REPORT OF THE 53rd PLENARY SESSION OF THE COORDINATION GROUP FOR METEOROLOGICAL SATELLITES

EXTRACT
WORKING GROUP SWCG

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PARALLEL WORKING GROUP SESSIONS

WG SWCG REPORT

Co-Chairs: *Tsutomu Nagatsuma, NICT (Day 1), Andrew Monham (Day 2)*
Rapporteur: *Andrew Monham (Day 1), EUMETSAT, Jesse Andries, WMO (Days 1,2)*

1. Welcome, objectives and review of agenda [10']

CGMS-53-SWCG-WP-12 *- Meeting objectives and expected outcomes by co-chairs (verbal) (Co-chairs)*

SWCG Chairs Dr. Tsutomu Nagatsuma, supported by Rapporteurs Mr. Andrew Monham and Mr. Jesse Andries, welcomed the participants, consisting of representatives from CMA, ESA, EUMETSAT, IROWG/JCSDA, ISRO, JAXA, JMA~~, JAXA~~, KARI, KMA, NASA, NICT, NOAA ~~, ROSCOSMOS, ROSHYDROMET~~ and WMO (see Annex 1 for full list of participants).

SWCG reviewed and adopted the draft agenda proposed by the CGMS Secretariat prior to the meeting which is in line with the Terms of Reference for SWCG.

CGMS-53-SWCG-WP-15 *- Status of SWCG Co-Chairs/Co-Rapporteurs Co-chair nominations (Co-chairs/rapporteurs)*

It was noted that the co-chair Dr. Elsayed Talaat has left NOAA and can no longer fulfil this CGMS role. NOAA has therefore nominated a replacement co-chair, Dr. James Spann.
The SWCG had no objections to the nomination and therefore proposes Dr. James Spann as co-chair for confirmation by the CGMS-53 plenary in June.

2. CGMS risk assessment and baseline update [15']

CGMS-53-WGIII-WP-02SWCG - Status and outcome of the 7th CGMS WGIII risk assessment (Melissa Johnson (remote))
CGMS conducts an annual risk assessment against the CGMS baseline to track how well CGMS is meeting its commitments. For each sensor/observation such assessment is based on a qualitative analysis of all the orbits and satellite missions from which the observation is provided. It is based on planned launch dates and design life while resiliency, quality and availability are not analyzed in detail. Hosted payloads operated by Members are included as well as commercially sourced data if the provision is consistent with the CGMS Baseline principles of sustained commitment to provide the data on a free and open basis for operational applications.
The Risk Assessment process is fully described in the CGMS Contingency Plan. The risk assessment was updated in a workshop in February following updates provided by the agencies.
In general, the risk posture has improved. Compared to last year the high risk for gap after 2031 for energetic particles, plasma analyser and magnetometer at L1 has been removed. The remaining risks are

a moderate risk for gap or performance degradation towards the middle of next decade for coronagraphy from GEO and energetic particle sensors in LEO
The following actions were requested:

- The SWCG to make a recommendation to WGIII how to separate RO and Ionospheric Electron Density profiles in the CGMS Baseline and Risk Assessment.
- The SWCG to define how to add each satellite position in the attributes of the in-situ measurements of CGMS Baseline.
- NASA to determine if IMAP mission data is compliant with CGMS Baseline criteria to be incorporated into the Risk Assessment. NASA has agreed to clarify this by next year.

Discussion
It has been suggested to adjust the colour scheme to better signal the remaining risks even if no large risks are present (the yellow colour is hard to distinguish from green).

CGMS-53-WGIII-WP-01SWCG - CGMS baseline document updates
Updates to the CGMS baseline were discussed and added to the draft version of the CGMS baseline.

- Coronagraph and EUV imager: a separate line for an off-Sun-Earth-line L5 mission is added (separate line but in same table row)
- The specific orbit locations have been removed for the X-ray measurements in GEO
- The specific orbit locations for the particle sensors and magnetometers in GEO have been updated
- Similar as above additional lines are included for a plasma analyser and a magnetometer in L5
- A Heliospheric imager and Solar magnetograph are added as remote sensing from off-Sun-Earth line

- To be clarified by SWCG:
  - Ddoes NASA JEDI meet all baseline EUV requirements?
  - Next year consider whether heliospheric imager from PUNCHunch should be identified.
  - Consider also NASA SDO
- **Proposed Actions on SWCG:**
  - Decide which NASA missions have sufficient commitment to include in the CGMS baseline (e.g. JEDI, PUNCHunch, SDO)
  - Recommend to WGIII how to separate RO Ionospheric Electron Density profiles in the CGMS Baseline and Risk Assessment.

CGMS-53-WGIII-WP-WP11swcg - CGMS contingency plan editorial updates
The presented and proposed updates to the document consist solely of specifying the update rate of the document as annually instead of every 4 years.

SWCG agreed the following actions.

CGMS-53 ACTIONS - SWCG					
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**
SWCG	SWCG/2	SWCG/A53.XX	Decide which NASA missions have sufficient commitment to include in baseline (e.g. JEDI, PUNCH~~unch~~, SDO)	CGMS-54	OPEN

3. Updates on space-based observational capabilities [75']

CGMS-53-CMA-WP-12 - The new-coming capabilities of FengYun satellites for space weather observation in 2025 [15']
(Weiguo Zong)

- In 2025, CMA/NSMC will launch two FengYun (FY) satellites - FY-4C in geostationary orbit and FY-3H in Sun-synchronous orbit (830 km, in afternoon orbit of 14:00 to replace FY-3D).
- There will be solar Extreme UltraViolet Imager (EUVI) (4 channels), solar X-ray and EUV Spectrometer (XEUVS) and Multiband Ultraviolet Spectrum Imager (MUSI) onboard FY-4C; Ionospheric PhotoMeter (IPM) and Wide-angle Aurora Imager-II (WAI-II) onboard FY-3H.
- The new space weather payloads onboard FY-4C and FY-3H will enhance CMA's capabilities for solar EUV imaging、solar X-ray flux and EUV spectra、ionospheric emission and spectrum、aurora monitoring.
- After the post-launch test for approximate six months to check the data validation, CMA/NSMC will provide these new space weather products to public in 2026, welcome to use these new observations in the operation and the science studies.

