



World Meteorological Organization
Weather • Climate • Water



GAW presentation at YESS meeting in Offenbach

Christian Plass-Duelmer, Greg Carmichael, ...

atmospheric composition ↔ *human impact*
GAW motivation: understanding, services

The GAW Mission



- *Systematic Global Monitoring* of the Chemical Composition of the Atmosphere.
- Analysis and Assessment in Support of *International Conventions*.
- Development of Air Pollution and Climate *Predictive Capability*.





GAW – *moving forward*

New Strategic Implementation Plan (2016 – 2023)

Research Enabling Services

Focuses on the theme - ***Atmospheric Composition Matters*** - to climate, weather forecasting, human health, terrestrial and aquatic ecosystems, agricultural productivity, aeronautical operations, renewable energy production, and more.

GAW has a central role to play in helping WMO members and society develop and deliver improved products and services involving atmospheric composition.





GAW – context

GAW Strategic Implementation Plan (2016-2023)
- within the context of WMO SP & CAS priorities

WMO Strategic Plan, which can be summarized as
«Science for service» and includes:

- Disaster risk reduction
- Global integrated polar prediction system (GIPPS)
- Megacities
- Global Framework for Climate Services (GFCS)
- WMO Integrated Global Observing System (WIGOS) and WMO Information System (WIS)





GAW – context

CAS-16, which identified six emerging areas:

1. High Impact Weather and its socio-economic effects in the context of global change;
2. Water modelling and predicting the water cycle for improved DRR and resource management;
3. Integrated GHG Information System (IG³IS) - serving society and supporting policy;
4. Aerosols and their impacts on air quality, weather and climate;
5. Urbanization - research and services for megacities and large urban complexes; and
6. Evolving Technologies (including geo-engineering) and their impact on science and its use.



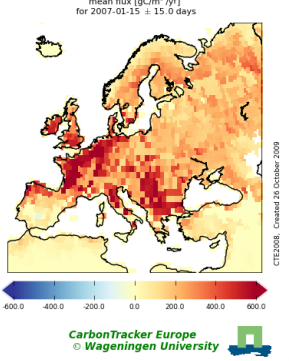
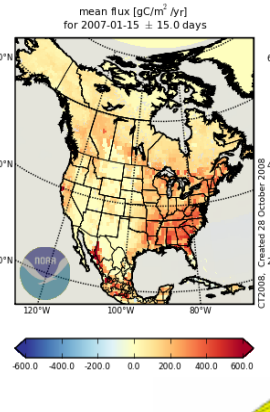
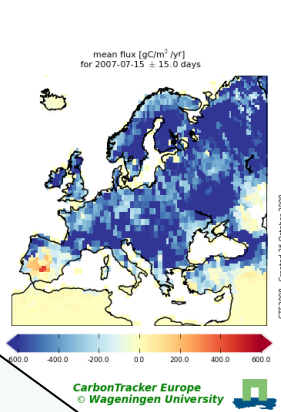
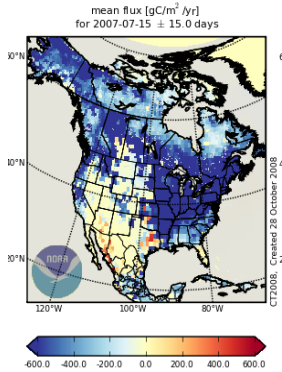
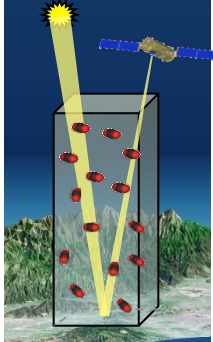
GAW – Directed Research

Advance observations and analysis of chemical constituents of the atmosphere and UV radiation and expand role in enhancing predictive capabilities (wrt atmospheric composition and its uses) to help reduce environmental risks to society from high-impact weather and air pollution, and to mitigate the impacts of, and adapt to, changing climate.

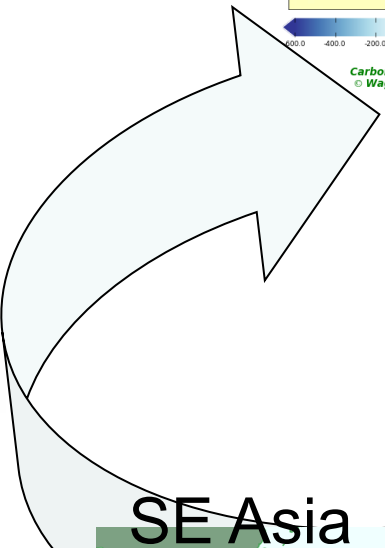


Example 1: Integrated, Global Greenhouse Gas Information System (IG³IS)

Satellites

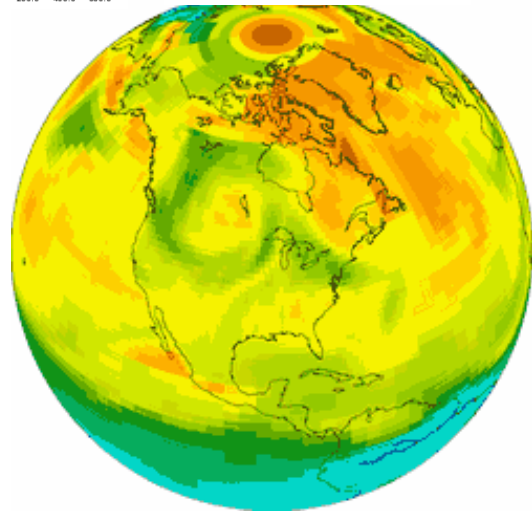


China



“Carbon Weather”

