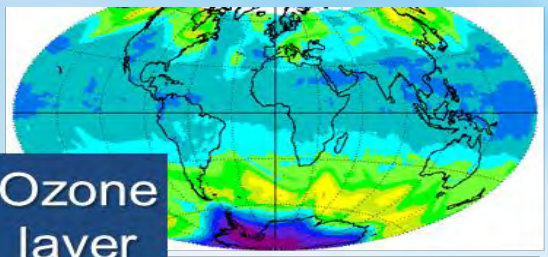
The Global Atmosphere Watch Programme -- Research Supporting Services

Gregory Carmichael & Oksana Tarasova

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

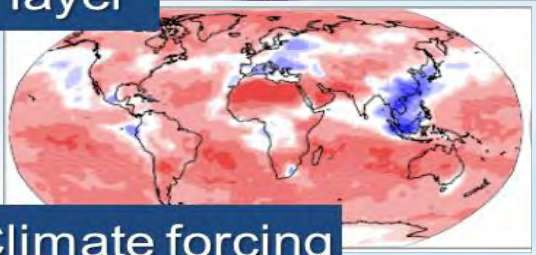

Disasters


Visibility


Ozone layer

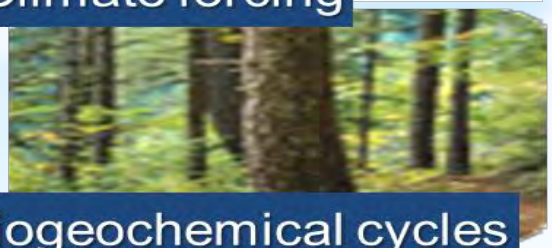

Urban smog


Regional smog


Climate forcing


Plume dispersion


Acid rain


Biogeochemical cycles

LOCAL
< 100 km

REGIONAL
100-1000 km

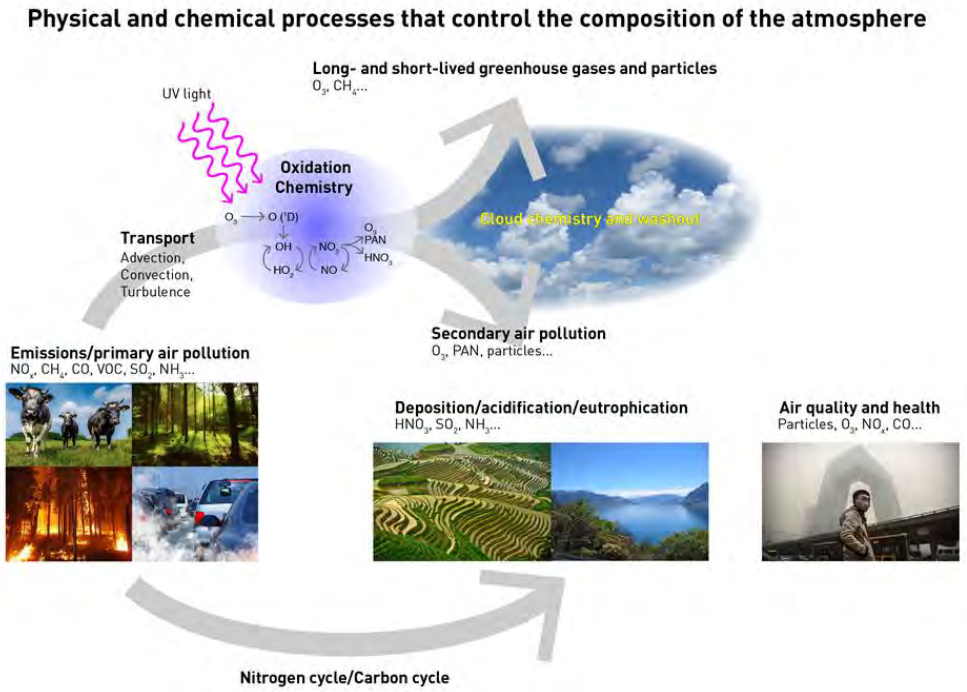
GLOBAL
> 1000 km

Atmospheric Chemistry Research is Important to Air Quality, Weather, Climate and More

What is the Global Atmosphere Watch Programme

GAW provides international leadership in research and capacity development in **atmospheric composition** observations and analysis through:

- *maintaining and applying long-term systematic observations of the chemical composition and related physical characteristics of the atmosphere,*
- *emphasizing quality assurance and quality control,*
- *delivering integrated products and services related to atmospheric composition of relevance to society.*



GAW builds on partnerships involving contributors from 100 countries (including many contributions from research community)

- NMHSs
- Academia
- Research Institutions
- Other public and private institution

