



# Report on the outcome of SWCG activities since last plenary

Presented to CGMS-51 plenary, agenda item 5

## SWCG and its role within CGMS

The CGMS Space Weather Coordination Group (SWCG) was established by the 46th CGMS plenary on 8 June 2018, building upon the work performed by the former Space Weather Task Team, created in 2015 during CGMS-43.

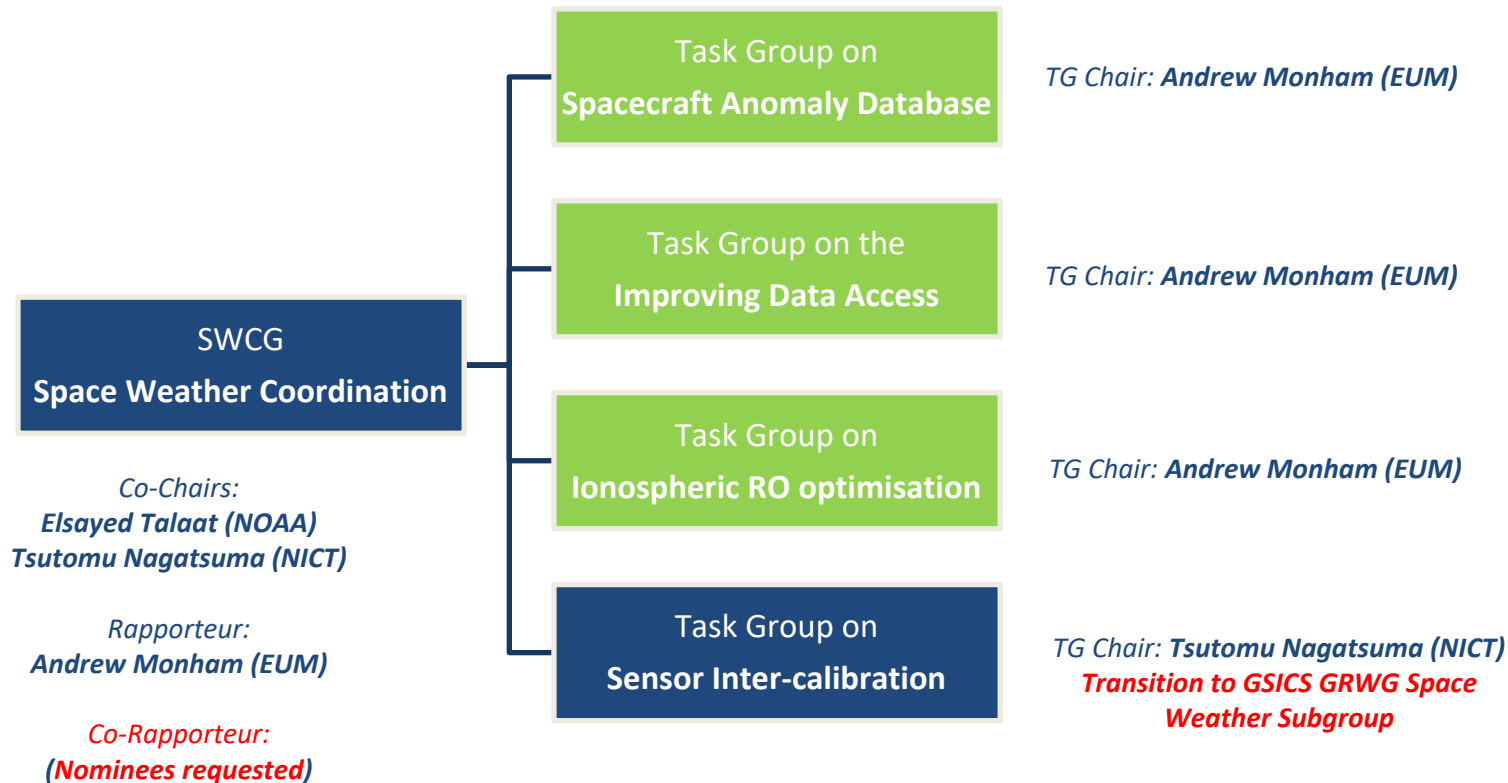
**SWCG co-chairs:** Elsayed Taalat, NOAA / Tsutomu Nagatsuma NICT/JMA

**SWCG rapporteur:** Andrew Monham, EUMETSAT

### Terms of Reference: Objectives

- Coordinate space weather activities within and across CGMS working groups including space weather data, ensuring space weather operational measurements are incorporated into the CGMS baseline, relevant frequencies, anomaly resolution, products, knowledge, policy, etc.;
- Address space weather topics relevant to CGMS that are not currently within the purview of other CGMS WGs;
- Facilitate dialogue between CGMS members and space weather communities;
- Identify which space weather organizations/forums the SWCG should interact with both as an active participant and/or engaging them within CGMS activities;
- Identify needs and requirements from space weather communities that should be managed and coordinated by CGMS or its members;
- Follow current and future international and domestic space weather policies which may have an effect on CGMS or its members; and
- Review the CGMS high level priorities related to space weather.

