

WORLD METEOROLOGICAL ORGANIZATION



INTER-PROGRAMME COORDINATION TEAM ON SPACE WEATHER

THIRD SESSION

BRUSSELS, 12-14 NOVEMBER 2012

FINAL REPORT





Participants in the third session of ICTSW. From left to right, seated: Jérôme Lafeuille, Terrance Onsager, Nicole Vilmer, Jan Janssens. Standing: Neil Mitchison, Stephen Foreman, Mauro Messerotti, Alain Hilgers, Ronald Van der Linden, Larisa Trichtchenko, Herbert Pümpel, Mamoru Ishii, Matt Francis, Xiaoxin Zhang. (Not present on the picture: Nilson Santanna, Vyacheslav Burov, Muhammad Ayyaz Ameen, Raül Romero)

REPORT

1. OPENING OF THE MEETING

The third session of the Inter-programme Coordination Team on Space Weather (ICTSW) was hosted by the Solar Terrestrial Centre of Excellence at the Royal Observatory of Belgium, from 12 to 14 November, upon invitation by its Director, Ronald Van der Linden.

Terrance Onsager, ICTSW co-chair, opened the meeting at 10:00 in thanking the hosts and welcoming the participants (Annex 1). He explained the scope of the meeting in the light of the Terms of Reference and initial objectives of the team, and presented the draft agenda, which was adopted (Annex 2). It was recalled that working documents and presentations given at the meeting were posted on the meeting web page (<http://www.wmo.int/pages/prog/sat/meetings/ICTSW-3.php>). Hyperlinks to these documents are included in the body of this report. A summary of actions is included as Annex 3.

Jérôme Lafeuille welcomed the participants on behalf of WMO. He was glad to note the first participation of Italy, through Mauro Messerotti, and of the Joint Research Centre of the European Union, through Neil Mitchison. He recalled the ultimate goal of WMO's involvement in space weather, which is to facilitate the establishment of globally coordinated, improved quality, operational, space weather services. He emphasized that ICTSW had achieved a lot over the past two years in working by teleconferences and correspondence; he felt however essential to also hold regular face-to-face meetings in order to allow the team members to better interact with each other, to share a common understanding of the goal, of the strategy towards this goal, and to coordinate actions to make it happen.

2. ICTSW IN THE WMO CONTEXT

J. Lafeuille gave an [overview of WMO](#), its status, mandate, governance scheme, top-level priority objectives, and provided illustrations of activities coordinated by WMO regarding the WMO Integrated Global Observing Systems (WIGOS), the WMO Information System (WIS), and Numerical Weather Prediction (NWP). The meeting noted that some "best practices" from the NWP community would be beneficial to space weather such as forecast verification metrics, and a methodology to evaluate the impact of observing systems. J. Lafeuille introduced the WMO Space Programme, which was officially tasked by the WMO Congress in 2011 to lead WMO activities in Space Weather. Finally he presented the rationale for WMO to engage in Space Weather and described the Terms of Reference of ICTSW, its linkage to the WMO Commission for Basic Systems (CBS) and Commission for Aeronautical Meteorology (CAeM). The last session of CBS (CBS-15, September 2012) has issued a statement inviting the ICTSW to work with the International Civil Aviation Organization (ICAO) towards the definition of Space Weather services to international air navigation.

T. Onsager emphasized the initial focus of ICTSW to demonstrate within a 2 or 3-year time frame the benefit of coordination of observation, data exchange, and product generation. All the activities conducted so far were directed towards this goal and have been successful; however in order to fully reap the benefits of these activities we should strive to pursue an end-to-end approach, and demonstrate that services delivered to the users have improved. He suggested a few [priority objectives for the next 1 or 2 years](#) be identified in this regard.

The meeting noted that the [Terms of Reference of the ICTSW](#) should be kept under review and that updates could be proposed to CBS and CAeM if necessary in order to ensure that the team is in a position to address both strategic issues and technical issues that need to be addressed.

Finally it was stressed that the relationship between ICTSW and the International Space Environment Service (ISES) was essential and should be clarified and better communicated. (See item 7 below).

3. INITIAL STATEMENT OF GUIDANCE ON OBSERVATIONS

J. Lafeuille presented the [WMO Rolling Review of Requirements \(RRR\)](#) process. He reported that the [Statement of Guidance on Space Weather Observations](#) developed by ICTSW had been considered in June 2012 by the Expert Team on Evolution of Global Observing Systems, who commended the ICTSW for the quality of this document. The main recommendations of the SOG have been incorporated as actions in the new "[Implementation Plan for Evolution of Global Observing Systems](#)" (EGOS-IP). Space Weather observations are addressed in a dedicated chapter (Chapter 7) of this implementation plan. The EGOS-IP was subsequently approved by the WMO Commission for Basic Systems (CBS-15, Jakarta, 10-15 September 2012) and will be submitted to the WMO Executive Council in May 2013 for endorsement.

