WEATHER CLIMATE WATER

World Meteorological Organization

COMMISSION FOR OBSERVATION, INFRASTRUCTURE AND INFORMATION SYSTEMS

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OUTCOME OF THE FIFTEENTH SESSION OF THE CONSULTATIVE MEETINGS ON HIGH-LEVEL POLICY ON SATELLITE MATTERS

Introduction and objectives of the session

The fifteenth session of the Consultative Meetings on High-level Policy on Satellite Matters (CM-15) was held in Geneva, Switzerland on 6–7 February 2024. Approximately 70 participants from space agencies and the World Meteorological Organization (WMO) elected officials and the Secretariat (both in person and online) attended the meeting.

The role of the Consultative Meetings on High-level Policy on Satellite Matters is to facilitate a formal and substantive exchange between leadership of space agencies and representatives of WMO, which includes Presidents of the Commission for Observation, Infrastructure and Information Systems (INFCOM) and the Commission for Weather, Climate, Hydrological, Marine and Related Environmental Services and Applications (SERCOM), as well as the Secretary-General and Directors.

Coordination Group for Meteorological Satellites (CGMS) Space Agencies' perspective

For this session, speakers from both operational and research space agencies provided a brief introduction of their agency and emphasized their interactions with WMO. This included how they coordinate global requirements, support ongoing projects on regional and national levels, and describe their response to WMO's major strategic initiatives.

China Meteorological Administration (CMA)

(1) Coordinating long-term plans to urge governments to act;

(2) Embracing new technologies, including Artificial Intelligence (AI)/Machine Learning (ML), for research-to-operation applications;

(3) Enhancing space weather activities and user engagement for disaster prevention in developing countries.

European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)

(1) Providing direct support to WMO priorities such as Early Warning for All and Greenhouse Gas Watch;

(2) Offering continuous support to Africa for the past 25 years.

Indian Space Research Organization (ISRO)

(1) Advancing the country's capability for weather and climate monitoring;

(2) Supporting disaster risk reduction through early warning systems;

(3) Contributing to climate research and assessment.

Japan Meteorological Agency (JMA)

(1) Providing essential information for disaster risk reduction in East Asia and the Western Pacific region through Himawari;

(2) Contributing to the Earth system monitoring and climate change research.

Japan Aerospace Exploration Agency (JAXA)

(1) Contributing to society through Earth observation satellites, supporting international agreements like the Paris Agreement and the Sustainable Development Goals (SDGs);

(2) Monitoring greenhouse gases with the Greenhouse Gas Observing Satellite (GOSAT) series since 2009.

Korea Meteorological Administration (KMA)

(1) Prioritizing satellite system enhancement, better data accessibility, and capacity building for satellite data utilization.

National Aeronautics and Space Administration (NASA)

(1) Engaging in weather research, space weather, and greenhouse gas monitoring;

(2) Active involvement in the US Greenhouse Gas (GHG) Centre and links to WMO activities.

National Oceanic and Atmospheric Administration (NOAA)

(1) Building a Climate-Ready Nation 2030;

(2) Supporting early warnings, climate resilience, ecosystem awareness, and adaptation.

Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET)

(1) Continuous development of the Group on Earth Observations (GEO), Low-Earth Orbit (LEO), and Highly Elliptical Orbit (HEO) missions.

In summary, the President of INFCOM expressed his appreciation of the contributions of space agencies, emphasizing:

(1) The need for engagement with SmallSat operators;

(2) The need to look at feeding service innovation with satellite data;

(3) Challenges of increasing data volumes, noting that the Infrastructure Commission recently established a corresponding task team reporting directly to the management group of the Commission. We need to look at how the WMO Information System (WIS) architecture can be future proof for satellite data dissemination;

(4) Clarify the definition of the set of Core Satellite data;

(5) The need to consider data security for meteorological data. Quantum computing will generate opportunities for data tampering.

Users' perspective to demonstrate the importance of space-based observations

In this session, we had presentations by Numerical Weather Prediction (NWP) centres (ECMWF), regional representatives from Asia-Oceania, Latin America, Africa and Arctic, and presentations for engagement with commercial sector.

ECMWF presented the use of satellite data for NWP. They highlighted the importance of the collaboration between ECMWF, the European Space Agency (ESA), EUMETSAT and other partners worldwide for the use of satellite data to maintain the goal of the seamless Ensemble Earth system maximizing the use of current and upcoming observations. The importance of satellite data was highlighted with several examples towards the fully coupled Earth system approach. In addition, they underlined the importance of the attention by the WMO Space Programme and space agencies for collaboration with NWP centres for optimizing global observation system, continuity and length of the missions, early engagement for data assimilation of new instruments, good error characterization and data sharing.

The Caribbean Institute for Meteorology and Hydrology (CIHM) gave a presentation on the regional coordination groups on satellite data requirements, and especially Satellite Data Requirement Group for WMO region III and IV. The mission of the groups is to facilitate the way for WMO Members to express their requirements for specific satellite data and products and coordinate the planning and deployment of satellite data reception equipment and related training.

