

WG-III: Operational Continuity and Contingency Planning Agenda Item 5.3

Outline

- Updated Terms of Reference
- Risk Assessment
 - Background
 - Approach
 - Results
 - Mitigation Actions
- Outcomes and Recommendations Resulting from WG-III Discussions

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Updated Terms of Reference

- CGMS-46 decided to have every Working Group review and update their respective Terms of Reference every five years; WG-III agreed to review and update its Terms of Reference and present a new version at CGMS-47; provided as CGMS-47 WGIII-WP-07
- Key objectives and responsibilities:
 - Establish, maintain, and monitor the CGMS Baseline
 - Conduct an annual Risk Assessment against the CGMS Baseline
 - Identify service continuity risks and issues
 - Propose contingency planning to address risks and potential gaps in service
 - Ensure migration and integration of R&D missions into operations
 - Ensure OSCAR/Space is updated
- Working arrangements:
 - Meet in advance of the annual CGMS Plenary Session
 - Conduct inter-sessional (in-person or virtual) meetings and workshops
 - Coordinate with other Working Groups to ensure CGMS Baseline and Contingency Plan are effectively monitored and implemented

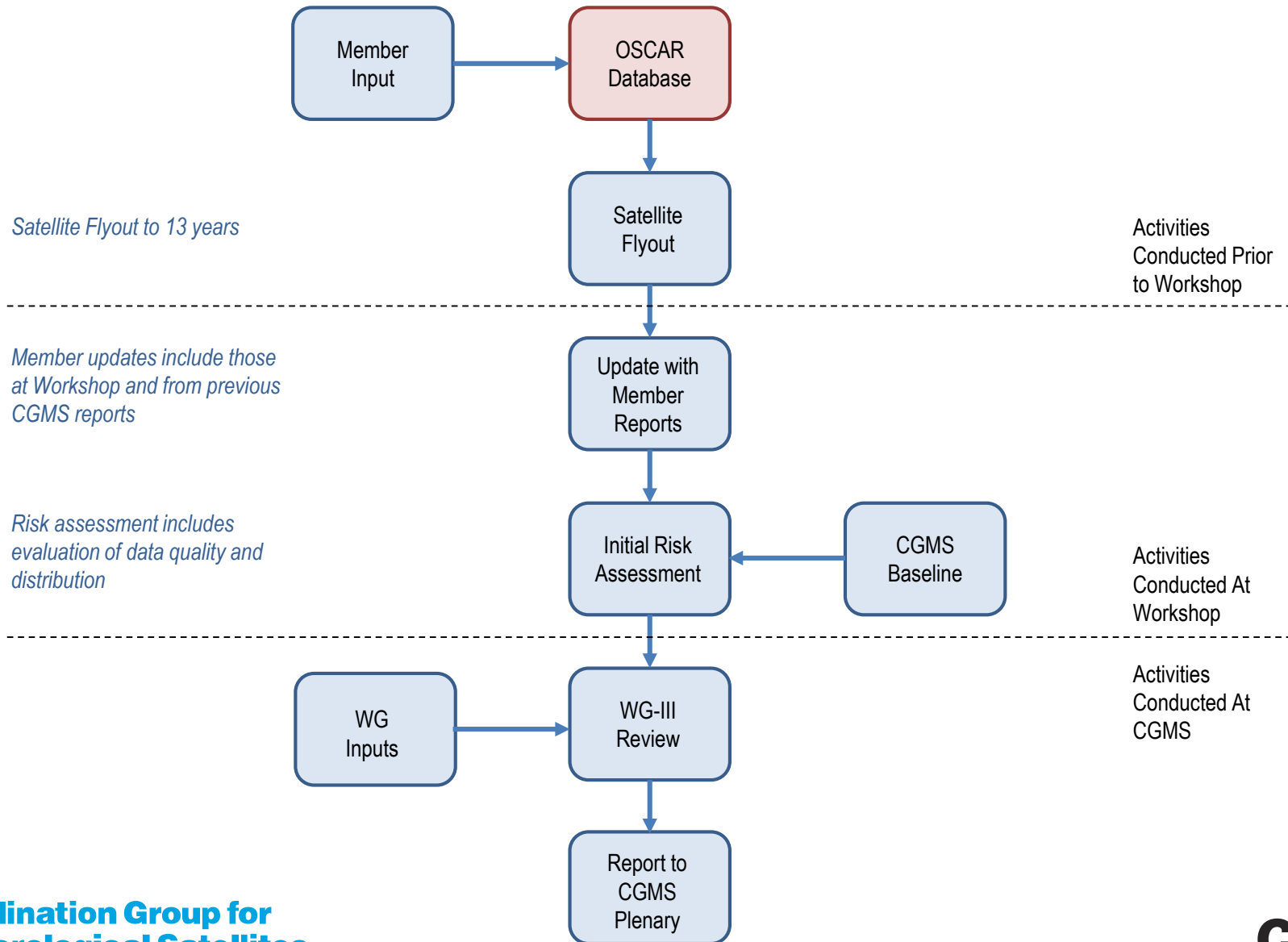
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Risk Assessment - Background