Discussion:

Jim Spann enquired about the data latency. For FY-3H, latency is several hours, for FY-4C, it is about 10 minutes.

CGMS-53-ESA-WP-01 - ESA Vigil (L5) and D3S missions update [15']
(Juha-Pekka Luntama)
A summary of the implementation status of the space weather missions in the framework of the ESA Space Safety Programme was provided.

- Missions in development
  - Vigil: the EUV imager is now also confirmed (addition wrt last year). Launch 2031 with nominal mission lifetime of 7.5 years, but additionally consumables. Major objectives are:
    - Improved assessment of CME motion and density, in the corona and heliosphere, in combination with L1 observations

        - Observations necessary to improve solar activity onset detection and identification
        - Measure vector components of the IMF
        - Determine the characteristics of solar wind features rotating towards Earth
        - Enable assessment of developing solar activity, through the monitoring of active region development up to 4 or 5 days beyond the East limb
    - Radiation monitors and magnetometers flown as hosted payloads on a range of missions including lunar pathfinder and lunar gateway
    - Space weather nanosatellites like SWING focus on radiation and plasma environments, with launches planned for 2026 and another mission in 2028.
    - Aurora: Single satellite demonstration mission is confirmed and planned to be launched 2029. Afterwards the vision is a 4-satellite constellation to be launched 2032 (TBC)
- New missions being proposed in the next ESA Ministerial Level Council: SWORD Space Weather Orbital Radiation Detector, a 2-satellite mission in GTO-like orbit.

Discussion

In the discussion it was clarified that the nanosatellites are making use of an already existing standard bus chosen by the industry.

CGMS-53-KMA-WP-01 - KMA update on its space weather activities [15']

(Daehyeon Oh)

- Using GK2A, Himawari-9, GOES-16 and -18, major space weather events from May and October 2024 were analyzed.
- During magnetopause compression, satellites in the dayside were exposed to interplanetary space, showing sharp electron flux drops and Bz reversals.
- Satellites in the nightside were not exposed but showed gradual changes in Bz and electron fluxes due to magnetospheric deformation.
- This shows the value of multi-point observations in providing a more comprehensive view of magnetospheric responses in space weather events.
- To maximize the effectiveness of multi-point observations, continuous cross-calibration and validation of space weather data are essential.
- Well-calibrated data enhances the synergy of multi-point observations, improves space weather modelling, increases satellite operation stability, and strengthens forecasting capabilities

CGMS-53-NICT-WP-01 - NICT space weather observation update [15']

(Tsutomu Nagatsuma on behalf of S. Saito)

The space environment in geostationary orbit is at risk of various anomalies and malfunctions due to solar energetic particles, galactic cosmic rays, and magnetospheric energetic particles caused by substorms and geomagnetic storms. For sustainable and stable satellite operation, it is necessary to monitor in-situ space environment. If an anomaly happens, it is necessary to quickly analyze the cause of the anomaly based on this information and take the necessary measures. In addition, it is necessary to reduce the risk of satellite anomalies and interruption of space-based observations by utilizing space weather information using energetic particle data. NICT is developing Radiation Monitors for Space

weather (RMS) onboard the meteorological satellite Himawari-10, which consists of a high-energy electron sensor and a high-energy proton sensor and is responsible for space environment measurements over Japan. The engineering model of the new space weather sensors, RMS, was finished to develop July 2024. The proto-flight model of the RMS is in the critical design phase from April 2025 after confirming the compatibility of the interface and the design standard. RMS onboard Himawari-10 will contribute to the global network of operational space-based space weather observation.

CGMS-53-NOAA-WP-13 - NOAA space weather observations update [15']
(James Spann (virtually))

- CCOR-1 launched on GOES-19 on June 25, 2024 and NOAA publicly released the first images from the instruments on October 22, 2024. GOES-19 is planned to become operational on April 4.
- SWFO-L1 is planned to launch in September 2025 and will feature CCOR-2 and numerous other Space Weather instruments including a Solar Wind Plasma Sensor (SWiPS), Suprathermal Ion Sensor (STIS), Magnetometer (MAG).
- The SOL project received Key Decision Point B (KDP-B) approval in December 2024.
- Space Weather Next GEO series requirement and concept definition work is ongoing

Discussion

- Concerning the GOES lifetime, it was noted that there is a long gap (10 years) before launching a new mission.

- X-ray flux is provided on GOES-19 – so no need to embark on SWFO, wWill be on SOL-A etc. This will be referenced as the Sun-Earth-Line in the CGMS Baseline.

4. Updates on space weather activities - agency reports [120']

CGMS-53-EUMETSAT-WP-12 - EUMETSAT space weather activity status and planning update
(Andrew Monham)
EUMETSAT presents the progress in implementing the space weather roadmap for an increasing role in delivery of operational space weather data services in support of European and global operational space weather services. A formal agreement with ESA is being considered for collaboration on operational space weather to be submitted for approval by Member States of both ESA and EUMETSAT in 2025. EUMETSAT has already embarked on limited low-cost activities such as supporting space weather data distribution from international satellite operators and the integration of the NOAA SEM-2 radiation monitor processor into the EUMETSAT Ground Segment. New activities in the framework of the proposed cooperation with ESA could include:

- Integration of a New Generation Radiation Monitor (NGRM) processor for one of the instances embarked on EUMETSAT satellites to demonstrate EUMETSAT capabilities.
- Potential for EUMETSAT to take full flight and ground segment operations for a new Aurora Constellation mission planned for launch in 2032 (one of the ESA D3S missions) and potential further operational roles.

- Operationalisation of topside TEC products from Metop, Metop-SG and multi-mission products, including commercial RO, is envisaged if use case expressed by partners.
- Potentially implement processing in EARS stations to reduce latency for limited data sets if use case is confirmed.

