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Committee on the Peaceful Uses of Outer Space

Reports on national and regional activities related to the International Space Weather Initiative

Note by the Secretariat

Contents

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I. Introduction

1. In its resolution 64/86 of 10 December 2009, the General Assembly endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that the Scientific and Technical Subcommittee, at its forty-seventh session, include a new agenda item entitled "International Space Weather Initiative", in accordance with the three-year workplan adopted by the Subcommittee at its forty-sixth session (A/AC.105/933, annex I, para. 16).

2. At its forty-sixth session, the Scientific and Technical Subcommittee agreed that it was important to continue to explore the solar corona; to deepen the understanding of the function of the Sun and the effects that variability of the Sun could have on the Earth's magnetosphere, environment and climate; to explore the ionized environments of planets; and to determine the limits of the heliosphere and to deepen the understanding of its interaction with interstellar space (A/AC.105/933, para. 167).

3. According to the three-year workplan, the Subcommittee would consider reports by interested Member States, scientific organizations and the International Space Weather Initiative secretariat on regional and international plans to implement the Initiative. The Subcommittee would encourage both the continued operation of existing instrument arrays and new instrument deployments.

4. The present document contains reports received from Armenia, Germany, Myanmar and the United States of America, as well as from the Committee on Space Research (COSPAR) and the World Meteorological Organization (WMO).

II. Reports received from Member States

Armenia

[Original: Russian]

As part of the Voluntary Cooperation Programme of the World Meteorological Organization, a Swiss Tecnavia Skyceiver Workstation was installed in 1996 to receive satellite data at the Armenian State Hydrometeorological and Monitoring Service, which operates within the Skyceiver System Tecnavia programme to present images received from meteorological geostationary and orbiting satellites (Meteosat-5, Meteosat-7, Geostationary Meteorological Satellite Himawari, Geostationary Operational Meteorological Satellite, Geostationary Operational Environmental Satellite and satellites of the National Oceanic and Atmospheric Administration (NOAA)). At present, that system is receiving data from orbiting NOAA satellites.

The Armenian State Hydrometeorological and Monitoring Service has a licence agreement with the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) to receive satellite data from the Meteosat Second Generation satellite, using the client software for the EUMETSAT Broadcast System for Environmental Data and the EUMETCast Key Unit. The received output is not processed further owing to a lack of necessary equipment and software.

Satellite data are also received from the Scientific Research Centre of Space Hydrometeorology Planeta, via the Internet (see http://sputnik.infospace.ru).

The Armenian State Hydrometeorological and Monitoring Service uses satellite data for operational purposes (short-term weather forecasts); delivery of services (weather forecasts on television and electronic media); and scientific purposes (climate research). Satellite information is also used by the Armenian State Hydrometeorological and Monitoring Service for monitoring the climate in real time.

The Armenian State Hydrometeorological and Monitoring Service and the German weather service, Deutsche Wetterdienst (DWD) are carrying out a project using output from the Satellite Application Facility on Climate Monitoring (CM-SAF) to monitor the climate in Armenia. The main aim of the project is to develop an online monitoring system based on a combination of satellite information from CM-SAF and data from observatories.

CM-SAF and DWD provided satellite data on solar radiation (monthly and daily) to complete this project. This included short-wave solar radiation data from the Solar Imaging Suite, the Surface Albedo and the data set from the Surface Radiation Budget project. The expected results are an evaluation of solar radiation as a possible source of energy (monthly charts), monthly charts on the radiation data set and monthly albedo charts.

Because of its mountainous terrain, Armenia is prone to experience frequent events such as heavy rains, hail, thunder and squally winds, and occasional tornadoes. Further analysis of satellite information is required in order to forecast those events and frontal precipitation.

Agrometeorological and hydrological forecasts are a central part of the forecast output of the Armenian State Hydrometeorological and Monitoring Service. Satellite information is required to forecast flooding, as the data from the meteorological network of the Armenian State Hydrometeorological and Monitoring Service are insufficient for accurate measuring of the area of snow cover and detection of the liquid-water content of snow. Data on ground humidity, the vegetation index and so on are also required for agrometeorological forecasts.

