

2.5 INTERNATIONAL ISSUES AND FUTURE SYSTEMS

Working Group members: Peng Zhang (CMA, Co-chair), Stephen English (ECMWF, Co-chair), Alan Beaulne (ECCC), Nancy Baker (NRL), Niels Bormann (ECMWF), Pascal Brunel (Météo-France), Philippe Chambon (Météo-France), Keyi Chen (CULT), Yong Chen (NOAA), Chu-Yong Chung (KMA), Louis Garand (ECCC), Ben Johnson (JCSDA), Masahiro Kazumori (JMA), Richard Kelley (NOAA), Dieter Klaes (EUMETSAT), Heather Lawrence (ECMWF), Heikki Pohjola (WMO), Ben Ruston (NRL), Joe Taylor (UW-SSEC), Christoforos Tsamalis (Met Office).

2.5.1 Introduction

The ITSC-22 Working Group on International Issues and Future Systems (IIFS) convened on Saturday 2nd November 2019 and discussed actions and recommendations from ITSC-21 and topics requiring coordination between agencies. The IIFS enjoyed a lively and useful discussion. Overall there were 25 new actions, 15 recommendations, many important statements arising from the discussions.

2.5.2 Summary of open ITSC-19, 20 and all 21 Actions and Recommendations

All past actions from ITSC-19, 20 and 21 are now closed. The actions that were open at the end of ITSC-21, including all new ones at ITSC-21 as well as older ones carried over from past ITSCs are summarised below.

- **Action IIFS19-1:** Steve English to request ITWG (involving the NWP Group) to provide input to CGMS WG III – via Jérôme Lafeuille – for updating the CGMS Contingency Plan.
CLOSE. WMO (Werner Balogh and Lars-Peter Riishojgaard) confirm this is now closed, comments received have been noted.
- **Recommendation IIFS19-3:** WMO to pursue SATURN, and all agencies to actively contribute information to this portal (and two associated actions).
CLOSE. SATURN is now well established. Suggest at each ITSC soundings be made about use of SATURN and feedback to WMO. This Recommendation does not need on-going reporting.
- **Recommendation IIFS20-12:** IIFS and other ITWG members to provide information on current usage of protected bands to Rich Kelley. (Action: Stephen English to provide copy of recent ECMWF submission to Ofcom, and to request Met Office to provide copy of their submission as well as encourage other NMSs to provide similar information where it exists).
CLOSE. The successful ECMWF workshop (see below and b.01 presentation) provides a mechanism. Recommendation does not need on-going reporting.
- **Recommendation IIFS20-13:** To make MW SRFs available to facilitate RFI investigations when needed. (Action: Stephen English to ask co-chairs to combine with Recs from other WGs and communicate to CGMS).
CLOSE. Some MW SRFs have been made available. Suggest this Recommendation does not need on-going reporting, but situation should be kept under review.
- **Recommendation IIFS20-14:** Update Steve English's study from 2005 on the value of individual MW protected bands. (Action: Sid Boukabara to ask Thomas Auligné to

consider making this part of the FSOI intercomparison study and presenting to the WMO impacts workshop in Shanghai in 2016).

CLOSE. See response to Action IIFS21-10. Recommendation does not need to continue to be reported on.

