

OUTCOME OF THE IROWG WORKSHOP (SPACEWEATHER SUBGROUP)

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Summary and Purpose of Document

The International Radio-Occultation Working Group (IROWG) held its 2013 workshop in Graz, Austria from 5 to 11 September 2013. Its sub-group on Space Weather raised several issues and actions of direct relevance to the ICTSW:

- the potential impact of cancellation of the COSMIC-2/FORMOSAT-7 high-inclination constellation,
 - the inclusion of ionospheric measurements such as scintillation into GNSS-RO mission objectives,
 - the harmonization of formats for GNSS radio-occultation data,
 - the organization of a workshop on ionospheric applications of GNSS,
 - the representation of ICTSW at IROWG workshops.
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ACTION PROPOSED

The Inter-Programme Coordination Team is invited to note the outcome of the space weather subgroup of IROWG and take action as appropriate.

REFERENCES

1. [Critical Impact of the potential Delay or Descoping of the COSMIC-2/FORMOSAT-7 Programme. IROWG/DOC/2013/01](#)
2. [Status of the Global Observing System for Radio Occultation \(Update 2013\). IROWG/DOC/2013/02](#)

DISCUSSION

1. INTRODUCTION

The International Radio-Occultation Working Group (IROWG)¹ is one of the international science groups sponsored by WMO and the Coordination Group for Meteorological Satellites (CGMS).

The objectives of the IROWG are to:

- (a) Make recommendations to national and international agencies regarding the utilization of current Radio-occultation (RO) data and the development of future RO systems;
- (b) Suggest and promote studies aiming at the definition of future RO satellite constellations that fulfil the expected operational and research user requirements;
- (c) Encourage cooperation on ground support infrastructure for RO systems;
- (d) Promote standard operational procedures and common software to the scientific community for processing and assimilating radio occultation measurements from satellites;
- (e) Stimulate increased international scientific research and development in this field and establish routine means of exchanging scientific studies and verification results;
- (f) Support and stimulate the training and education of the scientific community at large for the exploitation of RO product information;
- (g) Promote the exploitation of RO observations and their unique capability in the context of climate applications;
- (h) Foster communication between the RO scientific community, space agencies and science policy institutions such as the IPCC.

The IROWG holds a workshop normally every 18 months. The 2013 IROWG workshop was convened in Graz, Austria from 5 to 11 September 2013. Its sub-group on Space Weather raised several issues and actions of direct relevance to the ICTSW.

2. MAIN RECOMMENDATIONS AND ACTIONS FROM IROWG

2.1 COSMIC-2/FORMOSAT-7

The Space Weather subgroup of IROWG recommends that all reasonable effort be expended to launch the FORMOSAT-7/COSMIC-2 Polar mission in the 2018 time frame as originally planned. The first launch of COSMIC-2/FORMOSAT-7 spacecraft is planned for a low inclination orbit. They will not provide data at middle and higher latitudes, where space weather conditions need to be monitored as they have significant impact. With the decline of FORMOSAT-3/COSMIC and other research satellites, the lack of the COSMIC-2/formosat-7 high-inclination constellation would result in a gap in ionospheric radio occultation measurements above approximately 40° latitude.

¹ IROWG website : <http://www.irowg.org/>

2.2 GNSS RO data format

IROWG recommends that CGMS coordinate efforts to standardize an ionospheric data format for operational use of RO (similar to the BUFR format in the neutral atmosphere), create a real-time data accessing service available for space weather assimilation models, and archive historical data for ionospheric climate and scientific research purposes.

Terry Onsager (NOAA) and Bill Schreiner (UCAR) are invited to coordinate format development. Terry will help coordinate this through WMO ICTSW and the International Space Environment Service (ISES). UCAR is willing to inventory existing instrument formats to help determine the best approach.

2.3 Space-based ionospheric observation

IROWG recommends CGMS to encourage missions flying GNSSRO sensors to incorporate a complete set of ionospheric measurements including measurements of ionospheric scintillation (high rate data scintillation measurements on all available line of sight TEC measurements) and, wherever possible, to reduce data latencies to less than 30 minutes.

2.4 Workshop

A working group should be formed over the next 18 months to organize and conduct an international workshop on the aspects of RO analysis involving the ionosphere. The workshop would be supported by the WMO and other operational agencies and would bring together a cross-section of ionospheric space weather experts and the neutral atmosphere community concerned with removing ionospheric effects from RO for neutral atmospheric parameters. The workshop would address the effect of solar cycle, diurnal and seasonal variability, and sporadic-E climatologies.

Tentatively, the workshop would include the following sessions:

- (a) Removing ionospheric effects from RO for neutral atmospheric parameters; discussion of various ionospheric corrections currently used and possible improvements;
- (b) Discussion of various ionospheric data assimilation methods;
- (c) Ionospheric effects on RO, especially scintillation, using the extensive RO databases;
- (d) Extending atmospheric measurements to 40-90 km altitude range to improve characterization of lower-upper atmosphere coupling.

The location will be at the next COSMIC/FORMOSAT-3 Data User's Workshop in Boulder, CO planned for 2014.

2.5 Linkage with ICTSW

The sub-group should coordinate with space weather activities throughout WMO. It is recommended that a member of the WMO ITCSW attend future IROWG Space Weather sub-group meetings.

3. CONCLUSION

The ICTSW is invited to note the outcome of the IROWG subgroup on space weather, to consider the opportunities for collaboration, and take action as appropriate.
