WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Updates from the WMO/GAW Programme

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WMO **Science and Innovation Department**

Eight joint session of the Working Group on Effects,
Geneva, 12-16 September 2022

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

GAW

GAW -- **Research Programme Focused on Enabling Atmospheric Composition Services**

***Approach**: by advancing and enhancing atmospheric composition-related services for society through improved understanding of the roles of aerosols, reactive gases and greenhouse gases in the Earth System*

GAW SOs aligned with WMO SP Goal 3: Research

	GAW SO-1: Advance scientific knowledge		GAW SO-2: Improve predictive capabilities and analysis		GAW SO-3: Advance and contribute to policy-relevant science	
Atmospheric Composition (AC) Programme Foci ***These represent how our activities align with WMO SP and the other programs within the RB***	AC @ Research Infra. Interface	AC @ Process Understanding Interface	AC @ Weather Interface	AC @ Climate Interface	AC @ DRR Interface	AC @ Env Policy Interface
	• Innovation in obs (Instruments, satel) • New techs for meas./model fusion, data assimilation • Bio/ocean/atm coupling • AI applications • Data discovery/ utilization, NRT, … • Capacity development	• PBL • Emissions and attribution Deposition • Chemistry related to improved prediction • Better parame-terizations	• Improved cloud/prec • S2S pred. • SDS • Fires • Emission inversion capability	• Radiative forcing gases and aerosols • Biomass burning freq/intensity • Exacerbation of air pollution	• Human health • Food security • Smoke • Dust storms • Urban environments	• Montreal Protocol • LRTAP • Global stocktaking • SDGs

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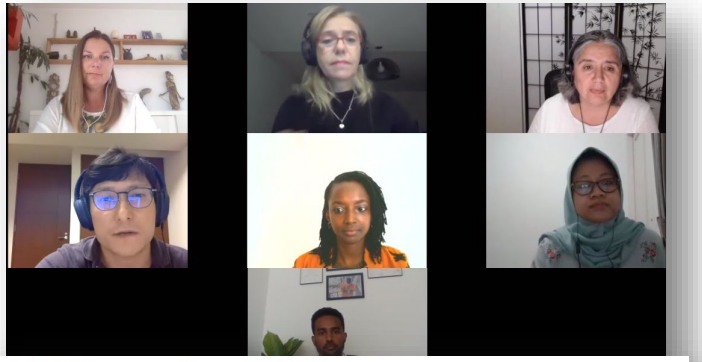
Strategic planning in GAW

- GAW conducted the Quadrennial GAW Symposium from 28 June to 2 July 2021. It included 300+ participants from over 70 countries. A follow-up survey was conducted to provide inputs to the next GAW Implementation plan.

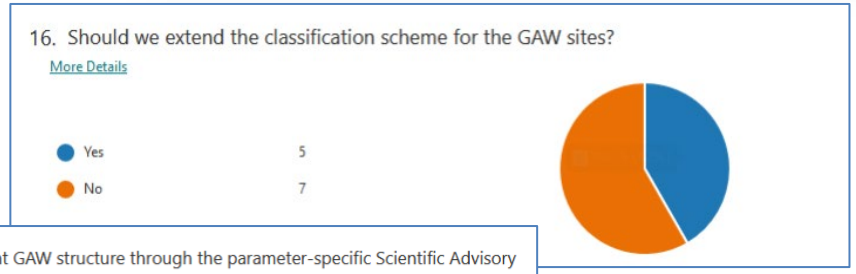


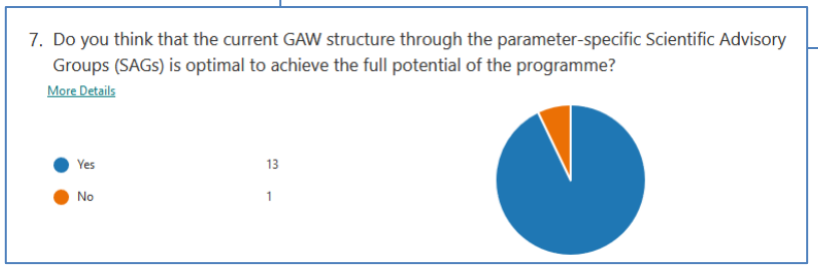
The Symposium consisted of the following scientific sessions:

