International Council of Scientific Unions

SPECIAL COMMITTEE
ON
SOLAR-TERRESTRIAL PHYSICS

78-5

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IMS NEWSLETTER

Nature and IMS meetings combined to change our plans for this NL 78-5. The solar flares of 28-30 April were exciting to follow; the notes from Miami make clear that the events of the July and September 1977 disturbances may yield a well-documented composite of the magnetosphere during those times. Actualities will return next month.

IMSCIE Office: Telex 45897 SOLTERWARN BDR
Telephone: 303-499-1000 x6501 (FTS 323-6501)
IMS Satellite Situation Center (J. Vette): Telex 89675 NASCOM GBLT
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PROGRAM PLANS FOR MAY 1978 - JULY 1978

SPECIAL IMS HIGH-ALTITUDE SATELLITE PERIODS - 1978

Special IMS High-Altitude Satellite Intervals for May-June 1978 are given here. On page 4 of IMS NL78-2 details are given listing all the SSC-selected Special Satellite intervals for January-June 1978 and the configurations that were the basis for this designation by the IMS Satellite Situation Center. Times of the intervals given below were extended by six hours at start and end of each period from those given in the detailed table because the boundaries used in the exact model calculations may fluctuate during disturbances. Similar extended periods were announced for 1976 and 1977 in IMS/SSC Reports and IMS NLs.

9 May	129/0100 UT to 10 May 130/1700 UT	22 May	142/1200 UT to 23 May 143/1600 UT
31 May	151/1400 UT to 3 Jun 154/0500 UT	28 Jun	179/0600 UT to 29 Jun 180/0300 UT

SPECIAL LOW-ALTITUDE SATELLITE CONJUNCTIONS

See Program Details NL78-4 for special request in re coordinated satellite data acquisition intervals and copy of a typical recent satellite conjunction forecast telex sent to spacecraft experimenters and staff. Magnetic flux tube conjunction times have been forecast by the IMS SSC for GEOS, ISEE, and selected low-altitude satellites and ground-based arrays on a weekly basis. These forecasts have been distributed via telex from the IMSCIE Office to provide two or three week advance notice of opportunities for coordinated data acquisition. Generally, these messages are too numerous and lengthy to include in these NLs.

GROUND-BASED, BALLOON AND ROCKET CAMPAIGNS:

----------Phenomena-related Campaigns----------

------ to Sep 30; Ejiri, Kimura, Oya, & Nakamura; "AUSTRAL WINTER CAMPAIGN"; Syowa; ROCKETS(4)- NL 78-3
May 1 to May 31; A. Christensen; "18.102JUE"; White Sands; ROCKET - Nike-Tomahawk for plasma physics
May 1 to May 31; E.C. Zipf; "31.004UE"; White Sands; ROCKET - Nike-Orion for plasma physics study
Jun 1 to Jun 30; Smith, Morse, Kelley; "JASPIC"; Wallops Isl; ROCKETS (4) - See 78-4, pg 3 for details
Jun 1 to Jun 30; ????; "JASPIC"; Shipboard launches; ROCKETS (5) - See 78-4, pg 3 for details
Jun 30 to Aug 8; S. Ullaland; "SEARMO"; Scandinavia; BALLOONS (36) - details in NL 78-3, pg 4
Jul 1 to Jul 31; G. Thomas; "31.xxxUE"; White Sands; ROCKET - Nike-Orion for plasma physics
Jul 1 to Aug 31; R.H. Holzworth; "E-Field Summer 78"; Canada; BALLOONS (10) - see NL 78-3, pg 4
Jul 25 to Aug 15; L. Bjorn; "D-Layer Campaign"; Kiruna, ESRANGE; ROCKETS (8) - See below for details

------Quasi-synoptic Observations involving Balloons, Rockets, Aircraft, Selected Surface Campaigns------

Jun 1-14; Bauer, Evans; IISN; Global Network; SURFACE - See NL 78-2, pg 2 for details
Monthly; Wright & Hilsenrath; "OZONESONDE"; Various Sites; ROCKETS - See Actualities, NL 77-10, pg 3

----------Observing Plans for Temporary Surface Stations----------

Apr 20 to Oct 15; Siebert; "GEOMAGNETIC PULSATIONS"; N. Scandinavia; SURFACE - details in NL 78-2, pg 3
May 1 to Nov 30; K. Wilhelm; "GEOMAGNETIC PULSATION CAMPAIGN"; 20 W to 40 E; SURFACE - See below

REGIONAL IMS SAT/GBR PROGRAM DETAILS, MAY - JULY 1978

Program details for many brief listings given above appeared, as indicated, in earlier IMS NLs.

SATELLITES

GEOS-1 --- K. Knott sends word that 20 April was the first birthday of GEOS-1. The inversion maneuver was successfully completed on 10 April. The spacecraft is still very healthy. Except for solar array degradation, there are no signs of further radiation damage. The local time of apogee has reached midnight on 17 April. Apogee now drifts into the evening sector at an approximate rate of 0.88 degrees/day. With the help of the battery it is still possible to operate 6 experiments for the 9 hours during the European pass.

By telephone this week (after the major solar activity was over), K. Knott confirmed that discussions about shutting-down GEOS-1 had included the present week. It may be turned-off very soon; however, the last weeks of GEOS' operational lifetime may prove to have been the most interesting (certainly the most active) for future studies.

GEOS-2 --- The official launch date is still 22 June; however, recent delays in the Delta launcher from the Eastern Test Range (BSE and OTS) are casting some doubts on the possibility that this date can be met. Final spacecraft and experiment checkout successfully completed to 14 April. Spacecraft is being packed now and shipment to ETR will take place on 3 May.

ISEE --- K. Ogilvey rescheduled the high-bit-rate orbits so that #s 80 and 81 will be successive hbr orbits. This should provide maximum data acquisition during the activity arising from the recent solar flares (see pg 5). Keith reminds us that the ISEE program office will close after the successful launch of ISEE-C. From that time contact with ISEE experimenters will be by telex for operational matters and via the IMS Newsletter for scientific, general information, or other appropriate communications.

EXOS-A --- A. Nishida forwarded information about data and a report of observations by K. Hirao. Events during the December special IMS interval (1-15 Dec 1977) did not appear particularly exciting. The data from this time will be published in the middle of May. Japanese experimenters would appreciate solar wind and IMF data for these times.

Note on EXOS-A: The fifth scientific satellite which was planned under the name EXOS-A was successfully launched into orbit by rocket M-3H-2 on 4 Feb 1978 at 1600 UT. This satellite is named "KYOKKO" and its international designation number is 1978-014A.

KYOKKO was placed into approximately the planned orbit and gave us great confidence to proceed with our future scientific satellite plans. Its orbital elements at the epoch 27 Feb 0000 UT are the following:

Semi-major axis	:	8684.5 km
Eccentricity	:	0.19197
Inclination	:	65.36 deg
Long of Asc node	:	172.5 deg
Arg of Perigee	:	329.6 deg
Mean Anomaly	:	53.9 deg
Period	:	134.2 min

(Continued on pg 3)

(Continued from pg 2)

We planned the inclination around 65.39 deg to put the apogee to be near the north of the orbit after fall of 1978. In fact, the apogee is between 32 & 33 deg N now so the altitude at the north end of the orbit is still very low.

