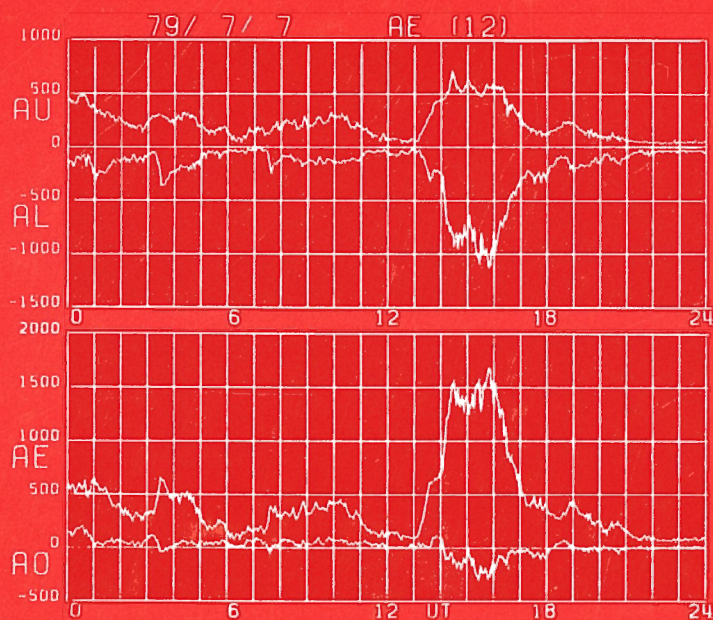


World Data Center C2 for Geomagnetism

DATA BOOK

No. 6

Auroral electrojet indices (AE)
for July-December 1979



JULY 1982

Data Analysis Center for
Geomagnetism and Spacemagnetism
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Auroral Electrojet Indices (AE)

for July - December 1979

by

T. Kamei and H. Maeda

1. Introduction

The Auroral Electrojet index (AE) was originally introduced by Davis and Sugiura in 1966 as a measure of global electrojet activity in the auroral zone, and it is now widely used for studying geomagnetism, aeronomy and solar-terrestrial physics. The index was first derived at the Geophysical Institute of the University of Alaska, and hourly values were published for the years 1957 to 1964. The production of 2.5-min values was then tried at the Goddard Space Flight Center of NASA, and the results from September 1964 to June 1968 were published.

After that, the index was regularly published at the World Data Center A in Boulder, Colorado, and the Center published 2.5-min values for the years 1966 to 1974 and 1.0-min values for 1975 and a half of 1976. We have published AE values for the year 1978 and 1979 as part of the data books (No.3 and No.4 for 1978 and No.5 for the first half of 1979). Please see data books No.3 or No.4 for the estimation of errors of our AE data.

2. Derivation and Representation

The AE index is derived from the horizontal component of geomagnetic variations observed at some (10-13) observatories along the auroral zone in the northern hemisphere. To normalize the data from each station, a base value of each station for each month is first calculated by averaging all the data of the station on the five international quiet days, and this base value is subtracted from every-day data of the station in that month. Then the largest and smallest values are selected from all the stations. The largest value is called the AU index and the smallest value is called the AL index. These names came from the upper and lower envelopes of the overlapped figure of the data from these stations. The difference between the AU and AL indices gives the AE index, and the mean value of the AU and AL indices gives the AO index. The term "AE indices" is usually used to describe those four indices (AU, AL, AE and AO) in all.

The AU and AL indices are understood to express the strongest current density of the eastward and westward auroral electrojet, respectively.

The AE index is understood to represent the overall activity of the electrojets, and the AO index is regarded as a measure of the equivalent zonal current.

In this report we shall present every-day diagrams and hourly values of the AE indices and "Contributing stations plot" of the AE indices which may give more information about the indices. That is, we named the stations which give the AU and AL indices "the contributing stations of the AU and the AL index, respectively, and a pair of these AU and AL contributing stations "the contributing stations of AE indices". The plot gives these AE contributing stations on a plane whose coordinates are UT in abscissa and LT in ordinate at the stations. For users who want to check the AE indices precisely, this plot gives an information about data availability of each station. Thus the plot will give us an idea which data are to be checked. For these users, we would like to suggest to check our way of derivation of the AE indices and our estimation of errors.

3. Selection of Observatories

To obtain good AE indices, we must use as many observatories as possible, but we meet two big difficulties: One is that the distribution of active observatories are not uniform over the auroral zone, and the other is that the digitization of analogue data (magnetograms) is a heavy job.

We selected 12 observatories listed in Table 1. Of these, only 5 stations are taking digital data directly (called digital stations). Our selection is almost the same as that of the WDC-A. (see Fig. 1)

Three of the stations (Fortchurchill, Great Whale River, and Yellowknife) are the digital stations which give data in the X, Y, Z coordinate system. To make these data more compatible to other stations, we converted the X and Y components to H component by $H=(X^2+Y^2)^{1/2}$, and we treated the resulted H component to be missing for the period either X or Y is missing. For other two digital stations (Barrow and College), we used the original digital H-component data.

4. Digitizing Machine

Our digitizing machine is made of a semi-automatic sonic digitizer, a large size microfilm reader and a mini computer system.

The sonic digitizer has a pointing pen and two microphone arrays. The pen emits a small sonic pulse from a small electric spark at the top of it. The position of the pen is detected by time lags between the spark and signals received by the microphone arrays. One of the microphone arrays is

Table 1. List of AE(12) stations.

Observatory	Abbreviations		Geographic		Geomagnetic	
	IAGA	WDC-A	Lat. (°N)	Long.(°E)	Lat. (°N)	Long.(°E)
Abisko	ABK	AI	68.36	18.82	66.04	115.08
Dixon Island	DIK	DI	73.55	80.57	63.02	161.57
Cape Chelyuskin	CCS	CC	77.72	104.28	66.26	176.46
Tixie Bay	TIK	TI	71.58	129.00	60.44	191.41
Cape Wellen	CWE	UE	66.17	190.17	61.79	237.10
Barrow	BRW	BW	71.30	203.25	68.54	241.15
College	CMO	CO	64.87	212.17	64.63	256.52
Yellowknife	YKC	YEK	62.40	245.60	69.00	292.80
Fort Churchill	FCC	FC	58.80	265.90	68.70	322.77
Great Whale River	GWC	GWR	55.27	282.22	66.58	347.36
Narssarssuaq	NAQ	NAS	61.20	314.16	71.21	36.79
Leirvogur	LRV	LR	64.18	338.30	70.22	71.04

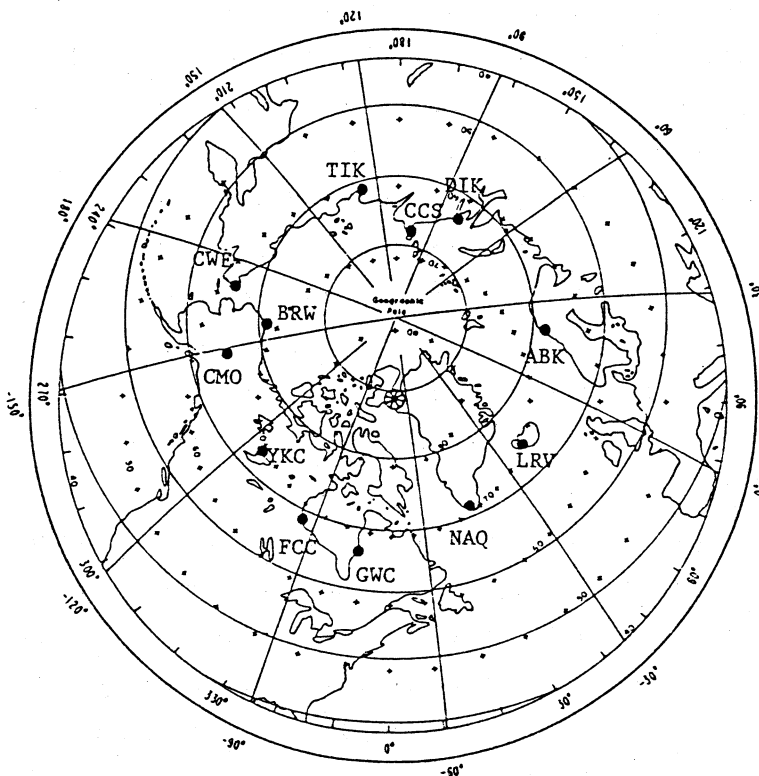


Fig. 1. Distribution of AE(12) stations.

Geographic latitude is indicated by the concentric circles of solid lines. Geomagnetic latitude is indicated by the numbered concentric circles formed by + signs. Geographic longitude is given by the outer circle of numerical values with meridians shown as solid lines every 30°. Geomagnetic longitude is given by the inner circle of numbers and the border of hash-marks at 10° intervals.

placed on the upper side of a microfilm reader and detects Y position of the pen, and another array is placed on the left side of the reader and detects X position of the pen.

The operator traces the projected figure (magnetogram) on the screen of the microfilm reader. The effective size of the screen is about 60 cm in width and about 40 cm in height. This screen is divided into 4000 x 3000 digital points. The emitting speed of the sparks can be controlled either by the computer or by the operator. Although the emitting speed can be as fast as 100 points per second, available speed is limited to 20 points per second, because of the speed of the CPU of computer and the recording media.

5. Digitization of Analogue Data

The magnetogram on 35 mm microfilm is projected directly on our microfilm reader. The projected figure is almost the same size as the original magnetogram whose size is about 2 cm/hour or 48 cm/day.

Usually, the magnetograms are digitized day by day. When the time marks on the magnetogram are not spaced uniformly or base lines are not straight enough, one magnetogram is divided into several uniform parts and then digitized. We used the ordinary magnetogram for all days. When the H trace crosses other traces, we tried to identify the H trace by referring the insensitive or storm magnetogram. When we trace the H component on magnetograms, we also feed three basic points to define the time and the absolute value of the digitized data, and feed other necessary information like the station identification and observation date.

In digitizing analog data, we could have trouble from the digitizer noise. To be free from such a noise, we digitized as many points as possible to get one value. In determining the three basic points we digitized each point more than 20 times, and we picked the point only when these consecutive 20 readings are all within a limited area. The traced digital data are logically checked by a quality control program to reject spikes caused by the noise. After cleaning by the quality program, the data are averaged to get the final one minute value. Usually, one-min value is determined from an average of 3 or 4 digital readings. We checked all the digitized data visually by the plot on a monitoring graphic display at the reading stage and by the finer common scale plot made by a X-Y plotter after processed by the quality control program.

6. The Overlapped Plot and the Plot of the Contributing Stations of the AE Indices.

Fig. 2a shows an example of the overlapped plot of the H traces from the AE stations on April 10, 1978. The upper envelope gives the AU index and the lower envelope gives the AL index. Figs. 2b and 2c show example plots of the contributing stations for the same day as in Fig. 2a, in the geomagnetic (2b) and geographic (2c) local times, where the upper and lower plumes on a diagonal line for each station show the contribution to the AU and AL indices of this station. In Fig. 2b, for example, the data of Dixon Island (DIK) give the AU index from 0000 to 0240 UT and again from 1330 to 1530 UT, and the AL index from 0640 to 0830 UT. It is seen that from 1100 to 1200 UT Leirvogur (LRV) offers no data. Since this is a key station for the AL index at that time, the exact AL values at that time have been lost.

We think some explanation are necessary for our trial plots of the contributing stations. On the plots hereafter, the ordinate is the geomagnetic local time (MLT). The MLT is defined by the difference of the geomagnetic longitude of the station and the geomagnetic longitude of the Sun, and it is a function of the geomagnetic longitude of the station, season, and universal time. Figs. 3a, 3b, 3c show the difference between the GLT and the MLT of the stations used to derive AE indices for winter, summer and equinox, respectively. In these figures the GLT is shown by the straight line which runs diagonally, and the MLT is shown by the T (or inverted T) shaped mark. The length of the vertical line between the T (or inverted T) shaped mark and the diagonal line is the difference between GLT and MLT.

Note that for some stations the difference between GLT and MLT is as much as 2 hours. The geomagnetic longitude of Cape Wellen (CWE) and Barrow (BRW) are very close, and so it is difficult to separate these two stations on the contributing stations plot. Sometimes, Cape Wellen gives AU and Barrow gives AL, and vice versa. This is thought to be an effect of local current system between the high latitude station and the low latitude station.

When we assume that the observed geomagnetic H component is a result of a simple combination of some simple current systems, this plot of the contributing stations can be regarded as an index of dominant current system at a certain time, though the current system in the auroral zone

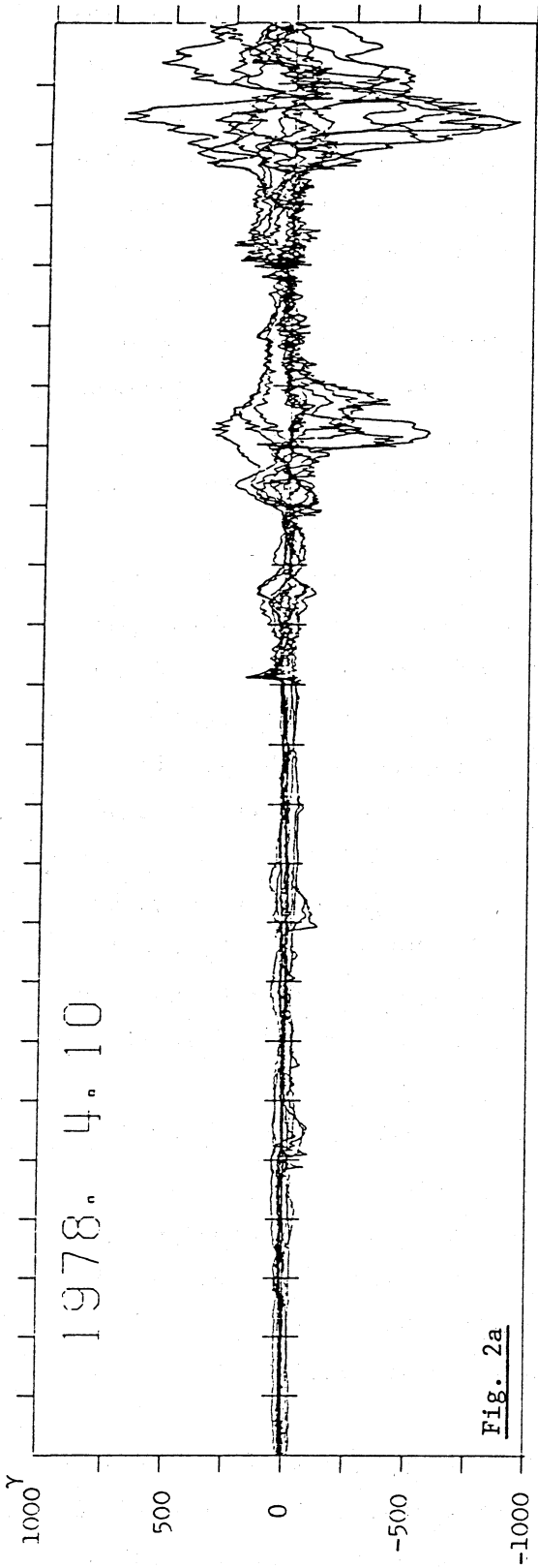


Fig. 2a

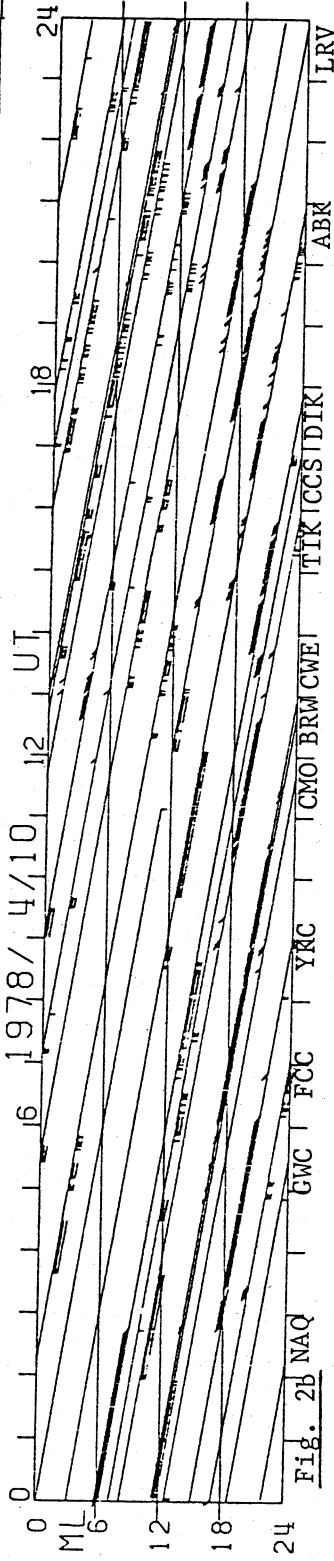


Fig. 2b

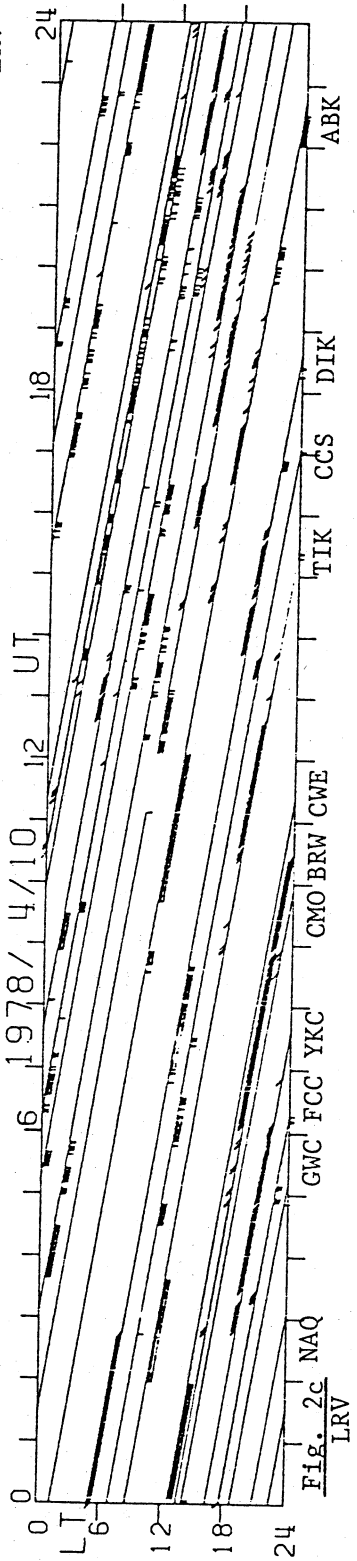


Fig. 2c

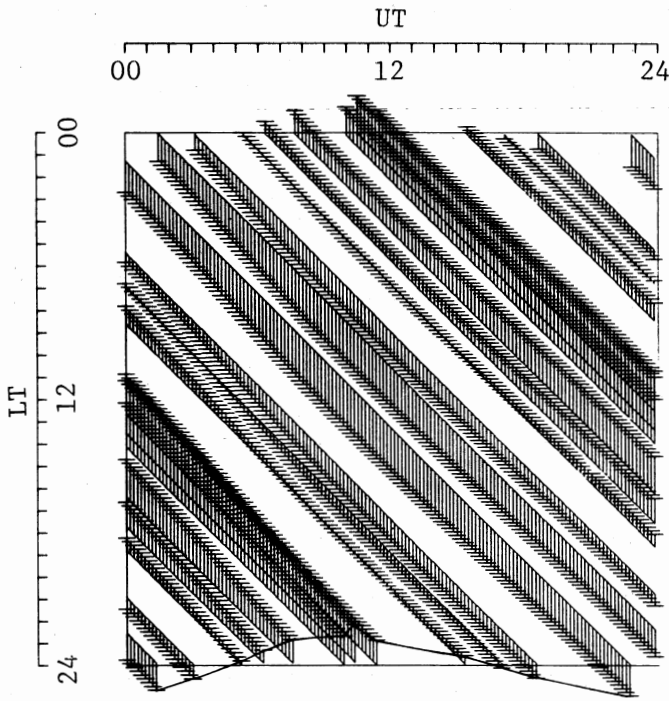


Fig. 3a Difference between GLT and MLT in winter.

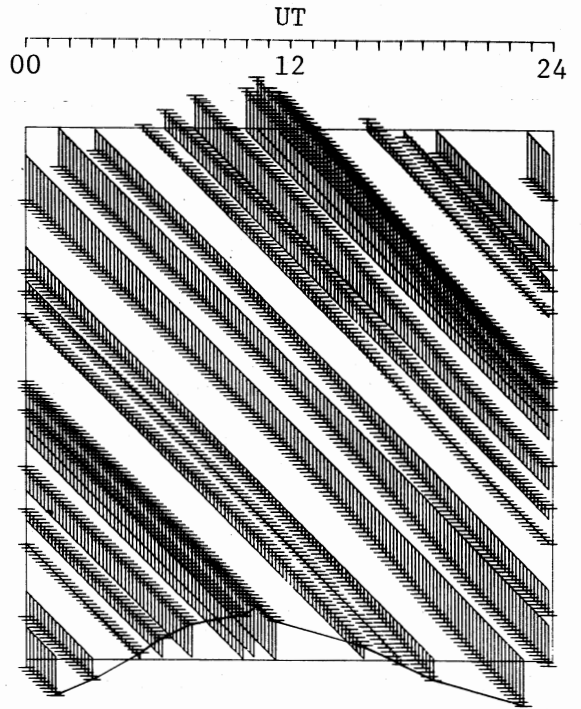


Fig. 3b Difference between GLT and MLT in summer.

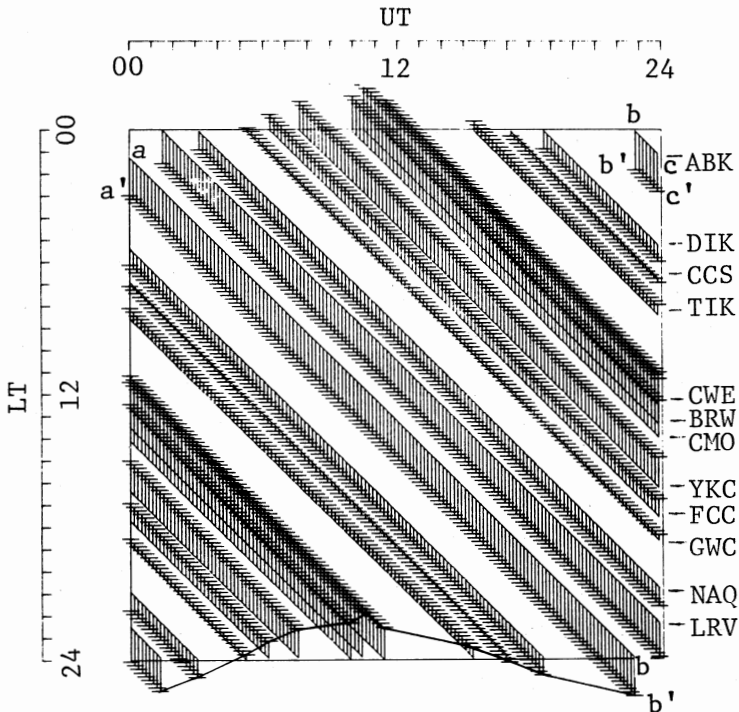


Fig. 3c Difference between GLT and MLT in equinox.

Fig. 3a, 3b and 3c show the difference between the geographic local time (GLT) and the geomagnetic local time (MLT) for winter, summer and equinox, where a-b-c (full line on the top or bottom of the vertical lines) shows the relation between UT and GLT, and a'-b'-c' (crossing of the vertical and horizontal lines) shows the relation between UT and MLT for each of the AE(12) stations.

is not very simple, and users must be very careful to check if local current systems may give a false impression of different current systems.

Although we have such limitation of the plot of the contributing stations, and we need more precise analyses, we can point out some characteristics from the plot, most of them confirm our previous knowledge.

(1) In quiet periods, the geomagnetic local time of the contributing stations to the AL index (called here AL time, shortly) is around noon. This is seen best in equinox. This may come from the low latitude Sq current system or from the field-aligned current system connected to the cusp region, or from both of them.

(2) In disturbed periods, the AL time is between midnight and morning.

(3) In some transition periods between quiet and disturbed states, the AL time moves gradually from noon to morning. Then, very sharp and short period AL spikes are seen and the AL time goes pre-midnight. Afterward, the AL time comes back to early morning.

(4) The geomagnetic local time of the AU contributing station (called AU time) is confined in the evening in disturbed periods. But in quiet periods, the AU time is distributed widely and it can be seen at midnight or in the morning.

7. Results

Monthly quiet-time H reference values for July-December 1979 are listed in Table 2, where for four stations only deviations ($H0^+$) from the H baseline are given, because we did not find out any base values. Table 3 gives the hourly average of AE indices on every day from July to December 1979.

Daily graphs of 1.0-min AE indices (AU, AL, AE and AO) are shown in Fig. 4, and corresponding plots of the contributing stations are shown in Fig. 5. Finally, Fig. 6 shows the H-traces of magnetograms from AE(12) stations in every month from July to December 1979.

8. Acknowledgements

This volume has been accomplished by the data supply from the AE stations through the World Data Centers and the financial support from the Ministry of Education, Science and Culture of Japan. Acknowledgement is due to Ms. Yohko Yamamoto for her assistance in digitizing magnetograms.

Note: Another example of wrong index is seen in the following figure; where the AU index around 1530 and 1620 (indicated by arrows) is incorrect, because of a lack of data at a key station for this index.

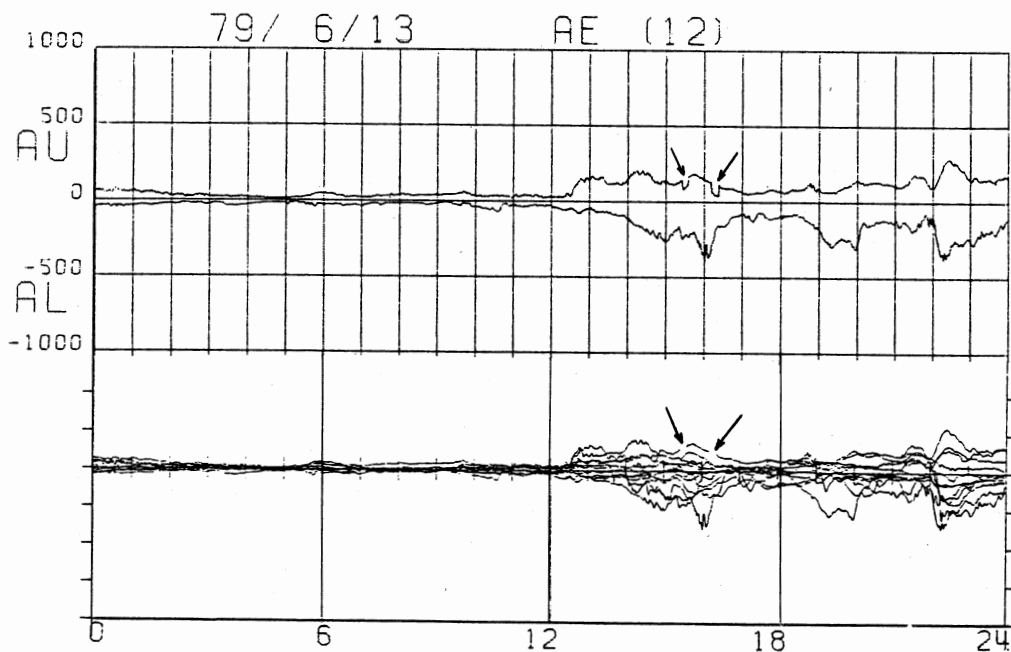


Table 2. MONTHLY QUIET-TIME H REFERENCE VALUES (UNITS : NT = GAMMAS)
(YEAR 1979)

STATION	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	
ABISKO	11817	11813	11792	11803	11809	11813	
DIXON ISLAND	-388	-393	-416	-404	-403	-400	(HO+)
CAPE CHELYUSKIN	531	529	508	511	509	514	(HO+)
TIXIE BAY	247	230	214	222	226	232	(HO+)
CAPE WELLEN	194	188	174	174	175	183	(HO+)
BARROW	9853	9838	9817	9817	9814	9824	
COLLEGE	13036	13023	13013	13013	13016	13023	
YELLOWKNIFE	8751	8722	8724	8724	8720	8736	
GREAT WHALE RIVER	10602	10599	10599	10608	10609	10623	
FORT CHURCHILL	7528	7496	7521	7512	7515	7537	
NARSSARSSUA@	12065	12058	12044	12062	12067	12080	
LEIRVOGUR	12394	12396	12380	12390	12398	12406	

(HO+) : DEVIATION FROM THE H BASE LINE
ON THE ORDINARY MAGNETOGRAM

CORRECTION: The monthly quiet-time reference value for YELLOWKNIFE Feb. 1979 was wrong (Data Book No.5, page 9). Please read "8719" for "8319".

TABLE 3

Hourly average AE indices (AU, AL, AE and AO) for
July-December 1979.

AU INDEX (HOURLY VALUES)

JULY 1979

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
Q	125	108	59	55	103	173	161	156	171	119	106	132	123	85	46	46	74	69	84	112	130	105	87	107	106
	123	149	126	68	42	23	25	25	31	22	23	25	24	31	34	31	48	62	83	60	44	39	43	39	51
	38	32	33	31	27	21	37	45	84	73	249	266	262	142	119	191	193	257	235	123	162	234	237	187	137
	133	271	173	178	326	326	286	237	201	114	88	58	82	83	41	44	64	62	79	101	99	67	38	33	133
	27	26	19	30	31	57	34	34	101	242	290	183	111	95	100	93	84	95	102	134	138	99	94	53	95
D	47	27	22	35	37	73	190	157	178	262	260	236	123	112	88	59	72	85	120	281	313	165	144	196	137
D	431	300	200	271	270	165	104	164	223	247	247	124	72	252	552	551	440	170	191	152	94	57	47	54	224
	44	39	82	82	101	71	77	159	171	176	154	86	99	90	134	187	173	148	119	110	116	102	93	59	111
	32	24	45	70	67	57	61	46	39	38	88	114	158	133	111	101	215	172	118	105	86	39	25	20	82
	26	24	71	69	53	36	17	29	27	50	80	117	94	81	61	66	80	69	53	115	124	123	64	69	67
Q	67	53	35	25	45	59	45	155	119	209	66	31	19	31	35	32	28	34	38	42	70	73	84	64	61
	49	41	30	26	25	41	13	21	30	31	48	47	55	49	47	62	106	218	284	253	113	131	72	117	80
	209	274	308	283	297	224	186	64	84	96	134	136	184	255	346	326	298	390	295	190	162	130	96	89	211
	67	40	52	46	18	18	18	16	23	68	79	115	70	103	66	27	41	38	60	261	214	158	193	220	84
	260	245	209	270	114	184	147	180	187	167	189	108	86	78	92	134	149	91	124	170	208	160	285	206	168
	222	136	169	137	62	30	69	169	129	58	33	18	14	33	25	26	38	89	79	82	140	131	170	285	98
	166	109	154	179	206	87	48	32	27	125	136	95	102	149	110	75	54	41	41	46	53	205	245	226	113
	165	183	90	64	173	178	206	200	65	25	81	132	94	53	51	45	51	64	82	97	130	262	135	223	119
	176	90	50	141	125	47	50	50	71	62	39	61	79	112	75	43	36	46	49	68	79	218	193	70	85
D	58	32	30	78	111	143	104	130	147	172	283	280	279	195	69	41	78	199	265	232	223	201	162	140	152
	119	84	80	127	174	169	60	40	30	139	121	111	93	50	87	91	47	24	45	55	133	237	215	176	104
	150	171	114	52	66	47	72	106	129	46	34	26	27	38	27	31	69	58	73	81	54	35	27	31	65
	28	23	17	15	154	160	99	32	38	39	49	46	38	51	39	39	32	39	47	85	151	142	70	135	65
Q	170	142	157	143	114	135	96	85	72	27	22	30	63	60	55	49	49	72	82	103	140	153	113	86	92
Q	70	110	151	149	181	61	26	28	22	21	21	21	31	40	29	31	23	31	33	34	31	37	36	33	52
	38	27	19	17	31	81	112	123	194	199	176	135	109	125	97	98	135	193	250	277	334	304	375	249	154
D	263	300	344	136	64	62	22	12	0	8	36	111	88	100	93	104	109	170	159	179	159	109	122	92	118
	112	120	208	100	21	17	9	0	-4	0	5	10	10	11	18	33	36	48	42	29	35	60	62	55	43
D	68	90	92	61	45	44	54	117	91	210	174	154	265	189	125	193	305	211	216	167	156	148	230	164	149
	126	152	39	43	34	41	50	29	35	188	119	103	111	138	121	113	153	91	118	99	92	109	44	30	91
Q	26	6	6	6	15	7	5	7	18	64	56	27	19	29	37	37	30	18	19	26	34	15	9	13	22
MEAN	117	110	102	96	101	91	80	85	88	106	112	101	96	96	94	96	106	108	115	124	129	130	122	113	105
50 MEAN	91	92	95	78	79	57	39	60	52	68	37	26	31	38	38	36	35	43	51	53	63	63	57	47	55
5D MEAN	173	149	137	116	105	97	94	116	127	179	200	181	165	169	185	189	200	167	190	202	189	136	141	129	156

AU INDEX (HOURLY VALUES)

AUGUST 1979

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
1	33	22	13	12	16	21	24	25	28	31	36	86	197	205	169	146	133	121	107	181	258	156	160	234	101
2	164	75	40	24	82	157	58	71	184	234	93	88	114	90	50	58	132	103	70	55	40	38	45	42	88
3	51	63	125	191	159	130	112	189	165	133	245	180	122	98	134	100	67	46	47	54	78	142	234	201	128
4	237	249	210	201	185	245	231	140	229	257	267	193	202	244	191	50	70	137	289	277	270	113	63	56	192
5	35	27	48	92	200	235	87	32	38	55	92	35	37	54	35	43	22	41	102	164	218	149	124	91	
6	170	96	90	165	252	107	99	275	235	160	348	248	151	102	96	68	175	109	94	82	89	112	83	88	146
7	79	87	104	102	135	220	153	163	68	60	168	200	237	204	210	172	158	186	243	245	270	226	222	233	173
8	219	150	141	118	121	90	109	64	83	169	165	115	140	103	82	86	38	76	166	143	65	92	159	221	122
9	153	67	63	98	113	72	53	51	67	88	74	103	105	82	68	60	103	114	100	83	69	38	35	28	79
10	54	71	66	71	68	94	82	60	83	151	199	165	167	130	72	73	77	111	107	57	72	183	138	65	101
11	86	91	89	113	62	55	76	30	33	41	73	78	93	59	64	57	44	37	66	78	160	292	321	327	101
12	244	167	77	32	95	33	36	65	48	152	107	51	19	21	28	27	54	82	131	201	226	253	376	209	114
13	158	85	59	32	34	35	64	99	199	137	166	329	286	450	382	330	400	353	331	340	253	160	227	250	215
14	178	113	71	47	34	19	35	20	23	12	13	20	19	16	20	25	39	42	70	58	40	44	38	30	43
15	32	37	34	58	59	40	35	26	18	11	6	32	28	38	28	41	45	45	69	95	92	71	38	66	44
16	69	37	43	73	84	103	166	91	98	89	85	49	30	24	42	37	27	22	40	26	21	37	41	25	57
17	63	124	52	24	98	36	40	51	44	18	16	13	15	25	21	13	24	113	99	169	155	58	38	55	77
18	49	18	25	32	66	64	61	38	26	26	28	35	38	56	46	47	60	71	89	136	186	179	286	192	77
19	220	181	233	240	264	280	186	43	260	296	156	132	114	144	93	137	205	157	173	184	133	126	177	140	178
20	147	167	167	109	51	42	102	117	98	134	107	151	138	131	81	59	158	464	284	388	186	165	171	209	159
21	201	249	204	309	246	205	221	181	194	264	126	153	78	94	76	54	87	114	104	114	110	107	105	109	154
22	121	104	112	135	127	114	103	83	108	130	132	127	92	98	82	58	65	105	110	86	88	62	42	33	97
23	25	28	40	37	48	61	31	33	32	25	26	33	27	22	18	19	25	39	42	80	77	29	34	32	36
24	27	23	30	26	28	33	26	41	56	92	119	112	105	104	137	104	83	305	254	143	166	159	125	114	101
25	58	51	43	42	44	53	68	130	176	250	259	278	258	188	104	88	55	112	198	215	198	154	134	220	141
26	210	132	99	161	129	146	183	207	168	82	48	38	115	134	94	60	78	175	245	155	114	59	55	40	122
27	32	20	95	106	107	88	139	203	158	147	240	290	161	55	21	95	113	159	161	162	115	63	35	84	119
28	92	104	79	143	84	96	52	77	96	139	113	148	135	100	59	105	64	49	54	43	58	119	182	137	97
29	180	229	218	217	272	333	416	244	370	275	326	331	433	527	366	364	129	114	138	255	171	113	81	100	259
30	125	185	161	140	99	143	105	85	70	99	67	100	51	25	18	15	12	17	9	11	23	37	28	28	69
31	31	16	21	17	17	18	21	39	46	219	72	31	92	86	36	27	40	106	80	61	94	149	96	62	62
MEAN	114	98	92	102	109	108	102	95	112	128	128	127	122	119	94	84	89	120	131	140	132	121	126	121	113
50 MEAN	66	48	49	67	74	74	73	52	59	72	78	76	71	59	45	46	55	66	71	68	66	71	57	43	63
5D MEAN	181	182	176	181	173	179	197	136	224	221	176	219	209	269	199	188	195	240	206	256	170	134	152	161	193

SEPTEMBER 1979

AU INDEX (HOURLY VALUES)

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
0	49	56	71	59	64	30	21	21	27	49	23	25	28	36	70	47	85	111	155	231	284	88	61	156	77
	93	94	38	30	27	28	36	36	31	31	56	32	37	43	53	69	36	42	36	59	56	69	61	68	48
	68	156	126	115	123	46	131	188	106	93	43	135	150	98	81	46	48	67	105	158	117	68	53	41	98
	41	43	39	70	137	116	50	91	125	59	72	85	101	52	70	66	88	102	104	110	109	74	108	78	83
	61	114	150	237	279	197	88	98	75	106	122	164	218	235	225	163	211	239	249	280	223	151	88	67	168
0	88	126	127	117	263	180	197	63	113	129	159	179	128	105	87	174	147	75	57	38	34	90	62	41	113
	24	55	105	57	58	40	18	34	38	35	29	47	61	61	55	55	73	85	86	52	36	32	45	82	53
0	78	74	95	65	55	143	80	115	174	146	48	43	18	22	27	32	33	44	52	77	90	83	73	70	72
0	65	85	109	148	100	82	119	54	51	58	39	28	28	27	37	38	70	107	151	168	150	112	108	117	86
	147	166	136	88	57	113	101	110	167	200	249	237	173	124	152	193	189	248	276	239	239	247	292	234	182
	160	102	97	123	165	169	152	159	166	236	315	347	194	180	229	221	244	272	309	204	104	91	94	117	185
	112	84	75	47	47	27	37	25	30	29	29	28	40	47	77	47	41	94	100	111	71	79	185	110	65
	68	69	67	49	41	29	25	28	30	22	22	25	28	66	64	41	31	49	51	37	45	68	56	37	44
	37	39	40	33	38	37	41	54	43	59	35	37	32	29	25	28	36	74	50	179	207	226	236	180	75
	107	78	76	39	28	35	33	35	63	56	70	54	74	54	33	33	36	52	49	40	47	61	51	50	52
	83	141	143	92	42	35	70	93	57	90	59	117	89	59	44	41	62	114	96	79	58	101	206	202	91
	147	72	54	55	46	91	85	67	49	44	75	86	68	76	71	87	69	66	66	54	74	95	85	223	79
D	253	153	166	79	91	172	283	89	38	210	240	186	318	310	382	341	310	102	55	67	65	45	42	27	168
0	25	19	14	11	5	9	5	6	8	4	8	6	4	4	5	4	6	13	28	35	89	71	76	100	23
D	122	84	47	40	21	20	15	32	59	41	49	77	172	269	257	291	318	117	88	70	71	141	105	120	109
	126	173	172	225	231	95	45	144	147	171	173	155	119	85	71	74	43	47	108	156	94	43	88	84	119
	43	30	35	25	18	19	17	23	20	21	36	49	80	125	115	47	39	43	35	24	33	34	31	39	41
	36	34	47	53	96	74	60	38	25	22	17	23	33	66	51	62	99	97	110	81	50	42	40	31	54
	35	26	30	77	140	116	174	74	29	53	154	234	218	147	247	124	55	32	46	59	133	199	269	208	120
D	202	165	192	168	192	187	163	114	73	41	39	33	36	37	76	194	279	249	205	113	112	106	135	73	133
	77	102	152	181	132	85	149	103	83	85	104	123	72	110	107	129	117	245	232	195	168	136	118	142	131
	107	155	124	176	107	66	35	42	48	48	59	72	101	100	48	36	62	120	118	134	90	103	77	32	86
	44	74	60	56	105	90	138	131	121	126	134	68	63	77	80	109	203	162	136	141	147	225	245	172	121
	108	57	87	105	75	64	33	69	95	64	36	34	127	85	67	57	101	92	81	78	35	42	51	44	70
	58	112	102	89	123	187	124	141	127	87	52	39	53	69	57	89	138	107	49	53	93	69	62	53	89
MEAN	88	91	92	90	96	86	83	75	73	80	84	92	95	93	98	97	108	108	109	110	104	97	106	99	94
50 MEAN	57	65	72	62	49	60	50	49	60	54	36	31	29	31	35	39	43	58	70	78	84	73	72	87	56
50 MEAN	156	135	145	138	133	111	131	96	80	109	121	114	143	162	178	205	213	152	137	120	102	94	97	89	132

OCTOBER 1979

AU INDEX (HOURLY VALUES)

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2	17	15	18	18	17	16	13	20	32	89	82	91	146	106	52	98	169	278	278	156	65	56	97	78	84
3	60	90	152	122	144	146	88	57	40	36	41	29	28	24	31	57	103	161	77	44	59	44	39	46	72
4	90	66	41	42	31	46	69	62	129	215	157	64	29	11	5	8	9	9	13	15	16	15	17	19	49
5	19	19	18	17	19	20	20	19	16	17	21	15	23	22	52	65	114	105	110	127	141	115	101	102	54
D 6	129	122	116	130	139	153	139	163	158	123	100	176	147	204	310	305	369	218	95	43	20	60	41	80	148
D 7	92	77	60	86	85	166	222	52	74	85	45	43	34	149	328	250	51	33	50	88	106	140	120	160	108
D 8	145	161	199	310	171	80	83	115	156	65	121	186	153	66	17	30	86	143	149	118	131	132	139	144	129
D 9	101	119	156	168	129	211	181	156	203	156	140	185	51	28	87	90	155	110	104	73	92	101	47	36	120
D 10	34	109	129	114	45	122	91	56	54	123	148	216	138	96	90	45	33	28	80	163	90	84	44	50	91
11	36	27	18	19	18	17	17	44	89	71	80	119	123	88	59	94	110	36	19	33	37	31	17	24	51
12	15	12	10	17	14	19	24	20	22	25	67	96	158	74	45	58	94	155	120	178	101	99	141	162	72
13	82	55	44	45	49	37	44	87	82	65	41	30	22	16	13	12	19	52	94	102	87	81	119	107	58
14	71	59	72	65	31	20	19	41	33	36	21	20	26	28	60	67	53	27	19	16	17	19	24	23	36
15	19	18	15	23	17	16	29	43	85	67	77	106	91	102	115	131	127	31	37	101	120	143	72	69	69
16	67	52	78	120	98	84	82	29	31	32	43	30	29	70	48	23	13	16	52	61	34	30	23	30	49
17	27	23	32	36	38	37	35	22	24	16	12	14	11	11	15	13	8	6	9	12	23	36	49	51	23
18	44	41	46	27	33	28	20	49	24	25	18	14	12	11	10	6	6	12	11	16	29	39	49	69	27
19	53	23	19	19	23	28	26	28	36	47	36	21	18	19	17	17	22	19	21	24	28	31	39	47	28
20	51	54	31	26	27	28	39	51	73	93	161	137	82	26	18	12	21	23	30	36	48	21	21	20	47
21	24	30	27	39	30	27	36	45	30	51	69	54	43	55	26	68	100	54	67	107	134	134	124	144	63
22	123	89	109	99	41	70	80	136	141	68	40	32	26	36	25	33	62	95	48	89	130	81	69	58	74
23	26	46	45	32	22	43	90	120	101	87	86	59	63	72	65	60	56	35	29	41	90	118	158	131	70
24	120	68	34	41	100	60	52	88	63	63	98	128	122	97	105	159	155	125	75	74	43	32	21	18	81
25	21	32	33	45	54	171	154	158	137	78	35	53	41	62	86	145	93	51	46	140	151	172	155	109	93
26	84	41	47	50	28	35	33	32	33	33	32	53	125	79	45	32	34	36	39	36	63	59	68	41	48
27	31	23	18	29	37	51	44	81	88	123	86	64	43	15	15	17	18	18	22	40	64	50	37	24	43
28	28	38	49	41	47	66	67	81	116	277	349	267	98	68	1	26	21	20	10	5	40	96	86	30	83
29	114	60	51	38	57	59	31	18	13	25	11	7	9	21	41	24	61	139	241	187	110	50	43	34	60
30	39	42	39	97	52	33	33	23	25	41	92	53	19	23	30	25	18	21	19	16	15	15	14	13	33
31	17	19	17	21	23	21	21	22	20	21	25	41	51	67	32	55	144	148	103	46	31	27	32	52	44
MEAN	60	55	58	64	53	62	62	63	70	74	78	82	67	60	63	68	76	71	68	71	69	69	66	66	66
50 MEAN	38	30	30	41	36	35	31	40	39	50	48	33	20	15	17	15	14	15	16	21	31	34	37	40	30
5D MEAN	100	117	132	161	113	146	143	108	129	110	110	161	104	108	166	144	138	106	95	97	87	103	78	94	119

NOVEMBER 1979

AU INDEX (HOURLY VALUES)

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D 1	58	111	118	127	151	146	89	38	28	27	49	99	94	61	29	38	96	148	113	89	91	110	117	116	89
D 2	84	59	53	100	103	152	123	82	55	88	146	141	94	94	120	59	68	119	109	37	41	32	31	18	84
D 3	16	31	26	26	19	28	23	23	19	22	24	52	86	56	33	36	67	111	78	103	96	93	59	40	49
D 4	48	58	81	164	76	50	128	59	51	37	59	123	131	140	70	31	27	33	22	47	29	23	22	24	64
Q 5	32	27	22	17	16	18	21	17	21	27	21	18	15	14	14	12	14	16	16	20	14	11	12	11	18
Q 6	14	20	25	29	38	37	31	30	36	33	26	16	27	19	15	17	13	13	15	15	17	16	15	12	22
D 7	12	15	20	25	26	56	47	105	101	68	147	181	39	42	39	48	124	157	154	127	65	40	18	29	70
D 8	19	20	39	48	58	46	66	58	155	182	62	139	92	11	13	3	8	22	18	14	15	15	10	17	48
D 9	25	38	38	38	27	38	35	39	38	29	19	17	47	54	215	232	211	218	104	72	72	59	65	36	74
D 10	33	34	45	57	53	42	26	23	30	26	9	8	9	7	8	7	2	13	25	45	81	103	74	55	34
D 11	75	66	94	95	122	89	46	25	13	15	14	21	26	22	26	39	39	42	42	26	22	26	23	23	43
D 12	26	30	33	39	27	26	28	19	24	45	22	22	18	16	17	21	29	30	32	37	29	22	18	23	26
D 13	47	40	46	123	114	170	202	81	91	69	162	147	145	172	196	155	273	151	293	151	102	172	47	-28	130
D 14	43	38	72	71	202	82	113	74	38	42	30	9	4	-2	13	29	30	9	7	6	5	6	7	9	39
Q 15	2	3	4	15	17	16	17	15	14	12	7	7	7	4	2	1	1	4	6	6	6	9	6	11	8
D 16	14	21	60	29	55	94	118	154	91	57	76	122	122	93	130	159	156	183	176	187	124	55	67	90	101
D 17	90	101	88	47	46	69	36	28	39	24	19	11	12	10	10	12	9	6	12	19	29	21	19	17	32
D 18	21	18	36	29	29	23	28	21	19	18	16	24	19	11	12	7	4	9	13	17	18	15	14	14	18
D 19	17	16	17	18	20	21	39	44	50	81	39	58	39	62	57	41	49	36	28	33	61	79	104	61	45
D 20	49	33	30	27	33	56	54	73	75	61	68	106	79	62	20	55	148	67	54	51	36	34	40	28	56
Q 21	39	42	105	106	98	116	93	59	110	119	112	63	37	29	56	43	25	17	11	14	12	11	16	17	56
Q 22	22	20	20	22	21	15	21	18	11	10	28	28	21	12	12	13	20	12	11	14	15	17	20	21	18
D 23	28	30	32	29	26	22	23	23	32	38	41	65	43	20	11	13	12	19	20	32	62	69	81	118	37
D 24	143	133	121	130	189	333	246	270	176	226	150	85	90	138	95	39	53	127	185	97	131	73	49	86	140
D 25	41	44	87	116	215	159	87	58	22	42	64	42	81	114	63	25	21	25	30	52	23	20	22	29	62
Q 26	32	24	20	17	17	19	21	22	20	24	22	21	31	32	37	24	15	10	25	44	55	36	25	39	26
Q 27	27	26	31	20	23	36	19	29	42	29	23	21	14	22	16	11	13	16	18	17	17	14	13	15	21
Q 28	19	20	19	17	14	15	14	15	16	15	15	14	13	10	10	9	10	10	11	17	21	20	22	23	15
Q 29	19	18	17	18	19	21	23	23	22	21	22	24	22	21	31	36	24	23	28	61	45	40	49	42	28
Q 30	45	49	50	53	41	55	47	126	154	199	140	135	203	110	63	37	31	66	34	29	27	26	29	28	74
MEAN	38	39	48	55	63	68	62	55	53	56	54	60	55	48	47	41	53	57	56	49	45	42	36	34	50
5Q MEAN	17	18	18	20	21	20	20	19	19	19	19	16	16	11	10	10	11	11	11	14	14	14	15	15	16
5D MEAN	58	68	72	93	107	146	127	101	97	106	88	97	93	87	109	93	128	133	142	84	82	85	57	45	96

DECEMBER 1979

AU INDEX (HOURLY VALUES)

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2	26	39	29	69	70	68	56	70	76	119	126	88	45	70	61	20	22	64	49	34	38	21	25	32	55
3	66	88	68	53	54	102	155	89	82	109	160	10	14	15	10	2	7	11	11	3	6	8	6	8	43
4	9	4	8	25	27	30	100	112	98	174	169	117	106	191	251	258	140	115	217	141	95	139	101	68	112
5	69	77	72	80	76	37	36	64	59	73	75	49	30	36	22	51	74	50	24	48	57	33	16	23	51
6	40	49	42	52	28	13	22	24	35	14	6	3	3	4	2	0	0	0	3	9	18	22	21	18	18
7	21	20	22	36	24	12	12	15	13	14	19	13	11	10	11	4	4	6	9	13	20	33	28	34	17
8	25	28	36	58	77	60	53	47	36	25	33	44	109	43	79	76	101	99	38	89	77	61	71	68	60
9	63	60	57	62	31	21	43	22	29	19	17	16	23	37	32	19	16	9	10	12	33	16	20	24	29
10	24	19	18	24	39	52	48	36	30	29	50	25	14	37	22	19	43	50	30	24	28	14	13	14	29
11	20	20	28	25	39	42	37	25	21	27	14	9	9	10	14	8	16	13	58	50	33	15	18	40	25
12	20	19	29	37	30	25	24	31	29	30	37	42	26	20	13	33	21	32	12	35	36	16	18	14	26
13	10	10	13	28	24	28	40	58	30	16	28	25	39	82	32	22	13	8	10	20	35	34	34	25	28
14	22	17	21	26	26	21	15	28	34	37	29	13	15	10	9	14	11	18	55	56	21	17	20	22	23
15	24	25	17	20	120	70	26	42	41	188	164	28	27	24	22	4	16	57	146	206	145	41	28	32	63
16	43	18	32	72	71	167	82	27	17	36	33	57	53	53	54	45	28	34	39	40	32	25	41	42	48
17	44	62	42	55	74	55	72	98	110	101	34	19	50	42	41	72	63	178	136	99	66	53	42	32	66
18	50	64	33	43	23	17	20	17	16	33	26	33	30	52	59	32	22	17	19	16	26	24	13	17	29
19	27	35	27	39	71	64	80	58	34	32	46	32	12	11	15	11	15	24	16	17	19	23	34	26	32
20	14	10	8	9	18	31	39	51	41	56	54	59	86	84	30	50	33	62	82	145	109	95	66	26	52
21	23	18	13	12	11	10	10	14	16	39	26	46	43	75	56	41	94	139	177	109	113	89	94	94	57
22	81	54	48	46	77	101	55	42	29	68	318	137	39	18	23	16	60	138	203	99	66	56	33	20	76
23	14	18	14	11	11	10	8	7	10	10	8	11	10	7	4	6	6	9	11	9	12	13	18	19	11
24	21	21	35	21	20	23	35	14	14	16	24	22	48	78	54	82	130	50	33	22	36	55	56	31	39
25	26	16	14	12	9	11	10	9	9	9	9	11	11	17	18	18	20	20	16	25	17	18	21	17	15
26	23	36	64	72	37	28	25	30	21	18	31	53	72	36	42	46	105	215	172	188	135	111	87	39	70
27	26	39	50	49	92	63	31	87	106	54	27	64	45	32	140	82	139	47	21	29	21	17	22	17	54
28	18	21	20	22	55	101	58	36	48	61	45	138	234	117	34	53	45	52	35	21	28	52	102	207	67
29	199	150	65	99	72	187	212	112	100	194	183	70	50	57	219	141	206	250	210	125	179	209	102	22	142
30	83	89	65	68	79	106	89	86	131	92	134	97	245	155	68	51	43	46	102	55	49	46	39	34	86
31	28	29	19	18	34	39	26	17	9	10	10	11	14	12	17	21	12	38	55	58	72	84	115	134	37
MEAN	37	37	32	40	46	51	49	44	44	57	61	44	50	48	48	43	50	62	66	57	53	47	42	39	48
50 MEAN	18	16	18	24	19	17	18	24	18	15	20	20	19	27	15	16	12	15	11	20	24	22	23	21	19
50 MEAN	78	63	41	52	62	105	102	77	81	117	169	111	134	107	119	103	98	120	153	88	83	100	75	70	96

AL INDEX (HOURLY VALUES)

JULY

1979

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	-56	-64	-138	-51	-18	-22	-18	-22	-27	-36	-38	-36	-29	-17	-18	-26	-28	-38	-55	-56	-53	-52	-51	-39	-42
	-28	-31	-30	-27	-27	-29	-33	-35	-14	-59	-49	-48	-142	-194	-196	-164	-148	-159	-114	-65	-74	-101	-269	-168	-92
	-67	-131	-253	-209	-320	-481	-274	-126	-143	-67	-53	-38	-42	-116	-51	-33	-60	-52	-47	-60	-126	-75	-45	-41	-121
	-37	-33	-30	-30	-39	-56	-43	-18	-52	-153	-152	-169	-109	-44	-35	1	-39	-173	-58	-81	-97	-119	-120	-44	-72
D	-42	-32	-38	-44	-30	-70	-94	-274	-212	-291	-267	-229	-210	-230	-175	-108	-124	-75	-97	-480	-539	-163	-93	-100	-167
D	-132	-199	-112	-199	-185	-60	-33	-85	-112	-128	-124	-41	-49	-160	-718	-920	-604	-268	-143	-161	-108	-52	-34	-31	-194
	-36	-32	-59	-57	-80	-118	-56	-119	-184	-144	-160	-126	-97	-55	-119	-189	-101	-191	-204	-72	-78	-145	-168	-37	-109
	-40	-39	-46	-53	-139	-67	-101	-85	-56	-42	-55	-143	-234	-254	-301	-238	-278	-205	-80	-66	-80	-56	-51	-52	-115
	-54	-47	-43	-113	-40	-34	-53	-42	-35	-38	-34	-41	-177	-114	-48	-54	-127	-83	-61	-83	-101	-165	-69	-32	-70
Q	-46	-44	-46	-39	-45	-123	-48	-72	-152	-180	-76	-22	-20	-19	-21	-31	-36	-32	-35	-40	-88	-71	-62	-57	-59
	-43	-41	-36	-38	-45	-37	-40	-44	-42	-46	-104	-82	-59	-60	-62	-77	-119	-417	-452	-269	-94	-62	-49	-95	-101
	-220	-347	-371	-291	-259	-190	-146	-55	-36	-45	-123	-254	-297	-430	-605	-482	-283	-206	-418	-273	-162	-58	-46	-78	-236
	-101	-53	-51	-55	-51	-51	-46	-42	-27	-44	-50	-109	-173	-185	-98	-79	-66	-26	-23	-233	-392	-132	-160	-315	-107
	-281	-324	-316	-314	-159	-170	-164	-152	-180	-144	-206	-125	-55	-145	-259	-325	-322	-178	-212	-268	-275	-221	-330	-191	-222
	-225	-186	-351	-205	-54	-53	-46	-256	-141	-51	-37	-34	-27	-20	-35	-53	-47	-115	-125	-113	-222	-186	-212	-237	-126
	-241	-114	-269	-323	-270	-113	-45	-36	-29	-60	-201	-237	-121	-287	-182	-91	-100	-45	-17	-26	-45	-149	-360	-367	-155
	-290	-251	-110	-42	-102	-201	-252	-184	-85	-33	-56	-195	-185	-126	-78	-42	-67	-112	-120	-107	-124	-303	-191	-322	-149
	-385	-48	-47	-204	-380	-76	-37	-45	-109	-45	-18	-36	-83	-163	-125	-116	-45	-36	-33	-68	-76	-244	-223	-46	-112
	-33	-37	-36	-39	-237	-240	-169	-110	-156	-236	-328	-234	-160	-209	-53	-44	-46	-280	-483	-221	-109	-154	-166	-283	-169
D	-85	-118	-194	-133	-306	-186	-51	-84	-23	-87	-260	-126	-87	-90	-144	-163	-147	-41	-39	-48	-207	-240	-206	-163	-135
	-129	-177	-141	-63	-121	-105	-73	-115	-143	-63	-29	-19	-21	-20	-33	-45	-114	-80	-87	-53	-78	-63	-61	-60	-79
	-50	-36	-35	-37	-105	-274	-139	-57	-33	-53	-68	-24	-25	-26	-51	-125	-137	-98	-45	-92	-205	-155	-87	-138	-87
	-190	-161	-169	-219	-94	-74	-85	-83	-50	-29	-40	-35	-46	-149	-123	-115	-160	-134	-104	-59	-61	-77	-91	-85	-101
Q	-50	-74	-137	-129	-110	-46	-33	-23	-23	-32	-28	-32	-30	-21	-20	-22	-30	-38	-28	-41	-58	-63	-57	-50	-49
	-33	-31	-32	-32	-25	-25	-122	-93	-196	-153	-105	-127	-138	-186	-198	-214	-222	-211	-358	-499	-385	-498	-517	-407	-200
D	-398	-541	-500	-150	-40	-47	-53	-41	-37	-27	-23	-64	-63	-85	-113	-87	-155	-253	-179	-85	-66	-42	-80	-154	-128
	-236	-297	-420	-246	-49	-55	-62	-43	-32	-36	-42	-34	-33	-29	-39	-65	-68	-60	-51	-40	-47	-45	-34	-36	-87
D	-40	-36	-74	-84	-31	-37	-27	-15	-40	-121	-126	-71	-172	-182	-93	-79	-164	-153	-191	-48	-56	-68	-66	-280	-94
	-143	-113	-27	-45	-37	-55	-36	-36	-39	-55	-217	-138	-158	-263	-274	-200	-129	-65	-108	-117	-82	-98	-61	-30	-105
Q	-22	-35	-55	-38	-37	-28	-32	-28	-31	-55	-63	-63	-59	-38	-39	-51	-51	-39	-55	-78	-81	-43	-43	-34	-46
	-122	-122	-131	-114	-111	-105	-81	-80	-81	-84	-102	-97	-105	-131	-141	-139	-133	-127	-132	-129	-138	-128	-131	-129	-116
50 MEAN	-72	-75	-109	-95	-62	-59	-43	-45	-56	-66	-49	-37	-36	-48	-44	-49	-61	-56	-55	-54	-68	-61	-60	-53	-59
50 MEAN	-129	-169	-112	-103	-104	-90	-75	-105	-111	-160	-173	-127	-130	-173	-230	-247	-218	-205	-218	-199	-175	-95	-87	-169	-150

AL INDEX (HOURLY VALUES)

AUGUST 1979

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
1	-30	-31	-35	-43	-44	-39	-33	-28	-29	-29	-24	-20	-102	-244	-213	-210	-103	-89	-92	-188	-250	-292	-140	-337	-110
2	-186	-34	-21	-24	-55	-145	-182	-61	-328	-446	-127	-36	-98	-72	-76	-112	-253	-216	-52	-40	-12	-17	-16	-15	-109
3	-24	-28	-77	-356	-288	-146	-112	-149	-251	-95	-289	-245	-165	-184	-177	-134	-159	-146	-27	-9	-58	-108	-270	-202	-154
4	-227	-312	-329	-361	-309	-265	-186	-98	-194	-171	-162	-193	-452	-397	-305	-86	-94	-158	-307	-376	-363	-127	-31	-19	-230
5	-20	-25	-29	-120	-227	-280	-106	-25	-48	-47	-48	-27	-14	-12	-16	-32	-75	-74	-141	-248	-277	-160	-89	-76	-92
6	-93	-71	-79	-97	-260	-104	-27	-294	-366	-70	-287	-226	-305	-252	-229	-158	-158	-143	-117	-48	-54	-111	-52	-68	-153
7	-105	-117	-82	-98	-187	-250	-319	-276	-97	-24	-52	-332	-317	-339	-342	-321	-188	-226	-304	-419	-259	-145	-225	-136	-215
8	-167	-113	-132	-109	-79	-143	-109	-105	-51	-38	-62	-58	-174	-136	-82	-71	-63	-66	-223	-188	-48	-36	-65	-117	-102
9	-134	-40	-52	-69	-122	-85	-102	-45	-32	-20	-48	-65	-183	-117	-84	-46	-157	-267	-189	-76	-56	-34	-42	-43	-88
0	-53	-56	-57	-58	-50	-181	-137	-67	-84	-55	-72	-147	-247	-212	-131	-57	-30	-194	-126	-7	-34	-86	-160	-90	-100
11	-58	-46	-77	-121	-27	-25	-29	-37	-35	-28	-64	-80	-90	-67	-50	-160	-28	-21	-31	-69	-148	-352	-321	-278	-93
12	-256	-216	-70	-53	-34	-80	-29	-32	-74	-152	-217	-18	-25	-29	-56	-37	-43	-91	-123	-172	-164	-68	-389	-277	-113
13	-103	-69	-40	-27	-30	-22	-48	-40	-133	-84	-68	-595	-1212	-646	-335	-300	-567	-573	-552	-423	-475	-351	-432	-414	-314
14	-248	-56	-90	-69	-24	-20	-34	-35	-42	-44	-40	-41	-36	-40	-37	-30	-82	-147	-68	-163	-46	-56	-46	-37	-64
0	-46	-43	-48	-96	-76	-68	-89	-27	-32	-30	-27	-31	-29	-22	-51	-85	-65	-105	-87	-129	-79	-76	-37	-47	-59
16	-92	-59	-41	-38	-48	-42	-189	-110	-46	-89	-73	-19	-16	-13	-39	-46	-35	-12	-30	-21	-25	-48	-49	-37	-51
17	-46	-136	-91	-25	-31	-39	-36	-23	-117	-53	-30	-29	-23	-20	-16	-24	-22	-153	-240	-233	-151	-53	-38	-34	-69
18	-38	-27	-26	-29	-48	-79	-21	-25	-37	-46	-46	-47	-14	-15	-32	-22	-26	-64	-142	-114	-308	-232	-243	-670	-98
19	-603	-498	-445	-128	-301	-266	-279	-53	-176	-222	-126	-69	-75	-129	-115	-156	-359	-245	-209	-177	-130	-188	-353	-218	-230
D	-116	-233	-251	-48	-34	-51	-130	-37	-15	-43	-34	-40	-61	-69	-71	-99	-89	-570	-1243	-611	-99	-208	-189	-247	-191
D	-346	-452	-395	-310	-409	-234	-319	-321	-269	-365	-38	-54	-65	-51	-70	-61	-96	-157	-130	-86	-130	-183	-115	-83	-197
22	-291	-221	-226	-214	-218	-408	-327	-117	-83	-198	-219	-169	-52	-89	-172	-182	-142	-153	-175	-53	-56	-82	-49	-43	-164
0	-37	-41	-40	-39	-37	-63	-54	-37	-39	-52	-59	-55	-56	-46	-34	-30	-31	-17	-25	-78	-68	-46	-34	-22	-43
24	-28	-41	-43	-41	-38	-31	-34	-35	-100	-105	-196	-154	-76	-73	-72	-81	-175	-298	-175	-119	-87	-55	-81	-86	-93
25	-52	-41	-39	-40	-44	-30	-35	-62	-182	-393	-317	-677	-507	-191	-105	-110	-62	-39	-215	-233	-223	-181	-92	-147	-167
26	-333	-232	-96	-200	-120	-101	-152	-317	-162	-46	-47	-47	-56	-259	-217	-98	-94	-168	-352	-89	-79	-29	-33	-35	-140
27	-35	-39	-64	-227	-254	-146	-162	-243	-183	-140	-296	-268	-172	-73	-23	-91	-144	-168	-106	-160	-77	-11	-18	-56	-131
28	-81	-207	-169	-132	-68	-166	-103	-62	-84	-153	-208	-170	-229	-208	-96	-143	-132	-48	-7	-8	-23	-70	-203	-161	-122
D	-273	-175	-257	-289	-178	-509	-388	-143	-175	-332	-379	-178	-518	-524	-667	-495	-813	-879	-709	-887	-648	-666	-524	-355	-457
30	-283	-209	-114	-219	-351	-256	-91	-79	-61	-72	-101	-144	-111	-49	-25	-40	-59	-43	-29	-33	-37	-46	-36	-46	-106
31	-52	-48	-44	-44	-33	-36	-42	-40	-35	-192	-110	-45	-98	-252	-115	-73	-31	-105	-90	-42	-116	-320	-156	-77	-91
MEAN	-143	-126	-114	-120	-129	-139	-125	-97	-114	-123	-124	-138	-179	-155	-130	-115	-141	-181	-203	-177	-147	-143	-146	-144	-140
50 MEAN	-72	-47	-47	-60	-66	-87	-114	-57	-46	-49	-55	-63	-106	-82	-67	-52	-63	-119	-91	-62	-52	-58	-64	-47	-68
50 MEAN	-288	-285	-277	-160	-190	-216	-232	-118	-153	-209	-129	-187	-386	-283	-251	-222	-384	-484	-568	-436	-296	-319	-322	-263	-277

SEPTEMBER 1979

AL INDEX (HOURLY VALUES)

