

# WG on International Issues and Future Systems

## ITSC-23 Actions and Recommendations

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# Status of actions and recommendations from ITSC-22

All actions from ITSC-22 now closed or superseded by new actions.

Recommendations and discussion on **spectrum management** transferred to revived **technical sub-group**.

Some past recommendations were identified as “**standing recommendations**”, remaining valid for now.

# Standing recommendations

Recommendation IIFS22-R5 to WMO and space agencies via CGMS: to coordinate an update of the **timeliness requirements** and continue to explore innovative methods, such as used by GPM, to provide global data with a timeliness that meets the new requirements, for next generation satellite programmes.

Recommendation IIFS22-R4 to WMO: WMO to continue to work with PRs in countries with **DBNet ground stations** to encourage provision of **sufficient bandwidth** to redistribute the hyperspectral IR sounder observations in addition to the MW sounder observations.

Recommendation IIFS22-R8 to CGMS: If a mission expects engagement from application areas with an **NRT data requirement**, **budget** should be allocated from the start to provide the required technical infrastructure.

Recommendation IIFS21-R8 to CGMS: Recognizing the growing need for assessment and on-orbit optimization of the accuracy of operational hyperspectral IR sounders, the traditional approaches for pre-flight SI traceability and post-flight validation should be enhanced by flying a **CLARREO-like on-orbit reference standard** capability (featuring on-orbit SI verification) with orbits designed to provide inter-calibration capability for refining the calibration of the international fleet of operational sounders.

Recommendation IIFS22-R11 To Space Agencies via CGMS: Space Agencies to note that the benefits of Satellite Missions to the ITWG community are increased when **early evaluation** is undertaken by many independent centres. Therefore to include as **many centres**, in particular NWP centres, in the early evaluation phase, will bring benefits both to the Space Agency and to the users, and is therefore highly desirable.

Recommendation IIFS22-R14 to ITWG Co-Chairs: To continue to actively pursue the **IRC/IAMAS relationship**, to gain more support for ITWG initiatives regarding Radiative Transfer.

# Evolution of the global observing system

Noting a number of recent and up-coming **milestone launches**, the group congratulates the respective agencies for these achievements, in particular:

- **FY-4B** (launched 3 June 2021 by CMA): First operational geostationary satellite with hyperspectral sounding capabilities. Also features the AGRI imager, a new Geostationary High-speed Imager (GHI), and other instruments.
- **FY-3E** (launch planned this July by CMA): First CMA LEO satellite to cover the early morning orbit.
- **Arktika-M N1** (launched 28 Feb 2021 by Roshydromet): First highly elliptic orbit, carrying a IR/VIS imager, incl water vapour channels.

For Arktika-M N1, a list of products is being defined by Roshydromet during the commissioning phase, and this will be of high interest to relevant users.

**Recommendation IIFS23-R1 to Roshydromet: To share information on products from Arktika-M N1 with ITWG when available.**

# Evolution of the global observing system: CGMS baseline

## **CGMS baseline for passive sounding instruments:**

3 sun-synchronous orbits with MW sounding and hyperspectral IR

GEO slots with hyperspectral IR

A recent **continuity assessment against the CGMS baseline**<sup>1</sup> and discussions at the WG concluded regarding the provision of passive sounding instruments up to 2032:

- Coverage of the morning and early afternoon orbits is well ensured by EUMETSAT and NOAA.
- CMA planning to ensure early-morning coverage beyond FY-3E is well advanced.

