Global Atmosphere Watch Programme: a framework for global atmospheric composition observations and analysis

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www.wmo.int/gaw

The rationale for Global Atmosphere Watch

- to understand the complex mechanisms with respect to natural and anthropogenic atmospheric change;
- improve the understanding of interactions between the atmosphere, ocean and biosphere;
- provide **reliable** scientific data and information for national and international policy makers.

GAW Strategy in achieving the goals in presented in the GAW Strategic Plan : 2008-2015 and its Addendum

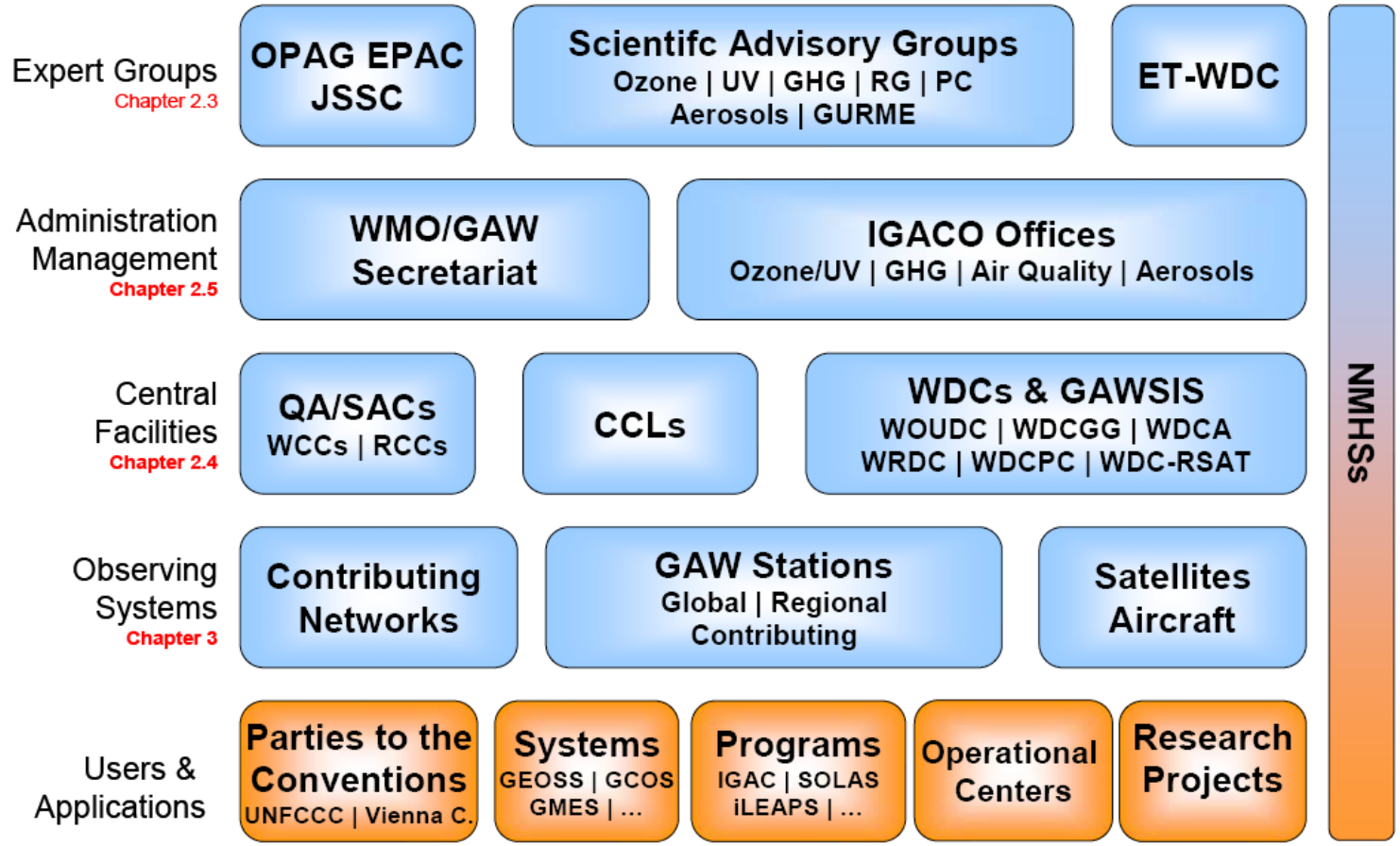
What is GAW?

- WMO/GAW was established 1989 by merging GO_3OS and BAPMoN.
- GAW focuses on global networks for **GHGs, ozone, UV, aerosols, selected reactive gases, and precipitation chemistry**.
- GAW is a partnership involving contributors from 80 countries.
- GAW is coordinated by the Research Department of WMO under the purview of WMO Commission for Atmospheric Science (CAS)

GAW focal areas

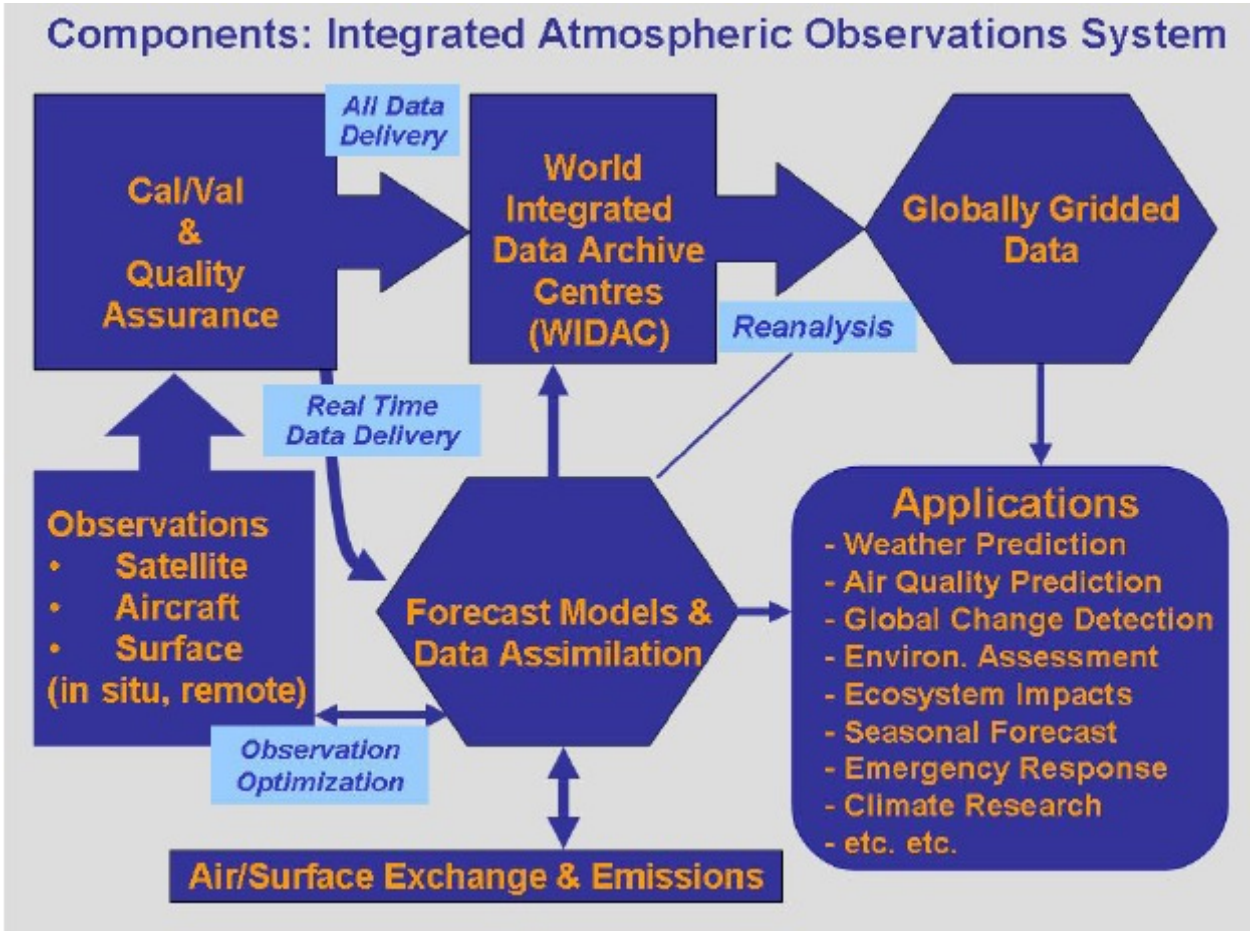
- Stratospheric Ozone
- Greenhouse Gases (*CO_2 and its isotopes , CH_4 and its isotopes, N_2O, SF_6, CFCs*)
- Reactive Gases (*O_3, CO, VOC, NO_x, SO_2*)
- Precipitation Chemistry
- Aerosols (*chemical and physical properties, AOD*)
- UV Radiation
- (Natural radionuclides, Rn^{222}, Be^{7}, ^{14}CO)
- The GAW Urban Research Meteorology and Environment (GURME) programme

