

# Topical Discussion Meeting report

Meeting topic: "[Coordination of international space weather activities](#)"

Conveners: Jesse Andries (ROB), Masha Kuznetsova (NASA), Kenneth Holmlund (WMO), Kirsti Kauristie (FMI)

1130-1245 Thursday 27<sup>th</sup> October 2022

Number of participants: ~60.

Chair: Jesse Andries. Online moderator: Masha Kuznetsova. Secretary: Suzy Bingham.

## Objective of the TDM

To update the space weather community on progress made since the UNCOPUOS recommendation for COSPAR-ISES-WMO to take a leadership role, in collaboration with other actors, in driving forward international coordination on space weather activities. To encourage discussion in the audience to identify which 'other actors' should be invited to engage in coordination activities. To get feedback from the audience for ideas for 'joint pilot projects', where the strengths of each of the three organisations could be applied, and to show the value of COSPAR-ISES-WMO working together.

## Some meeting highlights

### Introduction

Jesse Andries presented some background to the topic (see slides in Annex 1) before discussion was opened-up to the onsite and online audience. A recently published UNCOPUOS Report, [A/AC.105/C.1/L.401](#), includes six recommendations (see Annex 2 for summary of recommendations). The first recommendation (R1) was the focus of this TDM: for COSPAR-ISES-WMO to take a leadership role, in collaboration with other actors, to coordinate space weather activities. It was important to keep in mind the other five recommendations too during this TDM, of particular importance to today's discussion was the third recommendation (R3), Improved Space Agency Space Weather Mission Coordination.

Two representatives each from COSPAR-ISES-WMO met in Coimbra, Portugal, in September 2022, towards moving forward on R1. The representatives discussed roles and responsibilities of each organisation, members, strengths, deliverables, governance, etc. During the Coimbra meeting, there was discussion on a high-level basis where each of the organisations could lead, with others contributing. A 'Coimbra Declaration' was drafted along with next steps. The Coimbra Declaration stated that there was agreement between the three organisations in moving forward on the UNCOPUOS recommendation. The main roles of each organisation were identified as follows, COSPAR: research and development, ISES: operations and services, WMO: facilitating integration. Examples of overlapping areas were also identified where one of the organisations leads and others support activities. The three organisations agreed to work towards a more formalised partnership, in the form of an MoU for example. It was agreed that a Roundtable would be arranged in April-May 2023 when engagement would be sought with other actors.

Some TDM discussion highlights are below.

### Other actors

Regarding a proposed 'Round table' meeting between the three organisations and 'other actors', the TDM audience discussed which other actors should be invited to the Round table. A number of space weather actors were suggested: national/regional space agency's Forum, CGMS, ISWI, SCOSTEP, ILWS, URSI, IAGA, ESWAN (should other national regional associations/unions also be considered?)

### Ideas for projects

Over the next few months, COSPAR-ISES-WMO are collating and considering a list of potential joint pilot projects. One or two of these projects will then be chosen that can be addressed fairly quickly which they could work on together. The TDM audience proposed and discussed joint pilot projects. Discussion was around larger, long-term projects required by the community and whether there were any smaller, joint pilot projects that could be initial, quick-wins (any low hanging fruit) to demonstrate coordination between COSPAR-ISES-WMO and the expertise of each organisation, leveraging in different nations.

