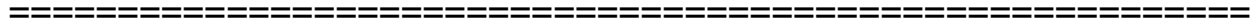


WORLD METEOROLOGICAL ORGANIZATION



**COMMISSION FOR BASIC SYSTEMS
&
COMMISSION FOR AERONAUTICAL METEOROLOGY**

INTER-PROGRAMME COORDINATION TEAM ON SPACE WEATHER

FIFTH SESSION

ISPRA, 24-26 NOVEMBER 2014

FINAL REPORT



EXECUTIVE SUMMARY

The fifth session of ICTSW was hosted by the Joint Research Centre of the European Commission in Ispra, Italy from 24 to 26 November 2014.

The main thrust of the meeting was the development of a four-year action plan for WMO activities in space weather coordination, which would be submitted to the World Meteorological Congress in May 2015 for endorsement. In addition, the session has:

- Been informed by ITU on the way forward to address the protection of radio-frequencies used for space weather observations, and on the possible support of ionospheric monitoring and forecasting services to radio-propagation issues;
- Reviewed the on-going updating process of the Statement of Guidance for space weather observations;
- Developed a preliminary set of expert rules for the assessment of space-based instruments for space weather observations, with the aim to provide input to OSCAR/Space;
- Addressed the way forward to exchange space weather data and products within the WMO Information System (WIS);
- Approved new products for inclusion in the WMO Space Weather Products Portal;
- Approved the draft letter exchange establishing a working arrangement for cooperation between WMO and the International Space Environment Service (ISES).



Participants in the ICTSW-5 meeting in Ispra. From left to right: Xiaoxin Zhang, Neil Mitchison, Iwona Stanislawski, Nicole Vilmer, Norbert Jakowski, Consuelo Cid, Yitaktu Tesfatsion, Kirsti Kauristie, Jérôme Lafeuille, Mamoru Ishii, Mauro Messerotti, MphoTshisaphungo, Daniele Biron, Mike Terkildsen, Vyacheslav Burov, Beata Dziak-Jankowska, Ki-Chang Yoon, David Jackson, Hyesook Lee, Jesse Andries, Clezio Marcos de Nardin, Larisa Trichtchenko, Antonio Vocino, Terry Onsager.

FINAL REPORT

1. OPENING OF THE MEETING

The fifth session of the Inter-programme Coordination Team on Space Weather (ICTSW-5) was hosted by the Joint Research Center of the European Commission (JRC) in Ispra, Italy. The session was opened on 24 November 2014 at 9:30 by Neil Mitchison, who welcomed the participants on behalf of the European Commission. Terrance Onsager and Xiaoxin Zhang as Co-chairs of ICTSW, and Jérôme Lafeuille, on behalf of the Secretary-general of WMO, thanked the European Commission and welcomed the participants.

It was agreed that the meeting would be chaired by T. Onsager. The Chairman introduced the participants (See Annex 1). He recalled the objectives of the session which are to review the progress made by ICTSW, to update the Statement of Guidance for space weather observations, and to elaborate a four-year work plan for WMO coordination of space weather activities that will be submitted to the WMO Congress in May 2015.

The draft agenda was approved (See Annex 2). The working documents and presentations are on line (<http://www.wmo.int/pages/prog/sat/meetings/ICTSW-5.php>).

2. CO-CHAIRS' REPORT

T. Onsager introduced the Co-chairs' report ([Doc.2](#)) which gives an overview of the activities conducted within the Terms of Reference of ICTSW and highlights the main current challenges.

3. OUTCOME OF RELEVANT WMO, ITU AND RELATED MEETINGS

3.1 WMO and CGMS meetings

J. Lafeuille summarized the main outcomes of the 66th WMO Executive Council, the 16th Commission for Instruments and Methods of Observation (CIMO-16), the 2014 Extraordinary Session of the Commission for Basic Systems (CBS-Ext(2014)) regarding space weather. ([Doc.3.1\(1\)](#)). ICTSW noted the request from EC-66, supported by CBS, to develop a four-year work plan on space weather for submission to the 17th World Meteorological Congress, which is a major subject of this ICTSW-5 meeting.