How does GAW work?



GAW approaches

- Global
- End-to-end (from observations to products)
- Integrated 3D observations



Observations

Surface-based *in situ* and remote sensing observations are the backbone of the GAW network, which consists of Global and Regional stations and stations working within contributing networks.

•Currently GAW coordinates activities and data from 28 Global stations, 400 Regional stations, and 100 Contributing stations (http://gaw.empa.ch/gawsis/)

GAW affiliated networks (in GAWSIS)

•AERONET, AGAGE/SOGE/NIES, BSRN, CAPMoN, EANET, EMEP, GALION, NADP, NDACC, NOAA-ESRL, RAMCES, SHADOZ, TCCON

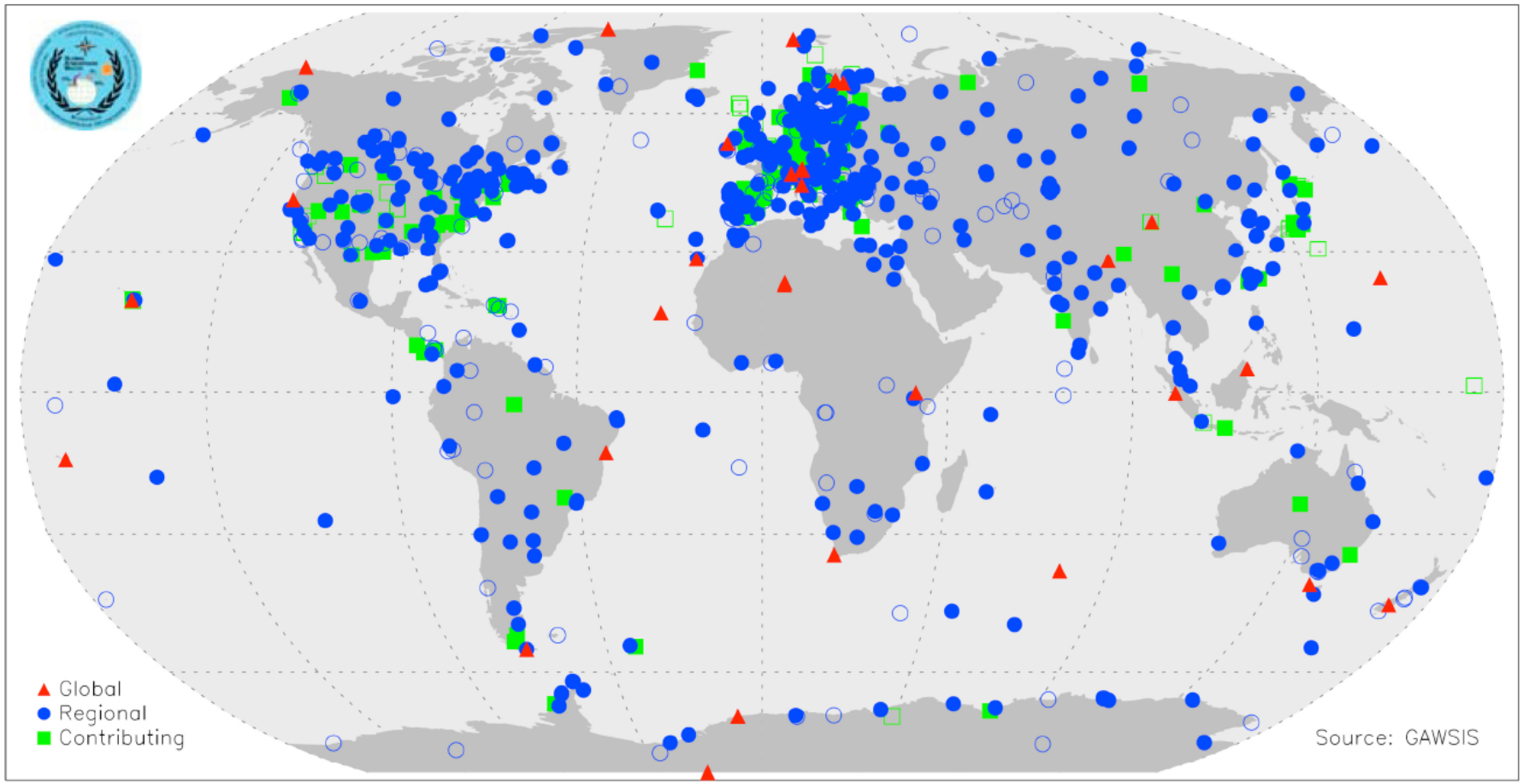
GAW Station Information System

GAWSIS Online - comprehensive information on all GAW stations

- *Database*
- *Search / Update*
- *Inventory / Audit*

(Supported by Switzerland)