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN	
0	-73	-74	-152	-78	-36	-13	-19	-13	-34	-26	-16	-18	-23	-35	-84	-87	-85	-119	-116	-219	-380	-76	-18	-135	-80
1	-169	-60	-19	-13	-24	-27	-25	-17	-17	-123	-93	-59	-37	-37	-49	-115	-56	-43	-23	-63	-71	-97	-147	-65	-60
2	-33	-295	-263	-177	-86	-48	-204	-219	-103	-69	-23	-97	-133	-198	-31	-29	-28	-45	-148	-242	-80	-20	-7	-7	-108
3	-6	-7	-9	-15	-48	-208	-152	-96	-154	-15	-43	-46	-87	-26	-52	-58	-232	-170	-56	-246	-214	-86	-47	-28	-87
4	-58	-167	-434	-382	-277	-96	-31	-64	-89	-82	-203	-132	-283	-462	-447	-203	-169	-328	-306	-289	-511	-126	-22	-10	-215
5	-93	-337	-408	-192	-277	-359	-187	-37	-29	-72	-216	-180	-152	-155	-85	-220	-143	-3	1	-4	-12	-14	-33	-45	-135
6	-37	-63	-176	-241	-89	-12	-42	-43	-42	-33	-18	-31	-52	-107	-103	-61	-102	-178	-150	-47	-14	-20	-20	-54	-72
7	-62	-85	-85	-46	-72	-125	-96	-113	-249	-141	-22	-31	-35	-34	-37	-34	-24	-30	-62	-76	-118	-72	-38	-46	-72
8	-34	-107	-159	-122	-36	-27	-120	-18	-22	-35	-23	-24	-28	-30	-46	-42	-138	-201	-208	-132	-133	-113	-109	-174	-87
9	-176	-192	-172	-43	-19	-85	-117	-151	-172	-214	-205	-226	-199	-261	-274	-158	-127	-125	-407	-342	-244	-200	-194	-168	-186
10	-135	-96	-63	-68	-94	-148	-179	-218	-307	-256	-446	-372	-273	-212	-262	-260	-234	-368	-219	-110	-46	-8	-45	-135	-190
11	-207	-101	-38	-6	-10	-5	-10	-18	-18	-21	-19	-16	-23	-27	-51	-58	-25	-61	-131	-103	-12	-36	-75	-318	-58
12	-143	-70	-167	-87	-5	-4	-9	-7	-10	-13	-21	-31	-20	-55	-54	-64	-59	-40	-18	-16	-16	-77	-68	-19	-45
13	-22	-73	-103	-12	-10	-74	-61	-25	-24	-31	-32	-29	-34	-34	-24	-26	-20	-44	-35	-217	-338	-239	-182	-64	-73
14	-118	-29	-19	-7	-15	-17	-7	-1	-10	-20	-22	-21	-42	-21	-24	-20	-22	-34	-22	-14	-13	-11	-8	-21	-22
15	-145	-222	-117	-22	-4	-13	-37	-130	-74	-51	-27	-94	-95	-27	-61	-32	-52	-205	-152	-67	-22	-52	-218	-345	-94
16	-135	-13	-8	-15	-22	-35	-92	-104	-16	-9	-24	-62	-59	-40	-49	-104	-101	-69	-33	-9	-17	-21	-27	-216	-53
17	-385	-447	-271	-60	-19	-76	-172	-483	-546	-394	-792	-509	-653	-413	-375	-462	-325	-193	-132	-96	-36	-3	-10	-22	-286
18	-2	-34	-47	-35	-35	-42	-30	-28	-26	-24	-25	-25	-27	-33	-33	-35	-43	-42	-40	-31	-63	-39	-130	-169	-44
19	-152	-67	-85	-21	-27	-26	-25	-10	-20	-27	-15	-27	-224	-576	-607	-553	-489	-230	-81	-43	-70	-124	-220	-148	-161
20	-367	-459	-465	-446	-419	-118	-26	-78	-221	-253	-183	-177	-170	-123	-96	-93	-66	-16	-88	-171	-54	-10	-67	-167	-181
21	-151	-43	-16	-12	-12	-10	-9	-8	-11	-22	-22	-25	-69	-319	-251	-50	-28	-27	-25	-25	-22	-19	-8	-6	-50
22	-2	-10	-56	-94	-154	-157	-65	-39	-18	-26	-26	-27	-19	-54	-98	-130	-215	-168	-107	-95	-42	-21	-16	-2	-68
23	-9	-15	-24	-155	-305	-158	-153	-84	-39	-20	-83	-413	-477	-342	-415	-111	-36	-33	-28	-40	-124	-321	-345	-267	-167
24	-261	-201	-235	-382	-207	-154	-232	-86	-67	-20	-24	-20	-19	-32	-73	-330	-513	-322	-265	-138	-191	-183	-203	-126	-179
25	-153	-348	-484	-205	-51	-38	-121	-218	-156	-91	-123	-145	-83	-298	-299	-199	-151	-203	-404	-378	-261	-171	-144	-231	-206
26	-202	-177	-309	-388	-83	-29	-42	-52	-79	-64	-59	-102	-147	-211	-40	-31	-154	-297	-278	-171	-158	-78	-161	-96	-142
27	-54	-88	-147	-99	-172	-446	-384	-223	-171	-221	-106	-66	-58	-182	-123	-202	-399	-234	-161	-226	-268	-380	-229	-125	-198
28	-346	-227	-143	-176	-146	-116	-65	-73	-179	-103	-49	-30	-185	-355	-102	-60	-172	-245	-117	-51	-45	-41	-118	-270	-142
29	-112	-167	-447	-636	-456	-160	-146	-147	-177	-98	-32	-40	-110	-169	-158	-185	-254	-97	-35	-27	-66	-229	-90	-50	-170
30	-128	-142	-170	-141	-107	-94	-95	-93	-102	-85	-99	-102	-127	-162	-146	-133	-148	-139	-128	-122	-121	-96	-99	-117	-121
MEAN	-64	-69	-97	-91	-51	-46	-62	-43	-71	-71	-36	-34	-35	-48	-53	-57	-72	-98	-96	-69	-79	-68	-88	-101	-67
50 MEAN	-263	-304	-308	-222	-144	-82	-115	-175	-202	-157	-227	-175	-229	-288	-290	-327	-308	-192	-194	-165	-122	-98	-128	-138	-202

AL INDEX (HOURLY VALUES)

OCTOBER 1979

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
1	-223	-333	-118	-109	-71	-56	-92	-65	-43	-66	-326	-402	-225	-183	-235	-382	-153	-49	-20	-10	-7	-5	-21	-19	-134
2	-22	-26	-25	-26	-15	-13	-9	-13	-11	-110	-121	-164	-231	-229	-172	-256	-376	-320	-354	-151	-51	-36	-74	-335	-131
3	-152	-207	-345	-251	-149	-98	-121	-84	-44	-18	-31	-43	-113	-39	-31	-46	-230	-463	-258	-44	-40	-34	-20	-19	-120
4	-285	-129	-113	-8	-8	-12	-34	-66	-239	-354	-182	-47	-38	-36	-27	-29	-28	-15	-10	-7	-9	-12	-10	-13	-71
5	-19	-23	-18	-11	-10	-9	-8	-19	-14	-16	-24	-32	-36	-37	-66	-171	-272	-239	-152	-149	-171	-140	-117	-182	-81
D 6	-163	-93	-207	-146	-244	-207	-335	-185	-73	-39	-42	-91	-434	-272	-259	-346	-281	-108	-17	-23	-51	-42	-29	-76	-157
D 7	-136	-84	-219	-172	-51	-175	-196	-54	-102	-173	-160	-171	-126	-368	-878	-414	-99	-55	-40	-84	-231	-341	-224	-228	-199
D 8	-439	-368	-536	-400	-140	-80	-117	-146	-512	-612	-535	-584	-339	-118	-51	-66	-224	-611	-392	-170	-185	-564	-536	-267	-333
D 9	-423	-421	-236	-211	-288	-321	-304	-293	-324	-240	-674	-239	-36	-36	-164	-324	-376	-220	-194	-199	-142	-178	-110	-38	-250
D 10	-45	-212	-460	-240	-111	-96	-121	-76	-47	-219	-318	-294	-260	-410	-324	-71	-107	-157	-175	-591	-152	-62	-146	-56	-198
11	-33	-31	-26	-19	-17	-16	-14	-27	-212	-338	-218	-244	-237	-182	-250	-243	-285	-103	-61	-38	-23	-48	-24	-11	-112
12	-23	-29	-40	-93	-20	-7	-6	-14	-25	-25	-64	-216	-285	-179	-232	-273	-316	-300	-220	-160	-178	-167	-167	-288	-139
13	-70	-42	-39	-29	-68	-51	-33	-43	-41	-39	-25	-41	-36	-32	-32	-76	-109	-198	-207	-168	-69	-50	-189	-70	-73
14	-31	-34	-45	-32	-15	-14	-9	-6	-15	-23	-28	-30	-26	-28	-73	-133	-142	-28	-28	-21	-13	-10	-9	-12	-34
15	-10	-13	-10	-12	-8	-9	-6	-52	-193	-240	-200	-342	-259	-488	-308	-254	-252	-70	-82	-212	-246	-62	-18	-28	-141
16	-29	-130	-158	-173	-173	-105	-135	-93	-16	-21	-25	-22	-26	-92	-122	-10	-21	-24	-144	-210	-39	-19	-21	-19	-74
17	-19	-19	-17	-9	-17	-4	-7	-6	-13	-15	-19	-17	-30	-25	-25	-24	-19	-13	-13	-13	-20	-39	-44	-20	-19
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20	-112	-41	-12	-12	-11	-4	1	-148	-355	-262	-196	-135	-80	-47	-45	-67	-35	-20	-23	-17	-64	-25	-16	-13	-72
21	-11	-30	-75	-192	-76	-52	-126	-126	-82	-76	-73	-72	-50	-80	-106	-324	-250	-129	-146	-137	-161	-270	-357	-227	-134
22	-166	-191	-197	-145	-97	-218	-253	-221	-244	-73	-31	-27	-18	-49	-167	-153	-154	-283	-71	-126	-145	-44	-56	-62	-133
23	-23	-36	-67	-121	-101	-96	-149	-189	-151	-151	-88	-89	-126	-165	-169	-154	-108	-132	-90	-82	-213	-186	-161	-157	-125
24	-142	-77	-50	-21	-91	-128	-115	-194	-79	-58	-136	-197	-195	-497	-368	-266	-347	-211	-151	-89	-29	-19	-19	-19	-146
25	-19	-58	-140	-158	-242	-207	-146	-445	-171	-74	-55	-143	-216	-366	-214	-158	-157	-95	-122	-256	-343	-221	-120	-91	-176
26	-84	-45	-32	-145	-99	-90	-74	-11	-18	-22	-60	-145	-269	-207	-130	-60	-83	-159	-74	-34	-63	-57	-133	-38	-89
27	-18	-21	-16	-13	-78	-150	-130	-80	-94	-99	-66	-114	-64	-36	-30	-89	-104	-33	-18	-73	-203	-75	-13	-16	-68
28	-12	-14	-92	-176	-104	-38	-46	-150	-297	-361	-436	-392	-271	-231	-95	-61	-40	-27	-20	-14	-38	-262	-299	-330	-159
29	-130	-59	-195	-204	-104	-38	-18	-21	-11	-90	-130	-36	-38	-73	-225	-250	-271	-452	-429	-253	-187	-166	-47	-121	-148
30	-50	-178	-121	-39	-32	-39	-53	-66	-96	-189	-95	-64	-134	-156	-142	-98	-40	-20	-9	-13	-17	-17	-11	-14	-70
31	-14	-15	-12	-13	-14	-17	-12	-10	-10	-26	-74	-178	-137	-176	-284	-240	-344	-265	-128	-47	-23	-31	-30	-122	-93
MEAN	-94	-96	-117	-103	-79	-76	-86	-93	-114	-131	-144	-149	-142	-158	-170	-164	-170	-156	-118	-110	-101	-103	-100	-97	-120
50 MEAN	-24	-49	-37	-18	-30	-40	-42	-40	-46	-69	-46	-53	-59	-57	-51	-54	-44	-22	-15	-27	-55	-33	-29	-38	-41
5D MEAN	-241	-235	-331	-233	-166	-175	-214	-150	-211	-256	-345	-275	-239	-240	-335	-244	-217	-230	-163	-213	-152	-237	-209	-133	-227

AL INDEX (HOURLY VALUES)

NOVEMBER 1979

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
D 1	-201	-181	-243	-248	-129	-99	-61	-12	-17	-24	-63	-217	-252	-53	-41	-117	-263	-366	-339	-169	-191	-325	-308	-207	-172
D 2	-240	-301	-192	-125	-169	-205	-125	-9	-88	-203	-320	-162	-181	-389	-245	-176	-185	-274	-190	-66	-23	-18	-13	-9	-165
3	-12	-12	-14	-12	-19	-16	-35	-9	-11	-10	-14	-146	-301	-135	-11	-56	-381	-457	-183	-213	-296	-299	-71	-23	-114
4	-29	-209	-239	-140	-32	-13	-67	-62	-28	-19	-76	-289	-219	-149	-116	-79	-138	-159	-68	-152	-142	-32	-9	-18	-104
0 5	-56	-10	-8	-10	-13	-11	-5	-7	-6	-5	-18	-23	-69	-72	-49	-45	-39	-31	-25	-78	-49	-23	-19	-17	-29
0 6	-15	-13	-12	-12	-9	-5	-9	-13	-19	-24	-37	-86	-38	-25	-37	-38	-30	-19	-12	-14	-15	-20	-21	-18	-23
7	-16	-19	-16	-18	-45	-35	-29	-71	-88	-93	-131	-136	-56	-121	-196	-96	-318	-332	-387	-329	-126	-131	-62	-155	-125
D 8	-114	-79	-98	-91	-97	-69	-93	-199	-404	-466	-301	-374	-190	-51	-67	-118	-73	-18	-18	-15	-11	-13	-15	-21	-125
D 9	-56	-146	-56	-41	-23	-27	-49	-134	-90	-52	-35	-32	-56	-273	-571	-550	-530	-353	-99	-135	-260	-273	-91	-18	-165
10	-17	-21	-16	-16	-14	-11	-12	-14	-19	-44	-35	-36	-34	-31	-27	-39	-61	-70	-44	-116	-75	-120	-186	-32	-46
11	-60	-96	-102	-86	-97	-84	-78	-40	-24	-36	-25	-21	-24	-25	-32	-26	-53	-48	-48	-11	-15	-23	-21	-24	-46
12	-25	-26	-19	-10	-16	-15	-13	-30	-258	-233	-197	-217	-268	-98	-115	-173	-199	-189	-68	-127	-49	-27	-33	-60	-103
D 13	-94	-255	-453	-426	-245	-268	-160	-299	-236	-403	-608	-384	-325	-492	-542	-794	-526	-507	-445	-410	-584	-225	-288	-495	-394
14	-315	-221	-245	-323	-189	-100	-127	-55	-43	-47	-35	-32	-33	-43	-52	-78	-60	-28	-18	-18	-25	-26	-29	-34	-91
0 15	-28	-29	-24	-19	-16	-13	-11	-15	-15	-16	-23	-26	-22	-23	-35	-35	-28	-21	-14	-11	-12	-13	-17	-20	-21
16	-13	-11	-8	-2	-105	-273	-262	-279	-118	-174	-182	-193	-197	-247	-306	-217	-187	-271	-339	-239	-81	-41	-80	-146	-165
17	-192	-177	-28	-10	-20	-97	-43	-41	-73	-209	-75	-28	-25	-20	-21	-27	-26	-18	-14	-68	-176	-26	-9	-12	-60
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19	-14	-16	-12	-9	-7	-7	-71	-56	-121	-101	-126	-55	-31	-75	-242	-112	-69	-6	-23	-57	-271	-228	-191	-75	-82
20	-21	-25	-44	-42	-28	-85	-115	-72	-86	-65	-251	-316	-246	-345	-257	-280	-372	-186	-1	-1	-9	-30	-46	-54	-124
21	-63	-84	-221	-104	-123	-111	-94	-245	-154	-59	-63	-54	-36	-74	-171	-134	-63	-80	-35	-27	-20	-18	-16	-14	-86
0 22	-11	-9	-5	-3	-13	-43	-26	-29	-129	-128	-132	-31	-16	-36	-109	-38	-15	-21	-21	-18	-14	-11	-12	-13	-37
23	-18	-16	-10	-5	-6	-7	-40	-58	-97	-99	-103	-121	-121	-107	-77	-143	-113	-55	-40	-115	-195	-149	-204	-223	-88
D 24	-153	-138	-259	-282	-368	-281	-275	-270	-268	-137	-356	-767	-468	-323	-216	-57	-117	-487	-522	-143	-226	-454	-297	-259	-297
25	-292	-347	-459	-402	-177	-69	-69	-27	-11	-18	-118	-46	-19	-38	-96	-78	-26	-20	-23	-45	-8	-15	-17	-14	-100
26	-11	-11	-9	-4	-6	-6	-4	-1	-5	-8	-6	-6	-42	-14	-3	-5	-6	-3	-23	-266	-224	-63	-19	-22	-32
27	-84	-81	-16	-4	-4	-21	-162	-121	-51	-36	-70	-75	-49	-167	-145	-109	-48	-42	-55	-54	-27	-14	-4	-11	-60
0 28	-11	-11	-8	-6	-7	-13	-36	-61	-4	-6	-21	-23	-17	-15	-34	-35	-13	-22	-5	-1	0	0	0	-1	-15
29	-3	-1	-2	0	0	1	2	4	1	-4	-4	-7	-10	-16	-86	-81	-21	-18	-30	-212	-101	-44	-36	-19	-28
30	-45	-55	-68	-41	-46	-46	-48	-225	-394	-277	-126	-80	-165	-31	-25	-23	-31	-105	-21	3	-23	-29	-45	-91	-85
MEAN	-74	-87	-96	-83	-67	-67	-69	-83	-95	-103	-117	-135	-121	-120	-132	-126	-134	-140	-104	-103	-108	-90	-72	-70	-100
50 MEAN	-24	-14	-11	-10	-11	-17	-17	-25	-34	-35	-46	-37	-33	-35	-52	-38	-25	-22	-15	-24	-18	-13	-13	-13	-24
5D MEAN	-123	-159	-221	-217	-172	-148	-127	-182	-203	-216	-272	-354	-258	-238	-287	-327	-301	-346	-284	-174	-254	-258	-199	-200	-230

DECEMBER 1979

AL INDEX (HOURLY VALUES)

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
1	-33	-14	-10	-10	-11	-26	-117	-239	-267	-255	-285	-230	-376	-341	-306	-211	-324	-338	-89	-51	-92	-162	-44	-24	-161
2	-15	-149	-95	-166	-112	-88	-248	-183	-342	-319	-319	-168	-100	-179	-82	-81	-99	-181	-144	-99	-170	-46	-63	-142	-142
3	-160	-123	-156	-202	-206	-211	-242	-124	-102	-254	-83	-29	-52	-65	-159	-67	-34	-38	-62	-61	-15	-14	-10	-12	-103
4	-22	-54	-121	-184	-238	-325	-380	-312	-237	-309	-258	-350	-453	-526	-500	-486	-402	-266	-223	-235	-318	-257	-168	-70	-280
5	-31	-35	-18	-3	-3	-17	-44	-93	-159	-105	-82	-45	-44	-132	-353	-211	-146	-112	-80	-93	-113	-51	-33	-38	-85
6	-49	-80	-49	-43	-15	-14	-29	-97	-169	-92	-36	-33	-34	-38	-42	-42	-41	-36	-27	-22	-68	-96	-45	-21	-51
7	-25	-22	-22	-18	-13	-4	-6	-10	-13	-17	-44	-23	-23	-19	-24	-31	-30	-24	-26	-47	-73	-62	-25	-12	-25
8	-6	-8	-14	-62	-33	2	-13	-5	-2	-5	-22	-27	-122	-267	-384	-171	-161	-214	-49	-97	-189	-96	-124	-110	-91
9	-50	-12	-22	-12	-5	-8	-14	-10	-29	-45	-28	-33	-37	-189	-114	-31	-30	-18	-25	-27	-76	-46	-59	-32	-40
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14	-19	-18	-15	-101	-25	-3	-6	-27	-73	-84	-40	-19	-19	-19	-20	-21	-19	-17	-56	-144	-104	-16	-11	-12	-14
15	-27	-24	-31	-91	-212	-48	-26	-65	-149	-317	-224	-37	-39	-39	-71	-58	-82	-304	-341	-285	-106	-23	-16	-62	-114
16	-173	-51	-41	-59	-152	-180	-79	-34	-11	-27	-47	-123	-221	-133	-204	-182	-83	-60	-90	-127	-88	-34	-83	-195	-103
17	-169	-56	-42	-72	-105	-127	-155	-207	-228	-121	-36	-22	-124	-276	-291	-320	-261	-339	-199	-72	-42	-84	-232	-104	-154
18	-111	-180	-37	-24	-17	-26	-31	-37	-24	-157	-212	-114	-109	-212	-160	-44	-71	-75	-19	-22	-183	-137	-78	-29	-88
19	-47	-118	-105	-159	-160	-130	-41	-32	-43	-18	-146	-115	-17	-19	-37	-180	-106	-110	-181	-42	-61	-220	-36	-15	-89
20	-11	-13	-26	-24	-34	-47	-58	-41	-95	-110	-158	-200	-215	-190	-305	-239	-190	-231	-197	-237	-169	-98	-53	-19	-123
21	-11	-12	-9	-10	-7	-5	-13	-11	-28	-29	-62	-137	-118	-155	-181	-193	-236	-337	-340	-177	-165	-161	-143	-102	-110
22	-99	-15	-88	-64	-144	-151	-77	-101	-189	-215	-510	-140	-64	-64	-77	-230	-272	-330	-582	-376	-114	-28	-43	-26	-165
23	-11	-11	-12	-9	-9	-13	-8	-11	-28	-9	-10	-10	-19	-18	-15	-13	-9	-13	-6	-1	-5	-9	-16	-52	-13
24	-61	-96	-37	-39	-14	-62	-81	-27	-28	-50	-73	-271	-184	-207	-209	-297	-391	-56	-39	-34	-70	-158	-75	-22	-108
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26	-3	-7	-24	-14	6	6	4	3	0	-4	-8	-25	-115	-30	-7	-31	-154	-326	-210	-241	-305	-127	-53	-17	-70
27	-15	-12	-11	-12	-95	-45	-38	-236	-237	-82	-43	-290	-283	-254	-381	-373	-423	-117	-50	-131	-25	-15	-22	-11	-133
28	-12	-13	-38	-83	-214	-122	-6	-3	-10	-39	-146	-513	-525	-118	-52	-256	-349	-89	-18	-32	-154	-248	-432	-472	-164
29	-268	-163	-277	-338	-404	-353	-305	-145	-162	-410	-250	-90	-126	-479	-748	-637	-609	-560	-427	-593	-386	-424	-514	-552	-383
30	-402	-275	-314	-380	-245	-263	-192	-227	-245	-210	-281	-489	-393	-317	-175	-270	-278	-177	-220	-118	-19	-24	-60	-64	-235
31	-35	-50	-25	-18	-4	-19	-63	-63	-66	-33	-80	-61	-67	-20	-16	-31	-63	-279	-303	-230	-154	-309	-345	-318	-110
MEAN	-62	-55	-55	-73	-85	-75	-72	-79	-91	-111	-116	-119	-132	-148	-174	-166	-168	-177	-138	-116	-108	-99	-91	-85	-108
50 MEAN	-14	-13	-11	-14	-14	-11	-13	-13	-13	-18	-27	-22	-43	-33	-23	-29	-21	-28	-24	-37	-59	-35	-17	-22	-23
5D MEAN	-160	-104	-167	-209	-253	-242	-192	-157	-168	-236	-289	-316	-312	-303	-341	-384	-393	-330	-252	-218	-181	-199	-240	-236	-245

JULY 1979

AE INDEX (HOURLY VALUES)

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
0	186	238	166	86	125	324	282	225	244	191	158	224	294	230	132	136	202	152	158	218	244	189	154	163	197
1	180	214	265	120	69	49	43	49	60	60	63	62	54	49	53	58	77	101	140	117	98	92	96	79	94
2	66	63	63	58	55	50	71	82	100	133	299	315	405	336	316	356	342	418	351	189	237	336	508	356	229
3	201	403	427	388	647	809	560	363	345	183	143	98	124	200	93	78	125	115	128	163	226	142	84	75	255
4	64	59	50	60	70	115	78	53	154	395	443	353	221	140	135	91	125	268	161	215	236	220	215	98	167
5	90	59	60	79	67	144	285	432	390	553	528	465	333	343	265	169	197	162	218	762	853	328	238	297	305
D	564	499	313	471	457	227	138	250	336	376	372	167	122	412	1271	1472	1045	439	335	314	204	110	82	86	419
D	81	72	142	140	182	191	134	279	335	320	315	213	198	147	253	377	274	339	324	183	195	249	263	96	222
8	73	64	91	123	206	126	163	133	97	82	145	259	393	388	414	340	493	377	199	173	167	96	76	73	198
9	80	72	114	183	93	71	72	72	63	89	116	159	273	197	110	121	208	152	115	199	226	289	134	101	138
10	113	98	82	65	90	183	94	229	272	390	144	54	39	50	56	64	65	67	75	82	159	145	147	122	120
11	92	83	67	65	71	78	54	66	74	79	153	130	116	110	110	139	225	635	737	523	208	194	122	213	181
12	430	621	679	575	558	416	334	120	121	141	258	391	482	685	951	809	581	597	713	463	325	189	143	168	448
13	170	94	104	102	70	69	65	58	51	113	130	226	245	290	165	107	107	65	83	494	607	290	354	536	191
14	542	570	526	586	274	356	313	333	367	312	396	234	142	225	352	459	471	270	337	439	484	382	617	399	391
15	448	322	520	343	116	83	116	426	271	110	71	53	42	54	61	80	86	204	205	196	363	318	382	523	225
16	408	224	424	503	478	201	93	69	57	186	338	334	224	437	293	167	154	87	60	73	100	355	606	593	269
17	456	435	200	106	276	380	460	384	152	60	138	328	280	181	129	87	119	177	203	206	256	567	327	546	269
18	562	138	97	345	507	123	88	96	182	109	58	98	163	276	201	159	82	82	82	138	156	463	417	116	198
19	92	69	66	118	350	385	274	242	303	409	611	515	441	405	123	86	124	481	749	453	332	356	328	424	322
D	205	203	275	261	482	356	112	125	55	226	382	238	182	141	231	255	194	66	85	104	341	478	422	340	240
21	279	348	256	116	188	153	146	222	273	110	64	46	49	59	60	76	183	138	160	136	133	98	89	92	145
22	79	60	52	52	261	435	240	90	72	93	118	71	65	77	90	164	169	138	93	179	358	298	157	274	154
23	361	303	327	363	210	211	182	170	123	57	63	66	110	210	179	165	209	206	186	164	202	230	205	171	195
24	121	184	289	280	292	108	60	52	46	54	50	53	62	61	49	53	53	70	62	76	89	100	94	84	102
25	72	59	51	49	57	107	236	217	390	353	283	263	248	312	297	313	358	405	609	776	720	803	893	657	355
D	662	842	646	287	104	109	75	54	36	37	60	176	152	185	206	192	265	423	339	264	226	152	203	247	248
27	349	418	629	347	71	72	72	44	29	36	49	46	44	41	58	98	105	109	94	71	83	106	96	91	131
28	109	127	167	146	77	82	81	133	133	332	300	225	438	371	220	272	469	364	408	216	213	217	298	445	244
D	269	265	66	89	72	97	88	67	75	244	338	243	270	401	396	315	283	157	228	218	175	209	106	60	197
30	49	42	62	45	53	36	38	36	51	120	120	91	79	68	77	89	83	58	74	104	115	58	53	48	69
31	240	233	234	211	213	198	162	166	170	192	216	199	202	228	236	237	241	236	248	255	268	259	255	244	223
MEAN	164	168	205	174	142	117	83	107	110	136	88	65	68	87	82	85	97	100	107	108	132	125	119	100	115
50 MEAN	303	319	250	220	211	189	170	222	239	341	374	309	297	343	417	438	420	373	409	401	365	232	229	299	307
5D MEAN																									

AE INDEX (HOURLY VALUES)

AUGUST 1979

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
1	64	54	49	56	61	62	58	55	58	62	61	107	299	450	382	357	236	211	200	371	509	449	301	573	212
2	351	111	62	49	138	302	241	133	513	681	221	124	213	163	127	171	386	321	122	96	53	57	62	58	198
3	77	92	203	547	448	277	225	339	417	229	536	426	288	282	312	234	227	193	75	64	136	251	505	405	283
4	466	561	540	562	495	511	417	239	425	430	430	386	655	682	496	136	165	296	596	654	634	241	95	76	423
5	56	53	78	213	428	515	194	57	86	103	141	64	53	67	52	76	98	116	245	413	496	377	239	201	184
6	264	167	170	262	513	212	127	570	602	231	636	475	457	354	326	226	333	254	213	131	144	224	136	157	299
7	186	205	187	200	322	471	473	440	167	86	221	534	555	544	592	494	348	413	548	665	530	372	449	371	389
8	388	264	274	228	201	233	218	174	134	208	228	174	315	241	165	158	103	144	391	332	114	129	226	339	224
9	288	108	117	168	235	157	156	97	101	109	123	169	289	200	154	107	261	383	291	161	126	73	78	72	168
0	108	129	124	130	119	276	220	128	168	207	272	314	415	343	204	132	108	305	234	65	107	270	299	156	201
11	146	139	167	235	90	81	106	68	68	69	138	159	185	128	115	219	73	59	99	149	309	644	644	607	196
12	501	384	147	86	129	114	66	98	123	304	326	71	45	51	85	66	99	174	256	374	391	322	767	488	228
13	262	156	101	61	65	58	113	139	334	222	235	925	1499	1097	718	630	968	927	884	764	728	512	660	665	530
14	427	170	162	117	60	39	70	57	66	57	54	62	57	58	58	56	123	190	140	221	86	102	85	68	108
0	79	82	82	155	135	109	125	54	51	42	35	64	58	62	80	127	111	151	158	225	172	148	76	115	104
0	162	96	85	111	133	145	356	201	144	179	159	69	47	39	82	84	63	36	71	48	46	86	92	64	108
17	110	261	144	51	130	75	77	76	162	73	47	43	53	46	37	39	47	268	341	402	307	113	77	90	127
18	88	46	52	61	114	144	83	64	64	74	76	83	53	71	79	69	87	137	232	251	494	412	531	863	176
D	823	680	680	369	566	546	466	97	437	520	283	203	190	274	208	294	564	404	383	362	264	315	531	359	409
D	264	400	419	157	85	94	233	155	114	178	142	193	200	201	153	158	249	1035	1528	1000	286	374	362	458	352
D	548	702	600	620	656	440	541	503	465	631	165	208	144	145	147	116	184	273	235	202	242	292	221	193	353
0	23	63	70	81	77	86	85	71	72	78	86	88	83	69	54	50	57	57	69	159	147	145	93	77	262
24	56	65	74	68	68	64	61	76	157	199	317	266	182	178	211	186	259	604	430	263	254	215	207	201	194
25	112	93	83	83	89	85	103	192	358	644	577	957	766	379	210	199	119	153	414	449	421	337	228	368	309
26	544	364	196	362	250	247	336	525	332	130	97	87	172	395	312	160	174	344	597	245	193	89	89	76	263
27	68	61	160	334	361	234	301	447	342	288	537	560	333	128	46	187	258	328	268	323	192	76	54	142	251
28	175	312	248	276	153	263	155	140	181	292	322	319	364	309	156	248	197	99	61	52	82	191	386	300	220
D	454	406	475	507	450	843	805	387	546	609	707	510	951	1052	1034	860	943	994	848	1143	820	779	605	455	716
30	408	394	276	360	450	399	197	164	132	173	170	245	163	75	45	57	71	60	39	45	61	85	66	76	176
31	85	65	66	63	52	54	64	80	81	412	184	77	190	339	152	102	72	212	172	104	211	471	253	141	154
MEAN	259	226	207	223	239	248	229	194	228	253	254	266	303	276	226	201	232	303	336	318	280	265	273	266	254
50 MEAN	140	97	97	128	141	162	188	110	107	123	135	140	178	142	114	100	120	186	164	131	119	130	123	92	132
5D MEAN	470	468	455	342	364	396	431	256	379	432	306	407	596	553	452	411	581	726	775	694	468	454	475	426	471

AE INDEX (HOURLY VALUES)

SEPTEMBER 1979

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
1	123	131	224	138	102	45	41	35	61	75	40	43	52	72	155	135	172	232	272	451	666	166	80	292	159
2	264	156	58	44	54	55	53	53	48	155	149	91	75	81	103	186	94	86	59	123	129	168	209	134	109
3	103	453	390	293	210	95	335	408	210	162	66	233	284	297	113	76	77	113	255	402	198	88	61	49	207
4	48	52	49	85	185	324	202	188	280	75	117	131	189	79	122	125	322	273	161	357	324	161	156	107	171
5	121	283	585	619	557	293	120	162	165	189	326	297	503	698	674	367	380	569	556	570	735	278	112	79	385
6	183	465	535	309	541	539	385	100	142	201	375	360	280	261	173	395	291	79	55	42	47	45	97	86	249
7	63	119	281	298	147	53	61	77	80	68	48	79	114	169	159	117	177	265	237	100	51	53	66	137	126
8	142	159	181	112	129	268	176	229	423	288	71	75	54	56	65	66	58	75	115	154	210	157	112	118	146
9	101	194	269	272	137	109	239	73	74	94	62	53	57	57	84	81	209	310	360	302	284	227	218	291	173
10	325	359	309	132	77	198	218	261	340	414	454	463	372	387	427	352	318	373	684	583	484	448	487	403	370
11	297	199	162	191	259	317	332	378	474	492	761	719	467	393	492	482	478	641	529	316	152	100	140	252	376
12	320	186	113	54	59	33	48	43	48	51	48	45	64	74	128	106	67	156	231	216	84	116	262	429	124
13	212	140	236	138	47	34	36	36	40	36	44	56	49	122	119	106	91	90	70	54	61	146	125	57	89
14	60	112	143	46	49	112	103	79	67	90	68	67	67	64	49	54	57	119	86	398	546	466	420	246	149
15	226	108	96	47	44	53	41	36	73	78	92	76	116	76	58	53	59	88	71	54	61	72	60	72	75
16	230	365	261	116	47	49	108	224	132	143	86	212	185	87	107	74	115	320	249	148	82	154	424	547	186
17	284	85	64	72	70	126	178	172	66	53	99	149	128	117	121	192	171	136	100	65	92	117	113	440	134
18	639	601	438	140	111	250	457	573	585	606	1034	696	972	724	758	804	636	295	188	164	102	49	53	50	455
19	48	55	62	46	41	52	36	35	35	28	34	32	31	37	38	39	49	56	69	66	153	111	206	270	68
20	276	152	134	63	49	47	41	42	79	69	65	105	397	847	865	845	808	347	171	114	142	267	326	268	272
21	494	634	637	672	652	213	71	222	369	425	356	332	289	209	168	168	110	65	197	328	149	53	156	252	301
22	196	74	52	38	31	31	27	31	32	43	58	75	149	445	367	97	69	70	61	50	55	53	40	46	91
23	39	46	103	148	251	231	126	78	44	49	43	50	52	120	149	193	315	266	219	177	92	63	57	34	123
24	45	43	55	233	446	275	328	159	68	73	237	647	695	490	663	236	92	66	75	100	259	521	615	476	287
25	464	367	428	551	400	342	396	200	141	62	64	54	55	70	150	525	792	573	471	253	305	290	338	199	312
26	231	451	637	387	184	124	271	322	240	177	227	269	156	408	406	329	269	450	637	574	431	308	263	374	338
27	310	333	433	565	191	96	78	95	128	113	119	174	249	312	89	68	218	418	398	307	249	183	239	128	229
28	100	163	209	156	278	537	522	354	293	347	241	134	121	260	204	311	604	397	298	368	416	607	475	298	321
29	455	286	230	281	222	180	99	142	274	167	86	65	312	441	169	118	274	339	199	130	81	85	170	315	213
30	171	280	550	726	579	348	270	288	305	186	85	80	164	239	216	274	393	205	86	82	160	300	154	105	260
MEAN	219	235	264	232	204	180	179	169	177	166	185	195	223	256	246	232	258	249	238	234	226	195	207	218	216
50 MEAN	123	136	170	154	101	107	113	93	132	126	72	66	66	80	89	97	117	158	168	149	165	143	162	190	124
50 MEAN	420	441	454	362	279	195	247	271	282	267	349	291	373	451	469	534	523	346	332	286	225	193	227	228	335

AE INDEX (HOURLY VALUES)

OCTOBER 1979

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
1	316	415	223	185	101	95	142	122	97	137	411	548	359	304	351	492	193	72	65	47	40	35	65	44	202
2	40	41	44	45	33	29	22	34	45	200	205	257	379	337	225	355	546	598	633	307	118	93	172	413	216
3	213	298	499	374	294	245	211	142	86	54	74	73	142	64	63	104	334	624	336	88	100	78	69	66	193
4	376	196	155	50	40	59	104	130	369	570	340	112	68	47	33	38	38	26	25	24	27	29	27	32	121
5	38	43	36	29	29	29	29	39	31	35	46	48	60	61	120	237	386	345	262	276	313	256	219	284	135
D 6	293	215	324	278	384	361	476	350	233	164	144	269	582	477	571	652	651	327	113	68	72	103	71	157	305
D 7	228	162	281	260	137	342	419	107	177	259	207	215	161	518	1207	665	152	89	92	173	337	482	345	388	308
D 8	584	530	735	711	312	161	202	263	670	678	657	770	493	185	69	97	311	754	542	289	316	697	675	411	463
D 9	524	541	393	380	418	532	486	450	528	397	815	425	88	64	252	415	532	331	298	273	235	279	158	74	370
D 10	80	322	591	356	158	220	213	134	102	344	468	512	399	507	414	117	141	185	256	754	243	147	191	106	290
11	70	59	44	38	36	34	32	72	302	411	300	365	361	272	310	338	396	140	81	72	61	79	42	37	165
12	39	42	51	111	36	27	31	35	48	52	132	314	444	254	278	331	411	456	340	339	279	267	309	451	212
13	153	97	84	75	118	89	78	131	125	104	67	72	59	49	46	88	129	251	301	270	156	132	309	178	132
14	103	93	118	98	47	34	29	48	48	60	50	51	53	57	134	200	195	56	48	38	32	30	34	36	70
15	30	32	25	36	26	26	37	96	280	308	278	450	351	591	424	386	380	102	120	313	367	206	91	97	210
16	97	182	238	295	272	190	219	64	48	55	69	53	56	163	170	34	35	40	196	271	75	49	45	49	124
17	47	42	49	46	55	41	43	29	39	32	32	33	42	38	42	37	28	19	23	27	43	76	93	72	43
18	55	51	61	39	40	32	34	89	34	49	47	49	37	38	38	35	35	33	33	39	55	68	116	139	52
19	75	42	40	40	44	34	34	37	56	71	59	58	65	62	54	54	54	46	42	41	41	38	50	120	52
20	163	96	44	40	39	33	37	200	429	356	358	274	163	74	63	80	58	43	54	54	113	47	39	34	120
21	36	61	102	232	108	81	163	172	114	128	143	127	95	136	133	393	351	183	214	244	296	404	482	371	199
22	290	281	308	246	140	289	334	359	386	142	71	59	45	86	193	186	217	378	119	215	276	125	126	121	208
23	51	83	112	154	124	141	241	310	254	240	175	150	191	238	235	215	165	167	119	125	504	304	319	289	196
24	263	145	84	63	192	189	169	283	143	122	235	326	318	596	474	426	503	337	228	164	74	52	41	37	228
25	41	90	173	204	297	379	301	604	309	154	91	197	258	430	302	304	250	147	168	396	495	393	275	201	269
26	169	87	81	196	128	126	108	44	52	57	93	199	396	288	176	93	118	196	114	71	127	116	202	79	138
27	50	45	34	43	117	203	174	162	184	223	154	179	107	52	46	107	123	52	41	114	268	126	52	40	112
28	40	53	142	218	152	105	115	233	414	639	786	661	371	301	97	87	62	48	30	20	78	359	386	421	242
29	244	120	247	243	163	99	51	40	26	117	142	44	47	95	267	274	332	591	671	440	298	216	90	156	209
30	90	220	160	137	85	73	87	90	122	231	189	118	154	179	173	124	59	41	29	30	34	33	26	28	105
31	32	35	30	34	38	39	34	33	31	49	100	220	189	244	317	296	488	414	232	94	55	59	62	174	137
MEAN	155	152	177	169	134	139	150	158	186	207	223	233	210	219	234	234	247	228	187	183	171	173	167	164	188
50 MEAN	63	80	68	61	68	76	74	81	87	121	96	87	81	73	70	71	59	38	33	50	88	68	67	79	72
5D MEAN	341	354	464	397	281	323	359	260	342	368	438	438	344	350	502	389	357	337	260	311	240	341	288	227	347

AE INDEX (HOURLY VALUES)

NOVEMBER 1979

DATE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	MEAN
D 1	259	293	361	376	281	246	152	51	46	51	113	316	348	116	71	156	360	515	453	259	283	436	426	324	262
2	326	361	247	226	273	358	249	152	144	292	467	305	276	483	366	236	255	394	300	104	64	50	45	28	250
3	29	44	41	39	46	36	64	34	31	33	39	199	388	193	46	93	449	568	262	317	393	393	132	64	164
4	77	268	322	305	109	64	197	122	80	56	136	414	351	291	187	111	166	192	91	200	172	56	32	43	168
5	89	38	32	28	31	30	27	25	28	33	41	42	85	87	65	59	55	48	42	98	63	34	32	29	48
6	30	34	38	43	49	43	41	44	56	58	63	103	66	45	53	56	44	33	28	31	32	36	36	31	45
7	29	35	38	45	72	93	77	177	177	190	162	279	318	96	164	146	443	489	541	456	192	171	81	186	196
D 8	135	100	138	141	156	116	160	282	560	649	363	513	283	63	81	121	82	41	36	30	27	29	27	39	174
D 9	83	185	95	81	51	67	85	174	129	83	56	51	103	328	787	783	742	572	205	209	334	333	156	54	239
10	50	56	63	75	68	54	39	38	51	72	46	46	44	58	36	47	63	84	69	162	157	224	262	88	80
11	136	163	197	182	220	173	125	66	38	52	40	43	51	48	60	65	94	90	90	38	38	51	46	48	90
12	53	57	53	51	45	42	42	49	282	279	219	240	287	116	132	195	228	220	101	165	79	51	52	85	130
D 13	142	286	501	550	361	439	364	381	328	473	770	532	471	665	738	949	800	659	739	563	686	399	336	466	525
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17	284	279	117	57	68	166	80	70	112	233	95	41	38	31	32	39	36	24	26	87	206	48	29	29	93
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20	71	60	76	70	62	141	170	146	161	127	320	423	326	409	278	336	521	255	56	53	46	65	86	84	181
21	104	127	327	211	223	229	188	304	265	178	176	117	74	104	229	179	88	97	47	42	34	31	34	32	143
22	34	29	26	26	35	59	48	47	141	139	160	61	39	48	123	52	35	34	33	33	30	30	34	35	55
23	46	47	42	35	33	30	63	81	129	138	145	187	165	129	89	157	125	75	60	148	257	219	286	341	126
D 24	298	271	380	412	559	616	522	542	446	363	507	852	559	462	312	97	171	615	707	241	358	528	347	346	438
25	335	392	548	519	393	230	116	70	41	161	111	62	120	210	143	52	43	49	62	98	32	36	40	44	163
26	44	36	31	23	24	26	26	23	26	33	29	28	73	47	41	29	22	14	48	311	279	99	45	62	59
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28	30	31	27	24	23	29	51	77	21	22	38	39	31	26	44	45	23	34	17	18	21	20	22	24	31
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MEAN	113	127	146	139	132	136	132	140	149	160	173	197	177	170	180	169	188	198	161	153	154	133	109	105	152
50 MEAN	42	32	30	31	34	38	39	44	55	56	66	55	51	48	64	49	37	35	28	39	32	28	29	30	41
5D MEAN	183	229	295	312	281	296	256	286	301	323	361	452	352	326	397	421	431	480	428	260	337	345	258	245	327

DECEMBER 1979

AE INDEX (HOURLY VALUES)

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3	226	212	225	255	261	314	398	214	185	364	144	40	67	82	170	70	42	50	73	65	21	22	16	21	148
4	32	59	130	210	286	357	481	426	335	484	428	469	560	718	751	744	543	382	441	377	414	397	270	139	393
5	100	113	91	84	81	54	81	159	219	180	159	96	75	169	377	264	220	164	105	142	171	85	49	63	138
6	90	130	92	96	43	28	52	122	205	107	43	37	39	43	46	41	41	36	31	32	86	118	67	39	69
7	47	42	45	54	38	17	20	26	26	32	64	37	35	31	37	37	35	31	36	58	93	95	53	46	43
8	32	37	51	121	110	57	67	52	39	31	57	72	232	311	464	248	264	315	88	187	267	157	196	179	151
9	114	72	79	75	36	29	58	33	59	65	46	50	61	227	147	52	47	29	35	40	109	63	79	57	69
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15	52	50	49	112	333	119	54	107	191	506	390	66	68	136	95	63	98	362	488	492	252	65	44	95	179
16	217	70	74	131	224	348	162	62	30	65	82	182	275	186	260	228	113	96	131	167	121	59	124	238	152
17	214	119	86	127	180	183	229	306	339	223	71	41	175	320	333	393	325	519	337	131	96	143	275	137	221
18	162	245	70	69	41	44	52	55	42	191	239	148	140	266	220	78	94	92	39	38	209	162	92	47	118
19	75	154	132	200	231	194	122	91	78	51	193	148	30	31	53	193	123	135	197	60	81	243	71	42	122
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21	35	30	22	22	19	16	24	25	44	69	90	184	161	231	238	235	331	477	519	287	279	251	237	196	168
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27	42	52	61	62	187	109	71	324	345	137	72	355	329	286	521	456	563	166	72	161	47	33	45	29	188
28	31	36	59	106	270	224	65	40	59	101	193	652	761	236	87	310	396	142	54	54	183	300	534	679	232
29	468	314	343	437	477	542	518	259	264	606	434	160	178	537	968	778	817	791	638	718	566	634	616	575	526
30	486	365	380	449	325	370	283	314	377	304	416	587	640	472	244	323	322	225	323	174	68	70	99	98	321
31	64	80	44	37	38	59	90	80	77	43	91	73	82	33	34	54	76	318	360	289	227	393	461	453	148
MEAN	101	93	88	115	132	128	122	125	136	170	179	165	183	197	224	211	220	241	205	175	162	147	135	125	157
50 MEAN	33	30	30	39	35	29	33	38	31	35	48	44	64	61	40	47	35	44	37	58	83	58	42	44	43
5D MEAN	239	168	209	262	316	349	296	236	250	356	460	429	448	411	460	488	493	452	407	307	265	300	315	306	343

JULY 1979

AO INDEX (HOURLY VALUES)

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D	4	0	1	1	0	-3	2	4	34	6	99	108	59	-26	-38	13	22	48	60	28	43	65	-15	9	22
0	32	69	-40	-15	2	-77	6	55	28	22	17	9	19	-16	-4	4	2	4	15	20	-13	-3	-3	5	5
D	-4	-3	-5	0	-4	0	-4	7	24	44	68	7	1	24	31	47	22	-38	21	26	20	-10	-12	4	11
D	2	-2	-7	-4	3	1	47	-57	-16	-13	-3	3	-43	-58	-43	-24	-25	5	11	-98	-112	0	25	47	-15
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5D MEAN	21	-9	12	6	0	3	9	5	8	10	13	26	17	-2	-22	-28	-8	-19	-14	1	6	19	26	-20	2

AO INDEX (HOURLY VALUES)

AUGUST 1979

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MEAN	-14	-13	-11	-8	-10	-15	-11	0	0	2	1	-5	-28	-17	-17	-15	-25	-30	-36	-18	-7	-10	-9	-11	-13
50 MEAN	-2	0	0	3	3	-7	-19	-2	6	11	10	6	-17	-11	-10	-3	-4	-26	-9	2	6	7	-3	-2	-42
5D MEAN	-53	-51	-50	10	-9	-18	-17	9	34	6	23	15	-88	-7	-25	-16	-94	-121	-180	-90	-62	-91	-84	-50	-42

AO INDEX (HOURLY VALUES)

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50 MEAN		-52	-83	-80	-42	-5	14	7	-39	-60	-23	-53	-42	-62	-55	-59	-46	-20	-27	-21	-10	-2	-15	-24	-34

AO INDEX (HOURLY VALUES)

OCTOBER 1979

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D 7	-21	-3	-78	-42	17	-4	12	-1	-14	-43	-56	-63	-45	-109	-274	-81	-24	-10	4	1	-61	-100	-51	-34	-45
D 8	-146	-103	-168	-44	15	0	-16	-15	-177	-273	-206	-198	-92	-26	-16	-17	-68	-233	-120	-26	-27	-215	-198	-61	-101
D 9	-160	-150	-39	-20	-78	-54	-61	-67	-60	-41	-266	-27	6	-3	-38	-116	-109	-54	-44	-62	-25	-38	-31	0	-64
D 10	-5	-51	-164	-62	-33	12	-15	-10	2	-48	-84	-38	-60	-156	-116	-12	-36	-64	-47	-213	-30	10	-50	-3	-53
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MEAN	-17	-20	-29	-19	-13	-6	-12	-14	-22	-28	-32	-33	-36	-48	-52	-47	-46	-41	-25	-19	-16	-17	-17	-15	-26
5Q MEAN	6	-10	-4	10	2	-2	-5	0	-3	-9	1	-9	-18	-19	-16	-18	-13	-3	0	-2	-12	0	4	0	-5
5D MEAN	-69	-58	-98	-35	-26	-14	-35	-20	-41	-72	-116	-57	-66	-65	-84	-49	-38	-61	-33	-58	-31	-67	-64	-19	-53

AO INDEX (HOURLY VALUES)

NOVEMBER 1979

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D 8	-47	-29	-29	-21	-19	-11	-13	-58	-123	-141	-118	-117	-48	-19	-26	-57	-31	2	0	0	1	1	-1	-1	-38
D 9	-15	-53	-8	-1	1	5	-6	-47	-26	-11	-8	-7	-4	-108	-177	-158	-159	-66	2	-31	-93	-106	-13	8	-45
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D 13	-23	-107	-203	-151	-65	-48	20	-108	-71	-167	-222	-117	-89	-158	-172	-319	-126	-177	-75	-128	-240	-26	-120	-261	-131
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D 24	-5	-2	-68	-75	-89	25	-14	0	-45	43	-103	-340	-188	-91	-60	-8	-31	-179	-168	-23	-47	-190	-123	-85	-78
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5D MEAN	-32	-45	-74	-61	-32	-1	0	-40	-52	-55	-91	-127	-81	-74	-88	-116	-86	-105	-70	-44	-85	-85	-70	-76	-66

AO INDEX (HOURLY VALUES)

DECEMBER 1979

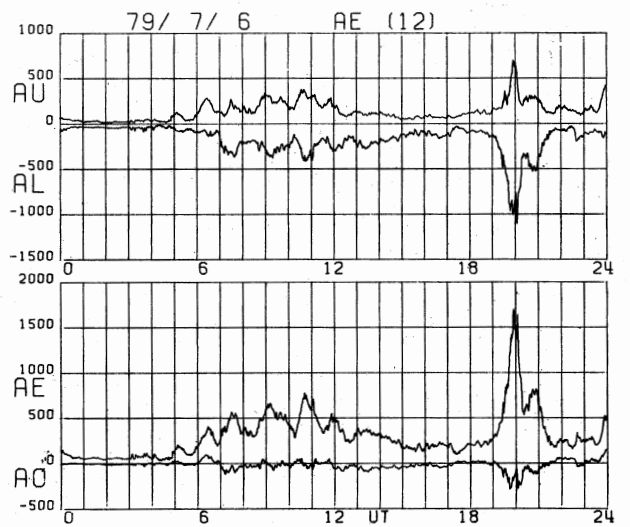
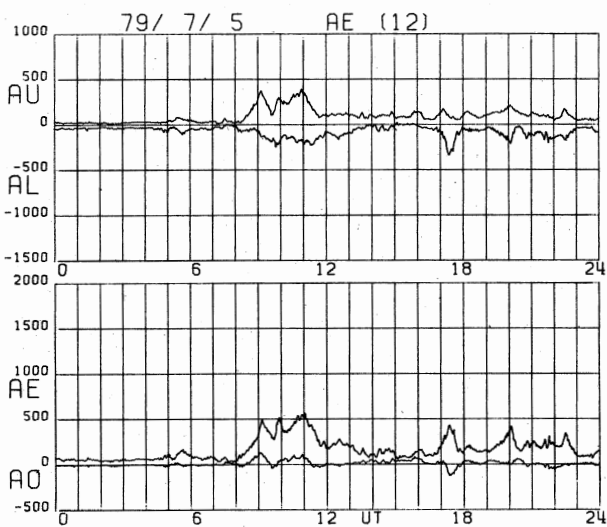
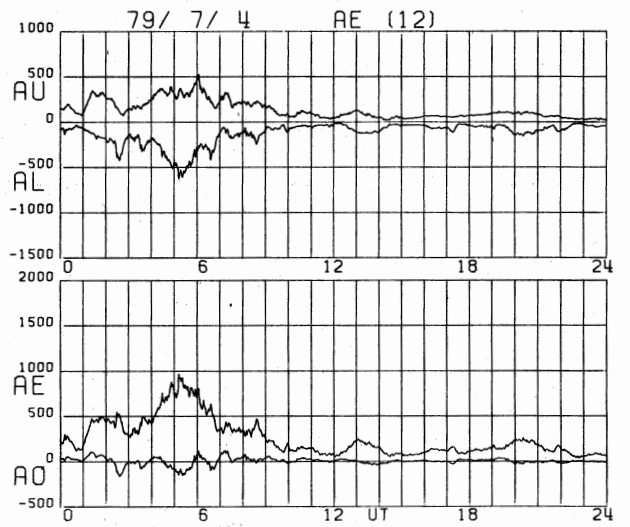
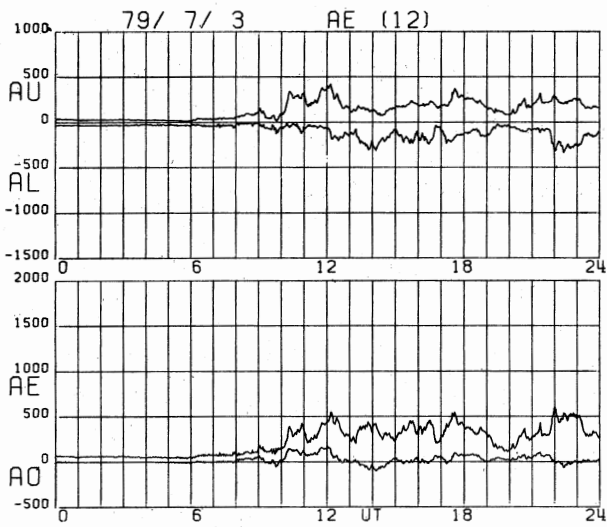
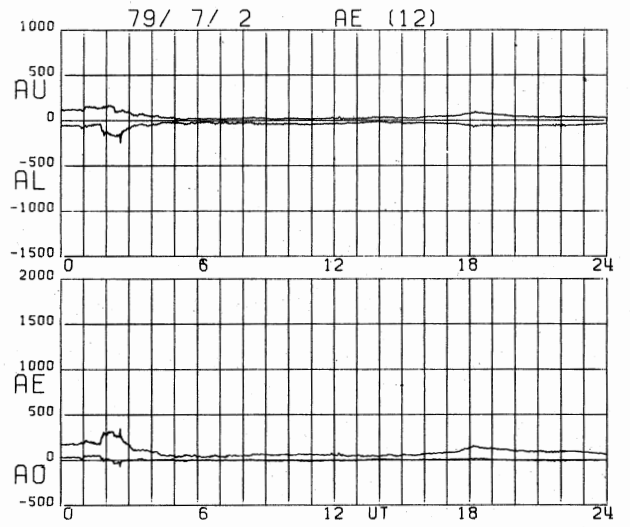
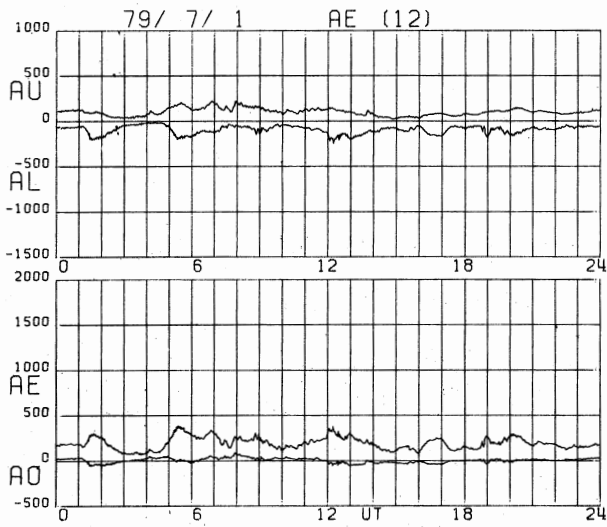
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15	-1	0	-6	-35	-45	10	0	-11	-53	-63	-29	-4	-5	-43	-24	-26	-32	-123	-97	-39	19	8	5	-14	-25
16	-64	-16	-4	6	-40	-6	1	-2	3	4	-6	-32	-83	-39	-74	-67	-27	-13	-25	-42	-27	-4	-20	-76	-27
17	-62	2	0	-8	-15	-35	-41	-53	-58	-9	0	-1	-36	-116	-124	-123	-98	-80	-31	-7	4	-12	-94	-35	-43
18	-30	-57	-1	9	2	-4	-5	-9	-3	-62	-92	-39	-38	-79	-49	-5	-23	-28	0	-2	-77	-55	-32	-6	-28
19	-9	-41	-38	-59	-44	-32	19	12	-4	6	-49	-41	-2	-3	-10	-83	-44	-42	-81	-11	-20	-98	-1	5	-28
20	1	0	-8	-6	-7	-8	-9	4	-26	-26	-51	-70	-63	-52	-136	-94	-78	-83	-57	-45	-30	-1	6	3	-35
21	5	2	1	0	1	2	-1	1	-5	4	-17	-44	-36	-39	-61	-75	-70	-98	-81	-33	-25	-35	-24	-4	-26
22	-8	18	-19	-8	-33	-24	-10	-29	-79	-72	-94	-1	-12	-28	-102	-128	-134	-221	-85	-8	18	6	3	-1	-44
23	1	2	1	0	0	-1	0	-1	-8	0	0	0	-3	-5	-5	-2	-1	-1	2	3	3	1	0	-16	-1
24	-19	-36	0	-8	2	-18	-22	-5	-6	-16	-24	-124	-66	-63	-76	-106	-130	-2	-3	-5	-16	-50	-8	3	-33
25	6	3	4	3	1	2	2	2	2	1	0	-2	-11	4	6	9	10	7	0	5	5	9	5	4	3
26	9	13	19	28	22	17	15	16	10	6	10	13	-20	3	16	7	-24	-55	-18	-26	-84	-7	16	10	0
27	5	12	19	17	-1	8	-3	-74	-64	-13	-7	-111	-118	-110	-119	-145	-141	-34	-13	-50	-1	0	0	2	-39
28	2	3	-8	-29	-79	-10	25	16	18	10	-50	-186	-144	0	-8	-101	-151	-18	8	-5	-62	-97	-164	-48	
29	-34	-6	-105	-118	-165	-82	-46	-16	-30	-107	-32	-9	-37	-210	-263	-247	-201	-145	-108	-233	-102	-107	-205	-264	-120
30	-158	-92	-123	-155	-82	-77	-50	-69	-56	-58	-72	-195	-73	-80	-52	-108	-116	-65	-58	-30	14	10	-10	-14	-74
31	-2	-10	-3	0	14	9	-18	-23	-27	-11	-34	-24	-26	-3	0	-4	-24	-119	-123	-85	-40	-112	-114	-92	-36
MEAN	-12	-8	-11	-16	-19	-11	-11	-17	-23	-26	-26	-37	-40	-49	-61	-60	-57	-56	-35	-28	-26	-25	-24	-22	-29
50 MEAN	1	1	2	4	2	2	2	4	2	-1	-3	-1	-11	-2	-3	-5	-3	-6	-6	-8	-17	-5	2	0	-2
5D MEAN	-40	-20	-62	-77	-94	-67	-44	-39	-43	-58	-58	-101	-87	-97	-109	-139	-146	-104	-49	-64	-48	-49	-81	-82	-73

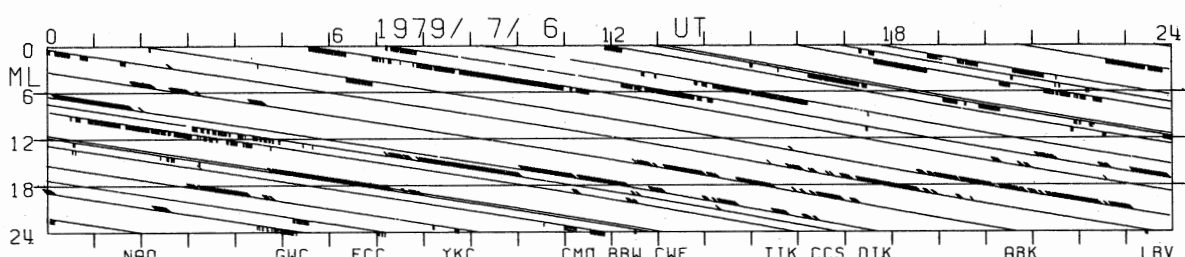
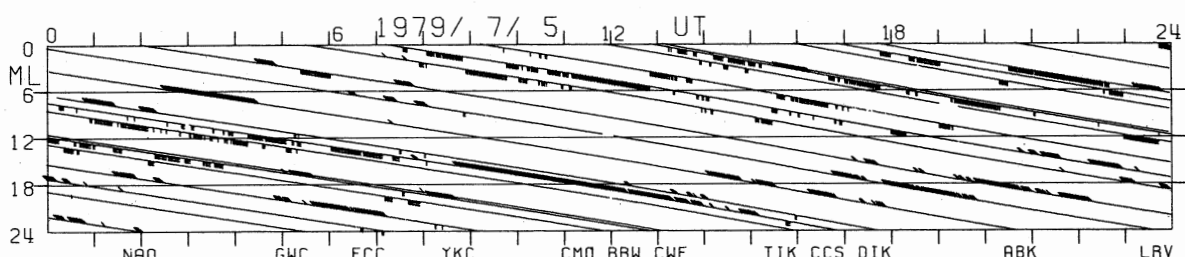
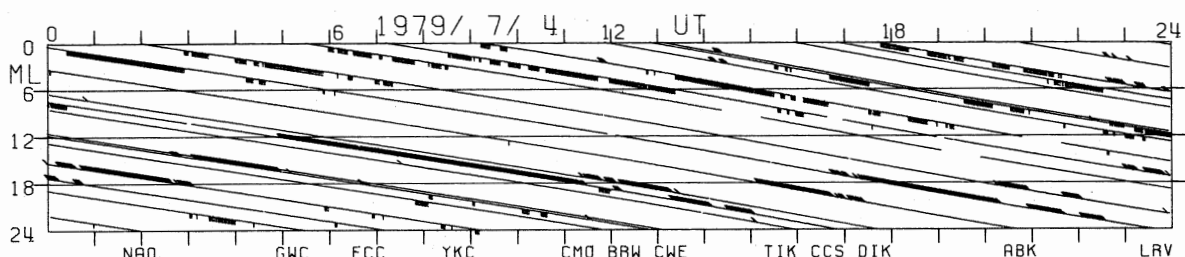
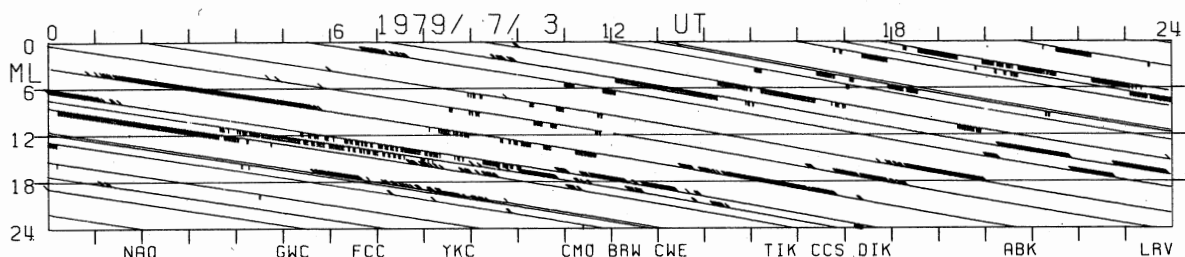
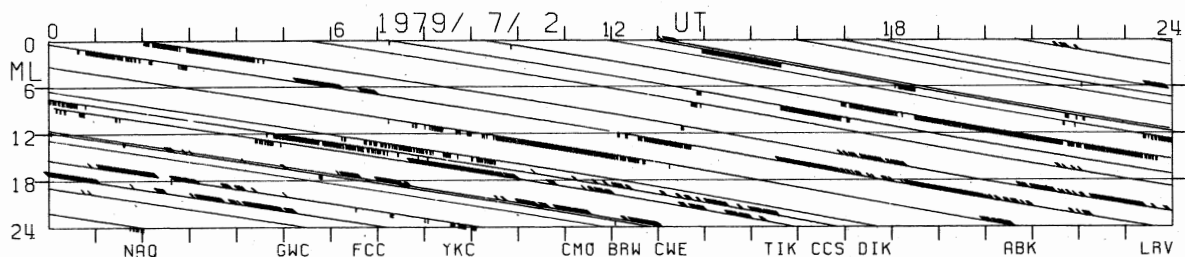
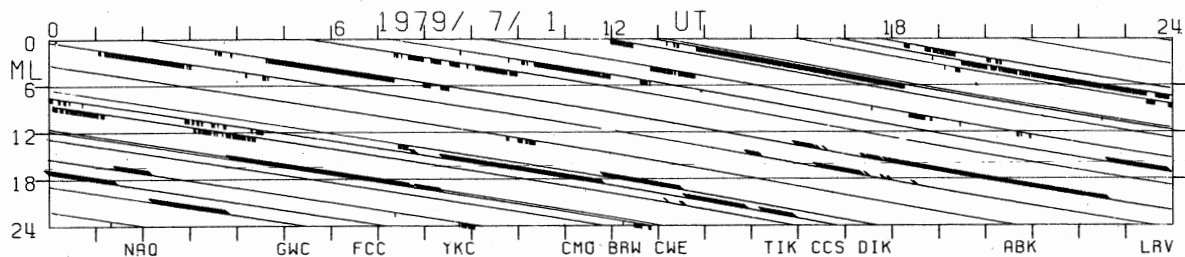
FIGURE 4 (on even pages)

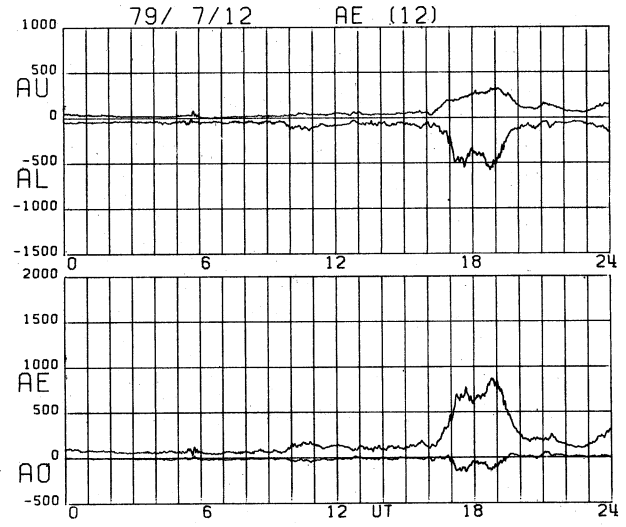
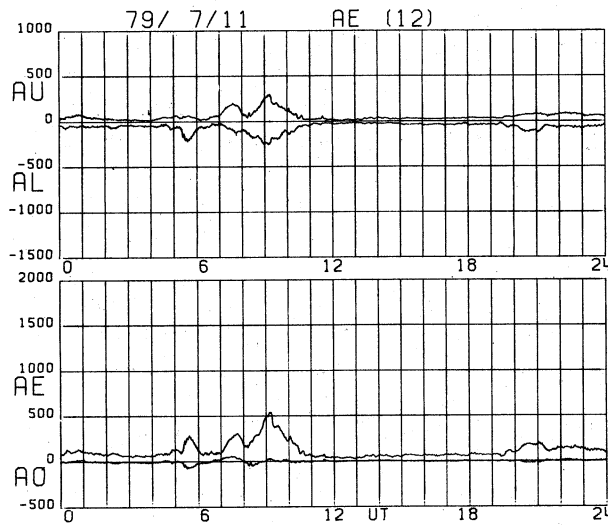
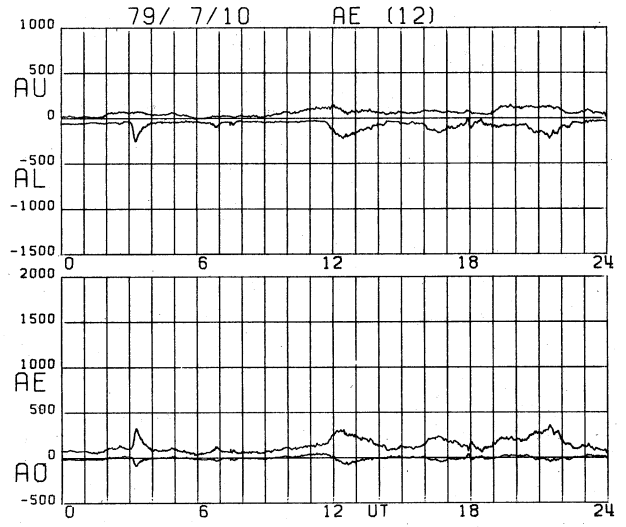
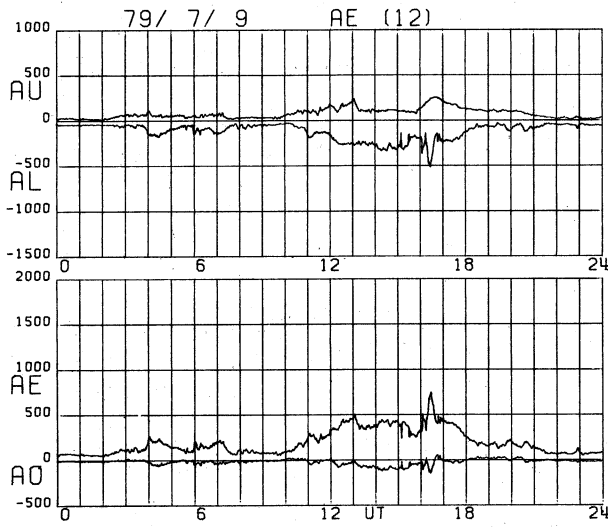
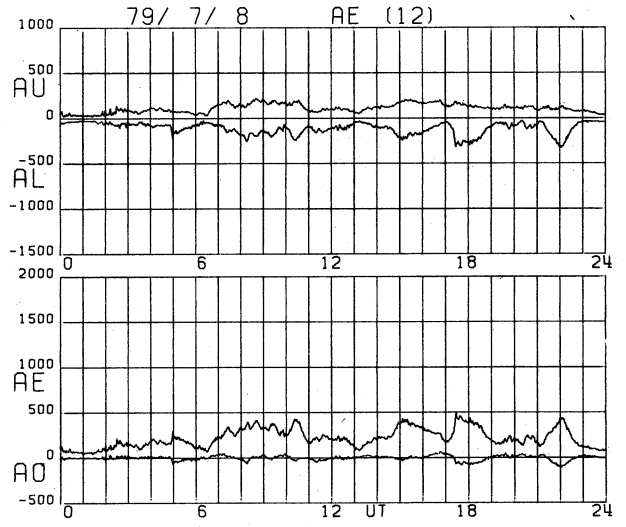
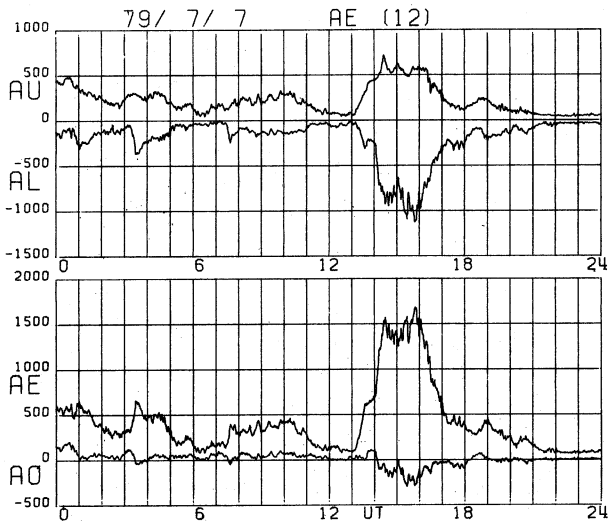
Daily graphs of 1.0-min AE indices (AU, AL, AE and AO) for July-December 1979. Graphs on very disturbed days (August 13 and 20, 1979) are reproduced on page 100.

