Minutes of the 2018 Annual GSICS Joint Working Groups Meeting

19 – 23 March 2018, Shanghai, China

GSICS WGs – 2018 Minutes. Action: in red, Recommendation: in green, Decision: in blue
Format of Action/Recommendation: [A,R].GsicsId.yyyy.agendaItemId.actionCount

Valid GsicsId : [GDWG | GRWG | GCC | GWG | GIR | GVNIR | GMW | GUV]
agendaItemId: agenda item ID (Example: A.GWG.2018.3o.1 – GRWG & GDWG action 1 at agenda#3o)

Contents

Plenary Mini Conference – AM on 19th March, 2018	
Chair	Peng Zhang (CMA)
Minute Taker	Tim Hewison (EUMETSAT)
Attendance	Lots - see attendance register
Remote Attendance	John Fulbright (NOAA)

Agenda Item: 1a Welcome to SITP – 9:15 (10 minutes)	
Presenter	Peng Zhang (CMA), Lei Ding (SITP)
Overview	Dohyeong introduced Peng Zhang as session chair, who welcomed all the participants to the meeting and stressed the importance of GSICS - and the benefits already realised to the FY satellites at CMA, which are now used worldwide. Peng in turn introduced Dr. Lei Ding (SITP), as our local host. Ding reflected on the growing importance of quantitative use of Earth Observing satellites, and SITP's role in the development of sensors to support these missions.

Agenda Item: 1b Introduction to Mini Conference & GSICS – 9:00 (15 minutes)	
Presenter	Dohyeong Kim (KMA)
Overview	Dohyeong provided an introduction to GSICS as an essential part of the Global Observing System.

Agenda Item: 1c Agenda, Announcements, etc – 9:25 (5 minutes)	
Presenter	Peng Zhang (CMA)
Overview	Agenda, Announcements, etc
Discussion point, conclusions, Actions, Recommendations, Decisions	
Thomas Xu firstly confirmed that WebEx connection was in place for this session, allowing remote attendance. Peng provided an overview of the agenda for the meeting. Tim pointed out the order of the agenda is changed for Friday morning plenary session. Philippe Goryl pointed out that he will not be available to give his report on the lunar calibration activities at ESA on Thursday, and requested that he could include this as part of the ESA agency report on Monday afternoon. This was supported by Tom Stone. Mitch Goldberg highlighted the importance of the combined GSICS report on the state of the Satellite Global Observing System, which will be presented to CGMS on an annual basis. Peng added the importance of this activity to GCOS programmes. Mitch also explained that he has taken over as chair of the GSICS Executive Panel, with Ken Holmlund remaining as vice-chair.	

Agenda Item: 1d Latest progress of CMA FY-3D and FY-4 satellite – 9:25 (20 minutes)	
Presenter	Peng Zhang (CMA)
Overview	Peng provided an overview of the 16 FY satellites already launched, of which 9 are still in orbit and 5 in operation, 1 in trial and 1 in on-orbit testing, which were briefly reviewed. These are complimented by the TanSat joint program on CO2, which uses FY-3 ground segments. CMA has added a new ground station in Antarctica (Troll) to improve data latency of their FY-

	3 polar orbiting satellites for users. Peng showed some exciting new results from the IR sounder and lightning imager on FY4. Peng also highlighted the importance of the GSICS/IVOS lunar calibration workshop, hosted in Xi'an in Nov 2017 to improve the calibration of the VIS/NIR channels and provide traceability.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Dohyeong asked about CMA's 30 years reprocessing project. Peng explained that CMA have started to work together with other satellite agencies in China to implement the CEOS/CGMS working group on climate recommendations to generate TCDR and FCDR.	

Agenda Item: 1e Development of SI-traceable Hyperspectral FTIR instrument – 9:45 (20 minutes)	
Presenter	Lei Ding (SITP)
Overview	Lei explained the motivation for the SITP activities to establish SI-traceable measurements to address the stability requirements for CDRs. He commented that the required accuracy of the IR imaging, sounding and oceanic (HY-1) instruments had evolved over recent years. He reflected on the goals of the CLARREO mission and its associated Pathfinder, which are being mirrored through developments at SITP. In particular the prototype Si-traceable IR interferometer, which has a calibration uncertainty budget of ~0.1K (k=2) at 20°C. This includes a highly uniform black body calibration target, populated with phase change cells.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Likun Wang asked whether multiple reference satellites are needed. This is the subject of ongoing discussions within GSICS. Hank Revercomb supported the case for operating multiple Si-traceable reference instruments	

Agenda Item: 1f FY-4A satellite commissioning latest outcome – 10:05 (20 minutes)	
Presenter	Qiang Guo (CMA)
Overview	Qiang introduced the three main meteorological sensors operating on FY-4A: GIIRS, AGRI and LMI. He provided many examples of In Orbit Tests. He confirmed the GIIRS spectral calibration is within 8ppm, and showed initial biases of ~0.6-1K wrt IASI.

Agenda Item: 1g GOES-16 calibration and validation – 10:25 (20 minutes)	
Presenter	John Fulbright (NOAA, remote)
Overview	John introduced the two main EO instruments on GOES-16 and -17: ABI and GLM. He reviewed the validation schedule for GOES-16, which is now being followed for the recently launched GOES-17 - but without the extended validation period. John highlighted the benefit of ABI's ability to view the Moon and perform N-S scans to validate the calibration and detector normalization. He explained that the VNIR radiometric calibration was initially unstable, due to ground-processing and identified a bias in Band 2, whereas the IR calibration was found to be stable (within 1K accuracy requirements) and in good agreement with CrIS. John also briefly described the airborne validation field campaigns made with the NASA ER-2, which included overflights of the Sonoran desert site along the line of dedicated ABI N-S scans, as well as flights over the ocean, fires and thunderstorms.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Zhangdong Yang (CMA) asked about the data sharing policy of the GOES-R validation campaign, commenting that it could be useful for TANSAT validation.	

A.GWG.2018.1g.1: Fred Wu (NOAA) to discuss with CMA potential sharing of GOES-R field campaign data for TANSAT validation.

Agenda Item: 1h Post-launch test progress of FY-3D – 10:45 (20 minutes)	
Presenter	Zhongdong Yang (CMA)
Overview	Zhongdong reported on the ongoing validation of the FY-3D, following its launch on 15 Nov 2017. He provided an overview of the new HIRAS IR spectrometer and the GAS greenhouse gas spectrometer with 4 bands in the VIS/NIR, as well an evolution of the MERSI VIS/IR imager, which now has 25 channels with up to 250m resolution. He showed preliminary validation results for these instruments, which are expected to be completed in mid-2018.

Agenda Item: 1i NOAA-20 Imager/Sounder SDR Maturity and Collaboration with FY3D through GSICS – 11:25 (20 minutes)	
Presenter	Mitch Goldberg (NOAA)
Overview	Mitch started by introducing the NOAA-20 Validation team. He explained the commonality between Suomi-NPP and JPSS, which benefited from the lessons learnt on S-NPP. ATMS gives better performances than S-NPP. NOAA now only distributes the Full Spectral Resolution CrIS data. Mitch stressed the importance of international cooperation to ensure fully diurnal coverage from polar satellites. He also reviewed the ICVS website. NOAA has now completed the reprocessing of S-NPP with the current versions of the algorithms. Data have been reprocessed up to March 2017 and are consistent with the current processing.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Peng Zhang asked about the benefit of multiple LEO satellites for polar regions. Mitch hopes that the role of GSICS will be extended in future to cover LEO-LEO inter-calibration to support this. Mitch explained that while the initial need for reprocessing as to fix mistakes, there is an addition benefit for re-analysis of climate data records.	

Agenda Item: 1j Solar band SI-traceable demonstration instrument – 11:45 (20 minutes)	
Presenter	Feng Jiang (SITP)
Overview	Feng Jiang introduced the calibrator module, which SITP are developing for MERSI, which is a spectrometer with 2nm resolution over the 400-1060nm range, and the standard radiometer used to characterize it with an overall uncertainty of 1.3%. It can also observe the Sun (through different onboard attenuators) and Moon.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Larry asked how attenuator changes can be tracked. Feng explained that this is first characterized on the ground, and validated using Moon views.	

Agenda Item: 1k Tansat/ACGS inflight calibration and validation – 12:05 (20 minutes)	
Presenter	Yanmeng Bi/Zhongdong Yang (CMA)
Overview	Zhongdong introduced the TanSat Atmospheric Carbon dioxide Grating Spectrometer (ACGS), which SITP have developed to monitor atmospheric CO2. He explained how observation of Fraunhofer lines are used to validate the spectral calibration, which was found to be very stable. He explained that the small variations observed in the (spectral?)

	calibration over the last year was due to orbital variations, which may reflect deficiencies in the diffuser BRDF(?). Presentation of inter-comparisons with OCO-2 show a good consistency.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Fred asked whether ACGS had been compared with MERSI, which could help understand MERSI calibration (esp spectral). **R.GWG.2018.1k.1: CMA to consider performing comparisons of MERSI and TanSat/ACGS.**	

Agenda Item: 1l TG-2 Multi-Angle Polarization Imager Calibration and evaluation - 12:25 (20 mintes)	
Presenter	Dekui Yin/Yipeng Zhang (SITP)
Overview	Tao introduced the Multi-Angle Polarization Imager (MAPI), an experimental instrument, which operates on the TG-2 spacecraft, which is similar to POLDER and short-wave channels of 3MI. He showed some example results of polarization and non-polarization views of different scenes. He explained how sun glint views were used to validate the on-orbit polarization calibration. He also outlined plans to develop a dual band polarization imager, with an additional 2.2 micron band.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Peng Zhang encouraged GSICS to consider focusing on polarization imagers in the future. Fred pointed out that these instruments can also be useful to characterize the polarization sensitivity of other sensors.	

Plenary GRWG+GDWG Agency Reports Session – PM on 19th March, 2018	
Chair	Dohyeong Kim (KMA)
Minute Taker	Jin Woo
Attendance	Lots - see attendance register!
Remote Attendance	Ashim Mitra (IMD), Munn Shukla (ISRO)

Agenda Item: 2a Agree Agenda & Minute Taking – 14:05 (15 minutes)	
Presenter	Dohyeong Kim (KMA)
Overview	Dohyeong coordinated volunteers to minute-taker each session as follows:

Discussion point, conclusions, Actions, Recommendations, Decisions

Session		Chair	Minute Taker
1: Plenary – Mini Conference	Day-1-AM	Peng Zhang	Tim Hewison
2: Plenary – Agencies Reports	Day-1-PM	Dohy Kim	Jin Woo
2: Plenary – Chairs Reports	Day-2-AM	Scott Hu	Xu Na
3: GRWG+GDWG plenary	Day-2-PM	Dohy Kim	Jin Woo
4: GRWG – IR Sub-Group	Day-3	Tim Hewison	Dorothee Coppens
5: GRWG – UV subgroup	Day-3-PM	Larry Flynn	Yuan Li
6: GRWG – VIS/NIR (1)	Day-4-AM	Tom Stone	Tim Hewison
6: GRWG – VIS/NIR (2)	Day-4-PM	Dave Doelling	Fred Wu
7: GRWG – Microwave Sub-Group	Day-4-PM	Ralph Ferraro	Likun Wang
8: GDWG	Day-3 Day-4	Masaya/Peter Peter/Masaya	Masaya / Peter
9: Plenary – Cross cutting issue	Day-5-AM	Larry Flynn	Ralph Ferraro
9: Plenary – Wrap-up	Day-5-PM	Tim Hewison	Peter Miu

GSICS wiki was not working at the time, so every presenter is encouraged to check their slides.
CMA proposed to change the agenda in Tuesday (Dinner at SITP) to Wednesday, which was accepted.

Agenda Item: 2b CMA Agency Report – 14:20 (15 minutes)	
Presenter	Xiuqing Hu (CMA)
Overview	The presentation was mainly focused on the satellites recently launched, FY-3D and

	FY-4A. HIRAS was switched on 1st of March 2017. Comparisons between HIRAS and LBLRTM are looking very good. Same with comparison with CrIS. Non-linearity correction has been improved and comparisons with CrIS are below 0.5K. Large use of GSICS inter-comparisons to perform the FY-4A calibration. As an example, the comparisons between AGRI and IASI are below 0.5K.

Agenda Item: 2c ESA Agency Report – 14:40 (15 minutes)	
Presenter	Philippe Goryl (ESA)
Overview	Presentation of the Copernicus program and the Copernicus expansion (Sentinel instruments) . The sentinel data are available via the Sentinel Open Access Data Hub. For the flying instrument, there is a good calibration for sentinel-1 (A&B) and Sentinel-2. Sentinel-3A radiometric validation are almost ok (still some work to do), with no impact on the level-2, like for example, the SST which has a stringent accuracy of 0.1K. Relatively large biases found in SLSTR SWIR channels are not yet fully understood, but will be corrected by vicarious calibration in the next release of the dataset. Concerning Sentinel-5P: Very good progress. The level 1b products will be made available around May-June 2018, and all level 2 products by the end of 2018.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Philippe also provided slides on ESA's lunar calibration activities and a forthcoming RTM workshop, which were presented in absentia later in the agenda.	
Agenda Item: 2d EUMETSAT Agency Report – 15:00 (15 minutes)	
Presenter	Tim Hewison (EUMETSAT)
Overview	Tim presented the whole team involved in GSICS on EUMETSAT side. He also presented a status on EUMETSAT actions, then on the EUMETSAT GSCIS products, followed by the EUMETSAT Satellites status.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Further promotion of GSICS products for Meteosat-7? A: Reprocessing and re-calibration of entire Meteosat First Generation archive currently underway as part of SCOPE-CM IOGEO and Fiduceo projects. Q: Knowing the Metop-A drift, how long EUMETSAT intends to continue operating Metop-A ? A: Until end of 2021, when final EoL tests will be followed by controlled de-orbiting Q: Blended VIS/NIR products? A: Initially DCC will be blended with lunar inter-calibration to generate a blended product, which will also contain the results from individual methods. Eventually these methods will be complemented by others, in particular Rayleigh scattering, but in future others.	

Agenda Item: 2e IMD Agency Report – 15:20 (15 minutes)	
Presenter	Ashim Mitra (IMD)
Overview	Presentation of the INSAT instruments and the present operational status. He explained the rapid scan scheme selected for INSAT-3DR, to provide scans of tropical parts of India every 4 minutes. Differences between successive scans highlight developing convection. Ashim also reviewed the current GSICS calibration activities undertaken at IMD, which focus on the development and processing of the Bhuj Pseudo Invariant Calibration site (Parihar and Mitra, 2018), as well as recalibration of Kalpana WV & IR archive data as part of SCOPE-

	CM. INSAT reprocessing is planned on the past 10 years, based on the comparisons with HIRS and IASI. The third topic was the recalibration of INSAT-3D VIS channel using lunar calibration. Ashim showed that a method of removing straylight from INSAT-3D improved the comparisons with GIRO. Finally, he reviewed progress with the implementation of the GSICS DCC method.
Discussion point, conclusions, Actions, Recommendations, Decisions	
IMD will contact EUMETSAT to obtain the necessary IASI data to develop inter-calibration of Kalpana data.	

Agenda Item: 2f ISRO Agency Report – 15:40 (15 minutes)	
Presenter	Munn Shukla (ISRO)
Overview	Munn explained that ISRO currently generate different versions of GSICS products for INSAT-3D, with different latencies, based on the availability of IASI data. They have also developed a physically-based correction, based on analysis of these results, and a Java-based plotting tool. ISRO have also started development of INSAT-3D/MODIS ray-tracing method for VIS/NIR channels, as they have difficulties applying DCC method. Munn also showed results of GEO-GEO comparisons between INSAT-3D and -3DR, which showed some seasonal variations.
Discussion point, conclusions, Actions, Recommendations, Decisions	
GSICS coefficients are not currently available on MOSDAC site. Do they need to be made available online? Where to put version number in filename? Will ISRO be able to join IR session on Wednesday morning? Yes And GDWG? Yes. Request access of DCC statistics (from MODIS?) from GCC? **A.GCC.2018.2f.1: GCC to coordinate DCC Statistics from NASA to ISRO** **A.GWG.2018.2f.1: Munn Shukla (ISRO) to update ISRO membership to WMO.** Q: Spatial resolution of GISAT? 1km-50m, depending on band Q: Does ISRO plan to process GEO-LEO with CrIS? A: AIRS has helped develop with Electro-Optical physical model and develop a delta correction of AIRS-IASI.	

Agenda Item: 2g JAXA Agency Report – 16:30 (15 minutes)	
Presenter	Hiroshi Murakami (JAXA) - Remote
Overview	JAXA launched GCOM-C, with carries SGLI - applying GIRO(Once/month, 7degs). Cross-calibration of passive microwave imagers(AMSR2, AMSR-E, GMI, TMI) and precipitation radars. He is giving an overview of the GSICS activities and status. He is showing the major changes in the GPM/PDM and TRMM/PR calibrations. Hiroshi also showed comparisons of the GSLI IR channels with IASI.