**The group highly appreciates CMA's efforts towards continued coverage of the early morning orbit.**

NWP centres are encouraged to evaluate the benefit of FY-3E in the early morning orbit and to share findings. Data are expected to be available to users approximately 6 months after launch. Centres are encouraged to register for the FY-Pioneer programme for early access to data:

<http://www.nsmc.org.cn/NSMC/project/pioneer/index.html>

<sup>1</sup> <https://www.cgms-info.org/Agendas/GetWpFile.ashx?wid=a23105b4-a44f-4299-9045-46f506917f16&aid=c7b98b87-8cbe-4da7-a00f-e69485ee5340>

# Evolution of the global observing system: Evolution of the CGMS baseline

The WG considered the current CGMS baseline in the context of potential future moves towards disaggregated systems and the use of smaller satellites. For the back-bone 3-orbit constellation, high-end, high quality observations tend to be assumed by users (“reference” system), though this is not explicit in the CGMS baseline.

**Recommendation IIFS23-R2 to CGMS: To explicitly consider instrument capabilities and data quality as well as data provision in future updates of the CGMS baseline, particularly for the 3-orbit backbone system of LEO passive sounders which plays an important role as a reference-style system.**

The WG noted that benefit has been demonstrated in NWP from passive sounding data beyond the 3-orbit CGMS baseline system.

**Recommendation IIFS23-R3 to CGMS and the NWP community: To advance the implementation of the WIGOS Vision 2040 for passive sounding with agency commitments beyond the established 3-orbit baseline in future updates of the CGMS baseline, and to gather requirements and perform trade-offs for such additional systems.**

# Evolution of the global observing system: Small satellites/cubesats

Constellations of small satellites/cubesats offer the potential for higher temporal sampling from LEO, beyond the 3-orbit baseline. The WG welcomes and encourages efforts to make use of these complementary opportunities and to establish relevant requirements (incl. orbits, instrument capabilities etc).

The WG notes limited experience within ITWG with existing passive sounding instruments from small satellites or cubesats, particularly for operational applications. Some NWP centres are planning to assess data quality of selected upcoming missions (e.g., NRL, ECMWF).

**Recommendation IIFS23-R4 to NWP centres and other organisations involved in the evaluation of existing data from smaller satellites: To report on experiences with passive sounding instruments from smaller satellites at future ITSCs, including evaluations of data quality and stability, with a view towards potential future operationalization of such systems.**

**Action IIFS23-A1 on Niels Bormann: To compile a list of existing and planned small-satellite/cubesat initiatives with passive sounding instruments and circulate among IIFS members.**

It was noted that NRT data downlink has been an issue for some current cubesats, but this is not a limitation for cubesats in general. Agencies should be forward-looking and include NRT capabilities from the start (see standing recommendation IIFS22-R8). Available bandwidth for downlinks could be an issue, discussed in the spectrum management sub-group.

Given shorter life-times of these satellites (especially of cubesats), efforts to accelerate data usage will be needed (→ NWP WG). Commonality in the provided data could greatly help such efforts:

**Recommendation IIFS23-R5 to providers of data from constellations of smaller satellites: To work towards a standardisation of downlink equipment and data protocols to ease provision of NRT capabilities.**

**Recommendation IIFS23-R6 to providers of data from constellations of smaller satellites: To work towards a common data outlay in a WMO-recognised data format to ease swift ingestion into NWP systems.**

# WMO activities, timeliness aspects

The WG noted with appreciation that the paper on “Satellite Data Requirements for Global Numerical Weather Prediction” has now been approved as position paper by WMO. See specific presentation by Ken Holmlund on this and other data policy initiatives. The paper is available here:

[https://groups.ssec.wisc.edu/groups/itwg/nwp/additional-files/INFCOM-1-III-d05-1-1-1-SATELLITE-DATA-REQS-FOR-GLOBAL-NWP-approved\\_en%20-3.docx/view](https://groups.ssec.wisc.edu/groups/itwg/nwp/additional-files/INFCOM-1-III-d05-1-1-1-SATELLITE-DATA-REQS-FOR-GLOBAL-NWP-approved_en%20-3.docx/view)

The group emphasised the importance of good data timeliness for operational applications, and fully supports WMO efforts in this area (standing recommendation). The WG also welcomed the WMO plan to include information on timeliness in the OSCAR database. The group was reminded that best practices for DBNet operators can be found under:

<https://www.cgms-info.org/index.php/cgms/page?cat=SATELLITES&page=Direct+Broadcast+>

To support timeliness activities, dedicated impact studies are very useful. Such studies have been conducted in the past by JMA and will be reported at ITSC-23, but it was felt more would be useful.