CGMS-53-ISRO-WP-10 - ISRO space weather activity report: Aditya L1 performance
(K Sankarasubramanian (virtually))
The performance of the Aditya payload was discussed. The Aditya spacecraft at L1 is now in its science phase with scientific objectives including understanding the initiation of CME's. Aditya carries the following instruments:

- VELC: Visible Emission line Coronagraph
- SUIT: Solar Ultra Violet Imaging Telescope
- HEL1OS: High Energy L1 Orbiting X-ray Spectrometer
- SoLEXS: Solar Low Energy X-ray Spectrometer
- PAPA: Plasma Analyzer Package for ADITYA
- ASPEX: Aditya Solar wind Particle Experiment
- MAGNETOMETER

Aditya-L1 data are released in public domain on Jan 6, 2025. Second data sets released on Feb 14, 2025. More data release are planned with the Indian Space Science Data Center (ISSDC) acting as the primary data center for the payload data archives of Indian Space Science Missions. (https://www.issdc.gov.in/adityal1.html, https://pradan.issdc.gov.in/al1 https://pradan1.issdc.gov.in/al1)

Discussion

It was noted that Aditya is not designed to support operational forecasting, but rather science applications with data available once per day.

CGMS-53-JAXA-WP-04 - JAXA space weather activities for science and research update
(Yugo Kimoto (virtually))
In May 2024, we experienced a harsh space environment, but there were no major problems with JAXA's satellite operations. This enabled to observe specific space environment data which could contribute to future space activities.
On the scientific side:

- JAXA contributes to international space weather observations by providing data obtained from the space solar observatory HINODE and the geospace explorer ARASE.
- JAXA will conduct extensive observations for heliospheric space weather from the Sun to Mars, integrating data from JAXA's planetary missions such as BepiColombo/MMO at Mercury and MMX at Mars along with those from HINODE and ARASE. JAXA is collaborating with Nagoya University to operate the Center for Heliospheric Science (CHS).

On the R&D side:

- JAXA has installed radiation monitors on several satellites and has contributed to satellite operations by providing radiation data.

- standardization activities in ISO and JAXA. These activities contribute to reducing the anomalies which is caused by the space environment in space projects.

CGMS-53-NASA-WP-01 - NASA space weather activities
(Jamie Favors (virtually))
Jamie Favors presented an update on the NASA space weather activities. There are currently 30 missions in operation or development in the Heliophyiscs division and a common theme was highlighted towards a lot more presence on Mars.
Already 3 successful launches in the heliophysics division were concluded this year: LEXI, PUNCH, EZIE. With several more to follow TRACERS, IMAP, CARRUTHERS and ESCAPADE. Many missions relate to SWx but especially PUNCH and IMAP relevant for SWx including operations.
The new decadal survey and User needs survey are important documents for the path to follow in the near future in the Space Weather program. Space Weather for Human exploration is an increasing thematic.
Recent accomplishments include:

- Established Space Weather Centers of Excellence (Mar 2024)
- Participated in first multi-agency, end-to-end Space Weather Tabletop Exercise (May 2024)
- Launched NASA Space Weather Program Office at Langley (Oct 2024)
- Developed new approach to R2O2R Program Element based on prior successes and similar programs
- Made selections for multiple R2O2R Transition projects
- Open modelling through CCMC
- Radiation measurements demonstrated from balloon
- SEP score board
- Hermes instruments delivered
- SEP score board
- Largest Space Weather event on Mars detected by Curiosity rover as well as Maven orbiter (Solar Orbiter helped a lot to understand the origin)

Discussion
The action item on requirements for Human exploration is still open. SRAG did a study few years ago. Jamie Favors will confirm if still up to date applicable before submitting that report with respect to the HLPP action.

CGMS-53-NICT-WP-02 - NICT Space Weather Activities
(Tsutomu Nagatsuma (virtually))

NICT Space Environment Laboratory routinely operate space weather services of Japan on 24/7 basis as a part of ICAO's global centers, ACFJ. Recent progresses about NICT's space weather activities include:

- NICT has developed a warning operation system for new criteria based on the report of "Study Group on the Advancement of Space Weather Forecasting" published in June 2022. Distribution to the public is scheduled for March 2025.

- NICT contributes to international activities such as ISES, WMO, COSPAR, ITU, ICAO, etc. and to facilitate information exchange among space weather forecasting organizations in the Asia-Oceania region through AOSWA.

- NICT has an internship program to support the travel fare to NICT and staying expense for students. We have received staffs for giving training as space weather forecasters since 2014, especially from South East Asian countries. Seven staff members were received in Feb. 2025

Discussion

It was noted that warnings issued are for Japanese customers. But from website and emails, the information is also visible. It was further clarified that while Solar flare products are global products, for HF communication and geomagnetic disturbances they are tailored to the Japanese customers.

CGMS-53-WMO-WP-09 - WMO report on the Space Weather Expert Team priorities and activities (Jesse Andries)

An overview of space weather activities in the WMO, as described in the Four-year Plan 2024-2027 adopted by Executive Council. The presentation focussed on the activities to integrate SWx into the core infrastructure elements: WIGOS (WMO Integrated Global Observing System - observations), WIS (WMO Information System - data exchange) and WIPPS (WMO Integrated Processing and Prediction System - Modelling). It highlighted the work to be performed for including SWx into the various WMO documents and frameworks such as the WIGOS Manual and Guide, the Rolling Review of Requirements and Gap analysis based on OSCAR/Surface, OSCAR/Requirements and OSCAR/Space, the of Core and Recommended SWx satellite data, as well as data formats and metadata specifications.

Core activities to collaborate on with CGMS include

- Actions on (meta)data and WIS2.0 data provision require close collaboration with CGMS and CGMS agencies when concerned with ~~space based~~space-based observations
- Update of the WIGOS Vision → 2050
- Space Traffic Coordination requirements to feed into requirements actions as one of the SWx application area

Discussion

It was clarified that Core and Recommended data should normally largely align with the CGMS baseline. But a rigorous process to determine the core data has not yet been followed for SWx data.

CGMS-53-NOAA-WP-14 - Update from the NOAA Space Weather Prediction Center (Steven Hill (virtually))

Steven Hill provided an update from SWPC with highlights of the past year:

- Customer engagement:
    - Space Weather Advisory Group's "User Needs" survey.
    - National Academies' Decadal Survey.