Agenda Item: 2h JMA Agency Report – 16:30 (15 minutes)	
Presenter	Masaya Takahashi (JMA)
Overview	Masaya presented Himawari-8 and -9 AHI calibration, based on inter-comparison with IASI, and also other GEO missions. Masaya reported an update to the processing of Himawari-8 to reduce striping, based on special observations during Himawari-9 health check activation, to perform the Best Detector Selection. He also showed GEO-GEO comparisons of Himawari-8/9 during this period, which showed ~4% difference in B01 and B05.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Masaya's investigation of various regression methods will be reported at future web meeting, in conjunction with Tasuku Tabata, who has applied a similar method as part of his contribution to SCOPE-CM IOGEO. Benefits of GEO-GEO comparisons will be written up in minutes of this meeting in response to EP action. Q: Is frequent update of the Best Detector Selection necessary? A: not for Himawari-8/AHI, but can be needed for Himawari-9, as detector can change during activation.	

Agenda Item: 2i KMA Agency Report – 16:50 (15 minutes)	
Presenter	Jin Woo (KMA)
Overview	COMS/MI IR GSICS products entered demonstration phase in April 2018. KMA are working to develop ray-matching method and update DCC algorithm for VIS calibration. KMA have been working to set up GitHub project to support GDWG activities. KMA are also developing GEO-GEO comparisons between COMS-AHI KMA changed SRF of COMS WV channel in 2017, based on GSICS results.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: GEO-GEO comparisons with which satellites? A: AHI. Q: Why not include comparisons with CrIS into Demo phase? A: So far only IASI and AIRS, but will do CrIS too.	

Agenda Item: 2j NASA Agency Report – 17:10 (15 minutes)	
Presenter	Xiaoxiong "Jack" Xiong (NASA)
Overview	Slides provide nice summary of NASA's GSICS activities from Langley and Goddard centers.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: how to convert MODIS C5 to C6? Adjust inter-calibration products derived from comparison with MODIS to be consistent with VIIRS. Which VIIRS? Jack will provide information to support decision of which to use as a reference in IR and VIS/NIR sessions.	

Agenda Item: 2k NIST Agency Report – 17:50 (15 minutes)	
Presenter	Xiaoxiong "Jack" Xiong (NASA)
Overview	Jack gave an overview of NIST's GSICS activities, which include: Ongoing development of NIST-traceable lunar observatory - will be operated on ER-2 in late 2018. Calibration of Orbiting Carbon Observators #3. Continued support of VIIRS and CrIS characterization. Continued use of NIST calibration services.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Would NIST also be interested in participation in potential workshop on development of SI-traceable hyperspectral reference instrument? A: NIST were involved in the initial stages of the CLARREO project and will be kept informed of the potential for a workshop on this subject. Comment: NIST is also involved in the development of microwave reference standards.	

Agenda Item: 2l NOAA Agency Report – 18:10 (15 minutes)	
Presenter	Fangfang Yu (NOAA)
Overview	Fangfang has presented the GSICS activities at NOAA, which include NOAA-20 calibration support. Also, SNPP CrIS SDR reprocessed data is completed and is available. Soon the VIIRS reprocessed data version 1 (2012-2017) will be made available. Version 2 will come. Several visiting scientists with CMA and EUMETSAT. NOAA-20 data will be declared provisional maturity and will be disseminated soon to the users. (Update VIIRS, CrIS and ATMS have been released. https://www.star.nesdis.noaa.gov/icvs/index.php)
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Is the reprocessing of S-NPP/VIIRS now available on CLASS? A: It is planned. Q: Will this include an updated set of f-factors? A: There are different sets of f-factors are available - will be discussed on Thursday afternoon.	

Agenda Item: 2m USGS Agency Report – 18:30 (15 minutes)	
Presenter	Tom Stone (USGS)
Overview	Active involvement on the lunar calibration workshop and validation of the GIRO lunar calibration reference. USGS is operating Landsat-7. End of mission in consideration. EROS calibration/Validation center of Excellence: formally established in June 2017 + workshop focused on cross-calibration of Landsat-8 OLI and sentinel 2 MSI Presentation of the Joint Agency Commercial Imagery Evaluation (JACIE) Program.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Will USGS do routine USGS-GOES comparisons? A: Not aware of any plans, although there is an activity at USGS to generate harmonised products with Sentinel-2.	

Plenary GRWG+GDWG WG Reports + Briefing Session – 20th March, 2018	
Chair	AM: Xiuqing "Scott" Hu (CMA) and PM: Dohyeong Kim (KMA)
Minute Taker	Lin Chen + Na Xu (CMA) and Jin Woo (KMA)

Agenda Item: 3a GCC Report – 8:30 (30 minutes)	
Presenter	Larry Flynn (NOAA)
Overview	Larry Introduced GCC activities, recent progress on GSICS Product status (Nine new products accepted), action webpage, action summary, and Near-term goals (GCC continues to publish the Newsletter, to support the collaboration and planning of GSICS research and other activities with complementary groups such as GRUAN, GNSS and WIGOS).
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Current status of actions? Which are now visible from GCC website? All 2016 and 2017 actions on GCC website https://www.star.nesdis.noaa.gov/smcd/GCC/MeetingActions.php. Users are requested to use the actions page on the google tracker as well as the GCC website and provide feedbacks for improvement. Q: GSICS Product Catalog out of date for NOAA product? A: Will discuss offline **A.GCC.2018.3a.1: GCC-NOAA GDWG to propose improvements (and provide prototype) in GSICS Product Catalog that can combine the plotting and data representation on the product catalog.**	

Agenda Item: 3b GDWG Report – 9:30 (30 minutes)	
Presenter	Masaya Takahashi (JMA)
Overview	Masaya introduced GDWG membership and current main activities at GDWG, updated ToR, Chairing (One chair and two vice chair), fact sheet (to solve limited resource issues at each agency),collaborative servers (currently 3 Collaboration Servers CMA/EUM/NOAA and potential 4th Server at ISRO), use of Github for collaborative work (How to actually work on GitHub need to be discussed), instrument event logging (1st step is to build Landing page to link WMO/OSCAR, and the 2nd step need a sub-working group with technical and database experts will be discussed). He introduced the new Action Tracker build by NOAA and the scripts that can be used to download the GSICS data shared by NOAA GDWG. Masaya also sought updates on the GSICS Wiki from NOAA.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Will each agency have its own GitHub account? A: Yes - but so far only for GDWG. It is also possible to set up for GRWG if needed Q: Is the incoming vice chair expected to attend the annual meeting to support the GDWG? A: Yes - this implies agency support, and the work group did not object to this. Suggestion: to request the participating agency to support the IMD member in attending future GSICS meeting to support GDWG activities. Tom commented that standard nomenclature for calibration events will be difficult to consolidate. Q: Can GDWG share predictions of SNOs?	

A: Yes - if GRWG provides tools. Fred added that NOAA has some online already, focusing on NOAA and IASI, but this relies on getting support. CMA also has these tools. Regarding the tools for predicting SNO (Simultaneous Nadir Overpassing) - If a new tool is required as a GSICS standard, User Requirements should be specified for discussion by the GDWG.

A.GCC.2018.3b.1: Manik Bali to set up web meeting in September 2108 to discuss requirements for sharing SNO predictions and/or tools.

Agenda Item: 3c GRWG Report – 9:30 (20 minutes)	
Presenter	Dohyeong Kim (KMA)
Overview	Dohyeong introduced all the actions from GSICS during 17/18, actions and commendations from CGMS, EP, all the web meeting, support the CLARREO , collaboration with ISCCP.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Hank commented the term of "SI traceability". It is also discussed that calibration event logging task team under GSICS prepared the "White paper" for the instruments calibration logging system, and that considering GSICS to confine only calibration not whole instrument event logging. As for the concerns of GSICS discussed above, Dohyeong Kim needs to feedback to CGMS-46 during the WG I and IV joint session in June 2018.	

Agenda Item: 3d GRWG IR Sub-Group Briefing Report – 10:00 (20 minutes)	
Presenter	Tim Hewison (EUMETSAT)
Overview	Tim reviewed the Terms of Reference of the IR Sub-Group. Likun Wang was elected as the new IR sub-group chair. Presentation of the IR sub group activities, followed by the products status. Review of the actions, some remaining ones from 2016 meeting.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Comment: GEO-LEO products need a reference instrument. How can choose which is a better reference? Need to give such report on references every year. Same for visible. A: Tim will make such a presentation. The difference between the sounder can based on double difference comparison. GRWG compares the difference, and users can choose any one of them. **D.GIR.2018.3d.1: Likun Wang nominated as new chair of IR Sub-Group.** **A.GIR.2018.3d.1: Likun Wang (NOAA) to coordinate routine comparisons of potential hyperspectral reference instruments (extended to include HIRAS) and report at annual meeting.**	

Agenda Item: 3e GRWG VIS-NIR Sub-Group Briefing Report – 10:20 (20 minutes)	
Presenter	Dave Doelling (NASA)
Overview	Dave reported VIS-NIR Sub-Group activities - VIS/NIR reference instrument, migrating to NPP-VIIRS as the reference instrument, introduce SBAF, Lunar calibration, GIRO benchmark, DCC calibration status. He pointed that GSICS to provide both lunar and DCC calibration coefficients. He also commented that both range and resolution of solar spectra are important.
Discussion point, conclusions, Actions, Recommendations, Decisions	

Q: if GSICS can share lunar calibration dataset, including space and ground-based observation
A: Yes, it can be share to anyone interesting on lunar calibration under GLOD.

Comment: DCC reflectance in shortwave is weak should be careful deal with.

R.GVNIR.2018.3e.1: When releasing new versions of reprocessed L1 data, GPRCs are recommended to consider whether a correction could be developed to approximate the changes from the previous version - and with level of uncertainty.

Agenda Item: 3f GRWG UV Sub-Group Briefing Report – 11:10 (20 minutes)	
Presenter	Larry Flynn for Rose Munro (EUMETSAT)
Overview	Larry presented the Baseline Projects of the UV group, including the Reference Solar Spectrum selection, white paper on Ground-based Characterisation of UV/Vis/NIR/SWIR spectrometers, Match-ups and Target Sites and Cross-calibration below 300nm.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Compare solar measurements from SBUV (Backscatter Ultraviolet) instruments. Larry commented that White Paper is still in drafting stage. He also commented that the first five years of S-NPP OMPS NP measurements will be reprocessed and compared to the NOAA-19 SBUV/2 instrument records.	

Agenda Item: 3g GRWG MW Sub-Group Briefing Report – 11:30 (20 minutes)	
Presenter	Ralph Ferraro (NOAA)
Overview	Ralph presented the goals, membership, progress on action items assigned one year ago and focus areas for the upcoming year. Overall, the MW sub group continues to thrive in terms of membership, including linking to similar activities carried out through other programs such as NASA's GPM X-Cal group, FIDUCEO and the GAIA-CLIMATE program, to name a few. Progress made on several action items.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Use of GNSS-RO to monitor calibration of microwave temperature sounders as per EP assigned action Use of GRUAN as reference data and provide any progress as input to Peng Zhang to report at CEOS AOPC Q: Are RTM comparisons GSICS business? Comment: RTM based on reference profile is an important supplement to SNO, but is only performs well in oxygen absorption bands (50-60 GHz). It is difficult to get clear profile for window channels, surface emissivity is important. The MWSG were encouraged to establish traceability chains for inter-calibration products and propagate uncertainties - particularly when using methods involving GNSS-RO, NWP+RTM and FCDR.	

Agenda Item: 3h Discussion – 11:30 (20 minutes)	
Presenter	All
Discussion point, conclusions, Actions, Recommendations, Decisions	
Discussion was taken above.	

Agenda Item: 3i Improved calibration results of FY-4A/AGRI and some recommendations to GSICS GEO-LEO IR baseline algorithm –12:40 (20 minutes)	
Presenter	Qiang Guo (CMA)
Overview	Early bias monitoring of AGRI wrt IASI showed relatively large biases (~0.5-1K) wrt IASI. Developed on-orbit SRF modification of IR2 band (~12micron) based on contamination by water ice. RSB now uses pre-launch calibration, as onboard calibration is problematic. Proposed revisions to GEO-LEO IR algorithm: more accurate spatial collocation and parallax correction. Wavelet processing used to remove stripes from absorption bands. Simulated parallax correction for GEO-LEO for clouds with different heights. CMA developed GeoCAVS system for quality monitoring.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Do IR SRFs continue to change? A: Agreed could correct in radiance-space with GSICS Correction. Q: Routine updates of RSB calibration coefficients? A: Yes - based on vicarious methods Q: accurate collocation and parallax correction - can introduce systematic bias? A: Difficult to determine given the sample size, but certainly reduces noise, as expected. Q: variable weightings? A: Refined collocation criteria - with dynamic weightings Q: For the window channel, ice contamination?	

Agenda Item: 3j Advanced next-gen GEO imagers - GOES-16 –13:00 (20 minutes)	
Presenter	Fred Wu (NOAA)
Overview	Fred provided an overview of the GOES-16 Cal/Val Plan. No radiance-dependence in bias of 13.4micron band - suggests no significant build-up of ice contamination. Seasonal variation of visible channel calibration due to angular variations on solar diffuser. Daily average of EW INR error is in 1 micro radian. Channel to channel registration error are less than 0.5km(14mrad), expect for channel 16. Collaboration with JMA allowed the development of straylight correction for ABI, based on lessons learnt from AHI.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Any radiance-dependence on bias in IR channels? (AHI does for 3.9 micron channel in cold scenes) A: Not significant in most channels. **A.GIR.2018.3j.1 Fangfang Yu (NOAA) and Masaya Takahashi (JMA) to investigate radiance dependence of ABI 3.9 micron channel.** Q: Raw data? A: Not required to archive, but available Q: what did cause the update of scan mirror emissivity? A: Tested at PLT(?), but additionally, user feedback suggested up and down residual errors in CONUS images, and confirmed based on Moon views. (?)	

Q: Any midnight calibration anomalies?
A: None find by comparison of IASI and CrIS inter-calibration results, which were further minimised by updating scan mirror emissivity LUTs.

Q: Cause of B02 channel bias?
A: not known but GOES-17 will provide some information.

Q: Vertical striping in 1.6micron band for dark scenes?
A: not investigated yet.

Agenda Item: 3k NOAA-20 CrIS calibration status and preliminary differences between SNPP and NOAA-20 CrIS –13:20 (20 minutes)	
Presenter	Likun Wang (NOAA Affiliate)
Overview	Likun showed differences between Cris in S-NPP and CrIS on NOAA-20. Black Body emissivity has been improved in the NOAA-20 CrIS. Noise(NEdN) is comparable to the S-NPP. Radiometric uncertainty and accuracy analysis is going (1K). In band 2, FOV 9 out of family. Non-linearity: Only FOV9 has non-linearity in band 2. Band to band registration: FOV8 still needs some adjustment. (+46) initial calibration table upload (v112) (+60) second calibration table (v113) Spectral offsets of relative and absolute for all 3 bands are all within +- 1ppm using engineering packet (v114). Geo-location trend (at nadir) after mapping angle updated (v114) decrease error (almost close to zero).
Discussion point, conclusions, Actions, Recommendations, Decisions	
Masaya Thanked Likun for providing the information regarding impacts of CrIS Normal/Full Spectral Resolution on GEO-LEO-IR.	

Agenda Item: 3l Dealing with Multiple References: NRTC & FCDR + Fiduceo Feedback –13:40 (30 minutes)	
Presenter	Tim Hewison(EUMETSAT)
Overview	Tim asked how to deal with multiple reference in NRT correction. 1. just switch refA => refB: single ref w/jumps. 2. switch refA => refB + delta: single ref, no jumps. 3. just average all ref: multiple ref, with jumps, assign uncertainty to cover. i) If so, what to call it ? ii) e.g. “Blind Blend”, “Consensus Reference”, … 4. Full Prime GSICS Corrections.
Discussion point, conclusions, Actions, Recommendations, Decisions	
While it was recognised that GRPCs will continue to generate NRT Corrections using single references, an additional step is needed to allow users to ensure temporal consistency between references. However, it was not felt that full Prime GSICS Corrections are needed for NRT applications. **D.GWG.2018.3l.1: The group recognized the important role of GSICS to monitor the calibration of different reference instruments. Where these are stable, GSICS should aim to derive delta corrections to allow the traceable transfer of reference instruments for NRT applications.**	

Agenda Item: 3m GEO-GEO benefits and RGB Composites – 14:10 (20 minutes)	
Presenter	Masaya Takahashi (JMA)
Discussion point, conclusions, Actions, Recommendations, Decisions	
The talk was postponed to future web meeting (May 2018) due to time constraints.	

