

Working Group III Report

Presented to CGMS-49 Plenary
Agenda Item 4: Working Group Reports

Agenda

- 3rd CGMS Risk Assessment Workshop Overview
- WGIII Meeting Report
- Final 2021 CGMS Risk Assessment
- CGMS Baseline Updates

Risk Assessment Workshop

- The 3rd CGMS Risk Assessment Workshop was conducted virtually 1-3 March 2021
 - Objective was to capture and convey CGMS' posture with respect to its baseline commitment (satellite programs and observations) and provide a high-level assessment of a gap, or degradation in service to operational users
 - Considered the following inputs:
 - WMO Gap Analysis
 - Annual Risk Assessment
 - CGMS Baseline

WGIII Meeting (1 of 3)

- WGIII Meeting held virtually 15-16 April 2021
 - Included a joint session with WGII on 27 April 2021 to discuss open science questions
 - Considered 25 papers/presentations between the two sessions
- Reviewed status of discussions on WM Resolution 42 and Satellite Data Requirements for Global NWP
 - WGIII analyzed the Satellite Data Requirements for Global NWP with respect to the CGMS Baseline and HLPP
 - CGMS Baseline includes all sensors identified as Backbone and Additional except for solar irradiance
 - HLPP highlights need for geostationary ring and extension of altimetry coverage
 - Emerging sensors such as wind lidar are not covered in the CGMS Baseline or HLPP
 - The 4th Risk Assessment and CGMS-50 will further consider the paper after it has been approved
- ISRO provided updates on current missions and future plans
- NOAA provided a status of their planning for the Geostationary and Extended Orbits (GEO-XO) program

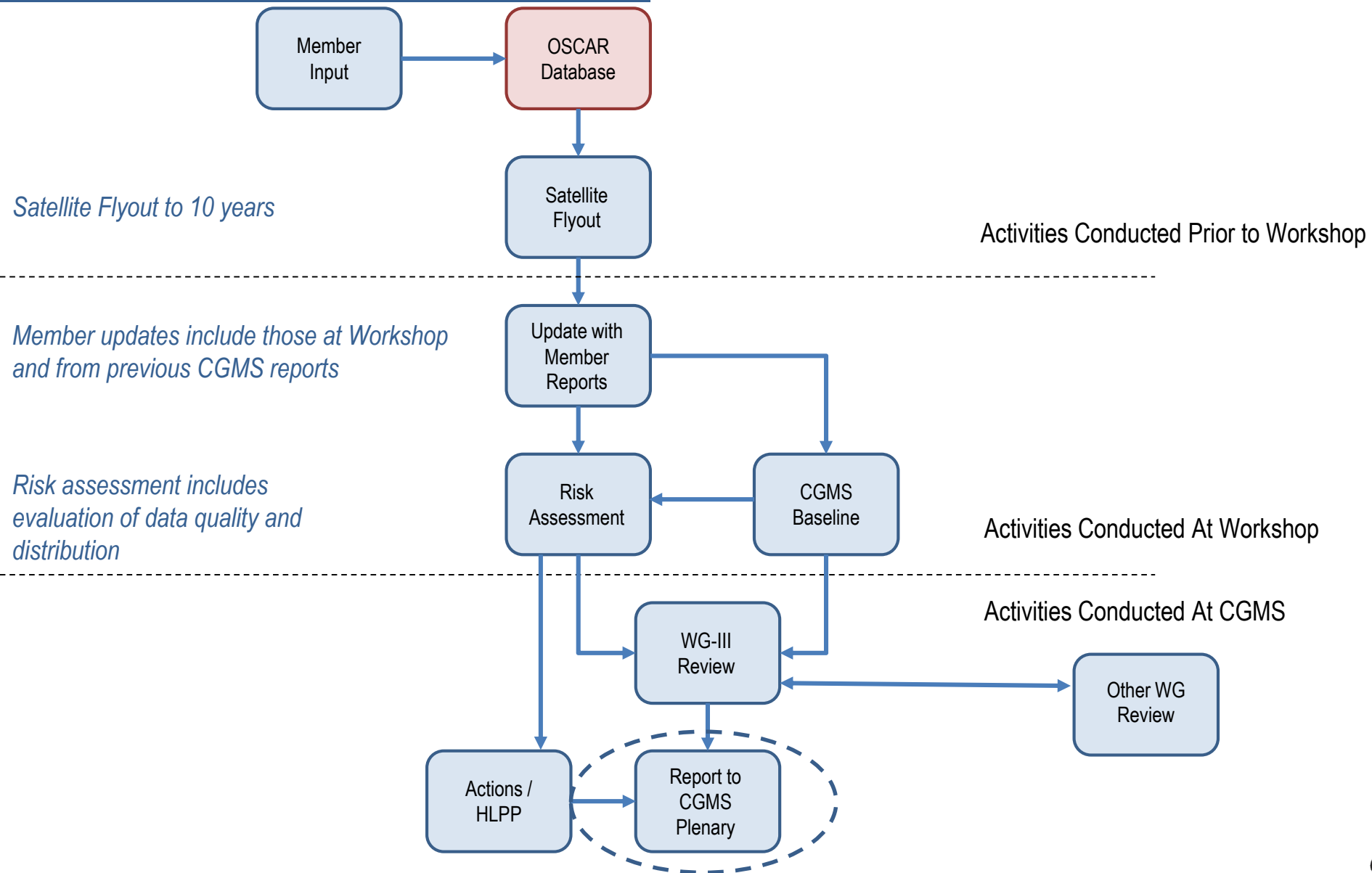
WGIII Meeting (2 of 3)

