



# Minutes of the 2017 Annual GSICS Joint Working Groups Meeting

20 – 24 March 2017, Madison, USA



## GSICS WGs – 2017 Minutes

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<b>Plenary Mini Conference – AM on 20<sup>th</sup> March, 2017</b>	
<b>Chair</b>	Dave Tobin (CIMSS/SSEC)
<b>Minute Taker</b>	S. Wagner
<b>Attendance</b>	CIMSS: D. Tobin, P. Menzel, J. Taylor, J. Li CNES: B. Fougne CSU: W. Berg EUMETSAT: P. Miu, T. Hewison, R. Munro, S. Wagner IMD: A. K. Mitra JMA: M. Takahashi, A. Okuyama Gaia 3D: H. Shin, J. Park KMA: D. Kim, H. Lee, J. Woo NASA: X. Xiong, D. Doelling, C. Lukashin NOAA: L. Flynn, M. Bali, F. Yu, A. Heidinger USGS: T. Stone UW: R. Holz
<b>Remote Attendance</b>	ISRO: M. Shukla NOAA: T. Reale, X. Wu, R. Ferraro

<b>Agenda Item: 1a Introduction to Mini Conference &amp; GSICS – 8:45 (15 minutes)</b>	
<b>Presenter</b>	Tim Hewison (EUMETSAT)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Tim recalled the GSICS scope, purpose and principles. He also reminded us about the GSICS internal structure and its interactions with other external activities such as CEOS WGCV working group and GPM X-Cal.</p> <p>General information about GSICS products and deliverables was provided together with the basis of the approaches implemented to create those products and deliverables.</p> <p>Products are available to users from GSICS GPRC data servers.</p>	

<b>Agenda Item: 1b Welcome to SSEC – 9:00 (10 minutes)</b>	
<b>Presenter</b>	Paul Menzel (CIMSS/SSEC)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Paul Menzel recalled the challenges of calibrating satellite data the remote sensing scientific community faced with the first instruments dedicated to Earth observation and meteorology.</p> <p>Together with the measurements, the understanding of the radiative transfer and the models developed and improved.</p> <p>Spectral response function characterisation was one of those challenges. The work done in particular for re-calibrating broadband instruments was recalled, much of which originated from work started at SSEC.</p> <p>The methods developed in framework such as GSICS will allow us to recalibrate missions to common references dating back to the late 70's.</p>	

<b>Agenda Item: 1d CLARREO Pathfinder inter-calibration in reflected solar: project status – 9:30 (20 minutes)</b>	
<b>Presenter</b>	Constantine Lukashin (NASA LaRC)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Costy presented the context of the CLARREO pathfinder project, with its scope and goals. One of the goals is to reduce the level of uncertainties on inter-calibration to common references.</p> <p>The pathfinder is currently on Formulation phase A. Payload is planned for ISS (18-month occupancy).</p>	

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CERES and VIIRS will be inter-calibrated using the CLARREO pathfinder. The principles of the approach were explained. Moon viewing will be impacted by some constraints due to the mounting of the ISS. The margin for performing the measurement with CERES may be a problem as it is less than 44% on average.

Inter-calibration data products will be made available.

Questions:

Larry: at the end of the mission, will the instrument be brought back on the ground?

Answer: not planned due to uncontrolled environmental conditions in the re-entry module.

Larry: for LEO, will CLARREO have similar viewing geometries as GEOs?

Answer: Yes.

D. Tobin: will the CLARREO pathfinder see the moon?

Answer: The moon will not be observed very often. Work is on-going together with T. Stone. The mounting on the ISS will restrict the moon phase availability. ARCSTONE is funded (good news!).

ARCSTONE will complement and compensate the lack of moon phase coverage. Pathfinder will provide a good benchmark for ARCSTONE.

### Agenda Item: 1e CLARREO IR Sensor, Calibration Accuracy and Traceability – 9:50 (20 minutes)

Presenter	Joe Taylor (CIMSS/SSEC)
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

Joe is taking part in the airborne activities for CAL/VAL of GOES-16/ABI.

CLARREO's goal is to have metrology on orbit. It will be providing state-of-the-art measurement accuracy for measurements. (0.1K 3-sigma requirement over the spectral range covered by the mission). For the Pathfinder, currently only RSB is going in ISS.

The details of the instrument design to achieve the radiometric calibration requirement were given. Polarisation assessment is taken care of. The possibility to achieve the requirements (0.1k 2ith 3-sigma) was successfully demonstrated in the on-ground measurement tests.

The tests in the vacuum chamber revealed a straylight issue, which was subsequently corrected and lab testing verified that the modification was successful.

Whereas the RS pathfinder is going forward, the IR pathfinder future is uncertain but the full mission remains in "Extended pre-phase-A". Efforts are ongoing to move the IR part forward.

The CLARREO pathfinder currently is only funding the RS instrument. Funding for the IR instrument is still being sought. However, the President's budget proposal (March 2017) explicitly terminates the CLARREO Pathfinder program: "The Budget terminates four Earth science missions (PACE, OCO-3, DSCOVR Earth-viewing instruments, and CLARREO Pathfinder) and reduces funding for Earth science research grants."

T. Hewison emphasised the importance for the GSICS community of the CLARREO mission.

Could GSICS help in supporting the project?

Answer: currently the decision is mostly political. D. Tobin mentioned that a white paper would help the project. Costy clearly said that such a paper needs to be written fast. Costy suggested to contact Bruce Wielicki. It should be followed by Exec Panel

**A.GWG.2017.1e.1: GRWG to coordinate with B. Wielicki + Exec panel the writing of a white paper to support the CLARREO project.**

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<b>Agenda Item: 1f CLARREO IR Intercalibration – 10:10 (20 minutes)</b>	
<b>Presenter</b>	Dave Tobin (CIMSS/SSEC)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Dave described the objectives, which are to provide a global benchmark for accurate calibration + bring metrology, traceability in space. The added-value of CLARREO in terms of economical return was clearly mentioned in B. Wielicki initial paper.</p> <p>Dave discussed the work done to show the ability of the CLARREO IR to serve as a satellite intercalibration reference (published in JGR). With six months of matchups. the intercalibration uncertainty is less than 0.05 K at 3-sigma for comparisons to Crls or AIRS. It is slightly bigger for IASI due to a difference in the footprint. With two months of SNOs, it is already less than 0.1 K for the infrared window wavelengths.</p> <p>Tim: trade-off between quality and quantity of collocations. Both can be achieved.</p>	

<b>Agenda Item: 1g GRUAN and GSICS – 10:50 (20 minutes)</b>	
<b>Presenter</b>	Tony Reale (NOAA) - remotely
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Ten active sites in GRUAN at the moment. Potential for more sites. GRUAN reference observations are calibrated through an unbroken traceability chain to SI.</p> <p>Tony described the concept of GSICS' potential to provide travelling reference standards for GRUAN.</p> <p>He also showed NPROVS graphical display and evaluation tools that offer a versatile environment for data analysis. The NOAA/NESDIS/STAR ICVS website provides the products of the collocations between the GRUAN and the satellites measurements.</p> <p>International coordination currently through:</p> <ul style="list-style-type: none"><li>• 3G coordination (GRUAN, GSICS, GNSS-RO) (a workshop was organised in May 2014)</li><li>• GAIA-CLIM</li><li>• GEWEX-GVAP</li></ul> <p>There are differences between the GAIA-CLIM and GRUAN collocation approaches.</p> <p>The sigma term (between RAOB and sat measurements) in the uncertainty equation represents the spatial and temporal variability, and can be quite large. GRUAN provides global reference observations of atm ECVs. Collocations are done routinely. There is a need for vertical uncertainty assessments. Xavier Calbet showed the importance of propagating vertical correlation of uncertainties in GRUAN profiles in comparisons with satellite radiances through RTMs.</p> <p>The idea of using GRUAN to help verify GSICS-corrected satellite radiances was discussed, and was followed up later in the meeting.</p>	

<b>Agenda Item: 1h GPM – 11:10 (20 minutes)</b>	
<b>Presenter</b>	Wesley Berg (CSU)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>The XCAL team is responsible for the Level 1C intercalibrated brightness temperature files used as input to the operational precipitation retrieval algorithm for all of the GPM constellation radiometers (and TRMM constellation radiometers). Specific tasks include:</p>	

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1. Identify sensor issues affecting the calibration and stability of the Tb for each of the constellation radiometers. This involves Investigating calibration errors across scan and/or along orbit (i.e. time-dependent).

2. Develop and apply corrections for sensor calibration issues.

Derive and deliver intercalibration tables to adjust for residual sensor calibration differences in a physically consistent manner.

GPM and TRMM challenge: inter-calibration due to differences in the frequencies available in the constellation of GPM/TRMM instruments. Inter-calibration is done by the XCal team, they are responsible for the L1c inter-calibrated BT files. The work includes assessing uncertainties, documenting results, and working to improve inter-cal techniques.

GPM GMI is the calibration reference sensor. It is extremely well calibrated and stable.

TRMM TMI v8 will be available late 2017. It includes among others corrections for spacecraft attitude, view-angle offset, along scan corrections, RFI in cold reflector correction, TMI antenna pattern, and reflector emissivity corrections. (Until 2003, TRMM was at a lower altitude. In 2003 it was boosted higher (400 km).)

The data analysis revealed an issue with RTM, which introduces small but significant errors in the GMI-TMI double differences, due to their difference frequencies on different sides of the 22GHz water vapour line. This sensitivity to the choice of RTM could introduce discrepancies in the derived L2 retrievals.

GPM v5 reprocessing is planned to be available in April 2017.

TRMM v8 is inter-calibrated to GMI v5.

Comment: Dave Tobin mentioned that some people have worked recently on the RTMs (22-23 GHz).

### Agenda Item: 1i Intercal activities and products within the Atmospheres SIPs – 11:30 (20 minutes)

Presenter | Robert Holz (UW/SSEC)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Robert introduced a fast analytical scheme developed by Fred Nagle for physical collocations (using the concept of master/follower). He also described the OrbNav system to predict SNOs, based on TLEs. The OrbNav is open and available as standalone package from <http://sips.ssec.wisc.edu/orbnav/#/tools/snotimes>

Robert also presented the activities on the effect of moving from MODIS to VIIRS Cloud Optical Properties. The difference in the location of the 2 micron band (MODIS is at 2.13, VIIRS is at 2.25 microns) impacts significantly the effective radius retrieval. The bias is about 6% for the M5 band and 4% for M7 when checking what VIIRS is expected to see and what it effectively sees.

The aerosol team did similar work and get consistent results with the cloud team. (See paper by Sayer and al, under review in Atm Measurement Techniques.)

Bob confirmed that it is possible to generate SBAF-like coefficients to allow direct comparison of VIIRS and MODIS, and that these can be made available to GSICS.

Dave: are all pixels of the same size? How the subpixel features are handled?

Answer: the follower pixels are projected into the master pixels.

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<b>Agenda Item: 1j Update on PATMOS-X products – 11:50 (20 minutes)</b>	
<b>Presenter</b>	Andy Heidinger (NOAA ASPB)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Andy introduced PATMOS-X, which is one of NOAA AVHRR data records. Channel 3a (1.6 micron) is now included in the dataset. Metop-B is also included. 4 reference sites are used for the inter-calibration of the AVHRR RSB inter-cal with MODIS and with the different AVHRR: Dome-C, Libya, Taklimakan, Greenland.</p> <p>AVHRR Chan 2 is very broad. It encompasses the 0.94 micron WV band and the O2 A-band. VIIRS is being included as a reference instrument for inter-calibration of AVHRR in Patmos-X. Current results show that brighter pixels are brighter in VIIRS than in MODIS. This could be caused by some calibration issue. Evidence from the Langley SBAF suggests PATMOS-x Ch2 calibration may be biased by 2%.</p> <p>Andy expressed concerns about whether VIIRS is ready to be used as a reference. There are some differences between calibration results from NOAA and from NASA. The calibration of VIIRS 0.65 and 0.86 micron needs to be improved. It seems that for those bands, VIIRS is 4 to 6% too high, which prevents VIIRS to be used as a reference for Patmos-X.</p> <p>Question: Are the spectral differences between the instruments accounted for?            Answer: Yes, spectral difference are accounted for in the analysis.</p> <p>Question: Is Andy planning to submit the data as a GSICS product,            Answer: Yes but need to be discussed with GCC.</p> <p>Question: AVHRR lunar observations?            Answer: Tom has tried to make use of the data. But it was unsuccessful (data are too difficult to use).</p> <p>Question: How do we know if MODIS is right or if VIIRS is right?            Answer: We do not know (Andy). Tom hoped with future development in Lunar Cal could resolve it.</p> <p><b>A.GWG.2017.1j.1: Andy to discuss with GCC how to promote the PATMOS-x products through the GPPA.</b></p>	

<b>Plenary GRWG+GDWG Agency Reports Session – PM on 20<sup>th</sup> March, 2017</b>	
<b>Chair</b>	Tim Hewison (EUMETSAT)
<b>Minute Taker</b>	Sébastien Wagner (EUMETSAT)
<b>Attendance</b>	CNES: B. Fougne CSU: W. Berg EUMETSAT: P. Miu, T. Hewison, R. Munro, S. Wagner IMD: A. K. Mitra JMA: M. Takahashi, A. Okuyama KMA: D. Kim, H. Lee, J. Woo, H. Shin, W. Park NASA: X. Xiong, D. Doelling, C. Lukashin, R. Bhatt, B. Scarino NOAA: L. Flynn, M. Bali, F. Yu, A. Heidinger, K. Knapp USGS: T. Stone
<b>Remote Attendance</b>	NOAA: X. Wu, R. Ferraro ISRO: M. Shukla

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Agenda Item: 2a Agree Agenda & Minute Taking – 13:35 (15 minutes)			
<b>Presenter</b>	Dohyeong Kim (KMA)		
Discussion point, conclusions, Actions, Recommendations, Decisions			
Minute takers were nominated for each section of the agenda as follows:			
Session		Chair	Minute Taker
1: Plenary – Mini Conference	Day-1-AM	Dave Tobin	Seb
2: Plenary – Agencies Reports	Day-1-PM	Tim Hewison	Seb
2: Plenary – Chairs Reports	Day-2-AM	Andrew Heidinger	Seb
3: GRWG+GDWG plenary	Day-2-PM	Dohyeong Kim	Hyesook Lee
4: GRWG – UV subgroup	Day-3-AM	Rose Munro	Larry
5: GRWG – Microwave Sub-Group	Day-3-AM	Ralph Ferraro	Tim?
6: GRWG – IR Sub-Group	Day-3-PM	Tim Hewison	Seb?
7: GRWG – VIS/NIR (1)	Day-4-AM	Sebastien Wagner	Dave Doelling
7: GRWG – VIS/NIR (2)	Day-4-PM	Dave Doelling	Andy/Tim
8: GDWG	Day-3 Day-4	Masaya Takahashi Peter Miu	Peter Miu Masaya Takahashi
9: Plenary – Cross cutting issue	Day-5-AM	Larry Flynn	Manik
9: Plenary – Wrap-up	Day-5-PM	Tim Hewison	Seb?

Agenda Item: 2b NOAA Agency Report – 13:50 (15 minutes)	
<b>Presenter</b>	Fred Wu (NOAA) (remotely)
<b>Purpose</b>	To present NOAA's progress on GSICS activities
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>Sub-group activities are covered by the sub-group presentations.</p> <ul style="list-style-type: none"> <li>● Various bilateral cooperations (JMA [AHI], KMA [MI and AMI] and EUMETSAT [GLM-LI, ABI-FCI] ).</li> <li>● NOAA also participates to the RadCalNet activities. A workshop was organised last week (IVOS meeting).</li> <li>● ABI prelaunch + cal/val activities</li> </ul> <p>Status of the actions:</p> <p>GIR.2016.3n.1: delayed as it is more complicated than foreseen.</p> <p>GRWG_14.25: delayed but results are coming. At the moment cannot be reported due to ABI “policy”</p> <p>GRWG_15.13: clarification is needed from IMD. GCC has all the codes from NOAA (Fangfang).</p> <p><b>R.GCC.2017.2b.1: GCC to check with NOAA the status of the IR code . GCC to follow up with IMD.</b></p> <p>GRWG_15.39: NOAA requests to close it. Statement is provided in the PPT. Agreed by GRWG chairs.</p> <p><b>A.GWG.2017.2b.2: GRWG_15.39 + GRWG_15.55 to be closed (with the provided statements).</b></p> <p>Jordan Yao will no longer be available to support. NOAA will not provide support to GDWG. No change in the other resources dedicated to GSICS.</p> <p>NOAA team is currently focused on GOES-R activities. So their involvement in GSICS current projects is</p>	

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impacted. However, Fred mentioned that GSICS complement bilateral cooperations.

Manik commented on the possibility to have technical discussion through web meeting instead of discussions at the annual meeting. This will be further discussed on Friday (format of the meeting).

### Agenda Item: 2c CNES Agency Report – 14:10 (15 minutes)

**Presenter** Bertrand Fournie (CNES)

**Overview** CNES activities on projects providing feedbacks to GSICS topics. This includes Sentinel mission (S2A, S2B, S3A), IASI instruments, and coming missions. News from SADE/Muscle and Lunar activities. Status on actions, CNES personnel supporting GSICS, and subject of interest.

**Purpose** CNES Agency report

### Discussion point, conclusions, Actions, Recommendations, Decisions

CNES instruments updates: CNES is involved in the Sentinel missions (S-2 and S-3) in support to ESA. Regarding IASI, L1 reprocessing is on-going. The performance of the instruments (IASI A and B) are good and consistent. CNES is also supporting EUMETSAT on 3MI and IASI-NG.

S-2A: Bertrand presented briefly some results from the vicarious calibration using PICS.

S-3A: some results were also presented for OLCI and SLSTR validation of the calibration using again vicarious calibration. More results are available on the VNIR session presentation [8s](#).

IASI: updated results show an identical behaviour to previous years wrt the cross-calibration with CrIs and AIRS. CNES also provided input to perform tests on IASI at the end of life.

Version 2 of MUSCLE is being developed (MUSCLE = vicarious calibration system) to address the evolutions of the needs and the methods.

CNES has also been working on an evolution of the ROLO model by including a spectral correction and phase angle correction to the existing model. The correction also allowed for an absolute correction using star observations by Pleiades. CNES is now able to share Pleiades data under license agreement. CNES is also intending of using IASI moon measurements to check the possibility of performing IASI inter-calibration in the IR.

CNES has no resource to work on inter-calibration using the Moon.

### A.GWG.2017.2c.1: CNES to report on progress with analysis of IASI moon observations at LCW

Among other CNES is interested by:

- Improvement of the calibration methods
- Maximise the use of Moon data to extract radiometric characterisation
- Defining a common reference for solar irradiance
- Defining the best radiometric reference

Question: Tom asked who is in charge of the lunar calibration activities at CNES? He also asked if he could get the Pleiades data?

Answer: Ayme Maignet is now in charge. Yes, Tom could have access.

### A.GCC.2017.2c.2: GCC to interact with EUMETSAT for IASI readers.

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Agenda Item: 2d CMA Agency Report – 14:30 (15 minutes)	
Presenter	Scott Hu (CMA) (presented by Jun Li)
Purpose	To present CMA's progress on GSICS activities
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>CMA performed a 3-month campaign for Lunar measurements (completed in Feb 2016).</p> <p>FY-4A was launched in Dec 2016 with the AGRI imager and the GEO Interferometric Infrared Sounder. The spatial resolution of the sounder will be increased for the successor. Commissioning activities will end at the end 2017.</p> <p>Tansat was also launched in Nov 2016 and is still in commissioning phase.</p> <p>FY-3D due to launch in Sept 2017. It will be an enhancement of the MERSI instrument. Other instruments are also part of the payload.</p> <p>CMA and EUM collaboration servers are now in line.</p> <p>CMA has implemented a method to use Arctic (Greenland) and Antarctic snow (Dome-C) for VNIR calibration.</p> <p>Results were presented for the current CMA contributions on VNIR and IR subgroups. In particular some results were presented on combined results (in particular DCC and snow). Vicarious calibration is also being developed. In the SWIR, the seasonality observed in the calibration results seem to be related to on-board temperature variations.</p> <p>CMA has been also extensively working on ground based measurements (lunar ground observations, reference site in Dunhuang).</p> <p>CMA recalled their wish to host the next GSICS annual meeting in 2018. In 2017 they will host the Second Joint GSICS/IVOS Lunar Calibration Workshop.</p> <p><b>R.GWG.2017.2d.1: CMA and CNES to provide more info on opportunities for inter-calibration with their respective CO2 band instruments (Microcarb and Tansat).</b></p>	

Agenda Item: 2e EUMETSAT Agency Report – 14:50 (15 minutes)	
Presenter	Rose Munro (EUMETSAT)
Purpose	To present EUMETSAT's progress on GSICS activities
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>Rose mentioned that GEO ring activities are on-going. But participants are requested to provide input to the project. Some actions have not been addressed due to a lack of resources.</p> <p>It was noted that while Action GRWG.2016.7f.1 on EUMETSAT to forward draft requirements for pre-launch characterisation to WMO was closed, other activities of interest related to on-ground calibration and characterisation are on-going - namely the preparation of the White paper on On-Ground Calibration and Characterisation in the frame of the UV-Subgroup activities and also the previously stated intention of CEOS WGCV to initiate a Workshop on a similar subject.</p> <p>Comment: Need to address the support by the agencies to GSICS effort as it is clear that everybody is short of resources.</p> <p>The tool to automate the generation of the config scripts and file to create the directories on the servers can be shared within GSICS.</p>	

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There as a change in the GSICS exchange format IASI data. It is recommended that products derived from these data are reprocessed with a new major version (although the impact is small). For EUM, only the Demo GSICS products are impacted - these will be reprocessed in summer 2017. Meanwhile, the impact of the change has been reverted in the processing to ensure consistency.

Rose provided information about the Metop-A end-of-life activities. The tests are also evaluated against cost and risk. 46 requests for test were received. The test baseline and timeline generation is being drafted (Q2 2017).

Additionally to the list of identified items proposed for discussion during this meeting, the UV subgroup will discuss the about establishing a reference solar spectrum.

### Agenda Item: 2f JMA Agency Report – 15:10 (15 minutes)

**Presenter** Masaya Takahashi (JMA)

**Overview** Himawari-8/-9 inter-calibrations have been developed/implemented for VNIR and IR bands under limited resources.

**Purpose** To report the progress on Himawari-9/AHI commissioning phase activities and clarify existing issues on the resources for GSICS activities.