- **Action IIFS21-1:** Mikael Rattenborg to note IIFS comments in next draft of the HLPP.
Status: Done. Mikael Rattenborg reflected the discussions at the IIFS at ITSC-21 in the HLPP paper that went to CGMS-46 in Bangalore. Mitch Goldberg, as ITWG rapporteur to CGMS, of course contributed to this.
- **Action IIFS21-2:** Christoforos Tsamalis to provide input to Mikael Rattenborg on item 3.4.1 (new common vocabulary and methodology for the errors associated with validation data).
Status: Done. New Action IIFS22-A1 arising (see below).
- **Action IIFS21-3:** Claude Camy-Peyret to provide more information to IIFS members on the FORUM proposal.
Status: Done. Information about FORUM was presented at ITSC-22. FORUM has now been selected as ESA Earth Explorer-9.
- **Action IIFS21-4:** IIFS members to provide science questions and undertake studies, and encourage others to do so, to WMO (Lars Peter Riishoejgaard at riishojgaard@wmo.int) to support this as a significant theme of the next OSE workshop.
Status: Done. Some science questions from the Working Groups were received by LPR via CGMS.
- **Action IIFS21-5:** S. English / P. Zhang to bring this* to attention of major NWP centres and TROPICS mission. *This = “evaluation of TROPICS mission.”
Status: Done. S. English presented TROPICS to WMO/IPETSUP, Bill Blackwell visited ECMWF and many NWP centres, detailed information was made available.
- **Action IIFS21-6:** Mikael Rattenborg to discuss with GODEX-NWP members how this* initiative could be implemented (next meeting Autumn 2018). *This = “sharing of evaluation of higher risk research missions.”
Status: Done. This was discussed and reported at GODEX-NWP. The activity has been adopted by GODEX-NWP.
- **Action IIFS21-7:** In partnership with the NWP WG the IIFS WG co-chairs to devise a set of criteria for this CGMS procedure to follow.
Status: Done. A criterion was proposed by the NWP WG, and that WG will take forward discussion in this area.
- **Action IIFS21-8:** Mikael Rattenborg and the IIFS co-chairs to draft a letter for ITWG co-chairs to send to Roscosmos and Roshydromet explaining the importance of access through DB-Net and processing of real time MTVZA-GY and MSU-MR data (Alexander Uspensky to advise full postal address of whom to send to).
Status: Done. This was done by Mikael Rattenborg and the letter sent. Note IPWG also sent a letter on another topic, and the implications for coordination are discussed in Section 2.5.5.

- **Action IIFS21-9:** Peng Zhang to check status of reference sites in China and their availability.
Status: Done. Dunhuang Gobi desert site and Qinghai lake site are organized by CMA. Dunhuang Gobi desert site for solar reflection bands and Qinghai lake site for thermal emission bands. Dunhuang Gobi desert site is prepared to be the site of RadCalnet through CEOS WGCV.
- **Action IIFS21-10:** Steve English to ask ECMWF if it is willing to host a short workshop (1-2 days) to present updated information with respect to Recommendations IIFS20-14 and IIFS20-15.
Status: Done. The workshop was held 13-14 September 2018, with a workshop report available. The general verdict is that the workshop was very successful. Outcomes were presented in item b.01 at ITSC-22.
- **Action IIFS21-11:** Steve English and Peng Zhang to bring these suggested changes* to WMO teams considering these questions (CGMS, IPETSUP, ICT-IOS...). *These suggested changes = changes to a WMO policy document on the growing role of commercial satellite observation providers.
Status: Stephen English brought this to attention of CGMS and WMO/IPETSUP and through WMO/IPETSUP minutes other WMO teams.
- **Recommendation IFS21-1 to IRC:** Development of a new unified model for describing spectroscopic and water vapour continuum absorption.
Status: This was also discussed by the RT WG and at the CMA-ECMWF-JCSDA workshop at Tianjin on Radiative Transfer Models. IIFS will not pursue this as the Recommendation was transferred to the RT WG.
- **Recommendation IIFS21-2 to ITWG members:** ITWG members to familiarise themselves with the HLPP.
Status: This was done for the HLPP version presented at ITSC21. The task needs to be repeated with each update of the HLPP, and there is a new action (IIFS-20) from IIFS22.
- **Recommendation IIFS21-3 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.
Status: This remains valid and a new action (IIFS-23) will actively seek a response to this Recommendation.
- **Recommendation IIFS21-4 to multiple agencies:** Evaluation of TROPICS mission to be undertaken by appropriate agencies in partnership with TROPICS mission (e.g., NWP centres).
Status: This remains valid, but was reformulated at IIFS22 to emphasise that NRT data provision is necessary to persuade NWP centres to engage.
- **Recommendation IIFS21-5 to GODEX-NWP:** For GODEX-NWP to organise and oversee agreed sharing of the evaluation of instruments not considered to be “core” by NWP centres.
Status: This has been adopted by GODEX-NWP so the Recommendation is closed.

