DAILY IUE PEAK RADIATION LEVELS

Muriel Taylor and Catherine L. Imhoff
18 February 1986

Each day the IUE satellite passes through the outer Van Allen radiation belts during the US2 shift. The particles trapped in the radiation belts cause increased fogging on the cameras during the time of this passage. The radiation background thus limits the length of the exposures that can be obtained during the second US shift. This communication is a continuation of the work reported by Broude and Imhoff (1984, NASA IUE Newsletter No. 24, p. 127) and earlier articles.

The IUE Observatory monitors the peak radiation levels which are encountered each day. These are recorded as a voltage on the Flux Particle monitor (FPM). The readings may be converted to an equivalent exposure rate for the most sensitive portions of the camera by:

$$\text{fogging rate (DN/hour)} = K * 10^{FPM},$$

where K=1.0 for the SWP camera, K=1.3 for the LWP, and K=0.7 for the LWR camera at its reduced UVC voltage. Thus when FPM=2.0 volts, the fogging occurs at a rate of 100 DN/hr for the SWP camera, 130 DN/hr for the LWP, and 70 DN/hr for the LWR.

Some small errors have been found in the statistics presented in our previous report. Therefore we present the corrected numbers for 1983 through 1985. Tables 1 through 3 list the number of days in each month that the FPM reached various peak levels. Please note that these are maximum values only.

Figures 1 through 3 depict the daily variation of the peak FPM for 1983, 1984, and 1985. Occasional variations in phase with solar rotation and solar activity levels may be seen.

The long-term trends of the radiation background have been presented in a previous article (Imhoff, 1985, NASA IUE Newsletter No. 27, p. 9). This analysis has been updated with the 1985 statistics. The results are depicted in Figure 4 as yearly averages. The anticorrelation of the FPM levels with solar activity (Zurich sunspot numbers) continues through 1985. Since the current low solar activity levels are expected to continue until 1989, the recent FPM levels are also expected to continue for several years.

TABLE 1

NUMBER OF DAYS REACHING PEAK RADIATION LEVELS

PEAK MONITOR READING	1983 JAN	FEB	MAR	APR	MAY	JUNE	MAXIMUM FOGGING RATE (DN/HOUR)
FPM<1.0	3	0	0	1	0	0	< 10
1.0<=FPM<1.7	10	4	9	3	5	5	10-50
1.7<=FPM<2.0	6	5	4	2	3	8	50-100
2.0<=FPM<2.4	5	10	6	5	10	5	100-250
2.4<=FPM<2.8	7	8	9	9	8	9	250-500
2.8<=FPM<3.0	0	0	3	6	2	3	500-1000
FPM>=3.0	0	1	0	4	3	0	>1000

PEAK MONITOR READING	1983 JUL	AUG	SEP	OCT	NOV	DEC	TOTAL FOR YEAR	MAXIMUM FOGGING RATE (DN/HOUR)
FPM<1.0	0	0	0	0	0	1	5	< 10
1.0<=FPM<1.7	4	11	4	4	7	6	72	10-50
1.7<=FPM<2.0	7	5	2	5	4	7	58	50-100
2.0<=FPM<2.4	12	7	5	13	9	9	96	100-250
2.4<=FPM<2.8	7	3	11	9	9	8	97	250-500
2.8<=FPM<3.0	1	5	5	0	1	0	26	500-1000
FPM>=3.0	0	0	3	0	0	0	11	>1000

TABLE 2

NUMBER OF DAYS REACHING PEAK RADIATION LEVELS

PEAK MONITOR READING	1984 JAN	FEB	MAR	APR	MAY	JUNE	MAXIMUM FOGGING RATE (DN/HOUR)
FPM<1.0	6	1	0	2	0	0	< 10
1.0<=FPM<1.7	16	18	10	11	12	6	10-50
1.7<=FPM<2.0	0	5	4	5	6	10	50-100
2.0<=FPM<2.4	6	3	11	3	2	10	100-250
2.4<=FPM<2.8	3	2	5	8	10	4	250-500
2.8<=FPM<3.0	0	0	0	1	1	0	500-1000
FPM>=3.0	0	0	1	0	0	0	>1000