- Science for services: The importance of atmospheric composition
- Filling critical gaps in observations
- Atmospheric composition, pandemics and support for a new health agenda
- Earth system modelling and data management

Plans :

- GAW 2024-2032 Implementation Plan to be drafted by the end of 2022 and approved at WMO EC meeting in February 2023





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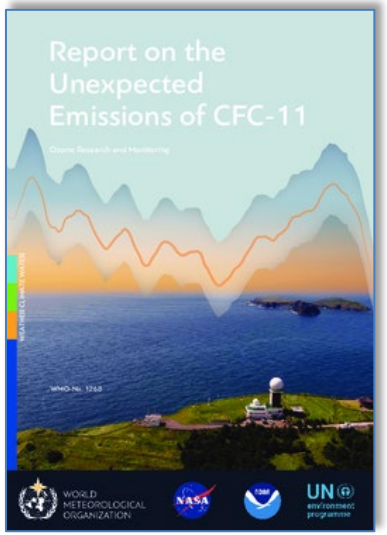
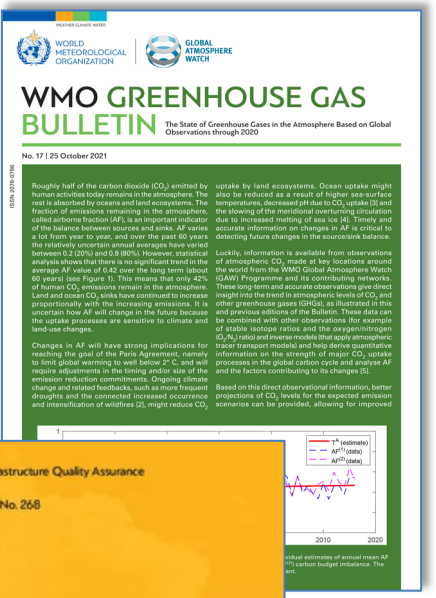
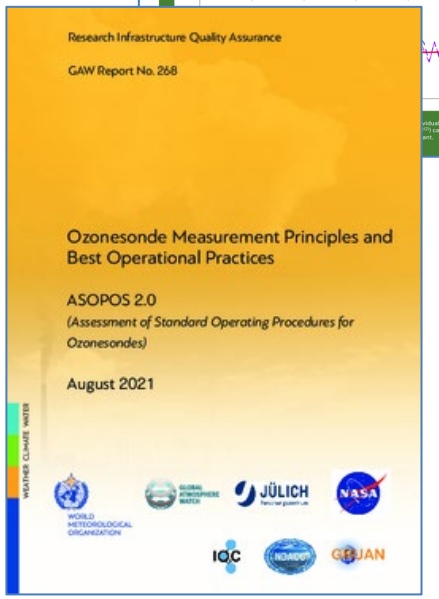
Support of environmental and climate policy

- The annual GHG Bulletin was launched before COP26 as a background document for climate policy (UNFCCC)
- Guidance was provided to the Montreal Protocol on gaps in the ozone observing network and research priorities
- Standard operating procedures for ozone sondes measurement finalized
- Scientific Report of the Unexpected Emissions of CFC-11 makes use of atmospheric observations and advanced analysis tools for emission quantification

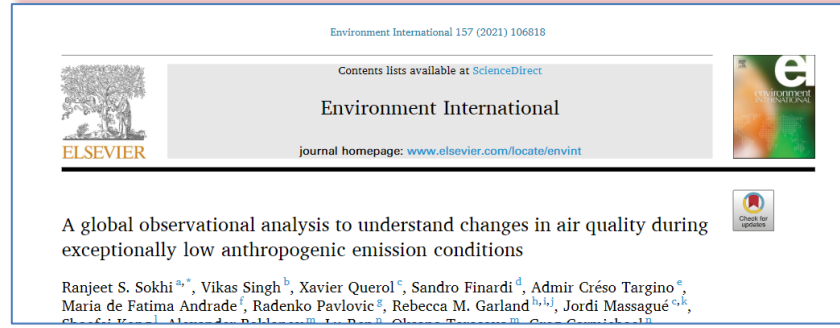






Plans and milestones:

- WMO/UNEP Ozone assessment was finalized in July/August 2022
- Modelling analysis as a follow up on the GAW coordinated study on COVID to be finalized in 2022