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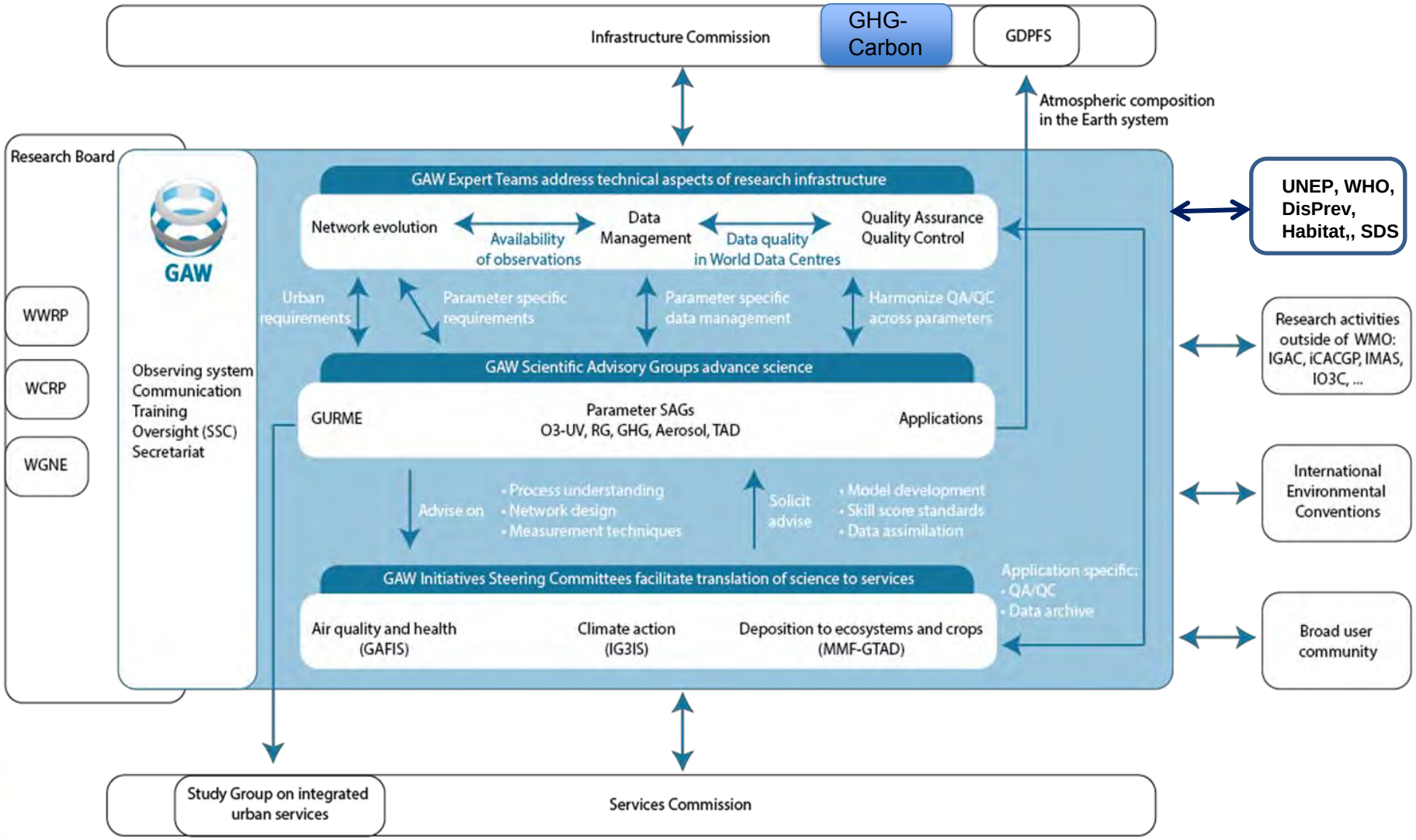
Organization of GAW



Observational (research) infrastructure

GAW Station Information System (GAWSIS): part of OSCAR-surface

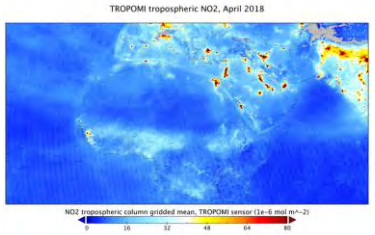
Station types: Global, Regional, local and mobile stations and contributing networks

Requirements: Requirements and procedures for GAW stations and contributing networks are articulated in the GAW IP. Decisions on stations inclusion in the program are taken by SAGs or SSC (**peer review process**).