The ICTSW agreed to review the SOG in principle every other year and update it as appropriate, taking into account the evolution of both requirements and capabilities.

The team discussed a [proposal for new requirements](#) for the observation of galactic cosmic rays at aircraft cruising altitude, and of temperature, wind and density in the thermosphere. The relevance of these requirements is to be further investigated before possible inclusion in the Space Weather requirements database.

- Action 3.1: David Jackson and Terry Onsager will further investigate and document the observation requirements for temperature, wind and density in the thermosphere (in support of NWP and space weather services), and clarify how we want to represent the thermosphere in OSCAR (as part of atmosphere or outer space domain)
- Action 3.2: David Jackson and Terry Onsager will further investigate and document the observation requirement for galactic cosmic rays at aircraft cruising altitude and clarify whether this requirement should be accommodated in the High Troposphere and/or Low Stratosphere layer requirements.

4. OBSERVATIONS: REVIEW OF SPACE WEATHER CAPABILITIES

OSCAR

J. Lafeuille introduced the team to the "OSCAR" (Observing System Capability Analysis and Review tool) on-line resource : www.wmo.int/oscar. In addition to factual information on satellites and instruments, OSCAR indicates the potential relevance of each particular category of instruments for measuring specific variables, based on expert assessments of instrument design features. This can be used for a first level of gap analysis related to particular variables or particular types of missions. OSCAR is fairly comprehensive for Earth Observation instruments, but still needs to be completed and reviewed for its Space Weather parts. The surface observation part is being designed. The team considered OSCAR as a very valuable tool, provided that it can be regularly updated. J. Lafeuille confirmed the intention of WMO to maintain such a resource and called upon ICTSW members to assist in the review of its expert assessments.

- Action 3.3: Alain Hilgers to lead a review of the Space Weather space-based capabilities recorded in OSCAR, including the assignment of missions to homogeneous « classes » of performance and the list of variables for which these classes are relevant.

- Action 3.4: Larisa Trichtchenko to provide WMO Secretariat (N. Hettich, E. Charpentier) with a high-level description of surface-based observing capabilities, to be taken into account in the specifications of the surface module of OSCAR (types of sensors, measured variables, typical observing cycles, typical data latency, uncertainty, coverage, approximate number of sensors of each type, sample of location information).

The team discussed the way forward to complete the actions identified in the SOG and the EGOS-IP, and noted that actions related to GNSS or altimeters were being addressed in the framework of the Coordination Group for Meteorological Satellites (CGMS), but this was not necessarily the case for all space-based observations. The team thus identified two actions, for GNSS missions and for other key space-based observations.

GNSS

The International Radio-occultation Working Group (IROWG) of CGMS was encouraged by WMO to consider the dual use of GNSS RO for neutral atmosphere sounding and for ionosphere sounding, and the possible trade-off to be made between these applications when designing and operating GNSS RO systems. The [Space Weather subgroup of IROWG](#) is planning a workshop towards end of 2013 or early 2014 to address these issues. The ICTSW expressed interest to collaborate with the IROWG for the organization of this workshop.

- Action 3.5: Xiaoxin Zhang, Matt Francis, and an expert from JRC to be designated by Neil Mitchison, are nominated to liaise with the Space Weather subgroup of the IROWG (Point of contact: Anthony Mannucci, NASA/JPL) for the preparation the workshop on atmosphere and ionosphere applications.

Continuity of other key space-based observations

- Action 3.6: The ICTSW co-chairs to set up a task team in charge of developing a plan to address space agencies and space weather service-providing agencies at the proper level for programmatic issues regarding the long-term continuity of essential space weather satellite observations (including future L1 missions, missions to other heliospheric locations, coronagraph measurements, and heliospheric imaging).

5. SPACE WEATHER PRODUCT PORTAL

The Space Weather Product Portal is potentially a very useful tool for at least three main purposes:

- To demonstrate the availability of products to potential users, thus increasing their visibility and helping to identify new services based on such products,
- For capacity building, especially for staff from meteorological services who is not familiar with space weather,
- To facilitate the harmonization of products among ICTSW members, including the way these products are documented.

However the frequentation of the portal remains very low. The portal should be expanded, made more attractive, and be actively promoted, in order to meet its goals.

