National Space Science Data Center

NSSDCNEWS

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Multi-Decadal Patterns Detected in Solar Wind Longitude Variations

By Joseph King

The Sun spins at approximately 360 deg per 27 days, but sunspots rotate faster near the Sun's equator than at higher latitudes. The Sun's effective magnetic dipole flips over once per 11-year solar activity cycle. The solar wind emanates from a solar atmosphere seething with activity. For all these reasons it might be expected that no long-term patterns dependent on solar longitude would be observed in the solar wind.

However, quite the opposite has just been found by Dr. Marcia Neugebauer of NASA JPL and collaborators. They used mainly data from NSSDC's 1963-1999 OMNI data set of near-Earth solar wind field and plasma observations and data from various other spacecraft away from the Earth in NSSDC's COHOWeb system. By using the times of interplanetary observations and the observed solar wind speeds, they were able to stamp each observation with the time the observed plasma left the Sun.

They then assumed a zero point for solar longitude at a time in 1962, prior to any data availability. For each of many assumed solar rotation rates, they were able to assign solar surface longitudes to each plasma element whose solar surface departure time had previously been determined. Then for each assumed rotation rate, they took averages of the flow speeds and magnetic field radial components, observed from many spacecraft over nearly 40 years, in each of many longitude bins. The expectation was that any shorter-lived longitudinal variations would be washed out by averaging such a long run of data.

However, for an assumed solar rotation period of 27.03 (+/- .02) days, significant longitudinal variations were obtained in both flow speed (amplitude ~ 30 km/s) and magnetic field radial component (amplitude ~ 0.2 nT). In the analysis published in the February 2000 issue of the *Journal of Geophysical Research,* the authors conclude that the solar magnetic dipole re-establishes the same longitude after each 11-year flip, a conclusion that is a very significant result in the study of solar processes.

The authors used some 1960s data from Mariner 2 (which initially confirmed the continued existence of the solar wind) and from Pioneers 6 and 7. It was, however, the longevity of the OMNI data set as well as the uniformity of the OMNI and COHOWeb data that enabled and greatly facilitated, respectively, this significant study.

ACE Mission Data Overview

By John Cooper

The Advanced Composition Explorer (ACE) satellite was launched on August 25, 1997. ACE measures the interplanetary magnetic field, plasma, and energetic particle environment at about one million kilometers upstream of the Earth's magnetosphere in the solar wind. The key science objective is to measure the elemental and isotopic composition of ions from solar, interplanetary, interstellar, and galactic sources at energies from keVs for solar wind plasma to 600 MeV/nucleon for cosmic ray nuclei. Definitive measurements of isotopic abundance are made for hydrogen to zinc (Z = 1 - 30) with more exploratory work extending up to zirconium (Z = 40). Six high-resolution ion spectrometers provide measurements of elemental charge, mass, or ion charge state with collecting powers ten to 100 times greater than those of previous experiments. Additional instruments provide monitoring for space weather applications of the local magnetic field, light ions (H, He), and energetic electrons. The ACE Science Center (ASC) at Caltech processes data and distributes them to experimenter teams. The spacecraft's Real Time Solar Wind (RTSW) system continuously transmits a separate stream of data from selected experiment channels to a global network of ground stations operated by NOAA's Space Environment Center (SEC) for space weather monitoring.

Dr. John Cooper and Dr. Natalia Papitashvili discuss ACE data.

The four categories of ACE public access data are browse, key parameter, Level 1, and Level 2. The browse data are intended only for monitoring of large scale plasma, energetic particle, and magnetic field variations and are generated at ASC using simple algorithms provided by instrument scientists. Key parameter data are formatted in NSSDC's Common Data Format (CDF) and submitted via NASA's International Solar-Terrestrial Physics (ISTP) project to NSSDC. Given the preliminary nature of the browse and key parameter data, any use thereof should be coordinated with the revelant ACE investigators. Level 1 data products in "engineering units" are produced at ASC in the HDF format from Level 0 telemetry data provided by GSFC and from ancillary data for spacecraft position and attitude, for distribution to experiment teams and for archiving at NSSDC. The Level 2 products returned to ASC by the experiment teams provide the most useful science content for archiving and public access, since these data are appropriate averaged over various time intervals in physical units such as flow velocity, particle flux, compositional ratios, and directional magnetic field magnitude. The Level 2 data are also formatted in HDF by ASC for usage by ACE experiment teams and for eventual public archiving. Time resolutions by instrument and data type are listed in Table I. (See page 4).