Many parts of the world are missing critical observations of atmospheric chemical composition

Low-cost sensors

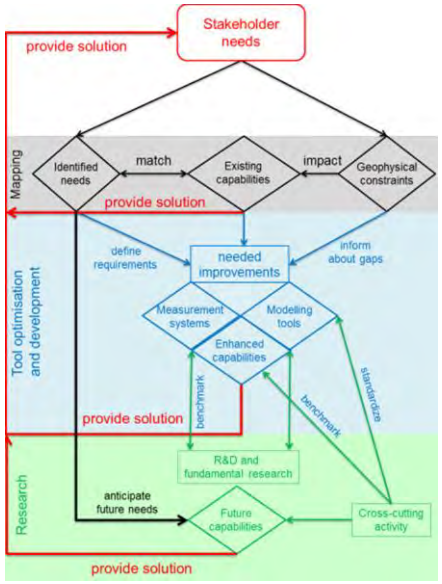
Use of the satellite data



Some ways of filling observational gaps

Value of the atmospheric composition data

- Support of international Conventions (Long-Range Transboundary Air Pollution, Vienna Convention and its Montreal Protocol, United Nation Convention on Climate Change, United Nations Convention to Combat Desertification, Climate and Clean Air Coalition etc.)
- Support of sectoral services for health, ecosystem, food security etc. that are build in consultation/co-design with the user community



The most efficient use of the atmospheric composition data is considering a multi-application at the nexus of air quality-climate-health

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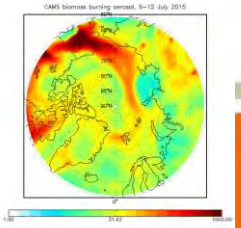
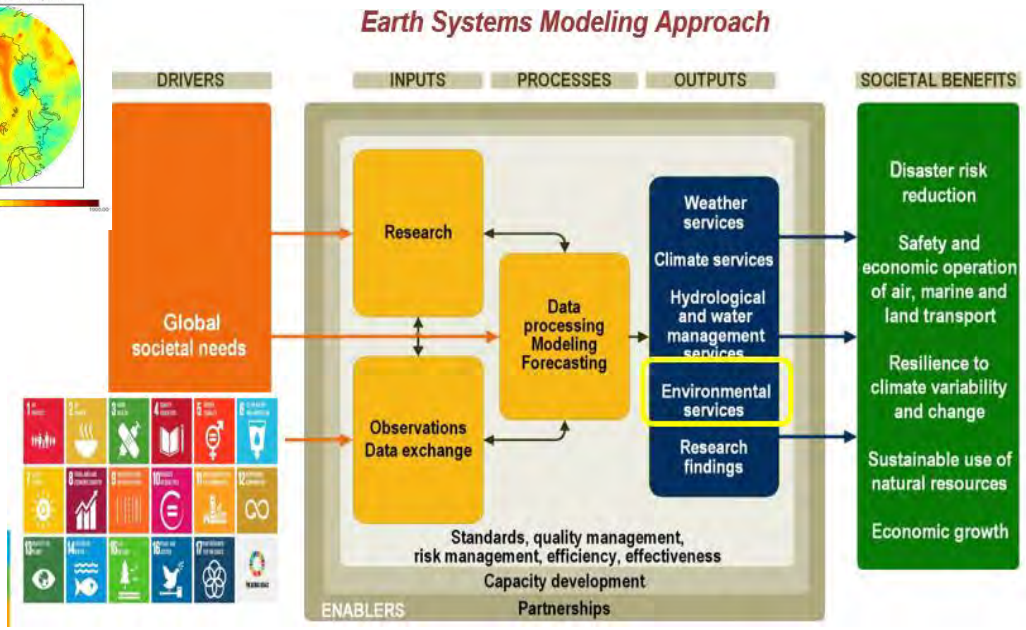
Modelling in GAW