It also noted that the CBS Expert Team on Satellites was developing a Vision of the space-based observation in 2040. This will be an input to an update of the overall vision of observing systems by the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) and CBS. This was seen as an opportunity to respond to the Statement of Guidance for space weather observations, in the context of the WMO Integrated Global Observing System (WIGOS). ICTSW should participate in this effort and the related workshop tentatively planned in November 2015.

Action 5.1: WMO Secretariat to ensure that ICTSW is represented in IPET-OSDE and in future discussions on the new vision of observing system components of WIGOS. (30 November 2015)

X.Zhang reported on his participation in the joint meeting of the Commission for Aeronautical Meteorology (CAeM) and the International Civil Aviation Organization (ICAO). Supporting ICAO to define future services to aviation shall be one of the priorities in the four-year plan.

T. Onsager summarized the outcome of the Ionosphere-atmosphere coordination workshop organized by the International Radio-Occultation Working Group (IROWG) in collaboration with WMO. ([Doc 3.1\(2\)](#)) The interaction between the ionospheric and meteorological users of radio-occultation are still limited but may increase as radio-occultation techniques are refined and are used at higher altitudes by meteorologists. The workshop suggested to define standardized ionospheric parameters – other than the bending angle - that could be made available in near real-time through the WMO Information System (WIS). The need for further workshops on this issue was expressed.

Recommendation: To consider ionospheric parameters derived from radio-occultation that could be standardized and disseminated through the WIS.

Recommendation: To support further IROWG workshops on the use of radio-occultation for ionospheric and meteorological monitoring.

J. Lafeuille reported on the steps taken by the Coordination Group for Meteorological Satellites (CGMS), which adopted Terms of Reference for future CGMS activities in space weather ([Doc 3.1\(3\)](#)). An action was initiated by CGMS to review with ICTSW the collection of satellite anomalies cause by space weather events.

Action 5.2: The ICTSW co-chairs and the Secretariat to establish the spacecraft anomaly group involving the points of contact designated by CGMS members. (30 April 2015)

3.2 ITU activities related to space weather

Vadim Nozdrin gave a brief introduction on the International Telecommunications Union (ITU), its organization and its activities in relation with space weather ([Presentation 3.2](#)). Some background material had been provided by the Secretariat on ITU decisions ([Doc. 3.2](#)) and on radio-frequency issues for space weather ([SG-RFC-2014/Doc.10](#)).

ICTSW noted that the relationship with ITU is important in two respects:

- Space weather disturbances affect the ionospheric and trans-ionospheric propagation of radio-waves such as communication and radio-navigation signals. The ITU-Radio-communication sector Study Group 3 Radio-propagation (ITU-R/SG-3) is in charge of these issues;
- Space weather observation is partly relying on passive and active surface-based, or space-based measurements in microwave frequency bands, for which frequency allocations and protection are required. Space weather interests should be represented in ITU-Radio-communication sector Study Group 7 on Science services (ITU-R/SG-7) for these issues, as part of the radio-frequency coordination exerted in WMO by the CBS Steering Group on Radio-Frequency Coordination (SG-RFC).

V. Nozdrin referred to the ITU Radio Regulations (RR) defining frequency allocations to “radio services” for frequencies between 8.3 kHz and 3000 GHz. Space weather is not identified by ITU as a radio service, but is covered in a large part by the “Radio astronomy” service, which includes e.g. all solar observatories. One should investigate whether other space weather frequency issues are not covered by the Radio-astronomy service, and which other “radio service” would then be relevant to address them. V. Nozdrin stressed that a frequency protection is difficult to obtain, requires a precise and well documented request relying on frequency compatibility studies taking into account the exact frequencies, signal type, signal power, etc. ITU can assist for such studies. Some solar radio-telescopes are currently facing frequency interference issues, which is detrimental to the reliability of observations. There are also issues for active frequencies, for example Incoherent Scatter

Radars (ISR). It was clarified that contributions to the ITU radio-frequency coordination should come from national radio-frequency administrations. However, within WMO, the Steering Group on Radio-Frequency Coordination (SG-RFC) works to elaborate a coordinated position compatible with the needs of WMO programmes. ICTSW agreed that a practical way to progress on this topic would be to provide input to the SG-RFC. Within ITU-SG7, Working Party 7C is considering to investigate in 2015-2017 the space weather frequency needs (See Doc. 3.2, Appendix C).