  - Revising the NOAA Space Weather Scales for clarity, relevance, and usability.
  - Testbed facility completed and first on-site exercise scheduled.
- New observations and products.
  - GOES-19 satellite and the CCOR-1 coronagraph.
  - Continued development of the SWFO-L1 satellite and ground system.
  - Other new space weather prediction products and models. Global TEC, Solar Cycle progression plot, >500MeV protons. Energetic heavy ion counts as well as SUVI flare locations will be available later this year.
- Operational improvements.
  - Achieved and maintained ISO 9001:2015 quality certification
  - Enhanced the Alternate Processing Site for improved system resilience.
- Space weather activity at solar maximum.
  - The Gannon Storm (May 2024 Storm), the first G5 event in 20 years.
  - Underscored the economic and operational impacts of space

Discussion

It was clarified that no detailed report of the impact of May event is planned from SWPC. Many other references exist (including inputs to the ISES report mentioned below). Jim Spann highlighted the impact on agriculture – in particular growing corn in the US. 400M-1.2B $ losses estimated. The losses were due to delays in planting at a critical time. The delays were caused by improper geolocation readings. The planting was halted to address the issue. At that time there was no awareness by the farmers of the space weather impacts on the geolocation systems. Impact studies are important.

CGMS-53-ESA-WP-03 - ESA space weather service network: progress and next steps
(Alexi Glover)

The ESA Space Weather Service network consists of 29 user driven services in demonstration & testing available via SWE Portal supported by SWE helpdesk (8/5) and second line support from Expert Groups. The portal provides access to products, modelling, applications, underpinning R&D, as well as data via data browser and HAPI interface.

The SWE portal is utilized as a research to operations framework (performance monitored) and supported with webinars and dedicated user campaigns and questionnaires. It is also useful for identifying promising business cases.

A one week residential course targeting Master/PhD students organised by SWE Office together with ESA Academy team, ESEC-Galaxia, Belgium 24-28th March 2025. The course touches on topics from Fundamentals of space weather science through modelling, forecasting, different application areas and socio-economic impacts and includes hands-on tutorials using the SWE portal and key tools.

5. International space weather data user activities - Part 2 [60']

CGMS-53-GUEST-WP-01 - Update of International Space Environment Services (ISES) activities in 2024
(Mamoru Ishii (virtually))

Mamoru Ishii presented recent activities of ISES starting with a summary of the changes to ISES officials and highlighting the addition of Thailand as a Collaborative Expert Centre.
ISES is preparing an overview paper about the May 2024 Storm events with compilation of observed impacts and inputs form all ISES centres.
ISES is also involved in an initiative to coordinate a Global Ionosonde Operation Network, which addresses one of the topics that was highlighted in the International Space Weather Coordination Forum: the coordination of operational ground based observations. The initiative grew out of one of the proposed pilot projects in the context of ISES-WMO-COSPAR collaboration.

Discussion
Jim Spann applauded the ISES group for the broad worldwide participation in the group which is very important.
Upon a question by Nagatsuma-san, Ishii-san clarified that the GION network has not yet taken any conclusions regarding whether full ionograms would be shared or only the scaled parameters.
Ishii-san clarified that the report on the May 2024 Storm events was not yet finalized but that it should be concluded in a month or two, and that it will include inputs from SWPC.

CGMS-53-NOAA-WP-15 - International L1 constellation collaborative research opportunity for solar wind spatial scales
(Dimitrios Vassiliadis (virtually))

NOAA's Space Weather Follow On – Lagrange 1 (SWFO-L1) and NASA's Interstellar Mapping and Acceleration Probe (IMAP) are scheduled for launch this year. After they reach the Sun-Earth Lagrange 1 (L1) point and complete their commissioning, there will be a total of six spacecraft (including Aditya-L1 and the legacy ACE, DSCOVR, and Wind missions) in the same location of space and measuring the solar wind plasma, particle, and magnetic parameters simultaneously. This unprecedented spatial coverage of the solar wind can be the basis for improving our understanding of the solar wind and its structures (CMEs, CIRs, shocks, etc.) at 1 AU, particle acceleration processes, and their relation to their coronal and/or photospheric origins. For operational purposes, the dataset can be used to develop more accurate solar wind/IMF time series; optimized numerical-propagation methods to the bow shock where the data can be used as inputs to geospace NWP models; and more effective coupling functions.
The need for coordination in data pre-processing and archiving procedures was highlighted and the steps taken among stakeholders up to this point were summarized.

The intercalibration of satellite data is one of the tasks coordinated by the SWCG. In addition, the activity is of interest to the GSICS SWx subgroup which has expanded its scope to include intercalibration among Lagrange-1 missions.
It is therefore proposed that project updates be regularly presented to an SWCG task group and/or the GSICS intercalibration subgroup for awareness/actions.

Discussion

Jim Spann thanked Dimitrios for taking the lead in this activity and taking advantage of this unique opportunity. He also pointed out that also IMAP, despite being a research directed spacecraft does provide a low latency datalink.

It was emphasized by Edmund Henley that these studies are not only about cross calibration issues and the turbulent scales, but also about assessing the models at the synoptic data scales, pointing out the L1 orbits are big enough to capture e.g. ENLIL grid size. A number of research projects were pointed out that could relate to this, e.g. based on IPS measurements, and about relations between the scales of variability of heliospheric structures and magnetospheric scales.

Andrew Monham pointed out that in addition to calibration, also the issue of data access to the suite of L1 constellation missions is of interest to the Space Weather Coordination Group.

Proposed action for the SWCG Data Access TG: Consider how to harness the suite of L1 constellation missions for operational space weather usage.