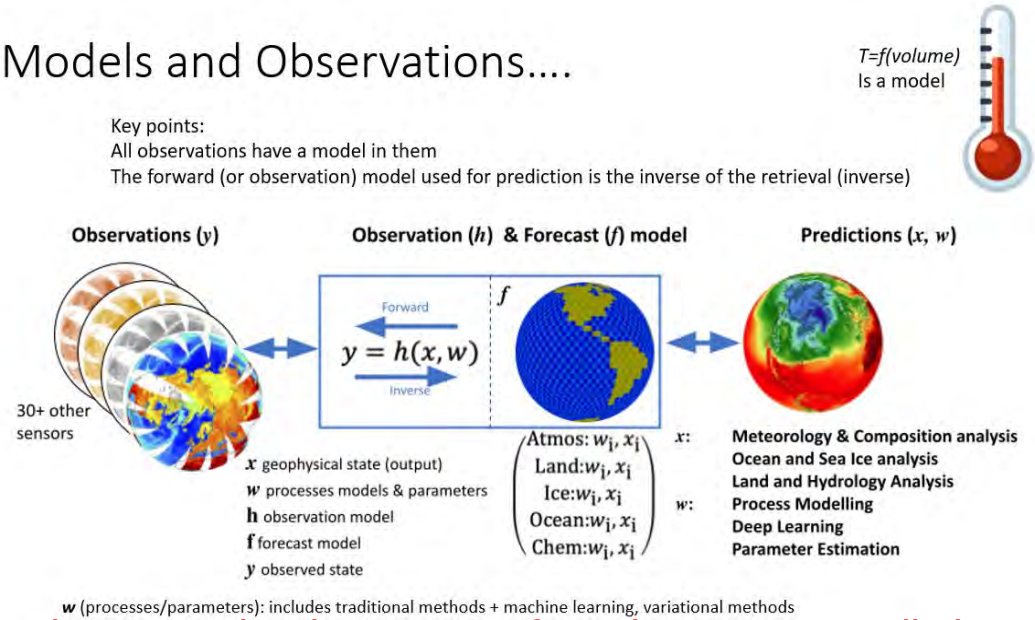


- SAG App (global to regional applications)
- SAG GURME (urban applications)
- Thematic SAGs (parameter specific applications)
- GAFIS, MMF, IG3IS



Types of modelling:

1) Forecasting (air quality, SDS, Biomass burning plumes, volcanic ash plumes, GHGs)
2) Analysis/reanalysis including measurement model fusion
3) Inverse modelling for emissions



Gettelman, et al., The Future of Earth System Prediction: Advances in Model-Data Fusion, Sci. Dir., 2022

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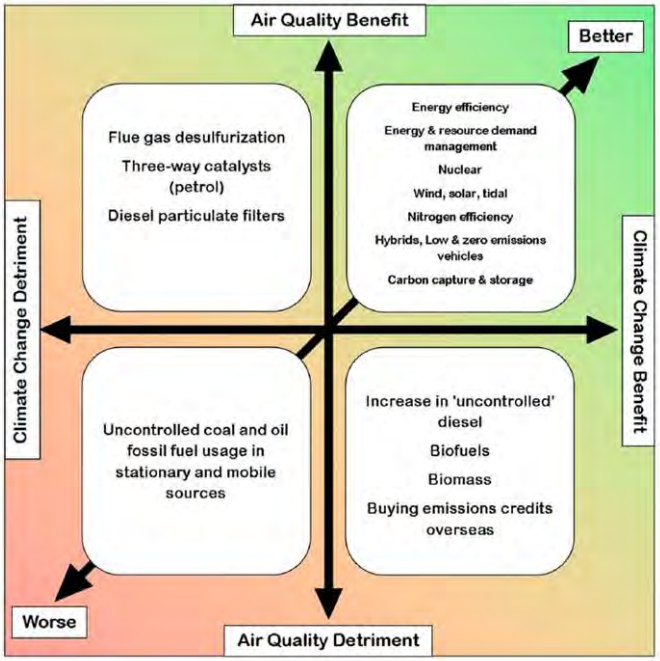
Connection between Air Quality and Climate Change



Von Schneidemesser & Monks (2013)