Manage
GHG
Budgets



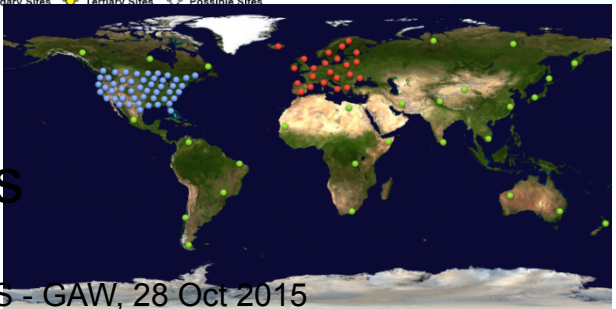
TCCON



SE Asia



Earth
Networks

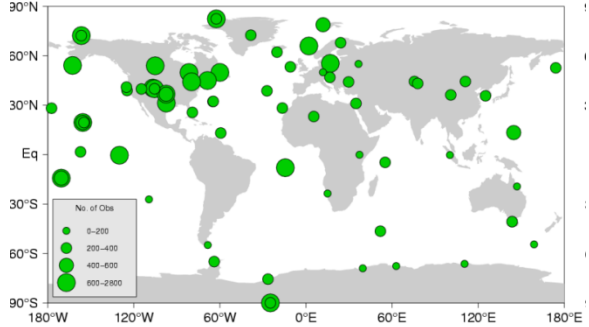


YESS - GAW, 28 Oct 2015

Brazil



Current Network



Example 2: ECMWF/MACC Daily (NRT) Service Provision

Monitoring atmospheric composition & climate

macc Monitoring atmospheric composition & climate

Home NEWS ABOUT THE PROJECT SERVICES DATA PRODUCTS DOCUMENTS EVENTS CONTACT US

Home >

macc - Monitoring Atmospheric Composition and Climate - is the current pre-operational atmospheric service of the European GMES programme. MACC provides data records on atmospheric composition for recent years, data for monitoring present conditions and forecasts of the distribution of key constituents for a few days ahead. MACC combines state-of-the-art atmospheric modelling with Earth observation data to provide information services covering European Air Quality, Global Atmospheric Composition, Climate, and UV and Solar Energy.

Services by theme

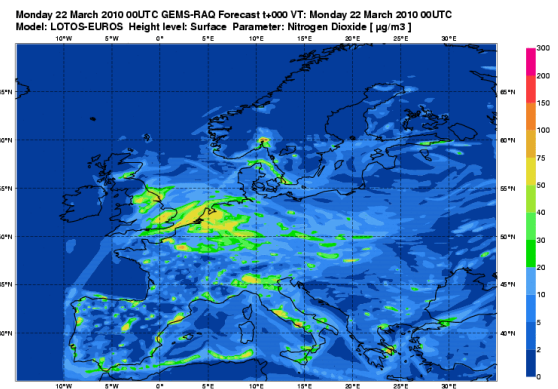
- European Air Quality
- Global Atmospheric Composition
- Climate
- UV and Solar Energy

Services by user

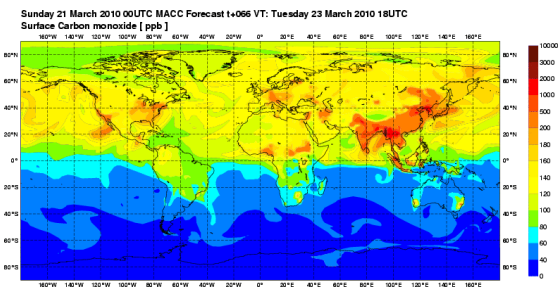
- Health
- Environment
- Science Community
- Citizen
- Meteorology

MACC is a Collaborative Project (2009-2011) funded by the European Community under the 7th Framework Programme. It is coordinated by the European Centre for Medium-Range Weather Forecasts and operated by a 45-member consortium.

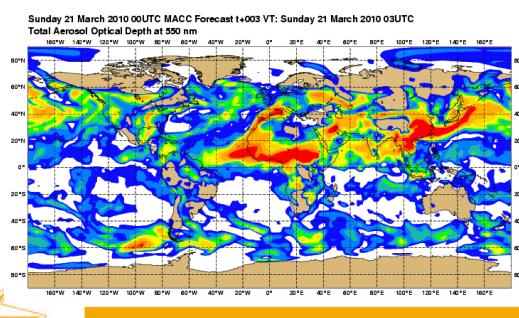
Air quality



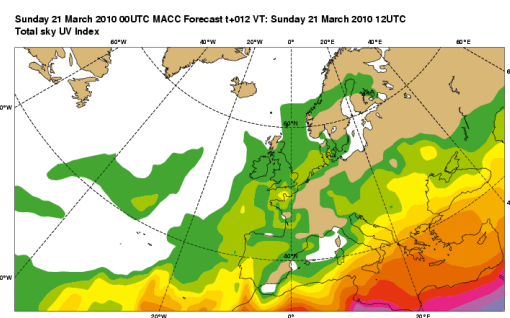
Global Pollution



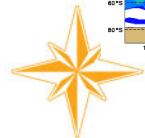
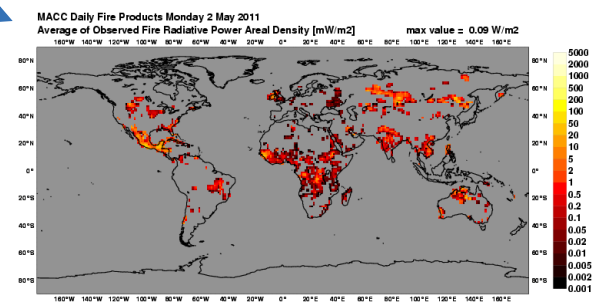
Aerosol