PEAK MONITOR READING	1984 JUL	AUG	SEP	OCT	NOV	DEC	TOTAL FOR YEAR	MAXIMUM FOGGING RATE (DN/HOUR)
FPM<1.0	0	0	0	0	1	0	10	< 10
1.0<=FPM<1.7	1	3	2	4	2	10	95	10-50
1.7<=FPM<2.0	4	6	1	1	3	0	45	50-100
2.0<=FPM<2.4	12	5	0	2	15	4	73	100-250
2.4<=FPM<2.8	6	8	10	10	5	11	82	250-500
2.8<=FPM<3.0	2	5	7	2	1	5	24	500-1000
FPM>=3.0	6	4	10	12	3	1	37	>1000

TABLE 3

NUMBER OF DAYS REACHING PEAK RADIATION LEVELS

PEAK MONITOR READING	1985 JAN	FEB	MAR	APR	MAY	JUNE	MAXIMUM FOGGING RATE (DN/HOUR)
FPM<1.0	0	3	9	1	1	2	< 10
1.0<=FPM<1.7	3	3	15	5	18	10	10-50
1.7<=FPM<2.0	4	5	1	4	3	3	50-100
2.0<=FPM<2.4	7	3	6	12	9	6	100-250
2.4<=FPM<2.8	10	13	0	3	0	9	250-500
2.8<=FPM<3.0	3	1	0	5	0	0	500-1000
FPM>=3.0	4	0	0	0	0	0	>1000

PEAK MONITOR READING	1985 JUL	AUG	SEP	OCT	NOV	DEC	TOTAL FOR YEAR	MAXIMUM FOGGING RATE (DN/HOUR)
FPM<1.0	0	0	0	0	0	0	16	< 10
1.0<=FPM<1.7	1	1	3	4	7	9	79	10-50
1.7<=FPM<2.0	1	4	6	0	7	2	40	50-100
2.0<=FPM<2.4	10	3	5	8	9	15	93	100-250
2.4<=FPM<2.8	10	15	12	14	6	5	97	250-500
2.8<=FPM<3.0	6	7	3	0	1	0	26	500-1000
FPM>=3.0	3	1	1	5	0	0	14	>1000

