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Connections between air quality and climate: The WMO Global Atmosphere Watch (GAW) programme

Sara Basart (sbasart@wmo.int)

Scientific Officer

WMO Science and Innovation Department

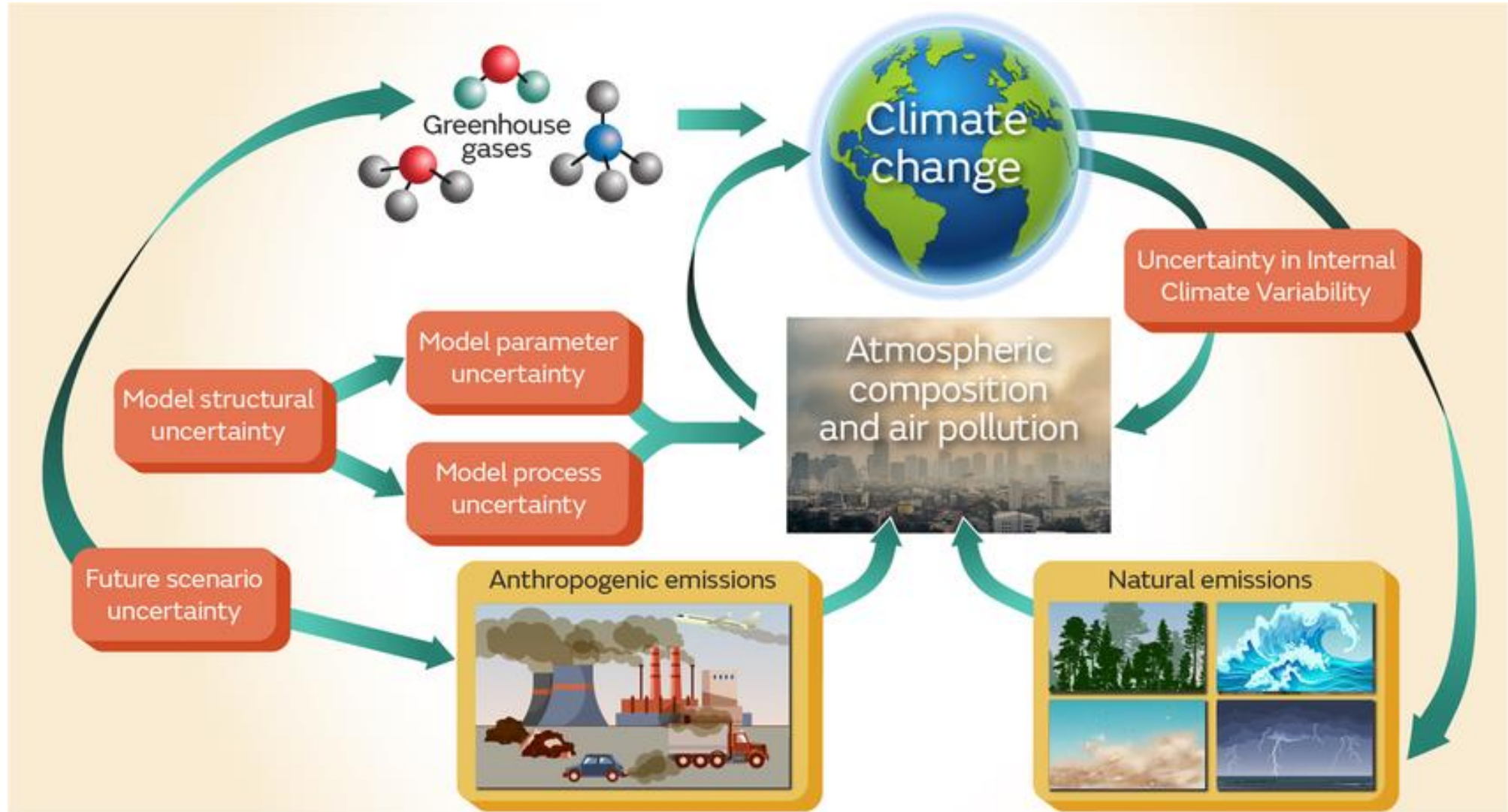


WORLD
METEOROLOGICAL
ORGANIZATION



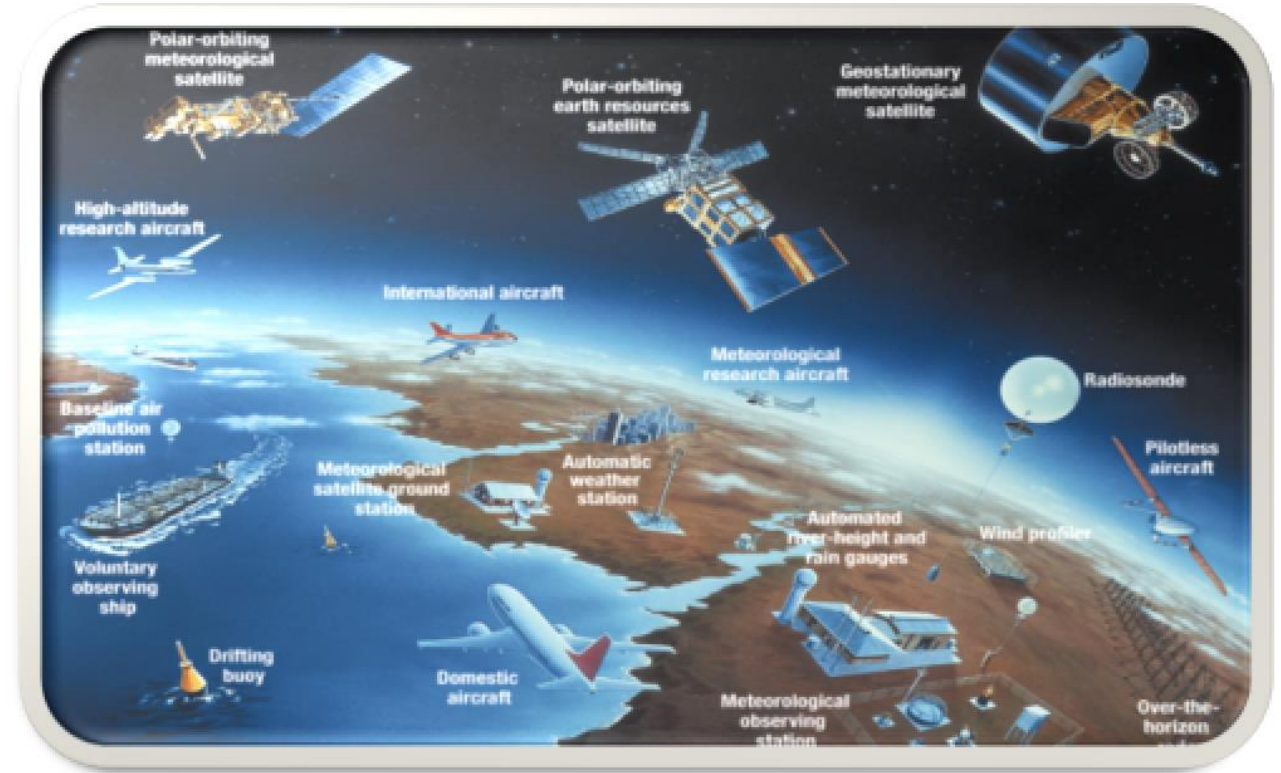
Scientific Scope | Atmospheric Composition