- **Recommendation IIFS21-6:** Note the growing evidence of likely benefits from hyperspectral geostationary soundings, and where possible to work towards the provision of such instruments in plans for future geo systems.
Status: This remains valid but as this forms part of the CGMS baseline, there is no need to repeat this Recommendation again to CGMS.
- **Recommendation IIFS20-7 to CGMS:** Re-emphasize best practise is to consider latency requirements early in the planning stage of new missions, including research and pre-operational.
Status: This remains valid but has been reformulated into a number of Recommendations and Actions from ITSC-22.
- **Recommendation 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.
Status: This Recommendation remains valid and will be communicated again to CGMS.
- **Recommendation IIFS21-9 to AOPC GCOS:** Maintain and where possible expand GRUAN and ARM sites.
Status: This was brought to the attention of Kenneth Holmlund, current chair of GCOS AOPC. (Peng Zhang is also a member of AOPC). There is a new action to check if the IIFS-21 outcome was sufficient.
- **Recommendation IIFS21-10 to CGMS:** Space agencies to develop, where possible, improved capability to detect RFI in level-0 data.
Status: This Recommendation is still valid but has been reformulated at ITSC22 with specific new actions (see text).
- **Recommendation IIFS21-11 to CGMS:** Space agencies to ensure that provision of SRFs for MW instruments is routine practise for future instruments and published on the SATURN portal. Furthermore to obtain wherever possible and practical the SRFs for existing and old instruments, and also to provide on the SATURN portal.
Status: This was reported to CGMS by Mitch Goldberg and brought to the attention of the GSICS EP chair at the GSICS EP meeting in Sochi, Russia in 2019.
- **Recommendation IIFS21-12 to WMO:** WMO to pursue SATURN, and all agencies to actively contribute information to this portal (and two associated actions). Reported. Still valid.
Status: This remains valid, but questions were raised at ITSC-22 about the uptake of SATURN. Therefore a new Action arose at IIFS22 to validate why the SATURN update has been slow.

2.5.3 Follow-up to Actions and Recommendations from ITSC-21

Action IIFS21-A2 was closed as described above because it came to the attention of the group that a meeting dedicated to this topic was held at the National Physics Laboratory in the UK in September 2019, and this has produced a draft white paper. The group considered

the best course of action was to review this, see if ITWG can endorse it, and provide feedback as appropriate to the authors. This resulted in Action IIFS-1:

Action IIFS-1

Stephen English to obtain copy of the White Paper from the NPL meeting on traceable calibration and circulate for comment, then feed back comments to White Paper authors.

The IIFS also noted that the Recommendation IIFS21-9 may merit further discussion to inform what more ITWG could do to assist with the long term future of GRUAN and super-sites for calibration and validation. This resulted in Action IIFS-A:

Action IIFS-2

Peng Zhang to discuss with Ken Holmlund if further action or comment is needed from ITWG on this topic (Link to Recommendation IIFS21-9).

2.5.4 Spectrum management issues

The World Radiocommunication Conference 2019 (WRC19) was taking place in Egypt at the same time as ITSC-22. We will know the outcome of WRC19 in December or January. There was concern that the position taken by WRC19 may not offer adequate protection to EESS at 24 and 50 GHz. Therefore IIFS considered that Space Agencies needed to consider what more could be done to detect and report RFI in their instruments, to protect their investment and users. This resulted in Recommendation IIFS-1 to CGMS to encourage such activities. Furthermore, it was noted that some work presented at ITSC (Simon E., 1p19) showed use of AI to detect anomalies and other work is known to be sponsored by ESA to examine what steps can be taken to detect and report RFI. It was felt that the IIFS should collect and share information on all such efforts. This discussion resulted in Actions IIFS-3 and 4.

