.9	-67.6	127.8				50.7
ATLAS-3	ATMOS	94	11	8	5	7	11	4	12	7	28	-54.9	300.7	49.9	-16.3	-69.3	317.6	977	2	28	78.0
UARS	MLS	94	11	8	7	36	10	1152	8	25	1	-50.0	11.0	90.0	-22.9	-66.6	340.0				52.5
ATLAS-3	ATMOS	94	11	8	6	37	39	4	13	37	56	-54.9	277.9	50.2	-16.3	-69.3	294.6	922	2	34	78.1
UARS	MLS	94	11	8	9	12	24	1152	10	1	20	-50.1	346.8	90.0	-22.9	-66.7	315.7				52.6
ATLAS-3	ATMOS	94	11	8	8	8	7	4	15	8	24	-55.0	255.0	50.5	-16.3	-69.4	271.7	867	2	40	78.2
UARS	MLS	94	11	8	10	48	38	1152	11	37	30	-50.1	322.5	90.0	-22.9	-66.8	291.5				52.7
ATLAS-3	ATMOS	94	11	8	9	38	35	4	16	38	52	-55.0	232.2	50.9	-16.3	-69.5	248.8	814	2	46	78.3
UARS	MLS	94	11	8	12	24	53	1152	13	13	49	-50.2	298.3	90.0	-22.9	-66.9	267.2				52.8
ATLAS-3	ATMOS	94	11	8	11	9	3	4	18	9	20	-55.0	209.4	51.2	-16.3	-69.5	225.8	760	2	52	78.4
UARS	MLS	94	11	8	14	1	7	1152	14	49	58	-50.2	274.1	90.0	-22.9	-67.0	243.0				52.9
ATLAS-3	ATMOS	94	11	8	12	39	31	4	19	39	48	-55.0	186.6	51.5	-16.3	-69.6	202.9	708	2	57	78.5
UARS	MLS	94	11	8	15	37	22	1152	16	26	18	-50.3	249.8	90.0	-22.9	-67.1	218.7				53.0
ATLAS-3	ATMOS	94	11	8	14	9	59	4	21	10	16	-55.1	163.7	51.8	-16.3	-69.6	179.9	657	3	3	78.6
UARS	MLS	94	11	8	17	13	36	1152	18	2	27	-50.4	225.6	90.0	-22.9	-67.1	194.5				53.2
ATLAS-3	ATMOS	94	11	8	15	40	27	4	22	40	44	-55.1	140.9	52.2	-16.3	-69.7	157.0	606	3	9	78.7
UARS	MLS	94	11	8	18	49	50	1152	19	38	47	-50.4	201.4	90.0	-22.9	-67.2	170.3				53.3
ATLAS-3	ATMOS	94	11	8	17	10	55	5	0	11	12	-55.1	118.1	52.5	-16.3	-69.8	134.0	557	3	15	78.8
UARS	MLS	94	11	8	20	26	5	1152	21	14	56	-50.5	177.1	90.0	-22.9	-67.3	146.0				53.4
ATLAS-3	ATMOS	94	11	8	18	41	23	5	1	41	40	-55.1	95.2	52.8	-16.3	-69.8	111.0	508	3	21	78.9
UARS	MLS	94	11	8	22	2	35	1152	22	51	26	-51.1	154.2	90.0	-22.9	-68.2	123.0				52.8
ATLAS-3	ATMOS	94	11	8	20	11	51	5	3	12	8	-55.2	72.4	53.2	-16.3	-69.9	88.1	458	3	26	79.0
UARS	MLS	94	11	8	23	38	50	1153	0	27	46	-51.1	130.0	90.0	-22.9	-68.3	98.8				52.9
ATLAS-3	ATMOS	94	11	9	0	11	19	5	7	11	36	39.0	270.8	126.0	-16.3	34.9	251.0	930	3	26	153.6
UARS	MLS	94	11	9	3	37	33	1153	4	26	29	47.5	240.8	90.0	-22.9	27.8	256.2				122.2
ATLAS-3	ATMOS	94	11	9	8	15	34	5	15	15	51	-55.4	249.7	55.8	-16.3	-70.3	264.3	949	2	36	79.9
UARS	MLS	94	11	9	10	51	58	1153	11	40	50	-50.5	317.8	90.0	-22.9	-67.4	286.7				55.0
ATLAS-3	ATMOS	94	11	9	9	46	2	5	16	46	19	-55.4	226.9	56.1	-16.3	-70.4	241.3	898	2	42	80.0
UARS	MLS	94	11	9	12	28	13	1153	13	17	10	-50.6	293.5	90.0	-22.9	-67.5	262.4				55.1
ATLAS-3	ATMOS	94	11	9	11	16	30	5	18	16	47	-55.4	204.0	56.5	-16.3	-70.4	218.3	848	2	47	80.1
UARS	MLS	94	11	9	14	4	27	1153	14	53	19	-50.7	269.3	90.0	-22.9	-67.6	238.2				55.2
ATLAS-3	ATMOS	94	11	9	12	46	58	5	19	47	15	-55.4	181.2	56.8	-16.3	-70.5	195.3	799	2	53	80.3
UARS	MLS	94	11	9	15	40	42	1153	16	29	38	-50.7	245.1	90.0	-22.9	-67.7	214.0				55.3

Appendix 2. 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-3	ATMOS	94	11	9	14	17	26	5	21	17	43	-55.4	158.4	57.1	-16.3	-70.5	172.3	751	2	59	80.4
UARS	MLS	94	11	9	17	16	56	1153	18	5	48	-50.8	220.8	90.0	-22.9	-67.8	189.7				55.4
ATLAS-3	ATMOS	94	11	9	15	16	58	5	22	17	15	35.6	44.9	122.6	-16.3	31.4	26.0	899	2	44	159.1
UARS	MLS	94	11	9	18	1	35	1153	18	50	26	43.1	14.2	90.0	-22.9	24.7	31.1				115.2
ATLAS-3	ATMOS	94	11	9	15	47	54	5	22	48	11	-55.5	135.5	57.5	-16.3	-70.6	149.3	703	3	5	80.5
UARS	MLS	94	11	9	18	53	10	1153	19	42	7	-50.8	196.6	90.0	-22.9	-67.9	165.5				55.5
ATLAS-3	ATMOS	94	11	9	16	47	32	5	23	47	49	35.2	22.4	122.3	-16.3	31.0	3.6	759	2	50	159.7
UARS	MLS	94	11	9	19	38	5	1153	20	26	57	43.8	350.9	90.0	-22.9	25.2	7.6				115.8
ATLAS-3	ATMOS	94	11	9	17	18	22	6	0	18	39	-55.5	112.7	57.8	-16.3	-70.6	126.3	656	3	11	80.6
UARS	MLS	94	11	9	20	29	25	1153	21	18	16	-50.9	172.4	90.0	-22.9	-68.0	141.3				55.6
ATLAS-3	ATMOS	94	11	10	6	22	3	6	13	22	20	31.6	179.3	119.3	-16.2	27.4	161.3	877	2	3	165.2
UARS	MLS	94	11	10	8	25	52	1154	9	14	45	39.0	149.4	90.0	-22.9	21.6	167.2				108.5
ATLAS-3	ATMOS	94	11	10	7	52	35	6	14	52	52	31.1	156.8	119.0	-16.2	26.9	138.9	714	2	9	165.8
UARS	MLS	94	11	10	10	2	23	1154	10	51	16	39.8	126.0	90.0	-22.9	22.2	143.6				109.2
ATLAS-3	ATMOS	94	11	10	9	23	7	6	16	23	24	30.7	134.2	118.7	-16.2	26.5	116.4	552	2	15	166.5
UARS	MLS	94	11	10	11	38	53	1154	12	27	46	40.6	102.6	90.0	-22.9	22.8	120.1				109.8
ATLAS-3	ATMOS	94	11	10	9	52	39	6	16	52	56	-55.7	221.8	61.4	-16.2	-71.1	233.7	980	2	38	81.7
UARS	MLS	94	11	10	12	31	33	1154	13	20	30	-51.0	288.8	90.0	-22.9	-68.1	257.7				57.3
ATLAS-3	ATMOS	94	11	10	10	53	39	6	17	53	56	30.2	111.7	118.3	-16.2	26.0	93.9	390	2	21	167.2
UARS	MLS	94	11	10	13	15	23	1154	14	4	16	41.4	79.2	90.0	-22.9	23.4	96.5				110.5
ATLAS-3	ATMOS	94	11	10	11	23	3	6	18	23	20	-55.7	198.9	61.8	-16.2	-71.1	210.7	932	2	44	81.9
UARS	MLS	94	11	10	14	7	47	1154	14	56	39	-51.1	264.6	90.0	-22.9	-68.2	233.5				57.4
ATLAS-3	ATMOS	94	11	10	12	24	12	6	19	24	29	29.7	89.1	118.0	-16.2	25.5	71.5	230	2	27	167.9
UARS	MLS	94	11	10	14	51	54	1154	15	40	46	42.1	55.8	90.0	-22.9	23.9	73.0				111.1
ATLAS-3	ATMOS	94	11	10	12	53	27	6	19	53	44	-55.8	176.1	62.1	-16.2	-71.2	187.6	886	2	50	82.0
UARS	MLS	94	11	10	15	44	2	1154	16	32	59	-51.1	240.3	90.0	-22.9	-68.3	209.2				57.5
ATLAS-3	ATMOS	94	11	10	13	54	44	6	20	55	1	29.2	66.6	117.7	-16.2	25.0	49.0	70	2	33	168.6
UARS	MLS	94	11	10	16	28	24	1154	17	17	17	42.9	32.5	90.0	-22.9	24.5	49.5				111.8
ATLAS-3	ATMOS	94	11	10	14	23	51	6	21	24	8	-55.8	153.2	62.4	-16.2	-71.2	164.6	839	2	56	82.1
UARS	MLS	94	11	10	17	20	16	1154	18	9	8	-51.2	216.1	90.0	-22.9	-68.4	185.0				57.6
ATLAS-3	ATMOS	94	11	10	15	25	17	6	22	25	34	28.7	44.1	117.3	-16.2	24.5	26.6	86	2	39	169.3
UARS	MLS	94	11	10	18	4	55	1154	18	53	47	43.6	9.2	90.0	-22.9	25.1	26.0				112.4
ATLAS-3	ATMOS	94	11	10	15	54	15	6	22	54	32	-55.8	130.4	62.8	-16.2	-71.3	141.6	794	3	2	82.2
UARS	MLS	94	11	10	18	56	31	1154	19	45	28	-51.2	191.9	90.0	-22.9	-68.5	160.8				57.7
ATLAS-3	ATMOS	94	11	10	16	55	50	6	23	56	7	28.2	21.6	117.0	-16.2	24.0	4.1	244	2	45	170.0
UARS	MLS	94	11	10	19	41	25	1154	20	30	17	44.3	345.9	90.0	-22.9	25.6	2.5				113.1
ATLAS-3	ATMOS	94	11	10	17	24	39	7	0	24	56	-55.8	107.5	63.1	-16.2	-71.3	118.5	748	3	8	82.4
UARS	MLS	94	11	10	20	32	45	1154	21	21	37	-51.3	167.7	90.0	-22.9	-68.6	136.5				57.8
ATLAS-3	ATMOS	94	11	10	18	26	23	7	1	26	40	27.7	359.0	116.6	-16.2	23.4	341.7	395	2	51	170.7
UARS	MLS	94	11	10	21	18	12	1154	22	7	8	45.7	323.7	90.0	-22.9	26.6	339.9				114.5
ATLAS-3	ATMOS	94	11	10	18	55	2	7	1	55	19	-55.8	84.7	63.5	-16.2	-71.3	95.5	704	3	13	82.5
UARS	MLS	94	11	10	22	8	59	1154	22	57	56	-51.4	143.4	90.0	-22.9	-68.7	112.3				57.9
ATLAS-3	ATMOS	94	11	10	19	56	56	7	2	57	13	27.1	336.5	116.3	-16.2	22.9	319.2	545	2	57	171.5
UARS	MLS	94	11	10	22	54	42	1154	23	43	39	46.4	300.5	90.0	-22.9	27.1	316.4				115.1

Appendix 2. Concluded.

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-3	ATMOS	94 11 10 20 25 26	7 3 25 43	-55.8	61.8	63.8	-16.2	-71.4	72.4	660	3 19	82.6
UARS	MLS	94 11 10 23 45 14	1155 0 34 6	-51.4	119.2	90.0	-22.9	-68.8	88.1			58.0
ATLAS-3	ATMOS	94 11 10 21 27 29	7 4 27 46	26.6	314.0	116.0	-16.2	22.3	296.8	694	3 3	172.2
UARS	MLS	94 11 11 0 31 29	1155 1 20 30	47.7	278.5	90.0	-22.9	28.0	293.9			116.6
ATLAS-3	ATMOS	94 11 10 21 55 50	7 4 56 7	-55.8	39.0	64.1	-16.2	-71.4	49.4	617	3 25	82.8
UARS	MLS	94 11 11 1 21 28	1155 2 10 25	-51.5	95.0	90.0	-22.9	-68.8	63.9			58.1
ATLAS-3	ATMOS	94 11 10 22 58 3	7 5 58 20	26.0	291.5	115.6	-16.2	21.8	274.4	640	1 28	173.0
UARS	MLS	94 11 11 0 26 8	1155 1 15 3	34.0	260.3	90.0	-22.9	17.6	278.6			100.6
ATLAS-3	ATMOS	94 11 11 0 28 36	7 7 28 53	25.5	268.9	115.3	-16.2	21.2	251.9	452	1 34	173.7
UARS	MLS	94 11 11 2 2 38	1155 2 51 33	34.8	236.7	90.0	-22.9	18.3	255.0			101.2
ATLAS-3	ATMOS	94 11 11 1 59 10	7 8 59 27	24.9	246.4	115.0	-16.2	20.6	229.5	265	1 39	174.5
UARS	MLS	94 11 11 3 39 9	1155 4 28 3	35.7	213.2	90.0	-22.9	19.0	231.4			101.9
ATLAS-3	ATMOS	94 11 11 3 29 44	7 10 30 1	24.3	223.9	114.6	-16.2	20.0	207.1	83	1 45	175.2
UARS	MLS	94 11 11 5 15 39	1155 6 4 34	36.5	189.7	90.0	-22.9	19.6	207.8			102.6
ATLAS-3	ATMOS	94 11 11 5 0 19	7 12 0 36	23.7	201.4	114.3	-16.2	19.4	184.6	111	1 51	176.0
UARS	MLS	94 11 11 6 52 10	1155 7 41 4	37.3	166.2	90.0	-22.9	20.3	184.2			103.2
ATLAS-3	ATMOS	94 11 11 6 30 53	7 13 31 10	23.1	178.9	113.9	-16.2	18.7	162.2	294	1 57	176.7
UARS	MLS	94 11 11 8 28 40	1155 9 17 34	38.1	142.7	90.0	-22.9	20.9	160.6			103.9
ATLAS-3	ATMOS	94 11 11 8 1 28	7 15 1 45	22.4	156.4	113.6	-16.2	18.1	139.8	479	2 3	177.5
UARS	MLS	94 11 11 10 5 11	1155 10 54 4	38.9	119.2	90.0	-22.9	21.5	137.0			104.6
ATLAS-3	ATMOS	94 11 11 9 32 3	7 16 32 20	21.8	133.9	113.2	-16.2	17.4	117.4	663	2 9	178.1
UARS	MLS	94 11 11 11 41 41	1155 12 30 35	39.7	95.8	90.0	-22.9	22.1	113.4			105.3
ATLAS-3	ATMOS	94 11 11 11 2 38	7 18 2 55	21.1	111.4	112.9	-16.2	16.8	94.9	847	2 15	178.6
UARS	MLS	94 11 11 13 18 11	1155 14 7 5	40.5	72.4	90.0	-22.9	22.7	89.9			105.9
ATLAS-3	ATMOS	94 11 11 12 33 13	7 19 33 30	20.5	88.9	112.6	-16.2	16.1	72.5	749	0 40	178.6
UARS	MLS	94 11 11 13 13 23	1155 14 2 20	27.0	59.2	90.0	-22.9	11.9	77.9			91.0
ATLAS-3	ATMOS	94 11 11 16 0 34	7 23 0 51	-56.0	124.5	68.2	-16.2	-71.8	132.1	935	2 59	84.5
UARS	MLS	94 11 11 18 59 51	1155 19 48 48	-51.6	187.2	90.0	-22.9	-69.1	156.1			60.0
ATLAS-3	ATMOS	94 11 11 17 5 1	8 0 5 18	18.4	21.5	111.5	-16.2	13.9	5.3	112	0 57	176.8
UARS	MLS	94 11 11 18 2 38	1155 18 51 30	28.9	347.5	90.0	-22.9	13.4	6.2			92.1
ATLAS-3	ATMOS	94 11 11 17 30 57	8 0 31 14	-56.0	101.6	68.6	-16.2	-71.9	109.0	894	3 5	84.6
UARS	MLS	94 11 11 20 36 5	1155 21 24 57	-51.7	162.9	90.0	-22.9	-69.2	131.9			60.1
ATLAS-3	ATMOS	94 11 11 20 31 44	8 3 32 1	-56.0	55.8	69.2	-16.2	-71.9	62.7	812	3 16	84.9
UARS	MLS	94 11 11 23 48 34	1156 0 37 26	-51.8	114.5	90.0	-22.9	-69.4	83.4			60.2
ATLAS-3	ATMOS	94 11 11 21 36 51	8 4 37 8	16.1	314.1	110.5	-16.2	11.6	298.1	535	1 15	174.2
UARS	MLS	94 11 11 22 51 53	1155 23 40 50	30.7	275.9	90.0	-22.9	15.0	294.5			93.3
ATLAS-3	ATMOS	94 11 11 22 2 7	8 5 2 24	-56.0	32.9	69.6	-16.2	-71.9	39.5	772	3 22	85.1
UARS	MLS	94 11 12 1 24 48	1156 2 13 46	-51.8	90.3	90.0	-22.9	-69.5	59.2			60.3
ATLAS-3	ATMOS	94 11 11 23 7 28	8 6 7 45	15.4	291.7	110.1	-16.2	10.8	275.7	752	1 20	173.3
UARS	MLS	94 11 12 0 28 24	1156 1 17 20	31.6	252.3	90.0	-22.9	15.7	270.8			94.0
ATLAS-3	ATMOS	94 11 11 23 32 31	8 6 32 48	-56.0	10.0	69.9	-16.2	-72.0	16.3	733	3 28	85.3
UARS	MLS	94 11 12 3 1 3	1156 3 49 55	-51.9	66.0	90.0	-22.9	-69.5	35.0			60.4
ATLAS-3	ATMOS	94 11 12 0 38 6	8 7 38 23	14.6	269.2	109.8	-16.2	10.0	253.3	969	1 26	172.4
UARS	MLS	94 11 12 2 4 54	1156 2 53 50	32.4	228.7	90.0	-22.9	16.4	247.2			94.7

Appendix 3. Correlative measurement opportunities between ATLAS-3 (CRISTA-144) 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-3	CRISTA-144	94	11	5	0	47	4	1	7	47	21	29.3	157.3	-144.0	-16.4	23.8	139.9				45.3
UARS	HALOE	94	11	4	21	21	43	1148	22	10	39	31.2	107.8	-45.6	-22.9	26.7	133.5	723	3	25	41.5
ATLAS-3	CRISTA-144	94	11	5	2	17	24	1	9	17	41	28.6	133.8	-144.0	-16.4	23.1	116.5				44.8
UARS	HALOE	94	11	4	22	58	2	1148	23	46	59	30.9	83.7	-45.7	-22.9	26.4	109.3	814	3	19	41.2
ATLAS-3	CRISTA-144	94	11	5	3	47	44	1	10	48	1	27.9	110.2	-144.0	-16.4	22.4	93.1				44.3
UARS	HALOE	94	11	5	0	34	21	1149	1	23	19	30.5	59.6	-45.7	-22.9	26.0	85.1	904	3	13	40.8
ATLAS-3	CRISTA-144	94	11	5	17	57	31	2	0	57	48	6.5	50.1	-144.0	-16.4	23.0	50.9				143.1
UARS	HALOE	94	11	5	14	29	47	1149	15	18	48	23.8	67.0	-134.3	-22.9	18.9	42.9	939	3	27	171.7
ATLAS-3	CRISTA-144	94	11	6	0	54	50	2	7	55	7	26.7	147.4	-144.0	-16.3	21.1	130.6				44.9
UARS	HALOE	94	11	5	21	26	34	1149	22	15	35	26.1	106.1	-45.6	-22.9	21.3	130.6	18	3	28	36.7
ATLAS-3	CRISTA-144	94	11	6	2	25	5	2	9	25	22	26.0	123.9	-144.0	-16.3	20.4	107.2				44.6
UARS	HALOE	94	11	5	23	2	53	1149	23	51	54	25.8	82.0	-45.6	-22.9	20.9	106.4	104	3	22	36.3
ATLAS-3	CRISTA-144	94	11	6	3	55	20	2	10	55	37	25.3	100.4	-144.0	-16.3	19.7	83.8				44.3
UARS	HALOE	94	11	6	0	39	13	1150	1	28	3	25.4	57.9	-45.6	-22.9	20.6	82.2	197	3	16	36.0
ATLAS-3	CRISTA-144	94	11	6	5	25	35	2	12	25	52	24.6	76.9	-144.0	-16.3	19.0	60.4				44.0
UARS	HALOE	94	11	6	2	15	32	1150	3	4	23	25.1	33.7	-45.5	-22.9	20.2	58.0	290	3	10	35.7
ATLAS-3	CRISTA-144	94	11	6	6	55	50	2	13	56	7	23.9	53.4	-144.0	-16.3	18.2	37.1				43.8
UARS	HALOE	94	11	6	3	51	52	1150	4	40	43	24.7	9.6	-45.5	-22.9	19.8	33.8	384	3	3	35.3
ATLAS-3	CRISTA-144	94	11	6	8	26	5	2	15	26	22	23.2	30.0	-144.0	-16.3	17.5	13.7				43.6
UARS	HALOE	94	11	6	5	28	11	1150	6	17	3	24.4	345.5	-45.5	-22.9	19.4	9.6	478	2	57	35.0
ATLAS-3	CRISTA-144	94	11	6	9	56	20	2	16	56	37	22.5	6.5	-144.0	-16.3	16.8	350.3				43.4
UARS	HALOE	94	11	6	7	4	31	1150	7	53	22	24.0	321.4	-45.5	-22.9	19.0	345.4	574	2	51	34.6
ATLAS-3	CRISTA-144	94	11	6	11	26	35	2	18	26	52	21.8	343.0	-144.0	-16.3	16.0	326.9				43.2
UARS	HALOE	94	11	6	8	40	50	1150	9	29	42	23.7	297.2	-45.4	-22.9	18.7	321.2	669	2	45	34.3
ATLAS-3	CRISTA-144	94	11	6	12	56	50	2	19	57	7	21.1	319.6	-144.0	-16.3	15.3	303.5				43.0
UARS	HALOE	94	11	6	10	17	10	1150	11	6	2	23.3	273.1	-45.4	-22.9	18.3	297.0	765	2	39	34.0
ATLAS-3	CRISTA-144	94	11	6	14	27	6	2	21	27	23	20.4	296.1	-144.0	-16.3	14.6	280.1				42.9
UARS	HALOE	94	11	6	11	53	30	1150	12	42	21	23.0	249.0	-45.3	-22.9	17.9	272.8	862	2	33	33.6
ATLAS-3	CRISTA-144	94	11	6	15	57	21	2	22	57	38	19.7	272.6	-144.0	-16.3	13.9	256.8				42.8
UARS	HALOE	94	11	6	13	29	49	1150	14	18	41	22.6	224.8	-45.3	-22.9	17.5	248.6	960	2	27	33.3
ATLAS-3	CRISTA-144	94	11	6	19	34	48	3	2	35	5	9.2	17.9	-144.0	-16.3	25.5	18.7				136.3
UARS	HALOE	94	11	6	16	10	53	1150	16	59	52	29.0	40.9	-134.8	-22.9	24.2	15.8	331	3	23	166.2
ATLAS-3	CRISTA-144	94	11	6	21	5	3	3	4	5	20	9.9	354.5	-144.0	-16.3	26.2	355.3				135.7
UARS	HALOE	94	11	6	17	47	12	1150	18	36	12	29.3	16.7	-134.8	-22.9	24.5	351.6	420	3	17	165.8
ATLAS-3	CRISTA-144	94	11	6	22	35	18	3	5	35	35	10.6	331.1	-144.0	-16.3	26.9	331.9				135.1
UARS	HALOE	94	11	6	19	23	30	1150	20	12	21	29.7	352.6	-134.9	-22.9	24.8	327.4	508	3	11	165.5
ATLAS-3	CRISTA-144	94	11	7	0	5	34	3	7	5	51	11.3	307.7	-144.0	-16.3	27.6	308.5				134.4
UARS	HALOE	94	11	6	20	59	49	1150	21	48	41	30.0	328.5	-135.0	-22.9	25.1	303.2	596	3	5	165.1
ATLAS-3	CRISTA-144	94	11	7	1	35	49	3	8	36	6	12.1	284.3	-144.0	-16.3	28.4	285.0				133.7
UARS	HALOE	94	11	6	22	36	8	1150	23	25	1	30.3	304.4	-135.0	-22.9	25.5	279.0	682	2	59	164.8
ATLAS-3	CRISTA-144	94	11	7	2	31	52	3	9	32	9	23.7	114.7	-144.0	-16.3	18.0	98.3				45.9
UARS	HALOE	94	11	6	23	7	47	1150	23	56	39	20.5	80.0	-45.0	-22.9	15.2	103.5	631	3	24	31.2
ATLAS-3	CRISTA-144	94	11	7	3	6	4	3	10	6	21	12.8	260.9	-144.0	-16.3	29.1	261.6				133.0
UARS	HALOE	94	11	7	0	12	27	1151	1	1	20	30.6	280.2	-135.1	-22.9	25.8	254.8	767	2	53	164.4

Appendix 3. 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-3	CRISTA-144	94	11	7	4	2	8	3	11	2	25	23.0	91.2	-144.0	-16.3	17.3	74.9				45.8
UARS	HALOE	94	11	7	0	44	7	1151	1	32	59	20.1	55.9	-44.9	-22.9	14.8	79.3	539	3	18	30.8
ATLAS-3	CRISTA-144	94	11	7	4	36	19	3	11	36	36	13.5	237.5	-144.0	-16.3	29.8	238.1				132.4
UARS	HALOE	94	11	7	1	48	46	1151	2	37	40	30.9	256.1	-135.1	-22.9	26.1	230.6	851	2	47	164.1
ATLAS-3	CRISTA-144	94	11	7	5	32	23	3	12	32	40	22.3	67.7	-144.0	-16.3	16.5	51.5				45.7
UARS	HALOE	94	11	7	2	20	26	1151	3	9	18	19.7	31.7	-44.9	-22.9	14.4	55.1	447	3	11	30.4
ATLAS-3	CRISTA-144	94	11	7	6	6	34	3	13	6	51	14.2	214.1	-144.0	-16.3	30.5	214.7				131.7
UARS	HALOE	94	11	7	3	25	4	1151	4	14	0	31.2	232.0	-135.2	-22.9	26.4	206.4	934	2	41	163.7
ATLAS-3	CRISTA-144	94	11	7	7	2	38	3	14	2	55	21.6	44.2	-144.0	-16.3	15.8	28.1				45.6
UARS	HALOE	94	11	7	3	56	46	1151	4	45	38	19.4	7.6	-44.8	-22.9	14.0	30.9	353	3	5	30.1
ATLAS-3	CRISTA-144	94	11	7	8	32	53	3	15	33	10	20.9	20.8	-144.0	-16.3	15.1	4.8				45.6
UARS	HALOE	94	11	7	5	33	5	1151	6	21	58	19.0	343.5	-44.7	-22.9	13.6	6.7	261	2	59	29.7
ATLAS-3	CRISTA-144	94	11	7	10	3	8	3	17	3	25	20.2	357.3	-144.0	-16.3	14.3	341.4				45.6
UARS	HALOE	94	11	7	7	9	25	1151	7	58	18	18.6	319.3	-44.7	-22.9	13.2	342.5	171	2	53	29.4
ATLAS-3	CRISTA-144	94	11	7	11	33	8	3	18	33	25	18.7	333.3	-144.0	-16.3	12.8	317.5				45.3
UARS	HALOE	94	11	7	8	45	45	1151	9	34	37	18.3	295.2	-44.6	-22.9	12.8	318.3	81	2	47	29.0
ATLAS-3	CRISTA-144	94	11	7	13	3	23	3	20	3	40	18.0	309.9	-144.0	-16.3	12.1	294.1				45.4
UARS	HALOE	94	11	7	10	22	4	1151	11	10	57	17.9	271.0	-44.5	-22.9	12.4	294.1	44	2	41	28.6
ATLAS-3	CRISTA-144	94	11	7	14	33	38	3	21	33	55	17.3	286.4	-144.0	-16.3	11.3	270.8				45.4
UARS	HALOE	94	11	7	11	58	24	1151	12	47	17	17.5	246.9	-44.4	-22.9	12.0	269.9	125	2	35	28.3
ATLAS-3	CRISTA-144	94	11	7	16	3	53	3	23	4	10	16.5	263.0	-144.0	-16.3	10.6	247.4				45.5
UARS	HALOE	94	11	7	13	34	44	1151	14	23	36	17.2	222.7	-44.4	-22.9	11.7	245.7	220	2	29	27.9
ATLAS-3	CRISTA-144	94	11	7	17	34	9	4	0	34	26	15.8	239.6	-144.0	-16.3	9.9	224.0				45.6
UARS	HALOE	94	11	7	15	11	3	1151	15	59	56	16.8	198.6	-44.3	-22.9	11.3	221.5	316	2	23	27.5
ATLAS-3	CRISTA-144	94	11	7	19	4	24	4	2	4	41	15.1	216.2	-144.0	-16.3	9.1	200.6				45.8
UARS	HALOE	94	11	7	16	47	23	1151	17	36	16	16.4	174.4	-44.2	-22.9	10.9	197.3	413	2	17	27.2
ATLAS-3	CRISTA-144	94	11	7	19	41	51	4	2	42	8	10.7	9.5	-144.0	-16.3	27.0	10.2				130.2
UARS	HALOE	94	11	7	16	15	33	1151	17	4	27	33.5	39.0	-135.8	-22.9	28.7	12.8	314	3	26	161.0
ATLAS-3	CRISTA-144	94	11	7	20	34	39	4	3	34	56	14.4	192.7	-144.0	-16.3	8.4	177.3				45.9
UARS	HALOE	94	11	7	18	23	43	1151	19	12	35	16.1	150.3	-44.1	-22.9	10.5	173.1	510	2	10	26.8
ATLAS-3	CRISTA-144	94	11	7	21	12	6	4	4	12	23	11.5	346.1	-144.0	-16.3	27.8	346.8				129.6
UARS	HALOE	94	11	7	17	51	52	1151	18	40	46	33.8	14.9	-135.9	-22.9	29.0	348.6	223	3	20	160.7
ATLAS-3	CRISTA-144	94	11	7	22	4	54	4	5	5	11	13.7	169.3	-144.0	-16.3	7.7	153.9				46.1
UARS	HALOE	94	11	7	20	0	2	1151	20	48	55	15.7	126.1	-44.0	-22.9	10.1	148.9	608	2	4	26.4
ATLAS-3	CRISTA-144	94	11	7	22	42	21	4	5	42	38	12.2	322.7	-144.0	-16.3	28.5	323.4				128.9
UARS	HALOE	94	11	7	19	28	10	1151	20	17	6	34.1	350.8	-136.0	-22.9	29.3	324.4	134	3	14	160.4
ATLAS-3	CRISTA-144	94	11	7	23	35	9	4	6	35	26	13.0	145.9	-144.0	-16.3	7.0	130.5				46.3
UARS	HALOE	94	11	7	21	36	22	1151	22	25	15	15.3	102.0	-43.9	-22.9	9.7	124.7	706	1	58	26.1
ATLAS-3	CRISTA-144	94	11	8	0	12	37	4	7	12	54	12.9	299.2	-144.0	-16.3	29.2	299.9				128.2
UARS	HALOE	94	11	7	21	4	29	1151	21	53	26	34.3	326.7	-136.0	-22.9	29.6	300.2	47	3	8	160.1
ATLAS-3	CRISTA-144	94	11	8	1	5	22	4	8	5	39	11.9	122.3	-144.0	-16.3	5.9	106.9				46.5
UARS	HALOE	94	11	7	23	12	41	1152	0	1	34	15.0	77.8	-43.8	-22.9	9.3	100.5	804	1	52	25.7
ATLAS-3	CRISTA-144	94	11	8	1	42	48	4	8	43	5	14.0	275.6	-144.0	-16.3	30.3	276.2				127.4
UARS	HALOE	94	11	7	22	40	47	1151	23	29	45	34.6	302.6	-136.1	-22.9	29.8	276.0	52	3	2	159.7

Appendix 3. 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-3	CRISTA-144	94	11	8	2	35	35	4	9	35	52	11.1	98.9	-144.0	-16.3	5.2	83.6				46.8
UARS	HALOE	94	11	8	0	49	1	1152	1	37	54	14.6	53.6	-43.8	-22.9	8.9	76.3	902	1	46	25.3
ATLAS-3	CRISTA-144	94	11	8	3	13	2	4	10	13	19	14.7	252.2	-144.0	-16.3	31.0	252.8				126.7
UARS	HALOE	94	11	8	0	17	6	1152	1	6	5	34.9	278.4	-136.2	-22.9	30.1	251.8	133	2	55	159.4
ATLAS-3	CRISTA-144	94	11	8	4	43	16	4	11	43	33	15.4	228.8	-144.0	-16.3	31.7	229.3				126.0
UARS	HALOE	94	11	8	1	53	24	1152	2	42	25	35.2	254.3	-136.3	-22.9	30.4	227.6	218	2	49	159.1
ATLAS-3	CRISTA-144	94	11	8	6	13	29	4	13	13	46	16.1	205.4	-144.0	-16.3	32.4	205.8				125.3
UARS	HALOE	94	11	8	3	29	42	1152	4	18	34	35.4	230.2	-136.4	-22.9	30.6	203.4	303	2	43	158.8
ATLAS-3	CRISTA-144	94	11	8	7	43	58	4	14	44	15	16.0	182.5	-144.0	-16.3	32.3	183.0				125.0
UARS	HALOE	94	11	8	5	6	0	1152	5	54	54	35.7	206.1	-136.5	-22.9	30.9	179.2	386	2	37	158.5
ATLAS-3	CRISTA-144	94	11	8	9	14	11	4	16	14	28	16.8	159.1	-144.0	-16.3	33.0	159.5				124.3
UARS	HALOE	94	11	8	6	42	19	1152	7	31	13	36.0	182.0	-136.6	-22.9	31.2	155.0	468	2	31	158.2
ATLAS-3	CRISTA-144	94	11	8	10	9	44	4	17	10	1	17.5	348.0	-144.0	-16.3	11.6	332.3				48.8
UARS	HALOE	94	11	8	7	14	19	1152	8	3	13	13.1	317.0	-43.4	-22.9	7.3	339.5	920	2	55	23.8
ATLAS-3	CRISTA-144	94	11	8	10	44	25	4	17	44	42	17.5	135.6	-144.0	-16.3	33.7	136.0				123.6
UARS	HALOE	94	11	8	8	18	37	1152	9	7	33	36.2	157.9	-136.7	-22.9	31.4	130.8	549	2	25	157.9
ATLAS-3	CRISTA-144	94	11	8	11	39	58	4	18	40	15	16.8	324.6	-144.0	-16.3	10.8	309.0				48.9
UARS	HALOE	94	11	8	8	50	39	1152	9	39	33	12.8	292.8	-43.3	-22.9	6.9	315.3	825	2	49	23.5
ATLAS-3	CRISTA-144	94	11	8	12	14	39	4	19	14	56	18.2	112.2	-144.0	-16.3	34.5	112.5				122.9
UARS	HALOE	94	11	8	9	54	55	1152	10	43	53	36.5	133.8	-136.8	-22.9	31.7	106.6	630	2	19	157.6
ATLAS-3	CRISTA-144	94	11	8	13	10	11	4	20	10	28	16.0	301.2	-144.0	-16.3	10.1	285.6				49.1
UARS	HALOE	94	11	8	10	26	59	1152	11	15	52	12.4	268.7	-43.1	-22.9	6.5	291.1	729	2	43	23.1
ATLAS-3	CRISTA-144	94	11	8	13	44	52	4	20	45	9	18.9	88.8	-144.0	-16.3	35.2	89.0				122.2
UARS	HALOE	94	11	8	11	31	13	1152	12	20	12	36.8	109.7	-136.9	-22.9	31.9	82.4	709	2	13	157.3
ATLAS-3	CRISTA-144	94	11	8	14	40	10	4	21	40	27	14.5	277.2	-144.0	-16.3	8.5	261.8				49.3
UARS	HALOE	94	11	8	12	3	18	1152	12	52	12	12.1	244.5	-43.0	-22.9	6.1	266.9	631	2	36	22.7
ATLAS-3	CRISTA-144	94	11	8	15	15	6	4	22	15	23	19.6	65.3	-144.0	-16.3	35.9	65.5				121.4
UARS	HALOE	94	11	8	13	7	31	1152	13	56	32	37.0	85.5	-137.0	-22.9	32.2	58.2	787	2	7	157.0
ATLAS-3	CRISTA-144	94	11	8	16	10	23	4	23	10	40	13.8	253.8	-144.0	-16.3	7.8	238.4				49.5
UARS	HALOE	94	11	8	13	39	38	1152	14	28	32	11.7	220.4	-42.9	-22.9	5.7	242.7	534	2	30	22.3
ATLAS-3	CRISTA-144	94	11	8	16	45	19	4	23	45	36	20.3	41.9	-144.0	-16.3	36.6	42.0				120.7
UARS	HALOE	94	11	8	14	43	49	1152	15	32	41	37.3	61.4	-137.2	-22.9	32.4	34.1	864	2	1	156.7
ATLAS-3	CRISTA-144	94	11	8	17	40	37	5	0	40	54	13.1	230.4	-144.0	-16.3	7.1	215.0				49.8
UARS	HALOE	94	11	8	15	15	57	1152	16	4	51	11.3	196.2	-42.8	-22.9	5.3	218.5	437	2	24	22.0
ATLAS-3	CRISTA-144	94	11	8	19	10	51	5	2	11	8	12.3	207.0	-144.0	-16.3	6.4	191.6				50.0
UARS	HALOE	94	11	8	16	52	17	1152	17	41	11	11.0	172.0	-42.7	-22.9	4.9	194.3	339	2	18	21.6
ATLAS-3	CRISTA-144	94	11	8	19	48	32	5	2	48	49	12.7	0.9	-144.0	-16.3	28.9	1.5				124.0
UARS	HALOE	94	11	8	16	20	8	1152	17	9	1	37.5	37.3	-137.3	-22.9	32.7	9.9	900	3	28	156.4
ATLAS-3	CRISTA-144	94	11	8	20	41	4	5	3	41	21	11.6	183.6	-144.0	-16.3	5.7	168.3				50.3
UARS	HALOE	94	11	8	18	28	36	1152	19	17	31	10.6	147.8	-42.6	-22.9	4.5	170.1	242	2	12	21.2
ATLAS-3	CRISTA-144	94	11	8	21	18	46	5	4	19	3	13.4	337.5	-144.0	-16.3	29.7	338.1				123.3
UARS	HALOE	94	11	8	17	56	25	1152	18	45	21	37.8	13.2	-137.4	-22.9	32.9	345.7	808	3	22	156.1
ATLAS-3	CRISTA-144	94	11	8	22	11	18	5	5	11	35	10.9	160.2	-144.0	-16.3	4.9	144.9				50.6
UARS	HALOE	94	11	8	20	4	56	1152	20	53	50	10.2	123.7	-42.5	-22.9	4.1	145.9	147	2	6	20.8

Appendix 3. 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-3	CRISTA-144	94 11 8 22 49 0	5 5 49 17	14.1 314.0	-144.0 -16.3	30.4 314.6			122.6
UARS	HALOE	94 11 8 19 32 44	1152 20 21 40	38.0 349.1	-137.5 -22.9	33.2 321.5	718	3 16	155.9
ATLAS-3	CRISTA-144	94 11 8 23 41 31	5 6 41 48	10.2 136.8	-144.0 -16.3	4.2 121.5			51.0
UARS	HALOE	94 11 8 21 41 15	1152 22 30 10	9.9 99.5	-42.3 -22.9	3.7 121.7	60	2 0	20.4
ATLAS-3	CRISTA-144	94 11 9 0 19 13	5 7 19 30	14.8 290.6	-144.0 -16.3	31.1 291.2			122.0
UARS	HALOE	94 11 8 21 9 2	1152 21 58 0	38.3 325.0	-137.6 -22.9	33.4 297.3	629	3 10	155.6
ATLAS-3	CRISTA-144	94 11 9 1 11 45	5 8 12 2	9.5 113.4	-144.0 -16.3	3.5 98.1			51.3
UARS	HALOE	94 11 8 23 17 35	1153 0 6 30	9.5 75.3	-42.2 -22.9	3.3 97.5	71	1 54	20.1
ATLAS-3	CRISTA-144	94 11 9 1 49 42	5 8 49 59	14.7 267.7	-144.0 -16.3	31.0 268.3			121.7
UARS	HALOE	94 11 8 22 45 20	1152 23 34 20	38.5 300.9	-137.7 -22.9	33.7 273.1	540	3 4	155.3
ATLAS-3	CRISTA-144	94 11 9 2 41 43	5 9 42 0	7.9 89.5	-144.0 -16.3	1.9 74.3			51.7
UARS	HALOE	94 11 9 0 53 54	1153 1 42 49	9.1 51.2	-42.1 -22.9	2.9 73.3	152	1 47	19.7
ATLAS-3	CRISTA-144	94 11 9 3 19 55	5 10 20 12	15.4 244.3	-144.0 -16.3	31.7 244.8			121.0
UARS	HALOE	94 11 9 0 21 38	1153 1 10 29	38.8 276.8	-137.9 -22.9	33.9 248.9	451	2 58	155.0
ATLAS-3	CRISTA-144	94 11 9 4 11 57	5 11 12 14	7.2 66.1	-144.0 -16.3	1.2 50.9			52.1
UARS	HALOE	94 11 9 2 30 13	1153 3 19 9	8.8 27.0	-42.0 -22.9	2.5 49.1	245	1 41	19.3
ATLAS-3	CRISTA-144	94 11 9 4 50 9	5 11 50 26	16.2 220.9	-144.0 -16.3	32.4 221.4			120.3
UARS	HALOE	94 11 9 1 57 55	1153 2 46 48	39.0 252.7	-138.0 -22.9	34.1 224.7	363	2 52	154.8
ATLAS-3	CRISTA-144	94 11 9 5 42 11	5 12 42 28	6.4 42.8	-144.0 -16.3	0.5 27.5			52.6
UARS	HALOE	94 11 9 4 6 33	1153 4 55 29	8.4 2.8	-41.8 -22.9	2.1 24.9	340	1 35	18.9
ATLAS-3	CRISTA-144	94 11 9 6 20 23	5 13 20 40	16.9 197.5	-144.0 -16.3	33.2 197.9			119.6
UARS	HALOE	94 11 9 3 34 13	1153 4 23 8	39.2 228.6	-138.1 -22.9	34.4 200.5	276	2 46	154.5
ATLAS-3	CRISTA-144	94 11 9 7 12 24	5 14 12 41	5.7 19.4	-144.0 -16.3	-0.2 4.2			53.0
UARS	HALOE	94 11 9 5 42 52	1153 6 31 48	8.1 338.6	-41.7 -22.9	1.7 0.7	436	1 29	18.6
ATLAS-3	CRISTA-144	94 11 9 7 50 36	5 14 50 53	17.6 174.1	-144.0 -16.3	33.9 174.4			118.9
UARS	HALOE	94 11 9 5 10 31	1153 5 59 28	39.5 204.5	-138.2 -22.9	34.6 176.3	192	2 40	154.2
ATLAS-3	CRISTA-144	94 11 9 8 42 38	5 15 42 55	5.0 356.0	-144.0 -16.3	-0.9 340.8			53.4
UARS	HALOE	94 11 9 7 19 12	1153 8 8 8	7.7 314.5	-41.6 -22.9	1.3 336.5	534	1 23	18.2
ATLAS-3	CRISTA-144	94 11 9 9 20 50	5 16 21 7	18.3 150.6	-144.0 -16.3	34.6 150.9			118.2
UARS	HALOE	94 11 9 6 46 49	1153 7 35 48	39.7 180.4	-138.4 -22.9	34.8 152.1	111	2 34	154.0
ATLAS-3	CRISTA-144	94 11 9 10 12 51	5 17 13 8	4.3 332.6	-144.0 -16.3	-1.6 317.4			53.9
UARS	HALOE	94 11 9 8 55 31	1153 9 44 28	7.3 290.3	-41.5 -22.9	0.9 312.3	630	1 17	17.8
ATLAS-3	CRISTA-144	94 11 9 10 51 3	5 17 51 20	19.0 127.2	-144.0 -16.3	35.3 127.4			117.5
UARS	HALOE	94 11 9 8 23 6	1153 9 12 7	39.9 156.3	-138.5 -22.9	35.1 127.9	50	2 27	153.7
ATLAS-3	CRISTA-144	94 11 9 11 42 50	5 18 43 7	2.7 308.7	-144.0 -16.3	-3.2 293.5			54.5
UARS	HALOE	94 11 9 10 31 50	1153 11 20 48	7.0 266.1	-41.3 -22.9	0.6 288.1	725	1 10	17.4
ATLAS-3	CRISTA-144	94 11 9 12 21 32	5 19 21 49	18.9 104.3	-144.0 -16.3	35.2 104.6			117.3
UARS	HALOE	94 11 9 9 59 24	1153 10 48 16	40.2 132.2	-138.6 -22.9	35.3 103.7	76	2 22	153.4
ATLAS-3	CRISTA-144	94 11 9 13 13 3	5 20 13 20	2.0 285.3	-144.0 -16.3	-3.9 270.1			55.0
UARS	HALOE	94 11 9 12 8 10	1153 12 57 7	6.6 241.9	-41.2 -22.9	0.2 263.9	819	1 4	17.0
ATLAS-3	CRISTA-144	94 11 9 13 51 46	5 20 52 3	19.6 80.9	-144.0 -16.3	35.9 81.1			116.6
UARS	HALOE	94 11 9 11 35 42	1153 12 24 36	40.4 108.1	-138.8 -22.9	35.5 79.5	144	2 16	153.2
ATLAS-3	CRISTA-144	94 11 9 14 43 17	5 21 43 34	1.2 262.0	-144.0 -16.3	-4.6 246.7			55.5
UARS	HALOE	94 11 9 13 44 29	1153 14 33 27	6.3 217.8	-41.0 -22.9	-0.2 239.7	913	0 58	16.7