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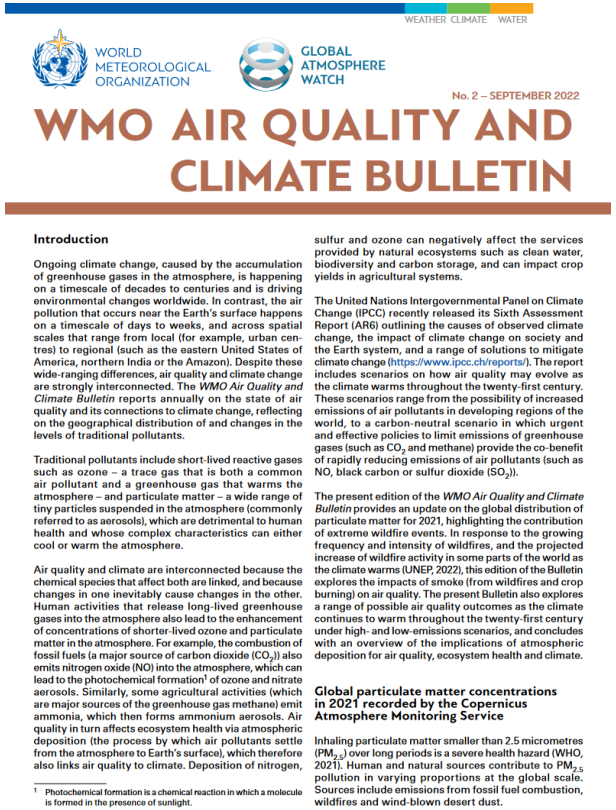
Support of the health sector

- Global Air Quality Forecasting and Information System (GAFIS) initiative finalized its Implementation Plan in Feb 2022. Engagement with UNEP being discussed.
- The 2022 Air Quality and Climate Bulletin was launched on 7 September to coincide with the UN's day for "Clean Air for Blue Skies"

The UV App was launched in November 2021, it was developed jointly with the health community (available in the Google Store).


WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

GLOBAL ATMOSPHERE WATCH

No. 2 – SEPTEMBER 2022

WMO AIR QUALITY AND CLIMATE BULLETIN

Introduction

Ongoing climate change, caused by the accumulation of greenhouse gases in the atmosphere, is happening on a timescale of decades to centuries and is driving environmental changes worldwide. In contrast, the air pollution that occurs near the Earth's surface happens on a timescale of days to weeks, and across spatial scales that range from local (for example, urban centres) to regional (such as the eastern United States of America, northern India or the Amazon). Despite these wide-ranging differences, air quality and climate change are strongly interconnected. The *WMO Air Quality and Climate Bulletin* reports annually on the state of air quality and its connections to climate change, reflecting on the geographical distribution of and changes in the levels of traditional pollutants.

Traditional pollutants include short-lived reactive gases such as ozone – a trace gas that is both a common air pollutant and a greenhouse gas that warms the atmosphere – and particulate matter – a wide range of tiny particles suspended in the atmosphere (commonly referred to as aerosols), which are detrimental to human health and whose complex characteristics can either cool or warm the atmosphere.

Air quality and climate are interconnected because the chemical species that affect both are linked, and because changes in one inevitably cause changes in the other. Human activities that release long-lived greenhouse gases into the atmosphere also lead to the enhancement of concentrations of shorter-lived ozone and particulate matter in the atmosphere. For example, the combustion of fossil fuels (a major source of carbon dioxide (CO_2)) also emits nitrogen oxide (NO) into the atmosphere, which can lead to the photochemical formation[1] of ozone and nitrate aerosols. Similarly, some agricultural activities (which are major sources of the greenhouse gas methane) emit ammonia, which then forms ammonium aerosols. Air quality in turn affects ecosystem health via atmospheric deposition (the process by which air pollutants settle from the atmosphere to Earth's surface), which therefore also links air quality to climate. Deposition of nitrogen, sulfur and ozone can negatively affect the services provided by natural ecosystems such as clean water, biodiversity and carbon storage, and can impact crop yields in agricultural systems.