Agenda Item: 3n GEO-Ring: SCOPE-CM IOGEO – 15:00 (20 minutes)	
Presenter	Rob Roebeling (EUMETSAT)
Overview	Rob introduced SCOPE-CM IOGEO project which aims to re-calibrate and inter-calibrate all available IR, WV and VIS radiances of geostationary imagers. GSCIS based re-calibration method and observation collocation software (STAMP) was developed within the project. Time series of reference radiances from HIRS, AIRS, IASI and version 2 HIRS netCDF dataset have also been generated. Member agencies re-calibrate MFG, FY-2, GOES, GMS/MTSAT observations. He also introduced ERA-CLIM2 which aims to achieve sensor equivalent calibration and reference sensor normalized calibration. The former refers to the calibration as it should be (i.e. individual reference across multiple monitoring sensors), and the latter refers to one reference sensor from a series or a hypothetical sensor. He presented both calibration results for MFG/MVIRI. Then Rob reported IOGEO/GSICS joint activity to inter-compare both calibration results. EUMETSAT setup FTP server to collect GEO re-calibrated L1 data (2015-08-19 and 2016-07-21) from all the member agencies. Almost all the data have been already collected, so the next step to inter-compare IOGEO/GSICS results including comparison of multiple imagers' calibration over GEO overwrapped area.
Discussion point, conclusions, Actions, Recommendations, Decisions	
This presentation and discussion was deferred to the Data Working Group at 16:00 on 21 March. A way to find IOGEO beta users who validate the re-calibrated radiance was discussed. Dohyeong commented that KMA would be interested in Clear Sky Radiances generated from re-calibrated data. Masaya proposed to call for the beta users at international meetings such as CGMS International Clouds Working Group (to be held in Madison, Oct/Nov 2018 and Rob is a rapporteur). The audience was limited number of GRWG, so detailed discussion will be done at the future web meeting. Q: Is ATBD available for VIS? A: Not yet, but the current method for MVIRI is vicarious calibration (i.e. SSCC).	

Agenda Item: 3o FIDUCEO Update – 15:20 (20 minutes)	
Presenter	Viju John (EUMETSAT)
Discussion point, conclusions, Actions, Recommendations, Decisions	
Viju was not available to give this presentation, so the update was included in the following item.	

Agenda Item: 3p FIDUCEO inter-calibration requirements and formats – 15:40 (20 minutes)	
Presenter	Frank Ruethrich (EUMETSAT)
Overview	Frank explained that FIDUCEO requirements for FCDRs were based on those from the GOC: that re-calibrated time series should include past/present/future instruments with suitable handling of their overlap periods. FCDRs should contain information needed to generate CDRs and provide traceability information; the uncertainty model used to create uncertainty information included in FCDRs must be characterized and clearly documents; FCDR

	uncertainty information must include a description of error correlations; FCDR documentation should make use of standard metrological definitions of uncertainty vocabulary; FCDRs should contain either uncertainty estimates separated into components - or be represented as an FCDR ensemble; FCDRs should be quality-controlled at pixel, scan-line and orbit level. Furthermore, all feasible telemetry information and metadata should be included in the FCDRs. Frank went on to introduce the reconstruction of the MVIRI visible channels' SRFs. Reconstruction spectral response curves are broadly similar to the MET7 pre-launch characterization. MET2: normalized count residuals show some seasonal variations for Desert, Ocean and DCC.

GRWG Breakout Session Day-1 (IR Sub-Group) – 21st March, 2018	
Chair	Tim Hewison (EUMETSAT)
Minute Taker	Dorothée Coppens (EUMETSAT)

Agenda Item: 4a Introduction to IR Sub-Group – 08:30 (10 minutes)	
Presenter	Tim Hewison (EUMETSAT)
Overview	Introduction of IR sub-group and the GEO-LEO IR products progress.

Agenda Item: 4b GEO-LEO IR Product Progress – 08:40 (30 minutes)	
Presenter	Each Agency
Overview	JMA: Masaya is presenting the IR update with the plan to implement the prime GSICS correction to AHI. Calculation of the systematic uncertainties. EUMETSAT: Tim is presenting the GEO-LEO IR update. Currently testing the impact of GSCIS correction in MPEF. Problem was found in the tropospheric humidity products. EUMETSAT is testing to use the GSICS calibration correction ad it has fixed the problem in the tropospheric humidity. This is under investigation ad could be reported during a next meeting. NOAA: FangFang is presenting. Comments on the plotting. They are using IASI-B for intercalibration with SNPP, not IASI-A. Q: GSICS correction for ABI? A: This is in the plans. Bias and the correction later. CMA: Scott is presenting. ATBD for FY-2 are being finalizing or the demonstration mode. KMA: Minju presents the operation of WV SRF shift, the double differences of COMS/MI and Metop/IASI-A. Comparison with IASI-B has highlighted the recent change last August 2017 in the IASI-B processing. The products are demonstration. ISRO: Nobody online. Status of the products is the demonstration phase. INSAT-3D imager and sounder. GSCIS coefficient are not currently available on MOSDAC site (comment raised on Monday). Do they need to be made them available? Discussion on whether to accept CrIS as GSICS reference? That question will be considered at the end of the session.
Discussion point, conclusions, Actions, Recommendations, Decisions	
A.GIR.2018.4b.1: Masaya Takahashi (JMA) to report double differences with of IASI and CrIS (using AHI). **A.GIR.2018.4b.2:** Xu Na (CMA) to prepare ATBD and other information to submit to GCC for the demonstration FY-2 products. **A.GIR.2018.4b.3:** Manik Bali (NOAA) to follow on distribution of the ISRO correction coefficients to GSICS.	

Agenda Item: 4c GEO-GEO comparisons – 9:10 (20 minutes)	
Presenter	Yusuke Yogo (JMA)
Overview	The purpose is to check the consistency of AHI-8/-9 calibration performances. SBAF analysis and comparison with IASI-A to check the spectral response functions. It helped at removed the spectral mismatch between AHI-8 and AHI-9. Then, the SBAFs are used to make GEO-GEO and GEO-LEO comparisons. Validation of the diurnal variations.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Comment: Temporal gaps in diurnal coverage would be improved with reference instrument in early morning orbit. Q: Limitations on longitude difference between GEOs? Q: Comparison of SBAF results with SBAF tool? Q: Would it be possible to make comparisons with FY-4 imager? A: FY-4 imager data will be disseminated in a month. **Proposed Recommendation:** JMA/CMA to work together on making GEO-GEO inter-comparison, using IASI. [Later agreed as unnecessary in 10i in view of the following action] **A.GIR.2018.4c.1:** JMA (Masaya Takahashi) / CMA (Na Xu) to work together on making GEO-GEO inter-comparison, using IASI. **A.GIR.2018.4c.2:** Yusuke Yogo (JMA) to make comparisons between JMA SBAF and NASA SBAF tool.	

Agenda Item: 4d CrIS Gap Filling toward Improving Inter-calibration Accuracy – 09:30 (20 minutes)	
Presenter	Hui Xu/Likun Wang (Univ. of Maryland/NOAA Affiliate)
Overview	Presentation of the preliminary results on the CrIS Gap filling, based on the PC analysis. Using Hamming apodised CrIS. Validation over the 3 bands of CrIS are below 0.1K. Comparisons with IASI is ok in band 1, end of band 2 are within 2K and end of band 3 within 5K. This method is used for inter-calibration only, not for retrievals.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Time taken in training dataset? A: static 4 days in different seasons. Comment: Even with 1 year of training data, still miss some rare extreme event. Q: Is there a nieed for scene-dependence? A: Not if the training dataset includes all eventualities - e.g. So2 from volcanoes. Q: Why add noise if real obs used in training data? Q: PC selection based on noise per FoV? Q: Share code? and coefficients? A: All will be put on line. Q: Comparison with JMA gap filling? A: Previous method did not work well for big gaps, because few profiles were used.	

Q: Application to extension of SWIR?

Q: Deficiency over desert - high radiance scenes or emissivity?

A.GIR.2018.4d.1: Na (CMA) to compare with the JMA gap filling methods. To report at the next web meeting in 2-3 months.

A.GIR.2018.4d.2: Likun Wang (NOAA) to set up web meeting to discuss comparisons of gap-filling methods and plan way forward by June 2018.

Comment: to make the test using IASI only. To pretend IASI has gaps, to fill them with this method, and to check over time the reality of the gaps filled with real IASI data. That would be the best validation.

A.GIR.2018.4d.3: Hui Xu to apply gap-filling method to IASI following to previous comment (two IASI data wt/wo gap).

Q: Can we use this method for HIRS?
A: No information, so probably not.

Agenda Item: 4f Vector-based Fast and Accurate Collocation Method for GEO and LEO instruments – 09:30 (20 minutes)	
Presenter	Likun Wang (NOAA Affiliate)
Overview	Presentation of difficulties to collocate measurements coming from different instruments, and platforms, in particularly the pixels distortion at the swath edges. A good methodology is the K-D tree search, to pair pixels. The method is simple and accurate, and can be easily transformed into other sensors. Current status of the code is dealing only with circular pixels. Future work is to include different pixel shapes.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Is the time difference or the geolocation uncertainty more important ? A: Depends on the application and users' needs Q: Comparison with collocation method proposed by Qiang Guo (CMA)? Q: How fast is it? **A.GIR.2018.4f.1**: CMA to apply Likun Wang's collocation method to LEO-LEO cases. Tim to consider applying method to SLSTR-IASI (not an action, just a note!)	

Agenda Item: 4g Early calibration results of FY-4A/GIIRS during in-orbit testing – 10:40 (20 minutes)	
Presenter	Xuan Feng (CMA)
Overview	Xuan introduced the GIIRS, a Michelson interferometer operating on FY-4A geostationary satellite and explained how the radiometric calibration is validated by comparison with IASI. Band edges noise is large, when comparing with IASI. Spectral calibration using earth scene atmospheric lines (IASI?). Results are better than 10 ppm.

Discussion point, conclusions, Actions, Recommendations, Decisions
Q: How many collocations per hour? A: 100-200 samples in 3 months for the one-to-one comparison with IASI. CMA will investigate relaxing the collocation criteria to attempt to average out the impact of cloud contamination in the match-ups. Q: Cause of calibration differences in different FoV? A: one to one pixel comparisons. Q: For the spectral calibration, which lines are used? A: CO2 band in band 1 (718-720 cm-1) more the left side of CO2 because of the noise in that region, and in band 2 (1965-1995cm-1). Q: Are the 2 bands co-registrated? A: No, they don't. The distance between the two bands is half pixel.

Agenda Item: 4h GIIRS and HIRAS Hyperspectral instrument evaluation for FY-4A and FY-3D – 11:00 (20 minutes)	
Presenter	Hanlie Xu (CMA)
Overview	Presentation of GIIRS/CrIS, HIRAS/CrIS and MERSI/HIRAS consistency checks. GIIRs/CrIS bias is less than 1K. GIRS is colder than CrIS of 0.5K. AGRI/GIIRS check: in the window bands, the bias is small. In the absorption band, bias is larger. HIRAS/CrIS: good consistency. Non-lineariy has been improved, less than 0.5K.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Which CrIS used? apodised? A: yes. That makes the large differences at the beginning of beginning of band 1. The comparison would improve in using unapodised CrIS spectra.	

Agenda Item: 4i Inflight SRF retrieval based on hyperspectral reference instrument – 11:20 (20 minutes)	
Presenter	Na Xu (CMA)
Overview	The results presented are based on ideal experimental measurements. The method is a 1-dvar retrieval method, which requires a priori information Na explained the use of "Smooth Index" to characterise the quality of the retrieval.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Addition of offset/slope/quadratic term to account for relative calibration differences? A: A term could be added to take into account the calibration differences, like the non-linearity. Q: Is additional noise diagonal? A: Yes. Q: Have you looked at the uncertainty on retrieved SRFs? A: Not done yet.	

Agenda Item: 4j SLSTR-IASI – 11:40 (20 minutes)	
Presenter	Tim Hewison (EUMETSAT)
Overview	Following the presentation done last year from EUMETSAT. Question of providing a GSICS correction for the LEO imagers. The answer is yes but this needs to be thought further,

	several open points to answer. No further development has been done since last year - the focus has been on developing an operational calibration monitoring system and on preparation for Sentinel-3B launch.

Agenda Item: 4k VIIRS/MODIS – 12:00 (20 minutes)	
Presenter	Jack Xiong (NASA)
Overview	Jack reviewed the on-orbit calibration of MODIS and VIIRS thermal emissive bands (TEBs) S-NPP/VIIRS is more stable than Aqua/MODIS, which in turn is more thermally stable than Terra. N-20/VIIRS gain degradation is much larger than expected (due to ice contamination), reset by decontamination procedure. Need to investigate if there is any source of ice contamination. Inter-calibration between A-MODIS and NPP VIIRS, using SNOs. Same for S-NPP and N-20.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Do we need GSICS Corrections for VIIRS/MODIS? Given that the on-orbit performance is monitored and remains "satisfactory"? A: Maybe needed for SST applications.	

Agenda Item: 4l HIRAS calibration algorithm and uncertainty budget & non-linearity – 13:20 (20 minutes)	
Presenter	Chengli Qi/ Chunqiang Wu/ Minjian Gu (CMA)
Overview	HIRAS: Radiometric requirement 0.7K, spectral requirement < 7ppm. 29 Scan + 2 Internal BB +2 deep space. HIRAS was switch on 1st of March 18. Optical alignment and ZPD position tuning have been done. Spectral validation using the LBLRTM simulation (with which SRF?): very good agreement in different bands, after only 3 weeks of data. Presentation of pre-launch radiometric uncertainties. BB emissivity = 0.9946 with 0.25% uncertainty.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Are any elements of Dave Tobin's CrIS uncertainty not included in this analysis? A: Seems to be complete, but will follow-up offline. Q: ICT Thermal gradients during cool-down tests? A: <0.2K and smaller gradients in cool-down than warm-up.	

Agenda Item: 4m IASI-A/B comparisons before/after the nonlinearity change – 13:40 (20 minutes)	
Presenter	Hank Revercomb (SSEC)
Overview	Hank presented the results of the SSEC analysis of comparisons of IASI-B and IASI-A before and after the non-linearity change, based on double differencing with CrIS in "big circle" polar SNOs (<100km, <45min). This showed changes from differences ~0.3K across the whole long-wave band to be more consistent with CrIS across the dynamic range. The consistency of these results with those of other groups are still in discussion. He emphasized the importance of having a HIRAS in the early morning orbit. He showed that the new non-linearity correction implemented on-board IASI-B has brought IASI-B more consistent with CrIS.

Agenda Item: 4n Roll-out changes to IASI Processing – 14:00 (20 minutes)	
Presenter	Dorothee Coppens (EUMETSAT)
Overview	Dorothee reminded us of why IASI was chosen as a reference for GSICS - the high spectral resolution and contiguous spectral coverage, with high spectral accuracy (<2ppm). Furthermore, the L1c products are harmonized and the SRF influence is removed, making is easy to use. One small change to the processing in 2011 - which effected pixel 2 application for trace gas application. Reprocessing implements this and introduces cloud mask to whole data record. Dorothee also described the roll-out of the change to the onboard processing in IASI-B to improve the non-linearity, and looked at the impact on comparisons with IASI-A and CrIS analysed by OBS-CALC (in addition to SNO methods used at CNES). However, users requested more time to assess impact, which will be reviewed by task force of ISSWG members on 6 April 2018, to be confirmed at RevEX.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Comment: Survey of GSICS users resulted in a 100% preference for not changing IASI-A processing! Q: Confirmation of spectral resolution and spectral sampling definitions. Did they change for IASI? A: No change for IASI. Explanation made on the confusion of the definition. 0.625 of CrIS or HIRAS are spectral sampling and have to be compared to 0.25 of IASI. The spectral resolution can't be the same numbers, by design. A good explanation is the apodisation: It affects the spectral resolution (enlarge the SRF for the same channels), but does not change the spectral channels sampling.	

Agenda Item: 4o Calibration status of NOAA20 CrIS and intercalibration – 14:20 (30 minutes)	
Presenter	Hank Revercomb (SSEC)
Overview	Hank is presenting the CrIS radiometric uncertainties. Correction of the polarization mostly in band 3, and the non-linearity mostly in band 1. Also ringing issues. He emphasized the importance of characterising instrument calibration over a realistic range of radiances - and that instruments should also be specified in those terms. Problem in FOV5 (Nadir pixel) unexplained for very cold scenes. Hank is calling for any ideas regarding this kind of problems. Hank is making the comment that spectroscopy needs to be improved, coming from the comparisons OBS-CALC, 1K differences coming from the CALC. Hank has made some comparison of 2.5h of GIIRS data with CrIS data showing a very good agreement.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Is the problem of the N20-FOV5 same than one FOV5 on S-NPP?	

Agenda Item: 4p IRRefUTable Report – 14:50 (40 minutes)	
Presenter	Each Agency
Overview	Presentation of previous Web meeting discussions. Also some differences (SEVIRI-IASI-A) - (SEVERI-IASI-B) showing that the worse case is 0.3K for the channel 13.3 microns for the cold scenes at 200K The way forward is presented with actionees. NWP double differences: Chengli should be added. Aircraft double differences: Joe Taylor is a good candidate. Timeline? => towards the end of the year. Mitch said August 2018 for CrIS.
Discussion point, conclusions, Actions, Recommendations, Decisions	
A.GIR.2018.4p.1: Tim Hewison (EUMETSAT) to organise a web meeting on IRRefUTable in September 2018.	