**Recommendation IIFS23-R7 to NWP centres: To conduct impact studies highlighting the benefit of good timeliness of observations, and to report on these at future meetings.**



# HLPP – items assigned to ITWG

The latest version of the CGMS HLPP is available here:

[https://www.cgms-info.org/documents/CGMS\\_HIGH\\_LEVEL\\_PRIORITY\\_PLAN.pdf](https://www.cgms-info.org/documents/CGMS_HIGH_LEVEL_PRIORITY_PLAN.pdf)

**Action IIFS23-A2 on IIFS members: To provide further feedback on the latest version of the HLPP to IIFS co-chairs.**

The WG discussed items assigned to ITWG with relevance to the WG:

***Item 4.4.1 (on error propagation vocabulary and methodology):***

No further feedback beyond what was discussed at previous IIFS meetings.

***Item 4.4.2 (on NEdT estimates for MW sounders):***

Tiger Yang: A TGRS paper that compares different NEdT algorithms is currently under review (“A New Algorithm for Determining the Noise Equivalent Delta Temperature of In-orbit Microwave Radiometers”).

The group reiterated that websites with timeseries of instrument performance indicators such as the NOAA/NESDIS ICVS monitoring are an invaluable resource for data users, including for NWP and reanalysis applications. The group would greatly appreciate such monitoring to be available from other space agencies.

**Recommendation IIFS23-R8 to CGMS members: To provide ICVS-style instrument performance monitoring for operational instruments.**

# HLPP – other selected aspects

Regarding the section “Advance the response to the Vision for WIGOS in 2040, by the implementation of new capabilities beyond the CGMS baseline”, the absence of advancing MW sounding capabilities for NWP beyond the CGMS baseline was noted (see also link to recommendation IIFS23-R3).

**Recommendation IIFS23-R9 to CGMS: To include an item on establishing requirements for MW sounding capabilities beyond the CGMS baseline for NWP in the relevant section of the HLPP.**

Regarding the section “Stimulate trade-off analyses for the development of future passive sounding instruments”: A previous item on trade-off studies that includes FOV-sizes for IR sounders has been closed. The group noted that such trade-off activities are still important.

**Recommendation IIFS23-R10 to CGMS: To reinstate an item in the HLPP on conducting trade-off studies regarding the benefits of spectral, radiometric, and spatial resolution of infrared sounders, taking into account aspects such as scene inhomogeneity and uncertainties in spectroscopy.**

The WG acknowledged the value of CGMS best practices and welcomed the review of best practices for achieving user readiness<sup>2</sup> mentioned in the HLPP. Engagement with NWP centres and other users via the CGMS SWGs (e.g., ITWG) will be important, and the CGMS secretariat confirmed that this is indeed planned.

<sup>2</sup>Current edition: [https://library.wmo.int/doc\\_num.php?explnum\\_id=3553](https://library.wmo.int/doc_num.php?explnum_id=3553))

# Calibration

The group reiterated the importance of reliable calibration for a wide range of application areas, incl. NWP and reanalysis. It discussed efforts to establish an in-orbit SI-traceable reference (see also standing recommendation on this), noting several planned or proposed concepts (LIBRA, CLARREO, TRUTHS, etc).

A workshop ‘An SI-Traceable Space-based Climate Observing System’ was held by CEOS WGCV and WMO-CGMS GSICS at NPL, UK on Sept, 2019. As a consequence, a special issue in Remote Sensing “The Needs and Path Toward an SI-Traceable Space-based Climate Observing System” has been published:

[https://www.mdpi.com/journal/remotesensing/special\\_issues/Space-based\\_COS](https://www.mdpi.com/journal/remotesensing/special_issues/Space-based_COS)

The whitepaper ‘SI-Traceable Space-based Climate Observing System’ is being drafted, led by Hewison, Fox, Wielicki and Kopp.