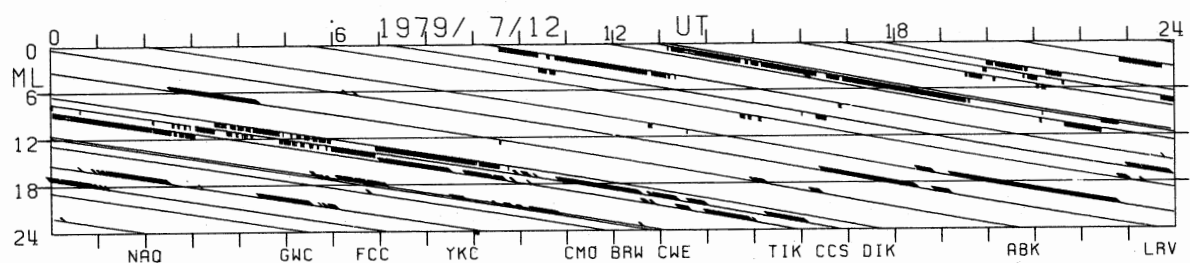
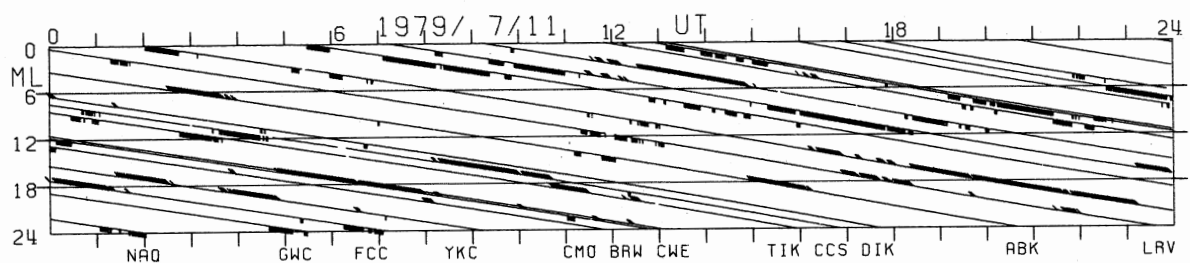
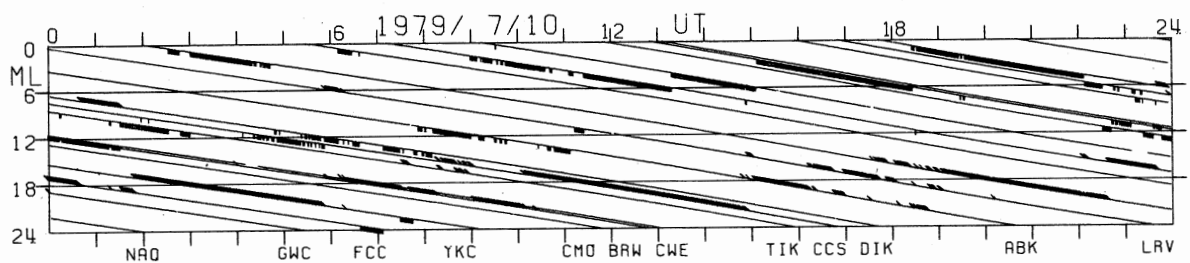
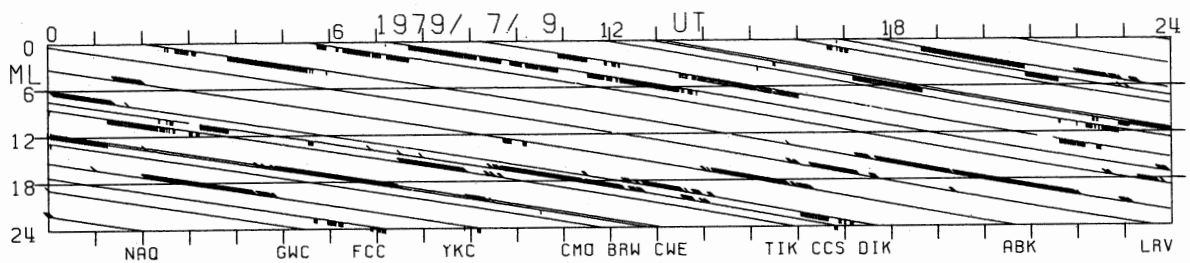
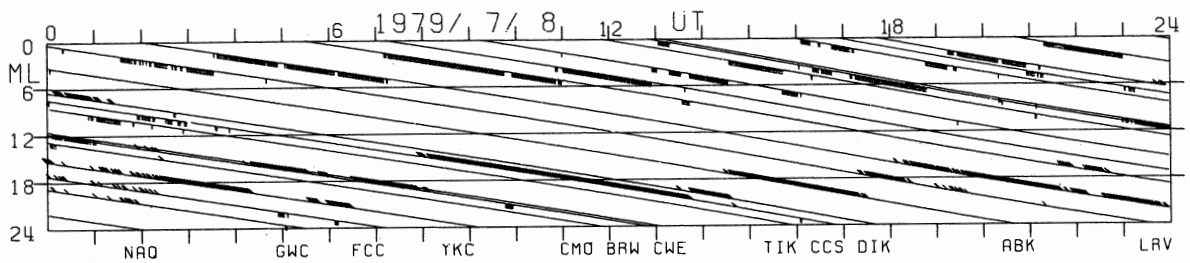
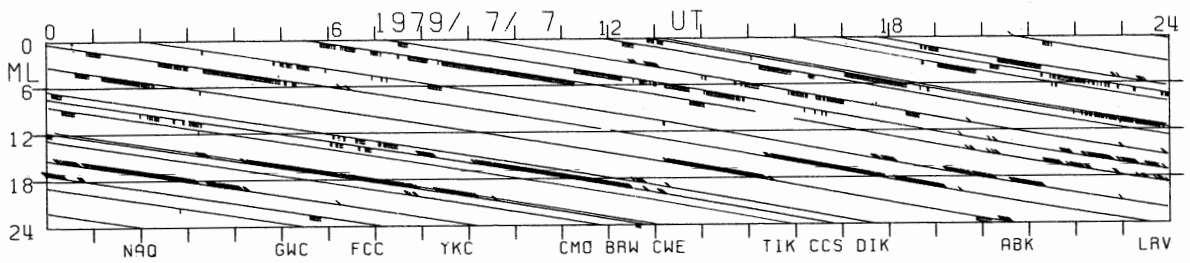
FIGURE 5 (on odd pages)

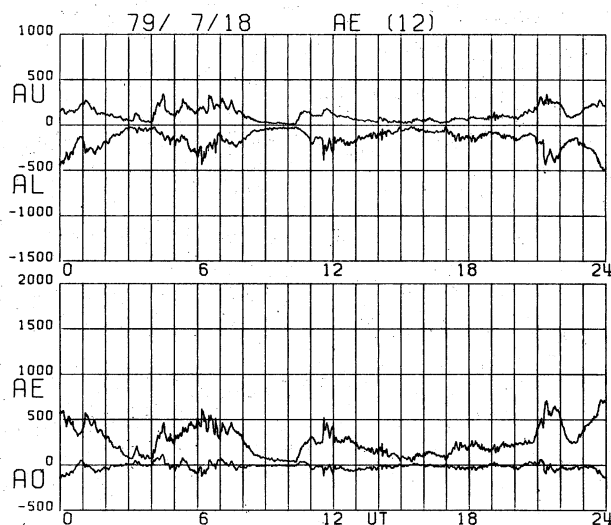
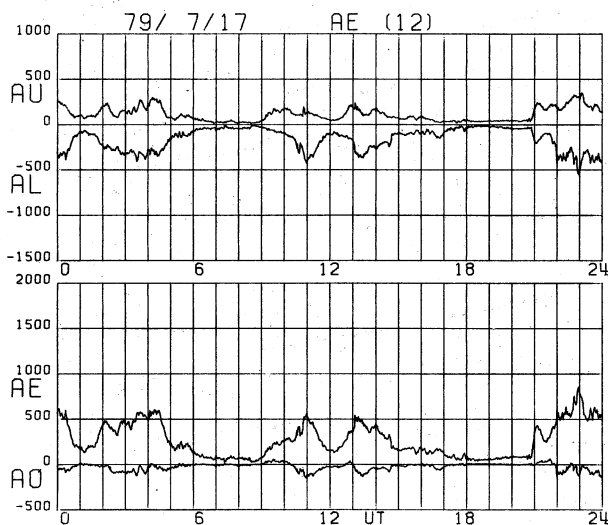
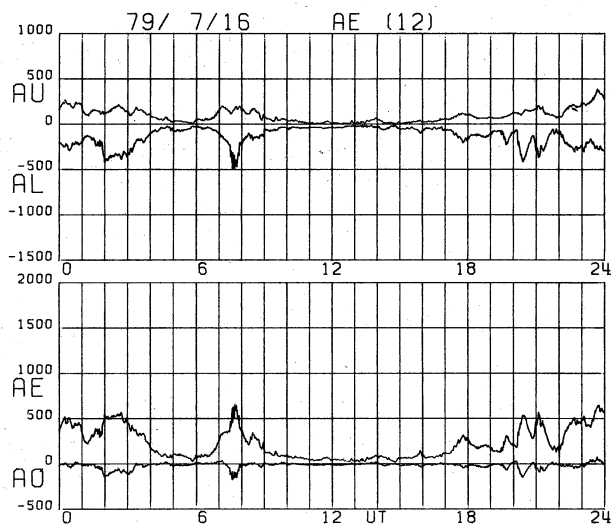
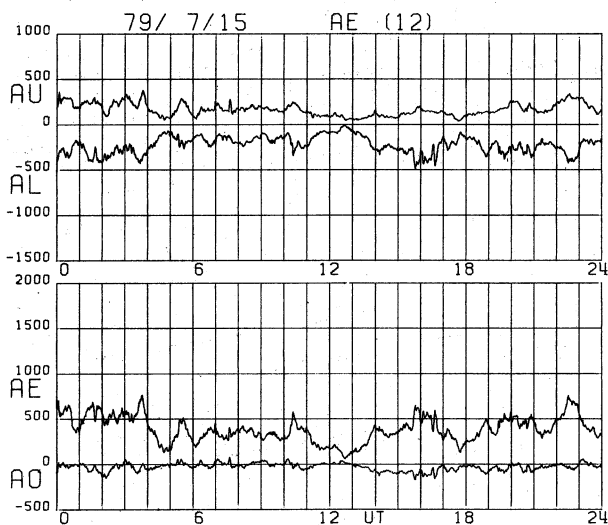
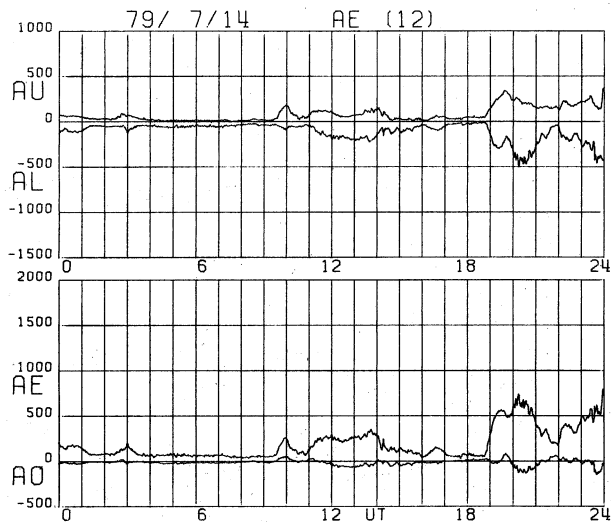
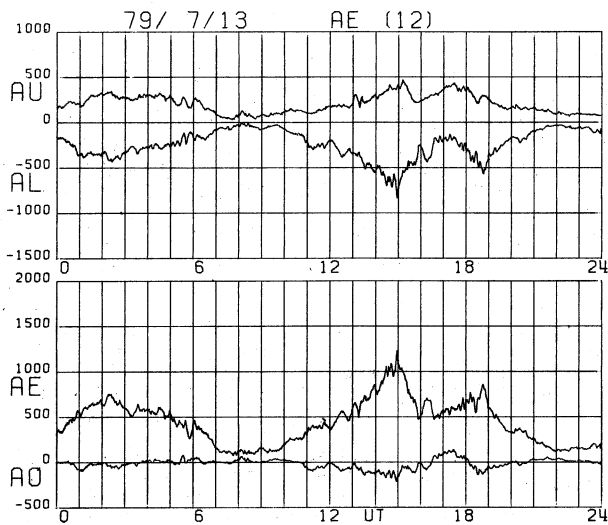
Plots of the contributing stations to the AU (upper plumes) and AL (lower plumes) indices, where you can see which station contributes to these indices at each UT minute.

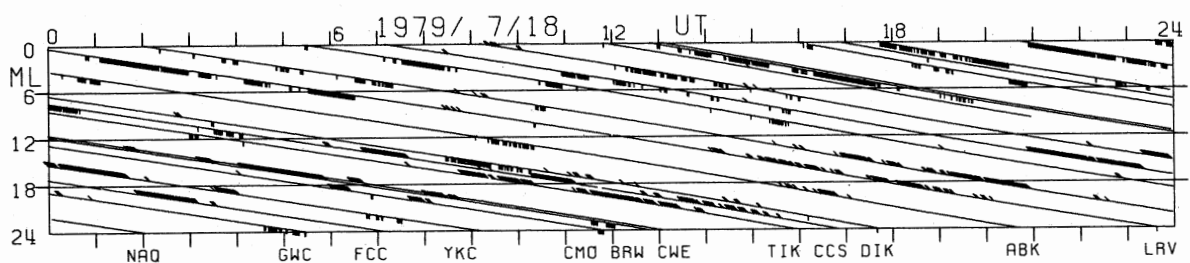
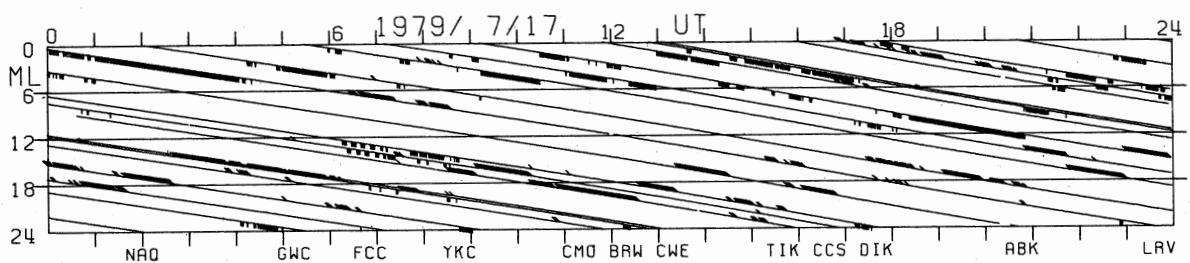
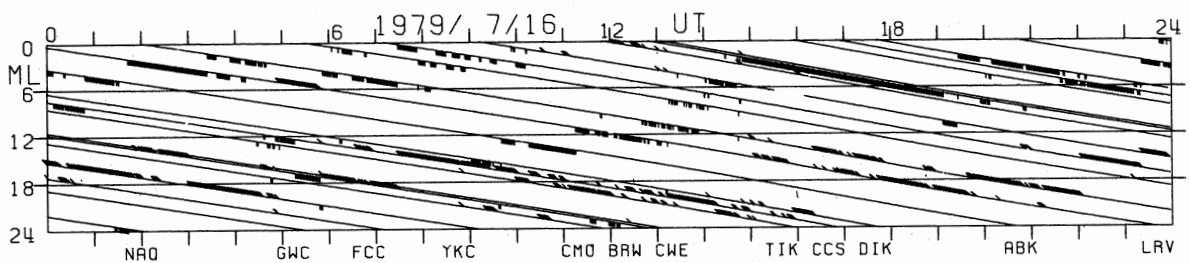
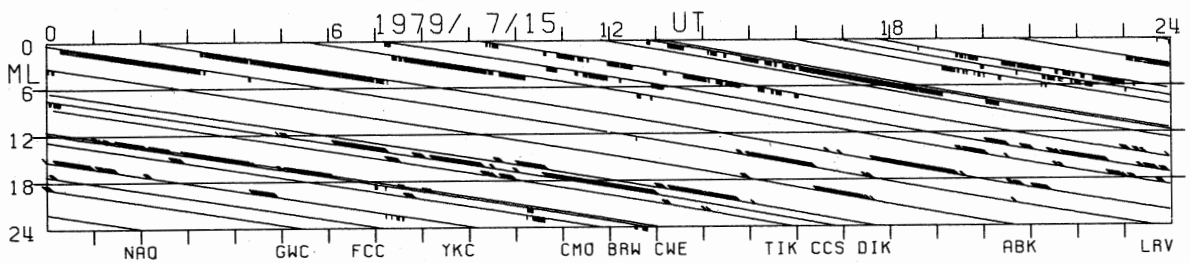
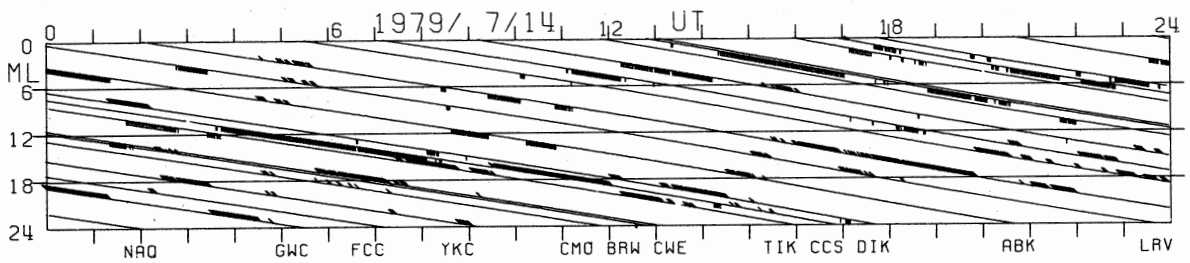
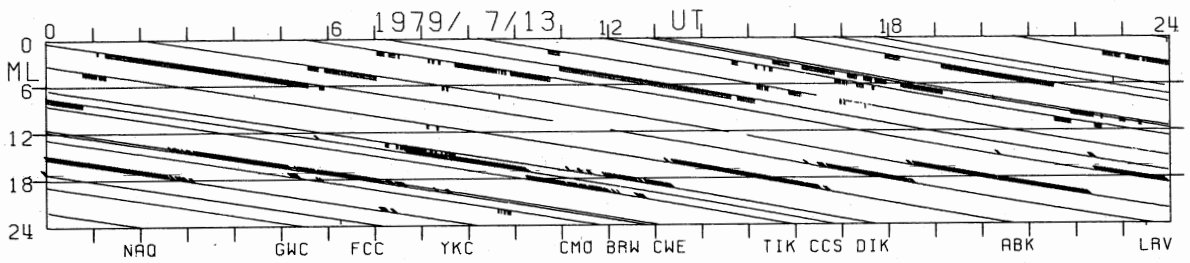


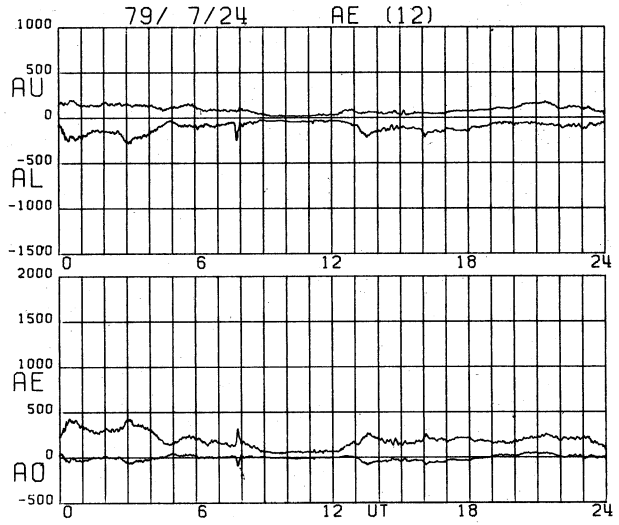
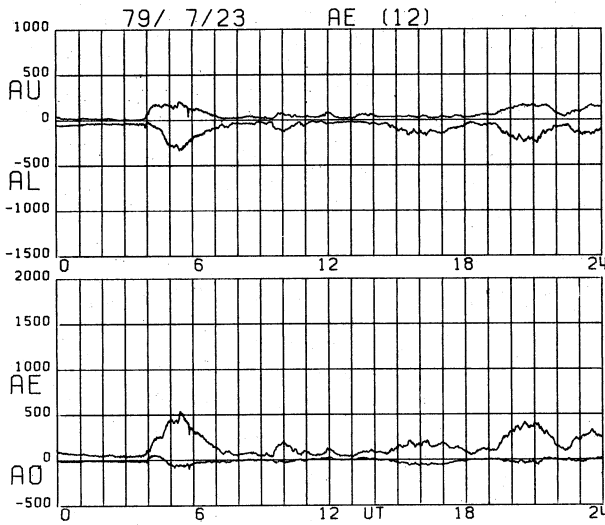
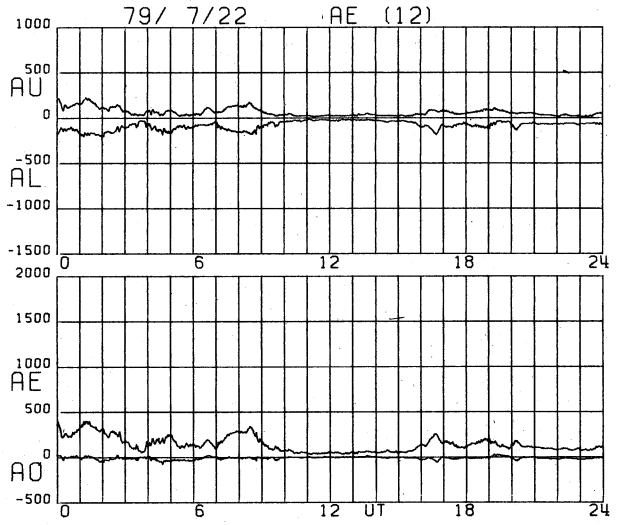
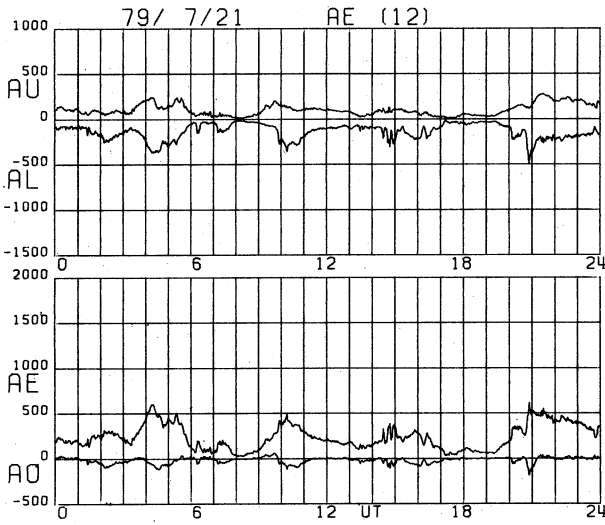
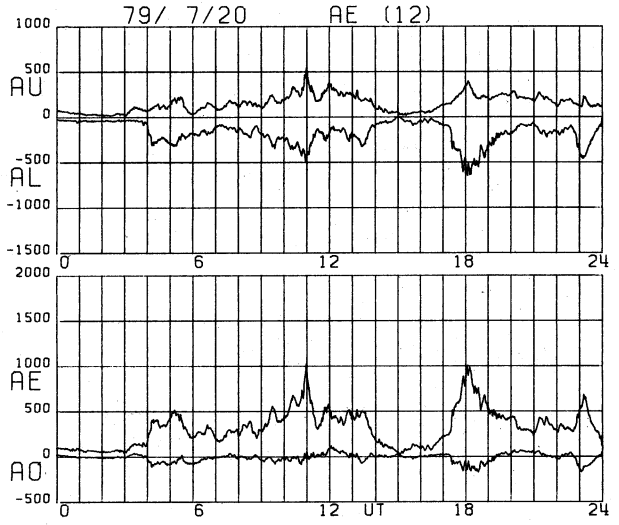
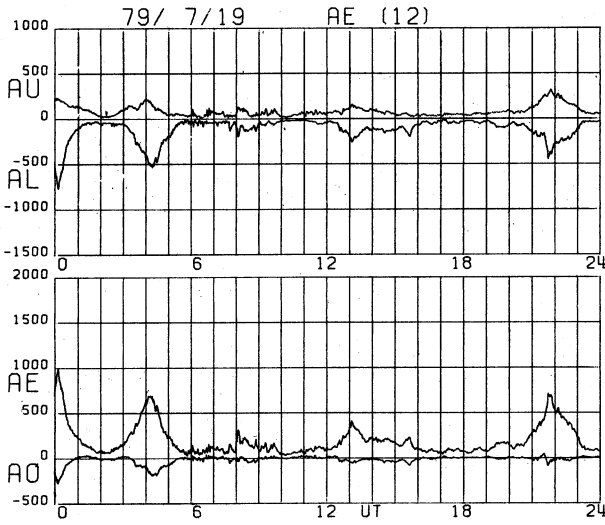


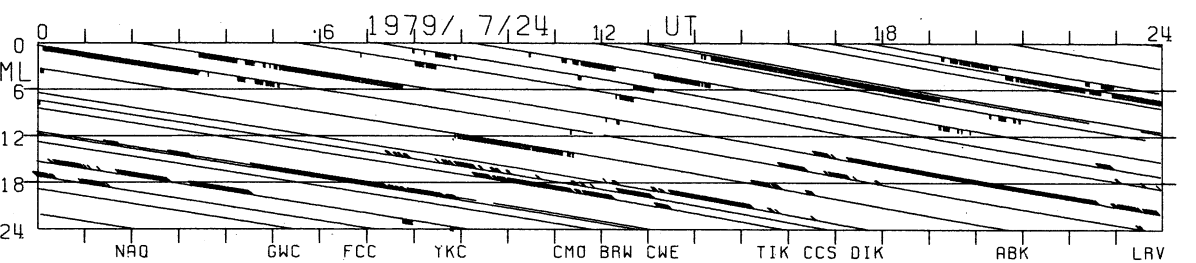
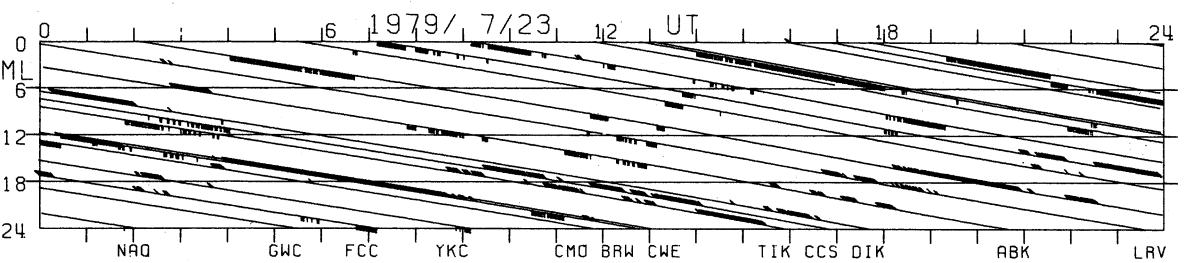
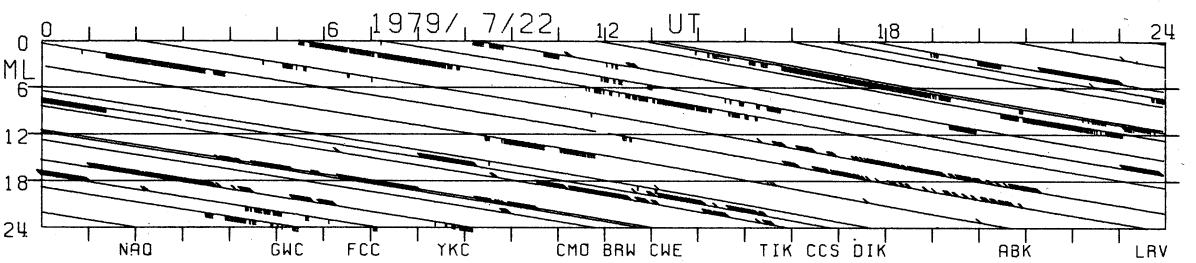
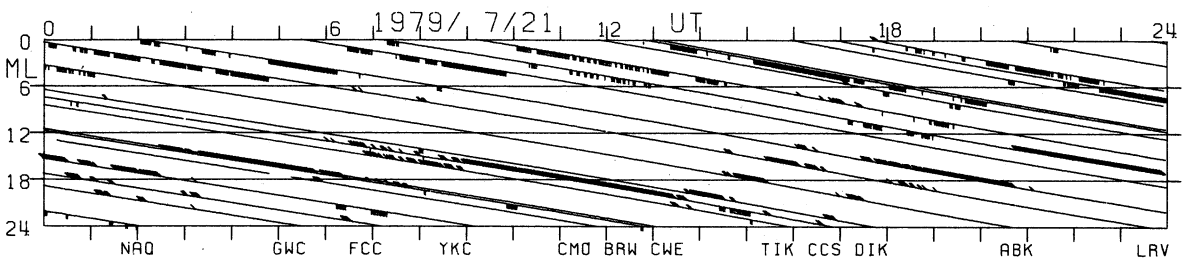
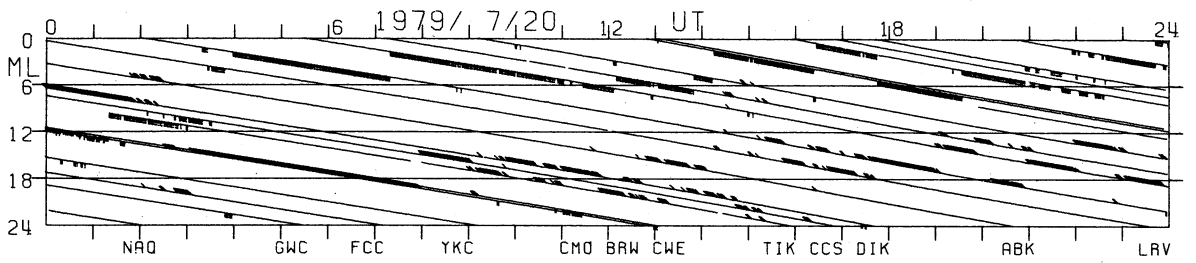
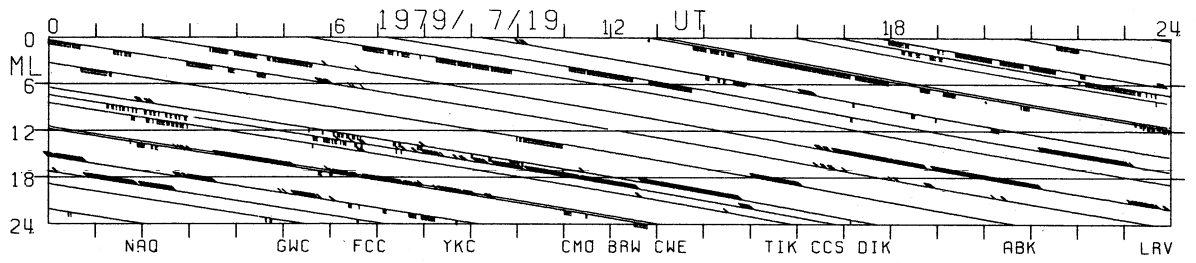


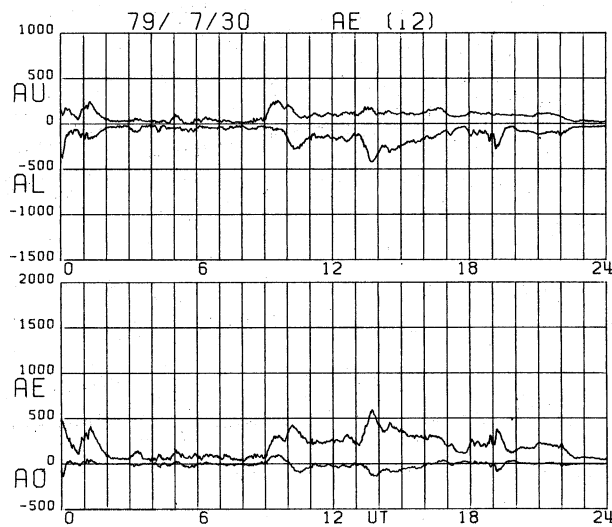
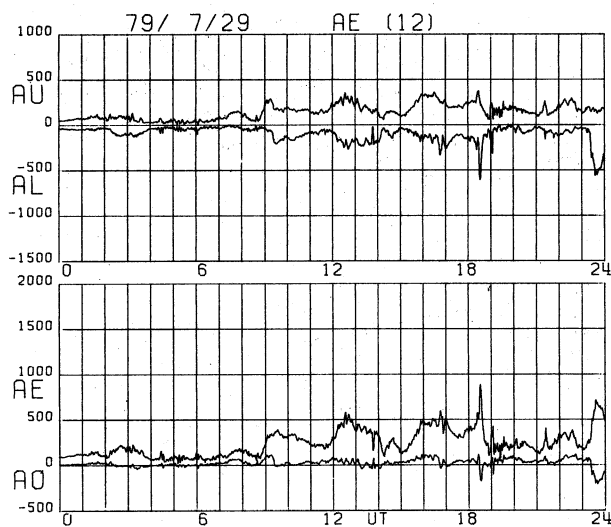
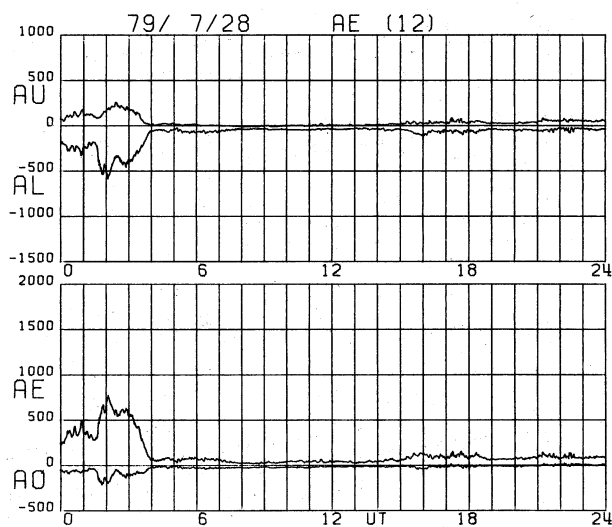
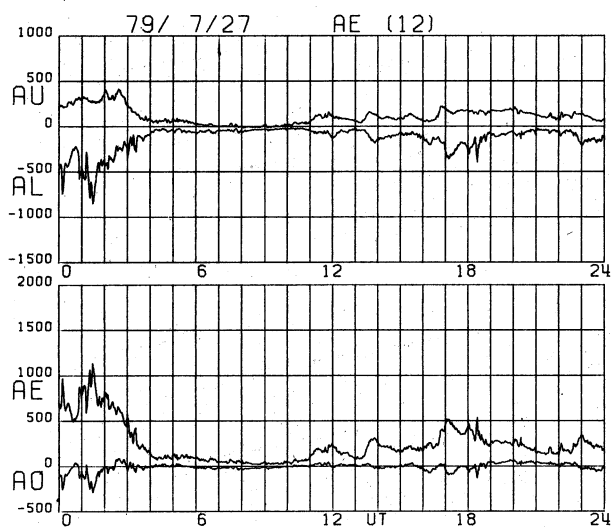
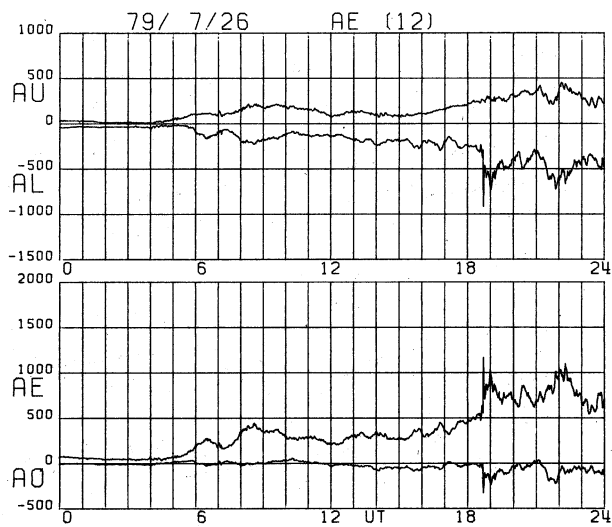
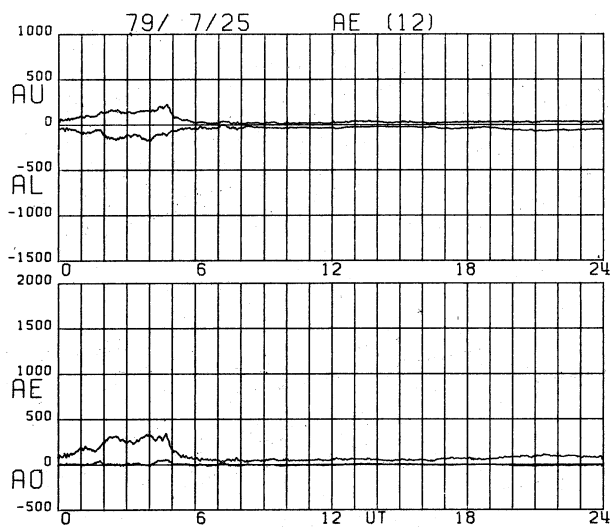


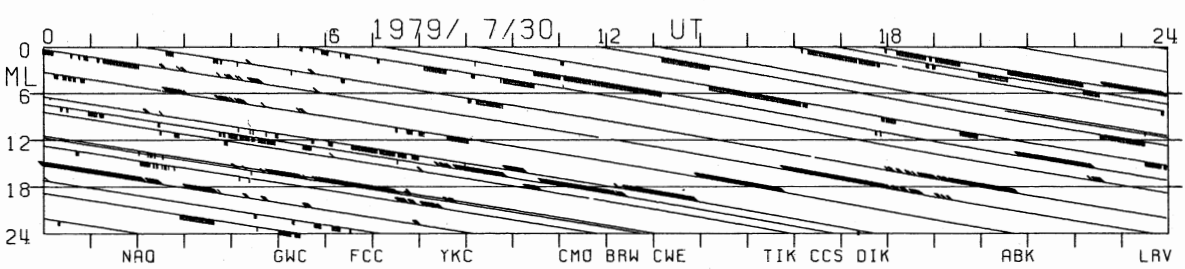
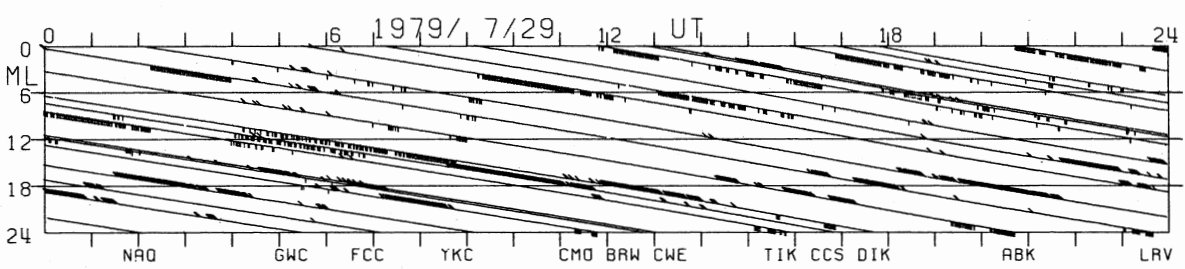
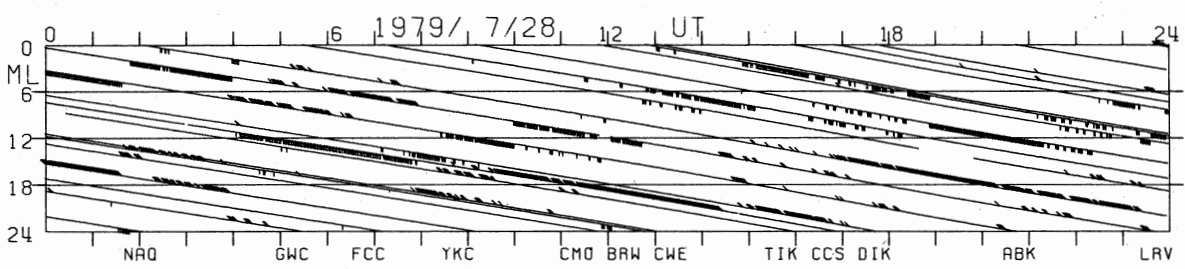
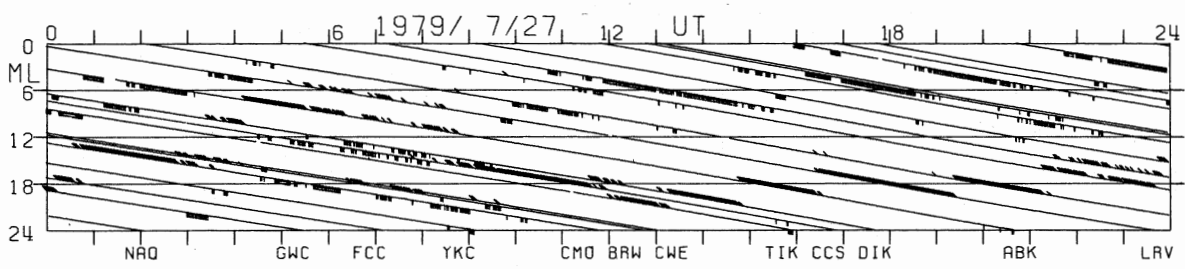
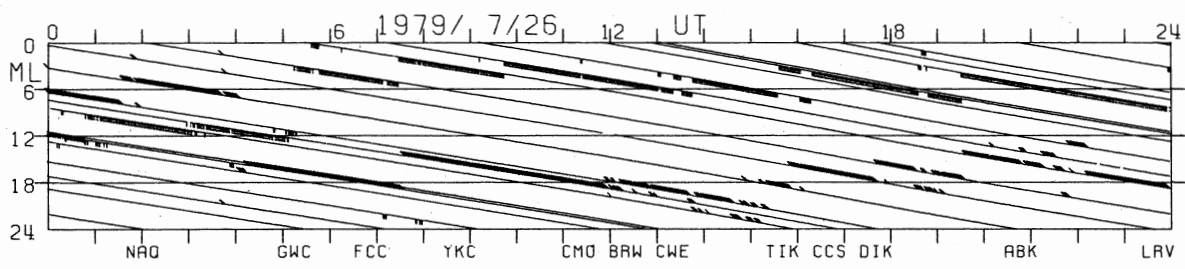
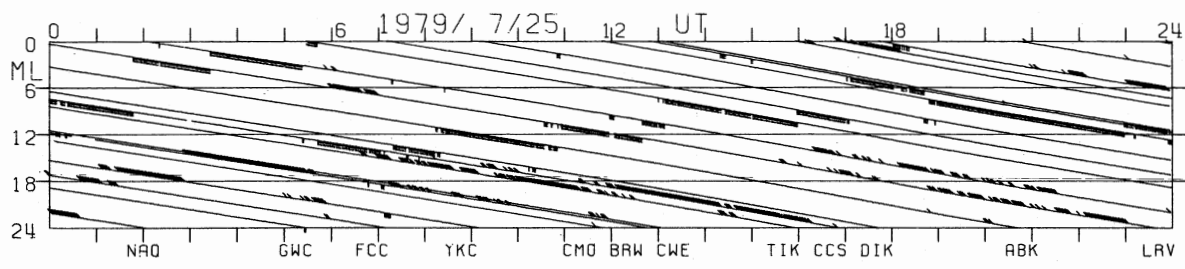


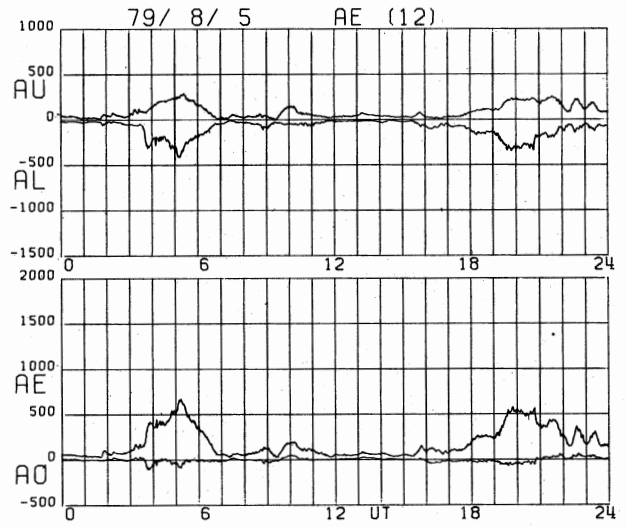
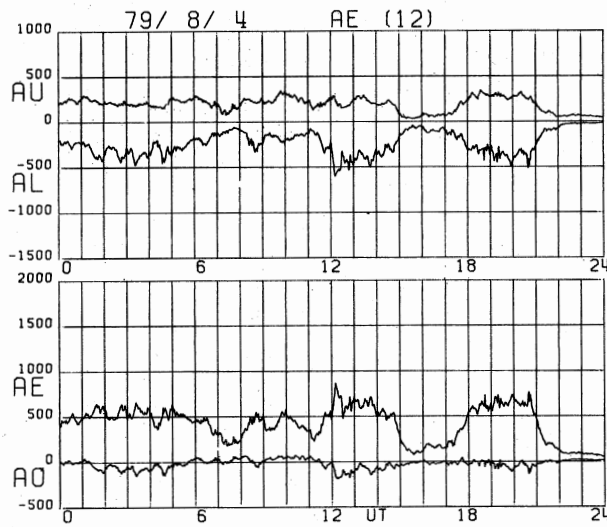
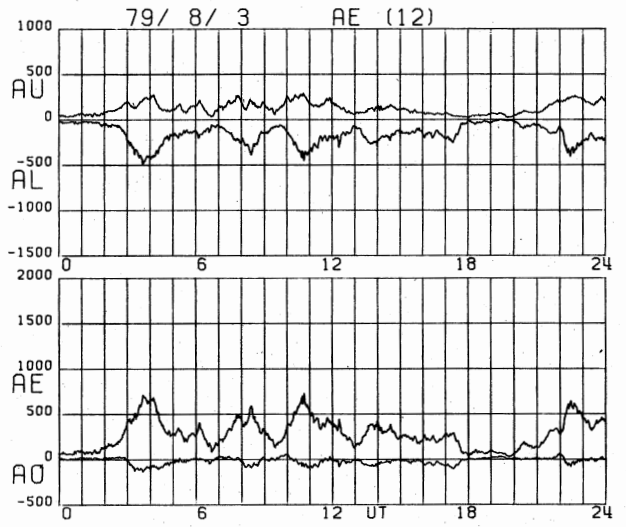
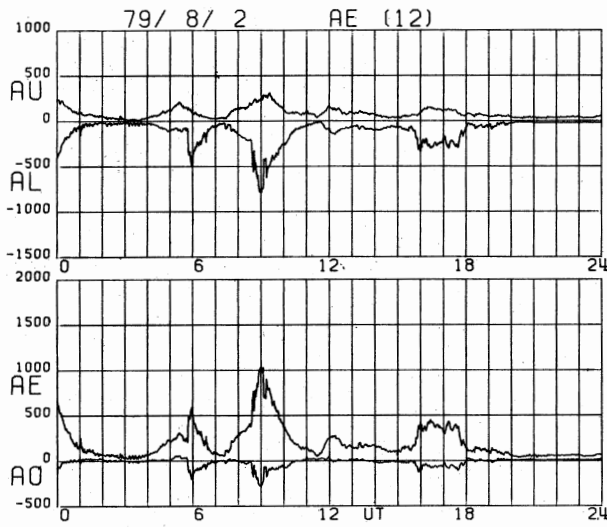
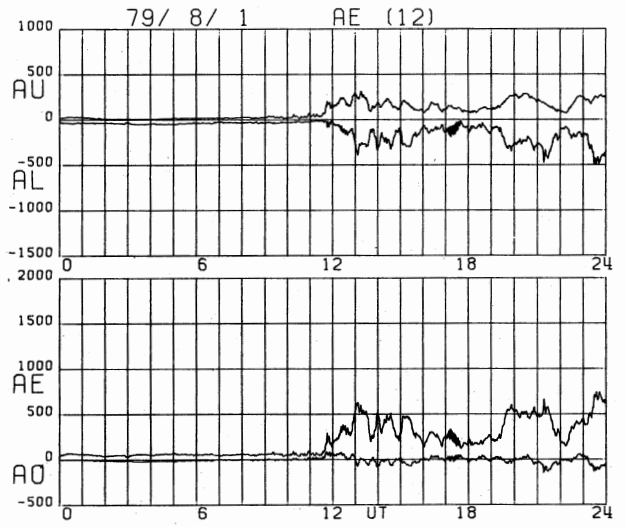
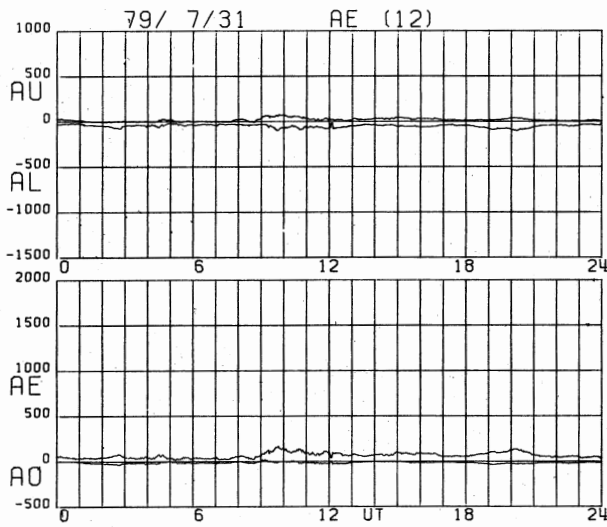


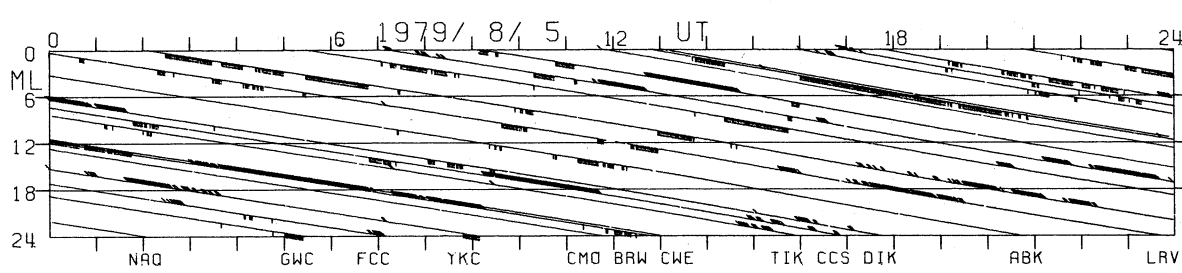
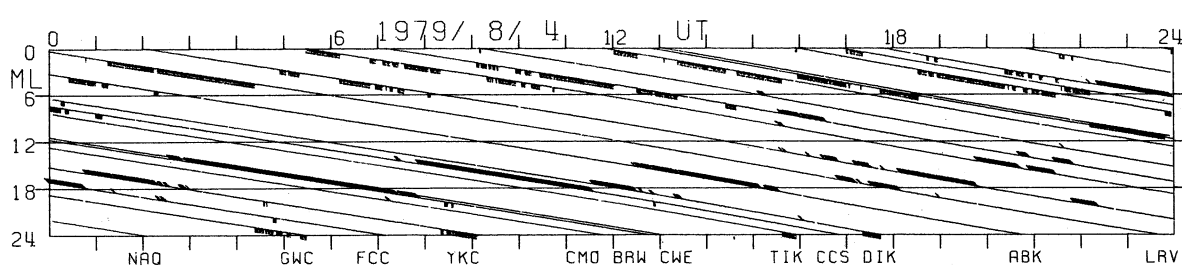
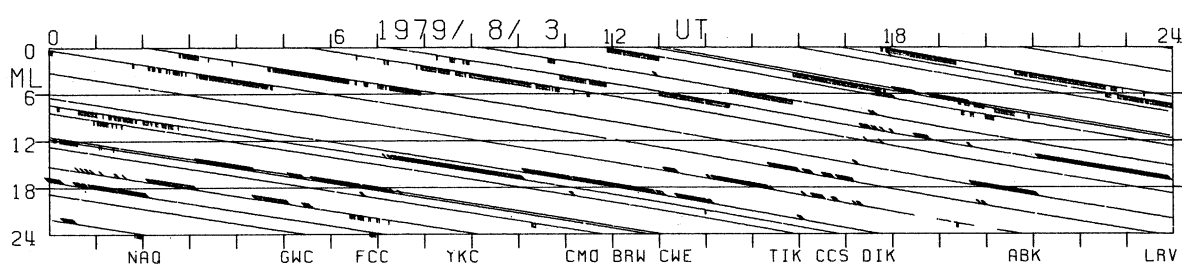
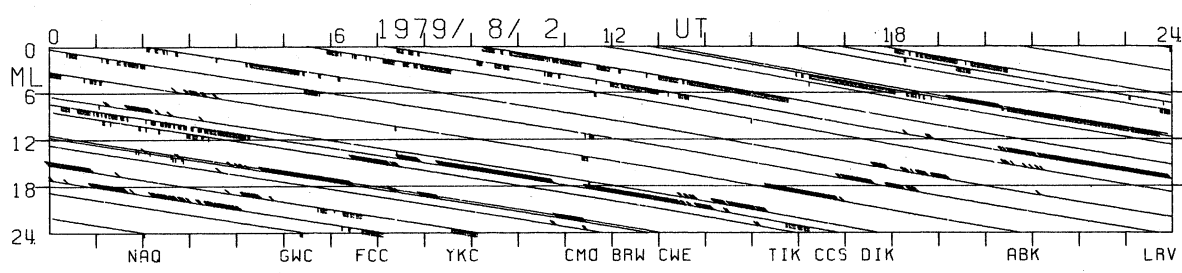
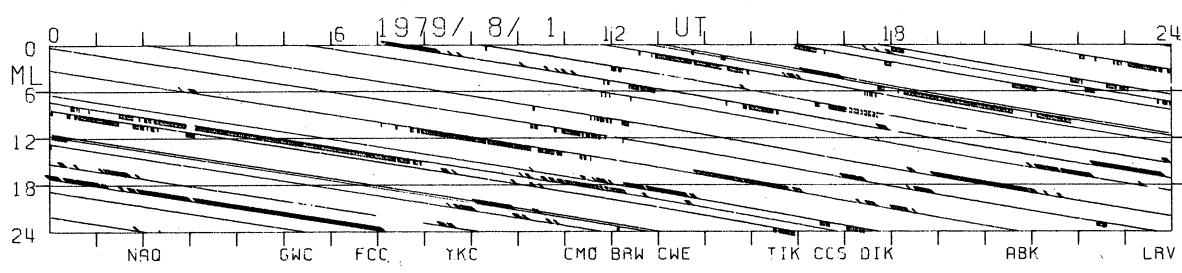


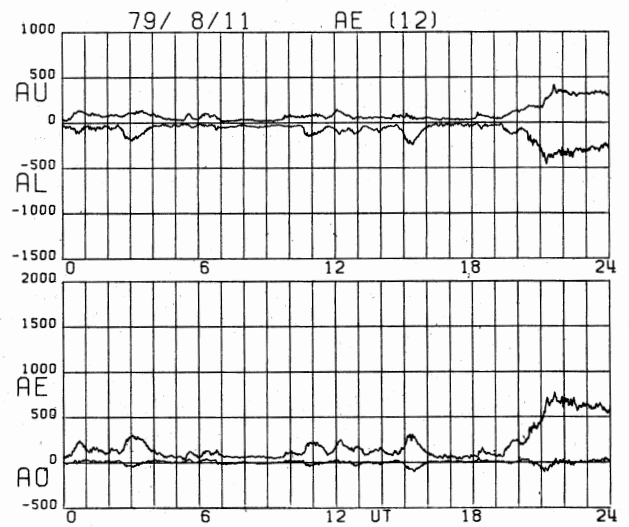
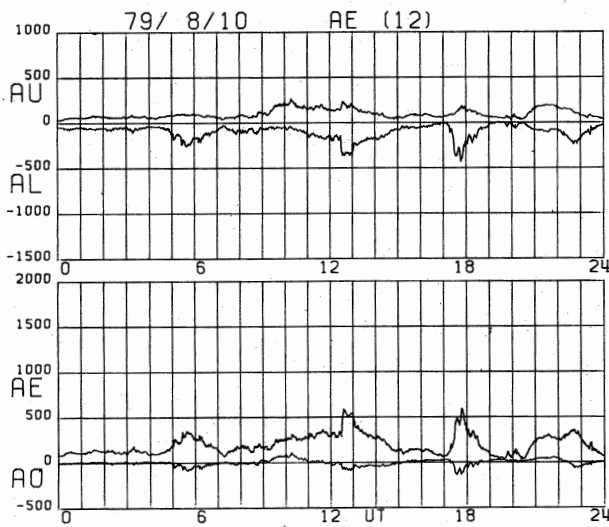
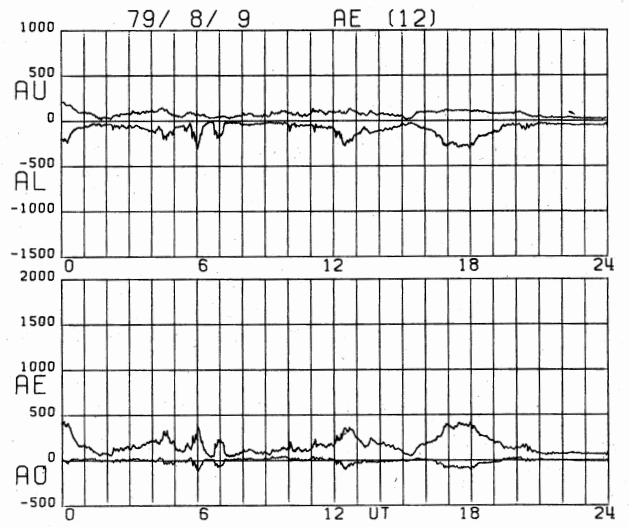
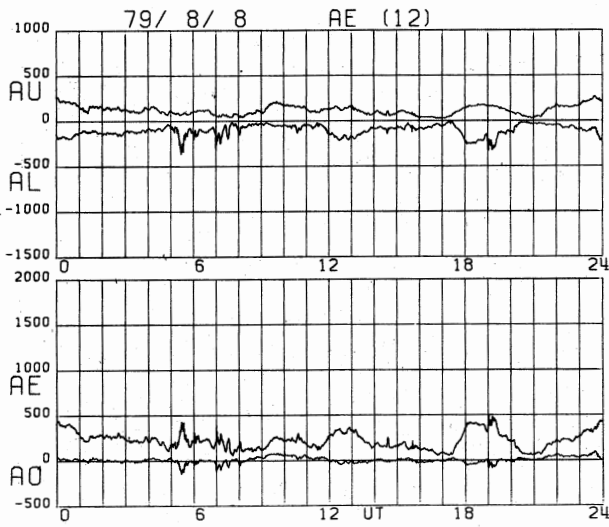
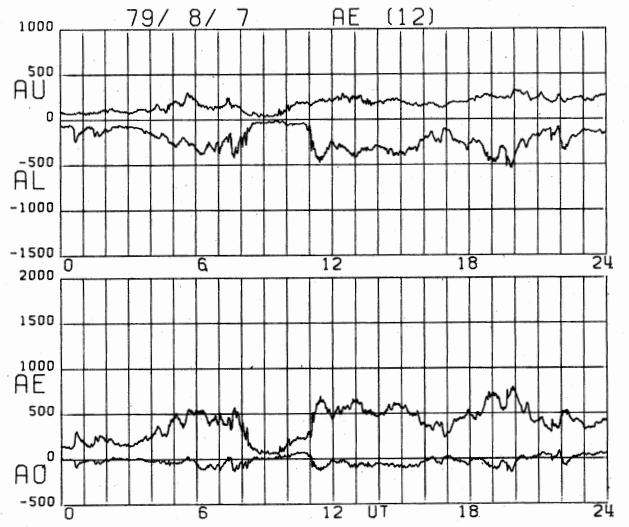
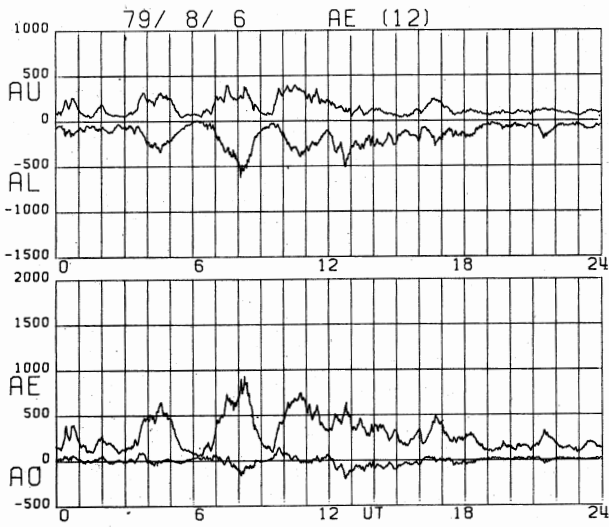