"KYOKKO" is the first of two satellites which we planned to launch to participate in the IMS, and we are very glad to be able to launch it at approximately the middle of the IMS period. KYOKKO was put under the field-aligned attitude control in its first orbit revolution; next day, in the 7th revolution we began tests of the observation equipment which do not need a high voltage power and we began some observations. In Syowa station of the National Inst of ,Polar Research, we succeeded in receiving the signals from the satellite since its 3rd revolution.

Since 23 Feb we have continuously received data from the plasma wave measurements, VLF, electron and proton measurements. During this period, we received through real time telemetry whistler waves which have very large dispersion and so-called dawn-chorus VLF waves very clearly. Beginning 24 Feb, the high voltage power was turned on with no problem for equipment in this order: 24 Feb - Aurora TV Camera; 25 Feb - electron energy analyzer; 27 Feb - ion mass spectrometers; and 28 Feb - UV airglow measurements. With these turned on, we confirmed all measurements are available. At Churchill, Canada a receiver and a command transmitter were constructed and checked and a part of data from the satellite were received. In March Churchill station became operational and from 10 March we were able to send commands to the satellite to enable routine observations at Churchill. We plan to receive data routinely from the satellite for four days, 4-5 times per day at Churchill. This decision is based on environmental limitations at the site.

At Syowa station we are receiving data from EXOS-A for 3 days per week, twice a day in winter (N. hemisphere). We plan to increase receiving hours at Syowa and decrease those at Churchill during austral winter.

At Uchinoura (Kagoshima) we hAve complicated reception hours because of the intersection of N-bound and S-bound orbits. On the average, we receive data for 6 days per week, 3 times a day using onboard data recorder. With the three stations, our data acquisition rate is supposed to approach 80%.

Following are the status of equipment using high voltage power supply: Aurora TV Camera is in very good condition. All variables such as shutter timing, etc. were set to proper values within the first 10 days after power-on. Auroral images obtained are now in processing. However, as we have not had enough time to calculate exact parameters of the satellite attitude and orbit position, we cannot yet identify the positions of the auroral images. Electron Energy Spectrum Analyzer is also in perfect condition. We frequently see precipitation of high energy electrons (KeV range) which seem to have correlations with the occurrence of aurora-like images obtained by the Aurora TV Camera mentioned above and with the occurrence of plasma waves. The Ion Mass Spectrometer hv-power supply works normally and we can see very clear separation of protons, helium ions, oxygen ions, etc. We now have the first operable on-board satellite Japanese ion mass spectrometer. The UV Airglow Analyzer is operating without problem and airglow spectra for He+ 304A, He 584A, O+ 833A, H 1216A and O 1304A have been measured. The exact spatial distribution of these airglow measurements will be determined by calculation of the satellite orbit and attitude.

The processing system for Kyokko data features a minicomputer (U-400) for quick look and prompt analysis of observed data. It is working normally and giving quick-look data and hardcopy output. Data transmission is divided into into two modes: NP and GL. In NP mode, electron density, temperature, and energy spectra are measured at a high data rate (2048 bps) and recorded by on-board data recorder for 140 min. In GL mode electron density, temp, and energy spectrum as well as ion mass spectrum, UV airglow, plasma waves and VLF waves are measured at a lower data rate (512 bps) and recorded on-board for 160 min. These recorded data are played back at a higher rate (8192 bps) and transmitted to Uchinoura for 9 min 58 sec. These data are analysed by the quick-look system and displayed on a CRT and hard copied simultaneously. Examples of the output are available for both NP and GL modes.

EXOS-A and its data acquisition are going very smoothly and we hope we will be able to discharge our responsibility of participating in the IMS. For the future, we are expecting cooperation with other experimenters, e.g. with Canadian experimenters to make simultaneous observations between ISIS-II Visible Aurora Camera and Kyokko UV Auroral Camera. We encourage questions and proposals from interested IMS scientists.

GMS --- The Geostationary Meteorological Satellite called "HIMAWARI" was launched 14 July 1977. After a period of testing, it began routine operation with continuous (24 hr/day) data acquisition starting 5 Feb 1978. In addition, special data recovery efforts have been made for data during 18-26 September 1977 and nearly all data of that period were obtained. Data quality is presently good except that some noisy channels obscure quiet times. For example, the quiet-time counting rate of channel P2 (4-8 MeV protons) is about 80 counts/cm sq/sec/sterad and this value should be taken as the noise level.

Dr. Kohno has given this office a brief technical description of the Himawari particle detectors (13 channels) with graphs of their detection efficiency and tables for converting counts to flux. We will be happy to share copies of this description with interested IMS participants. We note here that all sensors are directed perpendicular to the satellite spin axis which is parallel to the earth's axis.

GROUND-BASED, BALLOON, AND ROCKET CAMPAIGNS

Distributed Sites

GEOMAGNETIC PULSATIONS CAMPAIGN --- K. Wilhelm has provided an updated description of the postponed geomagnetic pulsation observation campaign at high latitudes to be performed by MPI fur Aeronomie in cooperation with the Univ of Tromso, Andoya Rocket Range, Univ of Iceland and the Meteorological Inst of Copenhagen. This revises slightly the detailed description in the CCOG Handbook, pgs 21-27. Six magnetometers are to be installed in two profiles crossing the auroral zone in a N-S direction. The profiles will complement/extend those of other IMS groups. Magnetic variations and pulsations in the H- and D-components of the geomagnetic field are recorded in a period range from 1-300 sec. The data is stored on magnetic tape. The networks will be close to the foot points of the magnetic field lines on which geostationary satellite GEOS-2 will be located when shifted from the geomagnetic longitude of Iceland to that of northern Sweden. Also, the summer 1978 SBARMO balloon project (see Program Notes) will take place in the area covered by the network.

Observations by this campaign should contribute to solution of the following problems:

1. Which are the excitation mechanisms of pulsations in the transition region between open and closed field lines on the dayside?

2. How far in longitude and latitude does the occurrence of those pulsations extend which are closely connected with the polar electrojet?

3. How does the ionosphere act on pulsations

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IMS WORKING MEETING IN MIAMI

At the Spring AGU Meeting in Miami there was an evening workshop bringing together a number of experimenters and others interested in the July 29 and September 18-23, 1977, solar-terrestrial events. Planning details about this meeting were provided by the US IMS Coordinator, Bob Manka, and were given in IMS NL 78-4, pg 6, together with preliminary information about available data for these events. Manka organized the Miami meeting with help from Johnson, Vette, and Fritz and in consultation with Knott and Pedersen. The following rough notes from this informal evening working meeting were compiled by Manka, Candidi and Johnson. They indicate the range of interest in events occurring during these two intervals (see also IMS NLs for the last nine months). About 50 participants were at the meeting, many for the full three hours of discussions. We look forward to the formal and informal sessions about these events/intervals scheduled for the Innsbruck meetings June 7 or 8 and June 9 & 10, 1978.

29 JULY 1979 Substorms: First Bob Manka showed ground magnetograms supplied by NOAA's National Geophysical and Solar-Terrestrial Data Center. He also showed satellite orbit plots from the IMS Satellite Situation Center (SSC) and Solar Wind data from the MIT experiment on IMP-J. Satellites for which orbit maps were shown are: GEOS, ATS-6, SMS-2&3, TRIAD, AE-C, HAWKEYE, DMSP, IMP-7&8, and ISIS-1&2. Satellite experimenter comments follow:

S3-3 --- Satellite experimenters showed composite data plots including: MIT plasma detector data from IMP-J (Sullivan); ring current composition data (Johnson); hot plasma data, pitch angle chart (Mizera); and identification of intervals when E-field data is available from S3-3 (Mozer from Mizera's slide). The MIT data showed a jump in n & v (plasma density & velocity) from 0030 through 0430 UT. n appears to be > 100/cc. Olson noted that n was > average background level before the shock. Discussion centered on the possibility of electrostatic shocks corresponding to detection of field aligned ions.

