

An Overview of the Global Greenhouse Gas Watch (G3W)



Carbon Monitoring System (CMS)
Policy Speaker Series (PSS)
Webinar-talk, May, 8, 2024

presented by Dr. Gianpaolo BALSAMO, G3W Director,
World Meteorological Organization (WMO)



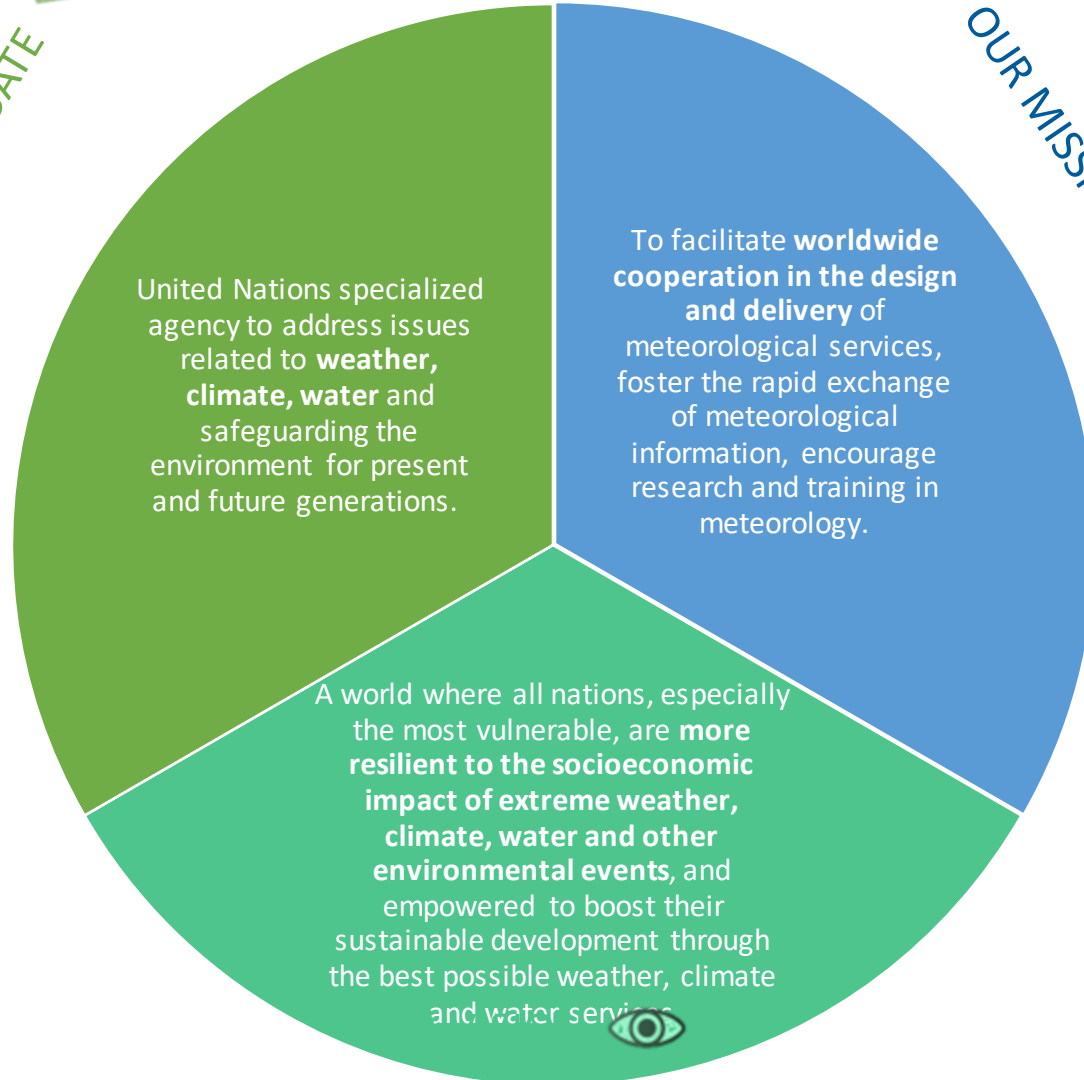
WORLD
METEOROLOGICAL
ORGANIZATION



WMO – the World Meteorological Organization in a




OUR MANDATE 



United Nations specialized agency to address issues related to **weather, climate, water** and safeguarding the environment for present and future generations.

To facilitate **worldwide cooperation in the design and delivery** of meteorological services, foster the rapid exchange of meteorological information, encourage research and training in meteorology.

A world where all nations, especially the most vulnerable, are **more resilient to the socioeconomic impact of extreme weather, climate, water and other environmental events**, and empowered to boost their sustainable development through the best possible weather, climate and water services 

OUR MISSION 

WMO plays a role as a **global coordinator** for Member countries, harmonizing and supporting the work done across National Meteorological and Hydrological Services around:

Protection of Life and Property
Safeguarding the Environment

Contributing to **Sustainable Development**

Monitoring the earth system (collecting and sharing **Data & Information**)

Defining **Best Practices**

Promoting targeted **Science** to improve **Infrastructure, Service delivery** and supporting **Policymaking**