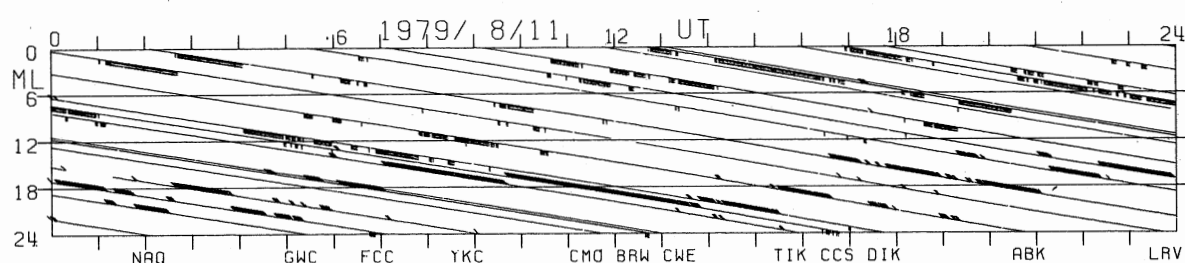
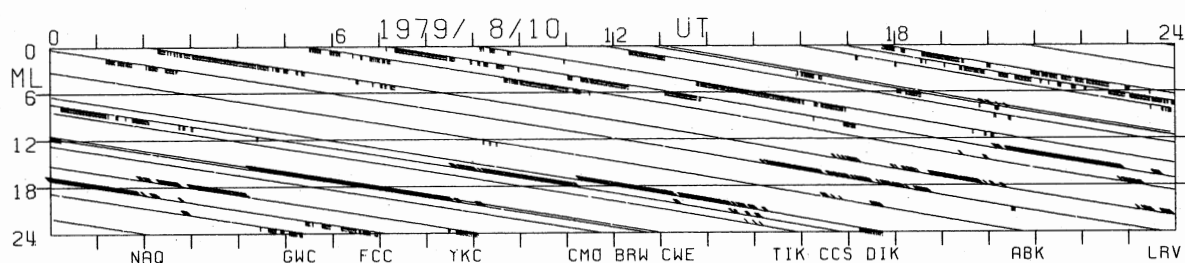
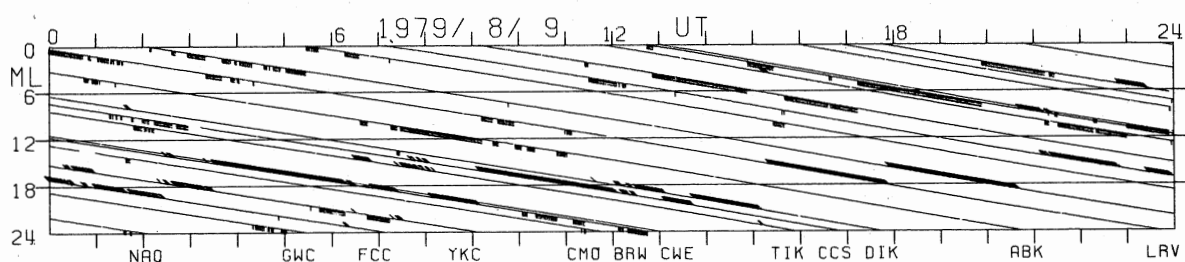
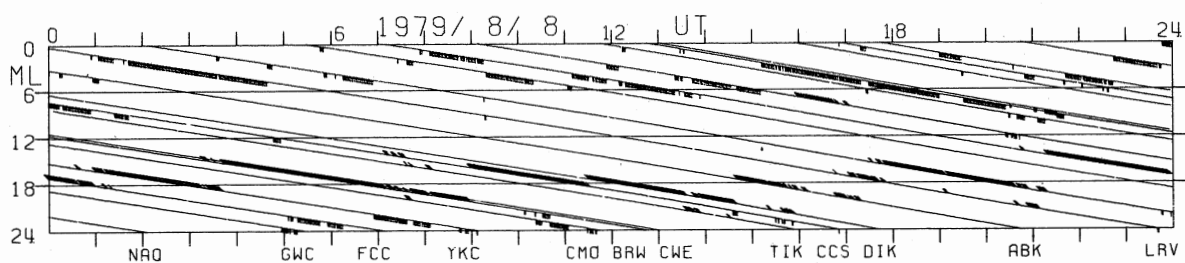
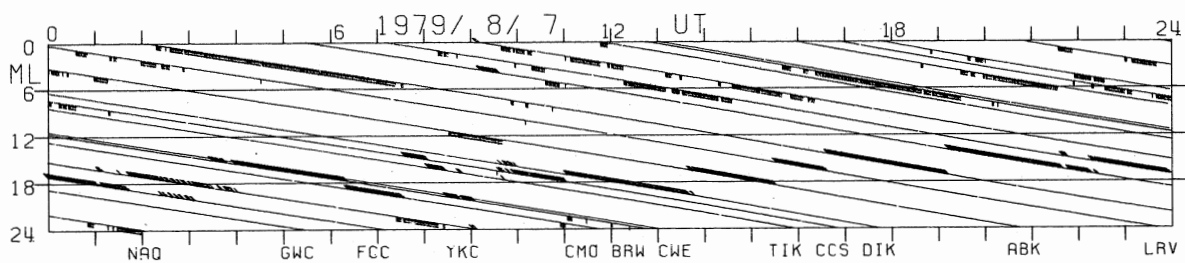
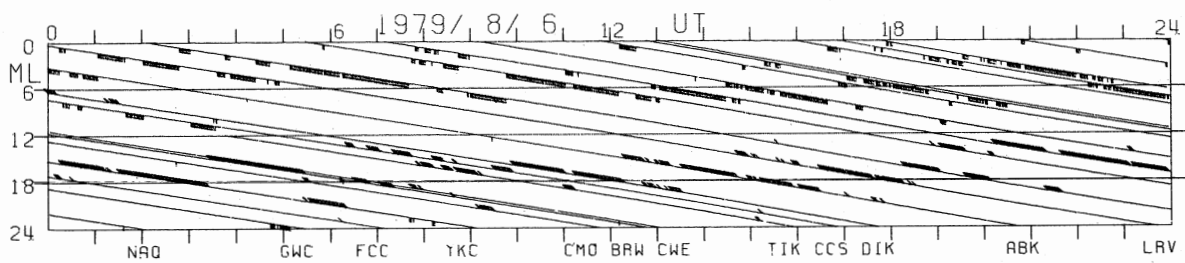


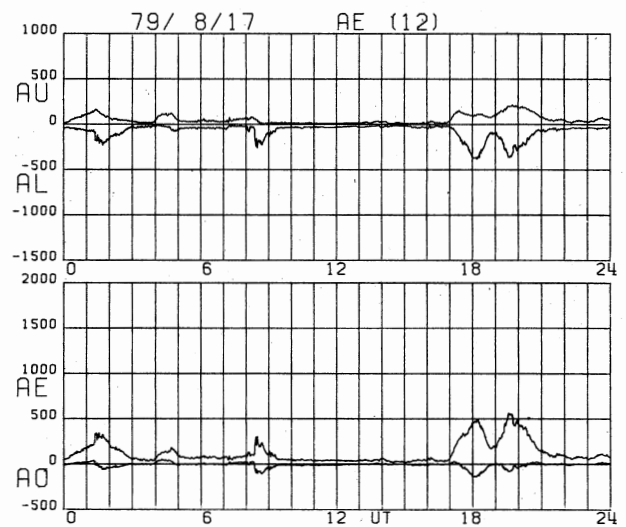
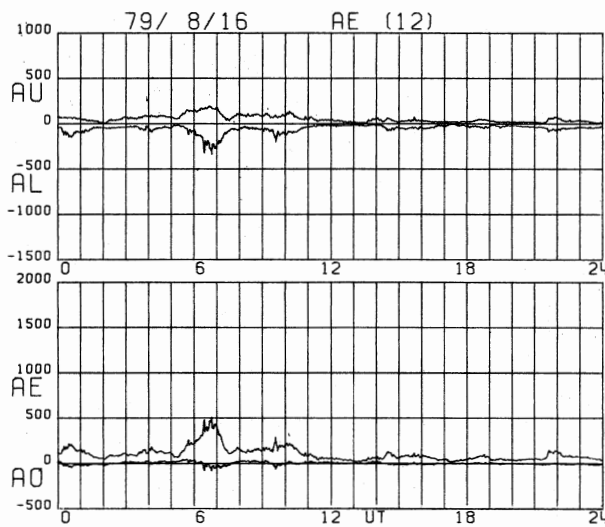
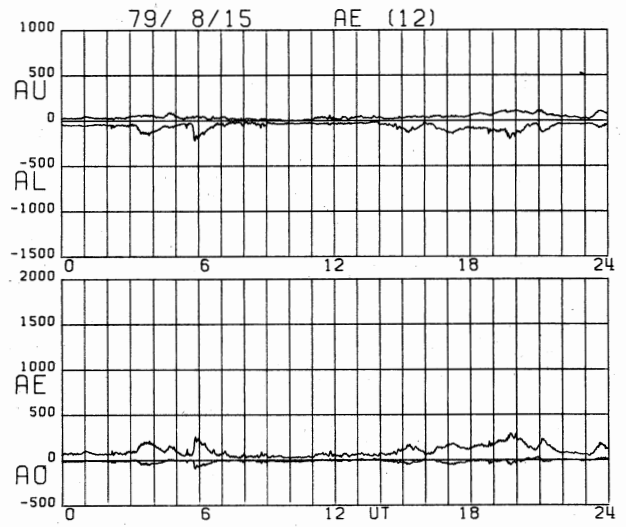
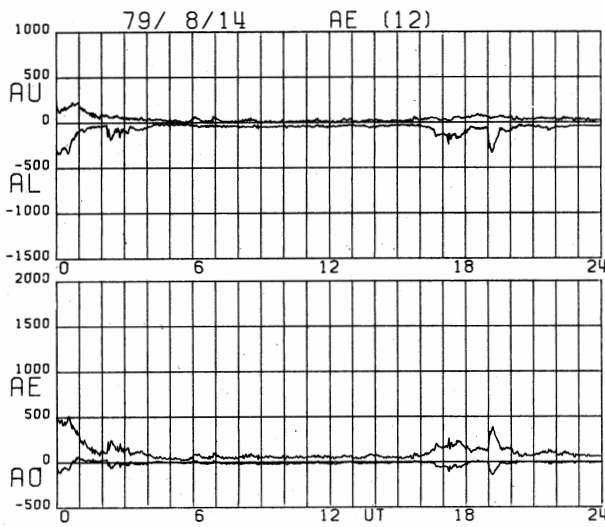
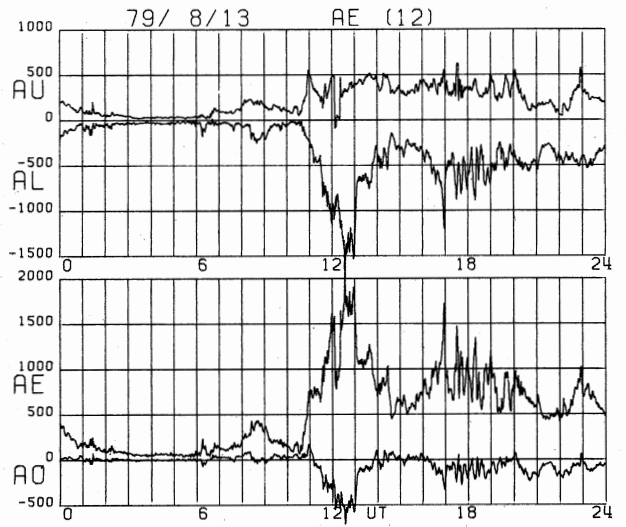
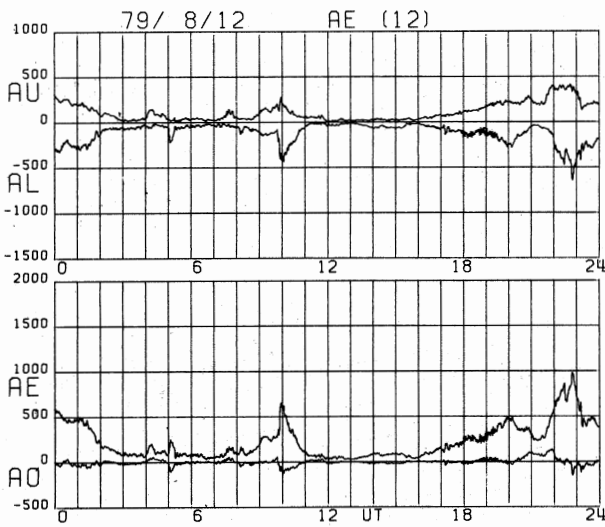


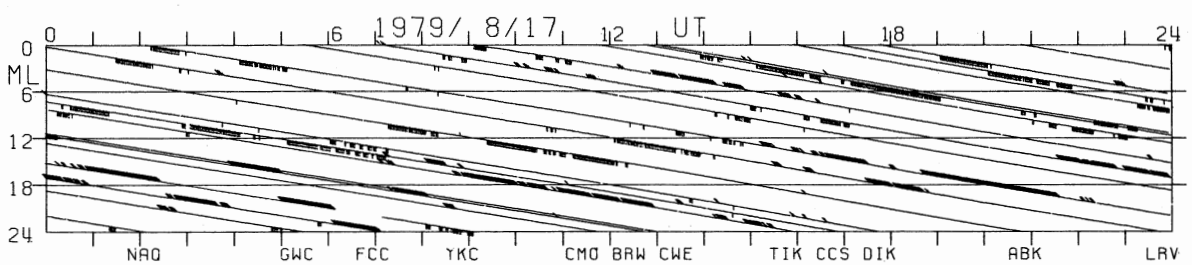
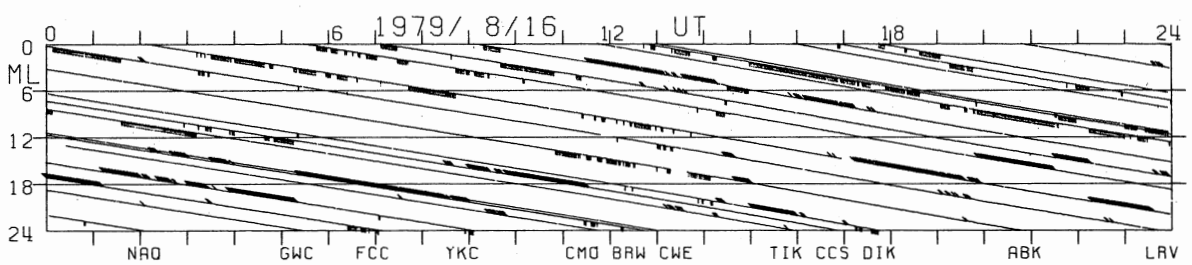
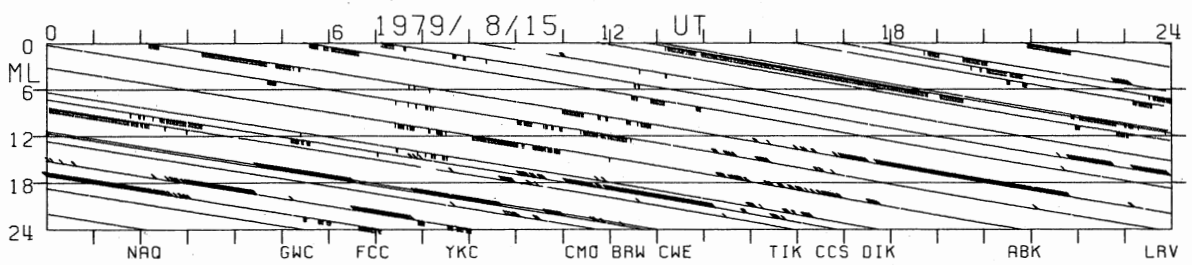
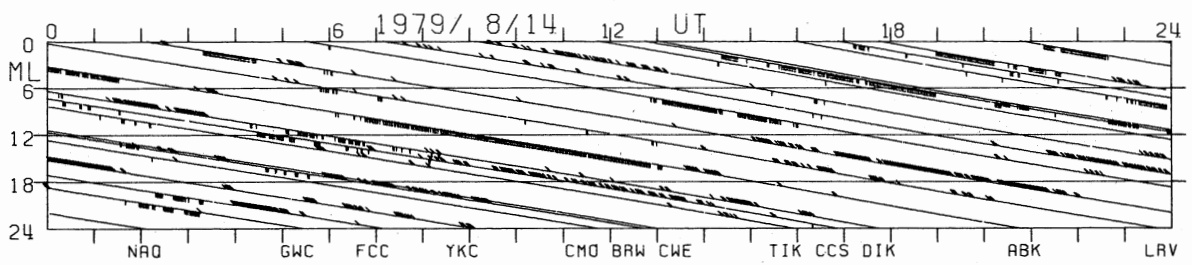
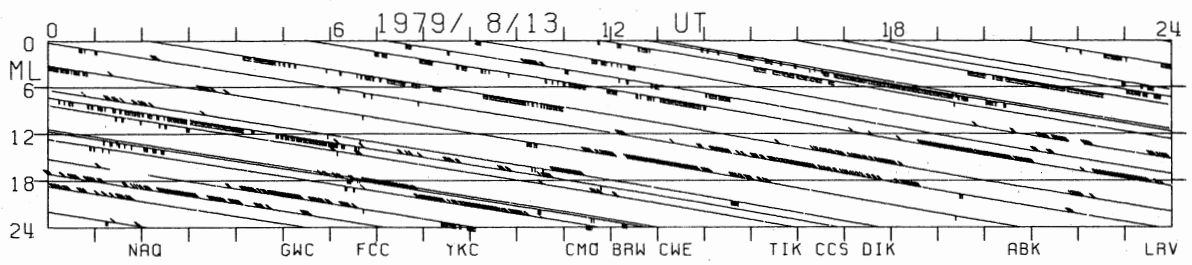
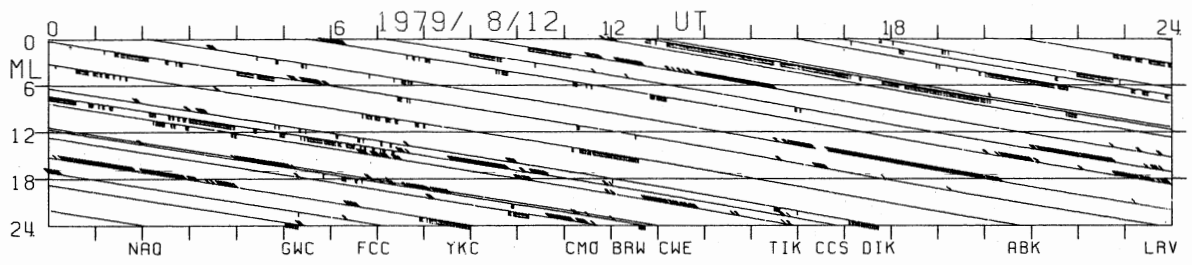


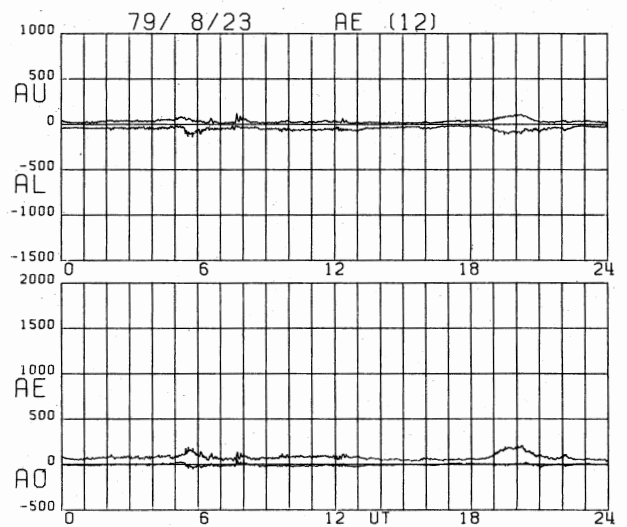
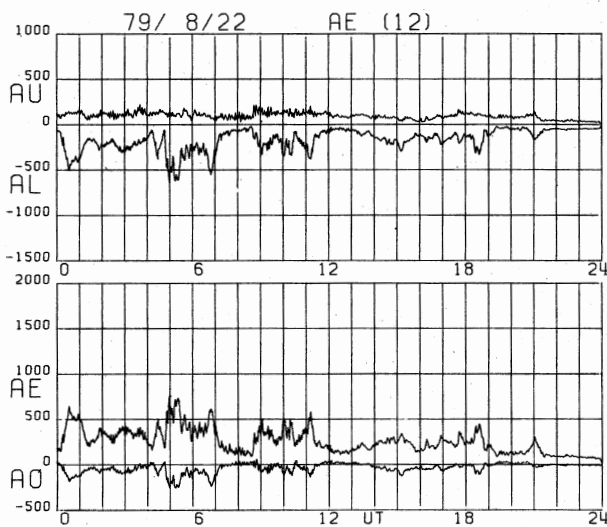
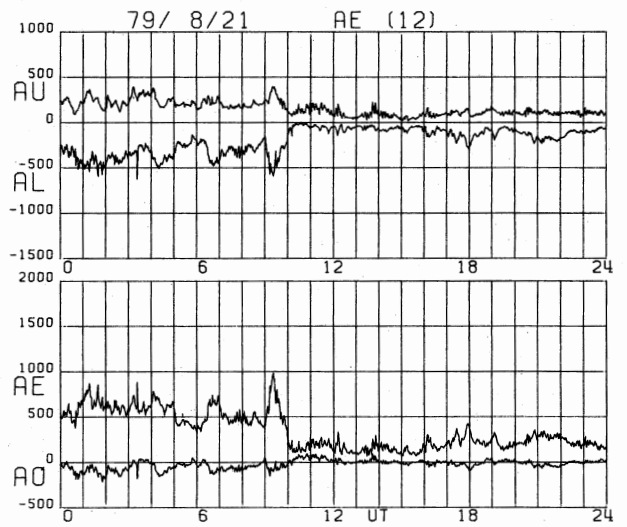
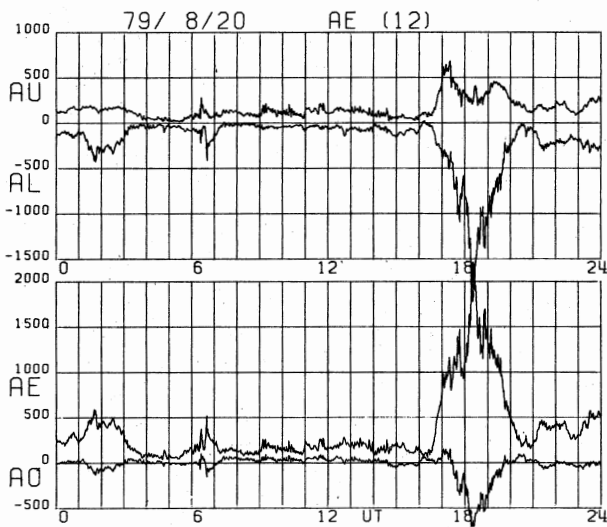
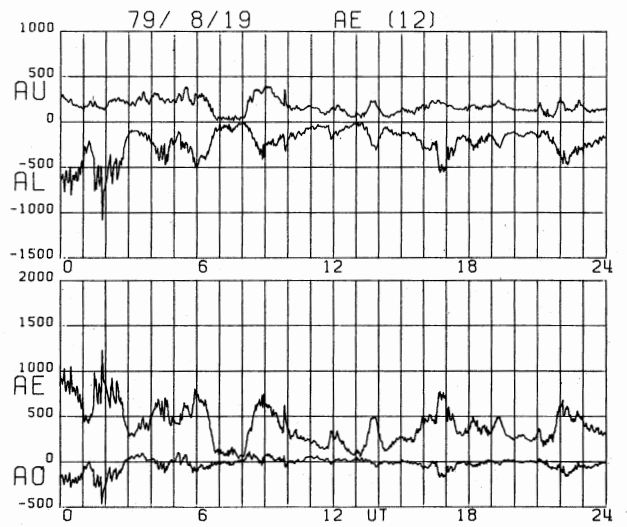
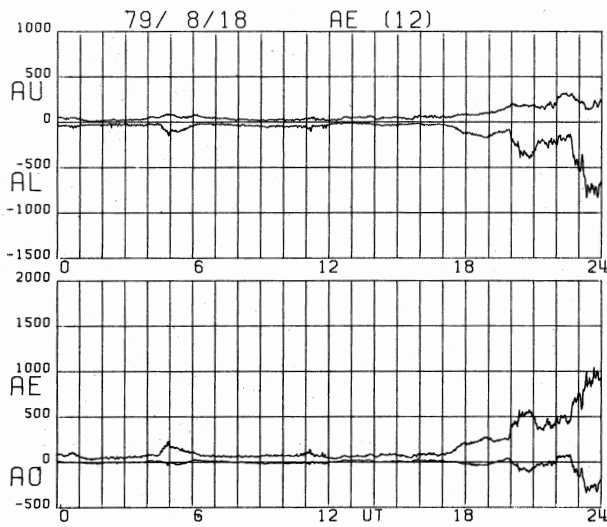


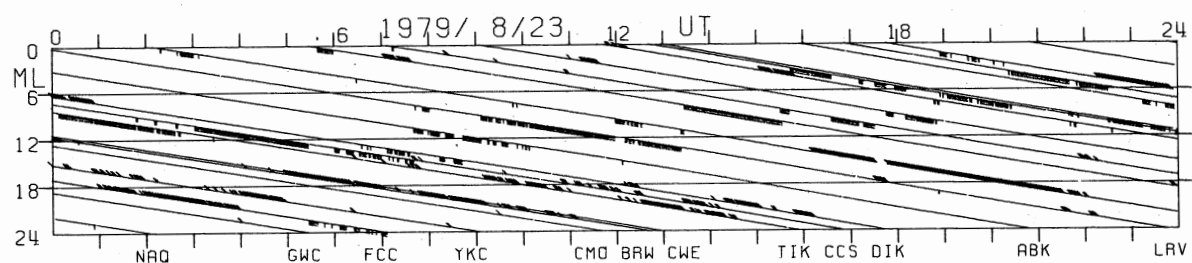
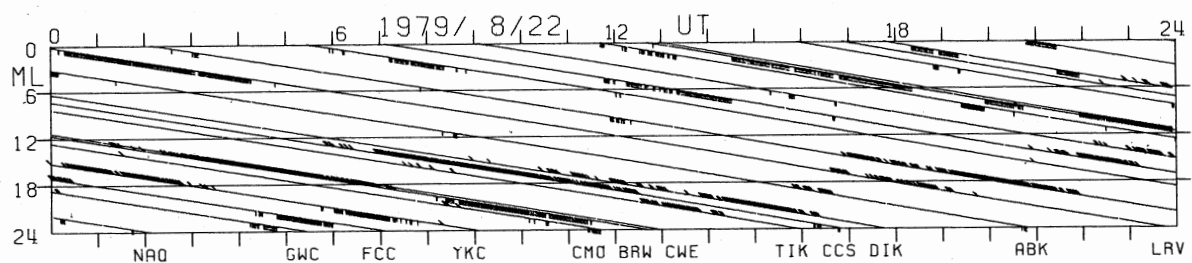
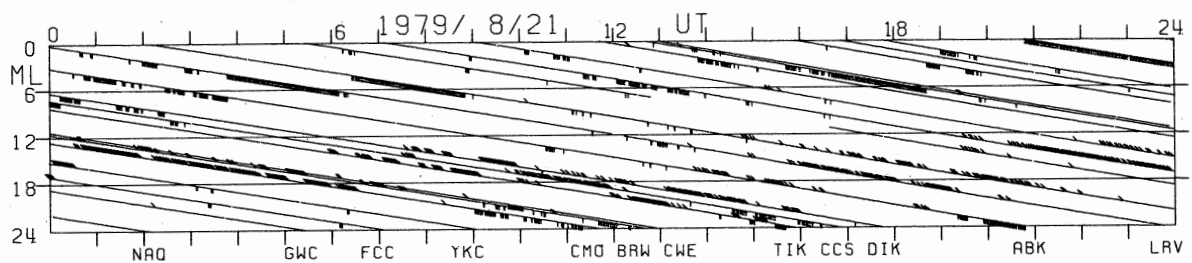
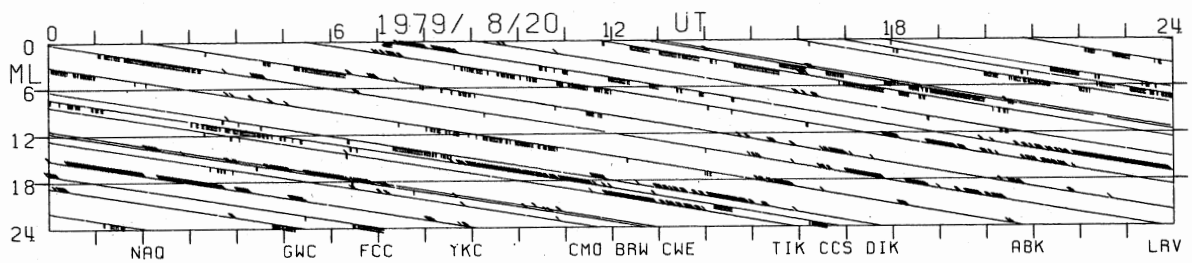
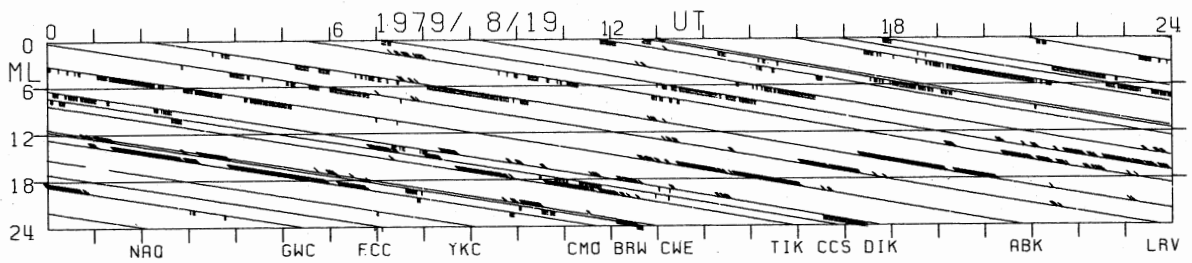
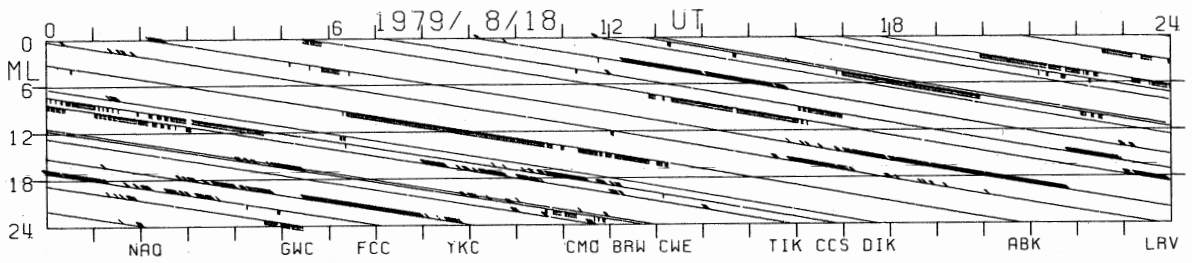


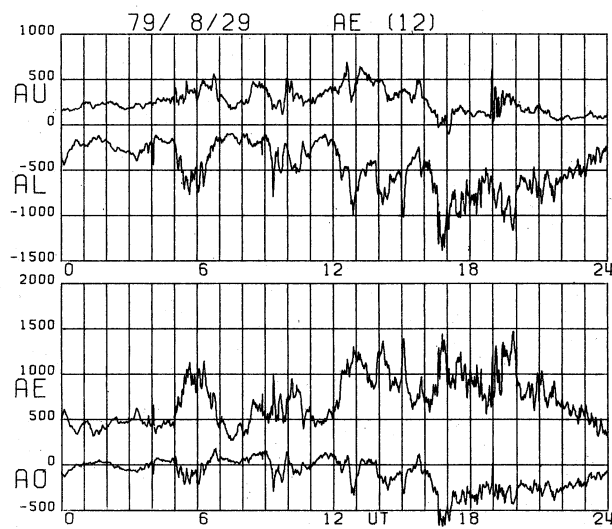
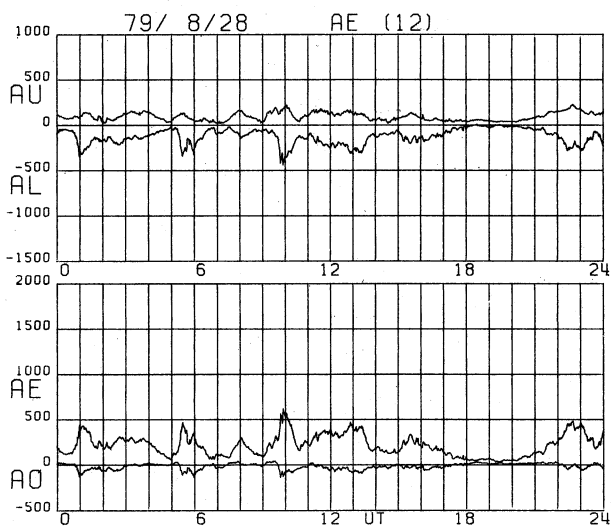
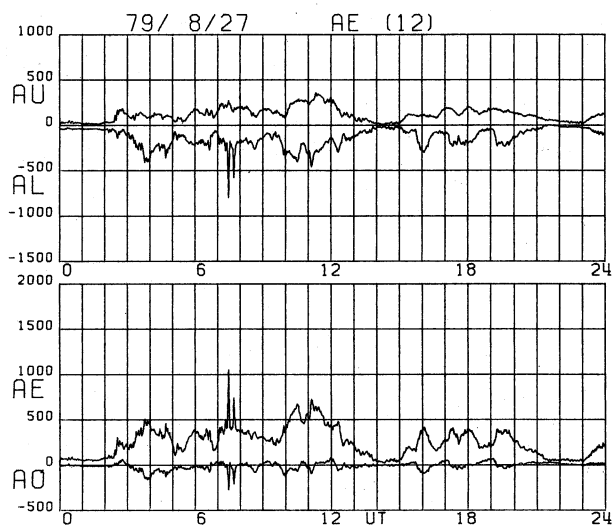
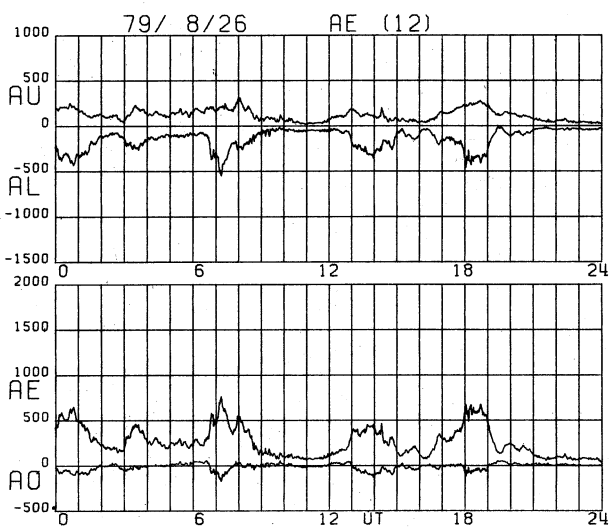
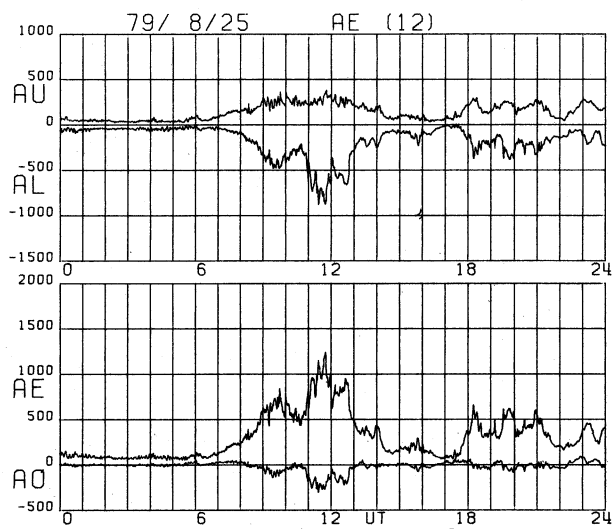
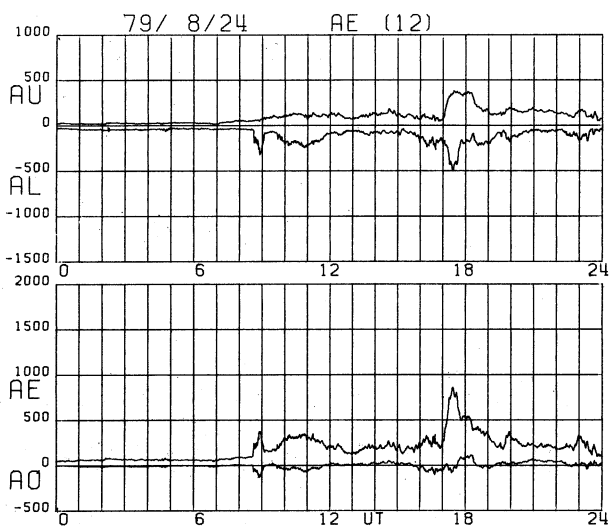


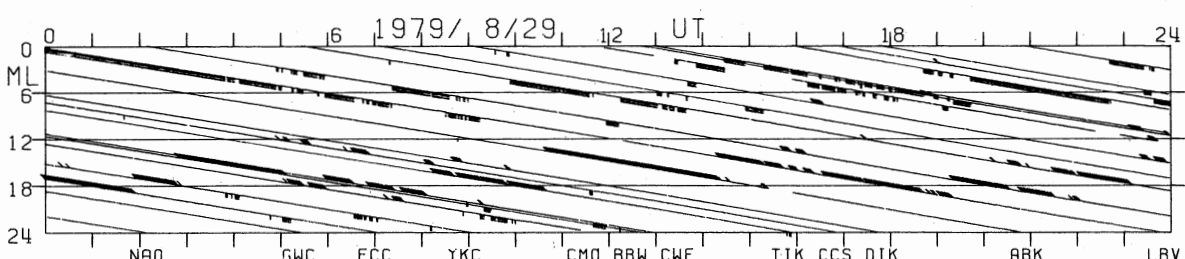
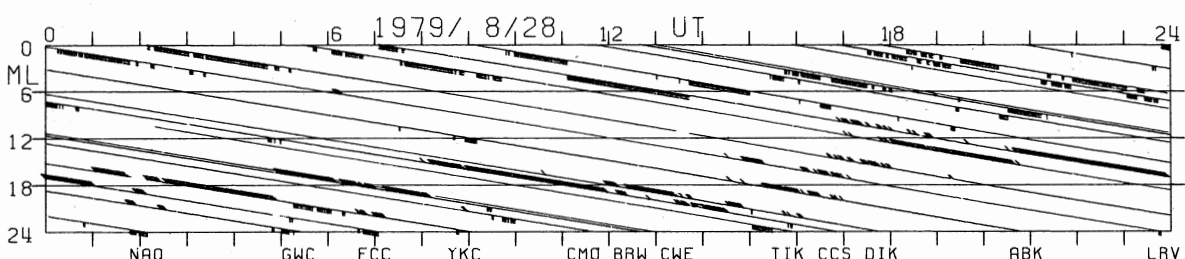
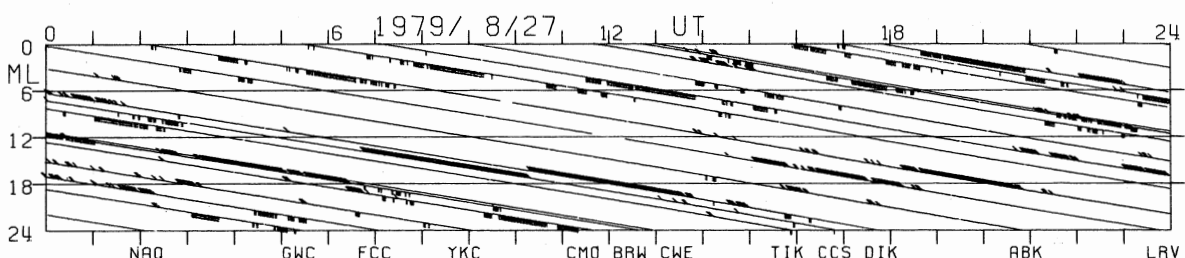
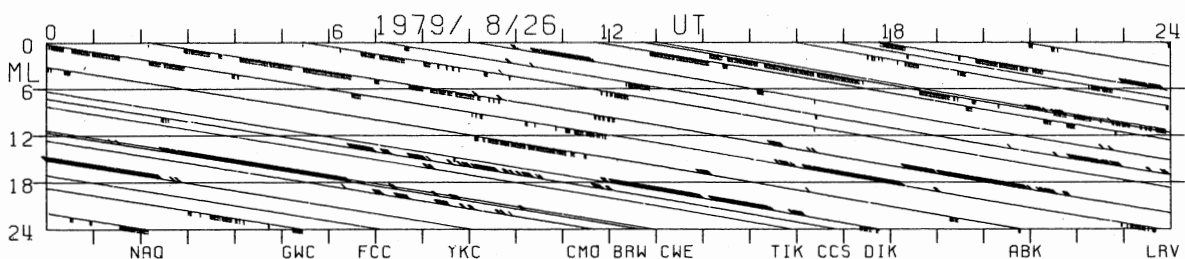
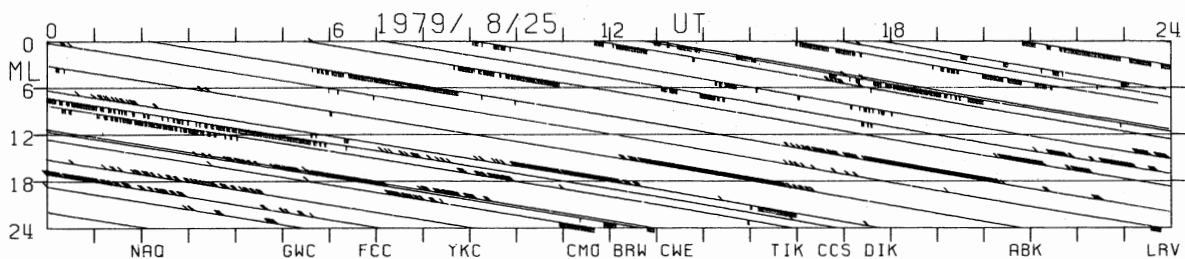
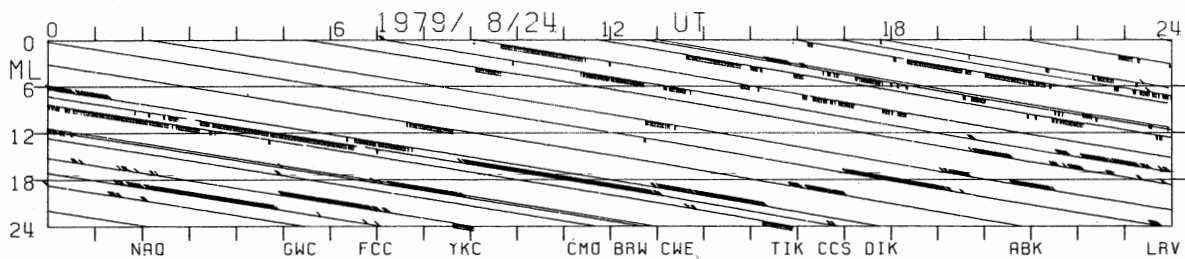


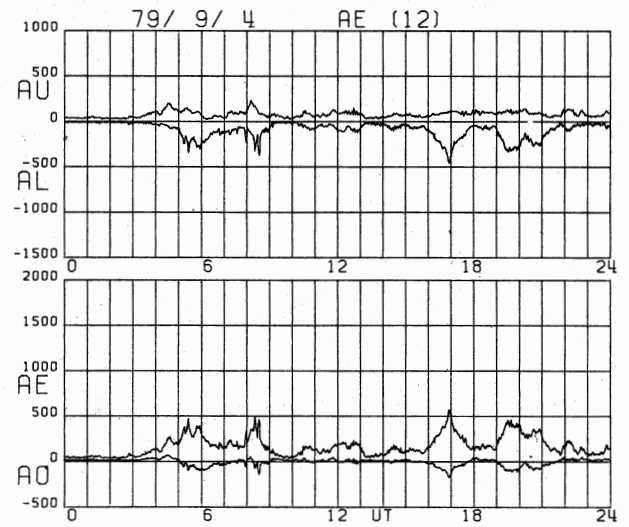
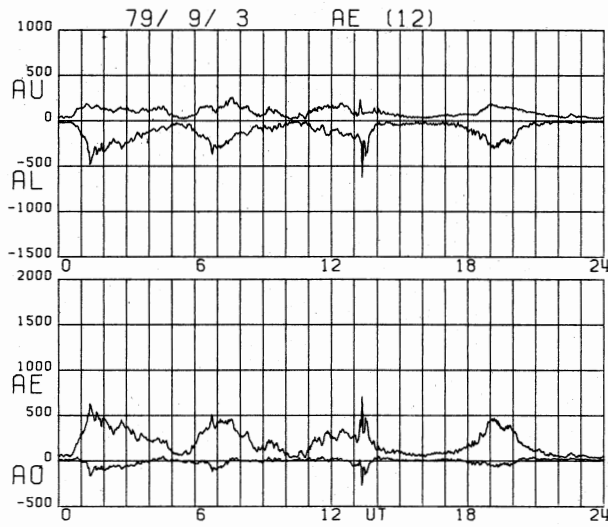
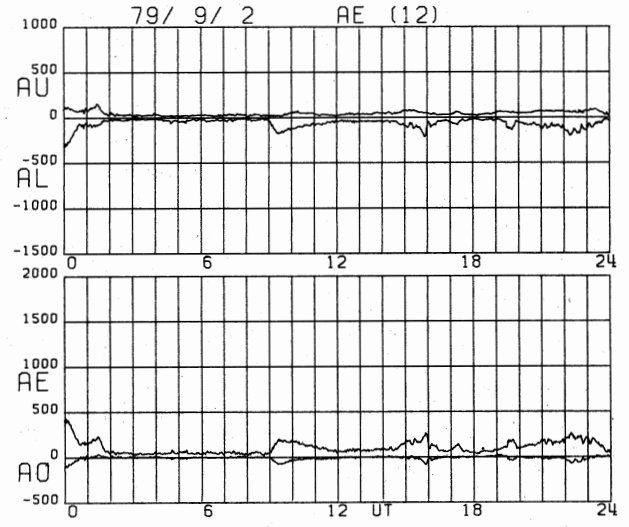
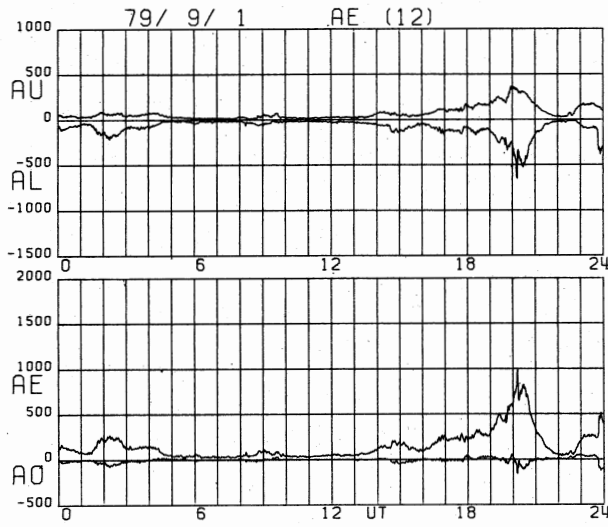
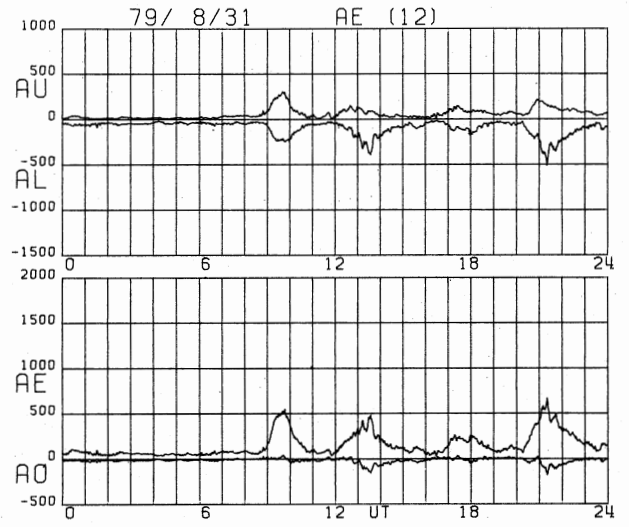
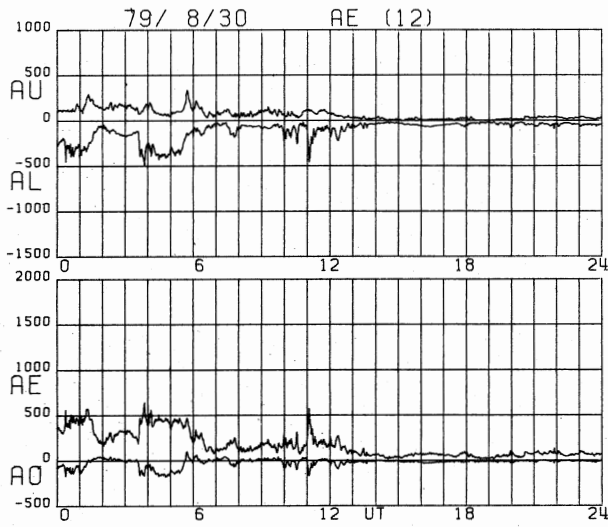


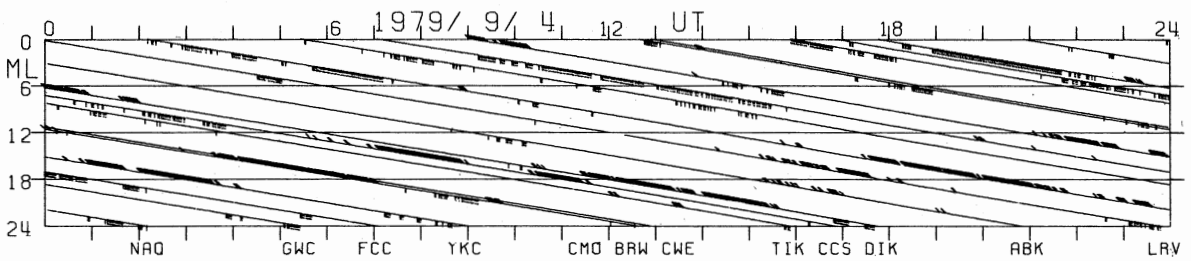
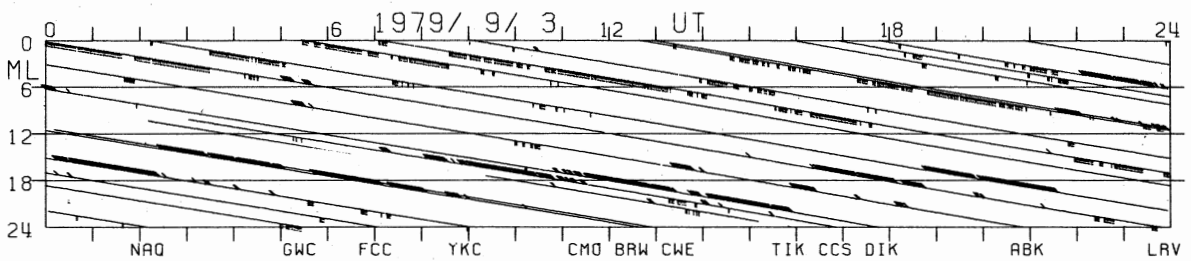
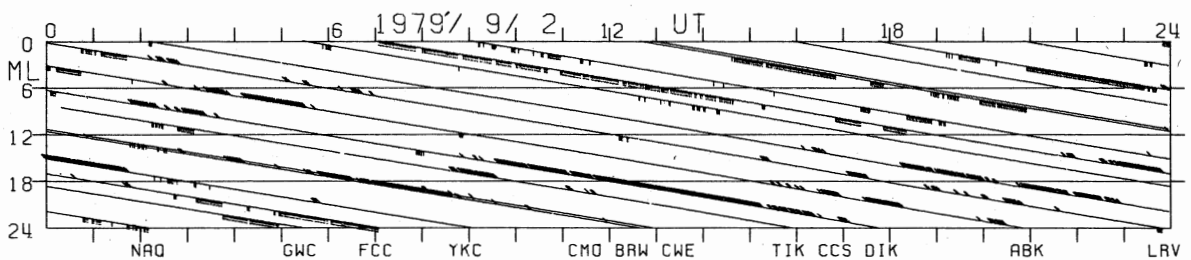
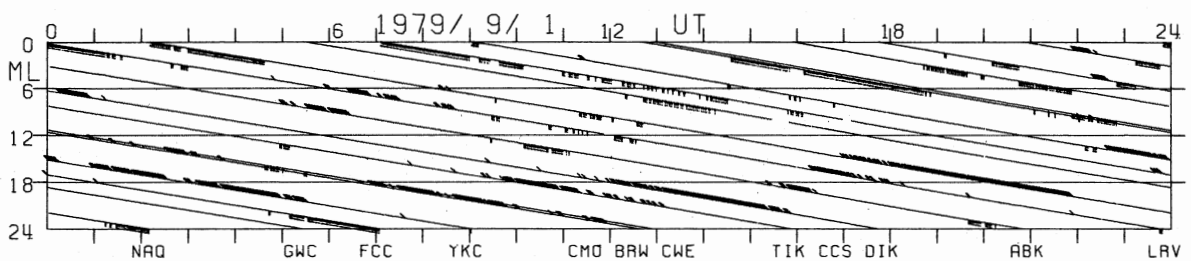
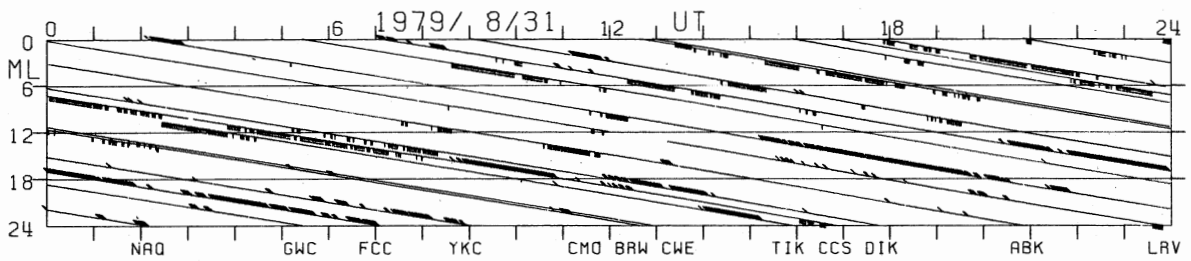
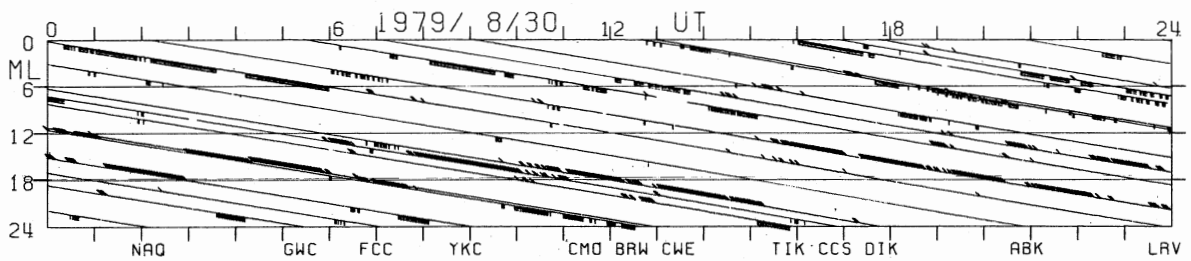


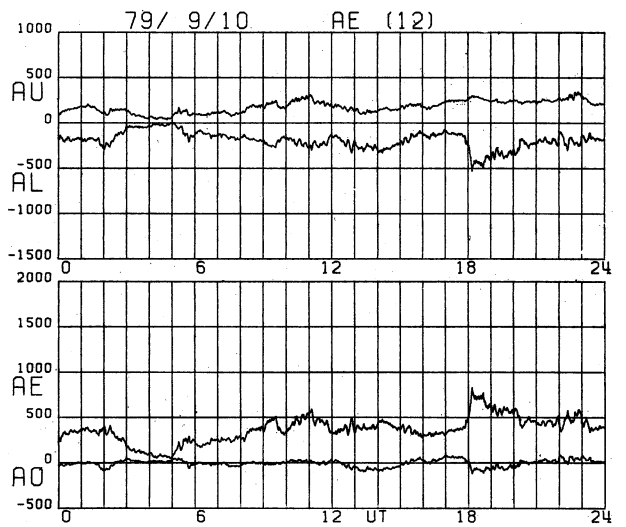
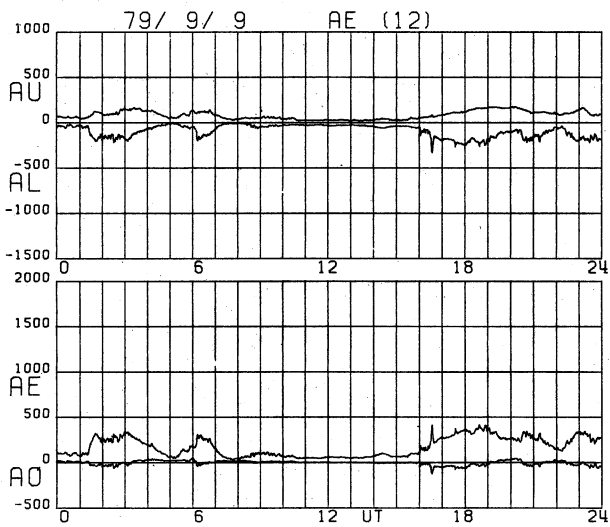
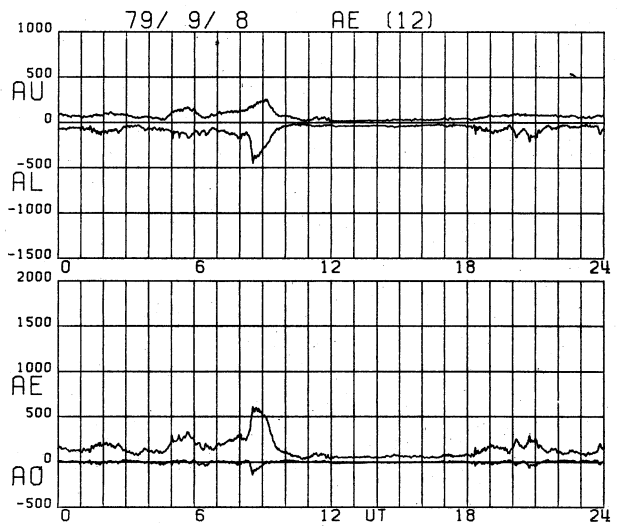
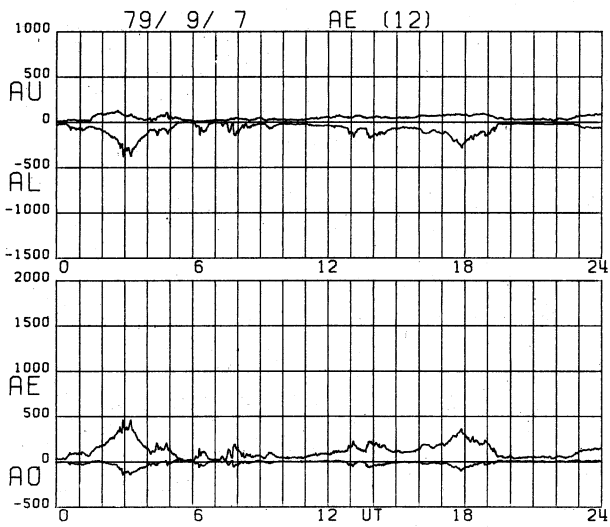
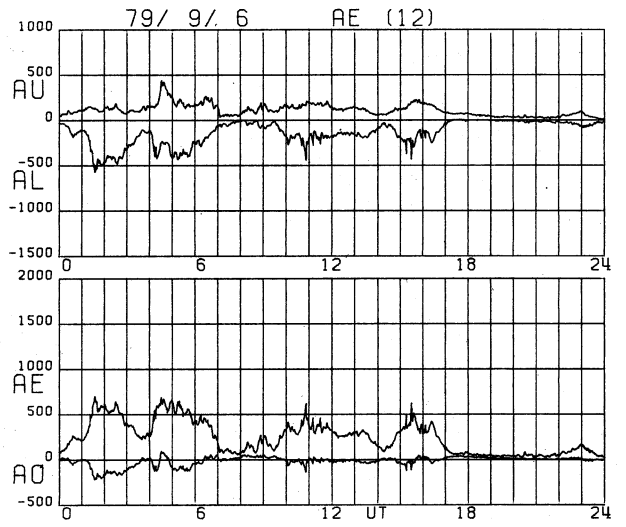
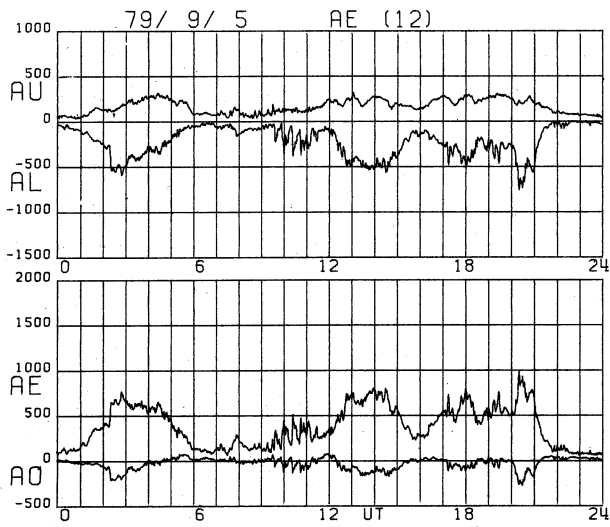


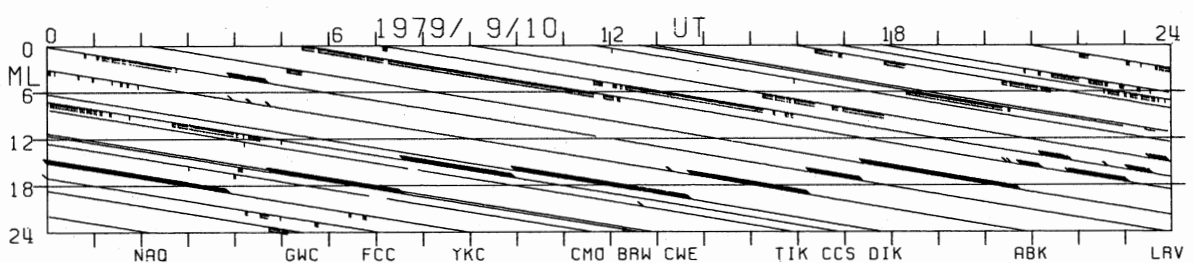
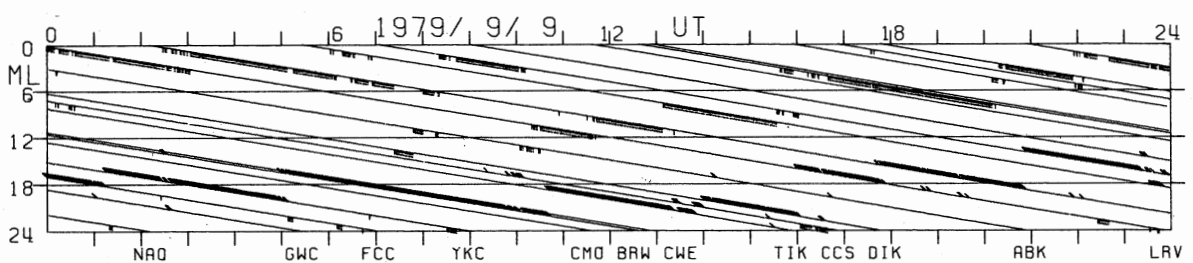
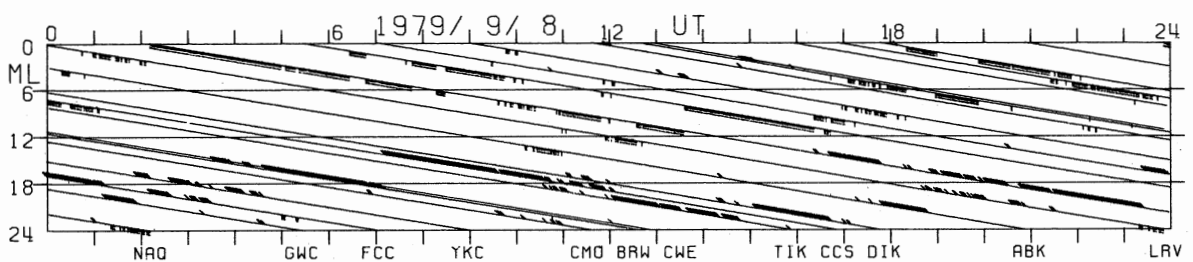
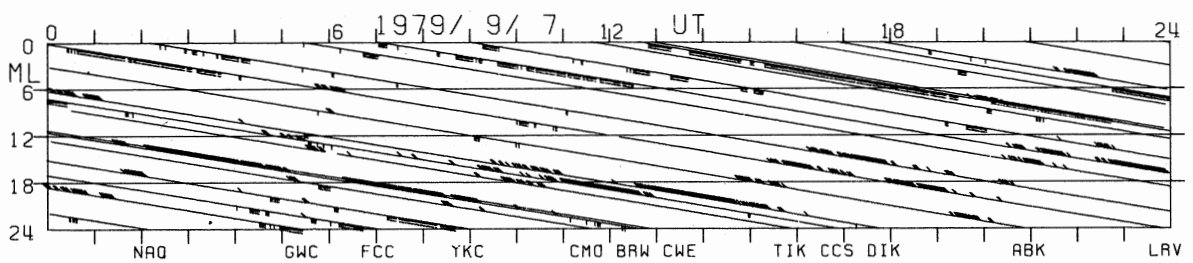
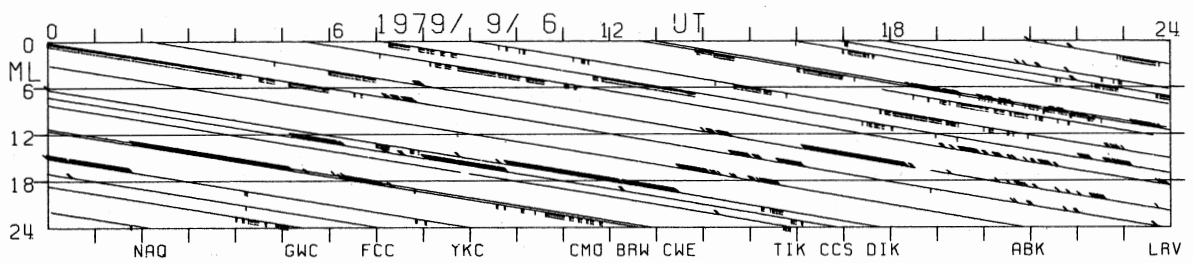
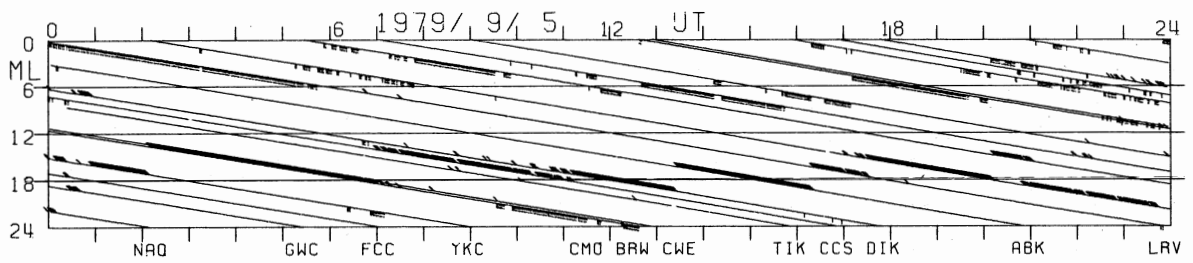