Recommendation IIFS-1 to CGMS WG I

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 the US, Japan and China.

Action IIFS-3 on IIFS members

To provide a summary of known activities, such as the ESA initiative (Link to Recommendation IIFS-1).

Action IIFS-4 on Rich Kelley

To contact Chris Kummerow about efforts in his team and report to ITWG (Link to Recommendation IIFS-1).

The IIFS recognised the high value of the ECMWF RFI workshop report, available at <https://www.ecmwf.int/en/learning/workshops/radio-frequency-interference-rfi-workshop>

This report not only documents the current impact of passive microwave bands in NWP, it also assesses the socio-economic benefits. The IIFS encouraged to bring the report to the attention of all Space Agencies, as evidence of the value of passive MW measurements. This resulted in Action IIFS-5.

Action IIFS-5 on Stephen English

To bring ECMWF RFI workshop report to the attention of all space agencies and CGMS.

The IIFS noted that the Radio Astronomy community is better organised in living with RFI than the weather community, as increasingly is the L-band community. These two communities organise a regular “Living with RFI” workshop. In order to engage with the weather community, it is likely the next workshop will be held at ECMWF. This may be followed immediately by a repeat of the ECMWF RFI workshop, which has different goals (about communicating value of the spectrum to society through meteorology, whereas the Living with RFI is about how to minimise the impact of RFI). It is also likely ECMWF will organise a telecall half day workshop to exchange updates on the 2018 workshop. It was also encouraged to present relevant studies to the WMO OSE workshop. It is vital that ITWG strongly support these efforts, if Spectrum Managers are to have high quality up to date information and evidence to use in negotiations. Hence Recommendation IIFS-2 and Action IIFS-6.

Recommendation IIFS-2 to ITWG members

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

Action IIFS-6 on Stephen English

To send information to the ITWG mailing list about RFI Workshops once dates are known (Link to Recommendation IIFS-2).

The IIFS heard that both in the USA and UK statements had been made suggesting a possible deregulation above 95 GHz. This increases significantly the risk to passive bands of MHS, ATMS and MWHS-2 and similar instruments, notably the channels centred on 183 GHz. It is useful therefore to anticipate the threat and begin to collate evidence of the value of these channels.

Recommendation IIFS-3 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 IIFS-7 on Stephen English

To ensure specific requests are made for studies of the value of bands above 95 GHz in preparation for workshops in 2021 (Link to Recommendation IIFS-3).

2.5.5 Near real time data exchange

The IIFS noted the remarkable progress of DBNet, now supplying near global coverage microwave sounding with typical timeliness better than 30 minutes. This complements nicely global data exchange, which usually has a timeliness of 1-3 hours, though the group also noted examples of using new approaches to facilitate global data exchange with excellent timeliness. Not all data is available within the requirements listed in the WMO Rolling Review of Requirements. The group continues to appreciate the efforts in Russia to provide high quality observations, and at ITSC-22 it was shown that the Russian hyperspectral sounder in particular appears very good. However the timeliness of the Russian data remains an issue. Independently IPWG and ITWG sent letters to Roscosmos and Roshydromet concerning Russian satellite data, albeit on different topics. ITWG and IPWG have a

common interest in the Russian programme and face similar challenges. It was agreed that closer collaboration between ITWG and IPWG on this and other data exchange issues would be of value, resulting in Action IIFS-8.

Action IIFS-8 on 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.

In addition to DBNet, EUMETSAT have been working to try and improve timeliness of Russian global data. This effort is strongly supported by IIFS. The group agreed to confirm to EUMETSAT the appreciation of their effort and encourage similar effort by other centres supporting collection and regional dissemination. This resulted in Action IIFS-9.

Action IIFS-9 on Stephen English

To thank EUMETSAT for their efforts regarding Russian data and to confirm ITWG's on-going requirement for observations with good timeliness.