Contributing to **Capacity development**, seeking to reduce the development gaps

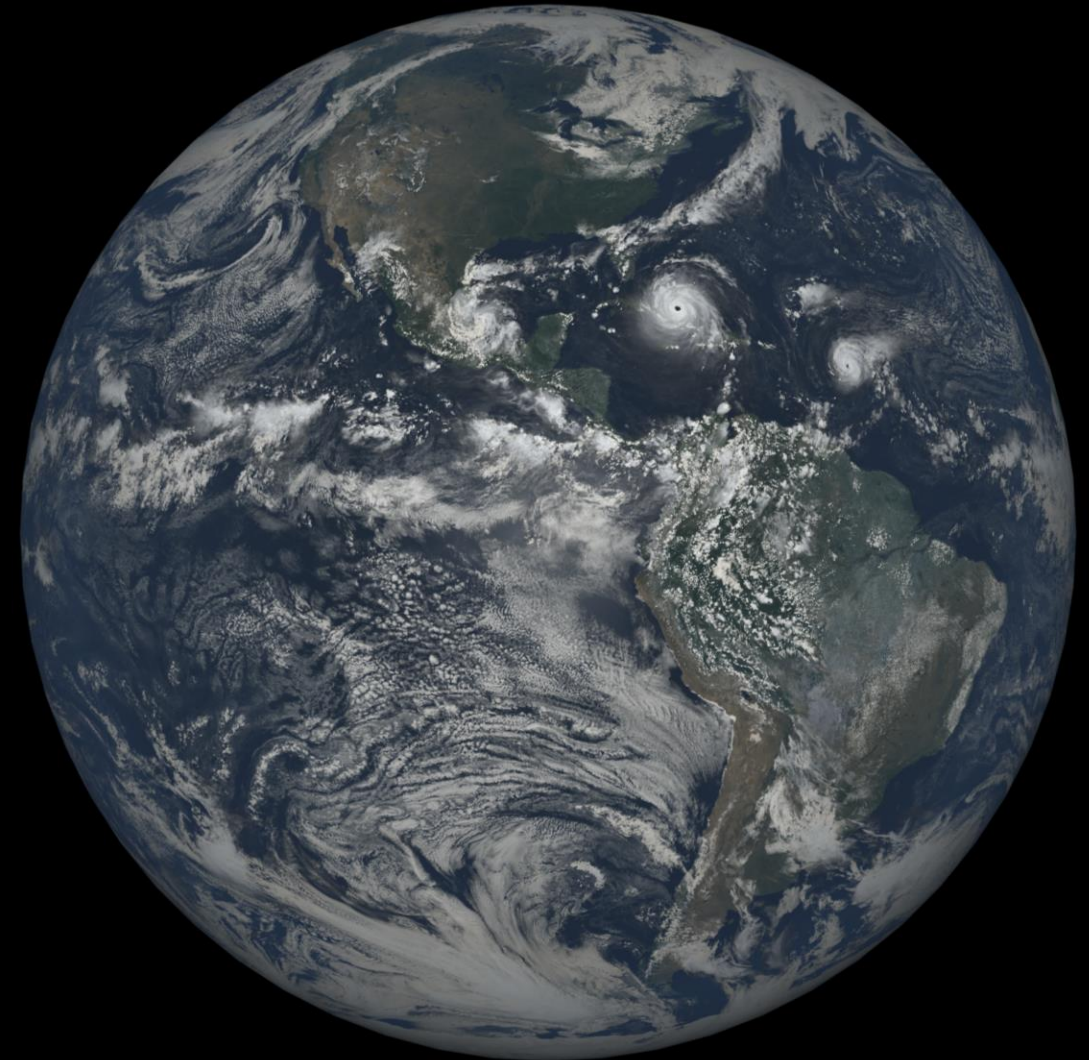
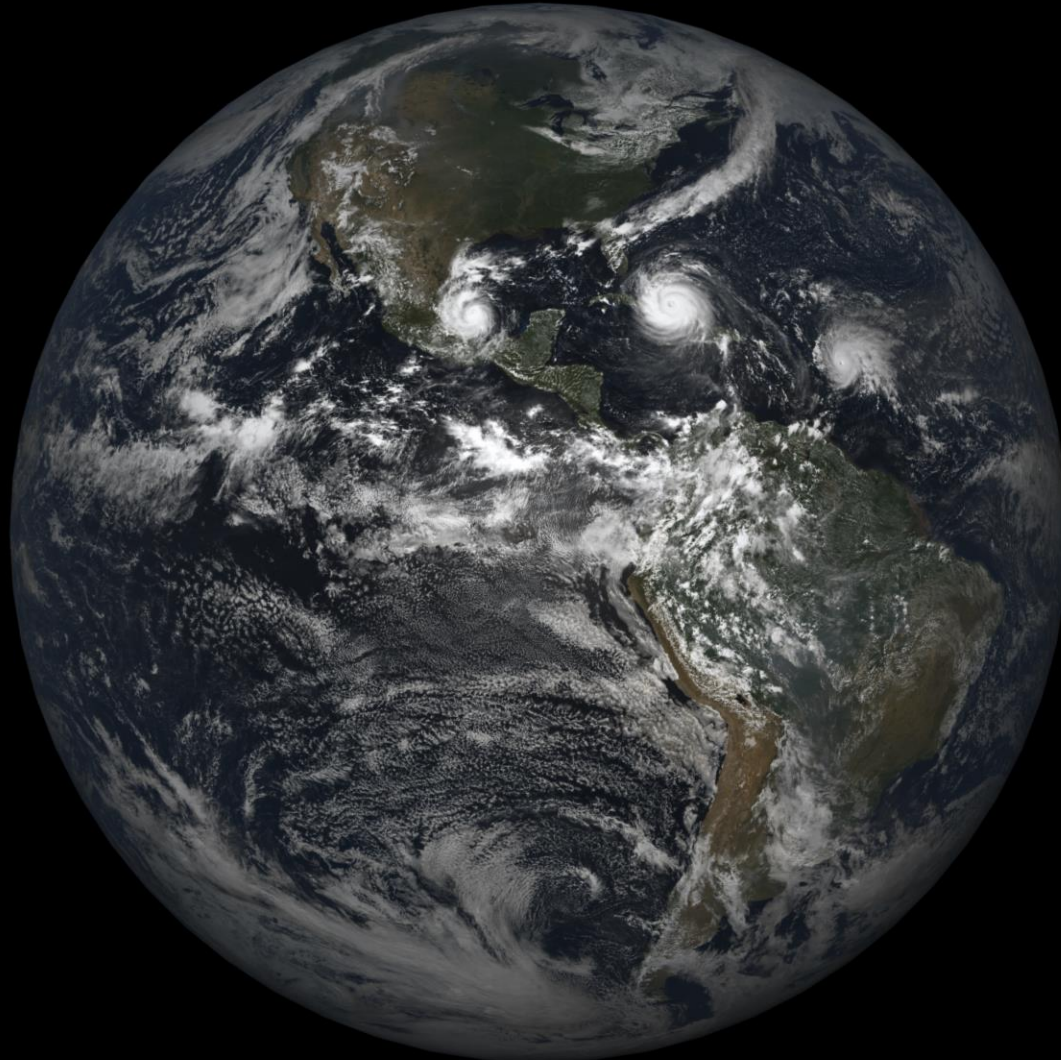
WMO convention

How do we drive change with a **Digital Twin of the Earth-system?**



GOES16_ABI CH2_3_1 composite 20170908 1800 UTC

IFS FC+18h at 2.5 km



Philippe Lopez

RTTOV-MFASIS: simulated imagery in the visible..

EW4All –the Early Warning for All Flagship in a



The EW4All Flagship will ensure every person on Earth is protected by lifesaving early warning systems by 2027

How?



Disaster risk knowledge

Systematically collect data and undertake risk assessments

- Are the hazards and the vulnerabilities well known by the communities?
- What are the patterns and trends in these factors?
- Are risk maps and data widely available?



Detection, observations, monitoring, analysis and forecasting of hazards

Develop hazard monitoring and early warning services

- Are the right parameters being monitored?
- Is there a sound scientific basis for making forecasts?
- Can accurate and timely warnings be generated?



Preparedness and response capabilities

Build national and community response capabilities

- Are response plans up to date and tested?
- Are local capacities and knowledge made use of?
- Are people prepared and ready to react to warnings?



Warning dissemination and communication

Communicate risk information and early warnings

- Do warnings reach all of those at risk?
- Are the risks and warnings understood?
- Is the warning information clear and usable?



Early Warnings for All



Pillar 2 is focused on delivering 5 outcomes:

- Increased availability of quality observation data to assess and monitor priority hazards.
- Enhanced data exchange and access for forecasting and warning systems.
- Increased capabilities to forecast all priority hydrometeorological hazards.
- Impact-based forecasts and warnings are produced for all priority hazards.
- Strengthened relevant policy, institutional mechanisms, and stakeholder engagement processes in place to support MHEWSs

The delivery of Early Warnings for All requires scale up and coordinated investments and action across the four essential pillars of end to end, people-centred Multi-Hazard Early Warning Systems