**Action IIFS23-A3 on Peng Zhang: To circulate the workshop report to IIFS members once available.**

# Status of actions and recommendations from ITSC-22

# Spectrum management (I)

Recommendation IIFS22-R1 to CGMS: Space Agencies to consider building in as much RFI screening and mitigation into their ground segment processing as possible, noting efforts already starting at ESA and in research groups in US, Japan and China.

**Action IIFS22-A3: IIFS members to provide a summary of known activities re RFI monitoring/screening, such as ESA initiative.**  
- Close

**Action IIFS22-A4: Rich Kelley to contact Chris Kummerow about efforts in his team and report to ITWG.** - Close

Feedback received from Steve English, Nancy Baker, Rich Kelley, and others regarding several activities:

- CSU, ECMWF, others: Evidence of at 6.9 GHz, 10 GHz
- GPM constellation and RFI detection: Draper et al 2018, doi: 10.1109/JSTARS.2018.280101
- Zenithal Blue/ECMWF: Enhanced SMOS RFI flagging; discussions on 24 GHz RFI monitoring
- NASA: Digital filtering in proposed Butterfly mission
- Etc

See also several RFI-related posters at ITSC-23.

# Spectrum management (II)

**Action IIFS22-A5: Stephen English to bring ECMWF RFI workshop report to attention of all space agencies, and CGMS. - Close**

Done, e.g. at ET-SSU, US NAS, US AMV.

Recommendation IIFS22-R2 to ITWG members: ITWG members to plan to participate as actively as possible in consecutive RFI-related workshops at ECMWF in 2021.

**Action IIFS22-A6: Stephen English to send information to ITWG mailing list about RFI Workshops once dates known.**

Workshop postponed to mid-February 2022 due to Covid; wide interest received earlier.

Recommendation IIFS22-R3 to ITWG members: ITWG to begin to assemble evidence of the value to society of bands above 95 GHz through their use in meteorology.

**Action IIFS22-A7: Stephen English to ensure specific requests are made for studies of this in preparation for workshops in 2021.**

See poster by Steve English on this aspect.

**Note: At ITSC-23 we're reviving the [technical subgroup on spectrum management](#) which will meet on 18 June 2021.**

Will provide overall coordination; link up with other WGs as required.

# Data Timeliness

Recommendation IIFS22-R5 to WMO: WMO to coordinate an update of the timeliness requirements and, with CGMS and Space Agencies, to continue to explore innovative methods, such as used by GPM, to provide global data with a timeliness that meets the new requirements, for next generation satellite programmes.

**Action IIFS22-A11: Heikki Pohjola to raise Rec IIFS22-R5 at WMO Space Secretariat. – Close**

Done. Plan to include latency information in OSCAR/Space; could then be used in gap analyses etc.

**Action: IIFS22-A8: Stephen English and Philippe Chambon (Co-Chair IPWG) to discuss joint ITWG-IPWG efforts on DBNet and science issues with respect to the Meteor-M programme. - Close**

Done. No further action needed at this stage, but benefit of coordination and communication recognised.

**Action IIFS22-A9: Stephen English to thank EUMETSAT for their efforts regarding Russian data and to confirm ITWG's on-going requirement for observations with good timeliness. – Close**

Done

Recommendation IIFS22-R4 to WMO: WMO to continue to work with PRs in countries with DBNet ground stations to encourage provision of sufficient bandwidth to redistribute the hyperspectral IR sounder observations in addition to the MW sounder observations.

