The WMO Global Atmosphere Watch (GAW) Programme

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For website Google “GAW”
Contents

- WMO GAW Programme
- GAW in the framework of GEOSS and IGACO
- Recommended GAW monitoring themes
- BEO Moussala, a potential GAW station
GAW: What is it?

- The Global Atmosphere Watch programme of WMO
- *Established* in 1989 by merging the Global Ozone Observing System (GO_3(OS)) and Background Monitoring of Air Pollution (BAPMoN) programmes
- *Coordinated* by the Environment Division of WMO’s Atmospheric Research and Environment Programme (AREP) department under the Commission for Atmospheric Science (CAS) and its Working Group on Environmental Pollution and Atmospheric Chemistry.
The GAW Mission

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

Better Understanding of:

- **Climate**, Climate Change and Climate Prediction
- **Improved Weather Forecasting**: By Including Aerosols, Ozone and Reactive Gas Observations
- **Air Pollution** Forecasting, Effects, Long Range Transport and Deposition
- **Stratospheric Ozone Depletion** and Surface UV Enhancement: Are Halocarbon controls working?
- **Oxidizing Power**: The Atmosphere As A Waste Processor
GAW GLOBAL TOTAL COLUMN OZONE NETWORK: 2001-2004
Stations Submitting Data

The symbols represent different instrument types.

Compliments of WOUDC, MSC, Toronto {Ed Hare Manager}. 
Central Calibration Laboratories
{Hosts of WMO World Reference Standards}

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<td>CO₂, CH₄, N₂O, CO</td>
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<td>Total Ozone</td>
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<td>MSC, Canada Brewer</td>
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<td>NIST USA</td>
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<td>Aerosol Optical Depth</td>
<td>WORCC, Davos, CH</td>
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World or Regional Calibration Centres

{Linking Observations to World Reference Standards and Ensuring Network Comparability}

- **Total Ozone**
  - 6 Regional Dobson Centres
  - 1 Regional EU Brewer Centre
  - 1 Brewer travelling standard
- **Ozone Sondes**
  - FZ-Julich, Germany
- **In Situ O₃, CO, CH₄**
  - EMPA, Switzerland
- **CO₂, CH₄, N₂O**
  - NOAA CMDL USA
- **N₂O, VOC**
  - IMK-IFU Garmisch Germany
- **Aerosol Optical Depth**
  - WORCC, Davos, CH
- **Aerosol physical**
  - IFT, Leipzig, Germany
- **Precip. Chemistry**
  - SUNY Albany USA
**Integrated Global Atmospheric Chemistry Observation (IGACO) System**

**Objectives:**
1. To ensure accurate, comprehensive global observations of key atmospheric gases and aerosols;
2. To establish a system for integrating ground-based, in situ and satellite observations using atmospheric models;
3. To make the integrated observations accessible to users.

**An international process:**
Panel of 19 experts from 12 countries and independent reviewers from 7 countries.

**Observations**
Satellite

**IGACO System**

**The Data Stream**
- Quality Assurance & Cal/Val
- Integrated Data Archives
- Assimilation of Real-time Data

**Products & Uses**
- Global Temporal & Spatial Distribution
- Uses
  1. Global Change Detection & Trends
  2. Environment Assessment
  3. Pollution Emissions & Pathways
  4. Improved Forecasts
  5. Research

**Links to:**
Space agencies, WCRP, GCOS, IGBP, IGOS themes

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A Hierarchy Of Conventions, Strategies, Systems, Programmes, Networks, Related To **Systematic** Atmospheric Chemistry Observations

IDEALLY:
The width of the triangle represents the level of resources applied

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**WMO/GAW & PARTNERS**

e.g. EMEP, AERONET, NDSC, SHADOZ
GROUP ON EARTH OBSERVATIONS (GEO)

- 58 Countries and EC
- 43 International Organizations
- Plenary
- Executive Committee
- Secretariat
- 4 Standing Committees
GEOSS

Earth System Models
- Oceans
- Cryosphere
- Land
- Atmosphere
- Solid Earth
- Biosphere

Predictions and Analysis
High Performance Computing;
Communication Visualization

Other Data Sources
Socio-economic data

Earth Observation Systems
- In situ
- Airborne
- Space-based

Assimilation

Decision Support
- Assessment
- Decision Support Systems

Policy Decisions

Management Decisions

Ongoing feedback to optimize value, reduce gaps, and account for human activity
Policy drivers for EU Environment

- Global Earth Observation System of Systems (GEOSS):
  - 9 societal benefit areas

- Climate Change:
  - Post-Kyoto Strategy (>2012): scenarios, mitigation and adaptation strategies, scientific knowledge

- Sustainable Development/Johannesburg process:
  - Sustainability impact assessment, integration of SD into management of land use and natural resources, modelling, externalities and thresholds

- Environmental technologies: Technology platforms

- Ecosystems and biodiversity:
  - Millennium Ecosystem Assessment

- Environmental EU Policies: Water, Soil, Marine Pollution, Urban Environment, Civil Protection, Habitats
The goals of the GEO initiative are highly relevant to EU policies in the areas of environment, sustainable development, research, external relations, which call for a strong European knowledge-based economy.