Which source of uncertainty is more important for projections of **future atmospheric composition and air quality**?



World Meteorological Organization (WMO)

- UN specialized agency on weather, climate and water.
- It's supported by 193 Members and the headquarters is in Geneva (Switzerland).
- Coordinates work of > 300,000 national experts from meteorological and hydrological services, academia and private sector.
- Co-Founder and host agency of IPCC.





WMO Research - Global Atmosphere Watch (GAW)

Research Enabling Atmospheric Composition Services

*Advance and enhance **science, services and infrastructure** related to atmospheric composition, and support policies for society through applied research aimed at improving the understanding of the roles of **aerosols, reactive gases, stratospheric ozone and greenhouse gases** and their interactions in the Earth System.*

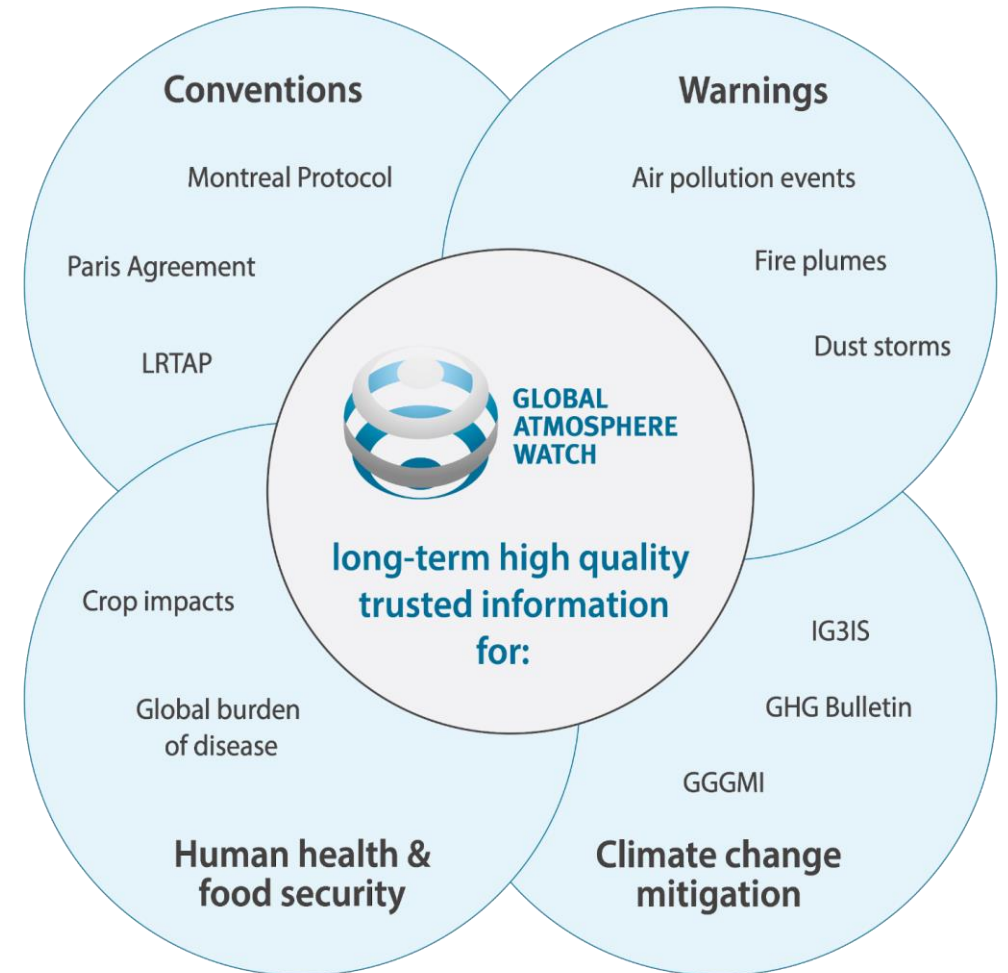
Drivers: Global societal needs





WMO Research - Global Atmosphere Watch (GAW)

- *Based on partnerships involving contributors from **100 countries** (including many contributions from research community)*
- *Maintains and applies **long-term systematic** observations of the chemical composition and related physical characteristics of the atmosphere*
 - Emphasizes **quality assurance and quality control**
- *Delivers integrated products and services of relevance to society.*