**Action IIFS-A10: Heikki Pohjola to raise Rec IIFS22-R4 in WMO Space. - Close**

Done. Also action from DBNet group: 4.15 WMO to identify a WIS expert team for dialogue about WIS/GTS capacity planning for DBNet products.

Recommendation IIFS22-R6 to CGMS: Space Agencies to consider DBNet requirements when designing core ground segment software, and then to make software available to DBNet operators.

**Action IIFS22-A12: Peng Zhang to ensure Rec IIFS22-R6 communicated to Space Agencies via CGMS. - Close**

Done. Part of 'CGMS agency best practices in support to local and regional processing of LEO direct broadcast data', reported against in CGMW WG1.

# Small satellites, including commercial

**Action IIFS22-A13: Philippe Chambon and Niels Bormann to inform TROPICS team of continued ITWG interest in TROPICS but stressing that to ensure engagement from the ITWG community delivery of a large proportion of TROPICS data in less than 3 hours is mandatory. – Close**

Done. Communicated at 2<sup>nd</sup> TROPICS applications workshop 2020. There is a continued effort by the TROPICS teams to increase NRT availability beyond the current plan of providing 40% with < 3h latency.

Recommendation IIFS22-R7 to ITWG Co-Chairs: ITWG Co-chairs to actively invite contributions from users and providers on experiences with Cubesats and Small Sats to ITSC-23.

**Action IIFS22-A14: IIFS Co-Chairs to assist ITWG Co-Chairs with Rec IIFS22-R7.**

Small satellites included explicitly in call for abstracts. A couple of posters on small satellite initiatives were received, but reports on experience with existing small satellites at ITSC remain low.

Recommendation IIFS22-R8 to CGMS: If a mission needs engagement from application areas with a NRT data requirement, budget should be allocated to provide this.

**Action IIFS22-A15: Co-Chairs to report Rec IIFS22-R8 to CGMS. – Close**

Reported at CGMS; will feed into best practice documentation, which agencies will report against periodically.



# Traceable calibration (instrument and RTM)

Recommendation IIFS22-R9 to CGMS: Space Agencies to note that strong requirement for traceable calibration comes from NWP as well as the climate application area.

**Action IIFS22-A17: Co-Chairs to ensure Rec IIFS22-R9 is communicated to CGMS. - Close**

Reported to CGMS, informing best practice initiatives etc.

Recommendation IIFS21-R8 to CGMS: Recognizing the growing need for assessment and on-orbit optimization of the accuracy of operational hyperspectral IR sounders, the traditional approaches for pre-flight SI traceability and post-flight validation should be enhanced by flying a CLARREO-like on-orbit reference standard capability (featuring on-orbit SI verification) with orbits designed to provide inter-calibration capability for refining the calibration of the international fleet of operational sounders.

**Action IIFS22-A18: Co-Chairs to ensure Rec IIFS21-R8 is again communicated to CGMS. - Close**

Reported to CGMS.

**Action IIFS22-A19: Peng Zhang to report to GSICS the appreciation of the IIFS WG for the GSICS effort and the presentations at ITSC-22. - Close**

Done. Conveyed to GSICS EP chair Mitch Goldberg and to GSICS community at GSICS EP meeting on 18-19 May, 2020

# WMO activities

**Action IIFS22-A16: Stephen English and Heikki Pojhola to circulate Critical Satellite Data Paper and papers on CGMS and WMO best practise to IIFS members, who will provide feedback to what extent these are being adhered to by Small Satellite operators.**

The paper has now been approved by INFCOM and circulated to IIFS members (now called “Satellite Data Requirements for Global Numerical Weather Prediction”). Feedback to what extent these are being adhered to by Small Satellite operators is requested.

See also presentation by Ken Holmlund in session 1 at ITSC-23.