Appendix 3. 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-3	CRISTA-144	94	11	9	15	21	59	5	22	22	16	20.3	57.4	-144.0	-16.3	36.6	57.6				115.9
UARS	HALOE	94	11	9	13	12	0	1153	14	0	56	40.6	83.9	-138.9	-22.9	35.7	55.4	221	2	9	152.9
ATLAS-3	CRISTA-144	94	11	9	16	52	13	5	23	52	30	21.0	34.0	-144.0	-16.3	37.3	34.0				115.1
UARS	HALOE	94	11	9	14	48	17	1153	15	37	15	40.8	59.8	-139.1	-22.9	35.9	31.2	299	2	3	152.7
ATLAS-3	CRISTA-144	94	11	9	18	22	26	6	1	22	43	21.7	10.5	-144.0	-16.3	38.0	10.5				114.4
UARS	HALOE	94	11	9	16	24	35	1153	17	13	35	41.1	35.7	-139.2	-22.9	36.2	7.0	376	1	57	152.4
ATLAS-3	CRISTA-144	94	11	9	19	52	24	6	2	52	41	22.5	347.0	-144.0	-16.2	38.7	347.0				113.7
UARS	HALOE	94	11	9	18	0	52	1153	18	49	44	41.3	11.6	-139.3	-22.9	36.4	342.8	455	1	51	152.2
ATLAS-3	CRISTA-144	94	11	9	20	47	9	6	3	47	26	9.2	174.7	-144.0	-16.2	3.2	159.6				55.4
UARS	HALOE	94	11	9	18	33	27	1153	19	22	26	5.2	145.2	-40.6	-22.9	-1.4	167.2	983	2	13	15.5
ATLAS-3	CRISTA-144	94	11	9	21	22	34	6	4	22	51	23.2	323.6	-144.0	-16.2	39.4	323.5				113.0
UARS	HALOE	94	11	9	19	37	10	1153	20	26	4	41.5	347.5	-139.5	-22.9	36.6	318.6	532	1	45	151.9
ATLAS-3	CRISTA-144	94	11	9	22	17	19	6	5	17	36	8.4	151.4	-144.0	-16.2	2.5	136.3				55.8
UARS	HALOE	94	11	9	20	9	46	1153	20	58	46	4.9	121.0	-40.5	-22.9	-1.8	143.0	884	2	7	15.2
ATLAS-3	CRISTA-144	94	11	9	22	52	44	6	5	53	1	23.9	300.1	-144.0	-16.2	40.1	300.0				112.3
UARS	HALOE	94	11	9	21	13	27	1153	22	2	24	41.7	323.4	-139.6	-22.9	36.8	294.4	607	1	39	151.7
ATLAS-3	CRISTA-144	94	11	9	23	47	14	6	6	47	31	6.9	127.5	-144.0	-16.2	1.0	112.4				56.3
UARS	HALOE	94	11	9	21	46	5	1153	22	35	5	4.5	96.8	-40.3	-22.9	-2.2	118.8	786	2	1	14.8
ATLAS-3	CRISTA-144	94	11	10	0	22	53	6	7	23	10	24.6	276.7	-144.0	-16.2	40.8	276.4				111.6
UARS	HALOE	94	11	9	22	49	45	1153	23	38	43	41.9	299.3	-139.8	-22.9	37.0	270.2	682	1	33	151.5
ATLAS-3	CRISTA-144	94	11	10	1	17	24	6	8	17	41	6.2	104.1	-144.0	-16.2	0.3	89.1				56.8
UARS	HALOE	94	11	9	23	22	25	1154	0	11	25	4.2	72.7	-40.2	-22.9	-2.6	94.6	686	1	54	14.4
ATLAS-3	CRISTA-144	94	11	10	1	53	3	6	8	53	20	25.3	253.2	-144.0	-16.2	41.5	252.9				110.9
UARS	HALOE	94	11	10	0	26	2	1154	1	15	3	42.1	275.2	-139.9	-22.9	37.2	246.0	755	1	27	151.2
ATLAS-3	CRISTA-144	94	11	10	2	47	33	6	9	47	50	5.4	80.7	-144.0	-16.2	-0.5	65.7				57.2
UARS	HALOE	94	11	10	0	58	44	1154	1	47	45	3.8	48.5	-40.0	-22.9	-3.0	70.4	587	1	48	14.0
ATLAS-3	CRISTA-144	94	11	10	3	23	13	6	10	23	30	26.0	229.7	-144.0	-16.2	42.1	229.3				110.2
UARS	HALOE	94	11	10	2	2	20	1154	2	51	12	42.3	251.1	-140.1	-22.9	37.4	221.8	827	1	20	151.0
ATLAS-3	CRISTA-144	94	11	10	4	17	43	6	11	18	0	4.7	57.4	-144.0	-16.2	-1.2	42.3				57.7
UARS	HALOE	94	11	10	2	35	3	1154	3	23	54	3.5	24.3	-39.9	-22.9	-3.3	46.2	489	1	42	13.6
ATLAS-3	CRISTA-144	94	11	10	5	47	53	6	12	48	10	4.0	34.0	-144.0	-16.2	-1.9	19.0				58.2
UARS	HALOE	94	11	10	4	11	22	1154	5	0	14	3.1	0.1	-39.7	-22.9	-3.7	22.0	391	1	36	13.3
ATLAS-3	CRISTA-144	94	11	10	6	26	34	6	13	26	51	17.7	189.6	-144.0	-16.2	33.8	190.1				114.0
UARS	HALOE	94	11	10	3	38	37	1154	4	27	32	42.5	227.0	-140.3	-22.9	37.6	197.7	798	2	47	150.8
ATLAS-3	CRISTA-144	94	11	10	7	18	3	6	14	18	20	3.2	10.6	-144.0	-16.2	-2.6	355.6				58.7
UARS	HALOE	94	11	10	5	47	41	1154	6	36	33	2.8	335.9	-39.5	-22.9	-4.1	357.8	294	1	30	12.9
ATLAS-3	CRISTA-144	94	11	10	7	56	43	6	14	57	0	18.4	166.2	-144.0	-16.2	34.6	166.6				113.3
UARS	HALOE	94	11	10	5	14	55	1154	6	3	52	42.7	202.9	-140.4	-22.9	37.8	173.5	710	2	41	150.6
ATLAS-3	CRISTA-144	94	11	10	8	48	13	6	15	48	30	2.5	347.2	-144.0	-16.2	-3.3	332.2				59.1
UARS	HALOE	94	11	10	7	24	0	1154	8	12	53	2.4	311.7	-39.4	-22.9	-4.5	333.6	200	1	24	12.5
ATLAS-3	CRISTA-144	94	11	10	9	26	53	6	16	27	10	19.1	142.8	-144.0	-16.2	35.3	143.2				112.6
UARS	HALOE	94	11	10	6	51	12	1154	7	40	11	42.9	178.8	-140.6	-22.9	38.0	149.3	624	2	35	150.3
ATLAS-3	CRISTA-144	94	11	10	10	18	23	6	17	18	40	1.8	323.9	-144.0	-16.2	-4.0	308.8				59.7
UARS	HALOE	94	11	10	9	0	19	1154	9	49	13	2.1	287.5	-39.2	-22.9	-4.9	309.4	113	1	18	12.1

Appendix 3. 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-3	CRISTA-144	94 11 10 10 57 3	6 17 57 20	19.8	119.4	-144.0	-16.2	36.0	119.7			112.0
UARS	HALOE	94 11 10 8 27 29	1154 9 16 20	43.1	154.7	-140.7	-22.9	38.2	125.1	538	2 29	150.1
ATLAS-3	CRISTA-144	94 11 10 11 48 17	6 18 48 34	0.2	300.0	-144.0	-16.2	-5.5	285.0			60.4
UARS	HALOE	94 11 10 10 36 39	1154 11 25 32	1.7	263.3	-39.1	-22.9	-5.3	285.2	36	1 11	11.8
ATLAS-3	CRISTA-144	94 11 10 12 27 13	6 19 27 30	20.5	96.0	-144.0	-16.2	36.7	96.2			111.3
UARS	HALOE	94 11 10 10 3 47	1154 10 52 40	43.3	130.6	-140.9	-22.9	38.4	100.9	456	2 23	149.9
ATLAS-3	CRISTA-144	94 11 10 13 18 27	6 20 18 44	-0.5	276.7	-144.0	-16.2	-6.2	261.6			60.9
UARS	HALOE	94 11 10 12 12 58	1154 13 1 52	1.4	239.2	-38.9	-22.9	-5.6	261.0	93	1 5	11.4
ATLAS-3	CRISTA-144	94 11 10 13 57 38	6 20 57 55	20.4	73.1	-144.0	-16.2	36.6	73.3			111.0
UARS	HALOE	94 11 10 11 40 4	1154 12 29 0	43.5	106.5	-141.0	-22.9	38.6	76.7	371	2 17	149.7
ATLAS-3	CRISTA-144	94 11 10 14 48 37	6 21 48 54	-1.2	253.3	-144.0	-16.2	-6.9	238.2			61.5
UARS	HALOE	94 11 10 13 49 17	1154 14 38 12	1.0	215.0	-38.7	-22.9	-6.0	236.8	186	0 59	11.0
ATLAS-3	CRISTA-144	94 11 10 15 27 48	6 22 28 5	21.1	49.6	-144.0	-16.2	37.3	49.8			110.3
UARS	HALOE	94 11 10 13 16 21	1154 14 5 19	43.7	82.4	-141.2	-22.9	38.7	52.5	287	2 11	149.5
ATLAS-3	CRISTA-144	94 11 10 16 18 47	6 23 19 4	-2.0	229.9	-144.0	-16.2	-7.6	214.8			62.0
UARS	HALOE	94 11 10 15 25 36	1154 16 14 31	0.7	190.8	-38.6	-22.9	-6.4	212.6	281	0 53	10.6
ATLAS-3	CRISTA-144	94 11 10 16 57 58	6 23 58 15	21.8	26.2	-144.0	-16.2	38.0	26.3			109.7
UARS	HALOE	94 11 10 14 52 38	1154 15 41 39	43.9	58.3	-141.4	-22.9	38.9	28.4	205	2 5	149.3
ATLAS-3	CRISTA-144	94 11 10 17 48 57	7 0 49 14	-2.7	206.6	-144.0	-16.2	-8.3	191.4			62.6
UARS	HALOE	94 11 10 17 1 55	1154 17 50 51	0.4	166.6	-38.4	-22.9	-6.8	188.4	375	0 47	10.3
ATLAS-3	CRISTA-144	94 11 10 18 28 7	7 1 28 24	22.5	2.8	-144.0	-16.2	38.7	2.8			109.0
UARS	HALOE	94 11 10 16 28 56	1154 17 17 48	44.1	34.2	-141.5	-22.9	39.1	4.2	127	1 59	149.1
ATLAS-3	CRISTA-144	94 11 10 19 18 52	7 2 19 9	-4.3	182.7	-144.0	-16.2	-9.8	167.5			63.4
UARS	HALOE	94 11 10 18 38 14	1154 19 27 11	0.0	142.4	-38.2	-22.9	-7.2	164.2	468	0 40	9.9
ATLAS-3	CRISTA-144	94 11 10 19 58 17	7 2 58 34	23.2	339.3	-144.0	-16.2	39.4	339.3			108.3
UARS	HALOE	94 11 10 18 5 13	1154 18 54 8	44.3	10.2	-141.7	-22.9	39.3	340.0	62	1 53	148.9
ATLAS-3	CRISTA-144	94 11 10 20 49 1	7 3 49 18	-5.0	159.4	-144.0	-16.2	-10.5	144.1			64.0
UARS	HALOE	94 11 10 20 14 33	1154 21 3 30	-0.3	118.2	-38.1	-22.9	-7.5	140.0	558	0 34	9.5
ATLAS-3	CRISTA-144	94 11 10 21 28 42	7 4 28 59	23.1	316.4	-144.0	-16.2	39.3	316.4			108.0
UARS	HALOE	94 11 10 19 41 30	1154 20 30 28	44.5	346.1	-141.9	-22.9	39.5	315.8	55	1 47	148.7
ATLAS-3	CRISTA-144	94 11 10 22 19 11	7 5 19 28	-5.7	136.0	-144.0	-16.2	-11.2	120.7			64.6
UARS	HALOE	94 11 10 21 50 51	1154 22 39 50	-0.6	94.0	-37.9	-22.9	-7.9	115.8	649	0 28	9.2
ATLAS-3	CRISTA-144	94 11 10 22 58 52	7 5 59 9	23.8	293.0	-144.0	-16.2	40.0	292.9			107.4
UARS	HALOE	94 11 10 21 17 47	1154 22 6 47	44.7	322.0	-142.1	-22.9	39.6	291.6	113	1 41	148.5
ATLAS-3	CRISTA-144	94 11 10 23 49 21	7 6 49 38	-6.4	112.6	-144.0	-16.2	-11.9	97.2			65.2
UARS	HALOE	94 11 10 23 27 10	1155 0 16 10	-1.0	69.8	-37.7	-22.9	-8.3	91.6	739	0 22	8.8
ATLAS-3	CRISTA-144	94 11 11 0 29 2	7 7 29 19	24.5	269.5	-144.0	-16.2	40.7	269.3			106.7
UARS	HALOE	94 11 10 22 54 4	1154 23 42 56	44.9	297.9	-142.2	-22.9	39.8	267.4	186	1 34	148.3
ATLAS-3	CRISTA-144	94 11 11 1 19 31	7 8 19 48	-7.2	89.2	-144.0	-16.2	-12.6	73.8			65.8
UARS	HALOE	94 11 11 1 3 29	1155 1 52 30	-1.3	45.6	-37.5	-22.9	-8.6	67.4	828	0 16	8.4
ATLAS-3	CRISTA-144	94 11 11 1 59 12	7 8 59 29	25.2	246.1	-144.0	-16.2	41.4	245.8			106.0
UARS	HALOE	94 11 11 0 30 21	1155 1 19 16	45.0	273.8	-142.4	-22.9	40.0	243.3	261	1 28	148.1
ATLAS-3	CRISTA-144	94 11 11 2 49 26	7 9 49 43	-8.7	65.4	-144.0	-16.2	-14.0	49.8			66.7
UARS	HALOE	94 11 11 2 39 48	1155 3 28 49	-1.6	21.4	-37.4	-22.9	-9.0	43.2	915	0 9	8.1

Appendix 3. 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-3	CRISTA-144	94 11 11 3 29 22	7 10 29 39	25.9	222.6	-144.0	-16.2	42.1	222.2			105.3
UARS	HALOE	94 11 11 2 6 38	1155 2 55 36	45.2	249.7	-142.6	-22.9	40.2	219.1	336	1 22	147.9
ATLAS-3	CRISTA-144	94 11 11 4 59 32	7 11 59 49	26.6	199.1	-144.0	-16.2	42.8	198.6			104.7
UARS	HALOE	94 11 11 3 42 55	1155 4 31 56	45.4	225.6	-142.8	-22.9	40.3	194.9	410	1 16	147.7
ATLAS-3	CRISTA-144	94 11 11 6 29 56	7 13 30 13	26.5	176.2	-144.0	-16.2	42.6	175.8			104.4
UARS	HALOE	94 11 11 5 19 12	1155 6 8 5	45.6	201.5	-142.9	-22.9	40.5	170.7	483	1 10	147.5
ATLAS-3	CRISTA-144	94 11 11 8 0 6	7 15 0 23	27.2	152.7	-144.0	-16.2	43.3	152.2			103.8
UARS	HALOE	94 11 11 6 55 29	1155 7 44 24	45.8	177.4	-143.1	-22.9	40.7	146.5	551	1 4	147.3
ATLAS-3	CRISTA-144	94 11 11 8 53 36	7 15 53 53	0.1	338.7	-144.0	-16.2	-5.6	323.6			65.1
UARS	HALOE	94 11 11 7 28 44	1155 8 17 38	-2.6	308.8	-36.8	-22.9	-10.1	330.6	917	1 24	7.0
ATLAS-3	CRISTA-144	94 11 11 9 30 16	7 16 30 33	27.8	129.2	-144.0	-16.2	44.0	128.6			103.1
UARS	HALOE	94 11 11 8 31 46	1155 9 20 44	45.9	153.3	-143.3	-22.9	40.8	122.4	620	0 58	147.2
ATLAS-3	CRISTA-144	94 11 11 10 23 46	7 17 24 3	-0.6	315.3	-144.0	-16.2	-6.3	300.2			65.7
UARS	HALOE	94 11 11 9 5 3	1155 9 53 57	-2.9	284.6	-36.6	-22.9	-10.5	306.4	821	1 18	6.6
ATLAS-3	CRISTA-144	94 11 11 11 0 26	7 18 0 43	28.5	105.7	-144.0	-16.2	44.7	104.9			102.4
UARS	HALOE	94 11 11 10 8 3	1155 10 57 4	46.1	129.2	-143.5	-22.9	41.0	98.2	688	0 52	147.0
ATLAS-3	CRISTA-144	94 11 11 11 53 56	7 18 54 13	-1.4	291.9	-144.0	-16.2	-7.0	276.8			66.2
UARS	HALOE	94 11 11 10 41 22	1155 11 30 17	-3.3	260.4	-36.5	-22.9	-10.9	282.2	725	1 12	6.3
ATLAS-3	CRISTA-144	94 11 11 12 30 36	7 19 30 53	29.2	82.2	-144.0	-16.2	45.4	81.3			101.8
UARS	HALOE	94 11 11 11 44 20	1155 12 33 13	46.3	105.1	-143.7	-22.9	41.1	74.0	755	0 46	146.8
ATLAS-3	CRISTA-144	94 11 11 13 23 51	7 20 24 8	-2.9	268.1	-144.0	-16.2	-8.6	252.9			67.1
UARS	HALOE	94 11 11 12 17 40	1155 13 6 37	-3.6	236.2	-36.3	-22.9	-11.2	258.0	630	1 6	5.9
ATLAS-3	CRISTA-144	94 11 11 14 54 0	7 21 54 17	-3.7	244.7	-144.0	-16.2	-9.2	229.5			67.6
UARS	HALOE	94 11 11 13 53 59	1155 14 42 56	-3.9	212.0	-36.1	-22.9	-11.6	233.8	535	1 0	5.6
ATLAS-3	CRISTA-144	94 11 11 15 33 41	7 22 33 58	21.8	42.0	-144.0	-16.2	38.0	42.1			104.9
UARS	HALOE	94 11 11 13 20 37	1155 14 9 33	46.4	81.0	-143.9	-22.9	41.3	49.8	757	2 13	146.6
ATLAS-3	CRISTA-144	94 11 11 16 24 10	7 23 24 27	-4.4	221.4	-144.0	-16.2	-9.9	206.1			68.2
UARS	HALOE	94 11 11 15 30 18	1155 16 19 16	-4.2	187.8	-35.9	-22.9	-11.9	209.6	441	0 53	5.3
ATLAS-3	CRISTA-144	94 11 11 17 3 51	8 0 4 8	22.5	18.5	-144.0	-16.2	38.7	18.6			104.3
UARS	HALOE	94 11 11 14 56 53	1155 15 45 52	46.6	56.9	-144.1	-22.9	41.4	25.7	676	2 6	146.5
ATLAS-3	CRISTA-144	94 11 11 17 54 20	8 0 54 37	-5.1	198.0	-144.0	-16.2	-10.6	182.7			68.8
UARS	HALOE	94 11 11 17 6 36	1155 17 55 36	-4.6	163.6	-35.7	-22.9	-12.3	185.4	347	0 47	4.9
ATLAS-3	CRISTA-144	94 11 11 18 34 16	8 1 34 33	22.4	355.6	-144.0	-16.2	38.6	355.7			104.0
UARS	HALOE	94 11 11 16 33 10	1155 17 22 1	46.8	32.8	-144.2	-22.9	41.6	1.5	594	2 1	146.3
ATLAS-3	CRISTA-144	94 11 11 19 24 30	8 2 24 47	-5.8	174.6	-144.0	-16.2	-11.3	159.3			69.4
UARS	HALOE	94 11 11 18 42 55	1155 19 31 56	-4.9	139.4	-35.5	-22.9	-12.7	161.2	254	0 41	4.6
ATLAS-3	CRISTA-144	94 11 11 20 4 26	8 3 4 43	23.1	332.2	-144.0	-16.2	39.3	332.2			103.3
UARS	HALOE	94 11 11 18 9 27	1155 18 58 21	46.9	8.7	-144.4	-22.9	41.7	337.3	512	1 54	146.1
ATLAS-3	CRISTA-144	94 11 11 20 54 40	8 3 54 57	-6.6	151.2	-144.0	-16.2	-12.0	135.9			70.0
UARS	HALOE	94 11 11 20 19 13	1155 21 8 5	-5.2	115.2	-35.3	-22.9	-13.0	137.0	165	0 35	4.3
ATLAS-3	CRISTA-144	94 11 11 21 34 36	8 4 34 53	23.8	308.7	-144.0	-16.2	40.0	308.6			102.7
UARS	HALOE	94 11 11 19 45 44	1155 20 34 41	47.1	344.6	-144.6	-22.9	41.9	313.1	432	1 48	146.0
ATLAS-3	CRISTA-144	94 11 11 22 24 50	8 5 25 7	-7.3	127.9	-144.0	-16.2	-12.7	112.5			70.6
UARS	HALOE	94 11 11 21 55 32	1155 22 44 24	-5.5	91.0	-35.1	-22.9	-13.4	112.8	85	0 29	4.0

Appendix 3. 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-3	CRISTA-144	94	11	11	23	4	46	8	6	5	3	24.5	285.3	-144.0	-16.2	40.7	285.1				102.1
UARS	HALOE	94	11	11	21	22	0	1155	22	11	0	47.2	320.5	-144.8	-22.9	42.0	289.0	356	1	42	145.8
ATLAS-3	CRISTA-144	94	11	11	23	54	44	8	6	55	1	-8.9	104.0	-144.0	-16.2	-14.2	88.5				71.5
UARS	HALOE	94	11	11	23	31	50	1156	0	20	44	-5.8	66.8	-34.9	-22.9	-13.7	88.6	48	0	22	3.7
ATLAS-3	CRISTA-144	94	11	12	0	35	10	8	7	35	27	24.4	262.4	-144.0	-16.2	40.6	262.2				101.8
UARS	HALOE	94	11	11	22	58	17	1155	23	47	10	47.4	296.5	-145.0	-22.9	42.2	264.8	278	1	36	145.7
ATLAS-3	CRISTA-144	94	11	12	1	24	54	8	8	25	11	-9.6	80.6	-144.0	-16.2	-14.8	65.0				72.1
UARS	HALOE	94	11	12	1	8	9	1156	1	57	4	-6.1	42.6	-34.7	-22.9	-14.1	64.4	108	0	16	3.4
ATLAS-3	CRISTA-144	94	11	12	2	5	20	8	9	5	37	25.1	238.9	-144.0	-16.2	41.3	238.7				101.2
UARS	HALOE	94	11	12	0	34	34	1156	1	23	29	47.5	272.4	-145.2	-22.9	42.3	240.6	198	1	30	145.5

Appendix 4. Correlative measurement opportunities between ATLAS-3 (CRISTA-162 or MAHRSI) 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-3	CRISTA-162	94	11	5	17	58	2	2	0	58	19	4.9	51.1	-162.0	-16.4	20.7	46.5				143.6
UARS	HALOE	94	11	5	14	29	47	1149	15	18	48	23.8	67.0	-134.3	-22.9	18.9	42.9	420	3	28	171.7
ATLAS-3	CRISTA-162	94	11	5	19	28	22	2	2	28	39	5.6	27.7	-162.0	-16.4	21.4	23.0				143.0
UARS	HALOE	94	11	5	16	6	6	1149	16	54	57	24.1	42.8	-134.3	-22.9	19.2	18.7	507	3	22	171.4
ATLAS-3	CRISTA-162	94	11	5	20	58	42	2	3	58	59	6.3	4.2	-162.0	-16.4	22.1	359.5				142.5
UARS	HALOE	94	11	5	17	42	25	1149	18	31	17	24.5	18.7	-134.4	-22.9	19.6	354.5	594	3	16	171.1
ATLAS-3	CRISTA-162	94	11	5	22	28	46	2	5	29	3	7.4	340.6	-162.0	-16.3	23.1	336.0				141.8
UARS	HALOE	94	11	5	19	18	45	1149	20	7	37	24.8	354.6	-134.4	-22.9	19.9	330.4	680	3	10	170.7
ATLAS-3	CRISTA-162	94	11	5	23	59	1	2	6	59	18	8.1	317.2	-162.0	-16.3	23.8	312.5				141.2
UARS	HALOE	94	11	5	20	55	4	1149	21	43	56	25.1	330.4	-134.4	-22.9	20.2	306.2	767	3	3	170.4
ATLAS-3	CRISTA-162	94	11	6	0	55	35	2	7	55	52	29.1	149.3	-162.0	-16.3	19.3	134.9				46.6
UARS	HALOE	94	11	5	21	26	34	1149	22	15	35	26.1	106.1	-45.6	-22.9	21.3	130.6	503	3	29	36.7
ATLAS-3	CRISTA-162	94	11	6	1	29	16	2	8	29	33	8.8	293.8	-162.0	-16.3	24.5	289.1				140.6
UARS	HALOE	94	11	5	22	31	23	1149	23	20	16	25.5	306.3	-134.4	-22.9	20.6	282.0	852	2	57	170.0
ATLAS-3	CRISTA-162	94	11	6	2	25	50	2	9	26	7	28.4	125.8	-162.0	-16.3	18.6	111.5				46.2
UARS	HALOE	94	11	5	23	2	53	1149	23	51	54	25.8	82.0	-45.6	-22.9	20.9	106.4	595	3	22	36.3
ATLAS-3	CRISTA-162	94	11	6	2	59	31	2	9	59	48	9.5	270.4	-162.0	-16.3	25.2	265.6				139.9
UARS	HALOE	94	11	6	0	7	42	1150	0	56	36	25.8	282.2	-134.4	-22.9	20.9	257.8	938	2	51	169.7
ATLAS-3	CRISTA-162	94	11	6	3	56	5	2	10	56	22	27.7	102.3	-162.0	-16.3	17.9	88.1				45.9
UARS	HALOE	94	11	6	0	39	13	1150	1	28	3	25.4	57.9	-45.6	-22.9	20.6	82.2	688	3	16	36.0
ATLAS-3	CRISTA-162	94	11	6	5	26	20	2	12	26	37	27.0	78.8	-162.0	-16.3	17.2	64.7				45.5
UARS	HALOE	94	11	6	2	15	32	1150	3	4	23	25.1	33.7	-45.5	-22.9	20.2	58.0	782	3	10	35.7
ATLAS-3	CRISTA-162	94	11	6	6	56	20	2	13	56	37	25.5	54.6	-162.0	-16.3	15.6	40.8				44.7
UARS	HALOE	94	11	6	3	51	52	1150	4	40	43	24.7	9.6	-45.5	-22.9	19.8	33.8	875	3	4	35.3
ATLAS-3	CRISTA-162	94	11	6	8	26	35	2	15	26	52	24.9	31.1	-162.0	-16.3	14.9	17.4				44.5
UARS	HALOE	94	11	6	5	28	11	1150	6	17	3	24.4	345.5	-45.5	-22.9	19.4	9.6	969	2	58	35.0
ATLAS-3	CRISTA-162	94	11	6	19	35	18	3	2	35	35	7.5	18.9	-162.0	-16.3	23.2	14.3				137.0
UARS	HALOE	94	11	6	16	10	53	1150	16	59	52	29.0	40.9	-134.8	-22.9	24.2	15.8	186	3	24	166.2
ATLAS-3	CRISTA-162	94	11	6	21	5	34	3	4	5	51	8.2	355.5	-162.0	-16.3	23.9	350.9				136.4
UARS	HALOE	94	11	6	17	47	12	1150	18	36	12	29.3	16.7	-134.8	-22.9	24.5	351.6	98	3	18	165.8
ATLAS-3	CRISTA-162	94	11	6	22	35	49	3	5	36	6	8.9	332.1	-162.0	-16.3	24.6	327.4				135.8
UARS	HALOE	94	11	6	19	23	30	1150	20	12	21	29.7	352.6	-134.9	-22.9	24.8	327.4	24	3	12	165.5
ATLAS-3	CRISTA-162	94	11	7	0	6	4	3	7	6	21	9.7	308.7	-162.0	-16.3	25.3	304.0				135.1
UARS	HALOE	94	11	6	20	59	49	1150	21	48	41	30.0	328.5	-135.0	-22.9	25.1	303.2	83	3	6	165.1
ATLAS-3	CRISTA-162	94	11	7	1	36	19	3	8	36	36	10.4	285.3	-162.0	-16.3	26.1	280.5				134.5
UARS	HALOE	94	11	6	22	36	8	1150	23	25	1	30.3	304.4	-135.0	-22.9	25.5	279.0	168	3	0	164.8
ATLAS-3	CRISTA-162	94	11	7	2	32	38	3	9	32	55	26.1	116.5	-162.0	-16.3	16.2	102.5				47.1
UARS	HALOE	94	11	6	23	7	47	1150	23	56	39	20.5	80.0	-45.0	-22.9	15.2	103.5	149	3	24	31.2
ATLAS-3	CRISTA-162	94	11	7	3	6	34	3	10	6	51	11.1	261.9	-162.0	-16.3	26.8	257.1				133.8
UARS	HALOE	94	11	7	0	12	27	1151	1	1	20	30.6	280.2	-135.1	-22.9	25.8	254.8	252	2	54	164.4
ATLAS-3	CRISTA-162	94	11	7	4	2	38	3	11	2	55	24.6	92.3	-162.0	-16.3	14.6	78.6				46.5
UARS	HALOE	94	11	7	0	44	7	1151	1	32	59	20.1	55.9	-44.9	-22.9	14.8	79.3	69	3	18	30.8
ATLAS-3	CRISTA-162	94	11	7	4	36	49	3	11	37	6	11.8	238.5	-162.0	-16.3	27.5	233.6				133.1
UARS	HALOE	94	11	7	1	48	46	1151	2	37	40	30.9	256.1	-135.1	-22.9	26.1	230.6	336	2	48	164.1

Appendix 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-3	CRISTA-162	94 11 7 5 32 53	3 12 33 10	23.9	68.9	-162.0	-16.3	13.9	55.2			46.4
UARS	HALOE	94 11 7 2 20 26	1151 3 9 18	19.7	31.7	-44.9	-22.9	14.4	55.1	57	3 12	30.4
ATLAS-3	CRISTA-162	94 11 7 6 7 4	3 13 7 21	12.6	215.1	-162.0	-16.3	28.2	210.1			132.5
UARS	HALOE	94 11 7 3 25 4	1151 4 14 0	31.2	232.0	-135.2	-22.9	26.4	206.4	420	2 41	163.7
ATLAS-3	CRISTA-162	94 11 7 7 3 8	3 14 3 25	23.2	45.4	-162.0	-16.3	13.2	31.8			46.3
UARS	HALOE	94 11 7 3 56 46	1151 4 45 38	19.4	7.6	-44.8	-22.9	14.0	30.9	139	3 6	30.1
ATLAS-3	CRISTA-162	94 11 7 7 37 19	3 14 37 36	13.3	191.7	-162.0	-16.3	28.9	186.6			131.8
UARS	HALOE	94 11 7 5 1 23	1151 5 50 19	31.5	207.9	-135.3	-22.9	26.7	182.2	502	2 35	163.4
ATLAS-3	CRISTA-162	94 11 7 8 33 23	3 15 33 40	22.5	21.9	-162.0	-16.3	12.5	8.4			46.2
UARS	HALOE	94 11 7 5 33 5	1151 6 21 58	19.0	343.5	-44.7	-22.9	13.6	6.7	232	3 0	29.7
ATLAS-3	CRISTA-162	94 11 7 9 7 34	3 16 7 52	14.0	168.3	-162.0	-16.3	29.6	163.1			131.1
UARS	HALOE	94 11 7 6 37 42	1151 7 26 39	31.8	183.7	-135.3	-22.9	27.0	158.0	583	2 29	163.0
ATLAS-3	CRISTA-162	94 11 7 10 3 38	3 17 3 55	21.8	358.4	-162.0	-16.3	11.7	345.1			46.1
UARS	HALOE	94 11 7 7 9 25	1151 7 58 18	18.6	319.3	-44.7	-22.9	13.2	342.5	326	2 54	29.4
ATLAS-3	CRISTA-162	94 11 7 10 37 50	3 17 38 7	14.7	144.8	-162.0	-16.3	30.3	139.6			130.4
UARS	HALOE	94 11 7 8 14 1	1151 9 2 59	32.1	159.6	-135.4	-22.9	27.3	133.8	663	2 23	162.7
ATLAS-3	CRISTA-162	94 11 7 11 33 53	3 18 34 10	21.1	335.0	-162.0	-16.3	11.0	321.7			46.1
UARS	HALOE	94 11 7 8 45 45	1151 9 34 37	18.3	295.2	-44.6	-22.9	12.8	318.3	420	2 48	29.0
ATLAS-3	CRISTA-162	94 11 7 12 8 5	3 19 8 22	15.4	121.4	-162.0	-16.3	31.0	116.1			129.7
UARS	HALOE	94 11 7 9 50 19	1151 10 39 18	32.4	135.5	-135.5	-22.9	27.6	109.6	742	2 17	162.4
ATLAS-3	CRISTA-162	94 11 7 13 4 8	3 20 4 25	20.4	311.5	-162.0	-16.3	10.3	298.3			46.1
UARS	HALOE	94 11 7 10 22 4	1151 11 10 57	17.9	271.0	-44.5	-22.9	12.4	294.1	517	2 42	28.6
ATLAS-3	CRISTA-162	94 11 7 13 38 5	3 20 38 22	17.0	97.5	-162.0	-16.3	32.5	92.0			128.5
UARS	HALOE	94 11 7 11 26 38	1151 12 15 38	32.6	111.4	-135.5	-22.9	27.9	85.4	820	2 11	162.0
ATLAS-3	CRISTA-162	94 11 7 14 34 24	3 21 34 41	19.7	288.1	-162.0	-16.3	9.5	274.9			46.1
UARS	HALOE	94 11 7 11 58 24	1151 12 47 17	17.5	246.9	-44.4	-22.9	12.0	269.9	613	2 35	28.3
ATLAS-3	CRISTA-162	94 11 7 15 8 20	3 22 8 37	17.7	74.0	-162.0	-16.3	33.2	68.5			127.8
UARS	HALOE	94 11 7 13 2 56	1151 13 51 47	32.9	87.3	-135.6	-22.9	28.1	61.2	895	2 5	161.7
ATLAS-3	CRISTA-162	94 11 7 16 4 39	3 23 4 56	19.0	264.6	-162.0	-16.3	8.8	251.5			46.1
UARS	HALOE	94 11 7 13 34 44	1151 14 23 36	17.2	222.7	-44.4	-22.9	11.7	245.7	710	2 29	27.9
ATLAS-3	CRISTA-162	94 11 7 16 38 35	3 23 38 52	18.4	50.6	-162.0	-16.3	33.9	44.9			127.0
UARS	HALOE	94 11 7 14 39 15	1151 15 28 7	33.2	63.1	-135.7	-22.9	28.4	37.0	970	1 59	161.4
ATLAS-3	CRISTA-162	94 11 7 17 34 54	4 0 35 11	18.3	241.2	-162.0	-16.3	8.1	228.1			46.2
UARS	HALOE	94 11 7 15 11 3	1151 15 59 56	16.8	198.6	-44.3	-22.9	11.3	221.5	806	2 23	27.5
ATLAS-3	CRISTA-162	94 11 7 19 4 54	4 2 5 11	16.8	217.2	-162.0	-16.3	6.5	204.2			46.1
UARS	HALOE	94 11 7 16 47 23	1151 17 36 16	16.4	174.4	-44.2	-22.9	10.9	197.3	903	2 17	27.2
ATLAS-3	CRISTA-162	94 11 7 19 42 21	4 2 42 38	9.1	10.5	-162.0	-16.3	24.7	5.8			130.9
UARS	HALOE	94 11 7 16 15 33	1151 17 4 27	33.5	39.0	-135.8	-22.9	28.7	12.8	827	3 26	161.0
ATLAS-3	CRISTA-162	94 11 7 21 12 36	4 4 12 53	9.8	347.1	-162.0	-16.3	25.5	342.3			130.3
UARS	HALOE	94 11 7 17 51 52	1151 18 40 46	33.8	14.9	-135.9	-22.9	29.0	348.6	736	3 20	160.7
ATLAS-3	CRISTA-162	94 11 7 22 42 52	4 5 43 9	10.5	323.7	-162.0	-16.3	26.2	318.8			129.7
UARS	HALOE	94 11 7 19 28 10	1151 20 17 6	34.1	350.8	-136.0	-22.9	29.3	324.4	647	3 14	160.4
ATLAS-3	CRISTA-162	94 11 8 0 13 7	4 7 13 24	11.2	300.3	-162.0	-16.3	26.9	295.4			129.0
UARS	HALOE	94 11 7 21 4 29	1151 21 53 26	34.3	326.7	-136.0	-22.9	29.6	300.2	558	3 8	160.1

Appendix 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-3	CRISTA-162	94	11	8	1	43	19	4	8	43	36	12.3	276.6	-162.0	-16.3	27.9	271.7				128.2
UARS	HALOE	94	11	7	22	40	47	1151	23	29	45	34.6	302.6	-136.1	-22.9	29.8	276.0	474	3	2	159.7
ATLAS-3	CRISTA-162	94	11	8	2	39	21	4	9	39	38	23.4	106.9	-162.0	-16.3	13.4	93.4				49.0
UARS	HALOE	94	11	7	23	12	41	1152	0	1	34	15.0	77.8	-43.8	-22.9	9.3	100.5	904	3	26	25.7
ATLAS-3	CRISTA-162	94	11	8	3	13	32	4	10	13	49	13.1	253.2	-162.0	-16.3	28.6	248.2				127.5
UARS	HALOE	94	11	8	0	17	6	1152	1	6	5	34.9	278.4	-136.2	-22.9	30.1	251.8	388	2	56	159.4
ATLAS-3	CRISTA-162	94	11	8	4	9	35	4	11	9	52	22.7	83.5	-162.0	-16.3	12.7	70.0				49.0
UARS	HALOE	94	11	8	0	49	1	1152	1	37	54	14.6	53.6	-43.8	-22.9	8.9	76.3	811	3	20	25.3
ATLAS-3	CRISTA-162	94	11	8	4	43	46	4	11	44	3	13.8	229.8	-162.0	-16.3	29.3	224.7				126.8
UARS	HALOE	94	11	8	1	53	24	1152	2	42	25	35.2	254.3	-136.3	-22.9	30.4	227.6	304	2	50	159.1
ATLAS-3	CRISTA-162	94	11	8	5	39	49	4	12	40	6	22.0	60.0	-162.0	-16.3	12.0	46.6				49.1
UARS	HALOE	94	11	8	2	25	21	1152	3	14	14	14.2	29.5	-43.7	-22.9	8.5	52.1	717	3	14	25.0
ATLAS-3	CRISTA-162	94	11	8	6	14	14	4	13	14	31	13.7	206.9	-162.0	-16.3	29.2	201.8				126.5
UARS	HALOE	94	11	8	3	29	42	1152	4	18	34	35.4	230.2	-136.4	-22.9	30.6	203.4	220	2	44	158.8
ATLAS-3	CRISTA-162	94	11	8	7	10	2	4	14	10	19	21.3	36.6	-162.0	-16.3	11.3	23.2				49.1
UARS	HALOE	94	11	8	4	1	40	1152	4	50	33	13.9	5.3	-43.6	-22.9	8.1	27.9	624	3	8	24.6
ATLAS-3	CRISTA-162	94	11	8	7	44	28	4	14	44	45	14.4	183.5	-162.0	-16.3	29.9	178.3				125.9
UARS	HALOE	94	11	8	5	6	0	1152	5	54	54	35.7	206.1	-136.5	-22.9	30.9	179.2	137	2	38	158.5
ATLAS-3	CRISTA-162	94	11	8	8	40	1	4	15	40	18	19.8	12.6	-162.0	-16.3	9.7	359.3				49.0
UARS	HALOE	94	11	8	5	38	0	1152	6	26	53	13.5	341.2	-43.5	-22.9	7.7	3.7	529	3	2	24.2
ATLAS-3	CRISTA-162	94	11	8	9	14	42	4	16	14	59	15.1	160.1	-162.0	-16.3	30.6	154.8				125.2
UARS	HALOE	94	11	8	6	42	19	1152	7	31	13	36.0	182.0	-136.6	-22.9	31.2	155.0	60	2	32	158.2
ATLAS-3	CRISTA-162	94	11	8	10	10	14	4	17	10	31	19.1	349.1	-162.0	-16.3	9.0	336.0				49.1
UARS	HALOE	94	11	8	7	14	19	1152	8	3	13	13.1	317.0	-43.4	-22.9	7.3	339.5	433	2	55	23.8
ATLAS-3	CRISTA-162	94	11	8	10	44	55	4	17	45	12	15.8	136.7	-162.0	-16.3	31.3	131.3				124.5
UARS	HALOE	94	11	8	8	18	37	1152	9	7	33	36.2	157.9	-136.7	-22.9	31.4	130.8	48	2	26	157.9
ATLAS-3	CRISTA-162	94	11	8	11	40	28	4	18	40	45	18.4	325.7	-162.0	-16.3	8.2	312.6				49.2
UARS	HALOE	94	11	8	8	50	39	1152	9	39	33	12.8	292.8	-43.3	-22.9	6.9	315.3	336	2	49	23.5
ATLAS-3	CRISTA-162	94	11	8	12	15	9	4	19	15	26	16.5	113.3	-162.0	-16.3	32.0	107.8				123.8
UARS	HALOE	94	11	8	9	54	55	1152	10	43	53	36.5	133.8	-136.8	-22.9	31.7	106.6	119	2	20	157.6
ATLAS-3	CRISTA-162	94	11	8	13	10	41	4	20	10	58	17.7	302.2	-162.0	-16.3	7.5	289.2				49.4
UARS	HALOE	94	11	8	10	26	59	1152	11	15	52	12.4	268.7	-43.1	-22.9	6.5	291.1	239	2	43	23.1
ATLAS-3	CRISTA-162	94	11	8	13	45	22	4	20	45	39	17.2	89.8	-162.0	-16.3	32.7	84.3				123.1
UARS	HALOE	94	11	8	11	31	13	1152	12	20	12	36.8	109.7	-136.9	-22.9	31.9	82.4	197	2	14	157.3
ATLAS-3	CRISTA-162	94	11	8	14	40	55	4	21	41	12	17.0	278.8	-162.0	-16.3	6.8	265.8				49.5
UARS	HALOE	94	11	8	12	3	18	1152	12	52	12	12.1	244.5	-43.0	-22.9	6.1	266.9	142	2	37	22.7
ATLAS-3	CRISTA-162	94	11	8	15	15	36	4	22	15	53	18.0	66.4	-162.0	-16.3	33.4	60.8				122.3
UARS	HALOE	94	11	8	13	7	31	1152	13	56	32	37.0	85.5	-137.0	-22.9	32.2	58.2	274	2	8	157.0
ATLAS-3	CRISTA-162	94	11	8	16	11	9	4	23	11	26	16.3	255.4	-162.0	-16.3	6.0	242.4				49.7
UARS	HALOE	94	11	8	13	39	38	1152	14	28	32	11.7	220.4	-42.9	-22.9	5.7	242.7	49	2	31	22.3
ATLAS-3	CRISTA-162	94	11	8	16	45	50	4	23	46	7	18.7	43.0	-162.0	-16.3	34.1	37.3				121.6
UARS	HALOE	94	11	8	14	43	49	1152	15	32	41	37.3	61.4	-137.2	-22.9	32.4	34.1	351	2	2	156.7
ATLAS-3	CRISTA-162	94	11	8	17	41	22	5	0	41	39	15.5	232.0	-162.0	-16.3	5.3	219.1				49.9
UARS	HALOE	94	11	8	15	15	57	1152	16	4	51	11.3	196.2	-42.8	-22.9	5.3	218.5	60	2	25	22.0