- WMO provided a report on their Gap Analysis with respect to the WIGOS Vision 2040
 - Gap Analysis compares satellite information in OSCAR/Space with user requirements
 - Gap Analysis is conducted against the WIGOS Vision 2040
 - Analyzed 16 gap areas (e.g., early-morning LEO, ocean altimetry, space weather)
 - Gaps identified by WMO are mostly covered by the CGMS Baseline, the HLPP or open recommendations and actions
 - The following areas are not specifically reflected in CGMS documentation
 - Polar ice observations
 - Deep space missions as Parker Solar Probe
- WMO provided WGIII with a status on OSCAR/Space; specifically, actions taken to maintain and evolve the technical capability
 - CGMS members are encouraged to provide accurate and timely updates to OSCAR/Space
 - WMO will continue to establish reliable focal points from CEOS, non-CGMS members, as well as from commercial satellite operators

WGIII Meeting (3 of 3)

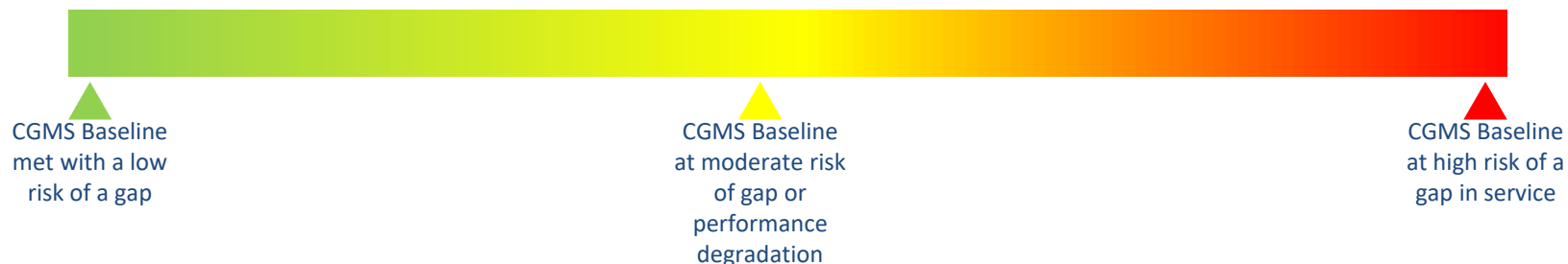
- The Socio-Economic Tiger Team noted the work completed to date and the update that the pilot socio-economic benefit study was cancelled
 - WGIII recommended that the SETT could be concluded but that a WGIII Agenda Item should be retained for future socio-economic studies and impact analyses
- WMO provided a verbal update on a FY-3E Tiger Team to evaluate the benefits of an early morning orbit.
- WGIII provide updates to the HLPP including:
 - Working towards increasing geographical resolution and coverage for altimetry measurements, including at very high latitudes
 - Including a section on assessing the impacts and benefits of CGMS satellite missions under Section 1 of the HLPP
- The Joint WGII-WGIII Session addressed the following:
 - UV observations in GEO, and the inclusion of trace gases observations from GEO to which CGMS could commit
 - Aerosol observations to which CGMS could commit