GREEN CLIMATE FUND

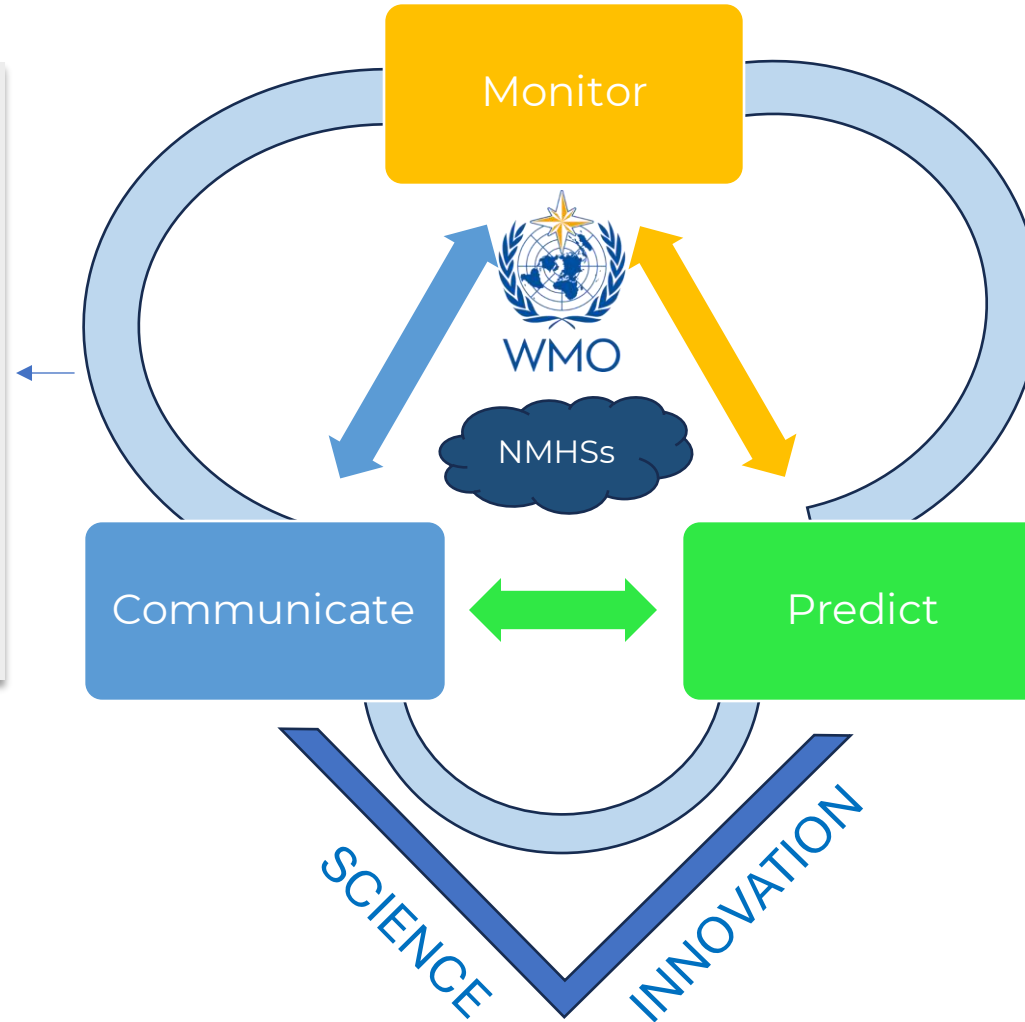


Global Status of Multi-Hazard Early Warning Systems 2023



WWW – Lesson Learnt from National Hydro-Met. Services

- Interact and engage with public, private and academic sectors.
- Engage with economic sectors
- Provide evidence to support decision-makers in developing and implementing policies



- Perform regular earth-system observations, according to established standards
- Establish, improve and maintain hydrometeorological networks.
- Collect and share data

- Provide forecasts at different time scales, from early warnings to climate outlooks
- Co-develop sectoral services (risk management, transport, energy, agriculture, health, tourism, etc.)



G3W – the Global Greenhouse Gas Watch Flagship in a

The G3W Flagship respond to UN sustainability's call, via **Climate Action** (mitigation) for **Climate Neutrality Goal**

- **G3W Master-Plan**

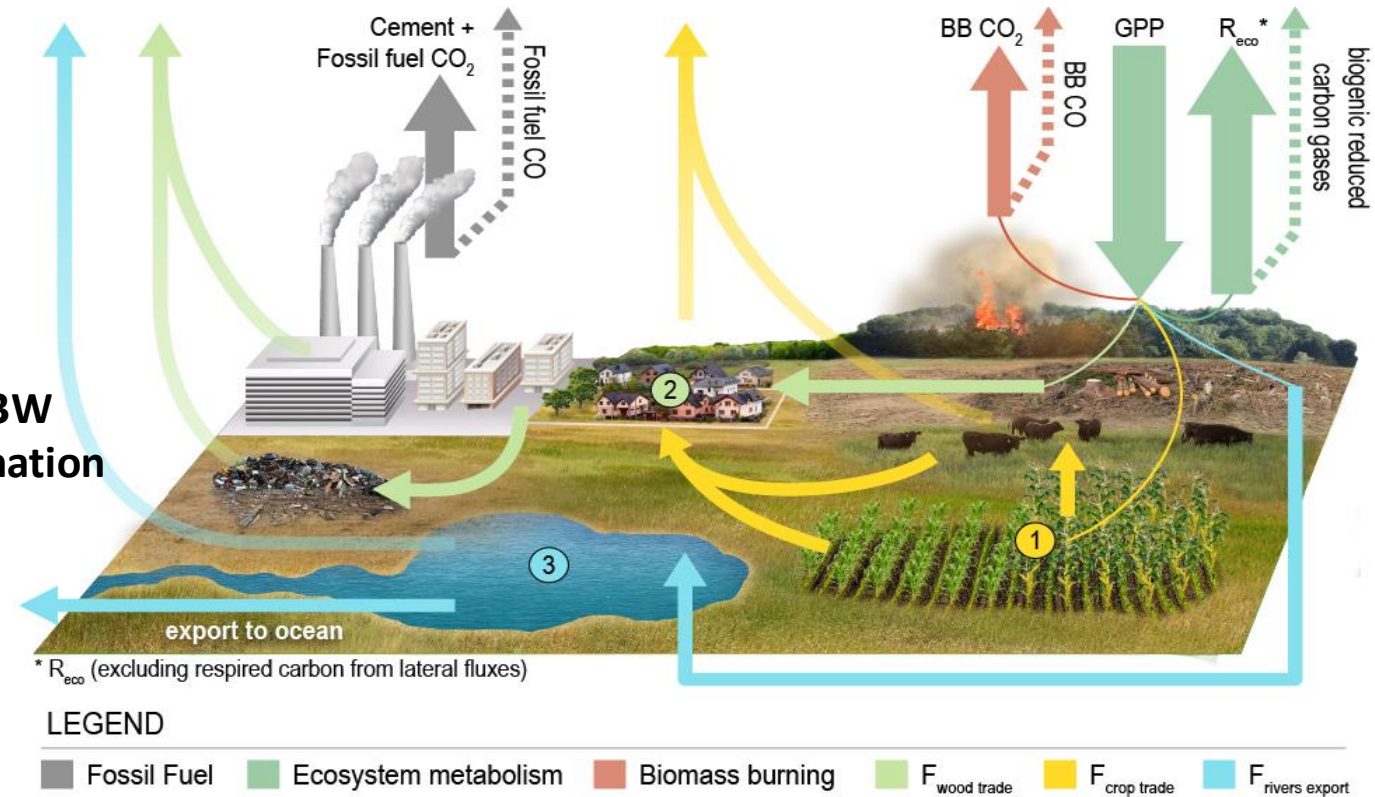
- G3W-IPP Implementation & Pre-Oper Phase **2024-27**
- G3W-IOP Initial Operational Phase **2028-31 (GST-2)**
- G3W-EOP Enhanced Operational Phases **2032-50**

- **G3W Financial Sustainability**

- WMO-RMS the Resources Mobilisation Strategy for G3W
- 1 B\$: 70% Observations, 29% Integration, 1% Coordination

- **G3W Working Structure**

- INFCOM-SC-ET Expert Teams
- AG-G3W joint INF / RB / SER
- WIGOS / WIPPS / WIS synergy