Agenda Item: 4q Scoring with Oscar + Dealing with Change – 15:30 (30 minutes)	
Presenter	Tim Hewison and Rob Roebeling (EUMETSAT)
Overview	Presentation on the need to keep score. Jerome Lafeuille had proposed OSCAR (WMO), which includes an expert score.intercalibration reference mission created in OSCAR.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Feedback on open action: IRRefUTable report will provide snapshot of performance of different reference instruments GSICS State of Observing System reports can be extended to include annual updates on reference instruments following the format of this report GSICS provide Sub-Group chairs as point of contact for enquiries about choice of reference instrument for different applications As such there is no requirement from GSICS for WMO OSCAR to provide a "GSICS inter-calibration reference" mission, as more specific information could be provided to users through the above channels.	

Agenda Item: 4r Best Practice for Hyperspectral IR Sounder SDR ground processing –16:30 (30 minutes)	
Presenter	Likun Wang (NOAA Affiliate)
Overview	Likun showed some examples of lessons learnt and issues with on-orbit and ground processing of hyperspectral sounders. These include: transmission of full complex interferograms, the question of whether to perform spectral or radiometric calibration first, and the order of processing and downlinking data.
Discussion point, conclusions, Actions, Recommendations, Decisions	
The scope of the initiative was discussed, and a title suggested as "Review of Issues in Processing Hyperspectral IR spectrometers" - could be partner to IRRefUTable? CMA are in the unique position of being able to downlink all the HIRAS raw data from these instruments to allow them to investigate different download options, together with SITP. Development of White Paper? Contributors? Likun Wang, Dorothee Coppens, Denis Jouglet?, Dave Tobin? Likun proposed himself as a coordinator. Alternatively: CMA (Scott?) Dave: Is it worth considering whether it is worth including UV/VIS/NIR in this review? **A.GIR.2018.4r.1:** Likun Wang (NOAA) to work with CNES and EUMETSAT to document the best practice of IR hyperspectral sounding processing.	

Agenda Item: 4t Inter-calibration Algorithm Evolution –17:00 (20 minutes)	
Presenter	Tim Trent (U. Leicester)
Overview	Presentation of the Inter-calibration algorithm (using ensembles methodology) fand its evolutions. The tool creates cluster meta data. There is also collocations with GRUAN (GAIA-CLIM).
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: When we could have some more results? A: In a couple of months. Tim Hewison highlighted several differences between the proposed method and the GSICS GEO-LEO IR algorithm, which would complicate comparison of the results. For example, this algorithm was developed	

for SST applications, so focuses on clear sky condition. Tim Trent explained that the method could be extended to a broader range of conditions.

A.GIR.2018.4t.1: Tim Hewison (EUMETSAT) to set up web meeting to review different GEO-LEO IR inter-calibration algorithm evolutions and invite Tim Trent to give update on results.

The GEO-LEO intercalibration algorithm presented by Qiang Guo (agenda item#3i) was recommended to be reviewed within A.GIR.2018.4t.1 as one of the potential methods for future updates of GEO-LEO-IR algorithm.

Agenda Item: 4v IR Sub-Group activities and leaders –17:20 (20 minutes)	
Presenter	Likun Wang (NOAA Affiliate) and Tim Hewison (EUMETSAT)
Overview	Presentation of the 2 main topics: Hyper-spectral instruments (Likun) and broad- and narrow- band instruments (Tim). Inputs from several agencies: JMA, EUMETSAT, NOAA, NASA, CMA and CNES.

Discussion point, conclusions, Actions, Recommendations, Decisions

KMA plan to:
Continue to collaborate with NOAA for the diurnal variation of IR channels
Continue to use the IASI/CrIS for AMI next year.
GEO-GEO direct comparison between COMS/MI (AMI next year) and AHI

EUMETSAT plan to:
Continue generating GEO-LEO IR Corrections for current GEO imagers
Consider starting to develop multispectral LEO-LEO GSICS products for SLSTR.
Consider continuing development of GSICS Prime Corrections and/or developing blended NRT reference products – subject to discussion at this year's meeting.
Continue involvement in IRRefUTable
Start to develop an SRF retrieval algorithm

NOAA plan to work on:
Vector-based fast and accurate satellite collocation software (Wang)
CrIS spectral gap-filling method and coefficients (Xu)
Creating calibration link between CrIS and GPS RO measurements (Wang) - Add Michele Feltz and Bob Knutson
Inter-comparing NOAA-20 and SNPP CrIS: a) Direct inter-comparison b) through AIRS, IASI, and ABI as a transfer target (Wang)
Best Practice for Hyperspectral IR Sounder SDR Ground Processing (up to discussion results) (Wang)
Continue collaboration with KMA on MBBC
SRF retrieval

NASA plan to:
Continue working on MODIS-VIIRS inter-calibration
Working on SNPP and NOAA-20 VIIRS Inter-calibration

CMA plan to:
Inter-comparing IRAS/FY3, GRIIS/FY4 with CrIS, IASI, and AIRS and report to GSICS
Testing CrIS gap-filling coefficients and method
Testing new collocation method is tested for other GPRO to check the impact of inter calibration of GEO

LEO, LEO LEO.
Continue working on FY4 and FY2 broadband instrument comparison
IR Hyperspectral uncertainty evaluation caused from polarization should be investigated within GSICS community in the near future
SRF retrieval (Xu Na)
Hyperspectral processing options

CNES plan to:
CNES will continue to perform inter-calibration between the 3 IASIs, and between each one with AIRS and CRIS (Denis Jouglet).
Will report IASI-C Cal/Val activities to the sub-group, if needed (Denis Jouglet).
Proposed action on Likun to identify a leader for each group of activities, or institute?

Agenda Item: 4w CrIS as Reference: Additional agenda item	
Presenter	Likun Wang (NOAA Affiliate) and Tim Hewison (EUMETSAT)
Overview	Agree on the questions required to be addressed in order to accept an instrument as a GSICS Inter-Calibration Reference.

Discussion point, conclusions, Actions, Recommendations, Decisions

In order to answer the question of whether to accept CrIS as GSICS Reference, we should address the following questions:
Is its calibration "in family"? (wrt other references) - CrIS agrees with IASI within 0.1K
Is its calibration stable? (wrt other references)
Is its data freely available - with sufficient latency?
Does its orbit, scan and spectral coverage provide suitable coverage?
Does this complement those of other references? (overpass times, spectral coverage)
Is its processing well documented?
Is its pre-launch characterization well documented?
Does it have a heritage as an inter-calibration reference? or is it operated as part of a committed series of satellites - providing continuity?
Are the operators committed to reprocessing for FCDRs?
Are the operators committed to provide scientific support in its use as a reference?

D.GIR.2018.4w.1: CrIS accepted as a GSICS reference on the basis of positive answer to all the above questions.

GRWG Breakout Session Day-1 (UV Sub-Group) – 21st March, 2018	
Chair	Larry Flynn (NOAA)
Minute Taker	Yuan Li (CMA)
Attendance	Guanyu Lin (CIOFMP/CAS) Yu Huang (CIOFMP/CAS) Yuan Li (CMA) Larry Flynn (NOAA) Yongmei Wang (NSSC/CAS) Houmao Wang (NSSC/CAS) Tom Stone (USGS) Dave Doelling (NASA)
Remote Attendance	Rosemary Munro (Chair) (EUMETSAT), Mina Kang (Ewha Womans University), Ruediger Lang (EUMETSAT) Iryna Kylystova (EUMETSAT)

Agenda Item: 6a The technology of a new generation of Ultraviolet Hyperspectral sensors for detecting global ozone profiles – 13:00 (20 minutes)	
Presenter	Guanyu Lin (CIOFMP/CAS)
Overview	Dr. Lin began with a review of the design of Solar Backscatter Ultraviolet Sensors (SBUS) (which flew on FY-3a, -3b and -3c) and the Limb Imaging Spectrometer (LIS) and Annular UV Imager (AUI) which were launched in Sept, 2016 on the Tiangong-2 Space Laboratory. He then gave details on the design and calibration of a new sensor under development for making UV/Vis measurements to generate ozone profile retrievals. It will be capable of making both nadir and limb with hyperspectral coverage from 250 nm to 500 nm at 0.5 nm resolution. On-board calibration will use solar diffusers for both viewing geometries as well as a Hg lamp. The instrument will fly on the FY-3 series of satellites. Guanyu reported on the optical design, the band path measurement, the MTF results and the demonstrated performance.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Yuan Li asked about the temperature control method. Guanyu answered that the sensor will use a thermoelectric method to control the temperature under 0℃. Larry asked if a similar instrument had been used for the ground-based instrument observing the Moon.	

Agenda Item: 6b The successor of the Total Ozone Unit (TOU) – 13:20 (20 minutes)	
Presenter	Yongmei Wang (NSSC/CAS)
Overview	Dr. Wang began with a review of the design, performance and products for the Total Ozone Unit (TOU) UV radiometers which we launched on FY-3a, -3b and -3c. The TOU has been well calibrated and the products such as Ozone were shown. She continued with an introduction to the next generation High Resolution TOU (HRTOU) with will fly on FY-3f. The HRTOU spectrometers will have hyperspectral coverage from 300 nm to 500nm with 0.5 nm resolution and 15x10 km^2 FOVs at nadir. The wide angle total FOR will allow daily global coverage. A dichroic optical element splits the UV/Vis at 370 nm.

Discussion point, conclusions, Actions, Recommendations, Decisions
Larry asked about the incident angles of the solar diffuser view and the Earth-view of the HRTOU. Yongmei answered that they are two different angles. Larry also advised the importance of temperature control and set points for the new CCD array detectors. The detector operating temperature for HRTOU will influence the SNR. The SNR affects the use of the measurements in DOAS retrievals. There is also a tradeoff in the spatial resolution and the SNRs. Yuan asked about the FWHM. Yongmei provided the spectral resolution of the HRTOU.

Agenda Item: 6c FY-3/TOU intercalibration with GOME-2 and OMPS for solar diffuser correction – 13:40 (20 minutes)	
Presenter	Houmao Wang (NSSC/CAS)
Overview	Dr. Wang described comparisons of the FY-3 TOU to Metop GOME-2 and S-NPP OMPS. Comparisons used the SNO method with 300 S and 25 km matchup criteria as well as a spatial uniformity test. Time series of the direct radiance comparison showed significant trends and offsets. Some of these could be accounted for by considering the irradiance (solar) measurement time series.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Larry commented that radiance of GOME-2 is not designed to be stable. The radiance to solar ratio of GOME-2 is stable. And S-NPP OMPS NM is believed to be stable for both. Also the GOME-2 Earth radiances developed a view-angle dependence. Forward modal comparisons using S-NPP OMPS, which can be used to calibrate the residual. Weihe Wang (CMA) had used similar method to predict the TOU radiance. Rose suggested some that the GOME-2 degradation studies can provide information on how it will affect their comparison. Houmao also commented that he only uses the nadir observing with the viewing zenith angles under 30°.	

Agenda Item: 6d In-orbit calibration for FY-3C/TOU – 14:00 (20 minutes)	
Presenter	Weihe Wang (CMA)
Overview	Yuan Li introduced Weihe Wang's work: The Solar irradiance (after BRDF correction) of FY-3C/TOU still has a large difference compared to that of FY-3B/TOU which is consistent with other UV instruments such as SBUS. The solar was significantly lower for all channels that the prelaunch estimates and the measurements from the FY-3b TOU. Since the solar measurements were not stable with time, they could not be used to normalize the Earth radiances. Weihe developed and applied a vicarious calibration approach, using the trends in the minimum estimated reflectivity over tropical Pacific was used to track the instrument throughput changes. After correction, the irradiance results were improved but didn't meet the requirement for ozone retrieval. Additional adjustments were identified with monitoring / validation by using ground-based ozone measurements for four stations reporting to the World Ozone and Ultraviolet Data Center.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Larry suggested using weekly one-percentile reflectivity values for the vicarious calibration method.	

Agenda Item: 6e Report on the NOAA-20 OMPS – 14:20 (20 minutes)	
Presenter	Larry Flynn (NOAA)
Overview	Dr. Flynn gave an update on the calibration and validation of NOAA-20 Ozone Mapping and Profile Suite (OMPS) measurements and products. The NOAA-20 OMPS Nadir Mapper and Nadir Profiler are in-family with the S-NPP OMPS. There are some minor problems but solutions are under development. The Level 1 Sensor Data Records (SDRs) are nearing provisional maturity and will soon be released.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Yuan Li asked about the unusual variation in the ozone products off of Africa. Larry explained that the instrument is sensitive to charged particles in South Atlantic Anomaly. The charged particles hit the detector and create noise. Further processing for outlier detection using the hyperspectral measurements instead of single channels will allow recovery of some of the data. Houmao Wang asked about wavelength shifts for the nadir mapper and why the aerosol index had large variations around Africa. Larry explained that the Solar radiance is compared to a proxy and the Earth radiances are compared to the Solar measurement to identify the shift by using the Fraunhoffer lines. The aerosol differences are created because of cross-track dependent bias in the detector. This means there will be features showing the orbital track and the bias between the left and right sides of the swath. Yu Huang asked how to compare and correct for solar activity. Larry introduced the idea of using Mg-II index and scale factors as a proxy for solar activity.	

Agenda Item: 6f Comparison among Reference Solar Spectra using TROPOMI Solar Measurements – 15:10 (20 minutes)	
Presenter	Mina Kang (EWU)
Overview	Dr. Kang introduced the Sentinel 5 Precursor Tropospheric Monitoring Instrument (TropoMI). The instrument has eight channels covering the spectrum from 270 nm to 2385 nm (with gaps). She gave results from analysis of the preliminary solar irradiance measurements. The solar measurement was first used to develop a fit of the spectral response functions. This was followed by comparisons to proxy spectra from currently available reference solar data sets. Given the large range, multiple references were used. The analysis revealed some disagreement between the KNMI and SAO reference spectra. The TropoMI measurements are at a very good spatial resolution and will be used in underflights matchups for the future GEO instruments (GEMS, TEMPO and S4).
Discussion point, conclusions, Actions, Recommendations, Decisions	
Yuan asked about the measurement method of the bandpass. Mina answered that it was calculated by fitting parameters in a model function. Larry asked how large the wavelength shifts were for each band. Mina answered that they were on the order of hundredths of a nm. So far her analysis is only for one solar measurement. The results for TEMPO are a proof of concept for future work with GEMS and TEMPO. Larry also noted that they can use TROPOMI radiance comparisons as a transfer to monitor the relative bias of the future GEO instruments.	

Agenda Item: 6g Update on Three GSICS UV Projects: Solar, Reflectivity and Residuals – 15:30 (20 minutes)	
Presenter	Larry Flynn (NOAA)
Overview	Dr. Flynn gave an update on NOAA and (some NASA) activities related to three of the UV projects. He began with a review of some key comparison techniques for space-based UV measurements. For the solar comparison project, he showed results for comparisons of solar spectra for NOAA-20 OMPS, NOAA-19 SBUV/2 and the Shuttle SBUV (SSBUV) to synthetic proxy spectra for the 250 nm to 380 nm interval. Some of the differences between the measured and proxy can be removed by including a term solar activity. For the reflectivity channel project, he showed weekly 1-percentile effective reflectivity results using the TOMRad forward model for a target region in the tropical Pacific for S-NPP OMPS and Metop-B GOME-2. For the ozone profile project, he showed time series of zonal means for measurement residuals from the SBUV/2 Version 8 profile retrieval algorithm for NOAA-9, -14, -16, -17, -18, -19 SBUV/2 and the S-NPP OMPS NP. Matchups from a comparison for a chasing orbit for S-NPP OMPS NP and NOAA-19 SBUV/2 were used to estimate calibration biases for the channels used in the Version 8 retrieval.

Discussion point, conclusions, Actions, Recommendations, Decisions

It was noted that the white paper on best calibration for UV Sensors, led by R. Lang of EUMETSAT, was related to the talk/discussion scheduled Friday in 10d.

The reflectivity comparison study uses similar methods as are employed in the visible for vicarious Rayleigh calibration.

A.GRWG.2018.6g.1: Munro to hold a UV Subgroup web meeting focused on a specific UV project topic during the coming six months.

A.GRWG.2018.6g.2: Flynn to provide information on the effect of dichroics on bandpass calculations.

A.GRWG.2018.6g.3: All members (UVSG Chair to coordinate) to find researchers interested in the four UV SG projects and invite them to future meetings as the agenda and their interests dictate.