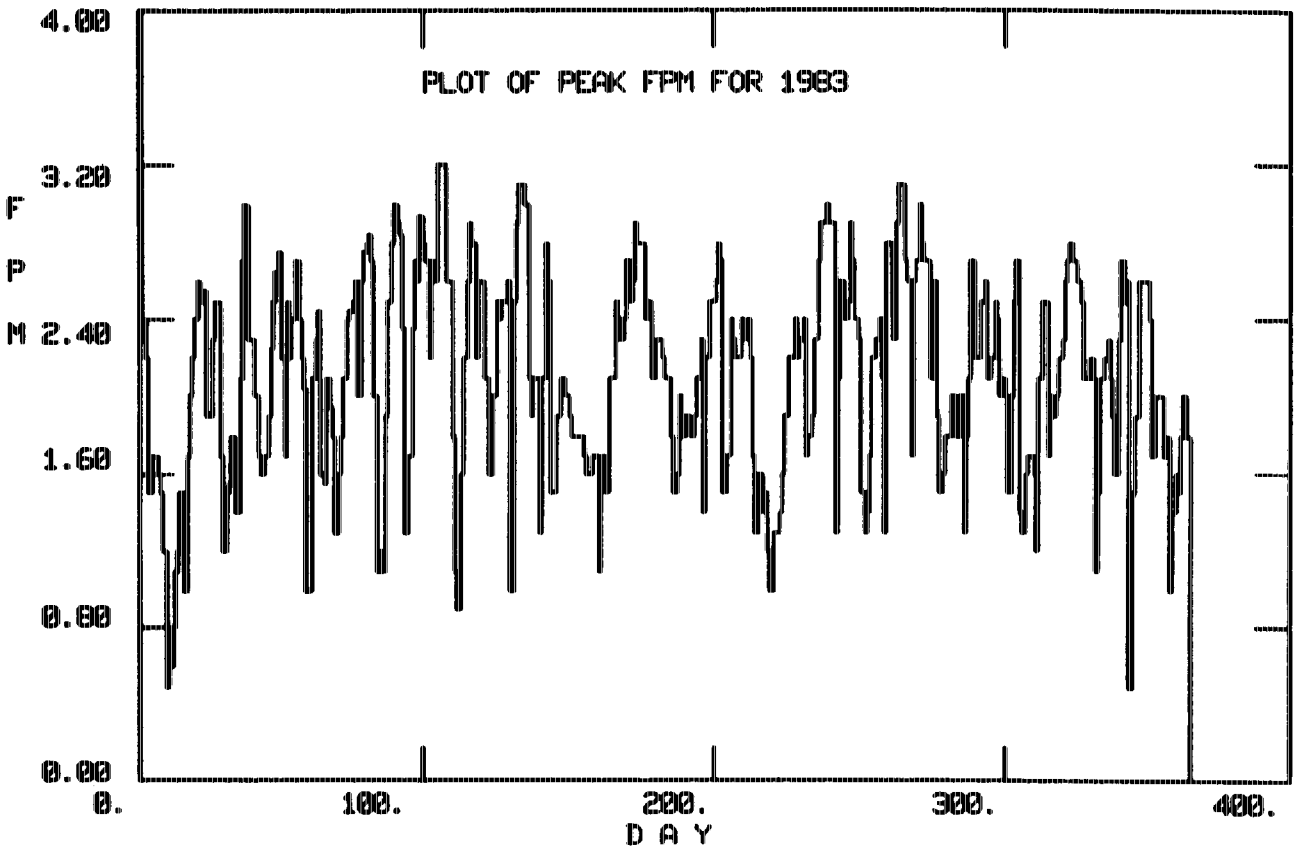

Figure 1. Daily values of the peak FPM versus day of year for 1983.