Software for further analysis and use of satellite images for synoptic charts will make it possible to carry out qualitative and quantitative analysis (to differentiate cloud types and evaluate the liquid-water content of clouds, cloud intensity, diameter of hail, the area of snow cover and its liquid-water content and so on) and to provide additional information for the purposes of forecasting.

Specialists from the Armenian State Hydrometeorological and Monitoring Service, with the support of the EUMETSAT, WMO and others, take part in various international seminars, conferences and training courses on the use of satellite data.

The Armenian State Hydrometeorological and Monitoring Service is planning in the near future to modernize its system for receiving and processing satellite information in order to monitor the environment and increase the accuracy of hydrometeorological forecasts and forecasts of dangerous hydrometeorological events, thereby supporting lasting socio-economic development in Armenia and protecting the people from injury and property from damage.

The Space Environmental Viewing and Analysis Network (SEVAN) particle detectors, located at middle to low latitudes, have been set up in connection with International Heliophysical Year 2007. Their purpose is to enable fundamental research on particle acceleration in the vicinity of the Sun and an investigation of space weather. The new type of particle detectors will simultaneously measure changing fluxes of most types of secondary cosmic rays, making it a powerful integrated system for exploring the effects of solar modulation. Ground-based detectors measure time series of secondary particles born in cascades originating in the atmosphere as the result of the atomic interaction between protons and nuclei accelerated in the galaxy. Where strong solar flares occur, additional secondary particles are sometimes added to the “background” stream. Research into the fluctuation in the time series of secondary particles can shed light on the high-energy particle acceleration mechanism. A time series for the intensity of high-energy particles can also provide significant information on the key properties of interplanetary storms. Recent results from the observation of solar events (2003-2005) by the Aragats Space Environmental Centre demonstrate the diverse opportunities the new particle detectors provide for measuring neutron, electron and muon streams with internal correlations.

Three SEVAN detectors are installed, two on the slopes of Mount Aragats in Armenia, at altitudes of 3,200 and 2,000 m, and one in the central department of the Cosmic Ray Division in Yerevan, at an altitude of 1,000 m. Another detector was installed in Bulgaria, on Mount Musala, and another in the Croatian observatory in Zagreb. The large volume of information provided by the detectors of the same type, working at approximately the same longitude and latitude, creates further opportunities for research in the fields of space weather and solar physics.

In its complete configuration, the SEVAN network provides reliable coverage of the Sun by at least one detector for 22 hours and by two detectors for 18 hours per day. Streams of particles measured by the new network at middle to low latitudes, in combination with the information from satellites and high-latitude detector networks, provide experimental data on actual energy processes in the solar system and will become an important element in the forecasting and monitoring of space weather worldwide.

Geophysical properties of possible locations for the Space Environmental Viewing and Analysis Network

Country	*Station*	*Latitude*	*Longitude*	*Altitude (m)*	*Cut-off rigidity (Gigavolts)*
Germany	Greifswald	54.5N	13.23E	6	2.34
Slovakia	Lomnický peak	49.2N	20.22E	2 634	3.88
Croatia	Zagreb	45.82N	15.97E	120	4.89
Bulgaria	Musala	42.1N	23.35E	2 430	6.19
Armenia	Aragats 1	40.25N	44.15E	3 200	7.1
Armenia	Aragats 2	40.25N	44.15E	2 000	7.1
Israel	Hermon	33.18N	35.47E	2 025	10.39
Costa Rica	San José	10.0N	84.0W	1.2	10.99
China	Tibet	30.11N	90.53E	4 300	13.86
India	Delhi	28.61N	77.23E	239	14.14
Indonesia	Jakarta	6.11S	106.45E	8	16.03

Experimental data were presented at the Workshop "First Results from the International Heliophysical Year 2007", held by the United Nations, the European Space Agency (ESA), the National Aeronautics Space Administration (NASA) and the Japan Aerospace Exploration Agency (JAXA). Reports on the SEVAN network were presented in several international forums (available at http://aragats.am).