GRWG Breakout Session Day-2 (VIS/NIR Sub-Group) – 22nd March, 2018	
Chair	AM: Tom Stone (USGS) PM: Dave Doelling (NASA)
Minute Taker	AM: Tim Hewison (EUMETSAT) PM: Fred Wu (NOAA)
Attendance	CMA: Peng Zhang, Scott Hu, Xu Na, Lin Chen, Xiaobao Wu, EUMETSAT: Tim Hewison, Dorothee Coppens JMA: Yusuke Yogo KMA: Dohyeong Kim, Minju Gu NASA: Jack Xiong, Ben Scarino, Dave Doelling NOAA: Franfang Yu, Fred Wu, Likun Wang, Mitch Goldberg, Ralph Ferraro, Larry Flynn (PM) SSEC: Hank Revercomb USGS: Tom Stone
Remote Attendance	Bertrand Fougnie (EUMETSAT) (part-time)

Agenda Item: 7a Outcome of the Lunar calibration workshop – 08:30 (20 minutes)	
Presenter	Tom Stone (USGS)
Overview	Tom introduced the lunar calibration portion of the agenda and provided a report on the outcome of the second lunar calibration workshop. He explained the objectives of the workshop and how the differed from the first workshop, due to the increased interest and greater participation. Key outcomes include: A recommendation to no not rely of the ratio of the measured Moon dimensions to characterise the oversampling factor. USGS has funded work to re-analyse the original ROLO telescope data and publish it. Creation of a benchmark to establish traceability of GIRO to ROLO model. Use of the Moon for inter-calibration requires the residual phase-dependence be accounted for. Use of Moon images to characterise MTF - which will be coordinate with IVOS. Ongoing coordination to build up the GSICS Lunar Observation Database (GLOD). CMA to consider similar plan to ESA to schedule ground measurements. Assess impact of sensor non-linearity on apparent phase angle dependence Agencies to investigate further calculation of oversampling factor NOAA/NASA to interact on VIIRS calibration dataset as inter-calibration reference Establish initiative to develop polarisation model of the Moon To organise a further workshop in ~2 years

Agenda Item: 7b Lunar model validation using ground-based hyperspectral measurement – 08:50 (20 minutes)	
Presenter	Lu Zhang for Yang Wang (CMA)
Overview	CMA have established a ground-based imaging spectrometer, which automatically scans the Moon. Results have been compared with a lunar photometer and found to be very stable. The data processing was described, accounting for dark current, spectral and smear corrections, radiometric calibration (using a lamp and reference plate to give a 1.5% total uncertainty) atmospheric correction before resampling to give an image of the lunar disc, which is integrated to give the irradiance. The

	difference to ROLO was found be ~10%., and depended on phase angle. The Lunar band ratio was calculated wrt the 700nm band. Phase reddening was also calculated.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: total uncertainty =1.5% (k=1) on calibrated radiance, but what about the irradiance? A: Not known yet. Q: Why does oversampling factor change with phase angle? A: Because the Moon drifts through the instruments FoV at different angles/rates. Tom commented that under-sampling of the Moon can introduce errors in the irradiance. He recommended to exclude under-sampled cases from further analysis. Dave asked what is the biggest uncertainty. A: Oversampling which could be addressed with an AOTF imager and atmospheric absorption, which is a limiting factor for all ground-based observations. Q: Which wavelength is best? A: 700nm has the least uncertainty, so is used as a reference band.	

Agenda Item: 7c Interband calibration for atmosphere absorption bands based on Lunar observation – 09:10 (20 minutes)	
Presenter	Ronghua Wu (CMA)
Overview	Ronghua introduced the new channels introduced in MERSI-II, which includes 3 water vapour bands, which are difficult to characterize in the lab. The irradiance was calculated from simultaneous Moon observations in different bands and the ratio used to define the inter-band calibration coefficient. Results showed small deviations (<2%) in bands 16 and 17, but ~10% in band 18 at small phase angles, but larger deviations at high phase angles. Although all the results were stable. He also showed the impact of the improved calibration on L2 products (PWV) wrt those from MODIS.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Tom commented that there should not be a large phase angle dependence, and that there may be some improvement in the processing necessary (e.g. straylight or over-sampling). It was suggested that the method could be used to monitor the stability of the calibration, if a small range of phase angle is analysed. Tom asked how different phase angles were observed. Ronghua explained that they are observed in different view angles through the same optics by changing the timing of the space view acquisition at the same mirror angle.	

Agenda Item: 7d Lunar Simultaneous observation intercomparison from FY-3D and ground-base – 09:30 (20 minutes)	
Presenter	Lu Zhang (CMA)
Overview	Lu explained how near-simultaneous Moon observations from MERSI and a ground-based spectrometer (400-1000nm) were compared. But only 7 cases are available since the FY-3D launch. However, these observations are separated by 3.5hr (~3°

	phase angle). He also raised the question of the influence of the different viewing geometry.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Tom recommended that the different viewing geometry and timing will always need normalisation against a model. Lu explained that the model was used to estimate the impact of these differences. Tom pointed out that the differences in the Sun-Moon-Observer distances also need to be accounted for, which can be done by the model. Dave asked about ARCSTONE's Moon viewing geometry on opposite sides of the orbit. Tom explained that this small-sat dedicated to observe the Moon would require at least ~3 years to build-up the required coverage of the Moon's phase and libration cycle, depending on when the mission starts.	

Agenda Item: 7f Update on the GIRO benchmark – 10:20 (20 minutes)	
Presenter	Tom Stone (USGS)
Overview	Tom introduced GIRO - the GSICS implementation of the ROLO lunar irradiance model, and the activity to build a synthetic dataset covering the full range of Moon viewing conditions to validate GIRO against ROLO. It can also be used to compare other lunar irradiance models. It covers 280 samples over a full 18.6yr Saros cycle for one band (500nm). Additionally, there are 9 SRFs at each of 456 channels covering the range 350-2500nm. This dataset was input to GIRO and ROLO and the results compared. Initial results confirmed the models' kernels agreed within machine precision. However, the resulting irradiances were found to deviate up to 0.14% (at highest phase angle, 86.6°). Further investigation found the difference could not be explained by the different interpolation methods of the SRFs or solar irradiance spectrum. The spectral smoothing of the disk reflectance model outputs was found to be the source of the spectral trend anomaly. The residual structure (~0.02-0.03%) as due to spectral interpolation. Tom introduced a mitigation strategy - he will review discrepancies in the coding implementations and collaborate with EUMETSAT to consolidate these.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Until the differences are consolidated, what recommendations for the use of GIRO? A: No - use as is. GIRO is suitable for satellite calibration purposes and agrees to ROLO within ~0.15%. After the spectral smoothing of the disk reflectance model outputs has been consolidated, the residual differences will be within 0.02-0.03%. Dave asked about the phase/libration coverage obtained within a 3 year observation period. This has not been fully quantified. Q: Could GIRO benchmark be used to address this? A: Only for the single case at 500nm.	

Agenda Item: 7g GOCI-II lunar calibration and MTF plan – 10:40 (20 minutes)	
Presenter	Kibeom Ahn (KIOST)
Overview	Kibeon introduced GOCI - the Geostationary Ocean Color Imager, operating on COMS, and plan of GOCI-II (next generation of GOCI). He reviewed the conditions for GOCI-II to observe the Moon, which result in observations being possible on 1

	or 2 days each month. He described how the oversampling factor was evaluated - based on the ratio of the observed lunar disc. The lunar ageing factor and PRNU were estimated using an implementation of ROLO. Earth-shine straylight was controlled by limiting the angular distance between the Moon and the Earth disc. Two MTF methods were compared - stars and the Moon edge.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Has a degradation in the solar diffuser been detected over 7 years? A: Yes - a little bit. Dohyeong explained further that GOCI has two solar diffusers - one for calibration and a small one for monitoring the degradation of the first. Q: How can stars provide sufficient signal to characterise MTF? A: Only possible in panchromatic band, but no results yet. Tom commented that the impact of the smearing caused by the Moon's movement during the 4.5s acquisition can be accounted for theoretically, but that this is not an over-sampling. Tom offered to provide offline advice on the PRNU characterisation using the Moon.	

Agenda Item: 7h Lunar MTF – 11:00 (20 minutes)	
Presenter	Fred Wu (NOAA)
Overview	Fred provided a summary of the session on the lunar calibration workshop on alternative uses of Moon measurements, focusing on MTF characterization. There are several varieties to the two basic steps needed. Fred showed the results of applying the NOAA method to derive 4 MTF parameters for AHI, ABI, COMS/MI, GOES-15/Imager, SEVIRI, FY-2G. Fred also compared different agencies' methods. He suggested other agencies review NOAA's method and highlight differences to their own method and encouraged GSICS to aim to recommend a best practice on MTF characterization using the Moon, but commented that the very definition of MTF should first be agreed. A working group has been established to address the remaining obstacles.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Dave asked whether a standard exists for ground characterization. Fred explained that it varies for different instruments. Lin Chen commented that the MTF results are very sensitive to the selected region of the Moon and SNR - e.g. CMA identify the line with the sharpest contrast. Fred explained the recommendation to use multiple lines near the lunar equator, and that SNR and MTF were often traded-off in instrument design.	

Agenda Item: 7e Presented in absentia - Philippe Goryl'S ESA lunar calibration activities	
Presenter	Tom Stone
Overview	Philippe's presentation describes a collaborative activity to deploy a new ground-based lunar photometers to improve the lunar irradiance model. The project is scheduled for 21 months starting Sept 2017. NPL are coordinating. 340-1640nm include some polarimetric measurements. The use of Langley plots will require iterative use of a lunar irradiance model. The plan is to apply the model to Proba-V, PLEIADES and GIRO and GLOD.
Discussion point, conclusions, Actions, Recommendations, Decisions	
A.GVNIR.2018.7e.1: Tom Stone (USGS) to invite ESA to present progress on lunar calibration at the 2019 GRWG meeting and next lunar calibration workshop	

Agenda Item: 7j Tansat/CAPI calibration and evaluation – 12:40 (20 minutes)	
Presenter	Ronghua Wu (CMA)
Overview	Ronghua introduced TanSat and described the CAPI instrument. He explained the solar diffuser calibration process and results, which are different from pre-launch calibration by more than 7% in some bands.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Why are the solar diffuser results different from the pre-launch values? A: Pre-launch calibration was performed with a LabSphere integrating sphere. Q: Why is degradation so small? A: Only been operated for 10 months, and solar diffuser door is usually closed.	

Agenda Item: 7k Consistent calibration of VIRRs onboard on FY-3A to 3C – 13:00 (20 minutes)	
Presenter	Ling Wang (CMA)
Overview	VIRR has been operated on FY-3 satellite series for 10 years, but has no onboard calibration. Vicarious calibration using Libya-4 shows large jumps. Uses 12 desert and salt lake targets and 3 dark sea targets with 6S RTM. This gave daily updates with good accuracy and lower temporal oscillations than operational calibration based on annual Dunhuang views.
Discussion point, conclusions, Actions, Recommendations, Decisions	
FY-3A/B/C Consistent calibration removed the apparent discontinuity (life time and across satellites) and reduced coefficient of variation, from ~10% to <3% for on channel. Tim: seasonal cycle in FY-3A? A: Band 2 is 0.9 um, affected by water vapor variation annually. Also found in FY-3B/3C. Dave: Force to zero? Yes. Q: Annual variations in calibration coefficients due to instrument or vicarious calibration? A: No sure - this is Band B02, which is sensitive to water vapour burden. So it could be a residual of an inefficient atmospheric correction. Dave suggested investigating the removal of some bright sites to check whether seasonal cycles remain.	

Agenda Item:7m FY-3D/MERSI-II calibration/validation – 13:20 (20 minutes)	
Presenter	Xiuqing Hu / Na Xu (CMA)
Overview	Scott described the evolution of the MERSI imagers on the Fengyun LEO satellites. Blue band (#8) was found to be quite different in orbit from pre-launch. Also used GSICS DCC method to monitor MERSI calibration, which showed most bands' calibration was stable. Comparisons of the IR bands with MODIS and IASI showed large difference in 4.05 micron band at low radiance, but otherwise good. Used mosaic images to validate geolocation.
Discussion point, conclusions, Actions, Recommendations, Decisions	
FY-3D/MERSI-II Early On-Orbit MERSI-I experimental on FY-3A/B/C, 19 VNIR and 1 IR bands. Progressively higher SNR.	

MERSI-II operational. 25 bands, four of the additional in IR (7.2, 8.5, split window 250m resolution) Stringent spec for SRF, learned from EUMETSAT. BB with higher emissivity and turnable temperature. Reduced stray light. INR error less than one pixel. Yu: spectral homogeneity improvement? A: Better specs. Dave: B21 poor performance at the cold end. A: expected. Jack: Performed Section rotation, instead of maneuver. Jack suggested comparing the 4.05micron band with MODIS band 22, instead of band 21. It was recommended that CMA adopt the term "data sector rotation", instead of manoeuver.

Agenda Item: 7n Calibration monitoring based on Tibet glaciers – 13:40 (20 minutes)	
Presenter	Ling Wang (CMA)
Overview	Ling Wang introduced the vicarious calibration method using Tibet glaciers to fill the gap of higher reflectance of dynamic range in calibration. CV (<5%) is used for Identifying snow PICS over TP. Seasonal variation of Lambertian corrected TOA reflectance compared with MODIS shown due to non-uniformity of surface reflectance and introduced the corrected TOA BRDF at Kunlun. After applying corrected BRDF to FY-3A MERSI, the seasonal oscillation decreased, and comparable to Libya-4.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Calibration monitoring via snow in Tibet. Tim: 0.865 um water vapor absorption? Fred: probably not. Dave: snow target has high reflectance but low radiance. Jack: depends on whether the calibration is based on radiance or reflectance. Q: annual cycle in 865nm channel over Libya 4? Discussion on trade-off between performing calibration in radiance or reflectance.	

Agenda Item: 7o New BRDF Model in Dunhuang field campaign for Vicarious calibration/validation – 14:30 (20 minutes)	
Presenter	Yuan Li (CMA)
Overview	Yuan Li introduced the new Equivalent Mirror Plane(EMP) BRDF model that is suitable for the near Lambertian surface in Dunhuang for vicarious calibration. EMP BRDF model is validated using four model including one empirical and 3 semi-empirical model. Results showed the EMP model can work at the larger view zenith angle.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Dunhuang campaign: BRDF first in 1999 and last in 2017. Fred: any change in BRDF since 1999? Have not compared, but it should not change. Has that been used as a constraint to understand measurements? Sometimes BRDF changes, e.g., after rain or dust storm. Dave: what limits sampling? Q: Do you think the BRDF has changed since it was last measured 18 years ago? Could use as a constraint	

on measurements?
A: It could change.

Q: What limits the samples (e.g. cloud)?
A: No - it is the BRDF characterisation that is sparsely sampled.

Agenda Item: 7p Status of Terra/Aqua-MODIS and NPP/J1-VIIRS – 14:50 (20 minutes)	
Presenter	Jack Xiong (NASA)
Overview	Jack Xiong introduced the status of T/A MODIS and VIIRS on NPP/JPSS-1 and the on-orbit performance of RSB. A-MODIS shows SD degraded larger at SW than T-MoDis and VIIRS. SNPP is closer to T-MODIS and N-20 is more close to A-MODIS. Much stable for SWIR band for both A/T MODIS. SNPP show large degradation in NIR/SWIR region, modulated RSR. N-20 VIIRS is much stable than S-NPP for all VIS, NIR, and SWIR spectral band. Challenging issues: changes in MDOIS VIS/NIR RVS (response versus scan angle), special cal/val effort in support of VIIRS data reprocessing, MODIS and VIIRS calibration consistency (within ~2-3%) and impact on science products.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Status of MODIS & VIIRS RSB calibration was discussed. Yu: solar cal for short term, lunar cal for long term – what's that mean? Yu: B07. Peng: GCOS recommend using the same instrument as long as possible. But technology improves over time. How to handle that? A: Data in extended year are often more valuable that the new instrument in the first year. Q: Solar cal has advantage for short-term monitoring in early days after launch, but lunar cal more stable to characterise long-term degradation? A: Yes. Year 5 could be the cross-over (?)	

Agenda Item: 7q Update on the NASA-Langley SBAF tool – 15:10 (20 minutes)	
Presenter	Ben Scarino (NASA)
Overview	SBAF tool now has 9 years' data from Metop-A/GOME-2 and spectra plotting tool
Discussion point, conclusions, Actions, Recommendations, Decisions	
Dave: acknowledge the work to keep funding going. Peng: SRF data from where – OSCAR? A: From users requesting data. Dave: please send those for FY-4A. Na: Yes. And FY-3D as well. And will acknowledge in future paper. Seb: Credit "sphere". A: Yes, we will. Lin: Interpolation? Dave: emphasize on relative, not absolute calibration.	

Tim: ocean color?
Dave: GOME-2.

Tim expressed appreciation for the development of this tool as an essential resource for GSICS - e.g. allowing comparison of FY-4A/AGRI and Himawari/AHI.

Q: For IR: SRF+Energy conversion for TB?
A: Specific for AVHRR ("T-STAR").

Q: Traceability of results? e.g. specify a URL to give reproduceable results.
A: Full configuration included on results.

Please acknowledge tool and data set source if used.

Agenda Item: 7r VIIRS to MODIS reflective solar band scaling – 15:30 (20 minutes)	
Presenter	Dave Doelling (NASA)
Overview	Dave proposed factors to scale MODIS to VIIRS VIS/NIR, including SWIR bands.
Discussion point, conclusions, Actions, Recommendations, Decisions	

Agenda Item: 7s AHI Rayleigh Scattering with MODIS – 16:20 (20 minutes)	
Presenter	Yusuke Yogo (JMA)
Overview	Yusuke reported some results of Rayleigh scattering approach in Himawari-8/AHI as one of JMA's vicarious calibration targets. Inter-comparison between JMA/CNES Rayleigh approaches implies under-estimations for AHI Band 1 and 2 in JMA's approach, which may be caused by lacks of consideration of polarization, chlorophyll-A and so on.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Lin commented AOD of 0.3 (for 0.5 um) seems too high because global average is about 0.1. Larry commented that Rayleigh scattering approach is very important. **A.GVNIR.2018.7s.1:** Bertrand Fougnie (EUMETSAT) to organize a web meeting before June 30 on Rayleigh scattering calibration.	