Public access to ACE data is provided by ASC, NOAA, and NSSDC. The browse data are posted in digital (HDF, ASCII) and graphic form by ASC immediately after processing from the daily telemetry data. The RTSW data are more immediately processed by NOAA within minutes of telemetry data receipt and made available for warnings of imminent space weather events affecting the Earth's magnetosphere and ionosphere. The ISTP-compliant

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Note: FULL versions of articles are available at http://nssdc.gsfc.nasa.gov/nssdc_news/

See Commonly Used Acronym list on page 4.

Vote on Data Base Protection Legislation Approaches

By Joseph King

The U.S. National Academy of Sciences convenes a meeting approximately annually of the directors of federally-funded National Data Centers, U.S. World Data Centers, and the EOSDIS Distributed Active Archive Centers. The most recent such meeting was hosted by NOAA's National Geophysical Data Center (NGDC) in Boulder, Colorado, on March 20-21, 2000. It was attended by this author.

Key issues addressed at the meeting included the status and potential impact of pending legislation on "data base protection," impact on data centers and their user communities of restrictions on obtaining and distributing data from foreign and private-sector sources, and relative roles of commercial companies generating and/or distributing data and federally-funded data centers. The second and third of these are primarily relevant to the Earth science enterprise at present.

The data base protection legislation has generated a great deal of interest with long lists of companies and other organizations on record as supporting and opposing the legislation. There are two proposed laws pending that would in different ways extend copyright laws protecting creative material to further safeguard compilations of data created without creative dimensions but with "sweat of the brow"; for example, telephone yellow pages may be copyrighted, but white pages may not be. The protection of white-pages-like compilations is the intent of the new legislation.

The first law, HR 354, has an emphasis on protection with limited exceptions for some research and other uses. The second, HR 1585, has an emphasis on data base users and specifies prohibitions only on uses intended as economically competitive with the data base creator. The first is well supported by the publishing industry and others and is likely to be the first (if not only) bill to be voted on this spring. It is generally opposed by library and scientific organizations owing to concerns about restrictions on data and information access and use. These bills are successors to yet more restrictive data base legislation, introduced in 1996 and 1997, that did not pass into law.

A more extensive discussion of the pending legislation, its history, and its relation to United Nations World Intellectual Property Organization actions and to the 1996 data-access-restricting Data Base Directive of the European union is given in the full on-line version of this article. Links to Web pages of proponents and opponents are also given there.

NASIRC Is Key to NASA Computer Security

By Nancy Laubenthal and Anthony Russo

The NASA Incident Response Center (NASIRC) researches, coordinates, and responds to all reported NASA computer and network security incidents resulting from unauthorized probes, intrusions, and system compromises. The Space Science Data Operations Office (SSDOO) manages NASIRC as a NASA-wide support contract. NASIRC involves a close working relationship between the NASIRC federal team and the NASIRC contractor (Allied Technology Group, Inc.) staff. NSSDC's Gregory Goucher is NASIRC's project manager, and Anthony Russo leads the contractor team. NASIRC's Web page is at http://www-nasirc.nasa.gov.

Specific NASIRC duties include the technical evaluation, preparation and distribution of security alerts, notifications, patches, and fixes; the proactive sharing of information technology (IT) security information; the evaluation, development, and sharing of security tools and techniques; technical training related to incident detection, analysis, and handling; the coordination of agency-wide and national-level vulnerability notification and incident response data via secure communications.

Within the past nine months NASIRC's role has been expanded in a number of areas: collaborations with other NASA Field Centers and with other federal agencies and national-level computer incident coordinating authorities; development of an on-line incident reporting Web application; and handling of classified incidents.

In the first two months of calendar year 2000, NASIRC saw a significant rise in the number of incidents being reported from agency-wide sources to over 1,000 per week and is experiencing a substantial increase in the number of bulletins, memos, and alerts issued. As of February 28, 2000, NASIRC had produced over 180 Alerts, Bulletins, and Vendor Releases as compared to a total of 275 for the entire year of 1999.

