PL-TR-96-2296

INVESTIGATIONS OF ULTRAVIOLET EMISSIONS FROM THE IONOSPHERE

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20 September 1996

Final Report
18 August 1993 - 17 August 1996

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	20 September 1996	Final Report, 18 August 1993 - 17 August 1996

4. TITLE AND SUBTITLE Investigations of Ultraviolet Emissions From the Ionosphere	5. FUNDING NUMBERS F19629-93-C-0092 PE35160F PRS321 TA06 WUA9
6. AUTHOR(S) Francis J. LeBlanc	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Northwest Research Associates, Inc. 14508 NE 20th Street P.O. Box 3027 Bellevue, WA 98009-3027	8. PERFORMING ORGANIZATION REPORT NUMBER NWRA-CR-96-R159
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Phillips Laboratory 29 Randolph Road Hanscom AFB, MA 01731-3010 Contract Manager: Dr. Robert Huffman/GPID	10. SPONSORING / MONITORING AGENCY REPORT NUMBER PL-TR-96-2296

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE
approved for public release; distribution unlimited	

13. ABSTRACT (Maximum 200 words)

The work of Contract F19628-93-C-0092 has improved the accessibility and utilization of databases containing ultraviolet (UV) measurements of the ionosphere obtained from satellite and Space Shuttle experiments. These experiments were the Ultraviolet Backgrounds on S3-4 satellite, the Auroral Ionospheric Remote Sensor (AIRS) on the PolarBEAR satellite, the Horizon Ultraviolet Program (HUP), and shuttles STS-4 and STS-39. These databases were used to analyze the ionosphere and to validate the Atmospheric Ultraviolet Radiation Integrated Code (AURIC). The S3-4 experiment measured the UV emissions from the ionosphere looking in nadir while in a polar orbit. Data were collected simultaneously from three instruments. The telemetry tapes, processed into VAX compatible tapes, are stored at the Phillips Laboratory/Geophysics Directorate, where they remain active in ionospheric analysis. The AIRS data contain a series of ionospheric images recorded mainly at high latitudes and at selected wavelength. These have been placed on a set of optical disks and are accompanied by software that allows quick looks at the images or the acquiring of a raw image for further processing. They have been used for comparisons with ground-based all-sky-camera measurements of the aurora and with the Defence Meteorologic Satellite Program (DMSP) measurements for Auroral Oval correlations. The Atmospheric Ultraviolet Radiance Analyzer (AURA) satellite instrument is functional and awaits final calibration.

14. SUBJECT TERMS ionospheric emissions, ultraviolet aurora, atmospheric radiance models, ultraviolet satellite	15. NUMBER OF PAGES 56
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	SAR

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List of Tables and Figures

The work of this contract involved:

1. Validating the Atmospheric Ultraviolet Radiation Integrated Code (AURIC) code by comparing its predictions with past satellite measurements.
2. Preparing the Atmospheric Ultraviolet Radiance Analyzer (AURA) satellite for flight.
3. Updating and accessing satellite databases.
4. Comparing near coincident Defence Meteorologic Satellite Program (DMSP) and the Auroral Ionospheric Remote Sensor (AIRS) observations.

1. AURIC

Horizon scan of the data from the 801-A (SETS) experiment on Shuttle STS-4 (part of the Horizon Ultraviolet Program, HUP) were compared to the predictions of Version 3.1 of the Atmospheric Ultraviolet Radiation Integrated Code (AURIC) being developed by Computational Physics Inc.

This validation effort involved comparing the horizon scan intensities of the Lyman-Birge-Hopfield (LBH) 2,0, 1,1, and 0,2 bands of nitrogen at 1384 Å, 1464 Å and 1554 Å, respectively. Different Extreme Ultraviolet codes (EUV) and different vibrational and rotational temperatures were tried. These plots employed the Hinteregger model. The AURIC curve (dotted line) in Figs. 1 to 15 were produced by merging the spectra from 1200 to 2400 Å, excluding Hydrogen Lyman-alpha. A grid spacing of 1 Å and a resolution of 1 Å were employed as well as a 750 deg k rotational temperature and a vibrational temperature of 1000 deg k.

After running the Auric code to calculate the thermospheric emission spectra, the IDL INTSLIT and COMPINT programs (final report #19628-90-C-0050) were executed to produce the figures. A resolution of 20 Å was used for INTSLIT.pro and COMPINT.pro was smoothed over 17 bins using IDL SUMIT (see below).

The peak altitudes show good agreement, but the intensities need further study. The following table summarizes some of the comparisons of the AURIC code predictions and selected HUP horizon scans.

IDL FUNCTION SUMIT, X,Y, CENTER, WIDTH

```
;  This function sums contributions from a synthetic spectrum
;from over
;   the effective area of a triangular slit function of fwhm
;'width' for
;   a region of the spectrum centered at the wavelength 'center'.
;Intended
;   at first for use where a spectrometer is held at a constant
;wavelength
;   and the instrument field of view may scan the limb, etc.
;
```

```
;  Note that this function has to be used carefully because it
;makes explicit
;  use of the assumption that the synthetic spectrum in question
;(in the
;  standard merge.syn format) has elements spaced 1 Angstrom unit
;apart,
;  that the spectrum has not previously been filtered and that
;the points
;  in the spectrum are located on integral values of wavelength.
;
   SUM = 0.0
   NUM = N_ELEMENTS(X)
   FOR I = 0, NUM-1 DO BEGIN
     DEL = ABS(X(I) - CENTER)/WIDTH
     SUM = SUM + Y(I)*(1-DEL)
   ENDFOR
   SUMIT = SUM
;
   RETURN,SUMIT
   END
```

Table 1. Summary of Figures 1 to 15 showing the peak intensities for the AURIC code predictions using the Hinteregger EUV model and HUP observations at three LBH wavelengths ( ) in Angstrom units (Å) and at various solar zenith angles (SZA).

PEAK INTENSITY

DATA	( )	CODE	HUP	SZA	%Diff
18A	1384	1403	1348	3.	-4
	1464	954	1316	7.4	38
	1554	524	982	19.2	87
18B	1384	1141	1303	41.9	14
	1464	599	1109	52.9	85
	1554	264	659	63.8	150
19A	1384	289	767	81.5	165
	1464	28	260	92.5	829
	1554	>1	40	103.4	---
21A	1384	1300	1303	26.1	0
	1464	877	1134	15.2	29
	1554	546	842	4.3	54
21B	1384	1433	1605	19.5	12
	1464	893	1170	30.5	31
	1554	426	840	41.5	97

The LBH 2,0 band (1384 Å) shows the best agreement where the LBH 0,2 band (1554 Å) has the greatest difference.

A possible explanation for this difference is that nitric oxide (NO) bands are not, as yet, included in AURIC, and the tables list some NO bands about 1500. Another consideration is that collision-induced electronic transitions (CIET) may add to the population of the lower vibrational levels of the upper LBH state (Private communication, R. Eastes). Also, the effect of the look angle with respect to the solar zenith angle (SZA) has not been factored in.

To better define this problem, an attempt is being made to compare AURIC with HUP spectra obtained on STS-39 while looking down. A large portion of the band system will be observed with a resolution ~ 7 Å and at a selected small SZA.

Also, AURIC version 4.5 has been delivered and awaits further study.

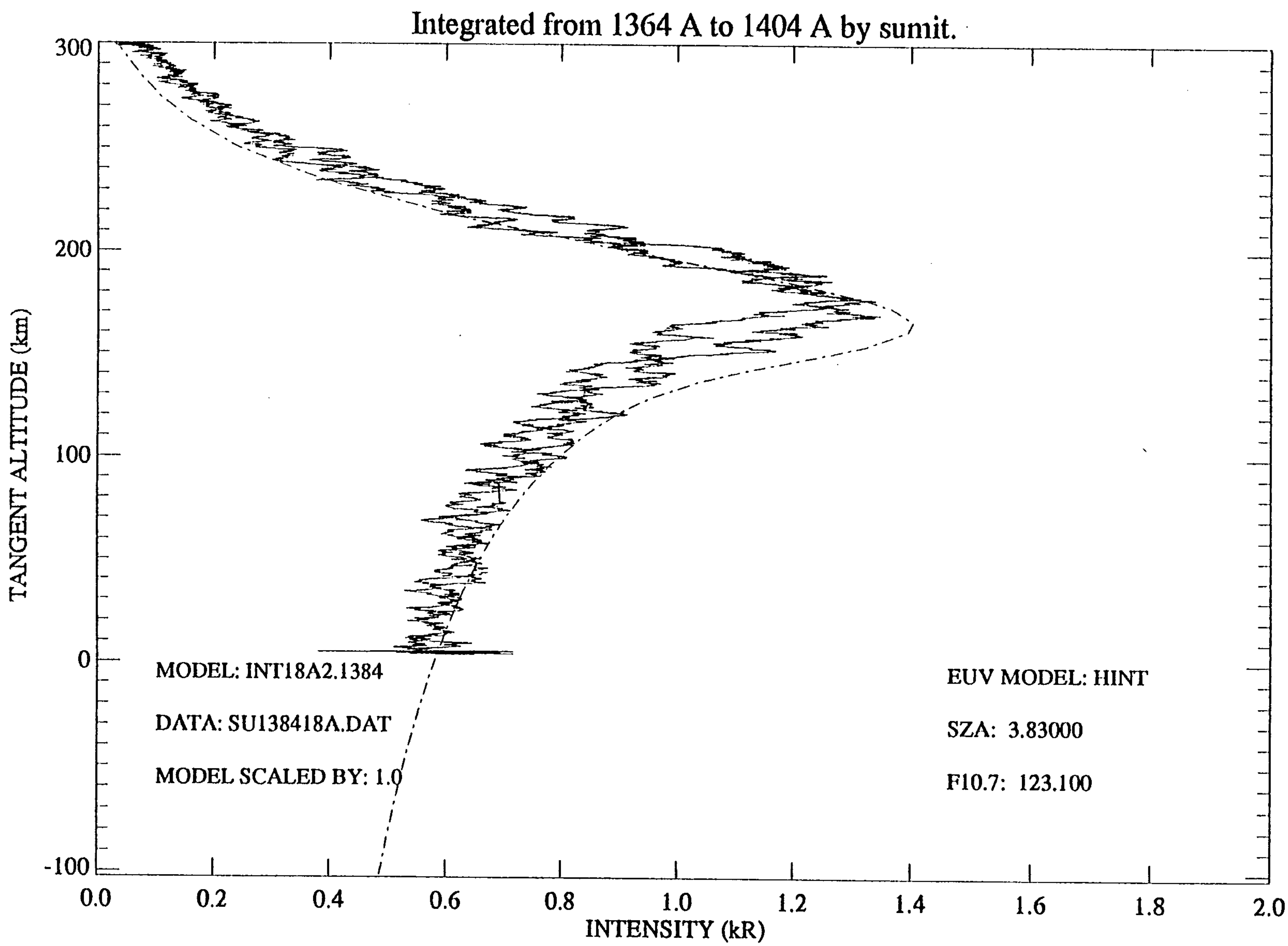


Figure 1. The AURIC model prediction (broken line) using 'Sumit' to integrate the synthetic spectra over a 20 A slit function is compared to HUP horizon scan data obtained from the STS 4 shuttle 28 June 1982 92852 Mission Elapsed Time (MET)/1146 Local Time (LT). The HUP spectrometer had a resolution of 20 A and was set at 1384 A. The model and HUP data file names are given, and the Hinteregger EUV model was used in the AURIC calculation.

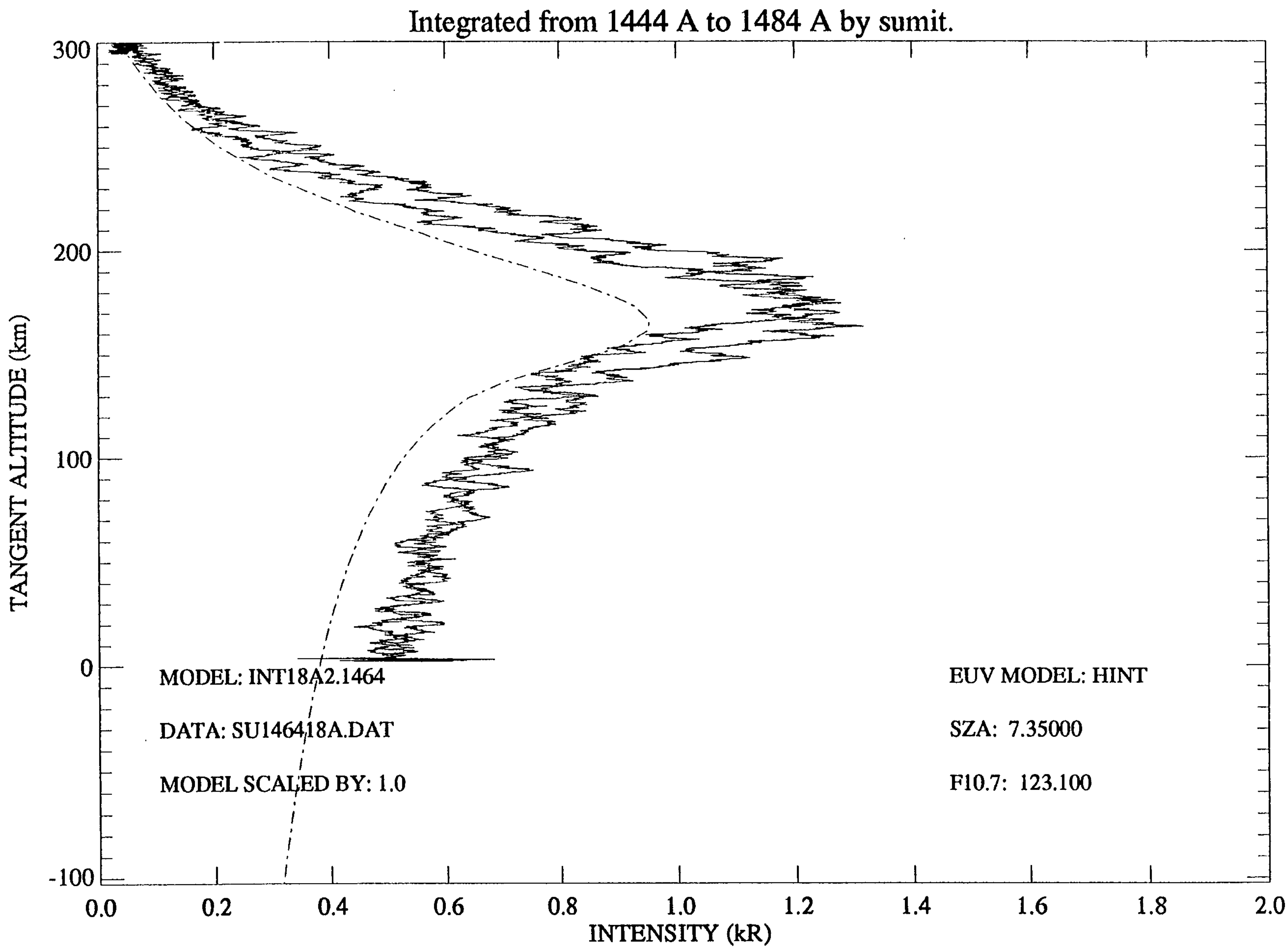


Figure 2. Same as Figure 1 except at 92935 MET/1231 LT with HUP spectrometer set at 1464 A.

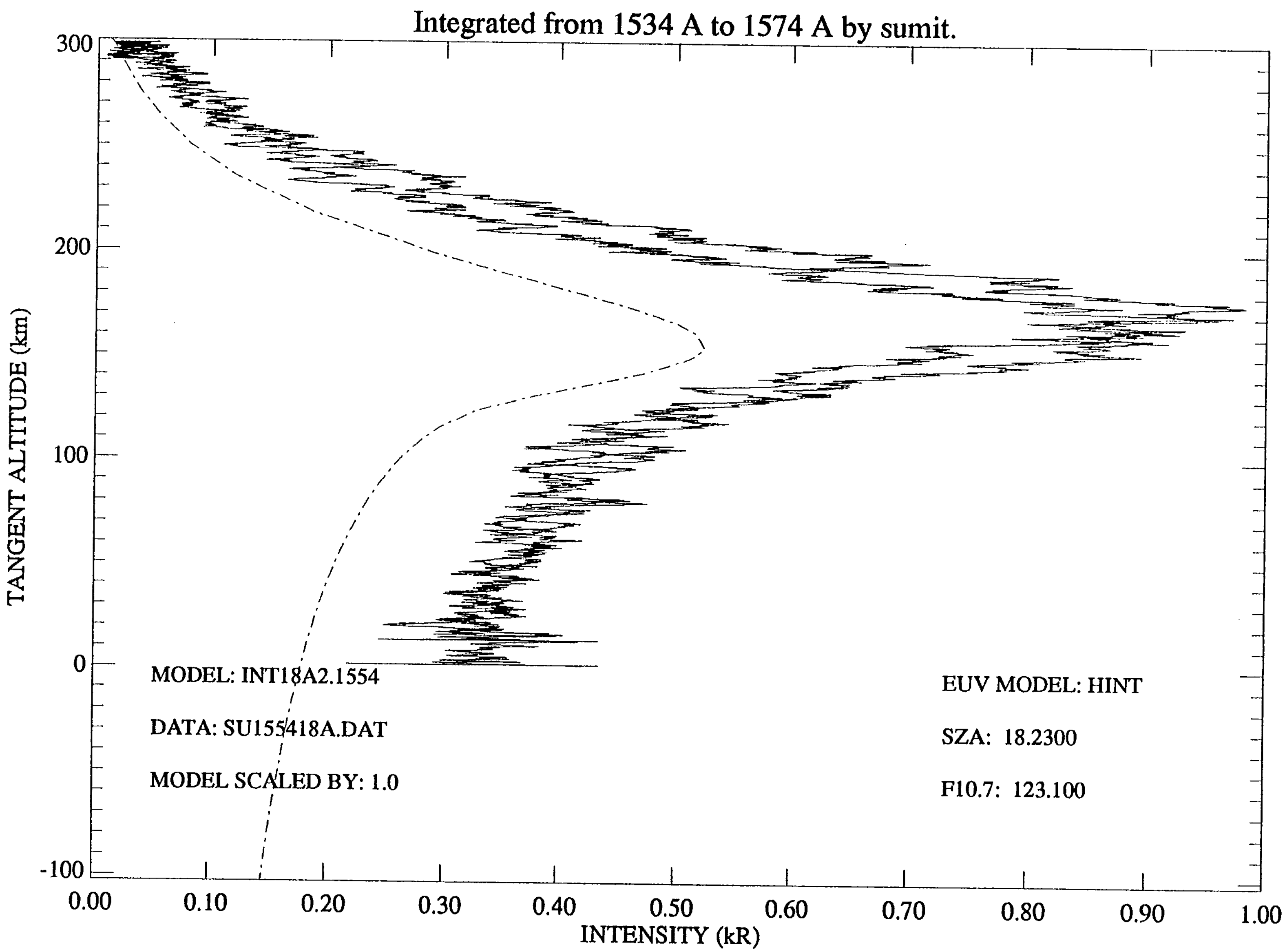


Figure 3. Same as Figure 1 except at 93100 MET/1313 LT with HUP spectrometer set at 1554 A.

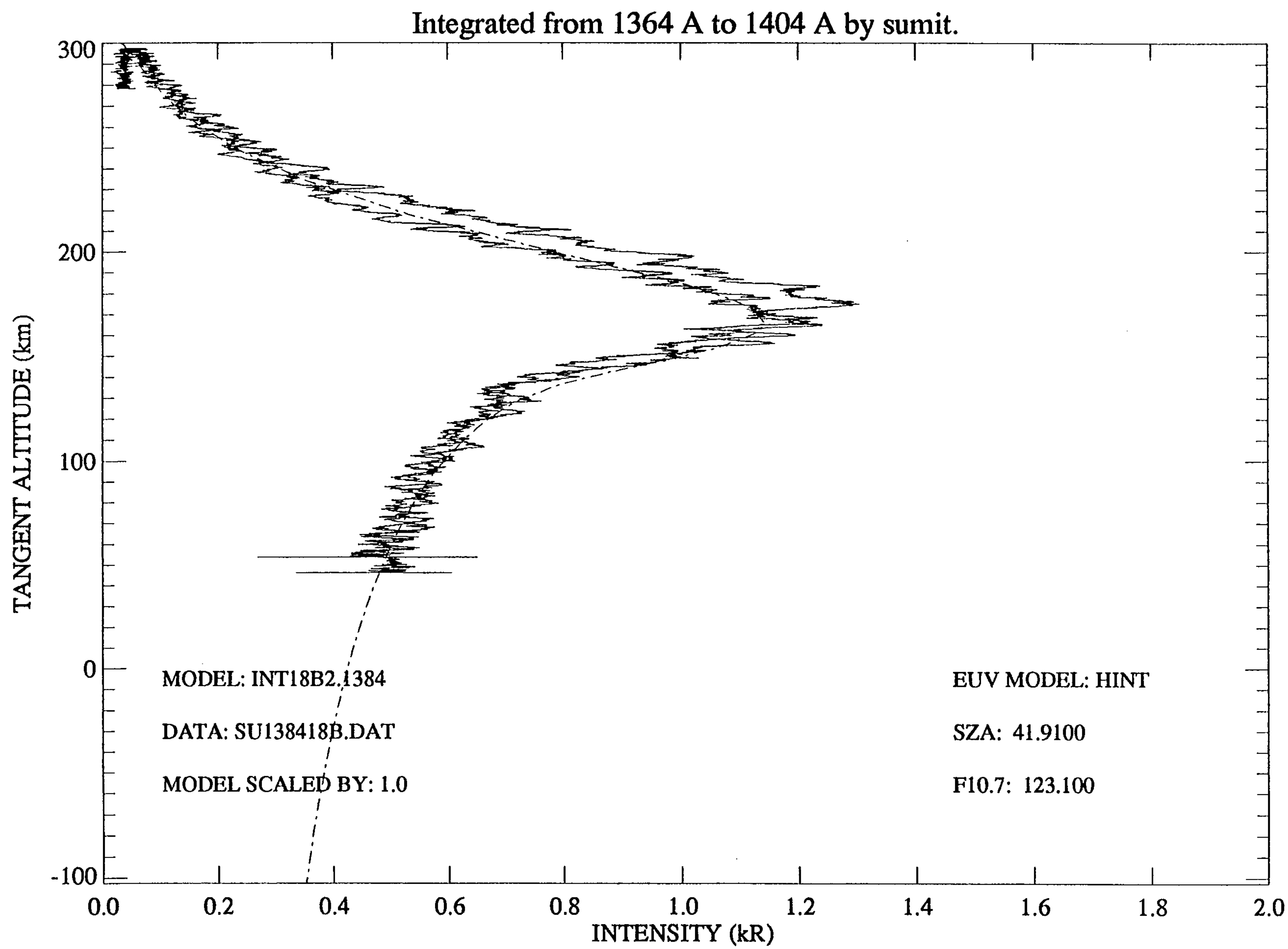


Figure 4. Same as Figure 1 except at 93456 MET/1139 LT with HUP spectrometer set at 1384 A.