GAW stations network



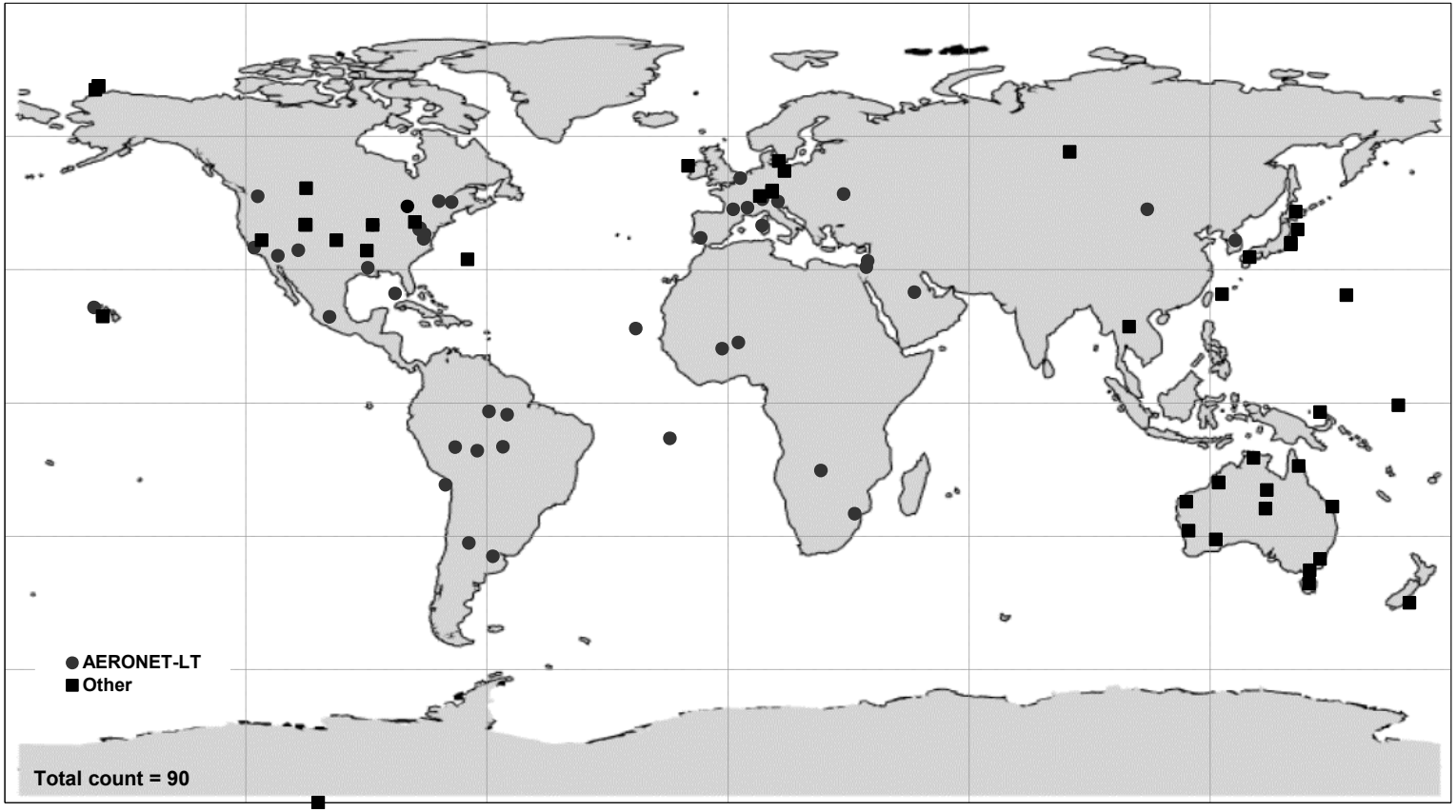
GAW thematic observations (subsets of the global network)


GAW
Neumayer
Novolazarevskaya
Scotia Sea
Ushuaia
Marambio
Syowa
Queen Maud Land
Drake Passage
Halley
Weddell Sea
Enderby Land
Vernadsky
Belgrano
Punta Arenas
Mac. Robertson Land
Palmer Land
Ronne Ice Shelf
Amery Ice Shelf
Davis and Zhong Shan
Rothera and San Martin
South Pole
Ellsworth
Vinson Massif
(highest point in Antarctica, 4897 m)
Vostok
90 W
90 E
Peter I Island
Land
Mirny
Bentley Subglacial Trench
(lowest point in Antarctica, -2540 m)
Shackleton Ice Shelf
Indian Ocean
South Pacific Ocean
Marie Byrd Land
Dôme C
Ross Ice Shelf
Amundsen Sea
McMurdo and Arrival Heights
Ross Sea
average minimum extent of sea ice
Victoria Land
Dumont d'Urville
Scott Island
Antarctic Circle
BALLENY ISLANDS
Antarctic Convergence
TOTAL OZONE