CGMS Baseline Update / Risk Assessment Process



CGMS Risk Assessment Assumptions

- CGMS Risk Assessment uses **Green**, **Yellow**, and **Red** to graphically represent the overall status of that sensor/observation. The criteria for each colour 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 Colour:** Observation is not planned to be available until a later date



Top-Level Risk Assessment (2021)

Sensor	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Microwave Sounder	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow
Hyperspectral Infrared Sounder	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow
Radio Occultation	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Red
Multi-purpose Meteorological Imager	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Multi-viewing, Multi-channel, Multi-polarisation imager	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
Broadband Short/Long Wave Radiometer	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow
Visible/UV Radiometer	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
UV Limb Spectrometer	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
SWIR Imaging Spectrometer	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Precipitation Radar	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Red
Microwave Imager	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Narrow Band Visible & Near Infrared Imager	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
Scatterometer	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow
Sub-Millimeter Ice Cloud Imager	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
High Resolution Optical Imager	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
EUV Imager	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
Energetic Particle Sensor	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow
Magnetometer	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

Risk in the early morning orbit after FY-3E;
no planned low-inclination RO observations
after COSMIC-2

Risk in the
early morning
orbit after FY-
3E

Risk in
continuity
after FY-3G
and GPM
Core

Risk in the early
morning and
afternoon orbits
after FY-3E and
Oceansat-3A

Risk of near-term gap until
SWFO-L1 is launched

Risk of near-term gap until SWFO-L1 and
GOES-U are launched

Top-Level Risk Assessment (2021) – Focus Areas (1 of 3)

- Complete 2021 Risk Assessment provided as a separate document
- Long term continuity risk for critical sensors (e.g., Microwave and Hyperspectral Sounders and Multipurpose Imagers) in the early morning orbit towards the end of the decade
 - CMA planning underway for a follow-on to FY-3E in the early morning orbit
 - A WMO Tiger Team will assess the benefit of the early morning orbit to inform CMA's plans
- Continuity risk for the number and geographic distribution of radio occultations; especially in the low inclination orbits
 - ***Note – the number of radio occultations in the Baseline will be met after the launch of the Metop-SG series of satellites***
 - Recommendation to CGMS members to fly RO sensor providing coverage in the low- to mid-latitudes
- Long term continuity risk for Broadband Short/Long Wave Radiometer in the early morning orbit
 - CMA planning is underway for a follow-on to FY-3E in the early morning orbit
 - GEO contributions are not identified in the CGMS Baseline; the WG has taken the action to consider whether they should be added at the WGII/III Joint Session in April

Top-Level Risk Assessment (2021) – Focus Areas (2 of 3)

- No long term plans for Precipitation Radar observations
 - CMA should confirm plans beyond FY-3G
 - NASA and JAXA should confirm plans beyond GPM Core
- Long term continuity risk for Scatterometry in the early morning and afternoon orbits
 - ISRO should confirm plans beyond Oceansat-3
- Risk of a gap in Coronagraph sensors in the near term
 - Recommend SWCG identify alternative data sources to mitigate potential unavailability of coronagraph observations
 - CGMS Members to continue to propose near-term alternative data sources for consideration as gap mitigation in event of loss or degradation of current L1 capabilities prior to SWFO-L1 data availability
 - WGIV to consider recommended gap mitigation observation requests and develop plans to ensure near real-time access to those data

Top-Level Risk Assessment (2021) – Focus Areas (3 of 3)

- Risk of gap in Energetic Particle sensor in the near term
 - Recommend SWCG review baseline requirement for orbital positions as opposed to number of satellites
- Risk of gap in Plasma Analyser and Magnetometer sensors at L1 in the near term
 - CGMS Members to identify near-term alternative data sources for consideration as gap mitigation in event of loss or degradation of current L1 capabilities prior to SWFO-L1 data availability