Appendix 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-3	CRISTA-162	94 11 8 18 16 3	5 1 16 20	19.4	19.5	-162.0	-16.3	34.8	13.7			120.9
UARS	HALOE	94 11 8 16 20 8	1152 17 9 1	37.5	37.3	-137.3	-22.9	32.7	9.9	427	1 55	156.4
ATLAS-3	CRISTA-162	94 11 8 19 11 36	5 2 11 53	14.8	208.6	-162.0	-16.3	4.6	195.7			50.1
UARS	HALOE	94 11 8 16 52 17	1152 17 41 11	11.0	172.0	-42.7	-22.9	4.9	194.3	155	2 19	21.6
ATLAS-3	CRISTA-162	94 11 8 19 46 17	5 2 46 34	20.1	356.1	-162.0	-16.3	35.5	350.2			120.2
UARS	HALOE	94 11 8 17 56 25	1152 18 45 21	37.8	13.2	-137.4	-22.9	32.9	345.7	502	1 49	156.1
ATLAS-3	CRISTA-162	94 11 8 20 41 34	5 3 41 51	13.3	184.6	-162.0	-16.3	3.0	171.8			50.3
UARS	HALOE	94 11 8 18 28 36	1152 19 17 31	10.6	147.8	-42.6	-22.9	4.5	170.1	250	2 12	21.2
ATLAS-3	CRISTA-162	94 11 8 21 16 30	5 4 16 47	20.8	332.7	-162.0	-16.3	36.2	326.6			119.5
UARS	HALOE	94 11 8 19 32 44	1152 20 21 40	38.0	349.1	-137.5	-22.9	33.2	321.5	575	1 43	155.9
ATLAS-3	CRISTA-162	94 11 8 22 11 48	5 5 12 5	12.6	161.2	-162.0	-16.3	2.3	148.4			50.6
UARS	HALOE	94 11 8 20 4 56	1152 20 53 50	10.2	123.7	-42.5	-22.9	4.1	145.9	344	2 6	20.8
ATLAS-3	CRISTA-162	94 11 8 22 46 44	5 5 47 1	21.5	309.2	-162.0	-16.3	36.9	303.0			118.7
UARS	HALOE	94 11 8 21 9 2	1152 21 58 0	38.3	325.0	-137.6	-22.9	33.4	297.3	648	1 37	155.6
ATLAS-3	CRISTA-162	94 11 8 23 42 1	5 6 42 18	11.8	137.8	-162.0	-16.3	1.6	125.1			50.9
UARS	HALOE	94 11 8 21 41 15	1152 22 30 10	9.9	99.5	-42.3	-22.9	3.7	121.7	440	2 0	20.4
ATLAS-3	CRISTA-162	94 11 9 0 16 57	5 7 17 14	22.2	285.7	-162.0	-16.3	37.6	279.4			118.0
UARS	HALOE	94 11 8 22 45 20	1152 23 34 20	38.5	300.9	-137.7	-22.9	33.7	273.1	718	1 31	155.3
ATLAS-3	CRISTA-162	94 11 9 1 12 15	5 8 12 32	11.1	114.4	-162.0	-16.3	0.8	101.7			51.2
UARS	HALOE	94 11 8 23 17 35	1153 0 6 30	9.5	75.3	-42.2	-22.9	3.3	97.5	537	1 54	20.1
ATLAS-3	CRISTA-162	94 11 9 1 47 11	5 8 47 28	22.9	262.3	-162.0	-16.3	38.2	255.8			117.3
UARS	HALOE	94 11 9 0 21 38	1153 1 10 29	38.8	276.8	-137.9	-22.9	33.9	248.9	788	1 25	155.0
ATLAS-3	CRISTA-162	94 11 9 2 42 29	5 9 42 46	10.4	91.0	-162.0	-16.3	0.1	78.3			51.6
UARS	HALOE	94 11 9 0 53 54	1153 1 42 49	9.1	51.2	-42.1	-22.9	2.9	73.3	634	1 48	19.7
ATLAS-3	CRISTA-162	94 11 9 3 17 25	5 10 17 42	23.6	238.8	-162.0	-16.3	38.9	232.2			116.5
UARS	HALOE	94 11 9 1 57 55	1153 2 46 48	39.0	252.7	-138.0	-22.9	34.1	224.7	857	1 19	154.8
ATLAS-3	CRISTA-162	94 11 9 4 12 42	5 11 12 59	9.7	67.6	-162.0	-16.3	-0.6	54.9			51.9
UARS	HALOE	94 11 9 2 30 13	1153 3 19 9	8.8	27.0	-42.0	-22.9	2.5	49.1	732	1 42	19.3
ATLAS-3	CRISTA-162	94 11 9 5 42 56	5 12 43 13	8.9	44.2	-162.0	-16.3	-1.3	31.5			52.3
UARS	HALOE	94 11 9 4 6 33	1153 4 55 29	8.4	2.8	-41.8	-22.9	2.1	24.9	829	1 36	18.9
ATLAS-3	CRISTA-162	94 11 9 6 20 53	5 13 21 10	15.2	198.5	-162.0	-16.3	30.8	193.2			120.4
UARS	HALOE	94 11 9 3 34 13	1153 4 23 8	39.2	228.6	-138.1	-22.9	34.4	200.5	790	2 46	154.5
ATLAS-3	CRISTA-162	94 11 9 7 12 54	5 14 13 11	7.4	20.3	-162.0	-16.3	-2.9	7.7			52.8
UARS	HALOE	94 11 9 5 42 52	1153 6 31 48	8.1	338.6	-41.7	-22.9	1.7	0.7	926	1 30	18.6
ATLAS-3	CRISTA-162	94 11 9 7 51 6	5 14 51 23	15.9	175.1	-162.0	-16.3	31.5	169.7			119.7
UARS	HALOE	94 11 9 5 10 31	1153 5 59 28	39.5	204.5	-138.2	-22.9	34.6	176.3	705	2 40	154.2
ATLAS-3	CRISTA-162	94 11 9 9 21 20	5 16 21 37	16.7	151.7	-162.0	-16.3	32.2	146.2			119.1
UARS	HALOE	94 11 9 6 46 49	1153 7 35 48	39.7	180.4	-138.4	-22.9	34.8	152.1	621	2 34	154.0
ATLAS-3	CRISTA-162	94 11 9 10 51 34	5 17 51 51	17.4	128.3	-162.0	-16.3	32.9	122.7			118.4
UARS	HALOE	94 11 9 8 23 6	1153 9 12 7	39.9	156.3	-138.5	-22.9	35.1	127.9	539	2 28	153.7
ATLAS-3	CRISTA-162	94 11 9 12 22 2	5 19 22 19	17.3	105.4	-162.0	-16.3	32.8	99.8			118.1
UARS	HALOE	94 11 9 9 59 24	1153 10 48 16	40.2	132.2	-138.6	-22.9	35.3	103.7	456	2 22	153.4
ATLAS-3	CRISTA-162	94 11 9 13 52 16	5 20 52 33	18.0	81.9	-162.0	-16.3	33.5	76.3			117.4
UARS	HALOE	94 11 9 11 35 42	1153 12 24 36	40.4	108.1	-138.8	-22.9	35.5	79.5	374	2 16	153.2

Appendix 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-3	CRISTA-162	94	11	9	14	47	18	5	21	47	35	14.6	269.9	-162.0	-16.3	4.3	257.0				53.9
UARS	HALOE	94	11	9	12	8	10	1153	12	57	7	6.6	241.9	-41.2	-22.9	0.2	263.9	901	2	39	17.0
ATLAS-3	CRISTA-162	94	11	9	15	22	29	5	22	22	46	18.7	58.5	-162.0	-16.3	34.2	52.8				116.7
UARS	HALOE	94	11	9	13	12	0	1153	14	0	56	40.6	83.9	-138.9	-22.9	35.7	55.4	293	2	10	152.9
ATLAS-3	CRISTA-162	94	11	9	16	17	32	5	23	17	49	13.9	246.5	-162.0	-16.3	3.6	233.6				54.2
UARS	HALOE	94	11	9	13	44	29	1153	14	33	27	6.3	217.8	-41.0	-22.9	-0.2	239.7	804	2	33	16.7
ATLAS-3	CRISTA-162	94	11	9	16	52	43	5	23	53	0	19.4	35.1	-162.0	-16.3	34.8	29.2				116.0
UARS	HALOE	94	11	9	14	48	17	1153	15	37	15	40.8	59.8	-139.1	-22.9	35.9	31.2	213	2	4	152.7
ATLAS-3	CRISTA-162	94	11	9	17	47	45	6	0	48	2	13.2	223.1	-162.0	-16.3	2.9	210.3				54.5
UARS	HALOE	94	11	9	15	20	48	1153	16	9	47	5.9	193.6	-40.9	-22.9	-0.6	215.5	707	2	26	16.3
ATLAS-3	CRISTA-162	94	11	9	18	22	57	6	1	23	14	20.1	11.6	-162.0	-16.3	35.5	5.7				115.3
UARS	HALOE	94	11	9	16	24	35	1153	17	13	35	41.1	35.7	-139.2	-22.9	36.2	7.0	136	1	58	152.4
ATLAS-3	CRISTA-162	94	11	9	19	17	44	6	2	18	1	11.6	199.1	-162.0	-16.3	1.3	186.4				54.9
UARS	HALOE	94	11	9	16	57	8	1153	17	46	6	5.6	169.4	-40.8	-22.9	-1.0	191.4	610	2	20	15.9
ATLAS-3	CRISTA-162	94	11	9	19	52	54	6	2	53	11	20.9	348.2	-162.0	-16.2	36.2	342.2				114.6
UARS	HALOE	94	11	9	18	0	52	1153	18	49	44	41.3	11.6	-139.3	-22.9	36.4	342.8	55	1	52	152.2
ATLAS-3	CRISTA-162	94	11	9	20	47	39	6	3	47	56	10.8	175.7	-162.0	-16.2	0.6	163.2				55.2
UARS	HALOE	94	11	9	18	33	27	1153	19	22	26	5.2	145.2	-40.6	-22.9	-1.4	167.2	498	2	14	15.5
ATLAS-3	CRISTA-162	94	11	9	21	23	4	6	4	23	21	21.6	324.7	-162.0	-16.2	36.9	318.7				113.9
UARS	HALOE	94	11	9	19	37	10	1153	20	26	4	41.5	347.5	-139.5	-22.9	36.6	318.6	31	1	45	151.9
ATLAS-3	CRISTA-162	94	11	9	22	17	49	6	5	18	6	10.1	152.3	-162.0	-16.2	-0.1	139.8				55.6
UARS	HALOE	94	11	9	20	9	46	1153	20	58	46	4.9	121.0	-40.5	-22.9	-1.8	143.0	398	2	8	15.2
ATLAS-3	CRISTA-162	94	11	9	22	53	14	6	5	53	31	22.3	301.3	-162.0	-16.2	37.5	295.1				113.2
UARS	HALOE	94	11	9	21	13	27	1153	22	2	24	41.7	323.4	-139.6	-22.9	36.8	294.4	103	1	39	151.7
ATLAS-3	CRISTA-162	94	11	9	23	47	59	6	6	48	16	9.4	129.0	-162.0	-16.2	-0.8	116.4				56.0
UARS	HALOE	94	11	9	21	46	5	1153	22	35	5	4.5	96.8	-40.3	-22.9	-2.2	118.8	299	2	1	14.8
ATLAS-3	CRISTA-162	94	11	10	0	23	24	6	7	23	41	23.0	277.8	-162.0	-16.2	38.2	271.5				112.5
UARS	HALOE	94	11	9	22	49	45	1153	23	38	43	41.9	299.3	-139.8	-22.9	37.0	270.2	177	1	33	151.5
ATLAS-3	CRISTA-162	94	11	10	1	18	9	6	8	18	26	8.7	105.6	-162.0	-16.2	-1.6	93.1				56.4
UARS	HALOE	94	11	9	23	22	25	1154	0	11	25	4.2	72.7	-40.2	-22.9	-2.6	94.6	201	1	55	14.4
ATLAS-3	CRISTA-162	94	11	10	1	53	33	6	8	53	50	23.7	254.4	-162.0	-16.2	38.9	247.9				111.8
UARS	HALOE	94	11	10	0	26	2	1154	1	15	3	42.1	275.2	-139.9	-22.9	37.2	246.0	250	1	27	151.2
ATLAS-3	CRISTA-162	94	11	10	2	48	19	6	9	48	36	7.9	82.2	-162.0	-16.2	-2.3	69.7				56.8
UARS	HALOE	94	11	10	0	58	44	1154	1	47	45	3.8	48.5	-40.0	-22.9	-3.0	70.4	105	1	49	14.0
ATLAS-3	CRISTA-162	94	11	10	3	23	58	6	10	24	15	23.6	231.5	-162.0	-16.2	38.8	225.1				111.6
UARS	HALOE	94	11	10	2	2	20	1154	2	51	12	42.3	251.1	-140.1	-22.9	37.4	221.8	321	1	21	151.0
ATLAS-3	CRISTA-162	94	11	10	4	18	28	6	11	18	45	7.2	58.8	-162.0	-16.2	-3.0	46.3				57.2
UARS	HALOE	94	11	10	2	35	3	1154	3	23	54	3.5	24.3	-39.9	-22.9	-3.3	46.2	41	1	43	13.6
ATLAS-3	CRISTA-162	94	11	10	4	54	8	6	11	54	25	24.3	208.0	-162.0	-16.2	39.4	201.5				110.9
UARS	HALOE	94	11	10	3	38	37	1154	4	27	32	42.5	227.0	-140.3	-22.9	37.6	197.7	390	1	15	150.8
ATLAS-3	CRISTA-162	94	11	10	5	48	23	6	12	48	40	5.6	35.0	-162.0	-16.2	-4.6	22.5				57.8
UARS	HALOE	94	11	10	4	11	22	1154	5	0	14	3.1	0.1	-39.7	-22.9	-3.7	22.0	106	1	37	13.3
ATLAS-3	CRISTA-162	94	11	10	6	24	18	6	13	24	35	25.0	184.6	-162.0	-16.2	40.1	177.9				110.2
UARS	HALOE	94	11	10	5	14	55	1154	6	3	52	42.7	202.9	-140.4	-22.9	37.8	173.5	459	1	9	150.6

Appendix 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-3	CRISTA-162	94 11 10 7 18 33	6 14 18 50	4.9	11.6	-162.0	-16.2	-5.3	359.1			58.3
UARS	HALOE	94 11 10 5 47 41	1154 6 36 33	2.8	335.9	-39.5	-22.9	-4.1	357.8	194	1 30	12.9
ATLAS-3	CRISTA-162	94 11 10 7 54 28	6 14 54 45	25.7	161.1	-162.0	-16.2	40.8	154.2			109.4
UARS	HALOE	94 11 10 6 51 12	1154 7 40 11	42.9	178.8	-140.6	-22.9	38.0	149.3	526	1 3	150.3
ATLAS-3	CRISTA-162	94 11 10 8 48 43	6 15 49 0	4.2	348.2	-162.0	-16.2	-6.0	335.7			58.8
UARS	HALOE	94 11 10 7 24 0	1154 8 12 53	2.4	311.7	-39.4	-22.9	-4.5	333.6	289	1 24	12.5
ATLAS-3	CRISTA-162	94 11 10 9 24 38	6 16 24 55	26.3	137.6	-162.0	-16.2	41.4	130.6			108.8
UARS	HALOE	94 11 10 8 27 29	1154 9 16 20	43.1	154.7	-140.7	-22.9	38.2	125.1	593	0 57	150.1
ATLAS-3	CRISTA-162	94 11 10 10 18 53	6 17 19 10	3.5	324.8	-162.0	-16.2	-6.7	312.3			59.3
UARS	HALOE	94 11 10 9 0 19	1154 9 49 13	2.1	287.5	-39.2	-22.9	-4.9	309.4	385	1 18	12.1
ATLAS-3	CRISTA-162	94 11 10 10 54 48	6 17 55 5	27.0	114.1	-162.0	-16.2	42.1	106.9			108.0
UARS	HALOE	94 11 10 10 3 47	1154 10 52 40	43.3	130.6	-140.9	-22.9	38.4	100.9	658	0 51	149.9
ATLAS-3	CRISTA-162	94 11 10 11 49 3	6 18 49 20	2.7	301.5	-162.0	-16.2	-7.4	288.9			59.8
UARS	HALOE	94 11 10 10 36 39	1154 11 25 32	1.7	263.3	-39.1	-22.9	-5.3	285.2	481	1 12	11.8
ATLAS-3	CRISTA-162	94 11 10 12 24 57	6 19 25 14	27.7	90.6	-162.0	-16.2	42.7	83.3			107.3
UARS	HALOE	94 11 10 11 40 4	1154 12 29 0	43.5	106.5	-141.0	-22.9	38.6	76.7	721	0 44	149.7
ATLAS-3	CRISTA-162	94 11 10 13 19 12	6 20 19 29	2.0	278.1	-162.0	-16.2	-8.1	265.6			60.3
UARS	HALOE	94 11 10 12 12 58	1154 13 1 52	1.4	239.2	-38.9	-22.9	-5.6	261.0	577	1 6	11.4
ATLAS-3	CRISTA-162	94 11 10 13 55 7	6 20 55 24	28.4	67.1	-162.0	-16.2	43.4	59.6			106.7
UARS	HALOE	94 11 10 13 16 21	1154 14 5 19	43.7	82.4	-141.2	-22.9	38.7	52.5	784	0 38	149.5
ATLAS-3	CRISTA-162	94 11 10 14 49 22	6 21 49 39	1.3	254.7	-162.0	-16.2	-8.9	242.2			60.8
UARS	HALOE	94 11 10 13 49 17	1154 14 38 12	1.0	215.0	-38.7	-22.9	-6.0	236.8	673	1 0	11.0
ATLAS-3	CRISTA-162	94 11 10 16 19 17	6 23 19 34	-0.3	230.9	-162.0	-16.2	-10.4	218.3			61.5
UARS	HALOE	94 11 10 15 25 36	1154 16 14 31	0.7	190.8	-38.6	-22.9	-6.4	212.6	767	0 53	10.6
ATLAS-3	CRISTA-162	94 11 10 16 58 28	6 23 58 45	20.2	27.3	-162.0	-16.2	35.5	21.5			110.5
UARS	HALOE	94 11 10 14 52 38	1154 15 41 39	43.9	58.3	-141.4	-22.9	38.9	28.4	715	2 5	149.3
ATLAS-3	CRISTA-162	94 11 10 17 49 27	7 0 49 44	-1.0	207.5	-162.0	-16.2	-11.1	194.9			62.1
UARS	HALOE	94 11 10 17 1 55	1154 17 50 51	0.4	166.6	-38.4	-22.9	-6.8	188.4	859	0 47	10.3
ATLAS-3	CRISTA-162	94 11 10 18 28 38	7 1 28 55	20.9	3.9	-162.0	-16.2	36.2	358.0			109.8
UARS	HALOE	94 11 10 16 28 56	1154 17 17 48	44.1	34.2	-141.5	-22.9	39.1	4.2	635	1 59	149.1
ATLAS-3	CRISTA-162	94 11 10 19 19 37	7 2 19 54	-1.7	184.2	-162.0	-16.2	-11.8	171.5			62.6
UARS	HALOE	94 11 10 18 38 14	1154 19 27 11	0.0	142.4	-38.2	-22.9	-7.2	164.2	951	0 41	9.9
ATLAS-3	CRISTA-162	94 11 10 19 58 47	7 2 59 4	21.6	340.5	-162.0	-16.2	36.9	334.4			109.1
UARS	HALOE	94 11 10 18 5 13	1154 18 54 8	44.3	10.2	-141.7	-22.9	39.3	340.0	557	1 53	148.9
ATLAS-3	CRISTA-162	94 11 10 21 29 12	7 4 29 29	21.5	317.6	-162.0	-16.2	36.8	311.6			108.9
UARS	HALOE	94 11 10 19 41 30	1154 20 30 28	44.5	346.1	-141.9	-22.9	39.5	315.8	478	1 47	148.7
ATLAS-3	CRISTA-162	94 11 10 22 59 22	7 5 59 39	22.2	294.1	-162.0	-16.2	37.5	288.0			108.2
UARS	HALOE	94 11 10 21 17 47	1154 22 6 47	44.7	322.0	-142.1	-22.9	39.6	291.6	399	1 41	148.5
ATLAS-3	CRISTA-162	94 11 11 0 29 32	7 7 29 49	22.9	270.7	-162.0	-16.2	38.1	264.4			107.5
UARS	HALOE	94 11 10 22 54 4	1154 23 42 56	44.9	297.9	-142.2	-22.9	39.8	267.4	322	1 35	148.3
ATLAS-3	CRISTA-162	94 11 11 1 23 32	7 8 23 49	6.2	97.0	-162.0	-16.2	-4.0	84.5			62.0
UARS	HALOE	94 11 10 23 27 10	1155 0 16 10	-1.0	69.8	-37.7	-22.9	-8.3	91.6	921	1 56	8.8
ATLAS-3	CRISTA-162	94 11 11 1 59 42	7 8 59 59	23.6	247.2	-162.0	-16.2	38.8	240.8			106.8
UARS	HALOE	94 11 11 0 30 21	1155 1 19 16	45.0	273.8	-142.4	-22.9	40.0	243.3	248	1 29	148.1

Appendix 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-3	CRISTA-162	94	11	11	2	53	42	7	9	53	59	5.5	73.6	-162.0	-16.2	-4.7	61.1				62.5
UARS	HALOE	94	11	11	1	3	29	1155	1	52	30	-1.3	45.6	-37.5	-22.9	-8.6	67.4	823	1	50	8.4
ATLAS-3	CRISTA-162	94	11	11	3	29	52	7	10	30	9	24.3	223.8	-162.0	-16.2	39.5	217.2				106.2
UARS	HALOE	94	11	11	2	6	38	1155	2	55	36	45.2	249.7	-142.6	-22.9	40.2	219.1	177	1	23	147.9
ATLAS-3	CRISTA-162	94	11	11	4	23	52	7	11	24	9	4.8	50.2	-162.0	-16.2	-5.4	37.7				63.0
UARS	HALOE	94	11	11	2	39	48	1155	3	28	49	-1.6	21.4	-37.4	-22.9	-9.0	43.2	725	1	44	8.1
ATLAS-3	CRISTA-162	94	11	11	5	0	2	7	12	0	19	25.0	200.3	-162.0	-16.2	40.1	193.6				105.5
UARS	HALOE	94	11	11	3	42	55	1155	4	31	56	45.4	225.6	-142.8	-22.9	40.3	194.9	112	1	17	147.7
ATLAS-3	CRISTA-162	94	11	11	5	54	1	7	12	54	18	4.1	26.9	-162.0	-16.2	-6.1	14.3				63.5
UARS	HALOE	94	11	11	4	16	7	1155	5	4	58	-2.0	357.2	-37.2	-22.9	-9.4	19.0	627	1	37	7.7
ATLAS-3	CRISTA-162	94	11	11	6	30	27	7	13	30	44	24.9	177.4	-162.0	-16.2	40.0	170.8				105.3
UARS	HALOE	94	11	11	5	19	12	1155	6	8	5	45.6	201.5	-142.9	-22.9	40.5	170.7	50	1	11	147.5
ATLAS-3	CRISTA-162	94	11	11	7	23	56	7	14	24	13	2.5	3.0	-162.0	-16.2	-7.7	350.5				64.2
UARS	HALOE	94	11	11	5	52	25	1155	6	41	18	-2.3	333.0	-37.0	-22.9	-9.8	354.8	529	1	31	7.4
ATLAS-3	CRISTA-162	94	11	11	8	0	36	7	15	0	53	25.6	154.0	-162.0	-16.2	40.7	147.1				104.6
UARS	HALOE	94	11	11	6	55	29	1155	7	44	24	45.8	177.4	-143.1	-22.9	40.7	146.5	49	1	5	147.3
ATLAS-3	CRISTA-162	94	11	11	8	54	6	7	15	54	23	1.8	339.6	-162.0	-16.2	-8.4	327.1				64.7
UARS	HALOE	94	11	11	7	28	44	1155	8	17	38	-2.6	308.8	-36.8	-22.9	-10.1	330.6	432	1	25	7.0
ATLAS-3	CRISTA-162	94	11	11	9	30	46	7	16	31	3	26.3	130.5	-162.0	-16.2	41.4	123.5				103.9
UARS	HALOE	94	11	11	8	31	46	1155	9	20	44	45.9	153.3	-143.3	-22.9	40.8	122.4	111	0	59	147.2
ATLAS-3	CRISTA-162	94	11	11	10	24	16	7	17	24	33	1.0	316.3	-162.0	-16.2	-9.1	303.7				65.2
UARS	HALOE	94	11	11	9	5	3	1155	9	53	57	-2.9	284.6	-36.6	-22.9	-10.5	306.4	335	1	19	6.6
ATLAS-3	CRISTA-162	94	11	11	11	0	56	7	18	1	13	26.9	107.0	-162.0	-16.2	42.0	99.8				103.3
UARS	HALOE	94	11	11	10	8	3	1155	10	57	4	46.1	129.2	-143.5	-22.9	41.0	98.2	179	0	52	147.0
ATLAS-3	CRISTA-162	94	11	11	11	54	26	7	18	54	43	0.3	292.9	-162.0	-16.2	-9.8	280.3				65.8
UARS	HALOE	94	11	11	10	41	22	1155	11	30	17	-3.3	260.4	-36.5	-22.9	-10.9	282.2	238	1	13	6.3
ATLAS-3	CRISTA-162	94	11	11	12	31	6	7	19	31	23	27.6	83.5	-162.0	-16.2	42.7	76.2				102.6
UARS	HALOE	94	11	11	11	44	20	1155	12	33	13	46.3	105.1	-143.7	-22.9	41.1	74.0	246	0	46	146.8
ATLAS-3	CRISTA-162	94	11	11	13	24	36	7	20	24	53	-0.4	269.5	-162.0	-16.2	-10.5	256.9				66.3
UARS	HALOE	94	11	11	12	17	40	1155	13	6	37	-3.6	236.2	-36.3	-22.9	-11.2	258.0	143	1	6	5.9
ATLAS-3	CRISTA-162	94	11	11	14	1	16	7	21	1	33	28.3	60.0	-162.0	-16.2	43.3	52.5				101.9
UARS	HALOE	94	11	11	13	20	37	1155	14	9	33	46.4	81.0	-143.9	-22.9	41.3	49.8	313	0	40	146.6
ATLAS-3	CRISTA-162	94	11	11	14	54	45	7	21	55	2	-1.1	246.2	-162.0	-16.2	-11.2	233.5				66.9
UARS	HALOE	94	11	11	13	53	59	1155	14	42	56	-3.9	212.0	-36.1	-22.9	-11.6	233.8	51	1	0	5.6
ATLAS-3	CRISTA-162	94	11	11	15	31	26	7	22	31	43	29.0	36.5	-162.0	-16.2	43.9	28.8				101.3
UARS	HALOE	94	11	11	14	56	53	1155	15	45	52	46.6	56.9	-144.1	-22.9	41.4	25.7	378	0	34	146.5
ATLAS-3	CRISTA-162	94	11	11	16	24	55	7	23	25	12	-1.9	222.8	-162.0	-16.2	-11.9	210.1				67.4
UARS	HALOE	94	11	11	15	30	18	1155	16	19	16	-4.2	187.8	-35.9	-22.9	-11.9	209.6	54	0	54	5.3
ATLAS-3	CRISTA-162	94	11	11	17	1	35	8	0	1	52	29.7	13.0	-162.0	-16.2	44.6	5.1				100.6
UARS	HALOE	94	11	11	16	33	10	1155	17	22	1	46.8	32.8	-144.2	-22.9	41.6	1.5	442	0	28	146.3
ATLAS-3	CRISTA-162	94	11	11	17	55	5	8	0	55	22	-2.6	199.4	-162.0	-16.2	-12.6	186.7				68.0
UARS	HALOE	94	11	11	17	6	36	1155	17	55	36	-4.6	163.6	-35.7	-22.9	-12.3	185.4	145	0	48	4.9
ATLAS-3	CRISTA-162	94	11	11	18	32	0	8	1	32	17	29.6	350.1	-162.0	-16.2	44.5	342.3				100.4
UARS	HALOE	94	11	11	18	9	27	1155	18	58	21	46.9	8.7	-144.4	-22.9	41.7	337.3	504	0	22	146.1

Appendix 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-3	CRISTA-162	94	11	11	19	25	0	8	2	25	17	-4.2	175.6	-162.0	-16.2	-14.1	162.8				68.8
UARS	HALOE	94	11	11	18	42	55	1155	19	31	56	-4.9	139.4	-35.5	-22.9	-12.7	161.2	235	0	42	4.6
ATLAS-3	CRISTA-162	94	11	11	20	2	10	8	3	2	27	30.2	326.6	-162.0	-16.2	45.1	318.5				99.7
UARS	HALOE	94	11	11	19	45	44	1155	20	34	41	47.1	344.6	-144.6	-22.9	41.9	313.1	563	0	16	146.0
ATLAS-3	CRISTA-162	94	11	11	20	55	10	8	3	55	27	-4.9	152.2	-162.0	-16.2	-14.8	139.3				69.4
UARS	HALOE	94	11	11	20	19	13	1155	21	8	5	-5.2	115.2	-35.3	-22.9	-13.0	137.0	323	0	35	4.3
ATLAS-3	CRISTA-162	94	11	11	21	32	20	8	4	32	37	30.9	303.1	-162.0	-16.2	45.7	294.8				99.1
UARS	HALOE	94	11	11	21	22	0	1155	22	11	0	47.2	320.5	-144.8	-22.9	42.0	289.0	622	0	10	145.8
ATLAS-3	CRISTA-162	94	11	11	22	25	20	8	5	25	37	-5.6	128.8	-162.0	-16.2	-15.5	115.9				70.0
UARS	HALOE	94	11	11	21	55	32	1155	22	44	24	-5.5	91.0	-35.1	-22.9	-13.4	112.8	412	0	29	4.0
ATLAS-3	CRISTA-162	94	11	11	23	2	30	8	6	2	47	31.6	279.5	-162.0	-16.2	46.4	271.0				98.5
UARS	HALOE	94	11	11	22	58	17	1155	23	47	10	47.4	296.5	-145.0	-22.9	42.2	264.8	679	0	4	145.7
ATLAS-3	CRISTA-162	94	11	11	23	55	30	8	6	55	47	-6.4	105.5	-162.0	-16.2	-16.2	92.5				70.6
UARS	HALOE	94	11	11	23	31	50	1156	0	20	44	-5.8	66.8	-34.9	-22.9	-13.7	88.6	501	0	23	3.7
ATLAS-3	CRISTA-162	94	11	12	1	25	39	8	8	25	56	-7.1	82.1	-162.0	-16.2	-16.9	69.1				71.2
UARS	HALOE	94	11	12	1	8	9	1156	1	57	4	-6.1	42.6	-34.7	-22.9	-14.1	64.4	591	0	17	3.4
ATLAS-3	CRISTA-162	94	11	12	2	5	50	8	9	6	7	23.5	240.1	-162.0	-16.2	38.7	233.7				101.9
UARS	HALOE	94	11	12	0	34	34	1156	1	23	29	47.5	272.4	-145.2	-22.9	42.3	240.6	707	1	31	145.5

Appendix 5. Correlative measurement opportunities between ATLAS-3 (CRISTA-180) 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-3	CRISTA-180	94	11	4	17	49	51	1	0	50	8	2.4	60.3	-180.0	-16.4	16.1	51.0				149.3
UARS	HALOE	94	11	4	14	24	55	1148	15	13	53	18.5	69.1	-134.4	-22.9	13.5	45.9	626	3	24	174.7
ATLAS-3	CRISTA-180	94	11	4	19	19	56	1	2	20	13	4.0	36.4	-180.0	-16.4	17.7	27.0				148.7
UARS	HALOE	94	11	4	16	1	15	1148	16	50	12	18.9	45.0	-134.4	-22.9	13.8	21.7	713	3	18	174.7
ATLAS-3	CRISTA-180	94	11	4	20	50	16	1	3	50	33	4.7	13.0	-180.0	-16.4	18.4	3.6				148.3
UARS	HALOE	94	11	4	17	37	34	1148	18	26	32	19.2	20.8	-134.4	-22.9	14.2	357.5	798	3	12	174.6
ATLAS-3	CRISTA-180	94	11	4	22	20	36	1	5	20	53	5.5	349.6	-180.0	-16.4	19.1	340.1				147.8
UARS	HALOE	94	11	4	19	13	54	1148	20	2	52	19.6	356.7	-134.4	-22.9	14.6	333.3	882	3	6	174.5
ATLAS-3	CRISTA-180	94	11	4	23	50	57	1	6	51	14	6.2	326.2	-180.0	-16.4	19.8	316.6				147.2
UARS	HALOE	94	11	4	20	50	13	1148	21	39	11	20.0	332.6	-134.4	-22.9	14.9	309.1	965	3	0	174.4
ATLAS-3	CRISTA-180	94	11	5	17	58	2	2	0	58	19	4.9	51.1	-180.0	-16.4	18.5	41.6				143.6
UARS	HALOE	94	11	5	14	29	47	1149	15	18	48	23.8	67.0	-134.3	-22.9	18.9	42.9	147	3	28	171.7
ATLAS-3	CRISTA-180	94	11	5	19	28	22	2	2	28	39	5.6	27.7	-180.0	-16.4	19.2	18.1				143.0
UARS	HALOE	94	11	5	16	6	6	1149	16	54	57	24.1	42.8	-134.3	-22.9	19.2	18.7	65	3	22	171.4
ATLAS-3	CRISTA-180	94	11	5	20	58	42	2	3	58	59	6.3	4.2	-180.0	-16.4	19.9	354.7				142.5
UARS	HALOE	94	11	5	17	42	25	1149	18	31	17	24.5	18.7	-134.4	-22.9	19.6	354.5	42	3	16	171.1
ATLAS-3	CRISTA-180	94	11	5	22	28	46	2	5	29	3	7.4	340.6	-180.0	-16.3	20.8	331.1				141.8
UARS	HALOE	94	11	5	19	18	45	1149	20	7	37	24.8	354.6	-134.4	-22.9	19.9	330.4	130	3	10	170.7
ATLAS-3	CRISTA-180	94	11	5	23	59	1	2	6	59	18	8.1	317.2	-180.0	-16.3	21.5	307.6				141.2
UARS	HALOE	94	11	5	20	55	4	1149	21	43	56	25.1	330.4	-134.4	-22.9	20.2	306.2	212	3	3	170.4
ATLAS-3	CRISTA-180	94	11	6	1	29	16	2	8	29	33	8.8	293.8	-180.0	-16.3	22.2	284.2				140.6
UARS	HALOE	94	11	5	22	31	23	1149	23	20	16	25.5	306.3	-134.4	-22.9	20.6	282.0	295	2	57	170.0
ATLAS-3	CRISTA-180	94	11	6	2	59	31	2	9	59	48	9.5	270.4	-180.0	-16.3	23.0	260.7				139.9
UARS	HALOE	94	11	6	0	7	42	1150	0	56	36	25.8	282.2	-134.4	-22.9	20.9	257.8	379	2	51	169.7
ATLAS-3	CRISTA-180	94	11	6	4	29	46	2	11	30	3	10.3	247.0	-180.0	-16.3	23.6	237.2				139.3
UARS	HALOE	94	11	6	1	44	1	1150	2	32	55	26.1	258.0	-134.5	-22.9	21.3	233.6	462	2	45	169.3
ATLAS-3	CRISTA-180	94	11	6	6	0	1	2	13	0	18	11.0	223.6	-180.0	-16.3	24.3	213.8				138.6
UARS	HALOE	94	11	6	3	20	20	1150	4	9	15	26.5	233.9	-134.5	-22.9	21.6	209.4	544	2	39	169.0
ATLAS-3	CRISTA-180	94	11	6	7	30	16	2	14	30	33	11.7	200.2	-180.0	-16.3	25.0	190.3				138.0
UARS	HALOE	94	11	6	4	56	40	1150	5	45	35	26.8	209.8	-134.5	-22.9	21.9	185.2	625	2	33	168.6
ATLAS-3	CRISTA-180	94	11	6	9	0	32	2	16	0	49	12.4	176.8	-180.0	-16.3	25.7	166.8				137.3
UARS	HALOE	94	11	6	6	32	59	1150	7	21	54	27.1	185.6	-134.5	-22.9	22.3	161.0	706	2	27	168.3
ATLAS-3	CRISTA-180	94	11	6	10	30	47	2	17	31	4	13.1	153.4	-180.0	-16.3	26.4	143.3				136.6
UARS	HALOE	94	11	6	8	9	18	1150	8	58	14	27.4	161.5	-134.6	-22.9	22.6	136.8	785	2	21	167.9
ATLAS-3	CRISTA-180	94	11	6	12	0	47	2	19	1	4	14.7	129.4	-180.0	-16.3	27.9	119.1				135.4
UARS	HALOE	94	11	6	9	45	37	1150	10	34	34	27.8	137.4	-134.6	-22.9	22.9	112.6	861	2	15	167.6
ATLAS-3	CRISTA-180	94	11	6	13	31	2	2	20	31	19	15.4	106.0	-180.0	-16.3	28.6	95.6				134.7
UARS	HALOE	94	11	6	11	21	56	1150	12	10	53	28.1	113.2	-134.7	-22.9	23.2	88.4	937	2	9	167.2
ATLAS-3	CRISTA-180	94	11	6	19	35	18	3	2	35	35	7.5	18.9	-180.0	-16.3	21.0	9.4				137.0
UARS	HALOE	94	11	6	16	10	53	1150	16	59	52	29.0	40.9	-134.8	-22.9	24.2	15.8	743	3	24	166.2
ATLAS-3	CRISTA-180	94	11	6	21	5	34	3	4	5	51	8.2	355.5	-180.0	-16.3	21.7	346.0				136.4
UARS	HALOE	94	11	6	17	47	12	1150	18	36	12	29.3	16.7	-134.8	-22.9	24.5	351.6	654	3	18	165.8
ATLAS-3	CRISTA-180	94	11	6	22	35	49	3	5	36	6	8.9	332.1	-180.0	-16.3	22.4	322.5				135.8
UARS	HALOE	94	11	6	19	23	30	1150	20	12	21	29.7	352.6	-134.9	-22.9	24.8	327.4	566	3	12	165.5

Appendix 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-3	CRISTA-180	94	11	7	0	6	4	3	7	6	21	9.7	308.7	-180.0	-16.3	23.1	299.0				135.1
UARS	HALOE	94	11	6	20	59	49	1150	21	48	41	30.0	328.5	-135.0	-22.9	25.1	303.2	479	3	6	165.1
ATLAS-3	CRISTA-180	94	11	7	1	36	19	3	8	36	36	10.4	285.3	-180.0	-16.3	23.8	275.6				134.5
UARS	HALOE	94	11	6	22	36	8	1150	23	25	1	30.3	304.4	-135.0	-22.9	25.5	279.0	392	3	0	164.8
ATLAS-3	CRISTA-180	94	11	7	2	32	53	3	9	33	10	26.9	117.1	-180.0	-16.3	13.7	106.9				47.5
UARS	HALOE	94	11	6	23	7	47	1150	23	56	39	20.5	80.0	-45.0	-22.9	15.2	103.5	409	3	25	31.2
ATLAS-3	CRISTA-180	94	11	7	3	6	34	3	10	6	51	11.1	261.9	-180.0	-16.3	24.5	252.1				133.8
UARS	HALOE	94	11	7	0	12	27	1151	1	1	20	30.6	280.2	-135.1	-22.9	25.8	254.8	308	2	54	164.4
ATLAS-3	CRISTA-180	94	11	7	4	3	8	3	11	3	25	26.2	93.6	-180.0	-16.3	12.9	83.5				47.3
UARS	HALOE	94	11	7	0	44	7	1151	1	32	59	20.1	55.9	-44.9	-22.9	14.8	79.3	501	3	19	30.8
ATLAS-3	CRISTA-180	94	11	7	4	36	49	3	11	37	6	11.8	238.5	-180.0	-16.3	25.2	228.6				133.1
UARS	HALOE	94	11	7	1	48	46	1151	2	37	40	30.9	256.1	-135.1	-22.9	26.1	230.6	224	2	48	164.1
ATLAS-3	CRISTA-180	94	11	7	5	33	8	3	12	33	25	24.7	69.5	-180.0	-16.3	11.4	59.6				46.8
UARS	HALOE	94	11	7	2	20	26	1151	3	9	18	19.7	31.7	-44.9	-22.9	14.4	55.1	593	3	12	30.4
ATLAS-3	CRISTA-180	94	11	7	6	7	4	3	13	7	21	12.6	215.1	-180.0	-16.3	25.9	205.1				132.5
UARS	HALOE	94	11	7	3	25	4	1151	4	14	0	31.2	232.0	-135.2	-22.9	26.4	206.4	140	2	41	163.7
ATLAS-3	CRISTA-180	94	11	7	7	3	23	3	14	3	40	24.0	46.0	-180.0	-16.3	10.7	36.2				46.6
UARS	HALOE	94	11	7	3	56	46	1151	4	45	38	19.4	7.6	-44.8	-22.9	14.0	30.9	687	3	6	30.1
ATLAS-3	CRISTA-180	94	11	7	7	37	19	3	14	37	36	13.3	191.7	-180.0	-16.3	26.5	181.6				131.8
UARS	HALOE	94	11	7	5	1	23	1151	5	50	19	31.5	207.9	-135.3	-22.9	26.7	182.2	60	2	35	163.4
ATLAS-3	CRISTA-180	94	11	7	8	33	38	3	15	33	55	23.3	22.5	-180.0	-16.3	9.9	12.8				46.5
UARS	HALOE	94	11	7	5	33	5	1151	6	21	58	19.0	343.5	-44.7	-22.9	13.6	6.7	780	3	0	29.7
ATLAS-3	CRISTA-180	94	11	7	9	7	34	3	16	7	52	14.0	168.3	-180.0	-16.3	27.2	158.1				131.1
UARS	HALOE	94	11	7	6	37	42	1151	7	26	39	31.8	183.7	-135.3	-22.9	27.0	158.0	31	2	29	163.0
ATLAS-3	CRISTA-180	94	11	7	10	3	53	3	17	4	10	22.6	359.0	-180.0	-16.3	9.2	349.4				46.4
UARS	HALOE	94	11	7	7	9	25	1151	7	58	18	18.6	319.3	-44.7	-22.9	13.2	342.5	875	2	54	29.4
ATLAS-3	CRISTA-180	94	11	7	10	37	50	3	17	38	7	14.7	144.8	-180.0	-16.3	27.9	134.6				130.4
UARS	HALOE	94	11	7	8	14	1	1151	9	2	59	32.1	159.6	-135.4	-22.9	27.3	133.8	105	2	23	162.7
ATLAS-3	CRISTA-180	94	11	7	11	34	8	3	18	34	25	21.9	335.5	-180.0	-16.3	8.5	326.0				46.4
UARS	HALOE	94	11	7	8	45	45	1151	9	34	37	18.3	295.2	-44.6	-22.9	12.8	318.3	969	2	48	29.0
ATLAS-3	CRISTA-180	94	11	7	12	8	5	3	19	8	22	15.4	121.4	-180.0	-16.3	28.6	111.0				129.7
UARS	HALOE	94	11	7	9	50	19	1151	10	39	18	32.4	135.5	-135.5	-22.9	27.6	109.6	183	2	17	162.4
ATLAS-3	CRISTA-180	94	11	7	13	38	20	3	20	38	37	16.1	98.0	-180.0	-16.3	29.3	87.5				129.0
UARS	HALOE	94	11	7	11	26	38	1151	12	15	38	32.6	111.4	-135.5	-22.9	27.9	85.4	261	2	11	162.0
ATLAS-3	CRISTA-180	94	11	7	15	8	35	3	22	8	52	16.9	74.6	-180.0	-16.3	30.0	64.0				128.2
UARS	HALOE	94	11	7	13	2	56	1151	13	51	47	32.9	87.3	-135.6	-22.9	28.1	61.2	337	2	5	161.7
ATLAS-3	CRISTA-180	94	11	7	16	38	50	3	23	39	7	17.6	51.1	-180.0	-16.3	30.6	40.4				127.5
UARS	HALOE	94	11	7	14	39	15	1151	15	28	7	33.2	63.1	-135.7	-22.9	28.4	37.0	411	1	59	161.4
ATLAS-3	CRISTA-180	94	11	7	18	9	5	4	1	9	22	18.3	27.7	-180.0	-16.3	31.3	16.9				126.8
UARS	HALOE	94	11	7	16	15	33	1151	17	4	27	33.5	39.0	-135.8	-22.9	28.7	12.8	485	1	53	161.0
ATLAS-3	CRISTA-180	94	11	7	19	39	20	4	2	39	37	19.0	4.3	-180.0	-16.3	32.0	353.3				126.0
UARS	HALOE	94	11	7	17	51	52	1151	18	40	46	33.8	14.9	-135.9	-22.9	29.0	348.6	558	1	47	160.7
ATLAS-3	CRISTA-180	94	11	7	21	9	35	4	4	9	52	19.7	340.8	-180.0	-16.3	32.6	329.7				125.3
UARS	HALOE	94	11	7	19	28	10	1151	20	17	6	34.1	350.8	-136.0	-22.9	29.3	324.4	629	1	41	160.4