- Capacity-building – a [COSPAR Panel on Capacity Building \(PCB\)](#) is already addressing this area and there could be collaboration/work to build-on (suggested by Alexi Glover).
- Cross-validation of space weather products – possibly starting with validation/assessment of quantities that feed into the products.
- Training.
- Ground-based observation networks. Coordination of observations was discussed, both research and science, and also local, regional and global. Mangala Sharma's vision is to have a ubiquitous, local, regional and global space weather observation network, including instruments of opportunity (e.g. soil moisture instruments supporting neutron monitor network) – the community needs a census of instruments and to look at bolstering current observations. CGMS/WMO identify and review current and planned *space-based* assets for space weather observations; Gap Analysis is reviewed annually. A similar process could be performed for *ground-based* observations, for both science and research, towards sustained ground-based space weather monitoring networks. Instruments that are implemented by other research areas but used for space weather should also be included. Some examples of ground-based networks are INTERMAGNET and SuperDARN; it was suggested that awareness of networks could be raised through COSPAR-ISES-WMO. An inventory of networks/instruments could be a starting point – categorise into user groups - with usefulness for specific space weather topic, maintenance information, risk of loss, data access, etc. How to coordinate and set government policy across *research* networks? At ESWW this week, it's been discussed several times that instruments can simply disappear – research instruments that are taken off-line without notice to users – it should be documented where instruments are located, both research and operational. WMO could maintain an inventory/census of instruments (identifying core/crucial), towards sustained ground-based observations. It's not just funding for hardware that needs to be provided but also funding for staff to maintain the instruments, i.e. human resource and keeping staff happy in the job. There could be a COSPAR Roadmap paper on the topics discussed on ground-based observations – including scientists being lost and how to solve this issue. Consider how countries without particular instruments could benefit, and explore synergies with other projects/areas.

- Radio/ionosonde - with just a small amount of money, networks could be expanded therefore a quick-win.
- Neutron monitors.
- GNSS – in the US there's a network of GNSS stations for geodetic measurements; the stations in the Antarctic are vital for space weather (lower and upper atmosphere modelling). Therefore, a sustained space weather network would also support others such as geodetic community but also, loss of an instrument means both communities lose out.
- VLF - an example of synergism: using VLF network for GIC (Mark Clilverd talk at ESWW).
- Empowering instrument hosts in remote locations (Africa, Antarctica, Islands) to understand the benefits of the data to them in their own context.
- Exploring synergism with other research fields that can benefit from the space weather monitoring instrumentation.
- Soil moisture measurements to supplement neutron monitor observations – quick win for a pilot project. There're soil moisture instruments world-wide, just need to improve the data and install some auxiliary sensors. (e.g. soil moisture measurements in UK [Hands et al., 2021: DOI: https://doi.org/10.1029/2021SW002800](https://doi.org/10.1029/2021SW002800)).
- Muon detectors.
- Data discovery - data portal, metadata archive, services' forecasts. To enable a query to be run to find data/forecasts for a particular event. Standardisation of metadata – ways to increase searchability – what information is required? – important for e.g. validation. Encourage data users to submit metadata to the World Data System.
- Establish a mechanism/means for scientists and users to exchange ideas – establish a survey – R2O.
- Citizen science project – to analyse space weather data, e.g. aurora structure. Mobile phone sensors (e.g. raw GNSS data, magnetometer data, radio noise levels) can be used in gathering data via citizen science.

There was some discussion on SANSa coordination efforts with other African countries and with end-users, through initial training by SANSa on space weather.

There could be sections in the COSPAR Roadmap on networks, e.g. ground-based capabilities and satellite capabilities – this could lead to a pilot project.

Jim Spann discussed a need for a Discussion/Communication Forum for national/regional space agencies and other entities that are providing funding for major space missions and space weather programs (including ground-based networks). Discussion in such a Forum could potentially lead to funding for pilot projects. International Solar-Terrestrial Physics (ISTP) did this type of coordination and it worked well, maybe this could be resurrected for space weather. ILWS or a new entity could play this role. Those invited to a funding forum would be anyone with money that funds space weather research/operations observations: space-based, ground-based.

The CGMS process for planning missions/identifying gaps is very good for operational space-based observations. Something similar is required for research space-based observations. And also for

space- and ground-based space weather observations. We need to keep in mind that research observations also sometimes become vital for operations (e.g. SOHO). Funding for analysis of the data should also be remembered – i.e. not just mission funding but follow-on use of data. If all the funding agencies were invited to a space weather funding forum/meeting, that would be a lot of people – so maybe a high-level meeting with sub-levels.

It's important to identify pilot projects and then a broader project, so time would be well spent on initial identification of pilot projects. ESWAN could be included as 'other actor', where user and research communities meet together.

Thank you to all those participating online and in the room in Zagreb. Particular thanks to those who agreed in advance to participate in discussions: Elsayed Talaat, Jim Spann, Alexi Glover and Rendani Nndanganeni.