CGMS-53-NOAA-WP-16 - Data requirements for space weather services to civil aviation
(Mike Bettwy (virtually))

ICAO Space Weather Centres were polled in late 2024 on their needs for space-based observational data to support the ICAO mission. The results can be summarised as follows
Near-real-time (or low latency) data in support of space weather operations and forecasting is essential

- GNSS observations, especially polar
    - GNSS with high sampling rates is needed for getting support for our ground-based scintillation measurements • Ideally, make plans for space-based ionospheric soundings with solutions that operate outside GNSS frequencies
    - EUMETSAT is pushing a solution of GNSS Radio Occultation (RO) data dissemination
    - There are restrictions in TEC estimates with ground-based instrumentation, but our space weather aviation partners need that information for all areas (above sea, etc.)
    - Some users appear to be using COSMIC-2 data to fill in GNSS data gaps, but this may not be readily available to many folks
- particle data:
    - At a minimum: future space-based solutions need to provide the information that we currently have today
    - ICAO space weather centres have expressed a need and interest in measuring solar energetic protons with higher-energy resolution for energies above 100 MeV
    - LEO observations of energetic protons and electrons are needed to support ground-based instrumentation for polar cap and auroral absorption efforts
    - LEO measurements of radiation, especially in polar areas, would be quite helpful
- Coronagraph data (multiple vantage points)
- Estimates of Coronal Mass Ejection (CME) speed
- L1, L5 data (solar surface, solar wind, flaring, Inter-planetary Magnetic Field, etc.)

- GOES satellite data (continuation):
- Although not currently ~~not~~ covered by the ICAO SWx product portfolio, there may be a need for covering solar radio burst information since these can disturb airport secondary surveillance radars and an increase noise levels in GNSS. A space-based radio burst measurement capability would be a practical approach to supplement ground-based observations.

Additional details and specificities may be gathered by the ICAO Space Weather Centres in the coming weeks.

Discussion

Irfan Azeem questioned what was the bottleneck in the availability and the access to the COSMIC-2 data. SWPC has near-real time access to the data, and in principle it should be available to others, but the issue seems to be primarily technical complications in centres setting up that real time access to the data.

While from OSCAR/Space it seems there are ~~actually~~ very many observations of particles in LEO, also here there appears to be a problem in that the data is in general not available in near-real time to all centres. Jim Spann further questioned if this is a regional issue or rather a global issue and it seems to be rather a regional issue which hence should be addressed regionally.

Jim Spann suggested the problem description needs to be more detailed such that the SWCG response can be addressed.

Proposed action on Data Access TG: Establish response to the ICAO space weather service identified needs.

SWCG agreed the following actions.

CGMS-53 ACTIONS - SWCG					
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**
SWCG Data Access TG	SWCG/5	SWCG/A53.XX	Consider how to harness the suite of L1 constellation missions for operational space weather usage.	CGMS-54	OPEN
SWCG Data Access TG	SWCG/5	SWCG/A53.XX	Establish response to the ICAO space weather service identified needs presented at CGMS-53.	CGMS-54	OPEN

6. WIGOS Vision, OSCAR/Space and Gap Analysis for Space Weather [35']

CGMS-53-WMO-WP-11 - WMO WIGOS Vision 2050 update activity – space weather aspects
(Jesse Andries)

An effort has been kick started (January 2025) to update the WMO Integrated Global Observing System (WIGOS) vision for the 2050 timeframe. A representative (but small-enough to be agile) core team was put together by WMO to this end, with the purpose of finalizing the product in 2026. The scope will include space- and surface-based components and will envision a global system to measure the Earth, and address WMO-relevant applications. Many driving factors are expected to influence this vision including technology evolution, applications/users needs, the future landscape of observing systems providers including non-traditional systems and commercial providers, etc. This effort is expected to provide the community with a vision that will help coalesce efforts toward a cohesive, complementary global observing system. The vision, should be as well-informed and technically accurate as possible, and should inspire the community to design, evolve and deploy a complementary global observing system that addresses the needs of the future, and leverages the emerging opportunities.
The presentation at the SWCG highlighted the importance for the SWx community to contribute to this effort by providing inputs, thoughts, ideas, and other contributions. These inputs include both technical content but also strategic and institutional guidance.
A number of technical elements of SWx items within the Vision document were also discussed.
Members are invited to engage, provide inputs and assist in reaching out to the broader SWx community. A questionnaire will be sent out at a later stage and more concrete engagement would be requested from around June after the core drafting team has initiated a first draft.

Discussion
Edmund Henley supported the need to increase the extent to which the ground-based instrumentation is being addressed. These data are increasingly being utilized but the fact that these are often provided from research funding is something that should be raised and improved. An additional point of attention may be the data from research missions that can be leveraged operationally. Some of that is really useful, but some reflection is needed on the how to approach the non-significant effort to setup the systems to actually be able to use that data.
Guidelines on that aspect would be very useful. In Europe in the context of the proposed ESA and EUMETSAT collaboration agreement it would be important as part of research missions to have clear plan to assess the operational potential to then be followed up by EUMETSAT for longer term operational implementation (as is proposed for Aurora). In the US the NASA Earth science division has an established focus when flying a research mission, to consider the application and build in the capability to support the application. The NASA heliosphysics division has picked up on this which is also mentioned in the decadal survey. NASA has addressed this through including Beacon data for real-time reception, whereas NOAA invest in receivers to ensure data acquisition.
A SWx research coordination group has been advocated, where funding agencies can come together and coordinate SWx activities. The relation between research missions and operational usage of the data would certainly also be a topic for that group to look into.

A discussion was also triggered regarding the apportionment of space and surface-based solutions. Which is not only a technical issue but also an issue of reliability and cost. OSEs and OSSEs would be needed to demonstrate the value of different components. Also in terrestrial weather, one only realizes how important weather balloons are when one sees the results of the studies. The space community is generally much better at performing such studies. Surface-based instrumentation is much easier to service and maintain, e.g. the GONG instruments. It is very important to keep this funded. Clearly, the surface-based space weather community could benefit a lot from more clearly presenting the value of these of these observations.