- The CGMS Baseline constitutes the CGMS response to the WIGOS 2040 Vision to document what missions are currently being, or planned on being flown. The CGMS baseline will be included in the WMO Manual on WIGOS.
- WMO will conduct a **Gap Analysis** between the WIGOS 2040 Vision Tier 1 and the CGMS Baseline to review implementation of WIGOS.
- CGMS will conduct a **Risk Assessment** against the baseline to ensure CGMS is meeting its commitments.
- The CGMS Baseline will be revised every four years to match the update cycle for the Manual on WIGOS.
- The WMO Gap Analysis will occur every four years, serving as an input to the definition of the revised CGMS Baseline.
- The CGMS Risk Assessment will be completed every year forming the basis for CGMS actions to ensure continuity.

Risk Assessment - Approach



Risk Assessment - Approach

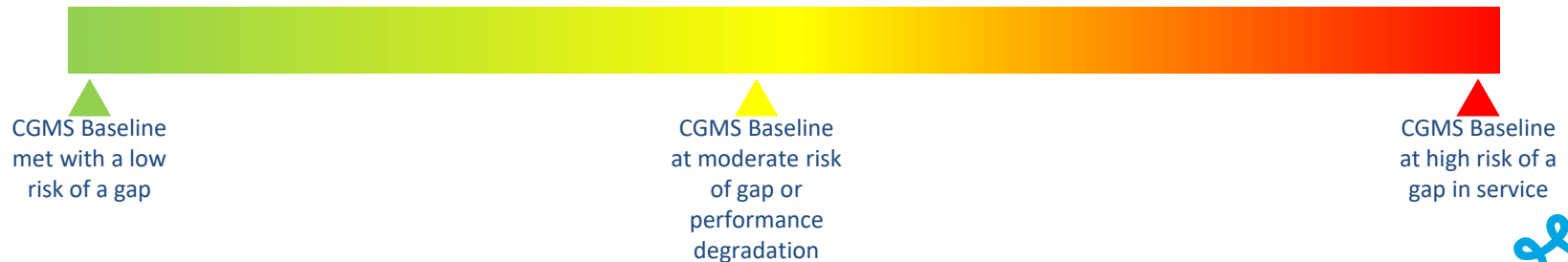
- Objective:
 - Convey CGMS's posture with respect to its baseline commitment
 - Provide a high-level assessment designed to allow members to assess the current contribution to the user community as well as coordinate future planning to meet current and future baseline commitments
- Working Group III held a workshop 27 Feb – 1 Mar, hosted by EUMETSAT and attended by EUMETSAT, NOAA, JMA, CMA, WMO, and CGMSSEC
- Working Group III reviewed how CGMS current and future missions match the commitments made in the CGMS Baseline
- The findings from this Workshop were sent to the other Working Groups for review and discussed at Working Group III Intersessional #3
- The results of the Risk Assessment were reviewed by other Working Groups at CGMS-47

Risk Assessment - Approach

- The final risk assessment for each sensor/observation was based on a qualitative analysis of all the orbits from which the observation is provided.
- This assessment is given from a CGMS Member prospective and does not currently include non-CGMS member, nor commercial contributions to the global observing system, or incorporate all WMO requirements (which are covered by the gap analysis).
- CGMS Members are going to operate satellites based on their national priorities.
- Resiliency was not specifically addressed in each observation and the first risk assessment focused on the probability or likelihood of a gap in service or performance, and not the consequence.
- Lack of a satellite in geostationary orbit is more likely to cause a gap in observations, while a lack of a satellite in low-Earth orbit may only degrade system performance.
- Quality and availability was not analysed in detail for all measurements, but was considered in some specific cases.
- The assessment is based on planned launch dates, design life, and updated by operational experience.