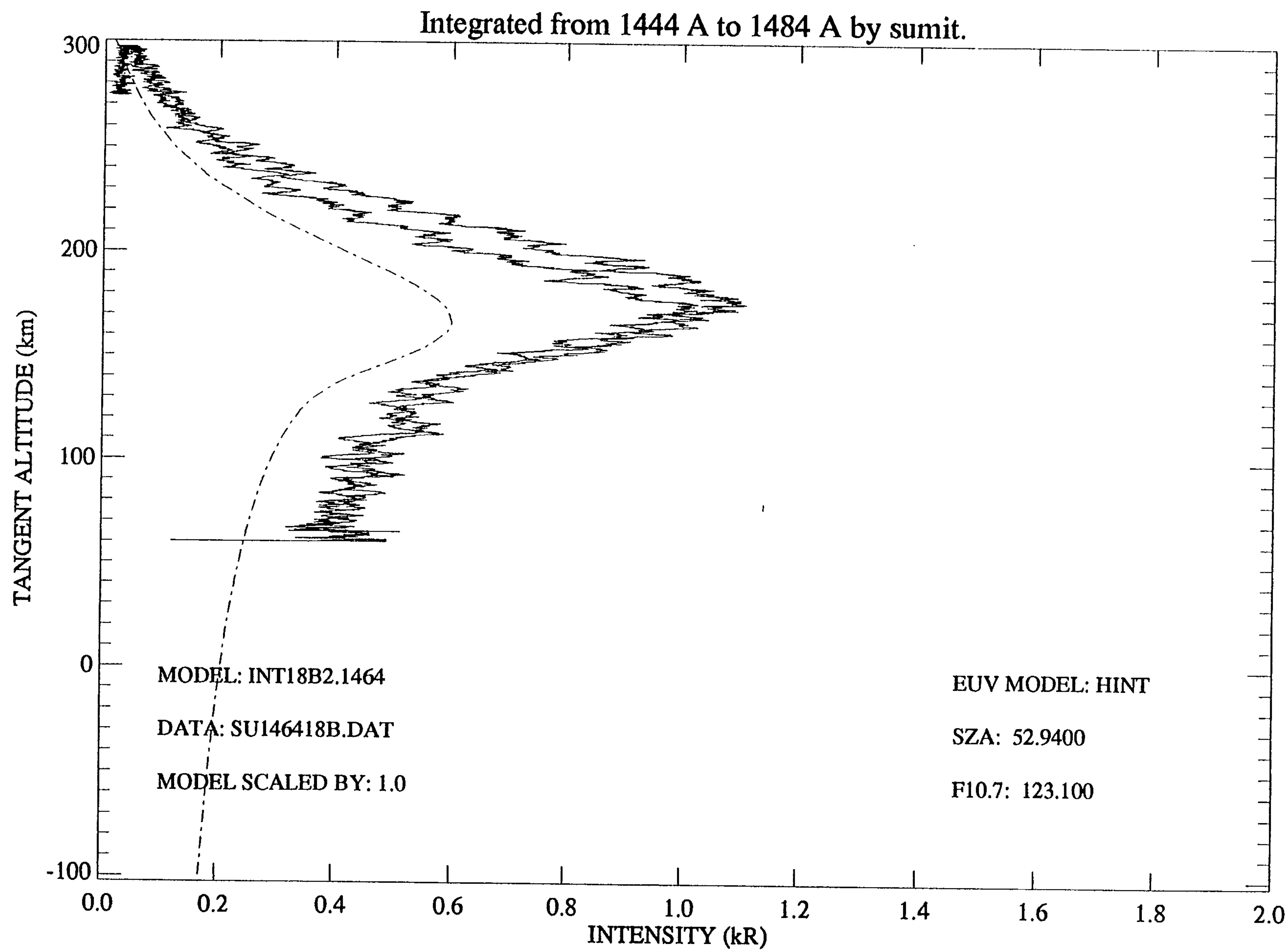


Figure 5. Same as Figure 1 except at 93622 MET/1518 LT with HUP spectrometer set at 1464 A.

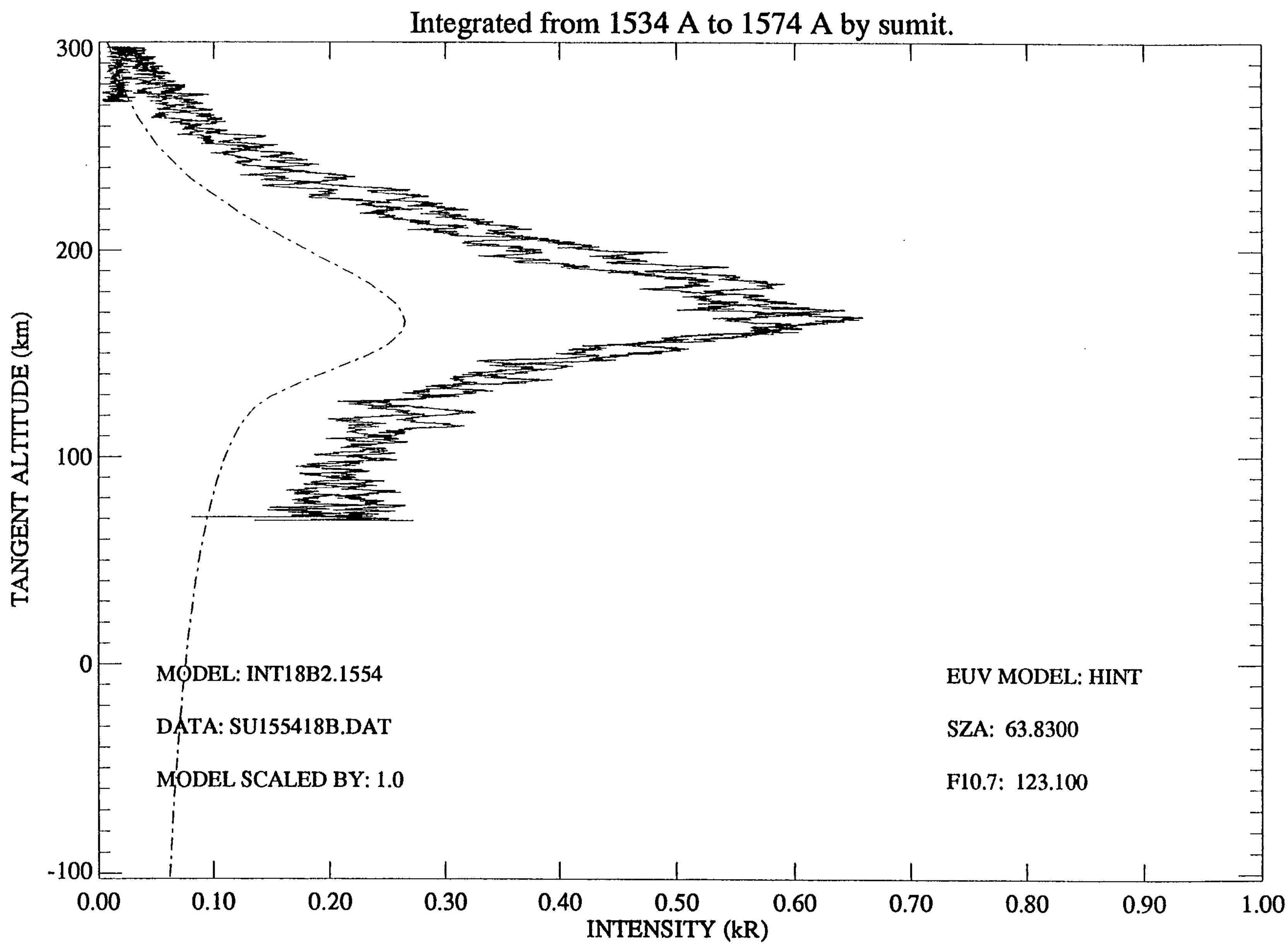


Figure 6. Same as Figure 1 except at 93787 MET/1557 LT with HUP spectrometer set at 1554 A.

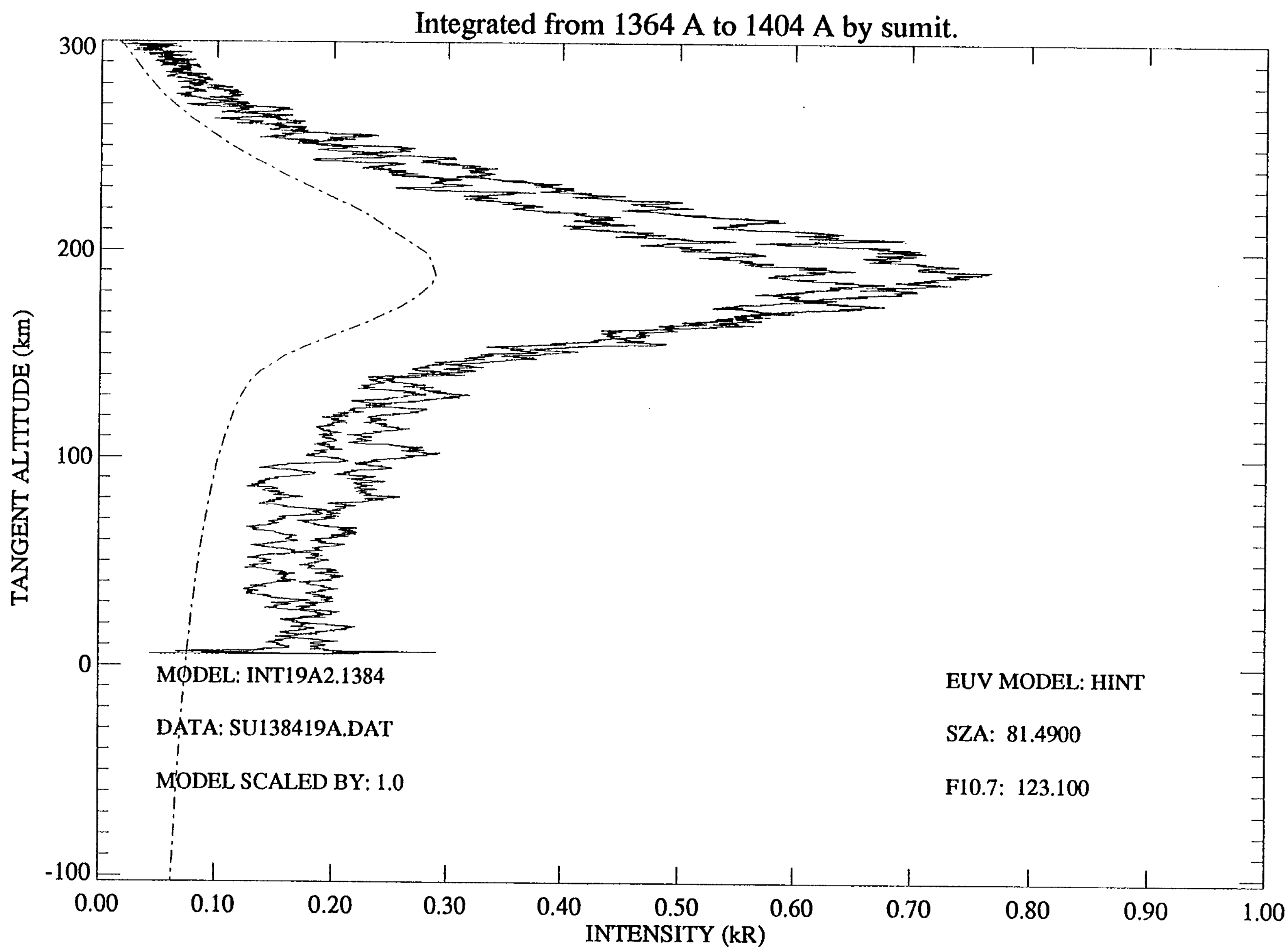


Figure 7. Same as Figure 1 except at 99480 MET/1700 LT with HUP spectrometer set at 1384 A.

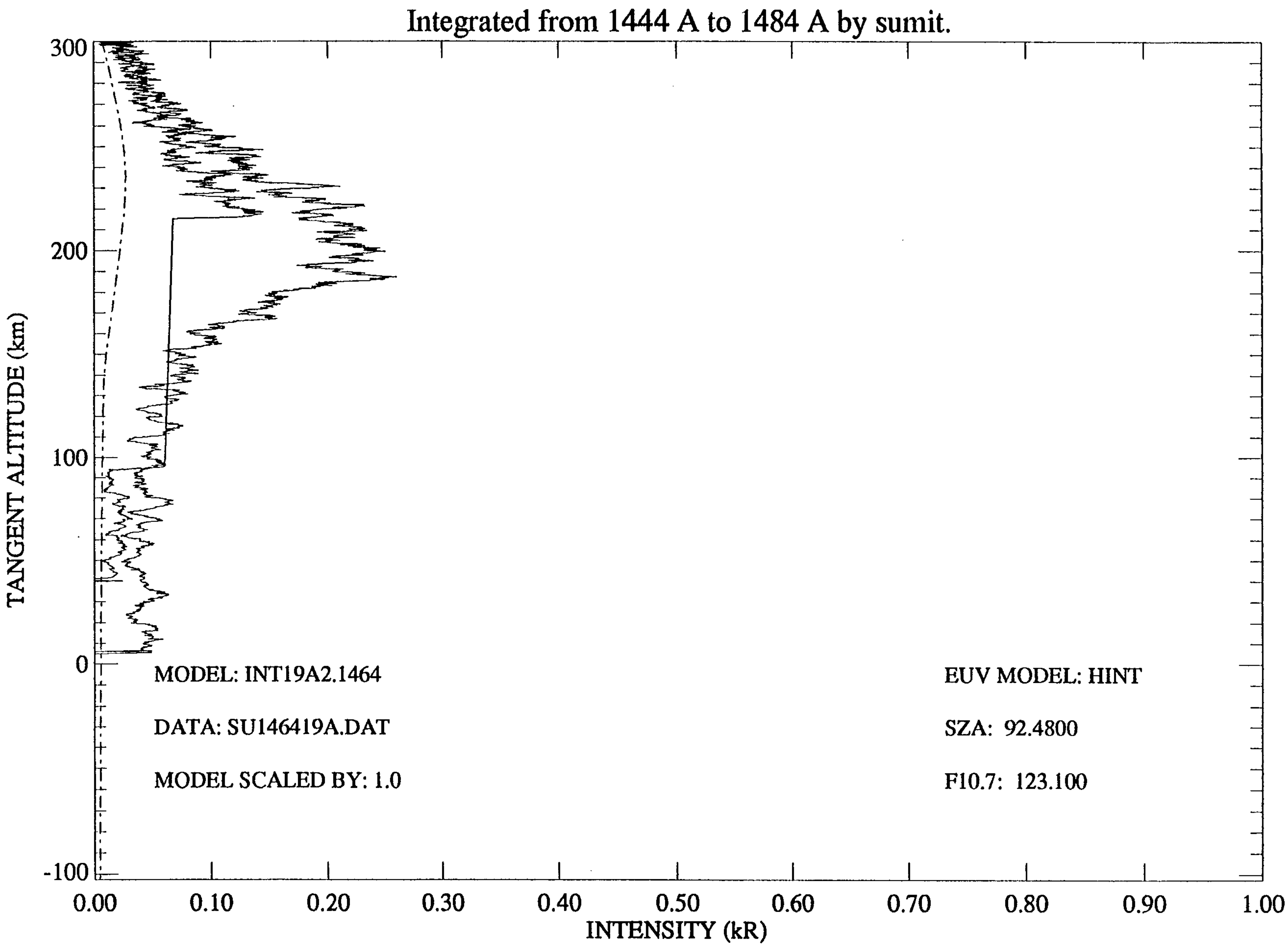


Figure 8. Same as Figure 1 except at 99645 MET/1742 LT with HUP spectrometer set at 1464 A.

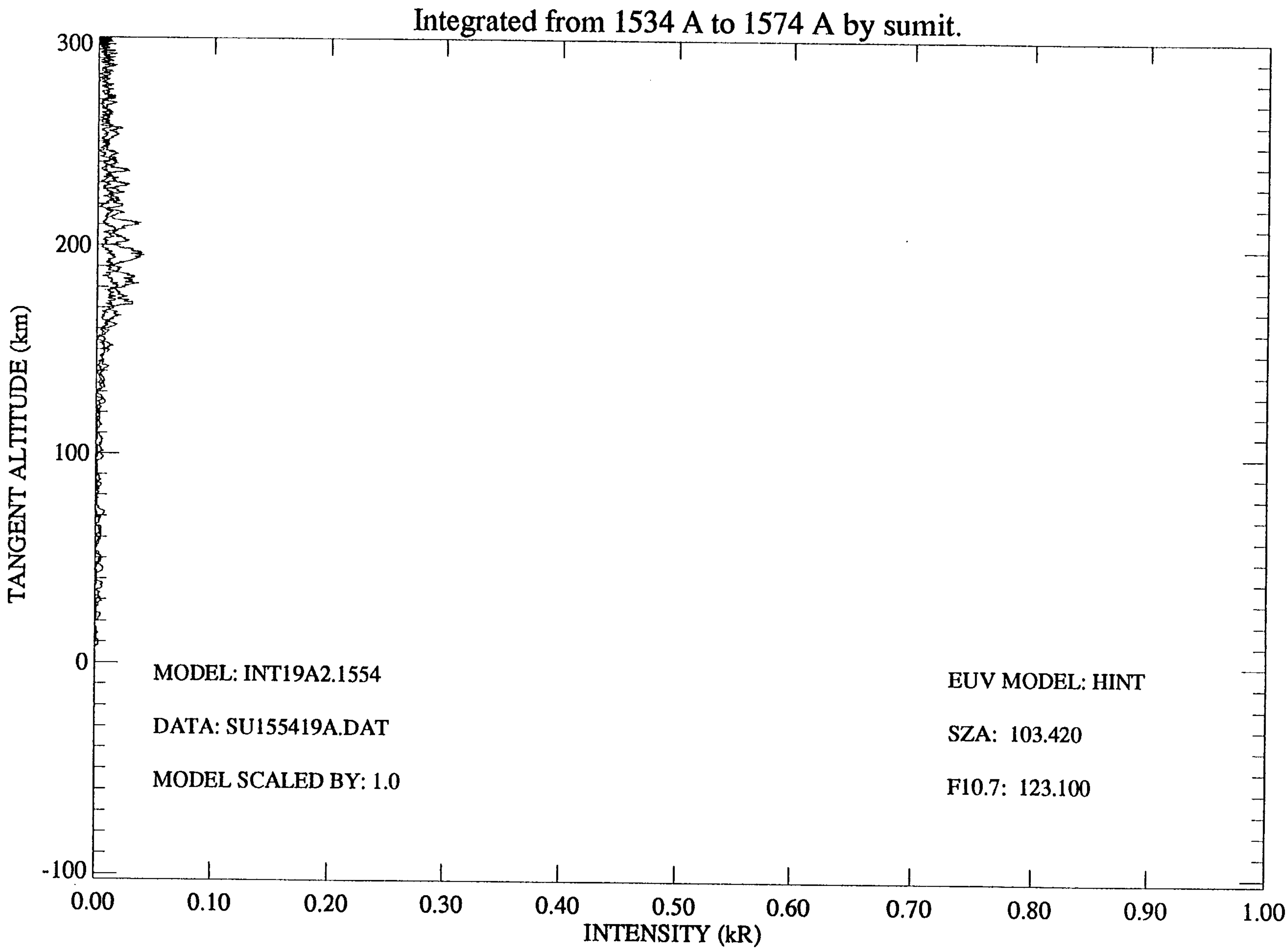


Figure 9. Same as Figure 1 except at 99810 MET/1825 LT with HUP spectrometer set at 1554 A.