#### Discussion point, conclusions, Actions, Recommendations, Decisions

JMA is currently working on the implementation of the GSICS products for AHI and is planning to start the GPPA for VNIR products soon.

JMA has many collaborations and is intending to continue them. Regarding the actions, JMA had also problem to address them all due to limited resources. Regarding the GDWG, there is also a resource problem. There is an agenda item to propose a change in the ToR for the GDWG. It was agreed that the discussion will also be done with the GRWG.

For contribution to the GRWG, JMA has resource problems. Arata will now leave GSICS activities. A new person will take over Arata's activities but needs to get up to speed on the activities.

Masaya showed some results of the AHI commissioning activities. For VNIR , ray-matching and vicarious calibration methods were used. Results for the 0.51 micron and 0.86 micron are different for H-8 and H-9. Still being investigated.

For the IR, there is a bit a variability of TB biases but not significant (biases at standard scene ~0.3K).

Question: Tom asked if JMA will also investigate lunar calibration for past data?

Answer: Yes, it is planned.

### Agenda Item: 2g JAXA Agency Report – 16:00 (15 minutes)

**Presenter** Arata Okuyama on behalf of JAXA GSICS members

**Overview** A system calibration method in the SST retrieval was developed. Lunar calibrations are planned for the forthcoming SGLI on the GCOM-C and CAI-2 on the GOSAT-2.

**Purpose** To report JAXA's activities related to GSICS

#### Discussion point, conclusions, Actions, Recommendations, Decisions

JAXA is developing a new approach for cross-calibration in the IR. They also prepare future missions using GIRO.

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JAXA requested to close the current actions they have as they responded.

Arata presented the details of the new cross-calibration approach for IR channels on behalf of JAXA GSICS members, which is performed in geophysical parameter-space (SST). The purpose is to have consistent SST products. The GSICS approach was applied to the Himawari-8/AHI data but improvement on the SST was very small (as expected as the AHI calibration is already good - this is why LEO-LEO inter-calibration is needed). Preliminary results are encouraging but the results need to be consolidated as for the moment, only one month of data was used.

JAXA is preparing the GCOM-C SGLI mission with the GIRO. They will share the data with the community. SGLI is the successor of GLI.

They also plan to apply the GIRO to GOSAT-2 CAI-2. They will also provide some data to the GLOD.

Planned launches:

- GCOM-C planned for launch late 2017 or early next year.
- GOSAT-2 and EarthCARE in 2018

Question: It seems like there is a need to develop IR corrections for the other set of instruments (MODIS, VIIRS, SGLI).

Question: the interband is more important than the absolute scale

Comment: It is not assured that this activity will be continued due to a re-assignment of the person (JMA detachment at JAXA).

Comments: Bertrand mentioned that such an approach is not recommended by the ocean color community. This is considered as a system calibration method to resolve the gap between the instrument calibration and the level 2 products. Tim mentioned that in order to have a GSICS correction the IR corrections for MODIS, VIIRS and SGLI shall be provided, which is currently not the case.

Bertrand emphasised on the wording as such an approach is a correction of the instrument + retrieval scheme.

**Decision: It is agreed that corrections based on comparisons purely in geophysical parameter spaces shall not be called a GSICS calibration correction.**

**R.GWG.2017.2g.1: GSICS shall provide recommendations on the naming of the corrections to separate calibration correction from system correction, following the results of the discussion raised by Bertrand and agreed.**

### Agenda Item: 2h IMD Agency Report – 16:20 (15 minutes)

**Presenter** Ashim Mitra (IMD)

**Purpose** To present IMD's progress on GSICS activities

#### Discussion point, conclusions, Actions, Recommendations, Decisions

INSAT-3DR and INSAT-3D are used in staggered mode to reach a 15-minute resolution.

The future generation of satellite (GISAT) will include more channels than the current system, including hyperspectral bands. The pixel resolution is at 50m for some bands! First launch is expected in 2018-19.

Ashim presented the range of applications and tools IMD is operating for providing information to their forecasters. Some activities are done with the support of EUMETSAT.

## GSICS WGs – 2017 Minutes

Action: in red, Recommendation: in green, Decision: in blue

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Main activities within GSICS:

- IMD is working on the establishment of in-situ calibration and validation for INSAT-3D/3DR for RSBs (Rann of Kutch site). This effort is done in collaboration with SAC/ISRO.
- SCOPE-CM for Kalpana-1 and past satellites
- Lunar calibration

Several campaigns of measurements were conducted for the in-situ calibration site. First was in 2015. Latest in 2017. They did simulations with 6S to establish a vicarious calibration system.

IMD would appreciate if LEO data could be provided over the in-situ site and the calibration campaign. Further collaboration with CEOS for instance would be welcomed.

IMD is participating to IOGEO activities. Data for Kalpana-1 were provided to EUMETSAT for the IOGEO project. IMD asked whether they could get some support for tools and software.

Comment: Bertrand commented that the choice of the RTM is a fundamental question to vicariously calibrate the RSB bands.

**R.GWG.2017.2h.1: EUMETSAT and IMD to interact for comparisons between Meteosat-8 and INSAT-3D/3DR.**

### Agenda Item: 2i ISRO Agency Report – 16:40 (15 minutes)

<b>Presenter</b>	Munn Shukla (ISRO, Remote)
<b>Purpose</b>	To present ISRO's progress on GSICS activities

#### Discussion point, conclusions, Actions, Recommendations, Decisions

INSAT-3DS is in standby mode. GISAT is due to launch in end 2017 early 2018.

GSICS website is developed and a link is created on MOSDAC ([http://as.mosdac.gov.in:8086/GSICS\\_ISRO](http://as.mosdac.gov.in:8086/GSICS_ISRO)) (demo)

ISRO asked if the ATBDs should be reviewed separately for the INSAT-3DR/Kalpana/INSAT-3A. Additionally, it was asked if the inter-calibration using AIRS could become part of the GSICS products.

A series of issues that ISRO is currently facing was presented. Data access is still an issue (data outage when retrieving the EUM data manually). A procedure for retrieving MODIS data still need to be put in place. Besides, what mechanism should be followed if new versions of INSAT-3D/3DR data become available?

Discussion to answer ISRO question:

- Separate GCC review? The same ATBD can be used (Manik)
- Inter-calibration using AIRS? Depends on the amount of diurnal variation there is in the data. IMD is invited to investigate the use of CrIs and AIRS. There will be further discussion in the IR session. IMD is invited to look at how JMA is handling the diurnal variation problem for their past satellites.
- Ray-matching with MODIS? NASA has an action item and will interact with ISRO to support them in getting the MODIS data needed for the inter-calibration.
- Version control policy is documented on the GSICS Wiki. ISRO are encouraged to review it.
- The existing approach to filenames is satisfactory to GCC. These can be revised when new codes are available from WMO.

## GSICS WGs – 2017 Minutes

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**A.GWG.2017.2i.1: EUMETSAT (P. Miu) to provide info to ISRO regarding the access to IASI data.**

**A.GWG.2017.2i.2: EUMETSAT (P. Miu) to investigate hosting ISRO GSICS products on the EUMETSAT GSICS collaboration server.**

**A.GWG.2017.2i.3: NASA to support IMD with MODIS data. - Existing action - no new one needed?**

### Agenda Item: 2j KMA Agency Report – 17:00 (15 minutes)

<b>Presenter</b>	Hyesook Lee (KMA)
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<b>Purpose</b>	To present KMA's progress on GSICS activities
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

KMA is about to enter the demo phase for GEO-LEO IR products. They have on their side some connection problems with the EUMETSAT server. KMA hopes to close the actions related to DCC activities in the VNIR in 2017. KMA is supporting the GDWG for GitHub.

As part of the recommendation from the last annual meeting (R.GWG.2016.3l.1: KMA to assess uncertainties in double differences between COMS-1/MI and IASI-A and -B (e.g. as standard error)), KMA looked at double differencing in the IR. Biases showed to be extremely small.

KMA also investigated SRF shift for COMS WV band about 3.5cm<sup>-1</sup> and its preparation for operation in 2017. Hyesook also presented some comparison of GEO-GEO between COMS and H8/AHI (and MT-2).

In 2017, KMA will prepare the GK2A AMI GSICS-based inter-calibration plan during the on-orbit verification in late 2018.

JMA congratulate KMA for uploading their products on the EUMETSAT server. GCC need to check what is the status of the products in the GPPA.

**A.GCC.2017.2j.1: GCC and KMA to check the status of KMA's products in the GPPA.**

### Agenda Item: 2k NASA Agency Report – 17:20 (15 minutes)

<b>Presenter</b>	Jack Xiong (NASA)
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<b>Purpose</b>	To present NASA's progress on GSICS activities
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

Jack recalled that NASA is not providing support to the GDWG as there is no needs as for other agencies (who need data server for instance).

Currently the IR reference for the CERES Edition 4A products is MODIS in order to have consistent cloud properties.

NASA contribution to the GRWG is:

- providing the reference for RSBs
- lunar calibration
- improvement and applications of calibration inter-comparison methodologies
- NASA ROSES Sat Cal Inter-Consistency Study: funding for 1FTE on their SBAF tool.

TSIS (T-1) will also be on the ISS in 2018. It is dedicated to Solar Irradiance Spectrum. T-2 is planned for 2020.

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Jack mentioned that NASA is interested by working with successors for instruments such as SCIAMACHY or GOME-2 to enhance the tool for SBAFs.

**A.GWG.2017.2k.1: EUM to provide the degradation model for GOME-2 to NASA (Dave Doelling).**

Agenda Item: 2k USGS Agency Report – 17:40 (15 minutes)	
<b>Presenter</b>	Tom Stone (USGS)
<b>Purpose</b>	To present USGS's progress on GSICS activities
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>Ron Morfitt is a member of the GRWG.</p> <p>Landsat-7: crossing time expected to drift to 09:45 (nominal is 10:00) by early 2020. Beyond that, data quality will be too degraded to be used. Landsat-8: on-board calibrators are more accurate than vicarious calibration. Performance are nominal. Tom presented some outcome of radiometric comparisons between Landsat-8 OLI and Sentinel-2A MSI over the Libya-4 site.</p> <p>USGS is also developing:</p> <ul style="list-style-type: none"> <li>- A Calibration/Validation Center of Excellence to consolidate the board expertise within USGS on on-orbit cal/val. A calibration workshop is planned in Fall 2017.</li> <li>- A Joint Agency Commercial Imagery Evaluation program, with representatives from USGS, NOAA, NASA and the US Dept of Agriculture. A workshop is organised yearly.</li> </ul> <p>A memorandum of understanding was written about a month ago to define joint agency efforts between USGS and NOAA. USGS has a huge amount of data that are fully available to the public.</p>	

Plenary GRWG+GDWG WG Reports + Briefing Session – 21 <sup>st</sup> March, 2017	
<b>Chair</b>	AM: Andrew Heidinger (NOAA ASPB) and PM: Dohyeong Kim (KMA)
<b>Minute Taker</b>	Sébastien Wagner (EUMETSAT) and Hyesook Lee (KMA)
<b>Attendance</b>	CIMSS: D. Tobin, P. Menzel, J. Taylor CMA: Xiuqing Hu (Scott), Zhe Xu (Thomas), Chengli Qi, Na Xu CNES: B. Fougne CSU: W. Berg EUMETSAT: P. Miu, T. Hewison, R. Munro, S. Wagner Gaid 3D: H. Shin, J. Park IMD: A. K. Mitra JMA: M. Takahashi, A. Okuyama KMA: D. Kim, H. Lee, J. Woo NASA: D. Doelling, X. Xiong, R. Bhatt, B. Scarino, C. Lukashin NOAA: L. Flynn, M. Bali, F. Yu, A. Heidinger, K. Knapp USGS: T. Stone UW: R. Holz
<b>Remote Attendance</b>	NOAA: R. Ferraro

## GSICS WGs – 2017 Minutes

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<b>Agenda Item: 3a GCC Report – 8:30 (30 minutes)</b>	
<b>Presenter</b>	Larry Flynn (NOAA)
<b>Purpose</b>	To report 2016-2017 GCC activities
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>GSICS messaging service subscriptions have significantly increased (more than 320 people in Feb 2017). Messaging service has been changed. Previously the service was outside the NOAA infrastructure. The new service is available from the GCC website. It is based on Google. This might be a problem for our Chinese partners.</p> <p>Newsletter: An editorial board is being set-up. Volunteers are welcomed to contact GCC (Larry or Manik). More than 60 attendees at the GSICS user workshop.</p> <p>The <a href="#">action tracking webpage</a> is now fully set up. It is a clear enhancement wrt the previous system.</p> <p><b>A.GWG.2017.3a.1: CMA(Scott) to confirm whether CMA can register for the <u>new messaging service from China</u>.</b></p> <p>New documents from WMO and GSICS-related are available. Members of the GRWG and GDWG are invited to provide feedback. The GitHub action on GCC is a problem due to NOAA policy. It will be discussed in the GDWG. 16-21 Oct 2017: 8th AOMSUC will host the next GSICS user workshop (Vladivostok, Federation of Russia)</p> <p>Question: Do we know where are the users (subscribing to the messaging service) are from? Answer: Yes, GCC has the geographical distribution.</p> <p>GCC confirmed that all users of the former system (MailChimp) have been transferred to the new system.</p> <p>Action GWG.2016.7i.4 was discussed. Some of it (user's requirement) should be reflected in the terms of reference.</p> <p><b>A.GCC.2017.3a.2: GCC to organise a web meeting before the User's workshop.</b></p> <p><b>A.GCC.2017.3a.3: Each agency should indicate who should represent the users on their side. Manik to coordinate.</b></p>	

<b>Agenda Item: 3b GDWG Report – 9:30 (30 minutes)</b>	
<b>Presenter</b>	Masaya Takahashi (JMA)
<b>Overview</b>	GSICS Wiki was migrated to the new server at UMD in June 2016. Mirroring GSICS products among the GSICS Collaboration Servers are ongoing. Revisiting GDWG ToR and discussing GDWG charing issues are main topic at the breakout session.
<b>Purpose</b>	To report notable progress last year and provide topics to be discussed at the breakout session and the plenary.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Currently there are 13 members in the GDWG. But some activities are delayed due to a lack of involvement of the various members. GDWG chairs recalled that GSICS is an international effort that requires the involvement of all partners. 2 actions from 2016 are pending + 19 older actions. For the latter, they are being reviewed to check if they are still relevant. The GSICS Wiki was successfully migrated. The new location allows members to freely contribute.</p>	

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CMA successfully implemented their collaboration server. EUMETSAT server is now ingesting KMA products in addition to the JMA products. The preservation of the RAC was endorsed by EP. Replication of data servers is an issue due to security constraints in some agencies.

An action from CGMS-44 indicates the the ToR for the GDWG need to be revisited. The operational tasks require substantial resources that are currently not available. It has to be discussed.

Regarding chairing the GDWG, it will be discussed in the break-up sessions as the current chairs are reaching the end of their mandate.

GSICS SRF format needs to be discussed to establish requirements on the contents. EUMETSAT is planning to provide MTG SRFs using the GSICS format. Some evolution of the format were proposed and need to be discussed.

The Plotting Tool is now supporting new products. Manik asked about the inclusion of the DCC product in the plotting tool. Presentation #2m open the discussion. However, Seb mentioned that VNIR product may not be mature enough to allow its inclusion in the plotting tool.

GDWG wants to discuss:

- NetCDF-4 Enhanced Data Model
- GSICS product generation framework
- Operation aspects
- Collaboration aspects.

After a question by Tim, Manik clarified the procedure to register to the GSICS wiki. It seems that some users had problems during the process. GDWG and GCC will investigate.

Comment: chairs emphasised that members of GRWG should specify the need for resources to their respective EP representative.

### Agenda Item: 3c GRWG Report – 9:3 (20 minutes)

**Presenter** Dohyeong Kim (KMA)

**Purpose** To report 2016-2017 GRWG activities

#### Discussion point, conclusions, Actions, Recommendations, Decisions

GRWG chair recalled the list of deliverables that GSICS is supposed to produce.

Interactions with CEOS activities and GPM-Xcal have been emphasised.

GRWG\_14.15 shall be closed.

GSICS\_15.1 could be part of the ToR. It should be closed.

**A.GWG.2017.3c.1: GRWG Chair to check with EP if the ToR could be changed to address GRWG\_15.1 (G.2/A43.16).**

GVNIR.2016.2n.1: NASA (Dave + his team) are in contact with ISRO and IMD to close the action.

GIR.2016.3o.1 can be closed

GIR.20163o.2 will be follow up by Arata's successor

GIR.2016.3p.4 is closed

GVNIR.2016. action on ARCSTONE can be closed as the project is going.

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Agenda Item: 3d GRWG IR Sub-Group Briefing Report – 10:00 (20 minutes)	
Presenter	Tim Hewison (EUMETSAT)
Purpose	To report 2016-2017 GRWG IR sub-group activities
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>Tim recalled the IR subgroup activities. Among others:</p> <ul style="list-style-type: none"><li>- Activities on IR sounders are now fully part of the identified activities as we have now instruments available</li><li>- Reference Sensor Traceability and Uncertainty is a key activity. A report is being prepared on the topic.</li><li>- The diurnal calibration variation is also now becoming more and more important as most of the platforms are now 3-axis stabilised.</li><li>- development of new technique on NWP inter-calibration</li><li>- GEO-GEO comparison</li><li>- Instrument specification, pre-launch char, cal/val testing: a workshop is being planned (date to be confirmed)</li></ul> <p>There is a lot of activities in the subgroup - although some are more active than others. Tim is keen in finding volunteers to coordinate some of the research activities.</p> <p>Hopefully soon KMA and ISRO prototype IR products will be promoted in demo version. The process is ongoing.</p> <p>Regarding broadband instruments and the generation of FCDRs, there is no specific requirements from the users. Tim reiterated that previously it was decided that FCDRs are not GSICS products in their own rights, but may be based on GSICS algorithms and corrections. If this view evolves within the GSICS and the user community, then it should be discussed.</p> <p>Is there NRT product among the operators with IR products in the L1b? For SEVIRI, L1.5 header include GSICS corrections. For MTG/FCI it is planned to do the same. But for some other missions it will be difficult if not at all possible to ingest those corrections into the L1b/c data. Other agencies such as CMA have used NRT corrections for the IR calibration.</p> <p>The GEO ring initiative will allow to see what is the impact of GSICS corrections on L2 product generation across the GEO constellation. The final decision on which correction to use is up to each data user.</p> <p>Dave pointed that a difference shall be made between expert users, who will keep using their specific calibration approach(es), and the normal users, who will be using the GSICS products. It was agreed that GSICS products should aim to be general, providing the best calibration for a broad range of applications, and that some specific applications (e.g. ocean colour) may have very specific calibration requirements and solutions. Bertrand recalled the discussion initiated on Monday about making the distinction between instrument calibration and system calibration.</p> <p>How could the products be best provided to the users? The GSICS servers are already providing the infrastructure. The definition of the user requirements is a key point. Those requirements shall be maybe few but consolidated.</p> <p>Dave mentioned that the reason why MODIS is so widely used is because the products are easy to find, easy to download and easy to read.</p>	

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Agenda Item: 3e GRWG VIS-NIR Sub-Group Briefing Report – 10:20 (20 minutes)	
Presenter	Dave Doelling (NASA)
Purpose	To report 2016-2017 GRWG VNIR sub-group activities
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>Dave gave a short overview of the CERES project goals. The GSICS effort helps in achieving those goals. Activities in 2016 include:</p> <ul style="list-style-type: none"><li>- the definition of the GSICS and IVOS recommended spectrum(-a): Tom commented that the definition such a spectrum is more a short/mid-term activity than a long term.</li><li>- reference instrument (NPP-VIIRS?)</li><li>- SBAF tool. Future version will also include the IR with IASI and AIRS.</li><li>- Combining method (as a start DCC and Lunar inter-calibration methods)</li><li>- Lunar Calibration</li></ul> <p>In 2017: focus on getting the GPRCs to enter the GPPA with their DCC product. Lunar calibration activities will continue with the 2nd lunar calibration workshop. More developments on the DCC will presented in the Thursday's session. New methods will discussed (such as Rayleigh scattering).</p> <p>Fangfang asked whether or not the hyperspectral data could also be provided through the SBAF tool. Will be discussed at the Thursday's session.</p> <p>Dave expressed a desire for the plotting tool to be updated to display DCC products. Resources for such tasks can be assigned to be coordinated by the requesting organisation's Data Management working group member. Since NASA does not offer such a member, the GDWG members will address how to deal with this type of request in the breakout session.</p>	

Agenda Item: 3f GRWG UV Sub-Group Briefing Report – 11:10 (20 minutes)	
Presenter	Rose Munro (EUMETSAT)
Purpose	To report 2016-2017 GRWG UV sub-group activities
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>Main projects are:</p> <ol style="list-style-type: none"><li>1. Reference solar spectrum</li><li>2. White paper on ground-based characterisation of UV/Vis/NIR/SWIR spectrometers</li><li>3. Match-ups and target sites</li><li>4. Cross-calibration below 300nm</li></ol> <p>Status of the projects:</p> <ol style="list-style-type: none"><li>1. many groups are participating to the activity including teams from the solar physics community</li><li>2. the white paper is in draft status. The proposed structure of the document was presented and Rose called for contributions in the various sections. Tim commented that this paper could be a template for other instrument types. See agenda item on Friday (by Dohyeong). Bertrand recalled that IOCCG had a similar report and concurred in saying it is very important (see <a href="http://www.ioccg.org/reports/IOCCG_Report13.pdf">http://www.ioccg.org/reports/IOCCG_Report13.pdf</a> for IOCCG paper).</li><li>3. Work currently being carried out by L. Flynn and colleagues. Resources for this activity are an issue. Tim commented that IVOS is taking care of this activity for Vis/NIR. Is there a counterpart for UV in CEOS? Rose and Larry were not aware of a group in CEOS doing that for the UV.</li><li>4. Comparisons of initial measurement residuals for O3 profile channels are done. This method is foreseen to be used to generate in-orbit calibration adjustments to remove biases between NOAA-19 SBUV/2 and S-NPP OMPS NP.</li></ol>	

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Agenda Item: 3g GRWG MW Sub-Group Briefing Report – 11:30 (20 minutes)	
Presenter	Ralph Ferraro (NOAA)
Purpose	To report 2016-2017 GRWG MW sub-group activities
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>Ralph recalled the scope of the MV sub-group. In particular he mentioned that coordination with CEOS WGCV MW and GPM X-cal would be required.</p> <p>On the top of the regular participating agencies, NIST and IISI is also contributing to the MW subgroup activities.</p> <p>Focus topics for 2016-2017:</p> <ul style="list-style-type: none"><li>- Defining clear path for GSICS MW products and algorithms</li><li>- Tying together other groups/opportunities</li><li>- Continued participation by subgroup at relevant meetings</li></ul> <p>A dedicated “workspace” (web page) was set up on the GSICS wiki for MW activities. The subgroup is meeting about every four months through Webex. Some additional meeting are organised in some specific context like GPM Xcal or GRUAN.</p> <p>Regarding the current ongoing activities, Ralph mentioned the work on SSTM/2 geolocation errors.</p> <p>Ralph also summarised the highlights of the 2016 GUW meeting - MW session, with in particular four contributions by W. Berg, J. Forsythe, G. Huffman and C.-Z. Zou.</p> <p>The CEOS joint session meeting in China (July 2016) was an opportunity to clarify the roles of the GSICS subgroup and the CEOS WGCV MW WG in order to avoid overlap and to rationalise the resources and efforts.</p> <p>During 2016 the key activities were building up the group, defining the main activities in coordination with other groups, and setting up some infrastructure. Ralph is hoping to report on “true” accomplishments in the upcoming year through specific actions that may result from the MW dedicated parallel session at this meeting.</p>	

Agenda Item: 3ka Aid to Users Selection of GSICS Products – 13:10 (30 minutes)	
Presenter	Tim Hewison (EUMETSAT)+ Manik Bali(NOAA)
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>Tim raised some questions at user side to aid users with GSICS products.</p> <p>Choice of the satellite calibration is application dependent. Users need to have some awareness of their needs in terms of required accuracy or level of uncertainties, sensitivity of their products to the calibration, etc. Users should also ask themselves if their application require the use of multiple references or not. SEVIRI-IASI user guide was presented as example however, there’s still question if those information is enough or if those information is useful for users.</p> <p>Some of this information is already provided in the User Guides, accessible from the GSICS Product Catalog. But it is heterogeneous in style and content. Andy concurs in the need to standardised the info provided to the users. A short summary is needed to allow the user to make a quick decision on the use or not of the GSICS products.</p>	

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Masaya commented user guides can be different with user group. Andy suggested firstly we can start the simple format but the user guide should include the information of sensor over whole operational time. Ken shared the experience of NCEI to support the various users and long document is not good and the simple and short document including the description of dataset is more efficient. Larry suggest some information need to be detailed for climate application including near-real time use but there still was concern with the long document.