Risk Assessment – Results / Top Level Legend

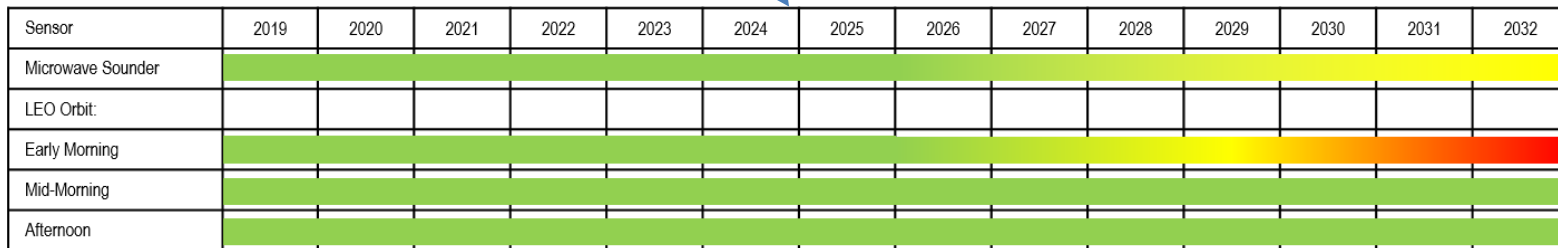
- CGMS Risk Assessment uses green, yellow, and red to graphically represent the overall status of that observation. The criteria for each color is as follows:
 - **Green:** CGMS Baseline met with a low risk of a gap.
 - **Yellow:** The CGMS Baseline is at moderate risk of not being fully met. Some mitigation by CGMS Members may be required.
 - **Red:** There is a high risk of not meeting the CGMS Baseline without CGMS Member action
 - **No Color:** Observation is not planned to be available until a later date



Risk Assessment – Results / Top Level Overview

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Microwave Sounder	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Infrared Sounder	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Radio Occultation	Yellow	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Multi-purpose Imager	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Narrow Band Imager	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
High Resolution Imager	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Microwave Imager	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Radar Altimetry	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Scatterometer	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Lightning Mapper	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Visible/IR Radiometer	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Visible/UV Radiometer	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Coronagraph	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
EUV Imager	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
X-ray Spectrograph	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Ion/Electron/Proton Spect	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Magnetometer	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Plasma Analyzer	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Precipitation Radar	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Ice Cloud Imager	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Synthetic Aperture Radar	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

Risk Assessment – Results



Risk Assessment – Results / Individual Sensor Legend

CGMS Risk Assessment uses green, yellow, and red to graphically represent the overall status of that orbit. The criteria for each color is as follows:

- **Green:** At least one mission flying that meets the CGMS baseline principles for that specific observation in that specific orbit with a low risk of a gap.
- **Yellow:** It is uncertain if there will be a mission flying that meets all the CGMS Baseline principles for that specific observation in that specific orbit with expected mission performance. There is at least a moderate risk of a gap; some mitigation by CGMS Members may be required.
- **Red:** There is a high risk of no mission that meets the CGMS Baseline principles for that specific observation in that specific orbit. There is a high risk of a gap or an actual gap without CGMS Member action.
- **No Color:** Observation is not planned to be available until a later date

Risk Assessment – Results / MW Sounder Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Microwave Sounder	[Color gradient from green to yellow]													
LEO Orbit:														
Early Morning	[Color gradient from green to red]													
Mid-Morning	[Green]													
Afternoon	[Green]													

- The CGMS Baseline commitment is microwave sounder observations in LEO from three sun synchronous orbits, nominally early morning, mid-morning, and afternoon.
- Both mid-morning and afternoon orbits have observations through 2032.
- The early morning orbit has observations through 2025. There is a risk of a gap after 2025.

WGIII Assessment:

Microwave sounding observations meet the CGMS Baseline with the risk of a gap in the early morning orbit after 2025.