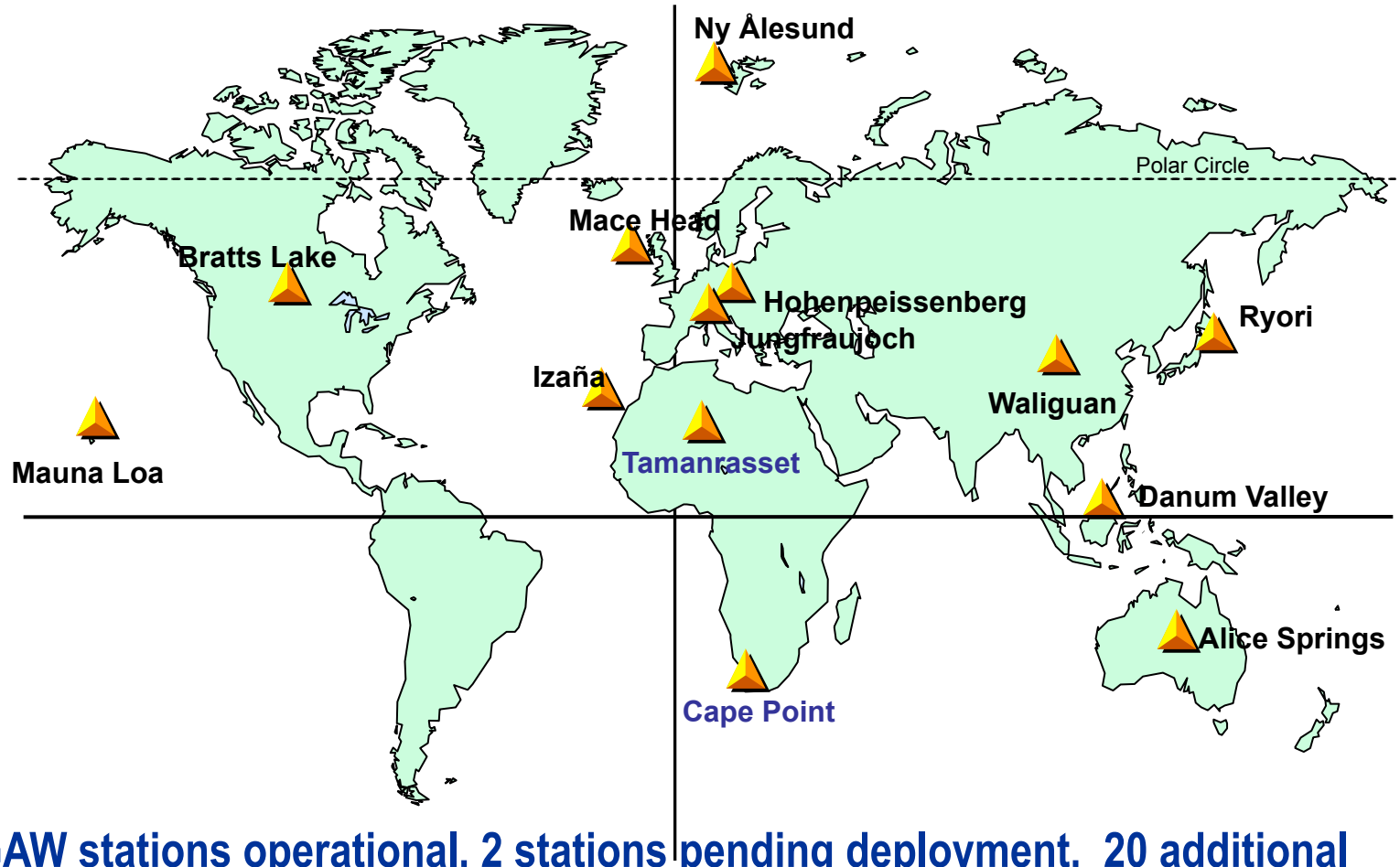
Global AOD observations

Global AOD Network Long-term Sites

4+ years in operation, >50% coverage, as of March 2004

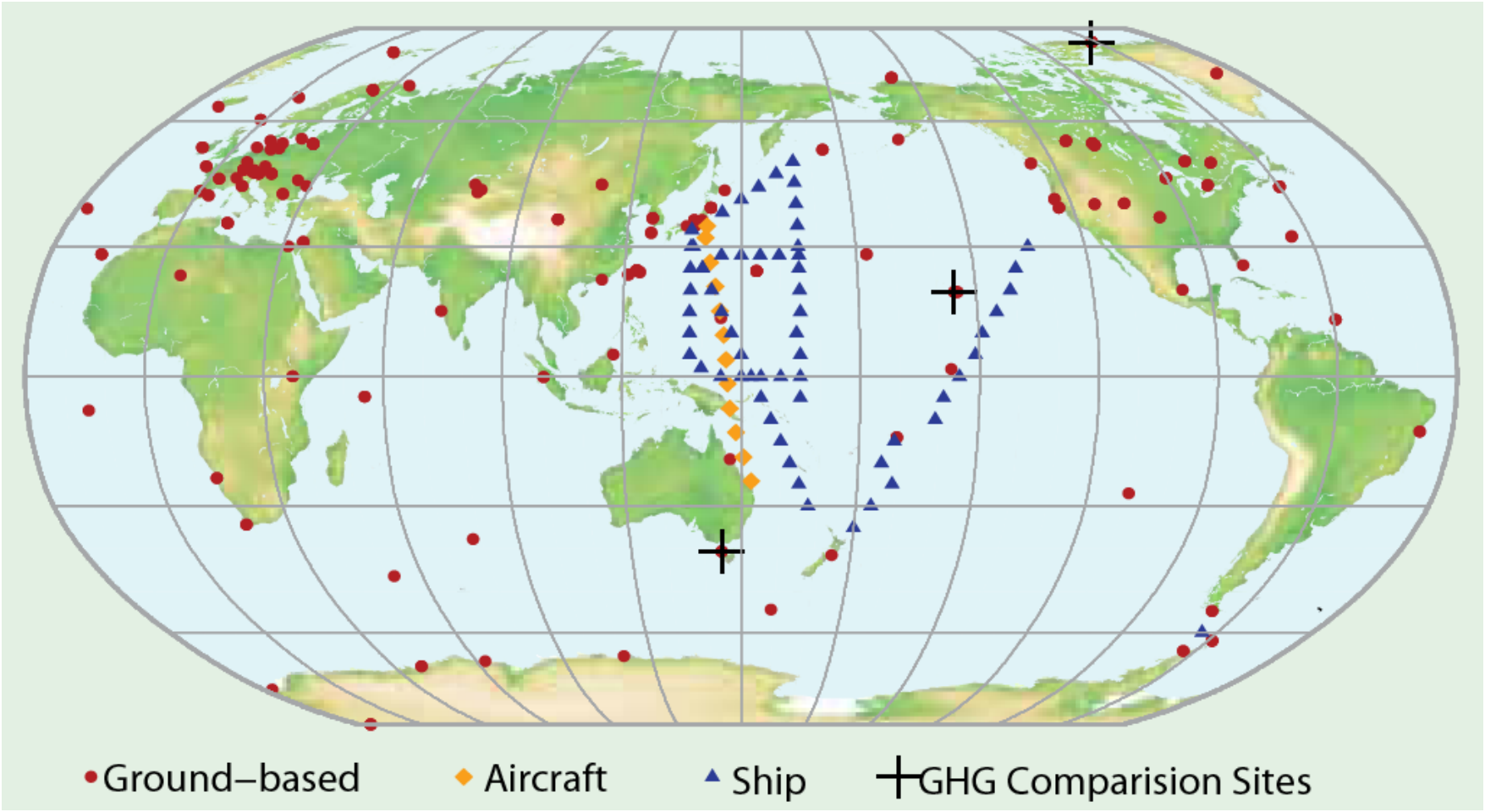


Global AOD Reference Network: GAWPFR



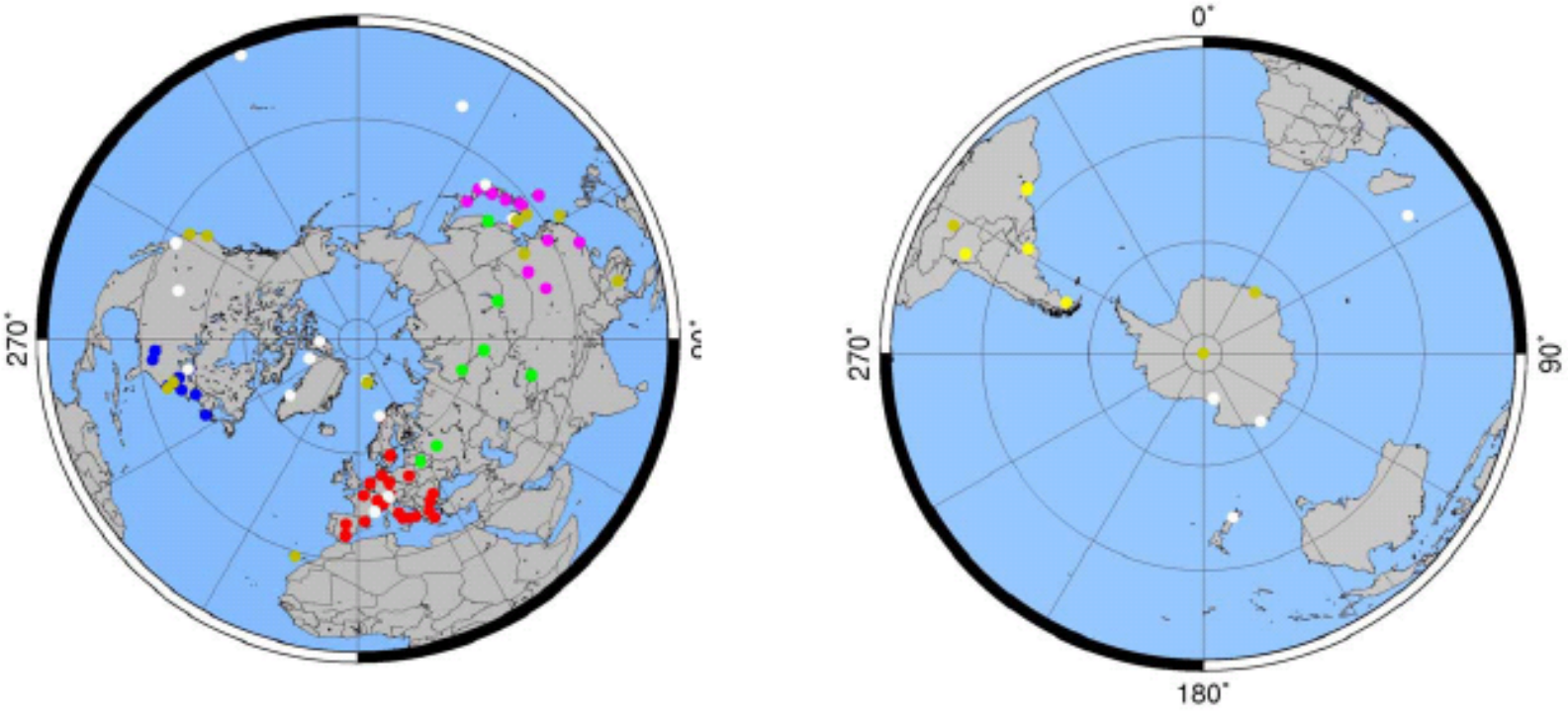
11 GAW stations operational, 2 stations pending deployment, 20 additional PFR operated worldwide by National Meteorological Institutes