The ICTSW first confirmed the overall concept of the portal as described in [Doc. 5.1](#) : its goals, the criteria for accepting products, the product description contents and template.

The product categorization scheme was confirmed in broad lines, but some adjustments should be made: do auroral products belong to the geomagnetic domain? Shall we define an

additional category for training material? Could we either make the product categories more self-explanatory, or better explain them? These points should preferably be addressed prior to adding further products.

L. Trichtchenko performed a systematic [review of the portal](#) and suggested a number of useful corrections. Some corrections have been immediately implemented. The team agreed that further revision of the portal should be done preferably in the light of user feedback.

Vyacheslav Burov presented the Institute of Applied Geophysics (IAG) web site: http://space-weather.ru/spaceweather/index_en.html and the portal link to IAG was updated.

The meeting clarified the process for including new products:

- (i) Proposals for new products should be submitted to the ICTSW (e.g. at one of the regular teleconferences) who would assess whether the conditions are fulfilled and decide on their inclusion;
 - (ii) Products are to be proposed by organizations that are members of ICTSW;
 - (iii) The proposing organization takes responsibility for sustaining these products and for complying with the ICTSW criteria and documentation requirements.
- Action 3.7: Larisa Trichtchenko to solicit comments from the team on the portal and to lead the ICTSW effort to propose, if necessary, minor updates to be implemented to the portal in advance of the Boulder Space Weather Workshop (16-19 April 2013), while recognizing that further and more substantial updates would be considered later, if relevant, in the light of user feedback.
 - Action 3.8: T. Onsager, in the context of ISES, and J. Lafeuille, at the WMO Executive Council, should encourage organizations/countries who operate an ISES Regional Warning Centre to join ICTSW if they are not currently an ICTSW member (e.g. Poland, India).
 - Action 3.9: J. Lafeuille and N. Hettich will implement the corrections relevant to the WMO web pages of the portal, as proposed by L. Trichtchenko in Document ICTSW-3/Doc.5.3.
 - Action 3.10: D. Jackson, K. Kauristie, T. Onsager, to check the pages under their responsibility in the portal and implement corrections, as appropriate, on the points raised by L. Trichtchenko in Document ICTSW-3/Doc.5.3.
 - Action 3.11: All ICTSW members to promote the portal in relevant occasions (e.g. conferences, including WMO events), offer constructive suggestions for its improvement, and ensure the completeness and correctness of their respective local pages (product description, originating centre with point of contact, target users, compliance with the template, link to product etc.)
 - Action 3.12: J. Lafeuille and N. Hettich to propose (i) a feedback mechanism and (ii) an introductory text indicating the purpose of the portal, for review by the ICTSW before inclusion into the portal home page.
 - Action 3.13: X. Zhang will lead the definition of a section to be added to the portal for training material.

6. DATA AND PRODUCT EXCHANGE ISSUES

S. Foreman introduced the WMO Information System (WIS), which is now operational with more than 350 centres already identified, either as National Centres, or Data Collection or

Production Centres (DCPC) or Global Information System Centres (GISC). He emphasized two aspects of WIS of relevance to ICTSW:

- Data discovery: Through the WIS framework, data are potentially visible and accessible by a large user community all around the globe since users can discover this data in the interconnected GISC catalogues, and retrieve them. It is important to properly describe data by metadata, including keywords. The WMO Core Metadata profile based on ISO 19115 is being updated, and ICTSW is invited to liaise with the Inter-Programme Expert Team on Metadata and Data Representation Development in order to ensure that the WMO metadata profile can properly describe space weather data.
- Near real time distribution: The WIS is an open system that can accommodate a wide range of distribution systems (including point-to-point dedicated telecom lines, Virtual Private Network (VPN), Internet FTP, satellite broadcast, etc). The Global Telecommunication System (GTS) is the backbone of the WIS for near-real time distribution. The typical end-to-end transfer time over the GTS is 1- 2 minutes (depending on the infrastructure of the centres involved in the data transfer), which is well suited for distributing hydro-meteorological alerts and warnings worldwide. The use of GTS for space weather alerts is to be investigated with the relevant GISCs with concrete samples of data files. If very time-critical space weather observation data need to be ingested into models with a latency of a few seconds, dedicated telecommunications should be more adequate than the current GTS.
 - Action 3.14: J. Lafeuille and S. Foreman to ensure that ICTSW is invited to contribute to revise the metadata profile.
 - Action 3.15: T. Onsager to coordinate with all ISES RWCs and the space weather service providers within ICTSW to develop a plan for registering relevant space weather products to the WIS (i.e., prioritizing products to be registered, ensuring consistency of information, and defining metadata accordingly).