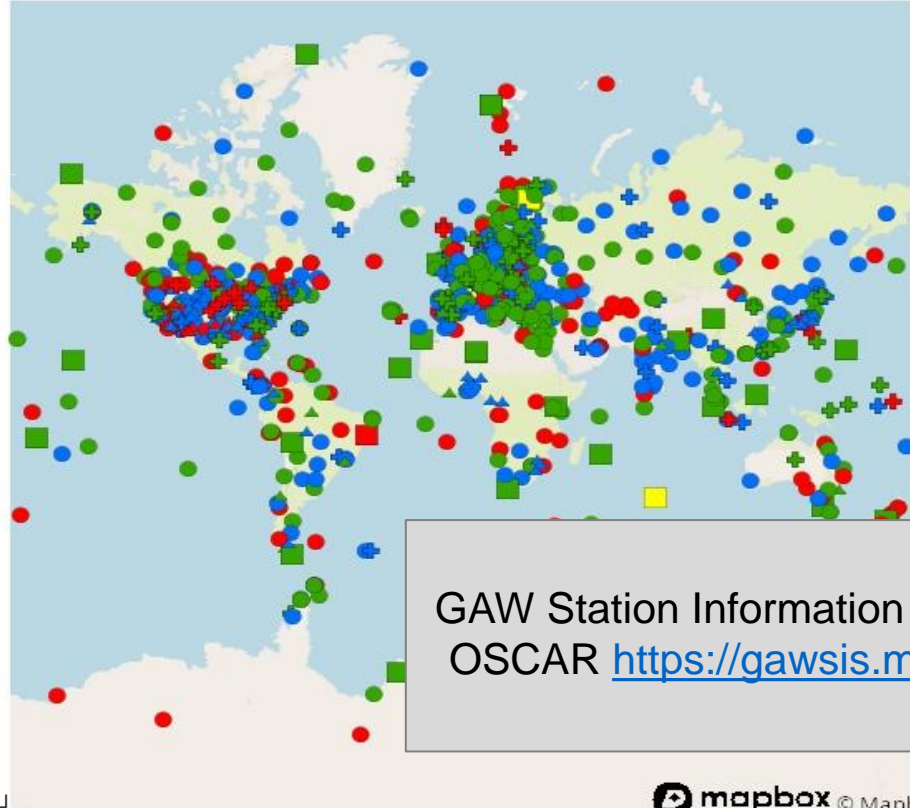


Observational (research) Infrastructure

Strengthen the atmospheric composition measurement and data infrastructure and contribute to understanding trends and variability and extremes.

Filling gaps:
LCS and satellites,
but also **National AQ networks**

Integration!



GAW Station Information System (**GAWSIS**) part of OSCAR <https://gawsis.meteoswiss.ch/GAWSIS/#/>

- More than 200 parameters
- Intercomparisons
- Measurement guidelines
- World Data Centers

Open access with emphasis in QA and QC



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology MeteoSwiss

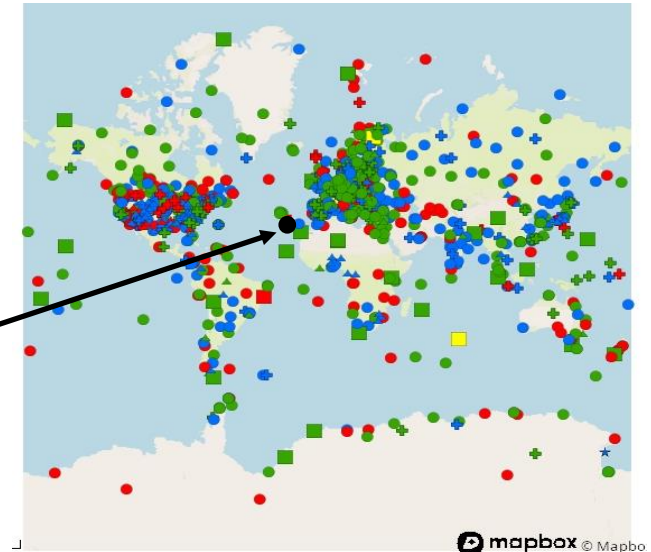
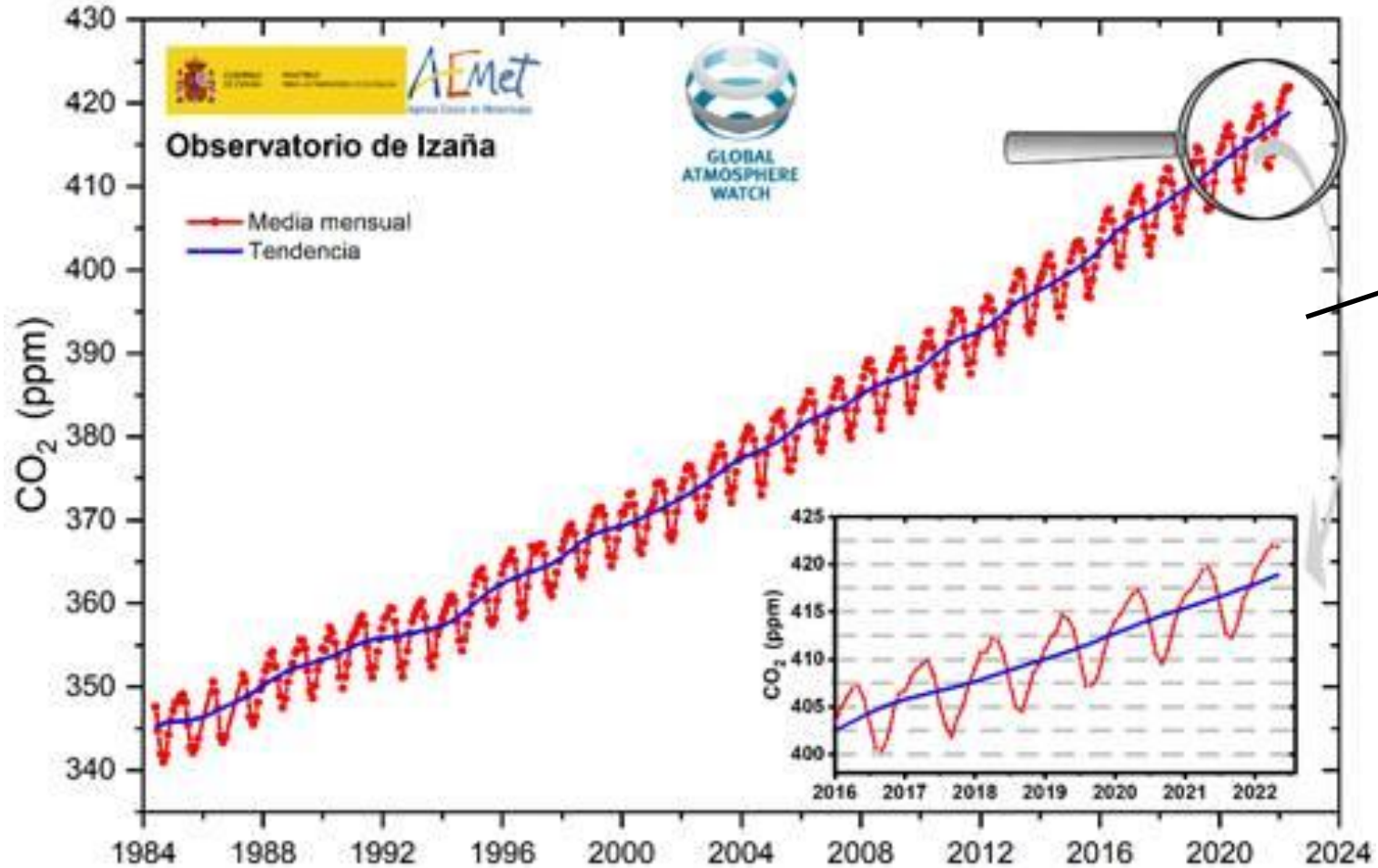
mapbox © Mapbox © WMO © OpenStreetMap