Appendix 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-3	CRISTA-180	94	11	7	22	39	51	4	5	40	8	20.4	317.4	-180.0	-16.3	33.3	306.1				124.6
UARS	HALOE	94	11	7	21	4	29	1151	21	53	26	34.3	326.7	-136.0	-22.9	29.6	300.2	699	1	35	160.1
ATLAS-3	CRISTA-180	94	11	8	0	10	4	4	7	10	21	21.5	293.7	-180.0	-16.3	34.3	282.2				123.6
UARS	HALOE	94	11	7	22	40	47	1151	23	29	45	34.6	302.6	-136.1	-22.9	29.8	276.0	765	1	29	159.7
ATLAS-3	CRISTA-180	94	11	8	1	40	18	4	8	40	35	22.2	270.2	-180.0	-16.3	34.9	258.6				122.8
UARS	HALOE	94	11	8	0	17	6	1152	1	6	5	34.9	278.4	-136.2	-22.9	30.1	251.8	832	1	23	159.4
ATLAS-3	CRISTA-180	94	11	8	2	39	36	4	9	39	53	24.2	107.5	-180.0	-16.3	10.9	97.7				49.3
UARS	HALOE	94	11	7	23	12	41	1152	0	1	34	15.0	77.8	-43.8	-22.9	9.3	100.5	356	3	26	25.7
ATLAS-3	CRISTA-180	94	11	8	4	9	50	4	11	10	7	23.6	84.1	-180.0	-16.3	10.2	74.3				49.3
UARS	HALOE	94	11	8	0	49	1	1152	1	37	54	14.6	53.6	-43.8	-22.9	8.9	76.3	263	3	20	25.3
ATLAS-3	CRISTA-180	94	11	8	4	44	1	4	11	44	18	12.9	230.3	-180.0	-16.3	26.2	220.3				127.2
UARS	HALOE	94	11	8	1	53	24	1152	2	42	25	35.2	254.3	-136.3	-22.9	30.4	227.6	855	2	50	159.1
ATLAS-3	CRISTA-180	94	11	8	5	40	4	4	12	40	21	22.9	60.6	-180.0	-16.3	9.5	50.9				49.3
UARS	HALOE	94	11	8	2	25	21	1152	3	14	14	14.2	29.5	-43.7	-22.9	8.5	52.1	171	3	14	25.0
ATLAS-3	CRISTA-180	94	11	8	6	14	14	4	13	14	31	13.7	206.9	-180.0	-16.3	26.9	196.8				126.5
UARS	HALOE	94	11	8	3	29	42	1152	4	18	34	35.4	230.2	-136.4	-22.9	30.6	203.4	771	2	44	158.8
ATLAS-3	CRISTA-180	94	11	8	7	10	17	4	14	10	34	22.1	37.1	-180.0	-16.3	8.7	27.5				49.3
UARS	HALOE	94	11	8	4	1	40	1152	4	50	33	13.9	5.3	-43.6	-22.9	8.1	27.9	85	3	8	24.6
ATLAS-3	CRISTA-180	94	11	8	7	44	28	4	14	44	45	14.4	183.5	-180.0	-16.3	27.6	173.3				125.9
UARS	HALOE	94	11	8	5	6	0	1152	5	54	54	35.7	206.1	-136.5	-22.9	30.9	179.2	686	2	38	158.5
ATLAS-3	CRISTA-180	94	11	8	8	40	16	4	15	40	33	20.6	13.1	-180.0	-16.3	7.2	3.6				49.2
UARS	HALOE	94	11	8	5	38	0	1152	6	26	53	13.5	341.2	-43.5	-22.9	7.7	3.7	56	3	2	24.2
ATLAS-3	CRISTA-180	94	11	8	9	14	42	4	16	14	59	15.1	160.1	-180.0	-16.3	28.3	149.8				125.2
UARS	HALOE	94	11	8	6	42	19	1152	7	31	13	36.0	182.0	-136.6	-22.9	31.2	155.0	603	2	32	158.2
ATLAS-3	CRISTA-180	94	11	8	10	10	29	4	17	10	46	19.9	349.7	-180.0	-16.3	6.5	340.2				49.3
UARS	HALOE	94	11	8	7	14	19	1152	8	3	13	13.1	317.0	-43.4	-22.9	7.3	339.5	122	2	56	23.8
ATLAS-3	CRISTA-180	94	11	8	10	44	55	4	17	45	12	15.8	136.7	-180.0	-16.3	28.9	126.2				124.5
UARS	HALOE	94	11	8	8	18	37	1152	9	7	33	36.2	157.9	-136.7	-22.9	31.4	130.8	522	2	26	157.9
ATLAS-3	CRISTA-180	94	11	8	11	40	43	4	18	41	0	19.2	326.2	-180.0	-16.3	5.7	316.9				49.4
UARS	HALOE	94	11	8	8	50	39	1152	9	39	33	12.8	292.8	-43.3	-22.9	6.9	315.3	213	2	50	23.5
ATLAS-3	CRISTA-180	94	11	8	12	15	9	4	19	15	26	16.5	113.3	-180.0	-16.3	29.6	102.7				123.8
UARS	HALOE	94	11	8	9	54	55	1152	10	43	53	36.5	133.8	-136.8	-22.9	31.7	106.6	441	2	20	157.6
ATLAS-3	CRISTA-180	94	11	8	13	10	56	4	20	11	13	18.5	302.8	-180.0	-16.3	5.0	293.5				49.5
UARS	HALOE	94	11	8	10	26	59	1152	11	15	52	12.4	268.7	-43.1	-22.9	6.5	291.1	308	2	43	23.1
ATLAS-3	CRISTA-180	94	11	8	13	45	22	4	20	45	39	17.2	89.8	-180.0	-16.3	30.3	79.2				123.1
UARS	HALOE	94	11	8	11	31	13	1152	12	20	12	36.8	109.7	-136.9	-22.9	31.9	82.4	362	2	14	157.3
ATLAS-3	CRISTA-180	94	11	8	14	41	10	4	21	41	27	17.8	279.3	-180.0	-16.3	4.3	270.1				49.6
UARS	HALOE	94	11	8	12	3	18	1152	12	52	12	12.1	244.5	-43.0	-22.9	6.1	266.9	405	2	37	22.7
ATLAS-3	CRISTA-180	94	11	8	15	15	36	4	22	15	53	18.0	66.4	-180.0	-16.3	31.0	55.6				122.3
UARS	HALOE	94	11	8	13	7	31	1152	13	56	32	37.0	85.5	-137.0	-22.9	32.2	58.2	284	2	8	157.0
ATLAS-3	CRISTA-180	94	11	8	16	11	24	4	23	11	41	17.1	255.9	-180.0	-16.3	3.5	246.7				49.8
UARS	HALOE	94	11	8	13	39	38	1152	14	28	32	11.7	220.4	-42.9	-22.9	5.7	242.7	501	2	31	22.3
ATLAS-3	CRISTA-180	94	11	8	16	45	50	4	23	46	7	18.7	43.0	-180.0	-16.3	31.6	32.1				121.6
UARS	HALOE	94	11	8	14	43	49	1152	15	32	41	37.3	61.4	-137.2	-22.9	32.4	34.1	209	2	2	156.7

Appendix 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-3	CRISTA-180	94 11 8 17 41 37	5 0 41 54	16.4	232.5	-180.0	-16.3	2.8	223.3			50.0
UARS	HALOE	94 11 8 15 15 57	1152 16 4 51	11.3	196.2	-42.8	-22.9	5.3	218.5	599	2 25	22.0
ATLAS-3	CRISTA-180	94 11 8 18 16 3	5 1 16 20	19.4	19.5	-180.0	-16.3	32.3	8.5			120.9
UARS	HALOE	94 11 8 16 20 8	1152 17 9 1	37.5	37.3	-137.3	-22.9	32.7	9.9	135	1 55	156.4
ATLAS-3	CRISTA-180	94 11 8 19 11 51	5 2 12 8	15.7	209.1	-180.0	-16.3	2.1	199.9			50.2
UARS	HALOE	94 11 8 16 52 17	1152 17 41 11	11.0	172.0	-42.7	-22.9	4.9	194.3	696	2 19	21.6
ATLAS-3	CRISTA-180	94 11 8 19 46 17	5 2 46 34	20.1	356.1	-180.0	-16.3	33.0	344.9			120.2
UARS	HALOE	94 11 8 17 56 25	1152 18 45 21	37.8	13.2	-137.4	-22.9	32.9	345.7	70	1 49	156.1
ATLAS-3	CRISTA-180	94 11 8 20 42 4	5 3 42 21	14.9	185.7	-180.0	-16.3	1.4	176.5			50.4
UARS	HALOE	94 11 8 18 28 36	1152 19 17 31	10.6	147.8	-42.6	-22.9	4.5	170.1	795	2 13	21.2
ATLAS-3	CRISTA-180	94 11 8 21 16 30	5 4 16 47	20.8	332.7	-180.0	-16.3	33.6	321.3			119.5
UARS	HALOE	94 11 8 19 32 44	1152 20 21 40	38.0	349.1	-137.5	-22.9	33.2	321.5	50	1 43	155.9
ATLAS-3	CRISTA-180	94 11 8 22 12 3	5 5 12 20	13.4	161.7	-180.0	-16.3	-0.2	152.7			50.6
UARS	HALOE	94 11 8 20 4 56	1152 20 53 50	10.2	123.7	-42.5	-22.9	4.1	145.9	891	2 7	20.8
ATLAS-3	CRISTA-180	94 11 8 22 46 44	5 5 47 1	21.5	309.2	-180.0	-16.3	34.3	297.7			118.7
UARS	HALOE	94 11 8 21 9 2	1152 21 58 0	38.3	325.0	-137.6	-22.9	33.4	297.3	103	1 37	155.6
ATLAS-3	CRISTA-180	94 11 8 23 42 17	5 6 42 34	12.7	138.3	-180.0	-16.3	-0.9	129.3			50.9
UARS	HALOE	94 11 8 21 41 15	1152 22 30 10	9.9	99.5	-42.3	-22.9	3.7	121.7	988	2 1	20.4
ATLAS-3	CRISTA-180	94 11 9 0 16 57	5 7 17 14	22.2	285.7	-180.0	-16.3	34.9	274.1			118.0
UARS	HALOE	94 11 8 22 45 20	1152 23 34 20	38.5	300.9	-137.7	-22.9	33.7	273.1	169	1 31	155.3
ATLAS-3	CRISTA-180	94 11 9 1 47 11	5 8 47 28	22.9	262.3	-180.0	-16.3	35.6	250.5			117.3
UARS	HALOE	94 11 9 0 21 38	1153 1 10 29	38.8	276.8	-137.9	-22.9	33.9	248.9	236	1 25	155.0
ATLAS-3	CRISTA-180	94 11 9 3 17 25	5 10 17 42	23.6	238.8	-180.0	-16.3	36.2	226.9			116.5
UARS	HALOE	94 11 9 1 57 55	1153 2 46 48	39.0	252.7	-138.0	-22.9	34.1	224.7	304	1 19	154.8
ATLAS-3	CRISTA-180	94 11 9 4 47 38	5 11 47 55	24.3	215.3	-180.0	-16.3	36.9	203.2			115.8
UARS	HALOE	94 11 9 3 34 13	1153 4 23 8	39.2	228.6	-138.1	-22.9	34.4	200.5	370	1 13	154.5
ATLAS-3	CRISTA-180	94 11 9 5 46 27	5 12 46 44	20.5	51.5	-180.0	-16.3	7.1	42.1			52.6
UARS	HALOE	94 11 9 2 30 13	1153 3 19 9	8.8	27.0	-42.0	-22.9	2.5	49.1	933	3 16	19.3
ATLAS-3	CRISTA-180	94 11 9 6 17 52	5 13 18 9	25.0	191.9	-180.0	-16.3	37.5	179.6			115.1
UARS	HALOE	94 11 9 5 10 31	1153 5 59 28	39.5	204.5	-138.2	-22.9	34.6	176.3	435	1 7	154.2
ATLAS-3	CRISTA-180	94 11 9 7 16 40	5 14 16 57	19.8	28.1	-180.0	-16.3	6.3	18.7			52.8
UARS	HALOE	94 11 9 4 6 33	1153 4 55 29	8.4	2.8	-41.8	-22.9	2.1	24.9	838	3 10	18.9
ATLAS-3	CRISTA-180	94 11 9 7 48 5	5 14 48 22	25.7	168.4	-180.0	-16.3	38.1	155.9			114.3
UARS	HALOE	94 11 9 6 46 49	1153 7 35 48	39.7	180.4	-138.4	-22.9	34.8	152.1	499	1 1	154.0
ATLAS-3	CRISTA-180	94 11 9 8 46 39	5 15 46 56	18.3	4.1	-180.0	-16.3	4.8	354.8			52.9
UARS	HALOE	94 11 9 5 42 52	1153 6 31 48	8.1	338.6	-41.7	-22.9	1.7	0.7	741	3 3	18.6
ATLAS-3	CRISTA-180	94 11 9 9 18 19	5 16 18 36	26.4	144.9	-180.0	-16.3	38.7	132.2			113.6
UARS	HALOE	94 11 9 8 23 6	1153 9 12 7	39.9	156.3	-138.5	-22.9	35.1	127.9	561	0 55	153.7
ATLAS-3	CRISTA-180	94 11 9 10 16 53	5 17 17 10	17.6	340.7	-180.0	-16.3	4.0	331.4			53.1
UARS	HALOE	94 11 9 7 19 12	1153 8 8 8	7.7	314.5	-41.6	-22.9	1.3	336.5	644	2 57	18.2
ATLAS-3	CRISTA-180	94 11 9 10 48 33	5 17 48 50	27.1	121.4	-180.0	-16.3	39.4	108.5			112.9
UARS	HALOE	94 11 9 9 59 24	1153 10 48 16	40.2	132.2	-138.6	-22.9	35.3	103.7	621	0 49	153.4
ATLAS-3	CRISTA-180	94 11 9 11 47 6	5 18 47 23	16.8	317.2	-180.0	-16.3	3.3	308.0			53.4
UARS	HALOE	94 11 9 8 55 31	1153 9 44 28	7.3	290.3	-41.5	-22.9	0.9	312.3	547	2 51	17.8

Appendix 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-3	CRISTA-180	94	11	9	12	18	46	5	19	19	3	27.8	97.9	-180.0	-16.3	40.0	84.8				112.1
UARS	HALOE	94	11	9	11	35	42	1153	12	24	36	40.4	108.1	-138.8	-22.9	35.5	79.5	681	0	43	153.2
ATLAS-3	CRISTA-180	94	11	9	13	17	20	5	20	17	37	16.1	293.8	-180.0	-16.3	2.6	284.6				53.6
UARS	HALOE	94	11	9	10	31	50	1153	11	20	48	7.0	266.1	-41.3	-22.9	0.6	288.1	450	2	45	17.4
ATLAS-3	CRISTA-180	94	11	9	13	49	0	5	20	49	17	28.4	74.3	-180.0	-16.3	40.6	61.1				111.4
UARS	HALOE	94	11	9	13	12	0	1153	14	0	56	40.6	83.9	-138.9	-22.9	35.7	55.4	739	0	37	152.9
ATLAS-3	CRISTA-180	94	11	9	14	47	33	5	21	47	50	15.4	270.4	-180.0	-16.3	1.8	261.3				53.9
UARS	HALOE	94	11	9	12	8	10	1153	12	57	7	6.6	241.9	-41.2	-22.9	0.2	263.9	353	2	39	17.0
ATLAS-3	CRISTA-180	94	11	9	16	17	47	5	23	18	4	14.7	247.0	-180.0	-16.3	1.1	237.9				54.2
UARS	HALOE	94	11	9	13	44	29	1153	14	33	27	6.3	217.8	-41.0	-22.9	-0.2	239.7	257	2	33	16.7
ATLAS-3	CRISTA-180	94	11	9	16	52	58	5	23	53	15	18.6	35.6	-180.0	-16.3	31.6	24.7				116.4
UARS	HALOE	94	11	9	14	48	17	1153	15	37	15	40.8	59.8	-139.1	-22.9	35.9	31.2	771	2	4	152.7
ATLAS-3	CRISTA-180	94	11	9	17	48	1	6	0	48	18	14.0	223.6	-180.0	-16.3	0.4	214.5				54.5
UARS	HALOE	94	11	9	15	20	48	1153	16	9	47	5.9	193.6	-40.9	-22.9	-0.6	215.5	163	2	27	16.3
ATLAS-3	CRISTA-180	94	11	9	18	23	12	6	1	23	29	19.3	12.2	-180.0	-16.3	32.2	1.1				115.7
UARS	HALOE	94	11	9	16	24	35	1153	17	13	35	41.1	35.7	-139.2	-22.9	36.2	7.0	693	1	58	152.4
ATLAS-3	CRISTA-180	94	11	9	19	18	14	6	2	18	31	13.3	200.2	-180.0	-16.3	-0.3	191.1				54.8
UARS	HALOE	94	11	9	16	57	8	1153	17	46	6	5.6	169.4	-40.8	-22.9	-1.0	191.4	80	2	21	15.9
ATLAS-3	CRISTA-180	94	11	9	19	53	9	6	2	53	26	20.1	348.7	-180.0	-16.2	32.9	337.7				115.1
UARS	HALOE	94	11	9	18	0	52	1153	18	49	44	41.3	11.6	-139.3	-22.9	36.4	342.8	608	1	52	152.2
ATLAS-3	CRISTA-180	94	11	9	20	47	54	6	3	48	11	11.7	176.2	-180.0	-16.2	-1.9	167.4				55.2
UARS	HALOE	94	11	9	18	33	27	1153	19	22	26	5.2	145.2	-40.6	-22.9	-1.4	167.2	57	2	14	15.5
ATLAS-3	CRISTA-180	94	11	9	21	23	19	6	4	23	36	20.8	325.3	-180.0	-16.2	33.5	314.1				114.4
UARS	HALOE	94	11	9	19	37	10	1153	20	26	4	41.5	347.5	-139.5	-22.9	36.6	318.6	531	1	46	151.9
ATLAS-3	CRISTA-180	94	11	9	22	18	4	6	5	18	21	10.9	152.8	-180.0	-16.2	-2.6	144.0				55.5
UARS	HALOE	94	11	9	20	9	46	1153	20	58	46	4.9	121.0	-40.5	-22.9	-1.8	143.0	147	2	8	15.2
ATLAS-3	CRISTA-180	94	11	9	22	53	29	6	5	53	46	21.5	301.8	-180.0	-16.2	34.2	290.5				113.7
UARS	HALOE	94	11	9	21	13	27	1153	22	2	24	41.7	323.4	-139.6	-22.9	36.8	294.4	455	1	40	151.7
ATLAS-3	CRISTA-180	94	11	9	23	48	14	6	6	48	31	10.2	129.5	-180.0	-16.2	-3.3	120.6				55.9
UARS	HALOE	94	11	9	21	46	5	1153	22	35	5	4.5	96.8	-40.3	-22.9	-2.2	118.8	245	2	2	14.8
ATLAS-3	CRISTA-180	94	11	10	0	23	39	6	7	23	56	22.2	278.4	-180.0	-16.2	34.8	266.9				113.0
UARS	HALOE	94	11	9	22	49	45	1153	23	38	43	41.9	299.3	-139.8	-22.9	37.0	270.2	380	1	33	151.5
ATLAS-3	CRISTA-180	94	11	10	1	18	24	6	8	18	41	9.5	106.1	-180.0	-16.2	-4.1	97.3				56.3
UARS	HALOE	94	11	9	23	22	25	1154	0	11	25	4.2	72.7	-40.2	-22.9	-2.6	94.6	344	1	55	14.4
ATLAS-3	CRISTA-180	94	11	10	1	53	48	6	8	54	5	22.9	255.0	-180.0	-16.2	35.5	243.3				112.3
UARS	HALOE	94	11	10	0	26	2	1154	1	15	3	42.1	275.2	-139.9	-22.9	37.2	246.0	307	1	27	151.2
ATLAS-3	CRISTA-180	94	11	10	2	48	34	6	9	48	51	8.8	82.7	-180.0	-16.2	-4.8	73.9				56.7
UARS	HALOE	94	11	10	0	58	44	1154	1	47	45	3.8	48.5	-40.0	-22.9	-3.0	70.4	442	1	49	14.0
ATLAS-3	CRISTA-180	94	11	10	3	23	58	6	10	24	15	23.6	231.5	-180.0	-16.2	36.1	219.7				111.6
UARS	HALOE	94	11	10	2	2	20	1154	2	51	12	42.3	251.1	-140.1	-22.9	37.4	221.8	235	1	21	151.0
ATLAS-3	CRISTA-180	94	11	10	4	18	43	6	11	19	0	8.0	59.3	-180.0	-16.2	-5.5	50.5				57.1
UARS	HALOE	94	11	10	2	35	3	1154	3	23	54	3.5	24.3	-39.9	-22.9	-3.3	46.2	541	1	43	13.6
ATLAS-3	CRISTA-180	94	11	10	4	54	8	6	11	54	25	24.3	208.0	-180.0	-16.2	36.8	196.1				110.9
UARS	HALOE	94	11	10	3	38	37	1154	4	27	32	42.5	227.0	-140.3	-22.9	37.6	197.7	165	1	15	150.8

Appendix 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-3	CRISTA-180	94 11 10 5 48 53	6 12 49 10	7.3	35.9	-180.0	-16.2	-6.2	27.2			57.5
UARS	HALOE	94 11 10 4 11 22	1154 5 0 14	3.1	0.1	-39.7	-22.9	-3.7	22.0	640	1 37	13.3
ATLAS-3	CRISTA-180	94 11 10 6 24 18	6 13 24 35	25.0	184.6	-180.0	-16.2	37.4	172.5			110.2
UARS	HALOE	94 11 10 5 14 55	1154 6 3 52	42.7	202.9	-140.4	-22.9	37.8	173.5	98	1 9	150.6
ATLAS-3	CRISTA-180	94 11 10 7 18 48	6 14 19 5	5.8	12.1	-180.0	-16.2	-7.8	3.3			58.1
UARS	HALOE	94 11 10 5 47 41	1154 6 36 33	2.8	335.9	-39.5	-22.9	-4.1	357.8	737	1 31	12.9
ATLAS-3	CRISTA-180	94 11 10 7 54 28	6 14 54 45	25.7	161.1	-180.0	-16.2	38.0	148.8			109.4
UARS	HALOE	94 11 10 6 51 12	1154 7 40 11	42.9	178.8	-140.6	-22.9	38.0	149.3	40	1 3	150.3
ATLAS-3	CRISTA-180	94 11 10 8 48 58	6 15 49 15	5.0	348.7	-180.0	-16.2	-8.5	339.9			58.6
UARS	HALOE	94 11 10 7 24 0	1154 8 12 53	2.4	311.7	-39.4	-22.9	-4.5	333.6	833	1 24	12.5
ATLAS-3	CRISTA-180	94 11 10 9 24 38	6 16 24 55	26.3	137.6	-180.0	-16.2	38.6	125.2			108.8
UARS	HALOE	94 11 10 8 27 29	1154 9 16 20	43.1	154.7	-140.7	-22.9	38.2	125.1	52	0 57	150.1
ATLAS-3	CRISTA-180	94 11 10 10 19 8	6 17 19 25	4.3	325.3	-180.0	-16.2	-9.3	316.5			59.1
UARS	HALOE	94 11 10 9 0 19	1154 9 49 13	2.1	287.5	-39.2	-22.9	-4.9	309.4	930	1 18	12.1
ATLAS-3	CRISTA-180	94 11 10 10 54 48	6 17 55 5	27.0	114.1	-180.0	-16.2	39.3	101.5			108.0
UARS	HALOE	94 11 10 10 3 47	1154 10 52 40	43.3	130.6	-140.9	-22.9	38.4	100.9	112	0 51	149.9
ATLAS-3	CRISTA-180	94 11 10 12 24 57	6 19 25 14	27.7	90.6	-180.0	-16.2	39.9	77.8			107.3
UARS	HALOE	94 11 10 11 40 4	1154 12 29 0	43.5	106.5	-141.0	-22.9	38.6	76.7	174	0 44	149.7
ATLAS-3	CRISTA-180	94 11 10 13 55 7	6 20 55 24	28.4	67.1	-180.0	-16.2	40.5	54.1			106.7
UARS	HALOE	94 11 10 13 16 21	1154 14 5 19	43.7	82.4	-141.2	-22.9	38.7	52.5	235	0 38	149.5
ATLAS-3	CRISTA-180	94 11 10 15 25 17	6 22 25 34	29.1	43.6	-180.0	-16.2	41.1	30.4			106.0
UARS	HALOE	94 11 10 14 52 38	1154 15 41 39	43.9	58.3	-141.4	-22.9	38.9	28.4	296	0 32	149.3
ATLAS-3	CRISTA-180	94 11 10 16 23 3	6 23 23 20	12.3	238.2	-180.0	-16.2	-1.3	229.4			59.1
UARS	HALOE	94 11 10 13 49 17	1154 14 38 12	1.0	215.0	-38.7	-22.9	-6.0	236.8	975	2 33	11.0
ATLAS-3	CRISTA-180	94 11 10 16 55 27	6 23 55 44	29.8	20.1	-180.0	-16.2	41.7	6.6			105.3
UARS	HALOE	94 11 10 16 28 56	1154 17 17 48	44.1	34.2	-141.5	-22.9	39.1	4.2	355	0 26	149.1
ATLAS-3	CRISTA-180	94 11 10 17 52 58	7 0 53 15	10.7	214.4	-180.0	-16.2	-2.8	205.5			59.6
UARS	HALOE	94 11 10 15 25 36	1154 16 14 31	0.7	190.8	-38.6	-22.9	-6.4	212.6	874	2 27	10.6
ATLAS-3	CRISTA-180	94 11 10 18 25 37	7 1 25 54	30.4	356.6	-180.0	-16.2	42.3	342.9			104.6
UARS	HALOE	94 11 10 18 5 13	1154 18 54 8	44.3	10.2	-141.7	-22.9	39.3	340.0	413	0 20	148.9
ATLAS-3	CRISTA-180	94 11 10 19 23 8	7 2 23 25	10.0	191.0	-180.0	-16.2	-3.6	182.2			60.0
UARS	HALOE	94 11 10 17 1 55	1154 17 50 51	0.4	166.6	-38.4	-22.9	-6.8	188.4	775	2 21	10.3
ATLAS-3	CRISTA-180	94 11 10 19 55 47	7 2 56 4	31.1	333.0	-180.0	-16.2	42.9	319.1			103.9
UARS	HALOE	94 11 10 19 41 30	1154 20 30 28	44.5	346.1	-141.9	-22.9	39.5	315.8	469	0 14	148.7
ATLAS-3	CRISTA-180	94 11 10 20 53 18	7 3 53 35	9.3	167.6	-180.0	-16.2	-4.3	158.8			60.5
UARS	HALOE	94 11 10 18 38 14	1154 19 27 11	0.0	142.4	-38.2	-22.9	-7.2	164.2	675	2 15	9.9
ATLAS-3	CRISTA-180	94 11 10 21 25 56	7 4 26 13	31.8	309.5	-180.0	-16.2	43.4	295.3			103.2
UARS	HALOE	94 11 10 21 17 47	1154 22 6 47	44.7	322.0	-142.1	-22.9	39.6	291.6	524	0 8	148.5
ATLAS-3	CRISTA-180	94 11 10 22 23 27	7 5 23 44	8.5	144.2	-180.0	-16.2	-5.0	135.4			60.9
UARS	HALOE	94 11 10 20 14 33	1154 21 3 30	-0.3	118.2	-38.1	-22.9	-7.5	140.0	575	2 8	9.5
ATLAS-3	CRISTA-180	94 11 10 22 56 6	7 5 56 23	32.4	286.0	-180.0	-16.2	44.0	271.5			102.5
UARS	HALOE	94 11 10 22 54 4	1154 23 42 56	44.9	297.9	-142.2	-22.9	39.8	267.4	577	0 2	148.3
ATLAS-3	CRISTA-180	94 11 10 23 53 37	7 6 53 54	7.8	120.8	-180.0	-16.2	-5.8	112.1			61.4
UARS	HALOE	94 11 10 21 50 51	1154 22 39 50	-0.6	94.0	-37.9	-22.9	-7.9	115.8	475	2 2	9.2

Appendix 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-3	CRISTA-180	94 11 11 0 26 16	7 7 26 33	33.1	262.4	-180.0	-16.2	44.6	247.7			101.8
UARS	HALOE	94 11 11 0 30 21	1155 1 19 16	45.0	273.8	-142.4	-22.9	40.0	243.3	629	0 4	148.1
ATLAS-3	CRISTA-180	94 11 11 1 23 47	7 8 24 4	7.1	97.5	-180.0	-16.2	-6.5	88.7			61.8
UARS	HALOE	94 11 10 23 27 10	1155 0 16 10	-1.0	69.8	-37.7	-22.9	-8.3	91.6	376	1 56	8.8
ATLAS-3	CRISTA-180	94 11 11 1 56 26	7 8 56 43	33.8	238.8	-180.0	-16.2	45.1	223.9			101.1
UARS	HALOE	94 11 11 2 6 38	1155 2 55 36	45.2	249.7	-142.6	-22.9	40.2	219.1	679	0 10	147.9
ATLAS-3	CRISTA-180	94 11 11 2 53 57	7 9 54 14	6.4	74.1	-180.0	-16.2	-7.2	65.3			62.3
UARS	HALOE	94 11 11 1 3 29	1155 1 52 30	-1.3	45.6	-37.5	-22.9	-8.6	67.4	278	1 50	8.4
ATLAS-3	CRISTA-180	94 11 11 4 24 7	7 11 24 24	5.6	50.7	-180.0	-16.2	-7.9	41.9			62.8
UARS	HALOE	94 11 11 2 39 48	1155 3 28 49	-1.6	21.4	-37.4	-22.9	-9.0	43.2	182	1 44	8.1
ATLAS-3	CRISTA-180	94 11 11 5 0 17	7 12 0 34	24.2	200.9	-180.0	-16.2	36.7	189.0			105.9
UARS	HALOE	94 11 11 3 42 55	1155 4 31 56	45.4	225.6	-142.8	-22.9	40.3	194.9	653	1 17	147.7
ATLAS-3	CRISTA-180	94 11 11 5 54 17	7 12 54 34	4.9	27.3	-180.0	-16.2	-8.7	18.6			63.3
UARS	HALOE	94 11 11 4 16 7	1155 5 4 58	-2.0	357.2	-37.2	-22.9	-9.4	19.0	93	1 38	7.7
ATLAS-3	CRISTA-180	94 11 11 6 30 27	7 13 30 44	24.9	177.4	-180.0	-16.2	37.3	165.4			105.3
UARS	HALOE	94 11 11 5 19 12	1155 6 8 5	45.6	201.5	-142.9	-22.9	40.5	170.7	581	1 11	147.5
ATLAS-3	CRISTA-180	94 11 11 7 24 11	7 14 24 28	3.3	3.5	-180.0	-16.2	-10.2	354.7			64.0
UARS	HALOE	94 11 11 5 52 25	1155 6 41 18	-2.3	333.0	-37.0	-22.9	-9.8	354.8	52	1 31	7.4
ATLAS-3	CRISTA-180	94 11 11 8 0 36	7 15 0 53	25.6	154.0	-180.0	-16.2	37.9	141.7			104.6
UARS	HALOE	94 11 11 6 55 29	1155 7 44 24	45.8	177.4	-143.1	-22.9	40.7	146.5	512	1 5	147.3
ATLAS-3	CRISTA-180	94 11 11 8 54 21	7 15 54 38	2.6	340.1	-180.0	-16.2	-10.9	331.3			64.5
UARS	HALOE	94 11 11 7 28 44	1155 8 17 38	-2.6	308.8	-36.8	-22.9	-10.1	330.6	119	1 25	7.0
ATLAS-3	CRISTA-180	94 11 11 9 30 46	7 16 31 3	26.3	130.5	-180.0	-16.2	38.6	118.1			103.9
UARS	HALOE	94 11 11 8 31 46	1155 9 20 44	45.9	153.3	-143.3	-22.9	40.8	122.4	444	0 59	147.2
ATLAS-3	CRISTA-180	94 11 11 10 24 31	7 17 24 48	1.9	316.7	-180.0	-16.2	-11.7	307.9			65.0
UARS	HALOE	94 11 11 9 5 3	1155 9 53 57	-2.9	284.6	-36.6	-22.9	-10.5	306.4	211	1 19	6.6
ATLAS-3	CRISTA-180	94 11 11 11 1 11	7 18 1 28	26.2	107.6	-180.0	-16.2	38.5	95.2			103.7
UARS	HALOE	94 11 11 10 8 3	1155 10 57 4	46.1	129.2	-143.5	-22.9	41.0	98.2	375	0 53	147.0
ATLAS-3	CRISTA-180	94 11 11 11 54 41	7 18 54 58	1.1	293.4	-180.0	-16.2	-12.4	284.5			65.5
UARS	HALOE	94 11 11 10 41 22	1155 11 30 17	-3.3	260.4	-36.5	-22.9	-10.9	282.2	306	1 13	6.3
ATLAS-3	CRISTA-180	94 11 11 12 31 21	7 19 31 38	26.8	84.1	-180.0	-16.2	39.1	71.6			103.0
UARS	HALOE	94 11 11 11 44 20	1155 12 33 13	46.3	105.1	-143.7	-22.9	41.1	74.0	307	0 47	146.8
ATLAS-3	CRISTA-180	94 11 11 13 24 51	7 20 25 8	0.4	270.0	-180.0	-16.2	-13.1	261.1			66.1
UARS	HALOE	94 11 11 12 17 40	1155 13 6 37	-3.6	236.2	-36.3	-22.9	-11.2	258.0	401	1 7	5.9
ATLAS-3	CRISTA-180	94 11 11 14 1 31	7 21 1 48	27.5	60.6	-180.0	-16.2	39.7	47.9			102.4
UARS	HALOE	94 11 11 13 20 37	1155 14 9 33	46.4	81.0	-143.9	-22.9	41.3	49.8	241	0 40	146.6
ATLAS-3	CRISTA-180	94 11 11 14 55 1	7 21 55 18	-0.3	246.6	-180.0	-16.2	-13.8	237.8			66.6
UARS	HALOE	94 11 11 13 53 59	1155 14 42 56	-3.9	212.0	-36.1	-22.9	-11.6	233.8	496	1 1	5.6
ATLAS-3	CRISTA-180	94 11 11 15 31 41	7 22 31 58	28.2	37.1	-180.0	-16.2	40.3	24.2			101.7
UARS	HALOE	94 11 11 14 56 53	1155 15 45 52	46.6	56.9	-144.1	-22.9	41.4	25.7	175	0 34	146.5
ATLAS-3	CRISTA-180	94 11 11 16 25 10	7 23 25 27	-1.0	223.3	-180.0	-16.2	-14.5	214.4			67.2
UARS	HALOE	94 11 11 15 30 18	1155 16 19 16	-4.2	187.8	-35.9	-22.9	-11.9	209.6	590	0 54	5.3
ATLAS-3	CRISTA-180	94 11 11 17 1 51	8 0 2 8	28.9	13.6	-180.0	-16.2	40.9	0.5			101.0
UARS	HALOE	94 11 11 16 33 10	1155 17 22 1	46.8	32.8	-144.2	-22.9	41.6	1.5	113	0 28	146.3

Appendix 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	miss time hr mn	solar zenith angle
ATLAS-3	CRISTA-180	94 11 11 17 55 20	8 0 55 37	-1.8 199.9	-180.0 -16.2	-15.3 191.0			67.7
UARS	HALOE	94 11 11 17 6 36	1155 17 55 36	-4.6 163.6	-35.7 -22.9	-12.3 185.4	684	0 48	4.9
ATLAS-3	CRISTA-180	94 11 11 18 32 0	8 1 32 17	29.6 350.1	-180.0 -16.2	41.5 336.7			100.4
UARS	HALOE	94 11 11 18 9 27	1155 18 58 21	46.9 8.7	-144.4 -22.9	41.7 337.3	53	0 22	146.1
ATLAS-3	CRISTA-180	94 11 11 19 25 15	8 2 25 32	-3.3 176.1	-180.0 -16.2	-16.8 167.0			68.5
UARS	HALOE	94 11 11 18 42 55	1155 19 31 56	-4.9 139.4	-35.5 -22.9	-12.7 161.2	777	0 42	4.6
ATLAS-3	CRISTA-180	94 11 11 20 2 10	8 3 2 27	30.2 326.6	-180.0 -16.2	42.1 313.0			99.7
UARS	HALOE	94 11 11 19 45 44	1155 20 34 41	47.1 344.6	-144.6 -22.9	41.9 313.1	27	0 16	146.0
ATLAS-3	CRISTA-180	94 11 11 20 55 25	8 3 55 42	-4.1 152.7	-180.0 -16.2	-17.5 143.6			69.1
UARS	HALOE	94 11 11 20 19 13	1155 21 8 5	-5.2 115.2	-35.3 -22.9	-13.0 137.0	868	0 36	4.3
ATLAS-3	CRISTA-180	94 11 11 21 32 20	8 4 32 37	30.9 303.1	-180.0 -16.2	42.7 289.2			99.1
UARS	HALOE	94 11 11 21 22 0	1155 22 11 0	47.2 320.5	-144.8 -22.9	42.0 289.0	77	0 10	145.8
ATLAS-3	CRISTA-180	94 11 11 22 25 35	8 5 25 52	-4.8 129.3	-180.0 -16.2	-18.2 120.2			69.7
UARS	HALOE	94 11 11 21 55 32	1155 22 44 24	-5.5 91.0	-35.1 -22.9	-13.4 112.8	957	0 30	4.0
ATLAS-3	CRISTA-180	94 11 11 23 2 30	8 6 2 47	31.6 279.5	-180.0 -16.2	43.3 265.5			98.5
UARS	HALOE	94 11 11 22 58 17	1155 23 47 10	47.4 296.5	-145.0 -22.9	42.2 264.8	133	0 4	145.7
ATLAS-3	CRISTA-180	94 11 12 0 32 40	8 7 32 57	32.3 256.0	-180.0 -16.2	43.9 241.7			97.8
UARS	HALOE	94 11 12 0 34 34	1156 1 23 29	47.5 272.4	-145.2 -22.9	42.3 240.6	190	0 1	145.5
ATLAS-3	CRISTA-180	94 11 12 2 59 20	8 9 59 37	3.9 65.5	-180.0 -16.2	-9.6 56.7			68.2
UARS	HALOE	94 11 12 1 8 9	1156 1 57 4	-6.1 42.6	-34.7 -22.9	-14.1 64.4	973	1 51	3.4

Appendix 6. Correlative measurement opportunities between ATLAS-3 (CRISTA-144) and HALOE (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-3	CRISTA-144	94	11	4	12	20	27	0	19	20	44	-41.6	290.3	-144.0	-16.4	-41.6	268.2	128	0	16	58.0
UARS	MLS	94	11	4	12	4	3	1148	12	53	5	-28.9	293.3	90.0	-22.9	-41.1	269.5				57.9
ATLAS-3	CRISTA-144	94	11	4	12	25	29	0	19	25	46	-26.7	305.2	-144.0	-16.4	-30.1	286.8	150	2	1	42.7
UARS	MLS	94	11	4	10	24	4	1148	11	13	3	-17.5	309.5	90.0	-22.9	-29.3	288.1				67.1
ATLAS-3	CRISTA-144	94	11	4	13	13	17	0	20	13	34	18.6	119.5	-144.0	-16.4	35.0	119.8	114	3	6	143.5
UARS	MLS	94	11	4	16	19	38	1148	17	8	29	57.0	120.2	90.0	-22.9	34.1	119.3				137.9
ATLAS-3	CRISTA-144	94	11	4	13	14	48	0	20	15	5	13.6	122.7	-144.0	-16.4	30.0	123.2	142	1	23	146.5
UARS	MLS	94	11	4	14	38	3	1148	15	27	4	52.6	111.5	90.0	-22.9	31.3	123.2				138.0
ATLAS-3	CRISTA-144	94	11	4	13	17	4	0	20	17	21	6.1	127.2	-144.0	-16.4	22.5	128.0	112	0	21	149.6
UARS	MLS	94	11	4	12	55	55	1148	13	44	56	39.4	111.4	90.0	-22.9	21.9	128.8				130.0
ATLAS-3	CRISTA-144	94	11	4	13	21	51	0	20	22	8	-9.8	136.4	-144.0	-16.4	6.6	137.0	99	2	8	148.5
UARS	MLS	94	11	4	11	13	0	1148	12	1	56	20.0	118.9	90.0	-22.9	5.9	137.6				114.9
ATLAS-3	CRISTA-144	94	11	4	13	41	59	0	20	42	16	-57.0	218.0	-144.0	-16.4	-46.0	198.1	77	3	12	88.7
UARS	MLS	94	11	4	16	54	7	1148	17	43	7	-33.0	223.7	90.0	-22.9	-45.6	198.9				55.5
ATLAS-3	CRISTA-144	94	11	4	13	46	30	0	20	46	47	-52.1	247.0	-144.0	-16.4	-47.0	222.8	102	1	31	73.2
UARS	MLS	94	11	4	15	18	8	1148	16	7	8	-33.7	248.8	90.0	-22.9	-46.3	223.7				54.7
ATLAS-3	CRISTA-144	94	11	4	13	50	47	0	20	51	4	-42.2	266.5	-144.0	-16.4	-42.0	244.2	120	0	10	58.9
UARS	MLS	94	11	4	13	40	34	1148	14	29	35	-29.8	269.6	90.0	-22.9	-42.0	245.7				57.5
ATLAS-3	CRISTA-144	94	11	4	13	55	49	0	20	56	6	-27.4	281.7	-144.0	-16.4	-30.7	263.2	106	1	55	43.6
UARS	MLS	94	11	4	12	0	35	1148	12	49	34	-18.4	285.7	90.0	-22.9	-30.2	264.1				

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Appendix 7. Correlative measurement opportunities between ATLAS-3 (CRISTA-162 or MAHRSI) 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-3	CRISTA-162	94	11	4	12	20	57	0	19	21	14	-40.2	292.0	-162.0	-16.4	-45.7	270.7	99	0	15	56.3
UARS	MLS	94	11	4	12	5	24	1148	12	54	18	-32.8	296.6	90.0	-22.9	-45.3	271.8				54.9
ATLAS-3	CRISTA-162	94	11	4	12	25	44	0	19	26	1	-25.9	305.8	-162.0	-16.4	-34.3	289.4	99	2	0	42.0
UARS	MLS	94	11	4	10	25	41	1148	11	14	38	-22.4	312.8	90.0	-22.9	-34.3	290.5				63.0
ATLAS-3	CRISTA-162	94	11	4	13	13	2	0	20	13	19	19.4	119.0	-162.0	-16.4	35.0	113.0	117	3	4	142.9
UARS	MLS	94	11	4	16	18	1	1148	17	6	54	56.7	109.7	90.0	-22.9	33.9	113.0				138.7
ATLAS-3	CRISTA-162	94	11	4	13	14	33	0	20	14	50	14.4	122.2	-162.0	-16.4	30.2	116.9	115	1	21	146.0
UARS	MLS	94	11	4	14	36	26	1148	15	25	18	49.7	103.6	90.0	-22.9	29.3	117.6				136.5
ATLAS-3	CRISTA-162	94	11	4	13	17	49	0	20	18	6	3.6	128.6	-162.0	-16.4	19.5	124.1	119	0	23	150.1
UARS	MLS	94	11	4	12	54	19	1148	13	43	11	35.1	106.7	90.0	-22.9	18.5	124.6				126.8
ATLAS-3	CRISTA-162	94	11	4	13	22	51	0	20	23	8	-13.1	138.4	-162.0	-16.4	2.7	133.9	138	2	11	147.0
UARS	MLS	94	11	4	11	11	40	1148	12	0	31	15.9	116.2	90.0	-22.9	2.3	135.0				111.4
ATLAS-3	CRISTA-162	94	11	4	13	43	14	0	20	43	31	-56.4	226.7	-162.0	-16.4	-51.0	200.2	128	3	12	84.4
UARS	MLS	94	11	4	16	55	43	1148	17	44	42	-37.5	228.3	90.0	-22.9	-50.6	201.9				52.0
ATLAS-3	CRISTA-162	94	11	4	13	47	16	0	20	47	33	-50.7	251.1	-162.0	-16.4	-51.4	224.8	138	1	32	70.6
UARS	MLS	94	11	4	15	19	45	1148	16	8	43	-38.1	253.3	90.0	-22.9	-51.3	226.7				51.3
ATLAS-3	CRISTA-162	94	11	4	13	51	17	0	20	51	34	-40.8	268.3	-162.0	-16.4	-46.1	246.7	99	0	9	57.3
UARS	MLS	94	11	4	13	41	54	1148	14	30	49	-33.6	273.1	90.0	-22.9	-46.2	248.0				54.5
ATLAS-3	CRISTA-162	94	11	4	13	55	49	0	20	56	6	-27.4	281.7	-162.0	-16.4	-35.6	264.9	159	1	53	43.6
UARS	MLS	94	11	4	12	2	11	1148	12	51	9	-23.3	289.0	90.0	-22.9	-35.2	266.6				62.5

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Appendix 8. Correlative measurement opportunities beween ATLAS-3 (CRISTA-144) 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-3	CRISTA-180	94	11	4	12	20	57	0	19	21	14	-40.2	292.0	-180.0	-16.4	-50.4	273.5	95	0	13	56.3
UARS	MLS	94	11	4	12	7	0	1148	12	55	53	-37.2	301.1	90.0	-22.9	-50.3	274.8				51.5
ATLAS-3	CRISTA-180	94	11	4	12	25	14	0	19	25	31	-27.5	304.6	-180.0	-16.4	-39.8	291.4	147	1	57	43.4
UARS	MLS	94	11	4	10	27	17	1148	11	16	13	-27.2	316.3	90.0	-22.9	-39.3	293.0				59.0
ATLAS-3	CRISTA-180	94	11	4	13	12	32	0	20	12	49	21.0	117.8	-180.0	-16.4	33.9	106.3	95	3	3	141.7
UARS	MLS	94	11	4	16	16	25	1148	17	5	19	55.5	99.5	90.0	-22.9	33.2	106.8				138.8
ATLAS-3	CRISTA-180	94	11	4	13	14	33	0	20	14	50	14.4	122.2	-180.0	-16.4	27.8	111.7	114	1	20	146.0
UARS	MLS	94	11	4	14	34	50	1148	15	23	43	46.2	96.7	90.0	-22.9	26.9	112.4				134.4
ATLAS-3	CRISTA-180	94	11	4	13	18	19	0	20	18	36	1.9	129.6	-180.0	-16.4	15.6	120.3	101	0	25	150.3
UARS	MLS	94	11	4	12	52	43	1148	13	41	36	30.5	102.4	90.0	-22.9	14.8	120.7				123.2
ATLAS-3	CRISTA-180	94	11	4	13	23	37	0	20	23	54	-15.6	139.9	-180.0	-16.4	-1.9	130.7	157	2	13	145.6
UARS	MLS	94	11	4	11	9	47	1148	11	58	46	10.1	112.7	90.0	-22.9	-2.9	131.7				106.4
ATLAS-3	CRISTA-180	94	11	4	13	44	15	0	20	44	32	-55.5	233.4	-180.0	-16.4	-56.6	203.8	136	3	13	80.9
UARS	MLS	94	11	4	16	57	35	1148	17	46	27	-42.4	234.3	90.0	-22.9	-56.4	206.0				48.4
ATLAS-3	CRISTA-180	94	11	4	13	47	46	0	20	48	3	-49.6	253.6	-180.0	-16.4	-56.1	228.3	108	1	33	68.9
UARS	MLS	94	11	4	15	21	5	1148	16	9	57	-41.6	257.6	90.0	-22.9	-55.5	229.7				48.7
ATLAS-3	CRISTA-180	94	11	4	13	51	17	0	20	51	34	-40.8	268.3	-180.0	-16.4	-50.9	249.4	96	0	8	57.3
UARS	MLS	94	11	4	13	43	14	1148	14	32	13	-37.3	276.8	90.0	-22.9	-50.4	250.5				51.6
ATLAS-3	CRISTA-180	94	11	4	13	55	34	0	20	55	51	-28.2	281.0	-180.0	-16.4	-40.5	267.7	122	1	51	44.3
UARS	MLS	94	11	4	12	3	47	1148	12	52	44	-28.1	292.6	90.0	-22.9	-40.2	269.1				58.6

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Appendix 9. Correlative measurement opportunities between ATLAS-3 (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-3	MAS	94	11	4	3	35	47	0	10	36	4	18.9	111.5	-90.0	-16.4	27.7	96.4				35.7
UARS	HALOE	94	11	4	0	29	34	1148	1	18	34	35.3	61.0	-45.2	-22.9	31.0	87.9	900	3	6	45.3
ATLAS-3	MAS	94	11	4	5	6	7	0	12	6	24	18.2	88.1	-90.0	-16.4	27.0	73.0				35.3
UARS	HALOE	94	11	4	2	5	53	1148	2	54	54	35.0	36.9	-45.3	-22.9	30.7	63.7	993	3	0	45.0