Also shown was evidence of ring current penetration inward to L <= 3. At the peak of the main phase, as much O+ as H+ was observed (0.5-16 KeV). Solar wind (He++) ions were seen as low as L=4. Widespread upstreaming ions (90 eV - 4 KeV) were seen with very high low-energy electron fluxes (0.2 - 16 KeV) over a wide latitude range at the time of the 4th substorm (counting from ground-based auroral zone magnetograms) about 1230 UT.

GEOS --- Ghielmetti showed GEOS ion composition: 0000 - 0200 UT, magnetosheath composition; 1230 UT saw O+ and He+ enhancement; and about 1800 UT O+ fluxes were seen comparable to H+ fluxes and >= 10*He+ fluxes at L = 3 to 4. Manka showed copies of the GEOS daily summary plots for the western (N. American) apogee pass; these figures were provided by the European Space Agency. Fortunately, a good block of data was acquired at just the time of the large solar wind shock at 0030 UT; major shock responses were seen in nearly all GEOS experiments and a possible interpretation is that the magnetopause was pushed in past the GEOS location at about 1330 LT and 7 Re.

ATS-6 --- Arnoldy saw dropout of >= 20 KeV protons following the Storm Sudden Commencement (SSC) at 0030 UT. At each of the "four" substorms they saw changes in fluxes.

ATS-6 --- Fritz reported a significant flux reduction in energetic H+ (20 to 300 KeV channels) ions at the time of the SSC and at each substorm.

IMP-H&J --- Williams reported an energetic ion flux increase (e- 25KeV, p+ to 100KeV, and heavier ions) starting at 0030 UT and lasting to 0450 UT when it dropped sharply.

HAWKEYE --- Van Allen reported that this satellite may have been tracked (i.e. data acquired). Hawkeye apogee was in the midnight sector and, if the data was acquired, it should be good to show the cusp crossings.

SEPTEMBER 19-23, 1977 Magnetic Storms: Manka showed satellite position plots for this interval as prepared by J. Vette and M. Teague of the IMS SSC. He also showed the magnetic field data from IMP-8 provided by Lepping and Ness (see figure page 7 of this NL). This is preliminary data and not all interplanetary field because some of the time the satellite was in the tail. Auroral zone and midlat magnetograms from NGSDC were also shown. The Miami session may prove a good exercise to illustrate the variety of data available for comparison at the Innsbruck IMS Working Conference (See IMS NL 78-4, pg 6). The following are brief summaries by satellite or ground array of the data discussed.

IMP-7&8 --- MIT plasma data and summary GSFC interplanetary magnetic field plots for 19-23 Sept were shown by Sullivan, Belcher, and Bridge. They saw the first rise in plasma velocity and density at about 1130 UT on 19 September 1977. Density was > 50/cc from 1300 - 1500 UT and about 100/cc from 1500 - 1700 UT. On 20 Sept from 0200 - 0700 UT, the solar wind displayed high densities of > or about = 50/cc. Another major shock occurred at about 0900 UT on September 21. About 0920 UT the solar wind velocity measured by IMP-7 jumped from 580 km/sec to 1015 km/sec. Also, no He enhancement was noted in the solar wind until 0900 UT on the 21st. See the figures on pages 6&7 in this NL. The data shown is preliminary and is shown to illustrate the event. Earlier, preliminary versions of the MIT solar wind data were published in WDC-A's Solar Geophysical Data, Part II, March 8, 1978. The present figure is an updated version but still preliminary and may contain some inaccuracies, particularly in the solar wind densities which are only accurate to about 10%. We trust that all IMS NL readers recognize the need to contact the responsible scientists before using any data shown in these pages. Only data collections or figures prepared directly by IMSCIE and/or NGSDC and WDC-A staff may be copied without obtaining permission. In most cases, our draftsmen (Chuck Shanks and Jerome Smith) have redrawn figures published in these NL's, we seldom use originals. We do not recommend direct research use of data in the IMS Newsletters.

AFGL Plasmapause Magnetometer Chain --- Data was shown by Fougere. At 2045 UT on 21 September an SSC was recorded with a slight time shift as it propagated across the U.S. There was general discussion of the propagation rate.

VOYAGER --- ELF data was shown by Scarf. At 0500 UT on 20 September a shock was seen at Voyager and others were seen at 1945 and 1600 UT on the 21st.

PIONEER 11 --- Particle data was discussed by van Allen and the 7 October signature of a shock was shown as seen in the threshold Geiger Counter and solid state detectors. This shock may have been related to the September shocks, depending on their propagation path. For an idea of the relative location of Pioneer 11, earth, and other satellites around this time, see the map STIP INTERVAL IV on page 5 of IMS NL 77-10. Pioneer 11 was about 5 A.U. from the Sun when these shocks were seen in early October.

AE-C --- Low-energy electron data (up to 100's of eV) were discussed by Potemra. On 21 September one pass sees the cusp at low latitudes.

DMSP --- Kroehl (NGSDC) and Candidi (IMSCIE Office) showed differential energy 3-D plots for 50 eV - 20 KeV precipitating electrons (see IMS NL 78-2, pg 5). At about 1015 UT on 21 Sept the cusp was not seen at its typical high latitude location during that polar region passage. However, the cusp was seen on the next pass at lower-than-usual latitudes. Very hard auroral electron precipitation was seen at 2300 UT. Also, on 21 Sept at 0650 UT there was a 20 KeV electron

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enhancement at about 0600 MLT (magnetic local time) in the southern hemisphere and similar enhancements at 0740 UT, and at 0600 and 1800 MLT over the northern hemisphere polar region of the DMSP orbit.

Alberta Magnetometer Chain --- Figures for these days were sent by G. Rostoker. Other high-latitude magnetograms were supplied by J. Allen from NGSDC archives.

ATS-6 --- Arnoldy provided data distributed earlier by Manka and showing electron injection events seen at ATS-6 geostationary altitude at 0445 UT (about 1900 LT) and 0630 UT (about 2100 LT) on 21 September.

One result from this meeting has been a request to the IMS SSC for a map series showing the relative positions of high altitude satellites during the critical times and another series giving the positions of the low-altitude satellites used in the magnetic conjunction forecasts (see IMS NL 78-4, pg 3).

Another result was a list of questions to which answers might be sought from the growing collection of IMS data, particularly that collected for these special study intervals. Cautionary comment was made that these are very broad questions and that if all were answered, at the least magnetospheric physics might become a bad employment risk discipline. Probably the risk isn't too great.

QUESTIONS:

1. What is the time dependence of the shape of the magnetosphere during a large compression event?

2. What is the timing of a shock from the Sun through the interplanetary medium using data from the IMPs, Earth, Voyagers, Helios, etc.?

3. What are the energetics during a magnetospheric disturbance --- how much energy is coming into the system, where and how is it transferred, where is it deposited, how much is passing out of the system, ... ?