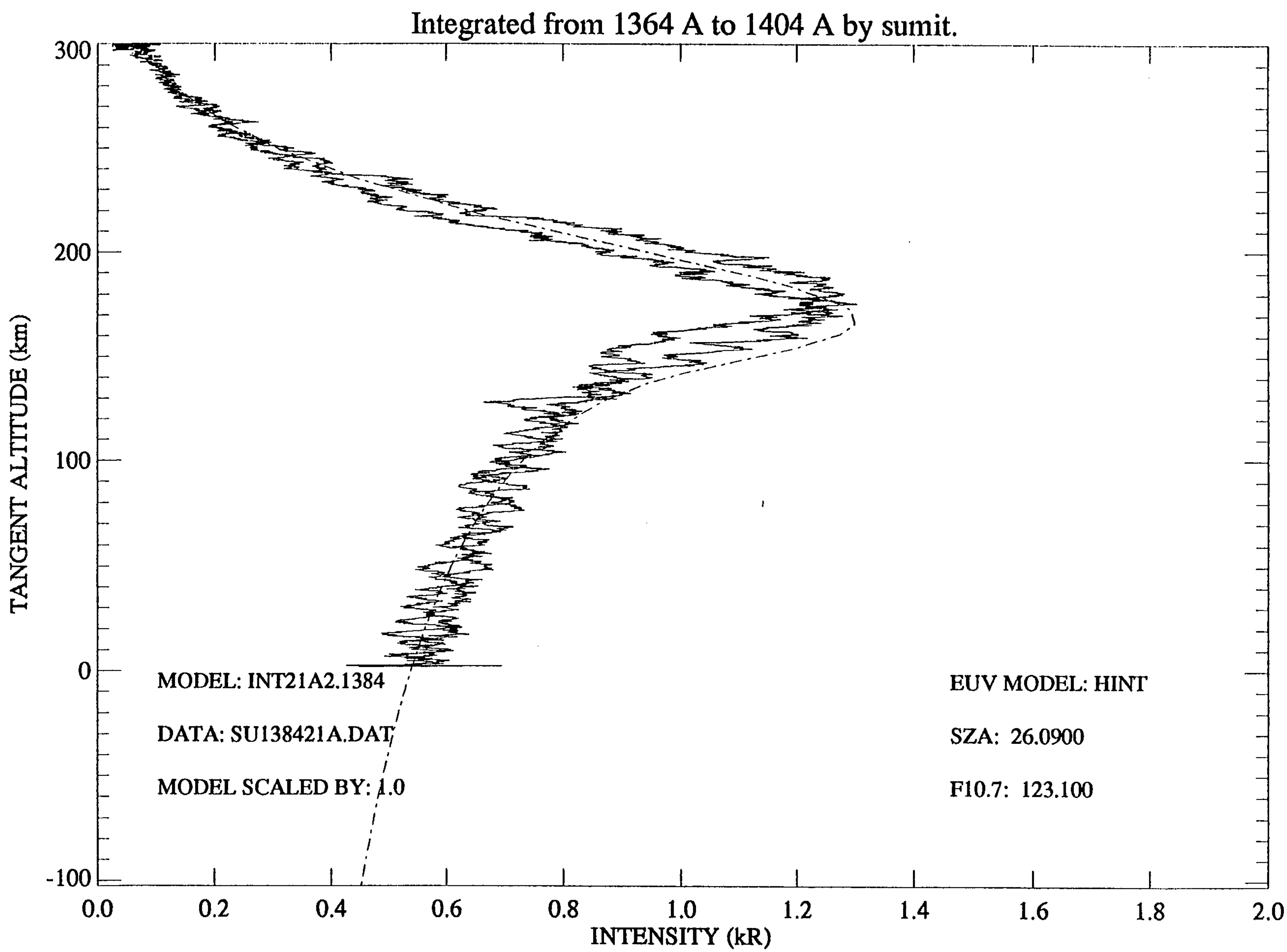


Figure 10. Same as Figure 1 except at 108714 MET/1009 LT with HUP spectrometer set at 1384 A.

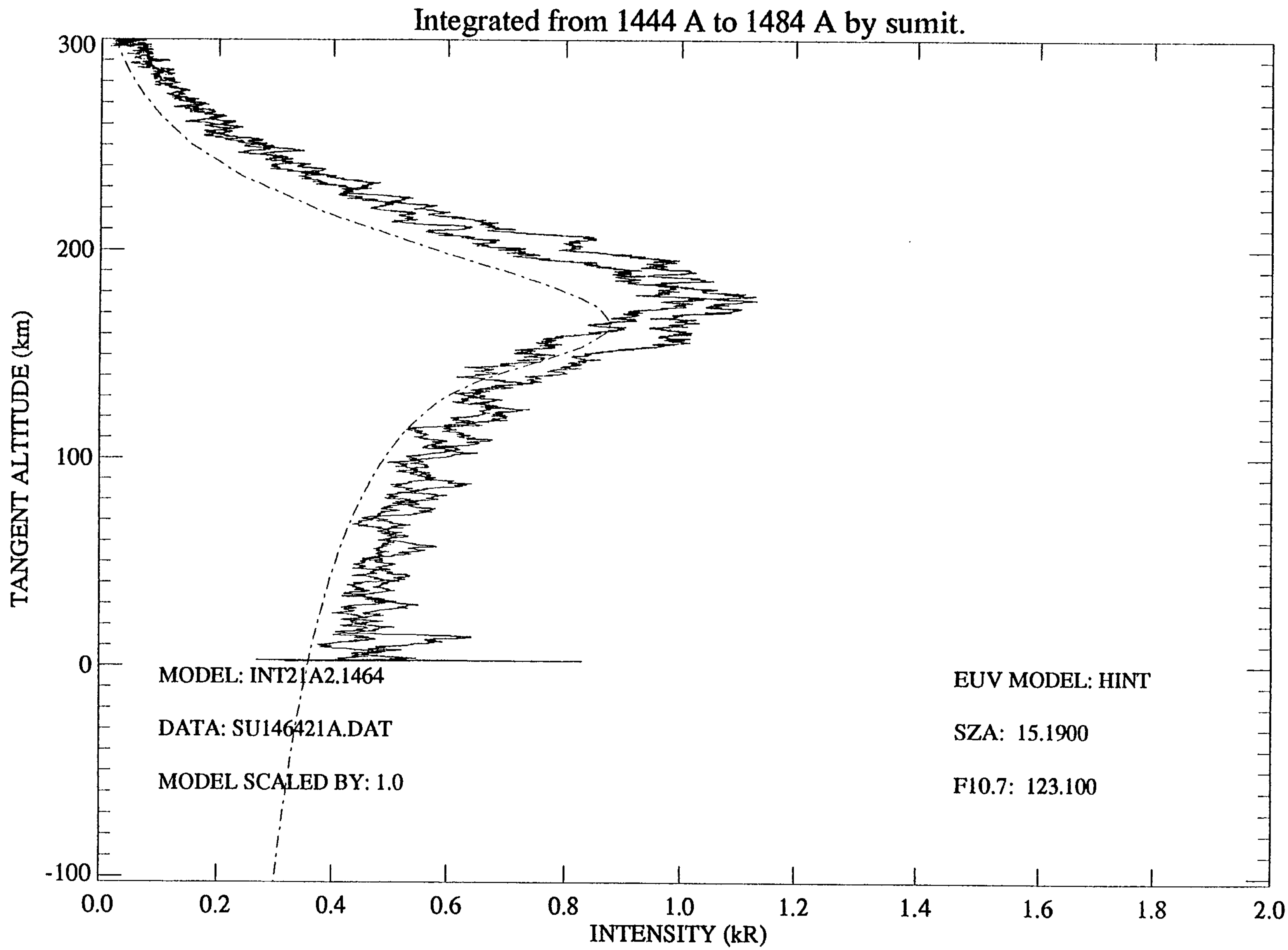


Figure 11. Same as Figure 1 except at 108879 MET/1057 LT with HUP spectrometer set at 1464 A.

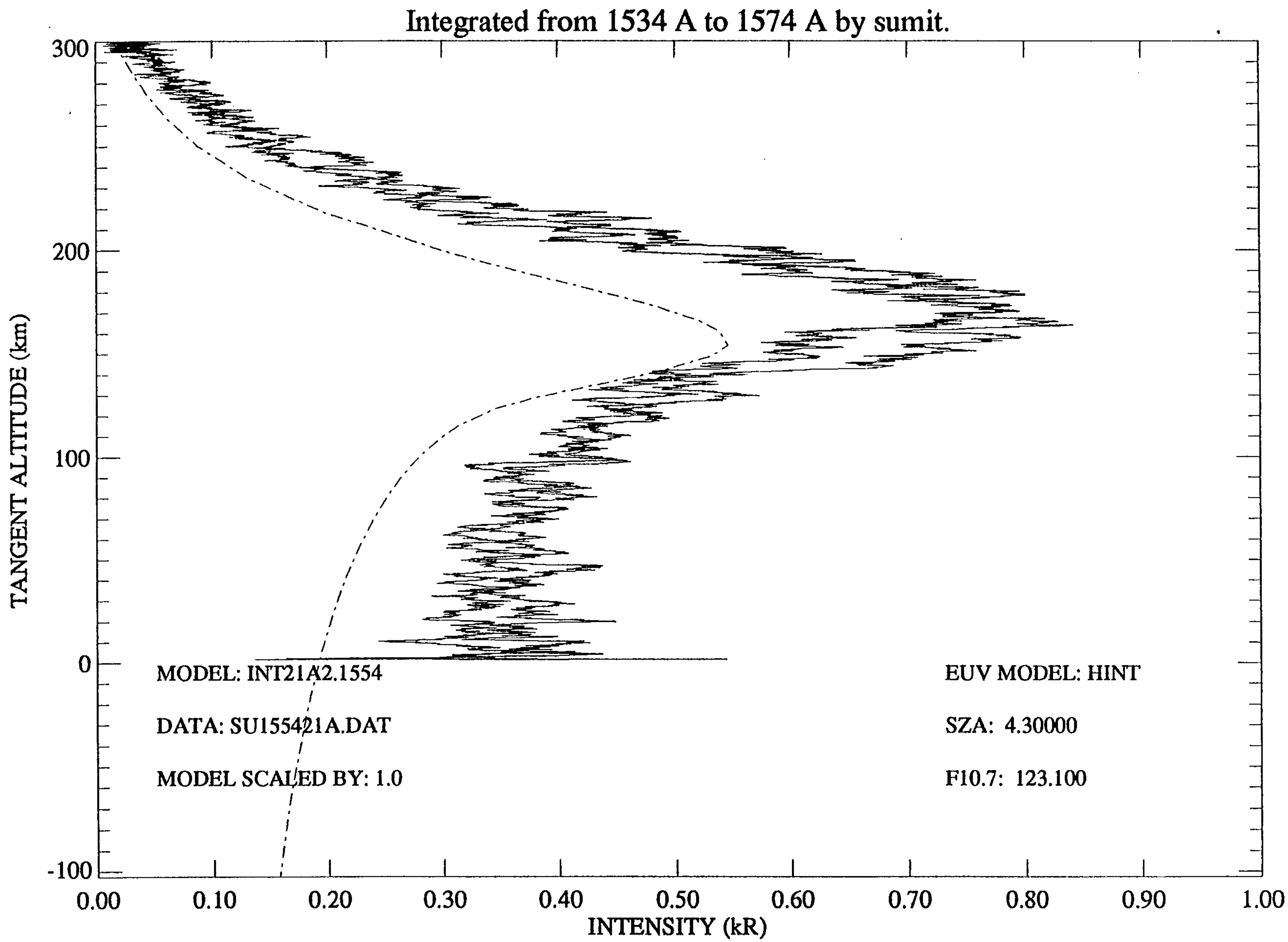


Figure 12. Same as Figure 1 except at 109044 MET/1144 LT with HUP spectrometer set at 1554 A.

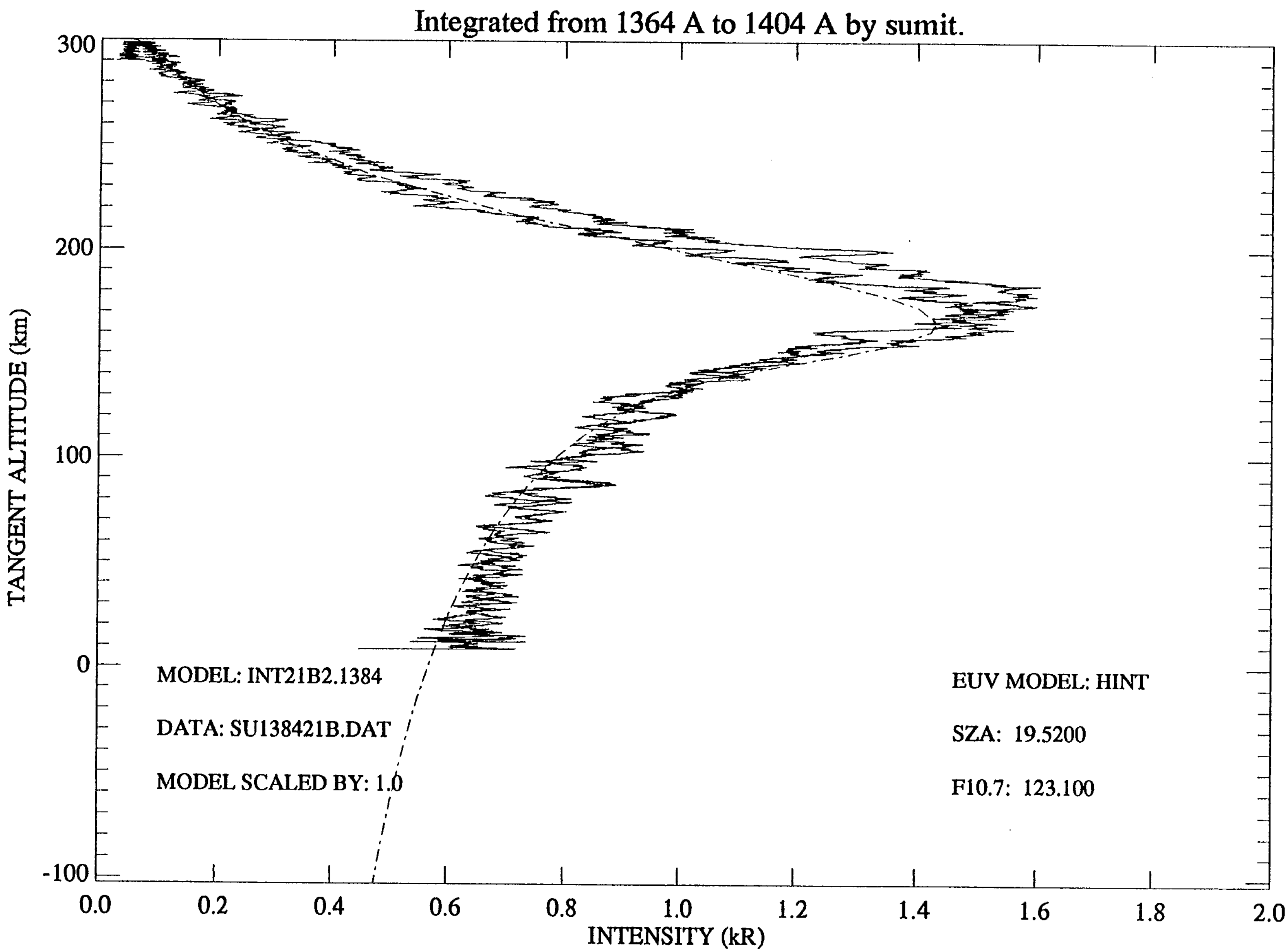


Figure 13. Same as Figure 1 except at 109401 MET/1317 LT with HUP spectrometer set at 1384 A.

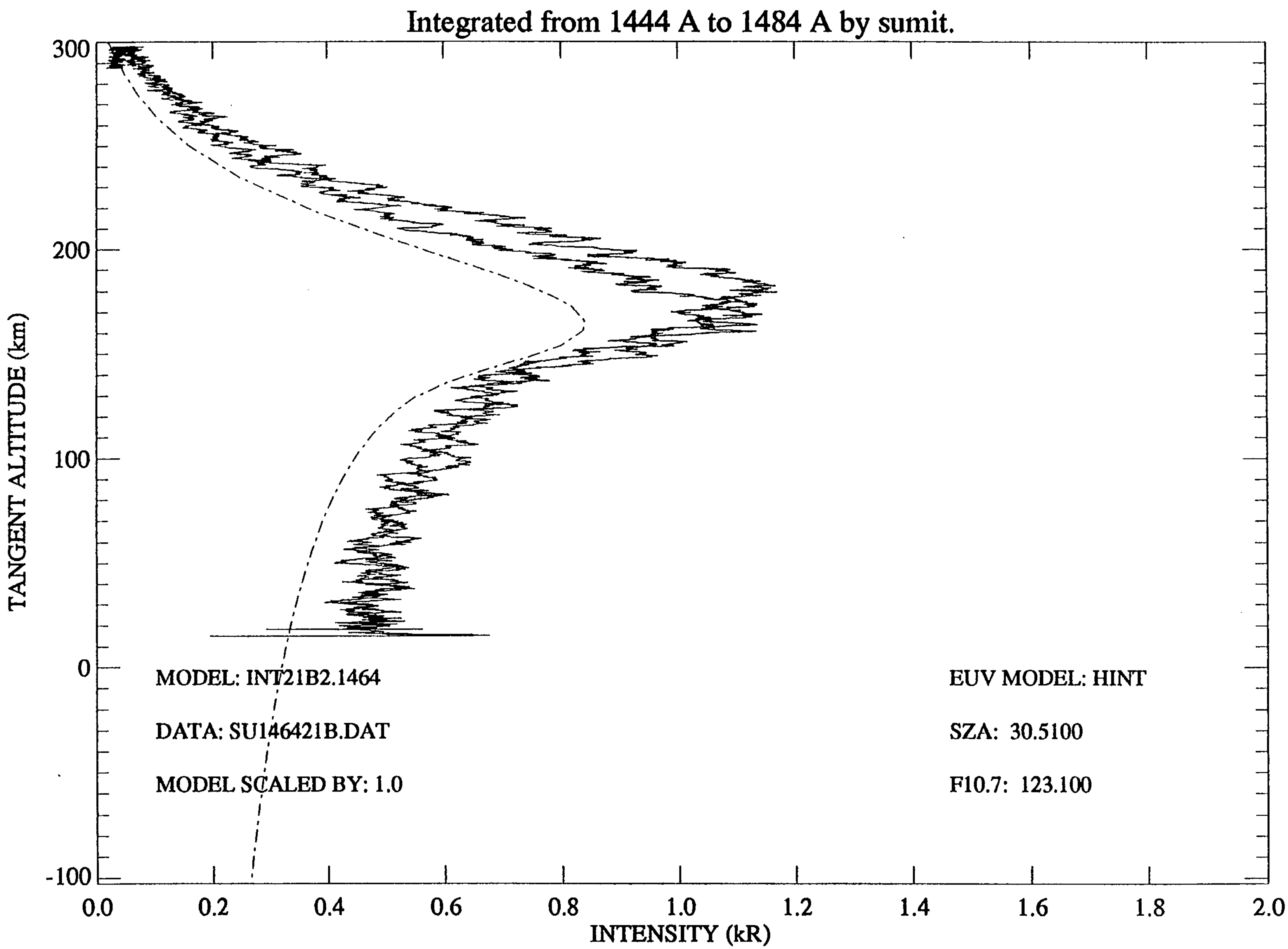


Figure 14. Same as Figure 1 except at 109566 MET/1357 LT with HUP spectrometer set at 1464 A.

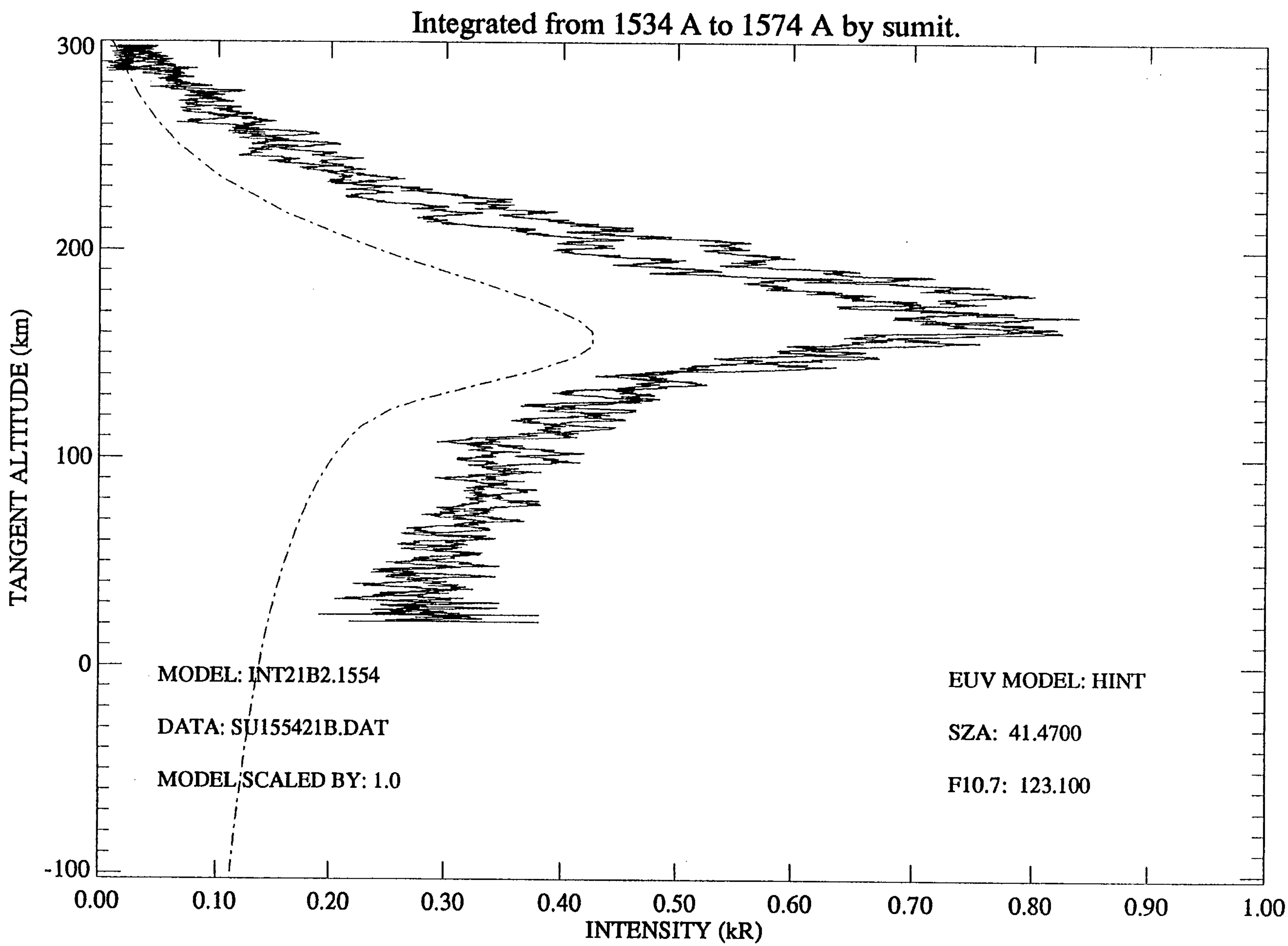


Figure 15. Same as Figure 1 except at 109731 MET/1436 LT with HUP spectrometer set at 1554 A.