Global	Operational	●
Regional	Partly operational	●
Contributing networks	Non-reporting	▲
Local	Closed	★
Other networks	Planned	+
	Pre-operational	●
	Stand-by	●



Global Atmosphere Watch (GAW)

Research Enabling Atmospheric Composition Services



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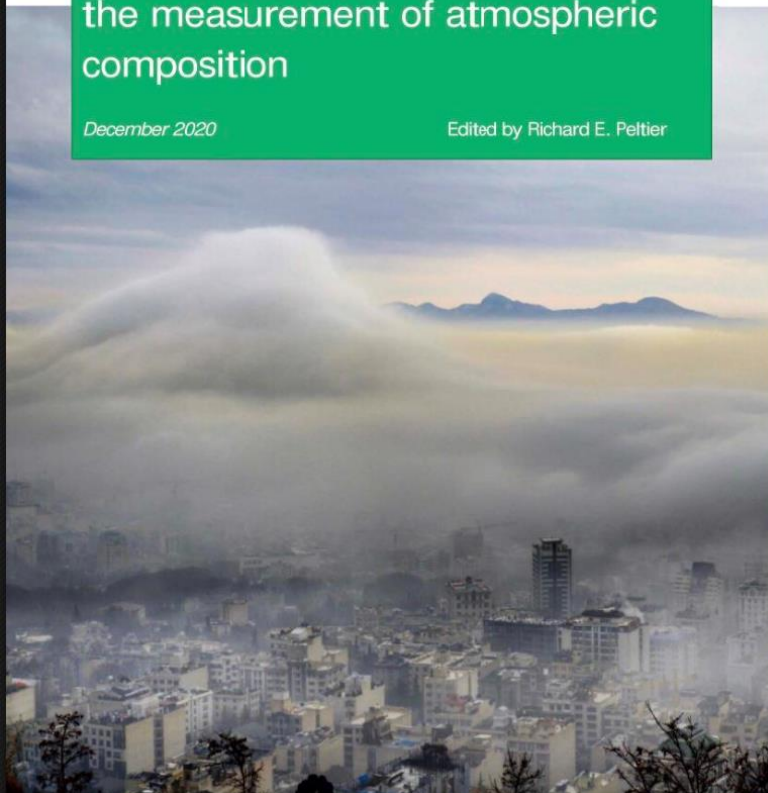


GAW: Observational (research) Infrastructure

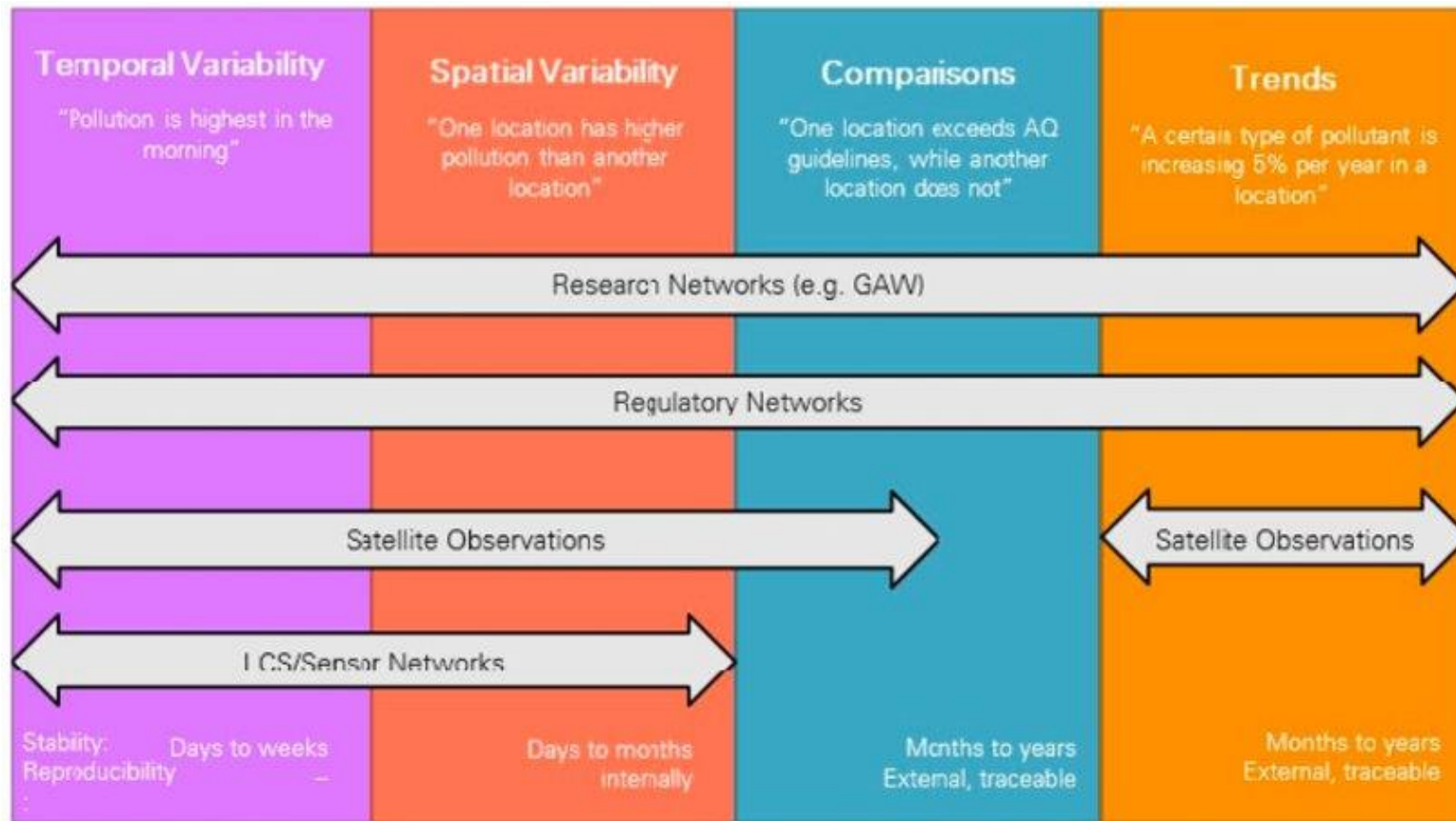
Integrating other sources of Air Quality information: Low-Cost Sensors