4. What is the sequence of events in substorm triggering --- what is the state of the magnetosphere before the substorm, what particle precipitation is present at the start of the substorm, what conditions are present in the magnetotail, are these conditions necessary or sufficient for all substorms?

5. What is the time development history of hot plasma in the magnetosphere?

SUPPLEMENTARY SEPTEMBER DATA --- Although not presented at Miami, the IMSCIE Office (and/or WDC-A for STP) has received daily summary plots of 2-min average particle counts from the Space Environment Monitor on the Japanese geostationary satellite GMS. Selected examples of these data were reproduced for 19 September 1977, in IMS NL 78-4, pg 5. Copies are available for the full set of proton sensors (7 energy ranges), alpha sensors (5 ranges) and electron sensor (1) for the days 18-26 September 1977, inclusive. However, the set consists of 36 pages of material and we can only distribute a limited number of copies. The lowest energy proton channel (P1: 1.2 - 4 MeV) displays many of the shocks, compressions, etc. described above for these active times. These include: 18 Sept --- Quiet- time P1 level at 4000 to 5000 counts/cm2/sec/ster; 19 Sept --- sharp p+ increase at 1130 UT; 20 Sept --- increases at about 1715 UT and 2030 UT; 21 Sept --- (all instruments off from 0500 - 1340 UT) wave-like variations in p+ from about 2040 - 2400 UT; 22 Sept --- rapid p+ increase at about 1245 UT, sharp decrease about 1450 UT (from 2000 to 30 counts/cm2/sec/ster) followed by large increase at 1530 UT (to about 200,000) with continued oscillations; 23 Sept --- large increases at 1330, 1540 (may be spurious) and 1920 UT; 24 Sept --- quiet-time P1 level at about 6000 counts; 25 Sept --- quiet daily variation in P1 counts similar to 24th; and 26 Sept --- sharp depressions in P1 protons beginning about 0940 UT and continuing for the rest of the day with the sharpest peak reaching about 30 counts at 1400 UT.

CURRENT SOLAR ACTIVITY

Beginning with the great solar flare on Friday morning, 28 April 1978, at 1308 UT, we found preparation of this IMS NL frequently interrupted by our sending telexes, talking with Space Environment Services Center (SESC) forecasters and staff to get the latest news, and with telephone conversations with ISEE, IMP, Voyager, GEOS, ... experimenters, project scientists, control staff, etc. The active sunspot region, #1092, is still transiting the face of the Sun and has produced as of this time at least 3 X-class flares. A summary of each of the events follows, taken from the SESC "Major Event Report" forms for 28-30 April. We are not aware of all actions that may have been taken to assure optimum data acquisition for this sequence of events; however, we are aware that the ISEE-A&B began a high-bit-rate orbit (Orbit # 80) starting at perigee around 1045 UT on 29 April. Dr. K. Ogilvie has informed IMSCIE that the high-bit-rate data collection that would normally have next occurred during orbit # 85 has instead been rescheduled for orbit # 81. Thus, the ISEE's should be collecting the maximum data possible from perigee on Saturday through next Thursday.

MAJOR FLARE REPORTS

28 APRIL 1978 --- Sunspot region # 1092 produced a major flare from a location east of central meridian (N22, E35). While not in the optimum position to affect the earth, this flare and subsequent activity to be expected from the same region may well prove very geoeffective. The X-ray event began at 1308 UT and reached maximum at 1335 UT when it was classed as X4. X-ray fluxes monitored by GOES-1&/or 2 (see fig pg 9) reached 4.6x10(-4) watts/m sq (i.e. class X4). The 10cm radio signal peak flux from Ottawa was 24,069. This was the highest peak flux in this frequency range attained by a flare since such measurements began routinely in 1947. The 200 MHz peak flux was 180,000. Optically, the flare was classed as a 4b (4 "Bright"). The associated Solar Ionospheric Disturbance (SID) was rated importance 3. The McMath-Hulbert (H. Dodson-Prince) Comprehensive Flare Index was 19+. Because of the distance of the flare east of the solar central meridian, it was estimated that only a "minor magnetic storm" (i.e. 30<=A<=49) might result, beginning on 30 April at 2100 UT. A small PCA event (Polar Cap Absorption) was forecast to start on 29 April at 0200 UT.

We reproduce here an extract from the Holloman Air Force Base solar observatory report of 28 April at 1400 UT. "Region 1092, N22 E39 has a most spectacular 4B flare in progress at this time. The flare began at 1308 UT with 5 small eruptive centers along the neutral line. The flare area and intensity continued to increase until optical maximum was reached at 1329 UT. At this point my system saturated and any further increase in intensity was not detectable. However, shortly thereafter the flare area began to decrease. Large extensive parallel ribbons are the most striking feature of this awesome and exciting event. The uncorrected area is 2837 millionths and this appears to be accurate as Ramey solar observatory assigned an area commensurate with mine."

The 1700 UT message from Holloman included "...still in progress but slowly decaying. The intensity is now normal and the area is approximately 200 uncorrected millionths. There was and still exists greater than 20% umbral coverage mostly the umbra in the two large stable spots. The flare caused no apparent annihilation of any portion of the spot group."