IIFS recognises the outstanding progress in delivering MW sounder data quickly via DBNet. There is a requirement for hyperspectral IR data to be made available with equally good timeliness. In some cases it appears local network bandwidth to remote DBNet stations is the limiting factor. The group recognised WMO's effort to facilitate improvements and support continued effort in this area, resulting in Recommendation IIFS-4 and Action IIFS-10.

Recommendation IIFS-4 to WMO

To continue to work with Permanent Representatives (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-10 on Heikki Pohjola

To raise Recommendation IIFS-4 with the WMO.

IIFS note that the benefits of timely observations in NWP has increased, thanks to improved DA methods (e.g., continuous DA) and convective scale NWP whose requirements are close to nowcasting requirements. Therefore, the value of initiatives such as DBNet and provision of timely global data has increased the value of satellite programmes. The group welcomes continued innovation to enable more timely provision of observations, and welcomes WMO's leadership in this area, resulting in Recommendation IIFS-5 and Action IIFS-11.

Recommendation IIFS-5 to WMO

To note increasing importance of timely observations and, with CGMS and Space Agencies, to continue to explore innovative methods, such as used by GPM, to provide global data with excellent timeliness for next generation satellite programmes.

Action IIFS-11 on Heikki Pohjola

To raise Recommendation IIFS-5 at WMO Space Secretariat.

IIFS recognises that it is often difficult to use core ground segment processing software to support DBNet. However, if planned from day-1, software could be developed flexibly to support both applications. Therefore the group made Recommendation IIFS-6 for Space

Agencies and associated Action IIFS-12 to consider DBNet application of software in the early planning of the core ground segment software development.

Recommendation IIFS-6 to CGMS

Space Agencies to consider DBNet requirements when designing core ground segment software, and then to make software available to DBNet operators.

Action IIFS-12 on Peng Zhang

To ensure Recommendation IIFS-6 is communicated to Space Agencies via CGMS.

2.5.6 New generation small satellites

IIFS noted that in future there may be new opportunities arising from small satellites. By small satellites we mean platforms range from a 3U Cubesat through to moderate sized multiple instrument platforms, but still far smaller than the big platforms like FY3, JPSS and Metop. This creates new opportunities, but these opportunities will not be realised without also addressing some issues specific to smaller platforms. In particular, it needs a strong engagement from the user community.

At ITSC-21 the IIFS made this recommendation: *Recommendation IIFS-4 to multiple agencies: Evaluation of TROPICS mission to be undertaken by appropriate agencies in partnership with TROPICS mission (e.g. NWP centres)*. This recommendation is still valid however there remain concerns over the availability of NRT TROPICS data, in common with many Cubesat programmes. Therefore although the group remains committed to evaluation of TROPICS if NRT data is made available, it is important data providers understand that without a commitment to NRT data, it is difficult for operational centres to justify evaluating the data. Many mission programmes have a stated goal of improving operational services such as NWP. This requires engagement from the NWP centres to evaluate the new observations. To gain the engagement of these centres there is a choice between committing to NRT data provision or funding the evaluation. Specifically for TROPICS this resulted in Action IIFS-13, though the point applies to all missions.

Action IIFS-13 on 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 NRT is necessary.

The IIFS noted that TEMPEST-D Cubesat data has already been evaluated at some centres. It would be ideal to share experience with Cubesats, and to explore quality and timeliness issues. This could be a topic for IIFS at ITSC-23 and hence Recommendation IIFS-7 and Action IIFS-14 were made.

Recommendation IIFS-7 to ITWG Co-Chairs

To actively invite contributions from users and providers on experiences with Cubesats and small satellites to ITSC-23.

Action IIFS-14 on IIFS Co-Chairs

To assist ITWG Co-Chairs with Recommendation IIFS-7.