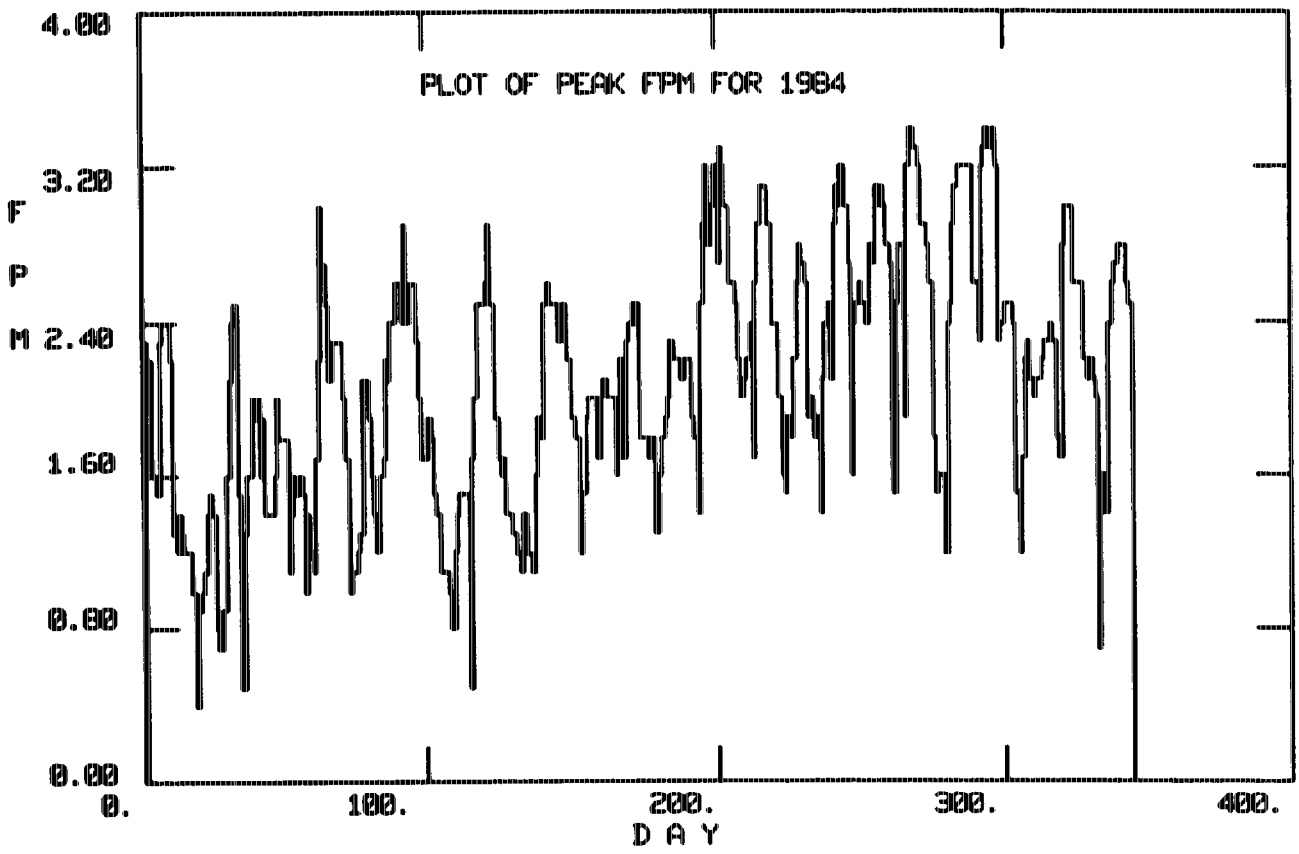

Figure 2. Daily values of the peak FPM versus day of year for 1984.

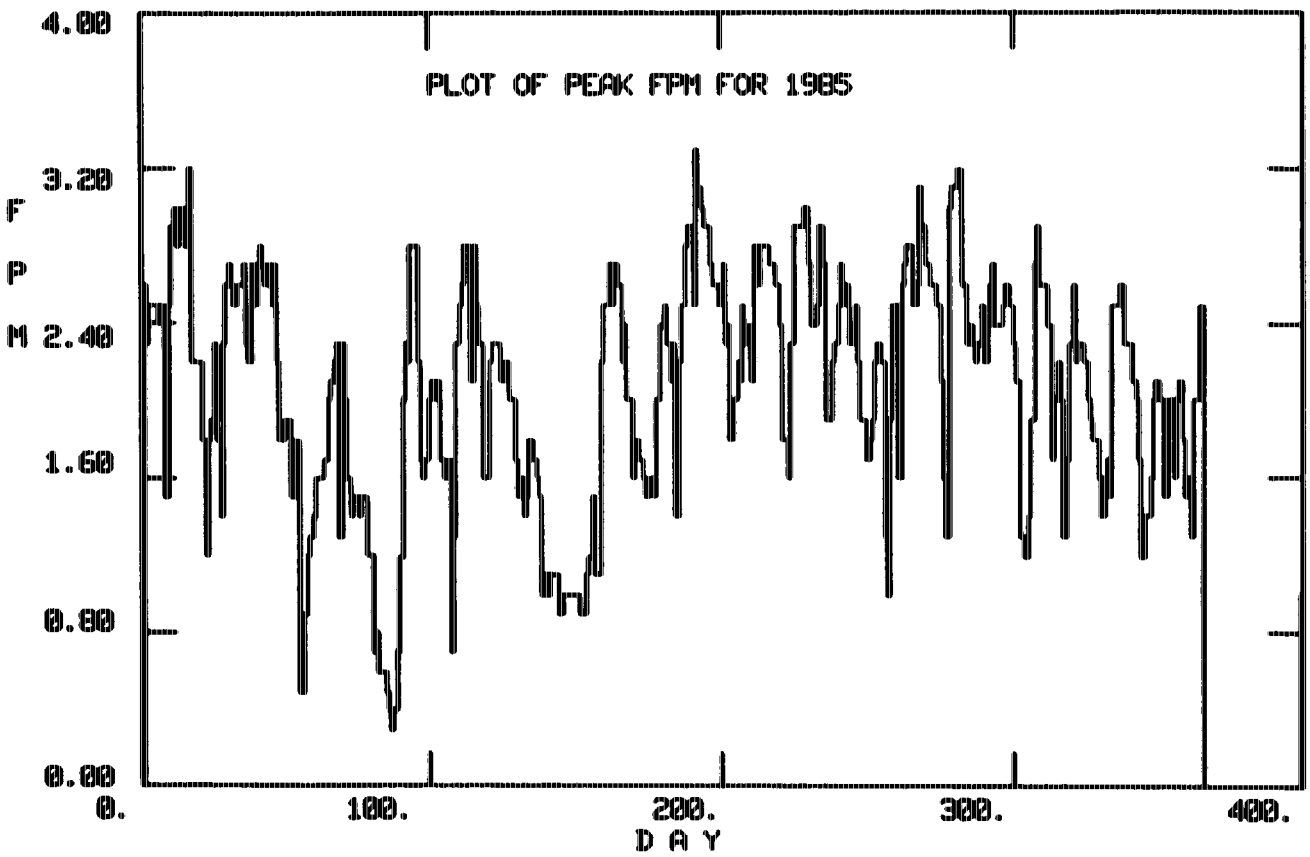

Figure 3. Daily values of the peak FPM versus day of year for 1985.

