題名　ISWI Newsletter - Vol. 5 No. 117
差出人　maeda@serc.kyushu-u.ac.jp

****
* ISWI Newsletter - Vol. 5 No. 117 12 November 2013 *
*
* I S W I = International Space Weather Initiative *
* (www.iswi-secretariat.org) *
*
* Publisher: Professor K. Yumoto, ICSWSE, Kyushu University, Japan *
* Editor-in-Chief: Mr. George Maeda, ICSWSE (maeda[at]serc.kyushu-u.ac.jp)*
* Archive location: www.iswi-secretariat.org (maintained by Bulgaria) *
* [click on "Publication" tab, then on "Newsletter Archive"] *
* Caveat: Under the Ground Rules of ISWI, if you use any material from *
* the ISWI Newsletter or Website, however minor it may seem *
* to you, you must give proper credit to the original source. *
****

Attachment(s):
(1) "GrazSymposium2013_REV1Draft", 700 KB pdf, 12 pages.

: Re:
: (Draft) Report on the United Nations/Austria Symposium
: on "Space Weather Data, Instruments and Models: Looking
: Beyond the International Space Weather Initiative (ISWI)"
: (Graz, Austria, 16-18 September 2013)

Dear ISWI Participant:

The Draft Report for the 2013 Graz Sympo is out. Please find it attached; it came to me courtesy of:
: Dr. Werner Balogh
: Programme Officer, Space Science & Technology
: Space Applications Section
: Office for Outer Space Affairs (OOSA)
: United Nations Office at Vienna (UNOV)
: E-0963, PO Box 500, 1400 Vienna, Austria
If the draft contains an error, please notify Dr Balogh quickly.

I would like to take this opportunity to remind you that a very important (ISWI, etc.) meeting will take place along side the STSC Meeting in Vienna next year February. The title of it is: "Expert Meeting on Improving Space Weather Forecasting in the Next Decade".
(See ISWI Newsletter Vol. 5, No. 113, for full details.)

Forecasting will get better and better as more of the deployed instrumentation base acquires real time data transmission capability. For example, the 72 stations of the MAGDAS network provides geomagnetic data in real time (1s resolution).

Always in the service of ISWI,
. George Maeda
. The Editor
. ISWI Newsletter

United Nations A/AC.105/1051 (Draft)

General Assembly

Distr.: General
10 November 2013

Original: English

Committee on the Peaceful Uses of Outer Space

(Draft) Report on the United Nations/Austria Symposium on "Space Weather Data, Instruments and Models: Looking Beyond the International Space Weather Initiative (ISWI)"

(Graz, Austria, 16-18 September 2013)

I. Introduction

1. The Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) through its resolution entitled "The Space Millennium: Vienna Declaration on Space and Human Development", recommended that activities of the United Nations Programme on Space Applications should promote collaborative participation among Member States, at both the regional and international levels, in a variety of space science and technology activities, by emphasizing the development and transfer of knowledge and skills to developing countries and countries with economies in transition.[1]

2. At its fifty-fifth session, in 2012, the Committee on the Peaceful Uses of Outer Space endorsed the programme of workshops, training courses, symposiums and expert meetings related to the socioeconomic benefits of space activities, small satellites, basic space technology, human space technology, space weather and global navigation satellite systems (GNSS) to be held in 2013.[2] Subsequently, the General Assembly, in its resolution 67/113, endorsed the report of the Committee on the work of its fifty-fifth session.

3. Pursuant to General Assembly resolution 67/113 and in accordance with the recommendations of UNISPACE III, the United Nations/Austria Symposium on Space Weather Data, Instruments and Models: Looking Beyond the International

---

[1] *Report of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 19-30 July 1999* (United Nations publication, Sales No. E.00.I.3), chap. I, resolution 1, sect. I, para. 1 (e)(ii), and chap. II, para. 409 (d)(i).

[2] *Official Records of the General Assembly, Sixty-seventh Session, Supplement No. 20* (A/67/20), para. 89.

