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IAA STUDY GROUP ON INTERNATIONAL COOPERATION ON SPACE WEATHER

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ABSTRACT

The complex interaction of the Solar magnetic field, electromagnetic radiation and particles emitted by the Sun and of galactic radiation with the interplanetary magnetic field and planetary atmospheres causes events and effects that are commonly referred to as space weather. Space weather can adversely affect spacecraft, satellites, electronic components and power-plant facilities, radio communications and other infrastructure elements on which human society is increasingly dependent. Over the last few decades a wide range of scientific programmes and international initiatives have been conducted to study space weather. They have contributed to increase our understanding of space weather-related events and effects. In 2010 the Scientific Activities Committee of the International Academy of Astronautics (IAA) approved the creation of a new Study Group on International Cooperation on Space Weather. The purpose of this Study Group is to review from an international, scientific, economic and policy perspective our present knowledge of space weather and its (socioeconomic) effects on human society, past and ongoing programmes and initiatives, identify possible existing gaps and untapped opportunities, and make recommendations and propose ways forward that could contribute to increase human society's understanding of - and resilience to - space weather. The paper will report on progress achieved in the work of the Study Group.

I. THE INTERNATIONAL SPACE WEATHER INITIATIVE

The growing interest in better understanding solar-terrestrial interactions, particularly patterns and trends in space weather is not only driven by scientific reasons, but increasingly also out of concern for the reliable operation of ground- and space-based assets and infrastructures vulnerable to the detrimental effects of space weather and for its societal and economic impact (see Fig. 1) [1]. International cooperation will be essential in setting up operational space weather monitoring capabilities. The United Nations Committee on the Peaceful Uses of Outer Space is the only body of

the United Nations that is exclusively concerned with international cooperation in the peaceful uses of outer space. Consequently, in February 2009, United Nations Member States represented UNCOPUOS proposed the International Space Weather Initiative (ISWI) as a new agenda item to be taken up in the UNCOPUOS Scientific and Technical Subcommittee under a three-year workplan from 2010 to 2012. The workplan states the following goals [2]:

- 2010 Consider reports on regional and international plans. Encourage continued operation of existing instrument arrays and encourage new instrument deployments;



Fig. 1 The impact of solar activity on planet Earth (NASA)

- 2011 Consider reports on regional and international plans. Identify gaps and synergies in ongoing activities. Encourage continued operation of existing instrument arrays and encourage new instrument deployments;
- 2012 Finalize a report on regional and international plans. Encourage continued operation of existing instrument arrays and encourage new instrument deployments.

The ISWI agenda item was subsequently endorsed by the Committee in June 2009 and by the General Assembly in December 2009 [3], [4]. At the level of the United Nations Secretariat, the Initiative is implemented by the United Nations Office for Outer Space Affairs (UNOOSA) in the framework of its United Nations Basic Space Science Initiative (UNBSSI)*. Member States themselves are also called upon to raise awareness for international cooperation in space weather under ISWI. The Initiative is open to scientists from all countries.

UNBSSI is a long-term effort by UNOOSA for the development of space science and regional and

* See <http://www.iswi-secretariat.org/>

international cooperation in this field on a worldwide basis, particularly in the developing countries. The original focus of the Initiative was geared towards capacity building in the basic space sciences, in fields such as astrophysics and observational astronomy [5], [6]. Following the proclamation of International Heliophysical Year (IHY) 2007 by the General Assembly of the United Nations, UNBSSI activities shifted to the promotion of activities related to the IHY [7], [8], [9]. IHY involved thousands of scientists from more than 70 United Nations Member States and included the deployment of a series of 14 instrumentation arrays, including in the developing countries. This result was the outcome of the early recognition in the planning of the IHY that the understanding of solar-terrestrial interaction was limited due to the lack of observations in key geographical areas [10].

ISWI is building on these accomplishments and is pursuing the following objectives: (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 [11].

As can be inferred from these objectives, ISWI will mainly be focused on ground-based observation networks. Many of the instruments in these networks are also operating in developing countries and therefore provide opportunities for scientists in these countries to make essential contributions to ISWI.

II. THE IAA STUDY GROUP ON INTERNATIONAL COOPERATION IN SPACE WEATHER

The International Academy of Astronautics (IAA) was founded in Stockholm on August 16, 1960 to foster the development of astronautics for peaceful purposes[†]. IAA has members in more than 65 countries and is cooperating with national science or engineering academies. The work of the

[†] See <http://iaaweb.org/>

Academy is structured around six Commissions: I. Space Physical Sciences, II. Space Life Sciences, III. Space Technology & System Development, IV. Space System Operation & Utilisation, V. Space Policy Law & Economy, and VI. Space & Society, Culture & Education. Over the years these Commissions have completed a series of influential studies conducted by Study Groups (“cosmic studies”).

At the meeting of Commission V held during 60th International Astronautical Congress (IAC) in Daejeon, Republic of Korea, on 11 October 2009, a cosmic study on International Cooperation on Space Weather was proposed as a joint study between Commission V and Commission I and in coordination with Commission IV.

