

Наблюдения и анализ состава атмосферы в рамках Глобальной Службы Атмосферы ВМО

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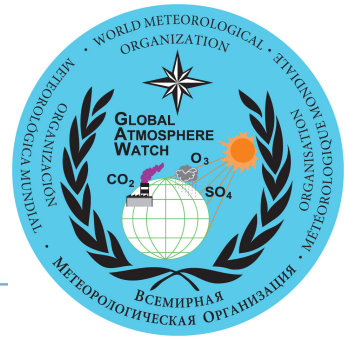
ВМО, Отдел Атмосферных Исследований и Окружающей Среды

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www.wmo.int/gaw



The rationale for Global Atmosphere Watch (GAW) is driven by the need :

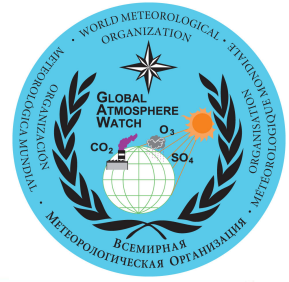


- to understand the complex mechanisms with respect to natural and anthropogenic atmospheric change;
- improve the understanding of interactions between the atmosphere, ocean and biosphere;
- provide **reliable** scientific data and information for national and international policy makers.

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



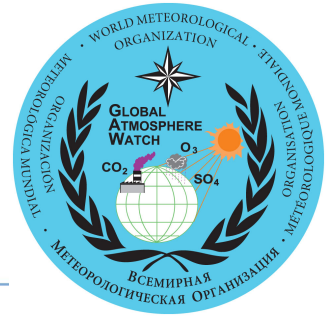
What is GAW?



- WMO/GAW was established 1989 by merging GO₃OS 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)