Risk Assessment – Results / IR Sounder Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Infrared Sounder	[Green to Yellow gradient bar]													
LEO Orbit:														
Early Morning	[Red]	[Green]	[Green]	[Green]	[Green]	[Green]	[Green]	[Green]	[Green]	[Green]	[Green]	[Green]	[Green]	[Red]
Mid-Morning	[Green bar]													
Afternoon	[Green bar]													
GEO Orbit:														
0°						[Green]	[Green]	[Green]	[Green]	[Green]	[Green]	[Green]	[Green]	[Green]
105° E	[Green bar]													

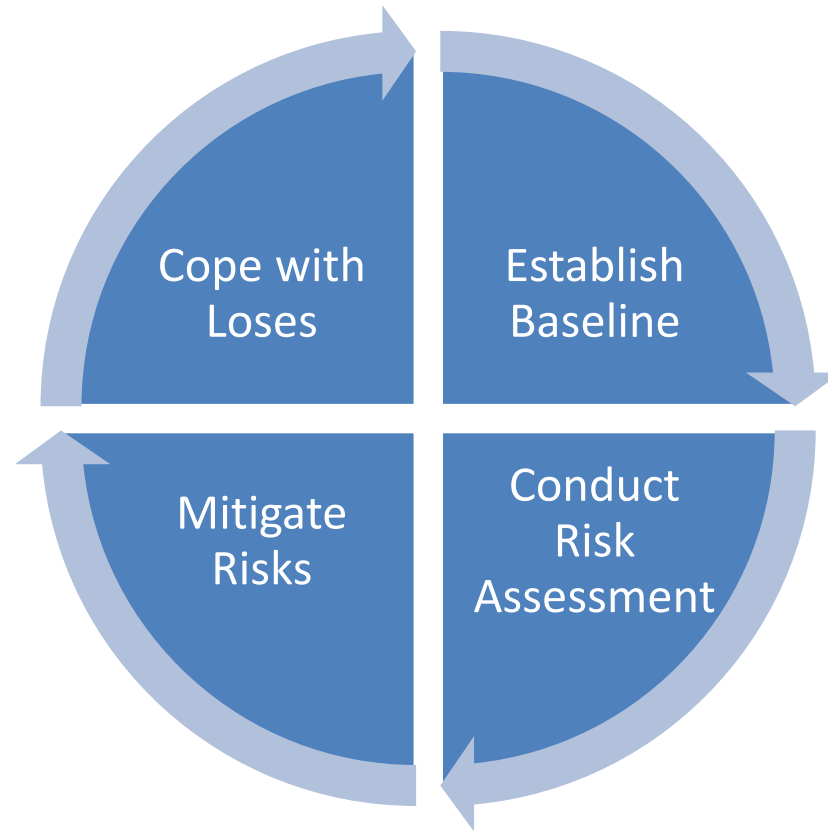
- The CGMS Baseline commitment is hyperspectral sounding observations in LEO from three sun synchronous orbits, nominally early morning, mid-morning, and afternoon as well as GEO at orbital positions 0° and 105°E.
- For LEO, both mid-morning and afternoon orbits have observations through 2032. The early morning orbit will have observations from 2020-2025. There is a gap in the early morning in 2019-2020 and there is a risk of a gap beyond 2025.
- For GEO, there observations at orbital position 105°E from 2019-2032. At orbital position 0°, the observation is not supported until 2024.

WGIII Assessment:

Infrared Sounder observations meet the CGMS Baseline with the risk of a gap in the early morning orbit after 2025.

CGMS Contingency Plan

- The CGMS level contingency planning follows a traditional risk management framework in order to avoid risks to service, and to minimize the impacts of any potential losses



Risk Assessment – Results / Mitigation Actions

- Working Group III recognized the need for continuity in the Early Morning Orbit and the gap it creates on microwave sounding, infrared sounding, multi-purpose imaging, visible/IR radiometer, ion/electron/proton spectrometer, and scatterometer observations.
 - **Recommended Mitigating Action #1: WMO to reconvene a WMO-CGMS Tiger Team on the impact of the Early Morning orbit. It is premature to convene this Tiger Team until an assessment of FY-3E is conducted.**
- Working Group III recognized that Radio Occultation does not meet the CGMS Baseline after 2025.
 - **Recommended Mitigating Action #2: IROWG and 7th WMO Impact Workshop needs to validate the current Baseline in terms of the coverage, number, quality and sampling of RO.**
- Working Group III recognized the gap in overall resilience and coverage of GEO in the IODC region.
 - **Recommended Mitigating Action #3: Conduct a study on the GEO imager coverage, data quality, availability and resilience in IODC region.**

