Research infrastructure as a key element of the Global Atmosphere Watch Programme

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WMO OMM

World Meteorological Organization
Organisation météorologique mondiale

Global Atmosphere Watch Programme



GAW is a research programmed of the World Meteorological Organization that 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 users.





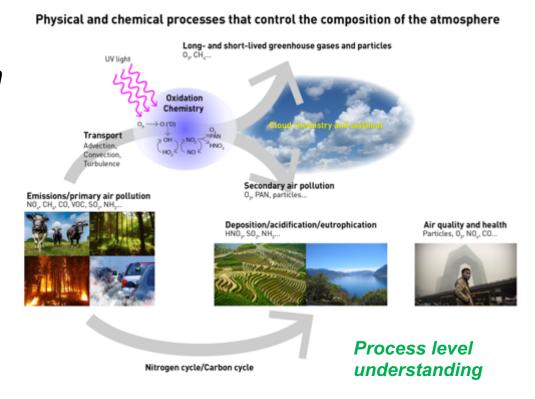




GAW Implementation Plan (2016-2023)



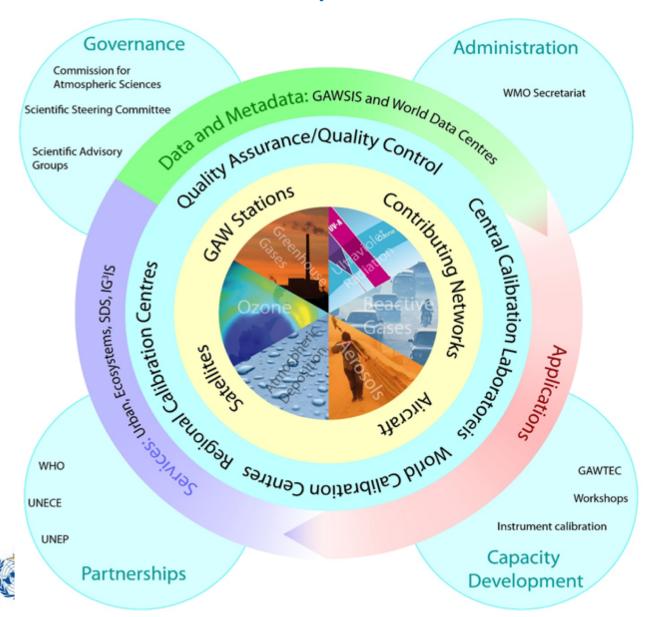
IP builds upon the premise that atmospheric composition matters - to climate, weather forecasting, human health, terrestrial and aquatic ecosystems, agricultural productivity, aeronautical operations, renewable energy production, and more.



The vision for the next decade of GAW is to grow the international network of high-quality atmospheric observations across local to global scales to drive high quality and impact science while co-producing a new generation of research enabled products and services.



GAW Implementation plan for 2016-2023 build on the concept "science for services"



GAW works with more than 100 variables!

GAW builds on voluntary contributions of partners.

GAW includes long-term infrastructure and utilizes it as a basis for research.

"Health" of the observational network





GAW in-situ observational network comprises:

- Global stations (31)
- Regional stations
- Local stations
- Mobile platform
- Contributing networks (11)

There are defined requirements and procedures for the GAW stations

With increasing focus on the science-for-services, we move to the notion of the "fit-for-purpose" observations

GAW Station Information System (GAWSIS)