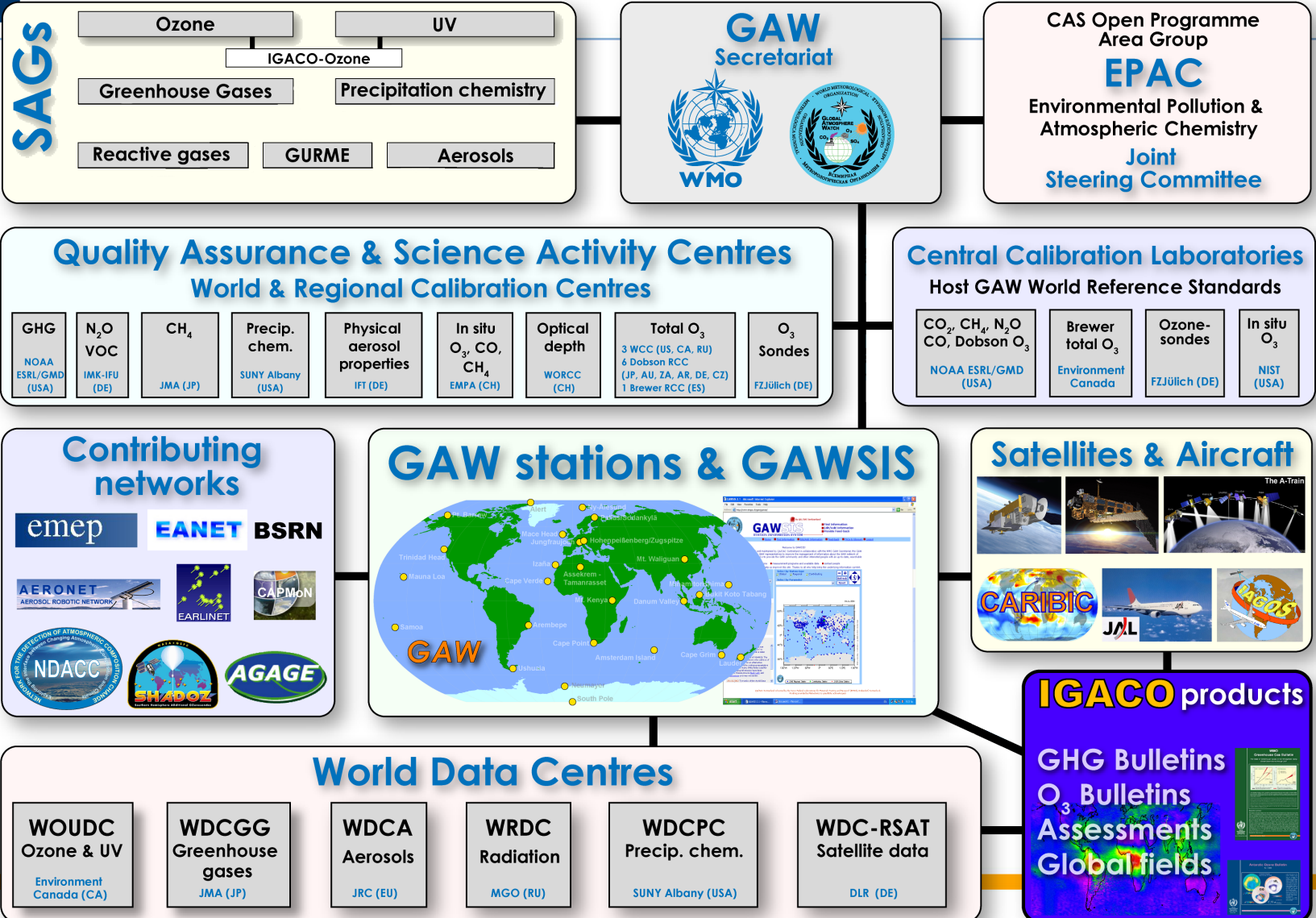
GAW focal areas



- Stratospheric Ozone
- Tropospheric Ozone
- Greenhouse Gases (CO₂, CH₄, N₂O, SF₆, CFCs)
- Reactive Gases (CO, VOC, NO_y, SO₂)
- Precipitation Chemistry
- Aerosols (chemical, physical, AOD)
- UV Radiation
- (Natural Radionuclides, Rn²²², Be⁷, ¹⁴CO)



How does GAW work?



SAGS

- Ozone
 - IGACO-Ozone
- Greenhouse Gases
- Precipitation chemistry
- Reactive gases
- GURME
- Aerosols

GAW Secretariat

WMO | IAGLR

CAS Open Programme Area Group

EPAC

Environmental Pollution & Atmospheric Chemistry

Joint Steering Committee

Quality Assurance & Science Activity Centres
World & Regional Calibration Centres

GHG NOAA ESRL/GMD (USA)	N₂O VOC IMK-IFU (DE)	CH₄ JMA (JP)	Precip. chem. SUNY Albany (USA)	Physical aerosol properties IFT (DE)	In situ O₃, CO, CH₄ EMPA (CH)	Optical depth WORCC (CH)	Total O₃ 3 WCC (US, CA, RU) 6 Dobson RCC (JP, AU, ZA, AR, DE, CZ) 1 Brewer RCC (ES)	O₃ Sondes FZJülich (DE)
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Central Calibration Laboratories
Host GAW World Reference Standards

CO₂, CH₄, N₂O, CO, Dobson O₃ NOAA ESRL/GMD (USA)	Brewer total O₃ Environment Canada	Ozone-sondes FZJülich (DE)	In situ O₃ NIST (USA)
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Contributing networks

emep | EANET | BSRN

AERONET | EARLINET | CAPMoN

NDACC | SHADOZ | AGAGE

GAW stations & GAWSIS

Satellites & Aircraft

CARIBIC | JAL | DLR

World Data Centres

WOUDC Ozone & UV Environment Canada (CA)	WDCGG Greenhouse gases JMA (JP)	WDCA Aerosols JRC (EU)	WRDC Radiation MGO (RU)	WDCPC Precip. chem. SUNY Albany (USA)	WDC-RSAT Satellite data DLR (DE)
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IGACO products