## Current SWCG Structure



**TG with green background report to the Joint WGI-SWCG-WGIV plenary session**

## Overview of CGMS-51 SWCG and Joint WGI-WGIV-SWCG Sessions

**SWCG Session: 23 WPs** (35% more contributions to main agenda items compared to CGMS-50)

SWCG/2: 3rd CGMS risk assessment and baseline update -1WPs

SWCG/3: Updates on space-based observational capabilities -6WPs - CMA, ESA, KMA, NOAA,  
**ISROx2**

SWCG/4: Updates on space weather activities -7WPs - ESA, NASA, NICT, NOAA, WMO, **EUMETSAT,**  
**JAXA**

SWCG/5: International space weather data user activities -4WPs - ISES, ESA , **ROSHYDROMET, FMI**

SWCG/6: OSCAR review for space weather -1WP

SWCG/7: Task Group on space weather calibration -1WP

**SWCG/9: Status Report on Future Directions – 1 WP**

SWCG/10: Review and updating of the HLPP -2WPs

**Joint WGI-WGIV-SWCG session: 6WPs**

WGI-WGIV-SWCG/2: Benefits of space weather data usage for satellite operators and role of  
Anomaly report database -3WPs

WGI-WGIV-SWCG/3: Task Group on Ionospheric Radio Occultation System Optimisation -1WP

WGI-WGIV-SWCG/5: Task Group on Improving User Data Access to Space Weather Data from Orbital  
Sensors -1WP

WGI-WGIV-SWCG/6: Frequency-related topics in support to space weather -1WP

## SWCG Main Session Report (1)

- The CGMS Baseline was confirmed as correctly addressing the space weather aspects, in particular the characteristics/definitions of the new energy ranges related to the high energy particles.
- Measurements from Lagrange Point 1 (L1) continue to rely on ageing spacecraft prior to the deployment of the NOAA SWFO mission. Actions to allow a limited mitigation from the STEREO mission are on-going (improvement of data latency for solar observation data).
- NOAA also reported on:
  - GEO-based space weather observations, with GOES-U to host the Compact Coronagraph CCOR in 2024.
  - Establishment of NOAA-NASA Space Weather Observations Programs Division (SWO)
  - The Space Weather Next program approval process is planned for late 2023
  - Award of the first Space Weather Data Pilot contracts: it is anticipated to secure free and open use of data in 2024.
- NASA presented their Heliophysics System Observatory, together with the heliophysics objectives, vision, overview of the space weather program. The potential for coordination of R2O efforts will be addressed by SWCG.

## SWCG Main Session Report (2)

- CMA presented the space weather monitoring capabilities of FY-3E and the successful intercalibration activities.
- A broad range of ESA activities was presented:
  - The ESA Vigil (L5) mission is on-track to be launched in 2029 and will embark a NOAA Coronagraph (CCOR) and a NASA EUV imager. X-ray and radiation monitors had to be descope. Continuity of ESA missions to L5 is foreseen.
  - Particle sensors are hosted in LEO and GEO on EUMETSAT and commercial satellites.
  - The SOSMAG magnetometer is on the KMA GK2A with NRT data available from ESA. A trial availability of this data from the WMO WIS2.0 is also being initiated.
  - Lunar hosted payloads are also planned on the ESA Lunar Pathfinder and in cooperation with NASA on Lunar Gateway.
  - A commercial space weather nanosat mission for launch in 2026 is supported
  - A demonstration auroral monitoring mission is planned for 2027.
  - The status and plans for the ESA space weather service network was were presented.
- EUMETSAT highlighted the cooperation with ESA to ensure the delivery of operational space weather data in support of European forecasting service users.

## SWCG Main Session Report (3)

- The Korea Meteorological Administration KMA GK2A KSEM space weather package has been delivering data since 25 July 2019 and intercalibration of electron flux with GOESR/MPS-HI has been successful. Continuity is ensured through an improved space weather payload on the GK5 satellite to be operational from end-2031.
- ISRO presented particle observations from the moon orbiter Chandrayan-2, relevant for lunar space weather as well as its X-ray spectral monitoring and recommend a dedicated “space weather index” for the Moon.
- The NICT Space Environment Laboratory continues to operate space weather services on a 24/7 basis as one of ICAO’s global centers, ACFJ and also serves domestic users. A new 7.3m antenna has been constructed for support of NOAA SWFO L1 mission. AI-based radiation belt electron forecast models and other tool improvements were also presented.
- JAXA presented their 5 spacecraft missions in operation targeting Sun and Solar-Terrestrial Sciences with focus on the research community. JAXA are very interested in cross-calibration of the sensors.