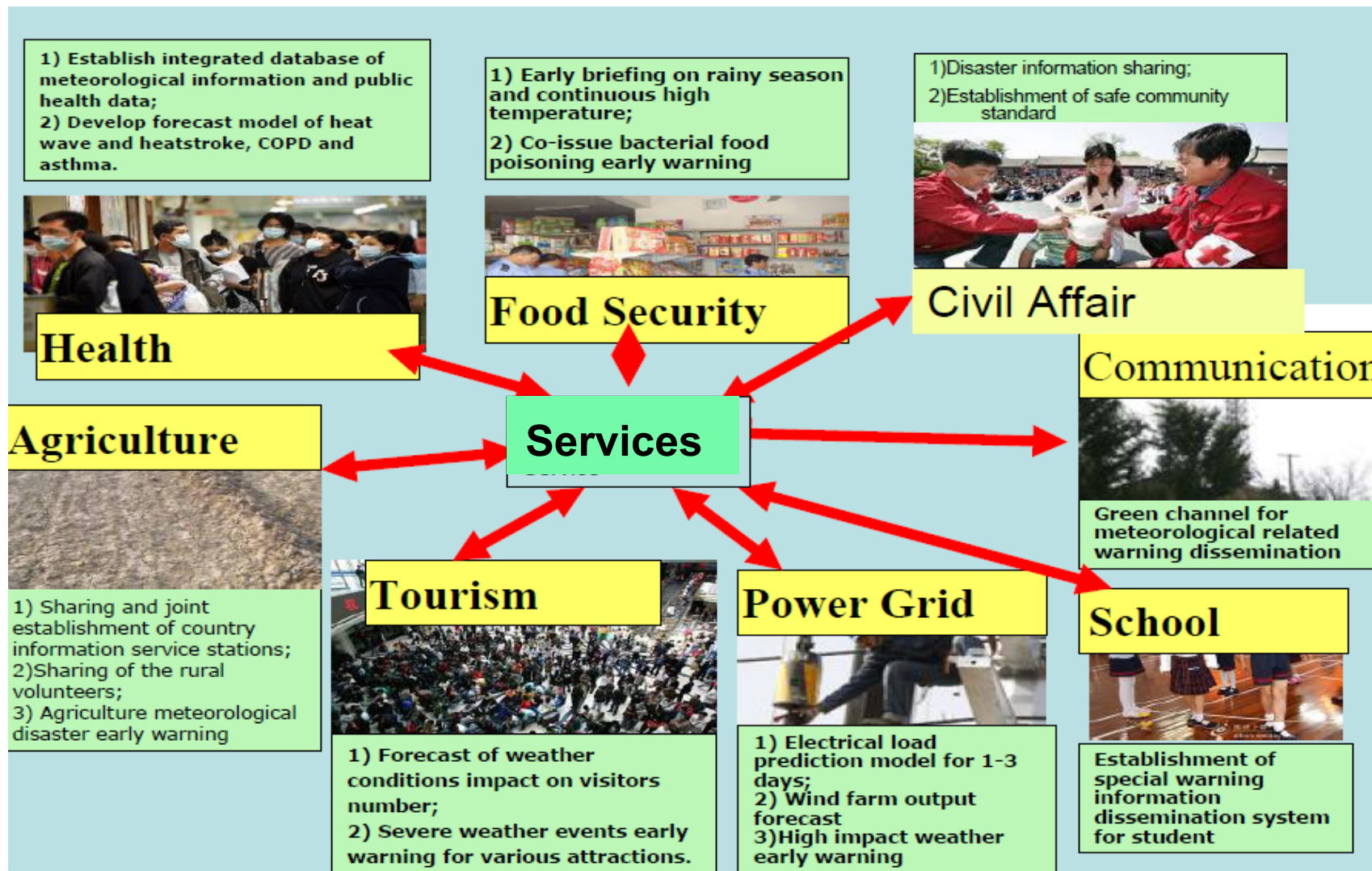
UV index



Fires



Example 3: Increasing focus on Megacities and large urban complexes (Shanghai (SMB))



Priority – Expanding GAW’s role in enhancing predictive capabilities (wrt atmospheric composition and its uses)

- The focus of the new SIP on services provides a framework via the priority application areas to evolve observations and to enhance modeling elements;
- GAW has played an active role in further developing urban air quality forecasting capabilities through (GURME) - these efforts will continue and expand;
- Establishing a new SAG (“GAW-Aps”) focused on the objective “To demonstrate usefulness of exchanging chemical observational data in NRT in support of monitoring and forecasting applications” targeting applications that use NRT data delivery on scales larger than urban; and
- Expand collaborations with WWRP/WCRP/WGNE and others...





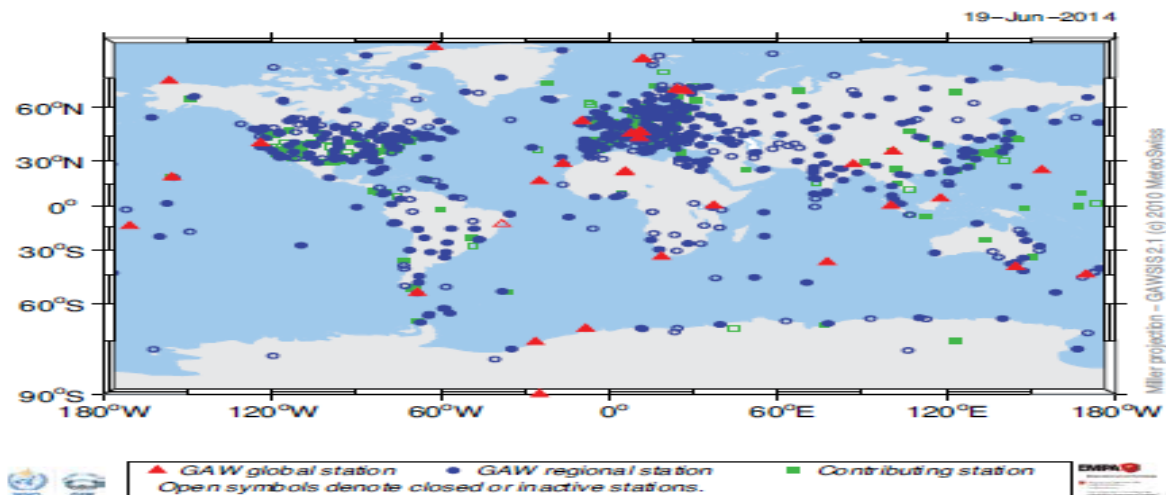
GAW – Actions/Needs

Continue to improve observational systems and data using **RRR and WIGOS/WIS** (WMO Integrated Global Observing System and WMO Information System) **to evolve the observing system for atmospheric composition to support the growing services to:**