As noted earlier TROPICS and other Cubesat missions have difficulties in meeting NRT requirements due to budget constraints, which may lead to non-engagement from operational

centres, which for many such missions is an important element of their Cal/Val. It is in general more efficient to plan NRT provision at an early design stage. Therefore Recommendation IIFS-8 encourages agencies planning missions to consider NRT data provision and provide budget to ensure it.

Recommendation IIFS-8 to CGMS

If a mission needs engagement from application areas with a NRT data requirement, budget should be allocated to provide this.

Action IIFS-15 on ITWG Co-Chairs

To report Recommendation IIFS-8 to CGMS.

IIFS noted that issues for small satellites can fall into three areas: 1) General issues related to the small platform size; 2) Non-compliance with best practise; 3) constraints when operated by commercial entities. The question of non-compliance with best practise is the most easily addressed, by bringing to their attention documents describing best practise. However IIFS felt it would be good for IIFS members to review documents that exist on best practise, prior to engaging with new operators on these questions. Therefore, Action IIFS-16 will ensure this review, compare to practise by existing small satellite operators, and then agree on next steps.

Action IIFS-16 on 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.

New commercial operators tend to favour small satellites, and in particular Cubesats, for obvious reasons. If observations from commercial satellites can't be licensed for free-exchange, then this will reduce their uptake. This is a complex issue, but IIFS consider that CGMS could consider a role to coordinate global access to observations from commercial satellite operators. The IIFS recognises that this is challenging. At this stage no recommendation or action is proposed.

Another important point related back to Section 2.5.4, as IIFS recognises that there is a bandwidth issue for command and control with very large constellations of Cubesats. This may in future bring them into conflict with EESS bands, including bands used for command and control of weather satellites. There is no recommendation or action at this time, but this is an issue IIFS members should keep watch over.

2.5.7 Traceable calibration for satellites and models

IIFS consider that a traceable calibration for core satellite observations would be of value to both climate and NWP application areas. Very well calibrated and stable core missions, including some devoted to in-flight inter-calibration of other missions to a reference mission, could help inter-calibrate the entire space component. The NWP requirement for this needs to be stressed as it is often assumed not to be an issue for NWP and to emphasise this point IIFS made Recommendation IIFS-9 and Action IIFS-17.

Recommendation IIFS-9 to CGMS

Space Agencies to note that the strong requirement for traceable calibration comes from NWP as well as the climate application area.

Action IIFS-17 on ITWG Co-Chairs

To ensure Recommendation IIFS-9 is communicated to CGMS.

Several Space Agencies are considering missions to perform reference quality calibration in flight. At ITSC-21 the following recommendation was made: *IIFS21-R8 Recommendation 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.* This recommendation remains valid and needs to be recommunicated until there is a firm commitment to such a mission. Therefore IIFS agreed on Action IIFS-18, to ensure this existing Recommendation is communicated again.

Action IIFS-18 on ITWG Co-Chairs

To ensure Recommendation IIFS21-8 is again communicated to CGMS.

IIFS strongly supports the GSICS effort and was grateful for the thorough presentations given on GSICS in the GSICS Workshop at ITSC-22. Peng Zhang will ensure through Action IIFS-19 that this message is passed on to other members of GSICS.

Action IIFS-19 on Peng Zhang

To report to GSICS the appreciation of the IIFS WG for the GSICS effort and the presentations at ITSC-22.

2.5.8 WMO

The IIFS noted the availability of an updated High Level Priority Plan (HLPP). IIFS members agreed to review and provide comments within one month of receiving the HLPP (Action IIFS-20).

Action IIFS22-20 on Stephen English

To circulate HLPP to IIFS members, then pass all comments received within one month to CGMS via Mitch Goldberg.

IIFS noted again the remarkable success of OSCAR/Space, which is an indispensable tool for all working in satellite meteorology. However IIFS noted anecdotal evidence that uptake of SATURN has been very slow by comparison. At a show of hands nobody at ITSC-22 said they had used SATURN as part of their preparation for new missions. This is disappointing given how long SATURN has now been available. The reasons need to be understood. IIFS members reported that they have no difficulty finding the information they need directly on Space Agency web pages. Therefore a question arises if SATURN is needed. IIFS agreed that before deciding it is not, renewed effort is needed to publicise SATURN, ensure the consistency of information available, and proactively seek feedback, perhaps through a survey. This resulted in Recommendation IIFS-10 and Action IIFS-21.