An update on low-cost sensors for the measurement of atmospheric composition

December 2020 Edited by Richard E. Peltier



WORLD METEOROLOGICAL ORGANIZATION | World Health Organization | UN environment | IGAC | emep



New report on low-cost sensors coming!

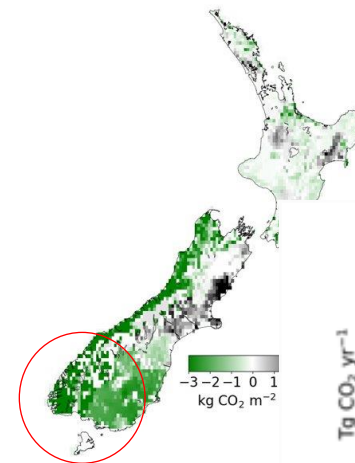
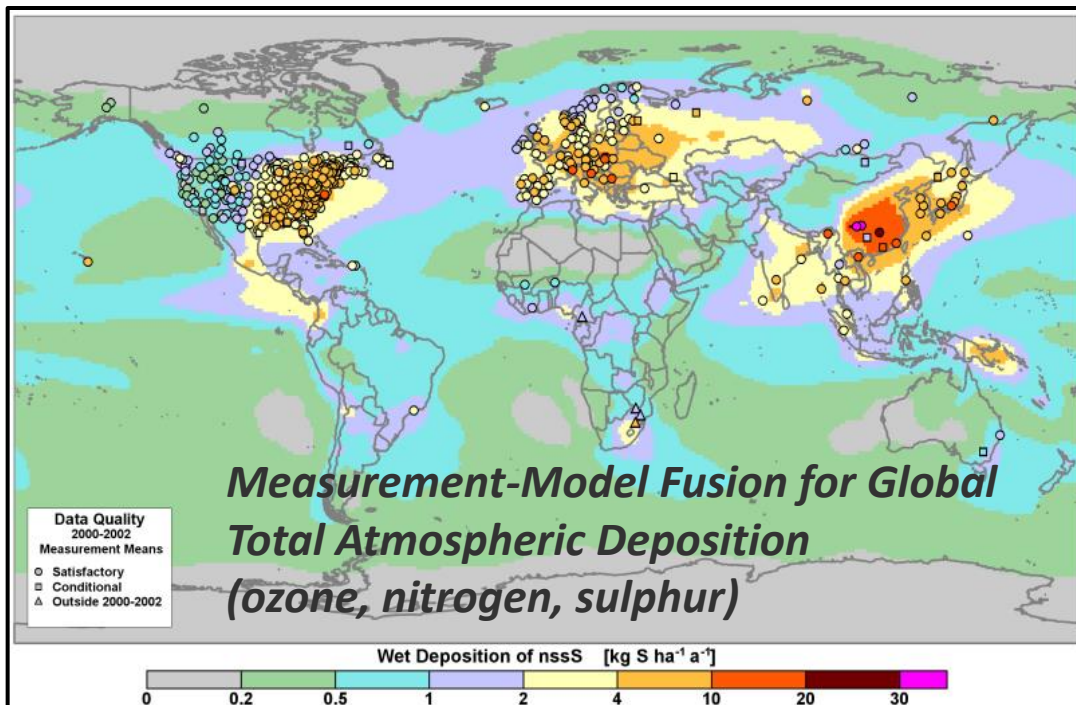
Extracted from (WMO, 2020)



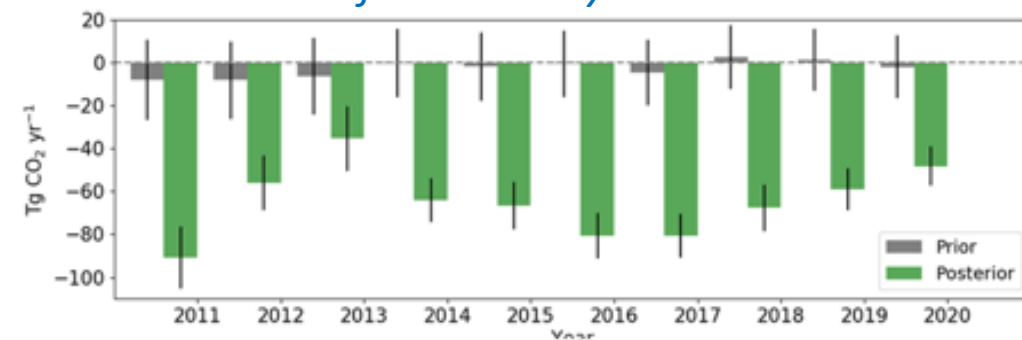
Science for Services

*Advance the application of atmospheric composition information in support of policies and conventions, and expand **societal services** related to air quality, human and ecosystem health, **climate change** and food production.*