2. AURA Satellite Experiment

The two AURA satellite instruments were attached to the GSE. After we replaced a cable and learned to integrate dark count for about ten seconds, to accumulate two or more counts allowing a chip in the GSE to function, the instruments functioned well. Macros and data files were created to provide assurance that the equipment is ready for calibration when the experiment is manifested.

The AURA satellite experiment had been selected to fly on the Space Test Experiment Platform (STEP) mission 4 (M4) before the program had operational problems. It was requested that the spacecraft deck on which AURA is to be mounted should be glass beaded and coated with 3M 401 low outgassing epoxy or, at least black anodized. Also, the instrument fabricator, Research Support Instruments (RSI), has been asked to position the nitrogen gas purge to maximize the protection of the scan mirror as it is potentially the greatest source of scattered light. Also, it was suggested that the scan mirror dust cover should have a test lamp port/window to allow liveness and wavelength checks without removing the cover.

As AURA has dual sensors that will be co-aligned to within 0.025 deg and will be mounted on the satellite deck, a detailed procedure should be formulated before delivery. An outline is as follows:

1. Level the rotary base laser.
2. Before deck removal, level the deck with the laser.
3. Check the rest of the surface for flatness.
4. Loosen the deck bolts and recheck.
5. Place the deck plate on a flat surface (e.g., granite table or aluminum plate).
6. Check for flatness.
7. Mount and align AURA as per Critical Design Review (CDR).
8. Remount the deck on the spacecraft and check for co-alignment.

As AURA will need a nitrogen gas purge during integration similar to that used in the HUP experiment, a description of the hardware (flow valve, filter and pop valve) was provided along with the calibration. Here, the flow valve was locked at 2.2 cc/sec when the gas pressure was set at 10 psi. At 15 psi the flow was 3.4 cc/sec, and at 20 psi the flow was 4.4 cc/sec. Therefore, a standard 220 cu.ft. cylinder at 2000 psi would provide a flow of 3.4 cc/sec for 21 days.

Ultraviolet (UV) instruments in space tend to become less sensitive with time. Because of this, it is planned to have the Atmospheric Ultraviolet Radiance Analyzer (AURA) satellite experiment periodically measure the intensity of UV stars of known UV brightness. These instruments will provide a record of any sensitivity changes with time.

Table 2 is a list of 17 selected UV stars of known brightness provided by HAO NCAR for possible viewing by the AURA experiment. The positions of these stars on the Galactic Sphere are shown in Figure 16.

A program, ATTSIM.EXE, to plot the track of AURA's field-of-view (FOV) on the Celestial Sphere for an orbit of the Earth has been provided by N. Bonito, Radex Inc. This program is accompanied with a file called CONTROL.CTL. Table 3 is an example of this file. By changing the various parameters, the direction of the FOV will vary, and it can be predicted whether or not a star will fall into AURA's FOV. The Keplerian Elements will be determined by the orbit attained by the spacecraft. The Right Ascension of the Ascending Node (AN) and the angular setting of AURA's scan mirror primarily determine the look direction. In the CONTROL.CTL file, the file UV1360.RWE, Table 4, is used to position the stars in the galactic sphere. This is a hybrid file in which the ANs and declinations (Dec) were introduced with the VAX editor.

Although AURA is designed to look in the nadir direction, it has a scan mirror that can be aimed crosstrack 180°, from horizon to horizon. When observing stars, looking through the atmosphere below 120 km will be avoided. Therefore, at 600 km satellite altitude, the mirror angle (MA) range, measured from the orbit tangent, will be 0° to 24° and 180° to 156°, depending on which side of the ground track is chosen. The limits for an 800 km orbit are 27° and 153°.

Because AURA will look to the left or the right of the velocity vector, the track of the FOV projected on the celestial sphere will have an AN either +90° or -90° of the orbital AN. Figures 16 and 17 have orbital ANs of 150°. Figure 16 looks to the left of the Velocity Vector with an MA of 20°. Adding 90° to 150° is equivalent to -120°. Figure 17 has an MA of 160° looking to the right of the Velocity Vector. Subtracting 90° from 150° results in an AN of 60°. Note that the FOV projection is in the lower half of the celestial sphere when the MAs are small-valued and vice versa.

Figures 18 to 21 show the effect of adjusting the MA. They all have orbital inclinations (INC) of 45° and ANs of -90°. As the MA goes from 25° to 2°, the projection path becomes smaller. Therefore, to intercept a star, we would first select an AN and then adjust the MA. The aitoff drawing in Figure 20 shows an intercepted star as a small circle. Also CONTROL.CTL produces a file, LOW_1S.PRN, which contains the AN and Dec of any encountered stars. Table 5 was produced with Figure 21. It shows an AN = 332.05° (-27.95°) and Dec = -45.97°.

Figures 23 and 24 with Figure 21 show the effect of orbital inclination. All have MAs of 20° and ANs of -90°. As the inclination becomes larger, the FOV track moves towards the center of the celestial sphere.

In the CONTROL.CTL, if 'no' is entered for the Aitoff_display, a more detailed FOV track is presented, e.g. Figure 25. An image of the slit FOV is also seen.

Table 2. UV Calibration Stars.

The coordinates for the right ascension of the ascending node (AN) are listed in hours and degrees.

	Rank	Star	AN (hr)	Declin.	Type	V	AN (deg)
1	2	Por	03 57.9	+40 00	B0.5	2.90	59.47
2	10	CMa	06 45.1	-16 43	A1	-1.46	101.27
3	2	Vel	09 22.1	-55 01	B2	2.50	140.52
4	7	Leo	10 08.4	+11 58	B7	1.35	152.10
5	4	Cen	12 08.4	-50 43	B2	2.60	182.10
6	1	Crv	12 15.2	-17 33	B8	2.59	183.80
7	9	Vir	13 25.1	-11 10	B1	0.97	201.27
8	7	Uma	13 47.5	+49 15	B3	1.86	206.87
9	7	Cen	13 55.5	-47 17	B2.5	2.55	208.87
10	4	Cen	14 03.8	-60 22	B1	0.61	210.95
11	3	Lup	15 35.1	-44 10	B2	2.78	233.77
12	2	Sco	16 00.3	-22 37	B0.5	2.32	240.07
13	4	Sco	16 35.9	-28 13	B0	2.82	248.97
14	2	Lyr	18 36.9	+38 47	A1	0.03	279.22
15	3	Sgr	18 55.3	-26 18	B2.5	2.02	283.82
16	2	Cru	22 08.2	-45 58	B7	1.74	332.05
17	2	Psa	22 55.7	-39 37	A3	1.16	343.92

Table 3. Example of CONTROL.CTL file that accompanies the ATTSIM program.

```
#
# Control file for the AURA satellite attitude simulation
#at this time all these parameters must have a valid value.
#
#                              Radex Inc,  May 12, 1994
#
#  Keplerian Elements for the definition of the orbit
#
Inclination     =  45.0        # Orbital Inclination
Mean_motion     =  15.0        # Mean Motion Revs per day
Eccentricity    =   0.00001    # Eccentricity (Applied for semi-
                               #    major axis)
Ascending_node  = -90.0        # Right Ascension of Ascending node
Arg_perigee     =   0.0        # Perigee location in orbit
Mean_anomaly    =   0.0        # Mean Anomaly for orbit at epoch
Element_epoch   =   0.0        # Days + Fraction of days
#
#  Uncertainty of the LVLH attitude values. These are applied
#using a Gaussian distribution (Press et. al.) of values"GASDEV".
#
Sigma_pitch = 0.10
Sigma_yaw   = 0.33
Sigma_roll  = 0.10
#
```

```
#  Attitude mean error or can be applied as the actual value
observed.
#
Mean_pitch = 0.3
Mean_yaw   = 1.0
Mean_roll  = 0.3
#
#  Output product definitions
#
Output_file      = low_1s.prn
Graphics         = yes
Aitoff_display   = no


Star_Catalog     = uv1360.rwe
Graphic_window   = 80.0
LOS_Display      = yes
FOV_Display      = yes
#
Number_iterate =  10    # Number of iteration for the distribution
#
Start_epoch    = 0      # Seconds from ascending node to start LOS
                        #    view processing.
Time_duration =  6000   # Amount of seconds for LOS view
                        #    processing
Time_FOV       =  1200  # Time into LOS view processing to perform
                        #    the distribution and FOV display.
Mirror_angle   = 20.0   # Mirror angle for the AURA slit
                        #    The angle is measured from the right
                        #    wing horizontal positive toward the
                        #    nadir (90.0) and left wing (180.0)

Micro_radians = no
Degrees = yes

X_plane_FOV = 0.2
Y_plane_FOV = 2.0

# End of Control file
```

Table 4. File UV1360.rwe.

The ANs and DECs are used in the CONTROL.CTL file to position the UV calibration stars.

1	0.59	11	CAS	03	57.9	+40	00	B9	5.56
6	0.81	14		06	45.1	-16	43	B7	5.89
9	0.11	0	AND	09	22.1	-55	01	A2	4.52
10	0.70	11	AND	10	08.4	+11	58	B8	6.11
13	2.23	3		12	08.4	-50	43	B5	5.57
19	33.70	3	CAS	12	15.2	-17	33	B2	3.66
20	6.84	0	AND	13	25.1	-11	10	B5	4.36
22	0.93	0	CAS	13	47.5	+49	15	B8	5.41
24	2.25	7	CAS	13	55.5	-47	17	B8	4.91
25	6.33	11	AND	14	03.8	-60	22	B5	4.53
28	5.51	0	SCL	15	35.1	-44	10	B8	4.33
29	0.29	10		16	00.3	-22	37	B9.5	5.70
31	0.88	24		16	35.9	-28	13	B3	6.54
34	6.31	13	PHE	18	36.9	+38	47	B7	3.94V
39	334.00	7	ERI	18	55.3	-26	18	B3	0.47
40	2.34	7	AND	22	08.2	-45	58	B8	4.95
41	0.24	21	CAS	22	55.7	-39	37	A0	5.59

Table 5. File LOW_1S.PRN produced with FOV track for : INC = 45, RA = -90, MA = 20.

0.176505	0.731467	0.152138	10.32	-64.31	
0.190309	0.634661	0.244011	10.60	-64.36	
0.407638	0.562404	0.360429	11.02	-64.41	
0.541847	0.720196	0.388694	10.83	-64.48	
0.346846	1.054044	0.278979	9.92	-64.53	
0.291457	0.957393	0.310206	10.10	-64.53	
0.334779	0.972791	0.305995	10.10	-64.52	
0.416097	0.885093	0.443223	10.47	-64.61	
0.327020	0.941031	0.097846	9.96	-64.32	
0.346642	0.934426	0.271375	10.15	-64.48	
2.34	332.05	-45.97	19.47	167.11	2673.78

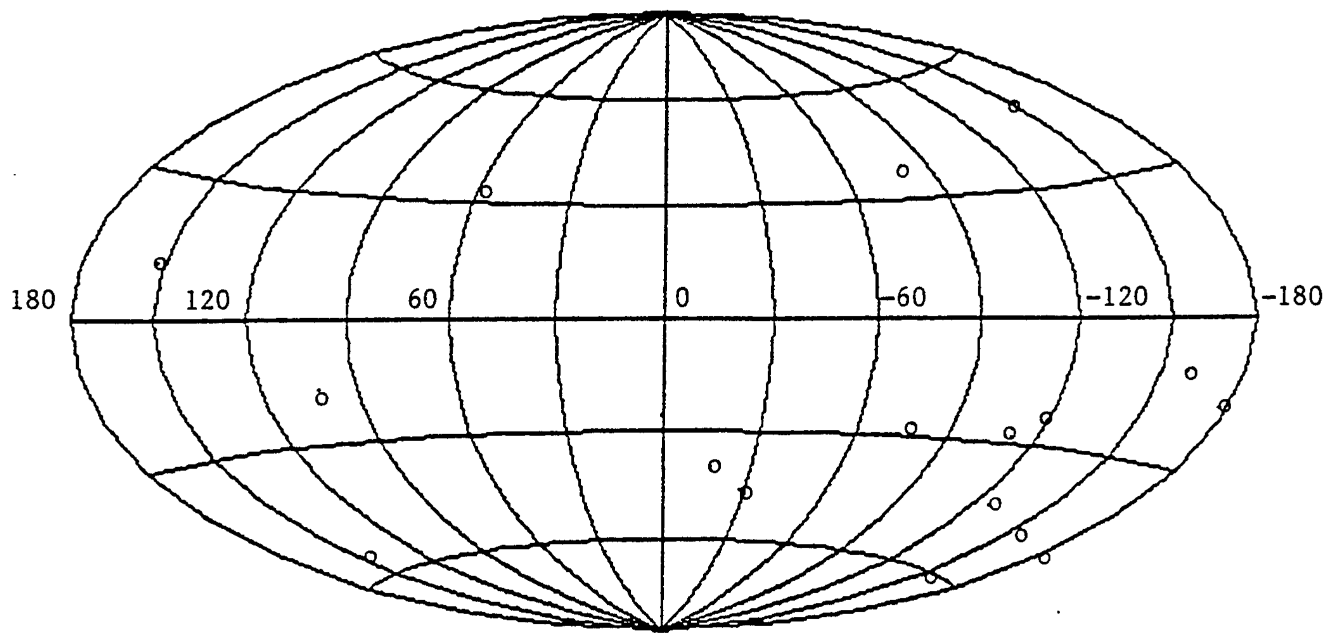


Figure 16. Celestial Sphere showing the locations of the UV stars.

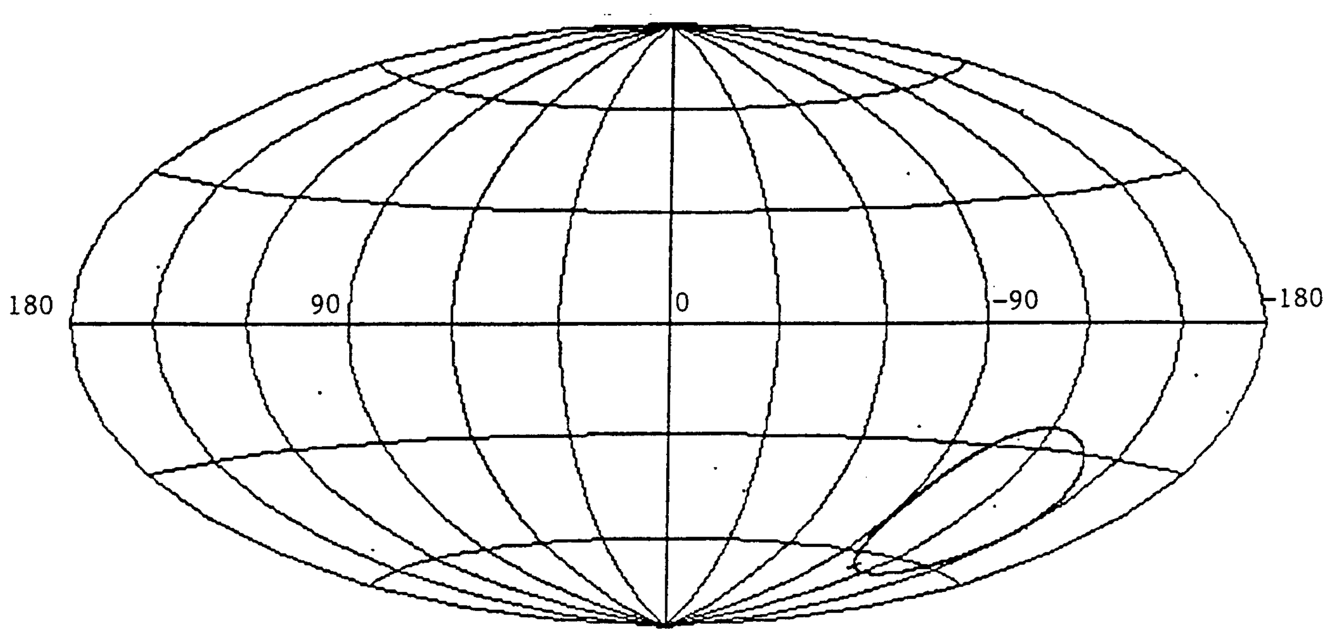


Figure 17. FOV track for: INC = 45, AN = 150, MA = 20.

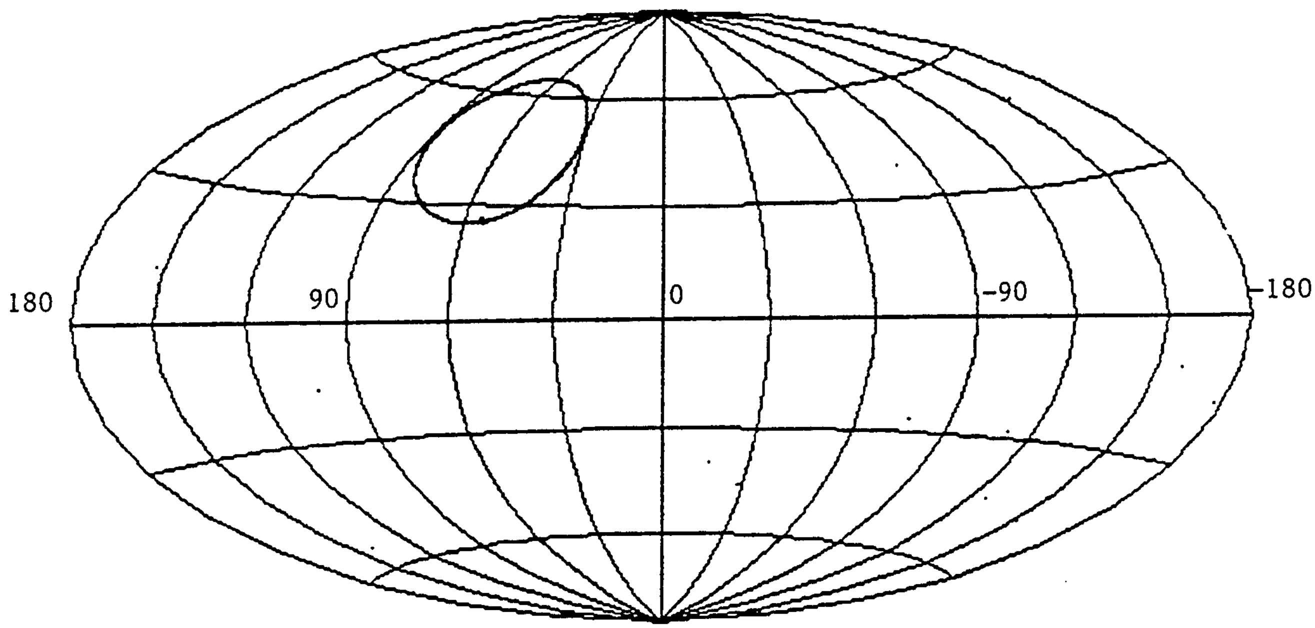


Figure 18. FOV track for: INC = 45, AN =150, MA = 160.

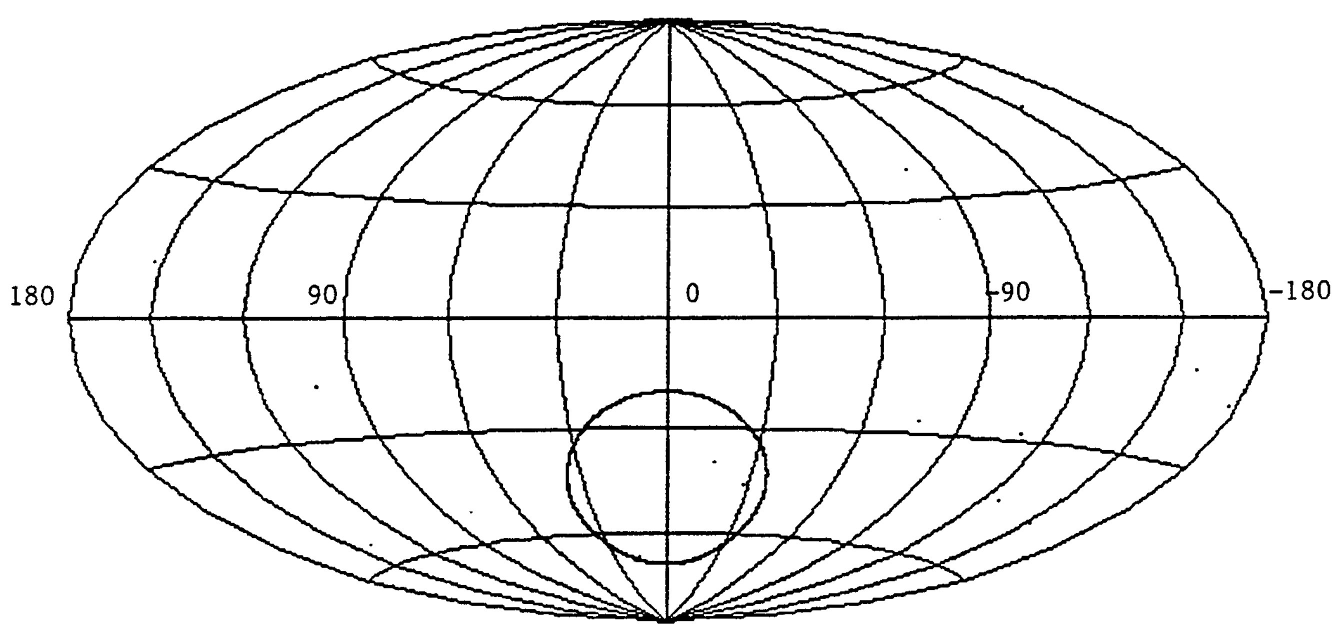


Figure 19. FOV track for: INC = 45, AN = -90, MA = 25.

