### ADVANCING THE ENVIRONMENTAL SUSTAINABILITY OF OBSERVING SYSTEMS AND METHODS: INSIGHTS FROM THE INTERNATIONAL COMMUNITY

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# Leadership is required to prioritize the environmental sustainability of weather and climate observations...

- Observing systems and methods provide critical weather and climate data, but can have significant environmental impacts
- Dissonance with requirements for WMO Global Basic Observing Network (GBON)
- Transition to more environmentally sustainable observing systems and methods requires practical and pragmatic guidance for NMHSs and industry

**Key outcome:** recommendations for amendments to WMO documentation



Canada & USA GBON surface observing stations reporting temperature (from GBON module in WMO Data Quality Management System)

...prompting the WMO to launch a **targeted initiative**, with Canada as the **International Focal Point**.

### An international survey was conducted to benchmark WMO Member experience and perspectives...

**Scope:** Gather information from National Meteorological and Hydrometric Services (NMHSs) regarding current, planned, and potential approaches to enhance the environmental sustainability of observations in meteorological, hydrological, atmospheric chemistry, and marine domains

- Survey addressed current, planned, and potential activities to incorporate sustainability across the operational life cycle
  - Network planning and design
  - Procurement
  - Siting and installation
  - Operations
  - o Decommissioning
- Domains: meteorological (upper air and surface), marine, hydrological, atmospheric chemistry



...creating an **inventory of sustainable practices**, revealing **gap areas**, and **establishing a baseline** from which to assess progress.

### The survey results framed how environmentally sustainable practices are viewed and prioritized by members...

#### Procurement

#### **Network Planning**

- Environmental sustainability is becoming an increasingly important consideration in procurement processes
- Some Members consider the environmental accreditations of vendors



- Environmental sustainability is **already a key factor** in network planning for many respondents
- Many Members are actively investigating new technologies to reduce environmental impacts



#### Observing system installations and infrastructure

- Environmental impact criteria are widely considered when selecting observing system locations, construction materials, and infrastructure
- Many Members are using renewable energy sources in installations



Example: the cost and availability of helium are affecting many WMO Members

#### 34% 🕸

Have replaced or are replacing helium with hydrogen gas for upper air, atmospheric chemistry obs

#### 14% 🗄

Use a chemical alkaline process for hydrogen generation

15% 🕲

Use or are exploring alternative hydrogen production systems

...establishing a baseline for assessing progress and identifying gap areas

Many organizations have already taken steps to improve the environmental sustainability of their observing system operations...



Use of renewable energy



Reducing emissions and costs by reducing number of field visits



Enhancing capacity for remote access by improving telecommunications capabilities



Transitioning to more sustainable lofting gas generation for upper air observations



Recovery of radiosondes and ozonesondes

#### Potential areas for improvement

- Monitoring of physical waste
- Greener vehicle fleets

WMO Member respondents are largely **compliant** with regulations for hazardous materials when decommissioning installations





Respondents are on track toward phasing out mercury from observing systems in accordance with the **Minamata Convention on Mercury** 

...highlighting the nascent commitment of WMO Members to reducing their environmental impacts.

# The WMO initiative on environmental sustainability of observing systems and methods will advance recommendations...

The transition to more environmentally sustainable observing systems and methods is challenged by:



The criticality of observations via established systems/methods



- Financial and operational feasibility considerations
- The requirement for clear guidance from WMO to Members and the vendor community to inform implementation

The 2022 Survey demonstrated that organizations are taking positive steps toward sustainability, but crucial gaps remain



Credit: Digi International

Our commitment aligns with the WMO's vision for environmentally sustainable observing systems within GBON and WIGOS

Together, Members can actively work toward a more environmentally responsible future in all observational domains

#### ...to mitigate challenges experienced by Members.

# The WMO virtual workshop on environmental sustainability of observing systems and methods...



...provided an international forum for discussion and collaboration to advance recommendations

# A holistic, end-to-end approach to observing systems can identify avenues to enhance environmental sustainability...

#### **Core issue:** maintaining system capabilities and essential data collection while reducing environmental impacts

#### Key approach: life cycle assessment

- Considering the full life cycle of weather and climate observing systems
- Thinking beyond technologies and factoring in design, manufacturing, installation, operation, maintenance, and decommissioning phases









#### How we design observing systems

- Tiered networks
- Re-thinking specifications
- Flexibility via tech choices, autonomous systems

#### What we procure

- Extending life cycles, reducing maintenance
- Sustainable materials

#### How we operate

- Renewable energy sources
- Mitigating risks to ecosystems
- Minimizing on-site presence

...opening the door for **innovation** and **collaboration** to advance viable solutions

### International guidance, standards, and best practices are needed for coordinated advancement...

#### **Establish baselines and track progress**

- International surveys
- Concept of voluntary "opportunity scans" for environmental sustainability within organizations

#### Set clear expectations and incentives for vendors

• Define environmental sustainability requirements and make them worthwhile to implement

#### **Remove barriers to implementation for Members**

• Acknowledge and address unique challenges faced by different Regions, Members

#### Transform "the norm"

• Build environmental sustainability into funding, procurement models



Advancement via a combination of top-down and bottom-up processes

### Collaboration is key

#### **Recurring theme**

"The ultimate value-multiplier"



...leveraging expertise and lessons learned at the national and organizational levels

### Through the presentations and discussions at the workshop, recurring themes emerged...



- Working in alignment with stakeholders, industry
- Identify opportunities to pool resources (e.g. funding, knowledge, development, testing) to achieve efficiencies
- Encourage new ways of thinking, approaches to observing system and policy challenges
- Active engagement with industry, academia
- Ongoing engagement, education, and capacity development
- Targeted engagement of Regions, young people
- Support for LDCs beyond infrastructure provision
- Necessity of quantitative assessments to frame impacts of infrastructure/data (e.g. on NWP) relative to environmental impacts
- Enable informed decision-making (e.g. cost-benefit analyses)

... providing guideposts for progress as the initiative moves to put forward recommendations

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### Active wide-scale participation is key to progress towards sustainable observing systems...

#### Summary

- The WMO Environmental Sustainability initiative will advance recommendations to mitigate challenges
- The transition to more environmentally sustainable observing systems and methods is challenged by:
  - 1. The criticality of observations via established systems/methods
  - 2. Financial and operational feasibility considerations
  - 3. The requirement for clear guidance from WMO to Members and the vendor community to inform implementation
- Results demonstrate that many organizations are taking positive steps toward sustainability, but gaps remain

#### Next steps:

Preparation of recommendations for WMO INFCOM consideration (Spring 2024)



Participation on WMO discussions for continuous advocacy and communication with members



Potential for a follow-up survey in 2024 to assess impacts of advocacy via this initiative



...and the continued success of this initiative as it progresses toward Statements of Guidance