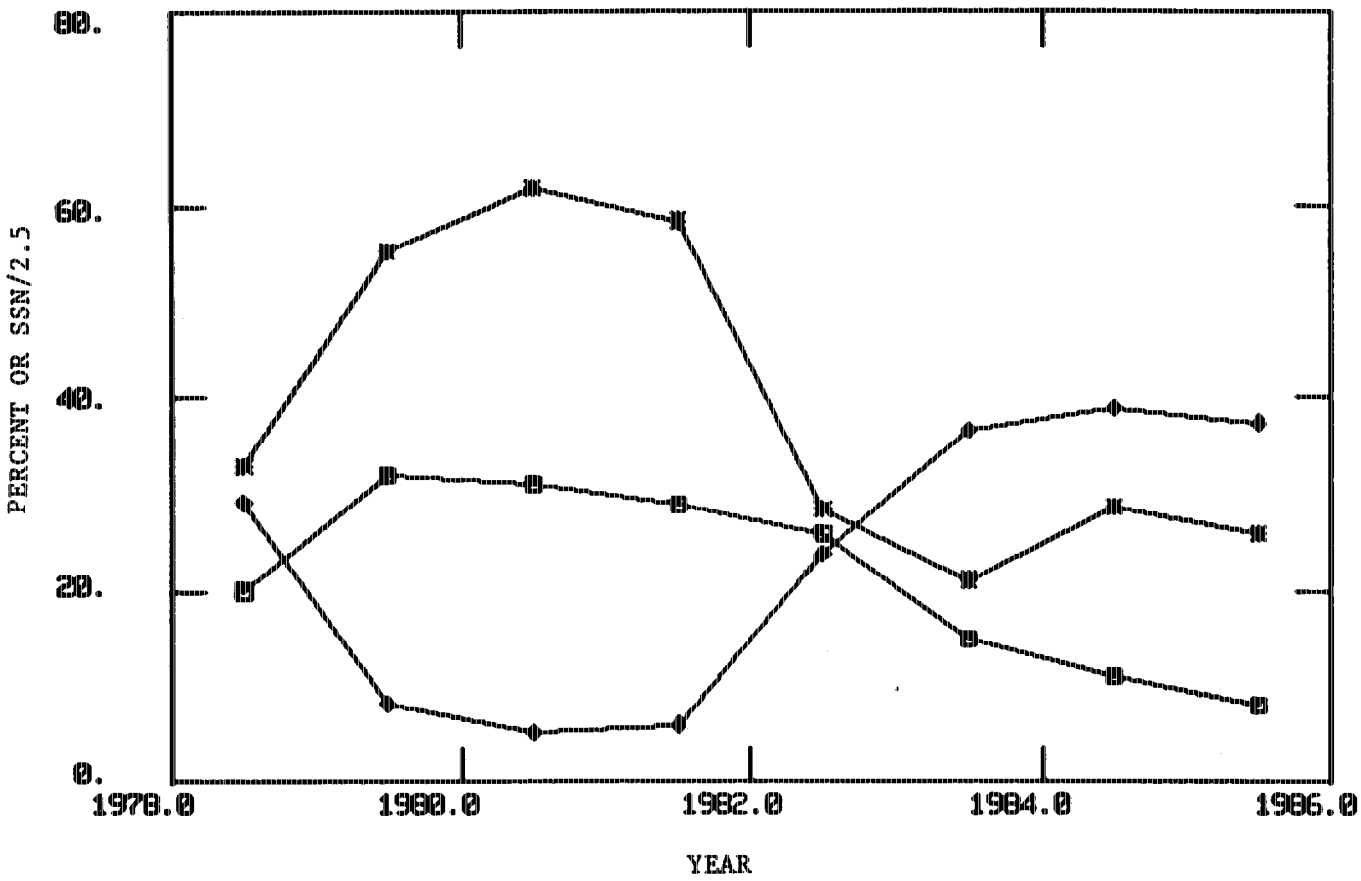

Figure 4. Comparison between IUE radiation statistics and mean Zurich sun spot numbers. Squares represent sun spot numbers divided by 2.5. Asterisks represent the percentage of shifts for which the peak FPM was under 1.7 volts. Diamonds represent the percentage of shifts for which the peak FPM was 2.4 volts or higher.