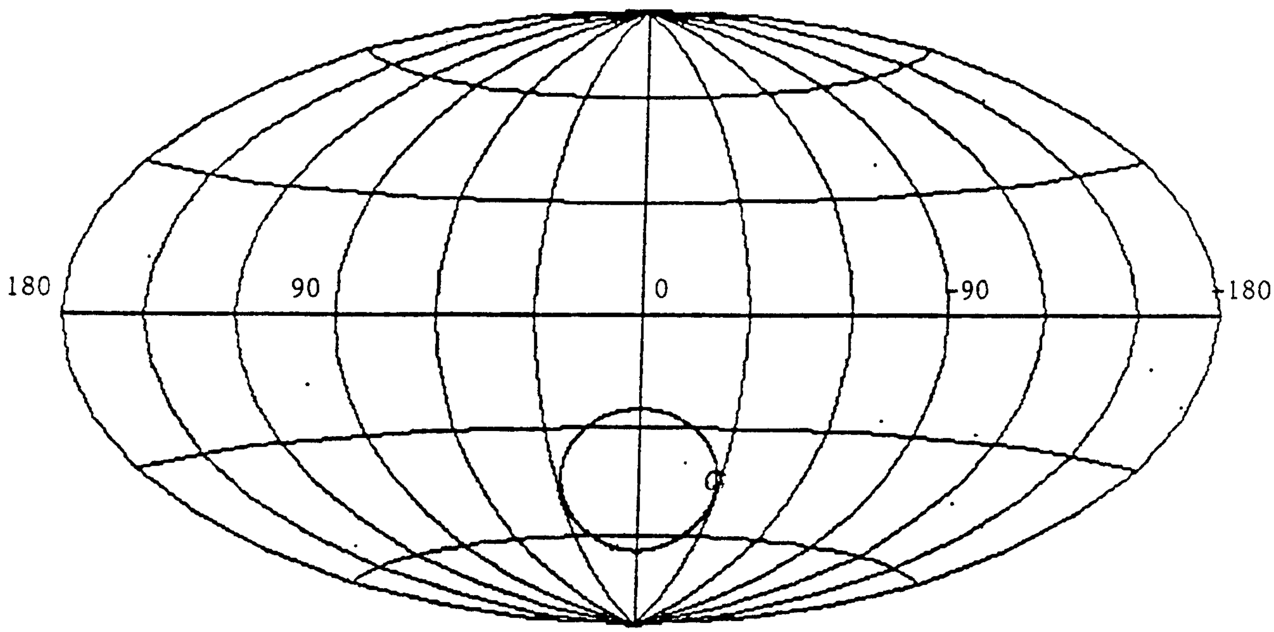


Figure 20. FOV track for: INC = 45, AN = -90, MA = 20.

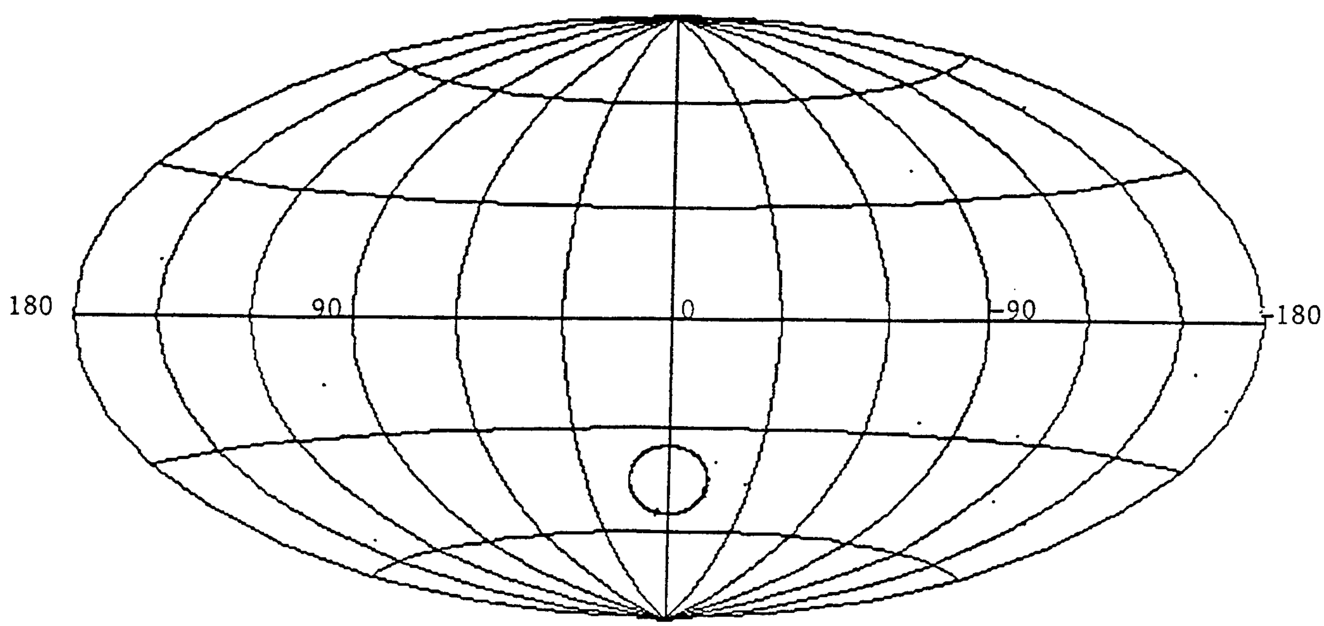


Figure 21. FOV track for: INC = 45, AN = -90, MA = 10.

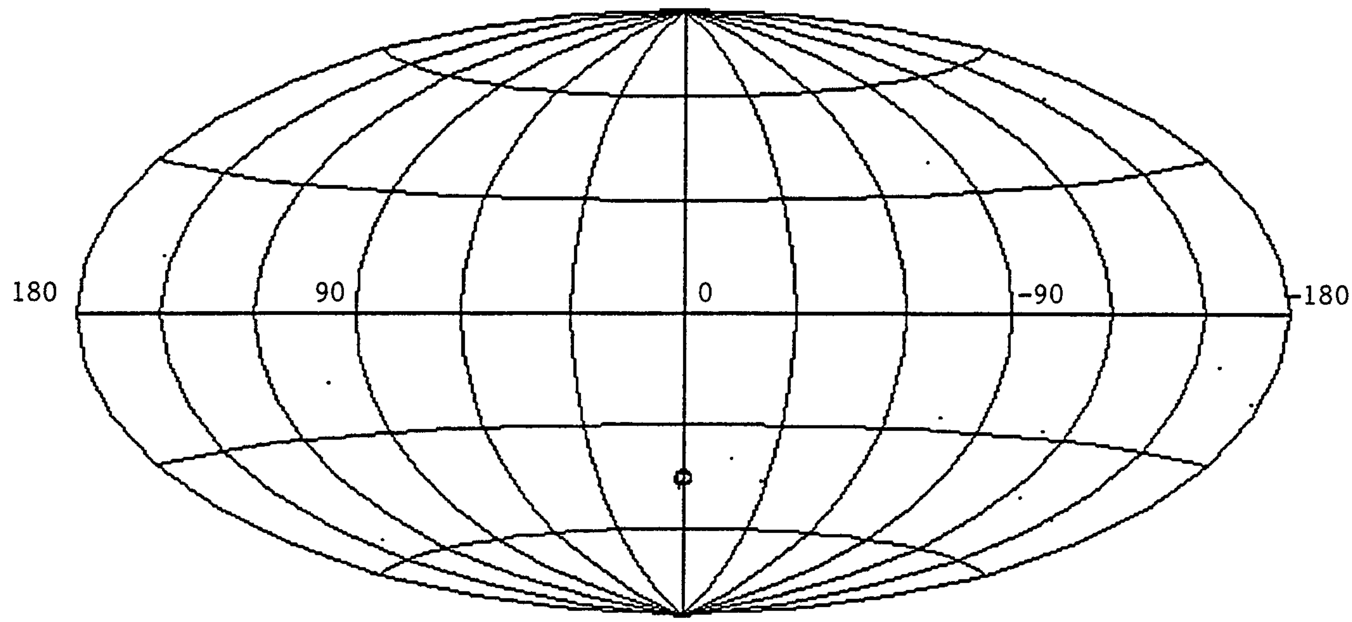


Figure 22. FOV track for: INC = 45, AN = -90, MA = 2.

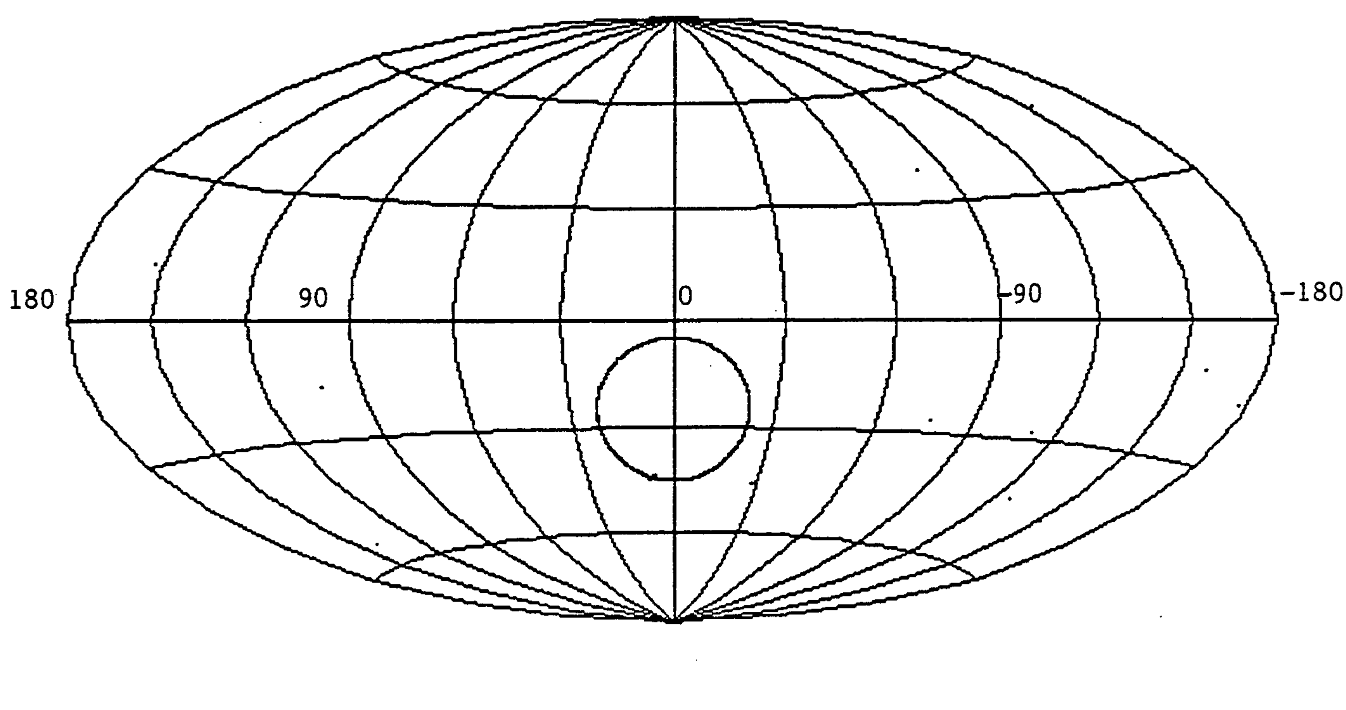


Figure 23. FOV track for: INC = 65, AN =-90, MA = 20.

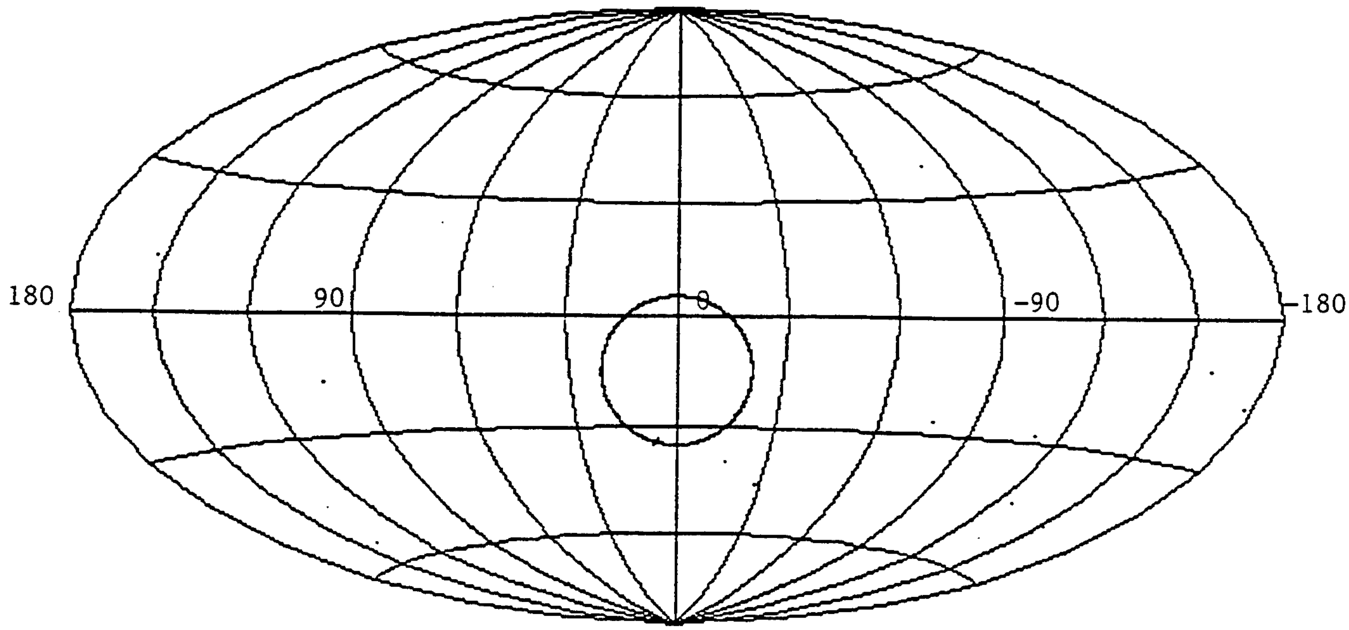


Figure 24. FOV track for: INC = 75, AN =-90, MA = 20.

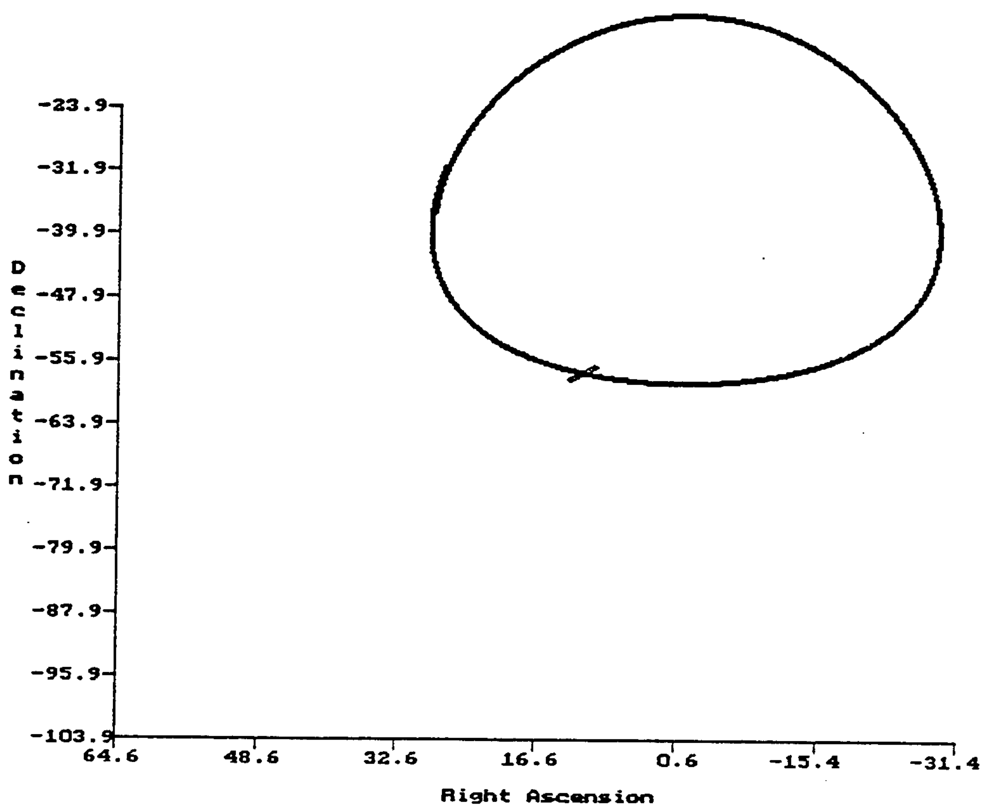


Figure 25. FOV track for: INC = 45, AN = -90, MA = 20.

3. HUP Database

The results of the HUP experiment on Shuttle flight STS39 have been made into a database. These files are on side FPD001 of a worm optical disk, readable on the Laserdrive unit attached to the GPX workstation. They also reside on the Data$Disk (now DUB3, labeled data1). At present, the worm drive is known to the system as DUB4.

There is no directory structure on this optical disk. The following listing of files has been obtained by sorting the directory of FPD001 using certain alphabetical keys, as seemed appropriate.

The master listing of data files is contained in a three-ring binder called 'Hup Data'. It also contains annotated mission timelines that will enable the user to correlate particular segments of the HUP data with the particular 'blocks' being performed by the orbiter crew. At the very rear of the binder are copies of the fifty or so pages that describe Lockheed's account of what portion of the telemetry collected at White Sands is on each original tape; those pages also collect comments made by BC (Brian Donovan) as he accomplished the initial processing of those tapes and extracted raw HUP data from them.

The files named HUPDnnnnn.dat (example, HUPD60653.dat) are as close to raw HUP data from the STS-39 flight as we have. They are still in binary form as extracted from the tapes collected on the ground during the flight. Each such tape could store about 12-13 minutes of telemetry, but those 12 minutes need not have been in one continuous collection (depending on orbiter orientation relative to the TDRS satellites, reception conditions, orbiter schedule, etc.) and a given 'block' of data taking time may appear on more than one tape. The name HUPD60653.dat implies that the data on the tape were collected on MET day 6, beginning at hour 6, somewhere in minute 53. Recall that data from HUP were collected only on MET days 6 and 7.

Those files whose names begin with the character 6 or 7 are the product of processing the raw HUPDnnnnn.dat data files with the program 'spectra.for'. Spectra is an adaptation of Dennis Delorey's program huplock; it strips out the spectral scans in the data, whatever mode HUP may have been in at the time. When HUP was in mode 1, every 80 seconds or so, some 40 seconds of spectra were collected; in mode 2, a new spectral scan should come up every six seconds or so. The spectra in these files have been truncated to include only the first 501 data points; there really is nothing out there at the long wavelength end. In some cases, the output from the spectra program had to be edited to account for false starts, data dropouts; who knows what else. Details on output format and other topics are included in the annotation in spectra.for.

The regular format for the file names in the '6' and '7' series is an extension of the one used in the 'HUPD' series. Example: 6071529.dat means data (almost always from a single 'HUPD' tape) from MET day 6, collected during hour 07 between (sometime in minute) 15 and (sometime in minute) 29. Further example: 607084308.dat means MET day 6 running between hour 07, minute 43, and hour 08, minute 08.

