JOHNS HOPKINS
UNIVERSITY

Applied Physics Laboratory
11100 Johns Hopkins Road
Laurel MD 20723-6099
240-228-5000 / Washington
443-778-5000 / Baltimore

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Notice to IMP-8 Merge CD Recipients:

Personnel at NSSDC discovered that Merge CD 009, which should contain files for 1975, days 133-216, actually contains data for 1976, days 133-216. The enclosed CD is the correct version of Merge CD 009. You can discard the previous version. Also enclosed is a copy of the most recent version of the Merge description file 0000_readme.txt.

Please direct inquiries regarding the Merge data set to Rob Decker:

e-mail: robert.decker@jhuapl.edu
phone: 240-228-8696
fax: 240-228-6670
address:
Applied Physics Laboratory
The Johns Hopkins University
11100 Johns Hopkins Road
Laurel, Maryland 20723-6099

Further information pertaining to the IMP-8 Merge project, instrumental details, data formats, etc., can be accessed at the Web site, *JHU/APL IMP-8 Charged Particle Measurement Experiment (CPME) & Energetic Particle Experiment (EPE),* at new URL

http://sd-www.jhuapl.edu/IMP/imp_index.html

A subset of Merge data is also online at NSSDC (in compressed text format) at

http://nssdc.gsfc.nasa.gov/space/ndads/spycat.html

(Press the "IMP-8" request button to go to the IMP-8 data availability page.)

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*          IMP-8 MERGE DATA:         *
*          USER INFORMATION          *
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I. BACKGROUND INFORMATION

The IMP-8 satellite was launched on 26 October 1973 into a nearly circular orbit about the Earth at a radius ~35 Earth radii. IMP-8 spends 60+% of each orbit in the solar wind, with the rest of the time in the magnetosheath/magnetosphere. It is a spin-stabilized spacecraft, with its spin vector nearly perpendicular to the ecliptic plane, and a spin rate of 24 rpm.

The purpose of the MERGE program is to combine or merge data from four instruments on IMP-8. A so-called MERGE record contains these data on a time resolution of 20 seconds. The four IMP-8 experiments whose data are part of the MERGE data set include two energetic charged particle measurement instruments, a magnetic field measurement instrument, and a solar wind plasma measurement instrument. Brief descriptions of the four experiments are given below.

II. EXPERIMENTS

The following sections A-D contain summary information for the four instruments whose data are contained in a MERGE record. Instrument summary descriptions are adapted from those on file at NSSDC under "IMP-8 Project Information."

A. CHARGE PARTICLE MEASUREMENTS EXPERIMENT (CPME)
Current P.I. (Institution): R. B. Decker (JHU/APL)
MERGE name (time resolution used): CPME (20.48 sec.)

CPME Summary Description:
Three solid-state detectors in an anticoincidence plastic scintillator observe electrons between 0.2 and 2.5 MeV; protons between 0.3 and 500 MeV; alpha particles between 2.0 and 200 MeV; heavy particles with Z values ranging from 2 to 5 with energies greater than 8 MeV; heavy particles with Z values ranging between 6 and 8 with energies greater than 32 MeV; and integral protons and alphas of energies greater than 50 MeV/nucleon, all with dynamic ranges of 1 to 1E+06 particles per (sq cm-s-sr). Five thin-window Geiger-Mueller tubes observe electrons of energy greater than 15 keV, protons of energy greater than 250 keV, and X-rays with wavelengths between 2 and 10 A, all with a dynamic range of 10 to 1E+08 per (sq cm-s-sr). Particles and X-rays, primarily of solar origin, are studied, but the dynamic range and resolution of the instrument also permits observation of cosmic rays and magnetotail particles.

Further Information:
(i) Sarris, E. T. et al., J. Geophys. Res., v. 81, p. 2341, 1976.
(ii) T. P. Armstrong et al., J. Geophys. Res., v. 83, p. 5198, 1978.

B. ENERGETIC PARTICLES EXPERIMENT (EPE)
Current P.I. (Institution): D.J. Williams (JHU/APL)
MERGE name (time resolution used): EPE (approx. 20 sec.)