The Environment and Climate Change Canada (ECCC) gave a presentation on the Arctic perspective on satellite data. Due to climate change the Arctic regions are warming up to four times the rate of the rest of the planet. This is effect on many ways the region's nature, biodiversity, infrastructure and economy. Therefore, Canada has a critical reliance on satellite Earth observation to monitor its vast territory, particularly in remote northern regions. Canada continues to expand its use of satellite data and is advancing research & development to strengthen services and programs that exploit satellite data for the benefit of Canadians and the world.

The Bureau of Meteorology (BoM) gave a presentation on the importance of space-based observation in the Asia-Oceania region. They pointed out that the main challenges are in training needs for forecasters and IT, fast and reliable communication infrastructure and visualization tools. In addition, BoM presented a concept for the role of regional coordination group in addressing satellite data challenges in the WMO initiatives related to infrastructure, capacity building, risk management and observations gaps.

First Vice-President of WMO Daouda Konaté gave a presentation on African user perspective. He pointed out that there were 20 years of continuous satellite data reception by all National Meteorological and Hydrological Services (NHMSs) in WMO RA I since 2005. However, there are many current needs for satellite data access and use like the Preparation for the Use of Meteosat Second Generation (PUMA) station maintenance to ensure satellite data reception, regular training needs to strengthen knowledge in African NHMSs and needs for research and development related to weather and climate services in Africa. It was concluded that the Meteosat Third Generation (MTG) will bring numerous new observation capabilities and utilizing those needs increased infrastructure and human capacity in Africa. Many African countries are establishing space agencies and possibly facilitating beneficial cooperation with NMHSs.

NOAA and EUMETSAT gave a presentation on engagement with the commercial sector from NOAA's and EUMETSAT's perspective. The clear driver for the engagement with the commercial sector is the huge growth of the SmallSat market creating vast offering for commercial

weather data buys. NOAA has created a commercial space policy containing guiding principles for commercial sector data buys. NOAA released so far four commercial data pilots on radio occultation, space weather and ocean surface wind data, which were followed by the commercial weather data buys for radio occultation data. It was pointed out that in data sharing NOAA is committed to WMO Unified Data Policy and NOAA will negotiate the least restrictive terms possible, while evaluating data sharing on a case-by-case basis avoiding duplicative data with other data buys. EUMETSAT released commercial data buy pilot from 2022 to 2026. Their policy framework states that commercial data should be complementary to data delivered through EUMETSAT main programmes and added value shall be demonstrated together with best value for money. They also prefer the global licensing approach enabling unrestricted data exchange with international partners. EUMETSAT concluded that commercial providers can fulfil operational service requirements showing clear value for money. The global licensing approach created synergies and benefits from US commercially produced data. EUMETSAT plans to develop a limited permanent budget line to procure commercial data, which is under discussion with EUMETSAT Member States.

Round table discussion

Six key topics were raised during the roundtable discussion, focusing on:

1. Increasing benefits of satellite data for Developing Countries

The collaboration between WMO and space agencies to support developing countries was discussed. Strong potential exists for increasing the value of satellite data for the Early Warnings for All Initiative (EW4ALL) through cooperation between WMO and space agencies.

A consensus emerged to focus data dissemination to developing countries based on specific regional needs, avoiding unnecessary costs and complexity. This targeted approach aims to ensure that essential data are disseminated, optimizing resources.

2. High Data Volumes

Participants acknowledged a disconnect between the sheer volume of available data and its effective use. The group has also acknowledged challenges of managing growing data volumes and integrating data.

The WMO Information System (WIS) 2.0 constitutes a major step forward for optimizing the global exchange of data. More innovative interoperability approaches to bring tools and data together should be considered for the future. A deeper dialogue between WMO WIS and space agencies is required to develop a future common vision.

3. Coordinated Involvement of the Private Sector

A collective agreement emerged on the necessity for coordinated involvement of the private sector in collaboration with WMO, the Committee on Earth Observation Satellites (CEOS), and CGMS.

The WMO Open Consultative Platform was highlighted as a valuable tool for continued engagement with commercial satellite data providers. The need for coordination with CEOS approaches and fostering a three-way dialogue involving WMO, space agencies, and the private sector was emphasized.

4. Coordination for Greenhouse Gas Monitoring

Participants emphasized the need for better coordination between CEOS and the Coordination Group for Meteorological Satellites (CGMS) for greenhouse gas monitoring.

Support for common messaging at COP (Conference of the Parties) levels was suggested to streamline efforts. It was acknowledged that achieving true operational greenhouse gas monitoring poses challenges related to validation and quality control of measurements.

Agencies identified their contributions to the Global Greenhouse Gas Watch (G3W) and discussed parallels with the development of NWP skills and satellite data. Common approaches to validation were deemed valuable.

5. WMO Integrated Global Observing System (WIGOS) Vision

An update on the WMO Information System (WIGOS) Vision was discussed, with participants expressing anticipation and looking forward to implications.

6. AI Technology for Improved Satellite Data Exploitation

Recognition of the potential of AI technology in enhancing the exploitation of satellite data, particularly in improving nowcasting products.