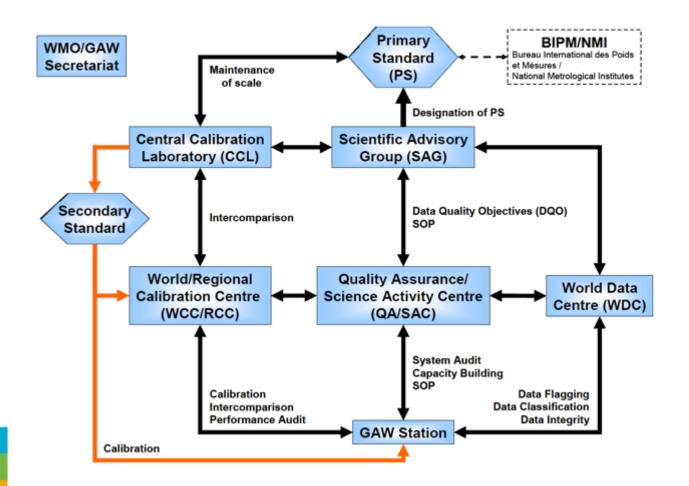
Schweizerische Eidgenossenschaft Conflederation suisse Conflederazione Svizzera Conflederazione svizzera

rederal Department of Home Affairs FDHA rederal Office of Meteorology and Climatology Meteoliwis Global Regional Contributing Local Reporting Partly Reporting Non-reporting Closed Planned Pre-operational

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Quality Assurance/Quality Control Concept of GAW





- One reference standard or scale
- The definition of data quality objectives (DQOs)
- Establishment of guidelines on how to meet these quality targets (MGs and SOPs)
- Timely submission
 of data and
 associated metadata
 to the responsible
 World Data Centre



Low Cost Sensors Statement

- Based on peer-reviewed publications through 2017
- Applications of sensors, definitions, sensor performance, evaluation exercises and facilities, quality assurance, conclusions and recommendations
- Covers on-line sensors for:
 - Reactive gases or other air pollutants including NO, NO₂, O₃, CO, SO₂, and total VOCs.
 - Long-lived greenhouse gases: CO₂ and CH₄
 - Airborne particulate matter (PM)









Low-cost sensors for the measurement of atmospheric composition: overview of topic and future applications valid as of May 2018

Editors: Alastair C. Lewis, Erika von Schneidemesser and Richard E. Peltier











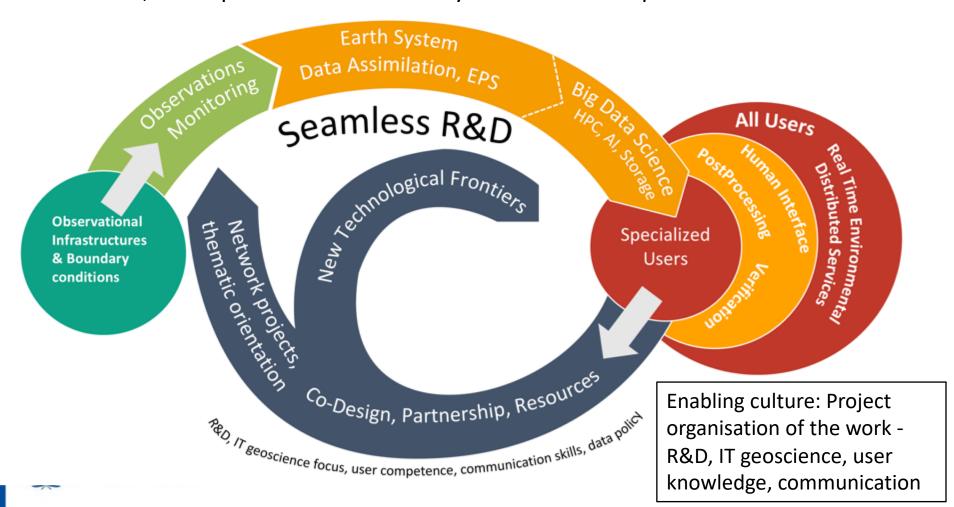
WMO-No. 1215 ISBN 978-92-63-11215-6

To share your experience, publications and related meetings please use the LCS forum https://wmoairsensor.discussion.community/



SCIENCE FOR SERVICES JOURNEY

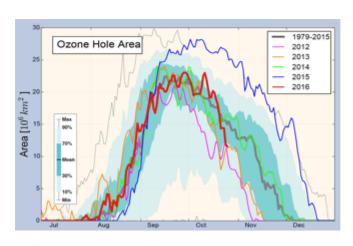
- Quality, Relevance and Impact:
- User Interactions forces exploration of "What works"
- Seamless Earth system modelling across weather, water, environment, ocean, climate; interoperable observation systems of ES components