NOST News: International Standards Development Update

By Donald Sawyer and John Garrett

A Panel 2 workshop of the joint ISO/CCSDS effort was held outside Madrid, Spain, November 3-12, 1999. Presentations and demonstrations of data management efforts using ISO/CCSDS standards included the following. *ESA/ESRIN Archive Management System (AMS):* The ESRIN archive at Frascati, Italy, has developed the AMS to provide files of Earth science data to requesters. It uses the EAST Data Description Language (CCSDS 644.0-B-1) to provide an inventory mapping to blocks within a given file to provide a useful and automated subsetting capability. *NSSDC Data Migration:* NSSDC is migrating files from VMS-based optical platters to UNIX-based DLTs and Raid disks. They are creating Archival Information Packages (AIPs) consisting of a data file in canonical form together with an NSSDC standard attribute object written using PVL (ISO 14961:1997/CCSDS 641.0-B-1). The packaging uses Standard Formatted Data Units (SFDU) (ISO 12175:1994/CCSDS 620.0-B-2.1). *Control Authority Agent:* NSSDC/NOST demonstrated a prototype "URN-like" service for access to data descriptions registered at various Control Authority offices among the space agencies. *Draft XML-SFDU:* The BNSC representative demonstrated an XML-based prototype version of the SFDU packaging information, including the identification of the "class" of the object and the unique identifier assigned by a Control Authority. Efforts to combine these classes triggered by the unique identifiers is also being investigated. The draft CCSDS/ISO standard Reference Model for an Open Archival Information System has been issued as a CCSDS Red Book for formal review within the space agencies. Comments are due by mid-August 2000 as per the instructions at http://www.ccsds.org/RP9905/RP9905.html. Harmonization between CCSDS work on Data Entity Dictionary Specification Language (DEDSL) and ISO SC 32 work on data element description and registration standards (ISO 11179) was pursued at Madrid. The DEDSL-abstract syntax was finalized at the workshop. The first concrete syntax, based on PVL, will be followed by an XML-based syntax.

An international conference on metadata registries was held in Santa Fe, California, during January 2000. NASA contributed three papers. The first, by Lou Reich/CSC, compared CCSDS DEDSL with ISO 11179. The second, by John Garrett/RITSS, compared the CCSDS Control Authority standards with corresponding ISO 11179 standards. The third, by Steven Hughes/JPL, described the uses of XML/DTDs and the DEDSL standards to further describe profiles of distributed resources accessible via distributed queries over CORBA.

IMP 15-s Magnetometer Data Added to CDAWeb

By Joseph King, Kent Hills, and Muriel Taylor

The IMP 8 magnetometer, now in its twenty-seventh year of in-space operation, has produced the most often and widely used data in the history of space physics. At hourly resolution it has been the chief contributor of interplanetary magnetic field data to NSSDC's 1963-2000 OMNI data set. At 15-s resolution it has long been the data set most often downloaded by space physicists from NSSDC's NDADS system.

While a 1-min resolution key parameter version of this data set has been created for the International Solar-Terrestrial Physics (ISTP) era (after 1991) and made accessible through the CDAWeb system, NSSDC (with the Space Physics Data Facility [SPDF]) is now creating a Common Data Format (CDF) version of the definitive 15-s data set for making these data accessible through the CDAWeb system. This effort will first load ISTP era data to CDAWeb and then will load the 1973-1991 part of the data set to CDAWeb.

The IMP 8 magnetometer was provided by Goddard Space Flight Center's Laboratory for Extraterrestrial Physics. Dr. Norman Ness was the original principal investigator. Dr. Ronald Lepping has played that role for most of the long IMP 8 life. Dr. Adam Szabo is about to assume the role.