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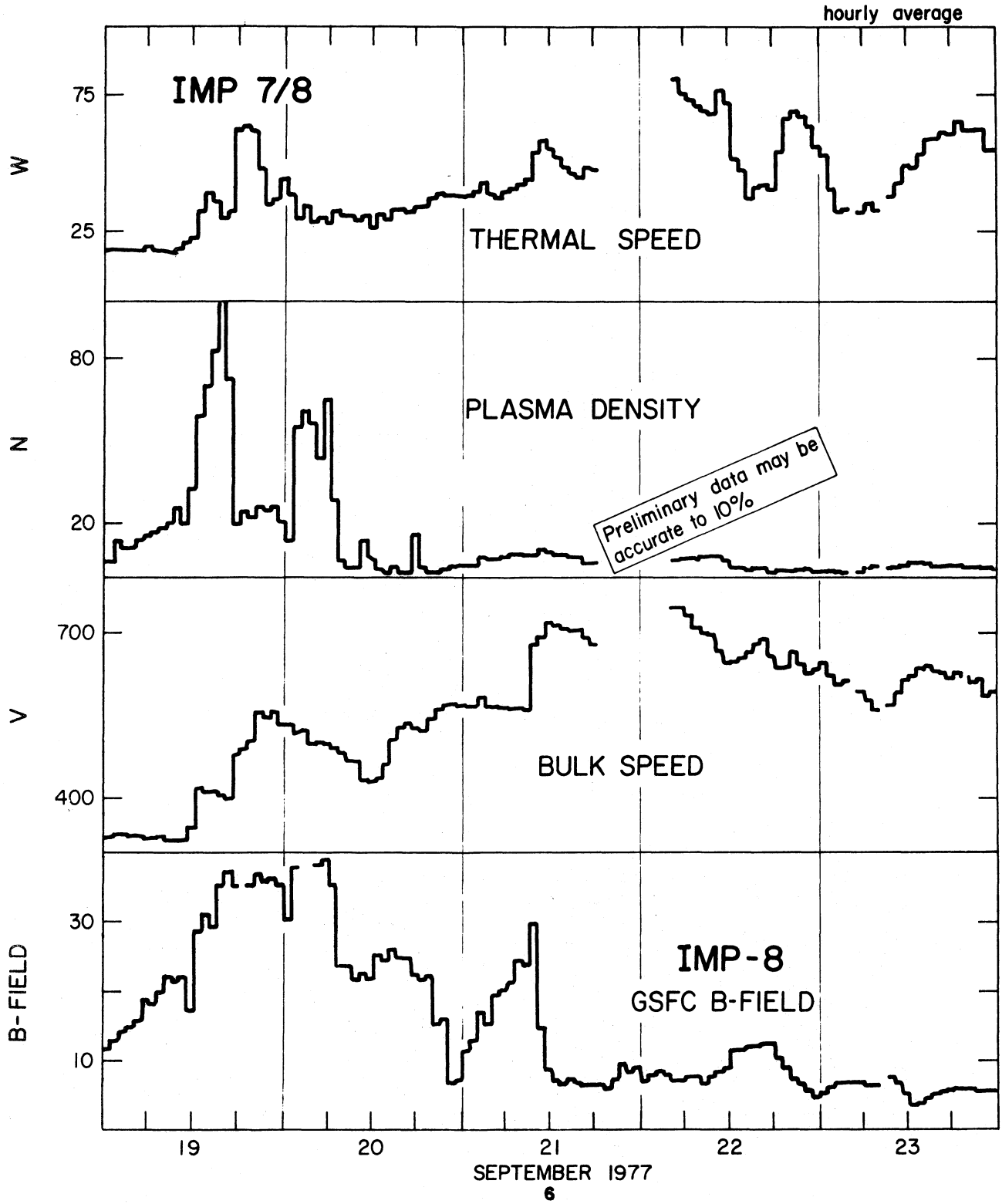
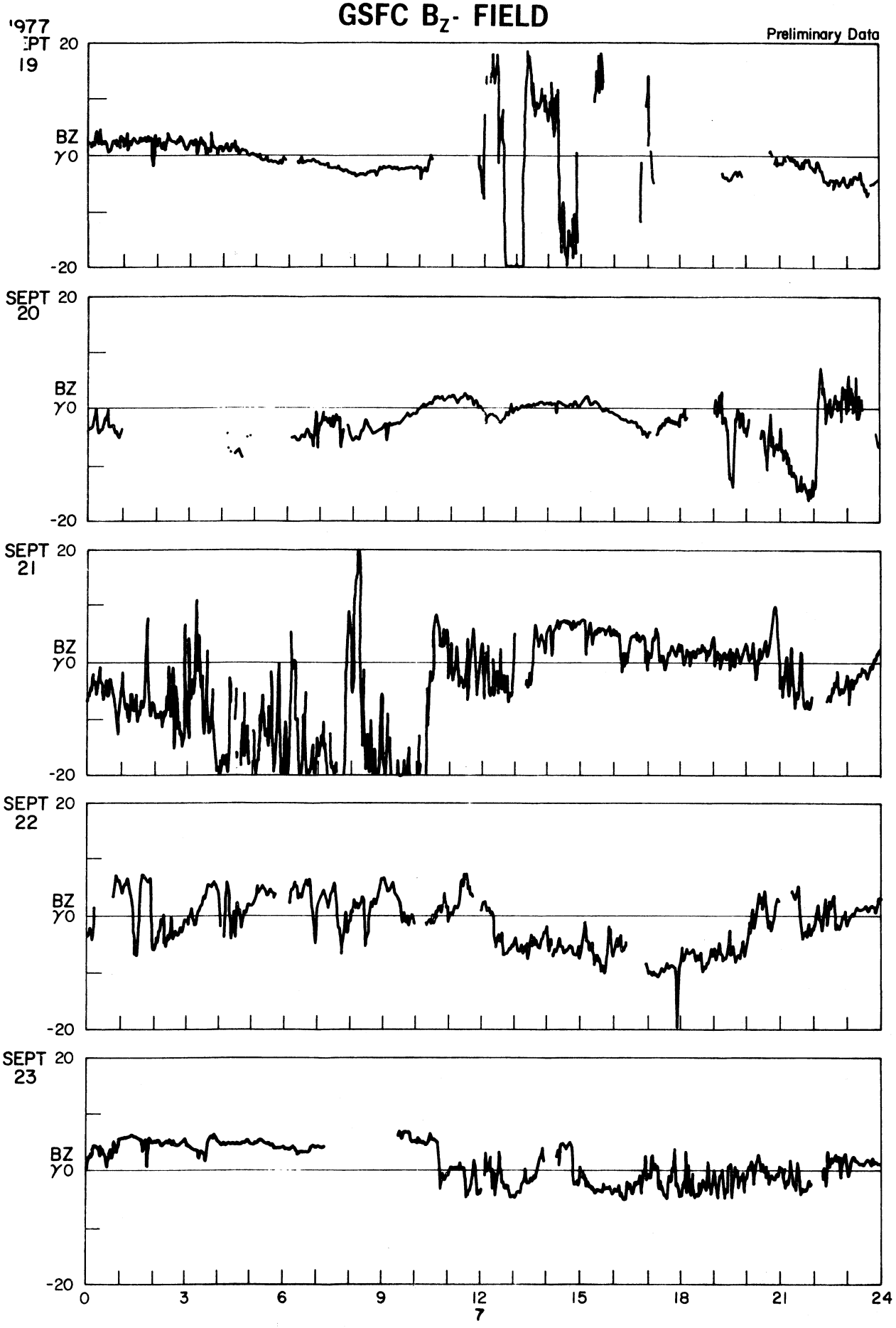
MIT SOLAR WIND PLASMA DATA AND GSFC B-FIELD DATA



GSFC B_Z- FIELD



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29 April --- Region 1092 again flared but by now had moved to N16 E18. The flare was a class X3 X-ray event and began at 1853 UT, reaching maximum at 1924 UT. The H-alpha optical class was 3B. Peak 10cm flux was 3580 and peak 200 MHz flux was 11,000. A major magnetic storm was forecast from this flare with dates and A-values possible given as: 31 April A=30; 1 May A=40; and 2 May A=60. A large PCA was forecast to begin on 30 April at 0800 UT. Umbral coverage was total. The comprehensive flare index was 16.

30 APRIL, 1978 --- The latest flare from region # 1092 was an X2 class event beginning at N24 E11 at 1439 UT and reaching maximum at 1452 UT. The H-alpha optical class was 3B. The 10cm peak flux was 2900 and the 200 MHz peak flux was 1700. Its SID importance was 1. A major mag storm is forecast to begin around 2030 UT on 1 May. The Comprehensive Flare Index for this event was 13. There was 20% umbral coverage.

RESULTS TO DATE (1 May @ 0045 Local Time)

A Polar Cap Absorption (PCA) event began at 1030 UT on 29 April 1978. This was indicated by >2.0 dB absorption recorded by the Thule 30 MHz A-riometer. The PCA was still in progress at 2045 UT on the 29.

A Proton Event commenced almost at the time of the flare on 28 April. The high level of proton flux at the time of the flare suggests the possibility that another source was supplying enhanced particles prior to the great flare. This will be one of the interesting matters to consider after all available data is collected. As of 1100 UT on 28 April the >10 MeV p+ flux was in the range 150 - 200 p+/cm sq/sec/ster.

MORE RESULTS (As of Tuesday, 2 May 1978)

A magnetic storm began with timing not yet certain. However, a SSC was recorded on the Boulder Magnetic Observatory real-time chart at 1840 UT on 1 May. The SELDADS real-time display of magnetic and riometer variations from the N. American IMS magnetometer arrays revealed substorms in progress during the 28th. Telephone conversations with G. Rostoker and S.-I. Akasofu confirmed that on 1 May there were substantial magnetic storms in progress as shown by auroral zone variations. We anticipate that copies of samples of these data sets will appear in the next IMS Newsletter.