GHG Bulletins

O₃ Bulletins

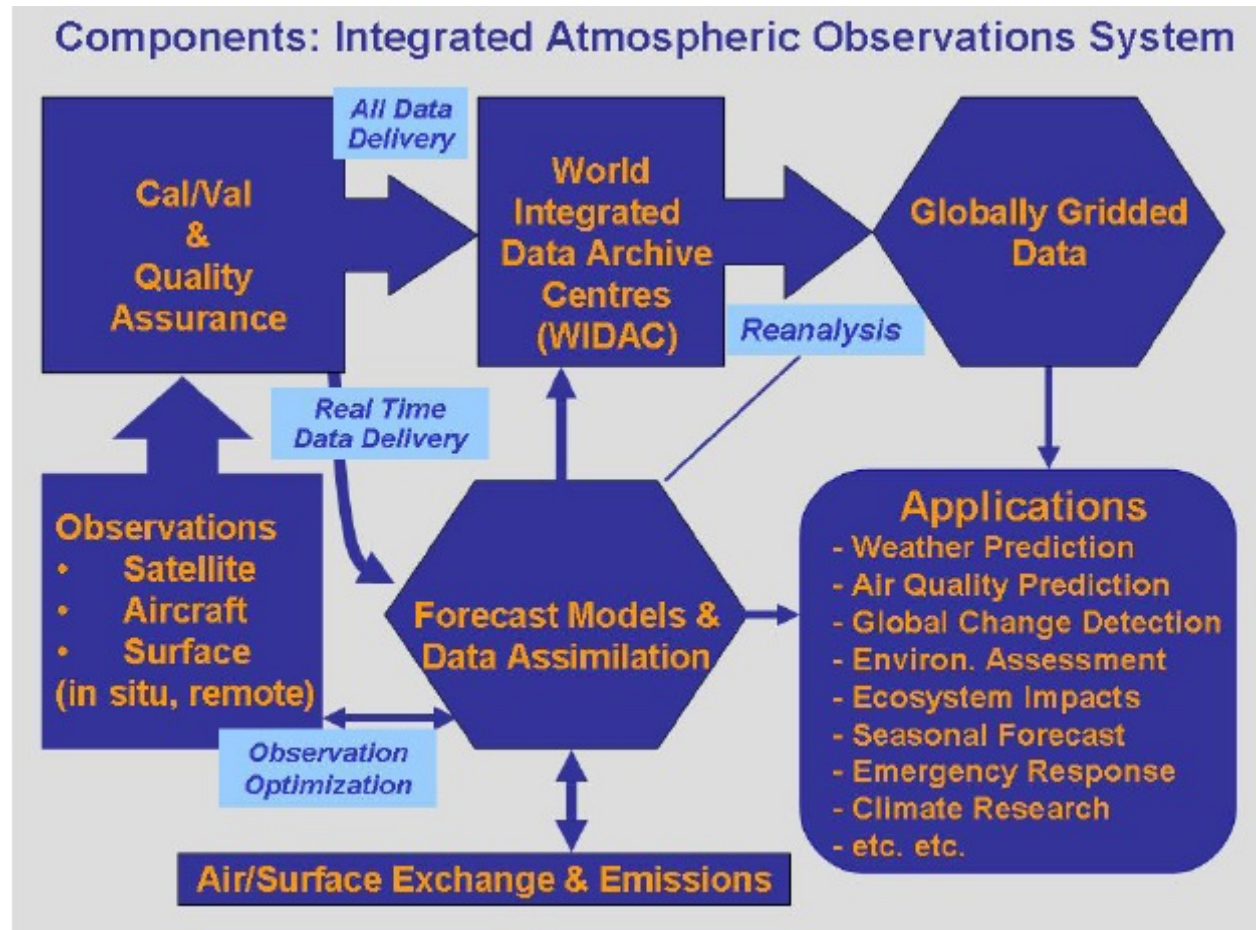
Assessments

Global fields



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, Regional and Contributing** stations.

- 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 GAWSYS)

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



GAW Station Information System

GAW SIS Online - comprehensive information on all GAW stations

- Database
- Search / Update
- Inventory / Audit

(Supported by Switzerland)

Welcome to GAW SIS!

GAW SIS is being developed and maintained by QA/SAC Switzerland in collaboration with the WMO GAW Secretariat, the GAW World Data Centres and other GAW representatives to improve the management of information about the GAW network of ground-based stations. The goal is to provide the GAW community and other interested people with an up-to-date, searchable data base of

- site descriptions
- measurement programs and available data
- contact people

Please provide **feed-back** that may help us improve this site. Thanks to all who help keep the underlying information current.

QuickFind

Station Report:

Contact Information:

GO! Clear

GAW World Data Centres

- [WDCRG \(Gases\)](#)
- [WDCR \(Radiation\)](#)
- [WDCR \(Ozone/UV\)](#)
- [WDCR \(Aerosols/AOD\)](#)
- [WDCR \(Precipitation\)](#)

What's New

29.04.2004 Minor bug fixes and a new feature: Click on 'Find Information' to produce lists of people involved in GAW.

26.12.2004 New Release of GAW SIS. The most obvious improvement is the addition of an interactive map as an alternative navigation tool and to produce presentation graphics. Also, many of the forms used for editing/adding information have been updated. Please provide **feed-back** and **report errors** you may encounter.

28.10.2002 The tasks of the World Data

QA/SAC Switzerland is hosted by the Swiss Federal Laboratories for Materials Testing and Research (EMPA), Dübendorf, Switzerland. Funding provided by MeteoSwiss is gratefully acknowledged.