The documentation can be detailed but at the same time it should not overwhelm the users. CERES is starting from the overview and provides links to more details information. The info is organised hierarchically.

**D.GWG.2017.3ka.1: It was agreed that it would be advantageous to provide basic information of the typical calibration biases of each instrument, derived from the GSICS Corrections, together with their variability and a statistical summary of the quality of the GSICS Corrections - i.e. their ability to correct the known bias. This information should be presented in a homogenous style for all instruments in a class for which GSICS products are available. It may be static - e.g. covering a snapshot (e.g. the last month/year), or covering the whole lifetime of the instrument - or dynamically updated, derived directly from the GSICS Corrections.**

The GDWG will discuss the possibility of providing these data as part of the Instrument Information landing pages.

Manik gave a presentation on the same topic: GSICS user requirements and feedback

Manik shared the feedback from the last surveys. Two user groups participated for the survey, which is one is subgroup inside GSICS community and the other group is subgroups outside of GSICS community. Manik presented the basic user requirements: 1) clear path towards benefiting from using the product, 2) Mature ATBD, 3) products related with Documents and Publications, 4) Users manual, 5) uncorrected/corrected radiances, 6) support from producer, 7) estimates of the GSICS references quality and traceability documentation, 8) products to be easy to use, 9) radiance values with uncertainties.

(Seb) To provide “5) uncorrected/corrected radiance” for L1B, it’s too much specially for AHI, ABI considering data size. GSICS correction information can be added to L1B header (?).

Manik summarized the user response and requirements on 1) GSICS intermediate data, 2) GEO ring, 3) IR products, 4) VIS products, 5) MW products, 6) UV products, 7) reference instrument and 8) climate users (Seb) need to be clarify who needs those information. For the case of moon data, it’s for the internal use as per GLOD policy

(Masaya) requires the moon data associated with the intermediate data for internal use.

### Agenda Item: 3k GEO-Ring test dataset - including VIS – 13:40 (60 minutes)

**Presenter** | Rob Roebeling (EUMETSAT, Remote)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Rob summarized the SCOPE-CM IOGEO project, which involves many international partners. IOGEO aims to re-calibrate and inter-calibrate the full time-series of IR, WV and VIS channels onboard of past and present geostationary satellites (CMS, Feng Yung, Himawari, Kalpana, METEOSAT, and NOAA). The ultimate project goal is to prepare a FCDR of re-gridded radiances normalised to a reference instrument.

Data from the HIRS infrared sounder are used as reference for the recalibration of the IR and WV channels. EUMETSAT have shared the HIRS data record (version 2, based on data provided by NOAA) with

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JMA and CMA. This dataset is available to the IOGEO community.

FCDR generation: re-calibration.

- A difference on “re-calibration” is made between “Sensor Equivalent Calibration”(GSICS definition) and “Harmonisation” (FIDUCEO definition).

FCDR generation: inter-calibration

- “Reference sensor normalised calibration” is different from “Homogeneisation” (FIDUCEO definition)

Objective: SCOPE-CM IOGEO and GSICS aim to compare their “Sensor Equivalent Calibration” (or re-calibrated) data from the CMS, Feng Yung, Himawari, Kalpana, METEOSAT, and NOAA geostationary satellites for two comparison days. Rob summarized that the joint IOGEO and GSICS inter-comparison is planned for the WV, IR,(and VIS) channels for 19 Aug. 2015 and 21 July 2016. Up to now, MET-7, Kalpana and FY-2D data were uploaded.

The timeline is as follow:

- 2017-2018 IR/WV/VIS recalibration of geostationary satellites for test days
- 2018: VIS recalibration geostationary satellites for FCDRs
- 2019-2020: gridded FCDR (GEO ring) of inter-calibrated radiances.

(Tim) VIS calibration is in 2 timeline of “2017-2018” and “2018”. Any difference?

(Rob) 2018 is overlapped period. For “2017-2018” period, we plan to recalibrate for test days and for “2018” we plan to generate full FCDRs.

(Scott) FY-2F is for rapid scan so needs to be excluded from GEO-Ring.

(Masaya) No consensus was made on visible calibration yet. Any recommendation?

(Rob) recommends to use vicarious calibration using DCC, desert or moon.

Tim explained that from a GSICS perspective, we should aim to all provide GSICS Corrected L1 data - based on IASI for the WV/IR and DCC(MODIS) for the VIS. This may be in addition to any other recalibration algorithms contributors may choose to provide. Rob explained that this is possible and encouraged - and that there are already folders set up on the ftp server (ftp.eumetsat.int, where the IOGEO and GSICS partners got username, password access for uploading their data). GSICS partners are encouraged to contribute these datasets, and invited to contact Rob if interested in analysing the results.

### Agenda Item: 3I Update on FIDUCEO to address inter-calibration requirements & formats – 14:40 (20 minutes)

**Presenter** Frank Ruethrich (EUMETSAT, Remote)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Frank presented the FIDUCEO project and its goals, which aims to develop and apply a rigorous metrology of Earth observation for climate data records and will provides FCDRs and TCDRs.

One key aspect of the FIDUCEO project is to establish the traceability and the uncertainty propagation. Six effects accounted for :

- Deep Space estimates
- SZA
- Earth count contribution

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- Irradiance contribution (= caused by errors in the SRFs)
- Calibration coeffs (slope + offset)

The overall uncertainty as obtained by the propagation chain will be provided in the end FCDR product.

2 products are defined commonly in FIDUCEO: full FCDR, easy FCDR. For MVIRI, they are complemented with a static FCDR (geometries) and a LUT-FCDR (for second order sensitivities) to account for some peculiarities of a geostationary satellite. FullFCDR (and LUT-FCDR) will be available on request but are not meant to be distributed to all users.

Seb asked whether or not the work on the SRF characterisation in time is of interest for the GRWG? There is some work on-going in the IR. Tim said that in general this is a topic that could be of interest for the GSICS community.

Frank commented that users (some) seemed reluctant to change their SRFs in time.

Andy asked whether there is a plan to reverse the evolution in time of the SRFs to reconstruct a stable instrument (homogenisation to FIDUCEO sense [Rob]). FIDUCEO plans is to provide the reconstructed radiances but not the SRFs.

**A.GWG.2017.3o.1: Rob (EUMETSAT) to report back at the next annual meeting on the investigation to do an homogenisation in the radiance space (instead of in the spectral space with the SRFs).**

Dave asked about the uncertainties on the pre-launch SRF uncertainties.

Frank: the pre-launch estimates presented are as provided by vendor for MET7. Vendor provided such measured SRF for each Satellite. They are significantly different from each other. This is not plausible, because MET5, 6 and 7 were produced in one batch. In fact it is assumed (and proven e.g. by Govaerts et al. 1999) that the MET7 SRF is applicable to all three sensors.

Post-meeting note: Frank confirmed *prior information is only used in the very red end of the spectrum (>0.8um). However, where used, the prior is not the pre-launch but a generic "silicon-like" SRF, which is, as far as I remember, a combination of transmissivities taken from documentation of SEVIRI. I.e. of the Telescope transmissivity (somehow modified because SEVIRI is silver coated and MVIRI was aluminium coated), Focal Plane Benches and the SEVIRI detectors. This setup has proven to yield most consistent results as compared to setups with pre-launch SRFs as prior or when priors were used over entire band.*

Fred commented on the fact that SRFs degrade faster in the shortwaves. For VIIRS, it is actually not the case (reference?).

### Agenda Item: 3p CGMS-45 working paper – 15:00 (20 minutes)

Presenter | All

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Two papers were submitted in WG II (Lunar Calibration by Tom + IR by Tim). Suggestions for working papers for this year's CGMS meeting are invited, which can be considered during the break-out sessions. This will be further discussed on Friday under agenda item [9b](#).

### Agenda Item: 3j Advanced Next Generation GEO Imagers

Presenter | Fred Wu(NOAA)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Fred gave a presentation on the next generation imagers and started with the improvement from 1st to

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2nd generation, which is the increase of duty cycle for 5% to > 80%, full-optical calibration and the stability of SI detector. The major improvement from 2nd to 3rd were made in three times more channels, four times finer spatial resolution, five times faster scan and six times better of data.

The major challenges in 3rd generation imagers :

- 1) Massive arrays of detectors
- 2) coordinate all those detectors : new paradigm of INR from “shoot where pointed” to “point where shot” required
- 3) onboard calibration for VNIR

The increased Repeat Cycle improves the collocations as no LEO observation is wasted so the sampling is much larger. The criteria for the collocations can also be refined, which improve the quality of the data analysis.

Dave: The SRF is now narrowed. How the throughput? How do get enough photons?

Fred cannot answer now. But hopefully will be able to talk about it later.

### Agenda Item: 3m Strategy for combining corrections for VIS/NIR+IR channels and plotting tool – 15:50 (30 minutes)

<b>Presenter</b>	Sébastien Wagner (EUMETSAT)
<b>Overview</b>	The VIS/NIR and IR product formats were compared in order to assess commonalities and specificities that would facilitate or prevent the merge of those products into one unique file. The potential implications of merging those products were listed for discussion. As a related item, the potential implications on the design and functionalities of the GSICS plotting tool were also presented. The choice made on the product specifications will clearly impact the definition of the user requirements for the GSICS plotting tool.
<b>Purpose</b>	This presentation was prepared to support a discussion on the feasibility or not to merge VIS/NIR and IR GSICS products in one unique product.

### Discussion point, conclusions, Actions, Recommendations, Decisions

Seb outlined the concept of combining the VIS/NIR and IR products into common files and highlighted the similarity between this and the CGMS recommendation to inject GSICS products into the L1 data.

The previous agreement to include the results of individual methods in the merged products for the VIS/NIR channels would be further complicated if there is an additional requirement to include the results from multiple reference instruments, following the example of the current demonstration Prime products for the IR channels. Seb explained that the simplest solution would be to remove the results of the individual methods from the final product.

R.GWG.2017.3m.1 : Recommendation from Data Management (P. Miu) - decisions taken on combining/including corrections within level 1 files should a) make use of the data easier for users and b) reduce maintenance activities as far as possible.

(Pete) DOI is assigned to ATBD.

Sebastien went on to outline potential requirements to apply the GSICS plotting tool to VIS/NIR products, and pointed out that the plotting tool provides a good means of checking products are compliant with the GSICS netCDF conventions.

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Fred suggested a prototype plotting tool should be developed for the VIS/NIR channels.

Manik suggested to keep the same DOI for ATBD. It's not likely there's no benefit for new DOI assigned when ATBD is updated.

Bertrand reiterated the need to keep the GSICS products simple for users, and recommended against providing individual results.

(Seb) It's hard to make the decision till we actually have more methods implemented and (Pete) it can be the matter of complexity in file or complexity in the selection of files.

(Tim) Is it possible to put the different groups of data into one file? (Pete) It may be very challenging.

(Dave) suggested to build the customize file which consists of groups of data for targeted users.

There was a broad consensus that we generate files that are complicated for users to use.

It is more beneficial for user to make the decision. (Tim) All users are not that expert to make the decision.

### Agenda Item: 3n Use of NWP+RTM as inter-calibration tool – 16:20 (20 minutes)

**Presenter** Tim Hewison (EUMETSAT)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Tim introduced the use of NWP+RTM as inter-calibration tool.

(Larry) Coordinates with NWP+RTM is very beneficial but it needs to be carefully used by considering the various differences with sensors like the scan angle.

(Rose) Simulating has different impact with sensors.

It is good to start with same sensor model.

(Larry) Even with the same instruments, it can be different with orbit and with other on-orbit condition.

(Fred) For the case of RTM, it's possible to simulate the orbit difference.

**D.GWG.2017.3n.1: NWP+RTM approach will not be pursued within the IR Sub-Group at this time. Instrument operators are encouraged to work together with NWP centres to understand their biases, but there remain many obstacles to achieving absolute agreement between NWP/RTM double differences with other inter-calibration methods due to incomplete cancellation of model biases - especially for window channels.**

### Agenda Item: 3o Spectral Response Function file towards "GSICS Standard netCDF" – 16:40 (20 minutes)

**Presenter** Masaya Takahashi (JMA)

**Overview** To introduce current status of NetCDF SRF and propose a new file convention as "GSICS Standard NetCDF"

**Purpose** To get requirements from GRWG for the following discussion at GDWG session.

#### Discussion point, conclusions, Actions, Recommendations, Decisions

The GIRO is the only user of the GSICS SRF format, in order to address the variety of instruments. EUMETSAT is also planning to use GSICS SRF format for MTG FCI. However, it supposes a change in the format. In order to follow the CF convention, some actions are needed (change in the units, additional fields, etc.) and these will be discussed at the GDWG breakout session.

One of the additional information in the new format is to have the uncertainties on the SRFs. Input from the GRWG is required, but nothing special requirements were provided at the talk.

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K. Knapp mentioned that the use of standard names is not necessary for SRF files as the purpose of standard names is to have automated extraction procedures, which is not really needed for SRF.

**GRWG Breakout Session Day-1 (UV Sub-Group) – 22<sup>nd</sup> March, 2017**

<b>Chair</b>	Rosemary Munro (EUMETSAT)
<b>Minute Taker</b>	Rosemary Munro (EUMETSAT) / Larry Flynn (NOAA)
<b>Attendance</b>	Rosemary Munro (EUMETSAT), Larry Flynn (NOAA NESDIS), Bertrand Fougne (CNES), Xiuqing Hu (CMA), Mina Kang (Ewha Womans University), Dohyeong Kim (KMA), Sergey Marchenko (SSAI), Ashim Mitra (IMD), Arata Okuyama (JMA), Chengli Qi (CMA), Tom Stone (USGS), Sébastien Wagner (EUMETSAT), Fangfang Yu (NOAA)
<b>Remote Attendance</b>	Berit Ahlers (ESA/ESTEC), Eric Beach (NOAA), Trevor Beck (NOAA), Kelly Chance (Harvard SAO), Odele Coddington (LASP, University of Colorado), Thorsten Fehr (ESA/ESTEC), Dave Flittner (NASA Langley), Liang-Kang Huang (SSAI), Glen Jaross (NASA), Jhoon Kim (Yonsei University), Ruediger Lang (EUMETSAT), Xiong Liu (Harvard SAO), Diego Loyola (DLR), Nischal Mishra (SSAI, NASA Langley Research Center), Lidia Saavedra de Miguel (ESA/ESRIN), Colin Seftor (SSAI), Martin Snow (LASP, University of Colorado), Kang Sun (Harvard SAO), Ben Veihelmann (ESA/ESTEC), Kai Yang (ASOC/UMCP), Zhihua Zhang (NOAA)

**Agenda Item: 4a Using Version 8 Ozone Profile algorithm initial and final residuals to track calibration drift and estimate biases between instruments – 8:30 (15 minutes)**

<b>Presenter</b>	Larry Flynn (NOAA)
<b>Overview</b>	The purpose of this project is to use initial measurement residuals from the Version 8 ozone profile retrieval algorithm to compare channels from 240 nm to 290 nm. Goals Agreement at 2% for Profile channels by using the Version 8 A Priori Profiles with TOMRad Tables and single scattering.
<b>Purpose</b>	Cross-calibration below 300 nm
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
Long-term inter-calibrated initial and final residuals were presented for SBUV/2. Also shown were inter-calibrated residuals compared to operational residuals with SZA drift and calibration adjustments for NOAA-19. Similarly operational Initial Residuals for SBUV/2 & OMPS with Operational Adjustments were shown. S-NPP and NOAA-19 are not in exactly the same orbit - this difference needs to be accounted for. Note that for the SBUV V8Pro algorithm: The change in the climatology used for the instruments causes some discontinuities in the residuals (the proposed approach is based on a double difference using climatology). Initial measurement residuals can identify calibration biases between instruments. The intention is to provide tools to create initial residuals for other instruments and to expand and formalize matchup techniques. NOAA will reprocess and homogenize NOAA-16 through NOAA-19 SBUV/2 and OMPS NP for a post-2000 Ozone Profile CDR and create invariant channel combinations under SZA & SVA changes.	

**Agenda Item: 4b Match-ups and Targets Sites: Vicarious calibration by using statistical properties for ozone, reflectivity and aerosol index products in a latitude/longitude box over the equatorial Pacific – 8:45 (15 minutes)**

<b>Presenter</b>	Larry Flynn (NOAA)
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<b>Overview</b>	The aim is to produce over-pass comparisons of UV/Vis sensors for specific target sites or regions in use by the community. As a first step, summaries of methods and results for target sites currently in use will be collected. We will compare measurements at reflectivity channels from 330 nm to 500 nm.
<b>Purpose</b>	Match-ups and Targets
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Weekly 1-percentile effective reflectivity, total column ozone and aerosol index values (measurement residuals for wavelengths in the 360-nm range using effective reflectivity calculated for the 331-nm range) for the V8 algorithm for all the data in a latitude/ longitude box in the Equatorial Pacific versus cross-track view position were presented. The reflectivity minimum is expected to be between 4% and 6% for open ocean, and the aerosol index values are expected to have approximately zero N-values for this region of the globe. The cross-track variations for positions around position #10 are related to sun glint effects. Consistent variations versus cross-track are due to calibration biases across the instrument CCD array.</p> <p>Open questions are: How stable are the values year-to-year? What factors produce the most instability? What should the 1-percentile effective reflectivity values be? Can the method be used for absolute calibration? Can minimum reflectivities over land be used for sunglint FOVs? Do we need to screen for aerosols? Can a V8TOz tool be developed to allow similar computations for other instruments' measurements? It is planned to generate and compare Equatorial Box time series for OMI, OMPS and GOME-2.</p> <p>Rose Munro queried how these activities could be generalised and made available to the wider GSICS community via the UV Subgroup? She also asked for a volunteer to lead the UV Subgroup Targets and Match-up project. None was forthcoming!</p> <p><b>A.GRWG.2017.4c.1: Rose to investigate what tasks and tools are needed to pursue the work presented by Larry in the broader context of the UV Subgroup and in particular to identify resources needed with the aim of bringing this to the attention of the EP.</b></p>	

<b>Agenda Item: 4c Project on Consistency of OMI and GOME-2 HCHO retrievals: overview and preliminary results – 9:15 (15 minutes)</b>	
<b>Presenter</b>	S. Marchenko (SSAI)
<b>Overview</b>	Aim is to examine the consistency of HCHO retrievals from GOME-2 and OMI data to extract information about the diurnal variation of HCHO. Conclusions are drawn about the quality of the level 1 data
<b>Purpose</b>	Comparison of Level-2 Retrievals from Different Instruments
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Challenges in the spectral fitting come from the the long-term changes of the spectral instrument transfer function for GOME-2, with some Earthshine/Solar inconsistencies and the orbital (along-track) ITF changes in the GOME-2 data. The orbital (x-track) ITF variability is rather subtle, &lt; 1%. It is more evident over the low-reflectance scenes suggesting influence from stray light. The current approach is not sensitive enough to characterize these ITF changes. Way forward: attempt to characterize changes in the instrument transfer function exploiting the PCA sensitivity to the Ring (RRS) spectrum, thus probably deriving ITF from RRS. Attempt to use, as a reference, the spatially- (viewing geometry) and time-dependent Earthshine radiances taken over clean and cloudy areas addressing the orbital GOME-2A ITF changes. To bring together the OMI and GOME-2A HCHO retrievals: compare the HCHO retrievals coming from the simultaneous nadir overpass events (to within ~15 min and +/- 0.15 degree; mostly circumpolar regions; ~few/day); match the footprints (OMI –</p>	

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to-- GOME-2) and, if deemed important, spectral resolution (GOME-2 –to– OMI); quantify the interference from aerosols and clouds.

This presentation reinforces the need for a stable ISRF (ITF).

**Agenda Item: 4d White Paper on Ground-based Characterisation of UV/Vis/NIR/SWIR spectrometers – 9:30 (15 minutes)**

<b>Presenter</b>	R. Lang (EUMETSAT)
<b>Overview</b>	A proposal was made for a ToC for a white paper on on-ground calibration of UVNS hyper-spectral sensors. The proposal was based on experience with the multiple GOME-2 calibrations (and other experience from the wider community). Comments and contributions were requested.
<b>Purpose</b>	To present a proposal for (on-ground) calibration white paper for UVNS hyper-spectral sensors and call for contributions and comment.