Agenda Item: 7t Calibration over Rayleigh Scattering – Needs and Open Questions – 16:40 (20 minutes)	
Presenter	Bertrand Fougnie (EUMETSAT)
Overview	Rayleigh scattering calibration is the properties: blue spectral, BT mode in blue, dart in red, very significant polarized signature, very smooth signature of directionality (phase function vs polarized phase fun showed upside down shape each other). Once selected as Rayleigh scattering cal, ~90% signal come from Rayleigh scattering. Ray cal can be seen as "vulnerable" but this is also powerful checking. The main contributors are accurate computation of Rayleigh scattering (> 85%), aerosol background (~10%in red), surface reflectance(~10% in blue) and gas absorption. GSICS needs to be discussed , e.g., cross-cal LEO-LEO, LEO-GEO, abs calibration.

Discussion point, conclusions, Actions, Recommendations, Decisions
Larry: surface atmospheric pressure? A: Yes, need to be considered.

Agenda Item: 7u KMA DCC calibration status – 17:00 (20 minutes)	
Presenter	Dohyeong Kim (KMA)
Overview	Dohyeong reported COMS/MI visible calibration results using Ray-matching with Terra/MODIS, GSICS DCC method, lunar calibration, vicarious calibration using RTM. Estimated degradation trends are from -1.03 to -1.93 % / year.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Tim: use NOAA-20 VIIRS? Dave: need more than one year to resolve the minor annual variation. Three months after the decision on which VIIRS and version and calibration team. **A.GVNIR.2018.7u.1:** Dave Doelling (NASA) to review KMA's implementation of the DCC method.	

Agenda Item: 7v Discussion: GSICS calibration paper, GSICS CLARREO PATHFINDER requirements, web meeting agenda – 17:20 (20 minutes)	
Presenter	Dave Doelling (NASA)
Overview	Dave firstly proposed that VIS/NIR Sub-group to use SNPP/VIIRS as the calibration reference because most of 3rd generation GEO imagers have similar spectral response functions as VIIRS. However, unlike MODIS, many calibrated datasets for VIIRS (e.g. NOAA IDPS, NASA LandPEATE, NOAA and NASA ocean and other retrieval teams) make it difficult to decide which datasets to be used. Dave proposed SNPP/VIIRS calibration reference dataset: to download IDPS VIIRS dataset and apply NASA-VCST correction factors that are referenced to the latest LandPEATE Version 5000 radiances. The he pointed impacts of MODIS/VIIRS solar band constants on the calibration: the biggest differences of +4.4 % between MODIS B3 and VIIRS M3. Calibration differences between VIIRS M/I bands were also presented (1.5% for M5/I1, but very few differences for M7/I2 and M10/I3). After that, Dave reported the current status of CLARREO Pathfinder to discuss GSICS requirements for the mission.
Discussion point, conclusions, Actions, Recommendations, Decisions	
VIIRS to MODIS RSB: Dave recommended using I1 of 0.65 um, primarily because its RSF is similar to other instruments. Tom: prefer M5. Fangfang: Jack and Changyong Cao prefers to I1. Larry: statistics over a week. Difference between forward and backward reflection, and between pre- and post-solstice (melt or sublime that changes particle size). Fred: similar to our AVHRR practice. Interested in its success or difficulties while applying to VIIRS. IDPS & MCST use different solar spectra. If not accounted for, that can lead to reflectance difference of 2-3% for some channel. DCC paper on GPRC implementation was also proposed. CLARREO-ISS-Pathfinder RS now has a 50 x 50 m resolution in a 70 km swath, allowing it to characterise any ground site at latitudes <51°N.	

A.GVNIR.2018.7v.1: Dave Doelling (NASA) to set up web meeting by end April 2018 to select reference bands and calibration processing version for S-NPP/VIIRS reference dataset for DCC and lunar inter-calibration.

A.GVNIR.2018.7v.2: Dave Doelling (NASA) to set up web meeting to plan journal paper on DCC method by end June 2018.

A.GVNIR.2018.7v.3: Dave Doelling (NASA) to set up web meeting to discuss extension of DCC method to NIR by 28 Feb 2019

A.GVNIR.2018.7v.4: Dave Doelling (NASA) to set up web meeting before 30 Sept 2018 to solicit inputs from all GPRCs on preferred sites to be characterised by CLARREO Pathfinder.

Sebastien Wagner reminded NOAA and NASA of the outstanding action from the second lunar calibration workshop on them to liaise on the selection of reference dataset and to consider an overlap period. This will be covered at the web meeting.

GRWG Breakout Session Day-2 (MW Sub-Group) – 22nd March, 2018	
Chair	Ralph Ferraro (NOAA)
Minute Taker	Likun Wang (NOAA Affiliate)
Attendance	CMA: Scott Hu, Qifeng Lu, Xueyan Hou, Shengli Wu, Xinxin Xie, Yang Guo, Xiyu Xu, Hao Liu, Xueyan Hou EUMETSAT: Dorothee Coppens NOAA: Ralph Ferraro, Manik Bali, Likun Wang, Lin Lin, Ninghai Sun

Agenda Item: 9a Introduction and Action Item/Discussion – 13:00 (30 minutes)	
Presenter	Ralph Ferraro (NOAA)
Overview	Ralph began the MW session with reviewing agenda. He went through the MW subgroup scope, member list from different agency, and action items from the past year, including 1) N20 ATMS calibration status (Ninghai will give more details) (closed) 2) Producing MW GSICS products (ongoing) 3) Matrix of sensor information (closed) 4) Lunar calibration for MW sensor (closed) 5) NIST MW ground calibration target (closed) 6) Inter compariosn of RTMs (ongoing) 7) GRUAN and GSICS coordination (closed)
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q (Mitch): Is it CDR or FCDR? It's better to have another product available for reanalysis use. GSICS product should not correct diurnal drift. **A.GMW.2018.9a.1:** Manik Bali to talk with Cheng-Zhi Zou to see if diurnal affects are included. If the answer is no, then it is a candidate for a GSICS product.	

Agenda Item: 9b Development of FY-3/MWRI Calibration on warm/cold targets and reflector emissivity – 13:30 (20 minutes)	
Presenter	Shenli Wu (CMA)
Overview	ECMWF O-B results indicate MWRI high bias. In addition, there is descending and ascending biases. Then he reviewed warm calibration system of FY3C/MWRI: two error sources from warm targets. And then he talked about reflector correction. After correction, descending/ascending biases are mostly removed. CMA will further look into the performance of MWRI on FY3B and FY3D.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q1(Ralph): How long is it FY3D MWRI? R: 2011 - present.	

Agenda Item: 9c Calibration and validation of Microwave Humidity Sounder onboard FY-3D satellite – 13:50 (20 minutes)	
Presenter	Yang Guo (CMA)
Overview	She first reviewed MWHS instrument, calibration equation, calibration process, example of FY-3D Global MWHS BTs, long term trend of instrument temperature and warm target temperature and warm counts. NEDT is comparable with FY3-C and FY3-D. She compared MHS with SNPP ATMS. The instrument works well.

Discussion point, conclusions, Actions, Recommendations, Decisions
Comments (Ralph): Suggest Tropical comparison using water vapor MW sensor SAPHIR on the Megha-Tropiques satellite. Comments (Ralph): What's the strategy about frequency choosing, 118 GHz vs. 52 GHz? R: Based on previous working group study. Also, 118 GHz gives you WV information as well.

Agenda Item: 9d Consideration of the on-board calibration of interferometric synthetic aperture microwave radiometer – 14:10 (20 minutes)	
Presenter	Hao Liu (NSSC)
Overview	Review the strategy to improve spatial resolution of MW instrument. And then proposed the concept of geostationary interferometric MW sounder – GIMS. And then talk about calibration needs: 1) Amplitude calibration, 2) inter-channel phase alignment, 3) antenna pattern. And he showed ground instrument calibration results as well as redundant phase self-calibration.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q (Manik): What are the onboard references that the instrument uses? R: Cold sky reflector and blackbody target.	

Agenda Item: 9e Development and Standardization of the Guidelines for Prelaunch Calibration of Microwave Sensors - Activities of the CEOS WGCV – 14:30 (20 minutes)	
Presenter	Xiaolong Dong (NSSC) presented by X. Xu
Overview	He introduced Microwave Sensors Subgroup of CEOS Working group on Calibration and Validation (WGCV), including missions, objectives. He reviewed the characteristics of MW instruments, requirements, challenges (no traceable standard available for MW sensors), priorities, and focuses. He proposed standardization of the guidelines for prelaunch calibration of passive MW sensors. He also presented requirements GSICS-MW for cal/val of MW sensors and future collaboration. Finally, he showed the future plans.
Discussion point, conclusions, Actions, Recommendations, Decisions	
It was suggested that GSICS and WGCV should work together and come out with some best practice. Any suggestions on best practice and documents for future benefits? **A.GMW.2018.9e.1**: GSICS (C. Zou, Q. Lu?) and CEOS WGVC (X. Dong) to coordinate on best practice for MW Sensors and coordinate on the development of a MW ISO sensor document (similar to other wavelengths) lead by Dong's group.	

Agenda Item: 9f ATMS SDR NOAA-20 and NPP ATMS calibration update – 14:50 (20 minutes)	
Presenter	Ninghai Sun (NOAA Affiliate)
Overview	He first reported SNPP ATMS status. And then began to talk NOAA 20 ATMS cal/val status, instrument performance. NOAA 20 ATMS NEDTs have better noise performance, better geolocation, and less reflector emissivity. Finally, he presented SNPP re-processing status.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q1: When did CrIS FSR begin? R: 12/2014.	

Agenda Item: 9g Introduction: Radio Occultation as a MW standard/calibration source – 15:30 (20 minutes)	
Presenter	Ralph Ferraro (NOAA)
Overview	Ralph present Cheng-Zhi's work, white papers, points, and recommendation: reference source few channels like AMSU 9-12, ATMS 10-13.
Discussion point, conclusions, Actions, Recommendations, Decisions	
We consider this previous action on this closed, however, based on the next two presentations, we can revisit the recommendations as to which channels GPSRO could be used as a reference. **A.GMW.2018.9g.1:** GPSRO focal points (X. Zou/Lin and S. Hu) to further evaluate their results for effects of cloud water and cloud ice and report back to the group within 6 months.	

Agenda Item: 9h Mutual Validations of Observations between lifetime S-NPP ATMS and GPS ROs from COSMIC, MetOp and KOMPSAT – 15:50 (20 minutes)	
Presenter	Lin Lin (NOAA)
Overview	She presented data, instrument characteristics, method, comparison results, annual variability, scan-dependent biases. She also talked about the quality control of GPS RO selection. She emphasized the importance of QC. She also showed scan-dependent biases.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q1: Suggest that try limb-adjust data or analysis data to further check scan dependent biases. Q2: QC control is too complicated and raise the concerns that how the different QC control impact on future results. Q3: Metop-A drift impacts on your results. R: No. I only use L2 data that should take care of it.	

Agenda Item: 9i RO discussion – 16:10 (20 minutes)	
Presenter	All
Discussion point, conclusions, Actions, Recommendations, Decisions	
Physically, from time delay -> bending angle-> profiles ->RTM -> ATMS, each steps needs quantifying each step's error. How can time measurements as a reference to evaluate radiation measurements? The purpose of this study to create the ATMS as refererce by comparing it with the stable GPS RO datasets. But how can we do that if we see there is bias, e.g. scan-dependent bias?	

Agenda Item: 9j ATMS Cal/Val evaluation using FY-3C/GNOS profile standard – 16:30 (20 minutes)	
Presenter	Scott Hu (CMA)
Overview	He first briefed GNOS characteristics, L2 product. Then he talked about ATMS and GNOS collocation procedures. Finally, he presented the inter-comparison results, conclusions, and future plans.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q1: What's ATMS data that you used? R: SDR. Q2: What is potential impact of ice clouds on the 118 GHz channels? R: Not sure.	

Agenda Item: 9k Proposed Best Practices – 16:50 (20 minutes)	
Presenter	Manik Bali (NOAA)
Discussion point, conclusions, Actions, Recommendations, Decisions	

He proposed a Matrix for a best practice for pre-launch and post launch characterization and brought out several questions.

A.GMW.2018.9k.1: In order to determine best practice for pre and post-launch best practices and share with MW members.

A.GMW.2018.9k.2: Manik will survey existing satellite operator monitoring pages and present finding within 6 months.

Comments: what's the purpose for this best practice document. Who are users?
Suggest: Each instrument agency submit their procedures on pre-launch characterization.

He proposed each agency should instrument monitoring website and also made it public available.
Proposed Action:

A.GMW.2018.9k.3: Manik will ask around to find these websites and make them available.

He proposed MW group an action on best practices for SNO collocation criteria, e.g. how to pair the pixels, what is the pixel distance, what is the time difference.

A.GMW.2018.9k.4: Check IR group's GSICS product ATBD and do some survey in the literature on how SNO has been done for imager, sounding, water vapor channels.

He proposed an action of using AMSU/MSU FCDR as MW in-orbit reference.
Q: How is 0.1-0.2K achieved?
R: for a few channels.

Q: What's status of this dataset?
R: will continue.

Q: Do you know the double difference to link two instruments, which will have more observations.
R: GPM use different technique.
Comment geostationary MW more important for this because it will have more collocation between GEO and LEO

A.GMW.2018.9k.5: To determine if the NOAA CDR (MSU/AMSU/ATMS) is a viable in-orbit reference, Zou and Bali will report back to the group after a forthcoming paper is published.

He proposed an action for a best practice on the procedures of how to recalibrate MW sensor measurements.

He proposed other practice for several others (7-10 items)... that we never got to, he will further discuss it in the coming web meeting in April or June 2018.

Agenda Item: 9l NASA GPM X-Cal Updates – 17:10 (20 minutes)	
Presenter	Ralph Ferraro (NOAA)
Overview	He showed the results of GPM inter-calibration based on different methods, TRMM/GPM MW imager versus other MW sensors calibration differences.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: GPM GMI data are shared? R: Yes. **A.GMW.2018.9l.1:** Collect and document "best practices" to see if GMI can serve as an in-orbit reference. (Ralph Ferraro and Wes Berg).	

Agenda Item: 9m GRUAN – 17:30 (20 minutes)	
Presenter	Manik Bali (NOAA)
Overview	GRUAN radiosonde data at Lindenberg, Germany are used to assess the NOAA STAR polar satellite MSU CDR in long-term climate monitoring.
Discussion point, conclusions, Actions, Recommendations, Decisions	

GDWG Breakout Session Day-1 – 21st March, 2018	
Chair	AM: Masaya Takahashi (JMA) and PM Peter Miu (EUMETSAT)
Minute Taker	Peter Miu (EUMETSAT) and Masaya Takahashi (JMA)
Attendance	CMA: Xuebao Wu, Zhe "Thomas" Xu, Yuan Li, Di Xian EUMETSAT: Peter Miu JMA: Masaya Takahashi KMA: Jin Woo
Remote Attendance	Munn Shukla (ISRO part time - Remote) Rob Roebeling (EUMETSAT part time - Remote)

Agenda Item: 5a Round Table Introduction + GDWG Actions Review – 09:00 (70 minutes)	
Presenter	Masaya Takahashi (JMA)
Overview	Getting to know each other and review GDWG activity progress
Discussion point, conclusions, Actions, Recommendations, Decisions	
The session started off round table introduction. It was a good opportunity to learn about each other's work, contribution towards GSICS and personal interest. One of the old open actions is assigning CCCC code (WMO Manual on the GTS) for ISRO (GDWG_2015.4b). Peter kindly proposed that he will communicate Simon Elliot of EUMETSAT to solve this issue, and the action was closed. Then the group reviewed statuses of all actions one by one, and 33 of 46 were closed. Investigation on use of netCDF enhanced data model (GDWG.2016.6g.2) was closed because GDWG member recommend GRWG to use classic data model with prefix for variable names and standard names. There is no practical reason for using the enhancement data model (e.g. file size limitations). The group also discussed requirements for GSICS baseline tools/systems. **A.GDWG.2018.5a.1:** GCC (Manik Bali) to propose updates to the Actions Tracker and GSICS User Messaging (GUM) service such that all GPRCs can use these applications. **A.GDWG.2018.5a.2:** Masaya Takahashi to upload the SRF format conversion script to GitHub.	

Agenda Item: 5b GDWG Baseline Reviews - website, products metadata and structures - 11:00 (60 minutes)	
Presenter	Jin Woo (KMA)
Overview	Jin reported her reviewing results of each GPRC website based on minimum requirements which is listed on the GSICS Wiki. It was commented that WMO GSICS Portal is recently considered as reference website which contains all the GSICS relevant baseline websites and documents (e.g. GCC/GPRC websites, product catalog, GSICS Collaboration Server).
Discussion point, conclusions, Actions, Recommendations, Decisions	
The group agreed that all GSICS related web-pages are expected to be up to date as part of their organisation standard operations. It was also agreed that minimum requirements for GPRC website are to be updated; GSICS websites do not need to have other GPRC website links but must have the WMO GSICS Portal link. This avoids the need to	

update broken links.