Appendix 10. Correlative measurement opportunities between ATLAS-3 (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-3	MAS	94	11	3	23	35	43	0	6	36	0	26.1	321.1	-90.0	-16.4	35.2	337.1	131	2	17	140.4
UARS	MLS	94	11	4	1	53	28	1148	2	42	25	57.0	337.8	90.0	-22.9	34.1	337.6				137.5
ATLAS-3	MAS	94	11	3	23	37	14	0	6	37	30	21.3	324.6	-90.0	-16.4	30.2	340.0	36	0	34	144.4
UARS	MLS	94	11	4	0	11	21	1148	1	0	17	51.2	326.8	90.0	-22.9	30.4	339.7				138.4
ATLAS-3	MAS	94	11	3	23	40	0	0	6	40	17	12.2	330.5	-90.0	-16.4	20.9	345.0	134	1	10	150.3
UARS	MLS	94	11	3	22	29	13	1147	23	18	9	37.2	328.4	90.0	-22.9	20.2	346.0				130.6
ATLAS-3	MAS	94	11	3	23	45	17	0	6	45	34	-5.3	340.7	-90.0	-16.4	3.7	354.4	97	2	59	152.2
UARS	MLS	94	11	3	20	46	2	1147	21	34	58	16.7	336.2	90.0	-22.9	3.0	354.9				114.8
ATLAS-3	MAS	94	11	4	0	4	39	0	7	4	56	-56.4	50.3	-90.0	-16.4	-40.2	54.0	109	2	21	94.8
UARS	MLS	94	11	4	2	26	21	1148	3	15	17	-27.5	78.5	90.0	-22.9	-39.6	55.1				57.3
ATLAS-3	MAS	94	11	4	0	9	41	0	7	9	58	-54.7	84.6	-90.0	-16.4	-38.9	77.6	121	0	40	77.0
UARS	MLS	94	11	4	0	49	51	1148	1	38	47	-26.7	102.2	90.0	-22.9	-38.7	79.0				57.8
ATLAS-3	MAS	94	11	4	0	14	43	0	7	15	0	-44.4	110.2	-90.0	-16.4	-31.1	97.8	162	1	3	59.5
UARS	MLS	94	11	3	23	10	56	1147	23	59	49	-18.5	120.8	90.0	-22.9	-30.3	99.2				64.2
ATLAS-3	MAS	94	11	4	0	20	46	0	7	21	3	-26.8	129.0	-90.0	-16.4	-16.2	115.5	120	2	50	40.4
UARS	MLS	94	11	3	21	29	53	1147	22	18	45	-3.4	136.1	90.0	-22.9	-15.5	116.4				76.9
ATLAS-3	MAS	94	11	4	1	6	18	0	8	6	35	26.0	298.2	-90.0	-16.4	35.1	314.1	113	2	23	140.2
UARS	MLS	94	11	4	3	29	58	1148	4	18	55	57.0	315.4	90.0	-22.9	34.1	314.4				137.3
ATLAS-3	MAS	94	11	4	1	7	49	0	8	8	6	21.2	301.7	-90.0	-16.4	30.0	317.1	101	0	40	144.2
UARS	MLS	94	11	4	1	47	51	1148	2	36	47	51.7	303.9	90.0	-22.9	30.7	316.4				138.4
ATLAS-3	MAS	94	11	4	1	10	20	0	8	10	37	13.0	307.0	-90.0	-16.4	21.7	321.6	125	1	4	149.6
UARS	MLS	94	11	4	0	5	44	1148	0	54	40	38.0	304.9	90.0	-22.9	20.8	322.4				130.9
ATLAS-3	MAS	94	11	4	1	15	22	0	8	15	39	-3.8	316.8	-90.0	-16.4	5.2	330.6	140	2	52	152.3
UARS	MLS	94	11	3	22	22	49	1147	23	11	50	18.4	312.9	90.0	-22.9	4.5	331.6				116.0
ATLAS-3	MAS	94	11	4	1	35	0	0	8	35	17	-56.2	25.8	-90.0	-16.4	-40.0	30.0	74	2	27	95.7
UARS	MLS	94	11	4	4	2	35	1148	4	51	26	-27.6	54.2	90.0	-22.9	-39.7	30.8				57.5
ATLAS-3	MAS	94	11	4	1	40	1	0	8	40	18	-54.9	60.3	-90.0	-16.4	-39.1	53.6	95	0	46	77.9
UARS	MLS	94	11	4	2	26	5	1148	3	14	56	-26.7	77.9	90.0	-22.9	-38.8	54.7				58.0
ATLAS-3	MAS	94	11	4	1	45	3	0	8	45	20	-45.0	86.3	-90.0	-16.4	-31.6	74.1	121	0	57	60.5
UARS	MLS	94	11	4	0	47	26	1148	1	36	19	-19.4	97.0	90.0	-22.9	-31.2	75.3				63.7
ATLAS-3	MAS	94	11	4	1	51	6	0	8	51	23	-27.5	105.5	-90.0	-16.4	-16.8	92.0	67	2	44	41.3
UARS	MLS	94	11	3	23	6	23	1147	23	55	15	-4.4	112.2	90.0	-22.9	-16.4	92.4				76.3
ATLAS-3	MAS	94	11	4	2	36	54	0	9	37	11	25.9	275.3	-90.0	-16.4	35.0	291.2	104	2	29	140.0
UARS	MLS	94	11	4	5	6	29	1148	5	55	25	56.9	293.0	90.0	-22.9	34.0	291.1				137.1
ATLAS-3	MAS	94	11	4	2	40	40	0	9	40	57	13.7	283.6	-90.0	-16.4	22.4	298.3	122	0	58	148.9
UARS	MLS	94	11	4	1	42	14	1148	2	31	10	38.8	281.4	90.0	-22.9	21.4	298.9				131.3
ATLAS-3	MAS	94	11	4	2	45	42	0	9	45	59	-3.0	293.4	-90.0	-16.4	5.9	307.2	96	2	46	152.2
UARS	MLS	94	11	3	23	59	19	1148	0	48	20	19.4	289.2	90.0	-22.9	5.4	307.8				116.4
ATLAS-3	MAS	94	11	4	3	5	5	0	10	5	22	-55.8	359.7	-90.0	-16.4	-39.8	4.8	132	2	33	97.5
UARS	MLS	94	11	4	5	38	34	1148	6	27	25	-26.9	29.3	90.0	-22.9	-39.0	6.0				58.4
ATLAS-3	MAS	94	11	4	3	10	7	0	10	10	24	-55.5	34.3	-90.0	-16.4	-39.5	28.5	171	0	52	79.7
UARS	MLS	94	11	4	4	2	19	1148	4	51	16	-26.8	53.6	90.0	-22.9	-38.9	30.3				58.2

Appendix 10. 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-3	MAS	94	11	4	3	15	24	0	10	15	41	-45.5	62.4	-90.0	-16.4	-32.0	50.3	98	0	51	61.5
UARS	MLS	94	11	4	2	23	57	1148	3	12	49	-20.3	73.2	90.0	-22.9	-32.1	51.3				63.2
ATLAS-3	MAS	94	11	4	3	21	11	0	10	21	28	-29.0	81.3	-90.0	-16.4	-18.1	67.8	115	2	38	43.0
UARS	MLS	94	11	4	0	43	10	1148	1	32	6	-6.1	88.9	90.0	-22.9	-18.1	68.9				75.1
ATLAS-3	MAS	94	11	4	4	7	29	0	11	7	46	25.8	252.4	-90.0	-16.4	34.9	268.3	103	2	35	139.8
UARS	MLS	94	11	4	6	42	59	1148	7	31	56	56.8	270.6	90.0	-22.9	34.0	267.9				136.9
ATLAS-3	MAS	94	11	4	4	11	1	0	11	11	18	14.4	260.2	-90.0	-16.4	23.1	274.9	125	0	52	148.1
UARS	MLS	94	11	4	3	18	45	1148	4	7	40	39.6	258.0	90.0	-22.9	22.1	275.3				131.6
ATLAS-3	MAS	94	11	4	4	15	47	0	11	16	4	-1.5	269.5	-90.0	-16.4	7.4	283.3	150	2	39	152.2
UARS	MLS	94	11	4	1	36	5	1148	2	25	1	21.1	265.9	90.0	-22.9	6.9	284.6				117.6
ATLAS-3	MAS	94	11	4	4	35	25	0	11	35	42	-55.6	335.3	-90.0	-16.4	-39.6	340.8	93	2	39	98.4
UARS	MLS	94	11	4	7	14	48	1148	8	3	45	-27.0	4.9	90.0	-22.9	-39.1	341.7				58.6
ATLAS-3	MAS	94	11	4	4	40	27	0	11	40	44	-55.7	9.9	-90.0	-16.4	-39.7	4.5	148	0	58	80.7
UARS	MLS	94	11	4	5	38	34	1148	6	27	25	-26.9	29.3	90.0	-22.9	-39.0	6.0				58.4
ATLAS-3	MAS	94	11	4	4	45	29	0	11	45	46	-46.7	37.4	-90.0	-16.4	-32.9	25.6	153	0	45	63.3
UARS	MLS	94	11	4	4	0	11	1148	4	49	9	-20.4	48.9	90.0	-22.9	-32.2	27.0				63.5
ATLAS-3	MAS	94	11	4	4	51	16	0	11	51	33	-30.5	57.1	-90.0	-16.4	-19.4	43.6	149	2	31	44.7
UARS	MLS	94	11	4	2	19	40	1148	3	8	36	-7.1	65.0	90.0	-22.9	-19.0	45.0				74.6
ATLAS-3	MAS	94	11	4	7	8	40	0	14	8	57	25.6	206.5	-90.0	-16.4	34.6	222.4	105	2	47	139.3
UARS	MLS	94	11	4	9	56	16	1148	10	45	17	56.3	227.4	90.0	-22.9	33.7	222.5				136.1
ATLAS-3	MAS	94	11	4	7	11	41	0	14	11	58	15.8	213.3	-90.0	-16.4	24.6	228.1	126	0	39	146.6
UARS	MLS	94	11	4	6	32	2	1148	7	21	2	41.9	212.1	90.0	-22.9	23.8	229.0				132.6
ATLAS-3	MAS	94	11	4	7	16	28	0	14	16	45	0.0	222.7	-90.0	-16.4	8.9	236.6	68	2	27	151.7
UARS	MLS	94	11	4	4	49	6	1148	5	38	1	22.9	218.4	90.0	-22.9	8.4	237.0				118.5
ATLAS-3	MAS	94	11	4	7	35	51	0	14	36	8	-54.8	284.9	-90.0	-16.4	-39.0	291.7	100	2	51	101.0
UARS	MLS	94	11	4	10	27	1	1148	11	15	52	-26.4	315.7	90.0	-22.9	-38.5	292.6				59.7
ATLAS-3	MAS	94	11	4	7	41	8	0	14	41	25	-56.1	321.0	-90.0	-16.4	-40.0	316.5	108	1	10	82.6
UARS	MLS	94	11	4	8	51	19	1148	9	40	15	-27.9	341.3	90.0	-22.9	-40.0	317.8				58.2
ATLAS-3	MAS	94	11	4	7	45	55	0	14	46	12	-48.3	348.4	-90.0	-16.4	-34.2	337.0	190	0	32	66.1
UARS	MLS	94	11	4	7	12	56	1148	8	1	48	-21.4	0.8	90.0	-22.9	-33.3	338.7				63.2
ATLAS-3	MAS	94	11	4	7	51	42	0	14	51	59	-32.6	9.2	-90.0	-16.4	-21.2	355.8	142	2	19	47.3
UARS	MLS	94	11	4	5	32	41	1148	6	21	37	-8.9	17.3	90.0	-22.9	-20.8	357.1				73.6
ATLAS-3	MAS	94	11	4	8	39	15	0	15	39	32	25.5	183.6	-90.0	-16.4	34.5	199.5	109	2	53	139.1
UARS	MLS	94	11	4	11	32	47	1148	12	21	47	56.1	204.9	90.0	-22.9	33.5	199.3				135.9
ATLAS-3	MAS	94	11	4	8	42	1	0	15	42	18	16.5	189.8	-90.0	-16.4	25.3	204.7	131	0	33	145.8
UARS	MLS	94	11	4	8	8	32	1148	8	57	32	42.6	188.7	90.0	-22.9	24.3	205.5				132.9
ATLAS-3	MAS	94	11	4	8	46	33	0	15	46	50	1.5	198.8	-90.0	-16.4	10.4	212.7	129	2	20	151.3
UARS	MLS	94	11	4	6	25	53	1148	7	14	52	24.6	195.3	90.0	-22.9	9.9	213.8				119.6
ATLAS-3	MAS	94	11	4	10	9	51	0	17	10	8	25.4	160.7	-90.0	-16.4	34.4	176.6	122	2	59	138.9
UARS	MLS	94	11	4	13	9	17	1148	13	58	18	55.9	182.4	90.0	-22.9	33.4	176.1				135.6
ATLAS-3	MAS	94	11	4	10	12	22	0	17	12	39	17.3	166.4	-90.0	-16.4	26.0	181.3	142	0	27	145.0
UARS	MLS	94	11	4	9	45	3	1148	10	34	2	43.4	165.4	90.0	-22.9	24.9	182.0				133.2
ATLAS-3	MAS	94	11	4	10	16	38	0	17	16	55	3.1	174.9	-90.0	-16.4	11.9	188.9	189	2	14	150.8
UARS	MLS	94	11	4	8	2	23	1148	8	51	23	25.5	171.6	90.0	-22.9	10.6	190.0				120.0

Appendix 10. 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-3	MAS	94	11	4	10	36	16	0	17	36	33	-53.8	234.7	-90.0	-16.4	-38.3	242.6	94	3	2	103.6
UARS	MLS	94	11	4	13	39	14	1148	14	28	11	-25.8	266.5	90.0	-22.9	-37.8	243.5				60.7
ATLAS-3	MAS	94	11	4	10	41	33	0	17	41	50	-56.6	270.3	-90.0	-16.4	-40.3	267.3	155	1	21	85.3
UARS	MLS	94	11	4	12	3	31	1148	12	52	22	-27.3	292.0	90.0	-22.9	-39.4	268.7				59.2
ATLAS-3	MAS	94	11	4	10	46	35	0	17	46	52	-49.3	300.3	-90.0	-16.4	-34.9	289.3	127	0	20	68.0
UARS	MLS	94	11	4	10	25	41	1148	11	14	38	-22.4	312.8	90.0	-22.9	-34.3	290.5				63.0
ATLAS-3	MAS	94	11	4	10	52	7	0	17	52	24	-34.6	321.3	-90.0	-16.4	-23.0	307.9	141	2	6	50.0
UARS	MLS	94	11	4	8	45	42	1148	9	34	37	-10.8	329.7	90.0	-22.9	-22.6	309.2				72.6

Appendix 11. Correlative measurement opportunities between ATLAS-3 (SSBUV) 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-3	SSBUV	94	11	7	0	58	6	3	7	58	23	13.7	131.0	0.0	-90.0	13.7	131.0				42.3
UARS	HALOE	94	11	6	21	31	27	1150	22	20	19	20.8	104.2	-45.0	-22.9	15.6	127.7	417	3	26	31.5
ATLAS-3	SSBUV	94	11	7	2	28	21	3	9	28	38	13.0	107.6	0.0	-90.0	13.0	107.6				42.5
UARS	HALOE	94	11	6	23	7	47	1150	23	56	39	20.5	80.0	-45.0	-22.9	15.2	103.5	509	3	20	31.2
ATLAS-3	SSBUV	94	11	8	1	4	54	4	8	5	11	11.3	122.0	0.0	-90.0	11.3	122.0				46.5
UARS	HALOE	94	11	7	21	36	22	1151	22	25	15	15.3	102.0	-43.9	-22.9	9.7	124.7	346	3	28	26.1
ATLAS-3	SSBUV	94	11	8	2	35	9	4	9	35	26	10.6	98.6	0.0	-90.0	10.6	98.6				46.8
UARS	HALOE	94	11	7	23	12	41	1152	0	1	34	15.0	77.8	-43.8	-22.9	9.3	100.5	253	3	22	25.7
ATLAS-3	SSBUV	94	11	8	5	35	32	4	12	35	49	8.7	51.6	0.0	-90.0	8.7	51.6				47.3
UARS	HALOE	94	11	8	2	25	21	1152	3	14	14	14.2	29.5	-43.7	-22.9	8.5	52.1	66	3	10	25.0
ATLAS-3	SSBUV	94	11	8	7	5	46	4	14	6	3	8.0	28.2	0.0	-90.0	8.0	28.2				47.7
UARS	HALOE	94	11	8	4	1	40	1152	4	50	33	13.9	5.3	-43.6	-22.9	8.1	27.9	30	3	4	24.6
ATLAS-3	SSBUV	94	11	8	8	35	59	4	15	36	16	7.3	4.8	0.0	-90.0	7.3	4.8				48.0
UARS	HALOE	94	11	8	5	38	0	1152	6	26	53	13.5	341.2	-43.5	-22.9	7.7	3.7	126	2	57	24.2
ATLAS-3	SSBUV	94	11	8	10	6	13	4	17	6	30	6.6	341.4	0.0	-90.0	6.6	341.4				48.4
UARS	HALOE	94	11	8	7	14	19	1152	8	3	13	13.1	317.0	-43.4	-22.9	7.3	339.5	222	2	51	23.8
ATLAS-3	SSBUV	94	11	8	11	36	27	4	18	36	44	5.8	318.0	0.0	-90.0	5.8	318.0				48.8
UARS	HALOE	94	11	8	8	50	39	1152	9	39	33	12.8	292.8	-43.3	-22.9	6.9	315.3	319	2	45	23.5
ATLAS-3	SSBUV	94	11	8	16	6	52	4	23	7	9	2.8	247.4	0.0	-90.0	2.8	247.4				50.2
UARS	HALOE	94	11	8	13	39	38	1152	14	28	32	11.7	220.4	-42.9	-22.9	5.7	242.7	607	2	27	22.3
ATLAS-3	SSBUV	94	11	8	17	37	6	5	0	37	23	2.1	224.0	0.0	-90.0	2.1	224.0				50.6
UARS	HALOE	94	11	8	15	15	57	1152	16	4	51	11.3	196.2	-42.8	-22.9	5.3	218.5	704	2	21	22.0
ATLAS-3	SSBUV	94	11	8	19	7	19	5	2	7	36	1.4	200.6	0.0	-90.0	1.4	200.6				51.1
UARS	HALOE	94	11	8	16	52	17	1152	17	41	11	11.0	172.0	-42.7	-22.9	4.9	194.3	801	2	15	21.6
ATLAS-3	SSBUV	94	11	8	20	37	33	5	3	37	50	0.6	177.2	0.0	-90.0	0.6	177.2				51.6
UARS	HALOE	94	11	8	18	28	36	1152	19	17	31	10.6	147.8	-42.6	-22.9	4.5	170.1	899	2	8	21.2
ATLAS-3	SSBUV	94	11	9	4	11	42	5	11	11	59	7.0	66.1	0.0	-90.0	7.0	66.1				52.2
UARS	HALOE	94	11	9	0	53	54	1153	1	42	49	9.1	51.2	-42.1	-22.9	2.9	73.3	923	3	17	19.7
ATLAS-3	SSBUV	94	11	9	5	41	56	5	12	42	13	6.3	42.7	0.0	-90.0	6.3	42.7				52.6
UARS	HALOE	94	11	9	2	30	13	1153	3	19	9	8.8	27.0	-42.0	-22.9	2.5	49.1	828	3	11	19.3
ATLAS-3	SSBUV	94	11	9	7	12	9	5	14	12	26	5.6	19.3	0.0	-90.0	5.6	19.3				53.0
UARS	HALOE	94	11	9	4	6	33	1153	4	55	29	8.4	2.8	-41.8	-22.9	2.1	24.9	732	3	5	18.9
ATLAS-3	SSBUV	94	11	9	8	42	23	5	15	42	40	4.9	356.0	0.0	-90.0	4.9	355.9				53.4
UARS	HALOE	94	11	9	5	42	52	1153	6	31	48	8.1	338.6	-41.7	-22.9	1.7	0.7	636	2	59	18.6
ATLAS-3	SSBUV	94	11	9	11	42	35	5	18	42	52	2.6	308.7	0.0	-90.0	2.6	308.7				54.5
UARS	HALOE	94	11	9	8	55	31	1153	9	44	28	7.3	290.3	-41.5	-22.9	0.9	312.3	444	2	47	17.8
ATLAS-3	SSBUV	94	11	9	13	12	48	5	20	13	5	1.8	285.3	0.0	-90.0	1.8	285.3				55.0
UARS	HALOE	94	11	9	10	31	50	1153	11	20	48	7.0	266.1	-41.3	-22.9	0.6	288.1	346	2	40	17.4
ATLAS-3	SSBUV	94	11	9	14	43	2	5	21	43	19	1.1	261.9	0.0	-90.0	1.1	261.9				55.5
UARS	HALOE	94	11	9	12	8	10	1153	12	57	7	6.6	241.9	-41.2	-22.9	0.2	263.9	248	2	34	17.0
ATLAS-3	SSBUV	94	11	9	16	13	15	5	23	13	32	0.4	238.6	0.0	-90.0	0.4	238.5				56.0
UARS	HALOE	94	11	9	13	44	29	1153	14	33	27	6.3	217.8	-41.0	-22.9	-0.2	239.7	150	2	28	16.7

Appendix 11. 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-3	SSBUV	94	11	9	17	43	29	6	0	43	46	-0.3	215.2	0.0	-90.0	-0.3	215.2				56.5
UARS	HALOE	94	11	9	15	20	48	1153	16	9	47	5.9	193.6	-40.9	-22.9	-0.6	215.5	53	2	22	16.3
ATLAS-3	SSBUV	94	11	10	7	14	32	6	14	14	49	-7.8	4.3	0.0	-90.0	-7.8	4.4				61.9
UARS	HALOE	94	11	10	5	47	41	1154	6	36	33	2.8	335.9	-39.5	-22.9	-4.1	357.8	839	1	26	12.9
ATLAS-3	SSBUV	94	11	10	8	44	42	6	15	44	59	-8.5	340.9	0.0	-90.0	-8.5	341.0				62.5
UARS	HALOE	94	11	10	7	24	0	1154	8	12	53	2.4	311.7	-39.4	-22.9	-4.5	333.6	937	1	20	12.5
ATLAS-3	SSBUV	94	11	10	14	48	22	6	21	48	39	-1.4	253.3	0.0	-90.0	-1.4	253.4				61.5
UARS	HALOE	94	11	10	12	12	58	1154	13	1	52	1.4	239.2	-38.9	-22.9	-5.6	261.0	969	2	35	11.4
ATLAS-3	SSBUV	94	11	10	16	18	32	6	23	18	49	-2.1	229.9	0.0	-90.0	-2.1	230.0				62.1
UARS	HALOE	94	11	10	13	49	17	1154	14	38	12	1.0	215.0	-38.7	-22.9	-6.0	236.8	869	2	29	11.0
ATLAS-3	SSBUV	94	11	10	19	18	52	7	2	19	9	-3.5	183.2	0.0	-90.0	-3.5	183.3				63.2
UARS	HALOE	94	11	10	17	1	55	1154	17	50	51	0.4	166.6	-38.4	-22.9	-6.8	188.4	670	2	16	10.3
ATLAS-3	SSBUV	94	11	10	20	49	1	7	3	49	18	-4.3	159.8	0.0	-90.0	-4.3	159.9				63.8
UARS	HALOE	94	11	10	18	38	14	1154	19	27	11	0.0	142.4	-38.2	-22.9	-7.2	164.2	572	2	10	9.9
ATLAS-3	SSBUV	94	11	10	22	18	56	7	5	19	13	-5.8	136.0	0.0	-90.0	-5.8	136.0				64.6
UARS	HALOE	94	11	10	20	14	33	1154	21	3	30	-0.3	118.2	-38.1	-22.9	-7.5	140.0	474	2	4	9.5
ATLAS-3	SSBUV	94	11	10	23	49	6	7	6	49	23	-6.6	112.6	0.0	-90.0	-6.6	112.7				65.2
UARS	HALOE	94	11	10	21	50	51	1154	22	39	50	-0.6	94.0	-37.9	-22.9	-7.9	115.8	373	1	58	9.2
ATLAS-3	SSBUV	94	11	11	1	19	16	7	8	19	33	-7.3	89.2	0.0	-90.0	-7.3	89.3				65.8
UARS	HALOE	94	11	10	23	27	10	1155	0	16	10	-1.0	69.8	-37.7	-22.9	-8.3	91.6	274	1	52	8.8
ATLAS-3	SSBUV	94	11	11	2	49	26	7	9	49	43	-8.0	65.8	0.0	-90.0	-8.0	65.9				66.4
UARS	HALOE	94	11	11	1	3	29	1155	1	52	30	-1.3	45.6	-37.5	-22.9	-8.6	67.4	175	1	45	8.4
ATLAS-3	SSBUV	94	11	11	4	19	36	7	11	19	53	-8.7	42.5	0.0	-90.0	-8.7	42.6				67.0
UARS	HALOE	94	11	11	2	39	48	1155	3	28	49	-1.6	21.4	-37.4	-22.9	-9.0	43.2	76	1	39	8.1
ATLAS-3	SSBUV	94	11	11	7	19	55	7	14	20	12	-10.2	355.7	0.0	-90.0	-10.2	355.8				68.3
UARS	HALOE	94	11	11	5	52	25	1155	6	41	18	-2.3	333.0	-37.0	-22.9	-9.8	354.8	120	1	27	7.4
ATLAS-3	SSBUV	94	11	11	8	50	5	7	15	50	22	-10.9	332.3	0.0	-90.0	-10.9	332.4				68.9
UARS	HALOE	94	11	11	7	28	44	1155	8	17	38	-2.6	308.8	-36.8	-22.9	-10.1	330.6	216	1	21	7.0
ATLAS-3	SSBUV	94	11	11	10	20	15	7	17	20	32	-11.6	308.9	0.0	-90.0	-11.6	309.0				69.5
UARS	HALOE	94	11	11	9	5	3	1155	9	53	57	-2.9	284.6	-36.6	-22.9	-10.5	306.4	314	1	15	6.6
ATLAS-3	SSBUV	94	11	11	10	52	54	7	17	53	11	48.8	80.3	0.0	-90.0	48.8	80.4				89.2
UARS	HALOE	94	11	11	11	44	20	1155	12	33	13	46.3	105.1	-143.7	-22.9	41.1	74.0	995	0	51	146.8
ATLAS-3	SSBUV	94	11	11	11	50	25	7	18	50	42	-12.4	285.5	0.0	-90.0	-12.4	285.6				70.1
UARS	HALOE	94	11	11	10	41	22	1155	11	30	17	-3.3	260.4	-36.5	-22.9	-10.9	282.2	411	1	9	6.3
ATLAS-3	SSBUV	94	11	11	13	20	20	7	20	20	37	-13.9	261.6	0.0	-90.0	-13.9	261.7				71.1
UARS	HALOE	94	11	11	12	17	40	1155	13	6	37	-3.6	236.2	-36.3	-22.9	-11.2	258.0	504	1	2	5.9
ATLAS-3	SSBUV	94	11	11	19	20	59	8	2	21	16	-16.8	168.0	0.0	-90.0	-16.8	168.1				73.6
UARS	HALOE	94	11	11	18	42	55	1155	19	31	56	-4.9	139.4	-35.5	-22.9	-12.7	161.2	874	0	38	4.6
ATLAS-3	SSBUV	94	11	11	20	51	9	8	3	51	26	-17.5	144.6	0.0	-90.0	-17.5	144.7				74.2
UARS	HALOE	94	11	11	20	19	13	1155	21	8	5	-5.2	115.2	-35.3	-22.9	-13.0	137.0	965	0	31	4.3
ATLAS-3	SSBUV	94	11	12	17	0	12	9	0	0	29	49.6	339.7	0.0	-90.0	49.6	339.8				85.0
UARS	HALOE	94	11	12	18	13	36	1156	19	2	34	49.1	7.4	-147.4	-22.9	43.8	334.7	752	1	13	144.0
ATLAS-3	SSBUV	94	11	12	19	26	22	9	2	26	39	-19.1	159.3	0.0	-90.0	-19.1	159.4				79.8
UARS	HALOE	94	11	12	18	47	30	1156	19	36	30	-9.4	136.3	-32.5	-22.9	-17.9	158.2	187	0	38	2.8

Appendix 11. 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-3	SSBUV	94	11	12	20	4	3	9	3	4	20	42.0	306.9	0.0	-90.0	42.0	307.0				89.2
UARS	HALOE	94	11	12	19	49	52	1156	20	38	43	49.3	343.3	-147.7	-22.9	43.9	310.6	357	0	14	143.8
ATLAS-3	SSBUV	94	11	12	20	56	32	9	3	56	49	-19.9	135.9	0.0	-90.0	-19.9	136.0				80.4
UARS	HALOE	94	11	12	20	23	48	1156	21	12	39	-9.7	112.1	-32.3	-22.9	-18.2	134.0	274	0	32	3.0
ATLAS-3	SSBUV	94	11	12	21	34	28	9	4	34	45	41.9	284.1	0.0	-90.0	41.9	284.2				89.0
UARS	HALOE	94	11	12	21	26	9	1156	22	15	3	49.4	319.2	-147.9	-22.9	44.0	286.4	294	0	8	143.7
ATLAS-3	SSBUV	94	11	12	22	26	42	9	5	26	59	-20.6	112.4	0.0	-90.0	-20.6	112.5				81.0
UARS	HALOE	94	11	12	22	0	6	1156	22	48	59	-10.0	87.8	-32.1	-22.9	-18.6	109.8	363	0	26	3.3
ATLAS-3	SSBUV	94	11	12	23	4	37	9	6	4	54	42.5	260.3	0.0	-90.0	42.5	260.4				88.5
UARS	HALOE	94	11	12	23	2	25	1156	23	51	23	49.5	295.1	-148.1	-22.9	44.2	262.3	232	0	2	143.6
ATLAS-3	SSBUV	94	11	12	23	56	52	9	6	57	9	-21.3	89.0	0.0	-90.0	-21.3	89.1				81.6
UARS	HALOE	94	11	12	23	36	24	1157	0	25	18	-10.3	63.6	-31.8	-22.9	-18.9	85.6	451	0	20	3.5

Appendix 12. Correlative measurement opportunities between ATLAS-3 (SSBUV) 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-3	SSBUV	94	11	5	7	51	4	1	14	51	21	-55.1	319.9	0.0	-90.0	-55.1	319.8	79	1	8	81.9
UARS	MLS	94	11	5	8	59	11	1149	9	48	9	-41.2	348.8	90.0	-22.9	-54.9	321.1				51.5
ATLAS-3	SSBUV	94	11	5	7	54	36	1	14	54	53	-48.8	339.5	0.0	-90.0	-48.8	339.4	134	0	33	70.3
UARS	MLS	94	11	5	7	20	49	1149	8	9	43	-35.3	6.5	90.0	-22.9	-48.1	340.9				56.0
ATLAS-3	SSBUV	94	11	5	7	59	23	1	14	59	40	-36.2	357.8	0.0	-90.0	-36.2	357.7	107	2	18	55.5
UARS	MLS	94	11	5	5	40	50	1149	6	29	42	-24.4	21.6	90.0	-22.9	-36.3	358.9				64.8
ATLAS-3	SSBUV	94	11	5	9	29	28	1	16	29	45	-37.6	333.3	0.0	-90.0	-37.6	333.3	159	2	12	57.1
UARS	MLS	94	11	5	7	17	20	1149	8	6	12	-25.3	357.8	90.0	-22.9	-37.3	335.0				64.4
ATLAS-3	SSBUV	94	11	5	18	23	39	2	1	23	56	-56.4	149.8	0.0	-90.0	-56.4	149.8	106	1	49	87.5
UARS	MLS	94	11	5	20	13	8	1149	21	2	6	-42.4	179.8	90.0	-22.9	-56.5	151.6				52.1
ATLAS-3	SSBUV	94	11	5	18	26	55	2	1	27	12	-52.1	170.2	0.0	-90.0	-52.1	170.2	169	0	8	77.0
UARS	MLS	94	11	5	18	35	18	1149	19	24	11	-38.1	198.8	90.0	-22.9	-51.4	172.3				55.4
ATLAS-3	SSBUV	94	11	5	18	31	11	2	1	31	28	-42.2	189.6	0.0	-90.0	-42.2	189.6	132	1	35	63.7
UARS	MLS	94	11	5	16	56	7	1149	17	45	3	-29.8	215.1	90.0	-22.9	-42.0	191.2				62.2
ATLAS-3	SSBUV	94	11	5	18	36	43	2	1	37	0	-25.8	206.0	0.0	-90.0	-25.8	206.0	136	3	22	48.2
UARS	MLS	94	11	5	15	14	32	1149	16	3	27	-13.5	228.0	90.0	-22.9	-25.3	207.3				76.1
ATLAS-3	SSBUV	94	11	5	19	53	54	2	2	54	11	-56.5	125.4	0.0	-90.0	-56.5	125.4	115	1	55	88.4
UARS	MLS	94	11	5	21	49	23	1149	22	38	15	-42.5	155.5	90.0	-22.9	-56.6	127.3				52.3
ATLAS-3	SSBUV	94	11	5	19	57	25	2	2	57	42	-52.1	147.4	0.0	-90.0	-52.1	147.4	80	0	14	77.1
UARS	MLS	94	11	5	20	11	32	1149	21	0	31	-38.2	174.5	90.0	-22.9	-51.5	148.0				55.6
ATLAS-3	SSBUV	94	11	5	20	1	27	2	3	1	44	-42.8	165.8	0.0	-90.0	-42.8	165.8	115	1	29	64.6
UARS	MLS	94	11	5	18	32	21	1149	19	21	12	-29.9	190.8	90.0	-22.9	-42.1	166.9				62.4
ATLAS-3	SSBUV	94	11	5	20	6	58	2	3	7	15	-26.5	182.5	0.0	-90.0	-26.5	182.5	85	3	15	49.0
UARS	MLS	94	11	5	16	51	2	1149	17	39	57	-14.5	204.2	90.0	-22.9	-26.2	183.3				75.6
ATLAS-3	SSBUV	94	11	5	21	24	9	2	4	24	26	-56.7	100.9	0.0	-90.0	-56.7	100.9	126	2	1	89.3
UARS	MLS	94	11	5	23	25	37	1150	0	14	35	-42.6	131.2	90.0	-22.9	-56.7	103.0				52.4
ATLAS-3	SSBUV	94	11	5	21	27	40	2	4	27	57	-52.5	123.2	0.0	-90.0	-52.5	123.2	69	0	20	78.0
UARS	MLS	94	11	5	21	48	2	1149	22	37	1	-39.0	151.1	90.0	-22.9	-52.4	124.2				55.2
ATLAS-3	SSBUV	94	11	5	21	31	27	2	4	31	44	-44.1	141.0	0.0	-90.0	-44.1	141.0	192	1	22	66.2
UARS	MLS	94	11	5	20	8	52	1149	20	57	42	-30.7	167.2	90.0	-22.9	-43.1	143.0				61.9
ATLAS-3	SSBUV	94	11	5	21	36	58	2	4	37	15	-28.0	158.4	0.0	-90.0	-28.0	158.4	135	3	9	50.5
UARS	MLS	94	11	5	18	27	32	1149	19	16	27	-15.4	180.4	90.0	-22.9	-27.2	159.4				75.1
ATLAS-3	SSBUV	94	11	5	22	54	39	2	5	54	56	-56.6	78.2	0.0	-90.0	-56.6	78.2	33	2	7	89.3
UARS	MLS	94	11	6	1	1	51	1150	1	50	44	-42.7	107.0	90.0	-22.9	-56.8	78.7				52.6
ATLAS-3	SSBUV	94	11	5	22	57	40	2	5	57	57	-53.3	97.5	0.0	-90.0	-53.3	97.5	180	0	26	79.7
UARS	MLS	94	11	5	23	24	17	1150	0	13	11	-39.1	126.8	90.0	-22.9	-52.5	99.9				55.3
ATLAS-3	SSBUV	94	11	5	23	1	42	2	6	1	59	-44.6	117.2	0.0	-90.0	-44.6	117.2	167	1	16	67.1
UARS	MLS	94	11	5	21	45	22	1149	22	34	23	-31.6	143.5	90.0	-22.9	-44.0	119.1				61.5
ATLAS-3	SSBUV	94	11	5	23	7	14	2	6	7	31	-28.7	134.9	0.0	-90.0	-28.7	134.9	87	3	3	51.4
UARS	MLS	94	11	5	20	4	3	1149	20	52	58	-16.3	156.6	90.0	-22.9	-28.1	135.5				74.6
ATLAS-3	SSBUV	94	11	6	0	25	10	2	7	25	27	-56.6	55.4	0.0	-90.0	-56.6	55.4	69	2	12	89.4
UARS	MLS	94	11	6	2	38	6	1150	3	27	4	-42.7	82.7	90.0	-22.9	-56.9	54.4				52.7

Appendix 12. 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-3	SSBUV	94 11 6 0 28 11	2 7 28 28	-53.2 74.8	0.0 -90.0	-53.2 74.8	88	0 32	79.8
UARS	MLS	94 11 6 1 0 31	1150 1 49 30	-39.2 102.5	90.0 -22.9	-52.6 75.6			55.5
ATLAS-3	SSBUV	94 11 6 0 31 57	2 7 32 14	-45.2 93.3	0.0 -90.0	-45.2 93.3	153	1 10	68.0
UARS	MLS	94 11 5 23 21 52	1150 0 10 53	-32.5 119.9	90.0 -22.9	-45.0 95.3			61.0
ATLAS-3	SSBUV	94 11 6 0 37 14	2 7 37 31	-30.1 110.7	0.0 -90.0	-30.1 110.7	125	2 56	52.9
UARS	MLS	94 11 5 21 40 49	1149 22 29 49	-18.0 133.3	90.0 -22.9	-29.8 111.9			73.3
ATLAS-3	SSBUV	94 11 6 1 55 40	2 8 55 57	-56.6 32.7	0.0 -90.0	-56.6 32.7	164	2 18	89.4
UARS	MLS	94 11 6 4 14 20	1150 5 3 13	-42.8 58.4	90.0 -22.9	-57.0 30.0			52.9
ATLAS-3	SSBUV	94 11 6 1 58 26	2 8 58 43	-53.6 50.5	0.0 -90.0	-53.6 50.5	88	0 38	80.7
UARS	MLS	94 11 6 2 37 2	1150 3 26 0	-40.0 79.1	90.0 -22.9	-53.5 51.8			55.1
ATLAS-3	SSBUV	94 11 6 2 2 12	2 9 2 29	-45.7 69.5	0.0 -90.0	-45.7 69.5	137	1 4	68.9
UARS	MLS	94 11 6 0 58 7	1150 1 47 3	-32.6 95.6	90.0 -22.9	-45.1 70.9			61.2
ATLAS-3	SSBUV	94 11 6 2 7 14	2 9 7 31	-31.6 86.4	0.0 -90.0	-31.6 86.4	173	2 49	54.4
UARS	MLS	94 11 5 23 17 20	1150 0 6 19	-19.0 109.6	90.0 -22.9	-30.8 88.0			72.8
ATLAS-3	SSBUV	94 11 6 4 58 56	2 11 59 13	-54.2 2.0	0.0 -90.0	-54.2 2.0	100	0 50	82.4
UARS	MLS	94 11 6 5 49 30	1150 6 38 29	-40.2 30.5	90.0 -22.9	-53.7 3.2			55.4
ATLAS-3	SSBUV	94 11 6 5 2 42	2 12 2 59	-46.8 21.6	0.0 -90.0	-46.8 21.6	116	0 51	70.7
UARS	MLS	94 11 6 4 10 52	1150 4 59 52	-33.5 47.7	90.0 -22.9	-46.1 22.8			60.9
ATLAS-3	SSBUV	94 11 6 5 7 44	2 12 8 1	-32.9 39.3	0.0 -90.0	-32.9 39.3	84	2 37	56.2
UARS	MLS	94 11 6 2 30 21	1150 3 19 20	-20.8 62.0	90.0 -22.9	-32.6 40.1			71.8
ATLAS-3	SSBUV	94 11 6 6 29 11	2 13 29 28	-54.5 337.6	0.0 -90.0	-54.5 337.6	114	0 56	83.3
UARS	MLS	94 11 6 7 25 45	1150 8 14 38	-40.3 6.2	90.0 -22.9	-53.8 338.9			55.6
ATLAS-3	SSBUV	94 11 6 6 32 57	2 13 33 14	-47.3 357.7	0.0 -90.0	-47.3 357.7	97	0 45	71.6
UARS	MLS	94 11 6 5 47 22	1150 6 36 23	-34.3 24.1	90.0 -22.9	-47.0 358.9			60.4
ATLAS-3	SSBUV	94 11 6 6 37 44	2 13 38 1	-34.3 15.0	0.0 -90.0	-34.3 15.0	142	2 30	57.8
UARS	MLS	94 11 6 4 6 51	1150 4 55 50	-21.7 38.3	90.0 -22.9	-33.5 16.2			71.3
ATLAS-3	SSBUV	94 11 6 7 59 26	2 14 59 43	-54.8 313.3	0.0 -90.0	-54.8 313.3	121	1 2	84.1
UARS	MLS	94 11 6 9 2 15	1150 9 51 9	-41.0 342.8	90.0 -22.9	-54.8 315.2			55.1
ATLAS-3	SSBUV	94 11 6 8 3 12	2 15 3 29	-47.8 333.7	0.0 -90.0	-47.8 333.8	100	0 39	72.5
UARS	MLS	94 11 6 7 23 37	1150 8 12 32	-34.4 359.9	90.0 -22.9	-47.1 334.6			60.6
ATLAS-3	SSBUV	94 11 6 8 7 59	2 15 8 16	-35.0 351.3	0.0 -90.0	-35.0 351.4	99	2 24	58.6
UARS	MLS	94 11 6 5 43 22	1150 6 32 20	-22.6 14.5	90.0 -22.9	-34.5 352.3			70.8
ATLAS-3	SSBUV	94 11 6 9 29 41	2 16 29 58	-55.1 289.0	0.0 -90.0	-55.1 289.0	126	1 8	85.0
UARS	MLS	94 11 6 10 38 30	1150 11 27 28	-41.1 318.5	90.0 -22.9	-54.9 290.9			55.3
ATLAS-3	SSBUV	94 11 6 9 33 13	2 16 33 30	-48.9 308.6	0.0 -90.0	-48.9 308.6	185	0 33	74.1
UARS	MLS	94 11 6 9 0 7	1150 9 49 2	-35.3 336.3	90.0 -22.9	-48.1 310.8			60.1
ATLAS-3	SSBUV	94 11 6 9 38 14	2 16 38 31	-35.6 327.7	0.0 -90.0	-35.6 327.7	61	2 18	59.5
UARS	MLS	94 11 6 7 19 52	1150 8 8 50	-23.5 350.8	90.0 -22.9	-35.4 328.4			70.3
ATLAS-3	SSBUV	94 11 6 10 59 56	2 18 0 13	-55.4 264.6	0.0 -90.0	-55.4 264.6	134	1 14	85.8
UARS	MLS	94 11 6 12 14 44	1150 13 3 37	-41.2 294.3	90.0 -22.9	-55.0 266.6			55.4
ATLAS-3	SSBUV	94 11 6 11 3 43	2 18 4 0	-48.8 285.8	0.0 -90.0	-48.8 285.8	88	0 27	74.3
UARS	MLS	94 11 6 10 36 21	1150 11 25 22	-35.4 312.0	90.0 -22.9	-48.2 286.5			60.3
ATLAS-3	SSBUV	94 11 6 11 8 14	2 18 8 31	-37.0 303.3	0.0 -90.0	-37.0 303.3	123	2 11	61.1
UARS	MLS	94 11 6 8 56 22	1150 9 45 21	-24.4 327.0	90.0 -22.9	-36.3 304.4			69.8