EPE Summary Description:

The purposes of this investigation are (1) to study the propagation characteristics of solar cosmic rays through the interplanetary medium over the energy ranges indicated below, (2) to study electron and proton fluxes throughout the geomagnetic tail and near the flanks of the magnetosphere, and (3) to study the entry of solar cosmic rays into the magnetosphere. The instrumentation consists of a three-element telescope using fully depleted surface-barrier solid-state detectors and a magnet to deflect electrons. Two side-mounted detectors are used to measure the deflected electrons. Two additional detectors in separate mounts are used to measure charged particles above 15 keV (detector F), Z greater than or equal to 2 above 0.6 MeV (detector G1) and above 1.0 MeV (detector G2), and Z greater than or equal to 3 above 2.0 MeV (detector G3). The telescope measures protons in three ranges between 2.1 and 25 MeV; Z greater than or equal to 1 in three ranges between 0.05 and 2.1 MeV; alpha particles between 8.4 and 35.0 MeV in two ranges; Z greater than or equal to 2 between 2.2 and 8.4 MeV; and a background channel. Deflected electrons are measured in two ranges between 30 and 200 keV.

Further Information:
D. J. Williams, NOAA Technical Report ERL 393-SEL 40, October 1977.

C. MAGNETIC FIELD EXPERIMENT
Current P.I. (Institution): R. P. Lepping (NASA/GSFC)
MERGE name (time resolution used): MAG (15.36 sec.)

MAG Summary Description:
This experiment consists of a boom-mounted triaxial fluxgate magnetometer designed to study the interplanetary and geomagnetic tail magnetic fields. Each sensor has three dynamic ranges of plus or minus 12, plus or minus 36, and plus or minus 108 nT. With the aid of a bit compaction scheme (delta modulation), 25 vector measurements are made and telemetered per second. The experiment operated normally from launch until mid-1975. On July 11, 1975, because of a range indicator problem, the experiment operation was frozen into the 36-nT range. The digitization accuracy in this range is about plus or minus 0.3 nT. On March 23, 1978, the sensor flipper failed. After that time, alternative methods of Z-axis sensor zero-level determination were required.

D. SOLAR PLASMA FARADAY CUP
Current P.I. (Institution): A. J. Lazarus (MIT)
MERGE name (time resolution used): PLS (approx. 1 min.)

PLS Summary Description:
A modulated split-collector Faraday cup, perpendicular to the spacecraft spin axis, is used to study the directional intensity of positive ions and electrons in the solar wind, transition region, and magnetotail. Electrons are studied in eight logarithmically equispaced energy channels between 17 eV and 7 keV. Positive ions are studied in eight channels between 50 eV and 7 keV. A spectrum is obtained every eight spacecraft revolutions. Angular information is obtained in either 15 equally spaced intervals during a 360-deg revolution of the satellite or in 15 angular segments centered more closely about the spacecraft-sun line.

III. MERGE RECORD AND FILE FORMATS

The MERGE files were produced at The Johns Hopkins University Applied Physics Laboratory (JHU/APL). All original MERGE software was written by P. R. Briggs (The Citadel). Current MERGE files were created using a version of this software as modified by R. B. Decker (JHU/APL), who is the point of contact regarding any problems/questions related to the MERGE software and data.

Each MERGE record contains 425 VAX-native floating point (real*4) values (1700 bytes/record). The four data files from the four separate instruments (see II above) were read, combined, and the merged records written using a FORTRAN program named MRG3.FOR. The records were written with an unformatted FORTRAN write, with the output file format defined by the FORTRAN OPEN statement:

```
      OPEN (unit=50, name=mrg3_data, form='unformatted',
     *       status='new', recordtype='fixed', recordsize=425)
```

IV. IMP-8 20-SECOND AVERAGE MERGE RECORD CONTENTS

The table below defines the MERGE record layout. Each of the 425 real*4 values (item number) is associated with a particular data value (see description). The time resolution of each MERGE record is 20 sec.