7. RELATIONSHIPS WITH OTHER ORGANIZATIONS

Coordination Group for Meteorological Satellites (CGMS)

The CGMS gathers all the satellite operators who are running missions in support of WMO programmes (CMA, CNSA, CNES, EUMETSAT, ESA, IMD/ISRO, JAXA, JMA, KMA, NASA, NOAA, ROSHYDROMET/ROSCOSMOS, and CSA as observer). It has held its 40th annual session in Lugano on 5-9 November 2012. The next meeting will be in Tokyo on 8-12 July 2013. The WMO Space Programme office maintains the link between ICTSW and CGMS in regularly providing a report from the ICTSW co-chairs (See [ICTSW report to CGMS-40](#)). The CGMS coordinates satellite mission plans globally, ensures their interoperability and establishes contingency arrangements. The CGMS has agreed to report to ICTSW on spacecraft anomalies due to solar events, following the template provided by ICTSW (See: [Doc.7 Report from CGMS satellite operators on spacecraft anomalies](#)). Furthermore, CGMS has established the International Radio-occultation Working Group ([IROWG](#)) which comprises a subgroup on space weather. The CGMS is therefore a privileged forum for ICTSW to interact with space agencies.

ISES

ISES was at the origin of WMO's involvement in Space Weather. The intention of WMO is to work with ISES and to leverage the technical coordination initiated by ISES to reach a truly global, operational stage, taking advantage of the longstanding coordination experience of WMO, its intergovernmental status, and its global membership.

From a legal viewpoint, the relationship between ICTSW and ISES could be formalized e.g. through a Memorandum of Agreement (MoA) between ICSU and WMO, recognizing the important role of ISES members within ICTSW. Establishing such an agreement might be facilitated if all ISES Members were also involved in ICTSW. (The 14 ISES members are included in the 19 countries currently participating in ICTSW, with the exception of Czech Republic, India, Poland and Sweden).

- Action 3.16: T. Onsager and J. Lafeuille to investigate the possibility of a Memorandum of Agreement between ICSU and WMO officialising the relationship between ISES and ICTSW.

8. SPACE WEATHER SERVICES TO AVIATION

The ICTSW reviewed the 2.0 draft of the [Concept of Operations for International Space Weather Information in Support of International Air Navigation](#) (CONOPS) developed by the International Airways Volcano Watch Operations Group (IAVWOPSG) of the International Civil Aviation Organization (ICAO). This document aims to define the functional, operational and performance requirements for the international production and delivery of space weather information to aviation. Once agreed by the relevant ICAO and WMO bodies in July 2014, these requirements will be the basis for international regulations recorded in an amendment to Annex 3 of the ICAO Convention that will become applicable to ICAO Member States upon its adoption by the ICAO Council in 2016.

The ICTSW noted a substantial improvement with respect to the previous draft it had reviewed in June 2012, but expressed concerns that the document still did not reflect a full understanding of space weather issues: phenomena (e.g. should not focus exclusively on polar regions); observations (e.g. should not omit ground observations or contributions from aircraft); impact (e.g. should not exclude the health impact); or services (e.g. what lead time is feasible in the short or longer term). The logic of the text was sometimes unclear, with statements without justification, and the proposed roles of the various players (ISES, and national entities) would deserve more in-depth analysis. Therefore, the ICTSW wished to take more time to work closely with ICAO over the coming months in order to bring this document in consistency with the state of the art in space weather, before its submission for approval by ICAO and WMO bodies.

Raúl Romero informed the group that the user requirements were being updated and that ICAO would welcome a quick review of their feasibility in advance of the IAVWOPS meeting in March 2013. The comments on the CONOPS were less time critical since the CONOPS is not a regulatory document. The CONOPS should indeed be reviewed after the requirements are updated, since it is meant to describe a way forward to respond to these requirements.

- Action 3.17: R. Romero will circulate –via J. Lafeuille- the updated draft requirements of ICAO for review (November 2012)
- Action 3.18: All ICTSW space weather experts to review the requirements and evaluate what is achievable at present or very short term (“threshold” requirement), and what is realistic for the longer term only (“goal” requirement). (Early December 2012)
- Action 3.19: ICTSW co-chairs to consolidate the outcome of this review and forward to R. Romero (mid December 2012).

- Action 3.20: All ICTSW space weather experts to review and provide detailed comments on the draft 2.0 of the ICAO CONOPS (January 2013).
- Action 3.21: Comments on the draft 2.0 of the ICAO CONOPS to be consolidated by the co-chairs for communication to ICAO early 2013.