Risk Assessment – Results / Mitigation Actions

- Working Group III recognized the need for a long term plan for ~6Ghz frequency microwave imaging in at least one LEO orbit for all weather Sea Surface Temperature observations.
 - **Recommended Mitigating Action #4: EUM to ensure data availability for HY-2B MWI. (WGIV).**
 - **Recommended Mitigating Action #5: CGMS Members to continue to support High Level Priority Plan 1.2.2.**
 - **Recommended Mitigating Action #6: NOAA to provide an update on SSMI status and possible follow-on.**
- Working Group III recognized that there is adequate coverage of microwave imaging, but operational usefulness is limited because they imagers are not cross calibrated.
 - **Recommended Mitigating Action #7: GSICS to continue cross calibration progress of microwave imagers. (WGII)**
- Working Group III recognized that there is no radar altimetry data availability in the early morning orbit in the short term and that there are no plans in the long term for coverage.
 - **Recommended Mitigating Action #8: EUM to ensure data availability for HY-2B ALT. (WGIV).**

Risk Assessment – Results / Mitigation Actions

- Working Group III recognized scatterometer observations are at risk of a gap in the early morning and afternoon orbits after 2025.
 - **Recommended Mitigating Action #9: ISRO to provide an update on its plans for follow-on mission to Oceansat-3A.**
- Working Group III recognized the risk of a gap in observations at L1 in the short term for coronagraph, ion/electron/proton spectrometer, magnetometer, and plasma analyser observations.
 - **Recommended Mitigating Action #10: ISRO to confirm data latency for Aditya-L1 mission.**
- Working Group III recognized the lack of magnetometer observations in the LEO in both the short and long term.
 - **Recommended Mitigating Action #11: ISES to provide rationale and need for operational magnetometer observations in LEO. (SWCG)**
- Working Group III recognized the risk of a gap in precipitation radar after 2028
 - **Recommended Mitigating Action #12: NASA and JAXA to confirm future plans for the Global Precipitation Measurement Mission (GPM).**

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Outcomes and Recommendations of WG-III

- WMO provided an update on the development of the Vision for WIGOS in 2040, the planned response to the Vision once its approved by Congress, and the WMO Gap Analysis
- WMO provided a status update on OSCAR/Space as well as its consideration of various options regarding sustainability and future evolution, both in terms of information content and the capabilities of the system. WMO also provided an illustration of how the system may be used to assist CGMS in its risk assessment
- ISRO provided plans on continuity of its operational missions; specifically plans for OCEANSAT-3 and -3A, TRISHNA, GISAT and NISAR and plans were in development for a follow-on to OCEANSAT-3A
- ISRO and CMA both reported on the process of requesting rapid scan operations to support user requests and emergency managers
- IMD provided an update on use of ground-based GNSS network for integrated precipitation of water vapour estimation and its validation

Outcomes and Recommendations of WG-III

- ROSCOSMOS provided an overview of a constellation of satellites to address hydro-meteorological and geophysical parameters; the constellation employed satellites in halo (L1/L5), geostationary, highly elliptical (Molniya, Tundra), and low-Earth orbits
- ROSHYDROMET updated WG-III on instruments and equipment to make helio-physical measurements
- JAXA provided an update on GCOM-W and that it had achieved its design life and had fuel to maintain its orbit for more than 15 years; JAXA also provided an update on a follow-on mission (GOSAT-3) that provides continuity for micro-wave imaging. GOSAT-3 is expected to complete a SDR by the fall of 2019
- KARI noted the status of GEOKOMPSAT-2B which provides both an ocean monitoring (e.g., ocean colour) and environmental monitoring (e.g., aerosols, ozone) mission
- WG-III noted the SETT's progress on conducting a pilot socio-economic benefit study focusing on the Arctic

Recommended Actions

- WG-III to update the CGMS Baseline and conduct the annual Risk Assessment for submission to CGMS-48
- WMO to conduct a Gap Analysis against the approved WIGOS Vision 2040 and to explore the possibility of coordinating this with the impact assessment planned by the CGMS Science Working Group reporting to WG-II
- WMO to hold a workshop on OSCAR/Space in order to develop plans for its sustainment and future development, both in terms of information content and system capability
- EUMETSAT to conduct a study on GEO Imager coverage, data quality, availability and resilience in the IODC region
- ISRO to provide CGMS-48 an update on its plans for a follow-on mission to OCEANSAT-3A
- ISRO to confirm data latency for the Aditya-L1 mission

Recommended Actions

- IROWG to review the CGMS Baseline and validate wording that captures CGMS Member contribution to RO data in terms of coverage, number, quality and sampling; and share impact studies of RO data between the CGMS Baseline and WIGOS 2040 vision observing targets.
- CGMS to write to SOA stating the importance of HY-2B MWI and ALT data.
- GSICS to continue cross calibration progress of microwave imagers
- SWCG to provide rationale and need for operational magnetometer observations in LEO and propose updates to CGMS Baseline as appropriate
- NASA and JAXA to confirm future plans for precipitation measurement mission(s)