Recommendation: ICTSW to continue to provide input to the SG-RFC on frequency allocation and protection issues for space weather.

The chair recalled the question raised by ITU SG-3 (See Doc. 3.2, Appendix A) concerning possible space weather services in support of radio-propagation activities. It was noted that future telecommunication standards optimizing the bandwidth may be more sensitive to ionospheric disturbances.

Action 5.3: Norbert Jakowski and Mamoru Ishii to prepare an input to ITU on behalf of ICTSW in response to Question ITU-R-213-3/3, and share it with the Co-chairs and Secretariat (30 April 2015).

4. FOUR-YEAR PLAN FOR WMO SPACE WEATHER ACTIVITIES

ICTSW noted the background of the four-year plan for WMO space weather activities ([Doc.4.\(1\)](#)) and took action to review the preliminary draft of this plan provided by the Secretariat ([Attachment](#) to Doc.4.(1)). ICTSW members supported the proposed outline; they provided substantial comments and editorial suggestions to the introductory sections of the document. It was then agreed to focus the review on two main sections:

- the detailed activities in Section 3,
- the organization and implementation issues in Section 4.

The detailed activities were reviewed in four parallel breakout groups (service delivery; observation; data management; training, research and communication) which shared their findings in plenary. The consolidated outcome of this exercise is provided in a separate addendum to this report. This list includes de facto the on-going actions agreed at previous ICTSW meetings ([Doc.4.\(2\)](#)). It was agreed that the plan to be submitted to WMO Congress should remain at a high-level and would concentrate on priority actions. The Secretariat would work with the Co-chairs to select the most relevant actions for inclusion in the revised draft plan.

Discussing the working structure, it first came out that the structure and operating mode of ICTSW were appreciated. The strengths of the current model were: a broad participation of space weather warning centres and other interested experts, frequent web meetings and team work by correspondence, one annual meeting scheduled in conjunction with a space weather conference, and significant engagement from the WMO Secretariat. However, some evolution would be necessary to take into account different factors:

- As more WMO Members will get involved in space weather and the activities will further develop, it may become necessary to have specialized teams focusing on certain areas of expertise;
- There is a demand of strong linkage with, or involvement in, the expert teams of other WMO programmes and projects, such as the Aeronautical Meteorology Programme (AeMP), the WMO Integrated Global Observing System (WIGOS) or the WMO Information System (WIS), and linkage with the different Regional Associations;
- A coordination is needed between these specialized technical teams and the participation in broader WMO expert teams;

- These groups should be at least partially funded by WMO, but the resources will remain limited;
- As WMO gets more engaged in space weather, it is important to maintain or strengthen the relationships with partner organizations involved in space weather.

The meeting identified three main poles of expertise: space weather systems (from observations to the generation of products); space weather applications (from the products to the delivery of services); and science (including transition from research to operations). Coordination among the various teams and points of contact must be achieved by a core management group. The team stressed the need to work in interaction with the space weather community (including at least all ISES warning centres) and with major users, while recognizing that the expert team could not increase indefinitely, for reasons of work efficiency and resource limitation.

The meeting thus suggested a combined organization comprised of:

- an inter-programme expert team of less than 20 members tentatively named Inter-Programme Team on Space Weather Information, Systems and Services (IPT-SWISS),
- a Space Weather Advisory Group (SWAG), open to the space weather provider and user community, which would be jointly supported by WMO and ISES but with no funding,
- ad-hoc teams composed of IPT-SWISS and voluntary SWAG experts, to progress on specialized technical issues.