Directory DUB4:[DELGRECO]

HUPD60653.DAT;1	1331	20-FEB-1992	10:23	(RE,RWED,RE,R)
HUPD60715.DAT;1	1331	20-FEB-1992	10:23	(RE,RWED,RE,R)
HUPD60743.DAT;1	1330	20-FEB-1992	10:23	(RE,RWED,RE,R)
HUPD60822.DAT;1	1331	20-FEB-1992	10:24	(RE,RWED,RE,R)
HUPD60836.DAT;1	240	20-FEB-1992	10:24	(RE,RWED,RE,R)
HUPD60837.DAT;1	1331	20-FEB-1992	10:24	(RE,RWED,RE,R)
HUPD60854.DAT;1	1331	20-FEB-1992	10:24	(RE,RWED,RE,R)
HUPD60922.DAT;1	1269	20-FEB-1992	10:24	(RE,RWED,RE,R)
HUPD61053.DAT;1	1331	20-FEB-1992	10:24	(RE,RWED,RE,R)
HUPD61107.DAT;1	1323	20-FEB-1992	10:25	(RE,RWED,RE,R)
HUPD61148.DAT;1	222	20-FEB-1992	16:26	(RE,RWED,RE,R)
HUPD61357.DAT;1	1285	20-FEB-1992	16:26	(RE,RWED,RE,R)
HUPD61410.DAT;1	837	20-FEB-1992	16:27	(RE,RWED,RE,R)
HUPD61416.DAT;1	1331	17-AUG-1991	14:25	(RE,RWED,RE,R)
HUPD61442.DAT;1	1331	17-AUG-1991	14:25	(RE,RWED,RE,R)
HUPD61642.DAT;1	227	17-AUG-1991	14:25	(RE,RWED,RE,R)
HUPD61643.DAT;1	1331	17-AUG-1991	14:25	(RE,RWED,RE,R)
HUPD61657.DAT;1	1068	17-AUG-1991	14:26	(RE,RWED,RE,R)
HUPD61714.DAT;1	1331	17-AUG-1991	14:26	(RE,RWED,RE,R)
HUPD61741.DAT;1	1331	17-AUG-1991	14:26	(RE,RWED,RE,R)
HUPD61753.DAT;1	1312	17-AUG-1991	14:26	(RE,RWED,RE,R)
HUPD61919.DAT;1	1331	17-AUG-1991	14:26	(RE,RWED,RE,R)
HUPD61932.DAT;1	1330	17-AUG-1991	14:27	(RE,RWED,RE,R)
HUPD61952.DAT;1	1119	20-SEP-1991	10:43	(RE,RWED,RE,R)
HUPD62001.DAT;1	1326	17-AUG-1991	14:27	(RE,RWED,RE,R)
HUPD62015.DAT;1	1296	17-AUG-1991	14:27	(RE,RWED,RE,R)
HUPD62029.DAT;1	1331	17-AUG-1991	14:27	(RE,RWED,RE,R)
HUPD62102.DAT;1	977	17-AUG-1991	14:27	(RE,RWED,RE,R)
HUPD62110.DAT;1	1320	17-AUG-1991	14:27	(RE,RWED,RE,R)
HUPD62124.DAT;1	1328	17-AUG-1991	14:27	(RE,RWED,RE,R)
HUPD62138.DAT;1	1331	17-AUG-1991	14:28	(RE,RWED,RE,R)
HUPD62152.DAT;1	1290	17-AUG-1991	14:28	(RE,RWED,RE,R)
HUPD62217.DAT;1	1331	17-AUG-1991	14:28	(RE,RWED,RE,R)
HUPD62250.DAT;2	918	17-AUG-1991	14:28	(RE,RWED,RE,R)
HUPD62300.DAT;1	1315	17-AUG-1991	14:28	(RE,RWED,RE,R)
HUPD70039.DAT;1	1068	17-AUG-1991	14:28	(RE,RWED,RE,R)
HUPD70048.DAT;1	1331	17-AUG-1991	14:28	(RE,RWED,RE,R)
HUPD70102.DAT;1	1331	17-AUG-1991	14:29	(RE,RWED,RE,R)
HUPD70116.DAT;1	249	17-AUG-1991	14:29	(RE,RWED,RE,R)
HUPD70116A.DAT;1	1330	20-SEP-1991	10:44	(RE,RWED,RE,R)
HUPD70130.DAT;1	1326	17-AUG-1991	14:29	(RE,RWED,RE,R)
HUPD70147.DAT;1	1328	17-AUG-1991	14:29	(RE,RWED,RE,R)
HUPD70201.DAT;1	1326	17-AUG-1991	14:29	(RE,RWED,RE,R)
HUPD70215.DAT;1	1330	17-AUG-1991	14:29	(RE,RWED,RE,R)
HUPD70246.DAT;1	1121	17-AUG-1991	14:29	(RE,RWED,RE,R)
HUPD70317.DAT;2	1325	17-AUG-1991	14:30	(RE,RWED,RE,R)
HUPD70331.DAT;2	1301	17-AUG-1991	14:30	(RE,RWED,RE,R)
HUPD70342.DAT;2	1328	17-AUG-1991	14:30	(RE,RWED,RE,R)
HUPD70356.DAT;2	1255	17-AUG-1991	14:30	(RE,RWED,RE,R)
HUPD70438.DAT;2	1282	17-AUG-1991	14:30	(RE,RWED,RE,R)
HUPD70500.DAT;2	1105	17-AUG-1991	14:30	(RE,RWED,RE,R)
HUPD70606.DAT;1	1326	17-AUG-1991	14:30	(RE,RWED,RE,R)

HUPD70624.DAT;1	1331	17-AUG-1991	14:31	(RE,RWED,RE,R)
HUPD70635.DAT;1	1331	17-AUG-1991	14:31	(RE,RWED,RE,R)
HUPD70649.DAT;1	1330	20-SEP-1991	10:44	(RE,RWED,RE,R)
HUPD70706.DAT;1	1331	17-AUG-1991	14:31	(RE,RWED,RE,R)
HUPD70720.DAT;1	1330	17-AUG-1991	14:31	(RE,RWED,RE,R)
HUPD70732.DAT;1	1326	17-AUG-1991	14:31	(RE,RWED,RE,R)
HUPD70746.DAT;1	1280	17-AUG-1991	14:31	(RE,RWED,RE,R)
HUPD70838.DAT;1	1331	17-AUG-1991	14:32	(RE,RWED,RE,R)
HUPD70852.DAT;1	1322	17-AUG-1991	14:32	(RE,RWED,RE,R)
HUPD70949.DAT;2	1221	17-AUG-1991	14:32	(RE,RWED,RE,R)
HUPD71001.DAT;2	1331	17-AUG-1991	14:32	(RE,RWED,RE,R)
HUPD71015.DAT;2	313	17-AUG-1991	14:32	(RE,RWED,RE,R)
HUPD71017.DAT;1	1331	17-AUG-1991	14:32	(RE,RWED,RE,R)
HUPD71100.DAT;1	1331	17-AUG-1991	14:33	(RE,RWED,RE,R)
HUPD71129.DAT;1	1331	17-AUG-1991	14:33	(RE,RWED,RE,R)
HUPD71143.DAT;1	1331	17-AUG-1991	14:33	(RE,RWED,RE,R)
HUPD71157A.DAT;1	222	17-AUG-1991	14:33	(RE,RWED,RE,R)
HUPD71157B.DAT;1	1331	17-AUG-1991	14:33	(RE,RWED,RE,R)
HUPD71259.DAT;1	1258	17-AUG-1991	14:33	(RE,RWED,RE,R)
HUPD71310.DAT;1	1331	17-AUG-1991	14:33	(RE,RWED,RE,R)
HUPD71324.DAT;1	1189	17-AUG-1991	14:34	(RE,RWED,RE,R)
HUPD71421.DAT;1	1331	17-AUG-1991	14:34	(RE,RWED,RE,R)
HUPD71438.DAT;1	1264	17-AUG-1991	14:34	(RE,RWED,RE,R)
HUPD71449.DAT;1	997	17-AUG-1991	14:34	(RE,RWED,RE,R)

Total of 76 files, 90983 blocks.

Directory DUB4:[DELGRECO]

607084308.DAT;1	3542	20-FEB-1992	16:48	(RE,RWED,RE,R)
6071529.DAT;1	3618	20-FEB-1992	16:48	(RE,RWED,RE,R)
608095408.DAT;1	3631	20-FEB-1992	16:49	(RE,RWED,RE,R)
6082236.DAT;1	3621	20-FEB-1992	16:49	(RE,RWED,RE,R)
6083754.DAT;1	3567	20-FEB-1992	16:50	(RE,RWED,RE,R)
6092253.DAT;1	3389	20-FEB-1992	16:50	(RE,RWED,RE,R)
610115307.DAT;1	3569	20-FEB-1992	16:50	(RE,RWED,RE,R)
6110747.DAT;1	3440	20-FEB-1992	16:51	(RE,RWED,RE,R)
6114850.DAT;1	593	20-FEB-1992	16:51	(RE,RWED,RE,R)
613145709.DAT;1	3160	20-FEB-1992	16:52	(RE,RWED,RE,R)
6141018.DAT;1	2244	20-FEB-1992	16:52	(RE,RWED,RE,R)
6141642.DAT;1	3516	17-AUG-1991	14:42	(RE,RWED,RE,R)
6144250.DAT;1	2115	17-AUG-1991	14:42	(RE,RWED,RE,R)
616175707.DAT;1	994	17-AUG-1991	14:43	(RE,RWED,RE,R)
6164244.DAT;1	561	17-AUG-1991	14:43	(RE,RWED,RE,R)
6164357.DAT;1	3516	17-AUG-1991	14:43	(RE,RWED,RE,R)
6171539.DAT;1	943	17-AUG-1991	14:43	(RE,RWED,RE,R)
617195419.DAT;1	867	17-AUG-1991	14:43	(RE,RWED,RE,R)
6174154.DAT;1	1045	17-AUG-1991	14:43	(RE,RWED,RE,R)
6191932.DAT;1	943	17-AUG-1991	14:44	(RE,RWED,RE,R)
619205302.DAT;1	765	20-SEP-1991	10:40	(RE,RWED,RE,R)
6193451.DAT;1	841	17-AUG-1991	14:44	(RE,RWED,RE,R)
6200220.DAT;1	867	17-AUG-1991	14:44	(RE,RWED,RE,R)

6201528.DAT;1	943	17-AUG-1991	14:44	(RE,RWED,RE,R)
620213002.DAT;1	700	17-AUG-1991	14:44	(RE,RWED,RE,R)
6210213.DAT;1	688	17-AUG-1991	14:44	(RE,RWED,RE,R)
6211022.DAT;2	765	17-AUG-1991	14:44	(RE,RWED,RE,R)
621225605.DAT;1	663	17-AUG-1991	14:44	(RE,RWED,RE,R)
6212437.DAT;2	943	17-AUG-1991	14:45	(RE,RWED,RE,R)
6213952.DAT;1	936	17-AUG-1991	14:45	(RE,RWED,RE,R)
6215259.DAT;2	536	17-AUG-1991	14:45	(RE,RWED,RE,R)
6223949.DAT;1	714	17-AUG-1991	14:45	(RE,RWED,RE,R)
6225059.DAT;1	739	23-SEP-1991	11:48	(RE,RWED,RE,R)
6723002939.DAT;1	943	17-AUG-1991	14:45	(RE,RWED,RE,R)

Total of 34 files, 59917 blocks.

Directory DUB4:[DELGRECO]

700014900.DAT;1	816	17-AUG-1991	15:05	(RE,RWED,RE,R)
7004049.DAT;1	739	17-AUG-1991	15:05	(RE,RWED,RE,R)
7010216.DAT;1	1071	17-AUG-1991	15:05	(RE,RWED,RE,R)
7011718.DAT;1	153	17-AUG-1991	15:06	(RE,RWED,RE,R)
7011728.DAT;1	918	20-SEP-1991	10:42	(RE,RWED,RE,R)
7013046.DAT;1	892	17-AUG-1991	15:06	(RE,RWED,RE,R)
7014759.DAT;1	739	17-AUG-1991	15:06	(RE,RWED,RE,R)
7020315.DAT;1	3261	17-AUG-1991	15:06	(RE,RWED,RE,R)
7021546.DAT;1	3389	17-AUG-1991	15:06	(RE,RWED,RE,R)
7024657.DAT;1	2930	17-AUG-1991	15:07	(RE,RWED,RE,R)
703045612.DAT;1	2370	17-AUG-1991	15:07	(RE,RWED,RE,R)
7031731.DAT;1	2574	17-AUG-1991	15:08	(RE,RWED,RE,R)
7033144.DAT;1	2242	17-AUG-1991	15:08	(RE,RWED,RE,R)
7034256.DAT;1	3007	17-AUG-1991	15:08	(RE,RWED,RE,R)
704053800.DAT;1	1835	17-AUG-1991	15:09	(RE,RWED,RE,R)
7050111.DAT;1	1580	17-AUG-1991	15:09	(RE,RWED,RE,R)
7060623.DAT;1	2548	17-AUG-1991	15:09	(RE,RWED,RE,R)
706074903.DAT;1	2854	20-SEP-1991	10:40	(RE,RWED,RE,R)
7062437.DAT;1	2319	17-AUG-1991	15:10	(RE,RWED,RE,R)
7063749.DAT;1	2599	17-AUG-1991	15:10	(RE,RWED,RE,R)
7070619.DAT;1	3134	17-AUG-1991	15:10	(RE,RWED,RE,R)
707084640.DAT;2	2574	9-JAN-1992	16:49	(RE,RWED,RE,R)
7072134.DAT;1	2548	17-AUG-1991	15:11	(RE,RWED,RE,R)
7073346.DAT;1	2013	17-AUG-1991	15:11	(RE,RWED,RE,R)
708095249.DAT;1	3134	17-AUG-1991	15:12	(RE,RWED,RE,R)
7083852.DAT;1	3491	17-AUG-1991	15:12	(RE,RWED,RE,R)
709104901.DAT;1	3058	17-AUG-1991	15:13	(RE,RWED,RE,R)
7100115.DAT;1	3516	17-AUG-1991	15:13	(RE,RWED,RE,R)
710111700.DAT;1	3389	17-AUG-1991	15:13	(RE,RWED,RE,R)
7101518.DAT;1	818	17-AUG-1991	15:14	(RE,RWED,RE,R)
7110031.DAT;1	3440	17-AUG-1991	15:14	(RE,RWED,RE,R)
711125759.DAT;1	3058	17-AUG-1991	15:14	(RE,RWED,RE,R)
7112943.DAT;1	3516	17-AUG-1991	15:15	(RE,RWED,RE,R)
7114357.DAT;1	3491	17-AUG-1991	15:15	(RE,RWED,RE,R)
7115759.DAT;1	561	17-AUG-1991	15:16	(RE,RWED,RE,R)
712135912.DAT;1	3134	17-AUG-1991	15:16	(RE,RWED,RE,R)

7131021.DAT;1	3426	17-AUG-1991	15:16	(RE,RWED,RE,R)
7132024.DAT;1	1159	17-AUG-1991	15:17	(RE,RWED,RE,R)
7132436.DAT;1	2726	17-AUG-1991	15:17	(RE,RWED,RE,R)
7142138.DAT;1	2395	17-AUG-1991	15:18	(RE,RWED,RE,R)
7143851.DAT;1	2956	17-AUG-1991	15:18	(RE,RWED,RE,R)
7144959.DAT;1	2574	17-AUG-1991	15:19	(RE,RWED,RE,R)

Total of 42 files, 98947 blocks.

The A7....dat files are the result of passing cleaned up spectra from the times indicated through hupave (average 1). The AC....dat and AV....dat files are consolidated spectra from the times indicated passed through hupave (average 6 generally).

Directory DUB4:[DELGRECO]

A700014900.DAT;1	236	9-JAN-1992	16:50	(RE,RWED,RE,R)
A7004049.DAT;1	214	9-JAN-1992	16:50	(RE,RWED,RE,R)
A7010216.DAT;1	309	9-JAN-1992	16:50	(RE,RWED,RE,R)
A7011728.DAT;1	265	9-JAN-1992	16:50	(RE,RWED,RE,R)
A7013046.DAT;1	258	9-JAN-1992	16:50	(RE,RWED,RE,R)
AC621223949.DAT;2	133	1-OCT-1991	15:21	(RE,RWED,RE,R)
AC7020357.DAT;1	464	1-OCT-1991	15:22	(RE,RWED,RE,R)
AC706072403.DAT;1	309	9-JAN-1992	16:56	(RE,RWED,RE,R)
AC708902802.DAT;1	353	1-OCT-1991	15:22	(RE,RWED,RE,R)
AC709104618.DAT;2	383	2-OCT-1991	14:50	(RE,RWED,RE,R)
AC711124306.DAT;1	273	1-OCT-1991	16:59	(RE,RWED,RE,R)
AC7112143.DAT;1	265	1-OCT-1991	16:59	(RE,RWED,RE,R)
AC7130231.DAT;2	324	9-JAN-1992	16:58	(RE,RWED,RE,R)
ACUVLIM1.DAT;1	522	9-JAN-1992	16:59	(RE,RWED,RE,R)
AV020357.DAT;1	456	9-JAN-1992	17:00	(RE,RWED,RE,R)
AV708092802.DAT;1	353	9-JAN-1992	17:01	(RE,RWED,RE,R)
AV709104618.DAT;1	383	9-JAN-1992	17:01	(RE,RWED,RE,R)

Total of 17 files, 5500 blocks.

B791P.dat is spectra from the BAY to EARTH block starting MET day 7, hour 9, minute 46, to hour 10, minute 18, passed through hupave (average 1). B791P1.dat is the result of passing B791p.dat through pntval.

Directory DUB4:[DELGRECO]

B791P.DAT;1	2287	9-JAN-1992	17:05	(RE,RWED,RE,R)
B791P1.DAT;2	104	9-JAN-1992	17:03	(RE,RWED,RE,R)

Total of 2 files, 2391 blocks.

The C6...dat, C7...dat and CBTE79.dat files are cleaned up, consolidated raw spectra taken during the times indicated in the file names. These files were used as input data to hupave.CACUVLIM1.dat is a treatment of UVLIM I data, passed through hupave (average 6) and an early version of pntval with no conversion to Rayleighs included. Historical interest only.

Directory DUB4:[DELGRECO]

C621223949.DAT;1	2574	26-SEP-1991	18:10	(RE,RWED,RE,R)
C7020357.DAT;1	9503	27-SEP-1991	15:32	(RE,RWED,RE,R)
C706072403.DAT;1	7694	9-JAN-1992	17:06	(RE,RWED,RE,R)
C708092802.DAT;1	7261	26-SEP-1991	18:11	(RE,RWED,RE,R)
C709104618.DAT;1	7924	26-SEP-1991	18:12	(RE,RWED,RE,R)
C711124306.DAT;1	5656	1-OCT-1991	17:00	(RE,RWED,RE,R)
C7112143.DAT;1	5503	1-OCT-1991	17:00	(RE,RWED,RE,R)
C7130231.DAT;1	7032	7-OCT-1991	16:31	(RE,RWED,RE,R)
CACUVLIM1.DAT;1	17	9-JAN-1992	17:08	(RE,RWED,RE,R)
CBTE79.DAT;1	7924	9-JAN-1992	17:09	(RE,RWED,RE,R)
CQBTE72.DAT;1	9503	9-JAN-1992	17:10	(RE,RWED,RE,R)
CQLIM78.DAT;1	7261	9-JAN-1992	17:14	(RE,RWED,RE,R)

Total of 12 files, 77852 blocks.

GGN1741AV1.dat contains spectra passed through hupave (average 1) from the GGN block MET day 6 hour 17, minutes 41-54. GGNSPECT.dat is a subset of the above from the first minute of data.

Directory DUB4:[DELGRECO]

GGN1741AV1.DAT;1	302	9-JAN-1992	17:15	(RE,RWED,RE,R)
GGNSPECT.DAT;1	30	9-JAN-1992	17:16	(RE,RWED,RE,R)

Total of 2 files, 332 blocks.

All these files are the result of treating spectra processed with hupave (average 6) and an early version of pntval that did not provide any conversion to Rayleighs. This treatment did not prove useful.

Directory DUB4:[DELGRECO]

PACUVLIM2.DAT;2	11	9-JAN-1992	17:23	(RE,RWED,RE,R)
PC621223949.DAT;1	5	9-JAN-1992	17:23	(RE,RWED,RE,R)
PC7020357.DAT;1	16	9-JAN-1992	17:23	(RE,RWED,RE,R)
PC708092802.DAT;1	12	9-JAN-1992	17:23	(RE,RWED,RE,R)
PC709104618.DAT;1	13	9-JAN-1992	17:23	(RE,RWED,RE,R)
PC711124306.DAT;1	9	9-JAN-1992	17:23	(RE,RWED,RE,R)
PC7112143.DAT;1	9	9-JAN-1992	17:23	(RE,RWED,RE,R)
PC7130231.DAT;1	11	9-JAN-1992	17:23	(RE,RWED,RE,R)
PQRAM.DAT;1	10	9-JAN-1992	17:23	(RE,RWED,RE,R)

PR621223949.DAT;1	5	9-JAN-1992	17:23	(RE,RWED,RE,R)
PR7020357.DAT;1	16	9-JAN-1992	17:23	(RE,RWED,RE,R)
PR708092802.DAT;1	12	9-JAN-1992	17:23	(RE,RWED,RE,R)
PR709104618.DAT;1	13	9-JAN-1992	17:23	(RE,RWED,RE,R)
PR711124306.DAT;1	9	9-JAN-1992	17:23	(RE,RWED,RE,R)
PR7112143.DAT;1	9	9-JAN-1992	17:23	(RE,RWED,RE,R)
PR7130231.DAT;1	11	9-JAN-1992	17:23	(RE,RWED,RE,R)
PRC.DAT;2	15	9-JAN-1992	17:23	(RE,RWED,RE,R)

Total of 17 files, 186 blocks

QB721P.dat collects all the usable data from the QRAM BAY to EARTHblock starting MET day 7, hour 2, after passing edited raw spectra through hupave (averaging 1). QB721P1.dat is the result of passing QB721P.dat through pntval. QB721PA.dat is a subset of QB721P.dat starting at minute 34 of the MET hour. QB721P1A.dat is the result of passing QB721PA.dat through pntval. The QBTE621...files are from the QRAM BAY to EARTH block MET day 6, hour 21. and are final products after both hupave and pntval processing of these mode-1 data. File...21A is a subset running only from minutes 39 to 43. QL781P.dat is spectra from the QRAM LIMB block taken MET day 7, hour 8, minute 28-63, after passage through hupave (average of 1). QL781P1.dat is the result of processing QL781P.dat through pntval.