Greenhouse gas observational network



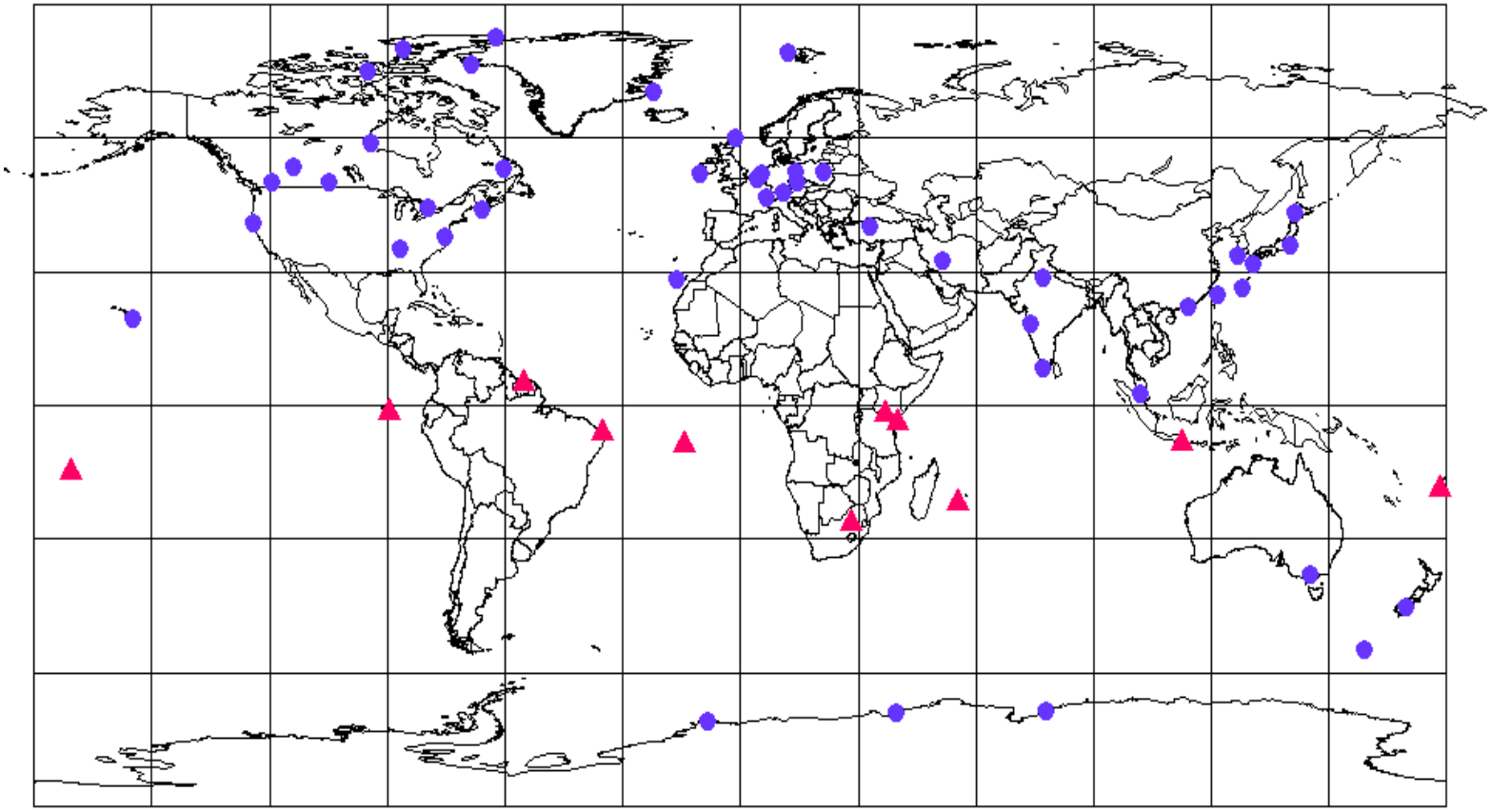
CO_2 and CH_4 observations

GAW Aerosol LIDAR Observing Network GALION

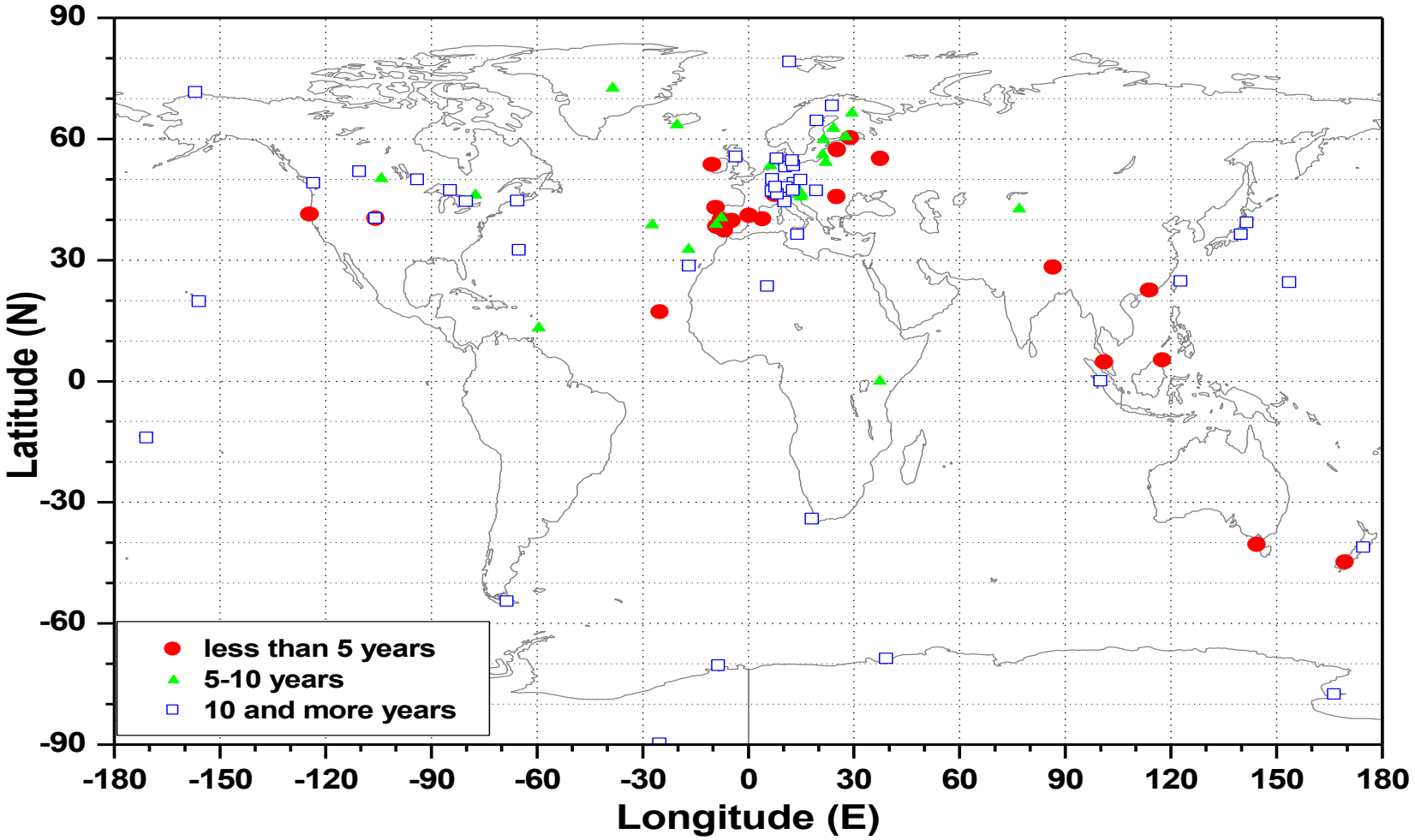


Parameters measured lidar instruments are: backscattering and extinction
2nd GALION workshop (20-23 September 2010 in Geneva) addressed QA/AC and SOPs for all type of instruments operated in the networks