The meeting stressed that a significant Secretariat support was necessary to ensure a successful coordination and continuity of these efforts.

The draft four-year plan would be revised along these lines, reviewed by ICTSW members by correspondence and teleconference, and then circulated for comments to the Presidents of CBS and CAeM, representing the most directly involved technical commissions, and to the President of WMO in his capacity as Chairman of the Working Group on the Strategic Operations Plan (WG-SOP) before submission to Congress.

Action 5.4: The Secretariat (J. Lafeuille) and T. Onsager to prepare a revised draft four-year plan in consultation with ICTSW Co-chairs and ICTSW members, for submission to CBS and CAeM and WG-SOP. (Completed on 16 January 2015)

5. EVOLUTION OF SPACE WEATHER OBSERVATIONS

5.1 Recall of the RRR process in the context of WIGOS

J. Lafeuille recalled the Rolling Review of Requirements ([RRR](#)), which is the process used by WMO to manage the evolution of observing networks (See Figure 1).

The Statements of Guidance (SOG) are important elements of the RRR process whereby each application community performs a critical review of the observing capabilities potentially responding to their observation requirements, identifies gaps and opportunities, and determines priorities and guidance for the evolution of observing systems. The main recommendations of the SOG are captured in a WMO-wide implementation plan submitted to the Commission for Basic Systems and the Executive Council for adoption.

5.2 Introduction to OSCAR/Requirements

The OSCAR database and interface has become an important building block of the RRR process in the context of WIGOS. It contains three modules: [OSCAR/Requirements](#),

OSCAR/Space-based capabilities, and OSCAR/Surface-based capabilities (the latter is still in development). Requirements are maintained by representatives of the various application areas.

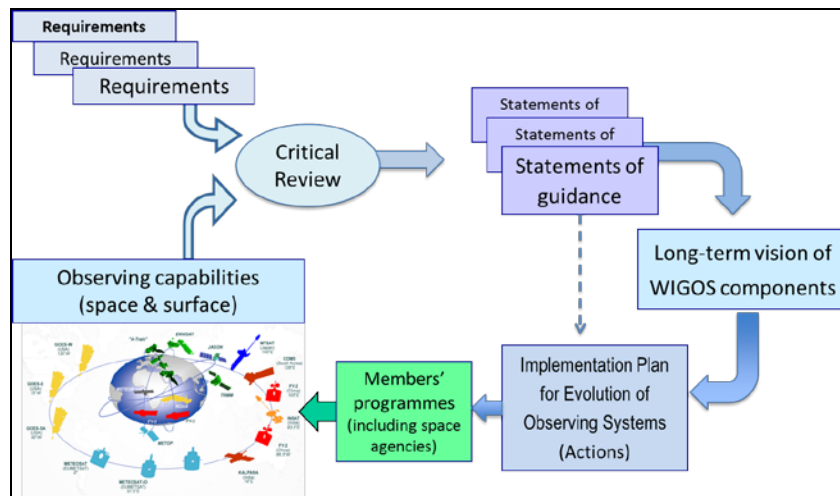


Figure 1

5.3 Space weather observation requirements

The observation requirements developed by ICTSW over the past years for space weather are contained in OSCAR/Requirements, under the "[Space weather application area](#)". The meeting reviewed briefly the variables addressed by these requirements and recommended minor updates of the variable and domain names, which were implemented on line (Interplanetary Magnetic Field, Energetic particles and solar wind, Solid Earth and geomagnetic field).

Action 5.5: All ICTSW members to review the space weather variables and the associated requirements recorded in OSCAR, in their respective field of expertise, and report to the team. (30 June 2015)

5.4 Space weather observing capabilities (from the ground)

Larisa Trichtchenko presented an updated list of geomagnetic observatories based on INTERMAGNET and other sources, with hyperlinks to the web site of each observatory ([Doc.5.4](#)). The document also contains a draft list of neutron monitors.