Top-Level Risk Assessment (2021) – Recommended Actions

- ISRO to update CGMS-50 on their plans for a hyperspectral sounder in geostationary orbit.
- CMA to confirm plans to fly a precipitation radar beyond FY-3G; and to deliver FY-3E data as soon as possible after commissioning so user communities can assess the benefit of the early morning orbit
- NASA and JAXA to confirm plans to fly a precipitation radar beyond the GPM Core.
- EUMETSAT and ESA to report on plans for the CIMR (Copernicus Imaging Microwave Radiometer) Mission
- ISRO to confirm plans beyond Oceansat-3 series
- SWCG identify alternative data sources to mitigate potential unavailability of coronagraph observations
- SWCG review baseline requirement for orbital positions as opposed to number of satellites for energetic particle observations

Top-Level Risk Assessment (2021) – Existing Associated Actions

- CMA planning is underway for a follow-on to FY-3E in the early morning orbit
- NOAA and NASA to confirm plans on accommodation of a radiation budget instrument on JPSS-3 and beyond
- WGII/III to consider whether observations from geostationary orbit should be added to the CGMS baseline requirements for the broadband short/long wave radiometer
- CGMS Members to continue to propose near-term alternative data sources for consideration as gap mitigation in event of loss or degradation of current L1 capabilities prior to SWFO-L1 data availability; WGIV to consider recommended gap mitigation observation requests and develop plans to ensure near real-time access to those data

CGMS Baseline - Background

- The CGMS Baseline enumerates the sustained observations, measurements, and services that form the CGMS contribution to observing the Earth System, Space Environment and the Sun.
- The CGMS baseline responds to end-user requirements expressed in WMO's Rolling Review of Requirements (RRR).
- The CGMS Baseline strives to support the WMO Integrated Global Observing System (WIGOS) 2040 vision.
- Key principles:
 - Commitment: The CGMS Members are providing, or have firm plans to provide, the observations, measurements, and services enumerated in the Baseline
 - Sustained: The observations, measurements, and services are provided on a sustained basis
 - Available: The observations, measurements, and services are available on a free and open basis
 - Operational: The data and products can be utilized in operational applications

CGMS Baseline Update

- The latest version being proposed to the Plenary contains editorial changes
- The IR dual-angle view imagery for high-accuracy SSTs was accidentally left out of the current version; the proposed version corrects this omission
- The Joint WG II-III meeting took stock of the capabilities for atmospheric composition and aerosol for the CGMS baseline missions:
 - Observations and application areas were expanded to capture support to atmospheric composition, including specific trace gases, for the hyperspectral sounder and visible/UV spectrometer (nadir and limb)
 - Observations and application areas were also expanded to capture support to aerosol observations from narrow band imagers and high resolution optical imagers
- Section on Direct Broadcast Services was updated to highlight low latency objectives
- CGMS Member instruments flown on commercial platforms will be included in the Baseline when launch dates are agreed with the commercial provider

Backup

CGMS Baseline - 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 conducts an annual **Risk Assessment** against the baseline to track how CGMS is meeting its commitments.
- The CGMS Risk Assessment will be completed every year forming the basis for CGMS actions to ensure continuity.

CGMS Risk Assessment Assumptions

- The top-level risk assessment for each sensor/observation is based on a qualitative analysis of all the orbits and satellite missions from which the observation is provided.
- This assessment is given from a CGMS Member prospective and may not:
 - Include contributions from non-CGMS agencies
 - Include contributions from commercial providers
 - Incorporate all WMO requirements (which are covered by the gap analysis).
- CGMS Members will develop and operate satellites in response to their national priorities.
- System resiliency, nor the consequence of not meeting commitments was not specifically addressed.
- 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 were not analyzed in detail for all measurements.
- The assessment is based on planned launch dates, design life, and updated by operational experience.

CGMS Risk Assessment Assumptions

- The information and assessment are based on the OSCAR Database as updated by WMO, member organizations and WGIII participants, as well as direct input from CGMS Members.
- The assessment is a qualitative assessment done by Risk Assessment Workshop participants.
- There is uncertainty in planned launch dates, satellite lifetimes (e.g., satellites often operate beyond their design life), operational readiness, and on-orbit health – all of which impact the risk assessment and ultimately the users.
- ***Member owned and operated payloads hosted on commercial platforms are included when launch dates are determined***

Note: The detailed charts are by calendar year. As such, if a mission launches in June, it will appear for the full calendar year, or if it's EOL is June, it will also still appear to go through the end of the calendar year.