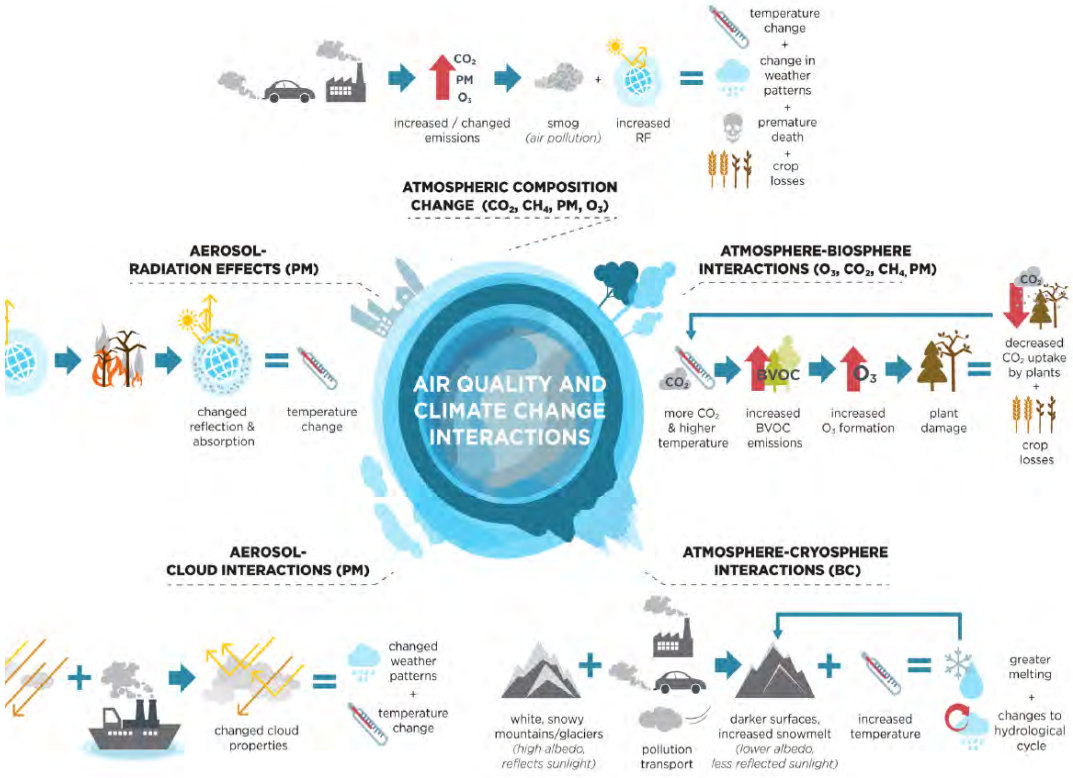


Figure from von Schneidemesser et al. (2015)

[Connections between air quality and climate - English - Sept. 2021 - YouTube]

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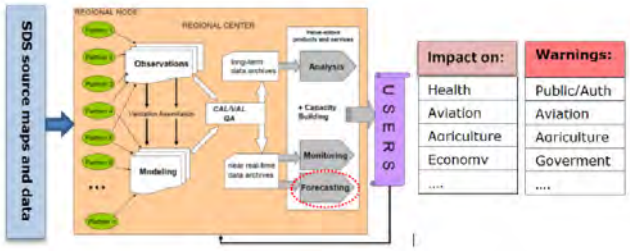
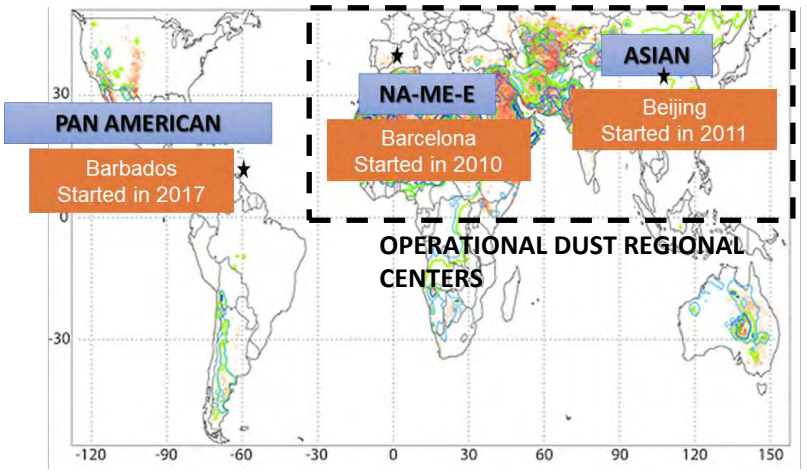
WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)

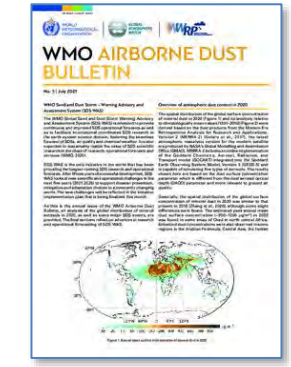
Objectives:

- Identify and improve products to monitor and predict dust by working with research and operational organizations, as well as with users.
- Facilitate **user access** to information.
- Strengthen the capacity of countries to use the observations, analysis and predictions provided.



Regional Nodes and Centers





[Sand and Dust Storms | World Meteorological Organization (wmo.int)]

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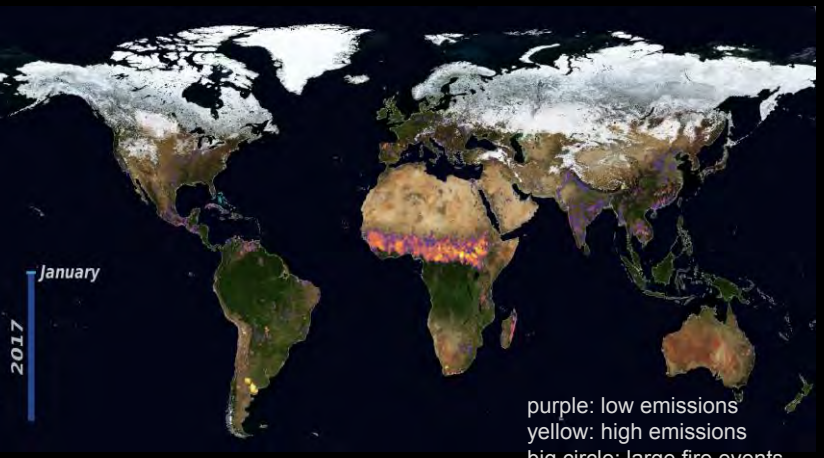
Support of assessment of human health impacts