Ozone vertical profiles observations in GAW



Surface ozone observations in GAW

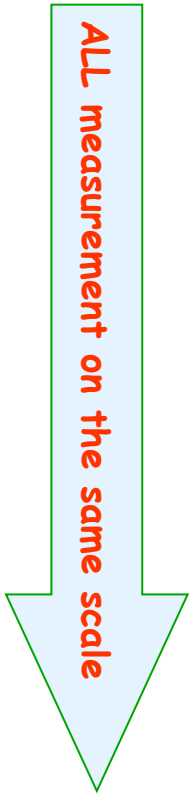


An Observational Network with Global Coverage

GAW Surface-Based In Situ (continuous and/or flask) and Routine Commercial Aircraft Observations

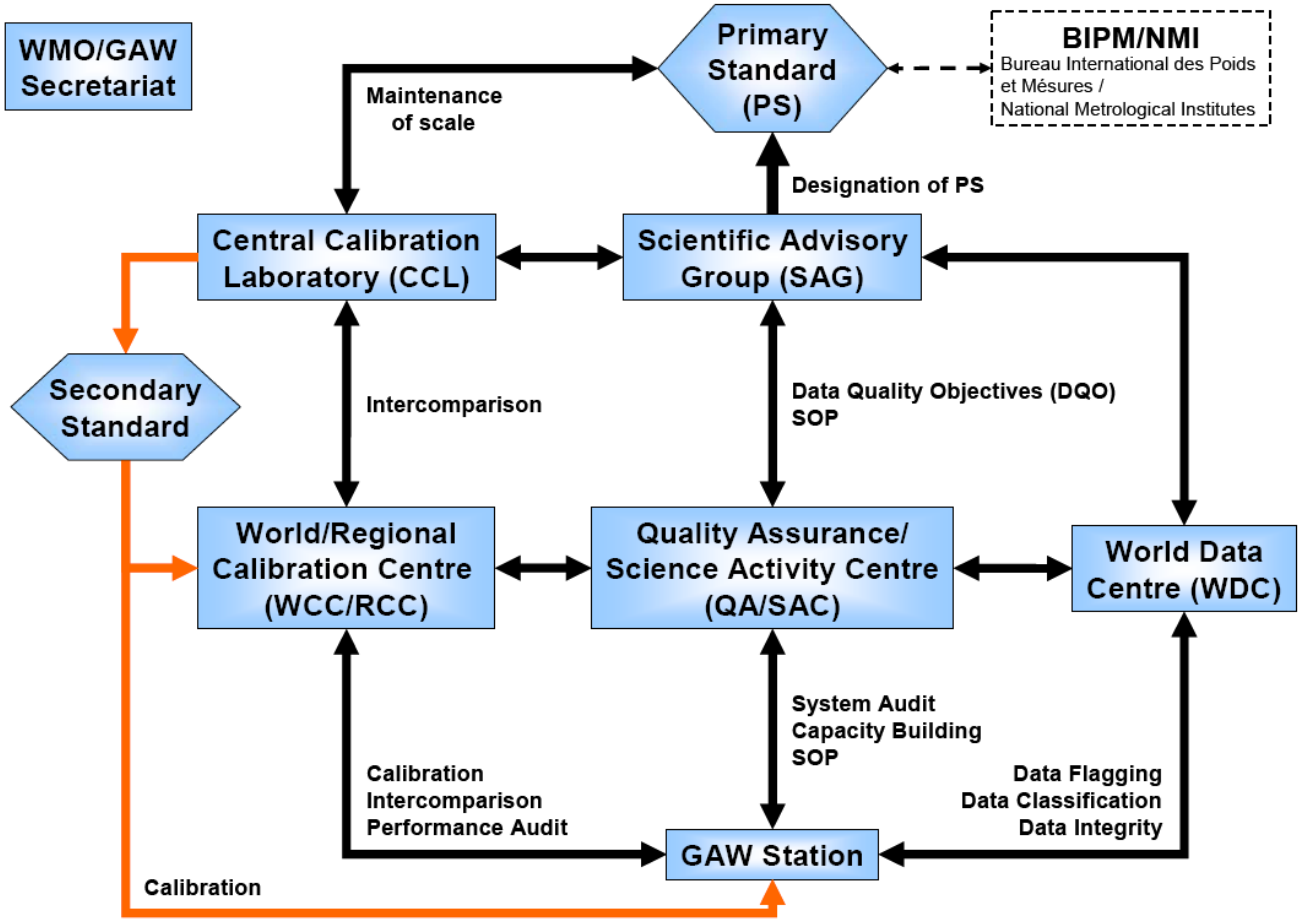
Contributing surface based networks and remote sensing