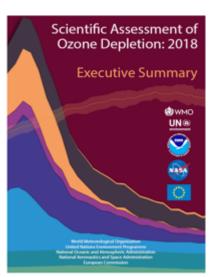


Direct use of observations to support Vienna Convention for the Protection of the Ozone Layer

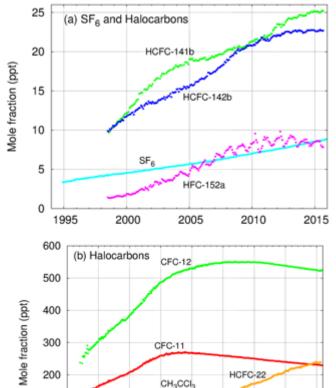


- GAW coordinates observations and QA of ozone depleting gases. These observations allow to monitor the effect of the actions taken under the Montreal protocol (decline of CFCs, fig. (b))
- GAW coordinates observations and QA of total ozone (Brewer and Dobson networks) and vertical ozone profiles (ozone sondes) that allow to follow the recovery of the ozone hole





100



Monthly mean mole fractions of sulphur hexafluoride (SF₆) and the most important halocarbons. SF₆ and lower mole fractions of halocarbons (a) and higher ones of halocarbons (b).

Year

1995 2000 2005 2010 2015

1985 1990



Observations in support of the new services :



- •Integrated Global Greenhouse Gas Information System - IG³IS (support of climate services)
- Measurement-model fusion for total deposition (support of the ecosystem assessment and food security)
- •Global Air Quality Forecasting services (support of the health sector)



Integrated Global Greenhouse Gas Information System (IG³IS) will be



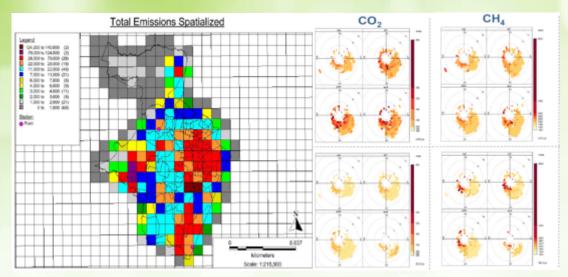
... a common framework for provision of the systematic services to user community who intend to reduce its greenhouse gas emissions

- 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



Example from Recife, Brazil Actual GHG datas



Paulo Barros President Advisor of CPRH

- GHG inventory of capital;
- Reliable data after the improvement by measurement and analysis;
- Main GHG emissions areas identified;
- High CH4 emissions with uncertainty sources;
- Also have a reliable "Start Point" for planning new policies and actions for NDC goals;











Why to look at deposition – user perspective



- Billions of US\$ in losses to crops worldwide due to tropospheric ozone damage – a food security problem
- Nitrogen deposition poses a significant threat to sensitive natural and seminatural habitats worldwide, despite emission reductions in some countries threat to bio-diversity and ecosystems
- Deposition of sulphur species emitted from combustion of fossil fuels threat to human health

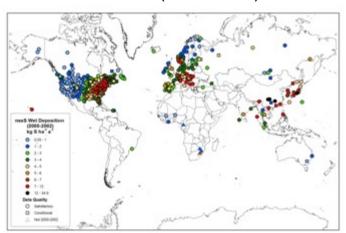
There is a clear need for a product that enables, on an operational or semi-operational basis, to keep track, on a global basis, of deposition of atmospheric pollutants to address the needs of the human health, food security and ecosystems studies. -> Measurement-Model Fusion for Global Total Global Atmospheric Deposition (MMF-TAD)