Station Characteristics 06.04.2004 10:04:29/0

GAW ID Jungfraujoch (Switzerland)

station status full operation

time zone UTC+1

climate zone xx (High Alpine)

description

The high alpine research station Jungfraujoch is situated on a mountain saddle between the two mountains Jungfrau (4158m) and Mönch (4099m). The station is located in the center of Europe and is surrounded by highly industrialized regions. This special geographical situation offers the opportunity to monitor background concentrations but also to investigate the transport of anthropogenic pollutants from the boundary layer to the free troposphere.

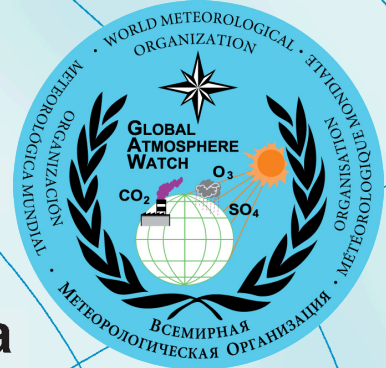
Measurement Program

type	parameter	method	start	end	details
Aerosol	Light absorption coefficient	Aethalometer	01.08.1995		i
	Light scattering coefficient	Nephelometer	01.08.1995		i
	Mass (major inorganic components)	Ion Chromatography (IC) [general]	01.07.1999		i
	Mass (total aerosol)	Filter sampling + gravimetry	1973		i
	Number concentration	Condensation particle counter (CPC)	01.08.1995		i
	Optical depth	Sunphotometry/Filter Radiometry	01.04.1999		i
Greenhouse Gas	CFCs	GC-MS	01.01.2000		i
	HCFCs	GC-MS	01.01.2000		i



GAW Global stations





Scotia Sea

Ushuaia

ARGENTINA

Punta Arenas

90 W

South Pacific Ocean

90 W

60

Drake Passage

Marambio

Vernadsky

Rothera and San Martin

Peter I Island

Halley

Weddell Sea

Palmer Land

Ronne Ice Shelf

Ellsworth

Vinson Massif

(highest point in Antarctica, 4897 m)

Bentley Subglacial Trench

(lowest point in Antarctica, -2540 m)