9. TRAINING AND OUTREACH

The ICTSW discussed the need for training, and considered as priority targets the new user groups of operational services and non-space weather meteorologists. We should let the users know what services are available, help them understand how they are impacted by space weather, help new service providers use what is available to develop and improve their own services, and help service providers better understand user needs. Training material should be made available through the portal.

The ICTSW welcomed the readiness of the Committee on Space Research (COSPAR) to support the organization of training sessions in developing or least developed countries.

10. ANY OTHER BUSINESS

10.1 Proposed new format for ground-based GNSS data exchange

Mamoru Ishii introduced the [NICT ionospheric monitoring activity](#) and emphasized the potential of ground-based GNSS networks for the fine-scale monitoring of ionospheric perturbations (e.g. during earthquakes). GNSS data exchange should be improved through more open data policy by certain countries. A new GNSS-TEC data exchange format “GTEX” was proposed instead of the RINEX and IONEX formats. The ICTSW agreed to evaluate this new format. The question was raised of whether advantage could be taken from the ground-based GNSS data exchange agreements among NWP centres, since these centres are routinely exchanging Zenith Time Delay (ZTD) data for assimilation in NWP models to inform on vertically integrated water content. These data exchanges for NWP are discussed within the North America-Europe Data Exchange (NAEDEX) and the Asia-Pacific Satellite Data Exchange and Utilization (APSDEU) groups.

- Action 3.22: T. Onsager and J. Lafeuille to investigate the modalities of ground-based GNSS network data exchange for NWP (as discussed at the NAEDEX-APSDEU meetings) and for ionospheric monitoring (as discussed within e.g. IGS) and evaluate whether there is any potential for synergy between the various operational data exchange agreements.
- Action 3.23: All ICTSW members to evaluate the proposed GNSS-TEC data exchange (GTEX) format. (See [NICT’s presentation](#)).

10.2 Extreme events

Mauro Messerotti introduced work initiated under a European “COST” action on preparedness to [extreme space weather events](#). The ICTSW agreed that we should aim at well-documented scenarios and procedures for such events. We need to ultimately establish a global system enabling to detect extreme events, to warn of them, and to facilitate national/regional responses to such events.

This may require consideration of a number of issues including:

- define what should be considered as extreme events, their occurrence probability, and characterize their potential regional impact (from existing literature)

- identify the information required to support decision making, the quality assurance required, and how to standardize such information (e.g. NOAA scales)
 - define the requirements for operational organizations to produce and exchange such information (acquisition/processing/communication capabilities, products generated, quality management, operational continuity, staffing, language,...)
 - define an organization of responsibilities to fulfil these requirements (e.g. based initially on ISES RWC, that would be officially recognized by WMO when the requirements are fulfilled, and be assigned regional or global responsibilities)
 - develop guidelines for national procedures for the preparedness for such events
 - develop guidelines for national procedures for the emergency response to such warning
- Action 3.24: T. Onsager, M. Messerotti, and J. Lafeuille to draft an overview of the processes involved and issues to be addressed in extreme event warning, for use by ICTSW as a background for organizing future work on this issue.

10.3 *Space Weather Scales*

M. Messerotti introduced work initiated under a European “COST” action on the [review of the NOAA space weather scales](#).

- Action 3.25: T. Onsager, M. Messerotti, and J. Lafeuille to draft a recommended approach to evaluate, improve, and expand as necessary the set of global and local Space Weather scales in order to ensure efficient and standardized information communication to the users

11. FUTURE WORK PLAN

The meeting acknowledged the need to update the work plan, and to devise and communicate the longer term strategy for space weather within WMO.

In the light of its two-year experience, and in view of the many key subjects to be tackled, the ICTSW discussed the organization and resources required to complete the actions discussed above. How can the team strengthen its organization, assume responsibility, and evolve to a more mature status? How to best use the current configuration of the team? It was agreed to develop a detailed and prioritized work plan. No fundamental change to the team was suggested for the time being, except broadening the membership in engaging other ISES RWC representatives. In order to complete the tasks identified, the ICTSW members should be ready to dedicate sufficient time and to seek support within their respective organization. Consideration should also be given to partnering with external bodies whenever appropriate. A prerequisite for mobilizing more support is to highlight the service improvement that is expected to result from the team’s work, and to emphasize the convergence between the goals pursued by the team and those of the participating organizations.

- Action 3.26: T. Onsager, X. Zhang, J. Lafeuille, to develop a more detailed and prioritized work plan for ICTSW, evaluating the resources needed and the timelines. Draft by December, 15, for review by the team.
- Action 3.27: Organizations participating in ICTSW to consider nominating additional experts to participate in the team and support its work.
- Action 3.28: Mamoru Ishii and other ICTSW members involved in the Asia-Oceania Space Weather Alliance (AOSWA) to inform AOSWA on ICTSW activities and seek

involvement of other countries (e.g. Indonesia, Philippines, Vietnam,..) The third meeting will be in October 2013.

