

2.5 INTERNATIONAL ISSUES AND FUTURE SYSTEMS

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2.5.1 Introduction

The ITSC-23 Working Group on International Issues and Future Systems (IIFS) met on-line on Friday 11th June 2021 to discuss actions and recommendations from ITSC-22 and new topics benefitting from coordination between agencies. The group started off by thanking Stephen English for expertly guiding the IIFS WG as co-chair during the past four meetings. Stephen English stepped down at the last meeting, and Niels Bormann is now co-chairing the group together with Peng Zhang (CMA) who remains co-chair.

Due to the on-line nature of the meeting, the IIFS had a much larger than usual attendance, with useful discussion on a range of topics regarding the evolution of the global observing system and other aspects of international coordination. The on-line nature of the meeting as well as holding the meeting before the conference nevertheless also brought about its challenges, and the usual physical WG format is considered preferable when possible.

The discussions resulted in ten new recommendations and three actions, alongside six standing recommendations.

2.5.2 Status of actions and recommendations from ITSC-22

All actions from ITSC-22 are now closed or superseded by new actions. More details on responses to previous actions can be found in slides shown at the meeting (see [meeting slides](#)). A number of past recommendations were identified as remaining valid, and these are included at the end of this report as “standing recommendations.” These will be reviewed again at upcoming meetings.

Spectrum management aspects were this time transferred to the newly revived technical sub-group on this aspect. It is expected that this sub-group will take leadership in spectrum management and Radio Frequency Interference (RFI) aspects, fielding specific topics to relevant other WGs of ITWG as required.

2.5.3 Evolution of the global observing system

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

- FY-4B (launched 3 June 2021 by CMA): First operational geostationary satellite with hyperspectral sounding capabilities. It also features the AGRI imager, a new Geostationary High-speed Imager (GHI), and other instruments.
- FY-3E (launch 5 July by CMA): First CMA LEO satellite to cover the early morning orbit.
- Arktika-M N1 (launched 28 Feb 2021 by Roshydromet): First meteorological satellite in highly elliptic orbit, carrying an IR/VIS imager, which includes water vapour channels.

FY-4B and FY-3E are of particularly strong interest to ITWG, and early evaluation and sharing of findings is encouraged. Data are expected to be available to users approximately 6 months after launch. Centres are encouraged to register [here](#) for the FY-Pioneer programme for early access to data.

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 IIFS-1 to Roshydromet

To share information on products from Arktika-M N1 with ITWG when available.

2.5.4 Review and evolution of the CGMS baseline

The CGMS baseline for passive IR and MW sounding instruments currently specifies three sun-synchronous orbits with MW sounding and hyperspectral IR, as well as slots of geostationary satellites with hyperspectral IR instruments.

Peng Zhang (CMA) summarised outcomes relating to passive sounding instruments from a recent overall assessment of the continuity of provision against the CGMS baseline (see [here](#) for the slides). In subsequent discussions it was established that with respect to the 3-orbit system resilient coverage of the morning and early afternoon orbits is well ensured by EUMETSAT and NOAA in this time-frame. CMA planning to ensure early-morning coverage beyond FY-3E is well advanced, though a moderate risk of losing coverage remains. The group highly appreciates and supports CMA's efforts towards continued coverage of the early morning orbit.

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 are usually assumed by users, continuing and improving on established capabilities. This 3-orbit constellation plays an important role as "reference" system for a range of applications, and it is considered important that this is maintained. The CGMS baseline is, however, not explicit regarding the expected capabilities. Hence the WG expressed the following:

Recommendation IIFS-2 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. This has been recognised, for instance, in the WIGOS Vision 2040 where such systems are mentioned as additional observations.

Recommendation IIFS-3 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.

2.5.5 Small satellites/cubesats

Constellations of small satellites/cubesats offer the potential to provide higher temporal sampling from LEO, beyond the 3-orbit CGMS baseline. In line with the previous recommendation, 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, however, that experience within ITWG about such systems is very limited, particularly for operational applications, and there are concerns about achievable capabilities, calibration accuracy or stability, geolocation, lifetime, etc. Given the great potential of such systems, it is important to establish what is possible with such system. Some NWP centres are planning to assess data quality of selected upcoming missions (e.g., NRL, Météo France, ECMWF).