Amundsen Sea

Marie Byrd Land

Ross Ice Shelf

Ross Sea

average minimum extent of sea ice

Antarctic Circle

Scott Island

BALLENY ISLANDS

Neumayer

Novolazarevskaya

Queen Maud Land

Belgrano

South Pole

Vostok

Dôme C

McMurdo and Arrival Heights

Dumont d'Urville

Enderby Land

Mac.Robertson Land

Amery Ice Shelf

Davis and Zhong Shan

Mirny

Shackleton Ice Shelf

Indian Ocean

McKean Land

Victoria Land

Antarctic Convergence

90 E

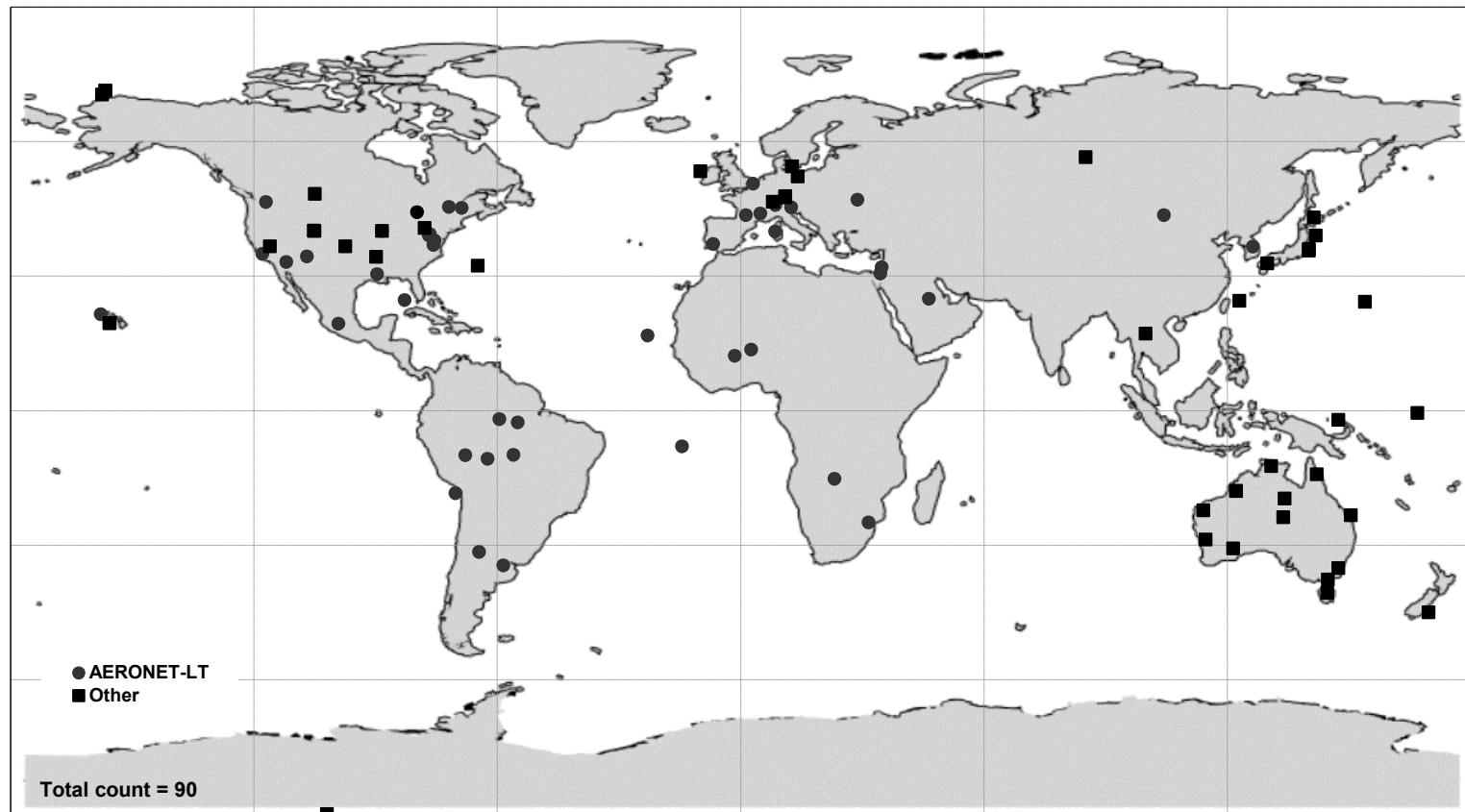
120



Global AOD observations

Global AOD Network Long-term Sites

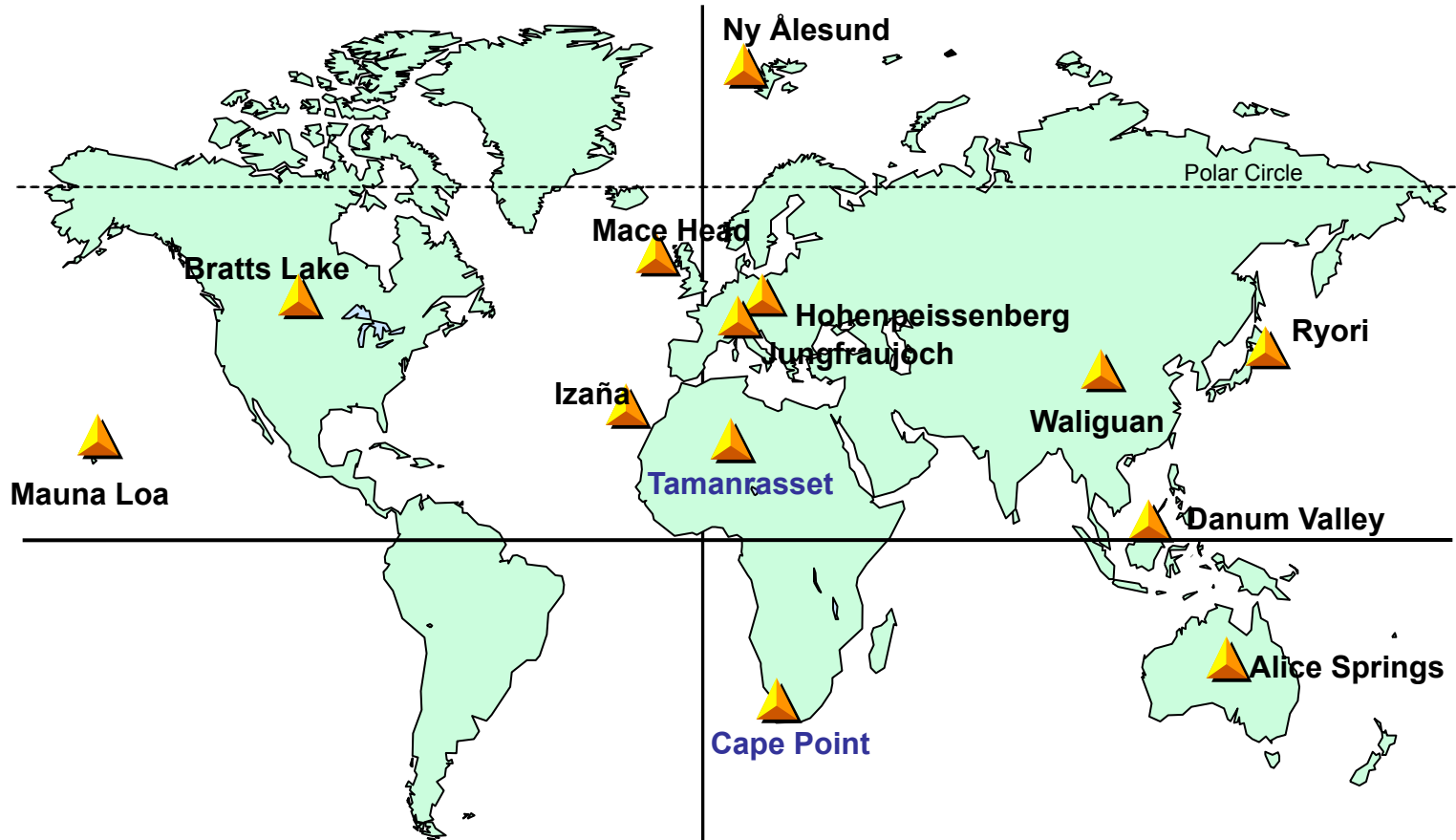
4+ years in operation, >50% coverage, as of March 2004