Notes:

(1) Created by FORTRAN source program MRG3.FOR.
(2) All items are in native VAX binary real*4 format.
(3) DQF = Data Quality Flag.
(4) This file last changed: 18-Mar-98

Item(s)		Description	
A. HEADER			
1		Type of record (equal to averaging interval in units of 20.48 seconds (e.g., for 5-minute averages, #1 = 15.0)	
2		Data completeness flag; indicates which types of info. are present on this record:	
	#2 =1.0	CPME only	= 0001
	=2.0	MAG only	= 0010
	=3.0	CPME, MAG only	= 0011
	=4.0	EPE only	= 0100
	=5.0	CPME, EPE only	= 0101
	=6.0	EPE, MAG only	= 0110
	=7.0	EPE, MAG,CPME	= 0111
	=8.0	SW only	= 1000
	=9.0	SW, CPME only	= 1001
	=10.0	SW, MAG only	= 1010
	=11.0	SW, CPME, MAG	= 1011
	=12.0	SW, EPE only	= 1100
	=13.0	SW, EPE, CPME	= 1101
	=14.0	SW, EPE, MAG	= 1110
	=15.0	SW, EPE, MAG, CPME	= 1111
	=16.0-31.0	Other data present	
3		Number of 20.48-second CPME averages merged on this record; #3 can run from 0.0 (NO records -> fill) up to the amount in #1	
4		Number of 15.36 sec. MAG records averaged in this record	
5		Number of 20.48 sec. EPE records averaged in this record	
6		Number of ~1 minute PLS records in this record	
7		Number of other data records in this record	

8	Year of record (4-digit, e.g. 1978.)
9	Day of record (Jan 1 = 1.0)
10	Hour of day for this record (0.0 - 23.0)
11	Minute of hour for this record (0.0 - 59.0)
12	Seconds elapsed during this minute (0.0 - 60.0)
13-15	Spacecraft's x, y, z position in Geocentric Solar Ecliptic coordinates (GSE); in kilometers
16-18	Spacecraft's x, y, z position in Geocentric Solar Magnetospheric coordinates (GSM); in kilometers
19-21	Spacecraft's x, y, z position in Geocentric Equatorial Inertial coordinates (GEI); in kilometers
22	Radial distance of spacecraft from center of Earth; in kilometers
23,24	Right Ascension and Declination of spacecraft in Celestial Inertial coordinates (CI); in degrees
25,26	Right Ascension and Declination of spacecraft's velocity vector in Celestial Inertial coordinates (CI); in degrees
27-29	Moon's position in Geocentric Solar Ecliptic coordinates (GSE); in kilometers
30-32	Sun's position in Geocentric Equatorial Inertial coordinates (GEI); in AU

B. CPME DATA

	Rate channels:
33	P1
34	P2
35	P3
36	P4
37	P5
38	Z4 (for IMP 8)
39	P7
40	P8
41	P9
42	P10
43	P11
44	A1
45	A2
46	A3
47	A4
48	A5
49	A6
50	Z1
51	Z1' (= Z1 - Z2)
52	Z2
53	Z3
54	E4
55	E5
56	E6
57	M
58	S
59-84	uncertainties of #33 - #58
85-110	number of records for #33 - #58
111	P1 (first 10.24 seconds of this interval)
112	P2 (first 10.24 seconds of this interval)
113	P3 (first 10.24 seconds of this interval)
114	E4 (first 10.24 seconds of this interval)
115	E5 (first 10.24 seconds of this interval)
116	E6 (first 10.24 seconds of this interval)
117-122	Uncertainties of #111 - #116
123-128	DQF's (Data Quality Flag) for #111 - #116
129	P1 (second 10.24 seconds of this interval)
130	P2 (second 10.24 seconds of this interval)
131	P3 (second 10.24 seconds of this interval)
132	E4 (second 10.24 seconds of this interval)