V.XX-XXXXX (E) XXXXXX XXXXX

XXXXXXX

Space Weather Initiative (ISWI) was held in Graz, Austria, from 16 to 18 September 2013.

4. The Symposium, the 20th in a series of UM/Austria Symposiums held since 1994, was organized by the United Nations in cooperation with the Austrian Academy of Sciences and Joanneum Research and supported by the Austrian Federal Ministry for European and International Affairs, the European Space Agency (ESA), the Austrian state of Styria, the city of Graz and Austrospace. The Austrian Academy of Sciences hosted the Symposium on behalf of the Government of Austria

A. Background and objectives

5. The Symposium was held as a follow-up to the activities conducted under the International Heliophysical Year 2007 (IHY) and the ISWI which was concluded in 2012. These activities were part of the Basic Space Science Initiative (BSSI) under the framework of the United Nations Programme on Space Applications (see A/AC.105/2013/CRP.11).

6. In 2012, at the conclusion of the ISWI, a number of recommendations including regular interaction and continuation of international cooperative efforts were made at the United Nations/Austria Symposium on Data Analysis and Image Processing for Space Applications and Sustainable Development: Space Weather Data, held in Graz, Austria, from 18 to 21 September 2012 (see A/AC.105/1026) and at the United Nations/Ecuador Workshop on the International Space Weather Initiative, held in Quito, Ecuador from 8 to 12 October 2012 (see A/AC.105/1030).

7. The purpose of the present Symposium therefore was to address the need to follow-up on the ISWI recommendations related to space weather instrument availability and data sharing and modeling requirements, by bringing together space weather experts from developed and developing countries, including representatives of the major instrument operators and data providers.

8. Participants were in particular tasked with reviewing the status of space weather instrument arrays (in-situ, space-borne), data collection efforts and data access conditions, as well as current modeling efforts, models availability and accuracy, and the access to documentation on data and models to identify synergies between the various on-going projects and initiatives and to improve international scientific cooperation.

9. The objectives of the Symposium that is the subject of the present report were:

(a) To review as an expert group world-wide existing and planned space weather-related data collection and development activities (space-based and ground-based observations, modeling and forecast development) and identify any gaps;

(b) To review international cooperation activities and the role of international cooperation in addressing space weather-related issues, such as possible further cooperation towards a truly global space-weather monitoring capabilities;

(c) To identify opportunities for international cooperation in the standardization, sharing and wider, timely use of data, also for operational purposes;

data interoperability and formats will be considered, as those are important aspects for any standardization;

(d) To review current models repositories and identify some opportunities for international cooperation to identify, create and better share optimized models to produce accurate simulations and predictions, timely forecasts tailored to needs in each country or region of the world;

(e) To identify concrete cooperation and knowledge sharing in this domain with other relevant initiatives or consortia, such as the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP);

(f) To discuss options for the continuation of the activities begun under the ISWI and to contribute to the discussions under the new regular agenda item on space weather at the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses Of Outer Space.

B. Attendance

10. Qualified space weather experts and scientists from developing and industrialized countries from all economic regions were invited by the United Nations to participate in and contribute to the Symposium. Invitations to participate in the Symposium were also disseminated through the world-wide UNDP offices, Permanent Missions to the United Nations and through various space science and space weather mailing lists. Participants were selected on the basis of their academic qualifications and on the basis of their professional working experience in the space weather field or their involvement in the planning and implementation of space weather activities of relevant governmental organizations, international or national agencies, non-governmental organizations, research or academic institutions or private sector companies.

11. The Symposium was attended by 42 space weather experts from governmental and non-governmental institutions, universities and other academic entities from the following 13 countries: Austria, Brazil, Bulgaria, China, France, Germany, India, Japan, Libya, Malaysia, Rwanda, Switzerland and United States of America.