Deposition to ecosystems and crops + climate action



Integrated Global Greenhouse Gas Information System



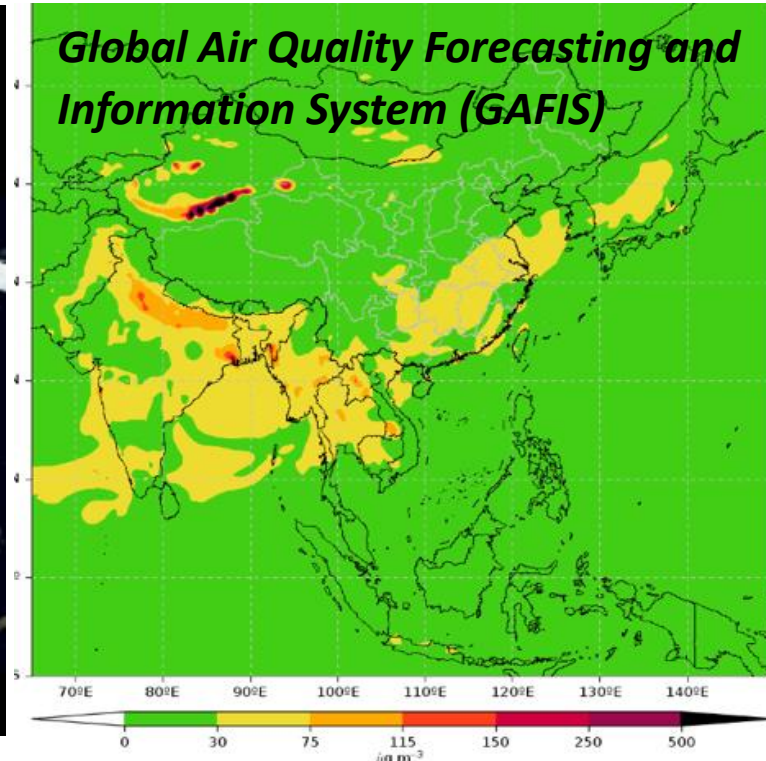
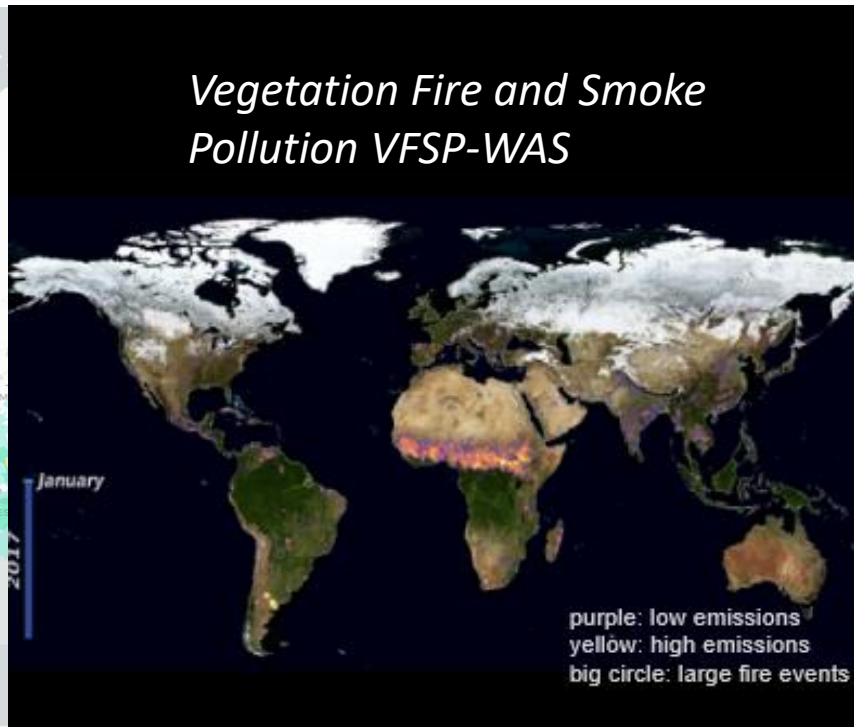
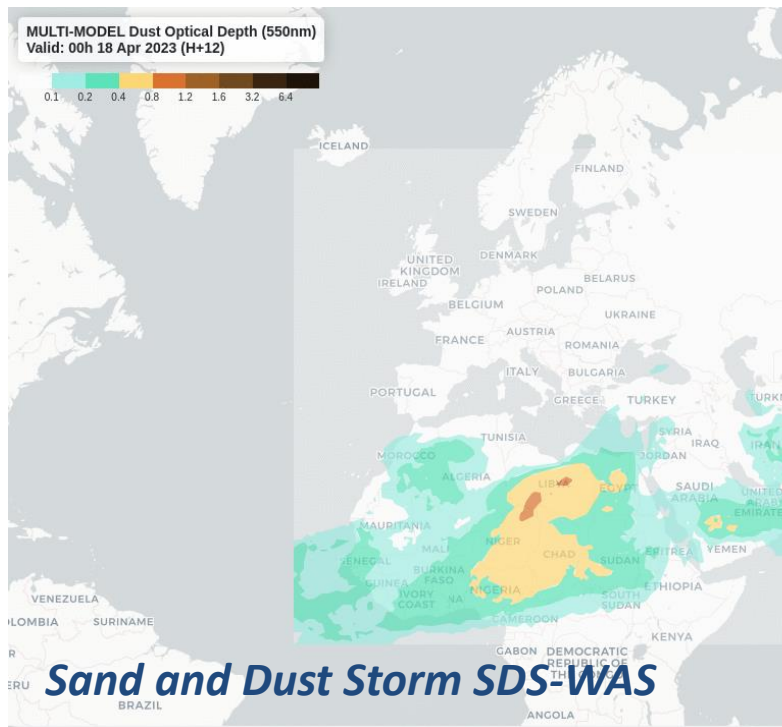
Aotearoa New Zealand's terrestrial carbon uptake



Science for Services

*Advance the application of atmospheric composition information in support of policies and conventions, and expand **societal services** related to air quality, human and ecosystem health, climate change and food production.*