Sun-Earth Connects to Education and Outreach

By James Thieman

On February 3-4, 2000, the Sun-Earth Connection Education Forum (SECEF) arranged a meeting among major groups working to enhance Education and Public Outreach (EPO) in the Sun-Earth Connection (SEC) science theme. SEC mission scientists and EPO coordinators met with "broker/facilitators" from the NASA Office of Space Science Education program as well as with many representatives of the Goddard Space Flight Center (GSFC) Education Office (http://education.gsfc.nasa.gov/). The broker/facilitators are members of five groups scattered across the United States with the responsibility to promote and facilitate NASA's space science education endeavors within their region of the U.S. The GSFC education office group included a large number of the Aerospace Education Specialists (AESP [http://www.okstate.edu/aesp/AESP.html]), each assigned two states in which they promote NASA education for all of NASA's enterprises. Most of the GSFC SECEF staff were present as well. In all, 57 people attended the meeting.

Twenty-three mission scientists and EPO leads from 14 SEC missions were gathered for the meeting, making it the largest education meeting ever of this type. They presented the latest science results for their missions and/or plans for the future. There

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IMP LEPEDEA Data Made FTP-Accessible

By Joseph King and Natalia Papitashvili

Over the years Professor Louis Frank and his colleagues at the University of Iowa have flown a series of increasingly sophisticated instruments for the determination of the distribution functions of protons and electrons within the Earth's magnetosphere, especially the Earth's magnetotail. One of this series, called the Low Energy Proton and Electron Differential Energy Analyzer (LEPEDEA), flew on the Interplanetary Monitoring Platform (IMP) 8.

The IMP 8 LEPEDEA determined distribution functions every 2+ minutes by measuring proton and electron fluxes in 15 energy windows between 60 eV and 40 keV (approximately) in each of 16 azimuthal directions about the IMP spin vector. The IMP spin vector is normal to the ecliptic plane.

The traditional approach to LEPEDEA data management at the University of Iowa has been to generate daily colored spectrograms from which times of special interest could be identified and then to do scientific analyses from essentially raw data for the times of interest. Unfortunately, such near-raw data were virtually impossible for use away from the University of Iowa.

Led by Dr. Cheryl Huang, the Iowa team created digital distribution function data for time spans jointly selected by Iowa and the IMP project and sent these data to NSSDC on six 9-track tapes in the early 1990s. The time spans included the 1978-1980 period of the early ISEE-IMP overlap, the 1982-1983 period in which ISEE 3 was in the Earth's deep magnetotail, and the 1986 Polar Region Outer Magnetosphere International Study (PROMIS) period. The data cover only the LEPEDEA-optimal magnetotail phase of the IMP orbit (near circular at approximately 200,000 km).

NSSDC has recently converted these data from binary to ASCII, g-zipped them, and made them FTP-accessible at ftp://nssdc.gsfc.nasa.gov/pub/spacecraft_data/imp8/u_iowa_lepedea/. In addition, NSSDC also created a single (non-zipped) file containing just the electron and ion densities and the ion velocity vectors (GSE X, Y components only) as extracted from the full data records.

NSSDC and SSDOO Quietly Ring in the New Century

By Nancy Laubenthal

The Space Science Data Operations Office (including NSSDC) shut down its computers and networks over the Y2K weekend as a general precaution. There were no complaints that computers were unavailable. This lack of complaints suggests that NSSDC's and SSDOO's research and other customers were busy celebrating the arrival of the new millennium.

Monday morning, January 3, 2000, equipment was powered up and has operated successfully in the new year. The Y2K validation, verification, and testing proved worthwhile, and for the most part, systems and software have been Y2K-compliant. NSSDC has experienced a couple of very minor Y2K problems with little to no impact.

Several Grants Won by SSDOO Staffers

By Joseph King

Several grants have been won by staffers of the Space Science Data Operations Office since the last listing of grants won was published in NSSDC's December 1998 newsletter. These grants and their recipients include the following in the specified areas.

Science, Using Extant Data

Magnetospheric Irradiation of Europa and Io, J. Cooper.

Rapid Detection of Magnetospheric Boundaries Using Neural Network Analysis Techniques Applied to the IMAGE Mission, J. Green et al.

IR Emission from the WIM and the CIB Intensity, N. Odegard, T. Sodroski (Co-Is).

Education-Oriented

Value-Added Educational Tutorials for HST Data, K. Borne.

OMNIWeb Data for Space Science Education, J. King et al.

Teens Listening to an All Natural Radio Station, J. Thieman et al.