12. Funds provided by the United Nations, the Government of Austria through the Federal Ministry for European and International Affairs, ESA, the city of Graz and Austrospace were used to defray – fully or partially - the costs of the air travel, daily subsistence allowance and accommodation of 20 participants. The sponsors also provided funds for local organization, facilities and the transportation of participants.

C. Programme

13. The programme of the Symposium was developed by the Office for Outer Space Affairs in cooperation with the programme committee of the Symposium. The programme committee included representatives of national space agencies, international organizations and academic institutions. An honorary committee and a local organizing committee also contributed to the successful organization of the Symposium.

14. The programme consisted of an opening session, three technical sessions, two panel discussions, and discussions on observations and recommendations, followed by closing remarks by the co-organizers. The presentations in the sessions were chosen from among the abstracts submissions of Symposium applicants.

15. The chairs and rapporteurs assigned to the technical sessions and three panel discussions provided their comments and notes as input for the preparation of the present report. The detailed programme, background information and full documentation of the presentations made at the Symposium have been made available on a dedicated Symposium website (http://www.unoosa.org/oosa/en/SAP/act2013/graz/index.html).

16. Copies of the presentations made during the Symposium were also made available to all participants and subsequently posted on the International Space Weather Initiative website (http://iswi-secretariat.org).

II. Summary of Symposium programme

A. Opening session

17. At the opening session welcoming remarks were made by representatives of the Austrian Academy of Sciences, city of Graz, Austrian Federal Ministry for European and International Affairs and the Office for Outer Space Affairs. A representative of the Office for Outer Space Affairs made a presentation highlighting that the 20th anniversary of the UN/Austria Symposium series and reviewed the objectives, and expected outcome and follow-up activities of the Symposium.

18. Following the formal opening of the Symposium, a keynote addresses on the results of the International Space Weather Initiative was delivered by an expert from the Centre for Mathematical Sciences, India. The presentation reviewed the activities under the BSSI with a focus on the ISWI accomplishments. Scientists from more than 100 countries had participated in the ISWI, which resulted in the establishment of an ISWI Instrument Network, composed of 16 instrument arrays with instruments in more than 1000 locations. Three ISWI workshops had been organized by the United Nations, hosted by Egypt (2010), Nigeria (2011) and Ecuador (2012). ISWI contributed to raising awareness on space weather issues among the space science and technology community and the general public, particularly also in developing countries. An ISWI newsletter is published by the International Center for Space Weather Science and Education (ICSWSE) of Kyushu University, Japan, and ISWI website is maintained by the Bulgarian Academy of Sciences (see http://www.iswi-secretariat.org).

B. Worldwide instrument arrays, data products

19. This session reviewed framework for international space weather research cooperation and the status of the worldwide ISWI instrument arrays and their data products.

20. The director of the International Space Environment Service (ISES) made a presentation on how the outcome of the ISWI could contribute to improving space weather services and global benefits to society. Space weather risks were being recognized worldwide and mitigation measures were being developed, indicating that the role of space weather is growing in importance around the globe. However, space weather services were lagging far behind what is needed to ensure the resiliency of the global economic and its security infrastructure. He stressed that space weather was more than space science and required the application of science to societal needs. Both, basic and applied research, were required to improve our knowledge and forecasting capabilities of space weather. Four elements were needed to improve space weather capabilities: 1) User Needs: to understand the risks and actions that need to be taken; 2) Targeted Services: to develop useable capabilities from basic science knowledge; 3) Observing Infrastructure: a shared approach for long-term continuity of data collections; 4) Global Coordination: to provide a consistent, accurate message on space weather related issues.

21. Ground-based data was collected by the ISWI instrument network, while space-based data was collected through the International Living with a Star (ILWS) Programme, that involved more than 25 space agencies. Internationally space weather services were coordinated by the ISES, with 14 regional and 3 associate warning centres and 1 collaborative expert centre, and the World Meteorological Organisation (WMO) Inter-Programme Coordination Team on Space Weather (ICTSW), with 21 Member Countries and 7 International Organizations. In addition to these two the Coordination Group for Meteorological Satellites (CGMS), the International Civil Aviation Organization (ICAO) and the Committee on the Peaceful Uses of Outer Space were also contributing to international space weather cooperation.