- Action 3.29: Alain Hilgers to encourage ESA members with Space Weather activities to join ICTSW (e.g. Norway, Denmark, Sweden, Spain)
- Action 3.30: J. Lafeuille to assist any interested organization to establish contact with its Permanent Representative with WMO (when the organization is distinct from the met service)
- Action 3.31: J. Lafeuille to investigate WMO funding possibility, especially to support the participation of members from Least Developed Countries (LDC) or developing countries.
- Action 3.32: All ICTSW members to investigate possibilities of their organization providing a seconded expert to WMO to support space weather and ICTSW activities, and/or financial resources to a WMO trust fund for these activities.

12. DATE AND PLACE OF NEXT MEETINGS

The ICTSW acknowledged the need to have an annual face-to-face meeting of at least 2-3 days, in addition to the regular web meetings and teleconferences, in view of the work to be accomplished.

The ICTSW welcomed the proposal from CMA to tentatively host the fourth ICTSW meeting in China, in the September-October time frame (e.g. on 10-12 September, or 15-17 October with possibility of collocation with AOSWA). Place and date should be confirmed in the coming month.

13. CLOSURE

The meeting was closed at 2:00 pm on Wednesday 14 November, with renewed thanks to all the participants, and in particular to Ronald Van der Linden, his staff and the Solar Terrestrial Centre of Excellence for their hospitality which had facilitated a very productive team work.

ANNEX 1

LIST OF PARTICIPANTS

Participants in person:

Matt Francis	IPS	Australia
Ronald Van der Linden	ROB	Belgium
Jan Janssens	ROB	Belgium
Nilson SantAnna	INPE	Brazil
Larisa Trichtchenko	NRCAN	Canada
XiaoXin Zhang	CMA,	China
Nicole Vilmer	OPSM	France
Mauro Messerotti	INAF	Italy
Mamoru Ishii	NICT	Japan
Vyacheslav Burov	IAG	Russian Federation
Terrance Onsager	SWPC	USA
Alain Hilgers	ESA	-
Neil Mitchison	EU/JRC	-
Jérôme Lafeuille	WMO	-
Stephen Foreman	WMO	-
Herbert Puempel	WMO	-

Remote participants (WEBEX)

David Jackson	Met Office	UK
Raúl Romero (For Item 8)	ICAO	-
Muhammad Ayyaz Ameen	SUPARCO	Pakistan

ANNEX 2

PROVISIONAL AGENDA (Rev.2)

The meeting will start on 12 November at 10:00 and is expected to close on 14 November at 16:00. It will be co-chaired by Dr Terrance Onsager and Dr Xiaoxin Zhang.

DAY 1: Monday 12 November

14. OPENING OF THE MEETING (10:00-10:15)

- Introduction and welcome
- Adoption of the agenda
- Introduction of new Members

15. ICTSW IN THE WMO CONTEXT (10:15-11:00)

- Origin, linkage with WMO structure and ISES
- Vision of international coordination of space weather activities
- Terms of Reference and Work Plan
- Outcome of WMO Executive Council and Commission for Basic Systems
- Status of previous actions
- Priority objectives for ICTSW

Break (11:00-11:20)

16. INITIAL STATEMENT OF GUIDANCE ON OBSERVATIONS (11:20-13:00)

- Status of the Statement of Guidance for space weather observations
- Space Weather actions included in the EGOS-IP
- Way forward for these actions

Lunch Break (13:00-14:00)

17. OBSERVATIONS: REVIEW OF SPACE WEATHER CAPABILITIES (14:00-16:30)

- OSCAR database on space-based capabilities (introduction and feedback ?)
- Update of the gap analysis

Break (15:00-15:30)

OBSERVATIONS: REVIEW OF SPACE WEATHER CAPABILITIES (Continued)

- Inventory of surface-based observation capabilities
- Way forward including for updating the overall statement of guidance
- Intercalibration issues
- Potential radio-occultation workshop with IROWG

Adjourn for Day 1 (16:30)

DAY 2: Tuesday 13 November

18. SPACE WEATHER PRODUCT PORTAL (9:00-9:45)

- Outcome of the internal/external review (is there any feedback?)
- Improvements to the portal
- Guidelines for additions to the portal (products and training resources)
- What are the user requirements for Space Weather products ?
- Actions to improve visibility and widen the audience