Therefore Europe strongly supports the implementation of GEOSS through:

- EU research activities (Environment, ICT, Space Programmes) supporting in FP6 and even more in FP7 the implementation of GEOSS in the different societal benefit areas;
  - Several running FP6 projects already address GEO;
  - 4th FP6 call on Environment RTD explicitly asking for contributions to GEOSS in several topics closes on 3 Nov. 2005;
  - Financial contribution for the operation of the GEO Secretariat;
  - FP7 will address contributions to GEOSS Implementation;
Contributions of Europe to GEOSS implementation (2)

- The ‘Global Monitoring for Environment and Security’ (GMES) initiative, developing user-driven, operational, environmental monitoring services based on integrated EO data;
  -> *The observation component of GMES will constitute a major European contribution to GEOSS*

- The 'INfrastructure for SPatial InfoRmation in Europe' (INSPIRE) initiative, aiming to make relevant, harmonised and quality geographic information available;
  -> *INSPIRE will be a major European contribution to the GEOSS data management system*

- Data and information products from many regional and national European Earth observation networks (e.g. *in situ* and remote sensing observation networks by NMHSS)
Memorandum of Understanding between EC and WMO

- Signed by former EC Research Comm. Busquin and by former WMO SecGen Obasi on 18 December 2003;

- Specifies areas of common interest and cooperation as well as priorities for action;

- Areas of cooperation include R+D, Policy development, Earth Observation, Global Change, Stratospheric ozone depletion, Supporting international conventions, Natural Hazards, Transport, Water resources, Urban environment, Air and water quality, Environment and health, Sustainable ecosystem management, Drought and desertification, Capacity building, Technology transfer, Education and training, Transfer of staff;

- Meeting of WMO SecGen Jarraud with EC Research Comm. Potocnik and Development Comm. Michel on 19 July 2005 in Brussels to discuss enhancing and strengthening of cooperation;
10 CHALLENGES TO GAW: 1 of 2

1. Maintaining long term measurements of quality in the current network
2. Establishing long term measurements of quality to improve global coverage, particularly in countries that are developing or in transition.
3. Developing collaboration between NHMSs and the chemical measurement community in some countries
4. Calibration, quality assurance and standard operating procedures: costly and not high profile but essential
5. Working with contributing partners that have networks as substantive as GAW to build a global network.
6. Developing World Data Centres that are comprehensive global repositories for high quality global observations of targeted GAW species.

7. Development of GAWSIS so that the GAW global network is accurately known.

8. Building a global aerosol monitoring network and integrated data analysis system in partnership with other organizations including satellite agencies.

9. Implementing with partners a Integrated Global Atmospheric Chemistry Observations (IGACO)

10. Continue to build air quality management capacity in countries with mega-city air pollution problems.
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Monitoring Themes

- Stratospheric Ozone
- Tropospheric Ozone
- UV Radiation
- Greenhouse Gases (CO₂, CH₄, N₂O)
- Synthetic Greenhouse Gases (CFCs, SF6 etc)
- Aerosols (optical, chemical, physical)
- Reactive Gases (CO, VOC, NOₓ, SO₂)
- Precipitation Chemistry
- (Natural Radionuclides, Rn²²², Be⁷, ¹⁴CO)
Objective for the GAW Aerosol Programme

To determine the spatio-temporal distribution of aerosol properties related to climate forcing and air quality up to multidecadal time scales
Aerosol recommended by the SAG Aerosol
(in bold: core parameters)

• Continuously:
  - Multiwavelength optical depth
  - Mass in two size fractions
  - Major chemical components in two size fractions
  - Light absorption coefficient
  - Light scattering coefficient at various wavelengths
  - Scattering and hemispheric backscattering coefficient
  - Aerosol number concentration
  - Cloud condensation nuclei at 0.5% supersaturation
  - Diffuse, global and direct solar radiation

• Intermittently:
  - Aerosol size distribution
  - Detailed size fractionated chemical composition
  - Dependence on relative humidity
  - CCN spectra (various supersaturations)
  - Vertical distribution of aerosol properties
The guidelines for aerosol measurements (WMO/GAW Report No. 153 (2003) can be downloaded from the WMO website at

http://netra1.wmo.ch/web/arep/gaw/publications.html