The United Nations Intergovernmental Panel on Climate Change (IPCC) recently released its Sixth Assessment Report (AR6) outlining the causes of observed climate change, the impact of climate change on society and the Earth system, and a range of solutions to mitigate climate change (https://www.ipcc.ch/reports/). The report includes scenarios on how air quality may evolve as the climate warms throughout the twenty-first century. These scenarios range from the possibility of increased emissions of air pollutants in developing regions of the world, to a carbon-neutral scenario in which urgent and effective policies to limit emissions of greenhouse gases (such as CO_2 and methane) provide the co-benefit of rapidly reducing emissions of air pollutants (such as NO, black carbon or sulfur dioxide (SO_2)).

The present edition of the *WMO Air Quality and Climate Bulletin* provides an update on the global distribution of particulate matter for 2021, highlighting the contribution of extreme wildfire events. In response to the growing frequency and intensity of wildfires, and the projected increase of wildfire activity in some parts of the world as the climate warms (UNEP, 2022), this edition of the Bulletin explores the impacts of smoke (from wildfires and crop burning) on air quality. The present Bulletin also explores a range of possible air quality outcomes as the climate continues to warm throughout the twenty-first century under high- and low-emissions scenarios, and concludes with an overview of the implications of atmospheric deposition for air quality, ecosystem health and climate.

Global particulate matter concentrations in 2021 recorded by the Copernicus Atmosphere Monitoring Service

Inhaling particulate matter smaller than 2.5 micrometres ($PM_{2.5}$) over long periods is a severe health hazard (WHO, 2021). Human and natural sources contribute to $PM_{2.5}$ pollution in varying proportions at the global scale. Sources include emissions from fossil fuel combustion, wildfires and wind-blown desert dust.

[1] Photochemical formation is a chemical reaction in which a molecule is formed in the presence of sunlight.

1

Animation on the connection between air quality and climate connection was launched in September 2021
https://www.youtube.com/watch?v=s4ly6o-VT90

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Measurement-Model Fusion for Global Total Atmospheric Deposition (MMF-GTAD)

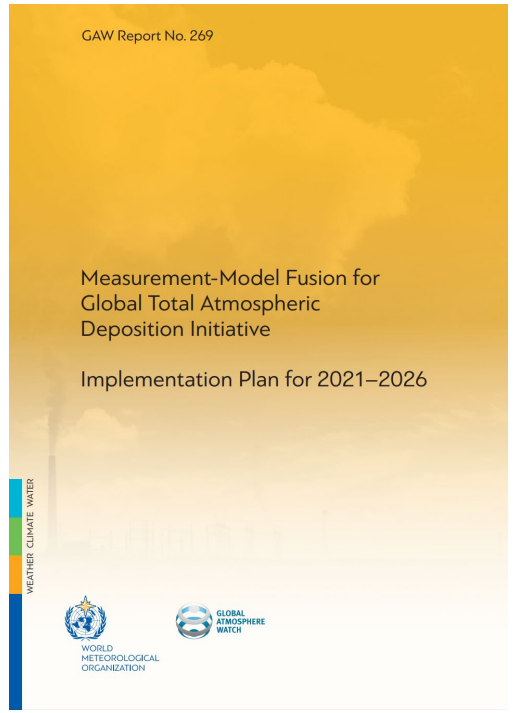
MMF-GTAD brings together best-available data and modelling results on precipitation chemistry, precipitation depth, air concentrations and dry deposition velocities to produce global maps of total (wet + dry) deposition of sulphur, nitrogen and ozone.