Discussion highlighted ongoing developments in AI-based weather modelling by various companies and institutes, showing promising results. The potential for AI to revolutionize data processing and analysis was acknowledged.

The potential disruptive impact of AI on data needs was acknowledged, emphasizing the importance of closely monitoring this evolving technology.

Data policy considerations for satellite data, including core data definition

WMO presented the approach for defining Core and Recommended satellite data following the approval of WMO Unified Data Policy (Resolution 1) in 2021. To identify an initial list of Core and Recommended satellite data for global NWP for adoption in WIGOS manual, the WMO Core Satellite Data Workshop was convened to bring together satellite operators and global NWP centres to address the WMO Unified Data Policy. The primary objective of the Workshop was for global NWP centres to identify an initial list of Core and Recommended satellite data to meet their needs, balancing feasibility and impact. The workshop was a first step to addressing the satellite data needs of other WMO weather, climate, and water application areas in an Earth system approach. The workshop was attended by 46 participants in person as well as 25 online participants, representing satellite operators and NWP centres around the globe. The workshop statement proposes sets of Core and Recommended satellite data required in near-real time by global NWP systems. These are subsets of the overall capabilities defined within the WIGOS Vision 2040. The CM-15 meeting participants were invited to review existing satellite data policies at the national/international space agency level and endorse the initial list of Core and Recommended satellite data for global NWP in advance of the presentation at INFCOM-3 (April 2024) and EC-78 (June 2024).

It was concluded that more work is needed to establish sustainable technological solutions to facilitate the data exchange for high data volumes in near-real time and establish the mechanism for regular consultation with satellite operators to periodically review Core and Recommended data in WIGOS manual. The future work will also cover core satellite data definitions for other application areas like nowcasting, hydrology and space weather.

JMA pointed out their concern on GEO hyperspectral sounder data defined as core dataset, which requires satellite operators to exchange that high volume dataset. It was concluded that attributes defining the details of Core and Recommended data are still open and will be defined in the draft WIGOS manual including Core and Recommended data tables.

Implementation of the space-based observing component of WIGOS

WMO presented the planned update cycle of WIGOS Vision 2040. WIGOS Vision responds to WMO strategic plan related to extreme weather, climate and other environmental events. It is a combination of space-based and surface-based components serving Earth system approach. It was noted that there are differences in the number of actors, WMO Member responsibilities and capacities between space- and surface-based components including different design processes. It was pointed out that the new WIGOS Vision should be more flexible in terms of the responses to user requirements and technological approaches. It was concluded that the update cycle for WIGOS Vision update shall be ready after consultation and revision process by Cg-20 in 2027.

NOAA presented the CGMS Baseline and Risk Assessment. CGMS Baseline enumerates the sustained observations, measurements, and services that form the CGMS contribution to observing the Earth system, Space Environment and the Sun, and responds to end-user requirements expressed in WMO's Rolling Review of Requirements (RRR) and constitutes the CGMS response to the WIGOS 2040 vision to document what missions are currently being or planned on being flown. CGMS conducts an annual risk assessment against the CGMS Baseline to track how well CGMS is meeting its commitments. 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. CGMS Risk assessment 2023 states high risk for radio occultation observations in the beginning of the next decade due to missing plans for the continuation of COSMIQ-2 mission. It also states high risk related to coronagraph, magnetometer and plasma analyser observations during the next decade. It was concluded that the Contingency Plan contains guidance and a process for identifying, mitigating, and coping with risks to continuity of the CGMS Baseline and informs the user community, such as WMO, of these processes.

Summary and conclusion

In summary, the meeting delved into numerous critical topics, including collaborative efforts to support Members with the least capacity, particularly in advancing the UN Early Warnings for All initiative. Dealing with new paradigms of bringing data and users together in the face of growing data volumes and capabilities, exploring best practices and emerging opportunities in collaboration with the commercial satellite sector. Pioneering the transformation of the Global Greenhouse Gas Watch (G3W) from concept to reality in the years ahead. Anticipating the impact of the impending but still nebulous AI revolution on weather and climate enterprise, particularly concerning satellite data. Examining the evolution of WMO, its space program, and WIGOS processes, including the co-design of the WIGOS 2040 Vision update, to better serve the framing of user requirements for weather, climate, water and related environmental applications, and the satellite agencies' responses.

The meeting defined following actions for WMO, to:

(1) Improve and develop regional specific approach for data use and dissemination supporting various infrastructures and needs, with clear statements of needs coordinated with the WMO Regional Associations and a framework for training and capacity development;

(2) Facilitate a dialogue between WMO and space agencies for WIS 2.0 implementation in light of growing data volumes;

(3) Organize an Open Consultative Platform event to improve commercial sector engagement related to space-based observing systems, in a three-way dialogue between WMO, space agencies and the private sector;

(4) Establish a task team to work for WIGOS Vision update, and maintain dialogue between WMO, space agencies and other stakeholders;

(5) Maintain close engagement of the space agencies in the development of the Global Greenhouse Gas Watch (G3W);

(6) Follow the development of AI/ML technologies with regards to space-based observing systems, in their potential to affect observing requirements and the full exploitation of integrated satellite and ground-based observations.

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