19. DATA AND PRODUCT EXCHANGE ISSUES (9:45-10:30)

- Update on ISES formats and standards
- Update on the WMO Information System (WIS)
- How can WIS facilitate data/product discovery and timely distribution?
- Experience of IPS and BOM as DCPC and GISC in Australia
- Way forward regarding ICTSW and WIS

Break (10:30-11:00)

20. RELATIONSHIPS WITH OTHER ORGANIZATIONS (11:00-12:30)

- ISES
- CGMS
- Other organizations: OOSA and ISWI, COPUOS Working Group on Long-Term Sustainability of Space Activities

Lunch Break (12:30-14:00)

21. SPACE WEATHER SERVICES TO AVIATION (14:00-15:00)

- (with remote participation of ICAO in Montreal)*
- Status of the ICAO CONOPS Review
- Organization of aeronautical meteorology
- Identification of key issues for space weather services to aviation
- Proposed way forward for future interactions with ICAO / IAVWOG in 2013

22. TRAINING AND OUTREACH (15:00-15:30)

- Development of training material
- Collaboration with COSPAR
- Outreach actions

Break (15:30-16:00)

23. SUMMARY OF ACTIONS (16:00-16:30)

- Summary of actions

24. ORGANIZATION OF BREAKOUT SESSIONS (16:30-17:00)

- Identification of key topics, deliverables, and lead persons for the breakout sessions

Adjourn for Day 2 (17:00)

DAY 3: Wednesday 14 November

25. BREAKOUT SESSIONS (9:00-12:30)

Actions on topics identified on day 2, e.g:

- updates to the OSCAR database
- updates to the portal or to the product template
- statement on the concept of services to aviation
- liaison statement to ISES
- introductory text on ICTSW for Space Weather website
- training plan
- draft scope of radio-occultation workshop
- etc.

Break (10:30-11:00)

BREAK-OUT SESSIONS (Continued)

Lunch Break (12:30-14:00)

26. REVIEW OUTCOME OF BREAKOUT SESSIONS (14:00-15:00)

27. FUTURE WORK PLAN (15:00-15:30)

Updating the initial work plan to take into account the achievements, the new priorities and issues, and the resources available or planned

28. ANY OTHER BUSINESS (15:30-15:45)

29. DATE AND PLACE OF NEXT MEETINGS (15:45-16:00)

30. CONCLUSIONS AND CLOSURE OF THE MEETING (16:00)

ADJOURN (16:00)

ANNEX 3

SUMMARY OF ACTIONS

- Action 3.1: David Jackson and Terry Onsager will further investigate and document the observation requirements for temperature, wind and density in the thermosphere (in support of NWP and space weather services), and clarify how we want to represent the thermosphere in OSCAR (as part of atmosphere or outer space domain)
- Action 3.2: David Jackson and Terry Onsager will further investigate and document the observation requirement for galactic cosmic rays at aircraft cruising altitude and clarify whether this requirement should be accommodated in the High Troposphere and/or Low Stratosphere layer requirements.
- Action 3.3: Alain Hilgers to lead a review of the Space Weather space-based capabilities recorded in OSCAR, including the assignment of missions to homogeneous « classes » of performance and the list of variables for which these classes are relevant.
- Action 3.4: Larisa Trichtchenko to provide the WMO Secretariat (Nils Hettich, Etienne Charpentier) with a high-level description of surface-based space weather observing capabilities in Canada, to be used as an example for the specification of the surface module of OSCAR (Types of sensors, measured variables, typical observing cycles, typical data latency, uncertainty, coverage, approximate number of each type, sample of location information).
- Action 3.5: Xiaoxin Zhang, Matt Francis, and an expert from JRC to be designated by Neil Mitchison, are nominated to liaise with the Space Weather subgroup of the IROWG (Point of contact: Anthony Mannucci, NASA/JPL) for the preparation the workshop on atmosphere and ionosphere applications.
- Action 3.6: The ICTSW co-chairs to set up a task team in charge of developing a plan to address space agencies and space weather service-providing agencies at the proper level for programmatic issues regarding the long-term continuity of essential space weather satellite observations (including future L1 missions, missions to other heliospheric locations, coronagraph measurements, and heliospheric imaging).
- Action 3.7: Larisa Trichtchenko to solicit comments from the team on the portal and to lead the ICTSW effort to propose, if necessary, minor updates to be implemented to the portal in advance of the Boulder Space Weather Workshop (16-19 April 2013), while recognizing that further and more substantial updates would be considered later, if relevant, in the light of user feedback.
- Action 3.8: T. Onsager, in the context of ISES, and J. Lafeuille, at the WMO Executive Council, should encourage organizations/countries who operate an ISES Regional Warning Centre to join ICTSW if they are not currently an ICTSW member (e.g. Poland, India).
- Action 3.9: J. Lafeuille and N. Hettich will implement the corrections relevant to the WMO web pages of the portal, as proposed by L. Trichtchenko in Document ICTSW-3/Doc.5.3.