22. The roles of these organizations were as follows: 1) ISES: to focus on user needs, improved services, formulating consistent messages during extreme events, and support the growth of service providers; 2) WMO: to work closely with ISES, leverage global infrastructure and membership, build capacity and increase the number of service providers; 3) CGMS: to understand satellite user needs, improve products, utilize space-based measurements and promote long-term availability of data; 4) ICAO: to refine aviation service requirements based on user needs and current capabilities and to ensure a consistent global/local message on space weather related events; 5) Committee on the Peaceful Uses of Outer Space: to facilitate international participation in space weather research-to-operations and long-term continuity of observations. The particular role of the Committee in this enterprise could be to foster the improvement of space weather services, by encouraging research activities, data availability, and capacity building aligned with service needs, for example, by expanding ISWI activities to include research for operations.

23. The new SCOSTEP scientific programme for 2014-2018 titled Variability of the Sun and Its Terrestrial Impact (VarSITI) was presented by one of the VarSITI co-chairs. SCOSTEP, a scientific committee of the International Council of Scientific Unions (ICSU) can trace its origins back to 1966 when it was established as the Inter-Union Commission of ICSU on Solar-Terrestrial Physics. SCOSTEP interacts with national and international programs involving solar terrestrial physics elements to: 1) run long-term (4-5 years) international interdisciplinary scientific programs in

solar- terrestrial physics; 2) to engage in capacity building activities; and 3) to disseminate new knowledge on the Sun-Earth System and how the Sun affects life and society through outreach activities. VarSITI will have four elements : 1) Solar Evolution and Extrema (SEE); 2) International Study of Earth-Affecting Solar Transients (ISEST)/MiniMax24 campaign; 3) Specification and Prediction of the Coupled Inner-Magnetospheric Environment (SPeCIMEN); and 4) Role Of the Sun and the Middle atmosphere/thermosphere/ionosphere In Climate (ROSMIC). It was noted that SCOSTEP has high relevance and synergy to all activities of the Committee on the Peaceful Uses of Outer Space as applied to Sun-Earth connections. SCOSTEP will strive to contribute to the discussions under the new permanent agenda item on space weather in the Committee.

24. The following three presentations focused on the status of instrument networks: the Optical Mesosphere Thermosphere Imagers (OMTIs), the MAGnetic Data Acquisition System (MAGDAS) project of the International Center for Space Weather Science and Education (ICSWSE) and the Compound Astronomical Low cost Low frequency Instrument for Spectroscopy and Transportable Observatory (e-Callisto) solar radio spectrometer network. OMTIs are in automatic operation at 13 stations in Australia, Canada, Indonesia, Japan, Norway, Russia, Thailand, and the United States. Station information and quick look plots are available at http://stdb2.stelab.nagoya-u.ac.jp/omti/. There are 72 observational sites in the MAGDAS instrument network. A metadata database for ground-based upper atmosphere observation data is being made available at http://www.iugonet.org/en/. The e-Callisto instrument network, with 65 instruments at 35 different locations worldwide, is the Swiss contribution to the IHY2007 and ISWI (see http://e-callisto.org). All data from e-Callisto is freely available.

25. The final two presentations in this session provided examples of space weather research and international cooperation activities on-going at the Institute of Space Science in the Universiti Kebangsaan Malaysia (UKM) and at the Laboratory of Space Environment Exploration (LSEE) of the Chinese Academy of Sciences.

C. Data analysis and models

26. This session discussed examples of space weather data exploitation and models. The first presentation introduced the concept of nonextensive statistical mechanics and its potential applicability to space weather science. The entropy of a system composed of several parts is often equal to the sum of the entropies of all the parts. This is the case if the energy of the system is the sum of the energies of all the parts and if the work performed by the system during a transformation is equal to the sum of the amounts of the work performed by all the parts. However, in some cases these conditions may not be fulfilled and then the Boltzmann-Gibbs statistical mechanics needs to be generalized. One such approach is the theory of nonextensive statistical mechanics. It was then shown how such a theory may be applicable to solar, nuclear and neutrino physics and space weather phenomena.