Daily VFEI emissions for 2017 (Ferrada et al., 2022)



Integrated Global Greenhouse Gas Information System (IG³IS) is

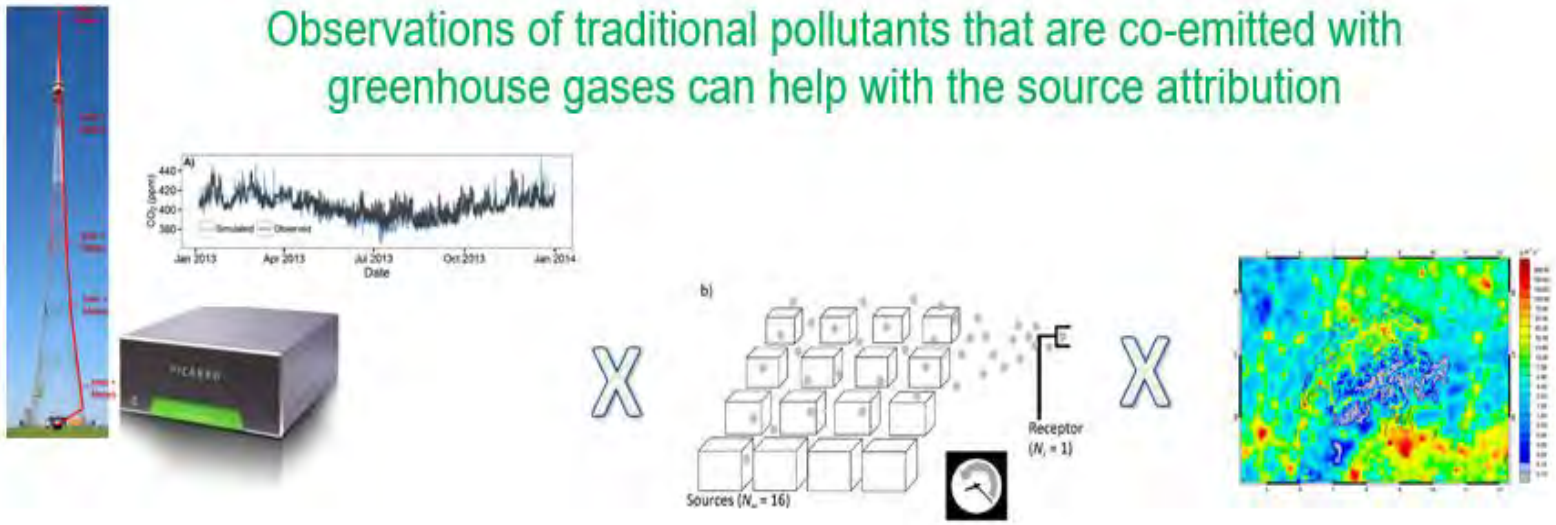
… a common framework for provision of the **systematic services to user community** who intend to reduce its greenhouse gas emissions

- Support the use of atmospheric concentration data to improve emission inventories (memorandum of understanding with UNFCCC, signed at COP23)
- Consensus on a coherent set of good-practice methods and guidelines
- Quality control (benchmarking)

Range of scales

Industry	Cities	Countries	Global Stock taking

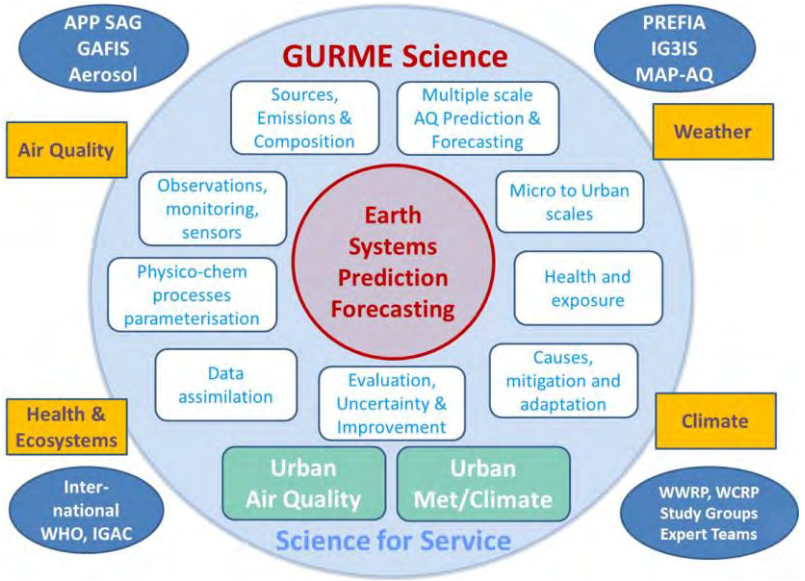
Observations of traditional pollutants that are co-emitted with greenhouse gases can help with the source attribution