Global AOD Reference Network

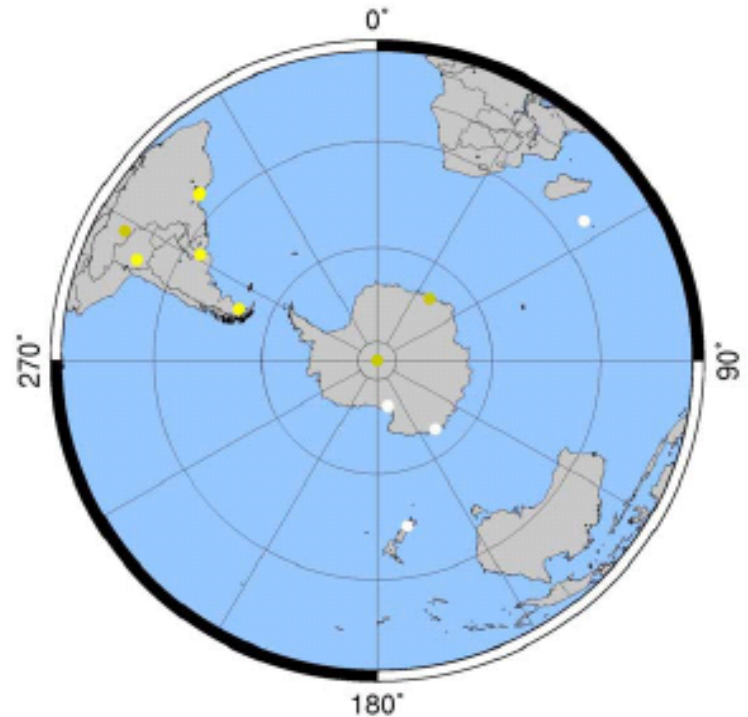
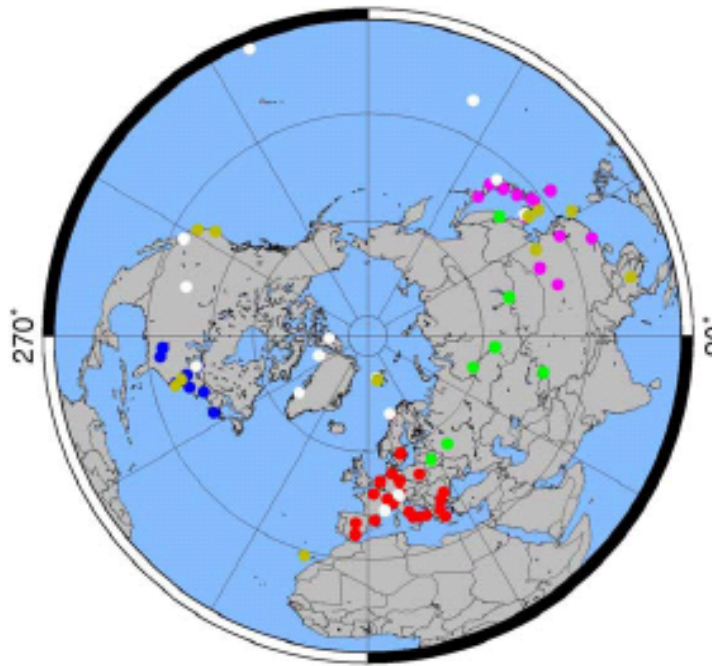
GAWPFR DAVOS WORCC