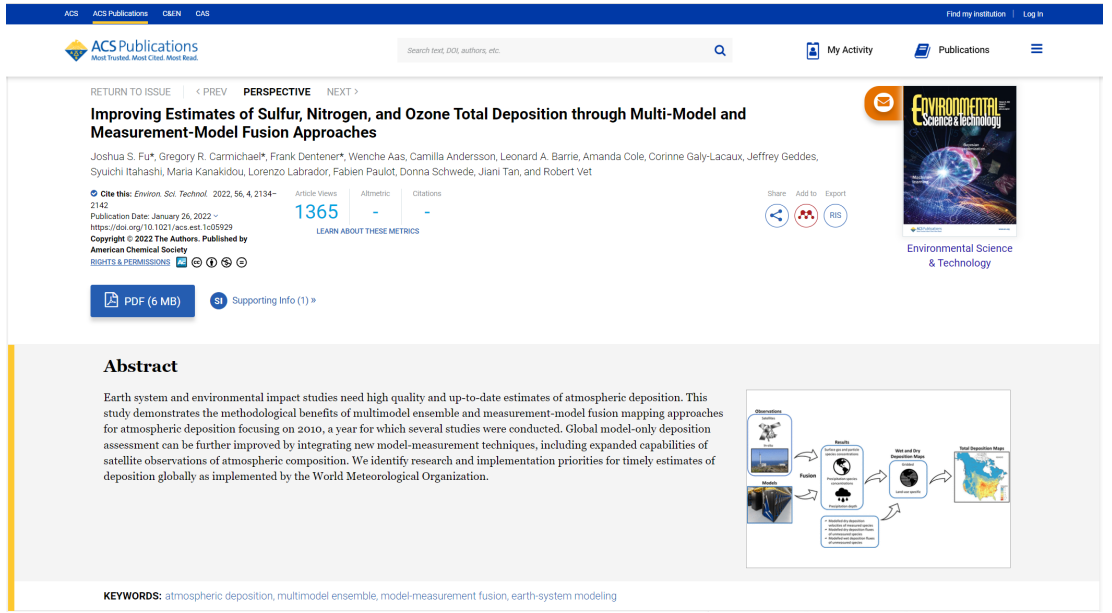
- The initiative's activities have been presented at different fora, including the 2021 UN Food Systems Summit and COP26
- A user/stakeholder mapping and engagement strategy to be finalized in 2022 (IVL)
- Dataset for the development of the first prototype product for 2010 collected (NILU)
- MMF techniques review community paper published in early 2022

Plans:

-MMF Science Symposium – September 2022

-MMF Workshop –October 2022





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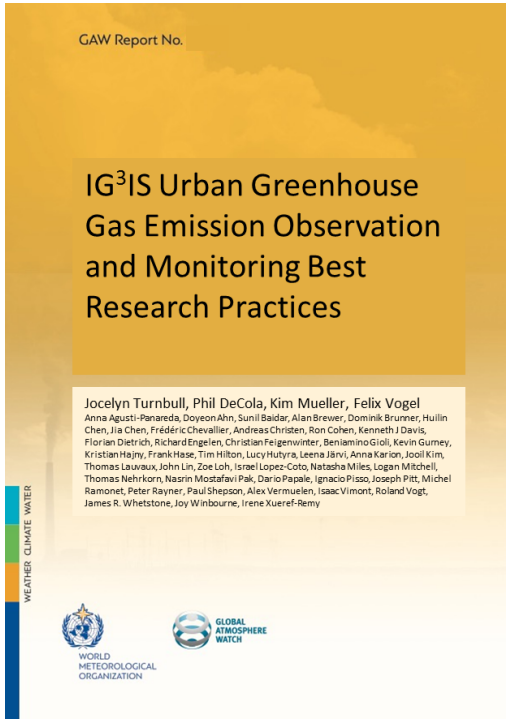
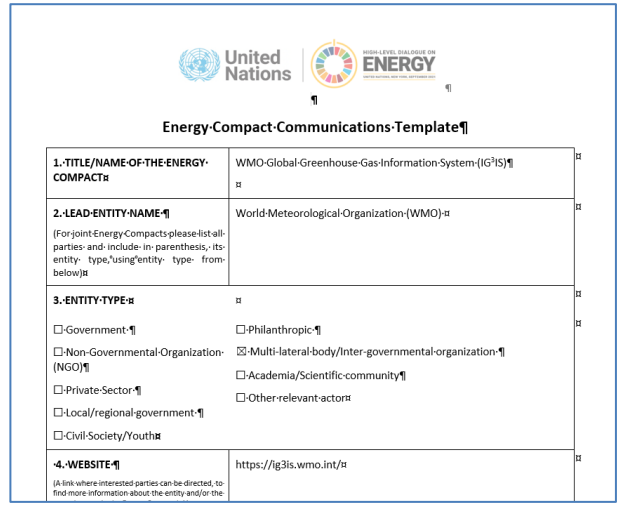
The Integrated Global Greenhouse Gas Information System (IG³IS)



IG3IS aims to coordinate an integrated global greenhouse gas information system, linking inventory and flux model-based information with atmospheric observations and modelling, in order to provide the best possible estimates of greenhouse gas emissions at the national and urban scales.