**Discussion point, conclusions, Actions, Recommendations, Decisions**

A ToC was presented (see presentation) with sections addressing accuracy, sensitivity and repeatability and also various instrument components. A number of examples from the GOME-2 calibration campaigns were presented. Three GOME-2 instruments were built at the same time and multiple on-ground calibration GOME-2 campaigns were performed for the same instrument. measurements providing the opportunity to see the changes in time in the instrument performances or alternatively the impact of differences in calibration set-up on the characterisation. One lesson learnt from this exercise is that it is very important to ensure repeatability.

The question was raised as to whether we should also cover in-orbit calibration activities and the consensus seemed to be that on-ground characterisation should be the focus and that in-orbit calibration should be included where appropriate for verifying the instrument behaviour on-orbi. It was also proposed to assess criticality and complexity in each section to assist in prioritisation of activities. Ruediger will send an email to the UV sub-group asking for feedback and contributions.

Bertrand Fougne commented on the usefulness of the work and supported the initiative including the assessment of complexity of the tests. He suggested that such a document could be used as a checklist. The white paper should be clear on what needs to be characterised on-ground, in particular when it is not possible to do so in-flight. Rose Munro invited people who want to contribute to the white paper to contact herself or Ruediger.

**Agenda Item: 4e Modeling OMPS Nadir Profiler solar measurements and comparisons to reference measurements – 10:30 (15 minutes)**

<b>Presenter</b>	Larry Flynn (NOAA)
<b>Overview</b>	Goals: Agreement at 1% on solar spectra relative to bandpass-convolved high resolution spectra as a transfer after identifying wavelength shifts and accounting for solar activity, long-term solar spectra drift and instrument degradation by using OMI solar activity pattern (with internal confirmation from Mg II Indices and scale factors)
<b>Purpose</b>	The purpose of the is project is to compare solar measurements from BUV (Backscatter Ultraviolet) instruments. The goals are to achieve agreement at 1% on solar spectra relative to bandpass-convolved high resolution spectra as a transfer after identifying wavelength shifts and accounting for solar activity Long-term solar spectra drift and instrument degradation will also be addressed by using OMI solar activity pattern (with internal confirmation from Mg II Indices and scale factors).

**Discussion point, conclusions, Actions, Recommendations, Decisions**

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The OMI, GOME-2 and OMPS teams have generated models of their time series of solar measurements by using Solar activity (with proxies (e.g., Mg II Indices) and directly estimating pattern over solar rotations) wavelength shifts, diffuser and instrument degradation. In this presentation an extensive analysis of the OMPS NP solar spectra was presented. It was concluded that we have a number of tools available to compare solar spectra from different instruments but that it would be useful to identify the time that reference spectra were taken (to know the influence of the solar cycle). Participants are encouraged to provide more reference spectra, including the solar activity patterns, also wavelengths, band-passes and day 1 solar spectra for more instruments and to share models of solar activity, degradation and wavelength shift patterns and time series. Participants are encourage to compare and inter-compare references and operational instruments.

**Agenda Item: 4f UVN hyper-spectral Solar reference spectra: Comparison to GOME-2 BOL and Modelling – 10:45 (15 minutes)**

<b>Presenter</b>	R. Lang (EUMETSAT)
<b>Overview</b>	The GOME-2 solar reference comparisons were presented.
<b>Purpose</b>	The aim of this presentation was to present the current state of analysis of the GOME-2 solar spectra including long-term modelling of the solar spectra behaviour taking into account instrument degradation, wavelength shifts and solar activity changes.

**Discussion point, conclusions, Actions, Recommendations, Decisions**

R. Lang presented the analysis of the GOME-2 solar spectra. He presented a number of reference spectra. Comparisons between solar reference spectra used in this study show generally good to very good performance above 400 nm (up to 780 nm) in the overall irradiance levels, when compared to a solar spectrum from GOME-2 taken at the very beginning of the mission (42 days in-orbit). Below 400 nm there can be substantial differences in the baseline performance. However, solar variability is not yet accounted for in this performance. Not all of the evaluated spectra possess the required spectral resolution required to serve as a UVN hyper-spectral reference. They may however be used for adjusting the baseline, if needed. EUM is currently in the process of implementing a solar- and instrument/platform-variability model for GOME-2 on Metop A developed by Krijger et al. (ESS) in a study with CGI. Initial and preliminary results show the capability of the model to forecast the solar variability for most of the 4096 spectral points of the GOME-2 solar spectrum. There is still some underperformance of the EUM proto-type implementation of the model in the UV. Future work includes applying the model of solar activity to the solar reference spectra, in case their solar activity levels and time of measurement are known.

**Agenda Item: 4g High resolution reference solar spectrum for GEMS and TEMPO – 11:00 (15 minutes)**

<b>Presenter</b>	M. Kang (Ewha Women's University)
<b>Purpose</b>	The aim of the work presented is to prepare a high resolution reference solar spectrum for use with TEMPO/GEMS and other future instruments.

**Discussion point, conclusions, Actions, Recommendations, Decisions**

A number of high resolution reference spectra were updated with a view to use for the spectral calibration algorithms of GEMS and TEMPO. The spectral calibration algorithm is highly sensitive to the reference solar spectrum. There is a newly derived solar line list from JPL. This is not radiometrically calibrated but has very high resolution. The SAO2010 and JPL (over 380nm) are the only very good measurements for TEMPO/GEMS and beyond after calibration with low resolution spectra (WHI below 310 nm and ATLAS above 310 nm). The final reference spectrum is likely to be of significant interest to the community - the study team are encouraged to provide the spectrum to Larry Flynn for the solar project.

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<b>Agenda Item: 4h Deriving the Instrument Transfer Function from OMI Solar Observations and its Implications for Ozone Retrievals – 11:15 (15 minutes)</b>	
<b>Presenter</b>	K. Sun (Harvard SAO)
<b>Overview</b>	The presentation describes the analysis of the OMI ITF in-orbit, as compared to the ITF measured preflight, and analyses the impact of various correction schemes on the quality of the ozone profile retrievals as compared to sonde data.
<b>Purpose</b>	To assess the need for in-orbit correction of the OMI ITF.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>OMI slit functions were thoroughly measured preflight (Dirksen et al. 2006). The aim is to assess whether the on-orbit slit function is the same as measured preflight, whether it is stable and whether it possible to derive on-orbit slit function and improve ozone profile retrievals? The ITF will be derived from the solar observations using a high resolution reference solar spectrum. Various fits were performed - a Gaussian function, a super-Gaussian function, the preflight IFT with a homogeneous stretch, both spectrally averaged and spectrally resolved. Temporal variability was also assessed using four spectral windows per OMI band. The on-orbit temporal variability was also compared to solar cycle variability. The effect of the OMI Row Anomaly (RA) was also considered. The conclusion was that derived OMI on-orbit slit functions are complicated by solar activities at certain wavelengths, slit functions of non-RA rows are stable over time, the RA had impact on slit functions for &lt; 300 nm and on-orbit slit function widths differ from preflight, varying by cross-track positions. This reinforces the need to confirm the measured preflight ITF when on orbit. Derived slit functions show better cross-track consistency in ozone retrievals.</p>	

<b>GRWG Breakout Session Day-1 (MW Sub-Group) – 22<sup>nd</sup> March, 2017</b>	
<b>Chair</b>	Ralph Ferraro (NOAA) (Remote)
<b>Minute Taker</b>	Martin Burgdorf (Univ. of Hamburg) (Remote)
<b>Attendance</b>	Wes Berg (Colorado State Univ./NASA GPM) Manik Bali (Univ. of Maryland/NOAA) Tim Hewison (EUMETSAT) Ed Kim (NASA/GSFC) Dohyeong Kim (KMA) Derek Houtz (NIST)
<b>Remote Attendance</b>	Jun Park (KMA) Martin Burgdorf John Yang (Univ. of Maryland/NOAA) Karsten Fennig (DWD) Ralph Ferraro (NOAA) Sante Laviola (ISAC/CNR) Sreerekha Thonipparambil (EUMETSAT) Sabatino DiMichele (EUMETSAT) Cheng-Zhi Zou (NOAA) Vinia Mattioli (EUMETSAT) Tony Reale (NOAA)

<b>Agenda Item: 6a Lunar Calibration – 8:00 (25 minutes)</b>	
<b>Presenter</b>	Martin Burgdorf
<b>Overview</b>	Lunar intrusions can contaminate cold space calibration of MW sensors, however, it can also be useful to characterize the sensor as well.
<b>Purpose</b>	To show how lunar intrusions affect AMSU-B and MHS sensor and can be used to

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characterize it - asymmetries, stability, alignment, non-linearity, etc.

### Discussion point, conclusions, Actions, Recommendations, Decisions

Martin explained how MHS scans the Moon in the space view, which traces a circle in the sky during each orbit, inclined to the celestial equator, covering  $\sim 4^\circ$ . However, the Moon orbits in the plane of the ecliptic, so there are only a few periods in the year when the Moon is visible in the space view.

Each lunar intrusion in the space view maps a Gaussian-type response, according to the antenna pattern, peaking in one of the space views, with weaker signals also visible in adjacent space views. The strongest signal should correspond to the minimum angle - any shifts indicate a misalignment in the AAPP, which can find errors  $< 0.3^\circ$ . Similarly the relative strength of the maxima in each channel can verify their respective alignment. He showed asymmetric antenna pattern results for Metop-B/MHS.

Martin reviewed different lunar radiance models, concluding that even the best current one has a relative uncertainty of 2% over a limited range of phase angles, which is not good enough for absolute calibration. However, the relative Tb difference between the channels should be consistent within 1%.

In summary: The Moon can give information about:

1. Asymmetries in beam pattern
2. Pointing error in scan and cross-scan direction
3. Alignment of channels and deep space views
4. Radiometric temporal stability
5. Inter-band photometric calibration
6. Inter-calibration independent of time and equator crossing time
7. Non-linearity

Issues:

- Careful analysis is laborious compared to that of SNOs.
- Beam size must have a diameter of one degree or smaller.
- Minor problems:
  - inhomogeneous temperature distribution, libration, etc.

Evaluate instrumental properties in flight and compare them to measurements on ground: values and uncertainties

Refine model by Mo & Kigawa with AMSU-B (constrain thermophysical models - useful for radio astronomy?)

Prepare for second generation instruments like ICI or MWI: smaller beam diameter will greatly increase signal-to-noise ratio.

Q: Error budget? Frequency-dependence of emissivity is weak - often assumed to be zero.

Q: What range of Moon phase is observed by MHS? Example of METOP-A and -B: Equator Crossing time is 21:30. Center of circle described in the sky by DSV is therefore approximately  $2.5 \times 15 \text{ deg} + 90 \text{ deg} = 127.5 \text{ deg}$  away from the Sun. Opening angle of DSV circle is  $2 \times (270 - 253.6 + 2.2) \text{ deg} = 37.2 \text{ deg}$ . So the possible range of S-O-T is  $127.5 \pm 37.2 \text{ deg} = 90.3 \dots 164.7 \text{ deg}$  (waning).

Q: Other geometric influences? The most important ones are phase angle and distance from satellite.

Q: Libration - Earth-Moon-Sun distances? Libration was looked at for the thermal infrared by J. Daniels et al. (2015) and seems negligible. Moon-Sun distance  $d$  varies little and can be approximately corrected for: Moon's flux  $F$  is proportional to  $1/d^2$  and  $T^4$ .

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Q: Application to microwave imagers? **Never thought about it - maybe I should.**

Q: Assumptions? same size, same emissivity, same temperature profile, penetration depth in each channel. **Size is indeed constant (the Moon's polar and equatorial radii are the same, only apparent size varies), for variation of temperature with channel see ICARUS 5, 606-634 (1966)**

**R.GMW.2017.6a.1: Get an update from Martin in approx. 6 months.**

**Agenda Item: 6b Update on JPSS-1 ATMS Calibration – 8:25 (15 minutes)**

<b>Presenter</b>	Ed Kim
<b>Overview</b>	A verbal update of JPSS-1 ATMS status
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Finished TVAC testing in Feb 2017 and instrument was bolted onto S/C last week.                  Spacecraft-level testing will start soon, with launch due in September                  This is the 3rd time for JPSS-1/ATMS has been tested, with both previous tests resulting in major repairs on 20 out of the 22 channels.                  NEdT is better than SNPP/ATMS, but non-linearity has increased - but worst case residual non-linearity (after correction) is &lt;0.1K.                  1/f noise has reduced, so less stripping is expect.                  Inter-channel correlation is also significantly better than for S-NPP.</p> <p>Q: Status of S-NPP/ATMS? Still operating, but bearings are gradually wearing out, which is one of the drivers for the launch of the replacement. Scan reversals are now being done every orbit. No gap is expected between S-NPP and JPSS-1.                  Q: Why is non-linearity worse? The physical mechanism is not fully understood.                  Q: Stripping has increased in some channels and reduced in others, but will be much less than for S-NPP. But the magnitude has not been calculated yet, but is expected to be &lt;~few tenths of a K.                  Q: What changes? No design changes - mostly workmanship</p> <p><b>A.GMW.2017.6b.1 : Ed Kim (NASA) to give an update on the status after launch.</b></p>	

**Agenda Item: 6c Candidate GSICS products - Window Channels – 8:40 (25 minutes)**

<b>Presenter</b>	Karsten Fennig (Remote)
<b>Overview</b>	Climate Monitoring SAF has produced a FCDR of Microwave Imager Radiances - SMMR, SSMI, SSMIS (1978-2015). It is well documented - ATBD, DOI
<b>Purpose</b>	This nearly 40-year time series may be considered by GSICS as a potential product for MW imager channels.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Karsten introduced the 3rd edition of the CM SAF FCDR for microwave imagers.                  This includes a complete reprocessing with extensive corrections, including the use of ERA-20c NWP re-analysis.                  The FCDR does not attempt to correct for the changing satellite overpass times - although this is accounted for in the inter-calibration.                  The inter-calibration method is based on cold and warm scenes, based on the double difference of V and H polarisations. These differences were also studied as part of the product validation.                  Further validation was done using ERA-interim and ERA-20c, which showed small differences. Both showed small, stable Robust standard deviations (~1K) - although these were larger for SMMR</p>	

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Summary

- CM SAF FCDR provides carefully inter-calibrated Brightness Temperatures for the instruments SMMR, SSM/I, and SSMIS aboard 10 different platforms covering 1978 – 2015.
- Extension of existing SSM/I FCDR with inter-calibration via F13/F16 overlap to SSMIS and ERA-20c to SMMR.
- FCDR data processing accounts for identified issues: moonlight-intrusions, sunlight-intrusions, along-scan correction, reflector emissivity and assigns quality control flags.
- Data files are available as daily collections in NetCDF-4 conforming to CF Metadata Conventions 1.6. from <http://wui.cmsaf.eu/> or via DOI [http://dx.doi.org/10.5676/EUM\\_SAF\\_CM/FCDR\\_MWI/V003](http://dx.doi.org/10.5676/EUM_SAF_CM/FCDR_MWI/V003)
- Individual Algorithm Theoretical Basis Documents (ATBD) and Product User Manuals for SMMR, SSM/I, and SSMIS, plus Validation Report are provided.
- Data files include all sensor specific raw data record sensor information to achieve full traceability plus:
  - Quality control flags (scan, channel, FOV),
  - Earth incidence angles,
  - Averaged 91 GHz TBs and 85 GHz TBs over ocean (SSM/I F08 and SSMIS),
  - Incidence angle normalization offsets (over ocean) as separate layer (SSM/I, SSMIS),
  - Inter-sensor calibration offsets as separate layer
  - Sensor sensitivities (e.g. NEdT) as daily estimates.
- FCDR was externally reviewed and released February 2017
- Extension planned within CDOP-3

There appear to be differences between the CM SAF and CSU FCDR's - mostly over land? Also, some difference noted over rain forest between SAF, RSS and CSU. Karsten notes that the APC may be one reasons - can this be made common? Karsten and Wes Berg do meet/collaborate; Berg notes that the CSU product, delivered to NOAA several years ago, is probably less mature than the CM SAF product.

**A.GMW.2017.6c.1: Karsten Fennig to determine feasibility of extracting the inter-calibration algorithms and coefficients from the FCDR and making them a GSICS product.**

<b>Agenda Item: 6d Candidate GSICS products - Oxygen Channels – 9:05 (25 minutes)</b>	
<b>Presenter</b>	Cheng-Zhi Zou (Remote)
<b>Overview</b>	To evaluate the performance of the NOAA AMSU-A FCDR after 6-years of recalibration
<b>Purpose</b>	This nearly 40-year time series may be considered by GSICS as a potential product for MW oxygen channels.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
Recalibration of the AMSU-A sounding channels was completed in 2011 (Zou and Wang 2011). All recalibration coefficients were obtained using overlaps before 2011	
It is desirable to understand how the recalibrated data perform after 6 years of recalibration	
Are calibration coefficients still working well in terms of minimizing inter-satellite biases?	
Only channels 4-9 are examined	
NPP ATMS is available since 2011--preparation of inter-satellite calibration for ATMS with similar channels	

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FCDR was validated by analysing inter-satellite biases - e.g. Ch4: All biases are within 0.1K, but NOAA -18 had a bias drift about 0.1K/Dec

Cheng-Zhi also validated the results for Ch9 with GPSRO, which gave amazing results for NOAA-15.

### Conclusions

- Biases for most satellite pairs are within 0.2K. Agreement between NOAA-15 and NOAA-18 are extremely well (within 0.05K) for all channels 4-9
- Aqua became noisier for channel 6 after 2011 and unusable for channel 5 after 2013
- NOAA-16 needs further recalibration to remove its nonlinear signals for channels 7 and 8
- The excellent agreement between NOAA-15, NOAA-18, and AQUA provides evidence that these satellites can be used as reference satellites (Bali et al. 2017)

Q: What are the main causes of the constant biases?

A: Maybe biases in warm target accuracy, mirror reflectivity, cold space.

**A.GMW.2017.6d.1: Cheng-Zhi Zou to determine feasibility of extracting the inter-calibration algorithms and coefficients from the FCDR and making them a GSICS product.**

### Agenda Item: 6e Blackbody targets - Future Reference Standard? – 9:30 (30 minutes)

<b>Presenter</b>	Derek Houtz
<b>Overview</b>	NIST is developing a ground based, pre-launch black body calibration. This work was initially led by David Walker, who has recently retired.
<b>Purpose</b>	This BB standard would serve as a pre-launch standard for future sensors.

### Discussion point, conclusions, Actions, Recommendations, Decisions

Derek described microwave blackbody built by NIST standard to meet requirements for ATMS pre-launch testing. These have been tested by NIST-traceable radiometers - although these are limited to an uncertainty of 0.7K (k=1). Conical target design is less frequency-dependent and more thermally homogeneous than pyramidal arrays. The design uses Stycast 2850FT, 23LV, instead of classic Eccosorb to be more cryogenic friendly, with thickness to minimise reflections from Geometric Optics model. 3mm layer of polyethylene foam is included to improve thermal stability and was tested and found to be almost transparent. This allows it to be thermally stable from LN2 temperatures to 350K.

Conclusions:

- This new blackbody is a candidate for primary standard.
- ATMS calibration creates desirable inter-calibration opportunity
- Pre-launch calibrate ATMS?
- Potential application to METOP-SG MWS instrument
- Ground-based traceability, Radiometrics, Radiometer Physics GmbH

**R.GMW.2017.6e.1: Get an update from Derek in approx. 6 months.**

### Agenda Item: 6f Discussion on in-orbit references - participants prepare a single slide on potential reference instruments to stimulate subsequent discussion – 10:30 (60 minutes)

<b>Presenter</b>	All - Manik Bali to lead discussion
<b>Overview</b>	With no true SI reference standard for passive MW, this session was created to solicit input from the MW subgroup on potential in-orbit references and to what sensors/needs are most important.

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<b>Purpose</b>	Can we use in-orbit references for GSICS MW products?
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>To date the discussions within GSICS have focused on trying to identify in-orbit references.</p> <p>Manik used material submitted from several contributors to consider:</p> <ol style="list-style-type: none"><li>1. What are the requirements for instrument in-orbit calibration monitoring?</li><li>2. How to define a reference? Candidates include RTMs, GPS-RO and NWP Re-Analysis</li></ol> <p><b>Discussion based on template</b></p> <p>Cheng-Zhi Zou: pointed out that FCDRs could only be used as a reference for the same channels and that any RTMs used in the transfer need to have carefully characterised uncertainties.</p> <p>Wes Berg: Suggested identifying the specific qualities required for the reference for different applications - e.g. stable instrument being independent of RTMs, careful published uncertainty analysis. He also pointed out that RTMs are always needed to account for slight differences - even between instruments in the same series. Tim cautioned about the need to maintain traceability through the chain of comparisons to whatever the ultimate reference is. Every time RTMs are used in this chain, the uncertainties are difficult to fully characterise. Wes suggests that GSICS clearly identify specific reference instruments based on their calibration and stability, e.g., GMI would be good (but it doesn't start until 2014 - how do you go back in time with it?) but it only has certain bands (but X-CAL has shown good success using it with MHS).</p> <p>Martin Burgdorf: outlined different methods of transferring reference instruments, including L2 comparisons to chain to IASI. Tim cautioned against this approach, due the complexity of tracing the uncertainties through two independent sets of RTMs.</p> <p>Ralph Ferraro: summarised Isaac Moradi's response, describing two point inter-calibration techniques, base on regional averages and his own thoughts as an end user, providing a comprehensive wish-list.</p> <p>Tony Reale: outlined the use of the NOAA Product Validation System (NPROVS+) to monitor the calibration of different instruments, which can use GRUAN radiosondes, which would need to include the propagation of uncertainties in the comparisons. He suggested setting up a GSICS task force to address the question of how well this can be done.</p> <p>Wes Berg: proposed compiling an inventory of potential reference instruments, as a collaborative activity. This should include the same basic information - time, frequency, spatial coverage, known issues, publications ...</p> <p>Ed Kim: further support the idea of setting up an inventory documenting our understanding of the instruments' calibration and added that these results should be visualised graphically. Tim supported the idea of setting up a series of comparisons of potential reference instruments, based on a review of their calibration error budgets, and inter-comparisons using different methods, following the approach being pursued for IR reference instruments (agenda item <a href="#">7d</a>).</p> <p>Manik suggested an inventory on comparison techniques.</p> <p><b>A.GMW.2017.6f.1: MW Subgroup chair to develop candidate satellite/sensor (inventory), perhaps in the form of a graphical aid, as in orbit references for specific channels (based on some predetermined set of parameters that Manik has outlined...) and note pros and cons, other attributes (publications, etc.)? It should include timelines of sensors and overlap periods.</b></p>	

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**A.GMW.2017.6f.2: Tony Reale (NOAA) to provide a draft uncertainty analysis describing the comparison of example (microwave) instruments to GRUAN sondes.**

**Agenda Item: 6g Discussion on RTM Issues (emissivity models, water vapor bands, quality of input data, etc.) - participants prepare a single slide to stimulate subsequent discussion – 11:30 (30 minutes)**

<b>Presenter</b>	All - Wes Berg to lead discussion
<b>Overview</b>	There are uncertainties with MW RTM's - both aspects of the model and input data - that need to be resolved in order to better use them within GSICS
<b>Purpose</b>	To discuss as a group what we can do to narrow down some of these uncertainties in the context of GSICS.