- + allow near real-time provision of GAW data,
- + support integration of surface, vertical profile and column datasets from different platforms to provide a unified understanding of aerosol and gas distributions,
- + minimize gaps in the measurement networks in data-poor regions,
- + support the expanding service needs related to cities, high impact weather, and climate

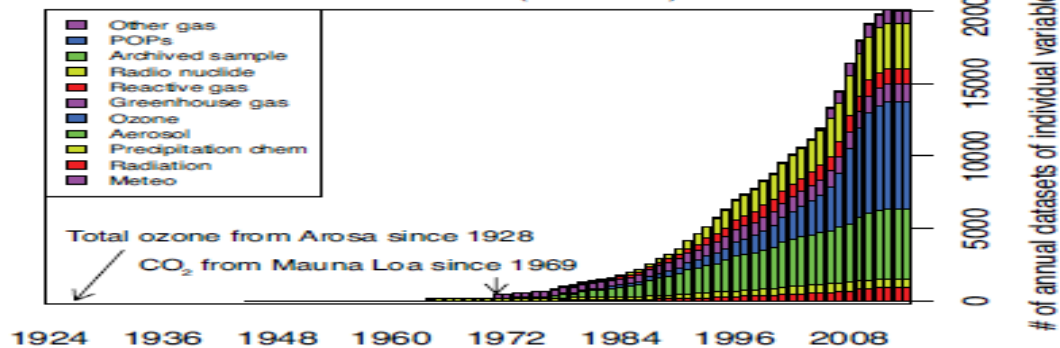


Need to Evolve Composition Observing Systems and Data Management



Datasets available from GAW

Source: GAW/SIS (June 2014)



GAW/CHC Chacaltaya Station
 (5240 masl)



GAW Station Information System
 (www.meteoswiss.ch/gaw/sis)

YESS - GAW, 28 Oct 2015

GAW Global Station Hohenpeißenberg

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

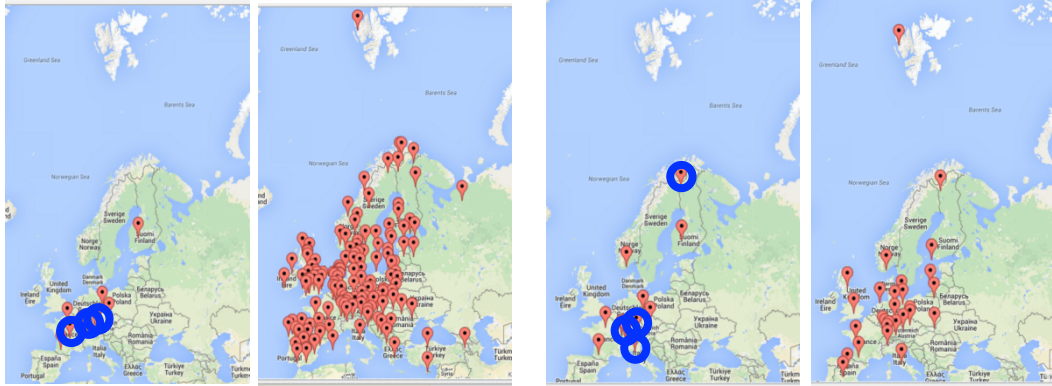


Example 1 – Networks and Quality



NO₂

VOCs



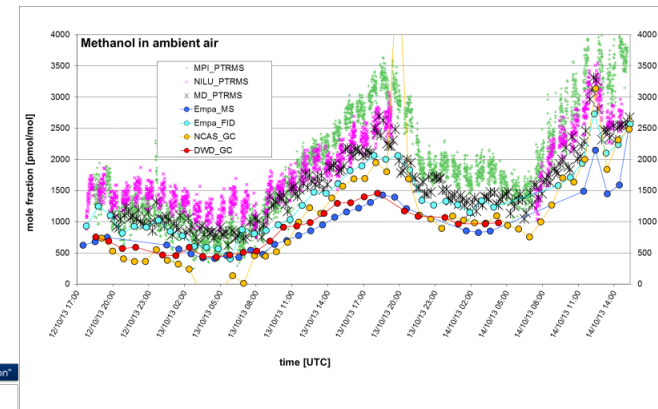
ACTRIS

EMEP

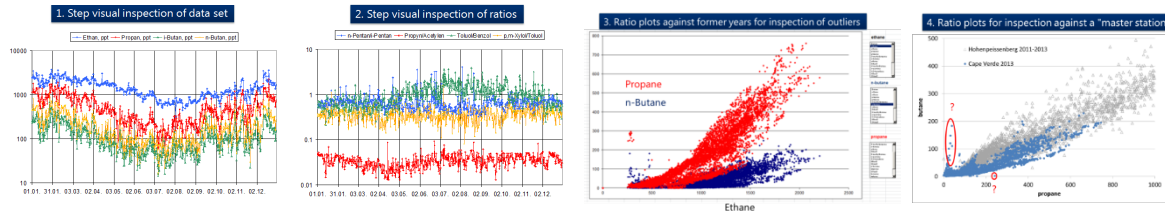
ACTRIS

EMEP

Intercomparisons



Implement control procedures for VOCs (Examples)