Warnings and Forecasting Services Model intercomparisons





Infrastructure for the provision of Services

Monitoring

746 active global/regional/urban/stations in 112 countries

Central Facilities

13 countries are hosting GAW central facilities

Forecasting

21 countries providing daily forecasts

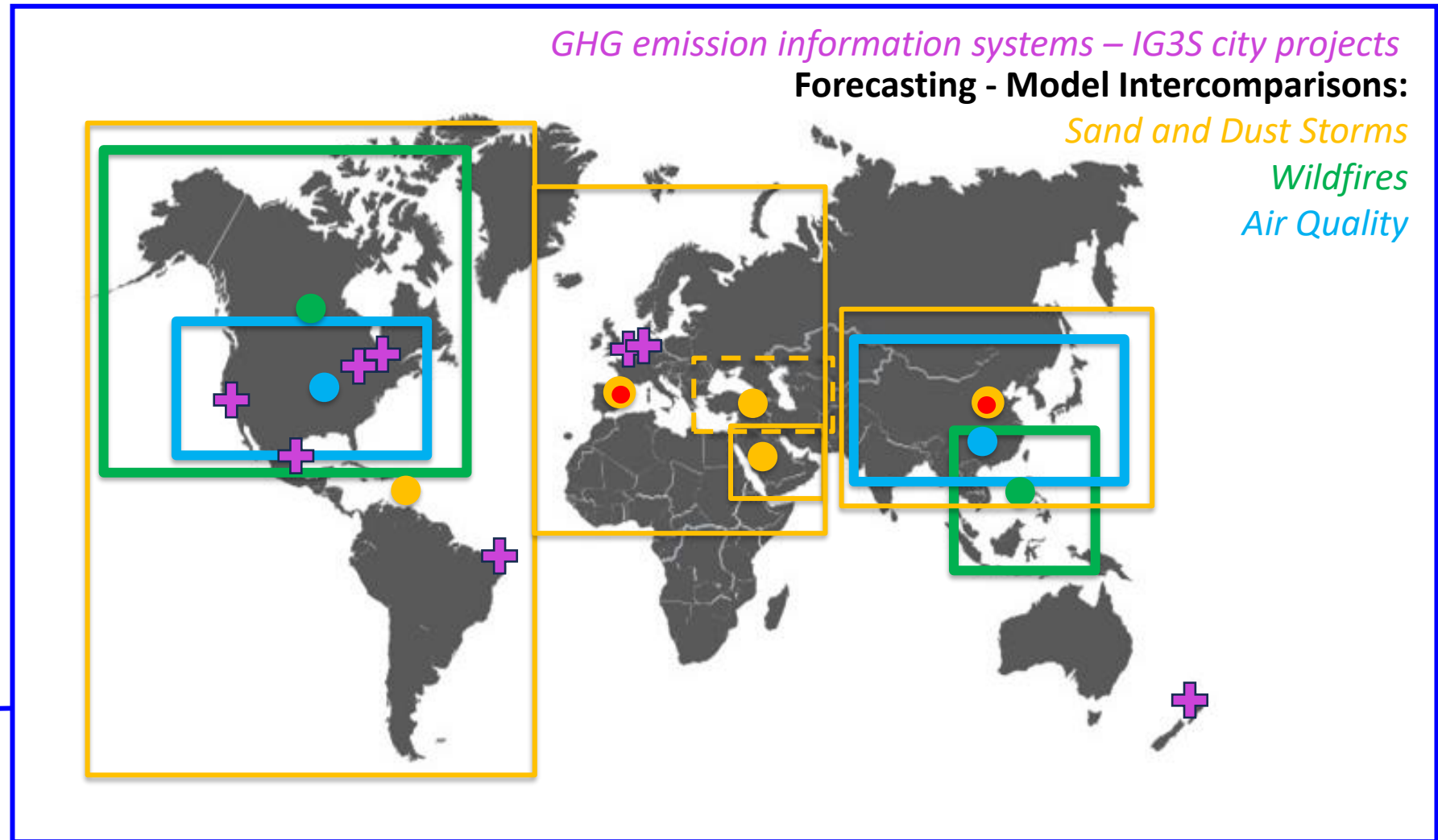
GHG emission information systems – IG3S city projects

Forecasting - Model Intercomparisons:

Sand and Dust Storms

Wildfires

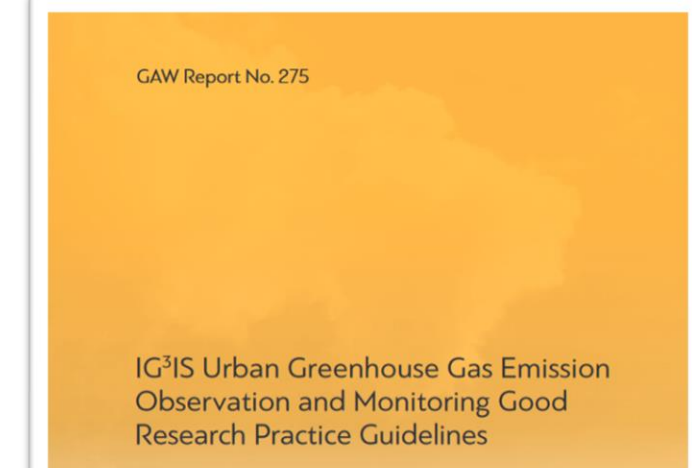
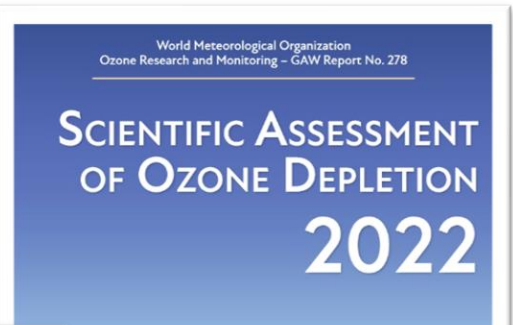
Air Quality





GAW Achievements

New Bulletins coming!



Atmos. Chem. Phys., 22, 4615–4703, 2022
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Atmospheric Chemistry and Physics
Open Access
EGU

Review article

Advances in air quality research – current and emerging challenges

Ranjeet S. Sokhi¹, Nicolas Moussiopoulos², Alexander Baklanov³, John Bartzis⁴, Isabelle Coll⁵, Sandro Finardi⁶, Rainer Friedrich⁷, Camilla Geels⁸, Tiia Grönholm⁹, Tomas Halenka¹⁰, Matthias Kretz⁸, Androniki Mouspidou⁹, Volker Matthias¹¹, Jana Moldanova¹², Greg Carmichael¹⁵, M. Velders^{18,19}, and

Climate Change Research,
9AB, UK
Mechanical Engineering,
ation (WMO), 7 bis,
land
ia, Kozani, 50100, Greece
10 Créteil, France

art, 70180 Stuttgart, Germany
de, 4000, Denmark
00101 Helsinki, Finland
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IG³IS Urban Greenhouse Gas Emission
Observation and Monitoring Good
Research Practice Guidelines

Article Type: Research Article

Global Atmospheric Composition Observations: The Heart of Vital Climate and Environmental Action

Gregory R. Carmichael, Oksana Tarasova, Øystein Hov, Leonard Barrie, and James H. Butler