Byrne et al. 2022 ESSD

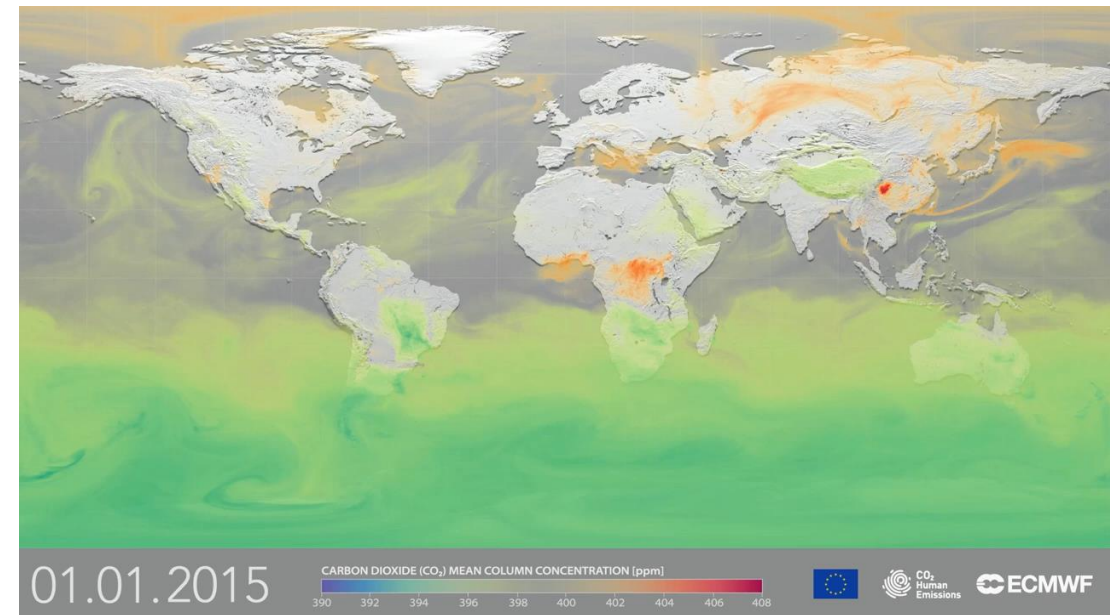


The “What, How & Why” for the G3W Flagship

What: The Global Greenhouse Gas Watch - **G3W** fills **critical information gaps** on greenhouse gases (GHGs), via an integrated **operational framework** that optimally combine **Earth Observations** with **Earth System Models** using **Data Assimilation & Artificial Intelligence** techniques to **reduce uncertainty** in assessing the efficacy of **Climate Action**.

How: a **Timely Policy-relevant information** on GHGs concentrations and fluxes allowing to assess both the **Natural & Human** influence on climate change <https://wmo.int/activities/global-greenhouse-gas-watch-g3w>

Why : an **Earth System Approach** is a must-have because **Earth’s climate responds to the laws of Climate Physics** and depends Atmospheric GHGs, **NOT** on Claimed Offset of Carbon emissions or to Good-will of Pledges.



Animation source: Copernicus Earth Observation Programme / ECMWF CAMS

G3W Plan in Action

In 2023 three key events

- 1st **WMO GHGs Monitoring Symposium**
G3W reaches broad science support
- 19th **World Meteorological Congress**
intergovernmental agreement approved **G3W proceeds with development**
- **COP28** raised the profile of the **Global Greenhouse Gas Watch – G3W**
 - **WMO prominent exposure at COP28** in particular at the **Earth Information Day**
 - **G3W is noted by 196 Nations** in the [SBSTA-59](#), providing a **successful closure of COP28 for G3W**



In 2024 one key event

- **INFCOM3 endorse G3W** plan & governance to be presented to **WMO Executive Council**



2023

2024 -- 2027

2028 -- 2031

2032 -- 2050

Cg-19 → G3W
WMO Congress

G3W – IPP
Implementation Pre-Oper Phase

G3W – IOP
Initial Operational Phase

G3W – EOP
Enhanced Operational Phase

GST-1
COP28

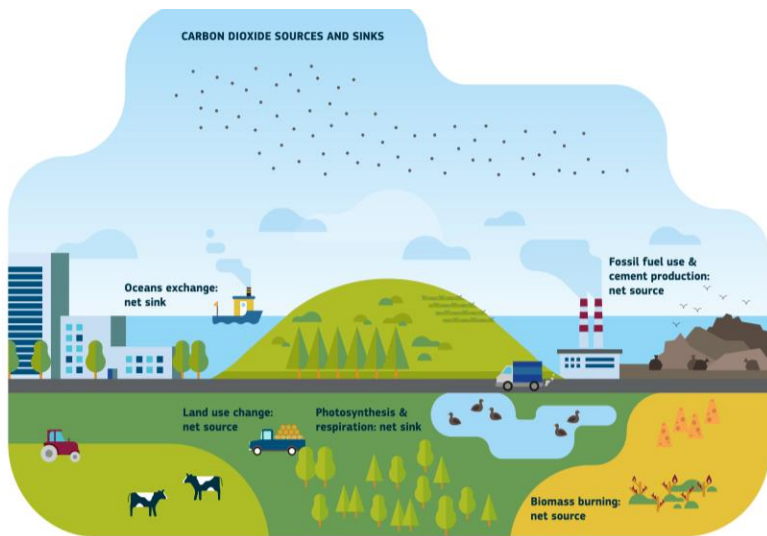
Initial Monitoring Systems

GST-2
COP33

Enhanced Systems

GST-n
ETF, NDCs

“for Measuring, Understanding, and Managing the Earth’s Climate”



UN family
IPCC-IOC-
UNEP-UNFCCC-
WHO-WMO-WTO

UNFCCC
COP-SBSTA

WMO
WIGOS-WIS-WIPPS

Public-Private Partnerships



CO₂, Carbon dioxide

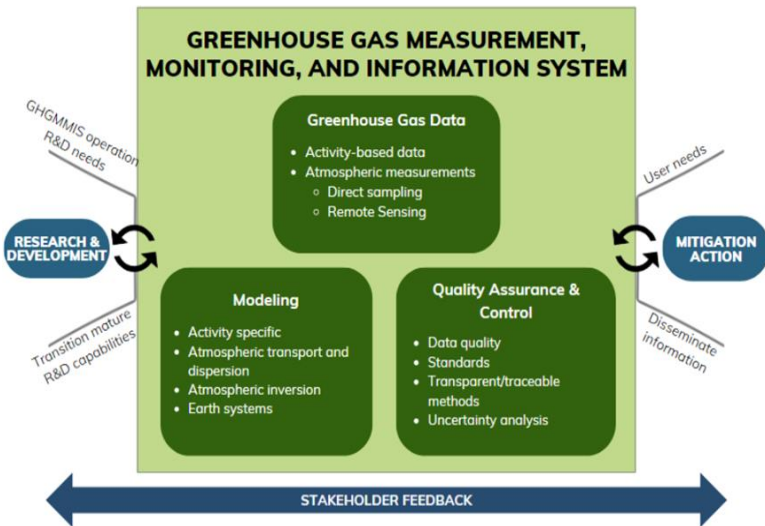
GHGs Earth’s Observing Systems is building on Weather experience