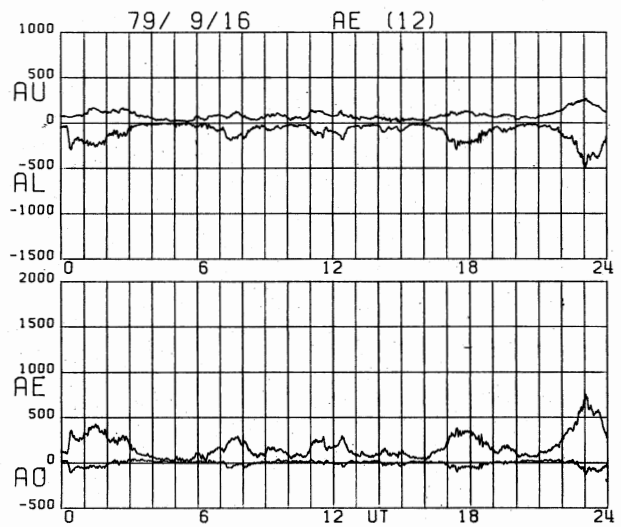
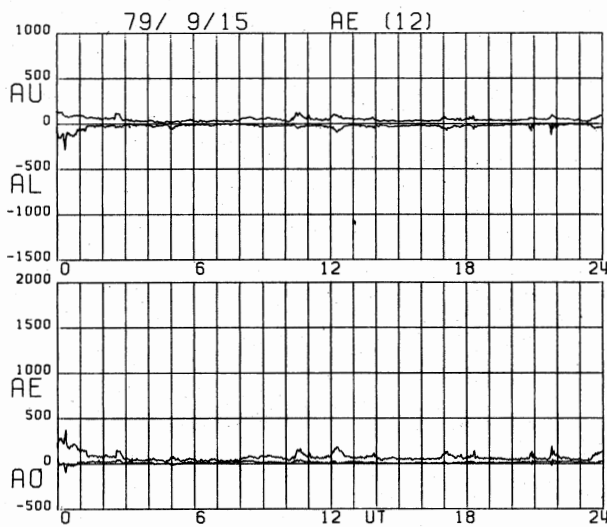
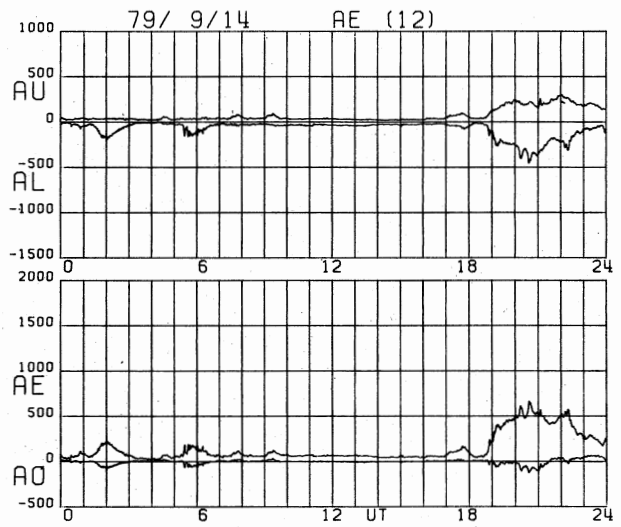
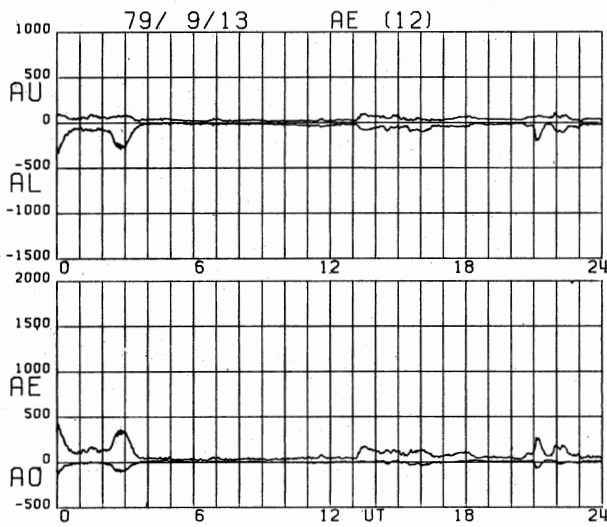
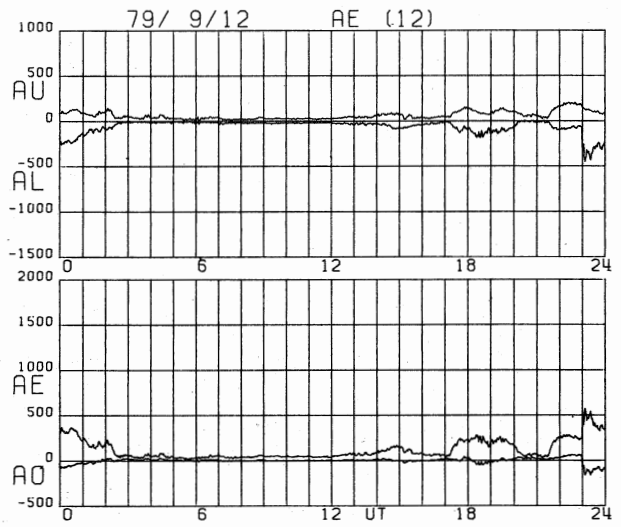
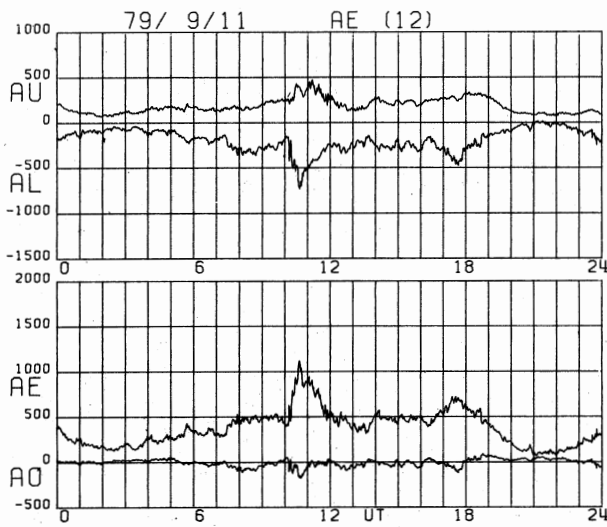


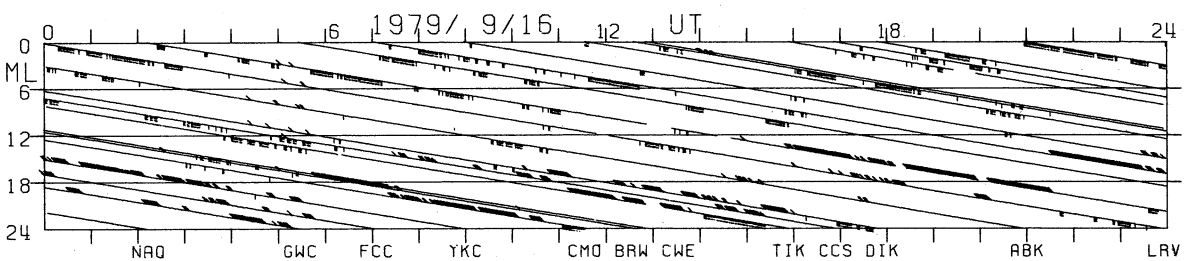
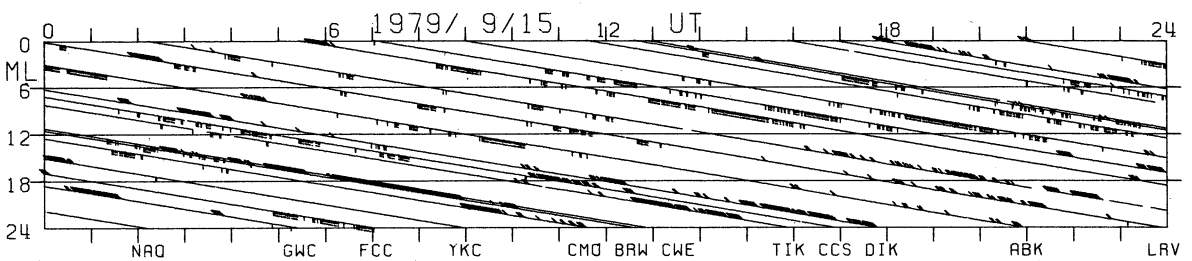
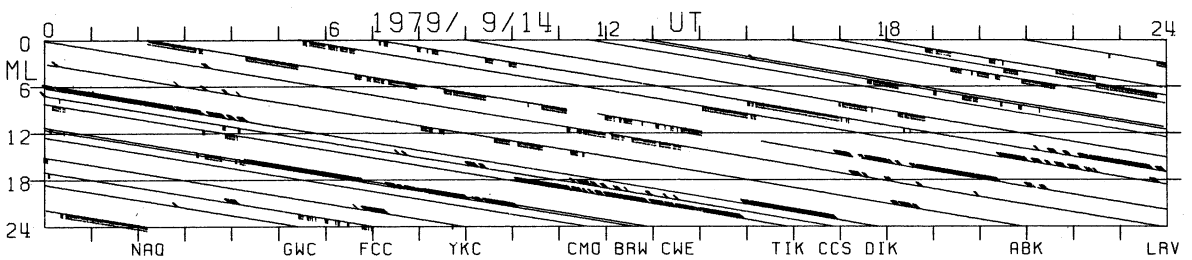
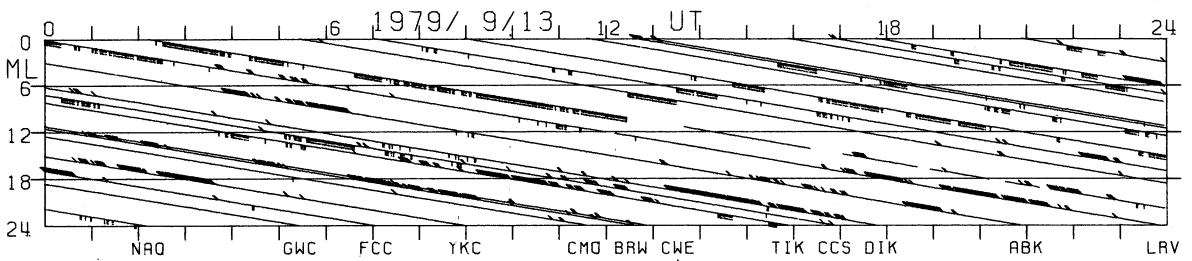
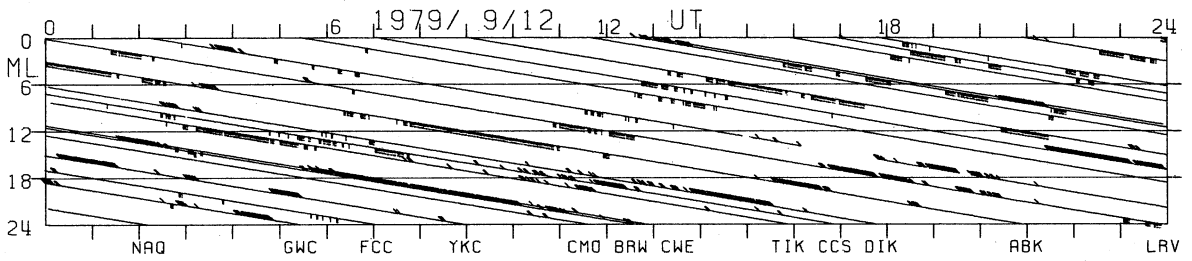
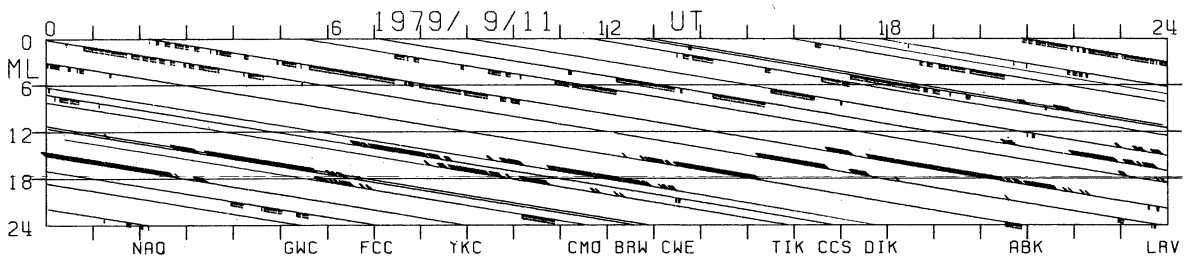


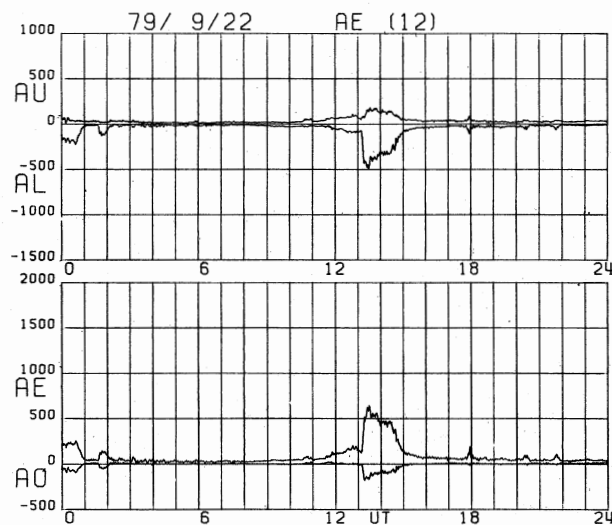
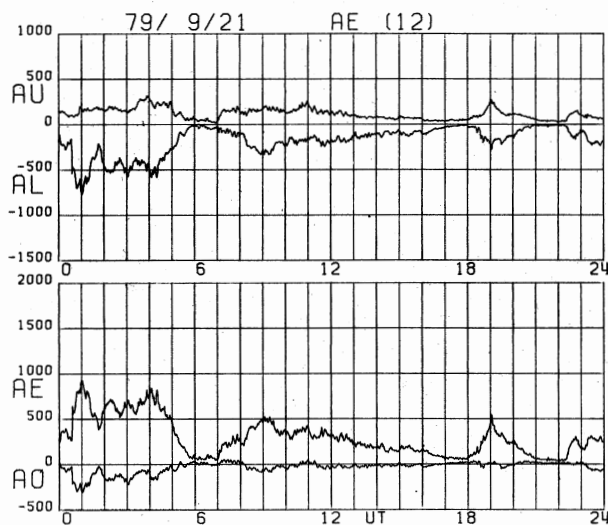
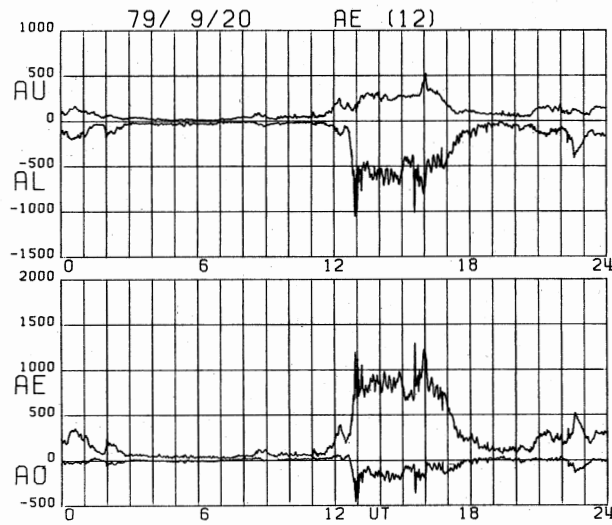
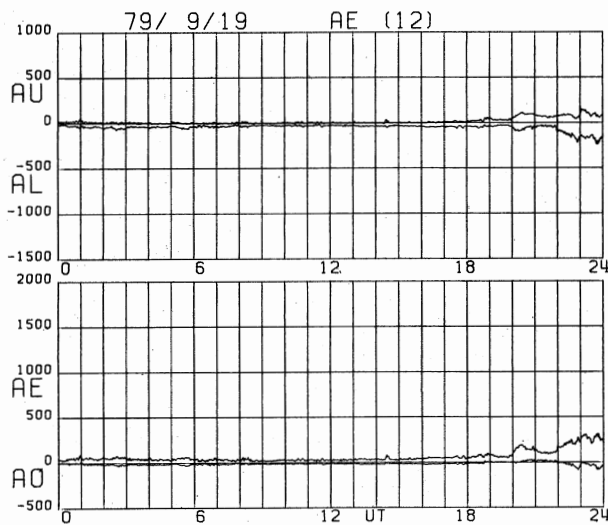
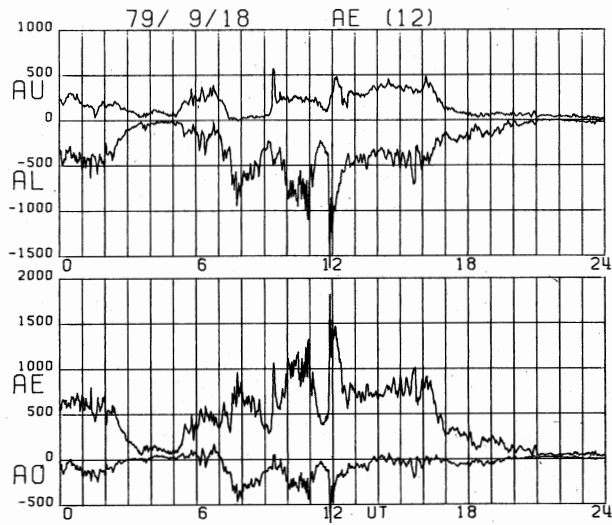
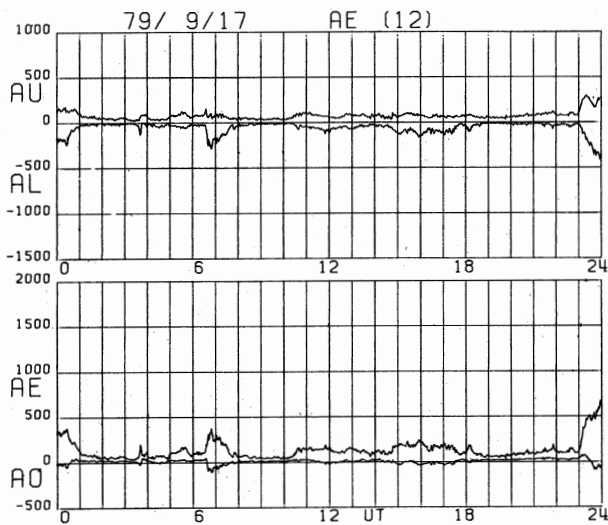


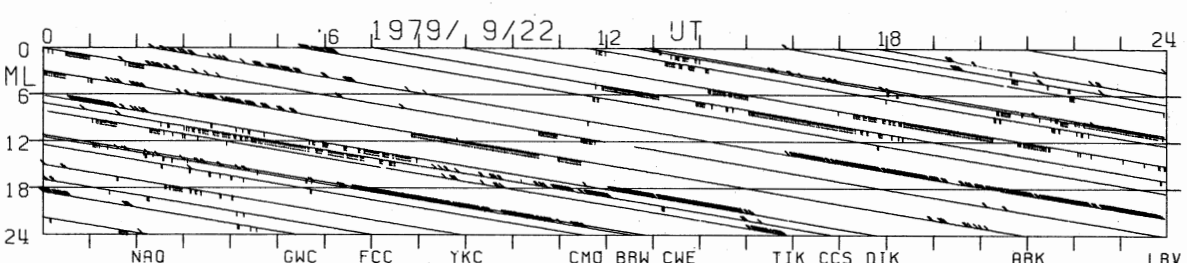
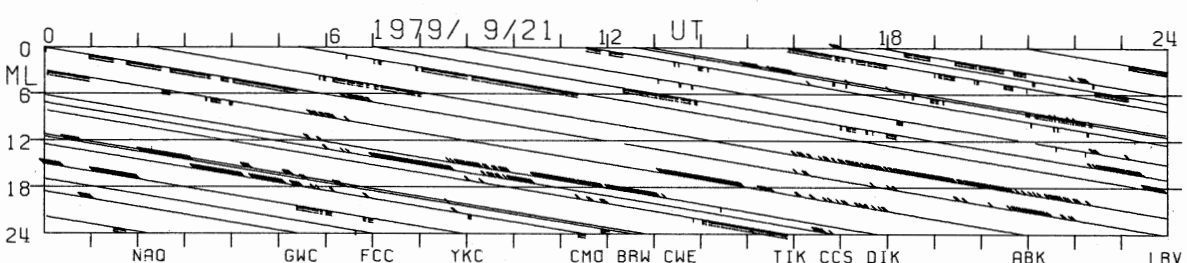
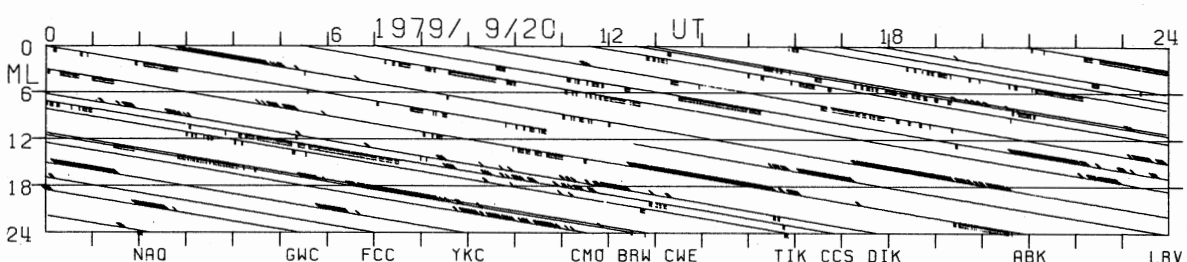
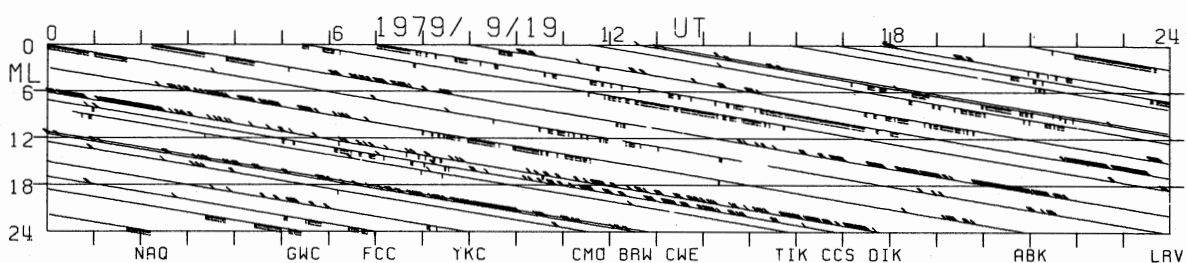
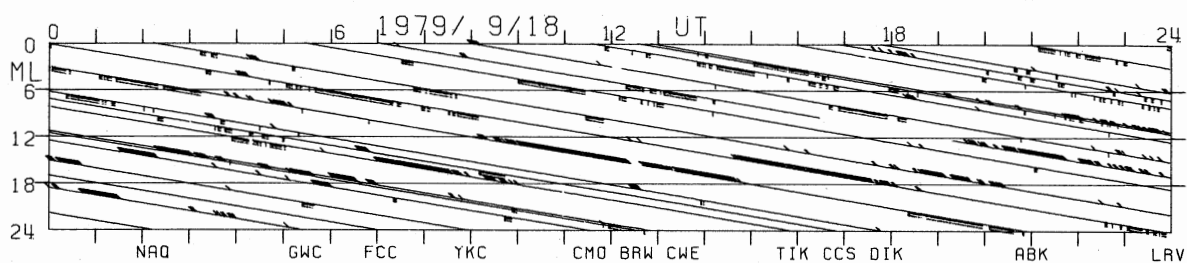
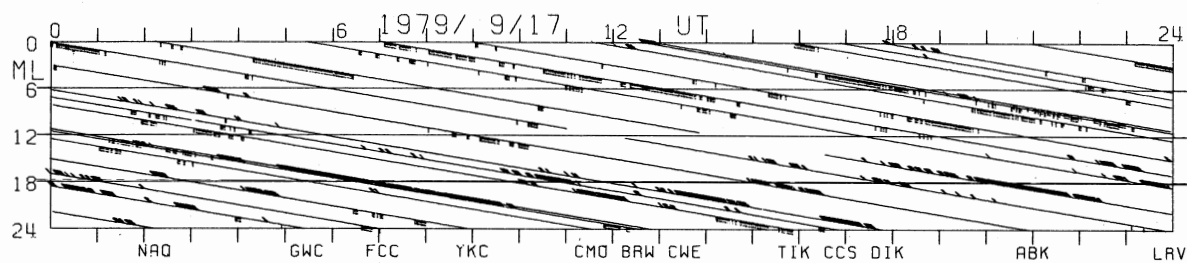


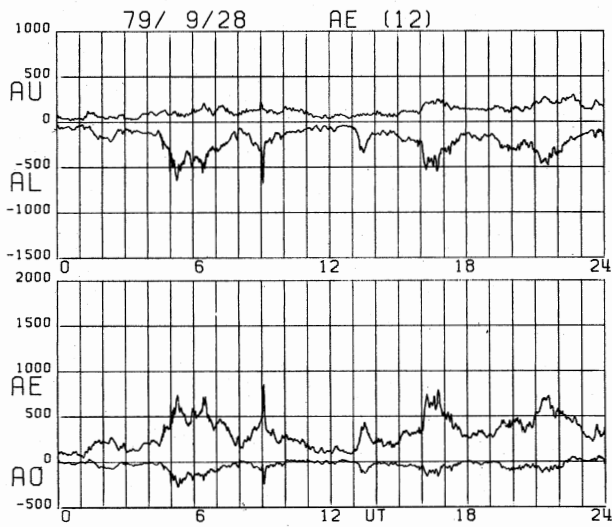
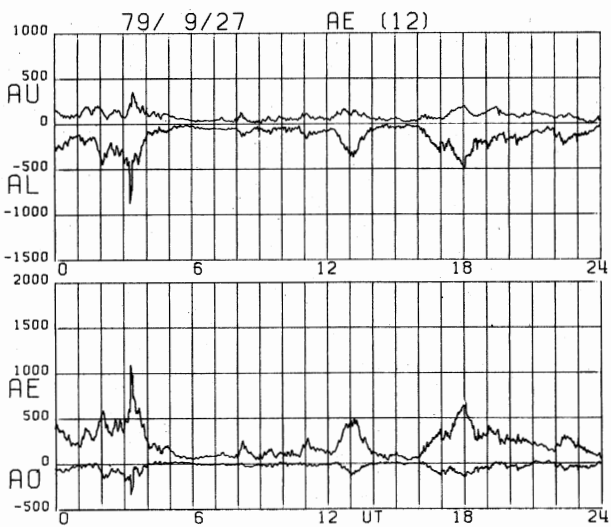
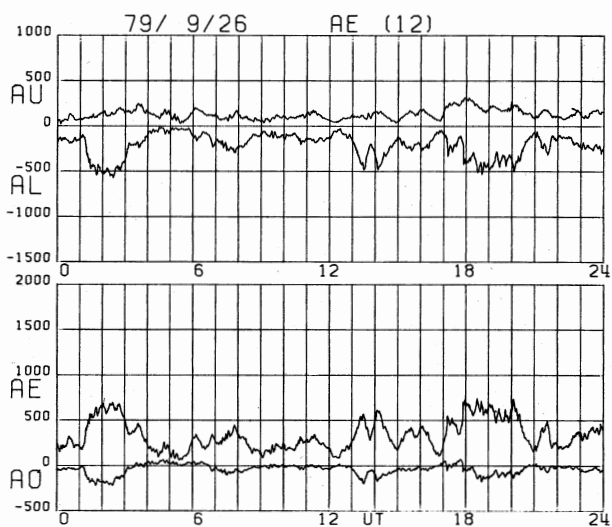
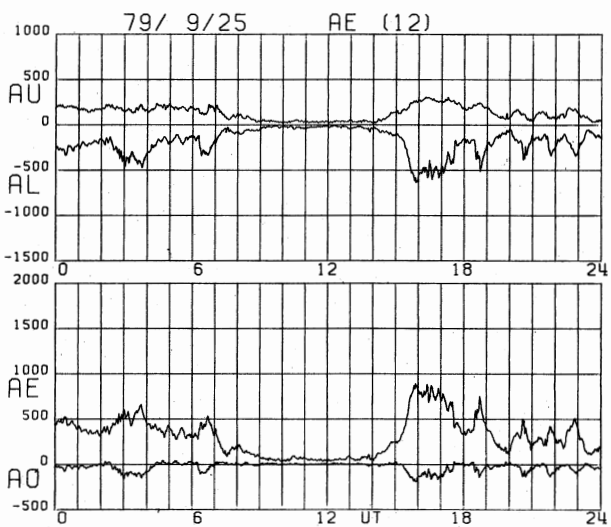
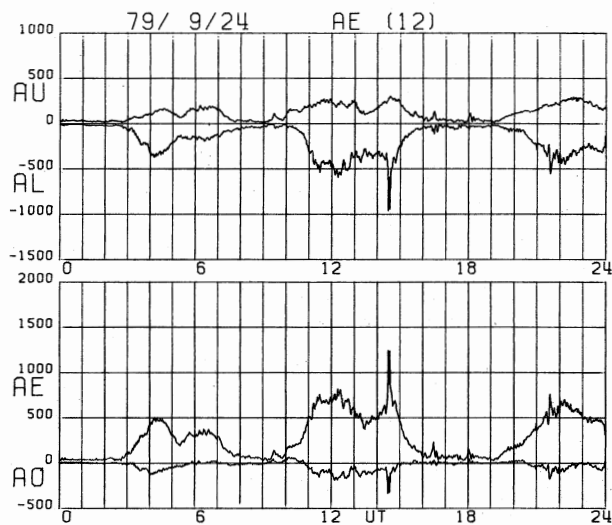
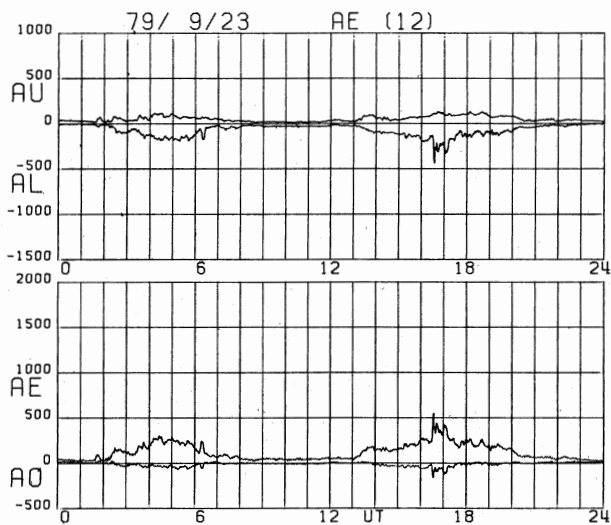


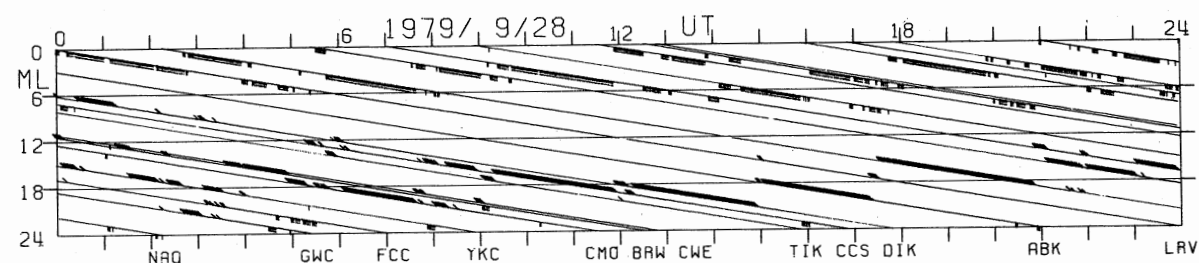
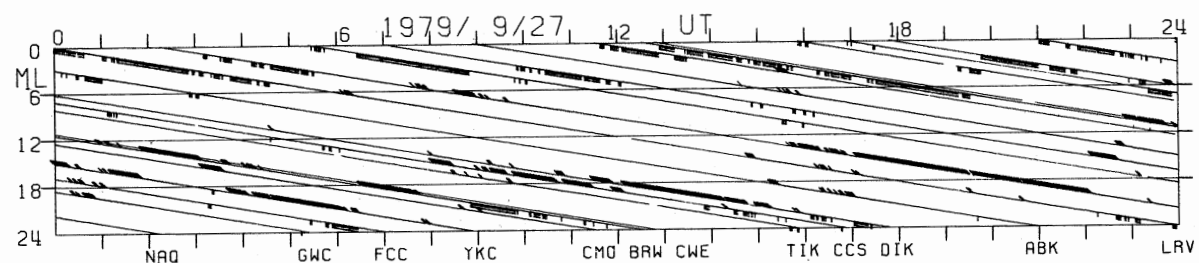
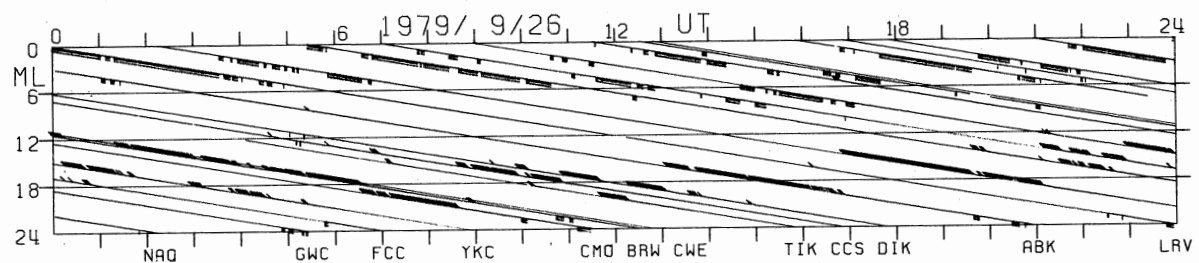
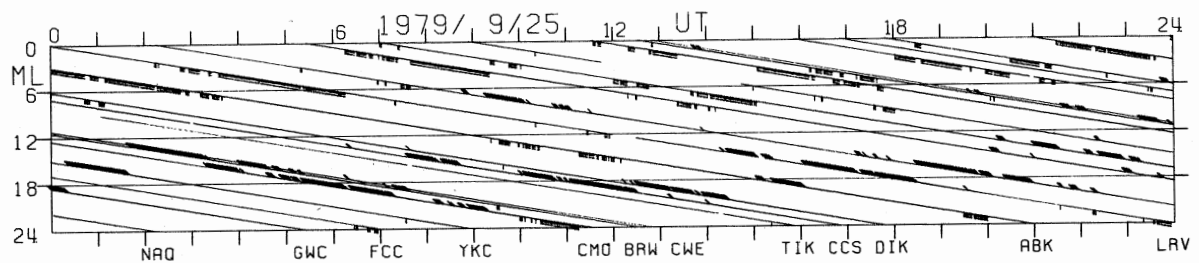
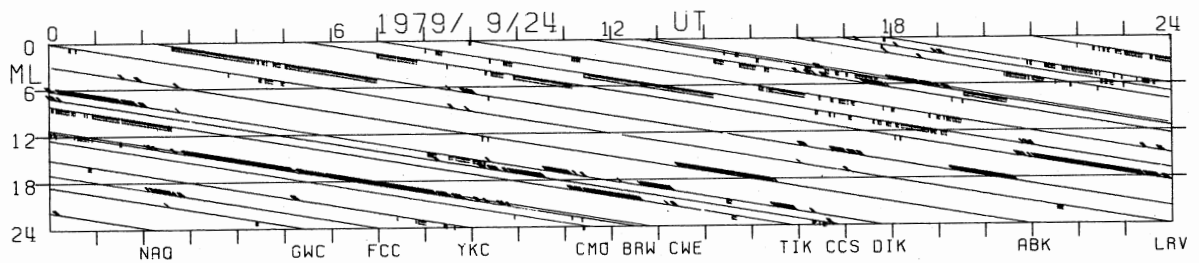
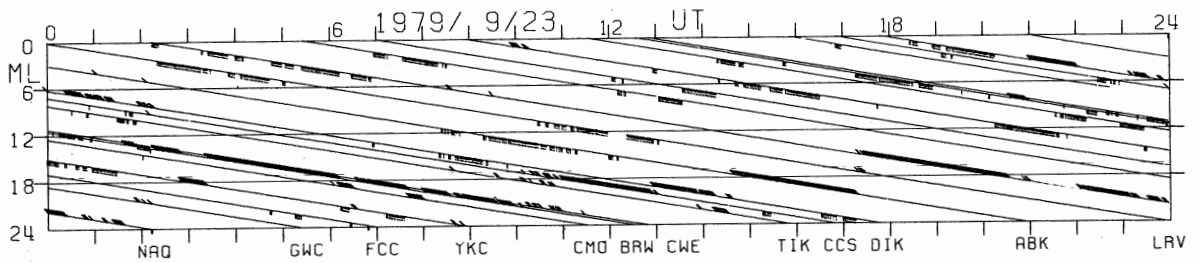


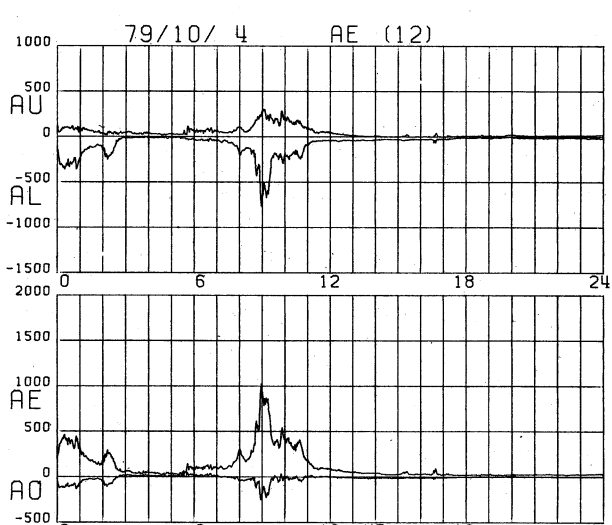
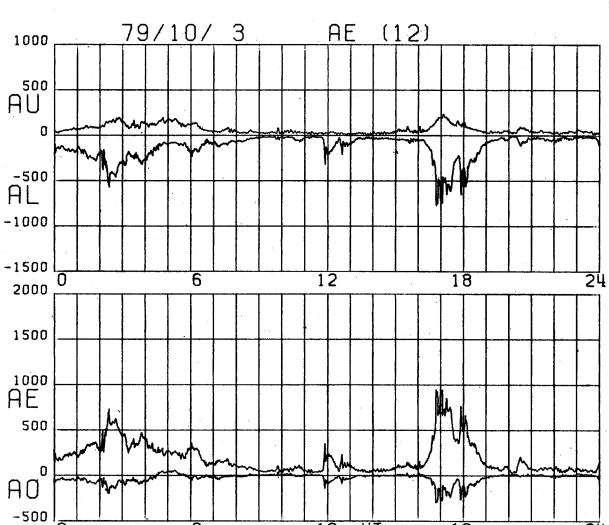
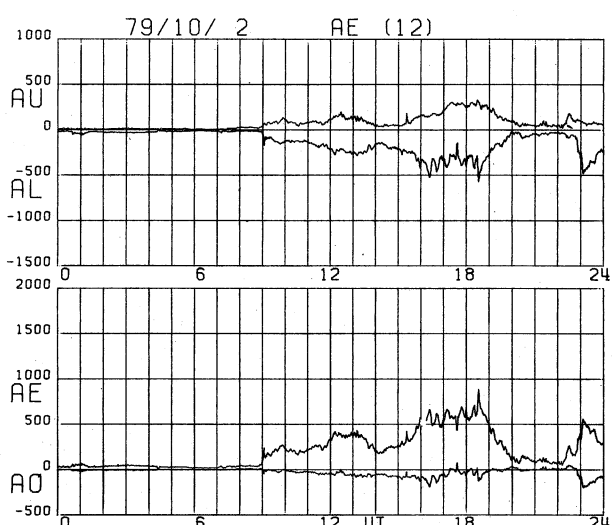
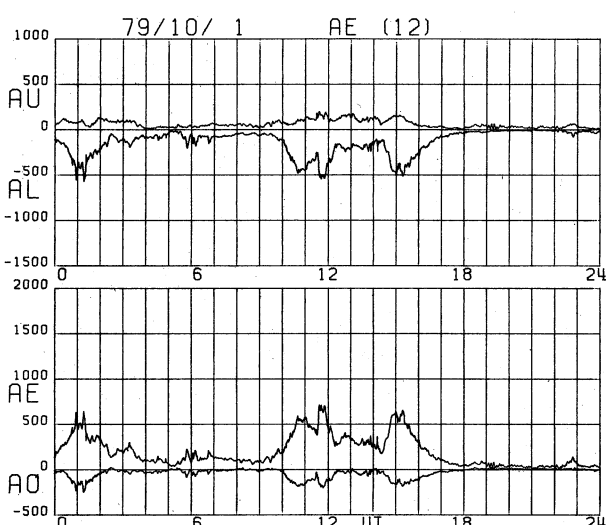
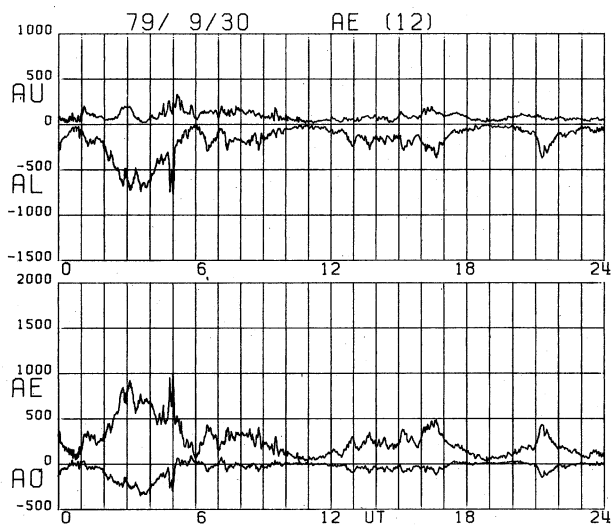
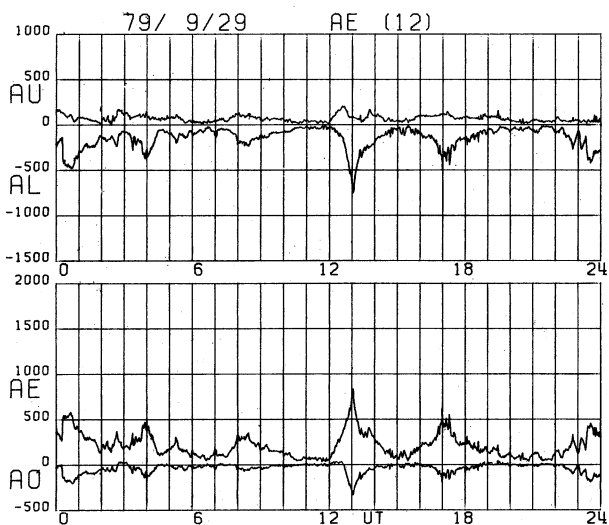


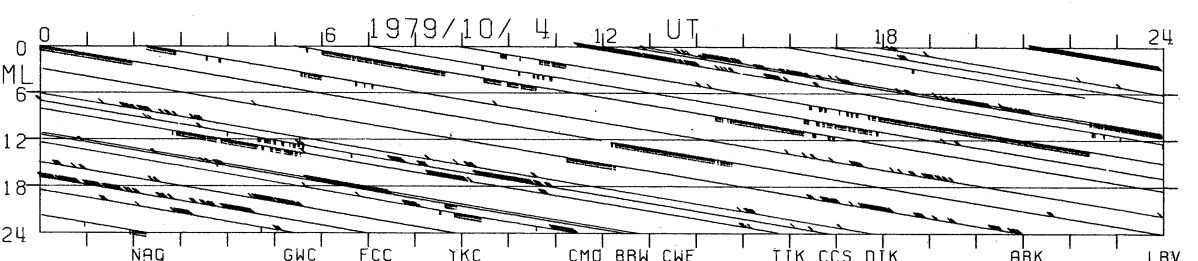
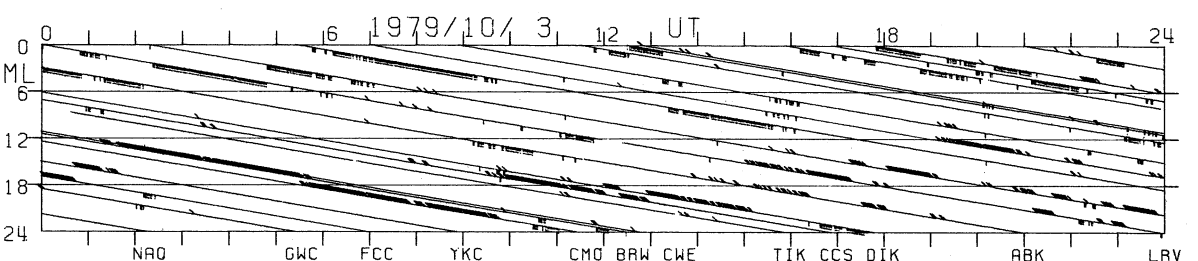
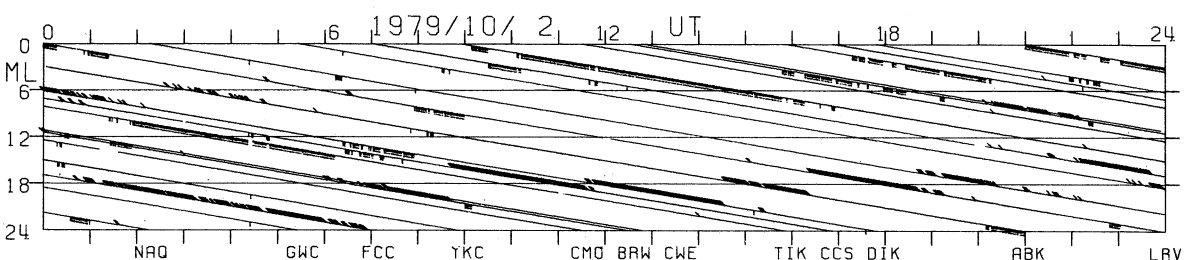
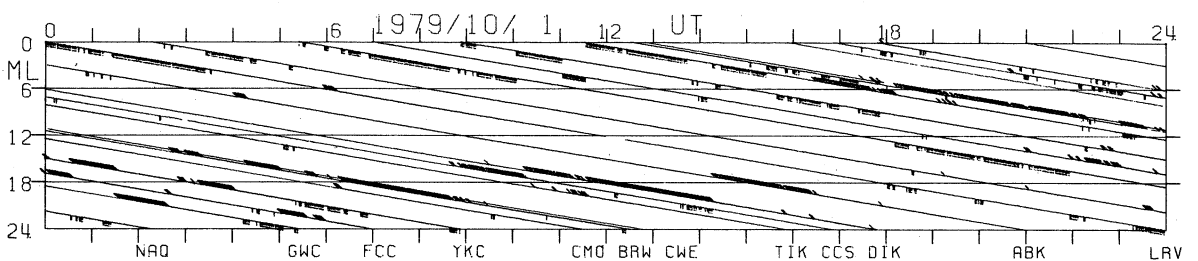
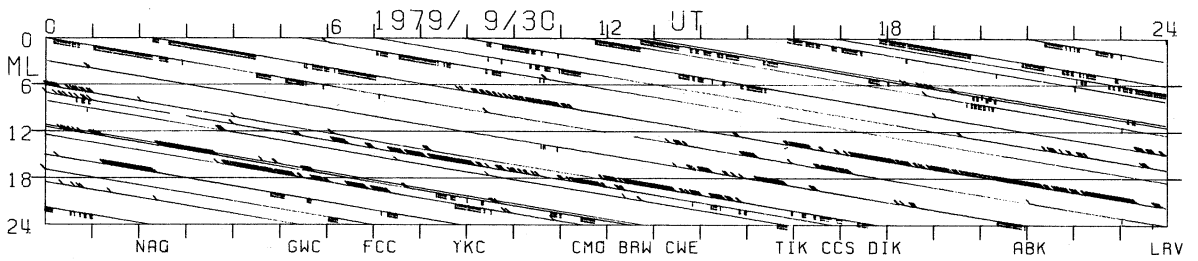
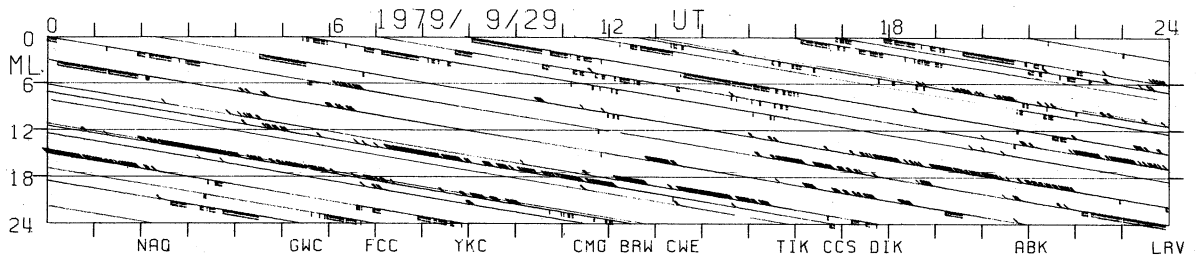


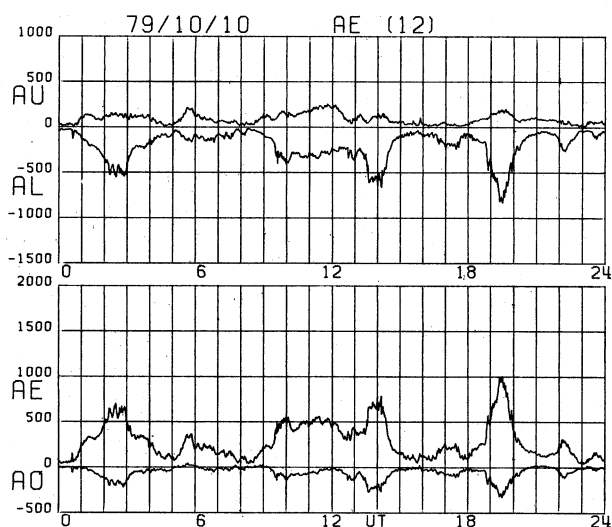
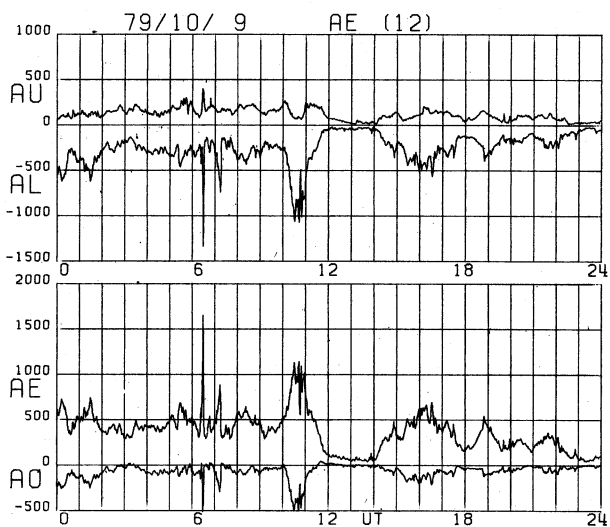
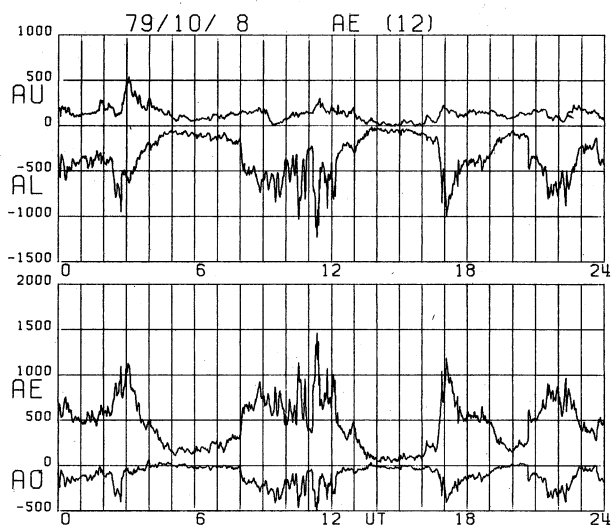
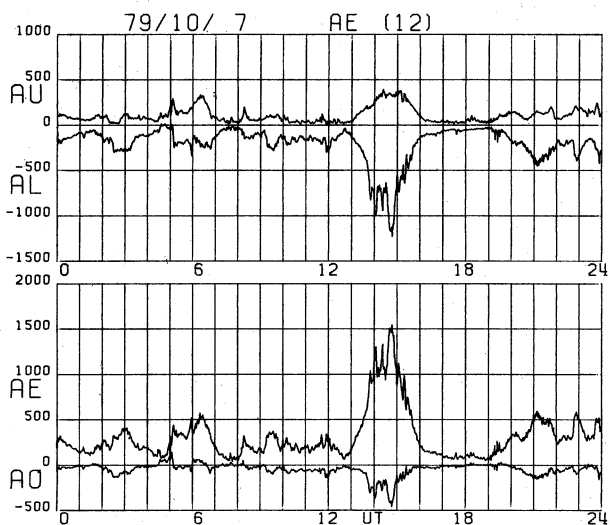
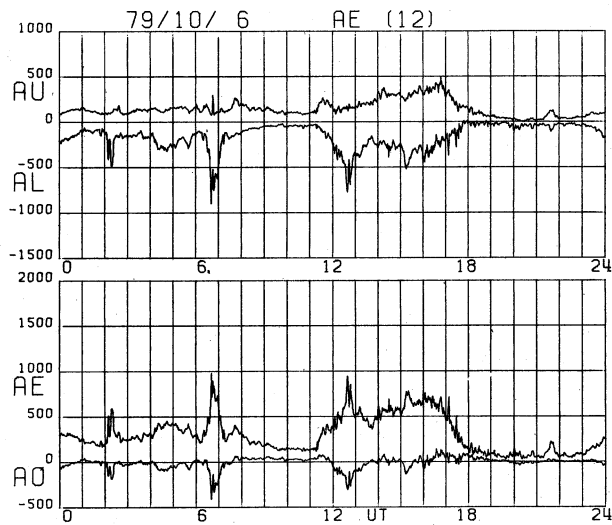
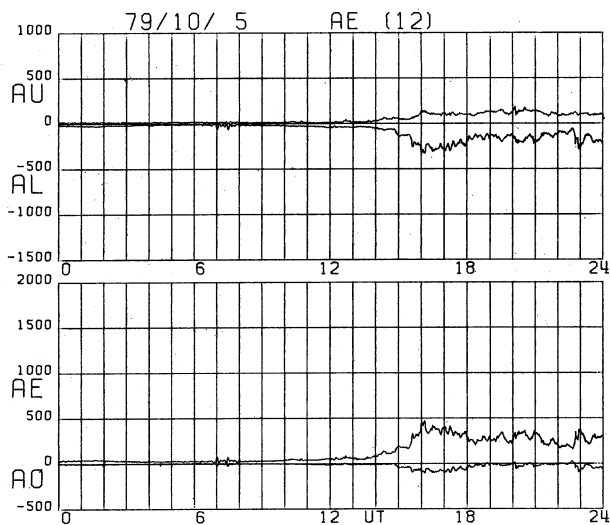


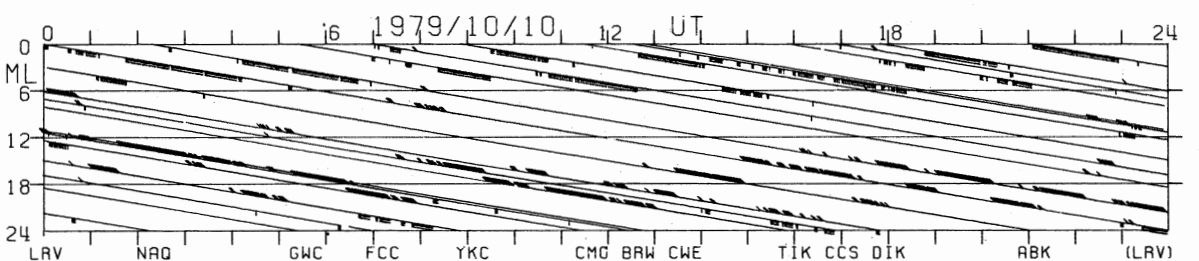
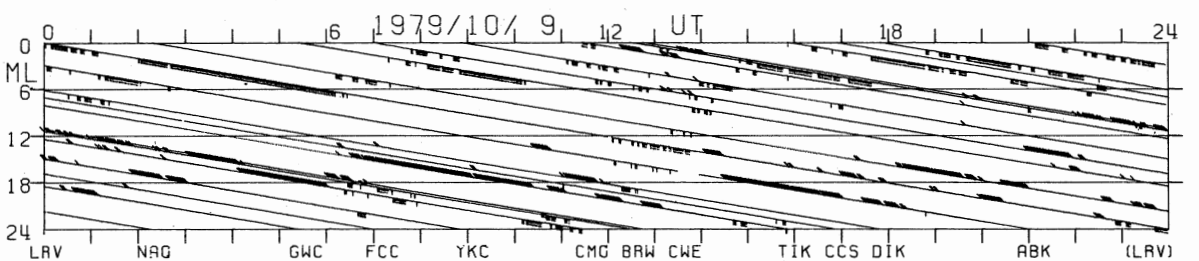
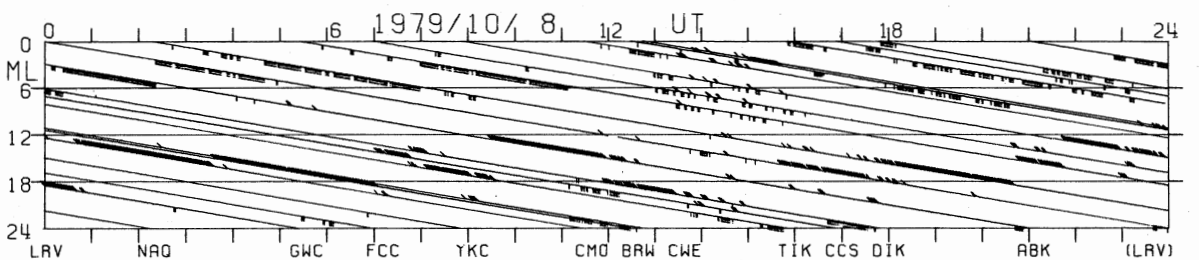
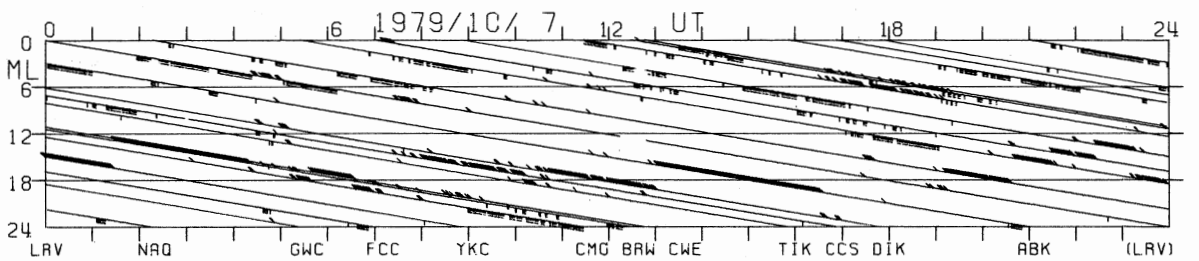
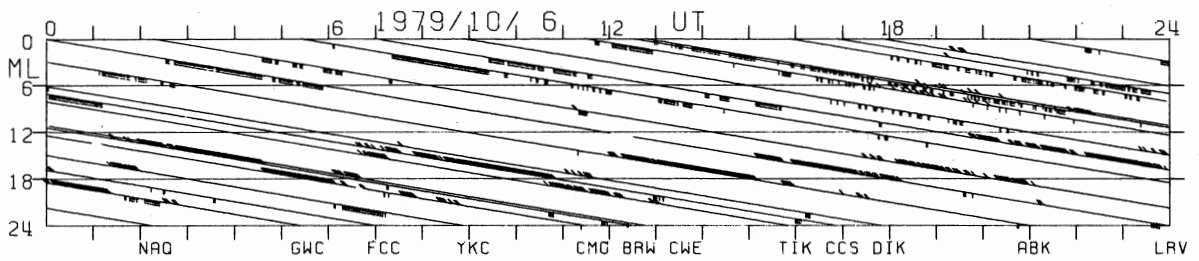
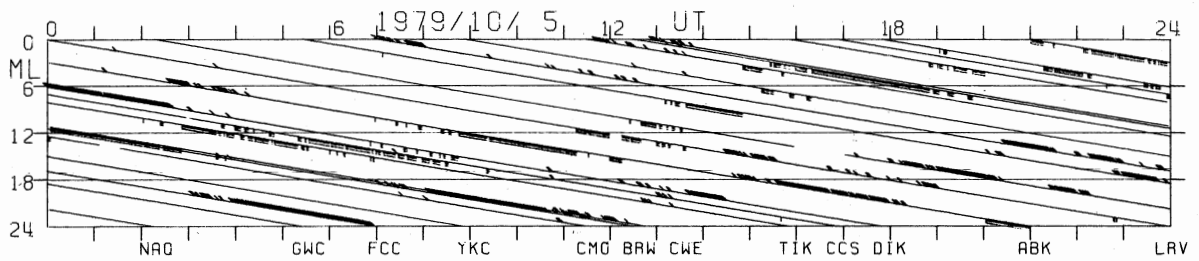


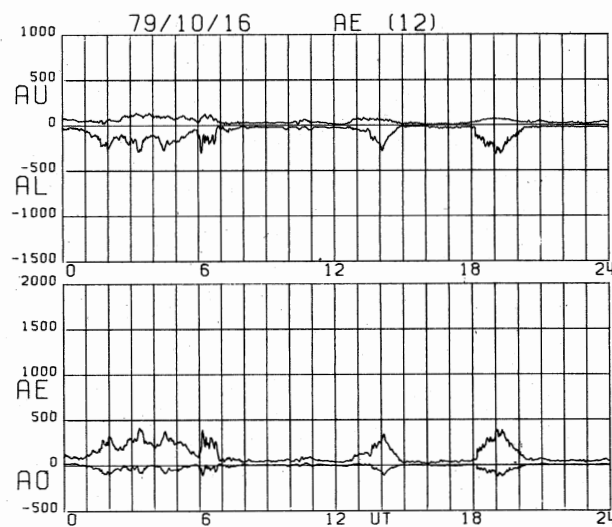
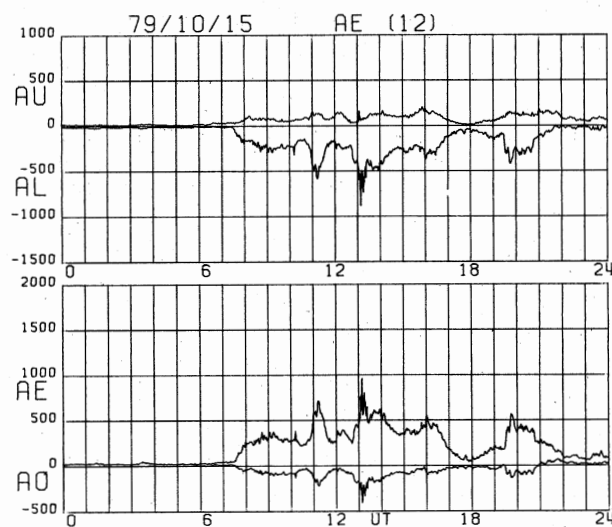
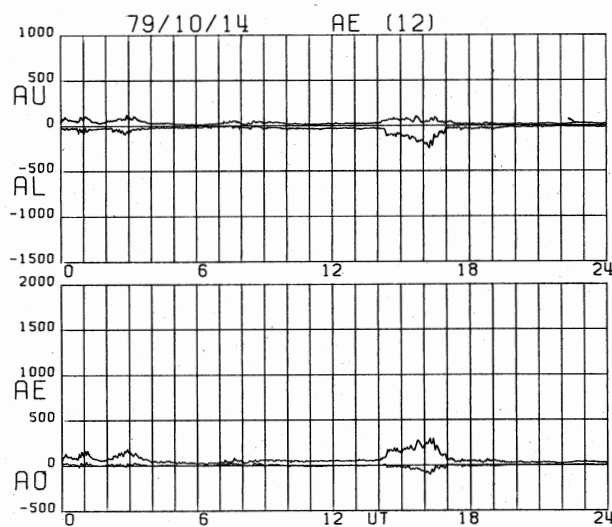
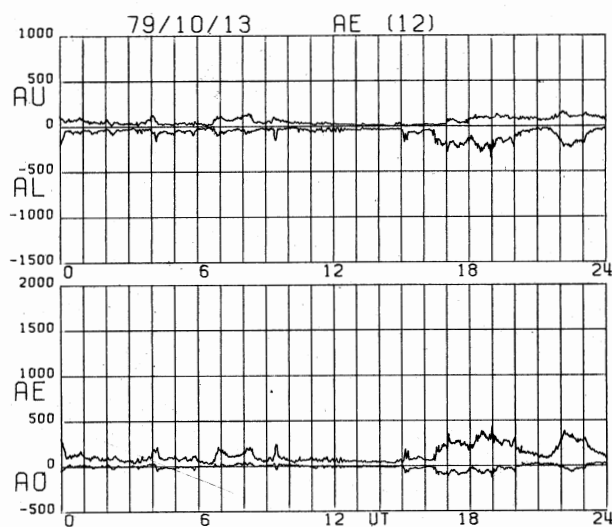
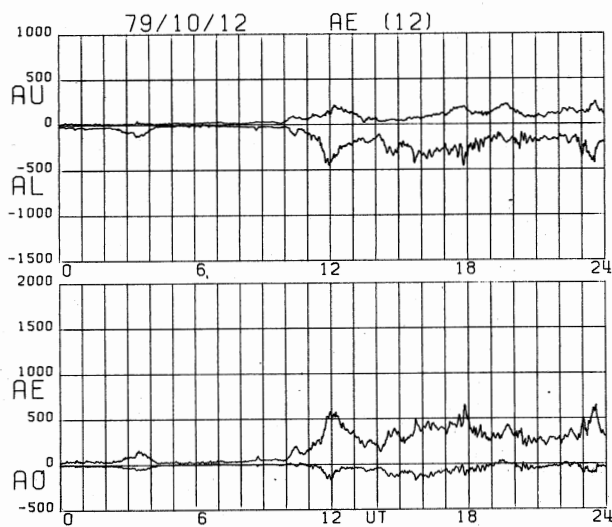
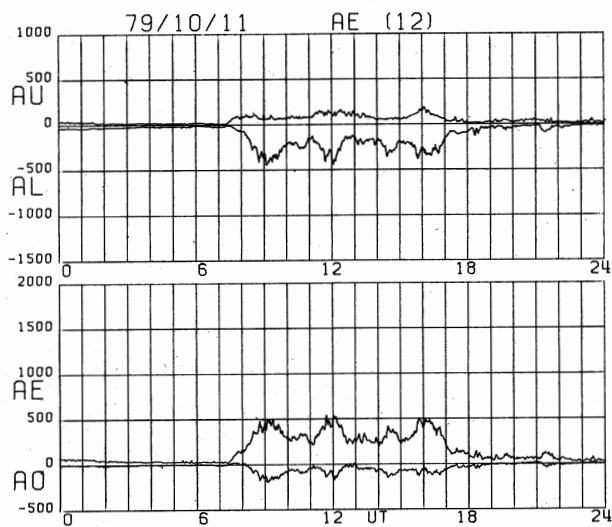