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



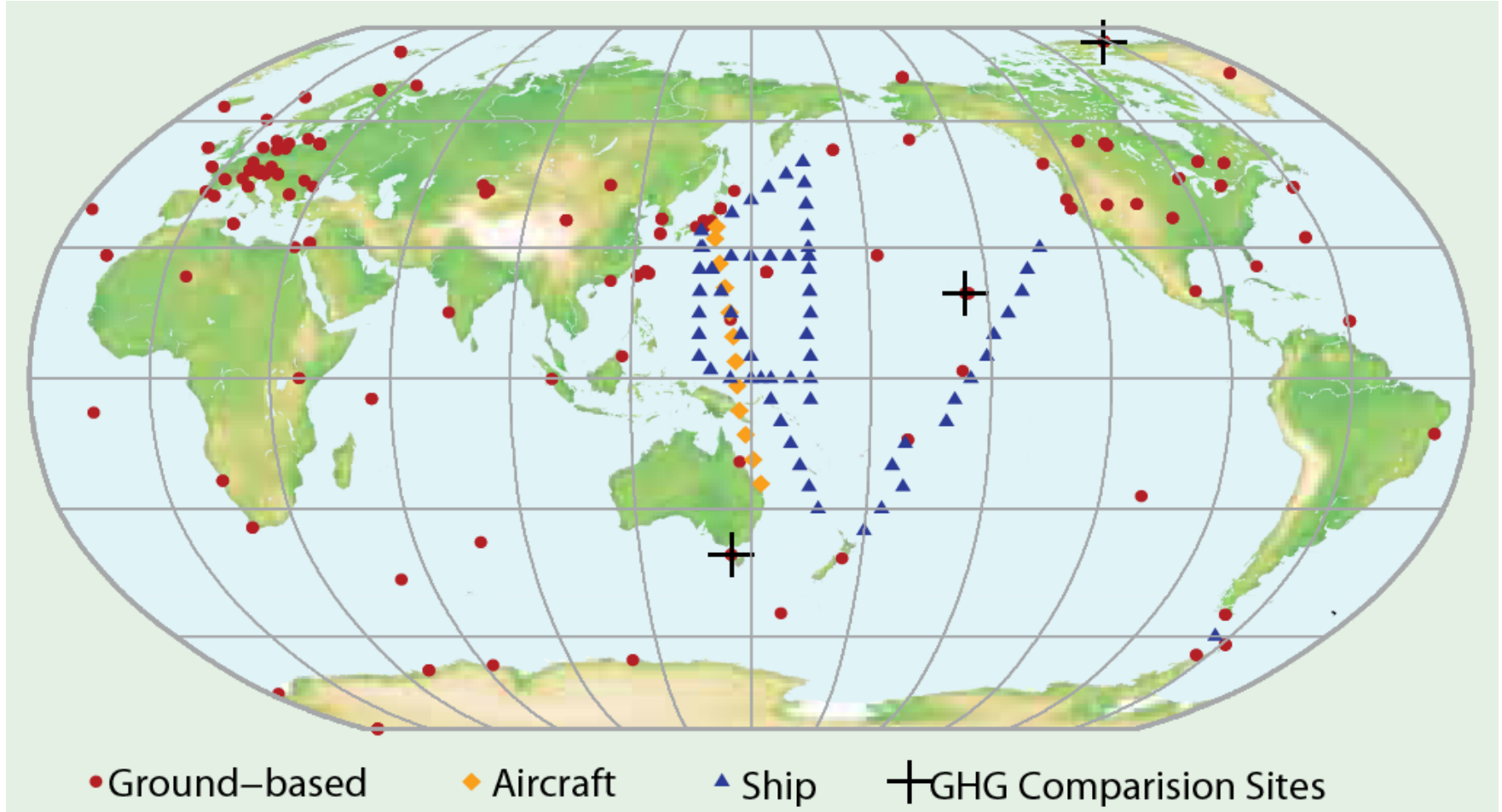
GAW Aerosol LIDAR Observing Network GALION