CGMS-53-WMO-WP-10 - Updates on Space Weather information in OSCAR/Space and WMO Gap Analysis
(Heikki Pohjola)

The WMO gap analysis for space weather observation capabilities against the requirements presented in WMO Vision for WIGOS 2040 was provided. It compares space-based observation capabilities recorded in OSCAR/Space to the WMO WIGOS Vision for 2040 requirements for the period of next decade. In this working paper detailed descriptions of the missing observations capabilities related to the specific observation types in WIGOS subcomponent 1 and 2 were given. The work summarises 4 gaps for space weather observation types as main concerns non-compliant with WIGOS Vision 2040 requirements. Related to space weather it concludes gaps with regards to WIGOS subcomponents 1 and 2 in magnetograph, radiospectrograph, X-ray imager and LEO magnetometer observations.

The presentation highlighted the need for presenting and evaluating the gaps for solar and heliospheric remote sensing and in situ measurements differently from the Earth observation remote sensing, since in these cases the orbits are not related to spatial coverage of the Earth surface, but rather to Solar surface and heliosphere. This should also be improved in the presentation within the update or the WIGOS Vision. Additionally, a number of required improvements to OSCAR were pointed out:

- separate ionospheric RO from neutral atmosphere RO
- improve filters for analysis of energetic particle sensor capabilities

Discussion
Fundamental questions were raised, to what extent there is a similar process in WMO for a gap analysis for surface-based observing systems. An overall process exists which includes both surface and space-based components. It is called the Rolling Review of Requirements (RRR), which consists first of updating the requirements but additionally also identifying gaps in the current observing system to meet the requirements. That gap analysis is not based on the WIGOS Vision but on OSCAR/Requirements. On the capabilities side it can make use of OSCAR/Space and OSCAR/Surface, but there is in no way any automated process to compare those databases. In addition, OSCAR/Surface contains only very incomplete information of observing systems for Space Weather. The gap analysis in the context of RRR is hence purely based on expert opinions and summarised in a report called the Statement of Guidance. It does not contain such detailed charts as those produced for the Space Weather gap analysis for space-based component presented here (which is moreover against WIGOS Vision and not OSCAR/Requirements).

It was pointed out that having such more elaborate gap analysis also for the surface-based component could be very beneficial to advocate for these surface-based systems and their funding. Making this process more mature would be considered very helpful. And this could not only be an issue of interest to Space Weather, but also to e.g. climate which depends on long term observations.

The analysis should be improved by better separating the contributions from operational missions and the contributions from research mission, though admitting that there is a big grey area of research missions that can be utilized operationally.

In the future, commercial providers would also need to be better captured in the analysis.

Jim Spann commented on the need to properly capture the transition of certain types of missions and data to becoming considered operational. An example is Auroral imaging. We had scientific missions earlier and we should now begin to see these observations show up operationally and hence in the gap analysis charts.
Auroral imaging is indeed not fully analysed here currently. Most properly because of the lack of its specification in the WIGOS Vision. This will need to be checked and improved.
More generally a good question to ask is which would be the next most valuable dataset to have in near real time.

Related to this, there is also a need to document more properly the data that are delivered in real-time and those that are retrospective or historical data. In the future the plan would be to make two separate analyses alongside each other. One with low-latency data/missions only, and one indicating the additional data.

It was pointed out that for terrestrial weather data streams well established monitoring systems exist (such as NWP SAF), from which performance, e.g. latency can be monitored and reported. This is not the case for space weather data in general. It would probably be good to flag this as something that needs to be invested in.
This relates a discussion about the recorded latency in OSCAR/Space. There are two different issues that need be kept separate: the declared latency by the agencies, the latency values reported from validation and monitoring activities. Currently some of the latency values in OSCAR/Space are sourced from NWP SAF, which can be useful but it mixes the functions of capabilities database with that of a monitoring tool, and may need to be reconsidered.

Edmund Henley commented that long-term, it might be worth thinking about "space climate" variables, although clearly a lower priority than "space weather".

7. Briefing from GSICS GRWG space weather subgroup on intercalibration [20']

CGMS-53-SWCG-WP-07 - GSICS GRWG space weather sub-group report
(Tsutomu Nagatsuma (NICT) (virtually))

The GSICS GRWG Space Weather Subgroup has started a dialogue with COSPAR/PRBEM for standardization of mutual calibration and reported the results of its review of the Data Analysis Procedure document at COSPAR 2024@Busan in July 2024. COSPAR/PRBEM and GSICS SWx Sub-group will work together to further revise the document.
The group has reviewed the data level definitions employed by various CGMS members and noted differences between these definitions across agencies.
As an introduction to the results of past activities, GSICS published a Newsletter's special issue on space weather cross-calibration on Sept. 30, 2024. Six articles are included in this newsletter.
Based on the current and future status of solar and solar wind observations by various CGMS agencies at L1 point, GSICS SWx sub-group decided to also include the cross-calibration of solar wind measurements within their activities.
The SWx breakout session at the 2025 GSICS Annual Meeting included eight talks related to cross calibration.

Discussion
Edmund Henley praised the team for also taking up the L1 wind measurement cross calibration issue as the large variations and discrepancies between e.g. DSCOVR, ACE data is a real complication to research to operations transition. In general the SWx modelling research community is not sufficiently aware of the complexity of performing such measurements, in particular higher order moments such as the density, while many models exactly depend on exactly that value.

Further expert participation in the GSICS team would be very much welcomed, especially more from the research community, possibly outside the CGMS community.

8. Review of SWCG list of actions [20']

CGMS-53-SWCG-WP-10 - Status of CGMS-52 SWCG list of actions (incl. review of any relevant CGMS-52 plenary actions)
(Andrew Monham)

Please refer to the SWCG action list below, updated with proposals for action closure and new actions. Note, this includes actions generated within the Joint WGI-WGIV-SWCG meeting (see separate report chapter).