Back-Up

Radio Occultation Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Radio Occultation	Yellow	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Orange	Red
Sun-Synchronous Orbit:														
Early Morning	Red	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Orange	Red
Mid-Morning		Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Afternoon		Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Designated Orbits:														
Equatorial			Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Orange	Red
60 Inclination			Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

- The CGMS Baseline commitment is radio occultation observations in LEO from three sun synchronous orbits, nominally early morning, mid-morning, and afternoon as well as other designated orbits such as equatorial with a minimum of 6,000 globally distributed occultations.
- Both mid-morning and afternoon orbits have observations through 2032. The early morning orbit will have observations from 2020-2025 with a risk of a gap after 2025.
- Equatorial orbit will have observations starting in 2020 through 2025 with a risk of a gap following 2025.

WGIII Assessment:

Radio Occultations observations meet the CGMS Baseline with the launch of COSMIC-2A with the risk of a gap in equatorial and early morning orbits after 2025.

Multi-Purpose Meteorological Imagers Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Multi-Purpose Meteorological Imagers	[Green to Yellow gradient]													
Sun-Synchronous Orbit:														
Early Morning	[Green to Red gradient]													
Mid-Morning	[Green gradient]													
Afternoon	[Green gradient]													
GEO Orbits:														
6 evenly spaced orbits	[Green gradient]													

- The CGMS Baseline commitment is multi-purpose meteorological imaging observations in LEO from three sun synchronous orbits, nominally early morning, mid-morning, and afternoon as well as 6 evenly spaced GEO satellites.
- Both mid-morning and afternoon orbits have observations through 2032. The Early Morning orbit will have observations from 2020-2025 with a risk of a gap after 2025.
- In GEO, there are observations from six globally space satellites through 2032.
- In the Indian Ocean Region [30°E-90°E], there are observations through 2021. After 2021, there is a potential reduction in coverage, quality, and availability of data. An analysis will need to be conducted of the overall space segment configuration to look at coverage, quality and availability of data and the overall resilience post 2021.

WGIII Assessment:

Multi-purpose meteorological imaging observations meet the CGMS Baseline with the risk of a gap in early morning orbit after 2025.

Narrow Band Visible Imagers Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Multi-Purpose Meteorological Imagers	[Green bar from 2019 to 2030, Yellow bar from 2031 to 2032]													
LEO Orbits:														
Mid-Morning	[Green bar from 2019 to 2032]													
Afternoon	[Green bar from 2019 to 2030, Yellow bar from 2031 to 2032]													
GEO Orbits:														
128.2°E	[Green bar from 2019 to 2032]													

- The CGMS Baseline commitment is narrow band visible imaging from 2 LEO orbits and GEO at orbital location 128.2°E. Narrow band visible means less than 10 nanometer resolution for open ocean and coastal areas.
- In LEO, there are observations in the mid-morning orbit through 2032 and the afternoon orbit through 2030 with a risk of a gap in the afternoon orbit after 2030.
- In GEO, there are observations at orbital location 128.2°E through 2032.

WGIII Assessment:

Narrow Band Visible observations meet the CGMS Baseline with the risk of a gap in the afternoon orbit after 2030.

High Resolution Visible Infrared Imagers Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
High Resolution Visible Infrared Imager														
LEO Orbits:														
Mid-Morning														

- The CGMS Baseline commitment is high resolution visible infrared imaging from 1 LEO orbit.
- There are observations through 2032 in the mid-morning orbit.

WGIII Assessment:

High resolution visible infrared imaging meet the CGMS Baseline.

Microwave Imager Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Microwave Imager	[Green to Yellow gradient bar]													
Sun-Synchronous Orbit:														
Early Morning	[Yellow to Red gradient bar]													
Mid-Morning	[Green to Yellow gradient bar]													
Afternoon	[Green to Yellow gradient bar]													

- The CGMS Baseline commitment is microwave imager observations in LEO from three sun synchronous orbits, nominally early morning, mid-morning, and afternoon.
- Both mid-morning and afternoon orbits have observations, there is a risk of a gap in the afternoon orbit after 2028.
- The early morning orbit has a risk of a gap because data availability is not assured.
- Although many applications have sufficient observations, ~6 Ghz frequency microwave imaging has a risk of a gap in the long term.
- Cross calibration between microwave imagers is still ongoing.