- IG³IS contributed to the UN Energy Compacts launched in January 2022
- The project on CO_2 uptake by the bamboo forest funded by the Quadrature Climate Foundation started on 1 March 2022
- IG³IS will provide contribution to the WMO GHG/Carbon Monitoring Workshop @ WMO HQ on "The case for a coordinated Global Greenhouse Gas Monitoring Infrastructure"
- Refined MoU between WMO and UNFCCC will include an annex on IG³IS
- IG³IS related submission was made by WMO for SBSTA 56 session in June 2022


United Nations | HIGH-LEVEL DIALOGUE ON ENERGY

Energy·Compact·Communications·Template¶

1.·TITLE/NAME·OF·THE·ENERGY·COMPACT¤	WMO·Global·Greenhouse·Gas·Information·System·(IG³IS)¶ ¤
2.·LEAD·ENTITY·NAME·¶ (For·joint·Energy·Compacts·please·list·all·parties· and· include· in· parenthesis,· its· entity· type,"using"entity· type· from· below)¤	World·Meteorological·Organization·(WMO)·¤
3.·ENTITY·TYPE·¤ ☐·Government·¶ ☐·Non-Governmental·Organization·(NGO)¶ ☐·Private·Sector·¶ ☐·Local/regional·government·¶ ☐·Civil·Society/Youth¤	¤ ☐·Philanthropic·¶ ☒·Multi-lateral-body/Inter-governmental-organization·¶ ☐·Academia/Scientific-community¶ ☐·Other·relevant·actor¤
·4.·WEBSITE·¶ (A·link·where·interested·parties·can·be·directed,·to·find·more·information·about·the·entity·and/or·the·	https://ig3is.wmo.int/¤

Good practices document was developed, went through public review and was launched on a webinar on 1 June 2022.

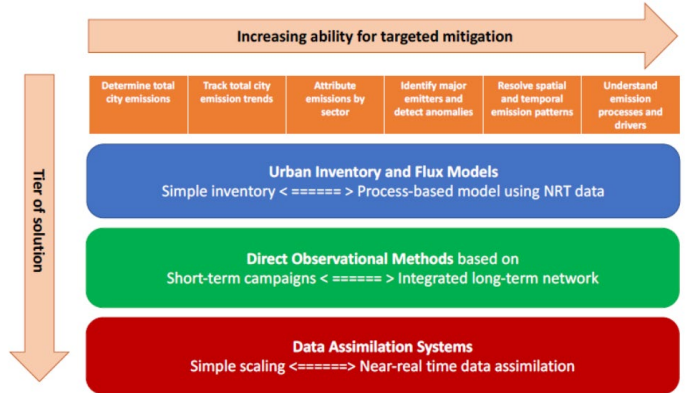
WMO OMM

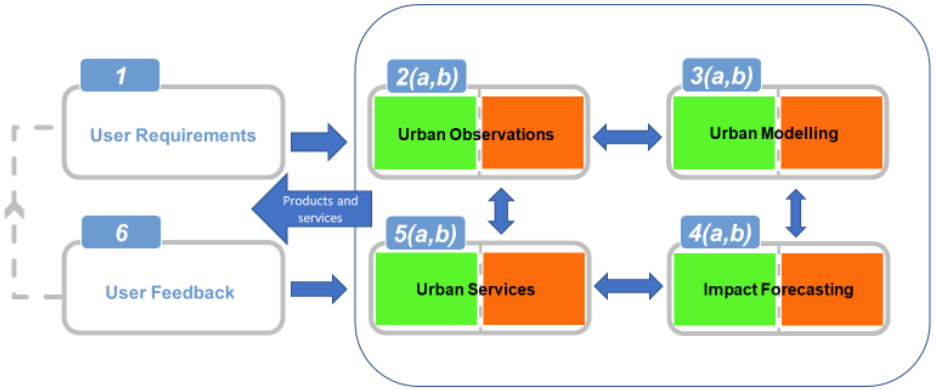
WMO GHG/CARBON MONITORING WORKSHOP
THE CASE FOR A COORDINATED GLOBAL GREENHOUSE GAS MONITORING INFRASTRUCTURE
10-12 MAY 2022