## **Main conclusion of the meeting**

Through this ESWW TDM, the community were given a summary on a recent meeting between COSPAR, ISES and WMO in Coimbra, Portugal. The meeting addressed the UNCOPUOS recommendation that these three organisations take a leadership role, in collaboration with other actors, to improve global coordination of space weather activities. The 'Coimbra Declaration' was outlined at the start of the TDM, stating agreement between the three organisations to address the recommendation positively, and stating next steps.

Discussion in the TDM audience provided a list of 'other actors' (not necessarily comprehensive) that could be included in Round table discussions arranged by COSPAR-ISES-WMO:

- Space agencies/space agency forum, role of ILWS
- CGMS
- ISWI
- SCOSTEP
- URSI
- IAGA
- ESWAN (need to decide the role of national/regional associations/unions)

Ideas suggested for joint pilot projects between the three organisations (which will be considered further by the three organisation) were:

- Coordination of ground-based observation networks – similar to the CGMS/WMO space-based observations Gap Analysis (this was the main topic/project discussed at this TDM, with sub-projects – see above)
- Capacity building
- Cross-validation of space weather products
- Training
- Exploring synergism with other fields
- Data discovery
- A Citizen science project

There was also discussion around a Funding Agency Forum.

## Annex 1: Presentation slides

Topical Discussion Meeting (TDM)



### Coordination of International Space Weather Activities

1130 - 1245 Thurs 27<sup>th</sup> Oct. Room: 'Air'.

Coordination between international organisations undertaking activities in space weather is critical to focus efforts, avoid duplication of effort and to improve harmonisation of space weather activities. UN COPUOS have this year recommended that the key international space weather organisations, COSPAR, ISES and WMO, take a leadership role in driving forward future international coordination on space weather activities between these key organisations in collaboration with other relevant entities. This TDM will begin with an overview of activities undertaken by the key space weather organisations and then active discussion from participants will be encouraged. Discussion topics may include: synergies in and harmonising of activities, challenges in harmonising activities, any gaps in activities, what entities and agencies can do to promote improvement on coordination. The goal of this TDM is to promote discussion on coordination of space weather activities and to encourage the COSPAR, ISES and WMO communities to work together for the benefit of the space weather community.

Conveners: Kenneth Holmlund (WMO), Kirsti Kauristi (FMI), Masha Kuznetsova (NASA), Jesse Andries (ROB)

#### UNCOPUOS Recommendations

#### Scientific and Technical Subcommittee

**A/AC.105/C.1/L.401**

[https://www.unoosa.org/oosa/oosadoc/data/documents/2022/aac.105c.1/aac.105c.1l.401\\_0.html](https://www.unoosa.org/oosa/oosadoc/data/documents/2022/aac.105c.1/aac.105c.1l.401_0.html)

- R1. Mechanism to Improve Global Coordination
- R2. Mechanism to Improve Global Information Sharing
- R3. Improved Space Agency SWx Mission Coordination
- R4. Support Transition and Implementation
- R5 & R6. Multi-Lateral Cooperation

## UNCOPUOS letter, 1st July '22

Recommendation: COSPAR, ISES & WMO lead efforts to improve the global coordination of space weather activities in consultation and collaboration with other relevant actors and international organizations, including COPUOS.

And that member States that are also members of, or are represented at, COSPAR, ISES or WMO engage with those organizations to encourage a response to COPUOS outlining the efforts they will undertake towards the goal of establishing a potential path forward to improve global coordination and collaboration.

## Moving forward on the recommendation

Coimbra 'Brainstorm', 30th Sept - 1st Oct - two representatives each from COSPAR, ISES, WMO

- For each organisation: overview, members, primary focus, strengths, deliverables, etc
- High-level basis where each organisation could potentially lead efforts, with others contributing
- Draft 'Coimbra Declaration'
- Initial discussion around 'pilot-projects' - actions to demo benefit of COSPAR-ISES-WMO working together
- Future regular meetings, future pathway

## The WMO-ISES-COSPAR 'draft' Coimbra Declaration

The three organisations agreed:

- To respond positively to UNCOPUOS, to take a leadership role, as equal partners, in delivering improved coordination of SWx
- To proceed in collaboration with others - with the three leading in distinct domains & to define overarching activities where there's overlap (e.g. R202R transitions, Capacity building, Collaboration for a global warning system)
- To add cross-membership between the three organisations on the relevant committees/groups - to facilitate improved info flow (e.g. WMO & ISES representatives at COSPAR PSW)
- To work towards formalising partnership e.g. an 'MoU'
- To define pilot-projects for collaborative activities
- To meet regularly (every 6 months + virtual meetings + meetings with broader community) - towards improved coordination, on-going activities, action plans, formal agreement (e.g. MoU)
- To report back to UNCOPUOS, Feb '23, formal statement at STSC 60th Session
- To organise Roundtable - April-May '23 - for international SWx info exchange & coordination (e.g. concepts for improvements to SWx research & services, mechanisms for delivering coordination of activities.)



DISCUSSION: other organisations

## Discussion topics

- Other organisations/actors & their roles/expertise/responsibilities?
- Perspectives on international agency coordination for space weather efforts - agency forum - [Jim Spann]
- Perspectives on coordination of space weather efforts - from service providers, end-users, etc - [Rendani]
- Ideas for Joint Pilot projects [Elsayed]

## Joint Pilot Projects - ideas

- Socio-economic study coordination,
- Global Warning System/Centres - expand out ICAO activity to other industries
- Ionosphere variability - data sharing, etc
- R2O pipeline for one major user group (e.g. navigation)
- ...

## Annex 2: UNCOPUOS recommendations

Thanks to Ian Mann for slides giving overview of the six UNCOPUOS recommendations.

### Overarching Recommendations R.1-R.6

#### R1: Mechanism to Improve Global Coordination.

**R.1:** The Expert Group recommends the Subcommittee request the Secretariat send a letter, on behalf of the Committee, to the leadership of COSPAR, ISES and the WMO, proposing that they lead efforts to improve global coordination of space weather in consultation and collaboration with other relevant actors and international organisations, including the COPUOS STSC.

The Expert Group further recommends Member States who are also Members of COSPAR, ISES and the WMO engage with these organizations to encourage a response to the STSC outlining the efforts they will undertake towards the goal of establishing a potential path forward to improve global coordination and collaboration.



## **Overarching Recommendations R.1-R.6**

### **R2: Mechanism to Improve Global Information Sharing.**

**R.2:** The Subcommittee identify a central repository for access by all States Members of the Committee to best practices, techniques, training materials, and standards, for space weather services, observations, research, mitigation approaches, capacity-building activities, and socioeconomic impact and risk assessment studies. The repository could also serve as a compendium for space weather information to support members as they implement the Guidelines for the Long-Term Sustainability of Outer Space Activities (LTS Guidelines), relating to space weather;

## **Overarching Recommendations R.1-R.6**

### **R3: Improved Space Agency Space Weather Mission Coordination.**

**R.3.** Consistent with LTS Guidelines pertaining to space weather, the Expert Group recommends the Subcommittee consider enhanced consultation with space agencies and international organizations to coordinate space weather satellite missions in support of sustained space-based observations for space weather services and research which address international space weather needs;

## **Overarching Recommendations R.1-R.6**

### **R4: Support transition and implementation.**

**R.4.** Recognizing the ongoing activity relating to the implementation of the LTS Guidelines and to support implementation of the LTS guidelines B6 and B7, the Expert Group recommends that the Subcommittee encourage the LTS 2.0 Working Group consider further analysis of the survey results and the additional domain specific recommendations in CRP.14 (reference to be updated) for possible inclusion in future guidelines. In parallel, the Expert Group recommends those Member States who have not yet participated in this process to engage with this activity and to consult with the relevant international organizations as needed to facilitate implementation of the guidelines;



## Overarching Recommendations R.1-R.6

### R5 & R6: Multi-lateral cooperation.

**R.5** The Committee on the Peaceful Uses of Outer Space Scientific and Technical Subcommittee should continue to include on its agenda an item on Space Weather;

**R.6** Bilateral and multilateral cooperation involving States and international intergovernmental organizations in space weather should be encouraged. New mechanisms and/or forums for cooperating in space weather activities should be identified, including by considering the participation of industry and States with emerging capabilities in space weather.