Action 5.6: All ICTSW members to review the inventory of ground-based observing capabilities and provide updates to L. Trichtchenko. (30 June 2015)

5.5 Space weather observing capabilities (from space) analysis

J. Lafeuille provided an update on OSCAR/Space with emphasis on the inventory and assessment of space weather instruments in OSCAR ([Doc. 5.5](#)). OSCAR/Space currently contains records of about 600 satellites and 800 instruments, including some 260 space weather instruments.

He informed the meeting that a new expert-system approach was being developed in order to better assess the suitability of space weather instruments for the measurement of space weather variables. This would rely on a collection of declarative "rules" bearing on the design properties of the instruments. The main advantage of this approach compared to the current

scheme used in OSCAR would be a greater transparency, thus enabling collaborative development, review and improvement.

In order to get familiarized with the issue, breakout groups were formed to try and derive rules for a few variables and the corresponding sensors. The outcome of this exercise will be used as a starting point to develop a draft set of rules for review by the team in the course of 2015.

5.6 Statement of Guidance for future space weather observation

The updated SOG has been revised substantially from the original Space Weather SOG, which was drafted in May, 2012. The new SOG follows the template recommended by the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE), and it will include a prioritization of the recommendations. The original SOG provided recommendations; however, these recommendations were explicitly not prioritized.

Development of the updated SOG has been conducted through the effort of five discipline-specific teams, with ICTSW team members leading the organization of the input. The discipline-specific teams are:

- Solar and Solar Wind – Hyesook Lee
- Ionosphere – Iwona Stanislawska
- Energetic Particles – Terry Onsager
- Geomagnetic – Clezio Marcos De Nardin
- Thermosphere - David Jackson

The most important function of the SOG is to provide guidance to WMO Members on the needs and benefits of investments in the global observing system. To assist investment decisions, it will be beneficial to include as much information as possible on the prioritization of observing system needs. The draft update still requires refinement before being submitted to the IPET-OSDE. As part of this process, the ICTSW should review with a particular attention the draft recommendations highlighted in the SOG.

The meeting agreed that this update should be pursued by correspondence in early 2015.

6. DATA AND PRODUCT EXCHANGE IN THE CONTEXT OF THE WMO INFORMATION SYSTEM

6.1 Status of designation of DCPC for space weather

The meeting was informed that NICT had been approved by CBS-Ext(2014) as a Data Collection or Production Centre (DCPC). This should now be formally endorsed by the WMO Congress.

6.2 Data and product format issues

An update was presented by Mamoru Ishii and Mike Terkildsen on the ICTSW-ISES WMO Information system (WIS) Pilot Project ([Doc.6.1](#)) to exchange a selection of data or products on WIS. The discussion highlighted that the aim of such a project was not to demonstrate the feasibility but rather to serve as a test bed to help understanding and evaluating the implications of expanding this exchange to all the other centres, and to identify the most efficient approaches.

Antonio Vocino explained that within the WIS a wide range of data formats is manageable and that there are ways to encapsulate data to avoid entering into format issues, recalling that the main WMO requirement for a format is that it is internationally recognized,

maintained and fully documented (especially for some open formats for which a specific implementation must be defined explicitly). Other simple questions need to be answered such as classifying the space weather data as either “essential” in the sense of [WMO Resolution 40 \(Cg-XII\)](#) (free and unrestricted, i.e. without charge and with no conditions on use) or subject to some limitation on access and use defined by the provider. He also agreed to report on ICTSW at the Expert Team on WIS Centres (ET-WISC).

A. Vocino underlined that WIS provides a framework to synchronize catalogues of global data centres (the GISC) and gave an example of the steps to be taken to easily share data through the WIS:

- a. Contact the focal point of the WIS data centre selected as a “publisher” of the data;
- b. Define a minimum set of metadata (less than 20 fields are mandatory) describing the data, which can be edited on line;
- c. Provide a link to the data, under the responsibility of the data custodian.