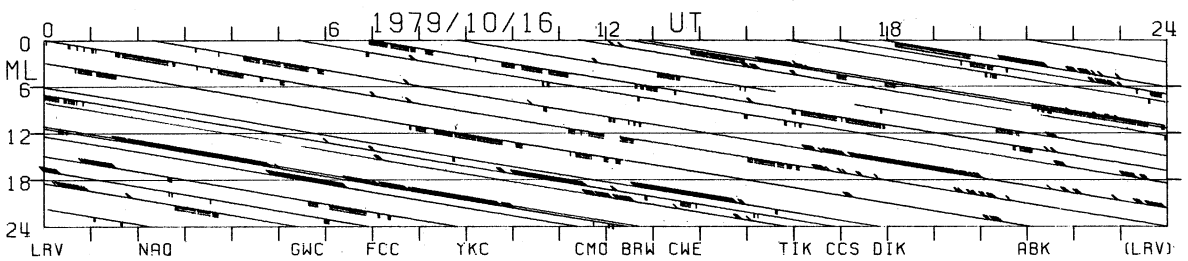
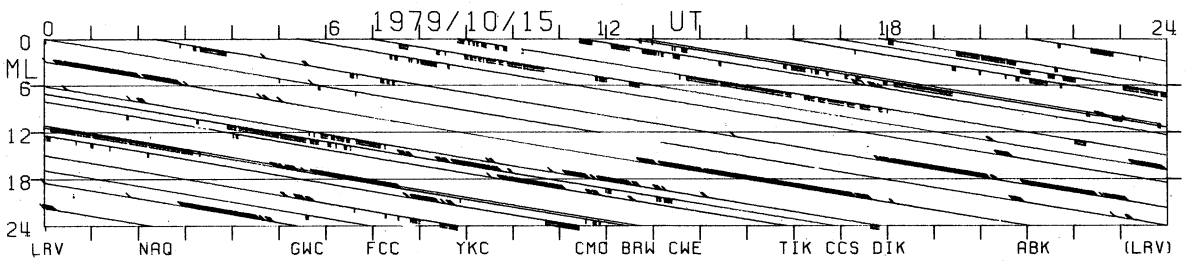
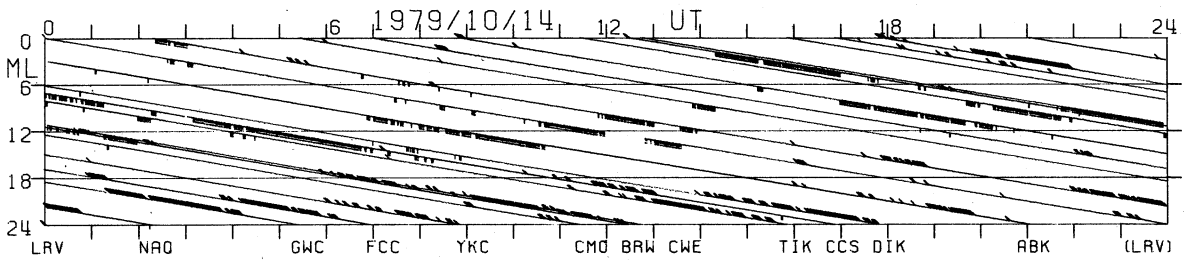
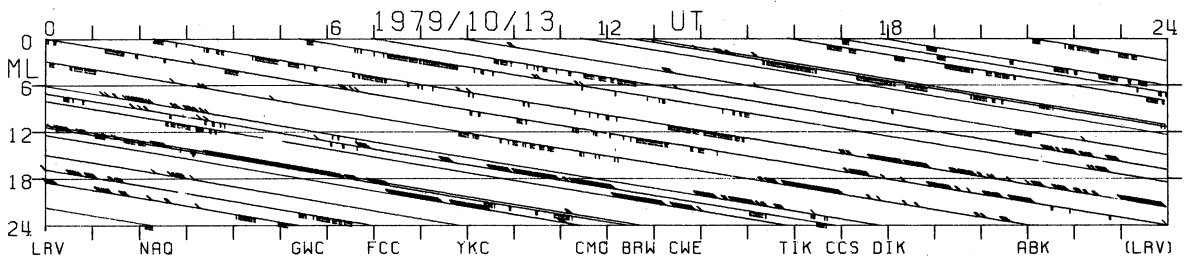
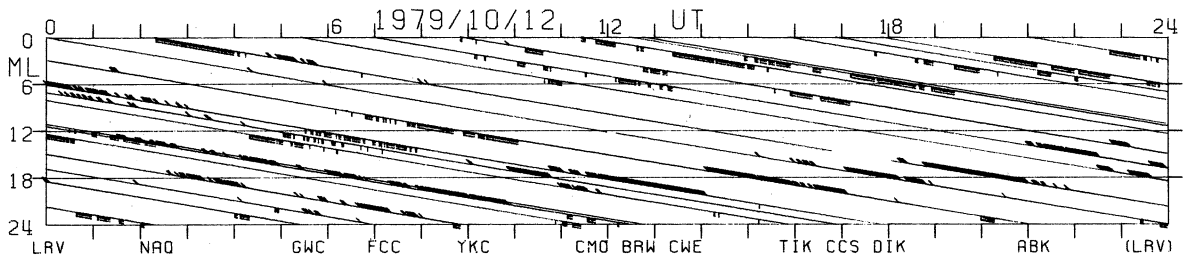
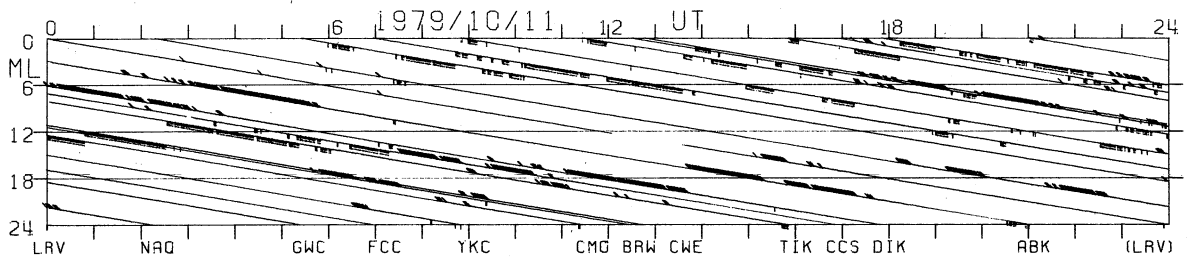


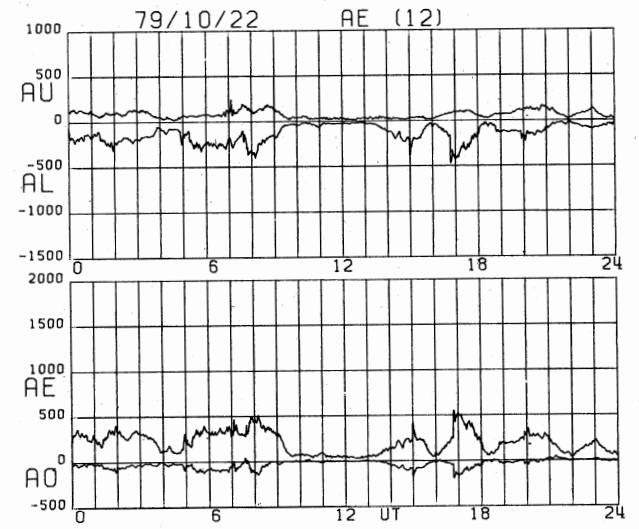
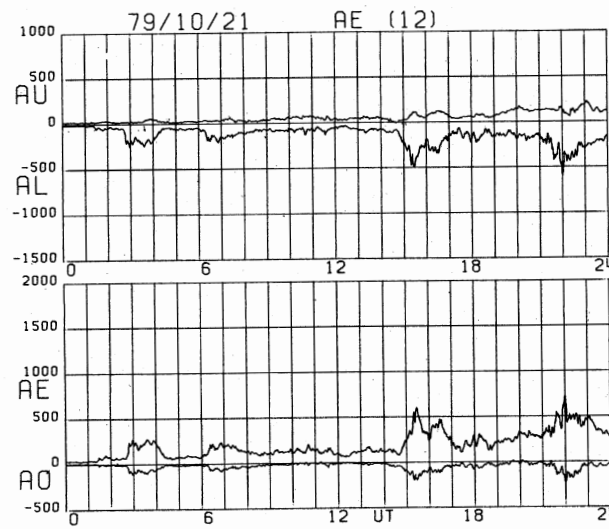
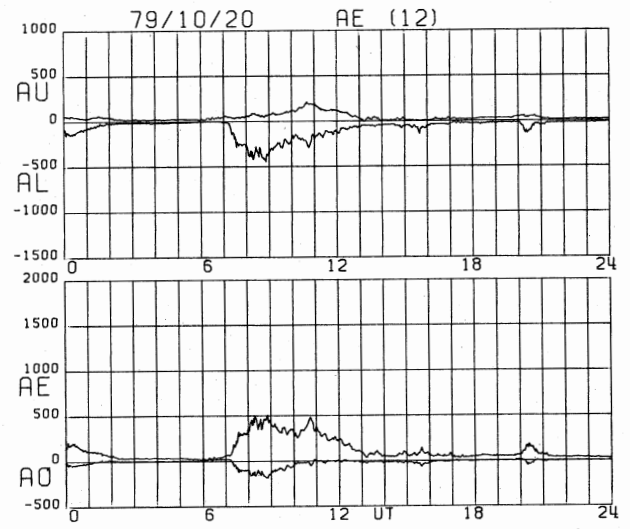
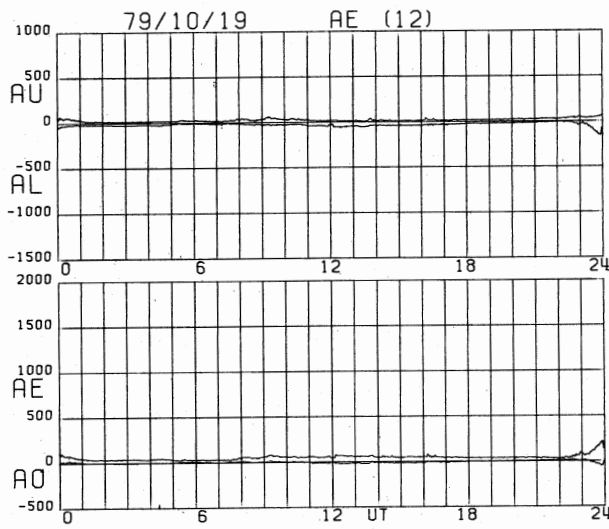
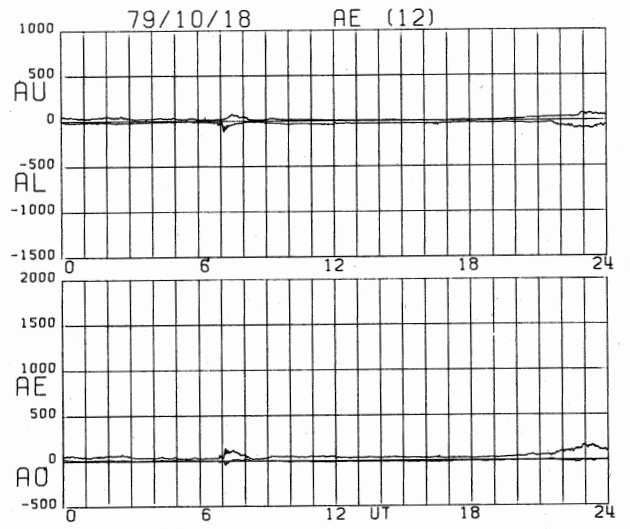
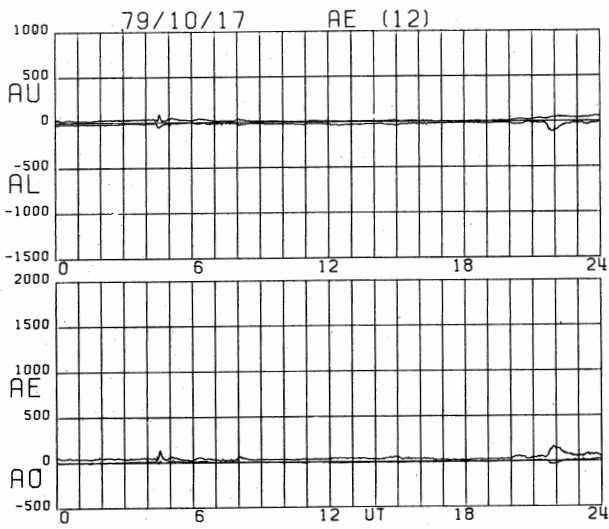


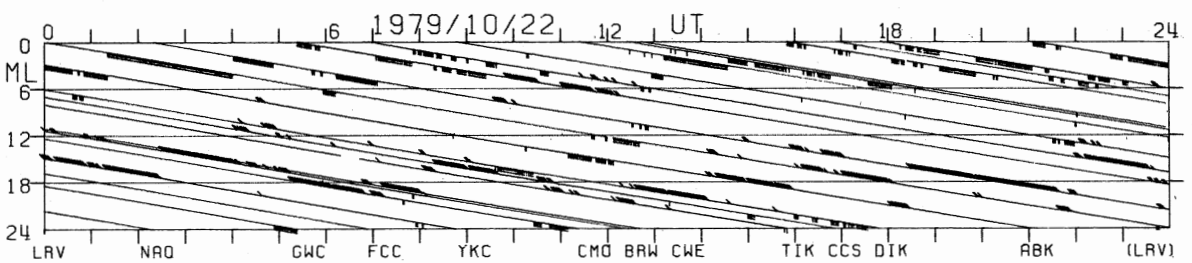
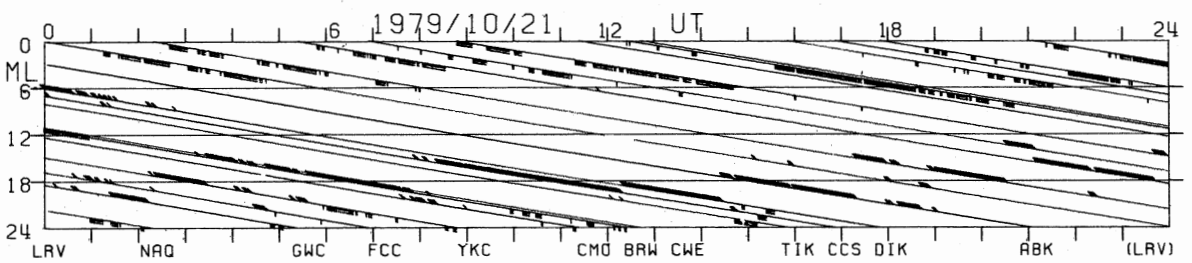
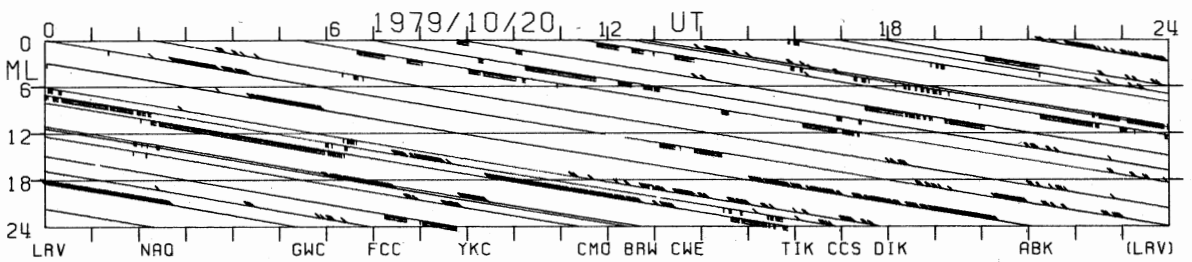
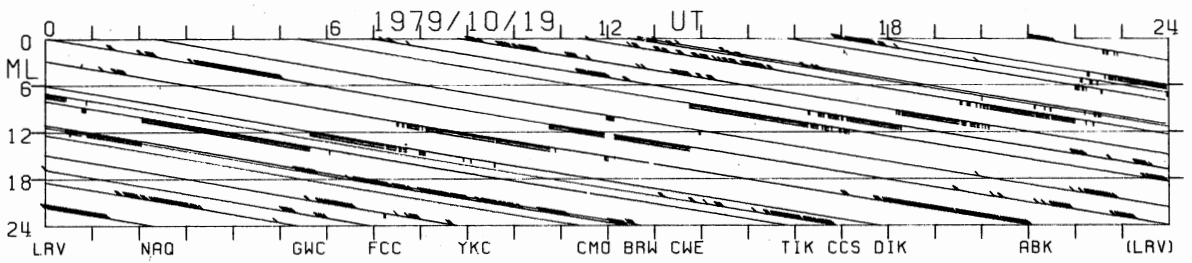
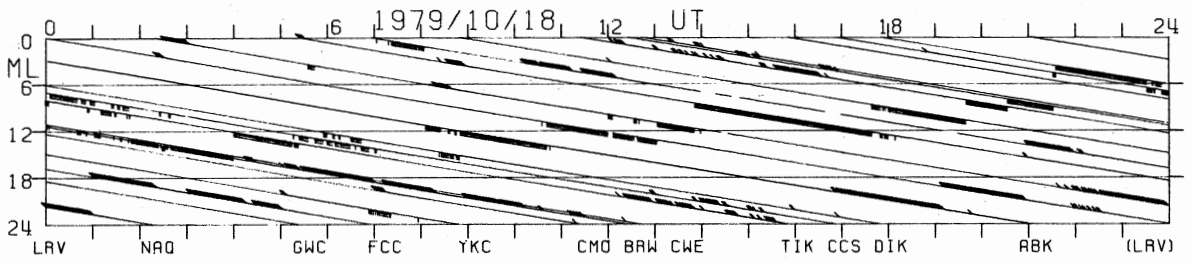
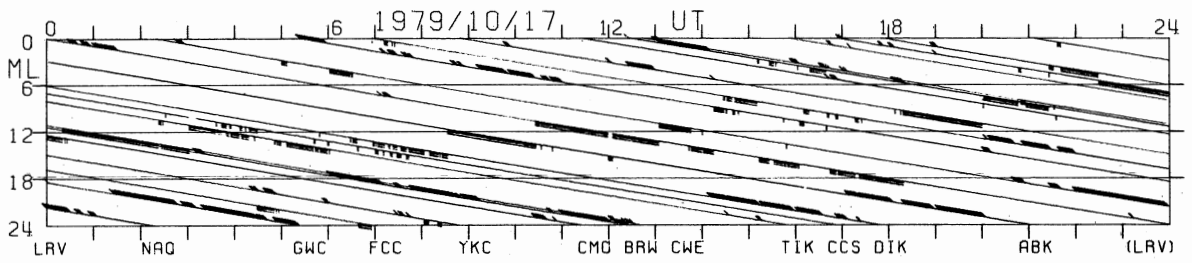


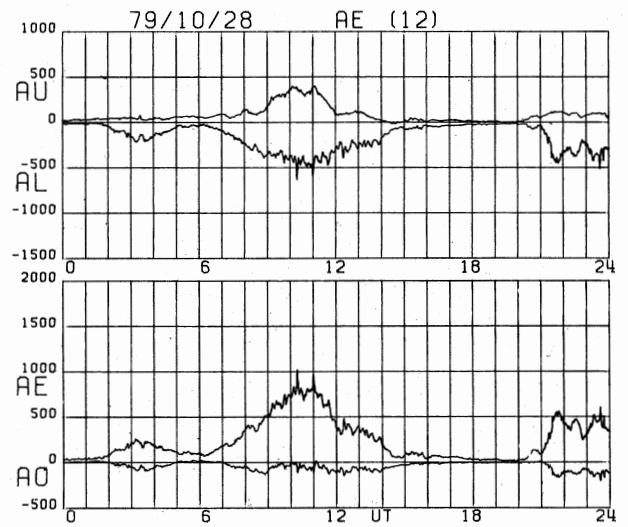
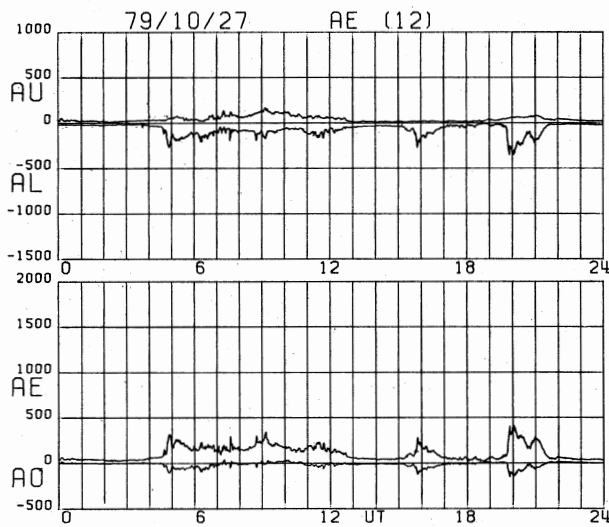
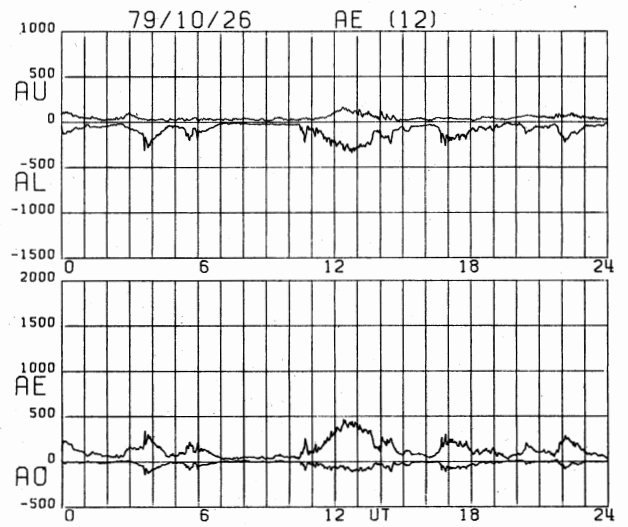
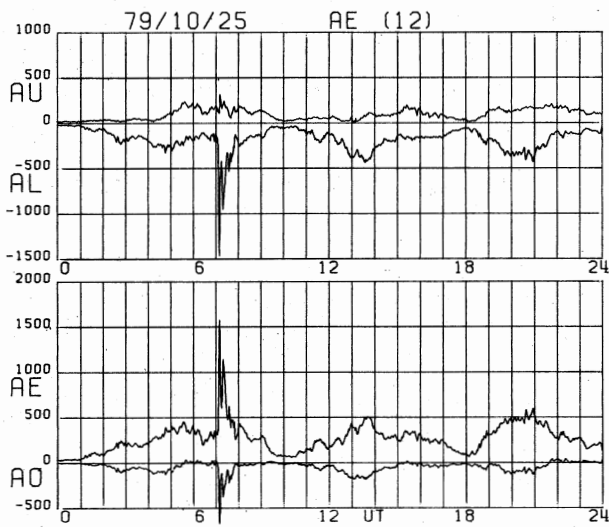
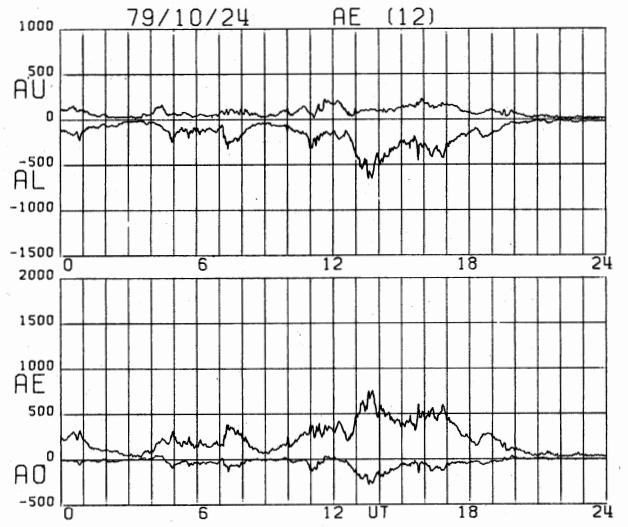
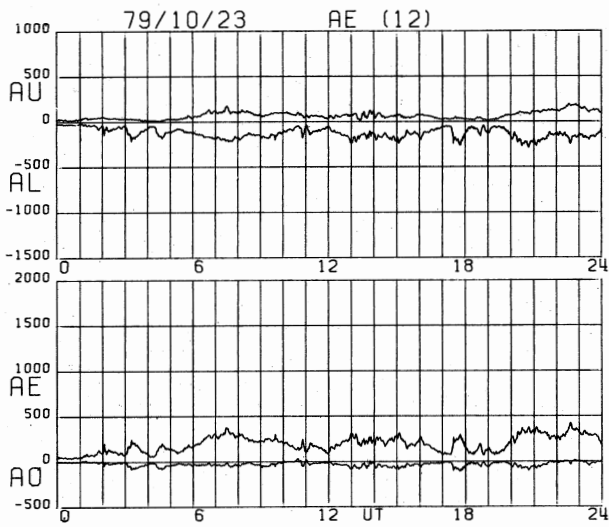


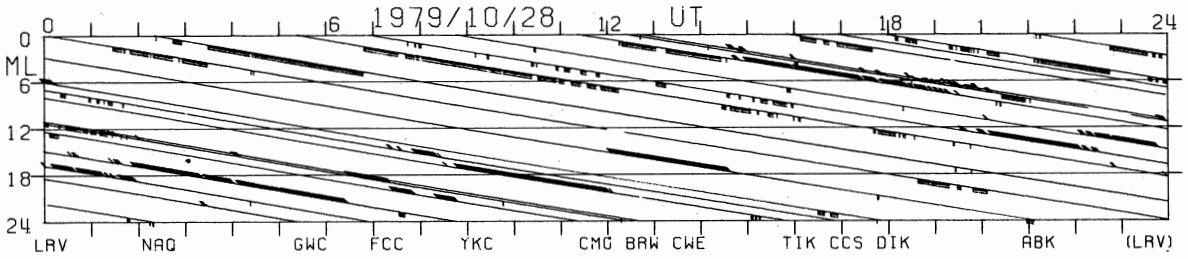
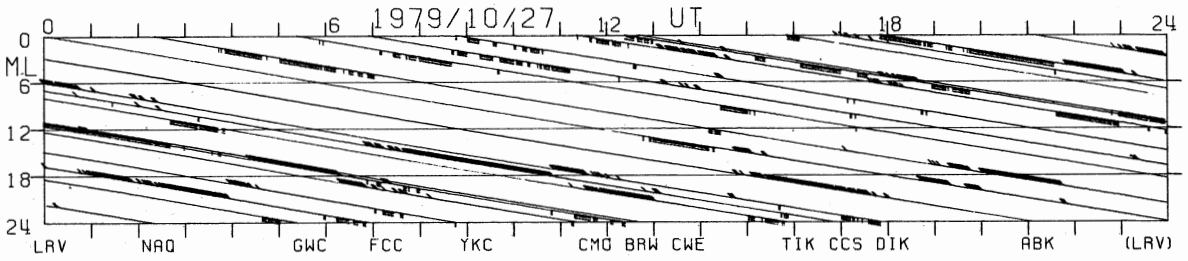
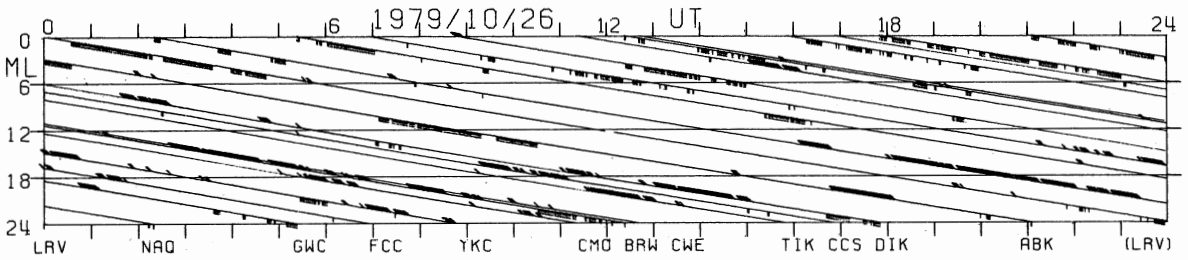
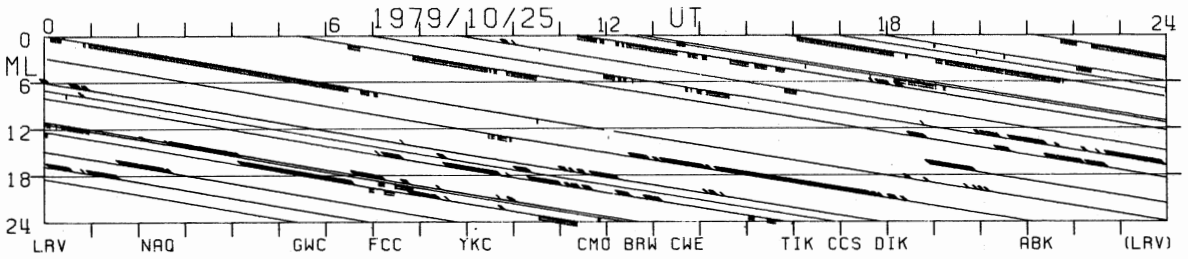
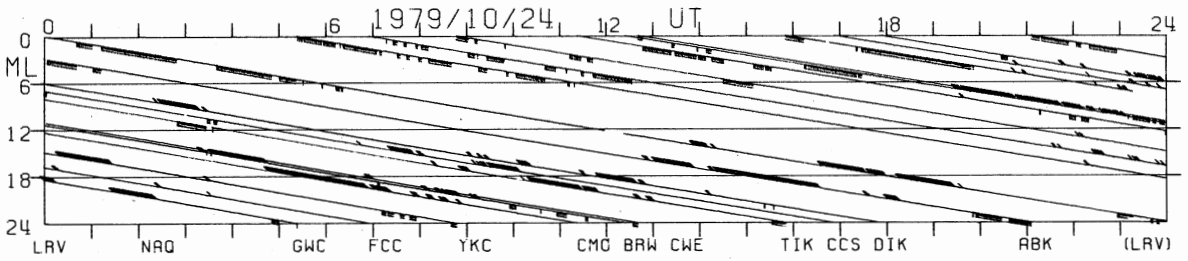
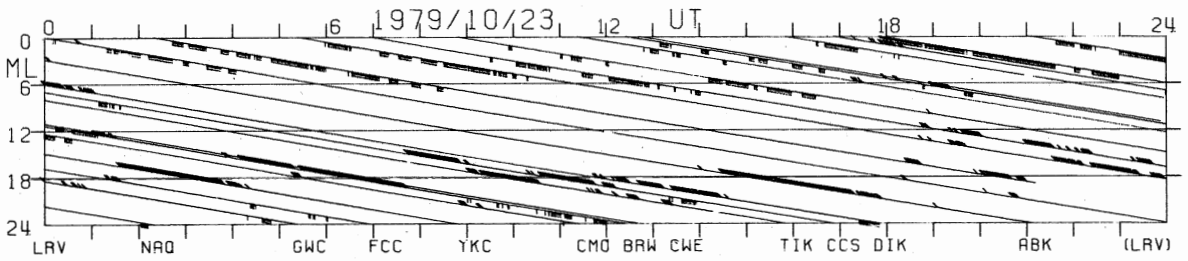


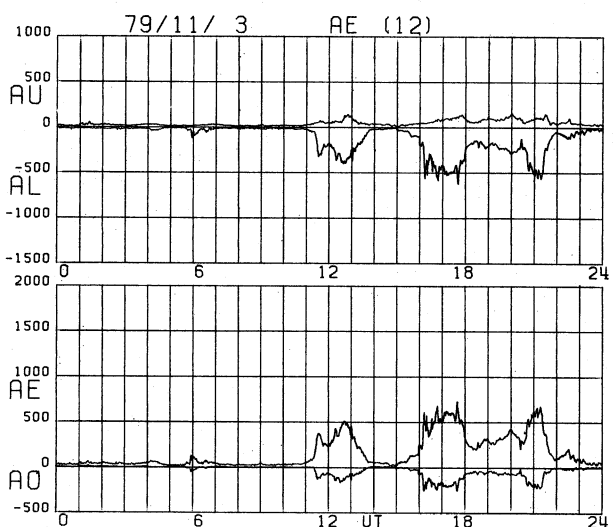
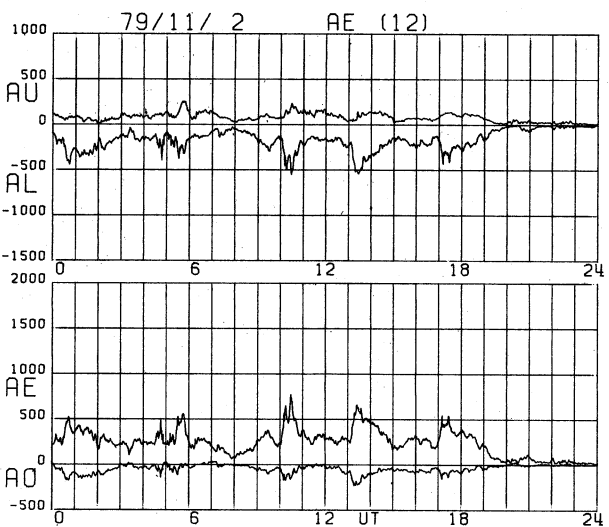
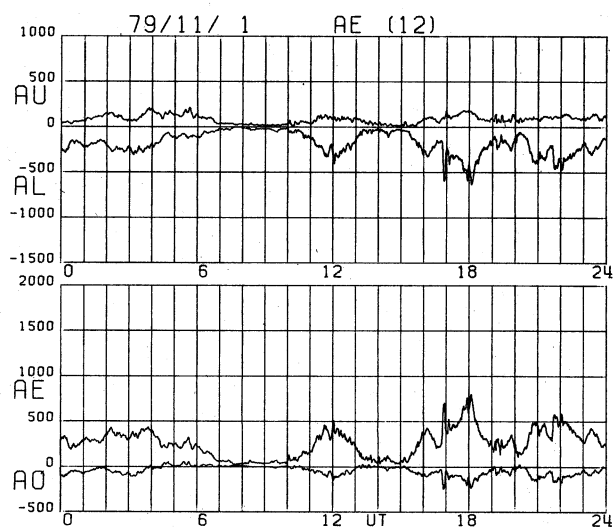
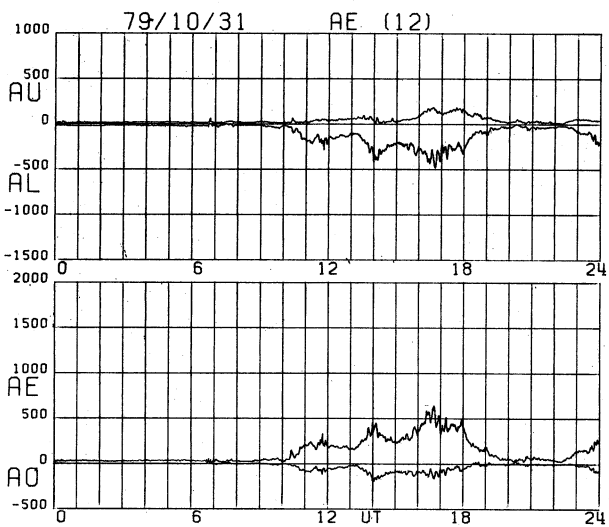
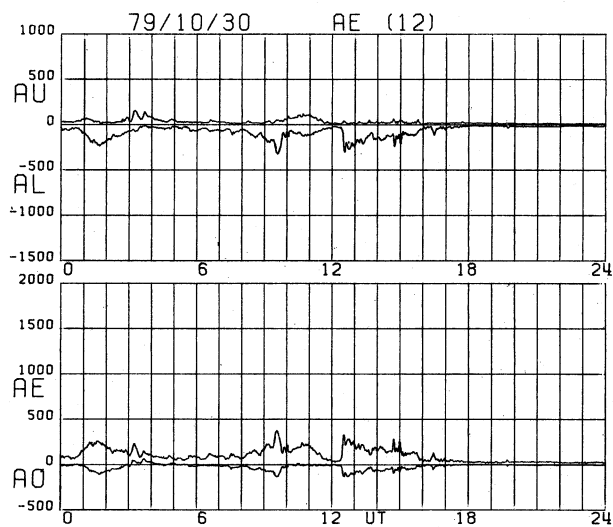
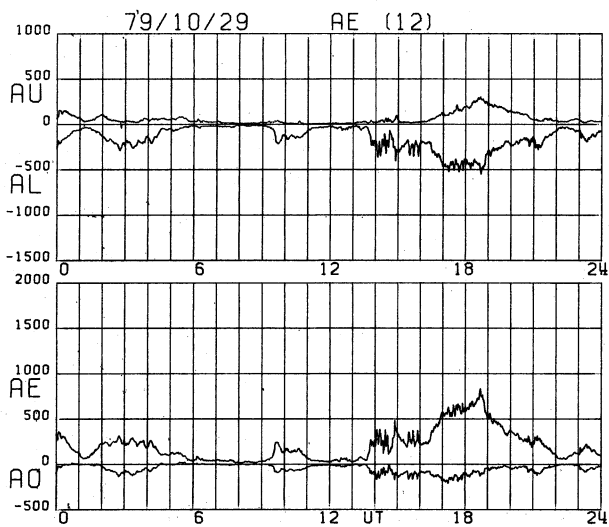


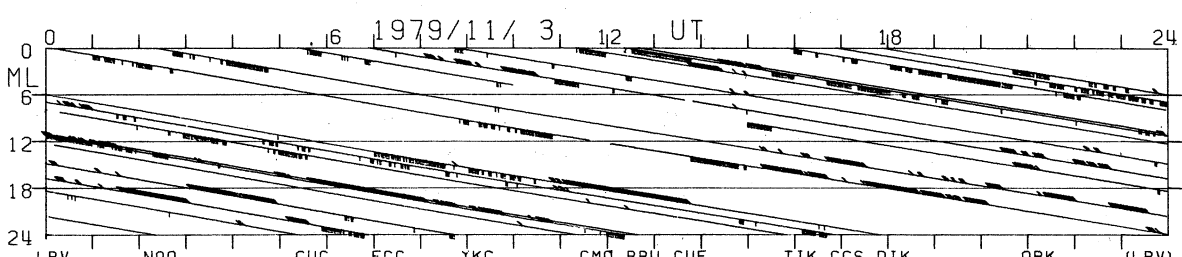
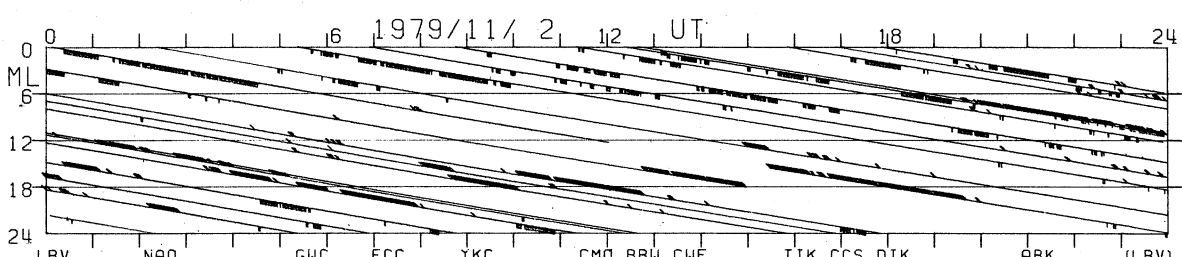
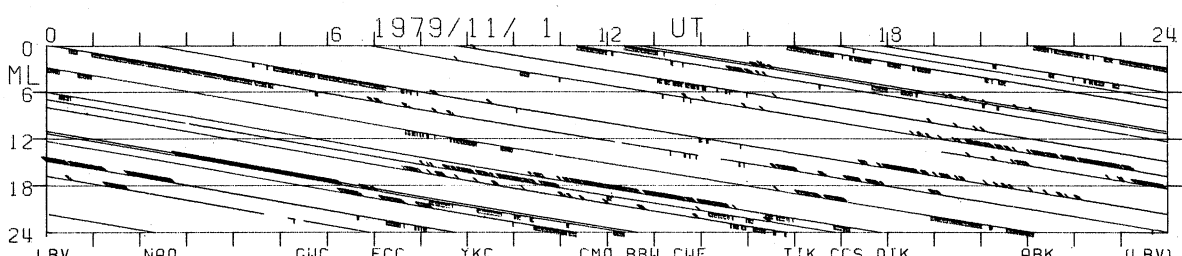
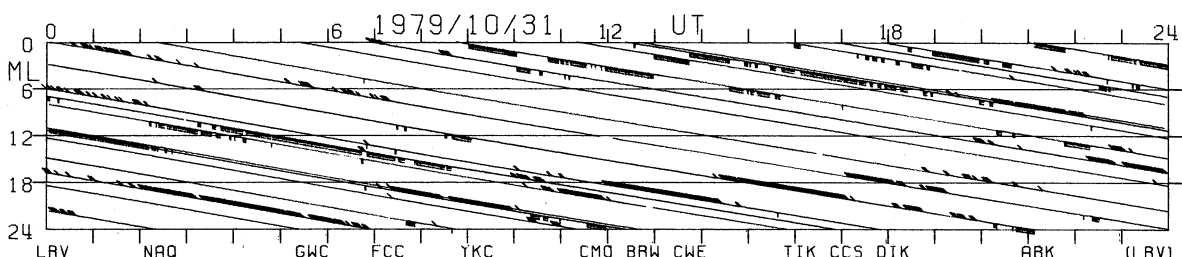
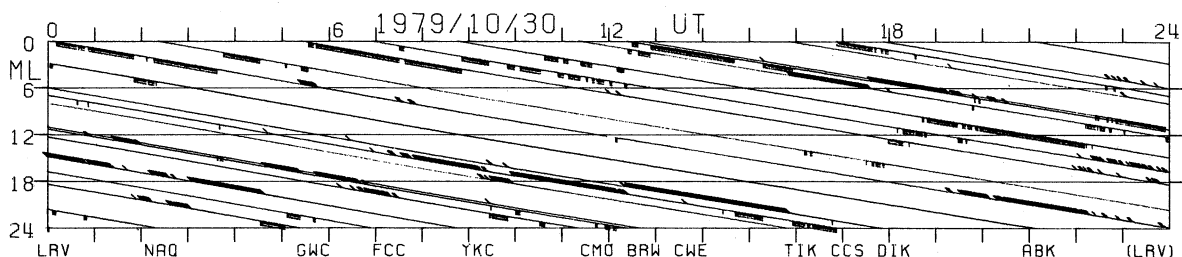
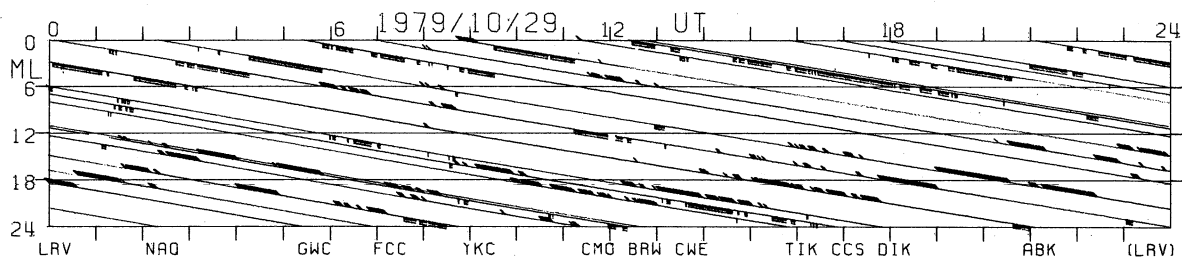


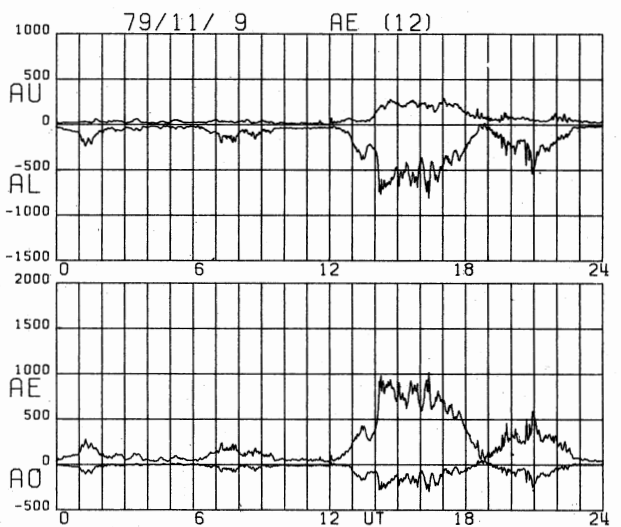
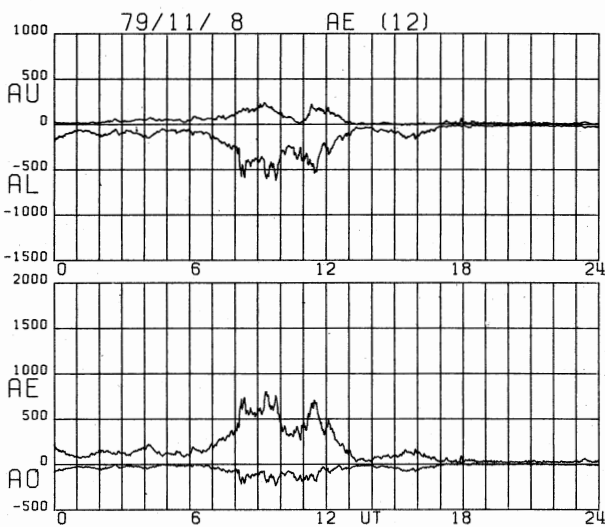
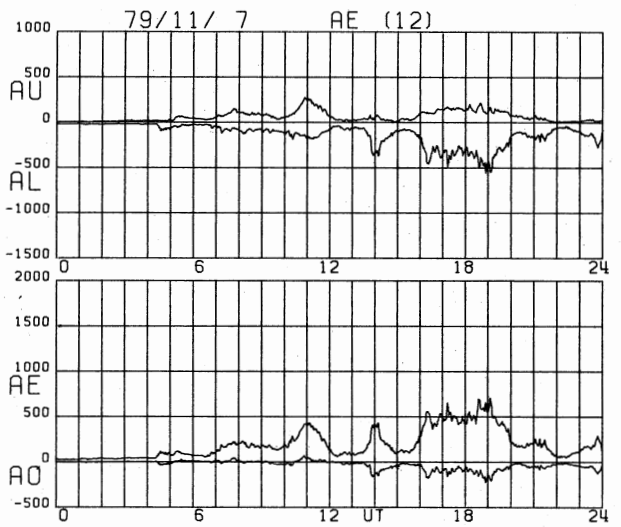
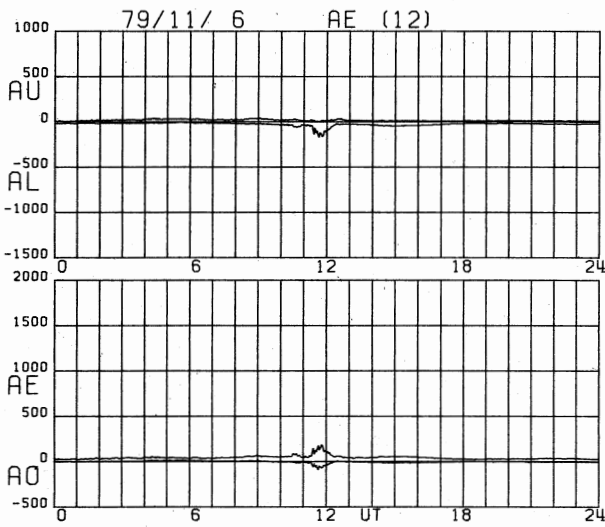
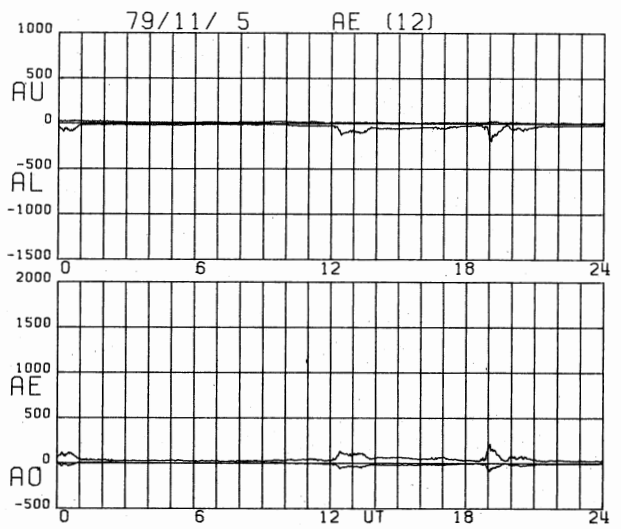
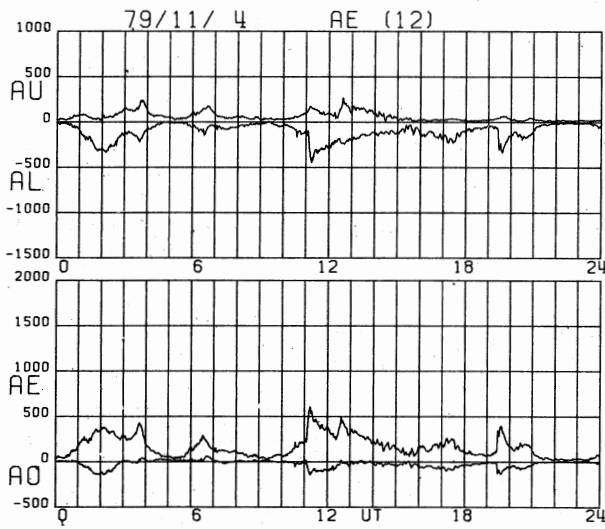


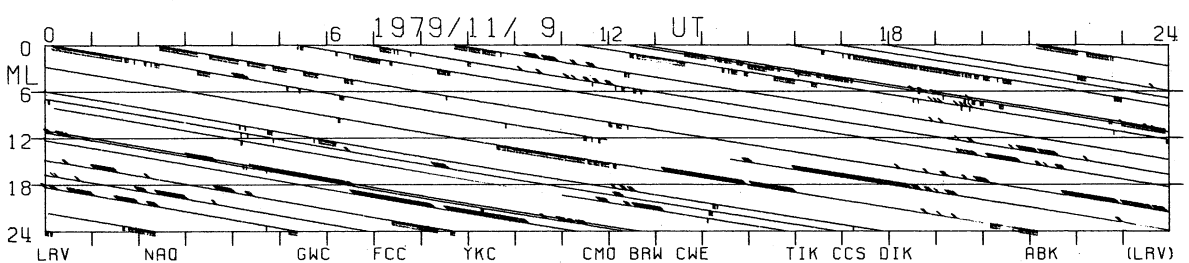
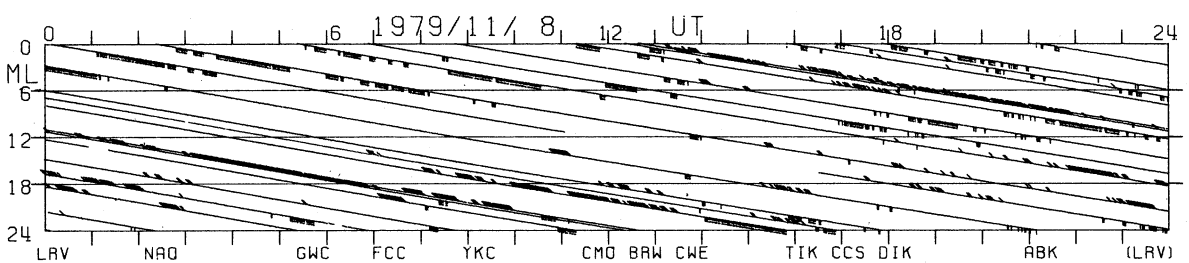
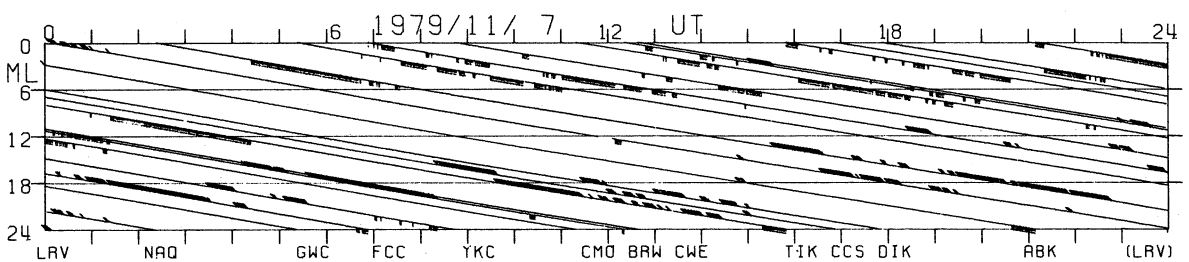
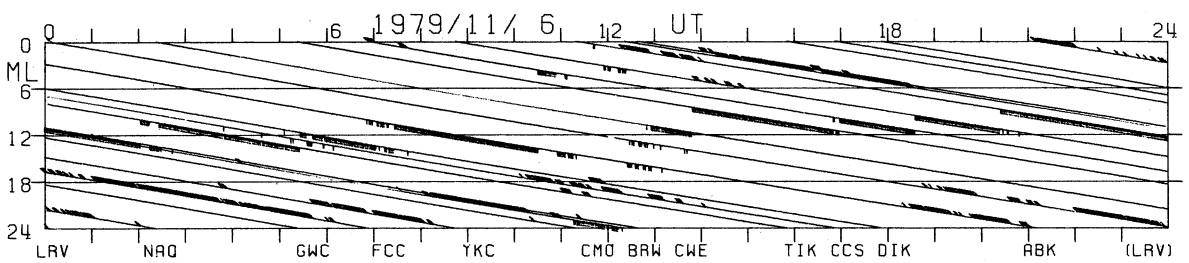
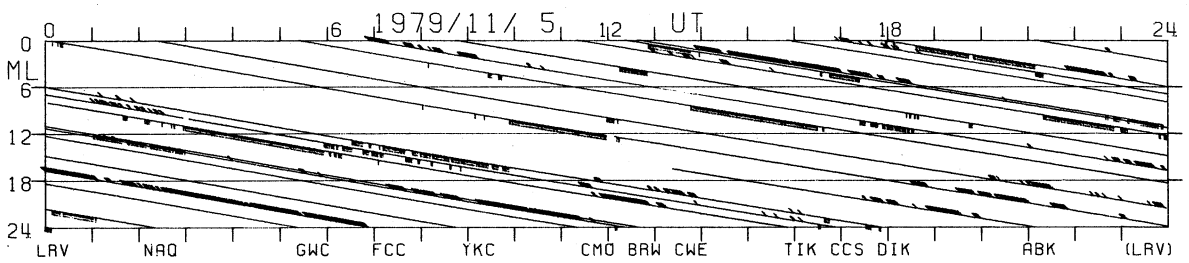


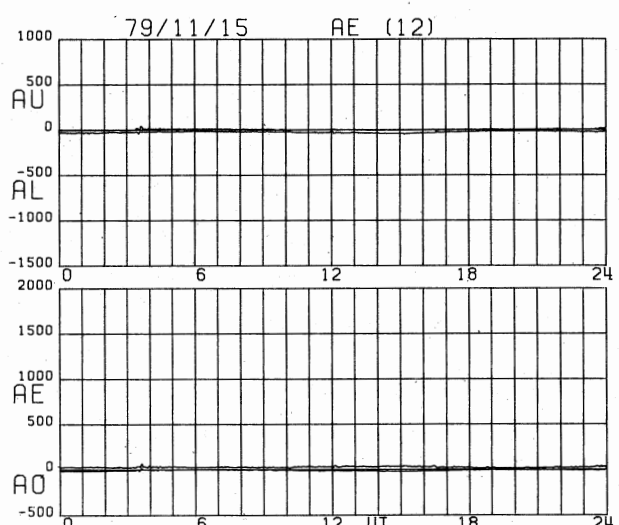
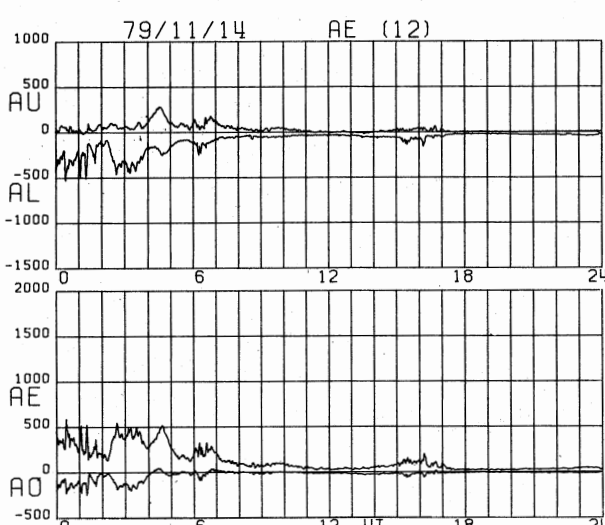
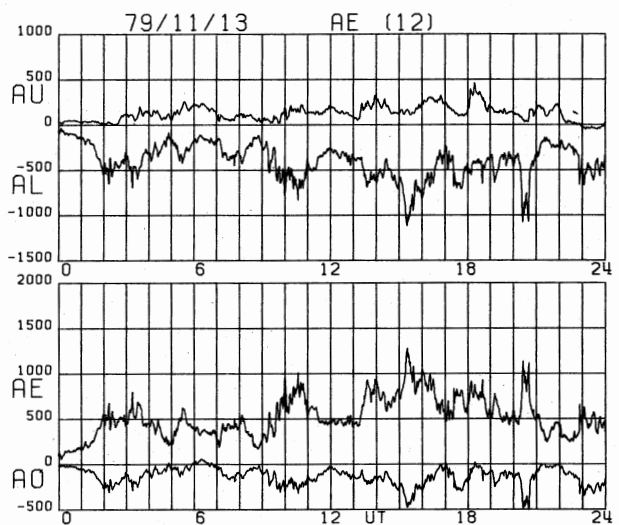
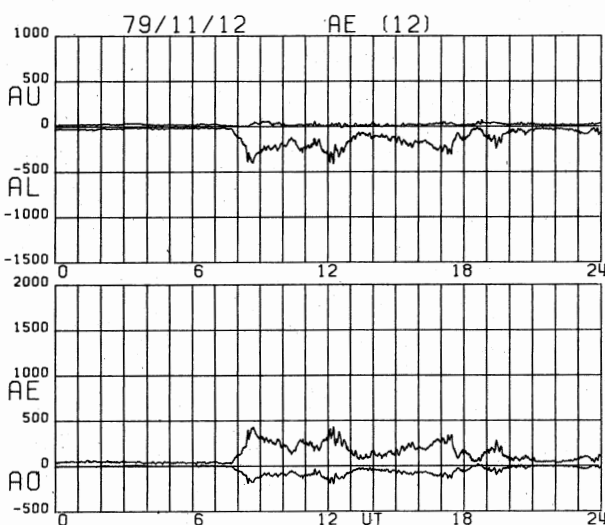
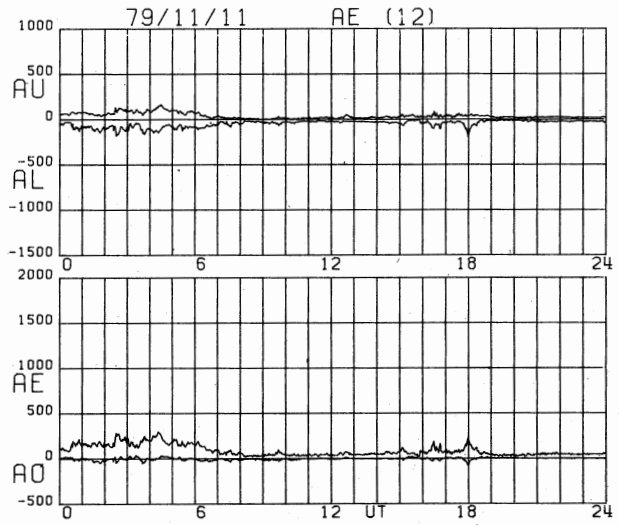
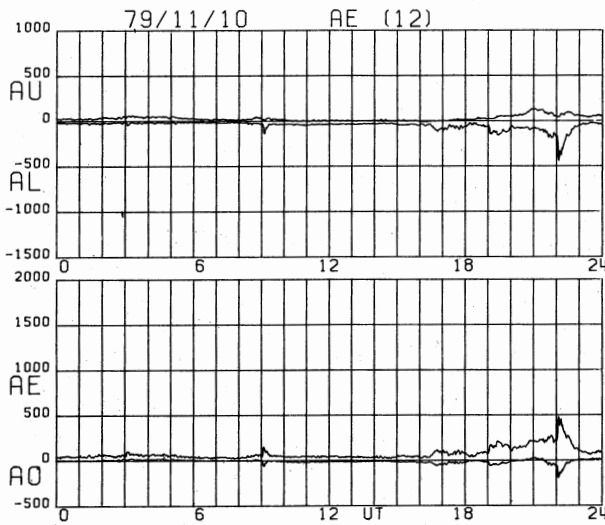


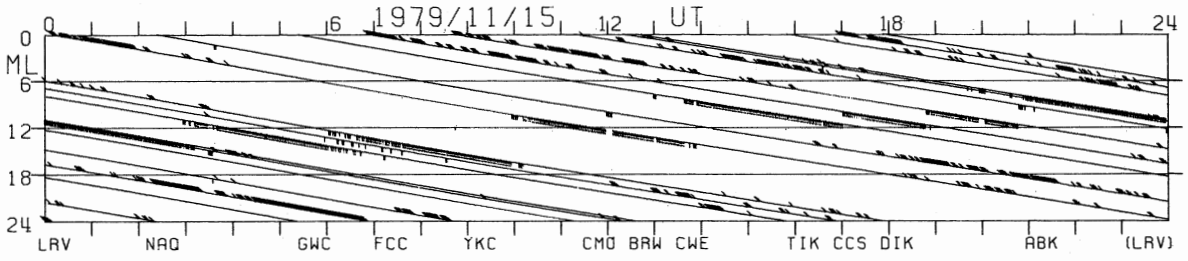
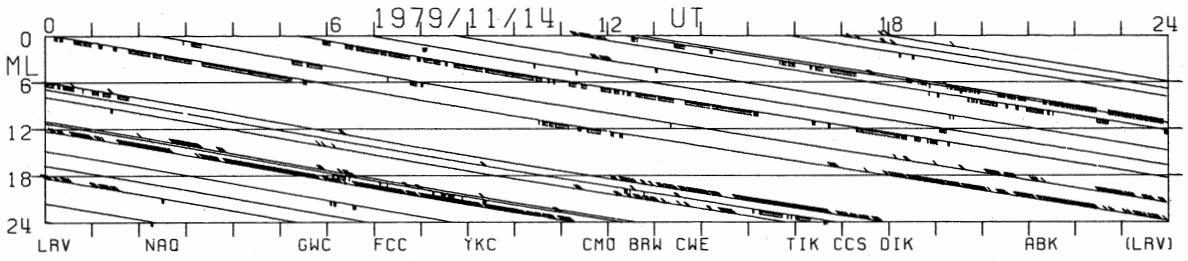
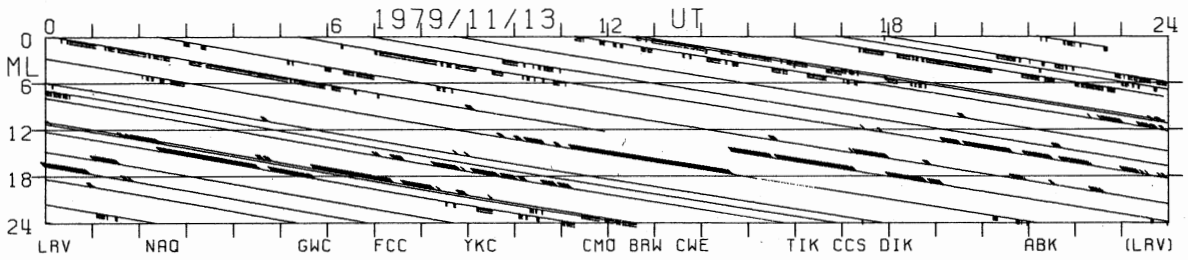
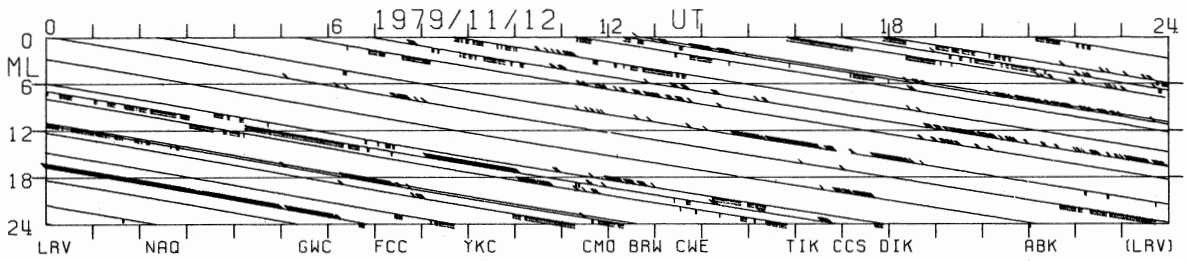
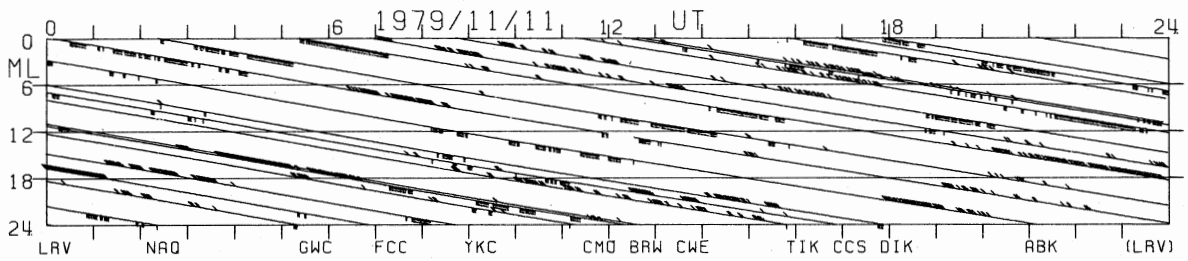
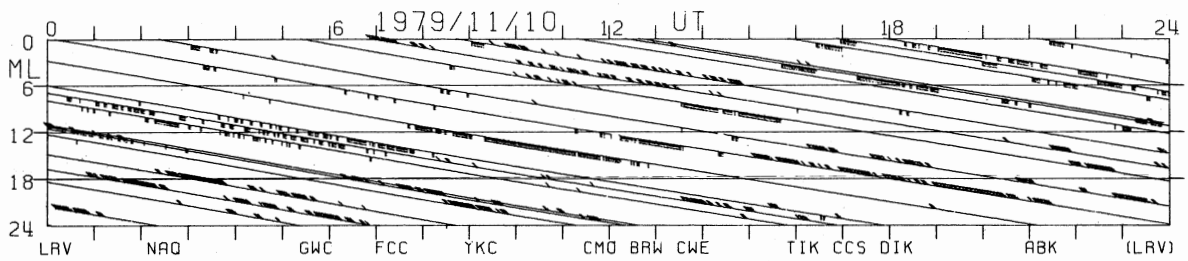