Directory DUB4:[DELGRECO]

QB721P.DAT;1	2735	9-JAN-1992	17:25	(RE,RWED,RE,R)
QB721P1.DAT;2	124	9-JAN-1992	17:25	(RE,RWED,RE,R)
QB721P1A.DAT;2	75	9-JAN-1992	17:25	(RE,RWED,RE,R)
QB721PA.DAT;2	1647	9-JAN-1992	17:25	(RE,RWED,RE,R)
QBTE621.DAT;2	25	14-JAN-1992	09:22	(RE,RWED,RE,R)
QBTE621A.DAT;2	5	14-JAN-1992	09:23	(RE,RWED,RE,R)
QBTE6SZA.DAT;2	1	14-JAN-1992	09:23	(RE,RWED,RE,R)
QL781P.DAT;1	2096	9-JAN-1992	17:25	(RE,RWED,RE,R)
QL781P1.DAT;2	95	9-JAN-1992	17:26	(RE,RWED,RE,R)

Total of 9 files, 6803 blocks.

These files were mostly testing programs, the result of averaging the spectral data from 6 successive scans using pntval and converting results to Rayleighs.

Directory DUB4:[DELGRECO]

RACUVLIM1.DAT;1	17	9-JAN-1992	17:27	(RE,RWED,RE,R)
RACUVLIM2.DAT;2	11	9-JAN-1992	17:27	(RE,RWED,RE,R)
RAV7020357.DAT;2	15	9-JAN-1992	17:27	(RE,RWED,RE,R)
RAV708092802.DAT;2	11	9-JAN-1992	17:27	(RE,RWED,RE,R)
RAV709104618.DAT;2	12	9-JAN-1992	17:27	(RE,RWED,RE,R)
RQRAM.DAT;1	10	9-JAN-1992	17:27	(RE,RWED,RE,R)

Total of 6 files, 76 blocks

These files preserve the results of processing mode-1 limb scan data at the constant wavelength settings of 175 and 194 with the program 'test80.for', which averaged counts from 80 successive clockpulses of collection. Signals are pretty weak, since the settings missed the peak of the lines.

Directory DUB4:[DELGRECO]

T61714.DAT;1	25	9-JAN-1992	17:28	(RE,RWED,RE,R)
T62029.DAT;1	17	9-JAN-1992	17:28	(RE,RWED,RE,R)
T62102.DAT;1	19	9-JAN-1992	17:28	(RE,RWED,RE,R)
T62110.DAT;1	26	9-JAN-1992	17:28	(RE,RWED,RE,R)
T62124.DAT;1	26	9-JAN-1992	17:28	(RE,RWED,RE,R)
T62138.DAT;1	24	9-JAN-1992	17:28	(RE,RWED,RE,R)
T62152.DAT;1	24	9-JAN-1992	17:28	(RE,RWED,RE,R)
T62217.DAT;1	28	9-JAN-1992	17:28	(RE,RWED,RE,R)
T62250.DAT;1	16	9-JAN-1992	17:28	(RE,RWED,RE,R)
T70048.DAT;1	26	9-JAN-1992	17:28	(RE,RWED,RE,R)
T70102.DAT;1	24	9-JAN-1992	17:28	(RE,RWED,RE,R)
T70116.DAT;1	25	9-JAN-1992	17:28	(RE,RWED,RE,R)
T70130.DAT;1	23	9-JAN-1992	17:28	(RE,RWED,RE,R)
T80.DAT;1	24	9-JAN-1992	17:28	(RE,RWED,RE,R)
TEST40.DAT;1	46	9-JAN-1992	17:28	(RE,RWED,RE,R)

Total of 15 files, 373 blocks.

These are files from the UVLIM experiment. UV11.dat and UV21.dat should be considered the basic files here. The raw data processed by 'spectra' was combined into files representing the usable parts of the UVLIM I and UVLIM II blocks. Those files were then passed through the program 'hupave', which 'averaged' one spectralscan at a time (basically a null operation), converted to a floating point value at each spectral point, and wrote out the points in a reformatted file suitable for input to 'pntval'. Then UV11P1.dat shows the result of processing UV11.dat (the UVLIM I file) through pntval. Similarly, UV21P1.dat and UV21.dat show the results of processing the UVLIM II file through pntval. UV11.dat and UV21.dat were renamed to their present names on 10-JUN-1993; otherwise unchanged. The other files are iterations on processing these data. UVLIM III data of acceptable quality are scanty so they have not been taken to this level. For UVLIM III, HUP seemed not to drive reliably in wavelength during most of the block.

UV11.DAT;1	3125	10-JUN-1993	17:28	(RE,RWED,RE,R)
UV11P.DAT;1	19	9-JAN-1992	17:29	(RE,RWED,RE,R)
UV11P1.DAT;1	142	9-JAN-1992	17:29	(RE,RWED,RE,R)
UV15P.DAT;1	625	9-JAN-1992	17:29	(RE,RWED,RE,R)
UV1P.DAT;2	142	9-JAN-1992	17:29	(RE,RWED,RE,R)
UV1P1.DAT;4	142	9-JAN-1992	17:29	(RE,RWED,RE,R)
UV1P5.DAT;3	29	9-JAN-1992	17:29	(RE,RWED,RE,R)
UV21.DAT;1	1912	10-JUN-1993	17:29	(RE,RWED,RE,R)
UV21P1.DAT;2	87	9-JAN-1992	17:29	(RE,RWED,RE,R)

Total of 9 files, 6223 blocks.

The following are source files for the programs used on the LIUGPX to work on HUP data from STS-39. The files have extensive annotation.

Directory DUB4:[DELGRECO]

```
ANGLES.FOR;2          21    7-NOV-1991 17:28   (RE,RWED,RE,R)
HUPAV1.FOR;1           6    7-NOV-1991 17:28   (RE,RWED,RE,R)
HUPAV2.FOR;1           6    7-NOV-1991 17:28   (RE,RWED,RE,R)
HUPAVE.FOR;1           7    9-JAN-1992 17:16   (RE,RWED,RE,R)
HUPLOCK.FOR;1         11    7-NOV-1991 17:28   (RE,RWED,RE,R)
HUPTIME.FOR;1          2    7-NOV-1991 17:28   (RE,RWED,RE,R)
PNTVAL.FOR;1          14    9-JAN-1992 17:32   (RE,RWED,RE,R)
POINTS.FOR;1           8    7-NOV-1991 17:28   (RE,RWED,RE,R)
SCAN40.FOR;8          21    9-JAN-1992 17:33   (RE,RWED,RE,R)
SCAN40.FOR;7          21    7-NOV-1991 17:28   (RE,RWED,RE,R)
SCAN80.FOR;5          21    9-JAN-1992 17:33   (RE,RWED,RE,R)
SCAN80.FOR;4          21    7-NOV-1991 17:28   (RE,RWED,RE,R)
SENSCALC.FOR;9         5    9-JAN-1992 17:33   (RE,RWED,RE,R)
SPECTRA.FOR;2         17    9-JAN-1992 17:33   (RE,RWED,RE,R)
SPECTRA.FOR;1         17    7-NOV-1991 17:28   (RE,RWED,RE,R)
TEST40.FOR;4          22    9-JAN-1992 17:37   (RE,RWED,RE,R)
TEST80.FOR;6          21    9-JAN-1992 17:37   (RE,RWED,RE,R)
TEST81.FOR;2          22    9-JAN-1992 17:37   (RE,RWED,RE,R)
```

Total of 18 files, 263 blocks.

Note that the following *.exe files were compiled on the LIUGPX when it was operating with VMS version 4.2. Sources will have to be recompiled to operate under the current VMS V5.4.

Directory DUB4:[DELGRECO]

```
ANGLES.EXE;2          11    7-NOV-1991 17:28   (RE,RWED,RE,R)
HUPAV1.EXE;1           7    7-NOV-1991 17:28   (RE,RWED,RE,R)
HUPAV2.EXE;1           7    7-NOV-1991 17:28   (RE,RWED,RE,R)
HUPAVE.EXE;1           7    9-JAN-1992 17:16   (RE,RWED,RE,R)
HUPLOCK.EXE;1         11    7-NOV-1991 17:28   (RE,RWED,RE,R)
HUPTIME.EXE;1          6    7-NOV-1991 17:28   (RE,RWED,RE,R)
POINTS.EXE;1          11    7-NOV-1991 17:28   (RE,RWED,RE,R)
SCAN40.EXE;3          10    7-NOV-1991 17:28   (RE,RWED,RE,R)
SCAN80.EXE;2          10    7-NOV-1991 17:28   (RE,RWED,RE,R)
SPECTRA.EXE;1         12    7-NOV-1991 17:28   (RE,RWED,RE,R)
```

Total of 10 files, 92 blocks.

These are some of the VAX 'format' IDL routines for processing and plotting HUP STS-39 data, usually output from pntval.

Directory DUB4:[DELGRECO]

```
PL12.PRO;2          7   9-JAN-1992 17:31   (RE,RWED,RE,R)
PLPK12.PRO;20       6   9-JAN-1992 17:31   (RE,RWED,RE,R)
PLPK35.PRO;11       6   9-JAN-1992 17:31   (RE,RWED,RE,R)
```

Total of 3 files, 19 blocks

4. Full Ovals

The PolarBEAR data transmissions were recorded at different tracking stations, but primarily from Sondrestrom, Greenland, and Tromso, Sweden. These two stations were thought to always record simultaneously. However, it was noticed that the Sondrestrom scan on day 025 1987, ran from 0609 to 0617 ut and Tromso, from 0617 to 0625 ut. By concatenating these two scans a fairly complete image of the Auroral Oval was obtained. (Figures 27 to 30)

A partial search of the AIRS data logs, from day 022 1987 to day 077 1987, produced the list as see in Table 6. More are expected to be found.

Table 6. UT times for full auroral ovals as seen in the AIRS data-transmission log.

	SONDRESTROM		TROMSO		
1987 DAY	START	END	START	END	COMMENTS
022	0625	0632	0634	0641	no Sondrestrom data
025	0609	0617	0617	0625	Fig. 26
028	0554	0602	0601	0609	Fig. 27
031	0538	0546	0546	0554	Sondre data broken
034	0523	0531	0531	0539	Fig. 28
037	0507	0515	0515	0527	Fig. 29
043	0436	0445	0444	0452	Good image
046	0420	0429	0429	0437	Good image
049	0405	0414	0413	0421	Good image
050	0436	0444	0443	0452	Good image
052	0349	0359	0358	0405	Good image
053	0421	0428	0428	0434	dropout in middle
056	0405	0413	0413	0421	Good image
058	0318	0328	0327	0335	data broken
065	0319	0327	0326	0359	no image
074	0232	0241	0240	0248	big rolls
077	0216	0225	0225	0233	big rolls

A request was made to search the AIRS database for images that coincide with AFPL all-sky-camera images obtained at Qaanaaq, Greenland.

One matching auroral oval image was found for 25 Jan 1987 at 0600 ut. There was good agreement between the ground and satellite images. Both displayed an arc at the same location. Investigators studying the Hudson Bay all-sky-camera photos were pleased with the AIRS ultraviolet auroral oval images provided them last quarter and have requested another set of images from four successive orbits so that a comparison can be made with their bottom side auroral images. The desired times were from Jan 26 1987 2000hrs to Jan 27 1987. They were provide with images (Figures 30 - 33). These bracket the desired time and show how the auroral oval changed at 1hr-and-46min orbital passes.

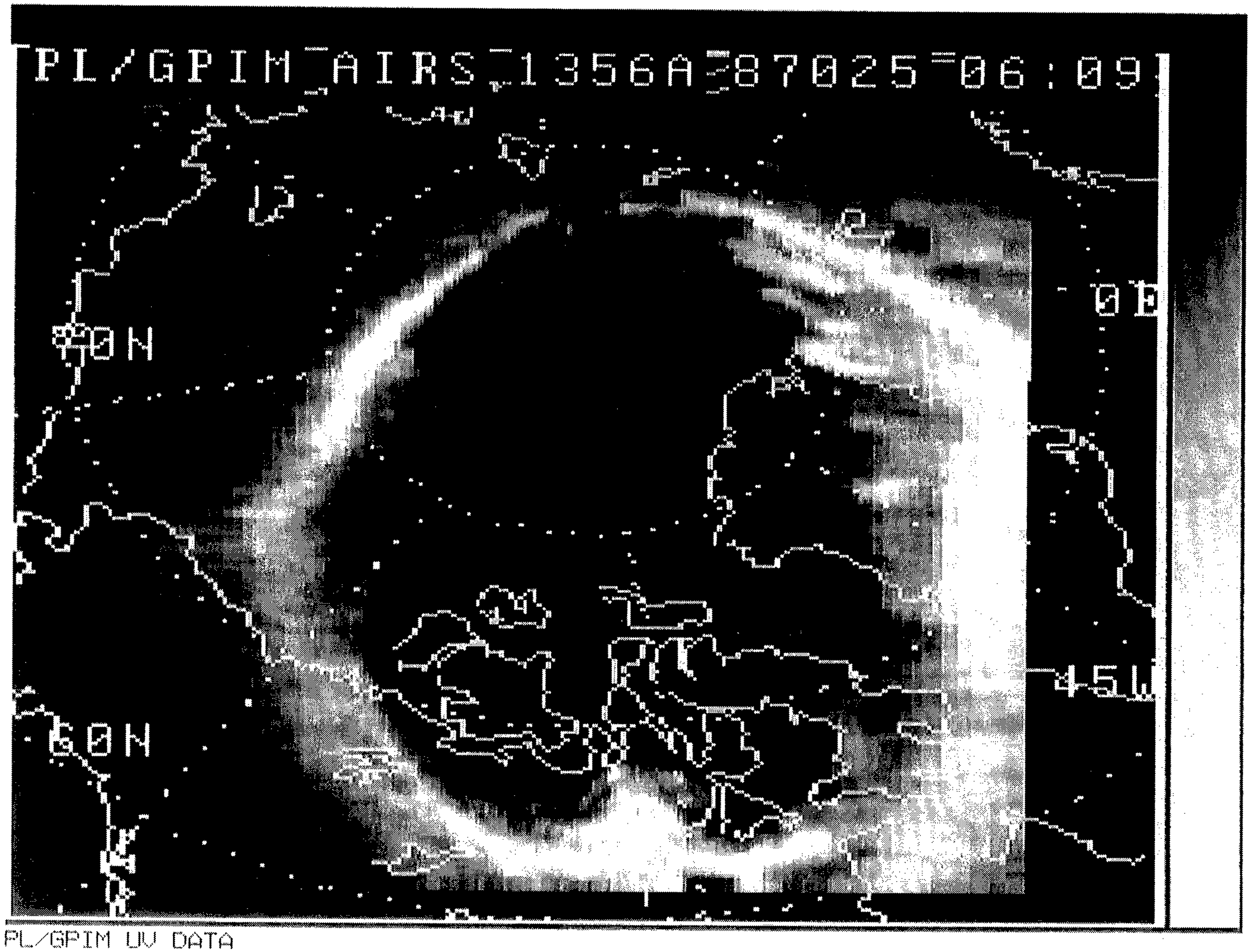


Figure 26. Image of 1356Å radiation of atomic oxygen being emitted by the Auroral Oval. This emission was detected by the AIRS experiment on board the PolarBEAR satellite 1/25/78 0609ut.

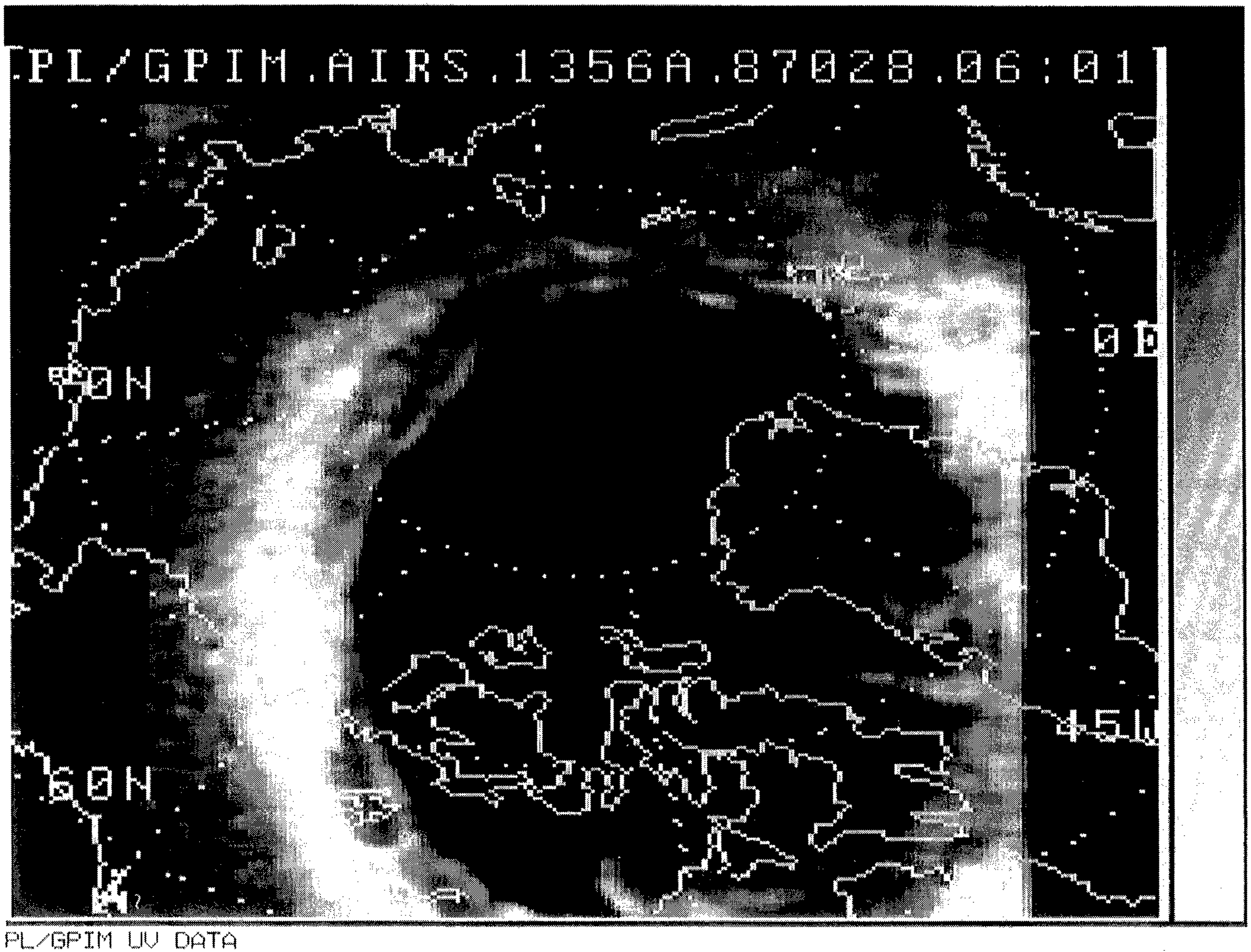


Figure 27. Image of 1356Å radiation of atomic oxygen being emitted by the Auroral Oval. This emission was detected by the AIRS experiment on board the PolarBEAR satellite 1/28/78 0601ut.

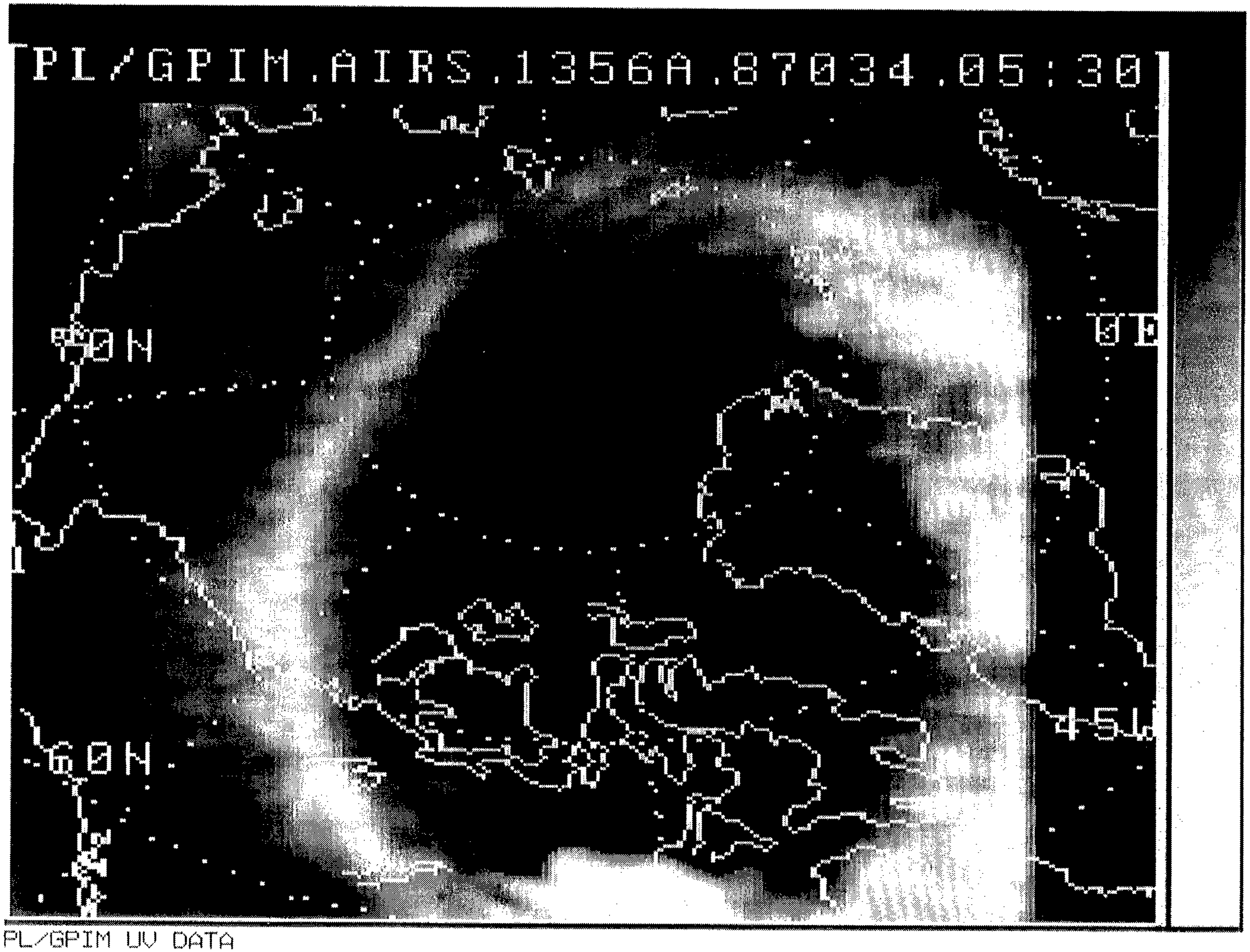


Figure 28. Image of 1356Å radiation of atomic oxygen being emitted by the Auroral Oval. This emission was detected by the AIRS experiment on board the PolarBEAR satellite 1/34/78 0530ut.