**Discussion point, conclusions, Actions, Recommendations, Decisions**

Some RTM issues from MW standpoint include:

1. Atm. absorption models - different models to choose from. Water vapor bands, cloud water and ocean wind speed all handled a bit differently
2. Emissivity models - Over ocean, FASTEM, RSS - how are high wind speeds handled across the wide spectrum of channels? Even more complicated over land.

Impacts double difference methods, esp. when sensors have slightly different wavelengths, e.g., 21 or 23 GHz (different sides of 22 GHz WV band).

GSICS goals should include:

1. Prescribe common RTM
2. Develop list of high-quality observations for MW calibration - GRUAN, buoys, well characterized targets
3. Identify calibration references for different MW bands - window (GMI); WV (MHS?), O2 (??)

What achievable actions can we come up within this group? Wes pointed out the 183 GHz workshop was a good example of closing the loop on one specific source of RTM uncertainty. What can we do at GSICS? Document differences using similar input data like GRUAN set? Over a static target like Amazon? John Yang suggests start with 183 GHz since less sensitive to surface - use RO as the input source.

**A.GMW.2017.6g.1 : MW co-chair to develop set of specific tasks to be performed by the Subgroup to intercompare RTM output over static references and surface models. Tasks to be identified within 6 months (Sep. 2017).**

**Agenda Item: 6h Session Wrap Up – 12:00 (20 minutes)**

<b>Presenter</b>	All
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
This was a very productive, first ever MW-Subgroup dedicated session at the annual meeting. The group has identified several specific actions that we can carry out over the upcoming year.	

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GRWG Breakout Session Day-1 (IR Sub-Group) – 22 <sup>nd</sup> March, 2017	
Chair	Tim Hewison (EUMETSAT)
Minute Taker	S. Wagner

Agenda Item: 7b Developing GSICS products for GEO imagers – 12:30 (80 minutes)	
Presenter	Tim Hewison (EUMETSAT)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Tim presented a summary of the current GSICS GEO-LEO IR products as available in Feb 2017.</p> <ul style="list-style-type: none"><li>- JMA is still working on the uncertainties for MTSAT and H-8 (time scale for concluding: products ready for H-8 by next annual meeting)</li><li>- NOAA: GOES-11 -12, issues with the operational implementation. The resources availability is concern. The fact that there are no identified user with an operational use of the data is also a problem to justify an operational production. The product itself is ready though. For the sounder, further clarification is needed with GCC.</li></ul>	
<b>A.GRWG.2017.7b.1: Larry to check the status of the GOES sounder product (demo?)</b>	
<ul style="list-style-type: none"><li>- CMA: could enter demo by next annual meeting (currently working on the ATBD)</li><li>- KMA: about to promote to demo phase</li><li>- ISRO/IMD: about to submit to demo</li></ul>	
<p>Tim commented on his analysis of the Met-8 data after the move over IODC. During the move some unexpected behaviour was observed due to some issues with the collocation criteria. It results in an increase in the bias. Further investigation is required.</p>	
<p>For Met-7 end of life, a decontamination was performed. Tim presented preliminary results. It seems that there was a ice build-up on the optics as confirmed by the observed gain change. Dave asked about de-icing. Tim confirmed that there was no decontamination of Met-7 at least for 10-11 years.</p>	
<p>One of the outstanding issue for the IR is the diurnal cycle. It is particularly important for 3-axis stabilised instruments. A recommendation was made to KMA to assess the uncertainties in double differences between COMS and IASI-A and -B.</p>	
<b>R.GIR.2017.7b.1: KMA to assess uncertainties in double differences between COMS/MI and IASI-A and -B (e.g. as standard error).</b>	

Agenda Item: 7bb Developing GSICS products for GEO imagers - including diurnal cycles	
Presenter	Fred Wu (NOAA)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Fred presented the outcome of the NOAA/KMA collaboration on Image IR midnight anomaly, which seem to be caused primarily by thermal stresses. The motivation for this work is that similar behaviour were observed on instruments from both agencies (KMA: 2010-18 and NOAA: 1994-2024). Goal: quantitative evaluation of the anomaly, identify the cause, mitigation, implementation.</p>	
<p>MBCC was a method to correct the anomaly (Fred presented the method and its initial impact). But NOAA no longer has the raw data after the MBCC implementation in 2004. KMA kept two chains, which allows data re-analysis.</p>	

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This contamination impact products such SST (product where the problem was first observed).

Some GEO-GEO direct radiance comparisons were performed to verify the impact of the MBCC.

Fred detailed his idea to adjust the MBCC method, based on fitting an empirical model to the GSICS corrections. His is planning to implement his approach in collaboration with KMA. But the timeline needs to be further discussed with KMA and will depend on the resources availability.

In the formulation proposed by Fred, there is no angular dependence as the BB is seen always in the same way. The temperature of the mirror changes from one side to another. But Fred's formulation is using only the reflective side.

### Agenda Item: 7bc Developing GSICS products for GEO imagers - accounting for seasonal variations

Presenter | Dohyeong Kim (KMA)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Dohyeong presented the KMA analysis on diurnal variation using IASI-A and -B, CrIs and AIRS and the comparison with the MBCC results. Those comparisons are done by season, in 2016 and 2017.

Dohyeong looked at 3 different slopes:

- original one,
- estimated one by MBCC
- GSICS (in collaboration with NOAA)

Original and MBCC slopes show a trend whereas GSICS results do not have any.

Systematic differences at summer and winter the performance of MBCC is low, whereas it is larger at Fall and Spring.

There are clear differences between IASI (A and B) and CrIs/AIRS time series due to different crossing times. Due to the diurnal variations, seasonal variations are also very different.

Dohyeong showed a nice time series of the telescope primary temperature for COMS.

Need for inter-channel calibration for SST community as well as diurnal variations.

Q: Proposed way forward?

A: Difficult!

Dohy finally presented the GEO-GEO intercomparison (between COMS and MTSAT-2), with the details of the collocation criteria. Other comparisons with H-8/AHI were performed.

Small systematic difference in timing of COMS and MTSAT-2 data - could bias results? Can mix pairs of images with COMS before/after MTSAT-2?

Arata: does KMA archive both data type of data (before and after MBCC)?

Dohy: for COMS yes. But for MTSAT it is not done.

Paul Menzel: is a spectral adjustment done wrt IASI? So that the systematic bias observed with IASI slopes could be reduced or even removed?

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Fred mentioned that they did some investigation on GOES but the root cause of the bias is unlikely to be due to such an adjustment or lack of adjustment.

**Agenda Item: 7bd Developing GSICS products for GEO imagers - Review Plans for GEO-LEO IR products**

**Presenter** All (incl Na Xu)

**Discussion point, conclusions, Actions, Recommendations, Decisions**

Na Xu presented the CMA progress on GEO-LEO IR activities: GEO FY-2 c/d/e/f/g are inter-calibrated against IASI A/B, CrIS and AIRS. RAC products have been generated starting in 2005.

CMA has made good progress to be able to provide an infrastructure to deliver GSICS products. A new web platform is available (<http://gsics.nsmc.org.cn>).

FY-2 calibration has significant seasonal variation. The operational calibration is updated only once a month. Na also showed temperature variation time series for the mirror temperature of FY-2.

Straylight is significant on FY-2D IR10.8. It impacts the east-west/north-south time series for the biases.

Also found a nonlinearity. Which is priority to correct?

IR038 gap - using the gap filling method?

For IR038, CMA does not advise to use the GSICS results due to the gap filling issue in that band. The question of the gap filling for the IR038 band will be addressed in the discussion on the LEO-LEO.

Q: Can distinguish stray light effects, by analysing just stable periods (Nov-Feb)?

Q: Can derive a straylight correction? Should probably do first...

CMA is facing many issues. What are the recommendations for priorities?

NOAA (Fred) congratulated CMA for the hard work done, in particular for the recalibration activities they undertook.

**R.GRWG.7bd.1: CMA (Na Hu) to prepare a report on the current work and to share it with the GRWG for feedback.**

**Agenda Item: 7be Developing GSICS products for GEO imagers - AHI IR bias diurnal & low temperature**

**Presenter** Arata Okuyama (JMA)

**Overview** This presentation reports on diurnal variation of AHI-8/-9 IR bands Tb bias and showed uncertainty of the Tb bias for each reference hyper sounder focusing on low Tb range.

**Purpose**

- To report that the Tb biases of AHI-9 IR bands are comparable with that of AHI-8
- To demonstrate that the GEO-GEO approach has potential to reveal Tb bias diurnal variation in finer temporal resolution by blending with GEO-LEO approach
- To show difference of Tb bias uncertainty in lower Tb range for each reference sensor as the Action GIR.2016.3o.1

**Discussion point, conclusions, Actions, Recommendations, Decisions**

Arata presented their analysis on the AHI diurnal cycle using H-8 and H-9 for a GEO-GEO comparison. (There is a 0.1 deg separation in longitude between H-8 and H-9.) There is a jump in the WV channels twice a day between AHI-8 and AHI-9. In order to double check, a GEO-LEO comparison was done on AHI-9. The largest jump was not expected to be for channel 6.2 micron (it is about 0.1K twice per day). Of course, AHI-9 has just been launched and further work is required to investigate the results.

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The problem of using the GEO-GEO approach is that we cannot use hyperspectral instruments as available on LEO platforms. So Arata raised the question of deriving a blend using GEO-GEO and GEO-LEO.

**A.GRWG.2017.7c.1: JMA to report at the next annual meeting on their investigations regarding the diurnal variation in AHI by using GEO-GEO approach.**

**A.GRWG.2017.7c.2: CMA is encouraged to investigate GEO-GEO comparison. In particular because FY-2 is spinning and therefore is not impacted by midnight anomaly. This exercise would help correcting for the SL issues.**

Then, Arata presented an update of the work presented last year in Tsukuba. He looked at AHI-8 bias in BT and its stability for lower temperatures, using CrIs, IASI A/B and AIRS. The presented std error is calculated over a one-month sliding window. The gap filling uncertainties are not accounted directly in the presented results on the std error for BT biases. IASI short-wave band is noisy at the cold end. CrIS is doing much better (comment by Likun at the previous annual meeting). Scott commented that there is more noise coming into the comparison at the cold end at the collocations are more spatially variable than in the warm end.

**A.GRWG.2017.c.3: JMA to report at the next annual meeting on their uncertainty analysis in the gap filling method with AHI/AIRS.**

In order to identify the difference between CrIS and AIRS, Arata could look at the double difference of biases presented in Slide 10, although the initial motivation of this work was to look at the noise.

**R.GRWG.2017.c.4: JMA to report at the next annual meeting on the double differences on the bias time series.**

### Agenda Item: 7ca Developing GSICS products for LEO imagers – 13:50 (40 minutes)

**Presenter** All, Aisheng Wu [NASA] ( CMA)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Tim introduced the status of the inter-calibration products developments in the area of LEO\_LEO comparisons, which are rather limited. It is important to look at the calibration of IR channels of LEO imagers as some other activities may be impacted, such as the DCC.

There were some initial development made by Tim on HIRS and IASI on same platform. At the end of 2016, some problems came out and are still under investigation. Fred commented that the observed jump maybe related to the nature of the instrument, which uses interferometric filters to define the channels SRFs. These are highly temperature sensitive. Fred Wu/Paul Menzel commented on the importance of these comparisons in helping understand the HIRS calibration. However, no participants are planning to investigate it further. Tim invited interested parties to contact EUMETSAT to obtain intermediate data for further analysis.

#### Aisheng:

Hyperspectral measurements from IASI, AIRS and CRIS can help high quality VIIRS-to-MODIS calibration and intercomparison. CrIS and AIRS were used to derive SBAFs. Results are very close to each other: some small differences, but within the uncertainties.

The 11 micron band is used as a reference band due to its stability (the time series are the difference

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between the BT in the 8.5 microns and the 11 microns. There is an increasing signal from electronic crosstalk and the derived correction is based on the lunar observations, developed by MCST. The correction adjusts efficiently the data and reduces significantly the bias in the BT. Because the Moon is very hot, the edges are used. It then relies on the channel alignment, which may change in time.

In the future Aisheng will use IASI instead of AIRS.

There must be enough dynamic range in order to perform this type of comparisons.  
Terra data will be reprocessed very soon to be corrected.

There is still some residual after the correction, but it is little.

### Agenda Item: 7cb Developing GSICS products for LEO imagers – including SLSTR

**Presenter** | Tim Hewison + Igor (EUMETSAT)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Dave commented on the need to VIIRS and MODIS tied to a common reference.

Most of the IR channels for MODIS are very stable in time. In order to have the right level of radiances, a spectral adjustment (by shifting the SRFs is enough). This work has been published (see D. Tobin). Dave Doelling is recommending to have those shifted SRFs are part of the GSICS products. But the shift would not apply to the 8.5 micron.

**A.GRWG.7cb.1: Aisheng Wu (NASA) to get in touch with Chris Moeller to investigate the possibility to have a SRF shift and report back at the later stage (for both VIIRS and MODIS).**

Dave Doelling asked if similar shifts should be applied to VIIRS. Dave Tobin mentioned that similar shifts do not appear to be needed.

**R.GRWG.2017.7cb.2: For MERSI-2, CMA is encouraged to perform similar analysis of SRF shifts in comparison of hyperspectral reference instruments.**

Tim subsequently presented the current EUMETSAT activities on SLSTR. He reminded the requirements of the mission. The bias increase in the cold end simply because the calibration is extrapolated far away from the BB temperatures (and SLSTR does not use space views). The preliminary results of the work with Igor was published in the GSICS Newsletter last year.

There was a discussion on the requirement for testing different “gap-filling” approaches to address the parts of the SWIR channel’s SRF not covered by IASI. However, there were no volunteers to investigate this - although it is a common problem facing several instruments with similar channels to SLSTR. Dave Doelling commented that such a comparison of the 3.7µm channel can be done only at night as during daytime, the solar component prevent it to be done.

### Agenda Item: 7d Reference Traceability and Uncertainty – 15:00 (60 minutes)

**Presenter** | Tony Reale, Dave Tobin, Steve Broberg, Tim Hewison

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Xavier Calbet showed the importance of propagating vertical correlation of uncertainties in GRUAN profiles in comparisons with satellite radiances through RTMs. The long wave channels show the largest biases in BT when doing the double differencing between SEVIRI-IASI/A and SEVIRI-IASI/B. In radiance

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results are a bit smoother.

Tim presented a summary of the previous web meetings (June and September 2016).

Tony presented the GRUAN activity and the operational set-up for the operational collocation of GRUAN measurements with multiple satellites (NPROVS+, GAIA-CLIM, etc.).

**A.GIR.2017.7d.1: Tony Reale (NOAA) to provide a draft uncertainty analysis describing the comparison of example (IR) instruments to GRUAN sondes by the next annual meeting.**

A preliminary strawman was discussed to use GRUAN for GSICS and ICVS calibration activities. An action is on the GRWG IR and MW subgroups to design an experiment using GRUAN observations (there will be a workshop in June 2017 in Helsinki, ICM-9). The previous "3G" Workshop provided some initial studies wrt radiance propagation problem (see publications by X. Calbet).

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Steve Broberg presented error analysis activities for AIRS, which showed:

- Last version of the data = v5 (good to 100-200mK on average).
- Number of channels at NedT < 1K greater than at launch.
- Radiometric stability is estimated daily relative to the SST.
- There are some unexplained time dependent drifts in the Short Wavelengths at cold scene temperatures.
- Radiometric stability is typically < 0.5mK/year (with similar uncertainty)

Foreseen to use the lunar roll view to characterise the mirror polarisation.

**A.GIR.2017.7d.2: Steve Broberg (JPL) to provide the theoretical uncertainties on the temperatures reported in slide 10 be split according to the scene temperature and the channels and consider updating the analysis accordingly.**

Dave Tobin is in the middle of a new uncertainty analysis to account for new sources of uncertainties.

### Agenda Item: 7e Strategy for hyperspectral LEO sounders – 16:00 (30 minutes)

<b>Presenter</b>	Chengli Qi (CMA)
<b>Overview</b>	Chengli gave an overview of the <a href="#">HIRAS</a> instrument, which will fly on FY-3D, which is scheduled for launch on September 3, 2017, into 14:00 asc sun-synchronous orbit.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
Similar to CrIS, HIRAS covers 3.92µm - 15.39µm, in three bands, but with some spectral gaps and similar to IASI, it has 4 detectors, providing 4 simultaneous iFoVs.	
Chengli gave a summary of the results of the thermal vacuum tests performed on the instrument: <ul style="list-style-type: none"><li>• HIRAS vacuum test data was used to characterize key performance parameters of instrument and to check out the test support equipment needed to test the HIRAS flight unit.</li><li>• Radiometric calibration results revealed some interferogram quality and spectra absorbing peak appearance, validated the feasibility of complex calibration method and test data.</li><li>• Ground pre-processing scheme and method was tested based on the measurements of test data.</li><li>• Future vacuum tests will solve remaining bias and improve measurement precision. Non-linearity correction and ILS correction will be optimized in following work</li></ul> Before the spectral alignment, a quality control assessment is needed.	

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There is a larger bias for FOV 3 because it did not see the BB properly.

Requirements for CrIS are formulated in NedR where for HIRAS the requirements are NedT

GRWG IR subgroup would be interested in knowing more about the error budget and the performances. Could CMA share information after commissioning?

**A.GIR.2017.7f.1: CMA to review the input needed for the error budget and request those information to the vendor.**

Q: Is CMA going to repeat the TVAC or to focus on the analysis?

A: Scott confirmed that another TVAC will be performed before launch.

### Agenda Item: 7f Spectral Corrections - SRF retrievals – 16:30 (30 minutes)

**Presenter** | Tim Hewison (EUMETSAT)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Tim introduced the idea of generating an alternative form of GSICS Corrections - whereby radiance differences are explained in terms of spectral difference. This could be implemented as a spectral correction (e.g. based on a simple shift of the nominal SRF), or by retrieving the true SRF from a large number of comparisons with a hyperspectral reference instrument, as presented by M. Bali in 2016. He noted that biases can also be caused by differential attenuation caused by ice contamination and that this can appear to be very similar to a shift of the SRF.

Fred supports the idea of pursuing the effort of produce spectral corrections. Larry underlined the difference between trying to find a shift pattern in the data, a ice-induced shift pattern or to find just a pattern.

**A.GIR.2017.7f.2: Fred Wu (NOAA) to explore the feasibility of retrieving SRFs using the method initiated by Manik Bali and report back.**

### Agenda Item: 7fa Prelaunch SRF evaluation and correction – 17:00 (15 minutes)

**Presenter** | Na Xu (CMA)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Na presented an approach to assess the impact of SRF contamination and sensitivity to the laboratory environment conditions (humidity). Even for very low levels of water vapour burden, a bias of ~0.5K could be introduced on the TOA radiance due to contamination of the SRF characterisation. This can increase to >4K for very warm, humid conditions.

**R.GIR.2017.7a.1: CMA are encouraged to analyse the results under different conditions to understand the level of WV contamination on the SRFs. the level of contamination by comparing results in different conditions, and recommend the nominal SRFs accordingly.**

### Agenda Item: 7g Discussion - Plan product development – 17:15 (30 minutes)

**Presenter** | All

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Discussion was taken after each presentation.

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<b>GRWG Breakout Session Day-2 (VIS/NIR Sub-Group) – 23<sup>rd</sup> March, 2017</b>	
<b>Chair</b>	AM: Sébastien Wagner (EUMETSAT) and PM: Dave Doelling (NASA)
<b>Minute Taker</b>	Fred Wu
<b>Attendance</b>	Sébastien Wagner, Jack Xiong, Dave Doelling, Larry Flynn, Dohyeong Kim, Shengli Qi, Na Xu, Scott Hu, Bertrand Fougne, Tim Hewison, Tom Stone, Ashim Mitra, Manik Bali, Arata Okuyama, Hyesook Lee, Ken Knapp, Raj Bhatt, Ben Scarino, Rose Munro, Fangfang Yu, Sergey Marchenko

<b>Agenda Item: 8a Moving from Aqua MODIS to NPP VIIRS as a new GSICS reference for VNIR – 8:30 (20 minutes)</b>	
<b>Presenter</b>	X. Xiong (NASA)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Discussion on the differences in processing of lunar observations by different teams working with VIIRS.</p> <p>Dave asked for clarification of whether lunar observations are used to support absolute calibration. Jack explained that differences between lunar and solar diffuser calibration results had been used to evaluate solar diffuser degradation for VIIRS, and to characterise the RVS response for MODIS.</p> <p>Dave asked for a recommended version of MODIS/VIIRS dataset. There is only one complete reprocessed L1b dataset. This will be discussed further under agenda item 8q.</p> <ul style="list-style-type: none"> <li>o Seb: How to reconcile any differences between two versions of VIIRS data (NOAA &amp; NASA)?</li> <li>o Jack: NASA is required to process VIIRS for S-NPP but not for J1. For lunar cal in particular, NOAA uses the same as NASA.</li> <li>o Tom: Completely disagree. NASA is more mature. Jason’s is sub-par. Jack agrees.</li> <li>o Dave: Is lunar used for relative only?</li> <li>o Jack: Started with relative. Later used for correction of large degradation in 417 nm band. Also for RVS. Lunar cal has direct impacts on MODIS and VIIRS.</li> <li>o Which version?</li> <li>o C5 (?) is the only one that has been completed.</li> </ul>	

<b>Agenda Item: 8b Update on lunar calibration development and applications – 8:50 (20 minutes)</b>	
<b>Presenter</b>	Tom Stone (USGS)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Tom provided an introduction to the concept of lunar calibration, then reviewed the requirements to further develop the ROLO model using new observations to address absolute calibration and polarisation sensitivity.</p> <p>Requirements (for improved reference)</p> <ol style="list-style-type: none"> <li>1. absolute accuracy &lt;1%</li> <li>2. Radiometric and geometric characterization</li> <li>3. Spectral, such as SCIAMACHY</li> <li>4. Polarization</li> </ol> <p>New Effort:</p> <ul style="list-style-type: none"> <li>● NIST LUSI. Commercial telescope. Mt. Hopkins and Mauna Loa. IS of similar size nearby for calibration. CLARA obtained good results, then left. Two FTE continue.</li> <li>● China - wait for Scott.</li> </ul>	

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- ARSTONE (Constantine Lukashin, NASA):
- GSICS Lunar Observation Database (GLOD): Collection of many. PLEIADES image is amazing!
- CIMEL at night: Sunphotometer for aerosol was adapted at nighttime.