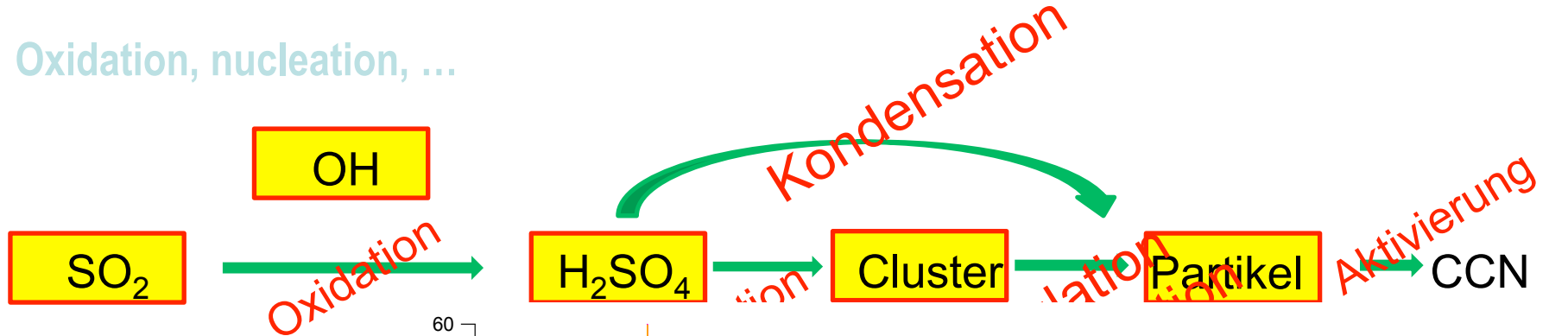
Implementation into EBAS

Annual VOC/NO_x QC-Meetings



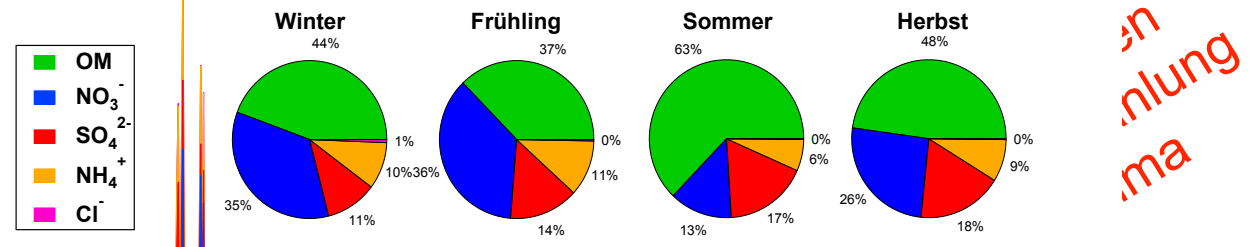
Example 2 - chemical process understanding

Oxidation, nucleation, ...



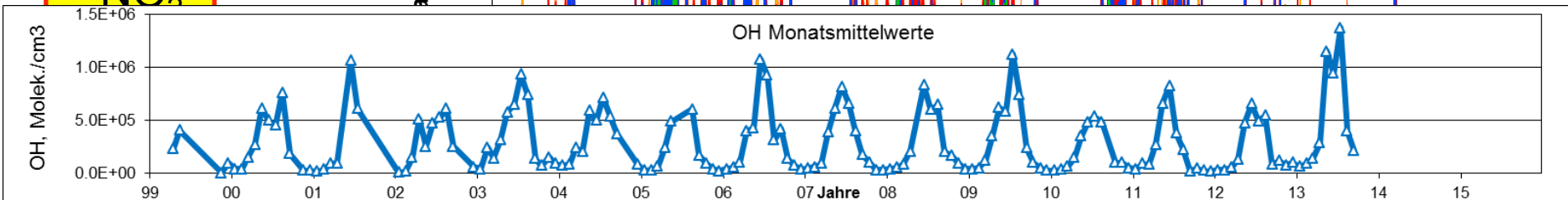
Crig
Wässrige Ph

Massenzusammensetzung / $\mu\text{g m}^{-3}$



Fluoreszenz

NO₂



an
nlung
ma

-
nat.

Example 3 – GHG

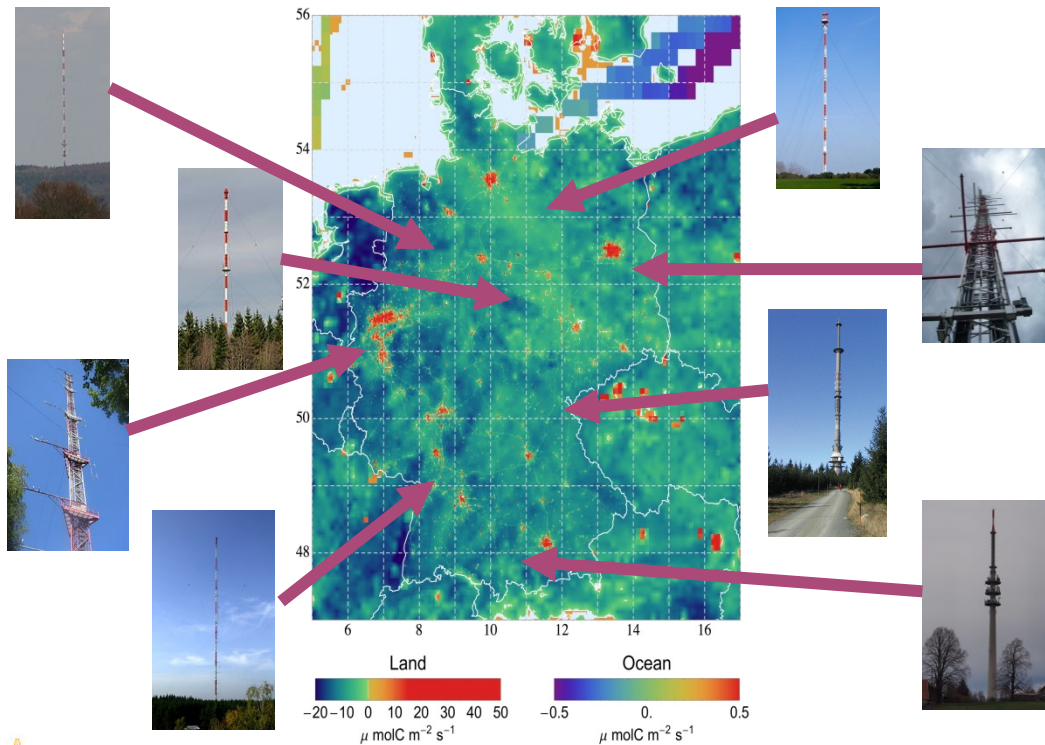
German ICOS-D (Atmosphere)