The report entitled "SEVAN particle-detector network located at middle-low latitudes for solar physics and space weather research" was presented to the Congress of the Committee on Space Research, held in Montreal from 12 to 20 July 2008, to the International Cosmic Ray Conference, held in Lodz, Poland, in 2009 and to the Workshop on Basic Space Science and the International Heliophysical Year 2007, held in Daejeon, Republic of Korea, in 2009.

The international consortium of the International Heliophysical Year rated the SEVAN project one of the three best projects of a total of 18 undertaken from 2006 to 2009.

Germany

[Original: English]

Space weather issues have been discussed in Germany for many years. The first National Space Weather Workshop, organized by the German Aerospace Center (DLR) Neustrelitz in 2000, reinforced national activities in various directions related to research, satellite missions and applications.

Germany was involved in the Space Weather Pilot Project of ESA by establishing an ionospheric data and information service for Global Positioning System (GPS) users in 2002. Thanks to the financial support of the state government of Mecklenburg-Vorpommern, this activity was further developed by establishing the Space Weather Application Centre Ionosphere (SWACI) at DLR Neustrelitz, and the activity is still ongoing.

At the 3rd National Space Weather Workshop, held in Freiburg in September 2008, the following relevant space weather activities and fields of expertise were identified:

(a) Several satellite missions related to space weather issues have been designed and constructed in Germany (e.g. Challenging Mini-Satellite Payload, Gravity Recovery and Climate Experiment, TerraSAR-X) or are under construction (e.g. SWARM). DLR and the German Research Centre for Geosciences (GFZ) Potsdam are deeply involved in preparing, operating and exploiting these satellite missions;

(b) At Fraunhofer-Gesellschaft Research Centre, specific payloads capable of measuring solar radiation and plasma parameters are under development. Extreme ultraviolet (EUV) fluxes are being measured by the International Space Station-ESA-Solar Auto-Calibrating EUV/UV Spectrophotometers experiment. New payloads and missions are discussed closely with the European Aeronautic Defence and Space Company Astrium Friedrichshafen;

(c) Solar and space weather research is performed at the Max Planck Institute for Solar System Research, the University of Göttingen, the Astrophysical

Institute Potsdam (AIP) and the University of Kiel. The data analysis is based on satellite missions such as Solar-Terrestrial Relations Observatory, Solar and Heliospheric Observatory and Project for On-Board Autonomy 2. AIP contributes to the European Low Frequency Array project by studying solar radio emissions using innovative technology. A muon detector has been installed at the University of Greifswald for monitoring space weather effects;

(d) A SWACI has been established at DLR Neustrelitz. Since challenges of accuracy, reliability, integrity and availability of modern radio techniques used in telecommunication, positioning, navigation and remote sensing are growing rapidly, there is an increasing market for specific ionospheric data products. This is the motivation for establishing an ionospheric data and information service that provides different user groups with specific information they need. Thus, the ionospheric service shall provide current information and forecasts on the ionospheric state, in particular on ionospheric perturbations.

Pursuant to the conclusions of the 3rd National Space Weather Workshop, the different national space weather contributors are recommended to coordinate their activities to support the SWACI ionosphere data and information service, which is under development at DLR Neustrelitz (http://swaciweb.dlr.de). Following this strategy of networking and bundling national assets, Germany may contribute substantially to the space weather element of the European Space Situational Awareness programme.

The SWACI service is planned to become fully operational by the end of 2010. The near real-time ionospheric information is mainly derived from ground- and space-based Global Navigation Satellite Systems (GNSS) measurements. Recently, DLR and NOAA agreed to receive the NASA Advanced Composition Explorer (ACE) spacecraft in Neustrelitz. ACE is located at the Earth-Sun libration point L1, carrying out in situ measurements of particles originating from the solar corona, the interplanetary medium, the local interstellar medium and galactic matter.