Way Forward:

- Goal:
  - SI traceable;
  - Accuracy (<1% ( $k=2$ ) is feasible)
- Reprocess ROLO
- Assimilate new data
- Collect new data
- Maintain and increase support.

Seb: EUMETSAT supports the effort to improve the ROLO.

Andy: Cloud products developers support lunar cal.

Scott: Need to consider obs and model together. Tom agrees.

A. K.: Continue to use GIRO? Tom: Yes.

Andy outlined the cloud working group requirements.

Scott expressed concerns about photometry observations and the need to site them in locations to avoid air pollution.

### Agenda Item: 8c Progress on lunar calibration at IMD – 9:10 (20 minutes)

<b>Presenter</b>	A.K. Mitra (IMD)
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

Moon appears in collected data of INSAT-3D routine full Earth scans - yielding ~30 observations/year  
GIRO is 30-40% lower than obs. large variations.

Seb encouraged him to attend the lunar workshop. Connect with ISRO.

Tim suggested the observed differences could be explained as an offset maybe due to straylight. Tom emphasised the usefulness of the lunar workshop to learn more about data preparation. Fred suggested to plot the ratio.

Recommendations:

**R.GVNIR.2017.8c.1: IMD to contact USGS and EUMETSAT for support in processing INSAT-3D Moon images.**

**R.GVNIR.2017.8c.2: IMD to attend 2017 Lunar Calibration Workshop.**

### Agenda Item: 8d Progress on lunar calibration at JMA – 9:30 (20 minutes)

<b>Presenter</b>	Arata Okuyama (JMA)
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<b>Overview</b>	This presentation reports on lunar calibration progress on AHI-8. The estimated sensor sensitivity trend is roughly comparable with the trend estimated by other approaches. AHI-8 Band 4 to 6 show the phase angle dependency known in the GIRO is similar to METEOSAT, however, the dependency in Band 1 to 3 is different from that in Band 4 to 6, which implies there is an artifact to be considered in JMA's lunar calibration approach. The presenters tried to explain the phase angle dependency by non-linearity in calibration characteristics, however its root cause is not found out yet. Masaya Takahashi has investigated an
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	application of double difference approach into the lunar calibration under a collaboration with Dr. Wagner. This topic is passed on to Dr. Wagner's presentation.
<b>Purpose</b>	<ul style="list-style-type: none"> <li>- To present the AHI-8 lunar calibration progress based on one and half years observation</li> <li>- To focus on the difference in the phase angle dependency among AHI bands and discuss its cause</li> </ul>
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>7000 lunar images taken by AHI-8 in 20 months (150 days) are investigated. Ray-matching with VIIRS, RTM-based vicarious calibration approach and SD observation show ~1% degradation for Band 1-4 of AHI-8. Lunar cal results are roughly consistent with the degradation trend. Phase angle dependency for 0.8, 1.6 and 2.3 um bands (B04-B06) is similar to that of METEOSAT-8/SEVIRI, but 0.47, 0.51 and 0.64 um bands (B01-B03) show opposite phase angle dependency. SEVIRI has no phase dependence for these bands. Suspect nonlinearity.</p> <p>Seb complimented JMA achievements in lunar calibration. What is JMA effort on radiance model development? Arata said the newcomer will be given the task.</p> <p>There was a lot of interest in the bias patterns observed in the VIS bands (1,2 and 3), which are not consistent with those from other sensors. Arata explained that the initial suspicion was that it was due to nonlinearity. However, ray-matching analysis showed this not to be the case.</p> <p>Fangfang asked whether the lunar images were obtained for each band separately? They are scanned simultaneously in the different bands. Band 1-3 are near the centre of the focal plane. Band 4-6 are nearer the edge.</p> <p>Tim asked about polarisation sensitivity? Arata explained that the vendors expected it to cancel out in the centre of the scans. Tom also pointed out that the observed bias patterns do not match the expected patterns due to polarisation.</p>	

<b>Agenda Item: 8f Moving toward inter-calibration using the Moon as a transfer – 10:40 (20 minutes)</b>	
<b>Presenter</b>	Sébastien Wagner (EUMETSAT)
<b>Overview</b>	<p>This presentation is a joint presentation with M. Takahashi from JMA. The scheme presented in 2016 at the GSICS annual meeting was explained again in this presentation. Preliminary results of the intercalibration with Aqua MODIS were presented for Meteosat-9 (VIS0.6 and VIS0.8 bands). Similarly the results obtained with Himawari-8 AHI were shown for the VIS0.8. The method seems promising but more work is needed. One important step is to use Suomi NPP VIIRS as a reference in order to inter-calibrate also the 1.6 micron bands.</p>
<b>Purpose</b>	Definition of a scheme to derive inter-calibration products using the Moon as a transfer target. This method would complement the DCC method as developed for GSICS by NASA.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Announcement: GIRO code will be released soon.</p> <p>DCC is for red band only, insufficient for SEVIRI and 3rd gen Imagers.</p> <p>Seb outlined a proposed scheme to develop inter-calibration products based on double-differencing pairs of lunar observations against the GIRO model, in comparable range of phase angles (to avoid any phase angle sensitivity).</p> <p>This method assumes i) that the bias in irradiance between reference instrument and the GIRO is on average constant (no trend) and ii) that this bias is not phase dependent.</p> <p>Phase angle dependence needs to be accounted for before making inter-calibration products. This can be</p>	

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addressed in two ways:

1. Improve the ROLO - long-term
2. Develop an empirical correction - short-term

It may also be possible to remote the phase angle dependence using double differences of lunar observations from pairs of instruments observing in similar bands.

Q: Dave: Is the SBAF phase-angle dependent?

A: Study with SCIAMACHY data confirmed there is very little phase angle dependence in the SBAF.

Q: What is the largest uncertainty in this method?

A: The lunar irradiance model (Tom agreed)

This could be overcome if we only compare observations in the same range of phase angles - although that is not always possible.

Comment: International Clouds WG would be happy to be tasked to investigate the impact of change in MSG calibration on cloud properties

**A.GVNIR.2017.8f.1: Seb to contact ICWG via Andy to evaluate re-calibrated MSG reflectance data.**

Q: Given the solar variability, is it more relevant to compare the lunar reflectance or irradiance?

(General CEOS recommendation: if instruments are calibrated in reflectance, they should be compared in reflectance)

The following are comments by Tom Stone:

The lunar model (ROLO or GIRO) generates irradiance by design. Although the ROLO model kernel is a reflectance model, the conversion of its outputs to irradiance must be done using the same solar spectrum that was used to build the model, otherwise errors will occur due to differences in the solar spectra. For the current ROLO and GIRO, the spectrum built into the model is Wehrli-PMOD (<ftp://ftp.pmodwrc.ch/pub/publications/pmod615.asc>). However, users do not need to use Wehrli for lunar calibration work external to the model. To use lunar calibration in terms of reflectance, the ROLO/GIRO-generated irradiance can be converted to disk reflectance using any solar spectrum, normally the one used to develop an instrument's reflectance-based calibration. But the irradiances must be generated first, then converted.

### Agenda Item: 8g Preliminary results of CMA ground-based Lunar observation – 11:00 (20 minutes)

<b>Presenter</b>	Scott Hu for Lin Chen (CMA)
<b>Purpose</b>	Scott provided an overview of the range of new Chinese instrumentation being used by CMA to obtain new lunar observations to support the further development of lunar radiance and irradiance models.

### Discussion point, conclusions, Actions, Recommendations, Decisions

Seb is glad to see CMA effort. What is long term plan?

Scott: these instruments were not designed for lunar observation, rather they were modified and adapted.

Seb: Data sharing?

Scott: Will share some data soon.

Larry: Was the instrument designed for Limb originally?

Scott: Yes.

Larry: Many expertise on that instrument and applications such as star obs. Tom agreed.

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Bertrand: How long does CMA plan to continue?  
 Tom: Minimum three consecutive years needed  
 Scott: Only Oct to Feb is feasible in Lijiang.  
 Tom: However the spectral information can be valuable, if properly calibrated.

Fred: What's the goal?  
 Scott: First to verify existing lunar model. Eventually to construct hyperspectral lunar model.

<b>Agenda Item: 8h Workshop activities – 11:20 (20 minutes)</b>	
<b>Presenter</b>	S. Wagner on behalf of LCWS organisers
<b>Overview</b>	The list of topics and activities for the Second Joint GSICS/IVOS Lunar Calibration Workshop were presented in detail together with the draft timeline for preparing the workshop.
<b>Purpose</b>	Summary of the main activities and topics proposed for the Second Joint GSICS/IVOS Lunar Calibration Workshop.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
Seb reviewed the themes, chairs, emphases, and preparation of the four sessions.	
<b>A.GVNIR.2017.8h.1: NOAA(Fred Wu) to solicit lunar images from the lunar calibration community to test evaluation of MTF.</b>	
A proposed action "GVNIR.2017.8h.2: Tom will inform Arata of some publication" was closed at the meeting. Tom provided "Polarimetric Properties of the Lunar Surface and its Interpretation" by A. Dollfus and E. Bowell, Astron. & Astrophys. 10, 29-53 (1971).	
It was agreed that the workshop should focus on working together on common activities, datasets, analyses and defining requirements for further research. Session chairs are encouraged to define aims for their respective sessions and homework activities for all participants to perform in preparation.	
The group also agreed that we should prepare a template for the workshop attendees to provide info on their lunar measurements from images, e.g. their methods for evaluating the dark level, evaluating oversampling, selecting Moon pixel, determining IFOV, etc.	

<b>Agenda Item: 8ha Workshop activities – info about venue– 11:40 (10 minutes)</b>	
<b>Presenter</b>	Xiuqing "Scott" Hu (CMA)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
Option 1: Dunhuang Oct 8-28. No direct flight after Oct 28. Option 2: Dunhuang after Oct 28. Option 3: Guangzhou, Shenzhen, Shanghai, Suzhou, Nanjing, ... CMA can only host the lunar workshop this year.	
<b>A.GVNIR.2017.8ha.1: EUM(Seb) to arrange web meeting in April to finalise date and venue for lunar calibration workshop.</b>	

<b>Agenda Item: 8i Definition of GIRO benchmark – 11:50 (10 minutes)</b>	
<b>Presenter</b>	Sébastien Wagner (EUMETSAT)
<b>Overview</b>	In order to ensure the traceability of the GIRO to the ROLO, a benchmarck will be

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	developed and shared with the Lunar Calibration Community as part of the GLOD. The tests foreseen to be part of the benchmark were presented with their intended purpose. This benchmark is intended to be used also as a reference data set for comparing with other models or with local implementations of the GIRO. The benchmark will be used to document the traceability of the GIRO to the ROLO in a peer-reviewed paper that will serve as a reference for the GIRO.
<b>Purpose</b>	The benchmark is a reference dataset to document the traceability of the GIRO to the ROLO. It is intended to be used to verify and validate new developments but also to compare the GIRO to other models that may be developed.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
Dave: Good strawman to start.	
Tim: Paper is a good idea. Authorship can be decided later.	

<b>Agenda Item: 8j Discussion – 12:00 (30 minutes)</b>	
<b>Presenter</b>	All
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
The discussions were covered under the above agenda items.	

<b>Agenda Item: 8k Customising DCC method to all AHI VIS/NIR channels – 13:30 (20 minutes)</b>	
<b>Presenter</b>	Raj Bhatt (NASA)
<b>Purpose</b>	To optimize the DCC method for wavelength channel greater than 1µm, which differ from the current GSICS DCC method for wavelengths less than 1µm.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
Does deseasonalisation help reducing the standard error in the trend derived from the DCC method? Mode method is more robust and resistant to calibration biases in the IR channel. Raj recommends using ocean only DCC pixels for 1.6µm channel and use the mean (rather than mode) - Hu model doesn't help here. Hu model developed for 0.65 micron. KMA may have BRDF for 1.6 micron. NIR/SWIR results shown for AHI 1.6µm and 2.2µm. 1.38µm for VIIRS was done but not shown.	
Detection of trend depends on size of trend, length of record, magnitude of variability of noise (sigma) - according to Weatherhead et al. 1998. Optimized DCC can cut trend detection time by half for some channels compared to the Standard DCC algorithm.	
Seb asked whether deseasonalization was applied to target and reference sensor? Yes. Dave said Raj will write an ATBD for DCC > 1 micron and provide test datasets based on VIIRS. Fangfang questioned the applicability at 1.38µm? Raj says 198K thresholds works best for this channel's DCC validation. Seb encourage the group to ultimately decide a reference sensor and period and develop a reference radiance. Dave agrees and will discuss. Seb explained that the current implementation takes care of backscattering and that avoidance of backscattering removes seasonal cycle. Raj will look into this. Fangfang asked whether the high bias for VIIRS can be addressed? Raj defers to Dave's talk. Seasonality is a tough issue and a general approach is sought.	

<b>Agenda Item: 8l DCC Progress - extension to IODC? – 13:50 (20 minutes)</b>	
<b>Presenter</b>	Sébastien Wagner (EUMETSAT)
<b>Overview</b>	This presentation provides an update on the EUMETSAT GSICS DCC product

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	<p>development. A demonstration product is now available also for the IODC mission. Preliminary results look promising but further analysis is required. The strawman for the GSICS VNIR product was detailed again (after an initial proposal made last year at the GSICS annual meeting). The need for inter-calibrating more bands was also emphasised and the need to use VIIRS as the next reference for reflective solar bands was emphasised.</p>
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>v1.10 current version at EUMETSAT. Include deseasonalization and desaturation. ATBD available. SSCC and DCC show an 8% difference and that is consistent with some feedback from cloud community.</p> <p>For Meteosat-10, SSCC and DCC show same trend in 2016. Show same bias. Meteosat-08, SSCC and DCC drifts show a discrepancy. Change to IODC has caused a change in drift. Seb wants to move VIIRS as a reference. Will add the GSICS VIS/NIR product</p> <p>Long-term plan is to have Rayleigh, Desert and DCC.</p>	

<b>Agenda Item: 8m Using DCC and multiple sites to calibrate MERSI and VIRR – 14:10 (20 minutes)</b>	
<b>Presenter</b>	Ronghua Wu (CMA)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
PASS - Information is in the CMA agency report.	

<b>Agenda Item: 8n Sensitivity of BRDF model in RTM DCC calculation – 14:30 (10 minutes)</b>	
<b>Presenter</b>	Dohyeong Kim (KMA)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Baum microphysical model used for DCC RTM with COMS and AHI SRF. RTM is accurate to within 5%. Sohn et al, 2009. COT = 200, Re = 20 micron. SBDART is the basis Model BRDF's for Baum differ from Mie microphysics. AHI and COMS BRDF are similar. Reflectances are similar for sun angles above 40 degrees: differences approach 1%. Calculated trend is small but not zero, due to drift in calibration of MODIS inputs since 2010 (Dave Doelling's statement). Obs trend is -7.84%/year.</p> <p>Dave Doelling recommended KMA provides the BRDF for each channel and as a function of wavelength. Hope they can continue this.</p> <p>Bertrand - CNES uses RTM for spectral variation.</p> <p>Arata asked which microphysical models were assumed? Andy says C5 used Baum but C6 used aggregate columns. Dave mentioned that this disconnect might have issues in the near-infrared.</p>	

<b>Agenda Item: 8o Update on <a href="#">SBAF Tool</a> - including GOME2 – 4:40 (20 minutes)</b>	
<b>Presenter</b>	Ben Scarino (NASA)
<b>Purpose</b>	To provide the SBAF web site users more spectral datasets and auxilliary parameters to aid the user in customizing the SBAF to their application in order to provide the lowest SBAF uncertainty.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	

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Goals are to provide Spectral Band Adjustment Factor tools for the intercalibration community.  
Adding new features - seeks input.

The website now offers more ability to script and automate results.  
These tools also includes a solar constant calculator.  
Added a spectra plotting tool.  
Hyperion allows you to pick exact location.  
Full record of GOME-2 will be integrated and AIRS will be introduced.  
Ben said GSICS link to LaRC SBAF needs to be updated, which was done during the meeting.

Sergey - OMI would also be good.  
Andy - Is TPW an option? Ben says it will be.  
Dave asked whether ESA would allow his site to use SCIAMACHY data.  
Rosemary said that ESA has no issues with distributing SCIAMACHY for specific applications.  
Seb - asked to include version of data used.  
Tim - as number of channels expands, so does complexity.  
Tim - HIRS spectral functions - Email Ben and he will add it.  
Seb - adopt the GSICS format of SRF and get from GCC. Number of significant digits matters.

**Agenda Item: 8p How to transfer DCC calibration MODIS-VIIRS – 15:00 (20 minutes)**

<b>Presenter</b>	Dave Doelling (NASA)
<b>Purpose</b>	To determine the accuracy of tying the DCC mode calibration to the VIIRS or any other reference instrument.

**Discussion point, conclusions, Actions, Recommendations, Decisions**

Geo domain standard deviations vary greatly, but the bias of each geo domain with the global mean is stable. 2016 had a very strong El Nino.  
Improved Ray-matching method by graduated angle matching with tighter constraints for clear scenes.  
For Meteosat-10, ATO, DCC (Ray Match), desert and DCC (Mode) agree well.  
Ray-matching works for all bands, not just 0.65 micron  
C6 MODIS Aqua has some RVS issues in B1. VIIRS does not show this.  
MODIS scan angle dependence impacting ray matching, which motivates move to VIIRS.  
DCC invariant target can be characterized by 1%.  
  
Ashim Mitra said the results are encouraging to IMD.

**Agenda Item: 8q Status of S-NPP VIIRS L1B – 15:50 (20 minutes)**

<b>Presenter</b>	X. Xiong and Chiang (NASA)
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**Discussion point, conclusions, Actions, Recommendations, Decisions**

Latest version 2.0.0 is for NASA VIIRS Level1b.  
IDPS calibration has been improved many times. Stable for 2 years.  
Solar diffuser degradation has been large - motivates use of lunar.  
Modulated RSR tracked well by lunar and solar diffuser. (wavelength dependant degradation).  
VIIRS Level-1b is the term used for the NASA product. SDR for NOAA.  
NASA adding an uncertainty index. NOAA SDR could not add it.  
F-factor is how sensor changes over time. I1 has a 2% difference between NASA and NOAA F-factor.  
Close relationship exists between NOAA and NASA.

Questions:

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At this time, no progress in fixing the M7 or M5 difference with VIIRS and MODIS. Discipline specific adjustments might be necessary. Andy expresses concerns that this would cause chaos. The question was raised of how GSICS can support this.

Dave recommends I1 be used as the reference 0.65 micron band instead of M5.

Dave recommends we use v2 Land PEATE, based on demonstrated stability and commitment to reprocessing.

Seb - Why tie to MODIS? But for GSICS, we don't need to use MODIS.

**Agenda Item: 8r Debrief on IVOS discussion on Reference Solar Spectrum – 16:10 (20 minutes)**

**Presenter** Kurt Thome (NASA)

**Discussion point, conclusions, Actions, Recommendations, Decisions**

Dave provided a summary of the recent discussion at IVOS on the selection of a reference solar spectrum: short term solution is GSICS scaled spectrum, adopting recommendation made at IVOS 2017. Greg Kopp will work on a longer-term solution. It would be nice to have a document or paper that can be cited describing how the reference solar spectra was obtained and a best practice guide to how it should be applied.

Tom: Kurucz is scaled and that idea can be used to Thullier or others.

**Agenda Item: 8s Vicarious Calibration for Sentinel-3 & Blending methods – 16:30 (30 minutes)**

**Presenter** Bertrand Fougnie (CNES)

**Overview** An overview of the vicarious calibration results for OLCI and SLSTR derived during the S3A commissioning phase and the routine phase is provided. Results includes cross-calibration over desert sites, rayleigh scattering, sunglint, and DCC. The combination of methods allow a quick assessment of the performance once in orbit, as well as a consolidation of the results. A discussion try to gather the feedback from past experience and S3A in order to highlight the benefit of a combination of method. A strategy is proposed to try to define a merged product. Many questions are still open.

**Purpose** In-flight results of the vicarious calibration of OLCI & SLSTR using different methods. Discussion on the ability to combine methods and the strategy to try to merge methods for a future GSICS product

**Discussion point, conclusions, Actions, Recommendations, Decisions**

SLSTR should be able to monitor its performance.  
 20 PICS (deserts), oceanic (very clear non-turbid scenes)  
 Rayleigh scattering and sun glint  
 DCC approach - is different than GSICS approach, and focuses on inter-band calibration for VIS/NIR.  
 Question of whether the diffuser can be trusted. Some bands are shown to be decreasing, some are increasing. Still a need to a check diffuser.  
 Various methods agree for spectral consistency - though sunglint is the worst.  
 OLCI has a 2% bias  
 SLSTR has a 3% bias for VIS/NIR and a large (10 to 40%) bias in SWIR.  
 Field-of-view consistency is also important for some applications and checked.  
 Wants to move to blending.

Questions

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Sergey: Do you filter wind speed in glint - Answer they do filter glint when wind speed > 5 m/s

Dave: questions glint issue -- aerosol modelling is a leading suspect.

Tim: important to know systematic and random components of error when combining.

Bertrand further explained that calibration error is only one type of error. Polarization and straylight are errors but not calibration errors.

GSICS Blending Strategy - need to define evaluation and scoring. Can do a blind blending or try to optimize the blending for each sensor based on the sensor's known behavior. He showed a synergy matrix to illustrate this. How to merge is needs a operational approach - not a hobby.

For S3A, DCC would be optimal for clouds, Rayleigh would be optimal for Ocean Color, desert would optimize consistency with MERIS.

More Questions.

Tim: Blending depends on requirements for sensor's application. Expectations for geostationary imager are less than Sentinel 3.

Seb: Take the user by the hand. Consensus of what you can do and what user needs. Ask the users if they want it. Offer it both ways and see what they ask for.

Bertrand: Go slow and be conservative in providing user options.

Ken: Provide the best possible estimate. He is discouraged. Who is your target audience?