Appendix 12. 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-3	SSBUV	94 11 6 15 30 42	2 22 30 59	-56.0 191.4	0.0 -90.0	-56.0 191.4	167	1 32	88.3
UARS	MLS	94 11 6 17 3 27	1150 17 52 26	-41.4 221.4	90.0 -22.9	-55.3 193.7			55.9
ATLAS-3	SSBUV	94 11 6 15 34 13	2 22 34 30	-50.8 212.4	0.0 -90.0	-50.8 212.4	167	0 8	77.6
UARS	MLS	94 11 6 15 25 37	1150 16 14 31	-37.1 240.7	90.0 -22.9	-50.1 214.5			59.6
ATLAS-3	SSBUV	94 11 6 15 38 45	2 22 39 2	-39.6 231.4	0.0 -90.0	-39.6 231.4	119	1 52	64.4
UARS	MLS	94 11 6 13 45 54	1150 14 34 51	-27.1 255.9	90.0 -22.9	-39.1 232.7			68.2
ATLAS-3	SSBUV	94 11 6 17 0 57	3 0 1 14	-56.2 166.9	0.0 -90.0	-56.2 166.9	178	1 38	89.2
UARS	MLS	94 11 6 18 39 42	1150 19 28 35	-41.5 197.2	90.0 -22.9	-55.4 169.4			56.1
ATLAS-3	SSBUV	94 11 6 17 4 28	3 0 4 45	-51.2 188.3	0.0 -90.0	-51.2 188.3	172	0 2	78.5
UARS	MLS	94 11 6 17 1 51	1150 17 50 51	-37.2 216.4	90.0 -22.9	-50.2 190.2			59.7
ATLAS-3	SSBUV	94 11 6 17 9 0	3 0 9 17	-40.2 207.7	0.0 -90.0	-40.2 207.7	94	1 46	65.3
UARS	MLS	94 11 6 15 22 24	1150 16 11 22	-28.0 232.2	90.0 -22.9	-40.1 208.8			67.7
ATLAS-3	SSBUV	94 11 6 18 31 12	3 1 31 29	-56.4 142.5	0.0 -90.0	-56.4 142.5	189	1 44	90.0
UARS	MLS	94 11 6 20 15 56	1150 21 4 55	-41.6 172.9	90.0 -22.9	-55.5 145.1			56.2
ATLAS-3	SSBUV	94 11 6 18 34 58	3 1 35 15	-51.1 165.5	0.0 -90.0	-51.1 165.5	67	0 3	78.6
UARS	MLS	94 11 6 18 38 22	1150 19 27 21	-38.0 192.9	90.0 -22.9	-51.2 166.4			59.2
ATLAS-3	SSBUV	94 11 6 18 39 0	3 1 39 17	-41.5 183.1	0.0 -90.0	-41.5 183.1	162	1 40	66.9
UARS	MLS	94 11 6 16 58 55	1150 17 47 52	-28.8 208.6	90.0 -22.9	-41.0 184.9			67.2
ATLAS-3	SSBUV	94 11 6 18 44 47	3 1 45 4	-24.1 199.8	0.0 -90.0	-24.1 199.8	115	3 27	51.9
UARS	MLS	94 11 6 15 17 3	1150 16 5 55	-11.7 221.1	90.0 -22.9	-23.5 200.7			82.4
ATLAS-3	SSBUV	94 11 6 20 1 57	3 3 2 14	-56.2 121.4	0.0 -90.0	-56.2 121.5	26	1 50	89.3
UARS	MLS	94 11 6 21 52 27	1150 22 41 25	-42.4 149.5	90.0 -22.9	-56.4 121.4			55.8
ATLAS-3	SSBUV	94 11 6 20 4 58	3 3 5 15	-52.0 140.0	0.0 -90.0	-52.0 140.0	169	0 9	80.2
UARS	MLS	94 11 6 20 14 36	1150 21 3 30	-38.1 168.6	90.0 -22.9	-51.3 142.1			59.4
ATLAS-3	SSBUV	94 11 6 20 9 15	3 3 9 32	-42.1 159.3	0.0 -90.0	-42.1 159.3	142	1 33	67.7
UARS	MLS	94 11 6 18 35 25	1150 19 24 22	-29.7 184.9	90.0 -22.9	-42.0 161.0			66.7
ATLAS-3	SSBUV	94 11 6 20 14 47	3 3 15 4	-25.6 175.7	0.0 -90.0	-25.6 175.7	152	3 20	53.3
UARS	MLS	94 11 6 16 53 50	1150 17 42 46	-13.5 197.8	90.0 -22.9	-25.2 177.1			81.1
ATLAS-3	SSBUV	94 11 6 21 32 28	3 4 32 45	-56.1 98.7	0.0 -90.0	-56.1 98.7	107	1 56	89.3
UARS	MLS	94 11 6 23 28 41	1151 0 17 34	-42.4 125.3	90.0 -22.9	-56.5 97.1			55.9
ATLAS-3	SSBUV	94 11 6 21 35 29	3 4 35 46	-52.0 117.2	0.0 -90.0	-52.0 117.2	77	0 15	80.3
UARS	MLS	94 11 6 21 50 50	1150 22 39 50	-38.2 144.3	90.0 -22.9	-51.4 117.8			59.6
ATLAS-3	SSBUV	94 11 6 21 39 30	3 4 39 47	-42.7 135.5	0.0 -90.0	-42.7 135.5	117	1 27	68.6
UARS	MLS	94 11 6 20 11 40	1150 21 0 31	-29.8 160.6	90.0 -22.9	-42.1 136.7			66.9
ATLAS-3	SSBUV	94 11 6 21 45 2	3 4 45 19	-26.3 152.2	0.0 -90.0	-26.3 152.2	103	3 14	54.1
UARS	MLS	94 11 6 18 30 20	1150 19 19 16	-14.4 174.0	90.0 -22.9	-26.2 153.2			80.6
ATLAS-3	SSBUV	94 11 6 23 5 44	3 6 6 1	-52.4 93.0	0.0 -90.0	-52.4 93.0	70	0 21	81.1
UARS	MLS	94 11 6 23 27 21	1151 0 16 20	-39.0 120.9	90.0 -22.9	-52.3 94.1			59.1
ATLAS-3	SSBUV	94 11 6 23 9 45	3 6 10 2	-43.2 111.7	0.0 -90.0	-43.2 111.7	93	1 21	69.5
UARS	MLS	94 11 6 21 48 10	1150 22 37 1	-30.7 136.9	90.0 -22.9	-43.0 112.8			66.4
ATLAS-3	SSBUV	94 11 6 23 15 2	3 6 15 19	-27.8 128.0	0.0 -90.0	-27.8 128.0	143	3 8	55.5
UARS	MLS	94 11 6 20 6 51	1150 20 55 46	-15.3 150.2	90.0 -22.9	-27.1 129.3			80.0
ATLAS-3	SSBUV	94 11 7 15 38 45	3 22 39 2	-55.5 187.3	0.0 -90.0	-55.5 187.4	55	1 27	89.3
UARS	MLS	94 11 7 17 6 31	1151 17 55 25	-41.3 215.5	90.0 -22.9	-55.1 187.8			59.6

Appendix 12. 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-3	SSBUV	94	11	7	15	42	16	3	22	42	33	-49.6	207.5	0.0	-90.0	-49.6	207.5	74	0	13	79.4
UARS	MLS	94	11	7	15	28	25	1151	16	17	20	-36.2	234.0	90.0	-22.9	-49.1	208.2				64.2
ATLAS-3	SSBUV	94	11	7	15	46	33	3	22	46	50	-38.8	224.8	0.0	-90.0	-38.8	224.8	159	1	57	67.9
UARS	MLS	94	11	7	13	48	42	1151	14	37	40	-26.1	249.4	90.0	-22.9	-38.1	226.5				73.4
ATLAS-3	SSBUV	94	11	7	18	39	45	4	1	40	2	-55.4	141.8	0.0	-90.0	-55.4	141.8	146	1	39	89.5
UARS	MLS	94	11	7	20	19	16	1151	21	8	15	-42.1	167.8	90.0	-22.9	-56.1	139.8				59.2
ATLAS-3	SSBUV	94	11	7	18	42	31	4	1	42	48	-51.1	158.1	0.0	-90.0	-51.1	158.1	171	0	1	81.7
UARS	MLS	94	11	7	18	41	10	1151	19	30	10	-37.1	186.2	90.0	-22.9	-50.2	160.1				63.8
ATLAS-3	SSBUV	94	11	7	18	47	3	4	1	47	20	-40.0	177.4	0.0	-90.0	-40.0	177.4	106	1	45	69.5
UARS	MLS	94	11	7	17	1	43	1151	17	50	41	-27.9	202.0	90.0	-22.9	-40.0	178.7				72.3
ATLAS-3	SSBUV	94	11	7	20	13	2	4	3	13	19	-51.0	135.3	0.0	-90.0	-51.0	135.3	70	0	4	81.8
UARS	MLS	94	11	7	20	17	40	1151	21	6	40	-37.9	162.7	90.0	-22.9	-51.1	136.3				63.3
ATLAS-3	SSBUV	94	11	7	20	17	18	4	3	17	35	-40.6	153.7	0.0	-90.0	-40.6	153.7	79	1	39	70.3
UARS	MLS	94	11	7	18	37	57	1151	19	26	50	-28.0	177.7	90.0	-22.9	-40.1	154.3				72.5
ATLAS-3	SSBUV	94	11	7	20	22	50	4	3	23	7	-23.9	169.4	0.0	-90.0	-23.9	169.4	128	3	26	57.2
UARS	MLS	94	11	7	16	56	22	1151	17	45	14	-11.6	190.9	90.0	-22.9	-23.4	170.5				87.4
ATLAS-3	SSBUV	94	11	7	21	43	2	4	4	43	19	-51.9	109.8	0.0	-90.0	-51.9	109.8	168	0	10	83.3
UARS	MLS	94	11	7	21	53	54	1151	22	42	49	-38.0	138.4	90.0	-22.9	-51.2	112.0				63.5
ATLAS-3	SSBUV	94	11	7	21	47	18	4	4	47	35	-41.9	129.0	0.0	-90.0	-41.9	129.0	151	1	32	71.8
UARS	MLS	94	11	7	20	14	28	1151	21	3	20	-28.9	154.0	90.0	-22.9	-41.0	130.5				71.9
ATLAS-3	SSBUV	94	11	7	21	53	5	4	4	53	22	-24.6	145.9	0.0	-90.0	-24.6	145.9	75	3	20	57.9
UARS	MLS	94	11	7	18	32	52	1151	19	21	44	-12.6	167.1	90.0	-22.9	-24.3	146.6				86.8
ATLAS-3	SSBUV	94	11	7	23	13	32	4	6	13	49	-51.8	87.0	0.0	-90.0	-51.8	87.0	74	0	16	83.4
UARS	MLS	94	11	7	23	30	9	1152	0	19	9	-38.1	114.1	90.0	-22.9	-51.3	87.7				63.6
ATLAS-3	SSBUV	94	11	7	23	17	33	4	6	17	50	-42.5	105.2	0.0	-90.0	-42.5	105.3	121	1	26	72.6
UARS	MLS	94	11	7	21	50	58	1151	22	39	50	-29.7	130.4	90.0	-22.9	-42.0	106.6				71.4
ATLAS-3	SSBUV	94	11	7	23	23	5	4	6	23	22	-26.1	121.8	0.0	-90.0	-26.1	121.8	123	3	13	59.3
UARS	MLS	94	11	7	20	9	39	1151	20	58	35	-14.3	143.8	90.0	-22.9	-26.1	123.1				85.5
ATLAS-3	SSBUV	94	11	8	2	13	58	4	9	14	15	-52.8	38.0	0.0	-90.0	-52.8	38.0	118	0	28	85.3
UARS	MLS	94	11	8	2	42	54	1152	3	31	48	-39.0	66.3	90.0	-22.9	-52.3	39.6				63.2
ATLAS-3	SSBUV	94	11	8	2	18	0	4	9	18	17	-44.0	57.2	0.0	-90.0	-44.0	57.2	129	1	14	74.6
UARS	MLS	94	11	8	1	3	59	1152	1	52	51	-31.5	83.1	90.0	-22.9	-43.9	58.8				70.3
ATLAS-3	SSBUV	94	11	8	2	23	16	4	9	23	33	-28.6	73.9	0.0	-90.0	-28.6	73.9	149	3	0	61.6
UARS	MLS	94	11	7	23	22	40	1152	0	11	36	-16.2	96.2	90.0	-22.9	-27.9	75.2				84.4
ATLAS-3	SSBUV	94	11	8	3	44	12	4	10	44	29	-53.2	13.8	0.0	-90.0	-53.2	13.8	129	0	34	86.1
UARS	MLS	94	11	8	4	19	8	1152	5	8	8	-39.1	42.0	90.0	-22.9	-52.4	15.3				63.4
ATLAS-3	SSBUV	94	11	8	3	48	13	4	10	48	30	-44.5	33.4	0.0	-90.0	-44.5	33.4	108	1	7	75.4
UARS	MLS	94	11	8	2	40	13	1152	3	29	10	-31.6	58.8	90.0	-22.9	-44.0	34.5				70.4
ATLAS-3	SSBUV	94	11	8	3	53	30	4	10	53	47	-29.3	50.4	0.0	-90.0	-29.3	50.4	100	2	54	62.4
UARS	MLS	94	11	8	0	59	10	1152	1	48	6	-17.1	72.4	90.0	-22.9	-28.9	51.2				83.8
ATLAS-3	SSBUV	94	11	8	5	14	26	4	12	14	43	-53.6	349.6	0.0	-90.0	-53.6	349.6	131	0	41	86.9
UARS	MLS	94	11	8	5	55	39	1152	6	44	38	-39.9	18.6	90.0	-22.9	-53.4	351.5				62.9
ATLAS-3	SSBUV	94	11	8	5	18	27	4	12	18	44	-45.1	9.5	0.0	-90.0	-45.1	9.5	89	1	1	76.2
UARS	MLS	94	11	8	4	16	44	1152	5	5	41	-32.4	35.2	90.0	-22.9	-44.9	10.6				69.9

Appendix 12. 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-3	SSBUV	94	11	8	5	23	43	4	12	24	0	-30.0	26.8	0.0	-90.0	-30.0	26.8	53	2	48	63.2
UARS	MLS	94	11	8	2	35	41	1152	3	24	36	-18.0	48.6	90.0	-22.9	-29.8	27.3				83.3
ATLAS-3	SSBUV	94	11	8	6	44	39	4	13	44	56	-53.9	325.3	0.0	-90.0	-53.9	325.3	134	0	47	87.6
UARS	MLS	94	11	8	7	31	53	1152	8	20	48	-40.0	354.3	90.0	-22.9	-53.5	327.2				63.0
ATLAS-3	SSBUV	94	11	8	6	48	40	4	13	48	57	-45.6	345.7	0.0	-90.0	-45.6	345.7	85	0	55	77.0
UARS	MLS	94	11	8	5	52	58	1152	6	41	50	-32.5	10.9	90.0	-22.9	-45.0	346.3				70.1
ATLAS-3	SSBUV	94	11	8	6	53	42	4	13	53	59	-31.4	2.6	0.0	-90.0	-31.4	2.6	110	2	41	64.6
UARS	MLS	94	11	8	4	12	11	1152	5	1	6	-18.9	24.8	90.0	-22.9	-30.7	3.4				82.7
ATLAS-3	SSBUV	94	11	8	8	14	53	4	15	15	10	-54.2	301.0	0.0	-90.0	-54.2	301.0	142	0	53	88.4
UARS	MLS	94	11	8	9	8	7	1152	9	57	7	-40.0	330.0	90.0	-22.9	-53.6	302.9				63.2
ATLAS-3	SSBUV	94	11	8	8	18	39	4	15	18	56	-46.8	320.7	0.0	-90.0	-46.8	320.7	164	0	49	78.4
UARS	MLS	94	11	8	7	29	29	1152	8	18	20	-33.4	347.3	90.0	-22.9	-45.9	322.5				69.5
ATLAS-3	SSBUV	94	11	8	8	23	40	4	15	23	57	-32.9	338.3	0.0	-90.0	-32.9	338.3	149	2	34	66.0
UARS	MLS	94	11	8	5	48	58	1152	6	37	58	-20.6	1.6	90.0	-22.9	-32.5	339.9				81.4
ATLAS-3	SSBUV	94	11	8	9	45	6	4	16	45	23	-54.5	276.7	0.0	-90.0	-54.5	276.7	154	0	59	89.1
UARS	MLS	94	11	8	10	44	22	1152	11	33	16	-40.1	305.8	90.0	-22.9	-53.7	278.6				63.3
ATLAS-3	SSBUV	94	11	8	9	48	52	4	16	49	9	-47.3	296.8	0.0	-90.0	-47.3	296.8	148	0	42	79.2
UARS	MLS	94	11	8	9	5	59	1152	9	54	50	-34.2	323.7	90.0	-22.9	-46.9	298.6				69.0
ATLAS-3	SSBUV	94	11	8	9	53	54	4	16	54	11	-33.5	314.8	0.0	-90.0	-33.5	314.7	110	2	28	66.8
UARS	MLS	94	11	8	7	25	28	1152	8	14	28	-21.6	337.8	90.0	-22.9	-33.4	315.9				80.8
ATLAS-3	SSBUV	94	11	8	14	16	32	4	21	16	49	-54.4	208.5	0.0	-90.0	-54.4	208.5	147	1	16	89.4
UARS	MLS	94	11	8	15	33	21	1152	16	22	15	-41.1	233.8	90.0	-22.9	-54.8	206.3				63.1
ATLAS-3	SSBUV	94	11	8	14	19	33	4	21	19	50	-48.8	224.9	0.0	-90.0	-48.8	224.9	129	0	24	81.5
UARS	MLS	94	11	8	13	54	58	1152	14	43	49	-35.2	251.6	90.0	-22.9	-48.0	226.2				68.7
ATLAS-3	SSBUV	94	11	8	14	24	5	4	21	24	22	-37.0	242.4	0.0	-90.0	-37.0	242.4	180	2	9	70.3
UARS	MLS	94	11	8	12	14	59	1152	13	3	59	-24.3	266.6	90.0	-22.9	-36.2	244.2				79.1
ATLAS-3	SSBUV	94	11	8	17	20	0	5	0	20	17	-49.8	176.8	0.0	-90.0	-49.8	176.8	116	0	12	83.1
UARS	MLS	94	11	8	17	7	43	1152	17	56	39	-36.1	203.7	90.0	-22.9	-49.1	178.0				68.3
ATLAS-3	SSBUV	94	11	8	17	24	32	5	0	24	49	-38.2	195.1	0.0	-90.0	-38.2	195.1	113	1	56	71.9
UARS	MLS	94	11	8	15	28	0	1152	16	16	59	-26.0	219.2	90.0	-22.9	-38.1	196.3				78.0
ATLAS-3	SSBUV	94	11	8	18	50	14	5	1	50	31	-50.2	152.8	0.0	-90.0	-50.2	152.8	107	0	6	83.8
UARS	MLS	94	11	8	18	44	14	1152	19	33	9	-37.0	180.2	90.0	-22.9	-50.0	154.2				67.8
ATLAS-3	SSBUV	94	11	8	18	54	45	5	1	55	2	-38.8	171.4	0.0	-90.0	-38.8	171.4	93	1	50	72.7
UARS	MLS	94	11	8	17	4	15	1152	17	53	8	-26.1	194.9	90.0	-22.9	-38.2	172.0				78.2
ATLAS-3	SSBUV	94	11	8	23	20	55	5	6	21	12	-51.5	80.5	0.0	-90.0	-51.5	80.5	103	0	12	86.1
UARS	MLS	94	11	8	23	33	13	1153	0	22	8	-38.0	108.1	90.0	-22.9	-51.1	81.8				67.5
ATLAS-3	SSBUV	94	11	8	23	25	11	5	6	25	28	-41.4	99.4	0.0	-90.0	-41.4	99.4	91	1	31	75.6
UARS	MLS	94	11	8	21	53	46	1152	22	42	39	-28.8	123.8	90.0	-22.9	-41.0	100.3				76.4
ATLAS-3	SSBUV	94	11	8	23	30	43	5	6	31	0	-24.8	115.4	0.0	-90.0	-24.8	115.4	123	3	18	63.4
UARS	MLS	94	11	8	20	12	11	1152	21	1	3	-12.5	136.9	90.0	-22.9	-24.3	116.5				91.8
ATLAS-3	SSBUV	94	11	9	0	51	8	5	7	51	25	-51.9	56.4	0.0	-90.0	-51.9	56.3	113	0	18	86.8
UARS	MLS	94	11	9	1	9	27	1153	1	58	28	-38.0	83.9	90.0	-22.9	-51.2	57.5				67.7
ATLAS-3	SSBUV	94	11	9	0	55	10	5	7	55	27	-42.6	74.7	0.0	-90.0	-42.6	74.7	166	1	24	76.9
UARS	MLS	94	11	8	23	30	16	1153	0	19	9	-29.7	100.2	90.0	-22.9	-41.9	76.4				75.8

Appendix 12. 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-3	SSBUV	94 11 9 1 0 56	5 8 1 13	-25.5	91.9	0.0	-90.0	-25.5	91.9	71	3 12	64.1
UARS	MLS	94 11 8 21 48 41	1152 22 37 33	-13.4	113.1	90.0	-22.9	-25.2	92.5			91.2
ATLAS-3	SSBUV	94 11 9 2 21 22	5 9 21 39	-52.3	32.2	0.0	-90.0	-52.3	32.2	109	0 24	87.5
UARS	MLS	94 11 9 2 45 58	1153 3 34 58	-38.8	60.4	90.0	-22.9	-52.2	33.7			67.1
ATLAS-3	SSBUV	94 11 9 2 25 23	5 9 25 40	-43.2	50.9	0.0	-90.0	-43.2	50.9	142	1 18	77.7
UARS	MLS	94 11 9 1 6 47	1153 1 55 39	-30.5	76.5	90.0	-22.9	-42.9	52.6			75.2
ATLAS-3	SSBUV	94 11 9 2 30 55	5 9 31 12	-27.0	67.8	0.0	-90.0	-27.0	67.8	119	3 5	65.4
UARS	MLS	94 11 8 23 25 28	1153 0 14 24	-15.2	89.8	90.0	-22.9	-26.9	69.0			89.8
ATLAS-3	SSBUV	94 11 9 3 51 36	5 10 51 53	-52.7	8.0	0.0	-90.0	-52.7	8.0	111	0 30	88.2
UARS	MLS	94 11 9 4 22 12	1153 5 11 7	-38.9	36.1	90.0	-22.9	-52.3	9.4			67.2
ATLAS-3	SSBUV	94 11 9 3 55 37	5 10 55 54	-43.8	27.1	0.0	-90.0	-43.8	27.1	130	1 12	78.5
UARS	MLS	94 11 9 2 43 17	1153 3 32 10	-31.4	52.9	90.0	-22.9	-43.8	28.7			74.6
ATLAS-3	SSBUV	94 11 9 4 0 53	5 11 1 10	-28.4	43.7	0.0	-90.0	-28.4	43.6	152	2 58	66.6
UARS	MLS	94 11 9 1 1 58	1153 1 50 55	-16.1	66.0	90.0	-22.9	-27.9	45.0			89.3
ATLAS-3	SSBUV	94 11 9 5 21 49	5 12 22 6	-53.1	343.8	0.0	-90.0	-53.1	343.8	122	0 36	89.0
UARS	MLS	94 11 9 5 58 27	1153 6 47 27	-39.0	11.8	90.0	-22.9	-52.4	345.1			67.4
ATLAS-3	SSBUV	94 11 9 5 25 50	5 12 26 7	-44.4	3.3	0.0	-90.0	-44.4	3.2	103	1 6	79.2
UARS	MLS	94 11 9 4 19 32	1153 5 8 29	-31.5	28.6	90.0	-22.9	-43.9	4.4			74.8
ATLAS-3	SSBUV	94 11 9 5 31 7	5 12 31 24	-29.1	20.1	0.0	-90.0	-29.1	20.1	103	2 52	67.4
UARS	MLS	94 11 9 2 38 29	1153 3 27 25	-17.0	42.2	90.0	-22.9	-28.8	21.1			88.7
ATLAS-3	SSBUV	94 11 9 9 53 0	5 16 53 17	-53.4	274.0	0.0	-90.0	-53.4	274.0	83	0 54	89.8
UARS	MLS	94 11 9 10 47 26	1153 11 36 26	-40.0	299.8	90.0	-22.9	-53.5	272.8			67.1
ATLAS-3	SSBUV	94 11 9 9 56 16	5 16 56 33	-46.6	290.6	0.0	-90.0	-46.6	290.6	158	0 47	82.0
UARS	MLS	94 11 9 9 8 47	1153 9 57 39	-33.3	317.1	90.0	-22.9	-45.9	292.3			73.8
ATLAS-3	SSBUV	94 11 9 10 1 18	5 17 1 35	-32.7	308.1	0.0	-90.0	-32.7	308.1	153	2 33	70.7
UARS	MLS	94 11 9 7 28 16	1153 8 17 17	-20.6	331.4	90.0	-22.9	-32.4	309.7			86.1
ATLAS-3	SSBUV	94 11 9 11 23 29	5 18 23 46	-53.3	251.2	0.0	-90.0	-53.3	251.2	187	1 0	89.9
UARS	MLS	94 11 9 12 23 40	1153 13 12 35	-40.1	275.5	90.0	-22.9	-53.6	248.4			67.3
ATLAS-3	SSBUV	94 11 9 12 56 43	5 19 57 0	-47.7	242.7	0.0	-90.0	-47.7	242.7	138	0 35	83.5
UARS	MLS	94 11 9 12 21 32	1153 13 10 29	-34.2	269.2	90.0	-22.9	-46.9	244.2			73.4
ATLAS-3	SSBUV	94 11 9 13 1 30	5 20 1 47	-34.8	260.2	0.0	-90.0	-34.8	260.2	161	2 20	72.7
UARS	MLS	94 11 9 10 41 17	1153 11 30 17	-22.4	283.9	90.0	-22.9	-34.3	261.9			84.9
ATLAS-3	SSBUV	94 11 9 14 26 57	5 21 27 14	-48.2	218.8	0.0	-90.0	-48.2	218.7	123	0 28	84.2
UARS	MLS	94 11 9 13 58 2	1153 14 46 59	-35.1	245.6	90.0	-22.9	-47.8	220.3			72.8
ATLAS-3	SSBUV	94 11 9 14 31 43	5 21 32 0	-35.4	236.6	0.0	-90.0	-35.4	236.6	125	2 13	73.5
UARS	MLS	94 11 9 12 17 47	1153 13 6 47	-23.3	260.1	90.0	-22.9	-35.2	237.9			84.3
ATLAS-3	SSBUV	94 11 9 15 57 10	5 22 57 27	-48.7	194.8	0.0	-90.0	-48.7	194.8	122	0 22	84.9
UARS	MLS	94 11 9 15 34 17	1153 16 23 8	-35.2	221.3	90.0	-22.9	-47.9	196.0			72.9
ATLAS-3	SSBUV	94 11 9 16 1 57	5 23 2 14	-36.0	213.0	0.0	-90.0	-36.0	213.0	95	2 7	74.2
UARS	MLS	94 11 9 13 54 18	1153 14 43 18	-24.2	236.4	90.0	-22.9	-36.1	214.0			83.7
ATLAS-3	SSBUV	94 11 10 5 29 3	6 12 29 20	-51.7	340.7	0.0	-90.0	-51.7	340.8	117	0 32	90.0
UARS	MLS	94 11 10 6 1 31	1154 6 50 26	-38.9	5.9	90.0	-22.9	-52.2	339.3			71.2
ATLAS-3	SSBUV	94 11 10 5 32 34	6 12 32 51	-43.7	357.0	0.0	-90.0	-43.7	357.0	120	1 9	82.4
UARS	MLS	94 11 10 4 22 36	1154 5 11 29	-31.3	22.7	90.0	-22.9	-43.7	358.5			79.0

Appendix 12. 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-3	SSBUV	94 11 10 5 37 50	6 12 38 7	-28.3 13.5	0.0 -90.0	-28.3 13.6	144	2 56	71.6
UARS	MLS	94 11 10 2 41 17	1154 3 30 14	-16.0 35.8	90.0 -22.9	-27.8 14.9			94.1
ATLAS-3	SSBUV	94 11 10 7 2 44	6 14 3 1	-44.2 333.2	0.0 -90.0	-44.2 333.2	91	1 3	83.1
UARS	MLS	94 11 10 5 58 50	1154 6 47 48	-31.4 358.4	90.0 -22.9	-43.8 334.2			79.2
ATLAS-3	SSBUV	94 11 10 7 8 0	6 14 8 17	-29.0 350.0	0.0 -90.0	-29.0 350.1	94	2 50	72.4
UARS	MLS	94 11 10 4 17 47	1154 5 6 44	-16.9 12.0	90.0 -22.9	-28.7 351.0			93.5
ATLAS-3	SSBUV	94 11 10 8 32 38	6 15 32 55	-45.4 308.3	0.0 -90.0	-45.4 308.4	172	0 57	84.3
UARS	MLS	94 11 10 7 35 21	1154 8 24 18	-32.3 334.7	90.0 -22.9	-44.8 310.4			78.5
ATLAS-3	SSBUV	94 11 10 8 37 55	6 15 38 12	-30.4 325.8	0.0 -90.0	-30.4 325.9	143	2 43	73.5
UARS	MLS	94 11 10 5 54 17	1154 6 43 14	-17.9 348.2	90.0 -22.9	-29.6 327.0			92.9
ATLAS-3	SSBUV	94 11 10 10 2 48	6 17 3 5	-46.0 284.4	0.0 -90.0	-46.0 284.5	156	0 50	85.0
UARS	MLS	94 11 10 9 11 51	1154 10 0 49	-33.1 311.1	90.0 -22.9	-45.7 286.5			77.9
ATLAS-3	SSBUV	94 11 10 10 8 5	6 17 8 22	-31.1 302.3	0.0 -90.0	-31.1 302.3	94	2 37	74.2
UARS	MLS	94 11 10 7 30 48	1154 8 19 44	-18.8 324.4	90.0 -22.9	-30.6 303.1			92.2
ATLAS-3	SSBUV	94 11 10 11 32 58	6 18 33 15	-46.5 260.5	0.0 -90.0	-46.5 260.6	143	0 44	85.6
UARS	MLS	94 11 10 10 48 5	1154 11 36 58	-33.2 286.8	90.0 -22.9	-45.8 262.2			78.1
ATLAS-3	SSBUV	94 11 10 11 37 59	6 18 38 16	-32.5 278.0	0.0 -90.0	-32.5 278.1	139	2 30	75.4
UARS	MLS	94 11 10 9 7 34	1154 9 56 36	-20.5 301.2	90.0 -22.9	-32.3 279.6			90.8
ATLAS-3	SSBUV	94 11 10 13 3 8	6 20 3 25	-47.0 236.6	0.0 -90.0	-47.0 236.7	126	0 38	86.3
UARS	MLS	94 11 10 12 24 36	1154 13 13 28	-34.1 263.3	90.0 -22.9	-46.7 238.3			77.4
ATLAS-3	SSBUV	94 11 10 13 8 9	6 20 8 26	-33.2 254.5	0.0 -90.0	-33.2 254.5	102	2 24	76.1
UARS	MLS	94 11 10 10 44 5	1154 11 33 6	-21.4 277.4	90.0 -22.9	-33.2 255.6			90.2
ATLAS-3	SSBUV	94 11 10 14 33 18	6 21 33 35	-47.6 212.7	0.0 -90.0	-47.6 212.8	122	0 32	87.0
UARS	MLS	94 11 10 14 0 50	1154 14 49 48	-34.2 239.0	90.0 -22.9	-46.8 214.0			77.6
ATLAS-3	SSBUV	94 11 10 14 38 4	6 21 38 21	-34.6 230.1	0.0 -90.0	-34.6 230.2	144	2 17	77.3
UARS	MLS	94 11 10 12 20 35	1154 13 9 36	-22.3 253.7	90.0 -22.9	-34.2 231.7			89.6
ATLAS-3	SSBUV	94 11 10 17 33 38	7 0 33 55	-48.6 164.8	0.0 -90.0	-48.6 164.9	105	0 20	88.3
UARS	MLS	94 11 10 17 13 35	1154 18 2 27	-35.1 191.1	90.0 -22.9	-47.9 165.9			77.1
ATLAS-3	SSBUV	94 11 10 17 38 9	7 0 38 26	-36.6 182.2	0.0 -90.0	-36.6 182.3	160	2 4	79.2
UARS	MLS	94 11 10 15 33 36	1154 16 22 37	-24.1 206.2	90.0 -22.9	-36.0 183.9			88.3
ATLAS-3	SSBUV	94 11 10 19 3 47	7 2 4 4	-49.1 140.8	0.0 -90.0	-49.1 140.9	87	0 13	88.9
UARS	MLS	94 11 10 18 50 6	1154 19 38 57	-35.9 167.6	90.0 -22.9	-48.8 142.1			76.4
ATLAS-3	SSBUV	94 11 10 19 8 19	7 2 8 36	-37.3 158.5	0.0 -90.0	-37.3 158.6	124	1 58	79.9
UARS	MLS	94 11 10 17 10 7	1154 17 59 7	-25.0 182.5	90.0 -22.9	-37.0 160.0			87.7
ATLAS-3	SSBUV	94 11 10 20 33 57	7 3 34 14	-49.5 116.8	0.0 -90.0	-49.5 116.9	91	0 7	89.6
UARS	MLS	94 11 10 20 26 20	1154 21 15 17	-36.0 143.3	90.0 -22.9	-48.9 117.7			76.6
ATLAS-3	SSBUV	94 11 10 20 38 28	7 3 38 45	-37.9 134.9	0.0 -90.0	-37.9 135.0	95	1 51	80.6
UARS	MLS	94 11 10 18 46 37	1154 19 35 37	-25.9 158.8	90.0 -22.9	-37.9 136.1			87.0
ATLAS-3	SSBUV	94 11 10 22 4 22	7 5 4 39	-49.5 94.0	0.0 -90.0	-49.5 94.1	44	0 1	89.7
UARS	MLS	94 11 10 22 2 50	1154 22 51 47	-36.8 119.8	90.0 -22.9	-49.8 93.9			75.9
ATLAS-3	SSBUV	94 11 10 22 8 23	7 5 8 40	-39.3 110.4	0.0 -90.0	-39.3 110.5	151	1 45	81.7
UARS	MLS	94 11 10 20 23 7	1154 21 12 7	-26.8 135.1	90.0 -22.9	-38.9 112.1			86.4
ATLAS-3	SSBUV	94 11 10 23 34 47	7 6 35 4	-49.4 71.3	0.0 -90.0	-49.4 71.3	138	0 4	89.8
UARS	MLS	94 11 10 23 39 5	1155 0 27 56	-36.9 95.5	90.0 -22.9	-49.9 69.6			76.1

Appendix 12. 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-3	SSBUV	94	11	10	23	38	33	7	6	38	50	-39.9	86.7	0.0	-90.0	-39.9	86.8	125	1	38	82.4
UARS	MLS	94	11	10	21	59	38	1154	22	48	37	-27.7	111.4	90.0	-22.9	-39.8	88.3				85.7
ATLAS-3	SSBUV	94	11	10	23	44	20	7	6	44	37	-22.3	102.7	0.0	-90.0	-22.3	102.8	126	3	26	72.0
UARS	MLS	94	11	10	20	17	31	1154	21	6	30	-9.6	123.7	90.0	-22.9	-21.5	103.7				103.6
ATLAS-3	SSBUV	94	11	11	1	8	43	7	8	9	0	-40.5	63.0	0.0	-90.0	-40.5	63.1	96	1	32	83.1
UARS	MLS	94	11	10	23	35	52	1155	0	24	47	-27.8	87.1	90.0	-22.9	-39.9	63.9				85.9
ATLAS-3	SSBUV	94	11	11	1	14	14	7	8	14	31	-23.8	78.6	0.0	-90.0	-23.8	78.7	154	3	19	73.1
UARS	MLS	94	11	10	21	54	17	1154	22	43	11	-11.4	100.3	90.0	-22.9	-23.2	80.1				102.1
ATLAS-3	SSBUV	94	11	11	2	38	53	7	9	39	10	-41.1	39.3	0.0	-90.0	-41.1	39.4	62	1	26	83.7
UARS	MLS	94	11	11	1	12	23	1155	2	1	17	-28.7	63.4	90.0	-22.9	-40.8	40.0				85.3
ATLAS-3	SSBUV	94	11	11	2	44	24	7	9	44	41	-24.5	55.2	0.0	-90.0	-24.5	55.3	99	3	13	73.8
UARS	MLS	94	11	10	23	30	48	1155	0	19	41	-12.3	76.5	90.0	-22.9	-24.1	56.2				101.5
ATLAS-3	SSBUV	94	11	11	5	38	57	7	12	39	14	-42.9	350.8	0.0	-90.0	-42.9	350.9	111	1	13	85.5
UARS	MLS	94	11	11	4	25	24	1155	5	14	17	-30.4	16.1	90.0	-22.9	-42.7	352.3				83.9
ATLAS-3	SSBUV	94	11	11	5	44	14	7	12	44	31	-27.4	7.0	0.0	-90.0	-27.4	7.1	175	3	0	75.9
UARS	MLS	94	11	11	2	44	5	1155	3	33	2	-15.0	29.4	90.0	-22.9	-26.8	8.7				99.5
ATLAS-3	SSBUV	94	11	11	7	9	7	7	14	9	24	-43.5	327.1	0.0	-90.0	-43.5	327.2	100	1	7	86.2
UARS	MLS	94	11	11	6	1	54	1155	6	50	48	-31.3	352.4	90.0	-22.9	-43.6	328.4				83.3
ATLAS-3	SSBUV	94	11	11	7	14	24	7	14	14	41	-28.1	343.5	0.0	-90.0	-28.1	343.6	123	2	53	76.6
UARS	MLS	94	11	11	4	20	35	1155	5	9	33	-15.9	5.6	90.0	-22.9	-27.7	344.8				98.8
ATLAS-3	SSBUV	94	11	11	8	39	17	7	15	39	34	-44.1	303.3	0.0	-90.0	-44.1	303.4	69	1	1	86.8
UARS	MLS	94	11	11	7	38	9	1155	8	27	7	-31.4	328.1	90.0	-22.9	-43.7	304.1				83.4
ATLAS-3	SSBUV	94	11	11	8	44	18	7	15	44	35	-29.6	319.3	0.0	-90.0	-29.6	319.4	171	2	47	77.7
UARS	MLS	94	11	11	5	57	5	1155	6	46	3	-16.9	341.8	90.0	-22.9	-28.6	320.8				98.2
ATLAS-3	SSBUV	94	11	11	11	39	22	7	18	39	39	-45.8	254.6	0.0	-90.0	-45.8	254.7	134	0	48	88.5
UARS	MLS	94	11	11	10	51	9	1155	11	40	8	-33.1	280.9	90.0	-22.9	-45.6	256.4				82.1
ATLAS-3	SSBUV	94	11	11	11	44	38	7	18	44	55	-30.9	272.3	0.0	-90.0	-30.9	272.4	73	2	34	79.0
UARS	MLS	94	11	11	9	10	6	1155	9	59	3	-18.7	294.2	90.0	-22.9	-30.5	273.0				96.9
ATLAS-3	SSBUV	94	11	11	13	9	32	7	20	9	49	-46.4	230.7	0.0	-90.0	-46.4	230.8	121	0	42	89.1
UARS	MLS	94	11	11	12	27	24	1155	13	16	17	-33.2	256.6	90.0	-22.9	-45.7	232.0				82.3
ATLAS-3	SSBUV	94	11	11	13	14	33	7	20	14	50	-32.4	248.0	0.0	-90.0	-32.4	248.2	121	2	27	80.1
UARS	MLS	94	11	11	10	46	53	1155	11	35	44	-20.4	271.0	90.0	-22.9	-32.2	249.4				95.4
ATLAS-3	SSBUV	94	11	11	17	44	32	8	0	44	49	-35.8	175.8	0.0	-90.0	-35.8	175.9	179	2	8	82.9
UARS	MLS	94	11	11	15	36	24	1155	16	25	25	-23.1	199.7	90.0	-22.9	-35.0	177.7				93.5
ATLAS-3	SSBUV	94	11	11	19	14	42	8	2	14	59	-36.5	152.2	0.0	-90.0	-36.5	152.3	139	2	1	83.6
UARS	MLS	94	11	11	17	12	55	1155	18	1	56	-24.0	176.0	90.0	-22.9	-36.0	153.7				92.8
ATLAS-3	SSBUV	94	11	11	20	44	52	8	3	45	9	-37.1	128.6	0.0	-90.0	-37.1	128.7	103	1	55	84.2
UARS	MLS	94	11	11	18	49	25	1155	19	38	26	-24.9	152.3	90.0	-22.9	-36.9	129.8				92.1
ATLAS-3	SSBUV	94	11	11	22	14	47	8	5	15	4	-38.5	104.1	0.0	-90.0	-38.5	104.2	162	1	48	85.3
UARS	MLS	94	11	11	20	25	55	1155	21	14	56	-25.8	128.6	90.0	-22.9	-37.8	105.9				91.5
ATLAS-3	SSBUV	94	11	12	17	51	11	9	0	51	28	-34.3	170.2	0.0	-90.0	-34.3	170.3	104	2	11	86.4
UARS	MLS	94	11	12	15	39	12	1156	16	28	3	-22.2	193.3	90.0	-22.9	-34.0	171.4				98.6
ATLAS-3	SSBUV	94	11	12	19	21	6	9	2	21	23	-35.7	145.9	0.0	-90.0	-35.7	146.0	157	2	5	87.3
UARS	MLS	94	11	12	17	15	43	1156	18	4	34	-23.1	169.5	90.0	-22.9	-35.0	147.5				97.9

Appendix 12. 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-3	SSBUV	94	11	12	20	51	16	9	3	51	33	-36.3	122.3	0.0	-90.0	-36.3	122.4	117	1	59	87.9
UARS	MLS	94	11	12	18	52	13	1156	19	41	4	-24.0	145.8	90.0	-22.9	-35.9	123.6				97.3
ATLAS-3	SSBUV	94	11	12	22	21	10	9	5	21	27	-37.7	97.8	0.0	-90.0	-37.7	98.0	178	1	52	88.9
UARS	MLS	94	11	12	20	28	43	1156	21	17	45	-24.9	122.1	90.0	-22.9	-36.8	99.7				96.6
ATLAS-3	SSBUV	94	11	12	23	51	20	9	6	51	37	-38.3	74.2	0.0	-90.0	-38.3	74.3	141	1	46	89.4
UARS	MLS	94	11	12	22	5	14	1156	22	54	15	-25.8	98.3	90.0	-22.9	-37.8	75.8				95.9

Appendix 13. ATLAS-3 overflights of 18 selected ground sites.

site	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	solar zenith angle
Dumont_D'Urville	ATMOS	94	11	4	15	7	13	0	22	7	30	-52.6	161.4	31.3	-16.4	-65.1	182.6	1898	72.6
Dumont_D'Urville	ATMOS	94	11	4	16	37	49	0	23	38	6	-52.7	138.6	31.6	-16.4	-65.2	159.7	908	72.7
Dumont_D'Urville	ATMOS	94	11	5	15	16	35	1	22	16	52	-53.4	156.1	36.5	-16.4	-66.5	176.5	1582	74.1
Dumont_D'Urville	ATMOS	94	11	5	18	17	51	2	1	18	8	-53.5	110.6	37.1	-16.3	-66.5	130.8	405	74.2
Dumont_D'Urville	ATMOS	94	11	5	19	48	21	2	2	48	38	-53.6	87.8	37.4	-16.3	-66.6	108.0	1389	74.3
Dumont_D'Urville	ATMOS	94	11	6	15	24	48	2	22	25	5	-54.1	151.2	41.7	-16.3	-67.6	170.5	1296	75.5
Dumont_D'Urville	ATMOS	94	11	6	16	55	18	2	23	55	35	-54.1	128.4	42.0	-16.3	-67.7	147.6	332	75.6
Dumont_D'Urville	ATMOS	94	11	6	18	25	48	3	1	26	5	-54.2	105.6	42.3	-16.3	-67.8	124.7	660	75.7
Dumont_D'Urville	ATMOS	94	11	6	19	56	18	3	2	56	35	-54.2	82.8	42.7	-16.3	-67.8	101.8	1611	75.8
Dumont_D'Urville	ATMOS	94	11	7	14	2	14	3	21	2	31	-54.6	168.9	46.6	-16.3	-68.7	186.8	1927	77.0
Dumont_D'Urville	ATMOS	94	11	7	15	32	44	3	22	33	1	-54.6	146.1	46.9	-16.3	-68.7	163.9	1013	77.1
Dumont_D'Urville	ATMOS	94	11	7	17	3	13	4	0	3	30	-54.7	123.2	47.2	-16.3	-68.8	141.0	204	77.2
Dumont_D'Urville	ATMOS	94	11	7	18	33	43	4	1	34	0	-54.7	100.4	47.6	-16.3	-68.9	118.0	936	77.3
Dumont_D'Urville	ATMOS	94	11	7	20	4	13	4	3	4	30	-54.7	77.6	47.9	-16.3	-68.9	95.1	1844	77.4
Dumont_D'Urville	ATMOS	94	11	8	14	9	59	4	21	10	16	-55.1	163.7	51.8	-16.3	-69.6	179.9	1636	78.6
Dumont_D'Urville	ATMOS	94	11	8	15	40	27	4	22	40	44	-55.1	140.9	52.2	-16.3	-69.7	157.0	755	78.7
Dumont_D'Urville	ATMOS	94	11	8	17	10	55	5	0	11	12	-55.1	118.1	52.5	-16.3	-69.8	134.0	393	78.8
Dumont_D'Urville	ATMOS	94	11	8	18	41	23	5	1	41	40	-55.1	95.2	52.8	-16.3	-69.8	111.0	1213	78.9
Dumont_D'Urville	ATMOS	94	11	9	14	17	26	5	21	17	43	-55.4	158.4	57.1	-16.3	-70.5	172.3	1343	80.4
Dumont_D'Urville	ATMOS	94	11	9	15	47	54	5	22	48	11	-55.5	135.5	57.5	-16.3	-70.6	149.3	546	80.5
Dumont_D'Urville	ATMOS	94	11	9	17	18	22	6	0	18	39	-55.5	112.7	57.8	-16.3	-70.6	126.3	680	80.6
Dumont_D'Urville	ATMOS	94	11	10	12	53	27	6	19	53	44	-55.8	176.1	62.1	-16.2	-71.2	187.6	1894	82.0
Dumont_D'Urville	ATMOS	94	11	10	14	23	51	6	21	24	8	-55.8	153.2	62.4	-16.2	-71.2	164.6	1073	82.1
Dumont_D'Urville	ATMOS	94	11	10	15	54	15	6	22	54	32	-55.8	130.4	62.8	-16.2	-71.3	141.6	478	82.2
Dumont_D'Urville	ATMOS	94	11	10	17	24	39	7	0	24	56	-55.8	107.5	63.1	-16.2	-71.3	118.5	968	82.4
Dumont_D'Urville	ATMOS	94	11	10	18	55	2	7	1	55	19	-55.8	84.7	63.5	-16.2	-71.3	95.5	1781	82.5
Dumont_D'Urville	ATMOS	94	11	11	12	59	47	7	20	0	4	-56.0	170.3	67.5	-16.2	-71.8	178.4	1564	84.2
Dumont_D'Urville	ATMOS	94	11	11	16	0	34	7	23	0	51	-56.0	124.5	68.2	-16.2	-71.8	132.1	619	84.5
Dumont_D'Urville	ATMOS	94	11	11	17	30	57	8	0	31	14	-56.0	101.6	68.6	-16.2	-71.9	109.0	1308	84.6
Fritz_Peak	ATMOS	94	11	3	23	25	22	0	6	25	39	53.3	281.8	152.0	-16.4	49.3	256.1	1051	128.1
Fritz_Peak	ATMOS	94	11	4	0	55	59	0	7	56	16	53.2	259.1	151.7	-16.4	49.2	233.5	1948	128.3
Fritz_Peak	ATMOS	94	11	5	22	14	20	2	5	14	37	49.7	299.1	142.0	-16.3	45.6	275.5	1823	135.1
Fritz_Peak	ATMOS	94	11	5	23	44	53	2	6	45	10	49.6	276.4	141.7	-16.3	45.5	252.9	635	135.3
Fritz_Peak	ATMOS	94	11	6	22	23	2	3	5	23	19	47.1	297.0	136.8	-16.3	43.0	274.6	1703	139.9
Fritz_Peak	ATMOS	94	11	6	23	53	35	3	6	53	52	46.9	274.4	136.5	-16.3	42.8	252.0	382	140.2
Fritz_Peak	ATMOS	94	11	7	22	32	1	4	5	32	18	43.7	295.0	131.6	-16.3	39.6	273.8	1651	145.8
Fritz_Peak	ATMOS	94	11	8	0	2	34	4	7	2	51	43.5	272.4	131.2	-16.3	39.4	251.3	280	146.2
Fritz_Peak	ATMOS	94	11	8	22	40	45	5	5	41	2	39.4	293.4	126.3	-16.3	35.2	273.5	1756	153.1
Fritz_Peak	ATMOS	94	11	9	0	11	19	5	7	11	36	39.0	270.8	126.0	-16.3	34.9	251.0	636	153.6
Fritz_Peak	CRISTA-144	94	11	5	17	27	35	2	0	27	52	42.2	278.0	-144.0	-16.4	38.3	256.9	279	58.0
Fritz_Peak	CRISTA-144	94	11	6	17	36	9	3	0	36	26	44.6	274.0	-144.0	-16.3	41.3	252.1	256	60.7
Fritz_Peak	CRISTA-144	94	11	7	3	2	48	3	10	3	5	23.4	253.9	-144.0	-16.3	39.7	253.7	68	126.8
Fritz_Peak	CRISTA-144	94	11	8	16	19	41	4	23	19	58	42.4	278.7	-144.0	-16.3	38.6	257.8	318	60.1
Fritz_Peak	CRISTA-144	94	11	9	16	27	35	5	23	27	52	44.5	274.3	-144.0	-16.3	41.1	252.5	216	62.9
Fritz_Peak	CRISTA-144	94	11	10	1	53	33	6	8	53	50	23.7	254.4	-144.0	-16.2	39.9	254.3	21	111.8
Fritz_Peak	CRISTA-162/MAHRSI	94	11	4	18	51	45	1	1	52	2	48.5	273.3	-162.0	-16.4	41.6	252.0	279	66.4
Fritz_Peak	CRISTA-162/MAHRSI	94	11	6	2	55	0	2	9	55	17	24.3	260.8	-162.0	-16.3	39.6	254.0	51	131.3
Fritz_Peak	CRISTA-162/MAHRSI	94	11	6	17	36	39	3	0	36	56	45.9	276.0	-162.0	-16.3	38.4	256.4	240	62.1
Fritz_Peak	CRISTA-162/MAHRSI	94	11	7	17	45	12	4	0	45	29	48.3	273.1	-162.0	-16.3	41.5	252.1	270	64.8
Fritz_Peak	CRISTA-162/MAHRSI	94	11	9	1	46	41	5	8	46	58	24.5	261.1	-162.0	-16.3	39.8	254.3	20	116.3
Fritz_Peak	CRISTA-162/MAHRSI	94	11	9	16	28	5	5	23	28	22	45.7	276.3	-162.0	-16.3	38.2	256.8	278	63.7
Fritz_Peak	CRISTA-162/MAHRSI	94	11	10	16	35	6	6	23	35	23	48.2	273.6	-162.0	-16.2	41.3	252.9	207	66.5
Fritz_Peak	CRISTA-162/MAHRSI	94	11	12	0	34	55	8	7	35	12	25.2	261.8	-162.0	-16.2	40.4	255.1	68	101.4
Fritz_Peak	CRISTA-180	94	11	4	18	52	0	1	1	52	17	49.0	274.5	-180.0	-16.4	38.4	257.0	276	67.3
Fritz_Peak	CRISTA-180	94	11	5	2	45	35	1	9	45	52	27.3	266.3	-180.0	-16.4	39.7	253.2	112	133.9
Fritz_Peak	CRISTA-180	94	11	5	19	1	52	2	2	2	9	51.0	271.3	-180.0	-16.3	41.1	252.5	216	69.2
Fritz_Peak	CRISTA-180	94	11	7	1	30	2	3	8	30	19	30.6	271.1	-180.0	-16.3	42.5	257.2	369	121.8
Fritz_Peak	CRISTA-180	94	11	7	17	45	27	4	0	45	44	48.9	274.3	-180.0	-16.3	38.3	257.0	280	65.4
Fritz_Peak	CRISTA-180	94	11	8	1	38	47	4	8	39	4	27.0	266.6	-180.0	-16.3	39.3	253.8	89	119.7
Fritz_Peak	CRISTA-180	94	11	8	17	53	41	5	0	53	58	50.9	271.4	-180.0	-16.3	40.9	252.7	189	67.6
Fritz_Peak	CRISTA-180	94	11	10	16	35	21	6	23	35	38	48.7	274.8	-180.0	-16.2	38.2	257.8	344	66.9
Fritz_Peak	CRISTA-180	94	11	11	0	28	2	7	7	28	19	27.7	267.1	-180.0	-16.2	39.8	254.3	21	105.0