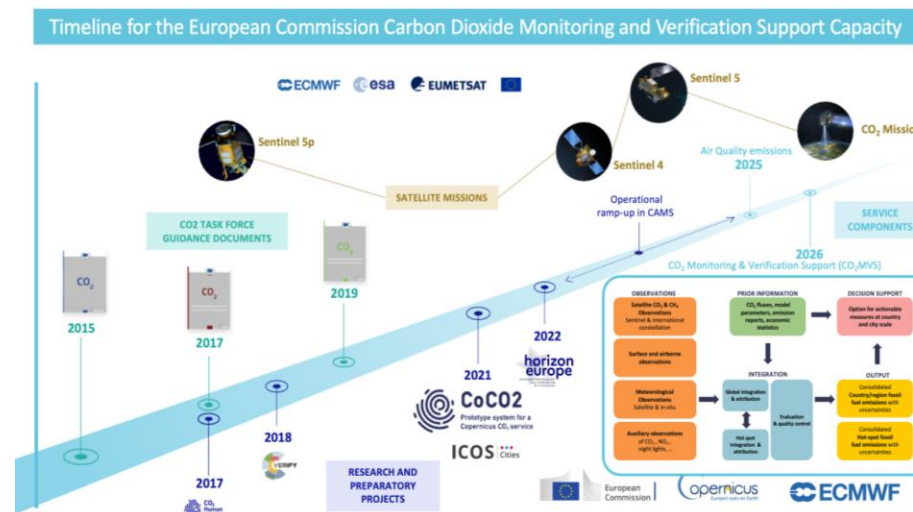
G3W – Global Greenhouse Gas Watch

Synchronizing with National & Regional efforts

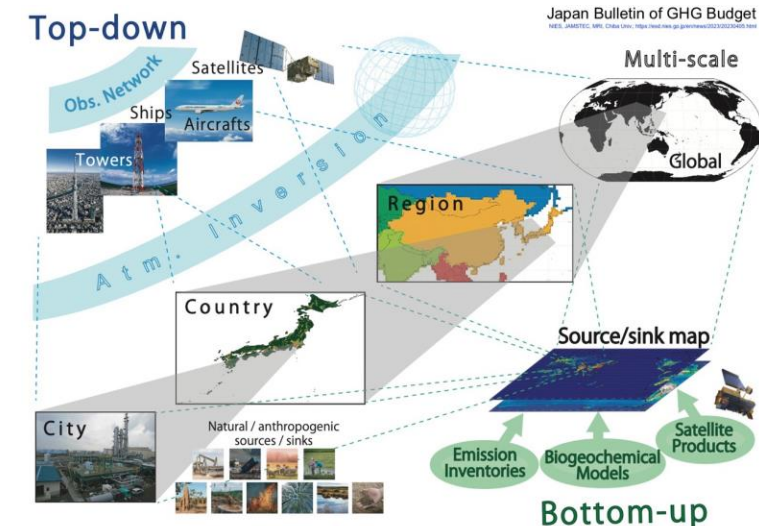
- In 2024 the **G3W Implementation Plan**, the **G3W Sustainability Strategy** documents.
- In 2025 & 2026 the **Ramp up Operations** with sustained funding sources (WMO + External).
- This is in good alignment with fast-track GHGs information efforts, such as in EU, JAPAN, US, ...



US GHGMMIS, 2023



EU COPERNICUS, 2023

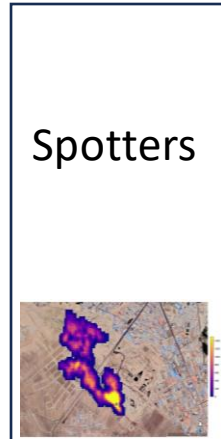
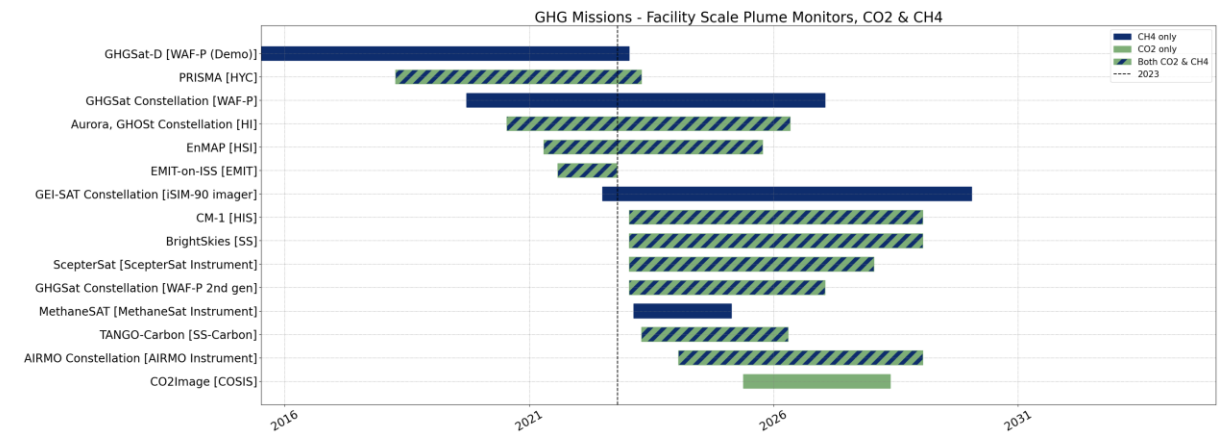
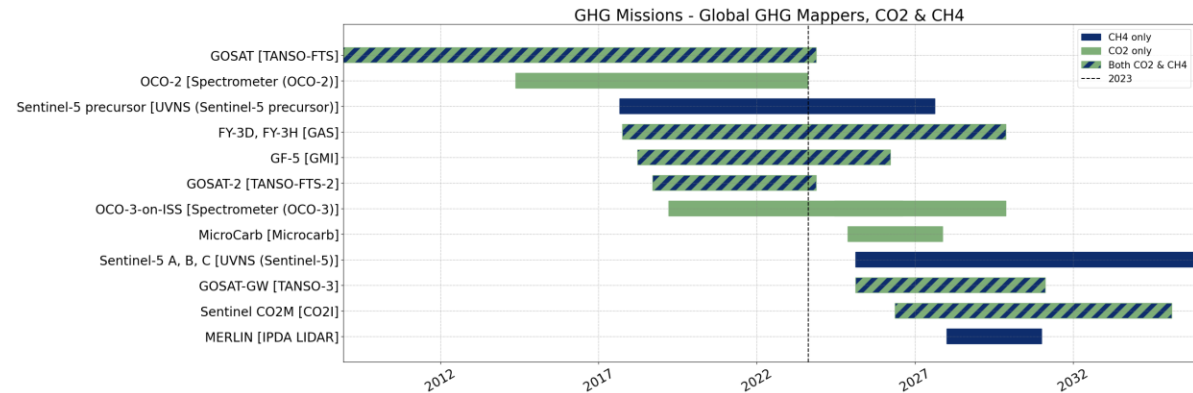
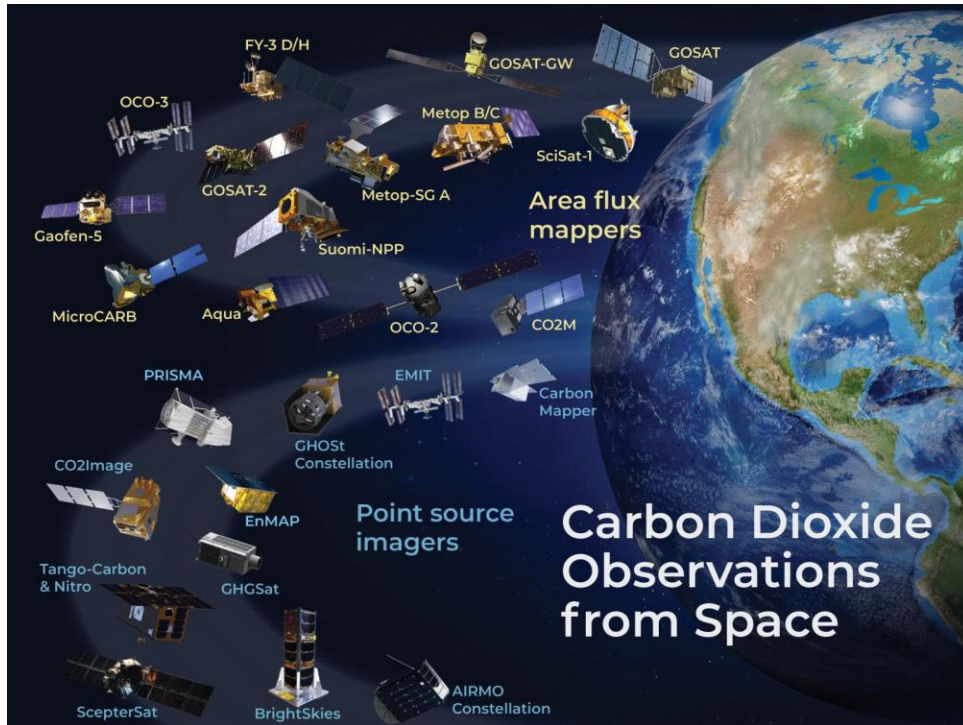