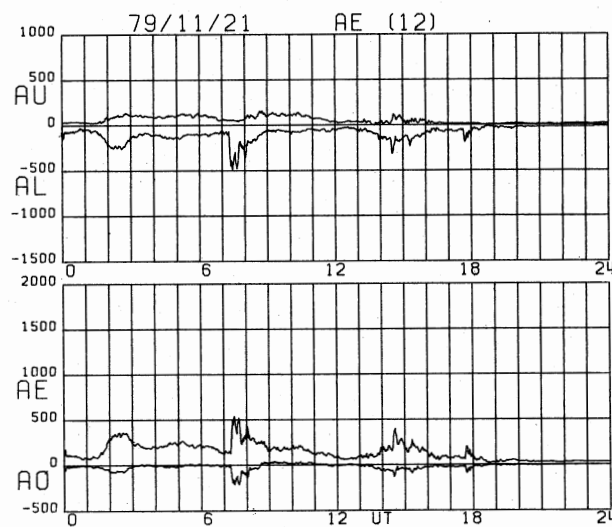
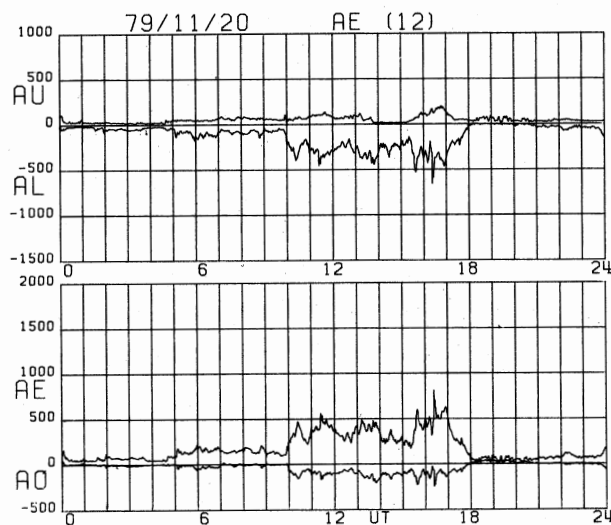
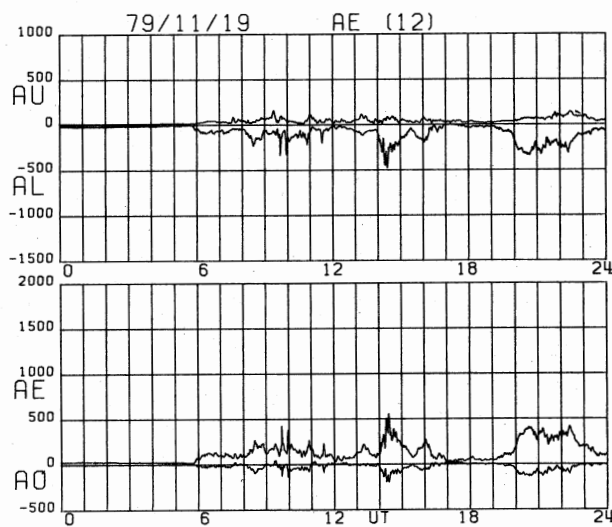
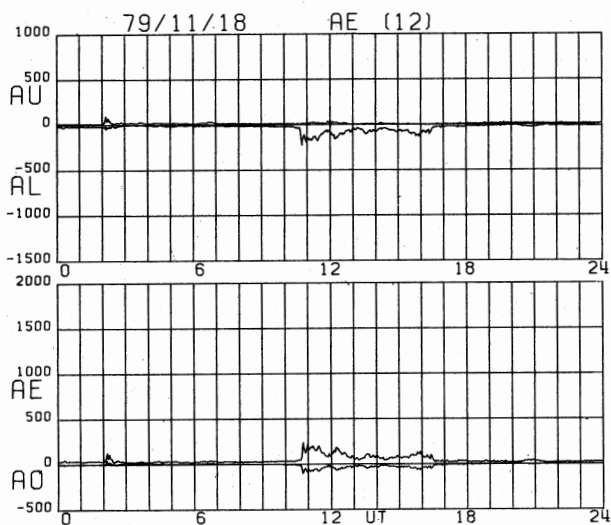
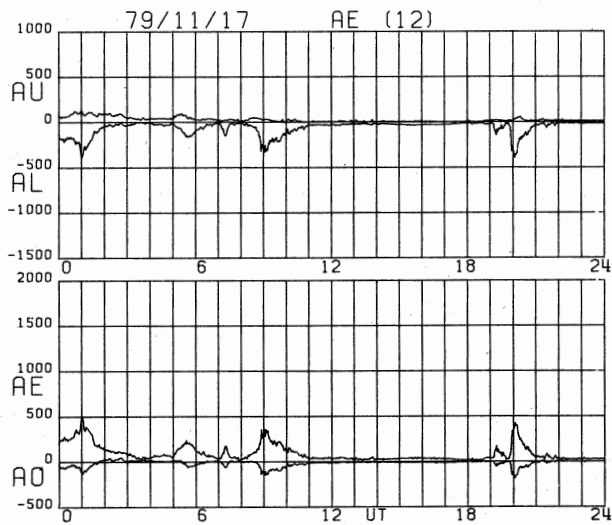
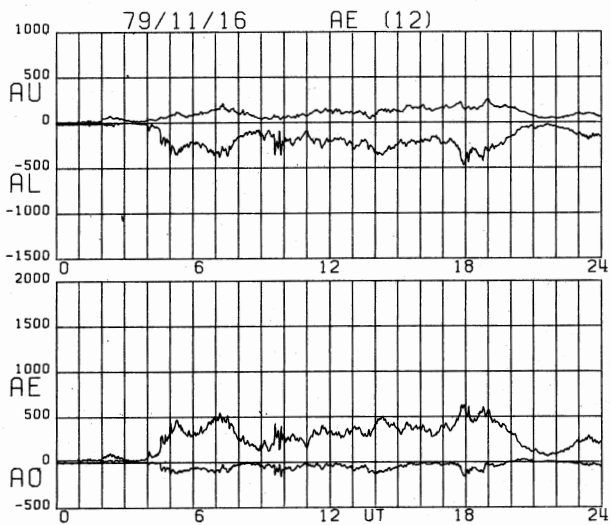


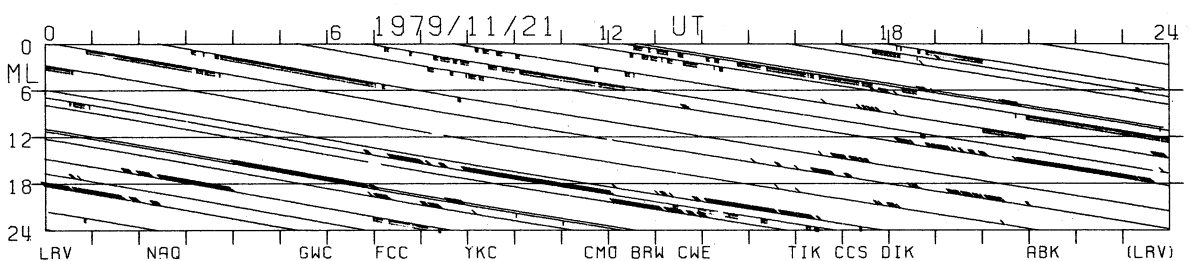
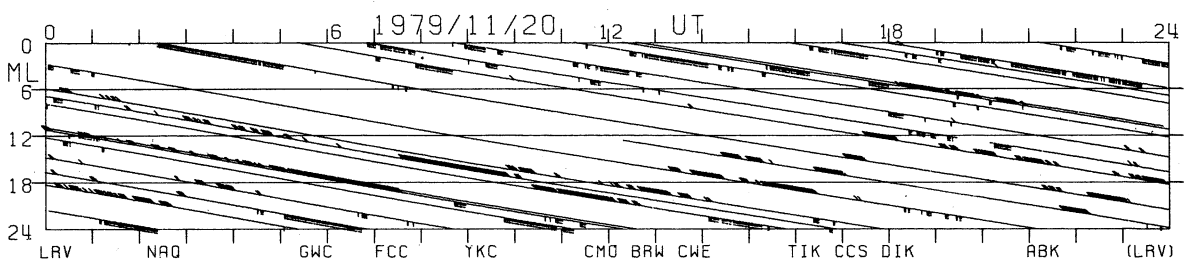
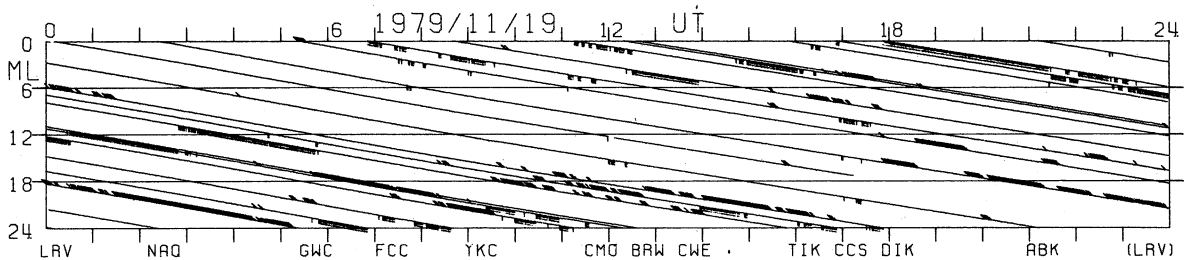
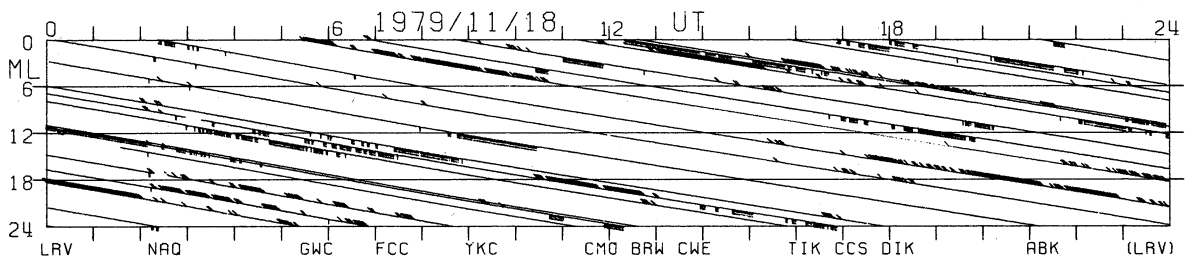
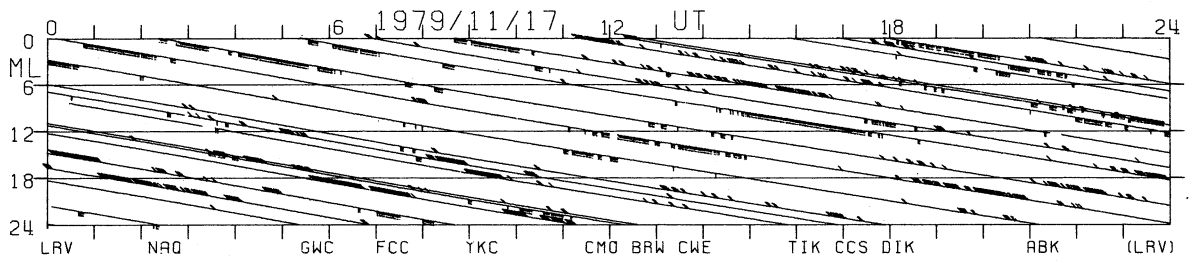
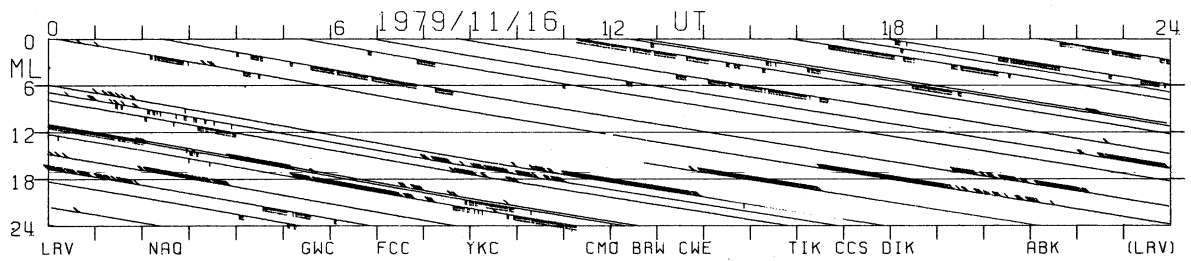


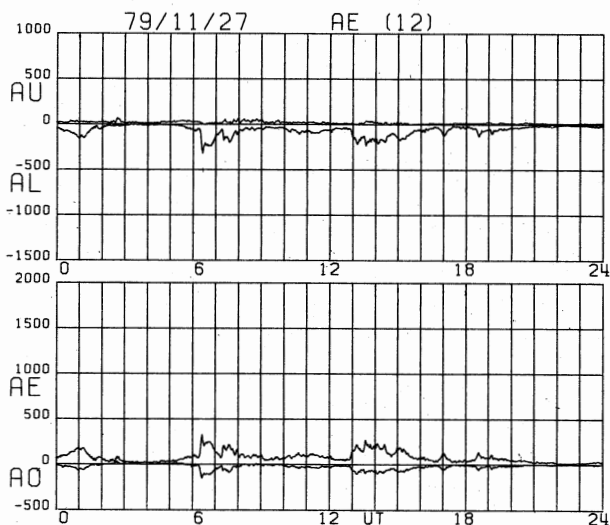
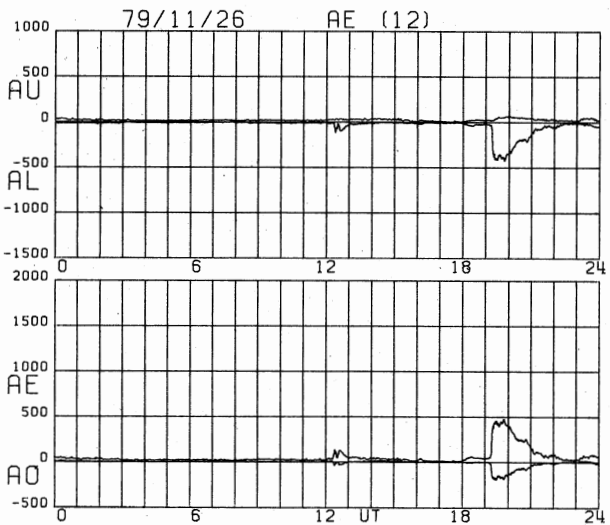
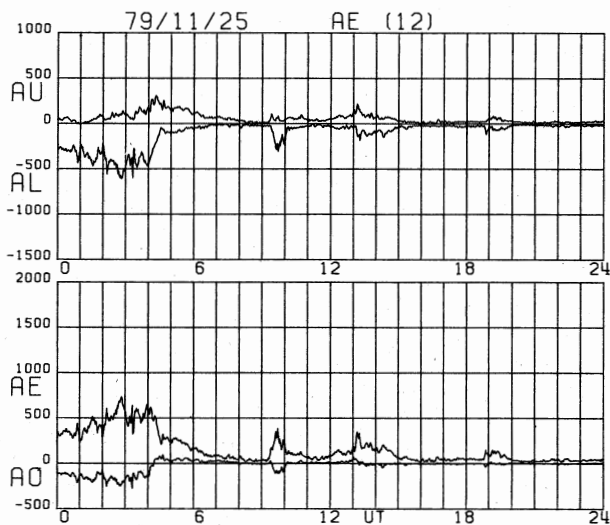
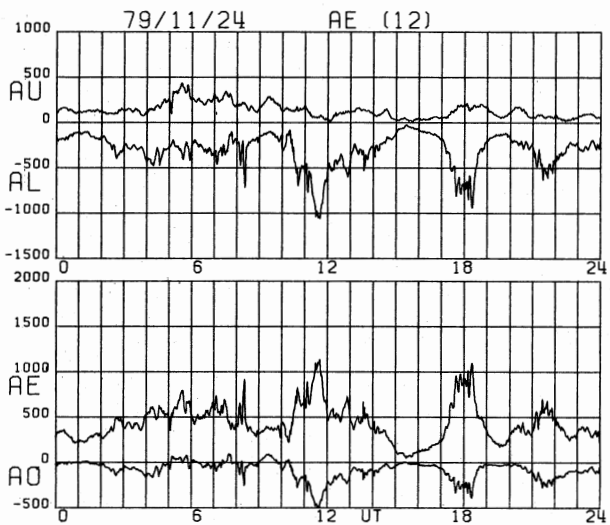
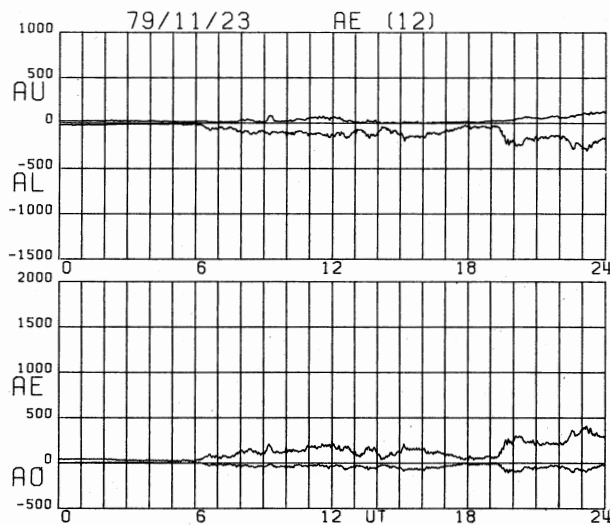
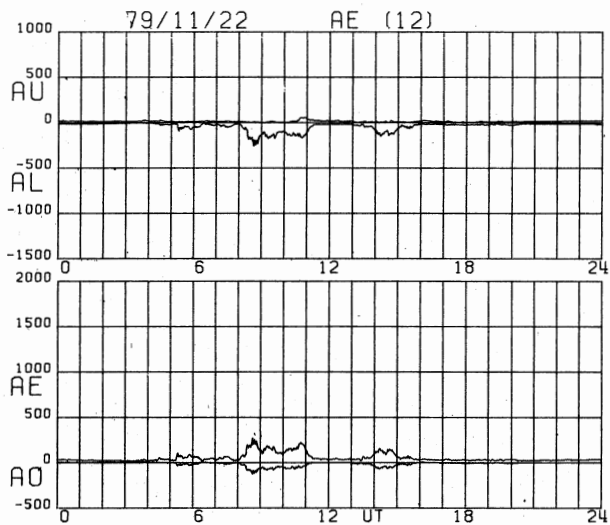


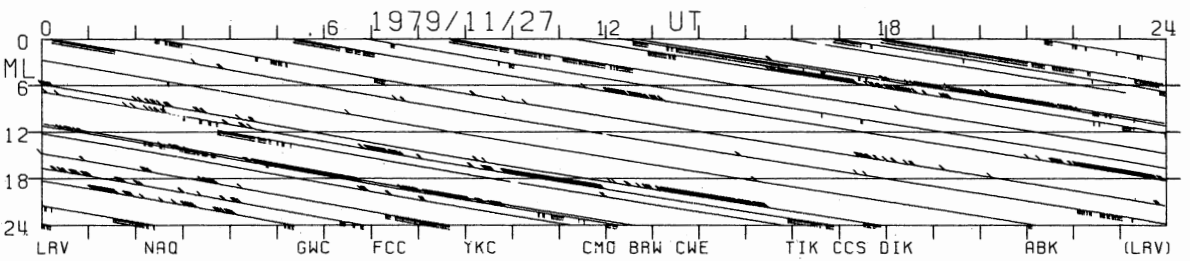
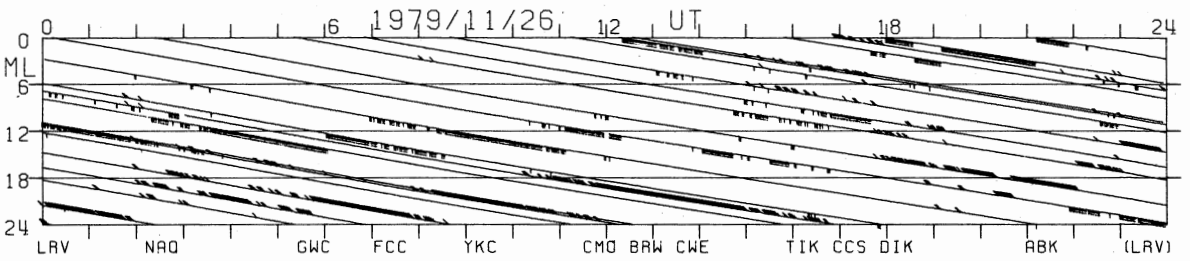
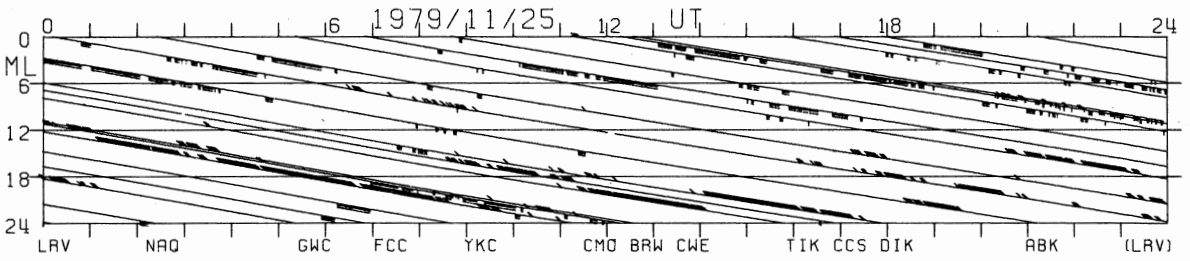
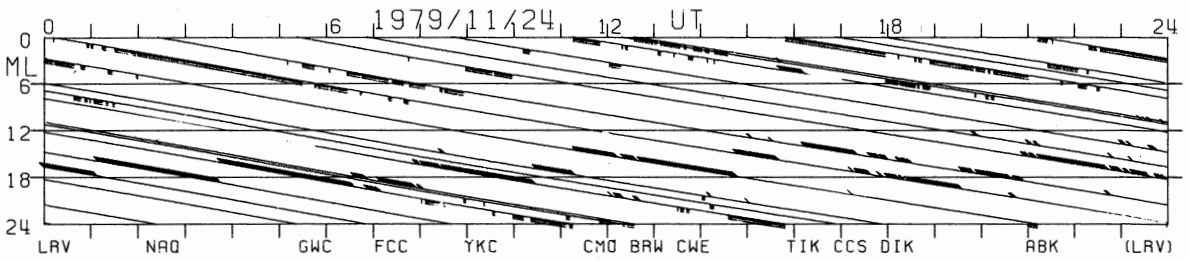
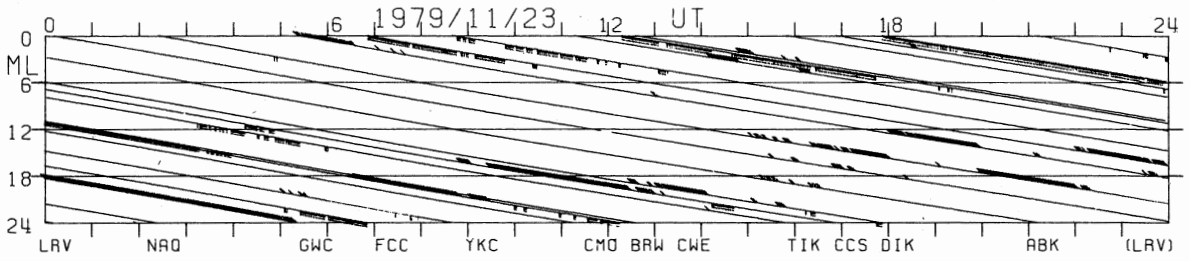
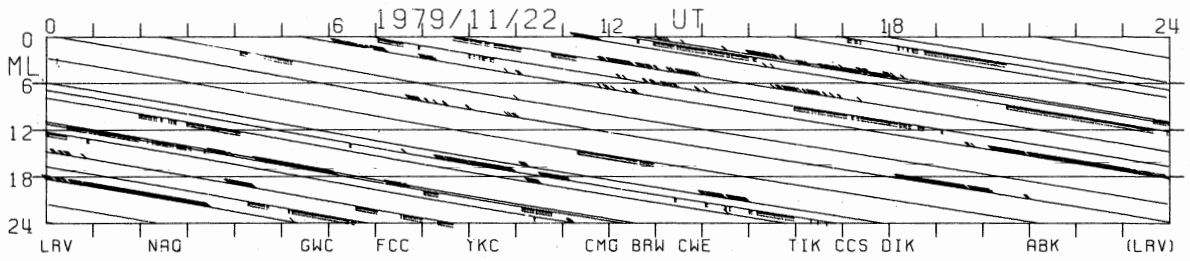


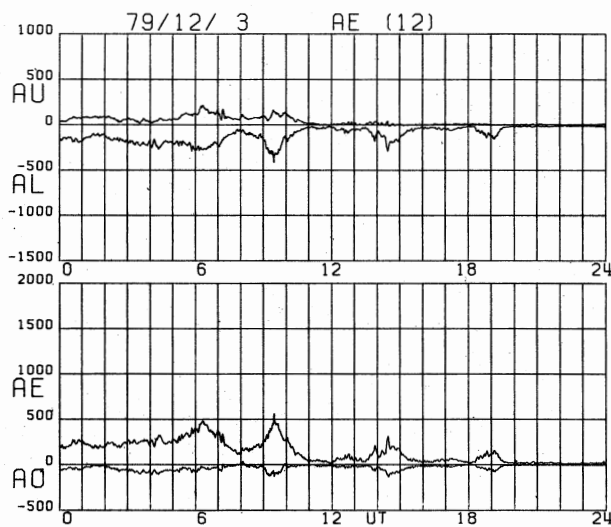
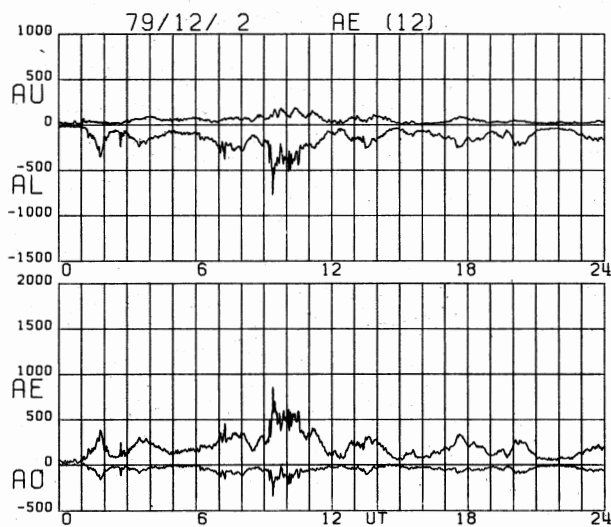
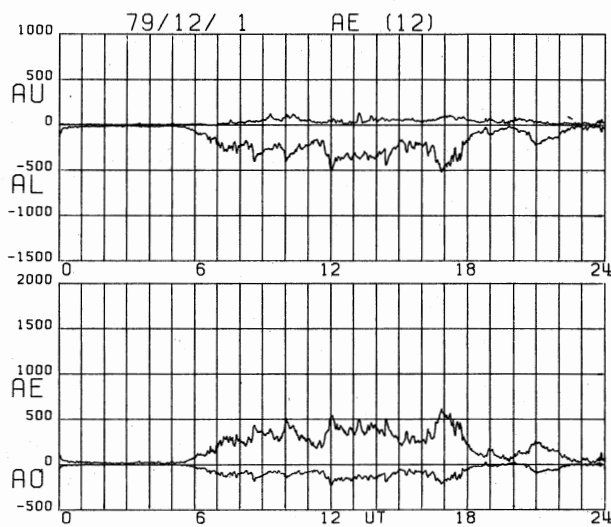
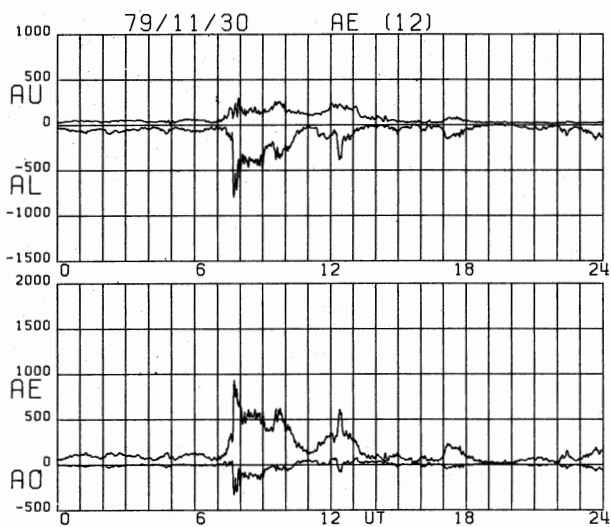
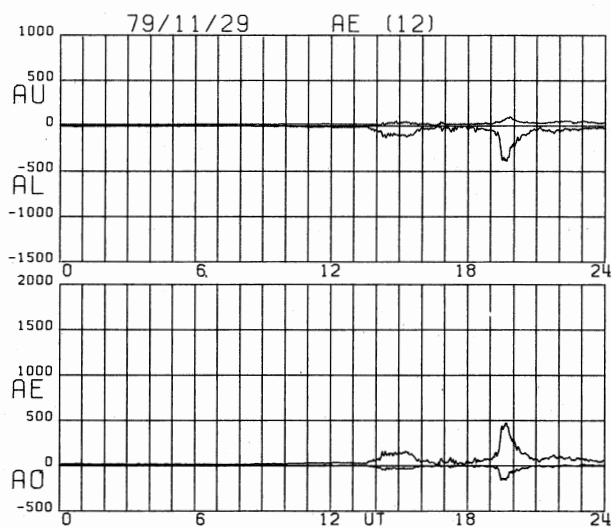
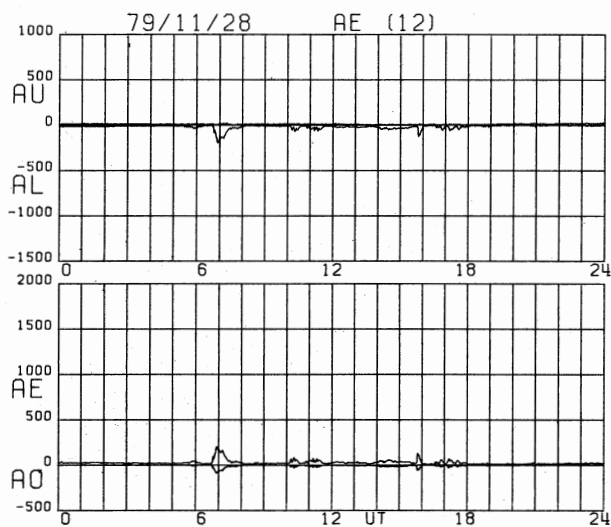


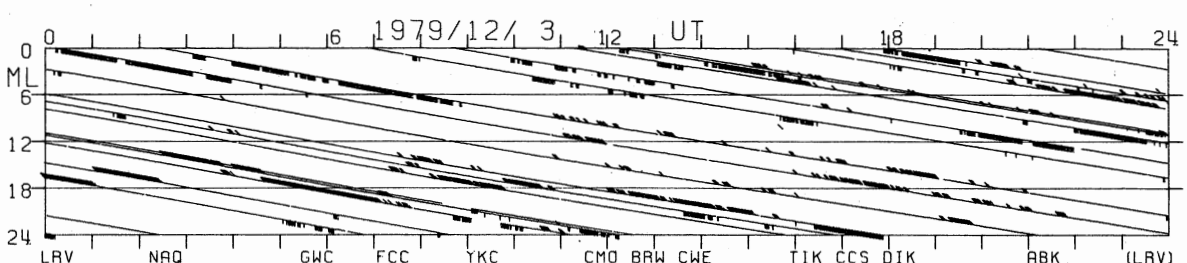
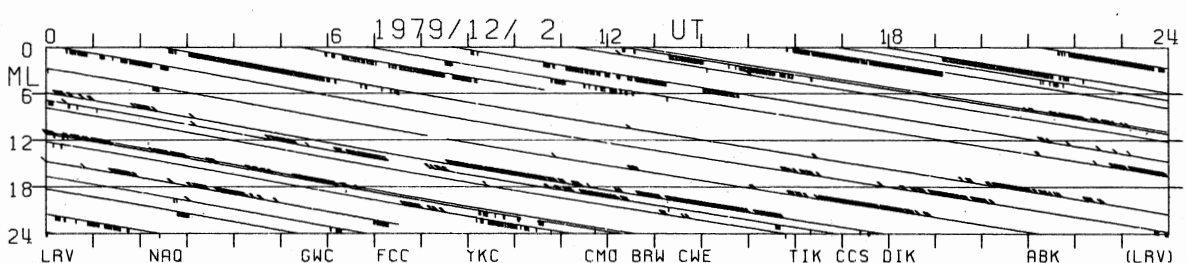
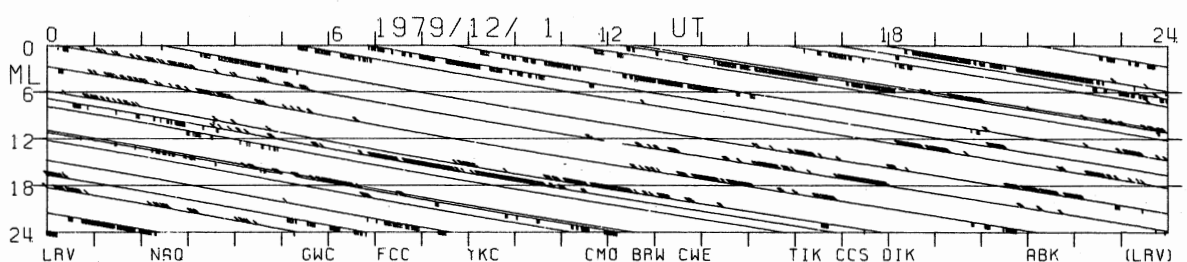
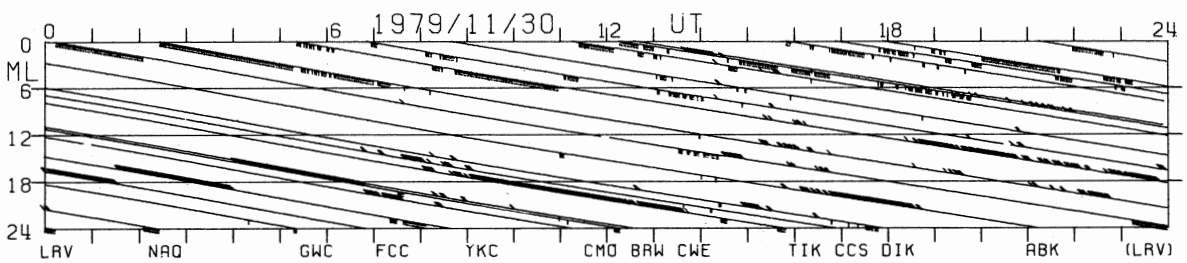
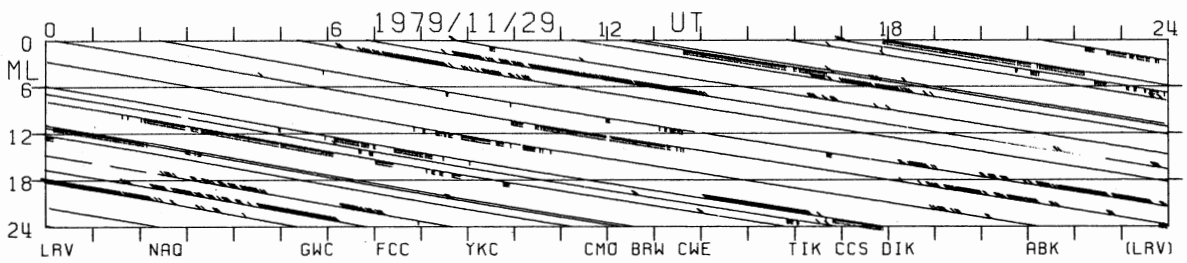
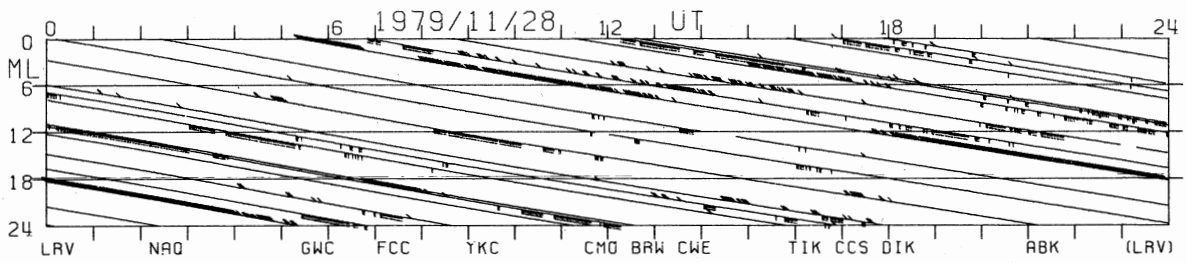


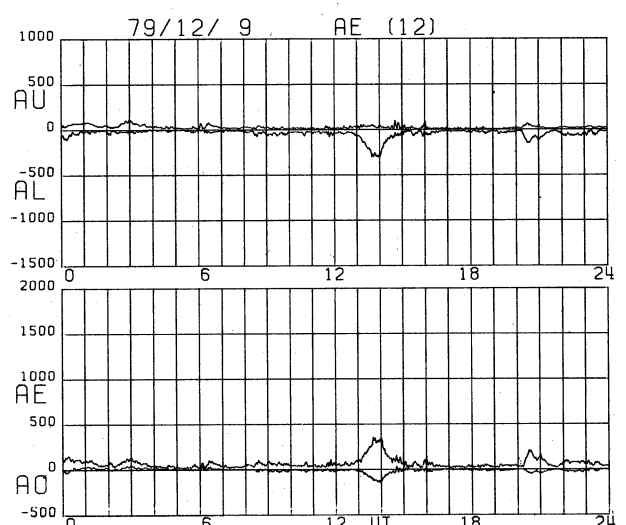
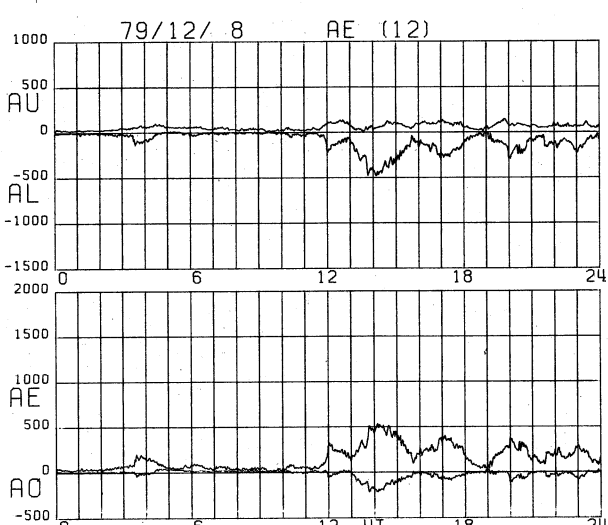
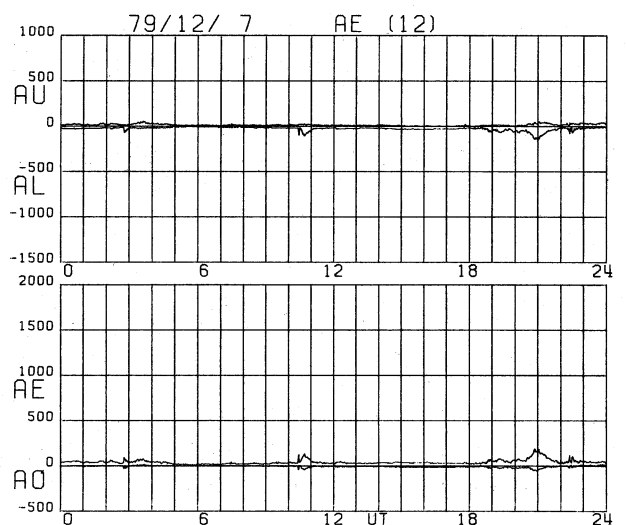
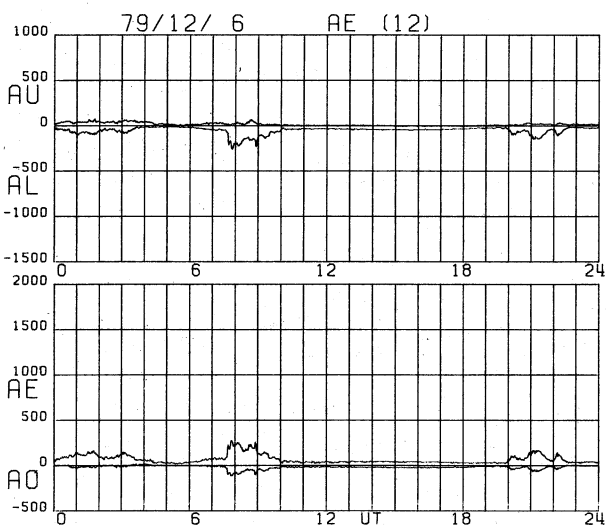
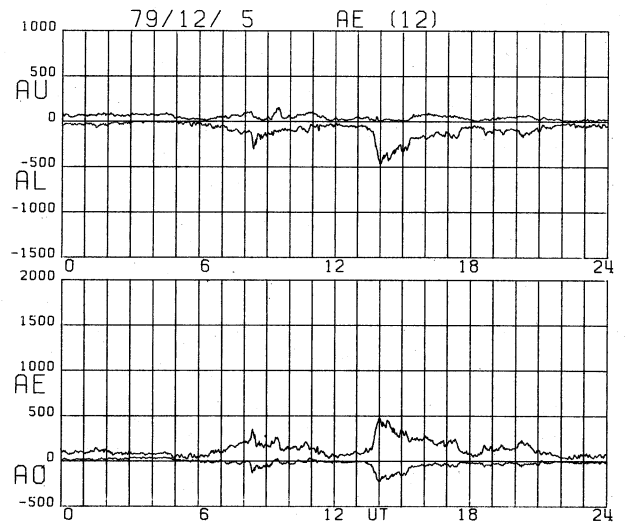
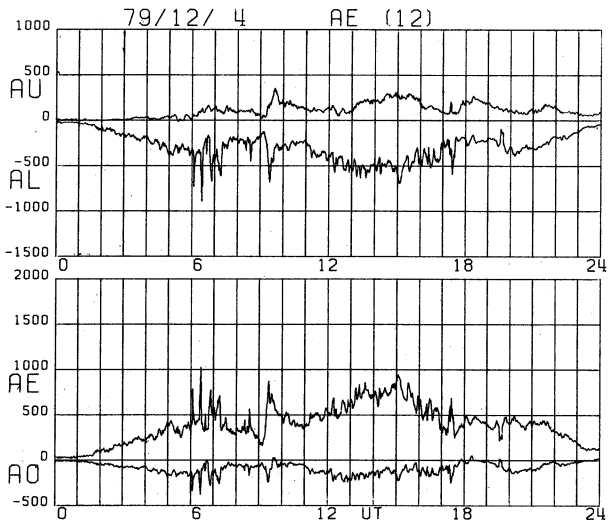


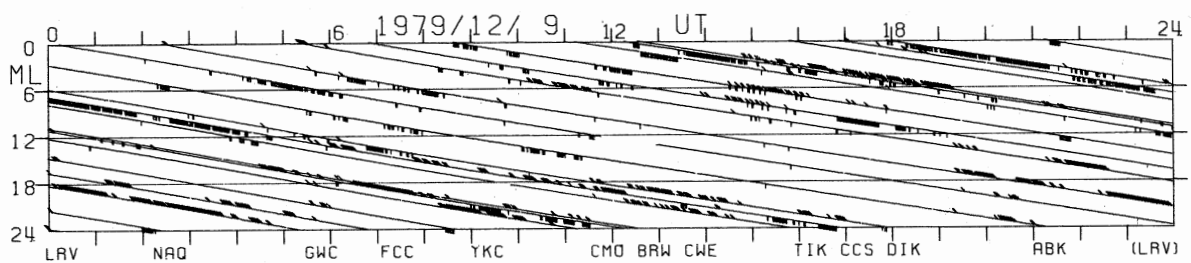
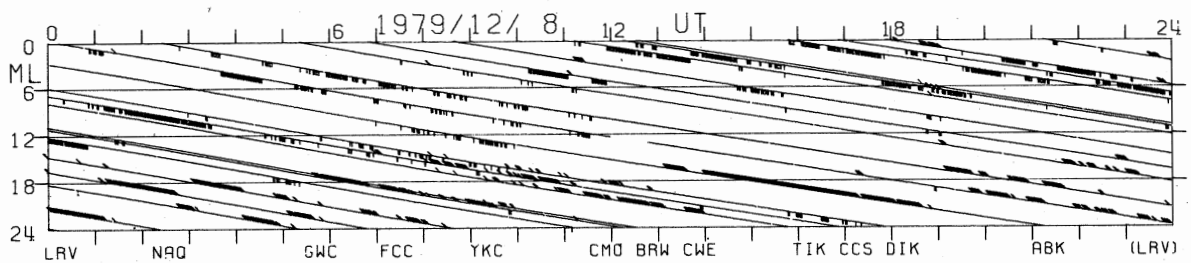
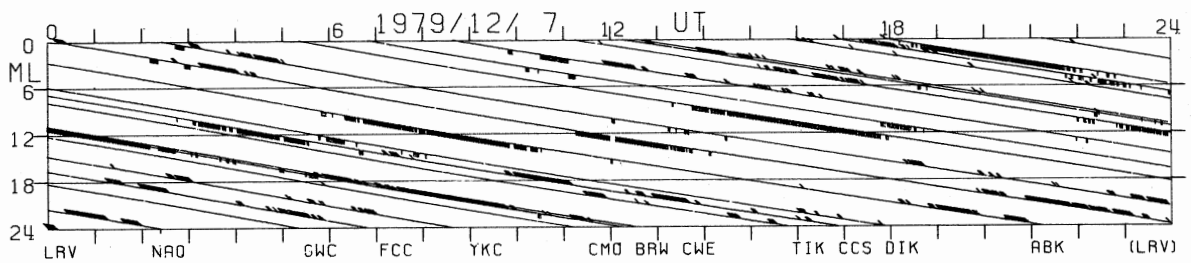
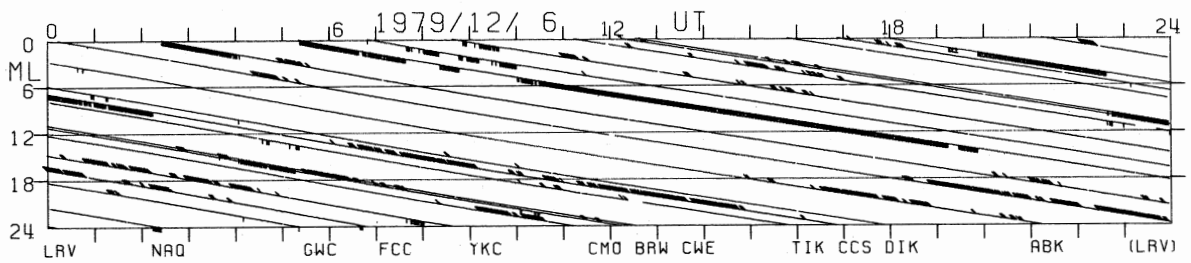
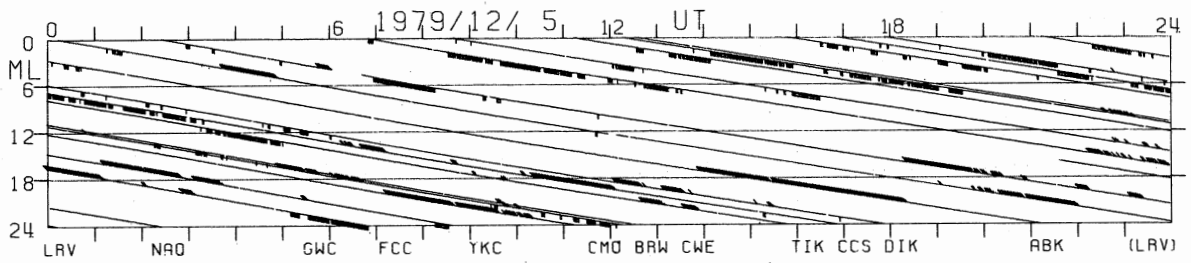
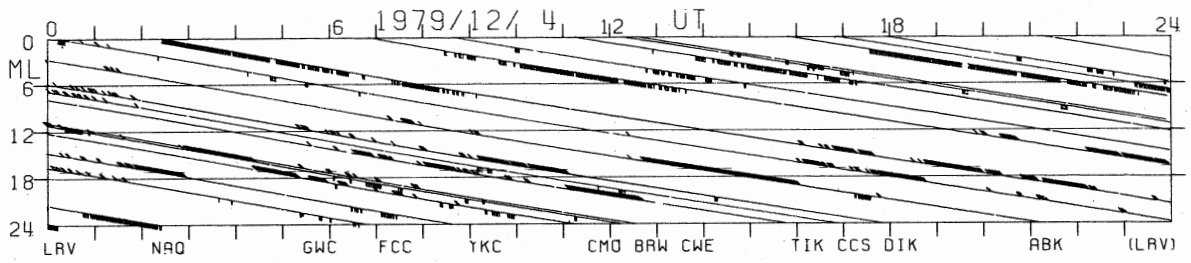


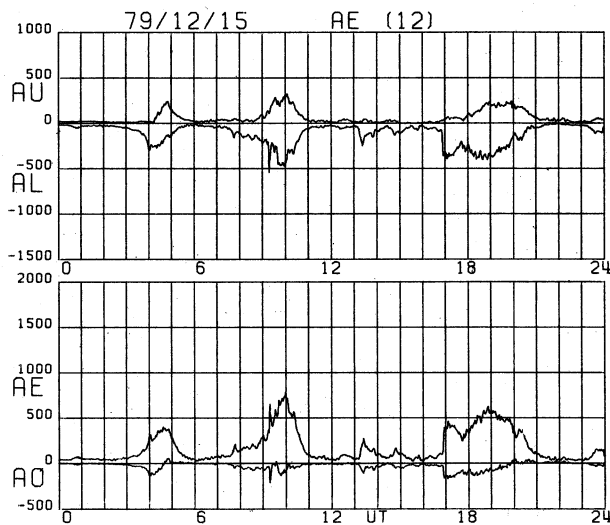
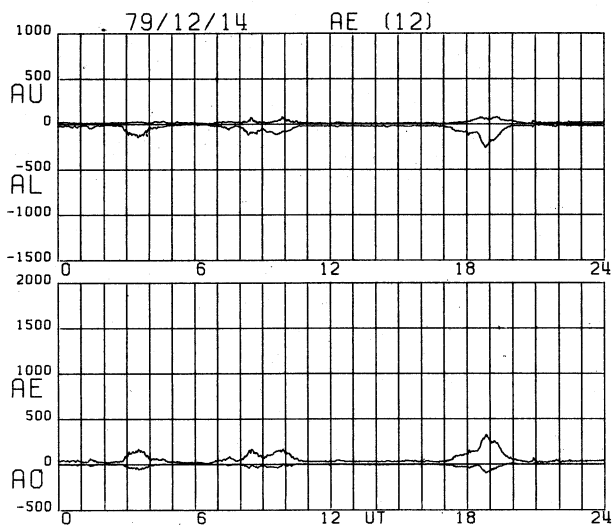
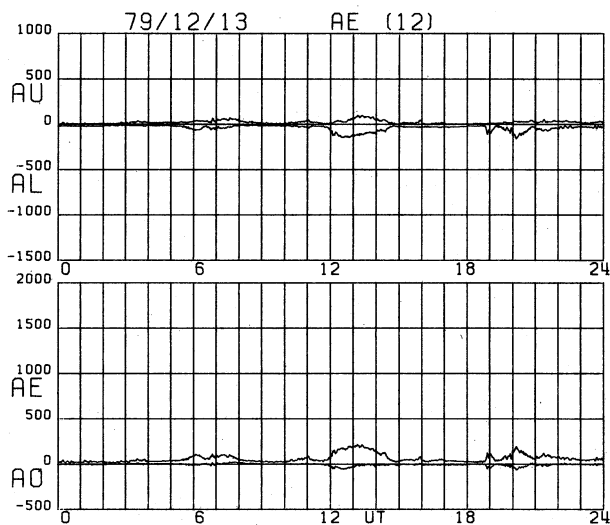
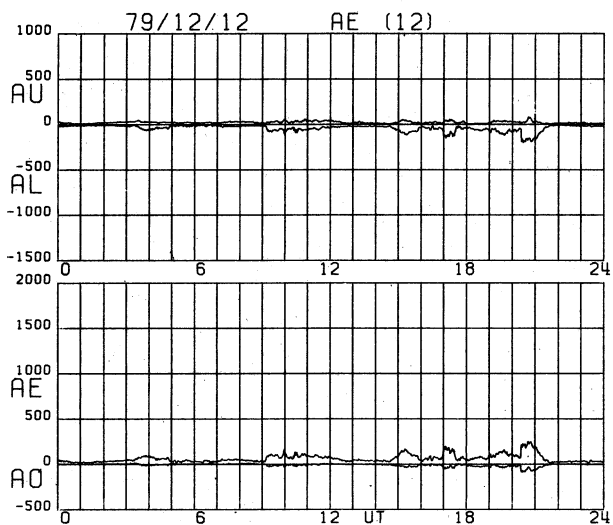
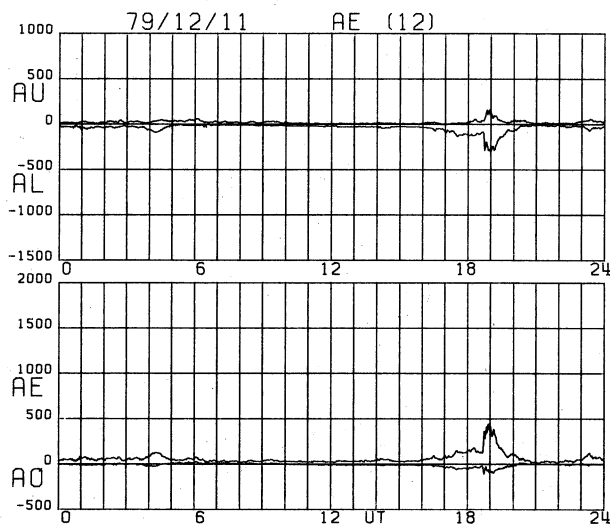
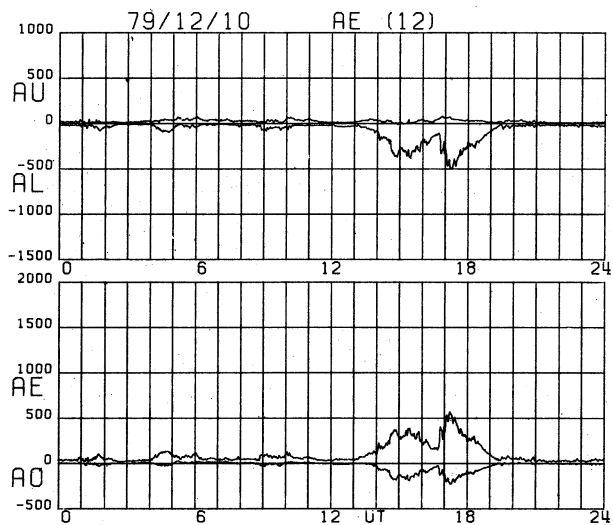


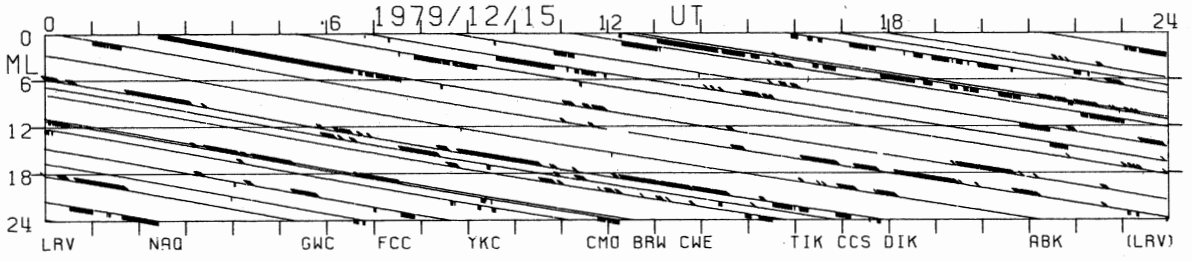
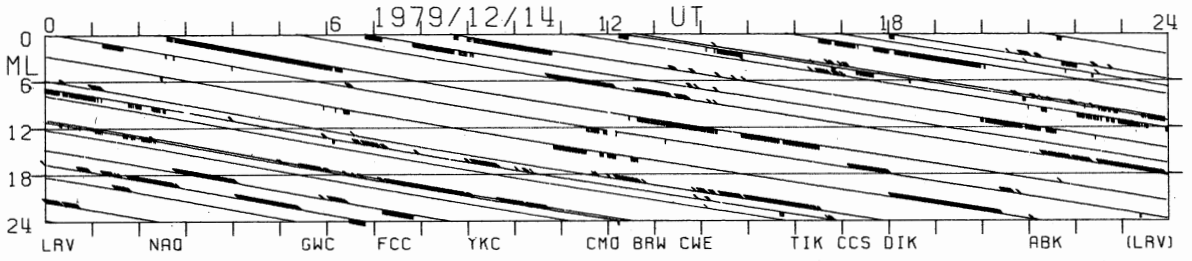
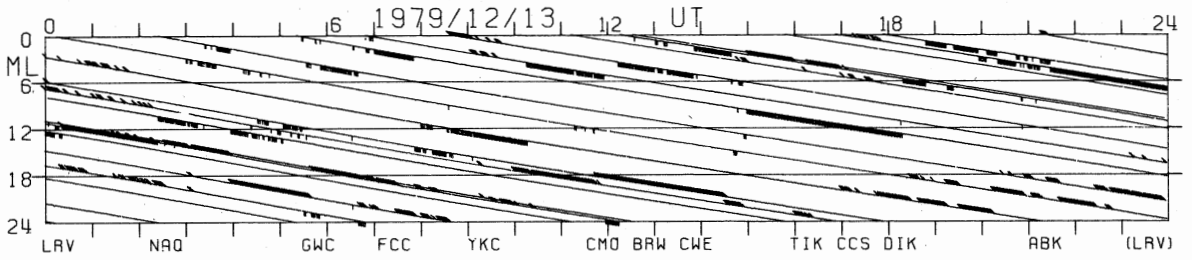
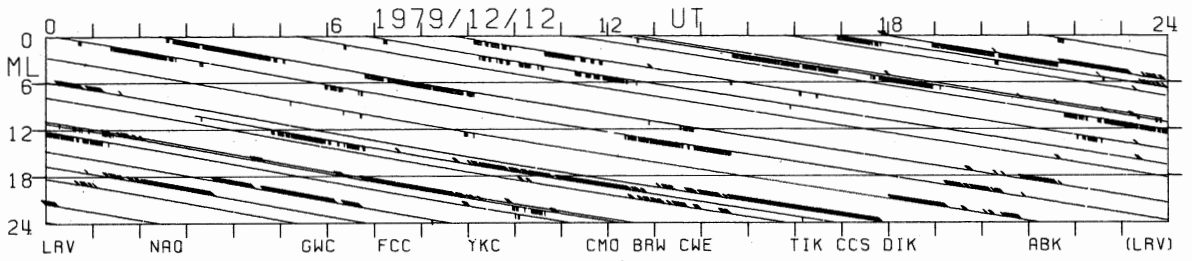
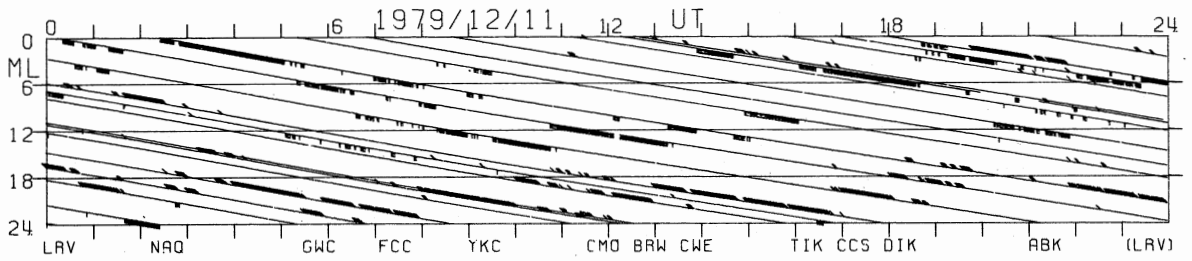
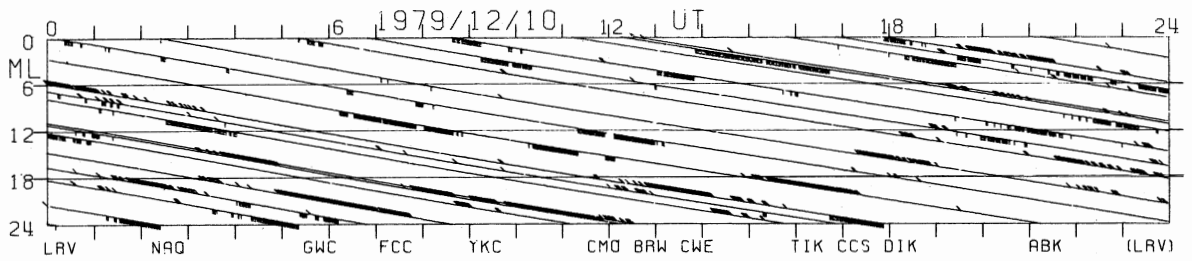


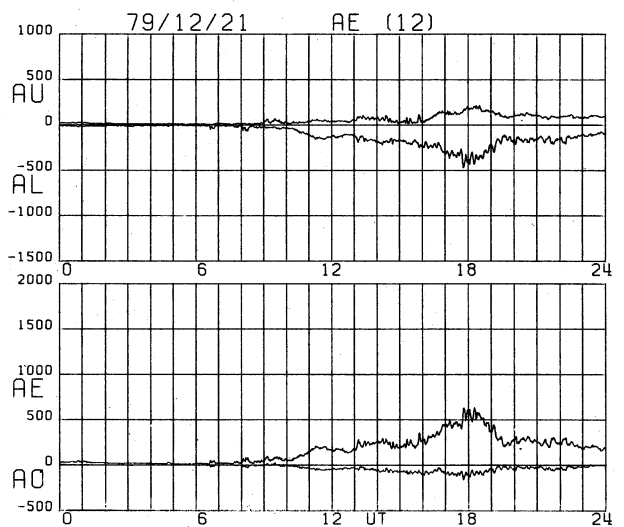
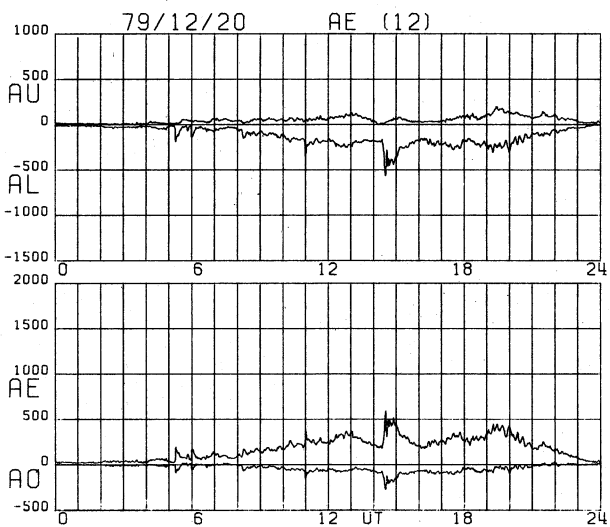
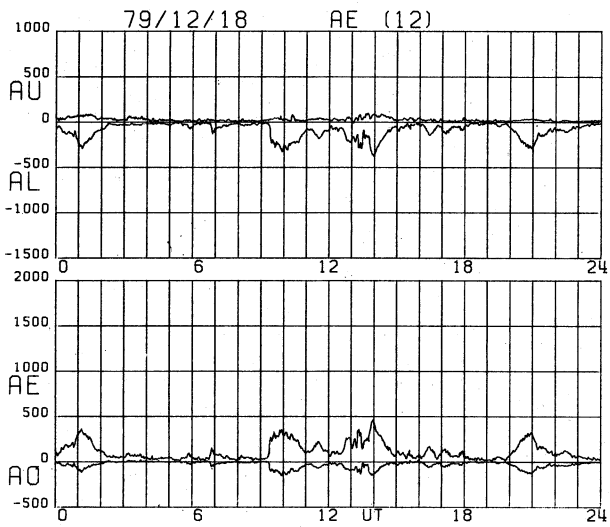
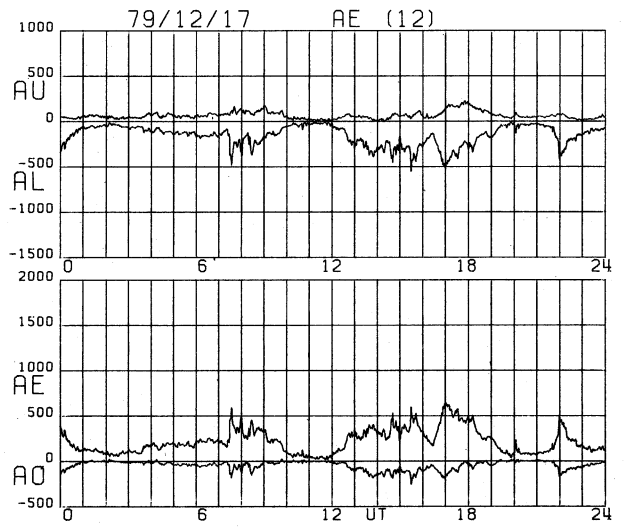
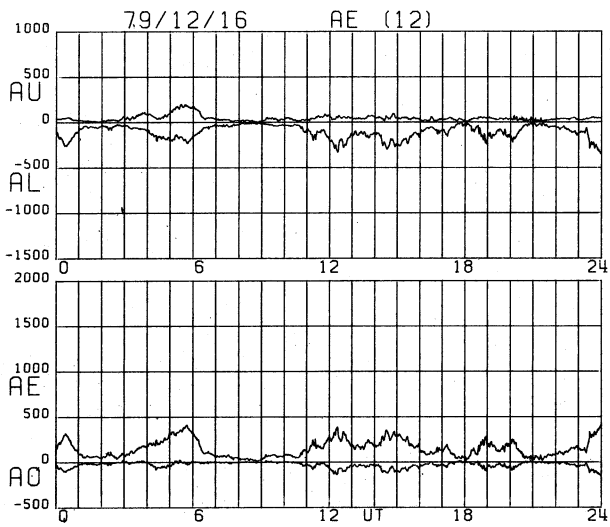