Actionee	AGN item	Action #	Description	Action feedback/closing document	Deadline	Status
CGMS Members	SWCG/6	SWCG/A50.01	Supply latency information to OSCAR DB with granularity of each relevant space weather sensor on their space missions.	**KEEP OPEN**	CGMS-53	**OPEN**
SWCG (RO TG)	Joint WGI-WG-IV-SWCG/4	SWCG/A50.03	Establish requirements for and recommend an implementation of an optimised system for radio occultation observations for ionosphere monitoring		CGMS-53	**OPEN**
CGMS Members	Joint WGI-WG-IV-SWCG/6	SWCG/A50.05	CGMS members are invited to support the WRC-23 preparatory process on agenda item 9.1 Topic A (space weather) through its national regulatory authorities, regional WRC-23 preparations or directly in the relevant ITU fora, as appropriate, i.e. identification of frequency bands requiring protection, with coordination with WMO-ET-SWx/WMO-ET-RFC	WRC-23 performed. RF standing agenda item	CGMS-53	**CLOSED**
GMS members (WGII and SWCG)	4.5	WGII+SWCG/(P)A50.05	CGMS WGII and SWCG members are invited to nominate candidates for a subgroup within GSICS on Space Weather Cal/Val and Intercalibration, which will be focused on providing intercalibration for Space Weather. Please provide nominations to cgmssec@eumetsat.int and mitch.goldberg@noaa.gov	Membership requests now managed by GSICS Subgroup	CGMS-53	**CLOSED**

SWCG (Anomaly TG)	Joint WGI-WG-IV-SWCG/2	SWCG/A51.01	Expand extent of anomaly data feedback	All CGMS members requested to provide updated anomaly data covering 2024.	CGMS-53	**OPEN**
SWCG (Anomaly TG)	Joint WGI-WG-IV-SWCG/2	SWCG/A51.02	Review current usage of space weather data for spacecraft operations and goals for improvement.	TRANSFERRED to SESTG of WG1	CGMS-53	**CLOSED (Transferred)**
SWCG (Data Access TG)	Joint WGI-WG-IV-SWCG/4	SWCG/A51.03	Report Space Weather data gaps & discrepancies between providers and user surveys and OSCAR DB and related priorities for resolution.	Existing surveys reviewed. Is normal work going forward	CGMS-53	**CLOSED**
SWCG (Data Access TG)	Joint WGI-WG-IV-SWCG/4	SWCG/A51.04	Propose standardised Space Weather operational formats and CF convention metadata examples.	CGMS-53 Proposal from Edmund Henley	CGMS-53	**PROPOSE CLOSED (2 New actions from Edmund presentation)**
SWCG (Data Access TG)	Joint WGI-WG-IV-SWCG/4	SWCG/A51.05	Implement improved data access through existing mechanism infrastructure	CGMS-53: Merge action with SWCG/A51.06:	CGMS-53	**PROPOSE CLOSED**
SWCG (Data Access TG)	Joint WGI-WG-IV-SWCG/4	SWCG/A51.06	Review future landscape of operational data delivery mechanisms and coordination taking into account WIS 2.0 and other cloud-based data access mechanisms.	CGMS-53: Merge action with SWCG/A51.05:	CGMS-53	**PROPOSE CLOSED**
NOAA	SWCG/2	SWCG/A51.07	Report on the STEREO-A coverage implementation	Input to WGIII RA group made	RA Worksh op 2024	**CLOSED**
NOAA	SWCG/4	SWCG/A51.08	Provide NOAA aviation and satellite industry testbed reports	Closed (see SWCG Report)	CGMS-53	**PROPOSE CLOSED**
SWCG	SWCG/5	SWCG/A51.09	Members to document any plans for NRT, operational thermospheric density measurements with consideration of observation requirements from atmospheric density models.	CMA Presentations / discussion made.	CGMS-52	**CLOSED**
SWCG/data access + RO TGs	SWCG/5	SWCG/A51.10	Consider ICAO PECASUS requirements for improved LEO RO observation, energetic (tens of Kev) electron precipitation flux from LEO orbit , SEP flux spectra (100s MeV to GeV)	Mike Bettwy, NOAA, presentation made to CGMS-53	CGMS-53	**PROPOSE CLOSED**

SWCG	SWCG/9	SWCG/A51.11	Produce a report of space weather observation requirements for improved STC services and space sustainability	**Transferred to WGI SESTG**	CGMS-53	**CLOSED (Transferred)**
SWCG	SWCG/5	SWCG/A52.01	Consider HLPP / Baseline updates on the following: Thermospheric density observations to be added to baseline (CMA observations) Assessment of thermospheric measurement means in HLPP Auroral observations to be added to baseline (CMA observations)	Updates proposed at CGMS-53	CGMS-53	**PROPOSE CLOSED**
SWCG	SWCG/10	SWCG/A52.02	Consider observation requirements in support of interplanetary human exploration	CGMS-53: See links provided in CGMS Report, Keep Open for NASA response.	CGMS-53	**OPEN**
SWCG/ Data Access TG	Joint WGI-WG-IV-SWCG	SWCG/A52.03	Report on space weather product level definitions, identify any differences and propose steps for alignment.	Data Access Action CGMS53-TG#2-7	CGMS-53	**OPEN**
SWCG / Anomaly Database TG	Joint WGI-WGIV-SWCG/2	SWCG/A52.04	SWCG to seek feedback from space weather analysts on value of the collected EDAC 2023 data	Closed by NICT report and new action to collect 2024, historical and future data.	CGMS-53	**PROPOSE CLOSED**
SWCG	SWCG/2	SWCG/A53.XX	Decide which NASA missions have sufficient commitment to include in CGMS baseline (e.g. JEDI, Punch, SDO)		CGMS-54	OPEN
SWCG	SWCG/2	SWCG/A53.XX	Recommend to WGIII how to separate RO Ionospheric Electron Density profiles in the CGMS Baseline and Risk Assessment.		CGMS-54	OPEN
SWCG Data Access TG	SWCG/5	SWCG/A53.XX	Consider how to harness the suite of L1 constellation missions for operational space weather usage.		CGMS-54	OPEN
SWCG Data Access TG	SWCG/5	SWCG/A53.XX	Establish response to the ICAO space weather service identified needs presented at CGMS-53.		CGMS-54	OPEN
SWCG Data Access TG	SWCG/8	SWCG/A53.XX	Review usage plans and implementation status for improved data access through heritage, new and future mechanism infrastructures, learning lessons from terrestrial data access approaches.	Merged from A51.05/51.06	CGMS-54	OPEN