JAPAN NIES, 2023



Synchronizing with Space Agencies

- In 2024-27 the **G3W IPP Implementation and Pre-operational Phase**, it is crucial for the global coverage of local relevance that **G3W Space Remote Sensing** components are well coordinated.
- This is thanks to **CEOS** and to **CGMS**

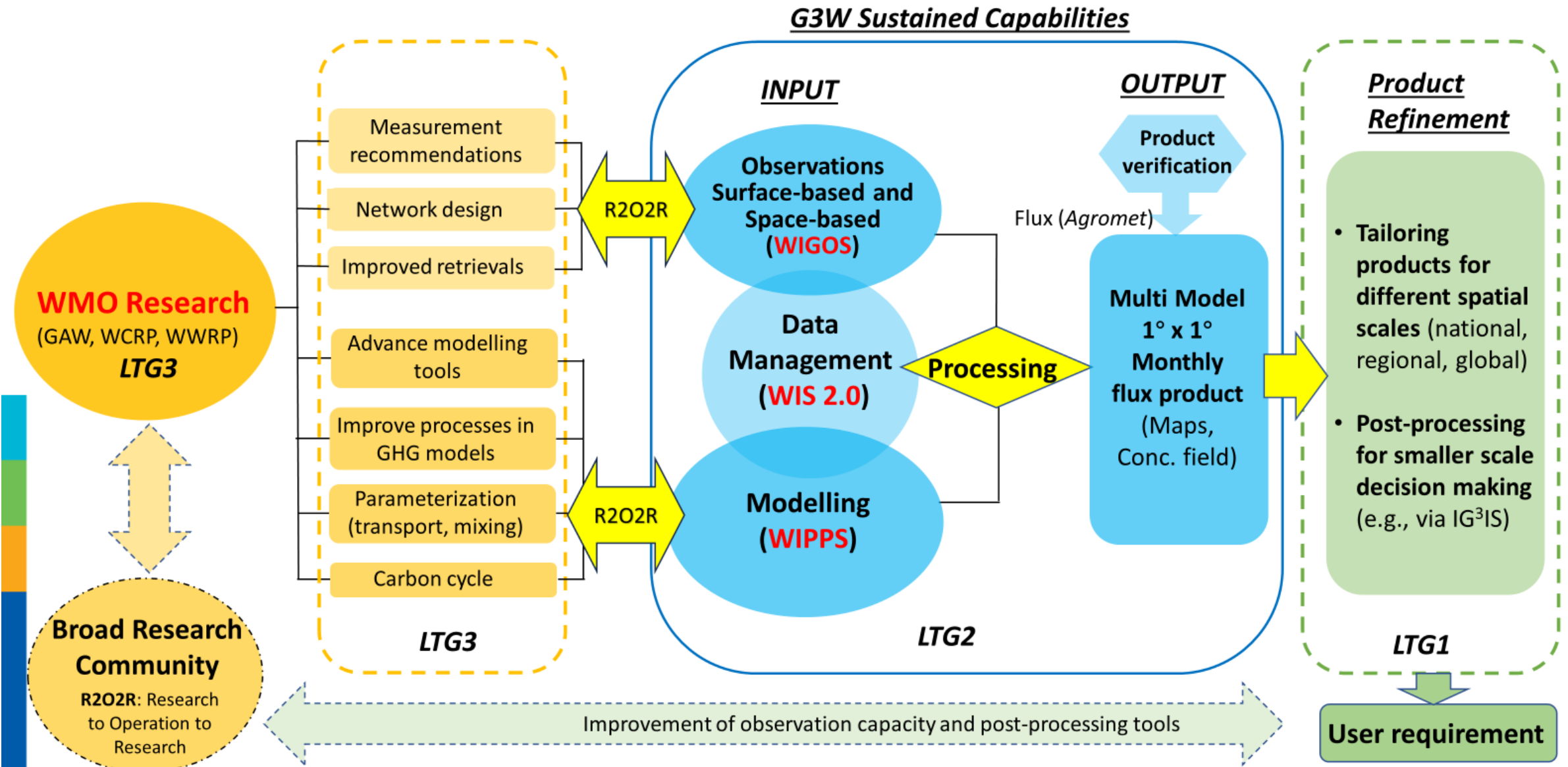


CEOS – Committee on Earth Observations Satellites



CGMS – Coordination Group on Meteorological Satellites

Synchronizing within the WMO shared Governance & Goals

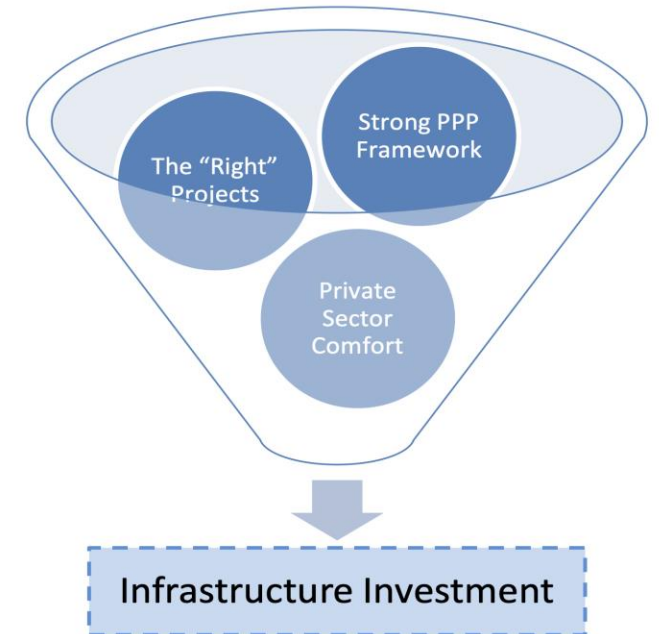


Synchronizing Public & Private Funding Opportunities

To address infrastructure / service needs G3W aims at Mobilising **significant resources increase in 2024-2027**.