Since 2 September 2009 DLR Neustrelitz is part of the Real Time Solar Wind (RTSW) monitoring capability of NOAA. The RTSW data are used to provide accurate alerts and warnings of major geomagnetic storms with a lead time of about one hour. The data shall be used to improve forecasts of the ionospheric perturbation degree in near real time.

Myanmar

[Original: English]

Planet Earth is unique in the solar system, as the only planet supporting the existence of life. Space, the medium connecting the solar system, has weather, whose variations have tremendous consequences for life on Earth. In the early 1950s only a few countries monitored space weather from ground-based observatories. As space missions have become more technically sophisticated, their sensitivity to the space environment has increased.

The modelling of the dynamics of the space environment with the use of data, the field known as “space weather”, is growing rapidly worldwide. At the moment the world's space weather activities are fragmented into different groups, and even region-wide initiatives are in an embryonic state.

Progress in space environment analysis is expected from extensive collaborative efforts using near real-time data from spacecraft and ground-based and theoretical simulations, with the aim of establishing predictive systems relating the cause (solar activity) to the effect on technological systems and human activity. At the same time, it has become evident for the scientific community that it also needs input from potential users of future space weather services.

Preliminary research on space weather forecasting and related international cooperation has been initiated in recent years. Foreign remote-sensing satellite images have been applied in weather forecasting, territorial surveys, agricultural output assessment, forest surveys, natural disaster monitoring, maritime forecasting, urban planning and mapping.

However, a regular operation of the meteorological satellite ground application system, in particular, has not been established yet. Conventional methods are being used for weather forecasting and monitoring. In addition, there is a need to improve the accuracy of current conventional forecasting of disastrous weather, as well as to upgrade the space weather programme in order to reduce the economic losses of both the State and individuals caused by such weather.

Therefore, a regional strategy forum on space weather research infrastructures should be set up by Asian member States to provide a multidisciplinary platform open to all Asian countries to respond to the needs expressed by the scientific community on an ongoing basis.

Infrastructural building

Prior to the development of infrastructural facilities, a forum is needed to investigate at what stage the State's agencies and institutions are, as compared with other States in the region, and how ready they are to collaborate with space weather services and to communicate on all scientific, technological, economic and environmental issues.

There is a need to build up a region-wide Earth and space observation system for long-term stable operation to conduct stereoscopic observation and dynamic monitoring of the Earth and space by networking satellites and ground stations.

Facilities for making meteorological and other environmental observations on a global scale, comprising operationally reliable surface-based subsystems and on-land observing facilities, and collaboration with other agencies and centres that have their own space-based subsystems and observing facilities, both in the air and in outer space, are intended to be established in accordance with the advice from the United Nations Office for Outer Space Affairs and related agencies.

As predictions of space weather and modern meteorology depend upon the instantaneous exchange of weather information all around the globe, smooth telecommunication facilities with other data-processing and forecasting centres has to be maintained.

Research and development

Standardized technical standards, guidance material, performance specifications, technology transfer and training assistance are needed to ensure the effective and economical use of instruments and methods of observation under varying working conditions of centres and in differing technical infrastructures of the region.

While climate-related diagnosis on the global scale is being done routinely, the comparative research on the products of analysis and forecasting, monitoring of observational data quality, verification of the accuracy of prepared forecast fields, diagnostic studies and model development will be carried out over the long term. Therefore, the long-term storage of observed data, processed data and analysis, the maintenance of a continuously updated catalogue of data and products and the verification of results should be not only for operational purposes, but also for further research.

A scoring system to provide a measure of the effectiveness of the forecasting system with respect to each location and major event, and which summarizes the results on a single sheet of paper, should be developed for use by all regional bodies to quickly highlight problem areas for appropriate remedial action.