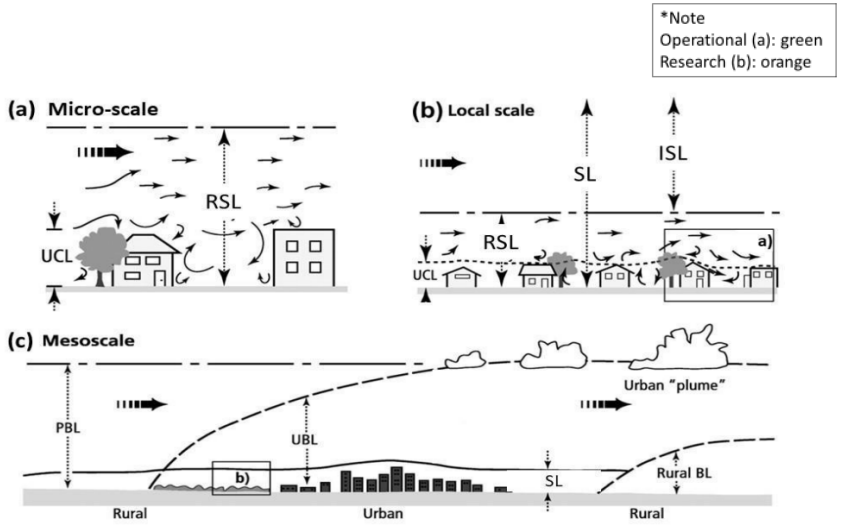
Urban Updates

- GAW is contributing to the integration of urban-related activities with the Urban Workshop held on 13-15 June 2022
  - Bring together diverse groups working on the WMO urban agenda
  - Take stock of the existing activities
  - Develop recommendations for improved coordination on urban-related activities

- Launch of 3 documents at the Urban Workshop in May/June 2022
  - IG^{3}IS Urban Greenhouse Gas Emission Observations and Modelling Good Practices on 1 June
  - Guidance on Measuring, Modelling, and Monitoring the Urban Heat Island (led by GURME) on 20 May
  - Good Practices on High-Resolution Modelling for Integrated Urban Services (by Study Group on Integrated Urban Services) on 24 May







WMO OMM

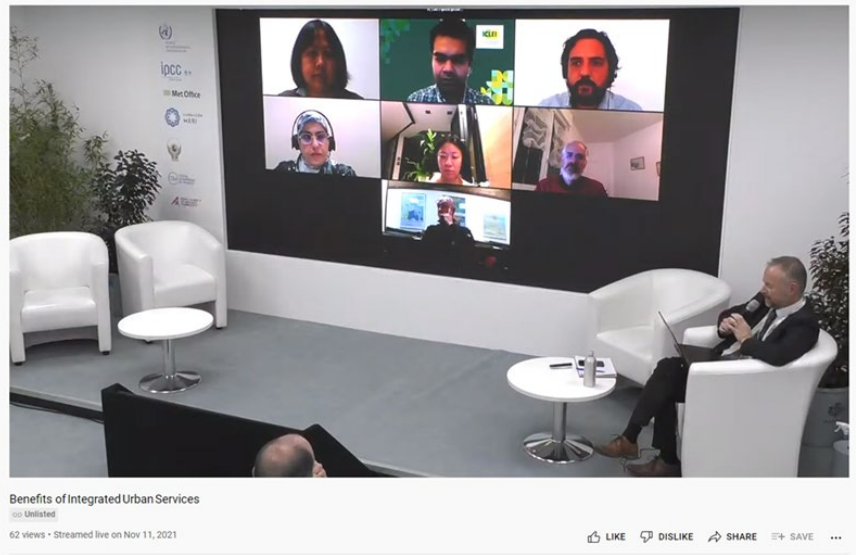
Major outreach events: COP26

IG^{3}IS and Carbon Budget- Observations-based approach to support efficient mitigation of greenhouse gas emissions 2021

Atmospheric Deposition, the invisible threat – impacts on agriculture, ecosystem and oceans (including MMF-GTAD)

Air quality and health: lessons learned from COVID

Benefits of Integrated Urban Services



https://community.wmo.int/meetings/gaw-supported-side-events-ipcc-wmo-ukmo-pavilion-unfccc-cop26

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Thank you for your attention!

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