All GPRCs were asked to look at Jin's presentation to see what updates should be performed.

A.GDWG.2018.5b.1: Masaya Takahashi to update minimumn requirements for GPRC website and inform WMO of the changes required for their website; addition of ISRO website.

Agenda Item: 5c GSICS Collaboration GSICS servers, configuration, products meta-data pages and data access services. – 09:30 (50 minutes)	
Presenter	Peter Miu (EUMETSAT)
Overview	Peter firstly introduced GSICS Collaboration Servers - implementation details at EUMETSAT, operational support such as THREDDS configuration, improvements on automating the server configuration, products replication. Additions of new server (e.g. ISRO THRDDS) would be a topic to be discussed at GDWG. At EUMETSAT, the system (server) will move to Virtual Machine. EUMETSAT server is currently in operation, which ingests EUM/JMA/KMA products. Implementing a mechanism to automate the "secure" access of the products to the users is a new/challenging topic for GDWG. For example, RSS feed continuing the URL of new products arriving on the server and GSICS product download client to automate the downloading of new products.

Discussion point, conclusions, Actions, Recommendations, Decisions

Munn remotely introduced ISRO's collaboration server. ISRO was kindly asked to inform contact person for collaboration server. For further discussions on harmonising the server to GSICS Collaboration Server, it was agreed to hold a dedicated web meeting.

A.GDWG.2018.5c.1: Peter Miu and Masaya Takahashi to organise a web meeting with ISRO and GDWG member to discuss bringing the ISRO server into the GSICS collaboration network.

Peter asked the group about GPPA activities expected in 2018 at each agency for smooth transition of GSICS products to Operational Phase.

A.GDWG.2018.5c.2: GDWG members (Jin Woo, Masaya Takahashi, Peter Miu, Thomas Xu and Manik Bali) to specify the plan and take care of progressing GSICS products through the GPPA (Lead: GDWG Chair). The goal is to being existed GSICS products into operations as soon as possible.

Then, the member discussed usefulness/necessity of automatic notification system such as EUMETSAT user notification service.

A.GDWG.2018.5c.3: Peter Miu to specify a technical note to propose several methods for the implementation of passive and active GSICS products access service such as RSS on THREDDS. Technologies to consider should be available to all GPRC; RSS, EUMETSAT UNS, SMS, WeChat, …

The group discussed data transfer to the Collaboration Servers. As discussed in 2017, KMA GSICS products sometimes have zero byte when they are transferred to the server. Masaya reported that data transfer from JMA to EUMETSAT Collaboration Server is sometimes slow (e.g. 10 KB/s) and asked the group whether other agency have similar experience. To solve such issues, the following actions were assigned to

EUMETSAT.

A.GDWG.2018.5c.4: Peter Miu to update the GSICS product moving process on the EUMETSAT GSICS server to ignore products being uploaded with .TEMP, .temp, .etc. This is to avoid zero size products to be served to users.

A.GDWG.2018.5c.5: Peter Miu to implement a product upload timer to provide a report on how long it takes to received products from the product producers.

Agenda Item: 5d Current status of CMA GSICS Collaboration Server THREDDS) – 12:00 (30 minutes)	
Presenter	Zhe "Thomas" Xu (CMA)
Overview	Thomas reported GDWG relevant activities at CMA; updates of CMA GPRC website, Landing Pages for instrument event logging, synchronisation of GSICS Collaboration Server. He also informed that netCDF format/data-field check tool is used at CMA to check FY-4A L2 products.

Discussion point, conclusions, Actions, Recommendations, Decisions

The group confirmed that GSICS products in Operational Phase are only expected to be synchronised among the Collaboration Servers (this is a decision at GSICS-EP-16 in 2015). EUMETSAT provided FTP account to CMA for uploading the GSICS products.

A.GDWG.2018.5d.1: CMA and EUMETSAT to work together to synchronise GSICS products across the servers.

The group also discussed how to check the contents of GSICS deliverables. Masaya commented a netCDF format checker developed by GDWG in 2012 is useful for the purpose, but CMA's tool would also be useful.

A.GDWG.2018.5d.2: CMA to check if their NetCDF format checking tool can be shared in GSICS.

Agenda Item: 5g Updating GSICS Plotting Tool to support VIS/NIR products – 13:30 on 22 March (60 minutes)	
Presenter	Masaya Takahashi (JMA)
Overview	Masaya introduced existing GSICS Plotting Tool, GRWG requirements for supporting GEO-LEO-VNIR products. Then, draft requirement document prepared by EUMETSAT was reviewed by the group. He also thanked EUMETSAT (Pablo Benedicto) for their prompt support to update the Plotting Tool in January 2018; an issue at JMA caused by updates of JMA proxy server was solved.

Discussion point, conclusions, Actions, Recommendations, Decisions

The group confirmed the requirements document is acceptable from data management point of view. Several parts need to be rephrased, so Peter agreed to do that.

R.GDWG.2018.5g.1: EUMETSAT to take into account the use of GitHub for updating the Plotting Tool.

Agenda Item: 5h Use of GitHub for GSICS developments – 14:30 on 22 March (60 minutes)	
Presenter	Jin Woo (KMA)
Overview	Jin reported on the progress of GDWG GitHub project; creation of a repository, current registered members (KMA, EUMETSAT, CMA and JMA), project for GSICS Plotting Tool. She also introduced a use of GitLab at KMA.

Discussion point, conclusions, Actions, Recommendations, Decisions
Jin proposed to give administration permission to all the registered members in order to allow the members to commit their updates and it was agreed. Regarding the implementation of the Plotting Tool at KMA, Jin reported that EUMETSAT (Pablo Benedicto) kindly helped KMA to solve the issues such as library version dependence. Peter recommended Jin to ask Pablo to solve existing issue: setup of GSICS product catalog in the Plotting Tool.

Agenda Item: 5j Event Logging – 16:50 (40 minutes)	
Presenter	Rob Roebeling (EUMETSAT)
Overview	Rob firstly reported the past activities on the instrument event logging (e.g. addition of "relevant documents" categories to the requirements for instrument Landing Page and white paper submitted to CGMS-45 in 2017). He reported that quite a lot of Landing Pages are currently linked from instrument pages on WMO OSCAR/Space, but not so many people accessed to EUMETSAT Landing Pages from OSCAR/Space. As for the second step to implement common data and naming conventions as proposed in the CGMS white paper, he pointed a call for forming a new sub-working group if GSICS aims for that.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Rob and Masaya introduced a proposal by WMO (Toshi Kurino) to improve usability of OSCAR/Space (e.g. replacing text hyperlinks to the Landing Pages by GSICS banner/logo), and the group welcomed the proposal. **A.GDWG.2018.5j.1:** Rob Roebeling to make a proposal for the WMO OSCAR/Space Instrument Pages for review by the GDWG so that a recommendation can be presented to WMO to improve the usability of these pages. As for the second step of the Event Logging activities, the group confirmed GDWG role in new GDWG ToR is to coordinate/support the specification of GSICS relevant systems, tools, data/metadata formats and procedures for data exchange between the satellite agencies. **A.GDWG.2018.5j.2**: GDWG members to take the event logging white paper to see whether their organisation can do with regards to implementing such a system and report back to GDWG by 30 April 2018. Lead: GDWG Chair. **A.GDWG.2018.5j.3:** GDWG Chair/Vice Chair to prepare a reply to "R45.05: Calibration Events Logging Task Team be formed under GSICS as a task team" for CGMS-46. Reply shall be sent to Rob (team lead) for review and presented to the EP by GDWG chair. EP chair shall present the result to CGMS-46 in the dedicate GSICS presentation.	

GDWG Breakout Session Day-2 – 22nd March, 2018	
Chair	AM: Masaya Takahashi (JMA) and PM Peter Miu (EUMETSAT)
Minute Taker	Peter Miu (EUMETSAT) and Masaya Takahashi (JMA)
Attendance	CMA: Xuebao Xu, Zhe "Thomas" Xu, Yuan Li, Di Xian EUMETSAT: Peter Miu JMA: Masaya Takahashi KMA: Jin Woo NOAA: Larry Flynn, Manik Bali, Ninghai Sun
Remote Attendance	Yong Zhang (CMA)

Agenda Item: 8a Action tracking and GSICS Wiki Updates – 09:00 (50 minutes)	
Presenter	Manik Bali (NOAA Affiliate)
Overview	Manik introduced Action Tracker Tool and reported recent updates to incorporate members' requirements: supporting web meeting actions on the Wiki, sorting/filtering, gathering all 2017 actions to one tab. He mentioned that the current system uses Google, but other Internet hosting service such as Zoho can also be available. Manik also introduced UMD Google Cloud for GSICS members, which enables GSICS members to collaboratively develop the Action Tracking Tool. In order to enable GCC/NOAA-GDWG to easily maintain GSICS Wiki, migration of the Wiki to ESSIC (UMD) was also proposed.
Discussion point, conclusions, Actions, Recommendations, Decisions	
The group discussed an accessibility of the Action Tracking page. It was confirmed that the web page generated from the API on the Google Sheet is available in China. Manik emphasized that following the action identifier convention is very important to utilize the tool. Masaya introduced WMO's requirement for defining the action ID convention for GSICS-EP meeting. The group agreed to adopt web meeting convention (e.g. A.GRWG.20180601.2) for EP meeting to distinguish EP and WG actions. **A.GDWG.2018.8a.1:** Masaya Takahashi to update action identifier definition for GSICS-EP meetings. Relationships between ESSIC and NOAA were also discussed. Larry commented that there is 5-year relationship and there is a possibility that the relationship is not renewed. Masaya introduced WMO's plan to migrate the WMO GSICS Portal website to new place (detailed information would be provided by WMO at the EP meeting) so that GSICS members would also be able to update the website. He also recalled WG's old request to WMO for incorporating the Wiki to WMO domain. The group confirmed further information exchange is needed between WMO and GCC/NOAA-GDWG. **A.GDWG.2018.8a.2:** GCC (Manik Bali) to summarize action tracking tool on the Wiki. **A.GDWG.2018.8a.3:** GCC (Manik Bali) to summarise current status of GSICS Wiki (e.g. server configuration, system requirements) and inform to WMO.	

Agenda Item: 8b Requirements on the GDWG activities - feedback from CMA GRWG members or satellite data users at CMA - 09:50 (40 minutes)	
Presenter	Lin Chen (CMA)
Overview	Lin reported CMA GRWG's requirements/proposal to GDWG: sharing reference/monitoring instrument (e.g. MODIS, VIIRS, CrIS, IASI, GOME-2, MERSI) L1 data (e.g. GEO-LEO/LEO-LEO collocation data and subsets over Pseudo Invariant

	Calibration Site such as Libya-4) on GSICS Collaboration Servers. This requires GSICS standardized collocation tool because the collocation positions are not fixed. He also stated that L1 data downloading from public data domain (e.g. NOAA/NESDIS CLASS) at CMA takes time and the proposal is expected to solve the time delay issue.
Discussion point, conclusions, Actions, Recommendations, Decisions	
The group welcomed CMA's proposal, even though new investments are needed to realize that. **A.GDWG.8b.1:** Zhe Xu to provide their Data needs to GDWG chair for presenting to EP chair to present to CGMS to see if agencies can provision of support to this data exchange request. As for the data downloading time, Masaya commented that government users can use NOAA's PDA (CLASS is mainly for non-government users).	

Agenda Item: 8c Introduction to Fengyun Satellite Data Center – 08:30 (30 minutes)	
Presenter	Di Xian (CMA)
Overview	Di kindly introduced CMA's Fengyun Satellite Data Center which freely provides various satellite data including third-party satellite data to registered users. FY-4 instruments data will also be available on the Center (e.g. AGRI L1 data are to be available in April 2018). Di informed the group that new data download client (interface) is planned to be updated in summer 2018. He also introduced Fengyun Toolkit for visualizations and FY-3 Preprocessing software packages.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Does the backup Data Center in Xi'an have the same functions as that in Beijing? A: No, the Center is under-construction and the data stored in Beijing are transferred to Xi'an.	

Agenda Item: 8d Introduction to Instrument Performance Monitoring – 11:00 (30 minutes)	
Presenter	Yuan Li (CMA)
Overview	Yuan introduced Instrument Performance Monitoring System for FY satellites. The System collect major parameters which characterize instruments' performance (e.g. blackbody temperature), orbit control, calibration event log and so on. Alerting messages are sent to CMA internal users via SMS in case of instrument events. Calibration Landing Pages and inter-calibration monitoring results are also incorporated to the system.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Are all the figures static? Does the system dynamically generate figures? A: Static.	

Agenda Item: 8f Introduction to ICVS – 11:30 (30 minutes)	
Presenter	Ninghai Sun (NOAA Affiliate)
Overview	Integrated Calibration/Validation System Long-Term Monitoring (ICVS) at NOAA/NESDIS/STAR was introduced by Ninghai. ICVS provides near real time and long-term health status/performance monitoring and data product quality trending for NOAA's operational spacecraft/instruments. ICVS primary users are NOAA/OSPO, NCEI, NWS, NASA/EUMETSAT/ECMWF etc. The system stores on-orbit events and anomalies and alerting (user notification) is supported for registered users.

	Ninghai also introduced reprocessing status for the instruments on S-NPP satellite: ATMS, CrIS, VIIRS and OMPS. The reprocessed SDRs are available on UMD THREDDS (user registration is required).
Discussion point, conclusions, Actions, Recommendations, Decisions	
The group confirmed ICVS (and similar system such as Instrument Performance Monitoring system at CMA) is very powerful/useful for users to monitor instruments performance and investigate details of Level-1/-2 (and higher level) data. Q: Is user notification (alerting) available for external users? A: Yes, everyone can receive emails. NOAA needs which instrument(s) information to be delivered. Q: Any plan to itegrate GEO instruments information to ICVS? A: Yes. Q: How to define thresholds for alerting? Updating dynamically? A: Static thresholds are currently used. The values are up to providers (e.g. instrument specification information such as NeDT could be used). Masaya commented that integration of GEO-LEO/LEO-LEO inter-calibration monitoring using GSICS method (e.g. https://www.star.nesdis.noaa.gov/GOESCal/) would realize one-stop shopping. Yuan commented on usefulness of ASCII data in addition to monitoring figures. **A.GDWG.2018.8f.1:** Ninghai Sun to share their ICVS user manual with the GDWG members when it becomes available.	

Agenda Item: 8e Drafting Requirements to Instrument Performance Monitoring System – 12:00 (30 minutes)	
Presenter	Masaya Takahashi (JMA)
Overview	To discuss GSICS-EP action from viewpoint of data management
Discussion point, conclusions, Actions, Recommendations, Decisions	
The group discussed requirements on ICVS-like system responsive to GSICS-EP-18 action: "GRWG to prepare specifications and methodologies for CGMS agency development of operational instrument performance monitoring systems", and confirmed the importance of user notification and event log in such systems.	

Agenda Item: 8g Lessons learned of using DOI/OID at EUMETSAT – 15:30 (20 minutes)	
Presenter	Peter Miu (EUMETSAT)
Overview	Peter introduced DOI (Digital Object Identifier) and OID (Object Identifier). OID is used in EUMETSAT to tag some meteorological products, but the user community prefer to DOI, which is also widely used at EUMETSAT/SAF (e.g. GSICS ATBD and GEO-LEO-IR Operational RAC). He recommended other agencies to assign DOIs to their documents/products because a web page which can be accessed via the DOI plays a role of stable reference for citation.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Q: Is "zero metadata" in the DOI name compulsory? A: No, but strongly recommend member agencies not to use metadata (e.g. organisation name) because the DOI becomes meaningless when it is changed.	

Q: Can we assign the same DOI to multiple files in the same category (e.g. SEVIRI-IASIA IR RAC)?
A: Yes.

The group understood the usefulness of DOI for GSICS deliverables.

Agenda Item: 8h ToR - GDWG Chairing – 15:50 (20 minutes)	
Presenter	Peter Miu (EUMETSAT)
Overview	Peter mentioned role and purpose of ToR; it is a reference to specify role/responsibilities, activities and processes in order to manage expectations, collaboration scopes and how members work together. GDWG ToR was updated in 2017 to remove assumptions, change the roles of GDWG (specification/investigation of tasks, not developing tasks), and clarify that implementation/operations are resourced by the partner agency. He reported GDWG Chairing status that two Co-Chairs were reformed to one Chair (Masaya Takahashi) and two Vice-Chairs (Ashim Mitra as incoming chair and Peter Miu as outgoing chair).
Discussion point, conclusions, Actions, Recommendations, Decisions	
Minor refinement on the expectation to GDWG members was discussed because the phrase "Software Development Life Cycle" is too strong. Then removing "Life Cycle" from the phrase was proposed. **A.GDWG.2018.8h.1:** GDWG Chair to propose a refinement to GSICS-EP.	

Agenda Item: 8i GDWG Collaboration - Future – 16:10 (20 minutes)	
Presenter	Peter Miu (EUMETSAT)
Overview	Peter reported GDWG activities since the beginning of GSICS in 2006: establishing Collaboration Servers, Defining GSICS Conventions for products' file naming/metadata, and building international collaboration among the member agencies.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Past and current collaborations have been done at Face-to-Face meetings, web meetings, via Collaboration Servers, Cloud technologies, GitHub, etc. The group agreed that visiting data management expert exchange is also very effective for the collaboration. **A.GDWG.2018.8i.1:** Peter Miu to contact ISRO to discuss future collaboration through visiting data management expert exchange.	