Appendix 13. Continued.

site	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	solar zenith angle
Fritz_Peak	CRISTA-180	94	11	11	16	42	15	7	23	42	32	50.4	271.4	-180.0	-16.2	40.4	253.3	117	69.0
Fritz_Peak	SSBUV	94	11	5	18	57	20	2	1	57	37	40.5	252.8	0.0	-90.0	40.5	252.8	158	56.3
Fritz_Peak	SSBUV	94	11	7	17	40	56	4	0	41	13	37.7	257.4	0.0	-90.0	37.7	257.4	352	55.5
Fritz_Peak	SSBUV	94	11	8	17	49	25	5	0	49	42	41.0	253.9	0.0	-90.0	41.0	253.9	132	59.3
Jungfraujock	ATMOS	94	11	5	14	41	26	1	21	41	43	50.3	52.5	143.6	-16.4	46.3	28.4	1560	133.9
Jungfraujock	ATMOS	94	11	6	14	50	18	2	21	50	35	48.0	50.1	138.4	-16.3	43.9	27.3	1543	138.3
Jungfraujock	ATMOS	94	11	6	16	20	51	2	23	21	8	47.8	27.5	138.1	-16.3	43.7	4.8	445	138.6
Jungfraujock	ATMOS	94	11	7	16	29	41	3	23	29	58	44.6	25.5	132.9	-16.3	40.5	4.0	790	144.2
Jungfraujock	ATMOS	94	11	8	15	8	0	4	22	8	17	40.8	46.4	127.9	-16.3	36.7	26.1	1880	150.6
Jungfraujock	ATMOS	94	11	8	16	38	33	4	23	38	50	40.6	23.8	127.6	-16.3	36.4	3.6	1232	151.1
Jungfraujock	ATMOS	94	11	9	16	47	32	5	23	47	49	35.2	22.4	122.3	-16.3	31.0	3.6	1819	159.7
Jungfraujock	CRISTA-144	94	11	5	19	20	28	2	2	20	45	31.1	10.1	-144.0	-16.3	47.4	8.7	68	127.3
Jungfraujock	CRISTA-144	94	11	6	10	5	8	2	17	5	25	47.9	34.6	-144.0	-16.3	45.5	11.0	282	64.5
Jungfraujock	CRISTA-144	94	11	7	10	13	26	3	17	13	43	49.6	30.7	-144.0	-16.3	47.9	6.0	177	66.3
Jungfraujock	CRISTA-144	94	11	8	18	12	17	5	1	12	34	31.3	10.4	-144.0	-16.3	47.6	8.9	92	113.3
Jungfraujock	CRISTA-144	94	11	9	8	56	42	5	15	56	59	47.8	34.8	-144.0	-16.3	45.3	11.3	316	64.9
Jungfraujock	CRISTA-144	94	11	9	18	19	58	6	1	20	15	29.0	5.0	-144.0	-16.2	45.1	4.1	366	110.2
Jungfraujock	CRISTA-144	94	11	10	9	3	47	6	16	4	4	49.5	31.1	-144.0	-16.2	47.7	6.8	119	67.1
Jungfraujock	CRISTA-144	94	11	11	17	0	50	8	0	1	7	32.0	11.0	-144.0	-16.2	48.1	9.4	164	99.4
Jungfraujock	CRISTA-162/MAHRSI	94	11	4	19	11	7	1	2	11	24	32.5	16.9	-162.0	-16.4	47.4	7.7	47	130.6
Jungfraujock	CRISTA-162/MAHRSI	94	11	5	11	30	0	1	18	30	17	52.7	31.4	-162.0	-16.4	47.7	6.7	127	72.5
Jungfraujock	CRISTA-162/MAHRSI	94	11	7	10	14	12	3	17	14	29	51.2	34.6	-162.0	-16.3	45.4	11.5	321	68.3
Jungfraujock	CRISTA-162/MAHRSI	94	11	7	18	4	34	4	1	4	51	32.6	16.7	-162.0	-16.3	47.4	7.7	50	117.0
Jungfraujock	CRISTA-162/MAHRSI	94	11	8	10	22	18	4	17	22	35	52.5	30.7	-162.0	-16.3	47.3	6.6	113	69.6
Jungfraujock	CRISTA-162/MAHRSI	94	11	10	9	4	17	6	16	4	34	50.5	33.6	-162.0	-16.2	44.6	11.3	374	67.9
Jungfraujock	CRISTA-162/MAHRSI	94	11	10	16	54	27	6	23	54	44	32.8	17.4	-162.0	-16.2	47.5	8.4	63	103.4
Jungfraujock	CRISTA-162/MAHRSI	94	11	11	9	11	26	7	16	11	43	52.5	32.0	-162.0	-16.2	47.5	8.0	54	70.1
Jungfraujock	CRISTA-162/MAHRSI	94	11	11	17	1	20	8	0	1	37	30.5	12.3	-162.0	-16.2	45.3	4.2	349	100.2
Jungfraujock	CRISTA-180	94	11	4	12	53	55	0	19	54	12	55.8	30.2	-180.0	-16.4	49.0	5.4	297	81.7
Jungfraujock	CRISTA-180	94	11	5	17	47	43	2	0	48	0	37.7	26.7	-180.0	-16.4	48.5	9.5	202	121.3
Jungfraujock	CRISTA-180	94	11	6	11	39	10	2	18	39	27	54.6	30.7	-180.0	-16.3	46.6	8.1	45	74.9
Jungfraujock	CRISTA-180	94	11	6	17	56	15	3	0	56	32	35.0	22.0	-180.0	-16.3	46.2	6.3	154	119.6
Jungfraujock	CRISTA-180	94	11	7	11	47	43	3	18	48	0	55.8	29.8	-180.0	-16.3	49.0	5.3	299	76.6
Jungfraujock	CRISTA-180	94	11	8	16	39	33	4	23	39	50	38.2	26.6	-180.0	-16.3	48.8	9.4	222	108.3
Jungfraujock	CRISTA-180	94	11	9	10	30	42	5	17	30	59	54.5	30.9	-180.0	-16.3	46.5	8.4	67	72.2
Jungfraujock	CRISTA-180	94	11	9	16	47	41	5	23	47	58	35.1	22.4	-180.0	-16.3	46.3	6.7	126	106.3
Jungfraujock	CRISTA-180	94	11	10	10	37	58	6	17	38	15	55.7	30.1	-180.0	-16.2	48.9	6.0	260	73.8
Jungfraujock	CRISTA-180	94	11	11	15	28	10	7	22	28	27	38.8	27.0	-180.0	-16.2	49.2	9.7	276	95.7
Jungfraujock	SSBUV	94	11	9	10	26	11	5	17	26	28	45.9	8.6	0.0	-90.0	45.9	8.6	127	63.5
Jungfraujock	SSBUV	94	11	10	10	33	27	6	17	33	44	48.4	5.8	0.0	-90.0	48.4	5.9	217	66.3
Kislovodsk	ATMOS	94	11	5	13	10	49	1	20	11	6	50.5	75.2	143.9	-16.4	46.4	51.0	790	133.6
Kislovodsk	ATMOS	94	11	5	14	41	26	1	21	41	43	50.3	52.5	143.6	-16.4	46.3	28.4	1174	133.9
Kislovodsk	ATMOS	94	11	6	14	50	18	2	21	50	35	48.0	50.1	138.4	-16.3	43.9	27.3	1228	138.3
Kislovodsk	ATMOS	94	11	8	15	8	0	4	22	8	17	40.8	46.4	127.9	-16.3	36.7	26.1	1549	150.6
Kislovodsk	ATMOS	94	11	9	13	46	23	5	20	46	40	35.9	67.5	123.0	-16.3	31.8	48.5	1338	158.5
Kislovodsk	ATMOS	94	11	9	15	16	58	5	22	17	15	35.6	44.9	122.6	-16.3	31.4	26.0	1924	159.1
Kislovodsk	CRISTA-144	94	11	4	17	42	18	1	0	42	35	27.1	44.4	-144.0	-16.4	43.5	43.7	128	135.8
Kislovodsk	CRISTA-144	94	11	5	8	26	3	1	15	26	20	46.8	63.2	-144.0	-16.4	44.0	40.0	241	63.7
Kislovodsk	CRISTA-144	94	11	7	7	10	25	3	14	10	42	44.7	67.4	-144.0	-16.3	41.4	45.5	292	61.0
Kislovodsk	CRISTA-144	94	11	7	16	35	49	3	23	36	6	27.3	44.2	-144.0	-16.3	43.6	43.6	124	121.3
Kislovodsk	CRISTA-144	94	11	8	7	18	35	4	14	18	52	46.4	62.7	-144.0	-16.3	43.6	40.0	218	63.0
Kislovodsk	CRISTA-144	94	11	10	6	0	57	6	13	1	14	44.5	67.8	-144.0	-16.2	41.2	46.2	356	63.7
Kislovodsk	CRISTA-144	94	11	10	15	25	47	6	22	26	4	27.5	44.9	-144.0	-16.2	43.7	44.3	177	106.9
Kislovodsk	CRISTA-144	94	11	11	6	7	50	7	13	8	7	46.5	63.9	-144.0	-16.2	43.7	41.3	135	66.4
Kislovodsk	CRISTA-144	94	11	11	15	32	41	7	22	32	58	25.0	39.6	-144.0	-16.2	41.2	39.4	308	103.3
Kislovodsk	CRISTA-162/MAHRSI	94	11	4	17	42	48	1	0	43	5	25.5	45.6	-162.0	-16.4	40.9	38.5	389	137.2
Kislovodsk	CRISTA-162/MAHRSI	94	11	5	8	26	48	1	15	27	5	48.6	66.6	-162.0	-16.4	41.7	45.3	261	66.0
Kislovodsk	CRISTA-162/MAHRSI	94	11	6	8	35	38	2	15	35	55	50.1	62.2	-162.0	-16.3	43.8	40.0	226	67.4
Kislovodsk	CRISTA-162/MAHRSI	94	11	6	16	28	1	2	23	28	18	28.1	51.1	-162.0	-16.3	43.2	43.4	95	125.6
Kislovodsk	CRISTA-162/MAHRSI	94	11	7	16	36	19	3	23	36	36	25.7	45.5	-162.0	-16.3	40.9	38.5	391	122.4
Kislovodsk	CRISTA-162/MAHRSI	94	11	8	7	19	20	4	14	19	37	48.2	66.1	-162.0	-16.3	41.3	45.2	280	64.7
Kislovodsk	CRISTA-162/MAHRSI	94	11	9	7	27	14	5	14	27	31	49.9	62.4	-162.0	-16.3	43.6	40.3	194	66.8
Kislovodsk	CRISTA-162/MAHRSI	94	11	9	15	19	29	5	22	19	46	28.3	51.5	-162.0	-16.3	43.4	43.8	127	111.2
Kislovodsk	CRISTA-162/MAHRSI	94	11	10	15	26	17	6	22	26	34	25.9	46.1	-162.0	-16.2	41.0	39.2	331	107.8

Appendix 13. Continued.

site	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	solar zenith angle
Kislovodsk	CRISTA-162/MAHRSI	94	11	11	6	8	20	7	13	8	37	47.7	66.1	-162.0	-16.2	40.7	45.7	358	67.0
Kislovodsk	CRISTA-180	94	11	5	16	19	23	1	23	19	40	31.0	56.3	-180.0	-16.4	43.0	41.9	44	127.9
Kislovodsk	CRISTA-180	94	11	6	8	35	53	2	15	36	10	50.6	63.5	-180.0	-16.3	40.5	45.0	331	68.1
Kislovodsk	CRISTA-180	94	11	7	8	44	27	3	15	44	44	52.5	61.5	-180.0	-16.3	43.3	41.3	112	70.3
Kislovodsk	CRISTA-180	94	11	8	15	11	35	4	22	11	52	30.8	56.8	-180.0	-16.3	42.6	42.9	39	114.3
Kislovodsk	CRISTA-180	94	11	9	7	27	29	5	14	27	46	50.4	63.7	-180.0	-16.3	40.4	45.3	361	67.3
Kislovodsk	CRISTA-180	94	11	10	7	34	53	6	14	35	10	52.4	61.8	-180.0	-16.2	43.2	41.9	62	69.5
Kislovodsk	CRISTA-180	94	11	11	14	0	16	7	21	0	33	31.4	57.4	-180.0	-16.2	43.1	43.3	83	100.3
Kislovodsk	SSBUV	94	11	10	7	30	21	6	14	30	38	42.5	42.0	0.0	-90.0	42.5	42.1	41	62.8
Kislovodsk	SSBUV	94	11	11	7	37	30	7	14	37	47	45.2	38.8	0.0	-90.0	45.2	38.9	389	65.9
Kitt_Peak	ATMOS	94	11	5	23	44	53	2	6	45	10	49.6	276.4	141.7	-16.3	45.5	252.9	1540	135.3
Kitt_Peak	ATMOS	94	11	6	23	53	35	3	6	53	52	46.9	274.4	136.5	-16.3	42.8	252.0	1229	140.2
Kitt_Peak	ATMOS	94	11	8	0	2	34	4	7	2	51	43.5	272.4	131.2	-16.3	39.4	251.3	846	146.2
Kitt_Peak	ATMOS	94	11	8	1	33	6	4	8	33	23	43.2	249.8	130.9	-16.3	39.1	228.8	1989	146.6
Kitt_Peak	ATMOS	94	11	9	0	11	19	5	7	11	36	39.0	270.8	126.0	-16.3	34.9	251.0	373	153.6
Kitt_Peak	ATMOS	94	11	9	1	41	52	5	8	42	9	38.7	248.2	125.6	-16.3	34.6	228.5	1922	154.1
Kitt_Peak	ATMOS	94	11	11	0	28	36	7	7	28	53	25.5	268.9	115.3	-16.2	21.2	251.9	1239	173.7
Kitt_Peak	CRISTA-144	94	11	5	4	19	27	1	11	19	44	16.7	250.8	-144.0	-16.4	33.1	251.2	242	141.4
Kitt_Peak	CRISTA-144	94	11	5	17	25	19	2	0	25	36	35.7	270.4	-144.0	-16.4	30.9	251.5	268	51.7
Kitt_Peak	CRISTA-144	94	11	6	17	33	53	3	0	34	10	38.5	265.7	-144.0	-16.3	34.0	246.2	339	54.9
Kitt_Peak	CRISTA-144	94	11	8	3	12	17	4	10	12	34	17.2	250.6	-144.0	-16.3	33.5	251.0	250	125.4
Kitt_Peak	CRISTA-144	94	11	8	16	17	10	4	23	17	27	35.3	270.3	-144.0	-16.3	30.4	251.7	316	55.7
Kitt_Peak	CRISTA-144	94	11	9	3	20	26	5	10	20	43	13.8	245.4	-144.0	-16.3	30.1	246.0	362	121.8
Kitt_Peak	CRISTA-144	94	11	9	16	25	4	5	23	25	21	37.6	265.3	-144.0	-16.3	33.0	246.1	293	59.1
Kitt_Peak	CRISTA-144	94	11	11	2	1	42	7	9	1	59	17.1	251.7	-144.0	-16.2	33.3	252.2	331	110.0
Kitt_Peak	CRISTA-162/MAHRSI	94	11	5	4	19	57	1	11	20	14	15.0	251.9	-162.0	-16.4	30.7	246.5	276	142.3
Kitt_Peak	CRISTA-162/MAHRSI	94	11	6	17	34	23	3	0	34	40	39.9	267.4	-162.0	-16.3	31.2	250.4	156	56.1
Kitt_Peak	CRISTA-162/MAHRSI	94	11	7	3	4	18	3	10	4	35	18.5	257.2	-162.0	-16.3	34.0	251.5	329	129.9
Kitt_Peak	CRISTA-162/MAHRSI	94	11	8	3	12	47	4	10	13	4	15.5	251.7	-162.0	-16.3	31.1	246.4	270	126.3
Kitt_Peak	CRISTA-162/MAHRSI	94	11	9	16	25	50	5	23	26	7	39.7	267.8	-162.0	-16.3	31.0	250.8	201	60.2
Kitt_Peak	CRISTA-162/MAHRSI	94	11	10	1	55	4	6	8	55	21	18.8	257.8	-162.0	-16.2	34.2	252.1	379	114.4
Kitt_Peak	CRISTA-162/MAHRSI	94	11	10	16	32	36	6	23	32	53	41.8	263.2	-162.0	-16.2	33.5	245.7	353	63.2
Kitt_Peak	CRISTA-162/MAHRSI	94	11	11	2	2	13	7	9	2	30	15.4	252.8	-162.0	-16.2	30.9	247.6	183	110.7
Kitt_Peak	CRISTA-180	94	11	4	18	49	44	1	1	50	1	43.5	264.8	-180.0	-16.4	31.7	250.2	123	59.9
Kitt_Peak	CRISTA-180	94	11	6	2	56	0	2	9	56	17	21.1	263.1	-180.0	-16.3	33.9	251.7	328	133.6
Kitt_Peak	CRISTA-180	94	11	7	3	4	33	3	10	4	50	17.7	257.8	-180.0	-16.3	30.8	247.0	231	130.4
Kitt_Peak	CRISTA-180	94	11	7	17	43	12	4	0	43	29	43.4	264.5	-180.0	-16.3	31.6	250.3	127	60.0
Kitt_Peak	CRISTA-180	94	11	9	1	47	41	5	8	47	58	21.3	263.4	-180.0	-16.3	34.1	252.0	362	118.2
Kitt_Peak	CRISTA-180	94	11	10	1	55	19	6	8	55	36	18.0	258.3	-180.0	-16.2	30.9	247.6	176	114.8
Kitt_Peak	CRISTA-180	94	11	10	16	32	51	6	23	33	8	42.5	264.2	-180.0	-16.2	30.7	250.4	197	63.5
Kitt_Peak	CRISTA-180	94	11	11	16	40	0	7	23	40	17	45.2	261.0	-180.0	-16.2	33.8	246.1	338	66.6
Kitt_Peak	SSBUV	94	11	5	18	55	4	2	1	55	21	33.9	245.6	0.0	-90.0	33.9	245.6	383	50.1
Kitt_Peak	SSBUV	94	11	8	17	46	54	5	0	47	11	33.8	245.9	0.0	-90.0	33.8	245.9	351	55.1
Kitt_Peak	SSBUV	94	11	10	16	28	35	6	23	28	52	30.7	251.4	0.0	-90.0	30.7	251.5	278	59.9
Lake_Issyk-Kul	ATMOS	94	11	4	9	59	40	0	16	59	57	52.6	123.1	149.8	-16.4	48.6	97.9	1799	129.5
Lake_Issyk-Kul	ATMOS	94	11	5	10	9	34	1	17	9	51	50.7	120.5	144.6	-16.4	46.7	96.2	1643	133.1
Lake_Issyk-Kul	ATMOS	94	11	5	11	40	11	1	18	40	28	50.6	97.8	144.3	-16.5	46.5	73.6	437	133.4
Lake_Issyk-Kul	ATMOS	94	11	6	10	18	40	2	17	18	57	48.5	118.0	139.4	-16.3	44.4	95.0	1532	137.3
Lake_Issyk-Kul	ATMOS	94	11	8	10	36	21	4	17	36	38	41.7	114.1	128.9	-16.3	37.6	93.6	1612	149.2
Lake_Issyk-Kul	ATMOS	94	11	9	10	45	15	5	17	45	32	36.7	112.7	123.6	-16.3	32.5	93.5	1927	157.4
Lake_Issyk-Kul	ATMOS	94	11	9	12	15	49	5	19	16	6	36.3	90.1	123.3	-16.3	32.2	71.0	1283	158.0
Lake_Issyk-Kul	ATMOS	94	11	10	12	24	12	6	19	24	29	29.7	89.1	118.0	-16.2	25.5	71.5	1993	167.9
Lake_Issyk-Kul	CRISTA-144	94	11	6	5	32	52	2	12	33	9	45.8	99.7	-144.0	-16.3	42.8	77.2	103	62.1
Lake_Issyk-Kul	CRISTA-144	94	11	6	14	58	16	2	21	58	33	25.9	75.8	-144.0	-16.3	42.2	75.4	105	127.6
Lake_Issyk-Kul	CRISTA-144	94	11	9	4	24	31	5	11	24	48	45.7	100.0	-144.0	-16.3	42.6	77.6	136	63.1
Lake_Issyk-Kul	CRISTA-144	94	11	9	13	49	45	5	20	50	2	26.1	76.2	-144.0	-16.3	42.3	75.7	77	112.9
Lake_Issyk-Kul	CRISTA-144	94	11	10	4	31	47	6	11	32	4	47.5	96.0	-144.0	-16.2	45.1	72.8	344	65.5
Lake_Issyk-Kul	CRISTA-162/MAHRSI	94	11	4	14	40	6	0	21	40	23	30.5	87.6	-162.0	-16.4	45.5	79.2	377	133.4
Lake_Issyk-Kul	CRISTA-162/MAHRSI	94	11	5	6	57	28	1	13	57	45	51.2	95.7	-162.0	-16.4	45.3	72.4	384	70.0
Lake_Issyk-Kul	CRISTA-162/MAHRSI	94	11	5	14	50	3	1	21	50	20	27.2	82.4	-162.0	-16.4	42.5	74.9	106	131.5
Lake_Issyk-Kul	CRISTA-162/MAHRSI	94	11	7	5	41	41	3	12	41	58	48.9	98.0	-162.0	-16.3	42.2	76.6	100	65.4
Lake_Issyk-Kul	CRISTA-162/MAHRSI	94	11	7	13	33	48	3	20	34	5	30.6	87.4	-162.0	-16.3	45.5	79.1	374	119.4
Lake_Issyk-Kul	CRISTA-162/MAHRSI	94	11	8	5	50	7	4	12	50	24	50.8	95.0	-162.0	-16.3	44.9	72.3	367	67.6
Lake_Issyk-Kul	CRISTA-162/MAHRSI	94	11	8	13	42	6	4	20	42	23	27.7	82.3	-162.0	-16.3	42.8	74.8	98	116.7

Appendix 13. Continued.

site	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	solar zenith angle
Lake_Issyk-Kul	CRISTA-162/MAHRSI	94	11	10	4	32	17	6	11	32	34	48.7	98.3	-162.0	-16.2	42.0	77.3	148	66.3
Lake_Issyk-Kul	CRISTA-162/MAHRSI	94	11	11	4	39	26	7	11	39	43	50.9	96.2	-162.0	-16.2	45.1	73.6	298	68.8
Lake_Issyk-Kul	CRISTA-162/MAHRSI	94	11	11	12	31	6	7	19	31	23	27.6	83.5	-162.0	-16.2	42.7	76.2	41	102.6
Lake_Issyk-Kul	CRISTA-180	94	11	4	14	40	22	0	21	40	39	29.7	88.3	-180.0	-16.4	41.8	74.5	185	134.1
Lake_Issyk-Kul	CRISTA-180	94	11	5	6	57	44	1	13	58	1	51.6	97.0	-180.0	-16.4	41.9	77.5	171	70.8
Lake_Issyk-Kul	CRISTA-180	94	11	6	7	6	54	2	14	7	11	53.3	94.5	-180.0	-16.3	44.5	73.5	259	72.6
Lake_Issyk-Kul	CRISTA-180	94	11	6	13	25	30	2	20	25	47	33.0	92.8	-180.0	-16.3	44.6	78.0	234	122.1
Lake_Issyk-Kul	CRISTA-180	94	11	7	13	34	3	3	20	34	20	29.8	88.1	-180.0	-16.3	41.8	74.4	185	120.0
Lake_Issyk-Kul	CRISTA-180	94	11	8	5	50	22	4	12	50	39	51.3	96.4	-180.0	-16.3	41.6	77.3	189	68.2
Lake_Issyk-Kul	CRISTA-180	94	11	9	5	58	31	5	12	58	48	53.2	94.7	-180.0	-16.3	44.3	73.8	232	70.4
Lake_Issyk-Kul	CRISTA-180	94	11	9	12	17	1	5	19	17	18	33.2	93.2	-180.0	-16.3	44.7	78.3	262	108.5
Lake_Issyk-Kul	CRISTA-180	94	11	10	12	24	12	6	19	24	29	30.1	88.7	-180.0	-16.2	42.0	75.1	136	106.0
Lake_Issyk-Kul	CRISTA-180	94	11	11	4	39	41	7	11	39	58	51.4	97.5	-180.0	-16.2	41.7	78.6	255	69.1
Lake_Issyk-Kul	SSBUV	94	11	5	6	53	12	1	13	53	29	41.4	78.0	0.0	-90.0	41.4	77.9	236	57.3
Lake_Issyk-Kul	SSBUV	94	11	6	7	2	37	2	14	2	54	44.6	74.7	0.0	-90.0	44.6	74.7	201	60.6
Lake_Issyk-Kul	SSBUV	94	11	8	5	46	6	4	12	46	23	41.7	78.5	0.0	-90.0	41.7	78.5	252	59.1
Lake_Issyk-Kul	SSBUV	94	11	9	5	54	14	5	12	54	31	44.4	75.0	0.0	-90.0	44.4	75.0	176	62.2
Lake_Issyk-Kul	SSBUV	94	11	11	4	35	10	7	11	35	27	41.1	78.7	0.0	-90.0	41.1	78.8	316	64.1
Luader	CRISTA-144	94	11	4	15	11	34	0	22	11	51	-56.9	188.2	-144.0	-16.4	-44.9	170.1	12	92.3
Luader	CRISTA-144	94	11	4	16	46	26	0	23	46	43	-54.1	194.2	-144.0	-16.4	-47.4	170.2	266	77.6
Luader	CRISTA-144	94	11	4	18	21	18	1	1	21	35	-45.2	193.0	-144.0	-16.4	-43.8	169.9	130	63.4
Luader	CRISTA-144	94	11	5	15	22	1	1	22	22	18	-56.8	191.1	-144.0	-16.4	-46.5	170.2	164	89.5
Luader	CRISTA-144	94	11	5	16	56	53	1	23	57	10	-51.5	195.1	-144.0	-16.4	-46.8	170.8	208	75.7
Luader	CRISTA-144	94	11	6	13	55	25	2	20	55	42	-55.3	179.8	-144.0	-16.3	-41.4	166.7	390	103.5
Luader	CRISTA-144	94	11	6	15	30	57	2	22	31	14	-56.0	191.6	-144.0	-16.3	-47.3	169.2	259	88.2
Luader	CRISTA-144	94	11	6	17	5	44	3	0	6	1	-49.0	193.4	-144.0	-16.3	-45.8	169.7	97	75.4
Luader	CRISTA-144	94	11	7	14	5	14	3	21	5	31	-56.9	187.7	-144.0	-16.3	-44.9	170.0	6	98.4
Luader	CRISTA-144	94	11	7	15	40	0	3	22	40	17	-54.2	193.8	-144.0	-16.3	-47.5	170.1	274	86.4
Luader	CRISTA-144	94	11	7	17	14	47	4	0	15	4	-45.4	192.7	-144.0	-16.3	-43.9	169.9	119	74.6
Luader	CRISTA-144	94	11	8	14	14	1	4	21	14	18	-56.8	190.3	-144.0	-16.3	-46.5	169.9	163	96.5
Luader	CRISTA-144	94	11	8	15	48	46	4	22	49	3	-51.8	194.6	-144.0	-16.3	-47.0	170.5	222	85.4
Luader	CRISTA-144	94	11	8	17	23	16	5	0	23	33	-42.3	189.9	-144.0	-16.3	-42.1	167.9	370	75.4
Luader	CRISTA-144	94	11	9	12	47	55	5	19	48	12	-56.2	186.5	-144.0	-16.3	-43.0	171.5	250	104.5
Luader	CRISTA-144	94	11	9	14	22	25	5	21	22	42	-56.0	191.7	-144.0	-16.3	-47.3	169.4	255	95.3
Luader	CRISTA-144	94	11	9	15	57	10	5	22	57	27	-49.1	193.7	-144.0	-16.3	-45.9	170.0	102	85.4
Luader	CRISTA-144	94	11	10	12	55	21	6	19	55	38	-56.9	188.0	-144.0	-16.2	-45.0	170.6	44	102.8
Luader	CRISTA-144	94	11	10	14	29	47	6	21	30	4	-54.6	192.7	-144.0	-16.2	-47.6	169.4	289	94.7
Luader	CRISTA-144	94	11	10	16	4	28	6	23	4	45	-46.2	192.2	-144.0	-16.2	-44.4	169.4	80	86.0
Luader	CRISTA-144	94	11	11	13	2	45	7	20	3	2	-56.9	189.9	-144.0	-16.2	-46.3	170.0	149	101.6
Luader	CRISTA-144	94	11	11	14	37	26	7	21	37	43	-52.2	194.5	-144.0	-16.2	-47.1	170.7	243	94.2
Luader	CRISTA-144	94	11	11	16	11	52	7	23	12	9	-42.9	190.2	-144.0	-16.2	-42.4	168.2	317	87.1
Luader	CRISTA-162/MAHRSI	94	11	4	18	21	18	1	1	21	35	-45.2	193.0	-162.0	-16.4	-48.9	169.3	382	63.4
Luader	CRISTA-162/MAHRSI	94	11	5	13	47	54	1	20	48	11	-55.6	189.5	-162.0	-16.4	-44.8	170.0	26	100.9
Luader	CRISTA-162/MAHRSI	94	11	5	18	31	57	2	1	32	14	-40.8	191.5	-162.0	-16.3	-46.0	170.2	117	62.0
Luader	CRISTA-162/MAHRSI	94	11	6	13	56	55	2	20	57	13	-56.6	189.8	-162.0	-16.3	-47.1	168.1	275	98.9
Luader	CRISTA-162/MAHRSI	94	11	6	18	40	45	3	1	41	2	-37.1	188.2	-162.0	-16.3	-43.4	168.5	213	62.6
Luader	CRISTA-162/MAHRSI	94	11	7	17	15	2	4	0	15	19	-44.7	193.8	-162.0	-16.3	-48.6	170.6	376	73.9
Luader	CRISTA-162/MAHRSI	94	11	8	12	40	2	4	19	40	19	-55.5	188.8	-162.0	-16.3	-44.6	169.7	53	105.4
Luader	CRISTA-162/MAHRSI	94	11	8	17	23	47	5	0	24	4	-40.9	191.7	-162.0	-16.3	-46.2	170.4	132	74.2
Luader	CRISTA-162/MAHRSI	94	11	9	12	48	26	5	19	48	43	-56.6	190.0	-162.0	-16.3	-47.0	168.4	257	103.4
Luader	CRISTA-162/MAHRSI	94	11	9	17	32	0	6	0	32	17	-37.3	188.5	-162.0	-16.2	-43.6	168.9	181	75.4
Luader	CRISTA-162/MAHRSI	94	11	11	11	28	49	7	18	29	6	-55.2	188.4	-162.0	-16.2	-44.2	170.0	91	107.2
Luader	CRISTA-162/MAHRSI	94	11	11	16	12	22	7	23	12	39	-41.5	192.1	-162.0	-16.2	-46.6	170.7	180	86.2
Luader	CRISTA-180	94	11	4	13	37	57	0	20	38	14	-54.4	190.8	-180.0	-16.4	-46.1	168.3	182	102.6
Luader	CRISTA-180	94	11	4	19	56	10	1	2	56	27	-33.2	184.7	-180.0	-16.4	-44.8	169.6	38	50.2
Luader	CRISTA-180	94	11	6	12	23	9	2	19	23	26	-52.6	191.9	-180.0	-16.3	-43.5	171.6	212	108.8
Luader	CRISTA-180	94	11	6	18	41	0	3	1	41	17	-36.4	189.0	-180.0	-16.3	-47.4	172.7	338	61.9
Luader	CRISTA-180	94	11	7	12	31	43	3	19	32	0	-54.3	190.4	-180.0	-16.3	-46.1	168.2	184	106.8
Luader	CRISTA-180	94	11	7	18	49	34	4	1	49	51	-33.3	184.5	-180.0	-16.3	-44.8	169.6	35	63.7
Luader	CRISTA-180	94	11	9	11	14	41	5	18	14	58	-52.5	192.1	-180.0	-16.3	-43.3	171.9	240	110.5
Luader	CRISTA-180	94	11	9	17	32	15	6	0	32	32	-36.6	189.3	-180.0	-16.2	-47.5	173.1	368	74.9
Luader	CRISTA-180	94	11	10	11	21	55	6	18	22	12	-54.2	190.7	-180.0	-16.2	-46.0	168.9	138	108.5
Luader	CRISTA-180	94	11	10	17	39	24	7	0	39	41	-33.6	185.2	-180.0	-16.2	-45.0	170.4	31	77.2
Luader	CRISTA-180	94	11	11	17	46	18	8	0	46	35	-31.2	180.2	-180.0	-16.2	-42.9	166.3	376	80.3

Appendix 13. Continued.

site	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	solar zenith angle
Luader	SSBUV	94	11	6	18	36	29	3	1	36	46	-47.9	172.9	0.0	-90.0	-47.9	172.9	388	74.1
Luader	SSBUV	94	11	7	18	45	2	4	1	45	19	-45.4	169.8	0.0	-90.0	-45.4	169.8	43	74.9
Luader	SSBUV	94	11	10	17	34	53	7	0	35	10	-45.6	170.4	0.0	-90.0	-45.6	170.5	73	85.7
Luader	SSBUV	94	11	11	17	42	2	8	0	42	19	-42.9	167.3	0.0	-90.0	-42.9	167.4	312	87.3
Mauna_Loa	ATMOS	94	11	9	3	12	26	5	10	12	43	38.4	225.6	125.3	-16.3	34.2	206.0	1589	154.7
Mauna_Loa	ATMOS	94	11	11	3	29	44	7	10	30	1	24.3	223.9	114.6	-16.2	20.0	207.1	215	175.2
Mauna_Loa	CRISTA-144	94	11	4	20	14	2	1	3	14	19	25.0	222.9	-144.0	-16.4	19.3	206.2	150	41.6
Mauna_Loa	CRISTA-144	94	11	6	7	32	32	2	14	32	49	4.2	204.6	-144.0	-16.3	20.5	205.5	74	140.7
Mauna_Loa	CRISTA-144	94	11	7	19	7	25	4	2	7	42	24.9	222.8	-144.0	-16.3	19.2	206.3	165	48.5
Mauna_Loa	CRISTA-144	94	11	9	6	24	9	5	13	24	26	4.4	205.0	-144.0	-16.3	20.7	205.9	116	124.8
Mauna_Loa	CRISTA-144	94	11	10	17	57	14	7	0	57	31	24.6	223.5	-144.0	-16.2	19.0	207.3	263	59.3
Mauna_Loa	CRISTA-162/MAHRSI	94	11	5	7	23	54	1	14	24	11	5.6	211.6	-162.0	-16.4	21.5	206.9	257	145.7
Mauna_Loa	CRISTA-162/MAHRSI	94	11	5	20	24	34	2	3	24	51	30.3	219.3	-162.0	-16.3	20.7	204.7	82	47.2
Mauna_Loa	CRISTA-162/MAHRSI	94	11	8	6	16	45	4	13	17	2	5.3	211.9	-162.0	-16.3	21.0	207.4	273	129.9
Mauna_Loa	CRISTA-162/MAHRSI	94	11	8	19	16	22	5	2	16	39	30.1	219.6	-162.0	-16.3	20.5	205.0	54	53.7
Mauna_Loa	CRISTA-162/MAHRSI	94	11	11	5	5	48	7	12	6	5	6.1	212.5	-162.0	-16.2	21.6	208.1	369	113.8
Mauna_Loa	CRISTA-162/MAHRSI	94	11	11	18	4	53	8	1	5	10	29.5	220.2	-162.0	-16.2	19.8	205.9	98	63.6
Mauna_Loa	CRISTA-180	94	11	5	7	24	9	1	14	24	26	4.8	212.0	-180.0	-16.4	18.4	202.6	307	145.9
Mauna_Loa	CRISTA-180	94	11	6	20	33	8	3	3	33	25	33.5	214.6	-180.0	-16.3	20.6	203.3	189	51.1
Mauna_Loa	CRISTA-180	94	11	7	6	8	20	3	13	8	37	8.4	217.6	-180.0	-16.3	21.8	208.0	376	134.3
Mauna_Loa	CRISTA-180	94	11	8	6	16	45	4	13	17	2	5.3	211.9	-180.0	-16.3	18.8	202.6	286	129.9
Mauna_Loa	CRISTA-180	94	11	9	19	24	16	6	2	24	33	33.2	215.0	-180.0	-16.2	20.5	203.9	130	57.7
Mauna_Loa	CRISTA-180	94	11	11	5	5	48	7	12	6	5	6.1	212.5	-180.0	-16.2	19.5	203.3	189	113.8
Mauna_Loa	MAS	94	11	4	8	43	17	0	15	43	34	12.4	192.4	-90.0	-16.4	21.1	207.0	240	148.2
Mauna_Loa	SSBUV	94	11	6	20	28	51	3	3	29	8	20.7	204.5	0.0	-90.0	20.7	204.5	98	43.8
Mauna_Loa	SSBUV	94	11	12	18	7	46	9	1	8	3	19.8	205.8	0.0	-90.0	19.8	205.9	99	68.4
Moscow	ATMOS	94	11	5	13	10	49	1	20	11	6	50.5	75.2	143.9	-16.4	46.4	51.0	1386	133.6
Moscow	ATMOS	94	11	5	14	41	26	1	21	41	43	50.3	52.5	143.6	-16.4	46.3	28.4	1195	133.9
Moscow	ATMOS	94	11	6	14	50	18	2	21	50	35	48.0	50.1	138.4	-16.3	43.9	27.3	1473	138.3
Moscow	CRISTA-144	94	11	5	10	1	10	1	17	1	27	55.3	64.8	-144.0	-16.4	57.2	35.1	237	78.3
Moscow	CRISTA-144	94	11	5	16	15	52	1	23	16	9	41.3	45.3	-144.0	-16.4	57.4	39.8	261	117.7
Moscow	CRISTA-144	94	11	6	16	24	30	2	23	24	47	38.7	40.9	-144.0	-16.3	54.8	36.9	78	116.3
Moscow	CRISTA-144	94	11	7	8	45	27	3	15	45	44	54.2	67.3	-144.0	-16.3	55.0	39.0	117	73.1
Moscow	CRISTA-144	94	11	8	8	53	35	4	15	53	52	55.1	64.0	-144.0	-16.3	56.8	34.9	213	73.9
Moscow	CRISTA-144	94	11	8	15	8	4	4	22	8	21	41.1	46.0	-144.0	-16.3	57.0	40.7	270	106.1
Moscow	CRISTA-144	94	11	9	15	15	57	5	22	16	14	38.9	41.3	-144.0	-16.3	54.9	37.1	59	103.8
Moscow	CRISTA-144	94	11	10	7	35	38	6	14	35	55	53.7	66.1	-144.0	-16.2	54.1	38.6	164	70.9
Moscow	CRISTA-144	94	11	10	15	22	31	6	22	22	48	37.4	35.7	-144.0	-16.2	53.4	32.4	392	100.7
Moscow	CRISTA-144	94	11	11	7	42	31	7	14	42	48	54.8	63.7	-144.0	-16.2	56.2	35.1	166	72.2
Moscow	CRISTA-144	94	11	11	13	56	45	7	20	57	2	41.7	46.3	-144.0	-16.2	57.5	40.8	310	94.1
Moscow	CRISTA-162/MAHRSI	94	11	4	16	6	40	0	23	6	57	42.1	52.2	-162.0	-16.4	55.7	37.9	45	120.9
Moscow	CRISTA-162/MAHRSI	94	11	5	10	1	40	1	17	1	57	55.8	68.1	-162.0	-16.4	53.5	39.7	266	79.9
Moscow	CRISTA-162/MAHRSI	94	11	5	16	16	22	1	23	16	39	39.9	47.1	-162.0	-16.4	54.0	34.3	257	119.2
Moscow	CRISTA-162/MAHRSI	94	11	6	10	10	40	2	17	10	57	56.5	66.7	-162.0	-16.3	55.6	37.3	21	81.1
Moscow	CRISTA-162/MAHRSI	94	11	6	14	51	44	2	21	52	1	44.9	55.5	-162.0	-16.3	57.8	39.1	279	110.0
Moscow	CRISTA-162/MAHRSI	94	11	7	10	19	13	3	17	19	30	57.0	66.4	-162.0	-16.3	57.7	35.9	265	82.3
Moscow	CRISTA-162/MAHRSI	94	11	7	15	0	17	3	22	0	34	42.2	51.9	-162.0	-16.3	55.7	37.8	40	109.0
Moscow	CRISTA-162/MAHRSI	94	11	8	8	54	20	4	15	54	37	55.9	68.9	-162.0	-16.3	53.8	40.7	287	75.8
Moscow	CRISTA-162/MAHRSI	94	11	8	15	8	34	4	22	8	51	39.7	47.7	-162.0	-16.3	53.6	35.3	243	107.3
Moscow	CRISTA-162/MAHRSI	94	11	9	9	2	14	5	16	2	31	56.5	66.8	-162.0	-16.3	55.5	37.5	11	76.6
Moscow	CRISTA-162/MAHRSI	94	11	9	13	43	13	5	20	43	30	45.1	55.8	-162.0	-16.3	57.9	39.3	292	98.8
Moscow	CRISTA-162/MAHRSI	94	11	10	9	9	18	6	16	9	35	56.9	64.8	-162.0	-16.2	57.1	35.0	236	77.2
Moscow	CRISTA-162/MAHRSI	94	11	10	13	50	21	6	20	50	38	42.4	52.5	-162.0	-16.2	55.8	38.4	76	97.3
Moscow	CRISTA-162/MAHRSI	94	11	11	7	43	17	7	14	43	34	55.7	68.5	-162.0	-16.2	53.3	40.9	334	73.4
Moscow	CRISTA-162/MAHRSI	94	11	11	13	57	15	7	20	57	32	40.3	48.1	-162.0	-16.2	54.0	35.5	195	95.0
Moscow	CRISTA-180	94	11	5	11	35	17	1	18	35	34	56.9	66.3	-180.0	-16.4	54.5	37.1	104	89.8
Moscow	CRISTA-180	94	11	5	14	43	16	1	21	43	33	46.6	60.3	-180.0	-16.4	54.6	37.3	90	111.7
Moscow	CRISTA-180	94	11	6	11	44	26	2	18	44	43	56.3	66.7	-180.0	-16.3	55.9	37.3	53	91.2
Moscow	CRISTA-180	94	11	6	13	18	13	2	20	18	30	51.8	64.0	-180.0	-16.3	56.8	37.3	145	101.1
Moscow	CRISTA-180	94	11	6	14	51	59	2	21	52	16	44.3	56.5	-180.0	-16.3	53.2	35.6	277	110.7
Moscow	CRISTA-180	94	11	7	10	19	13	3	17	19	30	57.0	66.4	-180.0	-16.3	52.9	38.7	295	82.3
Moscow	CRISTA-180	94	11	7	11	53	0	3	18	53	17	55.3	66.0	-180.0	-16.3	56.7	36.8	141	91.7
Moscow	CRISTA-180	94	11	7	13	26	46	3	20	27	3	49.7	61.8	-180.0	-16.3	56.1	36.8	77	100.9
Moscow	CRISTA-180	94	11	8	10	27	50	4	17	28	7	56.9	67.1	-180.0	-16.3	54.7	38.2	99	83.6