- Action 3.10: D. Jackson, K. Kauristie, T. Onsager, to check the pages under their responsibility in the portal and implement corrections, as appropriate, on the points raised by L. Trichtchenko in Document ICTSW-3/Doc.5.3.
- Action 3.11: All ICTSW members to promote the portal in relevant occasions (e.g. conferences, including WMO events), offer constructive suggestions for its improvement, and ensure the completeness and correctness of their respective local pages (product description, originating centre with point of contact, target users, compliance with the template, etc.)
- Action 3.12: J. Lafeuille and N. Hettich to propose (i) a feedback mechanism and (ii) an introductory text indicating the purpose of the portal, for review by the ICTSW before inclusion into the portal home page.
- Action 3.13: X. Zhang will lead the definition of a section to be added to the portal for training material.
- Action 3.14: J. Lafeuille and S. Foreman to ensure that ICTSW is invited to contribute to revise the metadata profile.
- Action 3.15: T. Onsager to coordinate with all ISES RWCs and the space weather service providers within ICTSW to develop a plan for registering relevant space weather products to the WIS (i.e., prioritizing products to be registered, ensuring consistency of information, and defining metadata accordingly).
- Action 3.16: T. Onsager and J. Lafeuille, to investigate the possibility of a Memorandum of Agreement between ICSU and WMO officialising the relationship between ISES and ICTSW.
- Action 3.17: R. Romero will circulate –via J. Lafeuille- the updated draft requirements of ICAO for review (November 2012)
- Action 3.18: All ICTSW space weather experts to review the requirements and evaluate what is achievable at present or very short term (“threshold” requirement), and what is realistic for the longer term only (“goal” requirement). (Early December 2012)
- Action 3.19: ICTSW co-chairs to consolidate the outcome of this review and forward to R. Romero (mid December 2012).
- Action 3.20: All ICTSW space weather experts to review and provide detailed comments on the draft 2.0 of the ICAO CONOPS (January 2013).
- Action 3.21: Comments on the draft 2.0 of the ICAO CONOPS to be consolidated for communication to ICAO early 2013.
- Action 3.22: T. Onsager and J. Lafeuille, to investigate the modalities of ground-based GNSS network data exchange for NWP (as discussed at the NAEDEX-APSDEU meetings) and for ionospheric monitoring (as discussed within e.g. IGS), and evaluate whether there is any potential for synergy between the various operational data exchange agreements.
- Action 3.23: All ICTSW members to evaluate the proposed GNSS-TEC data exchange (GTEX) format. (See [NICT's presentation](#)).

- Action 3.24: T. Onsager, M. Messerotti, and J. Lafeuille to draft an overview of the processes involved and issues to be addressed for extreme event warning, for use by ICTSW as a background for organizing future work on this issue.
- Action 3.25: T. Onsager, M. Messerotti, and J. Lafeuille to draft a recommended approach to evaluate, improve, and expand as necessary the set of global and local Space Weather scales in order to ensure efficient and standardized information communication to the users.
- Action 3.26: T. Onsager, X. Zhang, J. Lafeuille, to develop a more detailed and prioritized work plan for ICTSW, evaluating the resources needed and the timelines. Draft by December, 15, for review by the team.
- Action 3.27: Organizations participating in ICTSW to consider nominating additional experts to participate in the team and support its work.
- Action 3.28: Mamoru Ishii and other ICTSW members involved in the Asia-Oceania Space Weather Alliance (AOSWA) to inform AOSWA on ICTSW activities and seek involvement of other countries (e.g. Indonesia, Philippines, Vietnam,..) The third meeting will be in October 2013.
- Action 3.29: Alain Hilgers to encourage ESA members with Space Weather activities to join ICTSW (e.g. Norway, Denmark, Sweden, Spain)
- Action 3.30: J. Lafeuille to assist any interested organization to establish contact with its Permanent Representative with WMO (when the organization is distinct from the met service)
- Action 3.31: J. Lafeuille to investigate WMO funding possibility, especially to support the participation of members from Least Developed Countries (LDC) or developing countries.
- Action 3.32: All ICTSW members to investigate possibilities of their organization providing a seconded expert to WMO to support space weather and ICTSW activities, and/or financial resources to a WMO trust fund for these activities.