9 Stations

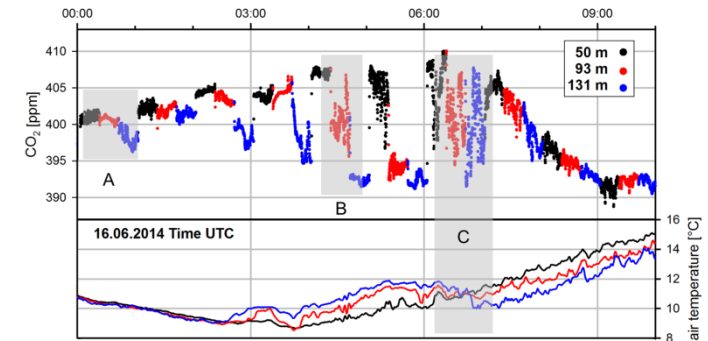
→ GHG

→ Tracers

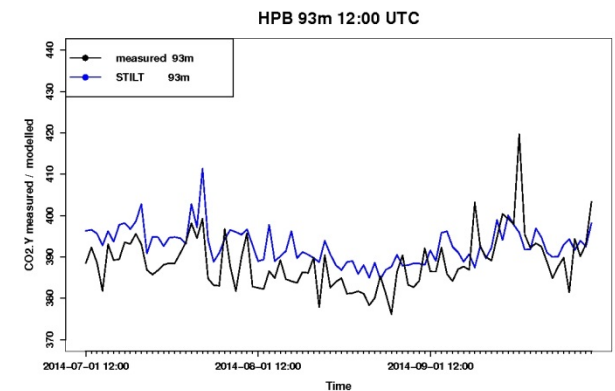
→ Meteorology



Height information – regional representativeness



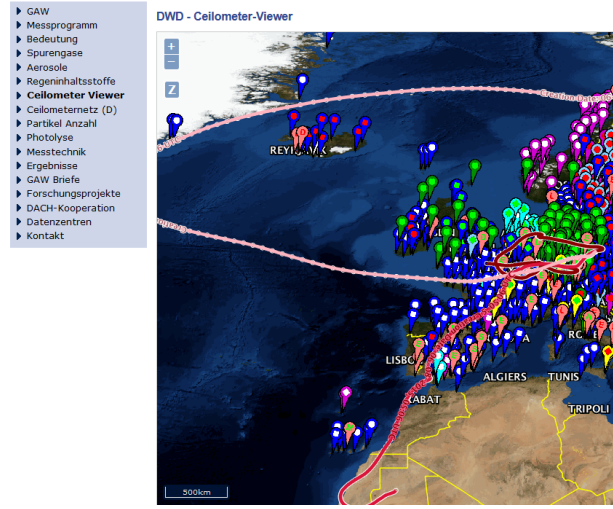
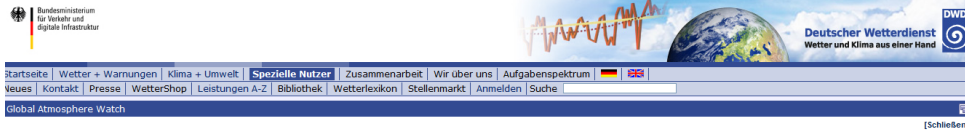
Model validation – Inverse modelling



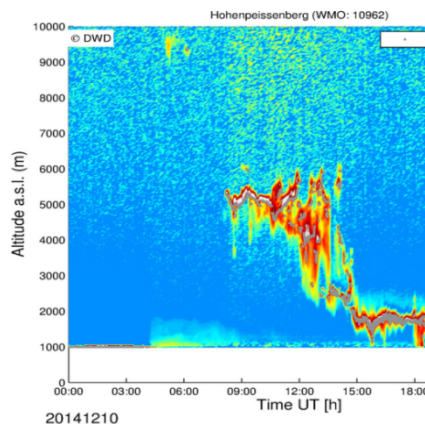
Products and Services
e.g. flux map of Europe



Example 4 – Ceilometers for CAMS Verification



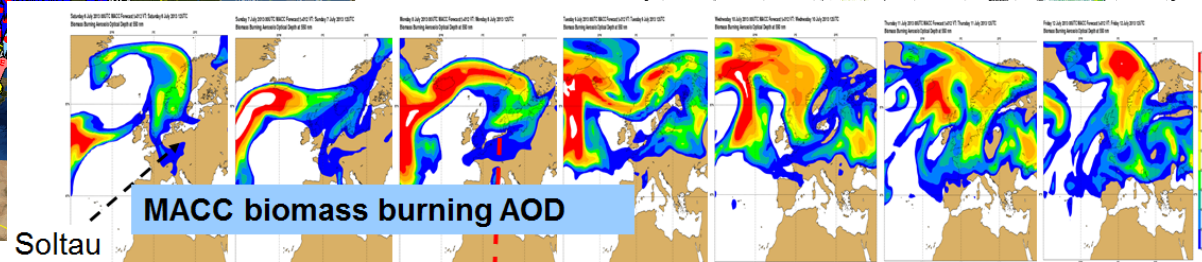
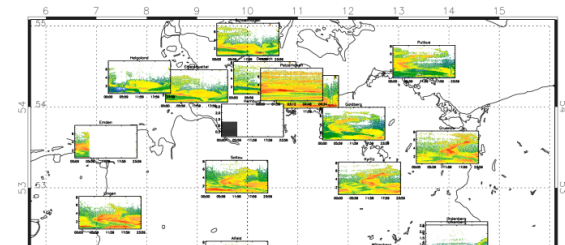
Hohenpeissenberg Ceilometer:



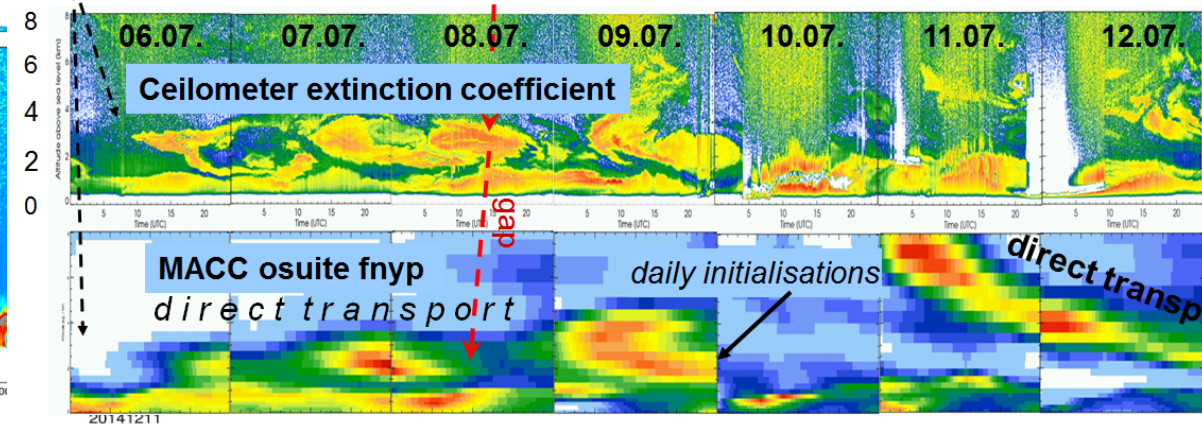
This instrument is a Jenoptik CHM15k Nimbus located at 47.8°N/11.01°E (WMO: 10962).
Data kindly provided by DWD

Canadian Forest Fires in July 2013

DWD Ceilonet – Backscatter Intensity
09.07.2013



Soltau



Explore collaborations around applications involving atmospheric composition

- Chemical weather / air quality forecasting and reanalyzes
- NWP for precipitation, visibility, thunderstorms, etc.
- Sand and Dust Storm Modelling and Warning Systems
- Wild fire atmospheric pollution and effects
- Volcano ash forecasting, warning and effects
- High Impact Weather and Disaster Risk
- Data assimilation for air quality and NWP
- Weather modification and geo-engineering
- Effects of Short-Lived Climate Forcers
- Earth System Modelling and Projections