Following the IAC a proposal for forming an IAA Study Group on this topic was prepared. The Study Group (S 5.9) was subsequently formally approved by IAA’s Scientific Activities Committee (SAC) in March 2010[‡].

Goals of the Study Group

The overall goals of the Study Group are to:

1. Prepare a comprehensive, trans-disciplinary review/overview - in an international context - of the present status of understanding of space weather-related events and their effect on human activities for different societies and for different economic sectors.

2. Prepare a comprehensive, trans-disciplinary review/overview of world-wide planned and ongoing space weather-related activities (space-based and ground-based observations, modeling and forecast development).

3. Review international cooperation activities and advice on the role of international cooperation in addressing space weather-related issues, such as possible cooperation towards global space-weather monitoring capabilities.

4. Identify opportunities for international cooperation in the standardization, sharing and assimilation of timely/operational data.

5. Identify opportunities for international cooperation to create optimized models to produce accurate (modeling/simulations/prediction), timely forecasts, tailored to needs in each country or region of the world.

6. Review existing and planned space-based missions and ground-based networks to identify gaps and opportunities not yet covered.

7. Provide policy makers with a range of options dealing with space weather effects.

8. Provide balanced and responsible information to the public, press and governments, particularly also in developing countries, about space weather causes and consequences.

The Study Group also aims to address the following three intermediate goals:

1. Support discussions under the agenda item “International Space Weather Initiative” in the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) (2010-2012).

2. Support discussion, if relevant, under the agenda item “Long-term sustainability of outer space activities” in the Scientific and Technical Subcommittee of UNCOPUOS (2010-2012/2013).

3. Support discussions of the Interprogramme Coordination Team on Space Weather of the WMO.

The Study Group will not duplicate work that is already ongoing in the framework of ISWI, but will consider how low impact data products from the ISWI ground-based instrument arrays may contribute to the wider framework of space weather operation (see Fig.2). The Study Group will also address other relevant space weather-related issues.

[‡] See <http://iaaweb.org/content/view/378/529/>

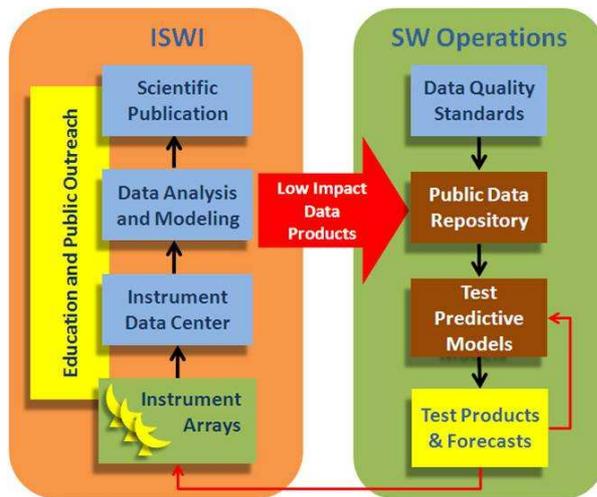


Fig. 2 ISWI and Space Weather Operations. The Study Group will consider how low impact data products from the ISWI ground-based instrument arrays may contribute to the wider framework of space weather operation (Graphics courtesy of Dr. Joseph Davila, NASA)

Target Community and Expected Effects

The study targets the international space community as well as all other communities that are potentially affected by space weather-related phenomena.

It is anticipated that the study team will provide valuable input to the discussions in the framework of the 3-year workplan of the International Space Weather Initiative in the Scientific and Technical 2010-2012.

In addition the discussions under the new agenda item on “Long-term sustainability of outer space activities” in the Scientific and Technical Subcommittee of UNCOPUOS in the years from 2010-2012/2013 may benefit from the study results.

The outcome of the study may also be relevant to the work of other international bodies, such as the International Telecommunications Union (ITU) and the World Meteorological Organization (WMO).

III. RESULTS OF THE FIRST MEETING OF THE STUDY GROUP

The 1st Meeting of the IAA Study Group on International Cooperation on Space Weather was held on 15 February 2010, on the margins of the 47th Session of the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space.

The Meeting was attended by 16 Study Group Members. Participation in the Study Group is open to all those with an interest/stake in space weather-related issues. Study Group members participate and act in their personal capacity.

Participants at the meeting refined the overall and intermediate goals of the Study Group as reflected in this paper. An initial outline of the Study Group Report was prepared.

IV. CONCLUSIONS

The study shall provide a comprehensive picture of how space weather effects on human activities and the role of international cooperation in understanding and minimizing potential threats posed by space weather.

It is also expected that the study will contribute to informed decision making and to the promotion of international cooperation.

The next meetings of the Study Group are planned to be held during the 61st International Astronautical Congress (IAC) in Prague, Czech Republic, taking place from 27 September to 1 October 2010 in connection with IAA Symposium/Session E3.2 on “Policy and economic aspects of space weather” and during the forthcoming 48th session of the UNCOPUOS Scientific and Technical Subcommittee, taking place from 7-16 February 2011 in Vienna, Austria.

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Note: United Nations documents quoted in this paper are available from the website of the Office for Outer Space Affairs at www.unoosa.org and from the Official Document System of the United Nations at documents.un.org.

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