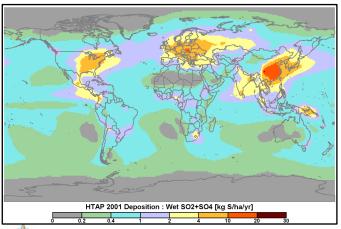
Combined measurement-model global maps of atmospheric deposition



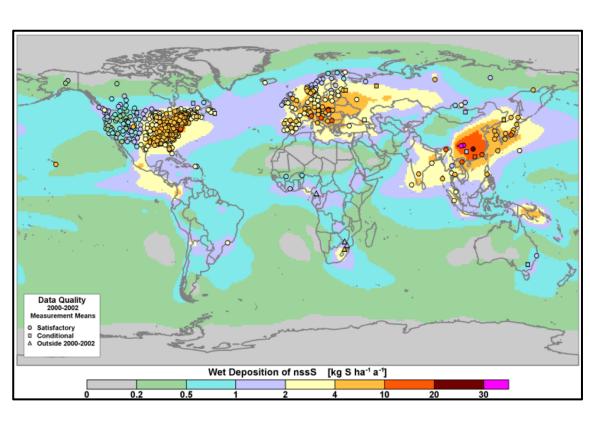
Measurement (2000-2002)



Model (2001 Ensemble Mean)







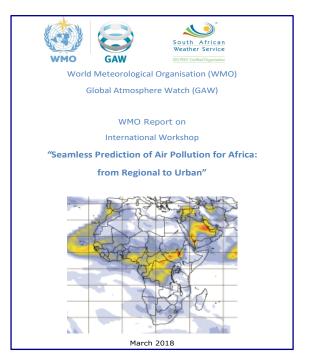
Vet et al. 2014. A global assessment of precipitation chemistry and deposition of sulfur, nitrogen, sea salt, base cations, organic acids, acidity and pH, and phosphorous, *Atmospheric Environment*, 93: 3-100.

Global Air Quality Forecasting services

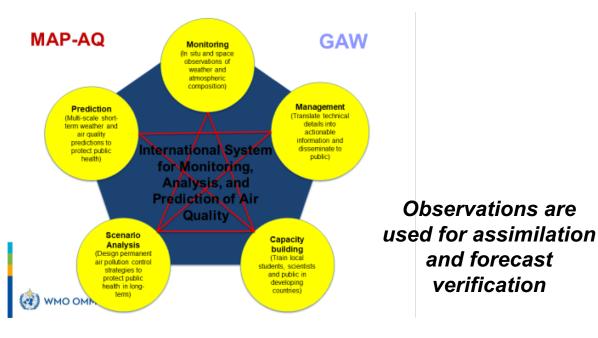
- Based on the best available science
- Address user community needs (health sector ->
 connection with Sand and Dust Storms Warning and
 Advisory System, ecosystem and food security- > linked
 to MMF, emission attribution-> linked to IG³IS)
- Operational or semi-operational

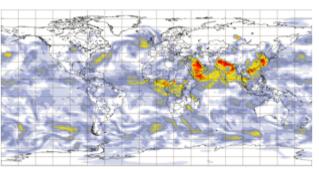


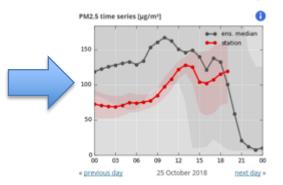
Towards Integrated Air Quality Forecast Systems in Africa

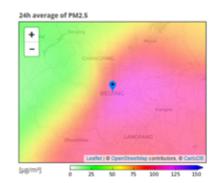


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Air Quality Forecast for Beijing

Observations in GAW:

- Can be used directly as observational evidences for environmental policy
- Can be used to study the processes that drive atmospheric composition changes
- Be combined with inverse modelling tools to understand fluxes/emissions
- Be combined with the modeling results to produce highly specially resolved deposition maps
- Be used for initiation of the forecasts and verification

 Many of the GAW observations are supported by the

 Research Infrastructures (ACTRIS, ICOS, IAGOS)



Thank you Merci



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