Overview of global airborne dust in 2021
The spatial distribution of the global surface concentration of mineral dust in 2021 (Figure 1) and its anomaly relative to climatologically mean values (1981–2010) (Figure 2) were derived based on the dust products from the Modern-Era Retrospective Analysis for Research and Applications, Version 2 (MERRA-2) (Gielaro et al., 2017). This is the latest atmospheric reanalysis version for the modern satellite era produced by the NASA Global Modeling and Assimilation Office (GMAO).
In general, the spatial distribution of the concentration of mineral dust in 2021 was present in 2020 (WMO Airborne Dust Bulletin 2020) although some differences were found. The average of annual mean dust surface concentration in 2021 was 13.9 µg m⁻³, which is slightly higher than in 2020 (12.8 µg m⁻³). This increase also been observed in several dust-affected regions around the world, such as Central Asia, Peninsula, the Iranian Plateau and north-western Africa. Spatially, the estimated peak annual mean concentration of mineral dust in 2021 was 140 µg m⁻³ in the Arabian Peninsula.

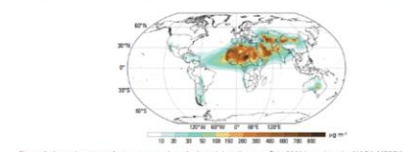


Figure 1. Annual mean surface concentration of mineral dust (in µg m⁻³) in 2021 based on the NASA MERRA-2 reanalysis.

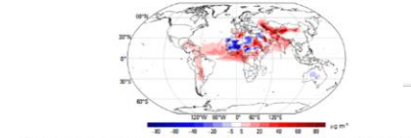


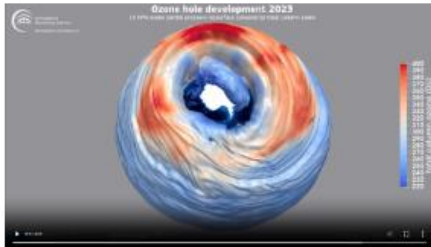
Figure 2. Anomaly of the annual mean surface dust concentration in 2021 relative to the 1981–2010 mean, based on the NASA MERRA-2 reanalysis.

Promoting latest Science achievements

WMO Bulletins in 2023

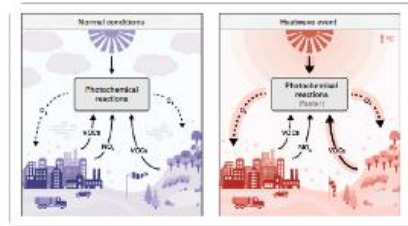
WMO Ozone and UV Bulletin

- Released on June 27 -



WMO AQ and Climate Bulletin

- Released on September 6 -



WMO Airborne dust Bulletin

- Released in October 19 -



WMO Greenhouse Gas Bulletin

- Released on November 15 -



Available at: <https://library.wmo.int/>

WMO-GAW Newsletter



Stay up to date on our core and related activities through our Newsletter

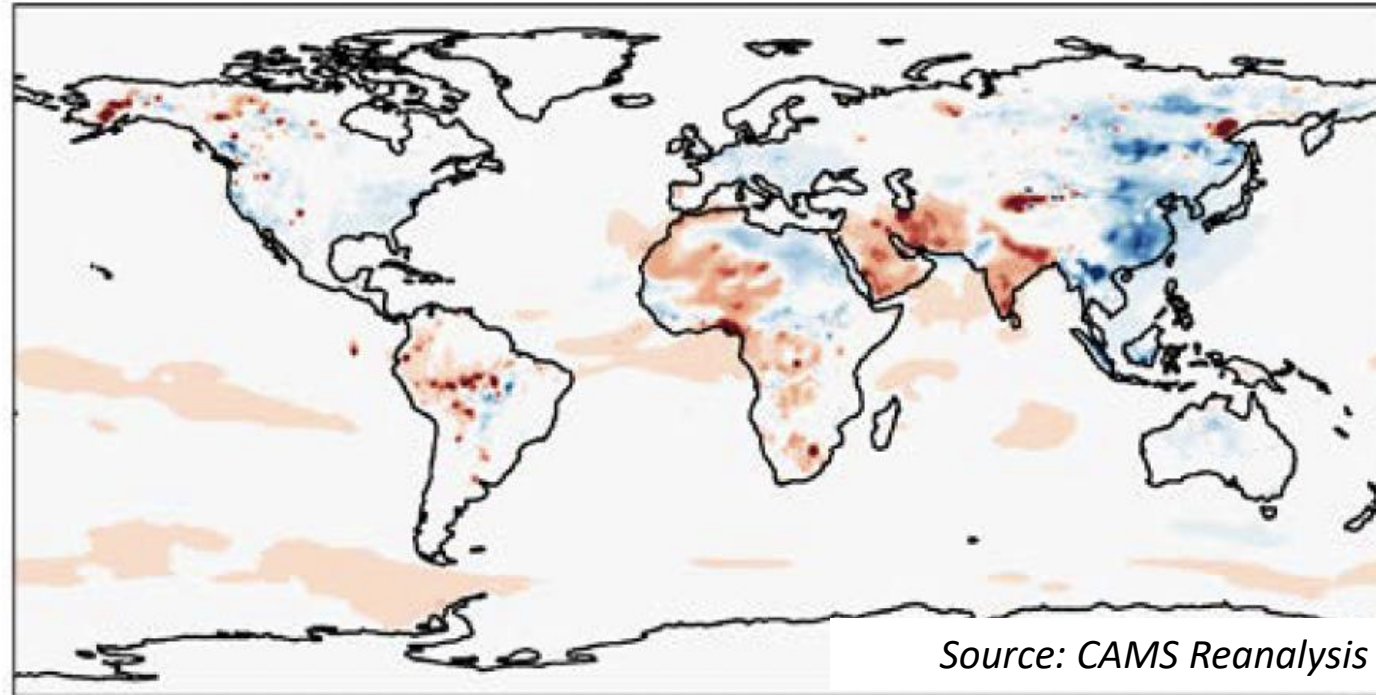
[Click here to Subscribe to the GAW Newsletter](#)





What did it happen in 2022?

PM2.5 anomaly for 2022 with respect 2003-2022



Thank you.



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<https://community.wmo.int/en/activity-areas/gaw>