WGIII Assessment:

Microwave imaging meets the CGMS Baseline with the risk of a gap in the early morning. There is a risk of a gap in the long term for the specific ~6Ghz frequency imaging.

Radar Altimetry Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
Radar Altimetry	Light Green							Yellow							
Sun-Synchronous Orbits:															
Early Morning	Yellow							Orange to Red							
Mid-Morning	Light Green														
Other LEO Orbits:															
Reference Mission	Light Green														

- The CGMS Baseline commitment is radar altimetry from 2 sun-synchronous orbits, nominally early morning and mid-morning as well as the reference mission on a high-precision, inclined orbit.
- There are observations in the mid-morning and reference mission orbits through 2032.
- The Early Morning orbit has a risk of a gap because data availability is not assured.

WGIII Assessment:

Radar Altimetry observations meet the CGMS Baseline with the risk of a gap in the early morning orbit after 2025.

Scatterometer Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Scatterometer	[Color gradient bar from green to red]													
Sun-Synchronous Orbits:														
Early Morning	[Color gradient bar from green to red]													
Mid-Morning	[Color gradient bar from green to red]													
Afternoon	[Color gradient bar from green to red]													

- The CGMS Baseline commitment is scatterometry from 3 sun-synchronous orbits, nominally early morning, mid-morning, and afternoon.
- There are observations in the mid-morning orbit through 2032.
- There are observations in the early morning and afternoon orbit through 2025 after which there is a risk of a gap.

WGIII Assessment:

Scatterometer observations meet the CGMS Baseline with the risk of a gap in the early morning and afternoon orbits after 2025.

Lightning Mapper Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Lightning Mapper	[Coverage]													
GEO Orbits:														
137°W	[Coverage]													
75.2°W	[Coverage]													
0°					[Coverage]									
Asian Region				[Coverage]										

- The CGMS Baseline commitment is lightning mapping observations from orbital slots 137°W, 75.2°W, 0°, and one in the Asian region.
- There are observations at orbital locations 137°W and 75.2°W. At orbital position 0°, the observation is not supported until 2023.
- There will be coverage in the Asian region after 2021 at a location to be identified.

WGIII Assessment:

Lightning Mapper observations meet the CGMS Baseline with the risk of a gap in the Asian region after 2029.

Visible/IR Radiometer Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Visible/IR Radiometer	[Color gradient from green to red]													
Sun-Synchronous Orbits:														
Early Morning	[Color gradient from green to red]													
Afternoon	[Color gradient from green to red]													

- The CGMS Baseline commitment is visible/IR radiometer observations from 2 sun-synchronous orbits, nominally mid-morning and afternoon.
- The Early Morning orbit has observations through 2025. There is a risk of a gap beyond 2025.
- This visible/IR radiometer coverage refers to upward radiances at the top of the atmosphere only.

WGIII Assessment:

Visible/IR radiometer observations meet the CGMS Baseline with the risk of a gap in the early morning orbit after 2025.

Visible/UV Spectrometer Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Visible/UV Spectrometer	[Green shaded]													
Sun-Synchronous Orbits:														
Mid-Morning	[Green shaded]													
Afternoon	[Green shaded]													
GEO Orbits														
0						[Green shaded]								
128.2°E	[Green shaded]													

- The CGMS Baseline commitment is visible/UV spectrometer observations from 2 sun-synchronous orbits, nominally mid-morning and afternoon as well as at GEO orbital locations 0° and 128°E.
- Limb soundings are available in the afternoon orbit.
- At orbital position 0°, the observation is not supported until 2024.
- Observations are available in the mid-morning and afternoon orbits as well as at GEO orbital location 128.2°E through 2032.

WGIII Assessment:

Visible/UV spectrometer observations meet the CGMS Baseline.

Coronagraph Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
Coronagraph	Yellow to Red Gradient						Green								
Sun-Earth Line:															
GEO – 1 Location							Green								
L1	Yellow to Red Gradient						Green								

- The CGMS Baseline commitment is coronagraph observations on the sun-earth line from L1 and one location in GEO.
- The current observations at L1 are passed design life and at a risk of a gap in the short term.
- Observations in GEO are not available until 2025 and offer resilience to the L1 observations.
- [Need to confirm with ISRO about their L1 mission]

WGIII Assessment:

Coronagraph observations meet the CGMS Baseline with the risk of a gap at L1 between 2020-2024.