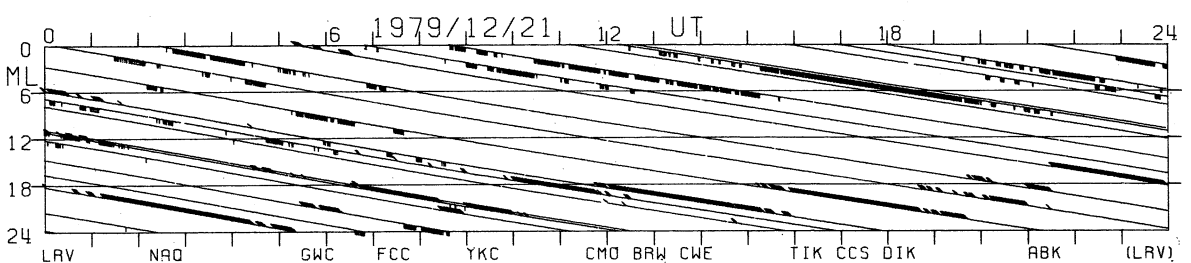
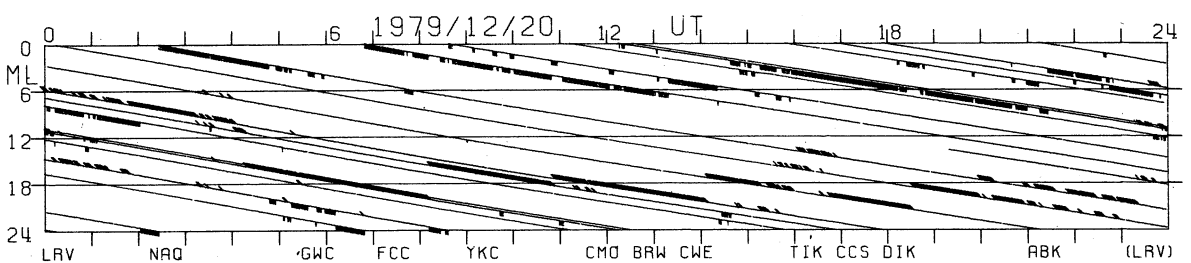
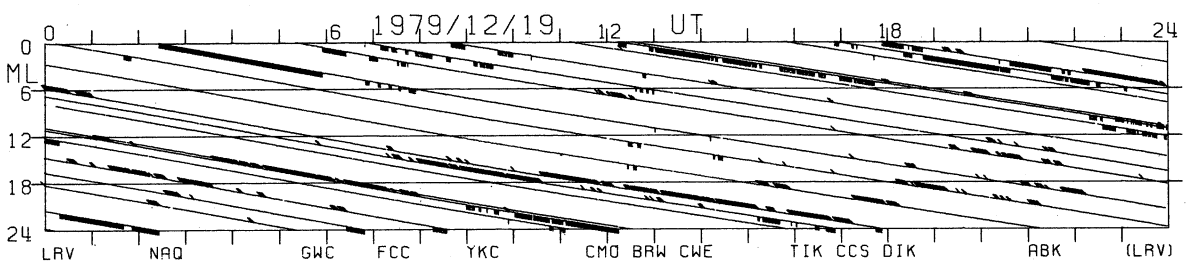
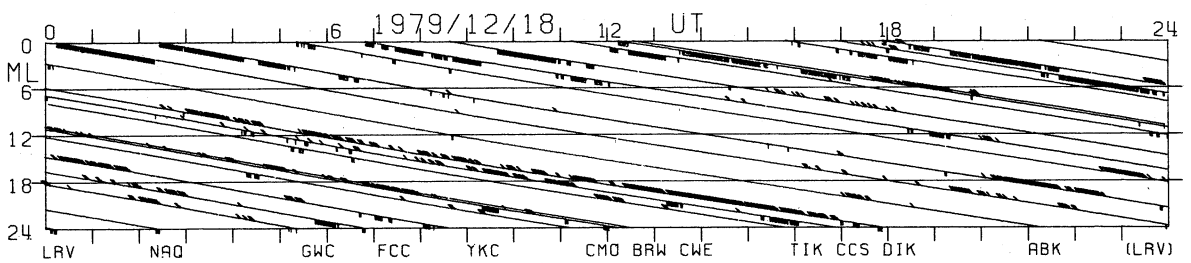
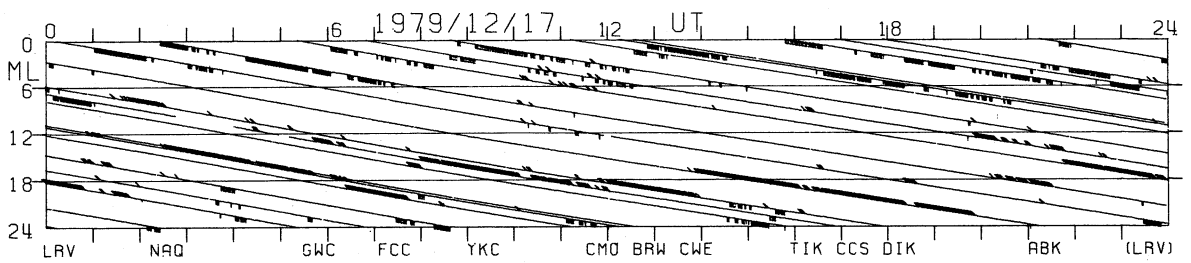
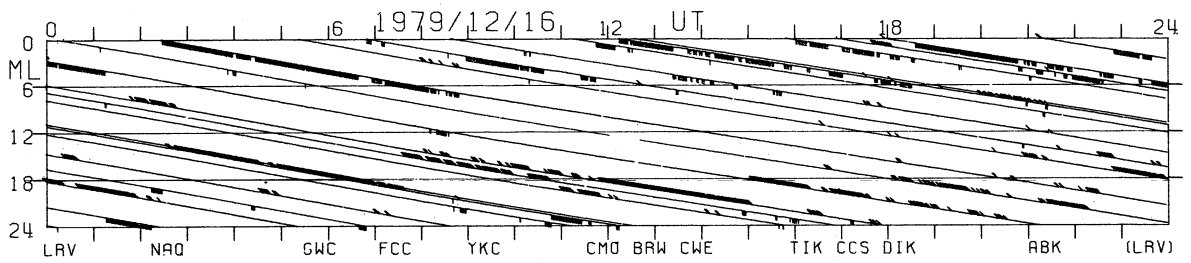


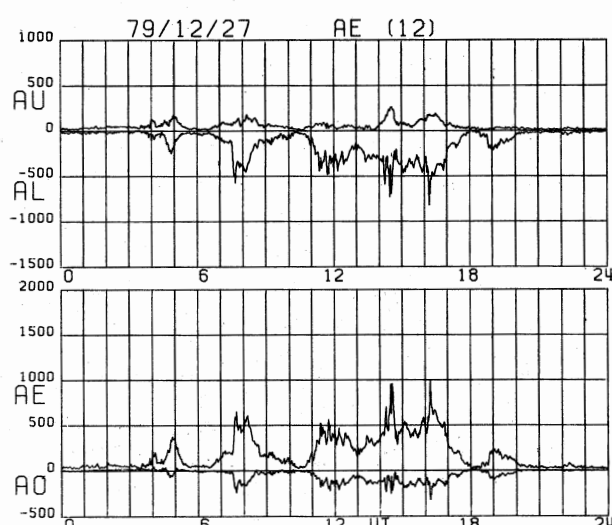
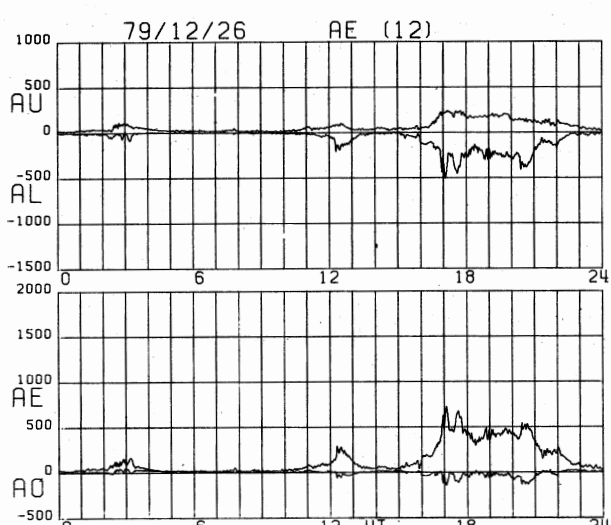
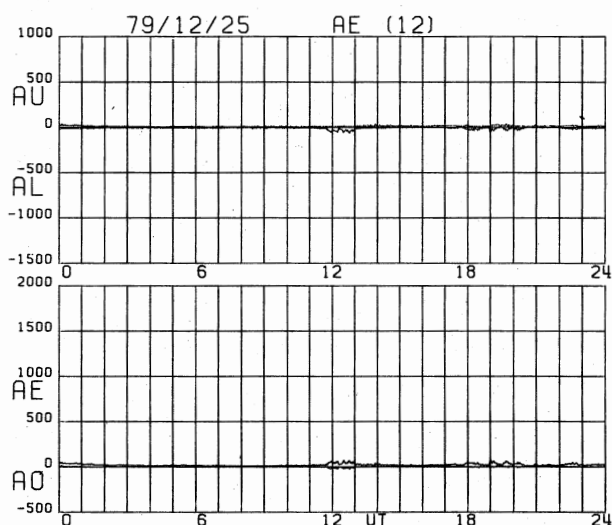
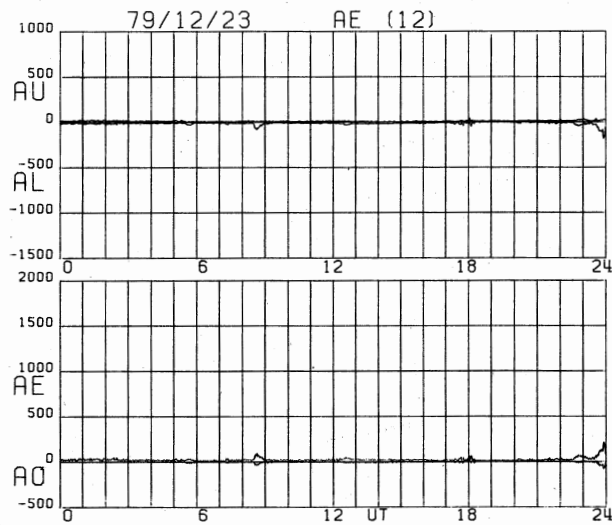
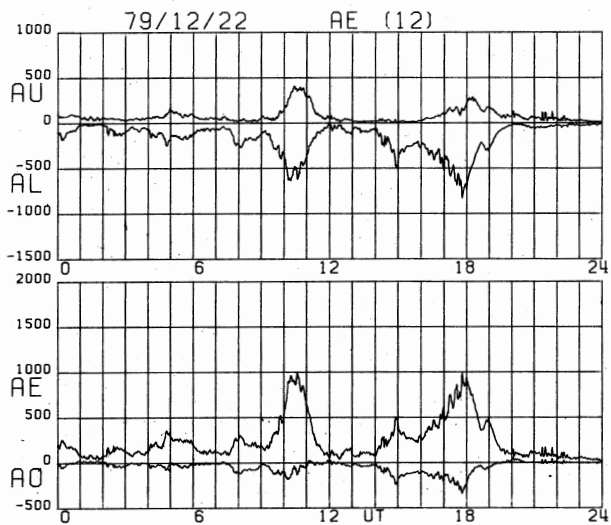


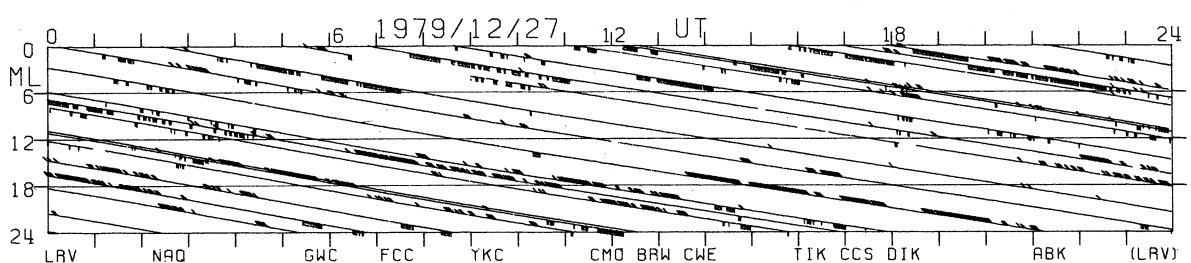
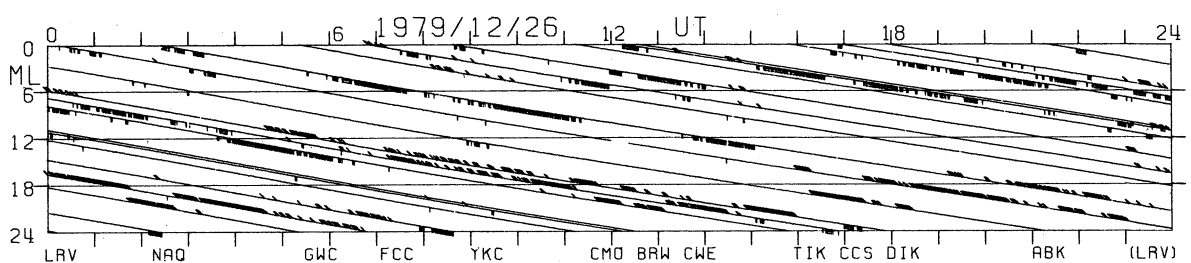
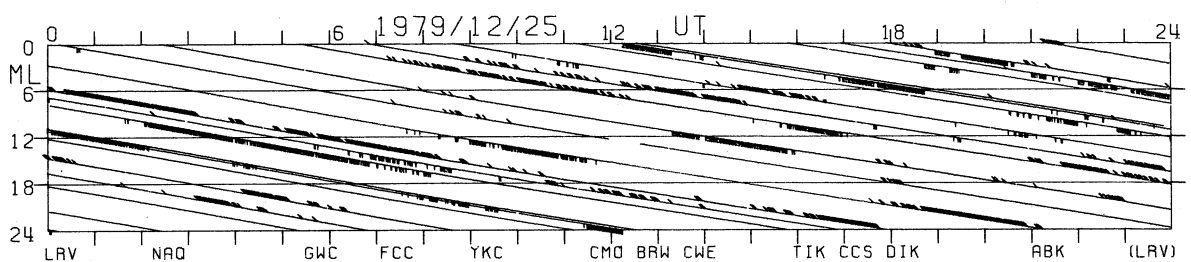
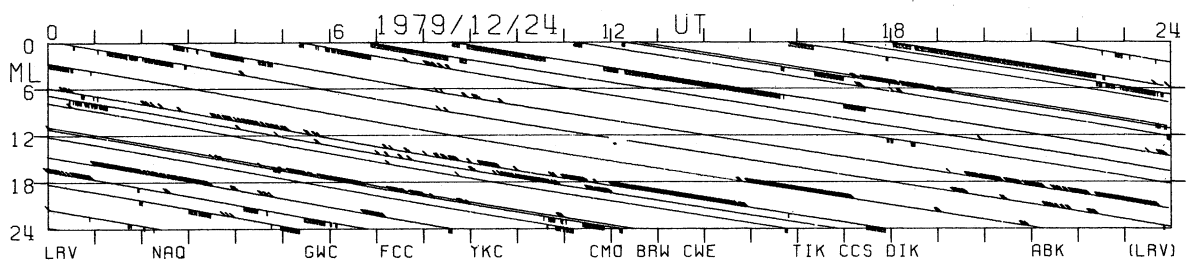
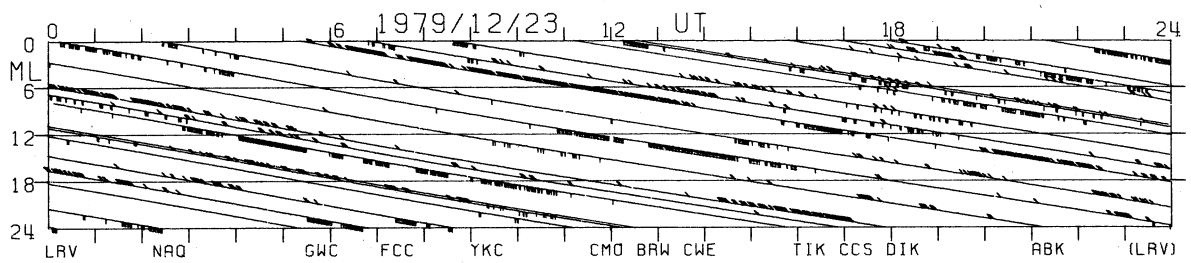
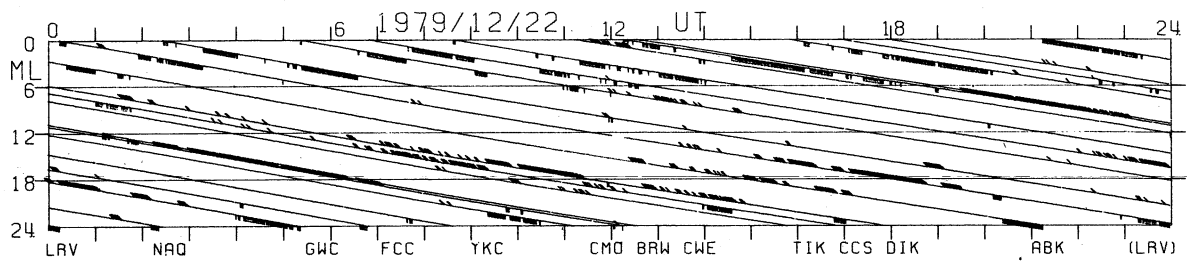


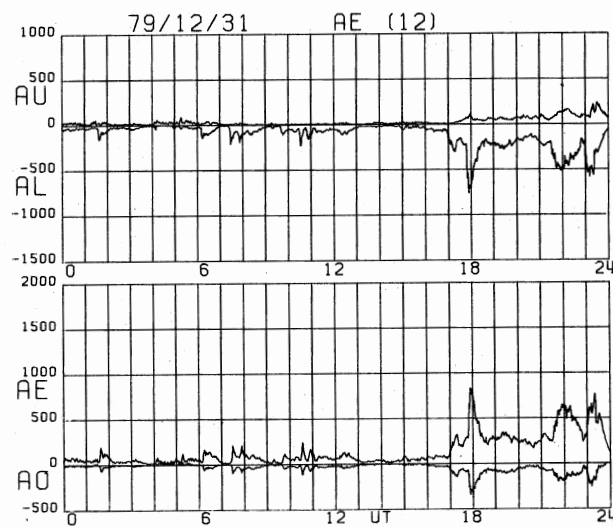
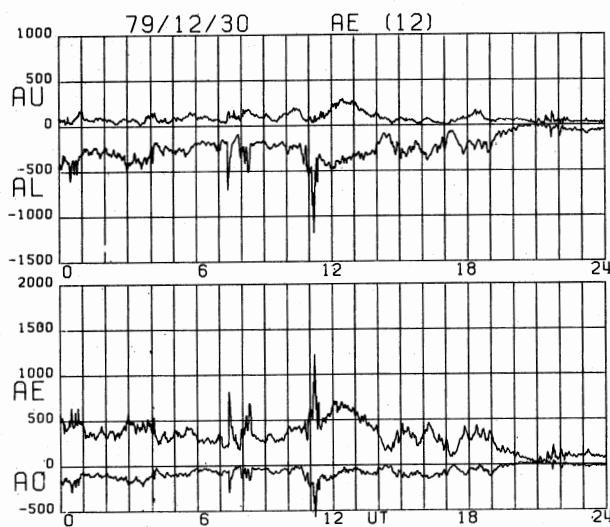
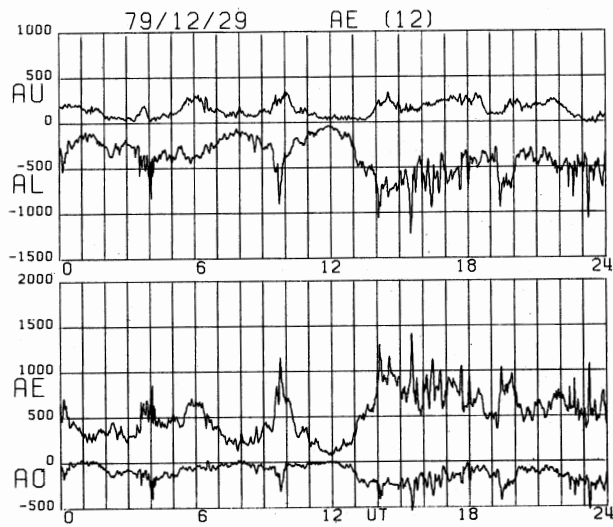
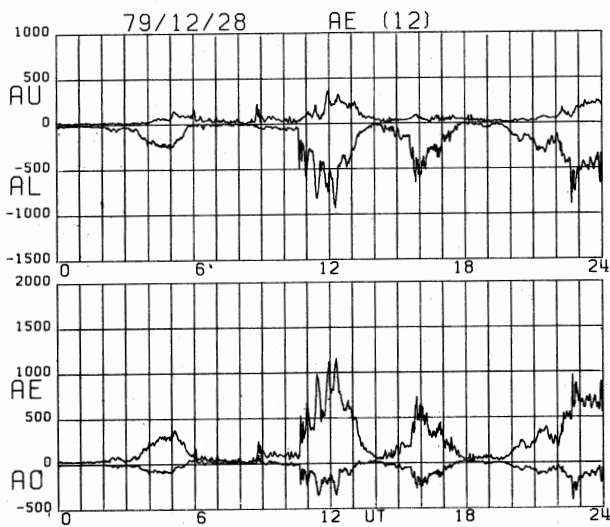


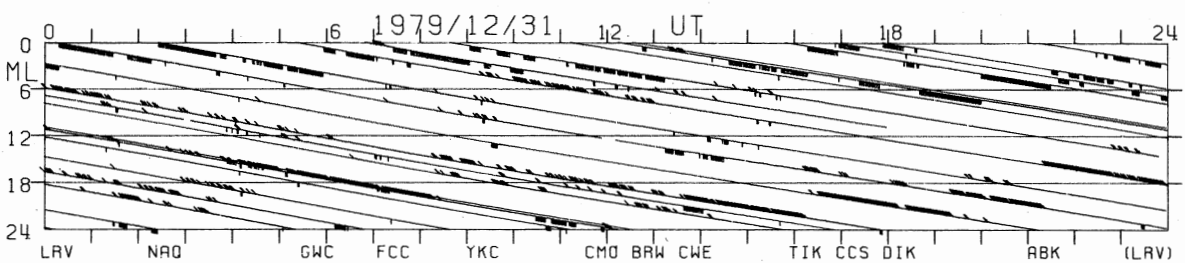
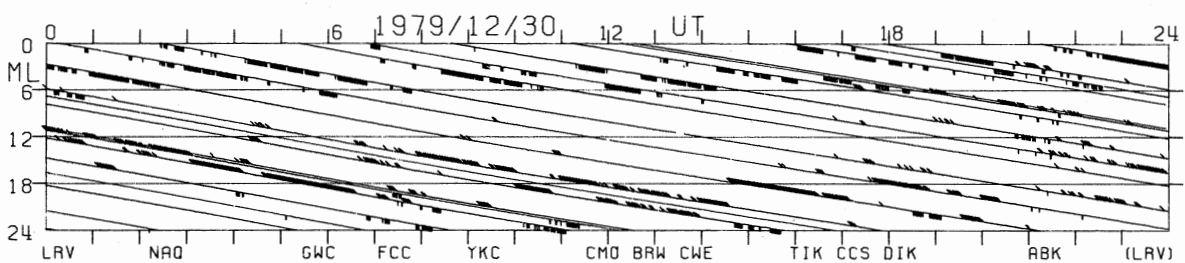
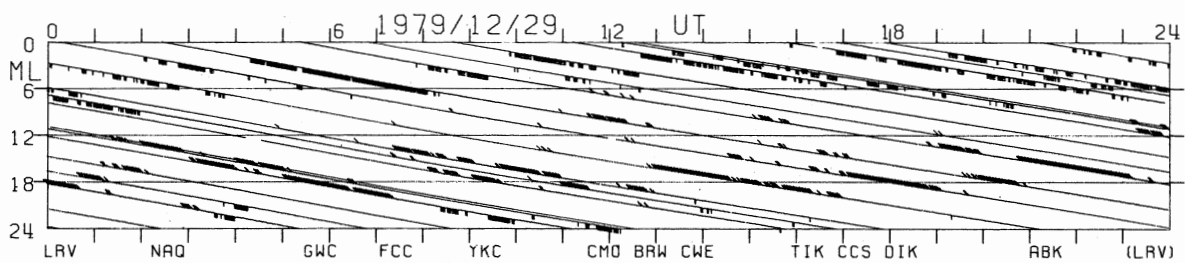
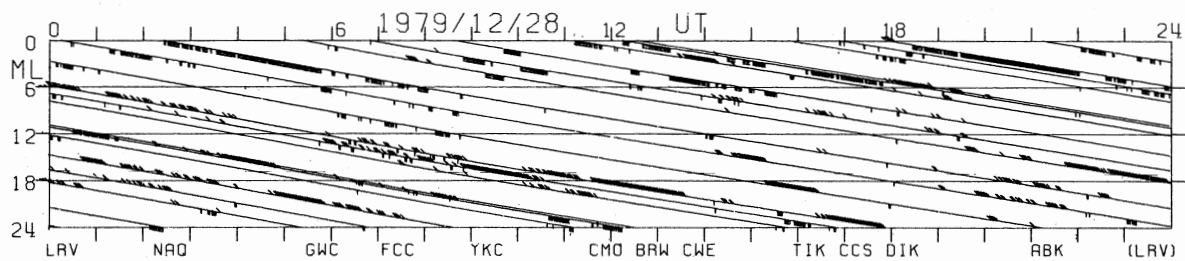












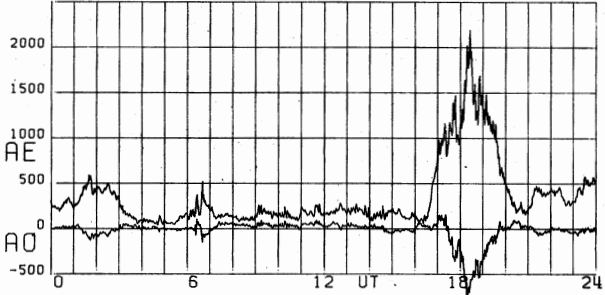
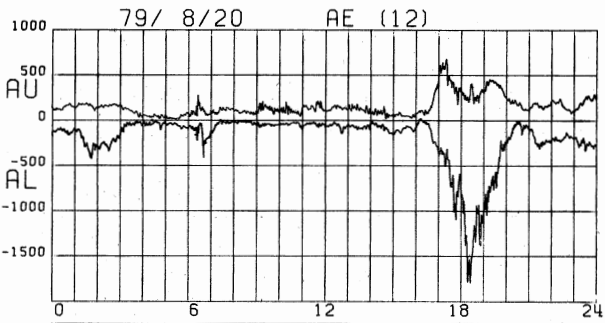
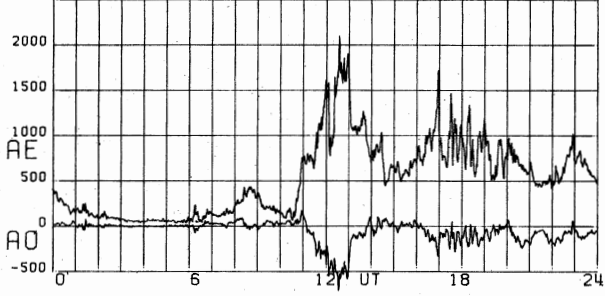
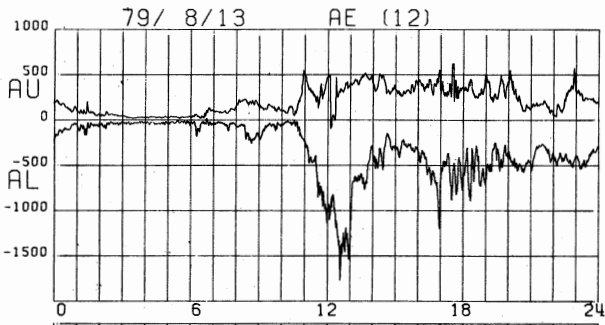
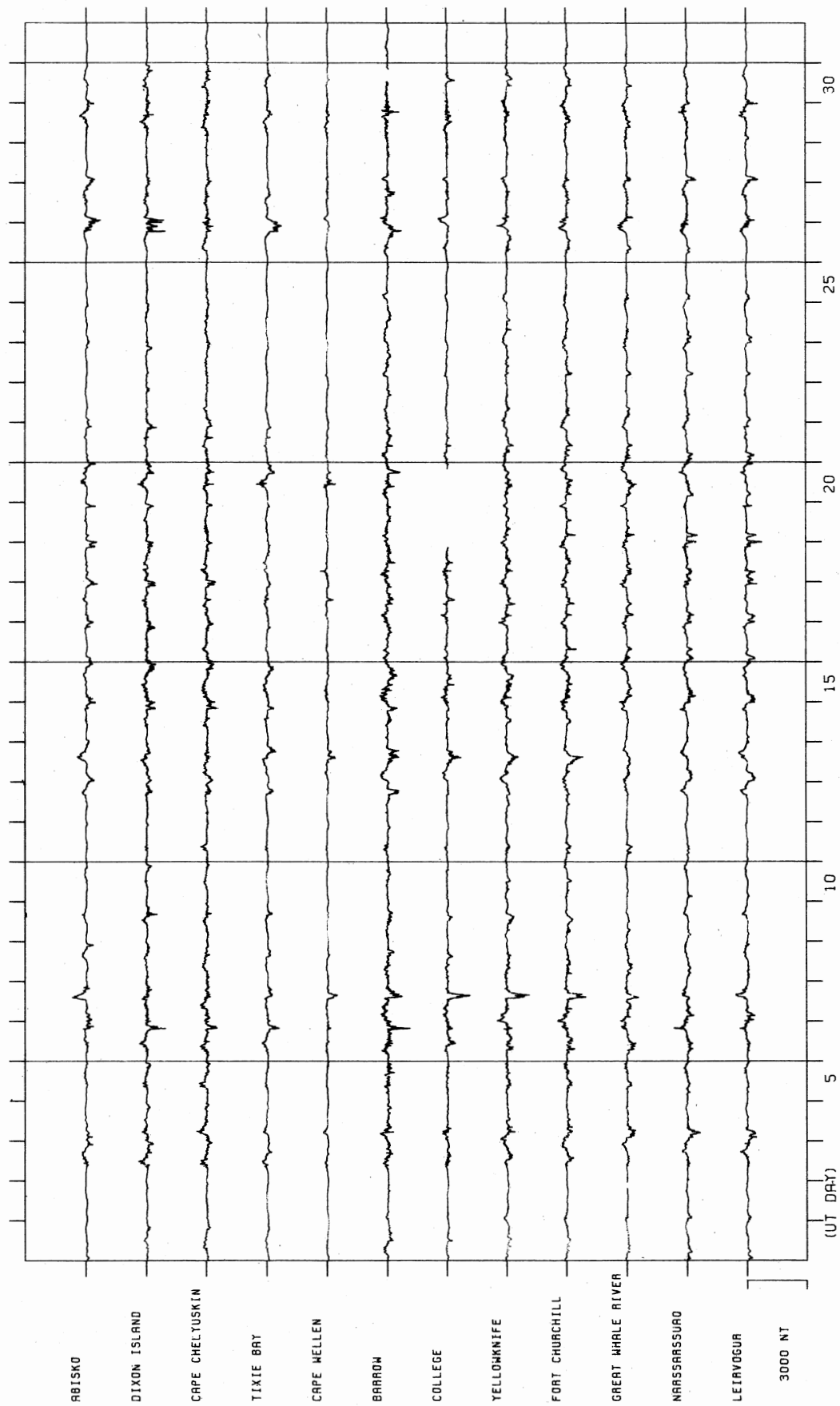
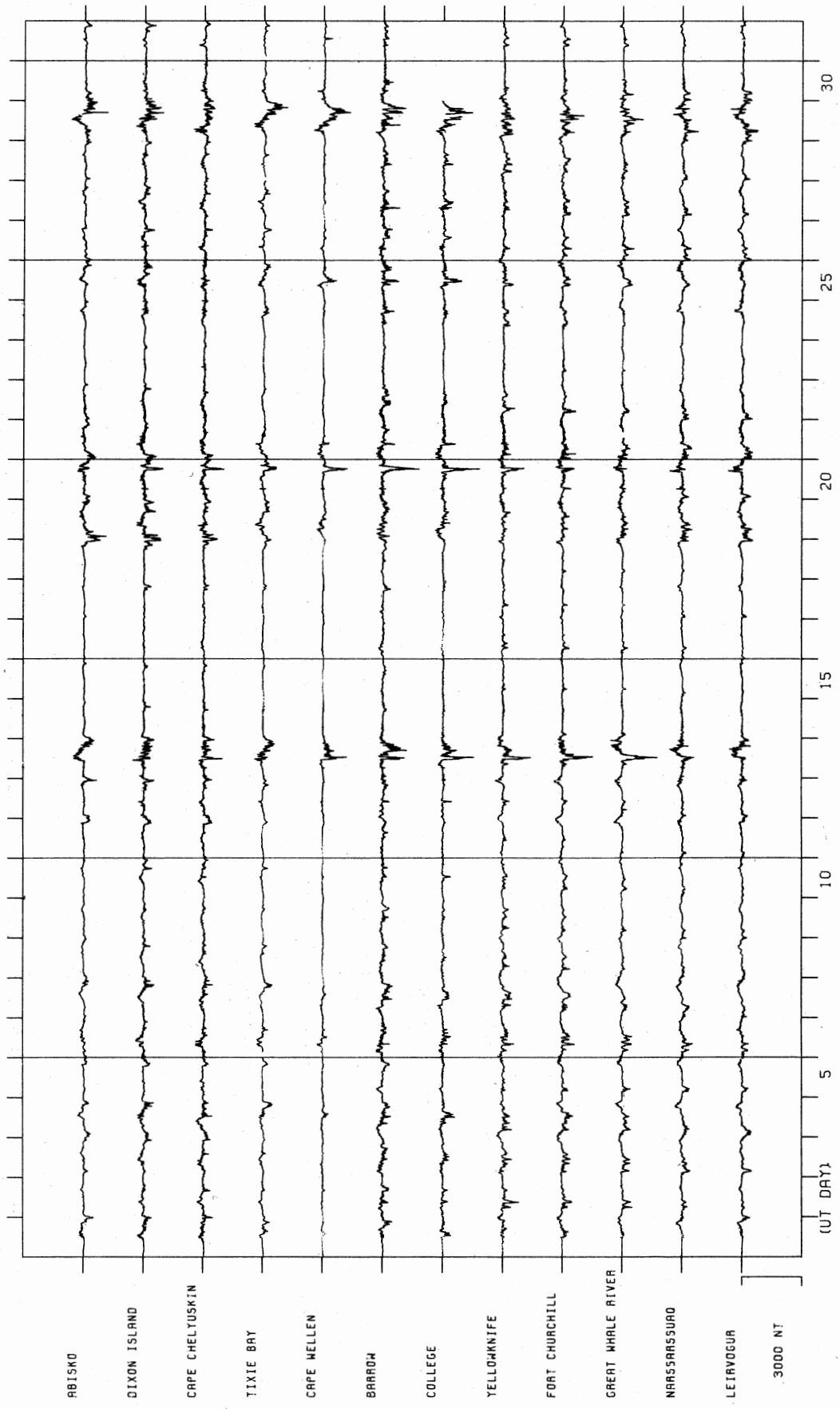


FIGURE 6

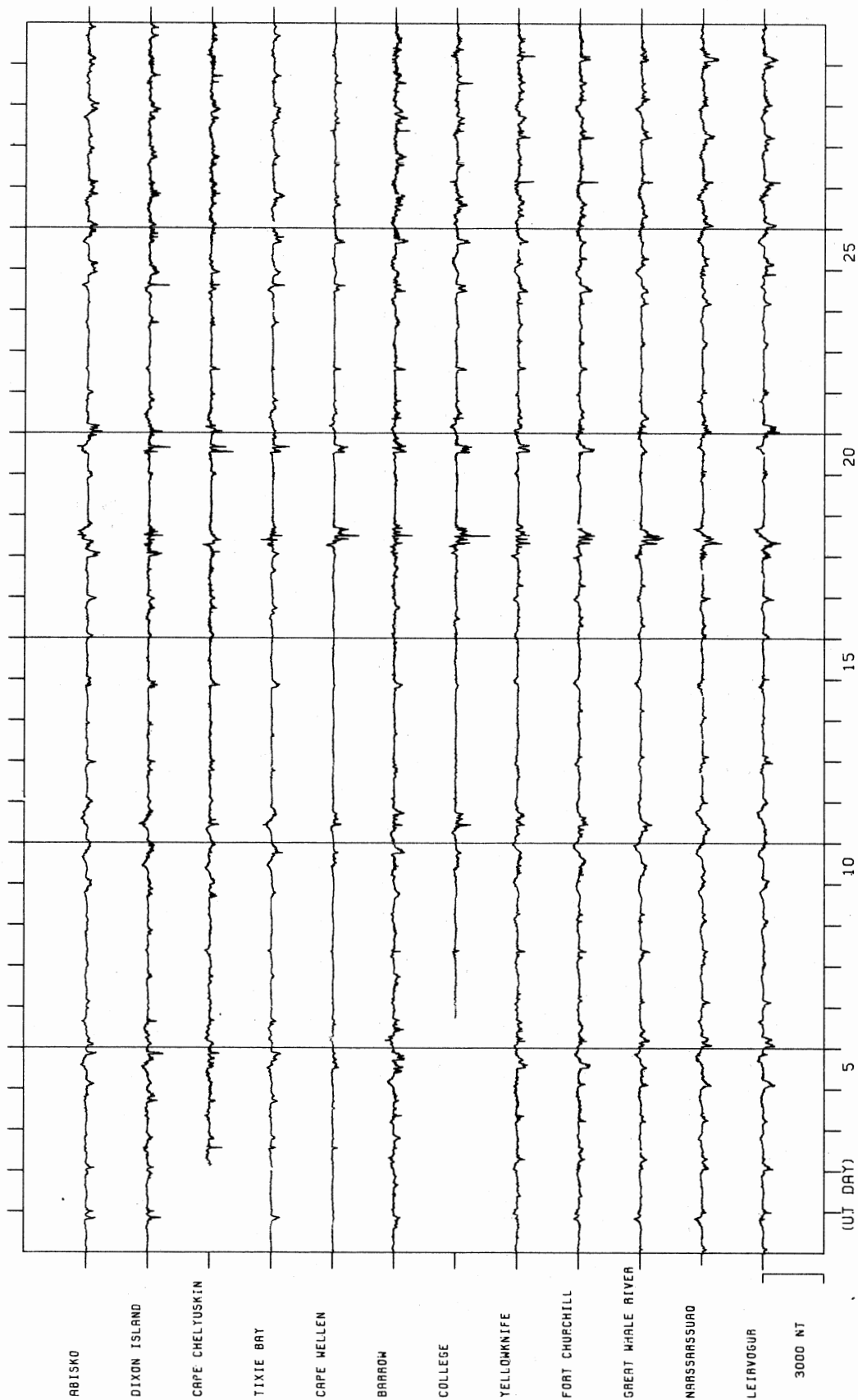
The H traces of magnetograms from AE(12) stations
in every month from July to December 1979.



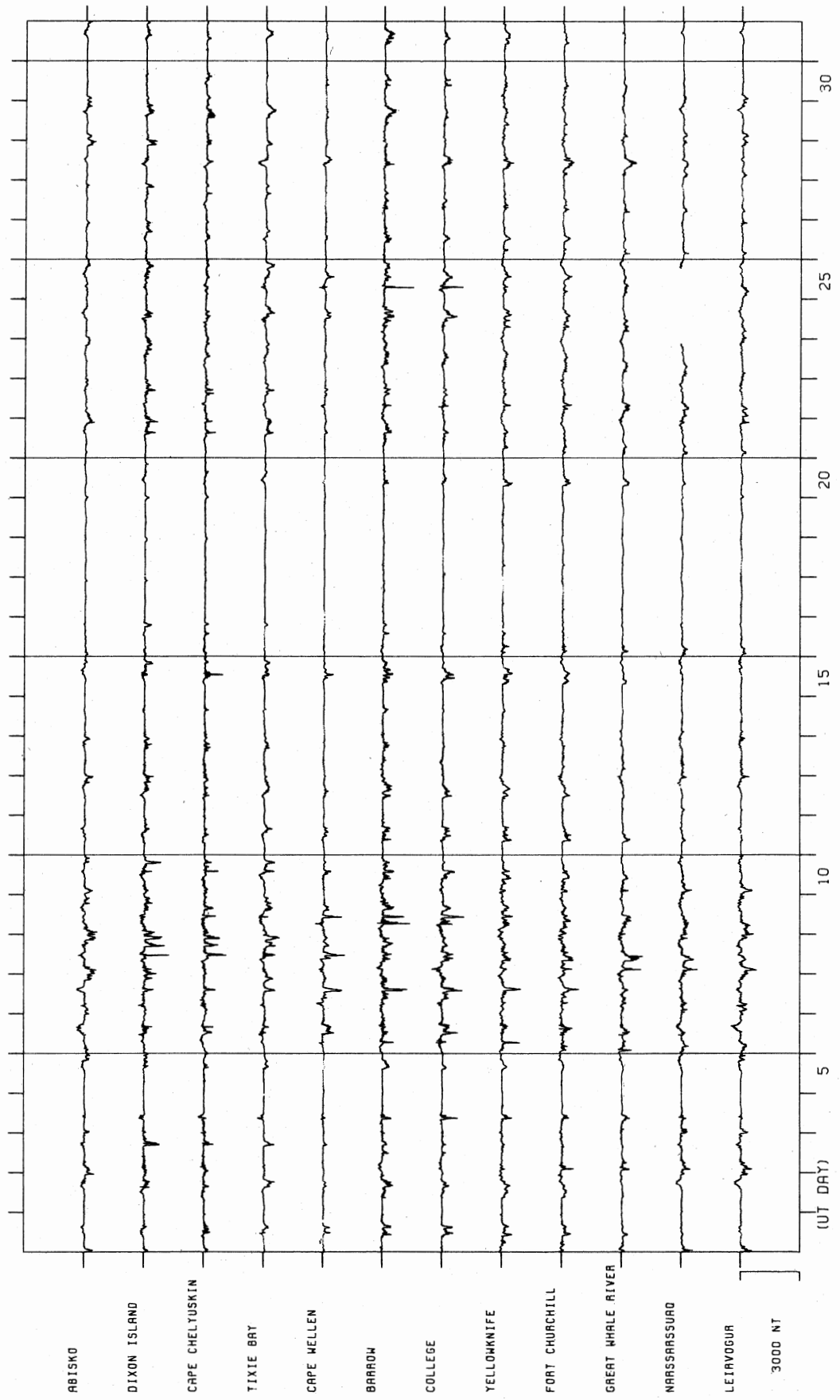
STACKED COMMON SCALE MAGNETOGRAMS FOR JULY 1979



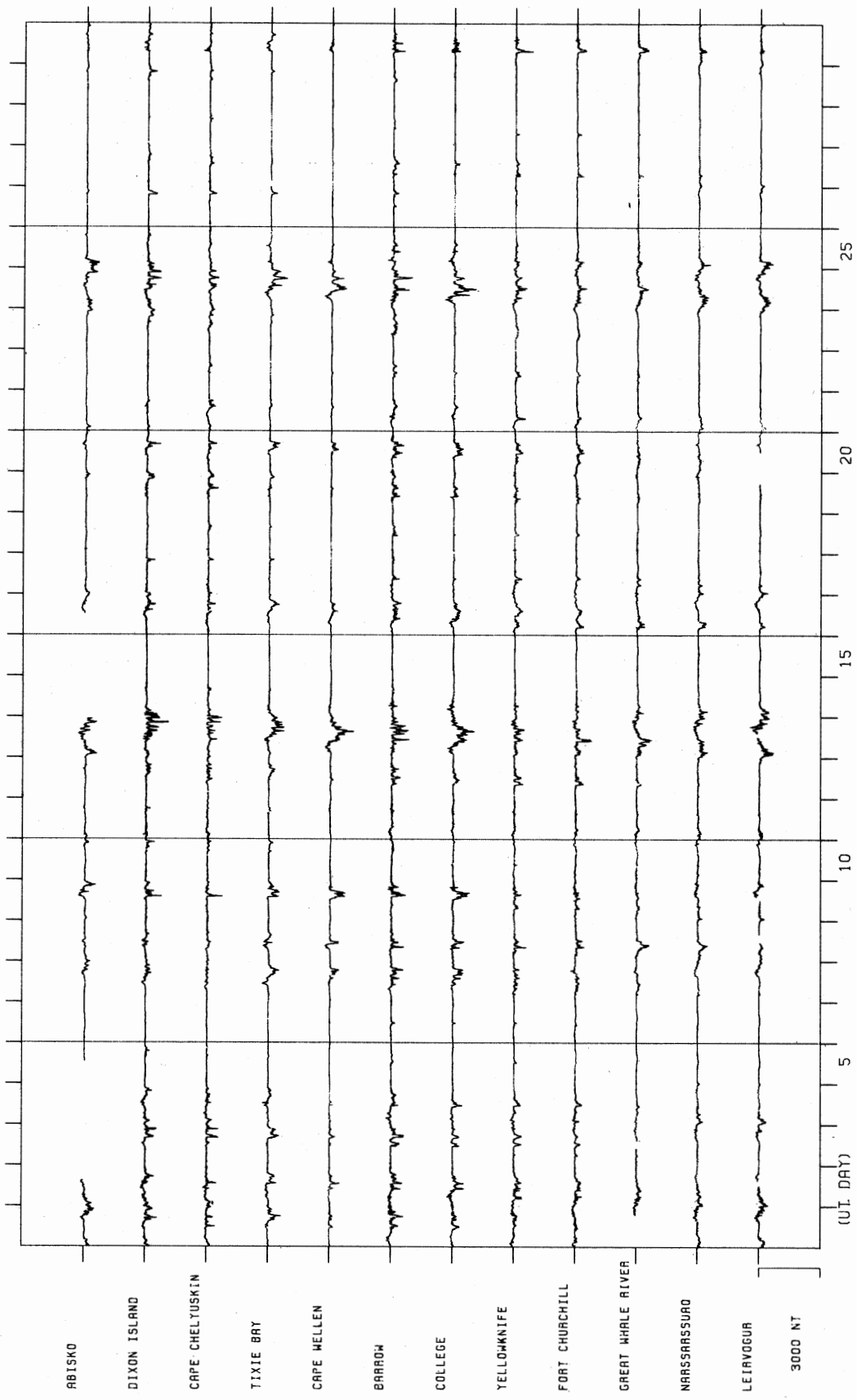
STACKED COMMON SCALE MAGNETOGRAMS FOR AUGUST 1979



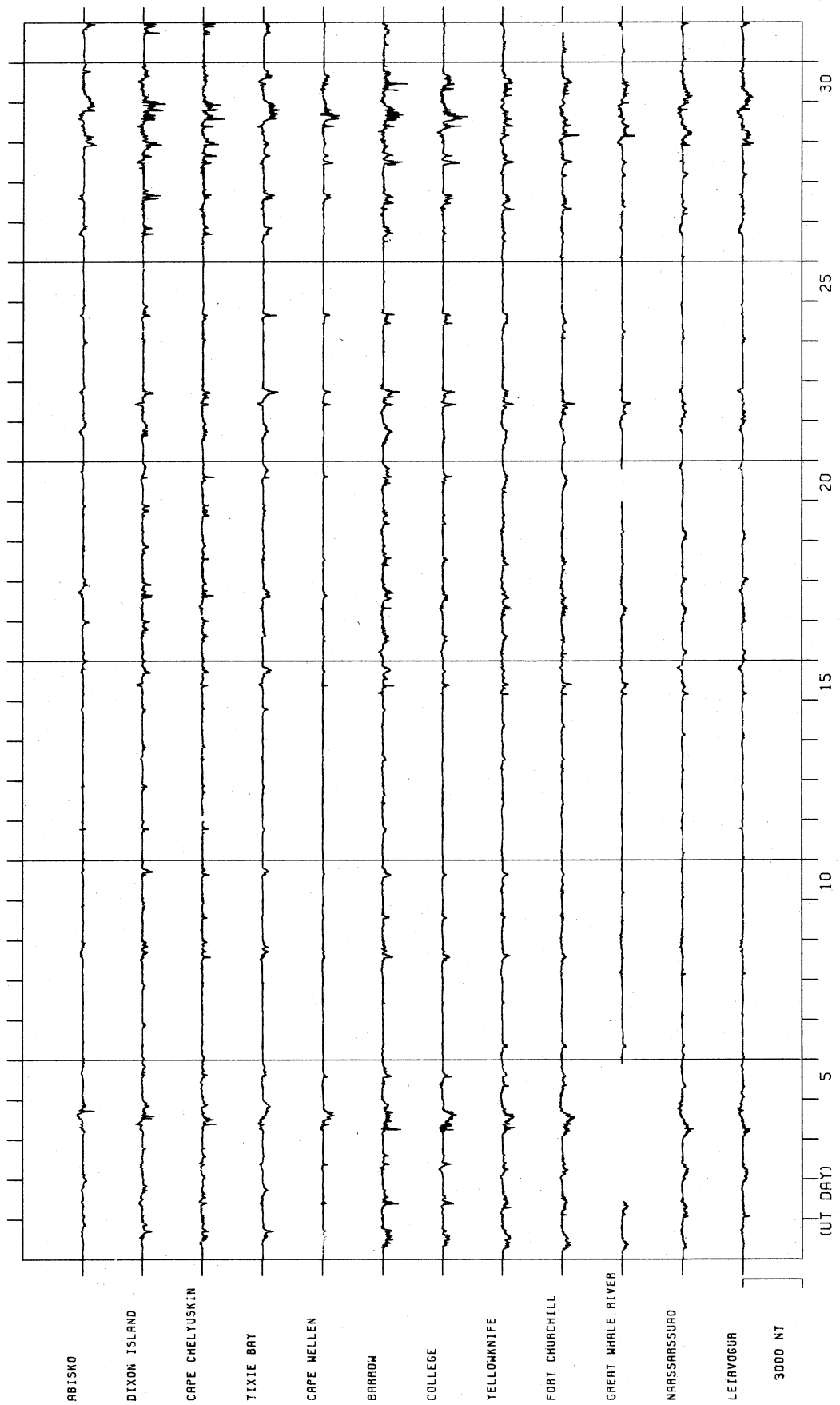
STACKED COMMON SCALE MAGNETOGRAMS FOR SEPTEMBER 1979



STACKED COMMON SCALE MAGNETOGRAMS FOR OCTOBER 1979



STACKED COMMON SCALE MAGNETOGRAMS FOR NOVEMBER 1979



STACKED COMMON SCALE MAGNETOGRAMS FOR DECEMBER 1979

Appendix

Digitizing System at the WDC-C2 for Geomagnetism

Kyoto University

1. Introduction

This is a brief description of the digitizing system at our data center. This system is used to digitize the ordinary magnetograms to derive AE indices for 1978 and 1979. The system can be used for similar digitizing jobs, but some minor changes may be necessary for other purposes. This is a special system with minicomputer, but techniques used in this system are also useful to other systems.

Fig. 1 illustrates the hardware at our data center. In many applications, more simple hardware may be enough. So we list some check points to construct a new digitizing system. First, the size of the CPU depends upon if the system is used only for digitization or used also for data processing. For the former, a small CPU will be enough without many peripherals or high speed channels. Second, the most important point is, of course, the selection of digitizer. We used a sonic digitizer because this allows correction of the original data before digitization, and also this can digitize ones on microfilm directly. Most common digitizer does not allow digitization of ones on microfilms but those on paper prints. The digitizer must be suitable in size for the object figure, and must have enough resolution and stability. The digitizer may not be computer controlled, but the output from the digitizer must be connected to the computer through a high speed channel or through a high speed communication line.

The output of the CPU (or the digitizer itself) must be recorded on large external memories like magnetic tapes or disks. And, the recording speed must be fast enough to keep up with the input speed. It is recommended to install a high speed graphic display which allows a quick look check of the digitized data.

2. Characteristics of the analogue data

We must know the characteristics of the analogue data to make digitization with necessary accuracy. This system is designed to digitize what

we call normal-run magnetograms. Fig. 2 shows a copy of typical normal-run magnetograms. These magnetograms are recorded at stations more than 100 all over the world. These records are microfilmed and collected at the World Data Centers since the IGY (1957-58). Many magnetic observatories have older data before the IGY and some of them are also available at the WDCs.

The format of the normal-run magnetograms varies by the observatory or the sponsoring agency of the station. Main features of the normal-run magnetograms are as follows: 1) They are usually recorded on a photographic paper or chart at a speed of 20 mm/hour. 2) One day (24 hours) data is recorded on one frame. The record is replaced manually by the operator of the station every day. 3) The magnetic 3 components (either H,D,Z or X,Y, Z) are recorded on one frame. 4) Time marks are recorded at every UT (or sometimes LT) hour. There are two ways to record the time marks; one is to record a straight time-line on the record, and the other is to make the data unrecorded for about one minute. Time marks are also used to show one axis of the record and the time marks are usually recorded from edge to edge of the frame. 5) Every record has at least two base lines to show the constant data values. These base lines are also used to show another axis of the record. The scale value (sensitivity) is determined by each station and each component, and is calibrated at least once a month. 6) The treatment of scale-out data also varies by the station. Some stations use La-Cour type mechanism which allow the scale-out data be recorded as shifted data so that the scale-out data are seen on the same paper. Some stations record another magnetograms (insensitive or storm magnetogram) together with the ordinary magnetograms.

The quality of the record differs greatly by the stations. And, overlapping of the components, scale-out of the data, missing data or thin traces are inevitable for almost all stations. Especially, the records from the auroral-zone stations have more trouble of these kinds, because of very large disturbances and very severe natural environments.

From our experience we know that each station has 1 to 5 % non-readable periods including no-record period or trouble of microfilm, and we usually recover the data by shifting the scale-out data, or by using insensitive recording, or rewriting complicated crossing data with the help of comments written on the sheet.

3. Design of our digitizing system

As mentioned above, every station has some kinds of trouble and many of them are correctable or recoverable manually, so we selected a semi-automatic reading for this system to allow manual selection of data availability and to allow manual correction of data as handy as possible. We can use a full automatic reader for some high quality data, but the quality of magnetograms from AE stations is not so good to use such a convenient reader. And even if we apply a full automatic reader, we need much time to check the quality of the data and to correct errors. Recently, some observatories are taking digital data directly and can supply 1 minute data on magnetic tape. Although old AE indices are derived for hourly or 2.5 minute values, 1 minute values are more convenient to compare with data observed by satellites. It is usually very hard to digitize exact 1 minute values from normal-run magnetograms, but we developed a system to obtain 1 minute values from the normal-run magnetograms.

The most common digitizing system make use of what is called "tablet" digitizing sensors. In our case, however, most of the input analogue data are available on microfilm. If we make prints from the microfilm, the cost of photographic printing may be too large, and the quality of the print will become more worse than that of microfilm (see Fig. 2). For this reason we preferred a sonic digitizing sensor. The sonic digitizer consists of a positioning pen which emits electric spark near the top end, and two microphone arrays which receive sound pulse from the pen. The time-lags of the spark determines the position in X,Y coordinates of the pen. The digitizer of this type can be used with microfilm reader screen instead of non-transparent tablet. By using this sensor we can omit a photographic processing, though it has demerits of instability of sparks and difficulty of adjustment of sparks. To decrease these demerits, we designed a software to read as many digitized points as possible and to increase fidelity of the digitizer by averaging these data points according to the significance of the data points.

4. Details of each program (operation phase)

Fig. 3 shows the flow of data processing in this system.

(A) Curve tracing

In this phase, the operator sets microfilm to the reader and feeds necessary informations to the system using a key-board written on the

curve reader (on the screen of the microfilm reader). Then the operator points 3 basic points and starts tracing. The program has 3 modes; i.e., 1) information input, 2) basic points, and 3) curve tracing. The operator selects one of these modes and can start and stop each action at any time.

In the tracing mode the system records all the data which the operator feeds by pushing the pointing pen onto the screen. The sensor reads the position of the pen every 0.001 sec to 2 sec. This sampling rate is set by the operator, and about 0.05 sec sampling rate is used in our system, because this sampling rate is enough to get reliable final result and not too fast for the CPU to miss data processing or data transfer. If this sampling rate is too low and the operator moves the pen too fast, the system loses the detailed variation on the record. If it is too high, on the other hand, the system may not be able to follow the data input. Especially, the external memory (magnetic tape or disk) must be fast enough to follow data input and must have enough capacity to record the data.

(B) Base value reading

The trace program is made to be convenient in tracing the data and in that phase the operator just gives 3 basic points. In this phase the operator gives the precise informations to determine the exact (absolute if possible) value of the 3 basic points. Usually, this phase is not necessary for every digitizing data, because the base line value and the scale factor does not change for several months. So each basic point is selected one of the crossing points of time marks and base lines.

Usually one base line value is known as H_0 , but another base line value is not known for the H component, scale value is known instead. So this program reads the H value of the another base line (denoted by D_0 or Z_0 on the magnetogram).

By using the length of the ruler recorded on the magnetogram, scale value and H_0 value, the base value for another base line is determined and every point on the magnetogram can then be able to be converted to time value for the H component.

Base line values are read at least 12 times for a station month. Average value and their standard deviation is calculated and checked, and only reliable value is used as the base line value. If any change of base line value or scale value is recognized or shown as a comment on the magnetogram, base line values are read more frequently and checked.

(C) Quality check

The raw data just read by the tracing program may have some spikes caused by some instability of the digitizing sensors and may have some miss-read data. This program checks and shows these data by detecting discontinuity in the raw data. Also, this program deletes single spikes from the data (but not continuous spikes). The operator can delete wrong data using a correction program.

(D) Smoothing and normalization

The raw data and the cleaned-up data show the data as the X and Y position on the microfilm reader. This program converts the position into the value and time. To have better quality, every point is weighted by the continuity of the data and averaged to give the final one minute values.

(E) Correction program

Raw, cleaned and smoothed data can have some errors because of machine troubles or operation errors. The correction program helps operator to make necessary corrections of the data by conversation with the graphic display.

5. Performance of this system

(A) Digitization speed

It takes 3 to 5 minutes to digitize (trace) one frame of the normal-run magnetograms.

(B) Rate of occurrence of unstable reading and rejection rate of spikes

From our experience, unstable reading occurs once every 100,000 points. 98 % of these unstable reading are deleted by the quality check program. Even if these data cannot be deleted by the program, the effect of the unstable reading is very small because of low weight of the unstable data point.

(C) Resolution

The reading system has 4000 (for X) x 3000 (for Y) resolution points on the effective screen of the microfilm reader. Usually the operator can pick up points within 2 resolution points (standard deviation). This resolution is about ± 40 sec of temporal resolution and ± 3 nT of H component on the ordinary magnetograms from the AE stations. But, because of many troubles of the records, final data may have temporal accuracy of ± 2 min, and accuracy of data may be improved if we can use the original magnetograms instead of the microfilm copy of them.

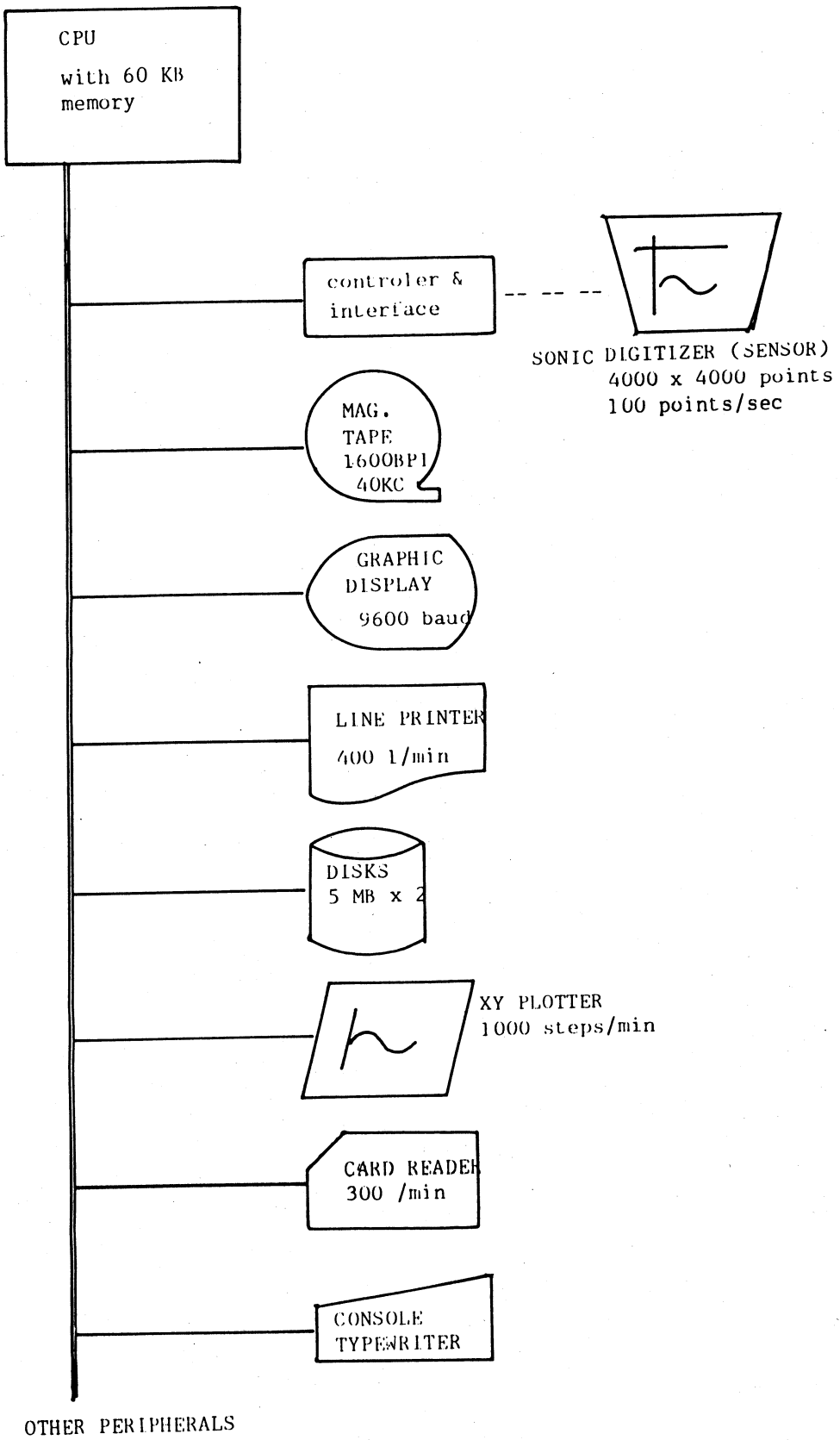


Fig. 1 Hardware

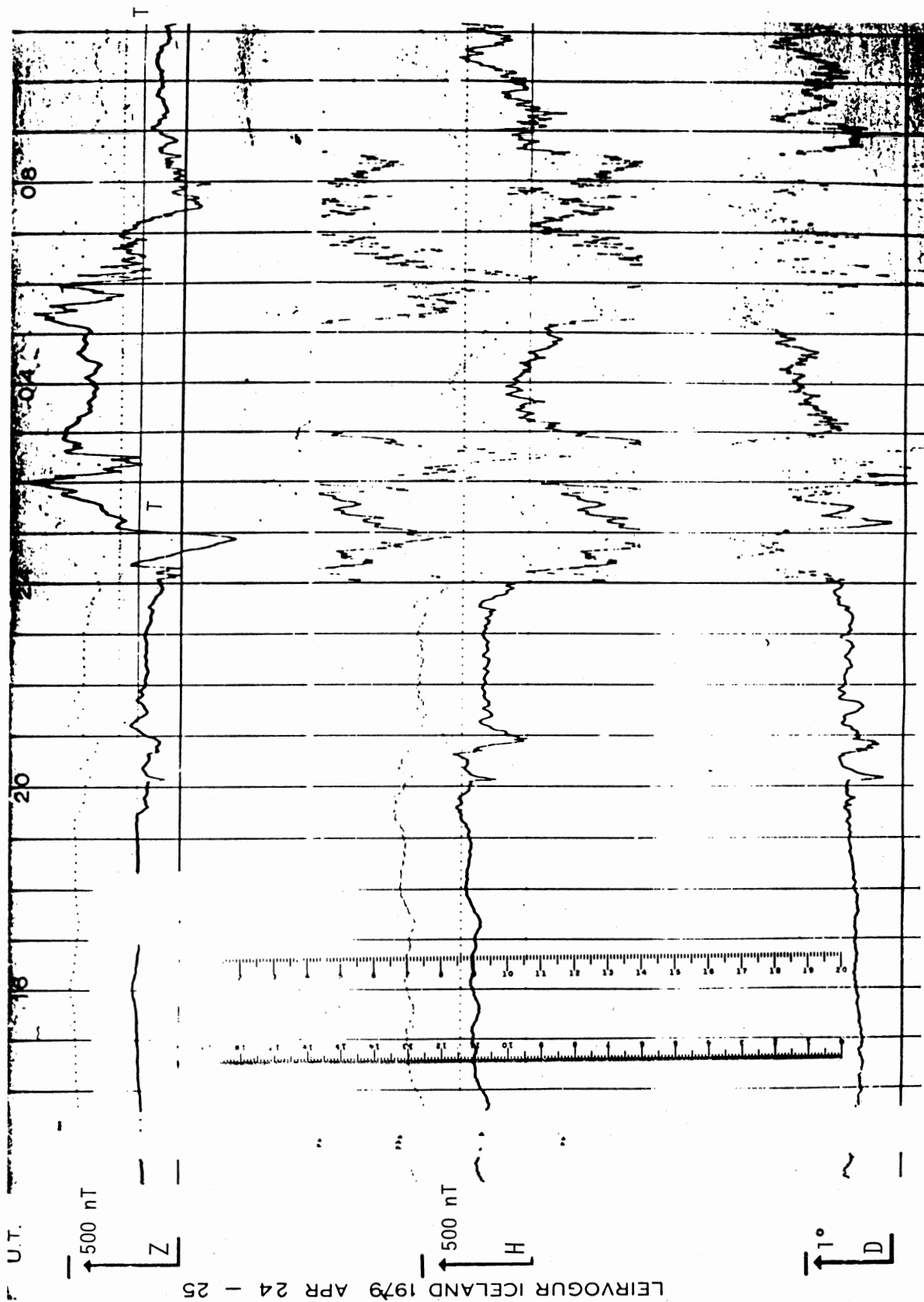


Fig. 2 An example of ordinary magnetogram

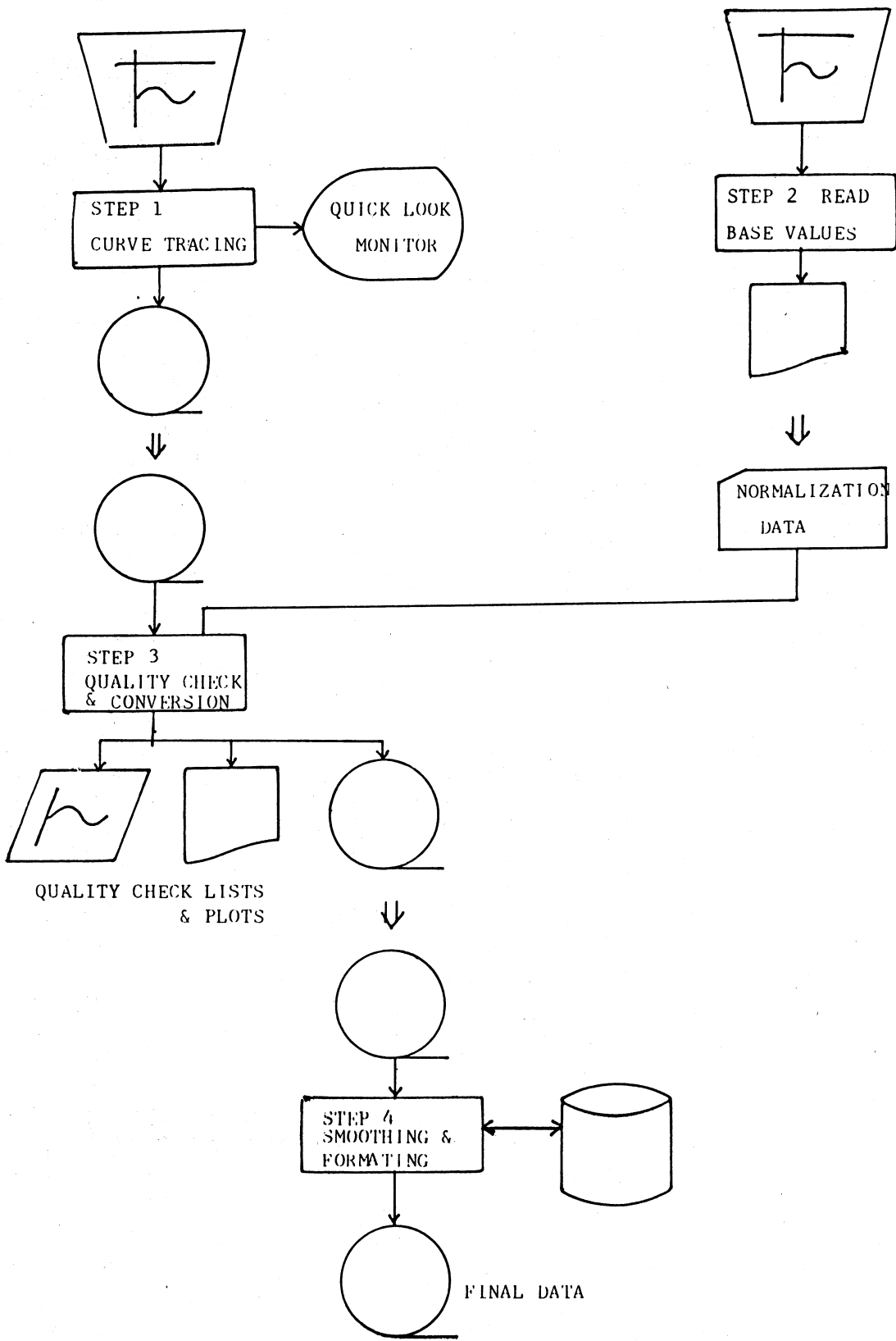


Fig. 3 Digitization