X-ray enhancements arising from these flares were measured by the SMS/GOES satellites and displayed via the SELDADS system. Selected plots from this system are combined on page 9 of this NL to show the signatures of the events. We repeat that most of the information about these events was obtained from staff of the NOAA Space Environment Services Center and from the SELDADS real-time data acquisition and display system. Anyone interested in learning about SELDADS should consult the NOAA Technical Report ERL 357-SEL 37, "SELDADS; An Operational Real-Time Solar-Terrestrial Environment Monitoring System," by D.J. Williams, March 1976. A full description is given in this report of the various data sets available through SELDADS and the meanings of many of the classifications used above in describing these events. For prompt information about the variety of solar, ionospheric, and geomagnetic activity and forecasts of future conditions, please contact G. Heckman, SESC, NOAA, Boulder, Colorado 80302, USA; telephone number 303-499-1000, extension 3171; telex 45897 SOLTERWARN BDR.

1 May 1978 --- Further flare information: Region # 1092 continued to produce flares with the probable largest on this day being an M7 X-ray event beginning at 1915 UT and reaching maximum emission at 1935 UT. Optically, this flare achieved an initial maximum of class 2B with a secondary maximum rated by some observers as 3B. Anyone interested in more systematically presented data on these events is encouraged to contact the SESC to obtain the weekly report distributed by them, "PRELIMINARY REPORT AND FORECAST OF SOLAR GEOPHYSICAL DATA". This non-referenceable report includes solar activity highlights for the previous week, activity forecast for the current week, 27-day forecast, summaries of solar and geomagnetic activity indices for the previous week, computer summary listings of events and activity by each region tracked, the Boulder Geomagnetic Substorm Log (see item on pg 11), recent monthly mean sunspot number tables, and selected graphs of SMS/GOES data and preliminary H-alpha synoptic solar charts.

2 May 1978 --- Telephone contact with the USAF Air Weather Service (operators of the DMSP satellites) confirmed that good auroral data were obtained for the recent activity, especially for 30 April to 1 May although some degradation was experienced due to moonlight. In general there is good auroral coverage for the S. Hemisphere since 25 April. Both noon-midnight and dawn-dusk orbital satellites are operational although the F2 satellite (dawn-dusk orbit) is drifting in longitude and will be replaced. However, it was operational during this active period.

According to the Air Weather Service, the inferred magnetic activity index Ap is running above 100 and mid-latitude K indices from Boulder have been 7's and 8's. Successive flares from region 1092 are expected (SESC forecasts 80% probability of class X level X-ray events for 2 May) and the magnetic storm in progress may increase.

SOLAR WIND AND IMF Bz DATA FIGURES

Data from IMP-7&8 solar wind and magnetometer experiments are shown on pages 6 and 7 of this NL. The data is preliminary and is shared here as a sample of what can be extracted from experimenter files. These data were presented at the IMS working meeting in Miami at the Spring AGU and their contents are discussed under the notes from the meeting, elsewhere in this NL.

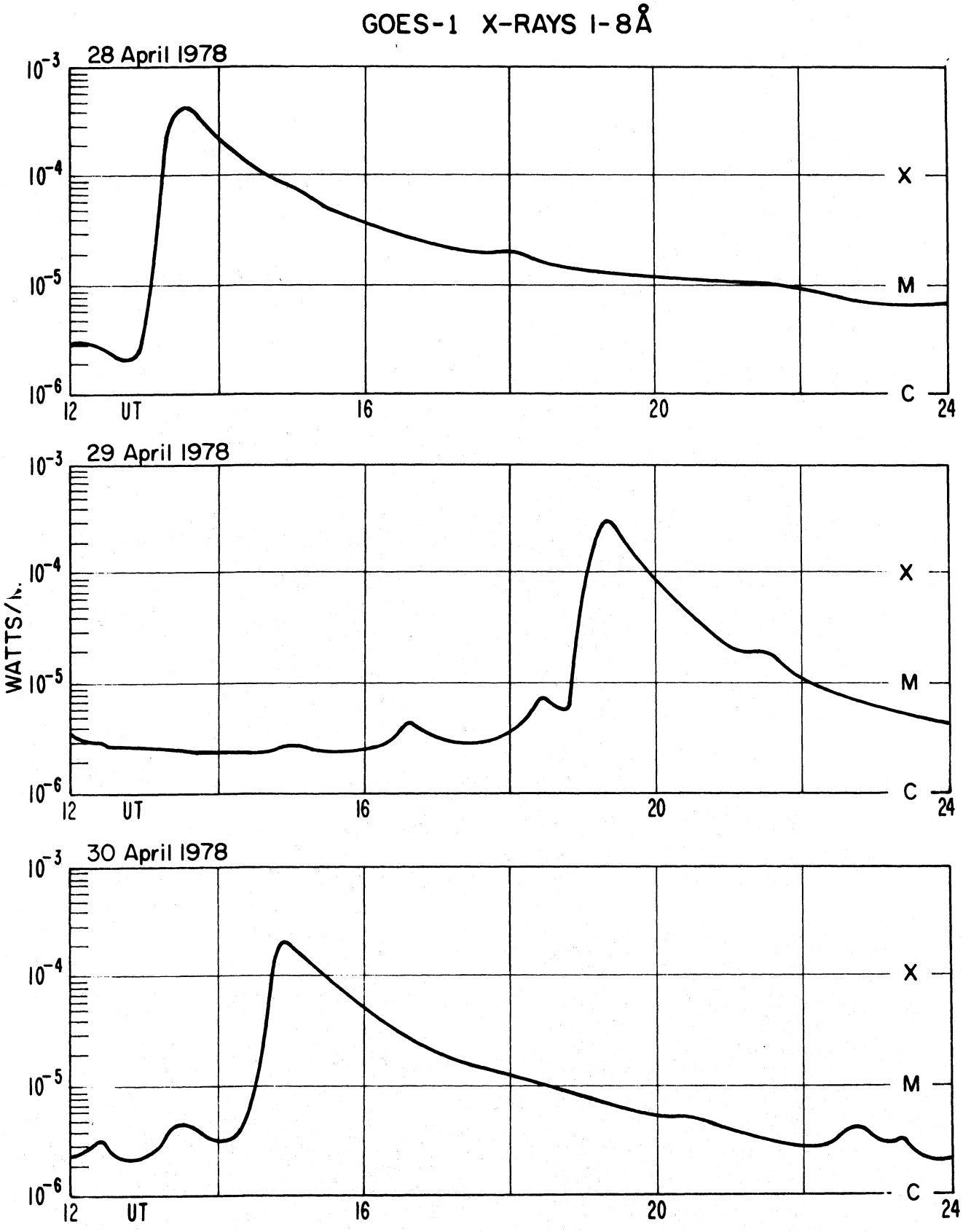
The IMP 7/8 solar wind plasma data (pg 6) was supplied by the MIT group of experimenters: Prof. H.S. Bridge, Dr. A.J. Lazarus, Dr. J.D. Sullivan, and others. Their address is MIT 37-675, Cambridge, Massachusetts 02139, USA. The magnetic field data in the bottom panel of the figure was supplied to the MIT group by Dr. R. Lepping, NASA Goddard Spaceflight Center (see below). The values shown are hourly averages of the total field data from IMP 8, which was also the source of the data plotted in the next figure (pg 7).