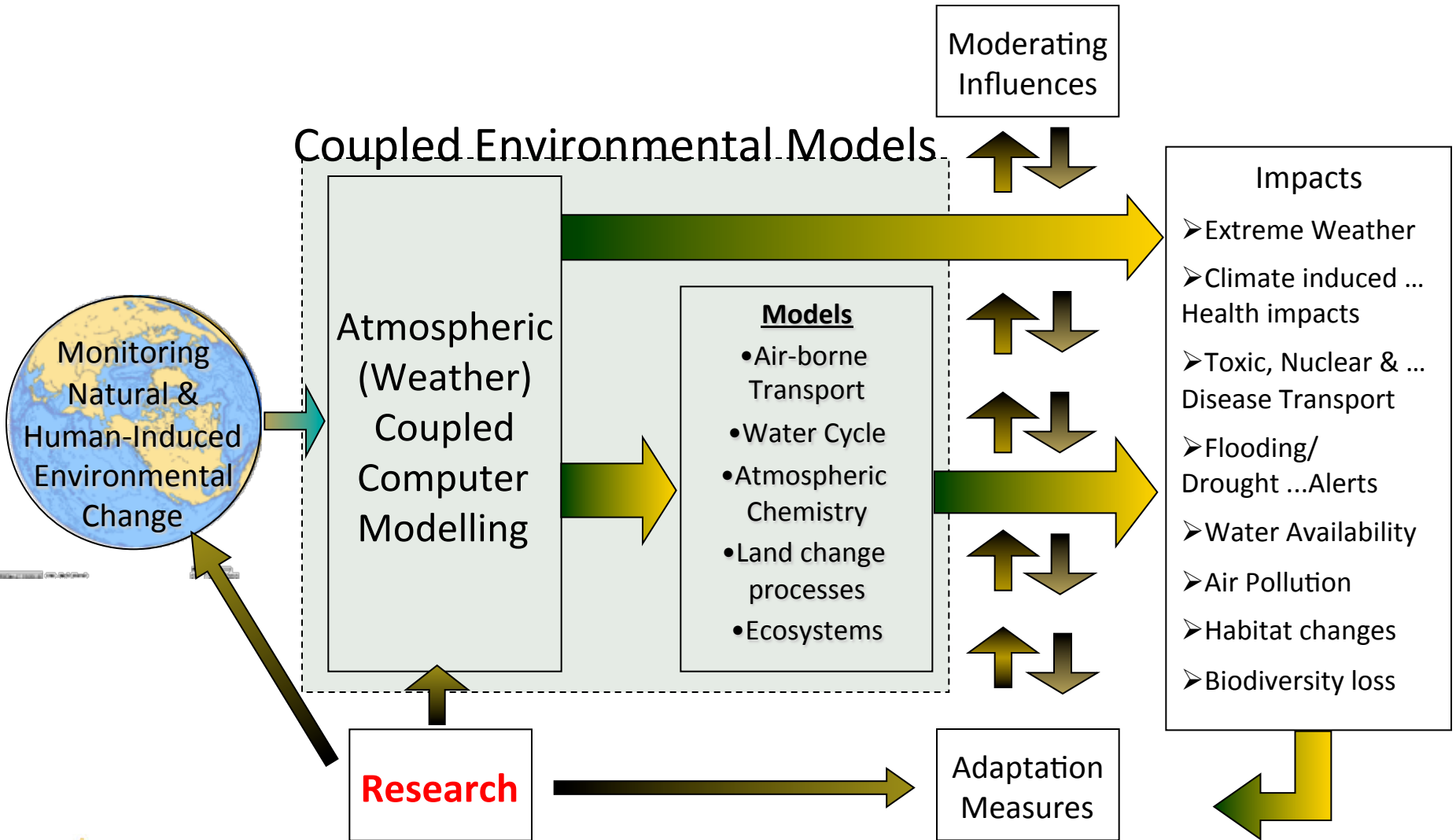


Ideas moving forward for collaborations

- Target activities related to:
 - 1) atmospheric composition forecasting with a focus on urban areas;
 - 2) role of atmospheric composition (e.g., aerosols) in NWP and climate prediction (CCMI);
 - 3) role of on-line seamless models (as discussed in recent CCMM meeting - Coupled chemistry–meteorology modelling: status and relevance for numerical weather prediction, air quality and climate communities);
 - 4) assimilation of atmospheric composition data in NWP with the purpose to improve the forecasting skills;
- Explore activities with WGNE on topics such as aerosol (WWOSC) and assimilation of atmospheric composition data to NWP models; and
- Establish joint vision and subsequent projects, working groups, etc. with GAW;
- Others....



Challenge: How Best to Incorporate/Integrate Composition, Weather and Climate Services





World Meteorological Organization

Weather • Climate • Water

- Backup slides

GAW - Thematic research application areas (1)

– used to help focus activities

- **Forecasting Atmospheric Composition (F)** – Covers applications from global to regional scales, with horizontal resolutions similar to global NWP (~ 10 km and coarser), and with stringent timeliness requirements (NRT). These applications, for example, include support for operations such as sand and dust storm warnings and chemical weather forecasts.



GAW - Thematic research application areas (2)

- **Analysis and Monitoring of Atmospheric Composition (M)** - Covers applications related to evaluating distributions of and analyzing changes in atmospheric composition on regional to global scales.
- In contrast to forecasting applications, this theme requires data of assured quality but with less stringent time requirements.
- These applications include assessments of trends in composition, deposition, and emissions; development of climatologies and re-analyses; evaluation of regional and global chemical transport models and their representation of processes; evaluation of satellite-derived retrievals of atmospheric composition variables; and support of treaty monitoring, etc.



GAW - Thematic research application areas (3)

- **Providing Atmospheric Composition information to support services in urban areas (U)** - Covers applications that target limited areas (with horizontal resolution of a few km or smaller) and, in some cases, with stringent timeliness requirements.
- A distinguishing feature of this category of applications is their emphasis on research in support of operational services, such as air quality forecasting, which use approaches such as pilot projects and feasibility demonstrations.



GAW - Targeted Services/Cross-Cutting Topics

- climate change;
- high-impact weather and events;
- urban meteorology, air quality and health;
- ecosystems; and
- conventions and treaties.

PLUS Cross cutting issues...

- aerosols
- GHG tracking
- Health



GAW – New Implementation Plan

Research Enabling Services

Focuses on the theme -

Atmospheric Composition

Matters - to human health,
& weather forecasting, climate,
terrestrial and aquatic ecosystems,
agricultural productivity, aeronautical
operations, renewable energy
production, and more.

(GHGs, aerosols, reactive gases)



3.7 million deaths
~21 % of **all** deaths from
ischaemic heart disease (IHD)
~23% of **all** deaths due to stroke
~13 % of **all** deaths to chronic
obstructive pulmonary disease
(COPD)



Research collaborations around applications involving atmospheric composition *(as discussed at recent Coupled chemistry–meteorology modelling: status and relevance for numerical weather prediction, air quality and climate communities)*

- Chemical weather / air quality forecasting and reanalyzes
- NWP for precipitation, visibility, thunderstorms, etc.
- Sand and Dust Storm Modelling and Warning Systems
- Wild fire atmospheric pollution and effects
- Volcano ash forecasting, warning and effects
- High Impact Weather and Disaster Risk
- Data assimilation of composition for air quality and NWP
- Weather modification and geo-engineering
- Effects of Short-Lived Climate Forcers
- Earth System Modelling and Projections





World Meteorological Organization

Weather • Climate • Water



World Meteorological Organization

Weather • Climate • Water



Global Atmosphere Watch – Opportunities for Fostering Enhanced Collaborations with WWRP/WCRP/ WGNE...

GAW Motivation: *Research conducted on atmospheric composition accounting for the human impact on the atmosphere enables better services*



GAW – What's Next?

Continue to improve observational systems and data using **RRR and WIGOS/WIS** (WMO Integrated Global Observing System and WMO Information System) **to evolve the observing system for atmospheric composition to support the growing services to:**

- + allow near real-time provision of GAW data,
- + support integration of surface, vertical profile and column datasets from different platforms to provide a unified understanding of aerosol and gas distributions,
- + minimize gaps in the measurement networks in data-poor regions,
- + support the expanding service needs related to cities, high impact weather, and climate