A Real-Time, Hands-On Space Science Classroom Activity, J. Thieman et al.

Data Management Oriented

Development of an SSDS Federation Interoperability Substrate Using MOCHA, C. Cheung, K. Borne.

Missions Operations Client Server Architecture, C. Cheung, N. Roussopoulos.

Development of 25-Year IMP 8 Bow Shock Crossing List, J. King et al.

Development of an IUE Time Series Browser, D. Massa, M. Van Steenberg.

Improved IUE High Dispersion Extraction Software, M. Van Steenberg, D. Massa.

Science, Observational Programs

Massive Star Clusters in Galaxy Interactions, K. Borne (Co-I).

Snapshot Survey of Dynamically Close Galaxy Pairs, K. Borne (Co-I).

AXAF Investigation of Arp 220, K. Borne (Co-I).

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IMAGE Spacecraft Is Successfully Launched

By Joseph King and James Green

The Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) spacecraft was successfully launched from Vandenburg Air Force Base on March 25, 2000. Although there were high thin clouds, the Vandenburg crew got off the Delta carrying IMAGE within the first minute of the 8-min launch window. IMAGE attained its intended 1,000 km x 46,000 km, 13.5-hour orbit. The apogee point is at 40 deg geographic latitude, and the spacecraft will drift over the Earth's North Pole and back down to 40 deg in two years. IMAGE is Explorer 78.

IMAGE is a MIDEX class mission selected by NASA in 1996 to study the global response of the Earth's magnetosphere to changes in the solar wind. IMAGE will (1) identify the dominant mechanisms for injecting plasma into the magnetosphere on substorm and magnetic storm time scales; (2) determine the directly driven response of the magnetosphere to solar wind changes; and (3) discover how and where magnetospheric plasmas are energized, transported, and subsequently lost during substorms and magnetic storms.

To fulfill its science goals, IMAGE will utilize neutral atom, ultraviolet, and radio imaging techniques. A suite of three neutral atom imagers (NAI) will provide energy- and composition-resolved images at energies from 10 eV to 200 keV with a time resolution of 300 seconds. Two ultraviolet imagers, covering wavelength ranges from 120nm - 180 nm (FUV) and 30.4 nm (EUV), provide coverage in the far and extreme ultraviolet. A radio plasma imager (RPI) will transmit and receive pulses from 3 kHz to 3 MHz allowing relative motions of the satellite and plasma to be determined to a resolution of 400 m/s and a time resolution as good as 4 s.

The IMAGE project scientist is Dr. James Burch at Southwest Research Institute. SSDOO's Drs. James Green, Shing Fung, and William Taylor are members of the Radio Plasma Imager team (principal investigator: Dr. Bodo Reinisch, University of Lowell). Richard Burley of the Space Physics Data Facility within SSDOO led the team defining and building the ground data system.

IMAGE Level 1 data in Universal Data Format (UDF) will become publicly accessible from NSSDC in May 2000. Higher level data including browsable images will become accessible through the CDAWeb system. The IMAGE science Web page is at http://image.gsfc.nasa.gov/.

Cascading Style Sheets Used for NSSDC Web Pages

By Edwin Bell

Over the course of the last two years, readers may have noticed a slow transformation in the appearance of NSSDC's Web pages (and those of its parent organization, the SSDOO). NSSDC strives, in general, to make its data and information as accessible as possible. This effort means that NSSDC's pages are often more utilitarian than those of other sites. As browsers and Web standards have evolved, NSSDC has kept abreast of developments to enhance readers' visits without compromising accessibility. To that end, NSSDC has begun to utilize a Web standard known as cascading style sheets (CSS).