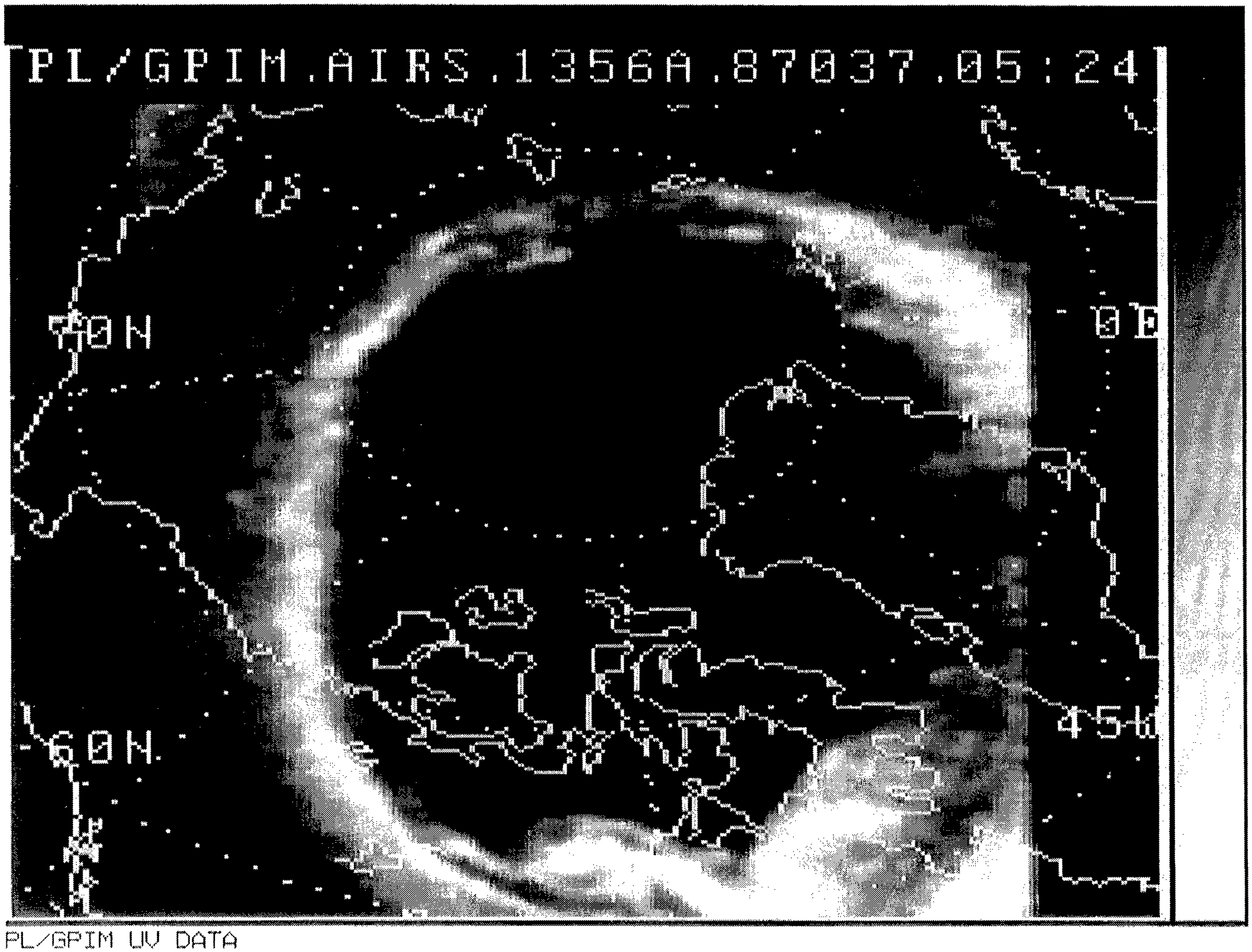
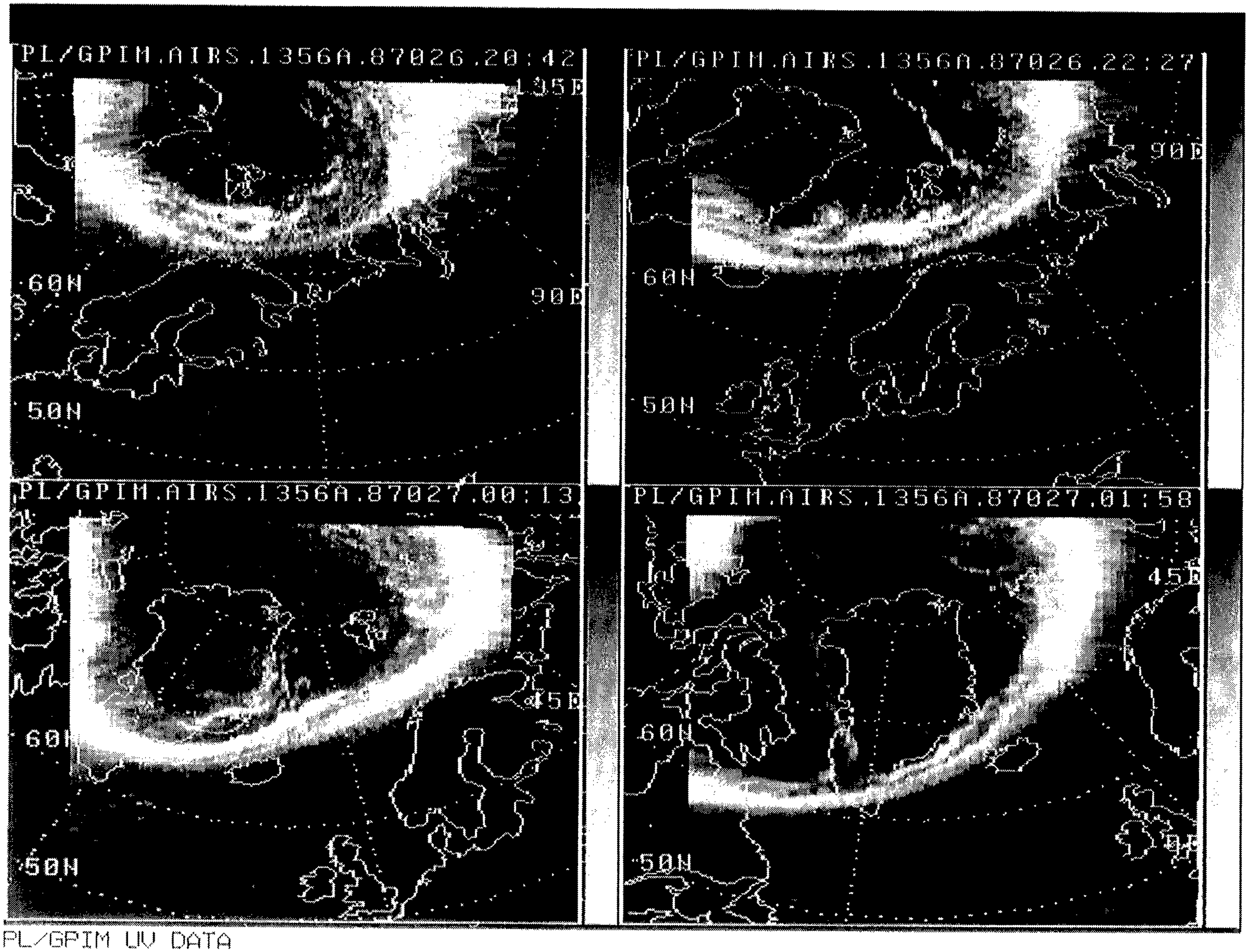


Figure 29. Image of 1356Å radiation of atomic oxygen being emitted by the Auroral Oval. This emission was detected by the AIRS experiment on board the PolarBEAR satellite 1/37/78 0524ut.



Figures 30 to 33. Auroral images as seen in ultraviolet 1356Å oxygen atom emission viewed from the AIRS satellite on consecutive orbits, starting on 01/26/87 2042ut.

5. AIRS/DMSP COMPARISON

An effort to find simultaneous measurements of the auroral oval with the Defence Meteorological Satellite's (DMSP) Electrostatic Analyzer and the AIRS imager is being pursued. The purpose of this study is to look for agreement in the detection of the boundary of the auroral oval.

A printout of the DMSP and PolarBEAR satellite ground tracks when the DMSP was above 30° north latitude and the separation angle was less than 30° was provided by N. Bonito, RADEX Corp.

This file was examined from 01/22/87 to 02/ 25/87 for times of close passes. That is, when the AIRS instrument obtained images, and the separation of the ground tracks between the two satellites was less than ten minutes in time at the oval and at a distance of less than 1300 km. (The AIRS images were east/west scans from horizon to horizon, more than 4000 km and would look under the DMSP track). Some 67 events worthy of further study are listed in Table 7.

Table 7. AIRS (1356) and DMSP Coincidences for the Julian day and UT in 1987. The comments refer to the DMSP orbital track over the AIRS image. The comment 'good' means that both DMSP and AIRS were over the oval simultaneously and with fair proximity. The satellites moved mainly in opposite directions and crossed the oval at separate times. The code is a number (nn) assigned to the image to aid in processing.

Code	Day	Hr to Hr	Comment
17	023	0701--0710	DMSP towards image horizon
18	027	0901--0909	DMSP towards image horizon
19	029	0635--0643	DMSP in daylight horizon
20	029	0819--0826	DMSP towards image horizon
21	029	1002--1009	DMSP towards image horizon
22	029	1837--1846	2 min apart at Oval
23	029	2020--2028	5 min apart at Oval
24	029	2204--2210	5 min apart at Oval
25	031	0734--9742	DMSP towards horizon daylight / -4 min Oval
26	031	1609--1620	7 min apart at Oval
7	031	1754--1802	3 min apart at Oval
28	031	1937--1945	on Oval edge
29	031	2121--2128	3 min apart at Oval
30	031	2304--2310	5 min apart at Oval
31	032	0048--0055	5 min apart at Oval
32	032	0227--0241	9 min apart at Oval
33	033	1019--1026	DMSP towards horizon daylight / -6 min Oval
34	033	1200--1210	1100 km apart in Oval
35	033	1855--1902	460 km apart in Oval
36	033	2038--2045	Good, 370 km apart in Oval
37	034	0002--0014	Paths cross 8 min apart in Oval
38	034	0146--0156	Paths cross 5 min apart in Oval
39	035	1444--1455	1500 km / 8 min apart
40	035	1810--1821	8 min apart at Oval
41	035	1955--2002	740 km / 1 min apart at Oval

42	035	2138--2145	Good, 370 km apart in Oval
43	035	2322--2329	350 km / 1 min apart at Oval
44	036	0104--0112	2 min apart
45	036	0247--0256	5 min apart
46	036	0427--0440	9 min apart
47	037	1218--1226	DMSP at horizon daylight
48	037	1402--1410	DMSP at horizon
49	037	1545--1553	1300 km apart
50	037	1910--1920	6 min / 650 km apart
51	037	2054--2102	4 min / 650 km apart
52	037	2238--2246	3 min / 360 km apart
53	038	0021--0029	Good, 300 km apart
54	038	0204--0212	Good, 450 km apart
55	038	0347--0355	Good, 180 km / 0.3 min apart
56	038	0529--0540	8 min apart
57	039	1135--1144	1300 km apart daylight
58	039	1318--1327	DMSP on horizon daylight
59	040	0304--0312	1 min / 360 km apart
60	040	0813--0821	daylight low lat
61	041	1053--1100	daylight 1300 km apart
62	041	2254--2305	7 min / 550 km apart
63	042	0036--0048	8 min / 440 km apart
64	043	1148--1158	daylight
65	043	1335--1344	daylight
66	043	1520--1527	daylight
67	045	1247--1259	daylight
68	045	1433--1443	daylight
69	045	1613--1625	daylight
70	046	0420--0429	830 km apart
71	047	1345--1358	450 km apart daylight
72	047	1530--1540	5 min
73	047	1858--1910	daylight
74	047	2044--2055	Good, 550 km apart
75	048	0335--0345	in cap with sun-aligned arcs
76	048	0702--0712	in cap with arc
77	048	0849--0901	1 min apart
78	049	1958--2010	daylight below Oval
79	050	0803--0816	Good, 740 km apart
80	051	2058--2109	daylight
81	053	2013--2024	daylight
82	055	1928--1940	daylight
83	056	0413--0421	daylight DMSP on horizon

The AIRS raw images have been processed, producing unpacked warped images that correspond to the Earth's surface. Table 8 is a list of these image files. The raw image files were extracted from the AIRS database and processed (Technical Report NWRA-CR-87-R016) to produce unpacked, warped, unsmoothed, and unamplified auroral images using the procedures starting with the "rawcvrt" command. See Table 8.

Table 8. List of AIRS image files, close in space and time with DMSP images, that were processed with a given code number producing unpacked, warped images.

CODE	FILE
17	t8702372.dat
18	t8702792.dat
19	t8702962.dat
20	t8702982.dat
21	t87029a2.dat
22	t87029j2.dat
23	t87029k2.dat
24	t87029m2.dat
25	t87031t2.dat
26	s87031g2.dat
27	t87031h2.dat
28	t87031j2.dat
29	t87031l2.dat
30	t97031n2.dat
31	s97032z2.dat
32	s8703222.dat
33	t87033a2.dat
34	s87033c2.dat
35	t87033i2.dat
36	t87033k2.dat
37	s87034z2.dat
38	s87034l2.dat
39	s87035e2.dat
40	t87035i2.dat
41	t87035j2.dat
42	t87035l2.dat
43	s87035n2.dat
44	s87036l2.dat
45	s8703622.dat
46	s8703642.dat
47	s87037c2.dat
48	s87037e2.dat
49	s87037f2.dat
50	t87037j2.dat
51	t87037k2.dat
52	s87037m2.dat
53	t87038z2.dat
54	s8703822.dat
55	s8703832.dat
56	t8703852.dat
57	s87039b2.dat
58	s87039d2.dat
59	s8704032.dat
60	t8704082.dat
61	t87041a2.dat
62	t87041m2.dat
63	t87042z2.dat
64	s87043b2.dat

65 s87043d2.dat
66 s87043f2.dat
67 s87045c2.dat
68 s87045e2.dat
69 s87045g2.dat
70 s8704642.dat
71 s87047d2.dat
72 s87047f2.dat
73 b87047i2.dat
74 b87047k2.dat
75 s8704832.dat
76 b8704872.dat
77 b8704882.dat
78 b87049j2.dat
79 b8705082.dat
80 b87051k2.dat
81 b87053k2.dat
82 b87055j2.dat
83 b8705642.dat

The ephemeris data was obtained from the DMSP Electrostatic Analyzer database using a FORTRAN-language utility developed by Boston College. These data were used to create an STRKnn.D file showing the position of the DMSP track. Table 9 illustrates such a file. This table was chosen to examine the edge of the Auroral Oval.

Table 9. The STRK35.D file for the DMSP ground track on 02/02/87 from 1900hrs to 1901hrs.

Yr	Day	Hr	Sec	Lat	Lon
87	33	19 00	00 000	67.6	63.9
87	33	19 01	00 000	70.8	68.4

A C-language program, QSCNTINT.EXE, provided by R. Eastes PL/GPIM, uses the STRKnn.D file to draw the DMSP track on AIRS image (Figure 34) interpolating between the points with the option of producing a file showing the Lat/Lon and the light intensity of the AIRS pixels traversed. Table 10 is a file for the AIRS pixel readings at the short DMSP ground track as shown in Figure 34.

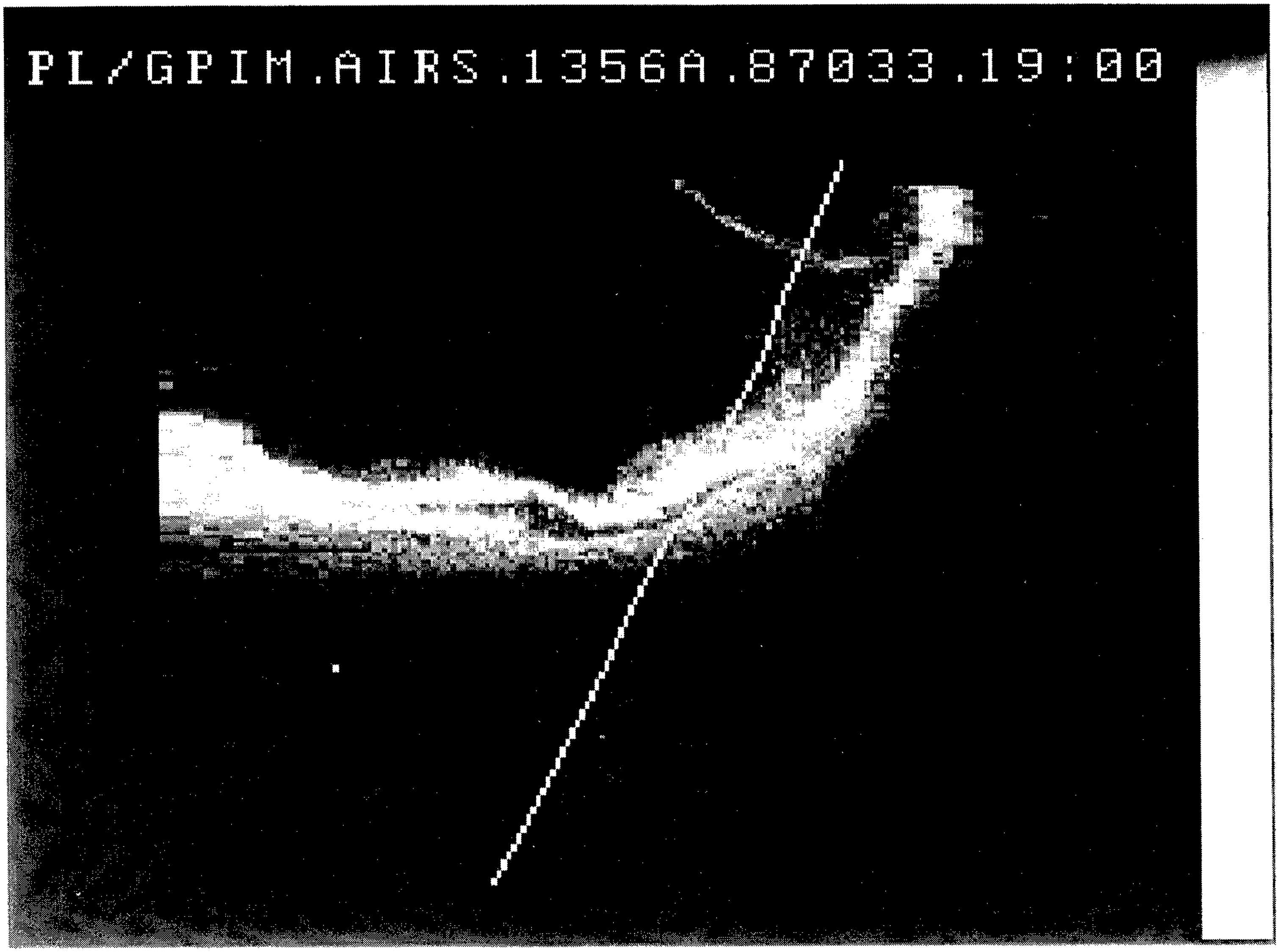


Figure 34. AIRS image with DMSP ground track superimposed. In this figure, the PolarBEAR satellite is moving from the bottom to the top. DMSP moves from top to bottom. Their paths crossed at universal time, 1858ut.

Table 10. File produced by QSCNTINT.EXE using Table 2. The intensity values of the AIRS pixels are shown along a portion of the DMSP track. Data for 02/02/87 1900 to 1901hrs.

```
each value = sum of =7 pts in horizontal row
lat=67.599998  long=63.900002  value=2
lat=67.788231  long=64.164711  value=1
lat=67.976471  long=64.429413  value=0
lat=68.164703  long=64.694122  value=0
lat=68.352943  long=64.958824  value=1
lat=68.541176  long=65.223534  value=1
lat=68.729408  long=65.488235  value=4
lat=68.917648  long=65.752945  value=3
lat=69.105881  long=66.017647  value=0
lat=69.294121  long=66.282356  value=12
lat=69.482353  long=66.547058  value=11
lat=69.670593  long=66.811768  value=19
lat=69.858826  long=67.076469  value=21
lat=70.047058  long=67.341179  value=19
lat=70.235298  long=67.605881  value=36
lat=70.423531  long=67.870590  value=32
lat=70.611771  long=68.135300  value=38
```

The AIRS UV emission values can be plotted and compared to the DMSP electron and ion counts in a range of energy channels.

It is planned to use these files in an algorithm to compare the auroral oval boundaries measured by AIRS and DMSP.