Recommendation IIFS-4 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.

As there was some uncertainty about which missions exist or are planned, it was considered useful to compile a list of these with relevance to ITWG.

Action IIFS-1 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 near-real-time (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 IIFS-3). Available bandwidth for downlinks could be an issue, a topic to be 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. It was suggested that the NWP WG consider this in an upcoming additional WG meeting after ITSC targeted at science and development questions. Commonality in the provided data could greatly help with the acceleration of efforts, hence the group formulated:

Recommendation IIFS-5 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 IIFS-6 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.

2.5.6 WMO activities and timeliness aspects

The WG noted with appreciation that the paper on “[Satellite Data Requirements for Global Numerical Weather Prediction](#)” has now been approved as a position paper by WMO, and a specific presentation by Ken Holmlund on data policy activities is included in the conference. IIFS members are encouraged to read the paper at the address provided.

The group emphasised the importance of good data timeliness for operational applications, and fully supports WMO efforts in this area (Standing Recommendation IIFS-1). 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 [here](#).

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 IIFS-7 to NWP centres

To conduct impact studies highlighting the benefit of good timeliness of observations, and to report on these at future meetings.

2.5.7 Review of the CGMS High-Level Priority Plan

The latest version of the CGMS High Level Priority Plan (HLPP) is now available, see [here](#).

Action IIFS-2 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. On item 4.4.1 (on error propagation vocabulary and methodology), there was no further feedback beyond what was discussed at previous IIFS meetings. On item 4.4.2 (on NEdT estimates for MW sounders), it was noted that a recent paper by Yang and Yang is currently under review, and this includes comparisons of different NedT algorithms (Yang and Yang, 2021, “A New Algorithm for Determining the Noise Equivalent Delta Temperature of In-orbit Microwave Radiometers,” IEEE Transaction on Geoscience and Remote Sensing).

The group reiterated that websites with timeseries of instrument performance indicators such as the [NOAA/NESDIS ICVS \(Integrated Calibration/Validation System\)](#) 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 IIFS-8 to CGMS members

To provide ICVS-style instrument performance monitoring for operational instruments.

The group also reviewed other aspects of relevance to ITWG in the HLPP and suggested new items for the HLPP, reflecting areas of importance with relevant activity in the community. Regarding the HLPP section “Advance the response to the Vision for WIGOS (WMO Integrated Global Observing System) in 2040, by the implementation of new capabilities beyond the CGMS baseline,” various activities are mentioned relating to increased temporal sampling for IR sounders are mentioned, but an item on advancing MW sounding capabilities for NWP beyond the CGMS baseline is missing (see also link to Recommendation IIFS-3).

Recommendation IIFS-9 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 HLPP 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 relevant and important to guide future evolution.

Recommendation IIFS-10 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 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.

2.5.8 Calibration aspects

The group reiterated the importance of reliable calibration for a wide range of application areas, including NWP and reanalysis. It discussed efforts to establish an in-orbit SI-traceable reference (see also Standing Recommendation IIFS-SR4), 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 in September 2019. One outcome of the workshop is a special issue in Remote Sensing “[The Needs and Path Toward an SI-Traceable Space-based Climate Observing System](#)” which has now been published.

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

Action IIFS-3 on Peng Zhang

To circulate the workshop report to IIFS members once available.

2.5.9 Standing recommendations

The following recommendations from the previous WG meeting have been adopted as standing recommendations and remain valid:

Standing Recommendation IIFS-1 (IIFS22-5) 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.

Standing Recommendation IIFS-2 (IIFS22-4) 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.

Standing Recommendation IIFS-3 (IIFS22-8) 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.

Standing Recommendation IIFS-4 (IIFS21-8) 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.

Standing Recommendation IIFS-5 (IIFS22-11) 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.

Standing Recommendation IIFS-6 (IIFS22-14) to ITWG Co-Chairs

To continue to actively pursue the IRC/IAMAS relationship, to gain more support for ITWG initiatives regarding Radiative Transfer.