Action 5.7: The Pilot Project to take the steps to exchange initial data sets on the WIS. (30 June 2015)

6.3 Metadata issues

Attention should be paid to participation in the relevant expert teams of the CBS Open Programme Area on Information systems and Services (OPAG-ISS), i.e. the Inter-Programme Expert Team on Metadata and Data Representation development ([IPET-MDRD](#)).

7. OPERATIONAL SPACE WEATHER PRODUCTS AND TRAINING

7.1 Space weather portal

The [Space Weather Product Portal](#) is now part of the WMO “Product Access Guide”. Space weather product collections are accessible either through typing a product name or an organization in the search box (top right), or in selecting the “Space” domain in the “Simple search” tab.

7.2 Guidelines for regional geomagnetic disturbance products

The action identified on this item (Action 4.14) was not discussed during the session.

7.3 New candidate products

Three products were proposed by the Korean Space Weather Center (KSWC), related to TEC, HF communications, and Solar activity ([Doc.7.3](#)). The meeting reviewed the proposal and unanimously agreed that the products were fully relevant, valid and properly documented, and were thus suitable for inclusion in the portal. KSWC was congratulated. Other ICTSW members were also encouraged to consider submitting products to increase their audience thus offering a wide international range of products on the WMO portal.

Action 5.8: KiChang Yoon and J. Lafeuille to implement the three KSWC products in the portal. (Completed on 7/01/2015, See [RRA/KSWC product entries](#))

7.4 Training material for the portal

T. Onsager introduced a draft version of a training material developed by NOAA, which is about to be publicly released. The group congratulated NOAA for this module, which was found very appropriate and well designed to explain the applications and practical usage

scenarios of space weather information. NOAA was encouraged to share it through the WMO portal.

Action 5.9: NOAA to submit to the WMO portal its training module on the use of space weather information. (30 June 2015)

7.5 Training strategy

Not discussed at this session.

8. EXTREME SPACE WEATHER EVENT WARNING

This item, subject of ICTSW-4 Recommendation 4.3 and Action 4.16 was not discussed.

9. ICTSW-ISES COLLABORATION

The meeting was informed that, based on the outcome of ICTSW-4 and further advice received from the WMO Legal Counsel, the collaboration between ISES and WMO would best be formalized by an official exchange of letters, a draft of which was presented ([Doc. 9](#)). The meeting supported this approach and approved the draft text with minor edits which were incorporated in a revision. The Director of ISES now needs to seek the approval of ISES members.

Action 5.10: T. Onsager, as the Director of ISES, to seek authorization from ISES members to sign the proposed exchange of letters with WMO, well in advance of the WMO Congress. (31 March 2015)

10. ANY OTHER BUSINESS

Four presentations were given by JRC experts on activities conducted by JRC in space weather, which included:

- [GNSS ionospheric activities in JRC/Ispra](#)
- [Prototyping a low-cost ionospheric scintillation monitoring receiver](#)
- [The impact of space weather on power grids](#)
- [Impact of an extreme space weather event on European space assets](#)

The chairman thanked JRC for the opportunity to be informed of these activities.

11. CONCLUSION OF THE MEETING

The Chairman underlined the great progress made by the meeting, in particular in developing the four-year plan, thus shaping the future role of WMO in this area, subject to approval by the WMO Congress. All ICTSW members were invited to report on this progress to their Permanent Representative with WMO and assist their delegation at the WMO Congress if there is any question related to the understanding of this plan.

The Chairman proposed that the next face-to-face meeting be tentatively scheduled in the September or October 2015 time frame.

He thanked all participants for their active contribution to the discussion and team work. He also expressed particular gratitude to the JRC for its hospitality in hosting the meeting. The meeting was closed on Wednesday 26 November at 4 pm.