CGMS Spacecraft Operators	Joint WGI-WGIV-SWCG/2	SWCG/A53.XX	CGMS Members operating satellites to produce EDAC data covering 2024 and report on ability to supply historical and future data.		CGMS-54	OPEN
SWCG Anomaly TG	Joint WGI-WGIV-SWCG/2	SWCG/A53.XX	Assess suitability of SPARK database tool as repository for CGMS anomalies, including data access criteria, metadata needs and standardisation.		CGMS-54	OPEN
SWCG TG on Improving User Data Access	Joint WGI-WGIV-SWCG/3	SWCG/A53.XX	Draft WMO-CF profiles with improved metadata in coordination with WMO ET-SWx, ISES, COSPAR and research community and proposed follow-up activities.		CGMS-54	OPEN
WGI SESTG & SWCG	Joint WGI-WGIV-SWCG/5	SWCG/A53.XX	Assess possibility to share satellite orbit data to estimate thermospheric drag.		CGMS-54	OPEN

Points of Note:

- SWCG/A51.02, A51.11 got transferred to the WGI Space Environment Sustainability Task Group
- SWCG/A50.05, 51.03 are now considered regular work of the data access TG and the actions were closed.
- SWCG/A51.04 ss proposed to be closed in favour of two new proposed actions (see the report of the joint WGI-WGIV-SWCG session)
- SWCG/A51.05 and SWCG/A51.06 are merged to become one comprehensive action on current status of dissemination mechanisms and future plans, including lessons learned from terrestrial weather
- SWCG/A51.08 is closed after receiving the following information as a full report is not likely to be expected.
    - Website for the satellite testbed with many available presentations: https://testbed.spaceweather.gov/exercises/2023-satellite-environment-testbed-exercise
    - Further presentation given at the Space Weather Workshop: https://www.swpc.noaa.gov/sites/default/files/images/u97/Fang-TzuWei.pptx_.pdf
    - For aviation testbed, there's brief discussion in a paper by Hazel Bain "NOAA Space Weather Prediction Center Radiation Advisories for the International Civil Aviation Organization", https://doi.org/10.1029/2022SW003346
    - Equivalent high level description for aviation to complement the paper mentioned above: https://testbed.swpc.noaa.gov/exercises/2022-testbed-exercise-aviation
    - Further presentation given at the Space Weather Workshop https://www.swpc.noaa.gov/sites/default/files/images/u97/Cash_Michele.pptx_.pdf

- SWCG/A51.10 regarding requirements for the aviation services is closed in favour of new action to compare in detail the extent to which each of the identified requirements for Aviation is being addressed
- SWCG/A52.04 action on EDAC data is closed in favour of a new action to collect the 2024 data and review more systematic collection. Backfilling data from earlier years should also be investigated.
- SWCG/A52.02 action on SRAG: for the SRAG work for interplanetary human exploration, refer to session from Gina DiBraccio at ISWAT - incl SRAG presentation from Katie Whitman
- Human exploration forecasting needs and gaps for Mars - Katie Whitman (NASA JSC/SRAG): https://docs.google.com/presentation/d/1_p6vvDUg7m9rmwFGtN_uedr8awWoyi6A/edit?usp=drive_link&ouid=115550485656956867570&rtpof=true&sd=true and https://iswat-cospar.org/wm2025_plenary_presentations > Plenary 2, Preparing for Mars Exploration

CGMS-53-CGMS-WP-14SWCG - Status of co-chairs/rapporteurs of the CGMS working groups, CGMS International Science Working Groups, VLab, and other groups
(SWCG rapporteurs)

The document provided by CGMS secretariat was reviewed and the only item identified for action by the SWCG was to nominate a new co-chair which the meeting agreed on already under Agenda Item 1.2.

9. Review and updating of the HLPP [20']

CGMS-53-CGMS-WP-07 - Status of implementation of CGMS High Level Priority Plan (2024-2028)
(Mikael Rattenborg)

This working paper provides the status of implementation of CGMS High Level Priority Plan (2023-2027). It incorporates inputs from: - WG I, II, III and IV Chairs and rapporteurs - CGMS Space Weather Coordination Group - International Science Working Group chairs and rapporteurs - GSICS project - SCOPE-CM project - CEOS-CGMS Joint Working Group on Climate.

CGMS-53-CGMS-WP-08SWCG - Revised HLPP 2025-2029 - for recommendation to plenary
(Mikael Rattenborg)

The meeting reviewed the items in the HLPP relevant to the SWCG. Several updates and edits were inserted in the document to be proposed to plenary. This includes all items in Section 6: ADVANCE OPERATIONAL SPACE WEATHER MONITORING FROM SPACE as well as in items 1.2.12, 1.2.14 and 1.2.15.

In particular a new item is proposed to be inserted in Section 6.

Ref	Target	Primary responsible for target in CGMS	Summary/highlights of progress (as reported at last CGMS)	Overall Status
6.8	Work on comparing different measurement strategies/techniques for characterising thermospheric environment.		New actions have been raised regarding the use of POD data for determination of thermospheric environment at satellite altitudes. CMA plans inclusion of mass spectrometer on FY3-J.	

There was some debate around the logic of including some items in Section 1 and others in Section 6. It was clarified offline after the meeting that items in Section 1 are those that would have immediate impact on the CGMS baseline.

10. Future CGMS SWCG meetings [10']

CGMS-53-SWCG-WP-02 - Decision on dates on SWCG intersessional activities in 2024-2025 (CGMS-52 to CGMS-53)
(Andrew Monham)

The SWCG group refined the preliminary plan for the following intersessional meetings in 2025-2026:

- ~~Tuesday 23~~ Wednesday 24 September 2025
- ~~Thursday 27 Wednesday November~~ Tuesday 2 December 2025
- Thursday 29 January 2026
- Thursday 19 March 2026

11. Election of CGMS SWCG co-chair

This item was already addressed under Agenda Item 1.2.

12. Any other business [10']

None

13. Conclusions, preparation of the SWCG report for plenary [20']

The SWCG Chairs and Rapporteurs thanked the SWCG members and external presenters for their active participation in the meeting and efforts throughout the year.

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