Contributing Aircraft and Satellite measurements



Integrated observations by means of models
Data products and assessments

GAW Quality Assurance framework



Central Facilities

Five types of central facilities:

- Central Calibration Laboratories (CCLs)
- Quality Assurance/Science Activity Centres (QA/SACs)
- World Calibration Centres (WCCs)
- Regional Calibration Centres (RCCs)
- World Data Centres (WDCs)

GAW World Central Facilities

Variable	QA/SAC	Central Calibration Laboratory (CCL) (Host of Primary Standard)	World Calibration Centre (WCC)	Regional Calibration Centre (RCC)	World Data Centre (WDC)
CO_2	JMA (A/O)	ESRL	ESRL (round robin) Empa (audits)		JMA
carbon isotopes		MPI-BGC			JMA
CH_4	Empa (Am, E/A) JMA (A/O)	ESRL	Empa (Am, E/A) JMA (A/O)		JMA
N_2O	UBA	ESRL	IMK-IFU		JMA
CFCs, HCFCs, HFCs					JMA
SF_6		ESRL			JMA
H_2		MPI-BGC			JMA
Total Ozone	JMA (A/O)	ESRL[1], EC[2]	ESRL[1], EC[2]	BoM[1], ESRL[1], IZO[2] JMA[1], MOHp[1], MGO[3], OCBA[1], SAWS[1], SOO-HK[1]	EC[5], DLR[6]
Ozone Sondes	IEK-8	IEK-8	IEK-8		EC
Surface Ozone	Empa	NIST	Empa	OCBA	JMA
Precipitation Chemistry	NOAA-ARL	ISWS	ISWS		NOAA-ARL
CO	Empa	ESRL	Empa		JMA
VOC	UBA	NPL	IMK-IFU		JMA
SO_2					JMA
NO_x	UBA		IEK-8 (NO)		JMA
Aerosol	UBA (physical properties)		IfT (physical properties)		NILU[5], DLR[6]
Optical Depth		PMOD/WRC[4]	PMOD/WRC		NILU
UV Radiation				ESRL (Am), EUVC/PMOD (E)	EC
Solar Radiation		PMOD/WRC	PMOD/WRC		MGO

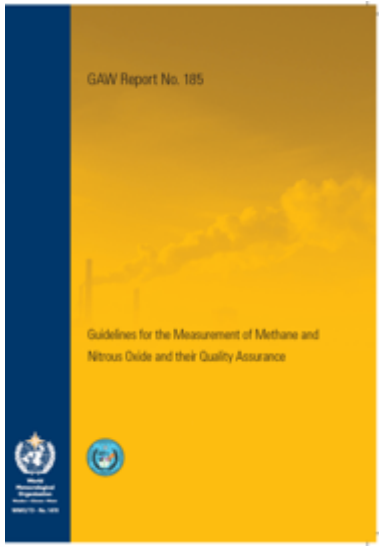
[1]Dobson, [2]Brewer, [3]Filter instruments, [4]Precision Filter Radiometers (PFR), [5]ground-based, [6]satellite-based

World Data Centers

- Ozone and UV http://www.woudc.org/
- Solar Radiation http://wrdc.mgo.rssi.ru/
- Greenhouse Gases http://ds.data.jma.go.jp/gmd/wdcgg/
- Aerosols http://www.gaw-wdca.org/
- Precipitation chemistry (not operational)
- The World Data Center for Remote Sensing of the Atmosphere http://wdc.dlr.de/about/

Capacity building and outreach within GAW

- Stations twinning
- Training
- Expert meetings



- GAW web page
- Technical publications and Bulletins

Training

The GAW Training and Education Centre, GAWTEC, hosted by Germany, gives two two-week courses annually for station personnel. In the 22 courses held since 2001, about 250 station operators were trained on atmospheric chemical and related physical observations.

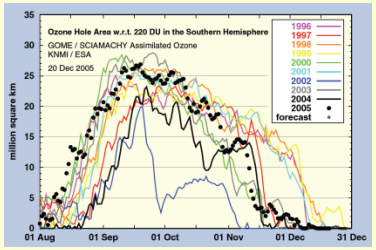
18 October 2011 was official celebration of 10th Anniversary of GAWTEC

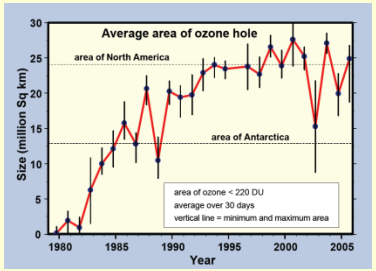
www.gawtec.de

WMO Antarctic Ozone Bulletins

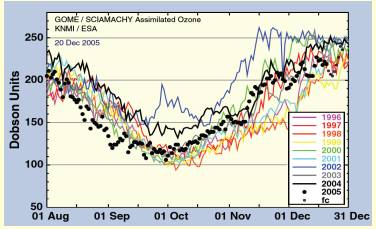
Every Two Weeks Aug to Nov + Summary in Dec/Jan