AGENDA

- 1. Opening**
 - 1.1. Introduction of participants
 - 1.2. Approval of agenda
 - 1.3. Practical arrangements for the meeting
- 2. Co-Chairs' report**
- 3. Outcome of relevant WMO, ITU and related meetings**
 - 3.1. WMO (Including Executive Council, CIMO, CAeM, CBS-Ext(2014)) and CGMS
 - 3.2. Space weather related ITU activities
 - 3.3. IROWG Ionosphere-Atmosphere Coordination Workshop
- 4. Four-year plan for WMO Space Weather Activities**

(Refers to Actions 4.23, 4.28, 4.31, 4.32)

 - 4.1. Introduction
 - 4.2. Statement of needs and high-level goals
 - 4.3. Short-term and long-term activities
 - 4.4. Organization and implementation roadmap
- 5. Evolution of space weather observations**
 - 5.1. Recall of the RRR process in the context of WIGOS
 - 5.2. Introduction to OSCAR/Requirements
 - 5.3. Space weather observation requirements
 - 5.4. Space weather observing capabilities (from the ground) (Action 4.20)
 - 5.5. Space weather observing capabilities (from space) analysis (Action 4.21, 4.22)
 - 5.6. Statement of Guidance for future space weather observation (Action 4.1, 4.2, 4.3)
- 6. Data and product exchange in the context of the WMO Information System**
 - 6.1. Status of designation of Data Collection or Production Centres (DCPC) for space weather
 - 6.2. Data and product format issues (Action 4.17, 4.18, 4.19)
 - 6.3. Metadata issues (Action 4.29, 4.30)
- 7. Operational space weather products and training**
 - 7.1. Space weather [portal](#)
 - 7.2. Guidelines for regional geomagnetic disturbance products (Action 4.14)
 - 7.3. New candidate products
 - 7.4. Training material for the portal (Action 4.15)
 - 7.5. Training strategy
- 8. Extreme space weather event warning** (Recommendation 4.3, Action 4.16)
- 9. ICTSW-ISES collaboration**
- 10. Any other business**
 - JRC activities on scintillation
- 11. Conclusion of the meeting**

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LIST OF ACTIONS AND RECOMMENDATIONS FROM ICTSW-5

Action 5.1: WMO Secretariat to ensure that ICTSW is represented in IPET-OSDE and in future discussions on the new vision of observing system components of WIGOS (30 November 2015).

Action 5.2: the ICTSW co-chairs and the Secretariat to establish the spacecraft anomaly group involving the points of contact designated by CGMS members (30 April 2015)

Action 5.3: Norbert Jakowski and Mamoru Ishii to prepare an input to ITU on behalf of ICTSW in response to Question ITU-R-213-3/3, and share it with the Co-chairs and Secretariat (30 April 2015).

Action 5.4: The Secretariat (J. Lafeuille) and T. Onsager to prepare a revised draft four-year plan in consultation with ICTSW Co-chairs and ICTSW members, for submission to CBS and CAeM and WG-SOP. (Completed on 16 January 2015)

Action 5.5: all ICTSW members to review the space weather variables and the associated requirements recorded in OSCAR, in their respective field of expertise, and report to the team. (30 June 2015)

Action 5.6: all ICTSW members to review the inventory of ground-based observing capabilities and provide updates to L. Trichtchenko. (30 June 2015)

Action 5.7: the Pilot Project to take the steps to exchange initial data sets on the WIS. (3 2015)

Action 5.8: Ki-Chang Yoon and J. Lafeuille to implement the three KSFC products in the portal. (Action completed on 7 January 2015)

Action 5.9: NOAA to submit to the WMO portal its training module on the use of space weather information. (30 June 2015)

Action 5.10: T. Onsager, as the Director of ISES, to seek authorization from ISES members to sign the proposed exchange of letters with WMO, well in advance of the WMO Congress. (31 March 2015)

Recommendation: To consider ionospheric parameters derived from radio-occultation that could be standardized and disseminated through the WIS.

Recommendation: To support further IROWG workshops on the use of radio-occultation for ionospheric and meteorological monitoring.

Recommendation: ICTSW to continue to provide input to the SG-RFC on frequency allocation and protection issues for space weather.