27. Ionospheric delay is the main source of error in using Global Navigation Satellite Systems (GNSS), especially over the equatorial region. This is called the equatorial ionospheric anomaly. The significance of three-dimensional regional ionospheric modeling over the equatorial region to improve GNSS measurement

precision and accuracy was the topic of the next talk, which also presented applications of GPS in Malaysia. This was followed by a presentation of observational data on the ionospheric response to the geomagnetic storm of 15 May 2005, caused by an M8 class solar flare and the associated coronal mass ejection (CME) that occurred on 13 May, over mid- latitudes in the day and night sectors, simultaneously.

28. The next presentation analysed how the Sun affects the Earth and its environment. In the heliosphere, which is the part of space that is directly affected by the Sun through the solar wind, the large-scale structure of the solar wind is dominated by two types of disturbances: transient and co-rotating disturbances. Transient disturbances are associated with episodic ejections of material into interplanetary space from solar regions not previously participating in the solar wind expansion, such as solar flares and CMEs. Co-rotating disturbances (CIRs) are associated with spatial variability in the coronal expansion and solar rotation that occur in response to the interaction of fast and slow solar winds. These disturbances generate 1) geomagnetic storms in Earth's magnetic environment; 2) forbush decreases in the heliosphere and on the Earth and 3) solar energetic particles (SEPs) in the heliosphere and ground level enhancements (GLEs) on the Earth, all of which were discussed in detail.

29. The session ended with a presentation of the automatic flare recognition and filament eruption detection at Kanzelhöhe Observatory of the University of Graz. Near real-time data is available from http://cesar.kso.ac.at/main/esa_live.php.

D. Data analysis and tools

30. New products for monitoring and forecasting space weather in South America, including regional magnetic indices and operational GNSS vertical error maps were presented by the head of the Estudo e Monitoramento BRAsileiro Do Clima Espacial (EMBRACE) Space Weather Programme of the National Institute for Space Research (INPE) of Brazil. All the data is available is free of charge and open to the whole world from http://www.inpe.br/spaceweather.

31. The results of GPS-Total Electron Content (TEC) measurements at low latitudes using the University of New Brunswick (UNB) Ionospheric Modeling Technique to provide ionospheric corrections for communication, surveillance and navigation systems operating at one frequency were presented next. It is expected that the solar maximum will provide ample opportunities to study in detail solar-terrestrial events using this method to better understand the effect of solar activity on TEC at low latitudes.

32. The Operational Space Weather Observing and Data Processing System of the National Space Science Center (NSSC) of the Chinese Academy of Sciences (CAS) was established in 1992 to support China manned space missions. It is an operational system automatically delivering accurate and reliable data (30 Gbyte/day) in real-time around the clock. Data from the Space Environment Prediction Centre (SEPC) is available from http://www.sepc.ac.cn.

33. Magnetic reconnection is a universal mechanism of the energy conversion in plasma, acting as a driver for space weather changes. This mechanism of space

weather changes was detailed in a presentation by the Space Research Institute of the Austrian Academy of Sciences.

34. Following an introduction to the characteristics of geoeffective solar and interplanetary shock events and geomagnetic storms and the applicable methods of investigation, the results of a descriptive and statistical analysis of magnetics storms and associated solar and interplanetary shock precursors during the solar cycle (SC) 23 were presented.

35. A presentation by the University of Graz discussed the effects of space weather on habitability and planetary evolution in other star systems. Up to now more than 2500 exoplanets have been detected and statistical interpretation of recent data from the Kepler mission suggests that there may be billions of potentially habitable planets in our Galaxy alone. For a planet to be habitable it must orbit the right host star at the right distance in to so-called habitable zone. Certain conditions for the planetary surroundings must also be met, such as the existence of a magnetic field, the evolution of an atmosphere, interactions with the heliosphere, the stability of the planetary system and the local stellar neighbourhood, the development of plate tectonics and the existence of a large satellite.