To establish research infrastructure, facilities and resources have to be provided. At present there are several services that can provide certain limited resources for the research community in both the academic and industrial fields. A cost-effective way should be planned to conduct analyses and research on space weather. There is evidence that even a short-term (i.e. three-year) research project can produce a useful data set and greatly improve forecasting ability and measures related to disaster preparedness. The research should contribute to the operational application of research results.

There is a need to upgrade the present curriculum and syllabus for space science courses to improve understanding of the space weather system and to apply this understanding for the benefit of societies coping with climate variability and change.

Data exchange and online access

To exchange and share real-time data with other agencies and centres, a suitable database system should be established. In addition, a regional network to computerize operational data handling, processing and display for space weather monitoring to improve warning systems in the region is also needed.

In combination with activities under the operational and technical plans of all the regional bodies, technology should be transferred through specialized training, field experiments, special projects and the publication of scientific guidance materials.

Several online laboratories for satellite training and data utilization have been established to maximize the exploitation of satellite data around the globe. They are designed to allow easy access for students and trainers to a wide range of satellite meteorology training resources.

Cooperation should be facilitated to provide training in meteorology, exchange and deliver online material and help with computer-assisted learning techniques. Resources such as educational modules should ideally be uploaded to a library in such forms as images, graphs or slides, as separate parts that can be downloaded by any user who wishes to create a lecture or a course.

A coordinated exchange of knowledge and proven methodology between States should be promoted, with the particular goal of upgrading the capabilities of collaborative forecasting and warning services throughout the region.

Capacity-building

There should be collaboration with other agencies that have space weather services for forecasting and warning about hazards and joint research on space weather, rather than unmanned spacecraft of agencies operating on their own.

Data and training material should be provided to enhance the exploitation of satellite data, either alone or in combination with other meteorological data. The training materials should be in the form of case studies, interactive exercises or manuals. Workshops and seminars should be conducted on the preparation and use of space weather analysis results to foster the development of new and improved instruments, observation methods and data reduction and quality control techniques, embracing all needed forms of instrumentation, including that used for remote sensing. Such workshops and seminars could enhance the effective and economical use of observing technology and systems through training and technology transfer in developing countries.

Expected benefits to society

Combined with more effective awareness programmes and simultaneous advances in risk evaluation, disaster prevention and other preparedness measures, the following are some of the expected benefits to society:

(a) Awareness of warnings and the conduct of activities at the interface between warning systems and users of warnings;

(b) Scientific and technical developments to strengthen warning and mitigation systems for national disaster preparedness and prevention;

(c) Further advances in areas such as meteorological satellite technology, computers and electronics, scientific knowledge, mathematical and physical modelling and international cooperation are expected to provide an incentive for continued improvements;

(d) Meteorological support for activities in the aviation, maritime, agriculture and energy fields.

United States of America

[Original: English]

International Heliophysical Year 2007 was an international programme of scientific collaboration involving thousands of scientists from more than

70 countries, conducted from February 2007 to February 2009. Along with programmes devoted to research, outreach and the commemoration of International Geophysical Year 1957, activities of International Heliophysical Year 2007 included the deployment of new instrumentation arrays, especially in developing countries, and an extensive education and public outreach component.

It was recognized early in the planning of International Heliophysical Year 2007 that the understanding of the global ionosphere and its linkage to the near-Earth space environment was limited by the lack of observations in key geographical areas. To address this need, a series of workshops was held to facilitate collaboration between research scientists in scientifically interesting geographic locations and researchers in countries with expertise in building scientific instrumentation.

Science teams emerged from those workshops, each team consisting of a lead scientist who provided the instruments or fabrication plans for instruments in the array. Support for local scientists, facilities and data acquisition was provided by the host nation. As a result of the International Heliophysical Year 2007 programme, scientists from many countries now participate in instrument operation, data collection and analysis, and publication of scientific results, working at the forefront of scientific research.