Agenda Item: 8j Annual GSICS Calibration Report – 16:30 (20 minutes)	
Presenter	Masaya Takahashi (JMA)
Overview	To discuss GSICS-EP action from viewpoint of data management
Discussion point, conclusions, Actions, Recommendations, Decisions	
The group discussed requirements on Annual GSICS Calibration Report responsive to GSICS-EP-18 action: "GDWG and GRWG to develop an approach for an Annual GSICS report on the State of the Observing System with respect to Instrument Performance and Inter-comparisons with GSICS Reference Instruments", and agreed to recommend the instrument status colour convention used at NOAA OSPO and CMA NSMC.	

Agenda Item: 8k GDWG fact sheet - information presentation – 16:50 (20 minutes)	
Presenter	Masaya Takahashi (JMA)
Overview	Information presentation to introduce the discussion at GSICS-EP-18 and the outcome.
Discussion point, conclusions, Actions, Recommendations, Decisions	
GDWG Fact Sheet was developed in 2017 to ask each agency to provide resources for GDWG collaborative activities. Masaya introduced the contents and ask the group to provide feedbacks. **A.GDWG.2018.8k.1:** Masaya Takahashi to circulate GDWG Fact Sheet to GDWG members to get feed backs and report to EP. Due by 19 May 2018.	

Agenda Item: 8l Wrap-up: Plan activities for 2018/2019 – 17:10 (40 minutes)	
Presenter	Masaya Takahashi (JMA)
Discussion point, conclusions, Actions, Recommendations, Decisions	
GDWG actions were reviewed by the group. The group agreed to hold the web meetings on GSICS Collaboration Server and 1 or 2 progress meeting(s).	

Plenary GRWG+GDWG Briefing + Summary Session – 23rd March, 2018	
Chair	AM: Larry Flynn (NOAA) and PM: Tim Hewison (EUMETSAT)
Minute Taker	AM: Ralph Ferraro (NOAA) and PM: Peter Miu (EUMETSAT)
Attendance	CMA and SITP: Scott Hu, Na Xu, Yang Zhongdong, etc. EUMETSAT: Tim Hewison, Peter Miu JMA: Masaya Takahashi, Yusuke Yogo KMA: Dohyeong Kim, Jin Woo, Minju Gu KIOST: Kibeom Ahn NASA: Dave Doelling, Ben Scarino NOAA: Fangfang Yu, Ralph Ferraro, Larry Flynn, Fred Wu, Likun Wang, Lin Lin, Mitch Goldberg, Hank Revercomb, Ninghai Sun USGS: Tom Stone
Remote Attendance	NASA: Bruce Wielicki

Agenda Item: 10e A potential workshop of best practices for pre-launch instrument characteristics – 08:30 (20 minutes)	
Presenter	Scott Hu (CMA), Lei Ding (SITP)
Overview	Scott presented some slides on a paper by NIST regarding best practices for optical sensors (they focused on hyperspectral). Topic also presented in the past at CGMS.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Is this also a duty of the vendor and not strictly GSICS? Hank R. says the real issue is that there is a gap between pre-launch (fine with SI traceability) and during operation practices - CLARREO is planning to do this - can this be expanded to other sensors as a best practice. Ralph mentioned that this general concept (at least ISO traceability) came up in MW group (topic 9e). Tim then said that maybe this should be more broad based. There is a meeting already planned (April 16, Orlando, FL) for a new initiate by IEEE to develop best practice for pre-launch characterization of hyperspectral UV/VIS/SWIR. This will be followed up at IGARSS 2018. Larry is concerned that we have no representation at the April meeting. Tom stated that GSICS is mostly doing on orbit work, so is this out of our scope? Tim suggests we have focal points for each wavelength to begin some connection to IEEE/NIST. **A.GRWG.2018.10e.1:** Eric Shirley (NIST) should be the GSICS focal point on IEEE Geoscience and Remote Sensing Society/Standards Committee (GRSS/SC) is sponsoring a new standard: P4001 - Standards for Characterization and Calibration of UV-SWIR Hyperspectral Imaging Devices - and report back.	

Agenda Item: 10f CLARREO Pathfinder Inter-calibration: Requirements and Objectives – 08:50 (20 minutes)	
Presenter	Tom Stone (USGS)
Overview	Tom presented material on the topic - CLARREO pathfinder mission (which is in extended Phase-A study period) is proposed to be the on-orbit transfer standard for N20 VIIRS and N20 CERES (SW channel). Seeking 0.6% uncertainty. He presented some detailed information via simulations on how CLARREO pathfinder (on space station for 1 year) would intersect with N20. Similar things shown for the full CLARREO mission with GOES. CLARREO would also look at lunar reflectance.
Discussion point, conclusions, Actions, Recommendations, Decisions	
CLARREO will have on-surface calibration targets - Tom can send GSICS requests for such targets to the CLARREO science team.	

Agenda Item: 10g Traceable Hyperspectral Reference Workshop – 09:10 (20 minutes)	
Presenter	Scott Hu (CMA)
Overview	Scott proposed a workshop for SI-traceable IR, and VIS workshop was proposed 1 year ago - GRWG.2016.3s.2; GRWG Chair sent out email about interest on this topic. Key players include Nigel Fox, Dave Doelling, Bruce Wilecki, Hank Revercomb, et al. The hope was to have this meeting planned by now, but logistical issues on getting the key people to be available. Scott presented objectives and agenda of "CLARREO-like" Workshop. The hope is to have a 2-3 day workshop in Europe or China.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Europe venue (with Nigel Fox) might attract greater participation. It was suggested (Mitch, Tim) that this be tied together with FIDUCEO follow on? Held in 2019. **A.GRWG.2018.10g.1:** Tim Hewison (EUMETSAT) to setup planning web meeting for the workshop on CLARREO-like reference instruments by September 2018.	

Agenda Item: 10j Role of inter-calibration in the future climate monitoring system (GCOS v2) – 09:30 (20 minutes)	
Presenter	Bruce Wielicki (NASA) (Remotely)
Overview	Bruce explained why intercalibration is important for the space-based climate monitoring system and its economic value. He showed what the accuracy requirements are for the system which varies based on the length of observed trend. He also showed requirements as a function of ECV and sensor type. Very detailed presentation - suggest one look closely at its content. Bottom line is that inter-calibration has tremendous economic value, with $50 return on $1 investment!
Discussion point, conclusions, Actions, Recommendations, Decisions	
Larry noted that the analysis on CERES and CLARREO might need adjusting because we already have 20 years of CERES data. Bruce noted that we don't have aerosol impact so maybe not.	

Agenda Item: 10a Drafting a template for Annual GSICS Calibration Report – 10:30 (30 minutes)	
Presenter	Masaya Takahashi (JMA)
Overview	The topic was discussed in response to EP-18.A03. Mitch further explained what the action was. Masaya and Dohyeyong developed a template for the instruments' performance report using GSICS inter-calibration approaches. The report is planned to be submitted to CGMS, and could also be posted on the GSICS Wiki. A good example from Himawari-8/AHI via GSICS plotting tool was presented.
Discussion point, conclusions, Actions, Recommendations, Decisions	
In general, the group liked what was shown, however, there was still further discussion as to what should exactly be shown. The group agreed that just some basic things should be shown in this report, e.g., the references are stable, sensors corrected are stable AFTER they are corrected. GRWG/GDWG chairs plan to have something to report at GSICS-EP meeting in June, so the following topics were discussed. Q: Do we focus on monitoring sensors (GSICS agencies have this already for some sensors) or reference sensors (e.g. IASI and CrIS)? The example Masaya showed for Himawari-8/AHI may be a good template for monitored sensors' reports. Mitch suggested that the report is to be prepared every year by GSICS member agencies, and these reports could be posted to GSICS Quarterly. **A.GRWG.2018.10a.1:** JMA to provide the template to GRWG to define attributes to show instrument's radiometric performance in a short report that is to be prepared by satellite operators on an annual basis.	

Agenda Item: 10b Performance monitoring requirements – 11:00 (30 minutes)	
Presenter	Dohyeong Kim (KMA)
Overview	GSICS EP18 Action-01. CGMS operators to consider displaying instrument performance in a way similar to ICVS. ICVS has nearly 400 parameters. NEDT is very important.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Some general discussion as to which parameters are the most important. Tim suggested its primarily sensor bias, Mitch thinks it should be a little more to better understand the character of the instrument throughout its life. There could be limitations as to which each agency can provide. **A.GRWG.2018.10b.1:** GRWG Chair to coordinate each agency to provide to define minimum information for performance monitoring "specification and requirements" by 15 May 2018.	

Agenda Item: 10c Requirements for GSICS Plotting Tool and implementation plan – 11:30 (30 minutes)	
Presenter	Masaya Takahashi (JMA) / Tim Hewison (EUMETSAT)
Overview	Masaya and Tim presented an overview of the development of a EUMETSAT facility for supporting calibration activities. On this facility (MICSMICS), the GSICS plotting tool will be incorporated and enhanced to support both internal and external users. The requirements and implementation plan for the updates are provided.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Masaya and Tim highlighted the purpose of the plotting tool and that GSICS product users are using it. The user requirements for the tool have been circulated by EUMETSAT for review by GSICS partners and some feedback has been received & these have been incorporated. MICMICS is currently being developed at EUMETSAT, but Tim indicated there is still time (by mid April) for updates to the requirements by GSICS partners if they have inputs.	

Agenda Item: 10d Updates of Action Tracking Tool – 12:00 (10 minutes)	
Presenter	Larry Flynn (NOAA)
Overview	Larry presented the set of updates implemented in the latest version of the action tracking tool. The presentation was already made in the GDWG breakout session, so he briefly presented the highlights.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Action tracker is implemented in Google sheets and there is a workaround for China. There have been updates for the Action Tracking identifiers to address specifics for different meetings, e.g., EP meeting does not require session IDs. These are specified in the GDWG minutes. There will be further updates in the next version; urgency column smaller, summary column bigger, automatic alerts for late actions, etc... Larry will discuss this with the developers. **A.GCC.2018.10d.1**: GCC to request the ESSIC/UMD to grant UMD-google accounts to the GSICS community for access. **A.GCC.2018.10d.2**: GCC to explore access to UMD VPN by GSICS members.	

Agenda Item: 10h GDWG Summary & Agree Actions – 13:10 (20 minutes)	
Presenter	Masaya Takahashi (JMA)
Overview	Report composed from the GDWG meeting from the last 2 days.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Masaya reported that the group had a good attendance this year, eight GDWG items discussed, 20 new actions, 33 of 36 old actions closed & 3 EP related matters. All the items and actions were presented. NOAA commented that the plan to implement calibration landing pages for instrument event logging.	

Agenda Item: 10i GRWG Summary & Agree Actions – 13:30 (30 minutes)	
Presenter	Dohyeong Kim (KMA)
Overview	Report composed from the mini-conference and GRWG meetings from the last days.
Discussion point, conclusions, Actions, Recommendations, Decisions	
A summary of the meetings was presented and the actions proposed were discussed and confirmed. **A.GWG.2018.10i.1: IR Sub-group Chair** to discuss Mitch's CGMS-46 Working Group Paper in the 2019 GSICS annual meeting. GRWG (UV-Sub Group) will be reviewed and updated by Larry so that it is workable. GRWG (MW-Sub Group) (3/3) will be reviewed and updated by Ralph for clarification. Recommendation: the GRWG actions should be confirmed when they are proposed instead of being queries and confirmed in this session. Otherwise additional time is required for a more interactive session (30 minutes is not enough).	

Agenda Item: 10k Future GSICS Users Workshops – 14:00 (20 minutes)	
Presenter	Larry Flynn (NOAA)
Overview	Information regarding the GSICS User Workshop (GUW) supported by the GCC is presented to the GSICS working groups.
Discussion point, conclusions, Actions, Recommendations, Decisions	
What do the working groups want as outputs from the User's Workshop? Some suggestions were presented to see how to get more users engagement for GSICS (see slides). **A.GRWG.2018.10k.1:** Tim Hewison (EUMETSAT) to invite a member of the FIUCEO project to attend the 2019 GSICS annual joint meeting. There is no plan for a GUW in 2018. Potential GUW in the 2019 EUMETSAT User Meeting in Boston. Mitch suggested to link GUW to scientific workshops.	

Agenda Item: 10l GRWG and sub-group Chairing – 14:20 (20 minutes)	
Presenter	Dohyeong Kim (KMA)
Overview	The chairing of the GRWG and sub-groups are up for renewal / change. This was discussed in this agenda items.
Discussion point, conclusions, Actions, Recommendations, Decisions	
A.GRWG.2018.10l.1: Scott Hu (CMA) to propose a solution for the chairing of GRWG in time for the	

executive panel meeting.

D.GRWG.2018.10l.1: Fang Fang Yu (NOAA) was proposed and accepted as the vice-chair of the GRWG.

D.GRWG.2018.10l.2: Qifeng Lu was proposed and accepted as the vice-chair of the MW sub-group.

Bertrand was proposed to lead the Rayleigh scattering activities in the VNIR sub-group - he will be asked to confirm his participation in this working group.

Agenda Item: 10m Topics & Chairing next Web Meetings – 14:40 (20 minutes)	
Presenter	All
Overview	Plan for these meetings.
Discussion point, conclusions, Actions, Recommendations, Decisions	
A.GRWG.2018.10m.1: GRWG chair to set up a web meeting to GEO-GEO comparison and contribution to IOGEO. **A.GRWG.2018.10m.2:** Fred Wu (NOAA) to set up a web meeting for MTF characterization on the moon & invite IVOS to participate.	

Agenda Item: 10n Date & Place of Next WG Meetings – 15:00 (20 minutes)	
Presenter	All
Overview	Suggestions and proposals for agreement for where the next GSICS annual joint meeting will take place.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Meeting to take place in March - or up to 1 week before Easter. Two places are proposed, WMO in Geneva or ESRIN in Frascati, and the working group preference was ESRIN. **A.GDWG.2018.10n.1:** GRWG Chair to contact ESA / ESRIN to investigate holding the 2019 GSICS annual meeting in Frascati / Italy. Report if this is possible in the EP meeting.	

Agenda Item: 10o Any Other Business – 15:20 (20 minutes)	
Presenter	All
Overview	To address any other business.
Discussion point, conclusions, Actions, Recommendations, Decisions	
Tim informed the working group of a workshop at JRC, Italy in April on "Principles for a 3D Radiative Transfer Model to support Cal/Val activities". Sebastien Wagner is attending. **A.GRWG.2018.10o.1:** Tim Hewison (EUMETSAT) to check if remote access is available for the RTM workshop at JRC. **A.GRWG.2018.10o.2:** Sebastien Wagner (EUMETSAT) to report on the RTM Workshop to the GSICS working groups.	

Participants list - 2018 GRWG/GDWG Annual Meeting

CIOFMP/CAS	Guanyu	Lin
CMA	Peng	Zhang
CMA	Zhiqing	Zhang
CMA	Zhongdong	Yang
CMA	Xiuqing	Hu
CMA	Qiang	Guo
CMA	Qifeng	Lu
CMA	Xuebao	Wu
CMA	Ling	Sun
CMA	Jian	Liu
CMA	Na	Xu
CMA	Yuan	Li
CMA	Zhe	Xu
CMA	Di	Xian
CMA	Xuan	Feng
CMA	Lin	Chen
CMA	Shengli	Wu
CMA	Lu	Zhang
CMA	Ronghua	Wu
CMA	Lu	Li
CMA	Zhenhua	Jing
CMA	Xin	Gao
CMA	Yang	Guo
CMA	Chengli	Qi
CMA	Hanlie	Xu
CMA	Ling	Wang
CMA	Chunqiang	Wu
CMA	Fang	Zhou
ESA	Philippe	Goryl
EUMESAT	Tim	Hewison
EUMESAT	Peter	Miu
EUMESAT	Dorothée	Coppens

Ewha Womans University	Mina	Kang
JMA	Masaya	Takahashi
JMA	Yusuke	Yogo
KIOST	Kibeom	Ahn
KMA	Jin	Woo
KMA	Minju	Gu
KMA	Dohyeong	Kim
NASA	Dave	Doelling
NASA	Benjamin	Scarino
NASA	Xiaoxiong "Jack"	Xiong
NOAA	Lawrence	Flynn
NOAA	Manik	Bali
NOAA	Ralph	Ferraro
NOAA	Mitch	Goldberg
NOAA	Xiangqian "Fred"	Wu
NOAA	Fangfang	Yu
NOAA	Ninghai	Sun
NOAA	Jon	Fulbright
NSSC/CAS	Yongmei	Wang
NSSC/CAS	Hao	Liu
NSSC/CAS	Houmao	Wang
SITP	Lei	Ding
SITP	Feng	Jiang
SITP	Dekui	Yin
SITP	Yipeng	Zhang
UMD	Lin	Lin
UMD	Likun	Wang
UMD	Hui	Xu
UW	Henry	Revercomb
UW	Allen	Huang
USGS	Tom	Stone