Fred: Used to be a user. Used to think the mean of the methods weighted by averages. He now sees this as each methods has independent errors.

Tim: The real GSICS progress comes from getting us together.

Larry: Expounds on the various questions users ask him. And there is a range of users.

Seb: We need to put things in context.

Tim: Seb solution of defining a product and provide multiple answers is perhaps best.

### Agenda Item: 8t Merging products DCC+Lunar – 17:00 (20 minutes)

<b>Presenter</b>	All
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

See discussion above

### Agenda Item: 8u Discussion – 17:20 (20 minutes)

<b>Presenter</b>	All
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

We need to get to a prototype for DCC and get to implementation and discussion.

GSICS paper is being written on DCC inter-calibration method.

Dave: Do we want another method in the blend? DCC is all that we have.

Seb: Move to VIIRS as a reference and Lunar is an obvious next step.

**D.GVNIR.2017.8u.1: We start now with S-NPP/VIIRS as inter-calibration reference.**

**A.GVNIR.2017.8u.1: NASA(Raj) to provide SBAF for each GEO imager based on VIIRS v2. Target date 30 May 2017. 2 Web meetings Implementation of DCC mode method and writing journal paper by early 2018.**

### Agenda Item: 8v Future Outlook– 17:40 (20 minutes)

<b>Presenter</b>	Dave Doelling (NASA)
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

See discussion above

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GDWG Breakout Session Day-1 – 22 <sup>nd</sup> March, 2017	
Chair	Masaya Takahashi (JMA) AM - Peter Miu (EUMETSAT) PM
Minute Taker	Peter Miu (EUMETSAT) PM - Masaya Takahashi (JMA) AM
Attendance	Jin Woo (KMA), Zhe Xu (CMA), Manik Bali (GDWG),
Remote Attendance	Jordan Yao (NOAA)

Agenda Item: 5a GDWG Baseline Reviews - website, products metadata and structures – 9:00 (60 minutes)	
Presenter	Jin Woo (KMA)
Overview	To Review the GPRC's GSICS Websites
Purpose	To ensure all website provide the minimum GSICS information to all users.
<p>The session was started by self introductions of the participants. Jin reviewed the websites based on the agreed minimum contents. Participants were asked whether the minimum contents needs updating - no update is needed. It was commented the GSICS bias plotting tool should be used as monitoring page where possible.</p> <p><b>Website review:</b></p> <p>KMA has done a detailed analysis of the website and these are provided in the slides. Each GPRC website was reviewed based on KMA's analysis. It was commented that nothing has changed since 2016 on the EUMETSAT website. This was due to no more resources to support the updates. JMA inter-calibration ATBDs are available in html files, but need for having the ATBD on the document file (e.g. PDF) was pointed. NOAA GPRC website was migrated from NOAA to UMD and the change was not informed to GDWG, so the review was not done.</p> <p><b>A.GDWG.2017.5a.1: All GPRCs to update the URLs of NOAA and ISRO websites.</b></p> <p><b>A.GDWG.2017.5a.2: CMA to add a link to the ATBD on their GSICS website.</b></p> <p><b>A.GDWG.2017.5a.3: NOAA to inform WMO of the new GSICS website URL:</b> <a href="http://gsicswiki.net/wiki/GPRC/">http://gsicswiki.net/wiki/GPRC/</a></p> <p><b>A.GDWG.2017.5a.4: EUMETSAT to add a link to WMO GSICS Portal on the GSICS logo.</b></p> <p><b>A.GDWG.2017.5a.5: ISRO to inform WMO of their GSICS website:</b> <a href="http://as.mosdac.gic.in:8086/GSICS_ISRO/">http://as.mosdac.gic.in:8086/GSICS_ISRO/</a>.</p> <p><b>A.GDWG.2017.5a.6: JMA to upload their inter-calibration ATBD as document files.</b></p> <p><b>A.GDWG.2017.5a.7: KMA to review NOAA website contents and update website reviewing slides.</b></p> <p><b>Metadata Review:</b></p> <p>Existing GSICS Products' Convention was reviewed. KMA pointed that having a convention on ordering the variables would be useful when ncdump is used for the reviewing. It was agreed that ordering convention is not needed for GSICS NetCDF Convention, but the convention should be documented.</p> <p><b>A.GDWG.2017.5a.8: Peter Miu to document formats of the GEOLEOIR products (example high level definition of the GIRO I/O [EUM/TSS/TEN/14/753739]).</b></p>	

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### Data Server Review:

As more products are being served, the THREDDS tree is difficult to navigate for users. The product catalogue should be used to jump to the right product BUT only for GSICS-stamped products.

**A.GDWG.2017.5a.9: Peter Miu to contact Unidata to see if branches can indicate data is available, hyperlink to logo and home at top of screen.**

### Agenda Item: 5b GSICS Documentation Discussion, classification and storage – 10:00 (30 minutes)

<b>Presenter</b>	Masaya Takahashi (JMA)
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<b>Overview</b>	Present the current status of the GSICS documentation
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<b>Purpose</b>	To agree how all GSICS documentation are handled by the GSICS members
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

The Executive Panel requested the GDWG to provide inputs for handling GSICS documents. GDWG needs to decide the storage for the different types of GSICS relevant documentation. To store the documents at WMO GSICS Portal, GSICS Wiki and GCC depending on the document types was proposed by Masaya and this was agreed.

A Wiki page is required to provide the list of documents and how to access them. Document list should also be accessible from the WMO GSICS Portal.

Masaya introduced WMO's (Toshiyuki Kurino) input on the possibility of storing GSICS relevant documents on WMO PAG (Product Access Guide) page (<https://www.wmo-sat.info/product-access-guide/>) by creating GSICS repository. Participants agreed to put a link to GSICS Product Catalog in the PAG page even though the purpose of PAG might not fit GSICS.

**A.GDWG.2017.5b.1: GDWG co-chair to create a list of GSICS relevant documentation on the Wiki.**

**A.GDWG.2017.5b.2: GDWG co-chair to propose EP and WMO to create a repository on the WMO PAG and put a link to GSICS Product Catalog.**

### Agenda Item: 5c GSICS Collaboration GSICS servers, configuration, products meta-data pages and data access services – 11:00 (30 minutes)

<b>Presenter</b>	Peter Miu (EUMETSAT)
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<b>Overview</b>	Present the services and statuses of the servers.
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<b>Purpose</b>	For information and to propose future updates.
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

Current collaboration server structure, status and operation of the EUMETSAT collaboration server were presented for information. Outline of the issue will be addressed at other agenda items.

**A.GDWG.2017.5c.1: NOAA to confirm whether their THREDDS configuration follows the latest one which was proposed by EUMETSAT.**

### Agenda Item: 5d GSICS Collaboration Servers Synchronisation and discussion of the netCDF generation framework – 11:30 (60 minutes)

<b>Presenter</b>	Thomas Xu (CMA)
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<b>Overview</b>	Present the prototype of how the CMA server is replicating its GSICS products from the EUMETSAT server.
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<b>Purpose</b>	To discuss if this method can be brought into operations.
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<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>
<p>Synchronisation of the products is a part of the data preservation of the RAC data sets. Lots of the security issues exist to overcome them. Thomas introduced that there is a “tamper -resistance” server which seats in the DMZ to stage income data sets at CMA.</p> <p>An experimental solution was presented which runs once a day and this retrieves all the data from another collaboration server; a 50 line script using wget.</p> <p>The results of the replication looks very promising to synchronisation the collaboration servers.</p> <p><b>A.GDWG.2017.5d.1: CMA to upload the product downloading script to Wiki for review.</b></p> <p><b>A.GDWG.2017.5d.2: Once CMA downloading script is reviewed, CMA and EUMETSAT to use the script to do synchronisation, and report to GDWG and EP.</b></p> <p><b>A.GDWG.2017.5d.3: CMA to investigate the timeliness of the product replication by checking for an update, before calling the replication script (EUMETSAT to support).</b></p> <p>Thomas introduced an idea of the netCDF generation framework - an offline application. It was identified that the framework would be very useful for GSICS community even though there are no urgent needs for the framework. It was also identified that the framework could be used to do the SRF format conversion and NetCDF Format Checking tool. The issue is GDWG does not have resources to establish the framework. It was agreed GDWG chairs will continue converting the SRF in response to requests from the community.</p> <p>Developing GSICS products format checking tool was discussed. Masaya introduced existing metadata checker developed by GDWG chair in 2012. The checker checks only Global Attributes, but a function to check variables’ values would also be useful. Thomas commented CMA can offer resource for the NetCDF Format Checking Tool once requirements are documented.</p> <p><b>A.GDWG.2017.5d.4: JMA to provide user requirement to CMA for the NetCDF Format Checking Tool.</b></p> <p><b>A.GDWG.2017.5d.5: CMA to develop the NetCDF Format Checking tool based on the requirements.</b></p>

<b>Agenda Item: 5e Spectral Response Function file towards "GSICS Standard netCDF": requirements – 13:00 (60 minutes)</b>	
<b>Presenter</b>	Masaya Takahashi (JMA)
<b>Overview</b>	Present current statuses of netCDF SRF prepared for GSCIS activities and propose GSICS SRF netCDF Convention for GSICS standards
<b>Purpose</b>	Discuss GSICS SRF netCDF Convention
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Background and proposal for this GSICS task were introduced - Instrument SRF characterises the instrument from a radiometric viewpoint. Satellite operators provides this file in various forms, xml, excel file, flat file, ...</p> <p>GDWG has generated a Python script to do this for internal use only; very simple information is included. User community needs to use these files, for example the GIRO requires these files to operate.</p> <p>A proposal on updating NetCDF SRF filenames/Global Attributes/Variables was discussed:</p>	

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- Specify radiation\_wavenumber with m-1;
- Documentation for this netCDF format is required;
- Remove time\_coverage\_end from global attribute to avoid confusion as this file is actually unknown if new versions are created.

GDWG will propose a format for this, and GPRCs are invited to convert their SRF files to this format. Converted SRF files are expected to be hosted on each GPRC's websites, and pointed to from the Wiki.

**A.GDWG.2017.5e.1: JMA to update Wiki with a proposal of NetCDF SRF, including a new international data category in Data Designators category.**

**A.GDWG.2017.5e.2: Simon Elliott to request these new designators e.g. "SRF" to be included in the WMO Common Table C-13. VISIR is optional and does not be included in the code.**

**A.GDWG.2017.5e.3: JMA to produce a prototype of the new NetCDF SRF for review by the GDWG; a template and an instance of the template with data.**

**Agenda Item: 5f GSICS Wiki Implementation overview, enhancements and future requirements – 14:00 (60 minutes)**

<b>Presenter</b>	Jordan Yao (NOAA, Remote)
<b>Overview</b>	GSICS Wiki Related matters
<b>Purpose</b>	To provide information and to discuss future requirements

**Discussion point, conclusions, Actions, Recommendations, Decisions**

Jordan presented the information for the Wiki and collaboration servers.

gsicswiki.net has been registered with the Godaddy (and gsics.info), 2 year term (from last year). At the end of June 2018, the financing of the website is done in Jordan's name by the University of Maryland (?); about \$20 / year... Jordan mentioned that the GCC should finance this.

The following action was assigned to GCC and NOAA, but Manik Bali informed the group in the action review that the domain will no longer be maintained, and following URL should be used for future access of the Wiki: <http://gsics.atmos.umd.edu/wiki/Home>

**~~GDWG.2017.5f.1: GCC and NOAA to work out the approach transfer responsibility and financing of the Wiki and collaboration servers.~~**

**A.GDWG.2017.5f.1: GDWG (Manik) to support the testing of why some KMA products are size 0 bytes. He can offer a FTP account from university and/or NOAA servers.**

**Agenda Item: 5g Microwave Product and Reference records Filenaming and Metadata standards – 15:30 (60 minutes)**

<b>Presenter</b>	Manik Bali (GDWG-NOAA)
<b>Overview</b>	Future microwave inter-calibration products would use FCDR as a reference
<b>Purpose</b>	To introduce ongoing activities in MW sub-group

**Discussion point, conclusions, Actions, Recommendations, Decisions**

Existing CF-1.6 and GSICS conventions are accepted for this product. Currently, draft template has been proposed for this inter-calibration product - possibly 2 years away. MW sub-group is discussing if the FCDRs (e.g. AMSU-A FCDR) could be the GSICS references to produce GSICS calibration products because

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there are no in-orbit reference instruments. Manik added new fields to make it look like a typical orbit file.

Conventions for metadata and file naming were presented If a MW inter-calibration product were to be created. These conventions are along the lines followed by IR and VIS cross calibration products.

A good presentation on creating a FCDR for the reference product. MW sub-ground is further invited to request Data Management needs when needed.

**A.GMW.2017.5g.1: MW subgroup would contact NOAA GDWG to get support for product creation if needed.**

**A.GDWG.2017.5g.2: GDWG co-chairs to attend MW sub-group web meeting.**

### Agenda Item: 5h GSICS Convention for FCDR – 16:30 (60 minutes)

<b>Presenter</b>	Manik Bali (GDWG - NOAA)
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

The topic was combined with 5g.

### Agenda Item: 5i Use of GitHub for GSICS developments – 17:30 (30 minutes)

<b>Presenter</b>	Jin Woo (KMA)
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<b>Overview</b>	To present how GitHub how it can be used to support GSICS Data Management developments.
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<b>Purpose</b>	To bring GitHub into GSICS to improve collaboration developments.
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

Jin provided an overview of Git and other version controlling system. GitLab, GitHub and Bitbucket are compared; GitHub is preferable because there are more free users licenses (10 people) - Git is an ideal version controlling system for collaboration developments.

Creation of GitHub project was discussed. Participants agreed to create a repository for GDWG activities and have an account for each GDWG member agency - number of accounts is expected to be less than 10. If GRWG needs a repository for their activities, dedicated one could be created.

Original actions was on the GCC but GCC agreed to transfer this action to KMA.

**A.GDWG.2017.5i.1: KMA to set up a GitHub project for GDWG activities and document how this is done such that another GPRC can take over the administration of the GitHub project.**

**A.GDWG.2017.5i.2: EUMETSAT will upload the plotting tool codes to the GitHub for collaboration once KMA sets up the GDWG GitHub project.**

### GDWG Breakout Session Day-2 – 23<sup>rd</sup> March, 2017

<b>Chair</b>	Peter Miu (EUMETSAT) - AM, Masaya Takahashi (JMA) -PM
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<b>Minute Taker</b>	and Masaya Takahashi (JMA) - AM, Peter Miu (EUMETSAT) PM
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<b>Attendance</b>	Jin Woo (KMA), Manik Bali (GDWG), Zhe Xu (CMA), Hayan Shin (KMA - Observer), Jinwoo Park (KMA - Observer)
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<b>Remote Attendance</b>	Rob Roebeling (EUMETSAT)
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Agenda Item: 6a Event logging – 9:00 (60 minutes)	
<b>Presenter</b>	Rob Roebeling (EUMETSAT, Remote)
<b>Overview</b>	Review CGMS Paper with the GDWG
<b>Purpose</b>	To finalise the paper for presentation
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>A draft white paper to be submitted to CGMS-45 (Korea, June 2017) was presented. The topic has been discussed for some time, moving in small steps and this has resulted in the paper presented.</p> <p>Rob added “Calibration related documents” as one of the categories required for the landing pages in response to the discussion at the Plenary session (3ka Aid to Users Selection of GSICS Products).</p> <p>Defining common standards is challenging to be coordinated amongst the agencies - that’s why a white paper is important to endorse the agencies to use the common standards.</p> <p>Manik is kindly requested to provide the paper to the CMA member (Yuan Li) to see if she can provide input as well.</p> <p><b>A.GDWG.2017.6a.1: GDWG members to consider to add “Calibration related documents” on their landing pages.</b></p> <p><b>A.GDWG.2017.6b.2: Rob is invited to provide the paper to the GDWG members. GDWG members shall review the paper by <u>14 April 2017</u>, and provide input to paper. After this <i>date</i>, the paper is endorsed by the GDWG.</b></p>	

Agenda Item: 6b Action tracking – 10:00 (60 minutes)	
<b>Presenter</b>	Manik Bali (NOAA) - Lori Brown is the NOAA Web Master
<b>Overview</b>	Action Tracker has been established by NOAA GDWG+GCC and several updates are planned in the near future.
<b>Purpose</b>	To provide information on the new Action Tracker.
Discussion point, conclusions, Actions, Recommendations, Decisions	
<p>Manik presented a new action tracking tool that has been developed at NOAA by the NOAA-GDWG - NOAA combine. The new tool was developed as result of actions put on NOAA GCC previous years. Manik presented the problems regarding previous action tracking page on the Wiki. The previous action tracking tool was on wiki and so the list of actions is huge and difficult to navigate open actions. EP asked their actions also to be tracked on the wiki or on other place.</p> <p>Following the presentation the group agreed that the updates to the actions list in Google Sheets should only be done by the chairs of the WG and the GCC.</p> <p>The GSICS identifier are required to be prefixed with “A.” or “R.” to indicate Action or Recommendation (reference - CGMS).</p> <p><b>A.GCC.2017.6b.1: GCC to update the action tracking page in response to GRWG/GDWG proposal.</b></p> <p>Requirements on the action tracking - fast search, easy tracking, etc. were discussed within members. Manik reported that activelink function is available on the spreadsheet, but not activated at present due to a technical problem. This would be solved in the near future.</p> <p><b>Proposed updates for the next version:</b></p>	

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- Attaching URLs to different words in a cell.
- Refreshing the page should keep the state of the tab selected.
- At present, there is a limitation in accessing Google Drive from China. Please bear this in mind as the GRWG chair will be from CMA - this could be solved by using Zoho or email.
- Remove “Effort Level” as this is the same as “What to do”. A table should be available to describe the “What to do” categories mean, and what the urgency means.
- Email notifications to be sent to the Actionee via a button press by chairs.

Use of “What to do” and “Urgency” columns were supported by the group from management point of view. The group confirmed the following definitions of types in “What to do” columns and “Urgency”.

What to do:

- Analysis: examining a subject and reporting if it is suitable/applicable for GSICS
- Configuration: Updates to websites, documentation and/or data files for GSICS Data Management systems.
- Implementation: The development of a GSICS Data Management System.
- Information: Provision of existing known material for use in GSICS.
- Specification: The development of a GSICS Data Management Concept.
- Tech Support: Provision of existing known material that requires tailoring for use in GSICS.

Urgency:

- High: to be closed within 1 month
- Medium: to be closed within 6 month
- Low: to be closed within 1 year or next joint meeting

### Agenda Item: 6c Requirements for GSICS Plotting Tool to support VIS/NIR products – 11:30 (30 minutes)

<b>Presenter</b>	Masaya Takahashi (JMA)
<b>Overview</b>	Provide information for discussion
<b>Purpose</b>	Tool to be updated for new products.

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Masaya presented current status of GRWG requirements to the GSICS plotting tool. GRWG VIS/NIR Sub-group does not have fix requirements yet so it is not an urgent task. The requirements are expected to be available by the next annual meeting, so it is a good time to think about this.

EUMETSAT informed the group that there is an existing tool developing document [EUM/OPS/TEN/12/2682]. This can be updated with new requirements for this GSICS product.

Manik asked the use of Enhanced Data Model within the netCDF community. The group agrees that we should continue to use the classic data model, and to have 1 file per method.

Once the requirements are available and the code is available in GitHub, the group will have a web meeting to discuss how to collaborate on this development.

**A.GCC.2017.6c.1: GCC to survey from the GSICS users (e.g. during the GSICS User’s Workshop), which netCDF models they are using; classic or enhanced. If enhanced, what features they are using in this model; chunking, ...?**

### Agenda Item: 6d Revisit of GDWG ToR - an action at EP-17 last June – 13:00 (60 minutes)

<b>Presenter</b>	Peter Miu (EUMETSAT)
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## GSICS WGs – 2017 Minutes

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<b>Overview</b>	To present the ToR and propose updates.
<b>Purpose</b>	To agree on how to update the ToR for discussion in the EP.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>One man month / year is not enough for GDWG - was discussed at EP-17 in 2016. A specific concern of GDWG activities shown. Peter pointed that operational matters are not documented in the current GDWG ToR.</p> <p>Date spent by the GDWG members were roughly estimated: EUM - 33 days, JMA - 37 days, CMA - 30 days, KMA- 20 days, NOAA - 100 days.</p> <p>ToR effort is not enough for chairs and active members. Need in ToR to stress that membership means that GPRC are obligated to provide a long standing members to support. If no members attend from GPRCs, how can we encourage tem to provide a member? ToR is very important to explicitly show the need for resources.</p> <p>In addition to this, the chairing of the working groups needs clarification as currently some ambiguity exist regarding the recommendation of member for the chairing of the working groups.</p> <p><b>A.GDWG.2017.6d.1: GDWG chair to revise GDWG ToR and circulate that to GDWG members for reviewing.</b></p>	

<b>Agenda Item: 6e Future Chairing of the GDWG - overview, status and proposal to EP – 14:00 (30 minutes)</b>	
<b>Presenter</b>	Peter Miu (EUMETSAT)
<b>Overview</b>	To present GDWG chairing information and such that a recommendation can be made for the GDWG chairs
<b>Purpose</b>	To discuss the chairing of the GDWG for the next 3 years starting from 2018
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>The presentation provided the working group with information regarding what chairing of the GSICS involves as the current co-chairs term is over at the end of 2017. The co-chairs have sent out an email for nominations for the chairs some weeks prior to the meeting so that potential candidates can be presented to the group during this agenda item but no nominations were received.</p> <p>Therefore the groups was presented with the option to extend the co-chairing of the GDWG by the existing chairs with a possible vice chair replacement for the near future (CMA GDWG member Xu Zhe - Thomas).</p> <p>Manik Bali invited Dr. Ashim Kumar Mitra (GSICS EP and GRWG members) to the presentation, and proposed that Dr Mitra will take on the role of chairing the GSICS Data management Working Group with himself taking on the vice-chair. Dr Mitra informed then the group that he could not commit to taking on the role of the chair as he requires consent from IMD once clarification is provided regarding the chairing tasks involved. It was unclear in what clarification was needed and who should provide this. Dr Mitra was advised to discussed this with the EP and/or the WMO.</p> <p>The group was unsure on how to progress on this proposal as the ToR is unclear for such a situation. Therefore, the group agreed to present this to the EP for guidance, and for the chairs to propose updates to the ToR to support GDWG members on making such recommendations in the future. These updates are expected to take into account of the discussions minuted in the GSICS Executive Panel Web Meeting (GSICS-EP-15-1_2015-01-28) i.e. the EP's endorsement of GSICS chairs is an element of GSICS governance,</p>	

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and the home organisation should consent to the recommendation.