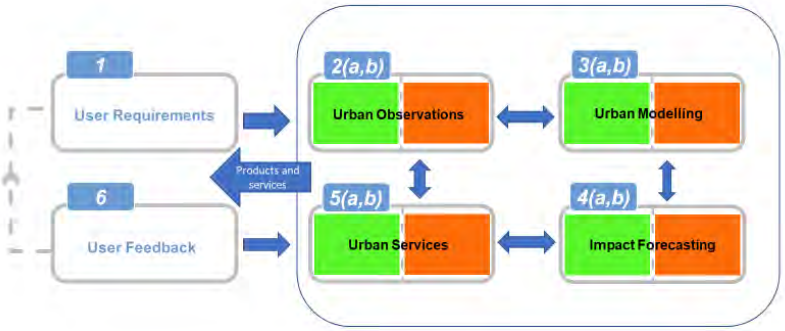


Urban related activities

- WMO/GAW URBAN Research in Meteorology and Environment (GURME) leads research on urban meteorology and air quality in GAW (major focus is on air quality forecasting in pilot cities)
- GAW is contributing to the integration of urban-related activities Workshop on 13-15 June 2022
  - Bringing together diverse groups working on the WMO urban agenda
  - Take stock of the existing activities
  - Develop recommendations for improved coordination of urban-related activities
- Launch of 3 documents prior to the Urban Workshop:
  - IG^{3}IS Urban Greenhouse Gas Emission Observations and Modelling Good Practices on 1 June
  - Guidance to Measuring, Modelling, and Monitoring the Canopy Layer Urban Heat Island (led by GURME)
  - Good Practices on High-Resolution Modelling for Integrated Urban Services (by Study Group on Integrated Urban Services)

Draft documents are available at
https://community.wmo.int/meetings/launch-3-urban-reports





*Note
Operational (a): green
Research (b): orange

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World Meteorological Organization
EXECUTIVE COUNCIL
Seventy-Fifth Session
20 to 24 June 2022, Geneva

EC-75/Doc. 4(3)
Submitted by:
Secretary-General
30.V.2022
DRAFT 1

AGENDA ITEM 4: STRATEGIC AND OPERATIONAL PLANNING

GLOBAL GREENHOUSE GAS / CARBON BUDGET MONITORING SYSTEM

Decides to proceed with the further development of the concept for a WMO-coordinated Global[Graham] Greenhouse Gas Monitoring Infrastructure, building on existing WMO programmes and other regional or global infrastructure and initiatives [Adrian];

~~**Requests**~~ **Decides** to form a joint study group between the Commission for Observation, Infrastructure and Information Systems, ~~in coordination with~~ the Commission for Weather, Climate, Water and Related Environmental Services and Applications, and the Research Board, with appropriate involvement of external stakeholders [Adrian, Graham, Hasegawa, Secretariat]:

(1) ~~t~~To ~~further~~ develop~~and refine~~ [Adrian] the concept, including identifying the future vision for WMO-coordinated GHG-related activities,~~including~~ its outputs and expected contributions from and benefits for Members[Graham, Hasegawa], leveraging synergies with existing frameworks such as the Global Atmospheric Watch (GAW) and the Integrated Global Greenhouse Gas Information System (IG3IS) [Saulo];

(2) ~~with the aim t~~To submit a final proposal of the concept for its architecture ~~with identified key gaps between Members' operational needs and existing relevant WMO activities[Graham, Hasegawa] for its architecture~~ to the 19th World Meteorological Congress in 2023;

Decides further to delegate the authority to develop and approve the Terms of Reference of this Study Group to the President of the Infrastructure Commission (INFCOM), the President of the Services Commission (SERCOM) and the Chair of the Research Board (RB);

Requests the Secretary-General:

(1) To allocate the necessary resources, ensuring adequate cross-cutting activities in the Secretariat,[Saulo] to support the further development and refinement of the concept [Graham]~~initiative~~;