The GSFC Bz-field data shown on pg 7 was extracted from 5 pages of data plots of 1-min average field values supplied by Dr. Lepping. Anyone interested in using the IMP-8 magnetic field data from this or other periods should contact Dr. R. Lepping and/or Dr. N.F. Ness, Code 690, NASA GSFC, Greenbelt, Maryland 20771, USA.

It is often a major effort for active research scientists to play the role of a data center and extract data upon request for special periods but from systems or times which may not be part of their immediate studies. For that reason, it is essential that anyone interested in using their unpublished data should contact them directly about possible collaboration.

WDC-A DATA PUBLICATION FOR SEPT-NOV 1977 EVENTS

Many satellite and GBR experimenters at the IMS meeting in Miami seemed unaware that WDC-A for STP is preparing a UAG data report on these events. This was announced in a widely mailed WDC brochure and in an unintentionally obscure item in IMS NL 78-2, pg 10. There is still time for data reports to be submitted by those wanting to include at least a data sample and catalog of available data. The deadline is 31 May 1978. Only 15 notices of intent to submit a data paper have been received from satellite experimenters. Please call or otherwise notify Ms. H. Coffey or Mr. J. McKinnon, NOAA, WDC-A for STP, Boulder, Colorado 80302, USA, telephone 303-499-100, ext 6223.


GOES-1 X-RAYS 1-8Å
28 April 1978
29 April 1978
30 April 1978
WATTS/M.
10^{-3}
10^{-4}
10^{-5}
10^{-6}
X
M
C
12
UT
16
20
24

IMS STEERING COMMITTEE MEETING --- MOSCOW

The IMS Steering Committee met in Moscow on 21-23 March 1978, at the invitation of the Soviet Academy of Sciences. About 20 Soviet scientists participated in some of the sessions for a very useful exchange of information and views with the Steering Committee. The agenda included: - a general review of the IMS to date, with special reference to the status of IMS-related spacecraft, coordinated campaigns, the functioning of the coordination services like IMSCIE, the SSC and SELDADS; data availability and exchange; planning for the remainder of the IMS through 1979; consideration of proposals for the coordinated study of IMS data sets now beginning to accumulate, and also consideration of proposals for systematic data reduction and analysis in the interval from 1980 on; the possible continuation of some IMS observing programs after 1979 and the continuation of the existing coordination services needed for these and other STP programs in the early 1980s; and ways of assembling a creditable record for the IMS. The IMS Steering Committee also agreed on the final schedule and format of the IMS Working Conference in Innsbruck (see IMS NL 78-4) and reviewed plans for several future meetings. These included the Japanese International IMS Workshop (March 1979) and the IAGA Symposium on the IMS, Melbourne, Australia (late November 1979).

Recommendations were adopted on the subjects listed below. These have not yet been approved in final text form so the wording here must be considered provisional. Subjects of the draft resolutions:

(1) The recommendation that it will take several years of concerted and coordinated efforts to digest, analyze, and interpret the large correlative IMS data sets which will accumulate and the possible formal declaration of an "IMS Data Analysis Phase" from 1980 to 1985 to call attention to this fact.

(2) An appreciation of the highly effective services provided by IMSCIE, the SSC, etc. and consideration of the steps needed to keep these services in operation for the coordination of Solar-Terrestrial programs from 1980 on.

(3) The possible appointment by SCOSTEP of a small ad hoc working group to collect and consolidate proposals for international cooperative programs in the 1980s and to suggest how they might be coordinated with already planned activities.

(4) The possible appointment of another small ad hoc working group to investigate the feasibility of establishing a "Data Analysis Workshop Center" (ideally a place equipped with a computer and accessories where data analysts and theorists can work together to interpret coordinated data sets).

(5) An announcement that the USSR and other socialist countries connected with the INTERCOSMOS program propose a concentrated observational campaign in January - March 1979 with all available resolutions, including, in particular, a high latitude balloon campaign. The campaign would take advantage of the INTERCOSMOS satellites MAGIK and IONOSONDE I-IK, and also of spacecraft like GEOS, ISEE, etc. to whatever extent is possible. The draft resolution invites IMS participants everywhere to coordinate their observational efforts with the proposed campaign. A more detailed plan will be available later.

IMS and RELATED MEETINGS

Innsbruck, Austria

MAP, 23-25 May --- An ad hoc Steering Committee for the Middle Atmosphere Program will meet on Tuesday through Thursday. An agenda has been distributed for this meeting. We understand it will include reports of National Representatives about national participation in MAP, discussion of the best structure for the general direction and coordination of MAP in the context of other STP programs, and decisions about the recommendations to be presented to the SCOSTEP General Meeting.

SCOSTEP Bureau I, 25 May --- In the evening, after the MAP final session, the Bureau will meet with Program Leaders to review and firm-up the agenda for the General Meeting. The session may continue on Friday morning.

SCOSTEP General Meeting, 26-27 May --- The first of 3 Plenary Sessions will convene at 1000 h. The second will convene in the afternoon at 1400 h. The third plenary session will convene on Saturday afternoon at 1400 h. Main agenda items are: 1. Review of planning for MAP, national participation in MAP, statement to ICSU on MAP; 2. Review of IMS progress, plans for post-IMS data analysis and possible continuation of coordinated observational programs; 3. The future of solar-terrestrial physics programs after 1980, future of SCOSTEP, position for XVII ICSU General Assembly, September 1978; and 4. Present and future financing.

Friday evening (after Plenary II) and Saturday morning will be available for meetings of SCOSTEP Steering Committees or subordinate groups. These will include the IMS Steering Committee, MONSEE Steering Committee, and meetings on STIP, SMY and FBS about possible combination for a year of solar-related observations from late 1979 through 1980. Some of these groups have already scheduled meetings during the STP Symposium (solar meeting on 30 May and 1 June) but they may wish to use the times mentioned here for additional meetings.

SCOSTEP Bureau II, 27 May --- Executive Session Saturday evening after General Meeting.

SMY, 29 May --- A group will meet at 1730 h to discuss planning for the Solar Maximum Year.

STIP, 31 May --- The Study of Travelling Interplanetary Phenomena will meet at 1730 h.

MAP, 31 May --- Open meeting on MAP for Symposium participants.

Other SCOSTEP special groups (IMS, MONSEE, etc.) meetings will be announced for the week of the 29th

ASHAY, 24-26 May --- The Antarctic and Southern Hemisphere Aeronomy Year Workshop will meet in parallel with the MAP and SCOSTEP meeting but will be held separately at Alpbach, Austria.

ISSTP, 29 May - 3 June --- International Symposium on Solar-Terrestrial Physics. For major program topics see IMS NL 77-10, pg 4.

XXIst COSPAR, 5 June --- Plenary Session of the XXI Meeting of the Committee on Space Research.

ESLAB Symposium, 5-9 June --- 13th ESLAB Symposium on Advances in Magnetospheric Physics with GEOS-1 and ISEE. See program schedule for details.

IMS Working Conference, 9-10 June --- There will be concentrated data comparisons for 3 special study intervals in September and December 1977. See IMS NL 78-4, pg 6 for detailed agenda. G. Rostoker has asked that we give the following information about Working Conference facilities. There will be four sets of 5x5 cm projectors, viewgraphs, and screens for the simultaneous display of data. Also, tables have been secured for spreading out chart rolls, etc. Microfilm and microfiche readers have been requested.