The instrument deployment programme was one of the major successes of the International Heliophysical Year. Arrays of small instruments such as magnetometers to measure the Earth’s magnetic field, radio antennas to observe solar coronal mass ejections, GPS receivers, very low frequency radio receivers, all-sky cameras to observe the ionosphere and muon detectors to observe energetic particles were installed around the world. These arrays continue to provide global measurements of heliospheric phenomena. An interesting side benefit of the instrument programme was the seeding of heliophysics research groups in universities where there had been none before, and the strengthening of existing heliophysics research groups where new instruments were installed.

Building on this concept, and to continue coordinated heliophysics research, in February 2009, the International Space Weather Initiative was proposed as a new agenda item to be taken up by the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space. Through the International Space Weather Initiative, coordinated international research will continue on universal processes in the solar system that affect the interplanetary and terrestrial environments, and there will be continued coordination on the deployment and operation of new and existing instrument arrays aimed at understanding and predicting the impacts of space weather on the Earth and the near-Earth environment. The agenda item was endorsed by the Committee in June 2009 and by the General Assembly in December 2009.

Participation in the International Space Weather Initiative is open to scientists from all countries as either instrument hosts or instrument providers. The Initiative will be governed by a Steering Committee of 15 to 20 members, which will meet once a year to assess progress and provide prioritization for the upcoming year.

Goals and objectives

The International Space Weather Initiative will help to develop the scientific insight necessary to understand the physical relationships inherent in space weather, to reconstruct and forecast near-Earth space weather and to communicate this knowledge to scientists and to the general public. This will be accomplished by (a) continuing to deploy new instrumentation, (b) developing data analysis processes, (c) developing predictive models using International Space Weather Initiative data from the instrument arrays to improve scientific knowledge and to enable future space weather prediction services and (d) continuing to promote knowledge of heliophysics through education and public outreach.

Instrument array development

The International Space Weather Initiative will continue to expand and deploy new and existing instrument arrays, following the successful practices of the International Heliophysical Year. The basic principles of this model are quite simple. Each instrument team is led by a single scientist. The lead scientist or principal researcher, funded by his or her country, provides instrumentation (or fabrication plans) and data distribution. In a few cases, where resources allow, the host country will pay for the instrument. The host country provides the workforce, facilities and operational support necessary to operate the instrument. This would typically be at a local university or government laboratory. Host scientists become part of the science team. All data and data analysis activities are shared within the science team, and all scientists participate in publications and scientific meetings where possible. Through workshops and other means, the International Space Weather Initiative will actively seek to identify additional instruments and instrument providers that could benefit from the Initiative, as well as new instrument hosts.

Data coordination and analysis

The International Space Weather Initiative will promote the coordination of data products in a form useful for input into physical models of heliospheric processes. These data will be used for both retrospective analysis aimed at physical understanding of space weather, and for models to predict future space weather conditions. To be useful for space weather prediction, data must be available in near real time. However, in many locations in the developing world, Internet connections are intermittent or slow, making near real-time data return impossible. Eventually, as Internet connectivity improves, these data will be made available in near real time in a form that can be incorporated into predictive models. In the near term, other strategies, such as data transfer by means of the Internet during selected time periods, or on recorded media such as DVDs and tapes, will be adequate for the retrospective scientific studies of space weather events and the development of physical models.

Data from the instrument arrays will be deposited in publicly available archives. For the most part, these will be existing data archives, such as the virtual observatory systems currently under development. This will make data from the International Space Weather Initiative instruments available to the broader community of researchers. To improve the coordination of the data and to enhance their value for future real-time prediction services, planning will begin for the availability and interoperability of these data. Although the infrastructure and institutional resources may not yet exist in many locations to support the real-time dissemination of quality-controlled data, it is important to begin the discussion now of data standards and the expectation of continuous operation so that data systems can be developed and the future resource allocations can be discussed with this goal in mind.