EUV Imager Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
EUV Imager														
Sun-Earth Line:														
GEO – 2 Locations														

- The CGMS Baseline commitment is EUV imager observations from 2 GEO locations.
- There are observations in 2 GEO locations though 2032.

WGIII Assessment:

EUV Imager observations meet the CGMS Baseline.

X-Ray Spectrograph Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
X-Ray Spectrograph														
Sun-Earth Line:														
GEO – 2 Locations														

- The CGMS Baseline commitment is x-ray spectrograph observations from 2 GEO locations.
- There are observations in 2 GEO locations though 2032.

WGIII Assessment:

X-ray spectrograph observations meet the CGMS Baseline.

Ion/Electron/Proton Spectrometer Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
Ion/Electron/Proton Spectrometer	Yellow						Light Green								
Sun-Synchronous:															
Early Morning	Light Green						Yellow			Red					
Mid-Morning	Light Green														
Afternoon	Light Green														
GEO															
6 Even Spaced Satellites	Light Green														
Sun-Earth Line															
L1	Yellow						Light Green								

- The CGMS Baseline commitment is ion/electron/proton spectrometer observations from 2 sun-synchronous orbits, 6 evenly spaced GEO orbits, and L1.
- There is a risk of a gap at L1 after 2020 in the short term. Observations will be available after 2025.
- There are observations in the mid-morning and afternoon orbits as well as 6 evenly spaced GEO orbits through 2032.
- In the early morning orbits, there are observations through 2025 with a risk of a gap after 2025.

WGIII Assessment:

Ion/Electron/Proton Spectrometer observations meet the CGMS Baseline with a risk at L1 between 2020-2025.

Magnetometer Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Magnetometer	[Green bar]													
Sun-Synchronous:														
Early Morning	[Red bar]													
Mid-Morning	[Red bar]													
Afternoon	[Red bar]													
GEO														
2 Locations	[Green bar]													
Sun-Earth Line														
L1	[Yellow/Orange bar]						[Green bar]							

- The CGMS Baseline commitment is magnetometer observations from 3 sun-synchronous orbits, nominally early morning, mid-morning, and afternoon as well as 2 GEO orbits and L1.
- There is a risk of a gap at L1 after 2020 in the short term. Observations will be available after 2025.
- There are no planned observations in LEO.

WGIII Assessment:

Magnetometer observations meet the CGMS Baseline observations in GEO with the risk of a gap at L1 between 2020-2025. There is a gap in all three LEO orbits.

Plasma Analyzer Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Plasma Analyzer	[Color-coded bar: Green (2019-2020), Yellow (2021-2022), Orange (2023-2024), Red (2025), Green (2026-2032)]													
Sun-Earth Line:														
L1	[Color-coded bar: Green (2019-2020), Yellow (2021-2022), Orange (2023-2024), Red (2025), Green (2026-2032)]													

- The CGMS Baseline commitment is plasma analyzer observations from L1.
- There is a risk of a gap at L1 after 2020 in the short term. Observations will be available after 2025.

WGIII Assessment:

Plasma analyzer observations meet the CGMS Baseline with the risk of a gap at L1 between 2020-2025.

Precipitation Radar Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Precipitation Radar	[Color gradient bar: Green to Red]													
LEO:														
Equatorial	[Color gradient bar: Green to Red]													

- The CGMS Baseline commitment is precipitation radar observations from 1 equatorial LEO orbit.
- There are sufficient observations until 2028 after which there is a risk of a gap.

WGIII Assessment:

Precipitation Radar observations meet the CGMS Baseline with the risk of a gap after 2028.

Submillimeter Ice Cloud Imager Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Submillimeter Ice Cloud Imager														
Sun-Synchronous:														
Mid-Morning														

- The CGMS Baseline commitment is submillimeter ice cloud imager observations from the mid-morning sun-synchronous orbit.
- The submillimeter ice cloud imager will be available in 2023.

WGIII Assessment:

Submillimeter ice cloud observations meet the CGMS Baseline after they become available in 2023.

Synthetic Aperture Radar Risk Assessment

Sensor	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Synthetic Aperture Radar														
LEO:														
One Orbit														

- The CGMS Baseline commitment is synthetic aperture radar observations from 1 LEO orbit.
- There are observations from one LEO orbit through 2032.

WGIII Assessment:

Synthetic aperture radar observations meet the CGMS Baseline.