The EP members are invited to discuss and nominate the chairing of the GDWG for the next 3 years starting from 2018.

### Agenda Item: 6f Future products - VNIR+IR in one GSICS Correction – 15:00 (60 minutes)

<b>Presenter</b>	Masaya Takahashi (JMA)
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<b>Overview</b>	Combining VNIR and IR inter-calibration products was proposed by GRWG and was discussed at the Plenary. The proposal was not fixed at this time, but the discussion could be continued.
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<b>Purpose</b>	To introduce topics which have been discussed among GRWG members.
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

The presentation is for information purposes only, will be discussed in the future.

Regarding combined/blended products who contain products that have DOIs themselves. If users of these products require to cite these products, then the combined/blended products also requires their own DOIs.

A question was raised regarding whether a netCDF variables can hold values that have multiple units. If CF standards are to be applied, standard names and have one unit. Storing values in an array with different units is possible, how the units for these values is up to the developer.

### Agenda Item: 6g Product versioning – 16:00 (30 minutes)

<b>Presenter</b>	Manik Bali (NOAA)
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<b>Overview</b>	GCC summarized discussions on GSICS product versioning on the Wiki
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<b>Purpose</b>	To introduce/confirm the current Convention.
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#### Discussion point, conclusions, Actions, Recommendations, Decisions

At the instance of Masaya, Manik (GCC) had taken a poll and sought recommendations from GSICS members on the versioning they have applied on their products. These are stated on the development page

The versioning with the GSICS netCDF files should follow the GSICS versioning convention. The following are the examples:

- demonstration/v1.0.0 => demonstration/v1.1.0 => demonstration/v1.1.1 => demonstration/v1.2.0
- pre-operational/v1.0.0 => pre-operational/v2.0.0 => pre-operational/v2.1.0 => pre-operational/v2.1.1
- operational/v1.0.0 => operational/v2.0.0 => operational/v3.0.1 => operational/v3.1.0

The group agreed that pre-operational or operational products should start from major version number of 1 (or 0) when the products are promoted to the next phase (e.g. from demo to pre-op).

Overall it was agreed that it is upto the agency to apply the versioning they wish to for their products. Details of are on the wiki page. GSICS can has provided recommendations.

### Agenda Item: 6h Wrap-up: Plan activities for 2017/2018 – 16:30 (60 minutes)

<b>Presenter</b>	Masaya Takahashi (JMA)
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<b>Purpose</b>	To provide the GDWG a summary of the decisions
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<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>28 Actions have been generated from the joint meeting. All the actions were presented for agreement by the working group members and they were uploaded to the action tracking spreadsheet - available on <a href="https://www.star.nesdis.noaa.gov/smcd/GCC/MeetingActions.php">https://www.star.nesdis.noaa.gov/smcd/GCC/MeetingActions.php</a>.</p> <p>The group discussed having web meetings dedicated to GDWG activities. 2 GDWG web meetings on GitHub and progress report were proposed as GDWG's plan this year and were agreed by the group.</p>	

<b>Plenary GRWG+GDWG Briefing + Summary Session - 24<sup>th</sup> March, 2017</b>	
<b>Chair</b>	AM: Larry Flynn (NOAA) and PM: Tim Hewison (EUMETSAT)
<b>Minute Taker</b>	AM: M. Bali and PM: S. Wagner

<b>Agenda Item: 9a Ongoing need for Re-Analysis Corrections – 8:30 (20 minutes)</b>	
<b>Presenter</b>	Rob Roebeling and Tim Hewison (EUMETSAT)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>The use of FCDRs as inter-calibration references was discussed. This follows the approach currently being pursued by SCOPE-CM, based on the time series from multiple HIRS instruments. Rob explained that following the FIDUCEO project these will be tied to IASI as an anchor reference.</p> <p>Further, it was agreed that GPRCs may choose to generate either NRTC and/or RACs for their instruments. However, to ensure the latter can support the generation of FCDRs, it was agreed:</p> <p><b>D.GWG.2017.9a.1: GSICS member agencies generating RACs are required to regenerate them for the entire record of each monitored instrument in event of a major version change in the processing algorithm.</b></p> <p>Post-meeting clarification: This requirement has no bearing on the product maturity and acceptance.</p> <p>The topic of generating prototype/demonstration products for the VIS/NIR channels of GEO imagers was also revisited. It was agreed that this is an important step to obtain feedback to guide further development, and that the current strategy for VIS/NIR products was on the right track. However, the Exec Panel are requested to provide more resources within the member agencies to support the generation and distribution of these demonstration products.</p>	

<b>Agenda Item: 9e GDWG Summary &amp; Agree Actions – 8:50 (30 minutes)</b>	
<b>Presenter</b>	Peter Miu (EUMETSAT)
<b>Overview</b>	To present the results and agreements from the GDWG discussions.
<b>Purpose</b>	For information to the working groups.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>The actions have already been reviewed and are covered separately.</p> <p>Pete reviewed the attendance of the GDWG and contributions of the GSICS member agencies, pointing out that decisions are being made with no input from the other agencies.</p> <p>Pete mentioned that NOAA-GDWG ( Manik ) has uploaded scripts on the wiki that can download GSICS products.</p> <p>Larry suggesting having a short GDWG session in plenary in future GRWG/GDWG meetings. This has</p>	

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already been covered to some extent in the Tuesday briefings, but could be strengthened.

The GDWG reviewed their terms of reference, highlighting the need for clarification over the situation for taking over the chairmanship from the current co-chairs. (Normally a vice-chair would be defined, and expected to take over from the chair after a pre-defined period.) The GDWG will make a recommendation to the Exec Panel,

The discussions covered review of GSICS websites, collaboration servers and the synchronisation of GSICS products, documentation, the GSICS Wiki, a product generation framework (GitHub), the netCDF format for SRFs.

Other discussion included the definition of future GSICS Products, following the discussion in the GRWG.

### Agenda Item: 9c Action tracking – 9:20 (30 minutes)

**Presenter** GCC

**Overview** Action Tracking

**Purpose** Introduce GSICS Action Tracking to the GSICS Community and seek requirements

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Action tracking tool was constructed by GCC-NOAA GDWG in the lead up-to the GSICS Annual Meeting. The basic working of the Action Tracking tool was introduced to the community. The action tracking tool has three main components. 1) The actions sheet 2) API that converts this sheet into a csv file 3) a Webserver that displays the actions on the web.

The Action tracking has a very fast search and has java based search button. GCC sought more feedback on the actions tracking tool. Larry announced requirements and ideas to be discussed with GCC so that their implementation could take place early.

**D.GWG.2017.9c.1: Actions are opened by chairs (including meetings). Actions can only be closed by groups/subgroups chairs.**

### Agenda Item: 9d GRWG Summary & Agree Actions – 9:50 (30 minutes)

**Presenter** Dohyeong Kim (KMA)

**Overview** GRWG Summary Decisions, Actions, Recommendations

**Purpose** Discuss Summary of Decisions Actions and Recommendation during the meeting

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Dohyeong Kim, (Chair GRWG) gave an overview of the Decision Action and Recommendation that were generated during the Annual Meeting. Doheyong began with a summary of the mini conference with the presentations on CLARREO by Lukashin, Taylor and Dave Tobin. He indicated that the discussions on GRUAN, GPM-XCAL introduced what is upcoming trends in the calibration community.

Overview of the decisions, actions and recommendations of the entire meeting was presented. It was decided that the actions would be further discussed in the minutes document and a final version would be prepared through discussions.

### Agenda Item: 9b WIGOS Vision/Space 2040 and OSCAR/Space v.2 – 10:40 (30 minutes)

**Presenter** Toshiyuki Kurino (WMO)

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<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>
<p>Toshi introduced the main task of OSCAR/Space is to update facts about instruments and keep under review assessments, functions, rules, interfaces. In that sense, WMO added the function of OSCAR/Space to provide instrument status and calibration.</p> <p>The quality of the information stored in the database is essential. GSICS community should validate the information made available through OSCAR. Agency members should support the effort made by WMO to establish the OSCAR database.</p> <p>IMD asked what kind of information WMO is needed. Toshi plans to present at the next CGMS meeting the “type of information” that should be provided by each agency to WMO to populate the OSCAR database.</p> <p>Toshi gave one more presentation on “the draft of WMO Vision 2040 Space”, which consists of 4 components:</p> <ul style="list-style-type: none"> <li>- Component 1: Backbone Component, with specified orbital configuration and measurement approach</li> <li>- Component 2: Backbone Component, with keeping open the orbital configuration and measurement approach</li> <li>- Component 3: Operational Pathfinders, with technology and science demonstrators</li> <li>- Component 4: Additional Capacities and Other Capabilities (e.g. academic, commercial)</li> </ul> <p>The final step is to submit it to Cg-18, 2019.</p> <p>Toshi encouraged GSICS members to review draft version 1.1 and comments will be very appreciated.</p>

<b>Agenda Item: 9f Interaction with ISCCP – 11:10 (60 minutes)</b>	
<b>Presenter</b>	Ken Knapp (NOAA)
<b>Overview</b>	ISCCP and GSICS: Future collaborations between GSICS and the ISCCP project
<b>Purpose</b>	An overview of the current ISCCP status and plans. We provide an overview of the current ISCCP intercalibration and leave for discussion the possibility of incorporating GSICS.
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Ken reviewed the history of ISCCP activities, starting in 1983 thru to 2009 and discussed how ISCCP and GSICS can work together.</p> <p>Over the years ISCCP data has evolved and the last data was produced in 2009. Showed reprocessing improvements due to higher resolution input data. Demonstrated a new product HXG. IT has cloud products at 0.1deg. Diurnal climatologies produced as HGH.</p> <p>Reprocessing schedule</p> <p>Phase 1            Base Period ( 1983 – 2009)</p> <p>Phase II           Extended Period (1/1982 -6/1983 and 1/2010 -6/2015)</p> <p>Ashim: Do you have flexibility in your scheme that can utilize variable resolution of satellite data?</p> <p>Ken: one takes the most coarse resolution</p> <p>Variables includes Cloud Amount CTH CTP.</p> <p>Cloud products uncertainties are limited by atmospheric correction, rather than calibration</p> <p>ISCCP calibration is performed in three stages:</p>	

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1. Nominal (NOM)- Calibration from the satellite provider, Pre-launch calibration
2. Normal (NORM) - Inter-satellite normalization
3. Absolute (ABS) - Temporally stable

For VIS channels, it is based on vicarious terrestrial targets, similar to the DCC methods and

For IR channels, it is based on the CDFs - 10th and 90th percentiles

So, ISCCP data cannot be used for temperature trends, but can trend some cloud products (e.g. cloudiness)

AVHRR GAC is calibrated. GEO -> GOES GMS Meteosat-2 to -10 and FY are calibrated.

Last step of calibration is to perform validation which is done by comparing L3 products from LEO and GEO. However, it is not known who would do retrospective calibration of AVHRRs.

Q: Flexibility on resolution?

A: 8 km was adopted as the lowest common resolution

Q: What cloud parameters are included?

A: Primary ones are cloud top pressure & temperature, cloud amount, optical depth. Many others (~150) are also available.

Dave: Discontinuities in clouds properties can be interpreted as climate change

Tim: Importance of providing feedback on impact of instrument calibration anomalies on cloud product of ISCCP

Ken: Yes it is possible.

Tim: Can we input DCC algorithm for example?

Dave: How long does it take to rerun a given version of the whole dataset?

Ken: We reprocess 3 yrs at a time. A whole dataset can be done in 1 Month because they have a cluster system.

Manik: Can we separate out the inter-calibration and the processing?

Ken: We can use calibration correction separately.

Ashim: We are interested in sharing INSAT and Kalpana data

Initially, reproducing what was done by ISCCP - Not able to use GSICS Corrections yet, through:

LEO/GEO normalisations - based on collocations in IR & VIS

Last step - normalisation through L2 alignment

Planning to process this year? Yes.

When ISCCP data become available, more information will be available at

<https://www.ncdc.noaa.gov/isccp>

Future:

- Include GOES-16, Himawari-8, etc
- JPSS VIIRS,
- IODC (Indian Ocean GEO replacement)
- How and what to incorporate from GSICS?

Discussion:

- ISCCP and GSICS Calibration(s)?
- ISCCP and the GEO Ring?
- Can calibration be divorced from algorithms? Tom: Yes - that is what GSICS does!
- ISCCP's final check is on retrieval

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- Know your users/uses
- Start with the end in mind.

Dave: Priority should be before 2000, because after that CERES is available.

Q: Involvement with IOGEO? Not clear

Q: Could Ken evaluate the impact of GSICS Corrections for GEO imagers on ISCCP cloud products, based on case studies? Yes! e.g. for a sample month, year, etc.

To support this, Ken requested GPRC to provide tables that map IR window (11 $\mu$ m) channel counts to radiance and/or brightness temperature. Also, centers should strive to produce/provide a table mapping VIS (0.6 $\mu$ m) channel counts to radiance/scaled radiance if possible. Updated tables for the month of Dec 2009 are the target. Additionally, tables for other months in 2009 are welcome, so that we can expand this test to a larger scale.

**A.GCC.2017.9f.1: GCC to coordinate provision of GSICS Corrected test data from the 0.6 $\mu$ m and 11 $\mu$ m channels of all available GEO imagers during Dec 2009 to Ken Knapp to assess the impact of the corrections on ISCCP products.**

### Agenda Item: 9g Workshop on best practices on pre-flight and onboard calibration – 13:10 (20 minutes)

**Presenter** | Dohyeong Kim (KMA)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Dohyeong provided a comparison of the work of GSICS and CEOS-WGCV. He recalled an action from web-meeting [20151203](#):

Rob Roebeling to draft a proposal for which instrument characteristics should be published 2-3 years before launch, and at what level of detail, for presentation at 2016 GRWG/GDWG meeting

Rose stated that a joint meeting with the WGCV ACSG meeting was held four months back and some overlap with the white paper under preparation in GSICS UV.

Jack Xiong is also a member of IVOS. IVOS working group has one annual meeting per year - this years was held the previous week - and lasted 2.5 days, included RADCALNET sites presentations. Fred Wu also attended the meeting. This meeting also had working group meeting on PICS, chaired by Patrice Henry, which included some applications to GSICS activity. In this meeting we also had agency reports. There were some talks in Lunar calibration. He feels that there is going to be a lot of interaction between GSICS and IVOS.

How can we Partnership with WGCV? How and what to incorporate from GSICS?

We can partner in Multiple ways. GSICS develops proposals to be implemented by satellite operators on the other hand in CEOS WGCV IVOS discussion, each satellite operator would at all times remain responsible for calibration. GSICS can also provide calibration infrastructure.

**A.GCC.2017.9g.1: GCC to get the names of POC of agencies for pre-launch characterization workshop. In touch with CEOS.**

Initial suggestions: Rudiger , Fred, Jack Cheng Li, Masaya Takahashi

Tim: What should be the topics?

Fred: Review of previous characterization workshop or review of pre-launch activities by the agency and lessons learnt.

Scott: Should we use a common SI traceable targets as a topic?

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Fred: Typically NOAA takes NIST traceable standards. Then it is someone else's job to interchange NIST to SI traceability .

### Agenda Item: 9h GSICS Quarterly Special Issues/Editors – 13:30 (20 minutes)

Presenter | Manik Bali (NOAA)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Manik gave an overview of the previous issues of the GSICS Quarterly newsletter, which now has doi numbers and is widely cited - even in social media! He reviewed the process of submitting and reviewing articles, which has not changed in the last year. The focus is now on review articles, summarising published work that has appeared in the peer-review literature.

To address copyright concerns, several journals have given permissions to reproduce figures, etc, with suitable credits. Larry requested that sub-group chairs help identify suitable reviewers for submitted articles.

Dave asked the aims of publishing review articles. Larry explained that it is primarily an outreach activity and to raise the profile of topics that could be of interest to GSICS. One good example was the recent article on the SLSTR commissioning results.

### Agenda Item: 9i Format for future GRWG/GDWG meetings + Users Workshops – 13:50 (45 minutes)

Presenter | Larry Flynn (NOAA)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Happy to announce that ROSHYDROMET has agreed to host GUV as a topical session at the AOSMUC in Vladivostok in October. You are invited submit abstracts to the GSICS Session. Two abstracts will be provided from the GCC. There is no conference fee. Also suggested that two talks from ROSHYDROMET on GSICS topics.

Members discussed frequency of GUV (every year or every two year)

Andy suggested to send a GSICS Rep to ITOVS and Users NWP Meetings, Cloud Working Group CGMS working groups.

**A.GCC.2017.9i.1: GCC to follow up with Andy Heidinger and Tim Hewison on to send a GSICS Rep to ITOVS and Users NWP Meetings, Cloud Working Group CGMS working groups.**

### Agenda Item: 9j Topics & Chairing next Web Meetings – 14:35 (20 minutes)

Presenter | Tim Hewison (EUMETSAT)

#### Discussion point, conclusions, Actions, Recommendations, Decisions

Tim proposed upcoming web-meetings. The main web-meetings are IR traceability report, one on GITHUB and instrument performance monitoring. Actions were also generated to initiate and support the web-meetings. 2 Web meetings: Implementation of DCC mode method and writing journal paper by early 2018. It is planned to have a web-meeting to prepare for the CLARREO workshop in China 2018.

Format of the annual meeting and the web-meetings was also reviewed. It was discussed if the web-meetings could have more technical discussion whereas the annual meeting was to provide more overview.

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<b>Agenda Item: 9k Date &amp; Place of Next WG Meetings – 14:55 (20 minutes)</b>	
<b>Presenter</b>	Scott Hu (CMA)
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
<p>Scott indicated that the annual 2018 meeting would be held in China. Also mentioned that a three day CLARREO workshop be held before or after the meeting. He outlined the proposed agenda for the annual meeting. He mentioned about the Chinese SI traceable instrument in the making and the future preparation for the CLARREO workshop.</p> <p><b>A.GCC.2017.9k.1 : GCC to coordinate a preparatory web meeting on clarreo and send out invitations to members to attend the webmeeting.</b></p> <p>Some of the proposed people are Pete Palosci and Constantin Lukashin , Wenjian Zhang, to be invited to the web meeting.</p>	

<b>Agenda Item: 9l Any Other Business – 15:15 (45 minutes)</b>	
<b>Presenter</b>	All
<b>Discussion point, conclusions, Actions, Recommendations, Decisions</b>	
There was no other business.	

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**Participants list - 2017 GRWG/GDWG Annual Meeting**

AOUC/UMCP	Kai Yang	Observer (remote)
CMA	Xiuqing "Scott" Hu	GRWG
CMA	Na Xu	GRWG
CMA	Zhe "Thomas" Xu	GDWG
CMA	Chengli Qi	Observer
CNES	Bertrand Fougne	GRWG
CSU	Wesley Berg	Observer
DLR	Diego Loyola	Observer (remote)
DWD	Karsten Fennig	Observer (remote)
ESA	Ben Veihelmann	Observer (remote)
ESA	Berit Ahlers	Observer (remote)
ESA	Lidia Saavedra de Miguel	Observer (remote)
ESA	Thorsten Fehr	Observer (remote)
EUMETSAT	Frank Ruethrich	Observer (remote)
EUMETSAT	Peter Miu	GDWG
EUMETSAT	Rob Roebeling	GRWG (remote)
EUMETSAT	Rosemary Munro	GRWG
EUMETSAT	Ruediger Lang	Observer (remote)
EUMETSAT	Sabatino DiMichele	Observer (remote)
EUMETSAT	Sébastien Wagner	GRWG
EUMETSAT	Sreerekha Thonipparambil	Observer (remote)
EUMETSAT	Tim Hewison	GRWG
EUMETSAT	Vinia Mattioli	Observer (remote)
Ewha Womans University	Mina Kang	Observer (remote)
Gaia3D Inc.	Hayan Shin	Observer
Gaia3D Inc.	Jimwoo Park	Observer
Harvard SAO	Kelly Chance	Observer (remote)
Harvard SAO	Xiong Liu	Observer (remote)
Harvard SAO	Kang Sun	Observer (remote)
IMD	Ashim Kumar Mitra	GRWG
ISAC/CNR	Sante Laviola	Observer (remote)
ISRO	Munn Shukla	Observer (remote)
JMA	Arata Okuyama	GRWG
JMA	Masaya Takahashi	GDWG
KMA	Dohyeong Kim	GRWG
KMA	Hyesook Lee	GRWG
KMA	Jin Woo	GDWG
KMA	Jun Park	Observer (remote)
LASP, University of Colorado	Odele Coddington	Observer (remote)
LASP, University of Colorado	Martin Snow	Observer (remote)

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NASA	David Doelling	GRWG
NASA	Dave Flittner	Observer (remote)
NASA	Glen Jaross	Observer (remote)
NASA	Xioaxiong "Jack" Xiong	GRWG
NASA	Rajendra Bhatt	Observer
NASA	Ben Scarino	Observer
NASA	Edward Kim	Observer
NASA	Constantine Lukashin	Observer
NASA	Aisheng Wu	Observer (remote)
NOAA	Andrew Heidinger	Local host
NOAA	Cheng-Zhi Zou	GRWG (remote)
NOAA	Eric Beach	Observer (remote)
NOAA	Ken Knapp	Observer
NOAA	John Yang	Observer (remote)
NOAA	Larry Flynn	GCC
NOAA	Manik Bali	GCC
NOAA	Ralph Ferraro	GRWG (remote)
NOAA	Tony Reale	Observer (remote)
NOAA	Trevor Beck	Observer (remote)
NOAA	Xiangqian "Fred" Wu	GRWG
NOAA	Yuanzheng "Jordan" Yao	GDWG (remote)
NOAA	Zihua Zhang	Observer (remote)
SSAI	Colin Seftor	Observer (remote)
SSAI	Liang-Kang Huang	Observer (remote)
SSAI	Nischal Mishra	Observer (remote)
SSAI	Sergey Marchenko	Observer
USGS	Tom Stone	GRWG
UW/SSEC	Dave Tobin	GRWG
UW/SSEC	Fred Best	Observer
UW/SSEC	Joe Taylor	Observer
UW/SSEC	Jun Li	Observer
UW/SSEC	Lori Borg	Observer
UW/SSEC	Michael Foster	Observer
UW/SSEC	Paul Menzel	Observer
UW/SSEC	Robert Knuteson	Observer
UW/SSEC	Steve Wanzong	Observer
Yonsei University	Jhoon Kim	Observer (remote)
WMO	Toshiyuki Kurino	Secretariat (remote)