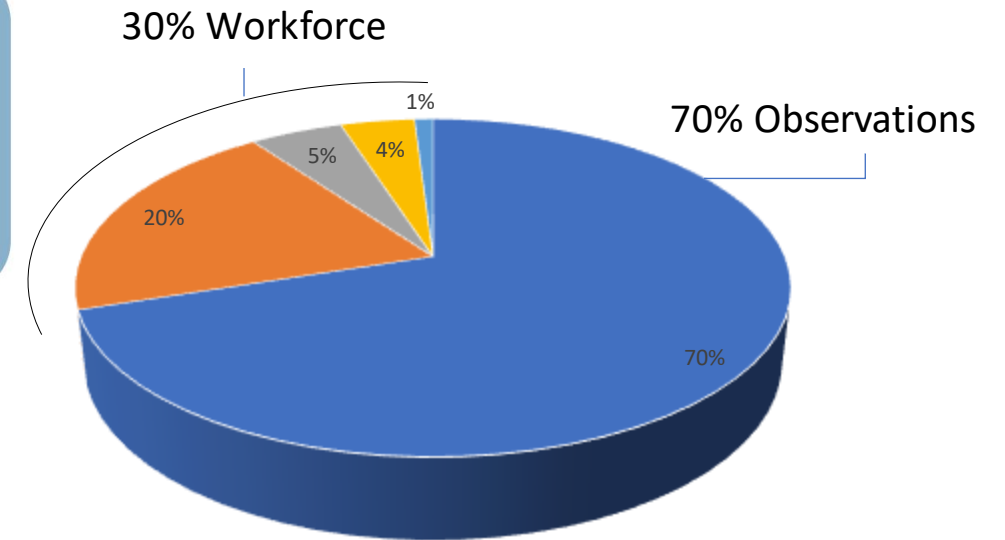
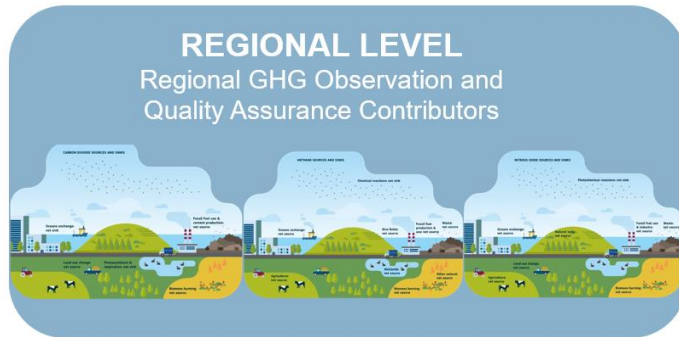
Funding mechanisms include 3 pathways:

- **G3W initial WMO-funds**, approved by the 19th World Meteorological Congress (Cg-19) [Resolution 5](#) of in 2023.
- **G3W trust-fund**, managed by WMO, with two Champions Nations contributing in 2023 and more expected from Public & Private sources from 2024.
- **Specialized G3W financial vehicle** to facilitate wider private sector contributions and activities, such as impact investing, that can be hosted outside of the UN system.



[World Bank, 2016a, #3553](#)

G3W Sustainability and Focus : A Region First Approach



The G3W will develop strategic actions to fund systematically infrastructure + workforce, beyond opportunity-based and development-based funding mechanisms.

The estimated costs in 3 scenarios (1 B\$, 500 M\$, 300 M\$)

- Observing system surface-based infrastructure
- Observing systems integration, modelling and data management
- Capacity building and capacity development for G3W input and uptake
- Regional Pilot Projects and supporting research for G3W emerging priorities
- Central coordination by WMO secretariat including public-private-partnerships (PPP) development



WMO Coordination: Space Agencies in Geneva Q1/2024

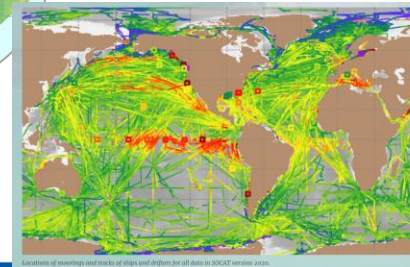
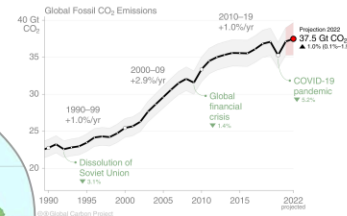
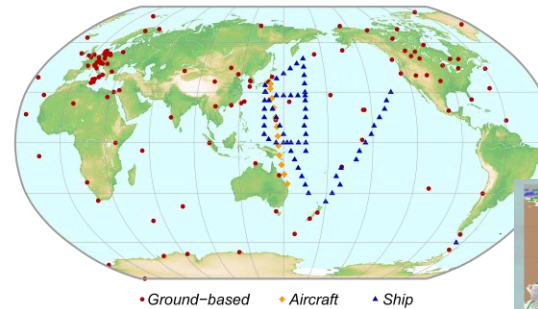
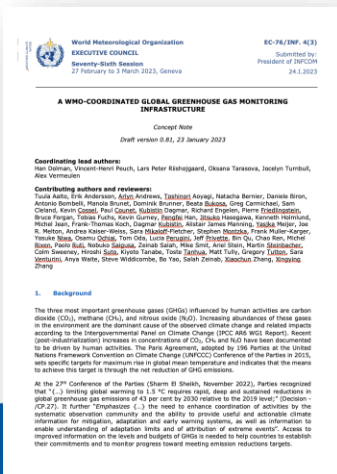
- **G3W** presented at 15th Session of Consultative Meetings on **High-Level Policy on Satellite Matters**
- **G3W** to be presented to **CEOS** and to **CGMS** and to **INFCOM-3** Intergovernmental session in **April 2024**



G3W Implementation Plan: Progress up to Q2/2024

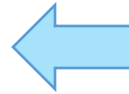
- A 1st complete draft of G3W IP with WMO RMS contribution on the 18th of January 2024.
- G3W-SG & G3W-Team worked to consolidate the G3W IP up to the 22nd of January 2024
- G3W IP v1.0 published on the web, for an **Open-Community-Review** on the 23rd of January 2024
- G3W IP v2.0 presented to INFCOM-Management on the 7th of February 2024
- G3W presented to WMO **INFCOM-3** and approved in the week of the 15th of April 2024.
- G3W to be presented to WMO **EC-78** in the week of the 10th of June 2024.

A successful journey from the concept presented to EC-76 **adopted by the 19th Meteorological Congress.**



G3W Implementation Plan: priority deliverables from Q3/2024

- Create inventory of observations
- Carry out observational Network design

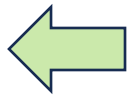


Section 3 Observing System – O (12)

- O1 – Observation inventory
- O2 – Obs. standards & requirement
- O3 – Longer term Obs.
- O4 – Surface-based Obs. Design
- O5 – Reference Network Development
- O6 – Basic (“fit-for-purpose”) network
- O7 – RS & vertically-resolved Obs.
- O8 – Ocean network design
- O9 – Gridded Air-Sea CO₂ flux
- O10 – Space-based Obs. with CEOS-CGMS, direct
- O11 – Space-based Obs. with CEOS-CGMS, indirect
- O12 – Space-based Obs. with CEOS-CGMS, future

Section 5 Prior Information – P (4)

- P1 – Identify needs – CO₂
- P2 – Identify needs – CH₄
- P3 – Identify needs – N₂O
- P4 – Fluxes characterization



Section 7 R&D Needs – R (3)

- R1 – G3W R2O Task Team establishment
- R2 – Advance Obs. & data exchange capabilities
- R3 – Advance modelling and flux inversion capabilities



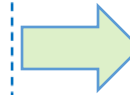
Section 4 Modelling System– M (7)

- M1 – Modelling center & data
- M2 – Modelling center-documentation
- M3 – Continuous Operations (RRR)
- M4 – Obs. acquisition and pre-processing
- M5 – Prior Implementation
- M6 – Production centers common approaches
- M7 – Modelling products evaluation



Section 6 Data Management – D (7)

- D1 – Data from Raw to Exchange
- D2 – Data from providers to assimilation
- D3 – Data for model intercomparisons
- D4 – Data discovery and distribution
- D5 – Data repository for prior and fluxes
- D6 – Definition of prior data providers
- D7 – Data policy for the repository of prior fluxes



Section 8 User Engagement & Uptake – U (4)

- U1 – Support the GST
- U2 – Guidance on regional products
- U3 – Establish relationship & pathway
- U4 – Develop user interface guidelines



- Definition of the output products and system requirements

- Evaluate applicability of WIS2.0 for G3W required data exchange
- Connect existing observations to WIS

- Identify product requirement
- Provide recommendations on the use of G3W outputs



Cross-cutting Theme: Reduce Capacity & Technology gaps

Collaboration on implementation is required with:

- NMHSs
- Training Centers
- Research community
- Capacity development panel
- Partner organizations

The highest **priority** activities:

- Establish a competence framework for participation in G3W
- Cataloguing of the existing capacity development resources on GHG.