## SWCG Main Session Report (4)

- Reports from representatives of all four ICAO space weather advisory centers - SWPC (US), FMI (PECASUS), NICT (AFCJ) and ROSHYDROMET (CRC) - were made, highlighting progress on services and identifying the need for improved Radio Occultation data access supporting TEC products and ionospheric tomography.
- The WMO Space Weather Expert Team kicked off in 2022, following on the work of IPT SWeISS which ended in 2020 and reflecting the COSPAR-ISES-WMO "Coimbra Declaration" to respond to the UN COPUOS STSC February 2022 recommendations. WMO ET-SWx comprises 32 expert from 20 countries and 7 international organisations and involves significant collaboration with CGMS, as well as ISES and COSPAR. An important overarching goal is identified as facilitating integration through data standards and CGMS SWCG activities are closely coordinated. The first International Space Weather Coordination Forum (ISWCF (former round table)) will be held in Nov. 2023
- The importance of space weather services to Space Traffic Coordination (STC) was presented by ESA (exemplified by the February 2022 loss of Starlink satellites). It is noted that the CGMS Future Direction Project's SSA Theme recommends to produce a report of space weather observation requirements for improved STC services and space sustainability.



## SWCG Main Session Report (5)

- WMO presented updates on Space Weather information in OSCAR/Space and WMO Gap Analysis, highlighting the entry of frequency information to support Space Frequency Coordination Group (SFCG) and the addition of data latency records to support the gap analysis for Space Weather – latency inputs are required from CGMS members.
- The Inter-calibration Task Group activities on high energy electron sensors have been transferred to the GSICS GRWG space weather subgroup, with KO in Dec. 2022 and a break-out session was held at the 2023 GSICS meeting. The scope and work plan were refined at the last meeting on 15 June 2023.

## Joint WGI-WGIV-SWCG Report (1)

- Space Weather Spacecraft Anomaly Database Task Group:
  - Good progress has been made on the prospect of establishing a satellite anomaly database for correlation with space weather effects, including identification of potential technical solutions and revision of the anomaly input forms to allow automated read/write.
  - Issues concerning the supply of data from CGMS members persist (only ESA, EUMETSAT and KMA have provided data this year, with CMA expressing intention to supply instrument related anomaly data).
  - Outreach to commercial operators is also on-going
  - Strong backing for this activity is received from representatives of UN COPUOS with the Long Term Sustainability Guidelines specifically encouraging support to this CGMS activity.
  - The TG also initiated steps to identify best practices in usage of space weather data by spacecraft operators and their goals for improvement.
  - Recommended that the TG continues the activities with focus on expanding the data input.

## Joint WGI-WGIV-SWCG Report (2)

- Task Group on Ionospheric Radio Occultation System Optimisation (HLPP 6.4)
  - In coordination with IROWG establish requirements for and recommend an implementation of an optimized system for radio occultation observations for ionosphere monitoring.
  - Very active and experienced group and significant progress has been made in:
    - developing the capability table of ionospheric RO missions,
    - reviewing methods to geolocate plasma bubble scintillation,
    - initiating Observing System Simulation Experiments (OSSE)
  - Work will continue through to CGMS-52 in line with the HLPP goal.
- Task Group on Improving User Data Access to Space Weather Data from Orbital Sensors
  - helps glue together the feedback obtained from the various outreach activities of SWCG and focus the objectives of new outreach interactions.
  - Very active and with diverse participation representing all actors and is coordinating with the WMO-ET-SWx, especially for format standardisation and metadata definition.
  - Previous data provider and user surveys have been updated and correlation with the OSCAR DB is on-going
  - Efforts also underway to improve data access reliability through leveraging of existing cooperation agreements for meteorological data exchange

## Joint WGI-WGIV-SWCG Report (3)

- Space Frequency Coordination Group (SFCG) topics in support to space weather
  - The ITU Radio Regulations do not contain any recognition or provisions related to space weather observations using radio frequencies, but will be addressed at the World Radiocommunications Conference 2023 (WRC-23)
  - It is foreseen regulatory actions will first be introduced at WRC-27, although some countries are proposing to already introduce some in WRC-23
  - CGMS agencies are requested to highlight important frequencies for protection ahead of the upcoming WRC-23. This is already covered by an open action and this should form part of the standard SWCG agenda. It was noted that is it too late to make a coordinated CGMS input to WRC-23 – inputs should be made at national level.
  - It was noted that the RO spectrum is already very well-protected through the frequency allocation for Radio Navigation Satellite Service (RNSS) systems.
  - Also CGMS should work with WMO-ET-SWx to protect ground-based measurements F10.7 and F30 (1-3 GHz frequencies), critical for atmospheric density models and ionospheric tomography.

## To be considered by CGMS:

- SWCG Terms of Reference will be reviewed and updated, based on the CGMS Future Directions Project outcomes and inputs from the Task Groups for presentation to CGMS-52
- Nominations for a co-rapporteur for SWCG are requested.