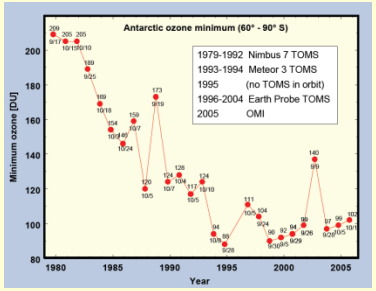
Ozone hole area



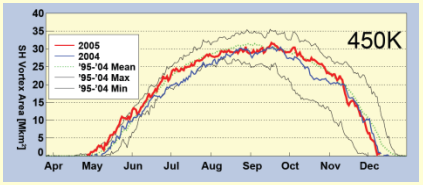


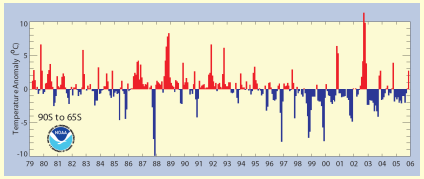
Minimum ozone



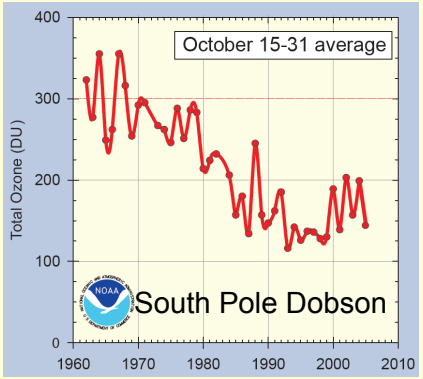


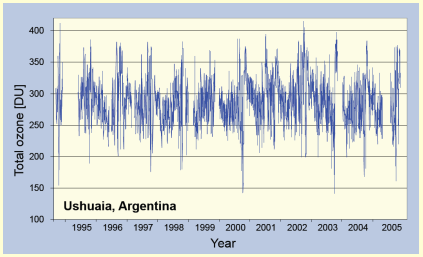
Meteorology



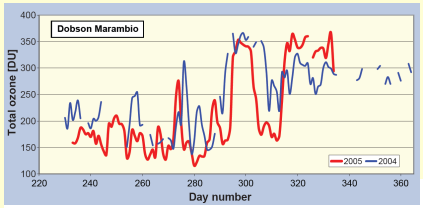


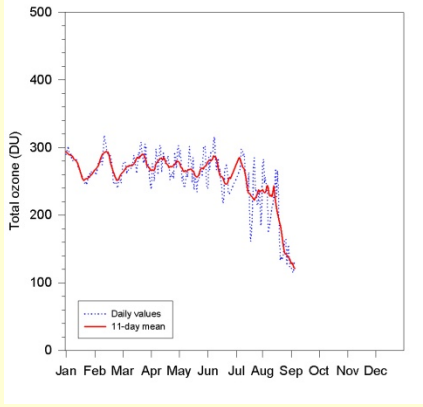
Station climatology



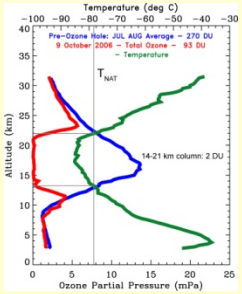


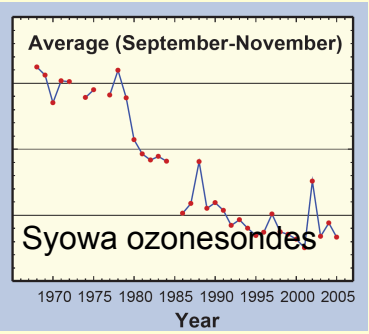
NRT Station data



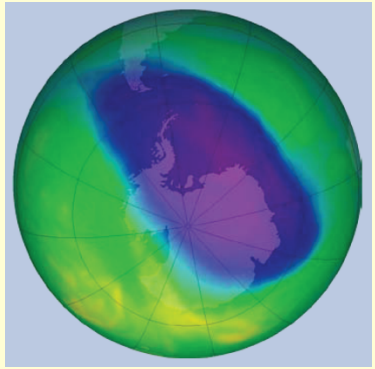


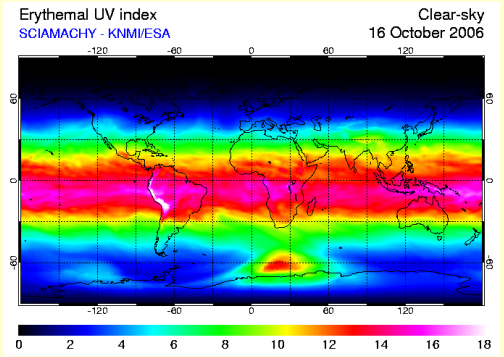
Sonde data





Satellite data + model data





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

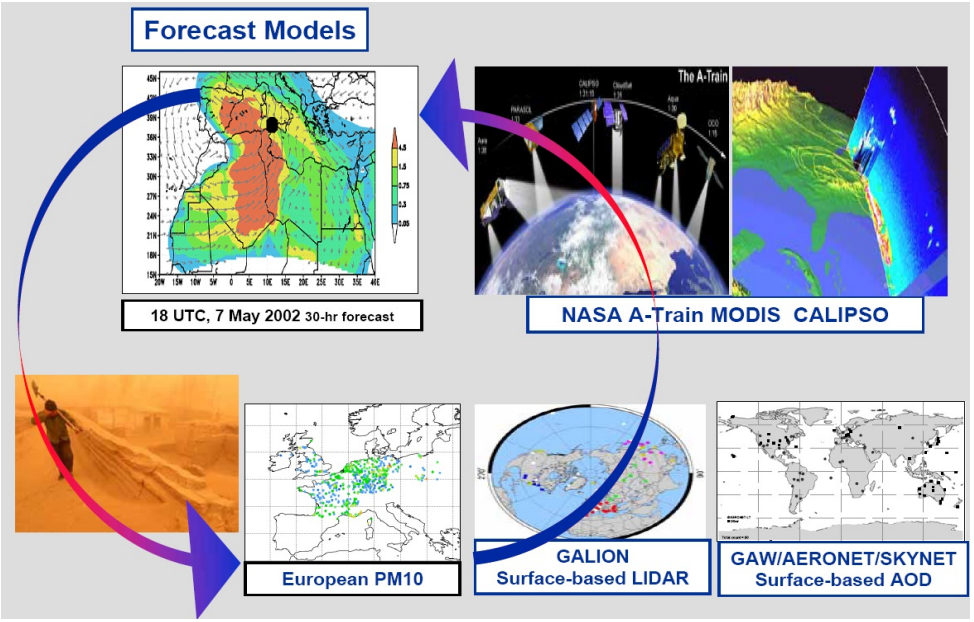
GAW

A Global Consortium Helping Society Reduce Risk Through Research, Assessments and Forecasts

IMPACTS: Human Health, Agriculture, Marine productivity, Weather and Climate, Aviation

SDS-WAS

- 40 WMO Members interested in the initiative
- ~ 15 institutions running research operational dust model forecasts
- 2 SDS-WAS modes (in China and Spain) established to coordinate regional cooperation



SDS integrates observations, models and delivers products to users

GAW Urban Project

GURME Tasks For The Strategic Planning Period 2008-2015

Observational Needs
- Chemical
- Meteorological

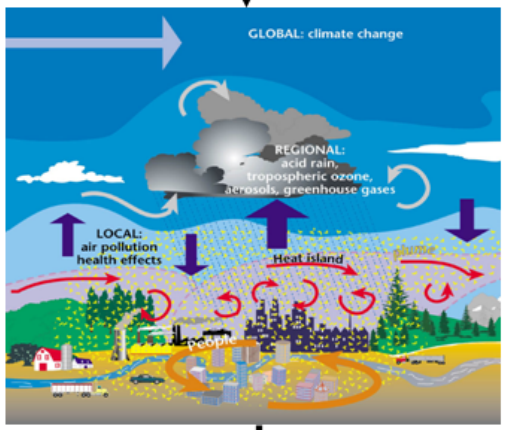
(Tasks: 3,6,17)

Assimilation

Modeling Needs
- Weather prediction
- Chemical weather and air quality prediction

(Tasks: 8,11,13,15)

Demonstration



Coordination

Capacity Building
- Workshops
- Training

(Tasks: 2,4)

Users
- Health
- Agriculture
- Environmental
- Public
- Emergency Response

(Tasks: 9,14,16,18)

Education

Air Quality & Related Products
- Improved Forecasts
- Guidelines
- Pilot Projects

(Tasks: 1,5,7,12)

Dissemination

Example of GURME project: Latin American Cities

Sao Paulo, Brazil

Mexico City, Mexico

Santiago, Chile

Improvement of AQ forecasting in Latin American cities through capacity building

First Air Quality Forecasting Workshop for the Latin American Cities October, 2003, Santiago, Chile;

Workshop on application of WRF/Chem Model and Use of Remote sensing, 2006, Sao Paulo

Training Workshop on AQF for Latin American countries, 2006, Lima

Air Quality Modeling for Latin America, August 2009, Mexico City

NMHSs - Universities - Environmental Agencies

WMO

THANK YOU