Special Study Meeting, 7 or 8 June --- R.H. Manka, US IMS Coordinator, has requested that we remind those interested in the joint GEOS-N. America study centered on the substorms of 29 July 1977, that there will be an evening working meeting at a time and location to be announced at the ESLAB Symposium. Probably it will be held on either June 7 or 8. This substorm interval and the multiple storm period during September 1977 (see above) were discussed at the Spring AGU meeting in Miami. All participants there and others interested are encouraged to attend both sessions at Innsbruck.

IMS SSC VISIT TO USSR SPACE RESEARCH INSTITUTE

The following report was submitted from the IMS SSC. "Following the IMS Steering Committee Meeting in Moscow on March 21-24, J. Vette, Director of the SSC, was invited by R.Z. Sagdeev, Director of the Space Research Institute (IKI) of the Academy of Sciences of the USSR to visit his institute and discuss with members of his organization, IZMIRAN, and WDC-B procedures for exchanging satellite data obtained during the IMS and utilizing the services of the SSC. As a result of these discussions, the following agreements were reached. Within 4 months IKI will submit to the SSC the universal times of satellite crossings of the bow shock, magnetopause, plasma sheet, and plasmapause based on the plasma data from Prognoz 4, 5, and 6. Orbital elements of these spacecraft necessary to make accurate calculations of their spatial position will also be given and the SSC will provide the periods when these satellites were on the same magnetic flux tube or near the various boundaries at the same time as other IMS satellites. In the case of Prognoz 6, predictive times for the satellite situations will also be provided. Requests addressed to the Soviet IMS Commission for the solar wind plasma parameters, bulk velocity, ion density, ion temperature and electron temperature (based only on core electrons) will be provided within 6 months of the request. By early 1979, periods during the lifetimes of Prognoz 5 and 6 when cold plasma ion temperature distributions within the plasmasphere can be provided on request will be identified. In addition, the data from the joint IKI/Saclay electron and proton spectrometer on Prognoz 6 will be provided on request as hourly averaged plots. Currently data for the September 22, 1977 - January 20, 1978, period is available for electrons in the energy range 0.3-20 MeV and for protons in the energy range 2.1-500 MeV including the major flare events of September 24-26 and November 22-27, 1977.

The Prognoz experimenters are interested in obtaining solar wind characteristics for the period July 20, 1977 (cessation of Prognoz 5 data) to September 22, 1977 (launch of Prognoz 6) and during later periods when Prognoz 6 is inside the magnetosphere. In addition, they are interested in obtaining X-ray, radio burst and solar flare particle data during all solar flares during the lifetime of Prognoz 6. Prognoz 6 data for the December 1-3, 1977, will be presented at the IMS Working Conference in Innsbruck; unfortunately the data for the December 10-12 interval will not be available due to a faulty data acquisition link for the 4-day period December 4-12.

In addition to these agreements, broad-based data from the VLF experiment of Likhter on Intercosmos 14 in the form of 1/4 inch and 1/2 inch analog tapes was given to J. Vette by I. Zhulin. This is the first data obtained by a Soviet IMS satellite made available to the scientific community. Anyone interested in further details of this data should contact the SSC.

NEW NOAA WEEKLY SUBSTORM LISTING

The NOAA Space Environment Services Center is now publishing a weekly catalog of substorm occurrences as detected by the North American IMS magnetometer network. The Boulder Substorm Catalog is now a feature of the SESC weekly **Preliminary Report and Forecast of Solar Geophysical Data.**

A copy of a recent weekly substorm catalog is shown below. Listed are substorm onset times, direction from Boulder of the central meridian of the substorm and qualitative remarks. The log should be quite useful to IMS investigators who are interested in substorm studies.

The SESC weekly report is now available by request. If you wish to receive the report, please write to: Substorm Catalog, NOAA Space Environment Services Center, Boulder, Colorado 80302, USA.

BOULDER GEOMAGNETIC SUBSTORM LOG

DATE mo/da	TIME OF ONSET	DIRECTION	COMMENTS
3/27			Mag storm continues through about 2000 UT
3/28	0145	east	1st of double onset SS; weak
	0250	east	2nd of double onset SS; major
	0745	west	
			1310-1645 UT - Auroral zone activity west; BOU disturbed, no clear beg
3/29	0645	west	1st of multiple onset SS; lasting to about 1700 UT
	0845	west	
	1045	west	
	1250	west	
	1600	west	
3/30	0245	east	
	0340	east	
	0505	east	
	0610	east	
	0735	centered	BOU on central meridian
	0815	west	Multiple onsets continue until 1725 UT
3/31	1100	west	1st of series of 4 SS
	1300	west	
	1410	west	
	1455	west	Auroral zone disturbance until 1650 UT
4/1	0130	east	BOU at dusk; auroral zone activity begins
	0210	east	
	0300	east	
	0330	east	
	0455	east	
	0525	east	1st of double onset SS; weak
	0530	west	2nd of double onset SS; major
	0735	west	
	0905	west	
	1150	west	
	2050		BOU on dayside; cusp activity began about 1800 UT in Alaska

(Continued from pg 3)

propagating from the GEOS satellite to the ground stations?

4. Which types of pulsations observed at the ground are generated by wave-particle interactions at the synchronous orbit?

5. Which types of pulsations influence the particle precipitation as measured indirectly by X-ray observations?

Observation sites and schedules are: Andoya (Andenes Rocket Range) - 69.2N, 16.0E, L=6.15; Bjornoya - 74.5N, 19.2 E, L=9.4; Spitzbergen (Ny Alesund) - 78.9N, 11.9E, L=16.1; Greenland (Angmagssalik) - 65.6N, 322.4E, L=9.1; Iceland (Thingeyri) - 65.9N, 336.5E, L=7.0; Iceland (Fagurholsmyri) - 63.9N, 343.4E, L=5.6. The stations at Iceland and Greenland will be installed in May and June 1978 and on Spitzbergen and Bjornoya in June and July 1978. Andenes has been operating for selected periods since Oct 1977. All stations will be dismantled in Nov 1978.

KIRUNA, ESRANGE

D-LAYER CAMPAIGN --- Six coordinated sub-programs to study mesopause region in presence of noctilucent clouds, particularly nucleation processes. L. Bjorn is Project Scientist. S-26 - L. Bjorn to launch 2 Skylarks having Exp/Sci: Ion mass spectrometer, E. Kopp; Ionizing radiation, total ion & e- dens & e- temp, Uppsala Ionospheric Obs; Scattered light from noctilucent clouds, solar irradiance (O2 dens), and ion mobility, G. Witt. S-32 - G. Witt, Nike-Orion to measure optical backscatter. D-Layer - F. Arnold has ions mass spectrometers on two Petrels. Atomic Oxygen - P.H.G. Dickinson will launch two Petrels to measure atomic oxygen at high latitudes with and without noctilucent clouds by resonance fluorescence and absorption and with Langmuir Probe. VLF - K. Bullough will launch a Petrel to measure VLF magnetic & electric fields. Aircraft - P. Rothwell and M. Gadsden will measure scattered light and SIT TV with polarimeter

IMS CALENDAR OF GBR CAMPAIGNS MARCH - AUGUST 78
(As of 24 April 1978)