133	E5 (second 10.24 seconds of this interval)
134	E6 (second 10.24 seconds of this interval)
135-140	Uncertainties of #129 - #134
141-146	DQF's for #129 - #134
147-154	P1 sectors 1 - 8 (first 10.24 seconds of this interval)
155-162	Uncertainties of #147 - #154
163	DQF for #147 - #154
164-171	P1 sectors 1 - 8 (second 10.24 seconds of this interval)
172-179	Uncertainties of #164 - #171
180	DQF for #164 - #171
181-188	E4 sectors 1 - 8 (first 10.24 seconds of this interval)
189-196	Uncertainties of #181 - #188
197	DQF for #181 - #188
198-205	E4 sectors 1 - 8 (second 10.24 seconds of this interval)
206-213	Uncertainties of #198 - #205
214	DQF for #198 - #205
215-222	A1 sectors 1 - 8
223-230	Uncertainties of #215 - #222
231	DQF for #215 - #222
232-239	A3 sectors 1 - 8
240-247	Uncertainties of #232 - #239
248	DQF for #232 - #239
249-256	Z1 sectors 1 - 8
257-264	Uncertainties of #249 - #256
265	DQF for #249 - #256
266-273	Z2 sectors 1 - 8
274-281	Uncertainties of #266 - #273
282	DQF for #266 - #273
283	S/C clock
284	Pseudo Sequence Counter

C. MAGNETIC FIELD DATA

1. INTERPOLATED (WEIGHTED AVERAGE) DATA

285-287	Magnetic field vector components (Bx, By, Bz) in GSE coordinates, in nT
288	Average vector field magnitude, in nT
289	Polar angle of vector-average magnetic field as measured from +Z_GSE axis, in degrees
290	Azimuth of vector-average magnetic field in GSE coordinates, in degrees
291-296	Uncertainties of #285 - #290
297	Average of field magnitudes, performed over record interval
298-300	Magnetic field vector components (Bx, By, Bz) in GSM coordinates, in nT
301	Polar angle of vector-average magnetic field as measured from +Z_GSM axis, in degrees
302	Azimuth of vector-average magnetic field in GSM coordinates, in degrees

2. RAW AVERAGE DATA

303	Number of 15.36-second magnetic field records used in interpolation (0.0 - 3.0)
304	Offset time for first mag field record (MAG - CPME)
305-307	Bx, By, Bz (GSE) from first record, in nT
308-310	Rms uncertainties of Bx, By, Bz (#305 - #307)
311	Offset time for second mag field record
312-314	Bx, By, Bz (GSE) from second record, in nT
315-317	Rms uncertainties of Bx, By, Bz (#312 - #314)

318	Offset time for third mag field record
319-321	Bx, By, Bz (GSE) from third record, in nT
322-324	Rms uncertainties of Bx, By, Bz (#319 - #321)

D. EPE DATA

325-340	L1 (counts), sectors 1 - 16
341-356	L2 (counts), sectors 1 - 16
357-372	1973/303 - 1989/365: L7 (counts), sectors 1 - 16 1990/001 - onwards : F (counts), sectors 1 - 16
373-388	1973/303 - 1989/365: L8 (counts), sectors 1 - 16 1990/001 - onwards : L7 (counts), sectors 1 - 16
389-404	1973/303 - 1989/365: F (counts), sectors 1 - 16 1990/001 - onwards : L8 (counts), sectors 1 - 16
405	EPE offset time, (EPE record time - CPME record time), in sec

E. SOLAR WIND (SW) PLASMA DATA

406	Source i.d. for plasma data: #406 = 1.0 MIT, acquisition mode = 2.0 MIT, tracking mode = 3.0 MIT, non-tracking mode = 4.0 MIT, no data = 5.0 LANL data
407	SW offset time, (SW record time - CPME record time), in sec
408	Raw averaging interval for SW records, in sec
409	Solar wind velocity, in km/sec
410	Plasma temperature, in K
411	Ion number density, in no./cc
412	Solar wind flow latitude (>0 from South of Sun), in degrees
413	Solar wind flow longitude (>0 from West of Sun), in degrees
414-418	For MIT high-resolution data, data quality flags for items #409 - 413, e.g.: #409 = 0.0 bad data = 1.0 good data

F. OTHER DATA (OPTIONAL)

419	Kp index
420	AE index
421	C9 index
422	Dst index
423	Sunspot index
424-425	Spares