36. There are many discussions on potential space weather affects on (human) terrestrial life, however, to date there is no conclusive evidence. The indication of a potential influence of space weather and variations in the Earth magnetic field on melanin production in animals determined in rigorous experiments was discussed. Such interaction, if confirmed, may also affect melanin production in humans.

37. The first European network on Space Weather, involving 24 countries and ESA, was established in 2003 through the European Cooperation in Science and Technology (COST) action 724. The network agreed on a definition for the term space weather: “Space weather is the physical and phenomenological state of natural space environments. The associated discipline aims, through observation, monitoring, analysis and modeling, at understanding and predicting the state of the sun, the interplanetary and planetary environments, and the solar and non-solar driven perturbations that affect them; and also at forecasting and nowcasting the possible impacts on biological and technological systems.” The definition is presently being translated into as many other languages as possible. The translations will be presented at the 10th European Space Weather Week to be held from 18 to 22 November 2013 in Antwerp, Belgium.

38. The Journal of Space Weather and Space Climate is an open access journal striving to be a link between all the communities involved in space weather and in space climate such as (but not limited to) space, solar, atmospheric scientists, engineers, forecasters, social scientists, economists, physicians, insurance experts. The journal is accessible via http://www.swsc-journal.org.

39. The final presentation in this session provided an update to the latest changes and additions to the ISWI Website and Newsletter (http://iswi-secretariat.org).

E. Panel discussions

40. Panel discussions were held on the following topics: (a) Towards Reliable Space Weather Forecasts: Results of the ISWI and (b) Recommendations for the Space Weather Expert Meeting at STSC in February 2014.

1. Towards reliable space weather forecasts: results of the ISWI

41. The panellists were tasked with reviewing ISWI achievements and the progress towards operational space weather forecasts - moving from reliable science to reliable weather forecasts - as well as with identifying possible missing links and the need for future actions.

42. There was agreement that the most outstanding output of ISWI was in the field of capacity building. While the ISWI instrument networks collected vast amounts of ground-based data, the quality of the data was generally not being assessed and the data was not being processed to contribute to actual space weather forecasts. It is recognized that inter-calibration would be necessary to improve overall data quality. Calibration however is difficult, expensive and time consuming and often beyond the capabilities of a single scientist.

43. While it is desirable to disseminate data as widely as possible, care must be taken to also provide the meta-data that allows to assess the quality and reliability of the data, as there is a danger that faulty data will be used for research and operational use.

44. The panellists agreed that it would be necessary to continue the efforts launched by the ISWI, to further develop the science, for example by better connecting solar and atmospheric scientists, and to improve our ability to predict space weather, by bringing together those working on the basic sciences and those involved in developing operational forecast systems. They also pointed out that continued efforts should be made to raise awareness on space weather issues among the general public and decision makers.

2. Recommendations for the space weather expert meeting at STSC in February 2014

45. The overall aim of the new item on space weather which is on the agenda of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space introduced from 2013 is to exchange views on national, regional and international activities related to space weather research and to promote greater international cooperation in support of efforts to close existing gaps in the space weather research field (A/AC.105/1001, para. 226).

46. On the margins of the fifty-first session of the Scientific and Technical Subcommittee in 2014, an Expert Meeting on Improving Space Weather Forecasting in the Next Decade will be held. The purpose of the meeting is to bring together international scientists currently working in space weather research to discuss the paths for improvement of space weather forecasting during the next decade and to discuss future space and ground-based instrumentation for space weather research and forecasting.

47. The panel concluded with a number of observations and recommendations for further discussion under the space weather agenda item and in the expert group. These observations and recommendations are reflected in the next chapter.