One benefit from using CSS is that its use makes NSSDC pages easier to maintain (much of the HTML is simplified) as well as to change. CSS allows use of external style sheets (files that contain directions to the browser that specify font faces and styles, colors, indentations, margins, etc.) that can be used by groups of files. Should NSSDC wish to alter the appearance of its pages, then staff can make changes in one file and those changes will be immediately made on all the pages that use that style sheet. Style sheets can also be used in a sequential (cascading) manner to produce cumulative effects. Use of style sheets also allows users more control over how pages appear to them. Some browsers permit users to define their own style sheets to supplement or supplant NSSDC's style sheets. This ability can be of particular significance to those users who have special needs. More information about cascading style sheets is available from the following resources: ***WebReview Magazine On-Line*** (http://webreview.com/pub/guides/style/style.html), ***Cascading Style Sheets: Designing for the Web (2nd Ed.)*** by Håkon Wium Lie and Bert Bos, **World Wide Web Consortium (W3C) Recommendation for CSS1** (http://www.w3.org/TR/REC-CSS1-961217.html), **W3C Recommendation for CSS2** (http://www.w3.org/TR/REC-CSS2).

ACE Mission Data Overview

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key parameter data are accessible in digital and graphic formats through NSSDC's Coordinated Data Analysis Web (CDAWeb) service. The Level 1 HDF data files are provided to NSSDC for off-line archiving on compact disk, but the more useful ancillary data are available on line at NSSDC's Anonymous FTP site. Currently, the Level 2 data are available in digital (HDF, ASCII) and plot formats only from ASC, but archiving and public access will commence at NSSDC in the near future.

Table I. Time Resolutions for Accessible Data Types from ACE Instruments

Instrument	Measurement	Time Resolution			
		ASC Browse	CDAWeb	RTSW	ASC Level 2
MAG	Interplanetary Vector Magnetic Field, RTN & GSE	16s, 5m, 1h, 1d	16s, 5m, 1h	1m	16s, 4m, 1h, 1&27d
SWIMS	Solar Wind Plasma Ion Mass, He - Ni				(1h, 1&27d)
SWICS	Solar Wind Plasma Ion Composition, He - Ni	1h, 1d			(1h, 1&27d)
SWEPAM	Solar Wind Plasma Ion & Electron Flux	5m,1h, 1d	64s, 5m, 1h	1m	64&128s, 1h, 1&27d
ULEIS	Solar/Interplanetary Energetic Ion Isotopes, H - Ni	5m, 1h, 1d			1h, 1&27d
SEPICA	Solar Energetic Ion Charge States, H - Fe	5m, 1h, 1d			120s, 1h, 1d
EPAM	Energetic Particle Flux Anisotropy: e-, H, He	5m, 1h, 1d		5m	1h, 1&27d
SIS	Solar High Energy Ion Isotopes, He - Ni	1h, 1d	1h	5m	256s, 1h, 1&27d
CRIS	Galactic Cosmic Ray Ion Isotopes, Li - Ni	1h, 1d			1h, 1&27d

Sun-Earth Connects to Education and Outreach

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were many discussions among the broker/facilitators, education office representatives, scientists, and EPO leads regarding how the groups relate to one another and how they can best work together. The meeting was clearly a success.

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Joe King: Head Miranda Beall: Editor Lori Ann Persichitti: Graphics, WWW Jay Friedlander: Photography

NSSDC Information

JOSEPH H. KING, HEAD
NSSDC, CODE 633
NASA GODDARD SPACE FLIGHT CENTER
GREENBELT, MD 20771, U.S.A.

To request data or information from NSSDC, contact
NSSDC (for U.S. requesters) or WDC-R&S, Greenbelt (for non-U.S. requesters)

both at
Coordinated Request and User Support Office (CRUSO)
NSSDC, Code 633
NASA Goddard Space Flight Center
Greenbelt, Maryland 20771, U.S.A.

Telephone: 301.286.6695
Internet: request@nssdca.gsfc.nasa.gov
FAX: 301.286.1635

Commonly Used Acronyms

BNSC	British National Space Centre	**ISEE**	International Sun-Earth Explorer
CCSDS	Consultative Committee for Space Data Systems	**JPL**	Jet Propulsion Laboratory
DLT	Digital Linear Tape	**MIDEX**	Medium-Class Explorers
EOSDIS	Earth Observing System Data and Information System	**NDADS**	NASA Data Archive and Distribution System
ESA	European Space Agency	**NOAA**	National Oceanic and Atmospheric Administration
ESRIN	European Space Research Institute	**SSDS**	Space Science Data System
HDF	Hierarchical Data Format	**URN**	Universal Resource Name
IMP	Interplanetary Monitoring Platform	**XML**	eXtensible Markup Language