**Action IIFS22-A20: Stephen English to circulate HLPP to IIFS members, then pass all comments received within one month to CGMS via Mitch Goldberg. - Close**

HLPP was circulated to IIFS members. Comment from Rich Kelley: “I suggest that the CGMS HLPP request CGMS membership to develop or support for development the techniques for inline detection of low level RFI, especially in channels used for NWP. By inline I mean as part of NWP centers' processing stream starting at level 0.” Propose to discuss this in the RFI sub-group.

Recommendation IIFS22-R10 To WMO: Link SATURN pages from relevant OSCAR to encourage use as OSCAR has become an indispensable tool and is widely used. If uptake remains low carry out a survey to establish if there is a requirement for SATURN, and if so what is preventing uptake. If there is no requirement for SATURN, to discontinue and concentrate resources on OSCAR.

**Action IIFS22-A21: Heikki Pohjola to bring Rec IIFS22-R10 to attention of WMO Space Secretariat. – Close**

Redefinition of SATURN vs VLab vs OSCAR/Space is pending recruitment of the responsible Technical Support Officer. WMO Space Programme recognizes the need for restructuring of the WMO Space Programme web instances.

# Preparation for new instruments

Recommendation IIFS22-R11 To Space Agencies via CGMS: Space Agencies to note that the benefits of Satellite Missions to the ITWG community are increased when early evaluation is undertaken by many independent centres. Therefore to include as many centres, in particular NWP centres, in the early evaluation phase, will bring benefits both to the Space Agency and to the users, and is therefore highly desirable.

**Action IIFS22-A22: Co-Chairs to ensure Rec IIFS22-R11 is brought to attention of CGMS.**

Reported at CGMS; will feed into best practice documentation, which agencies will report against periodically.

# Orbital configuration

Recommendation ITSC-21 IIFS21-R3 to CGMS: To show orbital coverage and other details when orbital configuration and formation flying is under discussion for new research missions, that may benefit from synergy flying with existing operational missions.

**Action IIFS22-A23: Stephen English and Peng Zhang to ask for feedback from CGMS on this recommendation. - Close**

Reported to CGMS WG III co-chair and CGMS HLPP Rapporteur.

Feedback: It is of course an important consideration for new R&D missions, but it is very much a case-by-case issue, depending on the specific payload characteristics of the R&D mission. CGMS can of course support an R&D agency on a case-by-case basis in the analysis of possible orbits for a proposed mission. One case where CGMS did just that: At CGMS-42 in Guangzhou 2014, there was a discussion (based on an analysis performed by NASA) about overlap of future GCOM-C1 and Sentinel-3 Ocean Colour observations and CGMS placed an action on JAXA to investigate how the orbit of GCOM-C1 could be adjusted to increase the benefits for the ocean colour community.

# Coordination with other CGMS sub-groups, CGMS and IRC

Recommendation IIFS22-R13 to ITWG Co-Chairs: ITWG co-chairs to share actions and recommendations from ITWG with co-chairs of other groups, and to consider the actions and recommendations from all groups prior to CGMS and identify actions and recommendations that are common to more than one group. These could be presented to CGMS as joint recommendations, given them stronger visibility.

Recommendation IIFS22-R14 to ITWG Co-Chairs: To continue to pursue very actively the IRC/IAMAS relationship, to gain more support for ITWG initiatives regarding Radiative Transfer.

**Action IIFS22-A24: IIFS Co-Chairs to assist ITWG Co-Chairs with Recommendations IIFS22-R13 and IIFS22-R14.**

Vincent Guidard reported on ITWG activities at IRC/IAMAS Business Meeting in August 2020.

## 20 years of EUMETSAT's Satellite Application Facilities (SAFs)

Recommendation IIFS22-R15: Other Space Agencies to consider if the SAF concept would be beneficial for them, as it has been for EUMETSAT.

**Action IIFS22-A25: ITWG Co-Chairs to ensure Rec IIFS22-R15 brought to attention of CGMS and to pass on ITWG congratulations on 20 years of the NWP and Climate SAFs to EUMETSAT.**

Reported to CGMS.

The SAFs were congratulated.