Training, education and outreach

During the International Heliophysical Year, space science schools in Brazil, China, India, Nigeria and the United States of America provided related training to hundreds of graduate students and new researchers. The International Space Weather Initiative will continue to provide support for space science schools and to promote space science and the inclusion of space science curricula in universities and graduate schools. This has been most effective when combined with the installation of instrumentation at universities.

The International Space Weather Initiative will continue to support public outreach projects. It is essential to communicate the excitement and the relevance of heliophysical research to scientists from other disciplines, and to the public at large. Through the Initiative, public outreach materials unique to the Initiative will continue to be developed, and their distribution will be coordinated through individual contacts and outreach workshops.

Collaboration with other programmes

The International Space Weather Initiative will continue to collaborate with other scientific research programmes, schools, scientific organizations and funding agencies. Through these collaborations, the Initiative will maximize the return from its programmes and minimize duplication of effort.

III. Reports received from international organizations

Committee on Space Research

[Original: English]

The present report was prepared by ESA and Rhea System S.A. on behalf of the Panel on Space Weather of the Committee on Space Research (COSPAR), with input from NASA.

The central objective of the International Space Weather Initiative is the development of the scientific insight necessary to understand, reconstruct and forecast near-Earth space weather. In addition, strong emphasis will be placed on education, training and public outreach.

The scientific benefits of the programme are expected to include an extension of the existing global ground-based measurement infrastructure, giving a more comprehensive view of the Earth’s response to external inputs. A data analysis and modelling programme will in parallel extend current exploitation of existing data sets and modelling codes through scientific exchange and sharing of data analysis.

The International Space Weather Initiative builds on work done within the framework of the International Heliophysical Year, in particular in the area of instrument deployment, where the same approach will be adopted. Initially the focus will be on deploying instrumentation capable of making good-quality scientific measurements and involving scientists from the host institutes in the analysis and exploitation of data. In the longer term, it is expected that networks will provide real-time data valuable for "nowcasting" and forecasting.

The above activities are of considerable interest to the COSPAR Panel on Space Weather, as it aims to support activities that improve our capability to provide expert knowledge on the space environment to society. The Panel also encourages the development of predictive techniques capable of forecasting changes in the space environment in a timely manner.

The International Space Weather Initiative is in its initial phases. The first workshop will take place in Morocco from 18 to 23 November 2009, focusing on establishing scientific and instrument collaborations for observing space weather phenomena in Morocco. The technical focus will be on the deployment of distributed ionospheric observatories. Morocco's location near the geographic equator makes it an interesting site for ionospheric measurements. The meeting will bring together local universities and potential instrument providers, with the intention of facilitating the installation of 10 to 20 instruments in Morocco, the identification of the responsible faculty and local participation in the instrument team.

World Meteorological Organization

[Original: English]

Being aware of the serious impact of space weather on meteorological infrastructure and on human activities in key socio-economic sectors, such as aeronautical travel, and considering the important benefits to be expected from increased coordination of efforts in space weather, the Executive Council of the World Meteorological Organization (WMO) endorsed the principle of WMO activities supporting international coordination in space weather. It was furthermore agreed to set up the Inter-Programme Coordination Team on Space Weather, involving experts to be designated by the Commission for Basic Systems and the Commission for Aeronautical Meteorology, with the following terms of reference:

(a) Standardization and enhancement of space weather data exchange and delivery through the WMO information system;

(b) Harmonized definition of end products and services, including quality assurance guidelines and emergency warning procedures, in interaction with aviation and other major application sectors;

(c) Integration of space weather observations, through a review of space- and surface-based observation requirements, harmonization of sensor specifications and monitoring plans for space weather observation;

(d) Encouraging dialogue between the research and operational space weather communities.

Consultations have been held with members and international organizations to explore collaboration opportunities. At the date of writing this report, replies are being received from members and potential partner agencies. It is anticipated that a space weather coordination office will be implemented in early 2010 with seconded staff; the office would support the Inter-Programme Coordination Team on Space Weather and work in close coordination with the International Space Environment Service.