Appendix 13. Continued.

site	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	solar zenith angle
Moscow	CRISTA-180	94	11	8	12	1	35	4	19	1	52	53.7	65.8	-180.0	-16.3	57.0	37.6	171	92.2
Moscow	CRISTA-180	94	11	8	13	35	19	4	20	35	36	47.0	59.9	-180.0	-16.3	54.8	37.0	76	100.6
Moscow	CRISTA-180	94	11	9	10	35	59	5	17	36	16	56.3	66.9	-180.0	-16.3	55.9	37.4	48	84.2
Moscow	CRISTA-180	94	11	9	12	9	43	5	19	10	0	51.9	64.3	-180.0	-16.3	56.8	37.4	147	91.9
Moscow	CRISTA-180	94	11	9	13	43	28	5	20	43	45	44.4	56.8	-180.0	-16.3	53.3	35.8	262	99.4
Moscow	CRISTA-180	94	11	10	9	9	34	6	16	9	51	56.9	66.6	-180.0	-16.2	52.8	39.2	316	77.7
Moscow	CRISTA-180	94	11	10	10	43	14	6	17	43	31	55.4	66.3	-180.0	-16.2	56.7	37.3	134	84.4
Moscow	CRISTA-180	94	11	10	12	16	55	6	19	17	12	49.8	62.3	-180.0	-16.2	56.1	37.4	74	91.2
Moscow	CRISTA-180	94	11	11	9	16	42	7	16	16	59	56.9	66.7	-180.0	-16.2	54.4	38.2	123	78.4
Moscow	CRISTA-180	94	11	11	10	50	23	7	17	50	40	54.0	65.6	-180.0	-16.2	57.0	37.4	170	84.2
Moscow	CRISTA-180	94	11	11	12	24	4	7	19	24	21	47.5	60.0	-180.0	-16.2	55.0	37.0	51	90.1
Moscow	SSBUV	94	11	9	10	31	27	5	17	31	44	55.7	37.1	0.0	-90.0	55.7	37.1	29	74.3
Moscow	SSBUV	94	11	9	12	5	12	5	19	5	29	56.9	37.0	0.0	-90.0	56.9	37.0	159	81.7
Moscow	SSBUV	94	11	9	13	38	57	5	20	39	14	53.6	35.6	0.0	-90.0	53.6	35.6	232	89.3
Moscow	SSBUV	94	11	10	9	5	17	6	16	5	34	52.8	40.3	0.0	-90.0	52.8	40.4	350	70.0
Moscow	SSBUV	94	11	10	10	38	43	6	17	39	0	56.5	36.7	0.0	-90.0	56.5	36.7	124	75.6
Moscow	SSBUV	94	11	10	12	12	24	6	19	12	41	56.3	36.7	0.0	-90.0	56.3	36.8	101	82.2
Moscow	SSBUV	94	11	11	9	12	11	7	16	12	28	54.1	37.7	0.0	-90.0	54.1	37.8	153	71.5
Moscow	SSBUV	94	11	11	10	45	52	7	17	46	9	56.9	36.7	0.0	-90.0	56.9	36.8	170	76.7
Moscow	SSBUV	94	11	11	12	19	33	7	19	19	50	55.3	36.4	0.0	-90.0	55.3	36.5	55	82.3
Reunion_Island	CRISTA-144	94	11	5	19	41	50	2	2	42	7	-37.8	58.1	-144.0	-16.3	-21.6	55.8	48	126.4
Reunion_Island	CRISTA-144	94	11	6	3	42	15	2	10	42	32	-17.8	73.8	-144.0	-16.3	-22.4	57.1	123	44.5
Reunion_Island	CRISTA-144	94	11	8	18	33	39	5	1	33	56	-37.6	58.3	-144.0	-16.3	-21.5	56.1	60	122.8
Reunion_Island	CRISTA-144	94	11	9	2	33	56	5	9	34	13	-18.0	74.2	-144.0	-16.3	-22.5	57.5	165	60.1
Reunion_Island	CRISTA-144	94	11	11	17	22	11	8	0	22	28	-37.0	58.8	-144.0	-16.2	-20.9	56.8	146	115.5
Reunion_Island	CRISTA-162/MAHRSI	94	11	4	19	32	31	1	2	32	48	-36.5	64.6	-162.0	-16.4	-21.4	57.3	147	127.9
Reunion_Island	CRISTA-162/MAHRSI	94	11	7	3	51	19	3	10	51	36	-12.7	69.5	-162.0	-16.3	-22.3	55.6	53	47.1
Reunion_Island	CRISTA-162/MAHRSI	94	11	7	18	25	56	4	1	26	13	-36.4	64.4	-162.0	-16.3	-21.3	57.3	148	125.4
Reunion_Island	CRISTA-162/MAHRSI	94	11	10	2	42	2	6	9	42	19	-13.0	70.0	-162.0	-16.2	-22.5	56.3	66	63.0
Reunion_Island	CRISTA-162/MAHRSI	94	11	10	17	15	48	7	0	16	5	-36.2	65.1	-162.0	-16.2	-21.2	58.1	231	118.7
Reunion_Island	CRISTA-180	94	11	5	5	7	30	1	12	7	47	-7.5	65.0	-180.0	-16.4	-21.0	55.3	127	34.4
Reunion_Island	CRISTA-180	94	11	6	18	17	22	3	1	17	39	-33.3	68.9	-180.0	-16.3	-20.5	57.7	243	129.1
Reunion_Island	CRISTA-180	94	11	8	4	0	17	4	11	0	34	-8.0	64.8	-180.0	-16.3	-21.4	55.2	100	50.5
Reunion_Island	CRISTA-180	94	11	9	17	8	39	6	0	8	56	-33.1	69.2	-180.0	-16.2	-20.3	58.2	293	122.6
Reunion_Island	CRISTA-180	94	11	10	17	15	48	7	0	16	5	-36.2	65.1	-180.0	-16.2	-23.6	53.3	328	118.7
Reunion_Island	CRISTA-180	94	11	11	2	49	26	7	9	49	43	-8.7	65.4	-180.0	-16.2	-22.1	55.9	11	66.7
Reunion_Island	SSBUV	94	11	8	3	55	46	4	10	56	3	-22.1	55.8	0.0	-90.0	-22.1	55.8	23	57.6
Reunion_Island	SSBUV	94	11	11	2	44	54	7	9	45	11	-22.8	56.4	0.0	-90.0	-22.8	56.4	104	72.9
Table_Mountain	ATMOS	94	11	4	0	55	59	0	7	56	16	53.2	259.1	151.7	-16.4	49.2	233.5	1829	128.3
Table_Mountain	ATMOS	94	11	5	23	44	53	2	6	45	10	49.6	276.4	141.7	-16.3	45.5	252.9	1581	135.3
Table_Mountain	ATMOS	94	11	6	1	15	25	2	8	15	42	49.4	253.8	141.4	-16.3	45.3	230.4	1606	135.6
Table_Mountain	ATMOS	94	11	6	23	53	35	3	6	53	52	46.9	274.4	136.5	-16.3	42.8	252.0	1309	140.2
Table_Mountain	ATMOS	94	11	8	0	2	34	4	7	2	51	43.5	272.4	131.2	-16.3	39.4	251.3	1022	146.2
Table_Mountain	ATMOS	94	11	8	1	33	6	4	8	33	23	43.2	249.8	130.9	-16.3	39.1	228.8	1310	146.6
Table_Mountain	ATMOS	94	11	9	0	11	19	5	7	11	36	39.0	270.8	126.0	-16.3	34.9	251.0	835	153.6
Table_Mountain	ATMOS	94	11	9	1	41	52	5	8	42	9	38.7	248.2	125.6	-16.3	34.6	228.5	1239	154.1
Table_Mountain	ATMOS	94	11	11	0	28	36	7	7	28	53	25.5	268.9	115.3	-16.2	21.2	251.9	1728	173.7
Table_Mountain	ATMOS	94	11	11	1	59	10	7	8	59	27	24.9	246.4	115.0	-16.2	20.6	229.5	1935	174.5
Table_Mountain	CRISTA-144	94	11	4	18	48	13	1	1	48	30	39.4	259.3	-144.0	-16.4	35.0	239.3	271	55.1
Table_Mountain	CRISTA-144	94	11	6	4	27	30	2	11	27	47	17.7	242.4	-144.0	-16.3	34.0	242.7	69	135.4
Table_Mountain	CRISTA-144	94	11	6	17	33	23	3	0	33	40	37.0	264.1	-144.0	-16.3	32.3	245.1	341	53.7
Table_Mountain	CRISTA-144	94	11	7	17	41	41	4	0	41	58	39.3	259.1	-144.0	-16.3	34.9	239.4	259	56.6
Table_Mountain	CRISTA-144	94	11	9	3	19	10	5	10	19	27	17.9	242.7	-144.0	-16.3	34.2	243.1	101	119.7
Table_Mountain	CRISTA-144	94	11	9	16	24	49	5	23	25	6	36.8	264.5	-144.0	-16.3	32.1	245.5	386	58.8
Table_Mountain	CRISTA-144	94	11	10	16	31	35	6	23	31	52	39.0	259.7	-144.0	-16.2	34.7	240.3	175	62.1
Table_Mountain	CRISTA-162/MAHRSI	94	11	4	18	48	59	1	1	49	16	41.5	261.9	-162.0	-16.4	33.0	244.1	227	57.5
Table_Mountain	CRISTA-162/MAHRSI	94	11	5	4	18	41	1	11	18	58	19.1	249.2	-162.0	-16.4	34.7	243.3	145	139.8
Table_Mountain	CRISTA-162/MAHRSI	94	11	5	18	58	51	2	1	59	8	44.0	257.5	-162.0	-16.3	36.0	238.9	363	60.0
Table_Mountain	CRISTA-162/MAHRSI	94	11	7	17	42	26	4	0	42	43	41.4	261.7	-162.0	-16.3	32.9	244.2	235	58.3
Table_Mountain	CRISTA-162/MAHRSI	94	11	8	3	11	32	4	10	11	49	19.6	249.0	-162.0	-16.3	35.1	243.1	158	124.0
Table_Mountain	CRISTA-162/MAHRSI	94	11	8	17	50	40	5	0	50	57	43.8	257.8	-162.0	-16.3	35.8	239.2	329	61.2
Table_Mountain	CRISTA-162/MAHRSI	94	11	10	16	32	21	6	23	32	38	41.1	262.3	-162.0	-16.2	32.7	245.1	316	62.9
Table_Mountain	CRISTA-162/MAHRSI	94	11	11	2	0	57	7	9	1	14	19.5	250.1	-162.0	-16.2	34.9	244.4	238	108.9
Table_Mountain	CRISTA-162/MAHRSI	94	11	11	16	39	14	7	23	39	31	43.2	258.0	-162.0	-16.2	35.2	239.9	233	66.0

Appendix 13. Continued.

site	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	solar zenith angle
Table_Mountain	CRISTA-180	94	11	5	18	59	6	2	1	59	23	44.6	258.5	-180.0	-16.3	33.1	243.7	187	60.8
Table_Mountain	CRISTA-180	94	11	6	19	7	39	3	2	7	56	47.2	255.4	-180.0	-16.3	36.1	239.2	349	63.5
Table_Mountain	CRISTA-180	94	11	7	3	3	18	3	10	3	35	21.8	255.0	-180.0	-16.3	34.6	243.5	151	127.9
Table_Mountain	CRISTA-180	94	11	8	17	50	55	5	0	51	12	44.5	258.8	-180.0	-16.3	32.9	244.0	220	61.7
Table_Mountain	CRISTA-180	94	11	9	17	58	53	6	0	59	10	47.0	255.6	-180.0	-16.2	36.0	239.7	308	64.7
Table_Mountain	CRISTA-180	94	11	10	1	53	48	6	8	54	5	22.9	255.0	-180.0	-16.2	35.5	243.3	205	112.3
Table_Mountain	CRISTA-180	94	11	11	2	0	57	7	9	1	14	19.5	250.1	-180.0	-16.2	32.4	239.2	319	108.9
Table_Mountain	CRISTA-180	94	11	11	16	39	29	7	23	39	46	43.9	259.0	-180.0	-16.2	32.3	244.7	312	66.2
Table_Mountain	SSBUV	94	11	5	18	54	34	2	1	54	51	32.4	244.2	0.0	-90.0	32.4	244.2	268	48.8
Table_Mountain	SSBUV	94	11	6	19	3	8	3	2	3	25	35.5	239.6	0.0	-90.0	35.5	239.6	273	52.6
Table_Mountain	SSBUV	94	11	8	17	46	24	5	0	46	41	32.2	244.5	0.0	-90.0	32.2	244.4	301	54.4
Tomsk	ATMOS	94	11	4	9	59	40	0	16	59	57	52.6	123.1	149.8	-16.4	48.6	97.9	1230	129.5
Tomsk	ATMOS	94	11	5	10	9	34	1	17	9	51	50.7	120.5	144.6	-16.4	46.7	96.2	1333	133.1
Tomsk	ATMOS	94	11	5	11	40	11	1	18	40	28	50.6	97.8	144.3	-16.5	46.5	73.6	1359	133.4
Tomsk	ATMOS	94	11	6	10	18	40	2	17	18	57	48.5	118.0	139.4	-16.3	44.4	95.0	1515	137.3
Tomsk	CRISTA-144	94	11	5	7	0	30	1	14	0	47	55.7	113.7	-144.0	-16.4	58.3	83.5	221	79.9
Tomsk	CRISTA-144	94	11	5	13	14	56	1	20	15	13	40.8	92.0	-144.0	-16.4	56.9	86.7	108	118.8
Tomsk	CRISTA-144	94	11	6	13	23	29	2	20	23	46	38.9	86.6	-144.0	-16.3	55.0	82.5	233	116.7
Tomsk	CRISTA-144	94	11	7	5	44	42	3	12	44	59	54.4	114.4	-144.0	-16.3	55.5	85.9	118	73.7
Tomsk	CRISTA-144	94	11	7	11	58	47	3	18	59	4	43.7	95.7	-144.0	-16.3	59.5	88.6	389	108.0
Tomsk	CRISTA-144	94	11	8	5	53	8	4	12	53	25	55.6	112.8	-144.0	-16.3	57.9	83.1	196	75.1
Tomsk	CRISTA-144	94	11	8	12	7	6	4	19	7	23	41.3	91.7	-144.0	-16.3	57.2	86.3	103	106.4
Tomsk	CRISTA-144	94	11	9	12	15	0	5	19	15	17	39.1	87.0	-144.0	-16.3	55.1	82.8	212	104.1
Tomsk	CRISTA-144	94	11	10	4	35	18	6	11	35	35	54.3	114.6	-144.0	-16.2	55.3	86.5	155	71.7
Tomsk	CRISTA-144	94	11	11	4	42	12	7	11	42	29	55.3	112.4	-144.0	-16.2	57.4	83.3	148	72.9
Tomsk	CRISTA-144	94	11	11	10	55	55	7	17	56	12	41.9	92.0	-144.0	-16.2	57.6	86.4	147	94.4
Tomsk	CRISTA-162/MAHRSI	94	11	4	13	5	29	0	20	5	46	42.3	97.9	-162.0	-16.4	55.8	83.5	121	121.1
Tomsk	CRISTA-162/MAHRSI	94	11	5	7	1	0	1	14	1	17	56.2	117.0	-162.0	-16.4	54.5	88.0	286	81.6
Tomsk	CRISTA-162/MAHRSI	94	11	5	11	42	5	1	18	42	22	46.8	105.9	-162.0	-16.4	59.1	87.6	326	111.9
Tomsk	CRISTA-162/MAHRSI	94	11	6	7	10	10	2	14	10	27	56.8	115.7	-162.0	-16.3	56.6	85.8	40	82.7
Tomsk	CRISTA-162/MAHRSI	94	11	6	11	50	58	2	18	51	15	44.4	102.1	-162.0	-16.3	57.4	86.2	123	111.0
Tomsk	CRISTA-162/MAHRSI	94	11	7	7	18	28	3	14	18	45	57.0	113.6	-162.0	-16.3	58.0	83.1	210	83.1
Tomsk	CRISTA-162/MAHRSI	94	11	7	11	59	17	3	18	59	34	42.4	97.6	-162.0	-16.3	55.8	83.4	129	109.3
Tomsk	CRISTA-162/MAHRSI	94	11	8	5	53	38	4	12	53	55	56.1	116.1	-162.0	-16.3	54.2	87.6	302	76.4
Tomsk	CRISTA-162/MAHRSI	94	11	8	10	33	37	4	17	33	54	48.9	102.0	-162.0	-16.3	60.3	81.6	387	98.9
Tomsk	CRISTA-162/MAHRSI	94	11	9	6	1	47	5	13	2	4	56.7	115.7	-162.0	-16.3	56.4	85.9	51	77.8
Tomsk	CRISTA-162/MAHRSI	94	11	9	10	42	31	5	17	42	48	44.6	102.4	-162.0	-16.3	57.5	86.4	137	99.7
Tomsk	CRISTA-162/MAHRSI	94	11	10	6	8	59	6	13	9	16	57.0	113.8	-162.0	-16.2	57.9	83.6	182	78.2
Tomsk	CRISTA-162/MAHRSI	94	11	10	10	49	31	6	17	49	48	42.6	98.1	-162.0	-16.2	55.9	83.9	96	97.7
Tomsk	CRISTA-162/MAHRSI	94	11	11	4	42	57	7	11	43	14	56.1	117.3	-162.0	-16.2	54.3	89.0	350	74.2
Tomsk	CRISTA-162/MAHRSI	94	11	11	6	16	8	7	13	16	25	56.9	113.9	-162.0	-16.2	59.6	83.4	359	78.9
Tomsk	CRISTA-162/MAHRSI	94	11	11	9	23	14	7	16	23	31	47.7	105.6	-162.0	-16.2	59.5	86.8	352	90.4
Tomsk	CRISTA-162/MAHRSI	94	11	11	10	56	25	7	17	56	42	40.5	93.8	-162.0	-16.2	54.2	81.1	361	95.3
Tomsk	CRISTA-180	94	11	5	8	34	36	1	15	34	53	56.7	115.3	-180.0	-16.4	55.1	85.8	162	91.6
Tomsk	CRISTA-180	94	11	6	8	43	41	2	15	43	58	56.1	113.9	-180.0	-16.3	56.1	84.5	59	92.0
Tomsk	CRISTA-180	94	11	6	10	17	27	2	17	17	44	51.4	111.0	-180.0	-16.3	56.7	84.5	42	102.1
Tomsk	CRISTA-180	94	11	7	7	18	43	3	14	19	0	57.0	115.4	-180.0	-16.3	53.6	87.1	345	83.8
Tomsk	CRISTA-180	94	11	7	8	52	29	3	15	52	46	54.7	114.7	-180.0	-16.3	56.9	85.8	57	93.3
Tomsk	CRISTA-180	94	11	7	10	26	1	3	17	26	18	49.3	108.7	-180.0	-16.3	55.9	84.0	95	101.8
Tomsk	CRISTA-180	94	11	8	7	27	8	4	14	27	25	56.8	114.4	-180.0	-16.3	54.9	85.3	173	84.4
Tomsk	CRISTA-180	94	11	8	9	0	52	4	16	1	9	53.4	112.8	-180.0	-16.3	57.0	84.8	56	93.0
Tomsk	CRISTA-180	94	11	8	10	34	37	4	17	34	54	46.6	106.6	-180.0	-16.3	54.5	84.1	226	101.5
Tomsk	CRISTA-180	94	11	9	7	35	16	5	14	35	33	56.2	114.0	-180.0	-16.3	56.1	84.6	58	84.9
Tomsk	CRISTA-180	94	11	9	9	9	1	5	16	9	18	51.5	111.2	-180.0	-16.3	56.7	84.6	36	92.7
Tomsk	CRISTA-180	94	11	10	6	9	14	6	13	9	31	57.0	115.6	-180.0	-16.2	53.6	87.7	366	78.7
Tomsk	CRISTA-180	94	11	10	7	42	40	6	14	42	57	55.1	113.4	-180.0	-16.2	56.7	84.5	45	85.1
Tomsk	CRISTA-180	94	11	10	9	16	20	6	16	16	37	49.4	109.1	-180.0	-16.2	56.0	84.5	70	92.0
Tomsk	CRISTA-180	94	11	11	6	16	23	7	13	16	40	56.8	115.6	-180.0	-16.2	55.0	86.8	196	79.4
Tomsk	CRISTA-180	94	11	11	7	49	48	7	14	50	5	53.7	112.6	-180.0	-16.2	57.0	84.6	63	84.8
Tomsk	CRISTA-180	94	11	11	9	23	29	7	16	23	46	47.1	106.7	-180.0	-16.2	54.8	84.0	199	90.8
Tomsk	SSBUV	94	11	5	8	30	5	1	15	30	22	54.9	85.8	0.0	-90.0	54.9	85.8	186	77.3
Tomsk	SSBUV	94	11	6	8	39	25	2	15	39	42	56.1	85.8	0.0	-90.0	56.1	85.8	60	79.4
Tomsk	SSBUV	94	11	8	7	22	51	4	14	23	8	55.0	86.6	0.0	-90.0	55.0	86.6	192	73.8
Tomsk	SSBUV	94	11	8	8	56	21	4	15	56	38	57.0	84.4	0.0	-90.0	57.0	84.3	71	81.6

Appendix 13. Continued.

site	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	solar zenith angle
Tomsk	SSBUV	94	11	9	9	4	45	5	16	5	2	56.7	85.9	0.0	-90.0	56.7	85.9	53	83.0
Tomsk	SSBUV	94	11	10	6	4	28	6	13	4	45	52.7	85.8	0.0	-90.0	52.7	85.9	386	69.8
Tomsk	SSBUV	94	11	10	7	38	23	6	14	38	40	56.8	85.6	0.0	-90.0	56.8	85.7	44	76.6
Tomsk	SSBUV	94	11	10	9	12	4	6	16	12	21	56.0	85.6	0.0	-90.0	56.0	85.7	69	83.3
Tomsk	SSBUV	94	11	11	6	11	51	7	13	12	8	54.7	86.3	0.0	-90.0	54.7	86.4	214	72.1
Tomsk	SSBUV	94	11	11	7	45	32	7	14	45	49	57.0	85.6	0.0	-90.0	57.0	85.7	67	77.5
Tomsk	SSBUV	94	11	11	9	18	58	7	16	19	15	55.1	83.5	0.0	-90.0	55.1	83.6	181	82.8
Volgograd	ATMOS	94	11	5	13	10	49	1	20	11	6	50.5	75.2	143.9	-16.4	46.4	51.0	558	133.6
Volgograd	ATMOS	94	11	5	14	41	26	1	21	41	43	50.3	52.5	143.6	-16.4	46.3	28.4	1213	133.9
Volgograd	ATMOS	94	11	6	14	50	18	2	21	50	35	48.0	50.1	138.4	-16.3	43.9	27.3	1397	138.3
Volgograd	ATMOS	94	11	8	15	8	0	4	22	8	17	40.8	46.4	127.9	-16.3	36.7	26.1	1969	150.6
Volgograd	ATMOS	94	11	9	13	46	23	5	20	46	40	35.9	67.5	123.0	-16.3	31.8	48.5	1888	158.5
Volgograd	CRISTA-144	94	11	4	17	41	17	1	0	41	34	30.2	41.8	-144.0	-16.4	46.7	40.5	346	133.0
Volgograd	CRISTA-144	94	11	5	8	27	34	1	15	27	51	50.2	70.3	-144.0	-16.4	48.6	44.9	55	68.4
Volgograd	CRISTA-144	94	11	6	16	26	30	2	23	26	47	32.8	47.0	-144.0	-16.3	49.0	45.2	94	121.7
Volgograd	CRISTA-144	94	11	7	16	34	49	3	23	35	6	30.4	41.6	-144.0	-16.3	46.7	40.4	351	119.0
Volgograd	CRISTA-144	94	11	8	7	20	5	4	14	20	22	49.9	69.7	-144.0	-16.3	48.2	44.9	53	66.5
Volgograd	CRISTA-144	94	11	9	7	27	59	5	14	28	16	51.4	66.3	-144.0	-16.3	50.5	40.3	366	68.3
Volgograd	CRISTA-144	94	11	9	15	17	58	5	22	18	15	33.0	47.4	-144.0	-16.3	49.2	45.5	122	108.1
Volgograd	CRISTA-144	94	11	10	15	24	47	6	22	25	4	30.6	42.3	-144.0	-16.2	46.8	41.0	302	105.0
Volgograd	CRISTA-144	94	11	11	6	9	6	7	13	9	23	49.4	69.6	-144.0	-16.2	47.6	45.4	128	67.9
Volgograd	CRISTA-162/MAHRSI	94	11	5	16	18	38	1	23	18	55	33.3	54.2	-162.0	-16.4	48.2	44.7	42	125.8
Volgograd	CRISTA-162/MAHRSI	94	11	6	8	37	9	2	15	37	26	52.9	70.3	-162.0	-16.3	48.1	45.6	109	71.9
Volgograd	CRISTA-162/MAHRSI	94	11	7	8	45	27	3	15	45	44	54.2	67.3	-162.0	-16.3	50.2	41.4	284	73.1
Volgograd	CRISTA-162/MAHRSI	94	11	8	15	10	34	4	22	10	51	33.8	54.0	-162.0	-16.3	48.5	44.5	21	112.0
Volgograd	CRISTA-162/MAHRSI	94	11	9	7	28	44	5	14	29	1	52.8	70.4	-162.0	-16.3	47.9	45.9	136	69.9
Volgograd	CRISTA-162/MAHRSI	94	11	9	15	18	28	5	22	18	45	31.4	48.8	-162.0	-16.3	46.3	40.2	388	109.1
Volgograd	CRISTA-162/MAHRSI	94	11	10	7	35	53	6	14	36	10	54.1	67.6	-162.0	-16.2	50.0	42.0	239	71.3
Volgograd	CRISTA-162/MAHRSI	94	11	11	13	59	15	7	20	59	32	34.5	54.5	-162.0	-16.2	49.0	44.9	78	98.5
Volgograd	CRISTA-180	94	11	4	16	8	41	0	23	8	58	36.4	58.9	-180.0	-16.4	47.5	42.4	173	127.2
Volgograd	CRISTA-180	94	11	5	10	1	40	1	17	1	57	55.8	68.1	-180.0	-16.4	49.0	43.3	87	79.9
Volgograd	CRISTA-180	94	11	6	10	10	55	2	17	11	12	56.7	68.4	-180.0	-16.3	51.5	41.9	379	81.9
Volgograd	CRISTA-180	94	11	6	14	53	44	2	21	54	1	39.5	62.9	-180.0	-16.3	49.8	45.0	164	115.8
Volgograd	CRISTA-180	94	11	7	8	45	42	3	15	45	59	54.5	68.9	-180.0	-16.3	46.5	46.4	268	73.8
Volgograd	CRISTA-180	94	11	7	15	2	18	3	22	2	35	36.5	58.7	-180.0	-16.3	47.5	42.4	173	114.3
Volgograd	CRISTA-180	94	11	8	8	54	20	4	15	54	37	55.9	68.9	-180.0	-16.3	49.2	44.3	89	75.8
Volgograd	CRISTA-180	94	11	9	9	2	29	5	16	2	46	56.7	68.5	-180.0	-16.3	51.4	42.1	362	77.2
Volgograd	CRISTA-180	94	11	9	13	45	14	5	20	45	31	39.7	63.3	-180.0	-16.3	49.9	45.3	183	103.4
Volgograd	CRISTA-180	94	11	10	7	36	8	6	14	36	25	54.4	69.1	-180.0	-16.2	46.4	47.0	307	71.8
Volgograd	CRISTA-180	94	11	10	13	52	21	6	20	52	38	36.8	59.3	-180.0	-16.2	47.6	43.1	125	101.4
Volgograd	CRISTA-180	94	11	11	7	43	17	7	14	43	34	55.7	68.5	-180.0	-16.2	48.8	44.5	45	73.4
Volgograd	MAS	94	11	4	8	14	6	0	15	14	23	39.3	60.2	-90.0	-16.4	49.7	42.1	206	55.2
Volgograd	SSBUV	94	11	6	10	6	24	2	17	6	41	51.1	41.8	0.0	-90.0	51.1	41.8	340	68.8
Volgograd	SSBUV	94	11	8	8	49	49	4	15	50	6	48.8	44.3	0.0	-90.0	48.8	44.3	34	65.3
Volgograd	SSBUV	94	11	9	8	57	58	5	15	58	15	50.9	42.0	0.0	-90.0	50.9	42.0	321	67.8
Volgograd	SSBUV	94	11	10	7	31	37	6	14	31	54	45.8	47.0	0.0	-90.0	45.8	47.0	362	64.6
Volgograd	SSBUV	94	11	11	7	38	45	7	14	39	2	48.3	44.3	0.0	-90.0	48.3	44.4	24	67.4
Yakutsk	ATMOS	94	11	4	6	58	26	0	13	58	43	52.8	168.5	150.4	-16.4	48.8	143.1	1679	129.1
Yakutsk	ATMOS	94	11	4	8	29	3	0	15	29	20	52.7	145.8	150.1	-16.4	48.7	120.5	1596	129.3
Yakutsk	ATMOS	94	11	5	7	8	19	1	14	8	36	51.0	165.8	145.2	-16.5	46.9	141.4	1825	132.6
Yakutsk	ATMOS	94	11	5	8	38	57	1	15	39	14	50.9	143.2	144.9	-16.5	46.8	118.8	1833	132.9
Yakutsk	CRISTA-144	94	11	5	4	0	4	1	11	0	21	56.3	164.2	-144.0	-16.4	59.9	133.5	297	82.4
Yakutsk	CRISTA-144	94	11	5	5	33	11	1	12	33	28	56.9	159.0	-144.0	-16.4	64.7	128.9	307	90.8
Yakutsk	CRISTA-144	94	11	5	8	39	38	1	15	39	55	49.8	145.8	-144.0	-16.4	64.5	131.7	289	108.1
Yakutsk	CRISTA-144	94	11	5	10	12	45	1	17	13	2	43.7	134.0	-144.0	-16.4	59.6	126.7	324	116.0
Yakutsk	CRISTA-144	94	11	6	4	9	9	2	11	9	26	56.7	161.1	-144.0	-16.3	61.4	130.4	66	82.7
Yakutsk	CRISTA-144	94	11	6	8	48	43	2	15	49	0	47.7	142.4	-144.0	-16.3	62.8	131.5	119	107.5
Yakutsk	CRISTA-144	94	11	7	4	17	28	3	11	17	45	57.0	159.1	-144.0	-16.3	63.0	128.4	135	83.1
Yakutsk	CRISTA-144	94	11	7	8	57	1	3	15	57	18	45.8	138.3	-144.0	-16.3	61.3	129.4	85	106.2
Yakutsk	CRISTA-144	94	11	8	2	52	56	4	9	53	13	56.2	163.3	-144.0	-16.3	59.6	133.0	316	77.1
Yakutsk	CRISTA-144	94	11	8	4	25	55	4	11	26	12	56.9	158.1	-144.0	-16.3	64.4	128.1	288	83.8
Yakutsk	CRISTA-144	94	11	8	7	32	24	4	14	32	41	49.6	146.4	-144.0	-16.3	64.2	132.9	286	98.5
Yakutsk	CRISTA-144	94	11	8	9	5	9	4	16	5	26	44.1	133.6	-144.0	-16.3	59.8	126.2	323	104.2
Yakutsk	CRISTA-144	94	11	9	3	0	49	5	10	1	6	56.7	161.2	-144.0	-16.3	61.3	130.5	83	77.8

Appendix 13. Continued.

site	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	solar zenith angle
Yakutsk	CRISTA-144	94	11	9	7	40	18	5	14	40	35	47.8	142.7	-144.0	-16.3	62.9	131.5	128	97.1
Yakutsk	CRISTA-144	94	11	10	3	8	9	6	10	8	26	57.0	159.2	-144.0	-16.2	62.8	128.8	108	78.2
Yakutsk	CRISTA-144	94	11	10	7	47	26	6	14	47	43	46.0	138.8	-144.0	-16.2	61.3	129.8	75	95.3
Yakutsk	CRISTA-144	94	11	11	1	42	22	7	8	42	39	56.2	164.5	-144.0	-16.2	59.6	134.5	356	74.5
Yakutsk	CRISTA-144	94	11	11	3	15	3	7	10	15	20	57.0	157.5	-144.0	-16.2	64.1	127.6	263	78.5
Yakutsk	CRISTA-144	94	11	11	6	21	24	7	13	21	41	50.1	146.4	-144.0	-16.2	64.5	132.4	298	88.7
Yakutsk	CRISTA-144	94	11	11	7	54	5	7	14	54	22	44.7	133.8	-144.0	-16.2	60.2	126.1	292	92.9
Yakutsk	CRISTA-162/MAHRSI	94	11	5	5	33	41	1	12	33	58	56.6	162.5	-162.0	-16.4	60.3	131.5	202	92.5
Yakutsk	CRISTA-162/MAHRSI	94	11	5	7	7	2	1	14	7	19	53.6	157.7	-162.0	-16.4	62.0	130.7	34	101.6
Yakutsk	CRISTA-162/MAHRSI	94	11	5	8	40	9	1	15	40	26	48.7	148.2	-162.0	-16.4	60.3	127.7	227	109.7
Yakutsk	CRISTA-162/MAHRSI	94	11	6	5	42	56	2	12	43	13	56.0	161.1	-162.0	-16.3	61.3	131.2	101	93.0
Yakutsk	CRISTA-162/MAHRSI	94	11	6	7	16	12	2	14	16	29	52.0	155.2	-162.0	-16.3	61.7	130.8	56	101.5
Yakutsk	CRISTA-162/MAHRSI	94	11	7	4	18	13	3	11	18	30	56.9	164.4	-162.0	-16.3	59.2	133.6	369	85.3
Yakutsk	CRISTA-162/MAHRSI	94	11	7	5	51	14	3	12	51	31	55.1	158.7	-162.0	-16.3	61.8	129.9	26	92.7
Yakutsk	CRISTA-162/MAHRSI	94	11	7	7	24	30	3	14	24	47	50.5	151.8	-162.0	-16.3	61.1	129.5	103	100.6
Yakutsk	CRISTA-162/MAHRSI	94	11	8	4	26	25	4	11	26	42	56.7	161.6	-162.0	-16.3	60.1	130.9	213	85.1
Yakutsk	CRISTA-162/MAHRSI	94	11	8	5	59	40	4	12	59	57	53.9	156.9	-162.0	-16.3	62.0	129.9	6	92.5
Yakutsk	CRISTA-162/MAHRSI	94	11	8	7	32	54	4	14	33	11	48.5	148.8	-162.0	-16.3	60.1	128.9	222	99.8
Yakutsk	CRISTA-162/MAHRSI	94	11	9	4	34	34	5	11	34	51	56.0	161.2	-162.0	-16.3	61.2	131.2	108	85.6
Yakutsk	CRISTA-162/MAHRSI	94	11	9	6	7	49	5	13	8	6	52.1	155.4	-162.0	-16.3	61.7	130.9	58	92.3
Yakutsk	CRISTA-162/MAHRSI	94	11	9	7	40	48	5	14	41	5	46.7	144.9	-162.0	-16.3	58.9	127.0	379	98.3
Yakutsk	CRISTA-162/MAHRSI	94	11	10	3	8	39	6	10	8	56	57.0	162.8	-162.0	-16.2	58.7	132.3	391	79.3
Yakutsk	CRISTA-162/MAHRSI	94	11	10	4	41	50	6	11	42	7	55.2	158.9	-162.0	-16.2	61.7	130.3	34	85.2
Yakutsk	CRISTA-162/MAHRSI	94	11	10	6	15	0	6	13	15	17	50.6	152.1	-162.0	-16.2	61.1	129.9	98	91.1
Yakutsk	CRISTA-162/MAHRSI	94	11	11	3	15	48	7	10	16	5	56.7	162.8	-162.0	-16.2	60.2	132.4	240	79.9
Yakutsk	CRISTA-162/MAHRSI	94	11	11	4	48	43	7	11	49	0	54.2	156.6	-162.0	-16.2	61.9	129.4	30	84.5
Yakutsk	CRISTA-162/MAHRSI	94	11	11	6	21	54	7	13	22	11	49.0	148.8	-162.0	-16.2	60.3	128.6	204	89.7
Yakutsk	MAS	94	11	4	3	46	51	0	10	47	8	50.4	147.6	-90.0	-16.4	63.2	128.5	158	70.2
Zvenigorod	ATMOS	94	11	5	13	10	49	1	20	11	6	50.5	75.2	143.9	-16.4	46.4	51.0	1442	133.6
Zvenigorod	ATMOS	94	11	5	14	41	26	1	21	41	43	50.3	52.5	143.6	-16.4	46.3	28.4	1234	133.9
Zvenigorod	ATMOS	94	11	6	14	50	18	2	21	50	35	48.0	50.1	138.4	-16.3	43.9	27.3	1513	138.3
Zvenigorod	CRISTA-144	94	11	5	10	1	10	1	17	1	27	55.3	64.8	-144.0	-16.4	57.2	35.1	175	78.3
Zvenigorod	CRISTA-144	94	11	5	16	15	52	1	23	16	9	41.3	45.3	-144.0	-16.4	57.4	39.8	228	117.7
Zvenigorod	CRISTA-144	94	11	6	16	24	15	2	23	24	32	39.4	40.1	-144.0	-16.3	55.5	35.7	99	115.6
Zvenigorod	CRISTA-144	94	11	7	8	45	27	3	15	45	44	54.2	67.3	-144.0	-16.3	55.0	39.0	168	73.1
Zvenigorod	CRISTA-144	94	11	8	8	53	35	4	15	53	52	55.1	64.0	-144.0	-16.3	56.8	34.9	157	73.9
Zvenigorod	CRISTA-144	94	11	8	15	7	49	4	22	8	6	41.8	45.1	-144.0	-16.3	57.6	39.4	232	105.4
Zvenigorod	CRISTA-144	94	11	9	15	15	42	5	22	15	59	39.6	40.4	-144.0	-16.3	55.6	35.9	78	103.2
Zvenigorod	CRISTA-144	94	11	10	7	35	53	6	14	36	10	54.1	67.6	-144.0	-16.2	54.8	39.7	214	71.3
Zvenigorod	CRISTA-144	94	11	11	7	42	47	7	14	43	4	55.1	65.3	-144.0	-16.2	56.9	36.4	107	72.6
Zvenigorod	CRISTA-144	94	11	11	13	56	30	7	20	56	47	42.4	45.4	-144.0	-16.2	58.1	39.5	276	93.6
Zvenigorod	CRISTA-162/MAHRSI	94	11	4	16	6	25	0	23	6	42	42.8	51.2	-162.0	-16.4	56.2	36.5	41	120.0
Zvenigorod	CRISTA-162/MAHRSI	94	11	5	10	1	40	1	17	1	57	55.8	68.1	-162.0	-16.4	53.5	39.7	329	79.9
Zvenigorod	CRISTA-162/MAHRSI	94	11	5	16	16	22	1	23	16	39	39.9	47.1	-162.0	-16.4	54.0	34.3	286	119.2
Zvenigorod	CRISTA-162/MAHRSI	94	11	6	10	10	40	2	17	10	57	56.5	66.7	-162.0	-16.3	55.6	37.3	43	81.1
Zvenigorod	CRISTA-162/MAHRSI	94	11	6	14	51	44	2	21	52	1	44.9	55.5	-162.0	-16.3	57.8	39.1	234	110.0
Zvenigorod	CRISTA-162/MAHRSI	94	11	7	10	19	13	3	17	19	30	57.0	66.4	-162.0	-16.3	57.7	35.9	200	82.3
Zvenigorod	CRISTA-162/MAHRSI	94	11	7	15	0	2	3	22	0	19	42.9	51.0	-162.0	-16.3	56.2	36.4	47	108.3
Zvenigorod	CRISTA-162/MAHRSI	94	11	8	8	54	20	4	15	54	37	55.9	68.9	-162.0	-16.3	53.8	40.7	344	75.8
Zvenigorod	CRISTA-162/MAHRSI	94	11	8	15	8	19	4	22	8	36	40.4	46.9	-162.0	-16.3	54.2	34.0	276	106.7
Zvenigorod	CRISTA-162/MAHRSI	94	11	9	9	2	14	5	16	2	31	56.5	66.8	-162.0	-16.3	55.5	37.5	62	76.6
Zvenigorod	CRISTA-162/MAHRSI	94	11	9	13	43	13	5	20	43	30	45.1	55.8	-162.0	-16.3	57.9	39.3	248	98.8
Zvenigorod	CRISTA-162/MAHRSI	94	11	10	9	9	18	6	16	9	35	56.9	64.8	-162.0	-16.2	57.1	35.0	176	77.2
Zvenigorod	CRISTA-162/MAHRSI	94	11	10	13	50	6	6	20	50	23	43.1	51.5	-162.0	-16.2	56.3	37.0	34	96.8
Zvenigorod	CRISTA-162/MAHRSI	94	11	11	9	16	27	7	16	16	44	57.0	64.9	-162.0	-16.2	58.9	34.4	360	78.0
Zvenigorod	CRISTA-162/MAHRSI	94	11	11	13	57	0	7	20	57	17	41.0	47.2	-162.0	-16.2	54.6	34.2	235	94.5
Zvenigorod	CRISTA-180	94	11	5	11	35	32	1	18	35	49	56.8	68.0	-180.0	-16.4	54.9	38.6	163	90.6
Zvenigorod	CRISTA-180	94	11	6	11	44	26	2	18	44	43	56.3	66.7	-180.0	-16.3	55.9	37.3	19	91.2
Zvenigorod	CRISTA-180	94	11	6	13	18	13	2	20	18	30	51.8	64.0	-180.0	-16.3	56.8	37.3	85	101.1
Zvenigorod	CRISTA-180	94	11	6	14	51	44	2	21	52	1	44.9	55.5	-180.0	-16.3	53.6	34.1	326	110.0
Zvenigorod	CRISTA-180	94	11	7	10	19	29	3	17	19	46	57.0	68.1	-180.0	-16.3	53.3	40.1	358	83.0
Zvenigorod	CRISTA-180	94	11	7	11	53	0	3	18	53	17	55.3	66.0	-180.0	-16.3	56.7	36.8	76	91.7
Zvenigorod	CRISTA-180	94	11	7	13	26	46	3	20	27	3	49.7	61.8	-180.0	-16.3	56.1	36.8	15	100.9
Zvenigorod	CRISTA-180	94	11	8	10	27	50	4	17	28	7	56.9	67.1	-180.0	-16.3	54.7	38.2	163	83.6

Appendix 13. Concluded.

site	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	solar zenith angle
Zvenigorod	CRISTA-180	94	11	8	12	1	35	4	19	1	52	53.7	65.8	-180.0	-16.3	57.0	37.6	115	92.2
Zvenigorod	CRISTA-180	94	11	8	13	35	19	4	20	35	36	47.0	59.9	-180.0	-16.3	54.8	37.0	134	100.6
Zvenigorod	CRISTA-180	94	11	9	10	35	59	5	17	36	16	56.3	66.9	-180.0	-16.3	55.9	37.4	30	84.2
Zvenigorod	CRISTA-180	94	11	9	12	9	43	5	19	10	0	51.9	64.3	-180.0	-16.3	56.8	37.4	90	91.9
Zvenigorod	CRISTA-180	94	11	9	13	43	13	5	20	43	30	45.1	55.8	-180.0	-16.3	53.7	34.3	310	98.8
Zvenigorod	CRISTA-180	94	11	10	9	9	34	6	16	9	51	56.9	66.6	-180.0	-16.2	52.8	39.2	381	77.7
Zvenigorod	CRISTA-180	94	11	10	10	43	14	6	17	43	31	55.4	66.3	-180.0	-16.2	56.7	37.3	76	84.4
Zvenigorod	CRISTA-180	94	11	10	12	16	55	6	19	17	12	49.8	62.3	-180.0	-16.2	56.1	37.4	27	91.2
Zvenigorod	CRISTA-180	94	11	11	9	16	42	7	16	16	59	56.9	66.7	-180.0	-16.2	54.4	38.2	188	78.4
Zvenigorod	CRISTA-180	94	11	11	10	50	23	7	17	50	40	54.0	65.6	-180.0	-16.2	57.0	37.4	112	84.2
Zvenigorod	CRISTA-180	94	11	11	12	24	4	7	19	24	21	47.5	60.0	-180.0	-16.2	55.0	37.0	106	90.1
Zvenigorod	SSBUV	94	11	9	10	31	27	5	17	31	44	55.7	37.1	0.0	-90.0	55.7	37.1	37	74.3
Zvenigorod	SSBUV	94	11	9	12	5	12	5	19	5	29	56.9	37.0	0.0	-90.0	56.9	37.0	95	81.7
Zvenigorod	SSBUV	94	11	9	13	38	57	5	20	39	14	53.6	35.6	0.0	-90.0	53.6	35.6	279	89.3
Zvenigorod	SSBUV	94	11	10	10	38	43	6	17	39	0	56.5	36.7	0.0	-90.0	56.5	36.7	59	75.6
Zvenigorod	SSBUV	94	11	10	12	12	24	6	19	12	41	56.3	36.7	0.0	-90.0	56.3	36.8	36	82.2
Zvenigorod	SSBUV	94	11	11	9	12	11	7	16	12	28	54.1	37.7	0.0	-90.0	54.1	37.8	217	71.5
Zvenigorod	SSBUV	94	11	11	10	45	52	7	17	46	9	56.9	36.7	0.0	-90.0	56.9	36.8	106	76.7
Zvenigorod	SSBUV	94	11	11	12	19	33	7	19	19	50	55.3	36.4	0.0	-90.0	55.3	36.5	80	82.3

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13. ABSTRACT *(Maximum 200 words)*

The third ATmospheric Laboratory for Applications and Science (ATLAS-3) mission was flown aboard the Space Shuttle launched on November 3, 1994. The mission length was approximately 10 days and 22 hours. The ATLAS-3 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 ATLAS-3 instrument operating schedules, simulations were performed to determine when and where correlative measurements occurred between ATLAS and UARS instruments, and between ATLAS and surface observations. Results of these orbital and instrument simulations provide valuable information for scientists to compare measurements between various instruments on the two satellites and at selected surface sites.

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