III. Observations and recommendations

48. The participants of the Symposium observed that:

(a) research through international efforts, such as IHY and ISWI, had helped to motivate and improve space weather research and generate awareness about its importance, particularly in developing countries. The further continuation and development of such activities would improve our understanding and ability to predict the behaviour of the Sun-Earth environment through international cooperation;

(b) many national, regional and international organisations and a wide range of programmes and projects were contributing to space weather research activities and to fostering international cooperation in the field; and that

(c) the instrument networks established during the IHY and ISWI were continuing to collect data, but there was a need to improve data-sharing, calibration and inter-calibrations of data as well as overall data quality to realize the potential of ISWI data to – in the future – contribute to operational space weather services.

49. Although observations of solar phenomena and in-situ data collected by spacecraft can now provide limited early warning of the potential threat of space weather events to ground- and space-based systems, more accurate and reliable warning systems will require:

(a) further improvements of models of the solar ejections, solar wind and the magnetosphere;

(b) continuous and uninterrupted space-based and earth-based observations;

(c) concerted efforts to maintain and upgrade the existing facilities; and

(d) easy access to real-time data.

50. Participants took note of the various mathematical models employed to analyse the data and the wide-range of on-going world-wide research activities in space weather as well as the availability of new data products. The WMO's Space Weather Product Portal lists approximately 40 space weather product references in 10 different categories (see http://www.wmo.int/sat). ISWI data products and data access conditions are available from the ISWI website (see http://www.iswi-secretariat.org and http://newserver.stil.bas.bg/ISWI/Projects/ISWI-DATAaccess.html).

51. The particular role of the Committee on the Peaceful Uses of Outer Space in this enterprise could be to foster the improvement of space weather services, by encouraging research activities, data availability, and capacity building aligned with service needs, for example, by expanding ISWI activities to include research for operations.

52. With the support of member States under the umbrella of the Committee, efforts should continue to achieve the goal of reliable space weather prediction, involving the whole space science community in general and the space weather community in particular.

53. The participants of the Symposium recommended that activities started under the ISWI, including global capacity building, education and outreach activities, should be continued and expanded by:

(a) taking greater advantage of cooperation between ISWI and scientific programmes such as SCOSTEP/VarSITI;

(b) encouraging the scientists, researchers and other members of the ISWI community to establish links to existing space weather activities towards establishing global space weather observing requirements, such as the WMO space weather observing requirements for services (see www.wmo.int/sat) and the Committee on Space Research (COSPAR) roadmap for space weather (to be completed in Summer 2014);

(c) encouraging the scientists, researchers and other members of the ISWI community to contribute to the discussions on space weather issues under the Working Group on the Long-term sustainability of outer space activities of the Scientific and Technical Subcommittee of the Committee on the Peaceful Uses of Outer Space, in particular to the work of Expert Group C on space weather and to circulate their relevant reports to the relevant actors;

(d) encouraging all ISWI instrument principal investigators to facilitate the sharing of their data, including meta data and tools for data analysis and use;

(e) organizing inter-calibration workshops or launching inter-calibration campaigns;

(f) continuing the ISWI website and newsletter as an important contribution to bringing together the international space weather community;

(g) leveraging data centres who are willing to share data, such as the WMO portal and the ICSU world data system and to make the issue of data sharing a central issue at the forthcoming space weather expert meeting to be held in February 2014;

(g) including easily accessible links on the ISWI website to ISWI instrument (and other) data and meta data for data sharing (see http://www.iswi-secretariat.org).

54. Member States, their national space agencies and relevant research funding entities should continue to include basic space science and operational space weather research as priority areas for funding.

IV. Conclusions

55. The Symposium, by bringing together space weather experts and instrument hosts from around the world, contributed successfully to highlighting the need to better understand space weather events.

56. The observations and recommendations made by the participants will be brought to the attention of the scientific community and to the member States of the Committee on the Peaceful Uses of Outer Space, when they discuss space weather issues at the fifty-first session of the Scientific and Technical Subcommittee in 2014.