Section 9 Capacity Building – C (5) (Overarching)

C1 – Technical participation framework
C2 – Continuously capacities evaluate

C3 – Members' capacities in data use
C4 – Capacity development programs for Member
C5 – National capacities development



Aligning with WMO Capacity Development Resolution 36 (Cg-19)



G3W Implementation Pilots in 2024-2027: A Methane case

COP28 Global Methane Pledge with 155 Countries

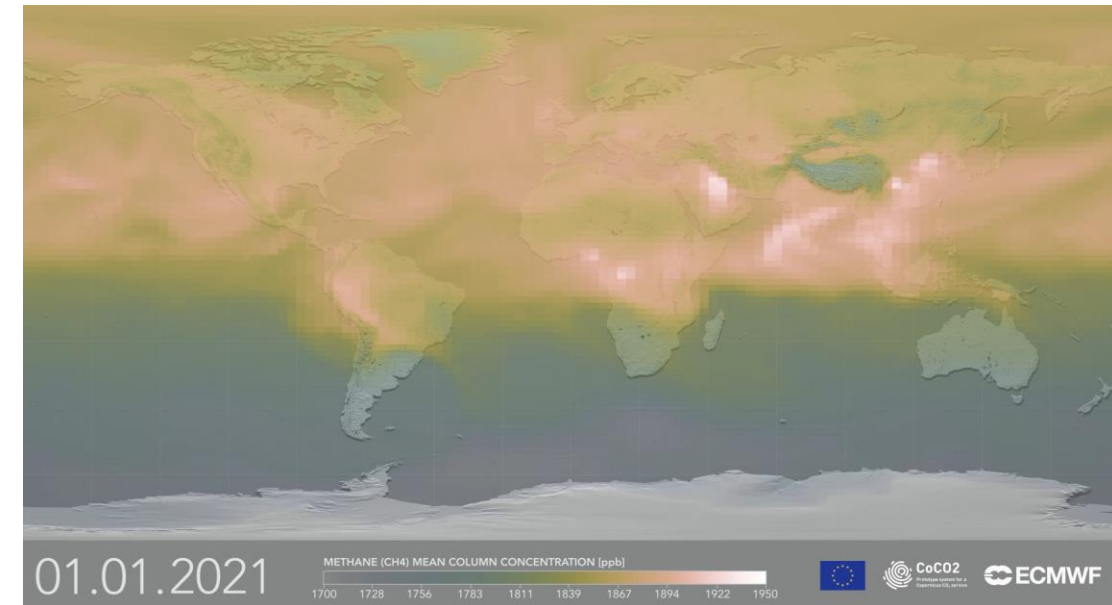
- <https://www.globalmethanepledge.org>

What: The Global Greenhouse Gas Watch – Surface-based and Satellite-based observation infrastructure can benefit from the COP28-COP29-COP30 momentum.

How: a **Public-Private Partnership** on GHGs concentrations and fluxes can tackle Methane as IPCC identified priority to preserve the remaining Carbon budget for Paris Agreement goals. A collaboration UNEP-IMEO, Global Methane Hub, CCAC, GMI and G3W.

Why : a Win-Win-Win approach in which Science-Economy-Society benefit from rapidly curbing emissions with the Agility of Private Sector investment and the Sustainability of Public Long-Term Goals and UN SDGs framework.

Methane is crucially connected to Climate-Change via the Cryosphere (eg. Permafrost melting)



Animation source: Copernicus Earth Observation Programme / ECMWF CAMS

G3W Communication: A key component

G3W has 3-level of communications

1. the **internal communication (KPI-based)**
 2. the **external collaborators (Milestones/Delivery based)**
 3. the **public (Broadcast and outreach/positioning based)**
- **G3W Team member's informal seminar as Informal example**
 - One topic/activity weekly or fortnight with a Team-coffee/tea
 - One email/teams update every week (beginning/end)
 - **G3W News bulletin as formal communication example**
 - One newsletter with few bullet points every Quarter (4 per Year)
 - **G3W blogs as informal public communication example**
 - *One blog every quarter formal WMO blog*
 - *"There is no Planet B" latest G3W blog*
 - **G3W General Assembly (in sync with other cluster events)**
 - *One per year in-person + online*



Dear Esteemed Contributors of the G3W,

I trust this message finds you well. The G3W team extend our deepest appreciation for your unwavering commitment to drafting the G3W implementation plan. Through this Newsletter, we would like to inform you the important updates on G3W which we were able to achieve. **Thanks to you All!**

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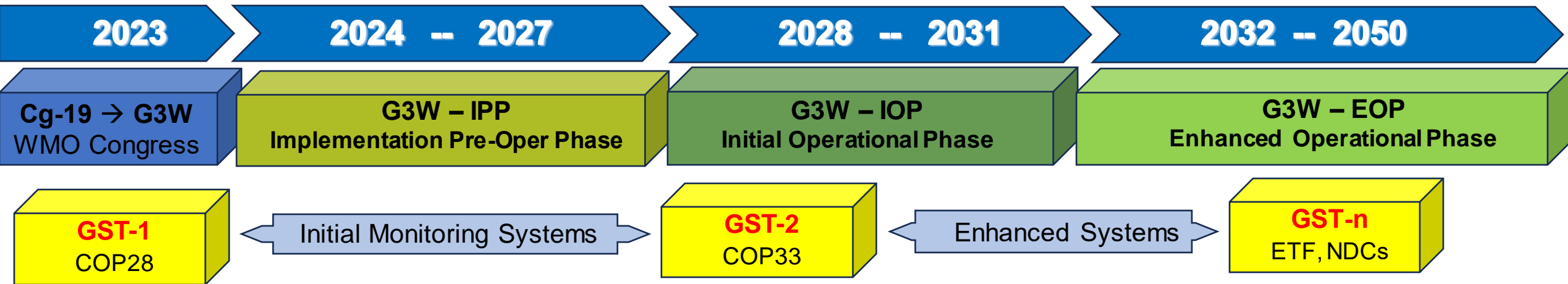


Read WMO blog recently published

G3W @ NASA CMS : Take Home Messages

The G3W Implementation Plan approval and endorsement provide a vision for GHGs monitoring. What next?

- Roadmap Activities to implement the plan will be next priority from Q3/2024 (eg. CEOS/CGMS/IOC started)
- The USA contributions to G3W will be crucial can benefit from G3W in two main ways:
 - 1 greater and more timely access to GHGs interoperable observations, as INPUT in National systems
 - 2 greater impact of the Monitoring information OUTPUT to global stakeholders
- via WMO consolidated channels, from 193 Members (NMHSs) to UN, UNFCCC, IPCC, States/non-States actors





Thank you. 🌻

Take Home 🏠 message



CLIMATE ACTION NEEDS

SCIENCE DRIVEN – CONSENSUS BASED

CLIMATE DATA – INFORMATION - KNOWLEDGE



WORLD
METEOROLOGICAL
ORGANIZATION

wmo.int