Recommendation IIFS-10 to WMO

Link SATURN pages from relevant OSCAR pages to encourage uptake of SATURN as OSCAR is an indispensable tool and is therefore 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 IIFS-21 on Heikki Pohjola

To bring Recommendation IIFS-10 to attention of WMO Space Secretariat.

IIFS noted that on several occasions observations from new satellite launches have been accessible to a small number of users (sometimes only one) during a long evaluation phase, while other users have had no access until a very long period after launch. There are diverse reasons for this, it is often not because the originating Space Agency was slow to release data, it can be other issues in the dissemination chain. IIFS noted that the benefits of missions are maximised when early evaluation is undertaken by many centres. Therefore both users and the originating Agency would benefit if the blocks to making data available quickly to multiple centres for initial evaluation could be identified and removed. This resulted in Recommendation IIFS-11 and Action IIFS-22.

Recommendation IIFS-11 to space agencies (and agencies involved in re-transmission of satellite data) 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. Facilitating early access to new data is therefore highly recommended.

Action IIFS-22 on ITWG Co-Chairs

To ensure Recommendation IIFS-11 is brought to the attention of CGMS.

2.5.9 Orbital configurations

At ITSC-21 the following Recommendation was made: *IIFS21-R3 Recommendation 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.* The IIFS suggests that provision of data coverage plots for individual instruments from future satellites, especially when options are being compared, would lead to easier and better decisions on best future configuration. Therefore IIFS would like to actively seek feedback from Space Agencies via CGMS on Recommendation IIFS21-3 (Action IIFS-23).

Action IIFS-23 on Stephen English and Peng Zhang

To ask for feedback from CGMS on CGMS response to this recommendation (link to Recommendation IIFS21-3).

The plans from CMA and Roshydromet/Roscosmos to put satellites in planes well spaced from other operators remains very welcome. Most centres in the ITWG community have confirmed they will be able to commit to a fast evaluation of observations in new orbital planes if/when requested to ensure continuity in these orbital planes if results are encouraging: This is most likely to apply in the near future to FY-3E E-AM by CMA and WMO and Meteor-M N2 (mid pm) by Roshydromet and WMO. The populating of multiple orbital planes with different ECTs provided by different agencies is extremely valuable. No action or recommendation was associated with these two important statements.

2.5.10 Relationship of ITWG to other CGMS science working groups and IRC

ITWG has tended to operate in isolation from other CGMS sub-groups, with little or no communication. This has led to missed opportunities (e.g. Roshydromet letter, see Section 2.5.5). IIFS consider that this could be improved, resulting in Recommendations IIFS-12 and 13 and Action IIFS-24.

Recommendation IIFS-12 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 IIFS-13 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 IIFS-24 on IIFS Co-Chairs

To assist ITWG Co-Chairs with Recommendations IIFS-12 and IIFS-13.

2.5.11 Distributed software and data product development

The IIFS recognises the remarkable achievement of the EUMETSAT SAFs, in particular 20 years of the NWP and Climate SAFs. EUMETSAT is warmly congratulated on the success of the SAF innovation. IIFS considers that EUMETSAT's SAFs provide an excellent model for other agencies to emulate. This resulted in Recommendation IIFS-14 and Action IIFS-25.

Recommendation IIFS-14 to space agencies

To consider if the SAF concept would be beneficial for them, as it has been for EUMETSAT.

Action IIFS-25 on ITWG Co-Chairs

To ensure Recommendation IIFS-14 brought to attention of CGMS and to pass on ITWG congratulations on 20 years of the NWP and Climate SAFs to EUMETSAT.