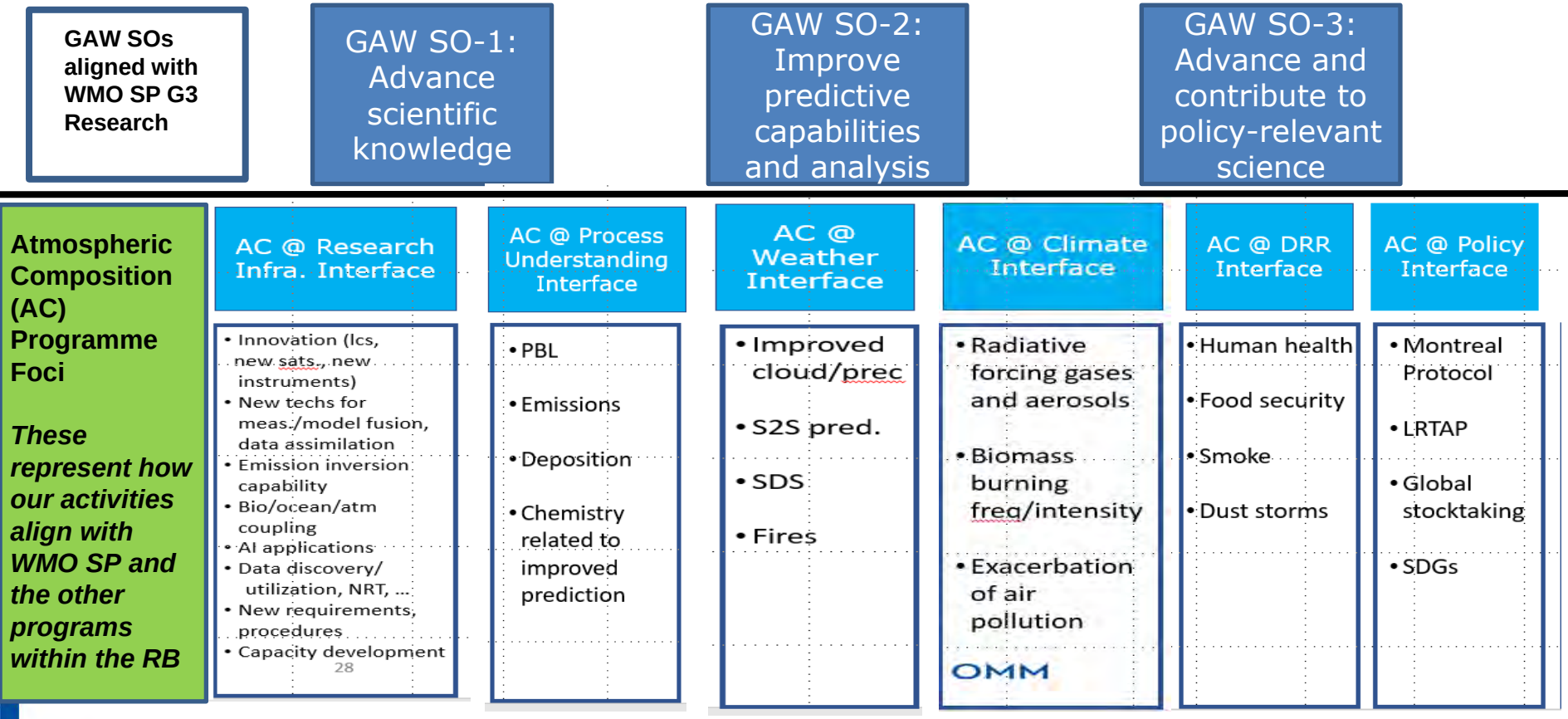
(2) To maintain close collaboration and coordination with relevant United Nations agencies and other international partners engaged in greenhouse gas monitoring and modelling[Adrian] activities;

(3) To engage with stakeholders at international fora, such as ~~brief~~[Graham] the 27th Conference of the Parties to the UNFCCC (COP27), CEOS, GEO, CGMS and others[Graham], ~~on the initiative and use this as an opportunity to refine it further.~~ to publicize the concept underway so it can benefit from the feedback received~~, as appropriate~~ [Saulo];

Urges Members to support the development of this ~~initiative~~ concept. ~~by contributing resources (financial or in-kind) and by bringing it to the attention of their national delegations to the UNFCCC.~~ [Graham]

(DRAFT) *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*



Get in touch with us at gaw@wmo.int

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TEMPS CLIMAT EAU

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World Meteorological Organization
Organisation météorologique mondiale

DRAFT) *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 G3 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 Cross-cutting Priorities/ Demonstrations ***(need to identify 3-5 of these)***

Advancing/enabling GHG related services (IGIS, SAGs GHG, APPS, ExTs; adv instrumentation (NRT), emission inversion, use of satellites, IPCC, Global stocktaking,)

AC Innovation Hub - Accelerate S4S in DRR in support of SDGs (human & ecosystem health) and urban agenda through development of digital twins, new obs. and data streams, novel applications of AI and engagements of social sciences, advances in MMF, supporting ways to reduce inequities and support analysis of carbon neutrality.

(Need catchy title) other topics that address regional engagement, source attribution, intercomparisons, QA of services, …