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

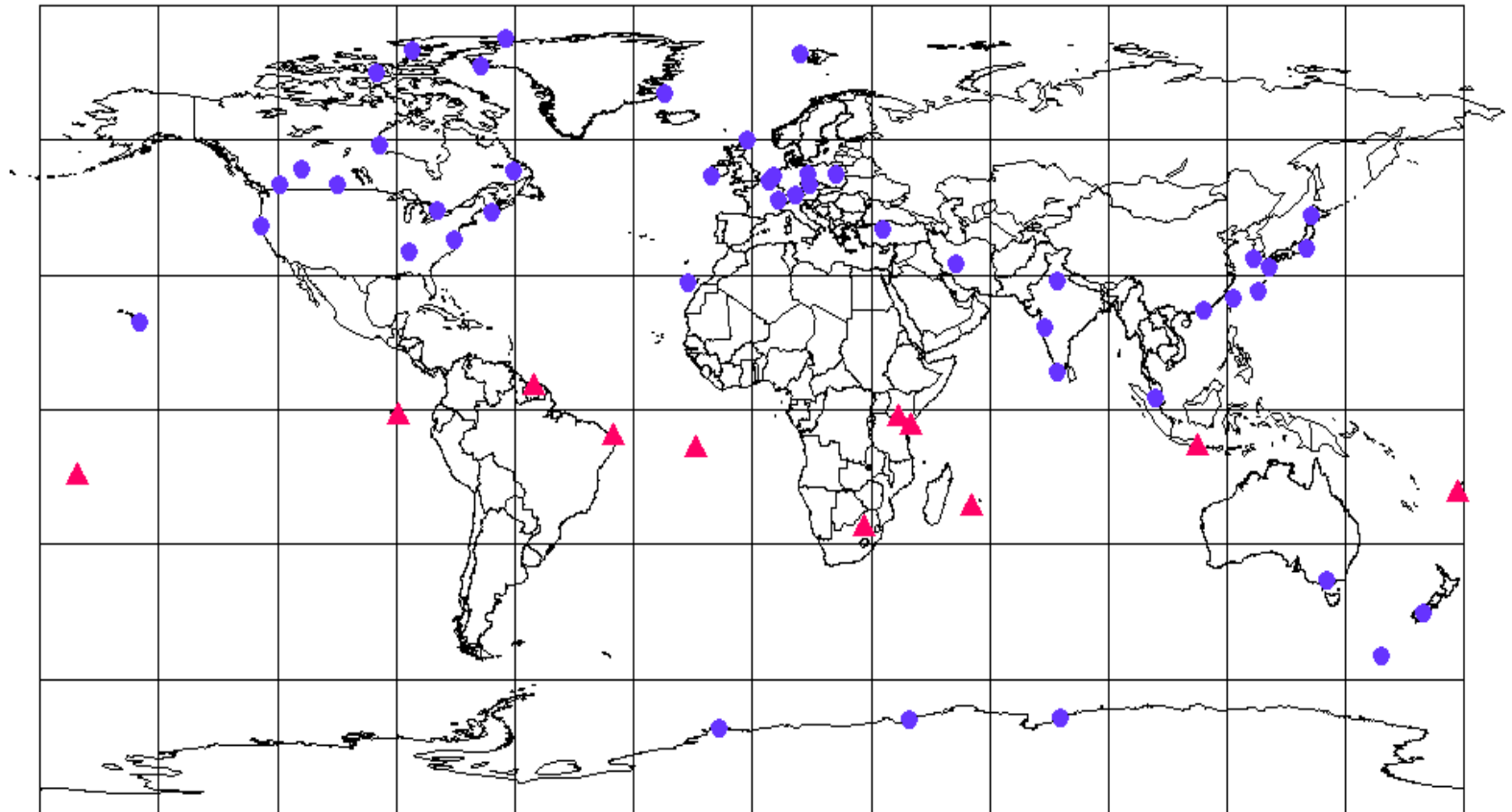


Greenhouse gas observational network (CO₂ and CH₄)





Ozone vertical profiles observations in GAW

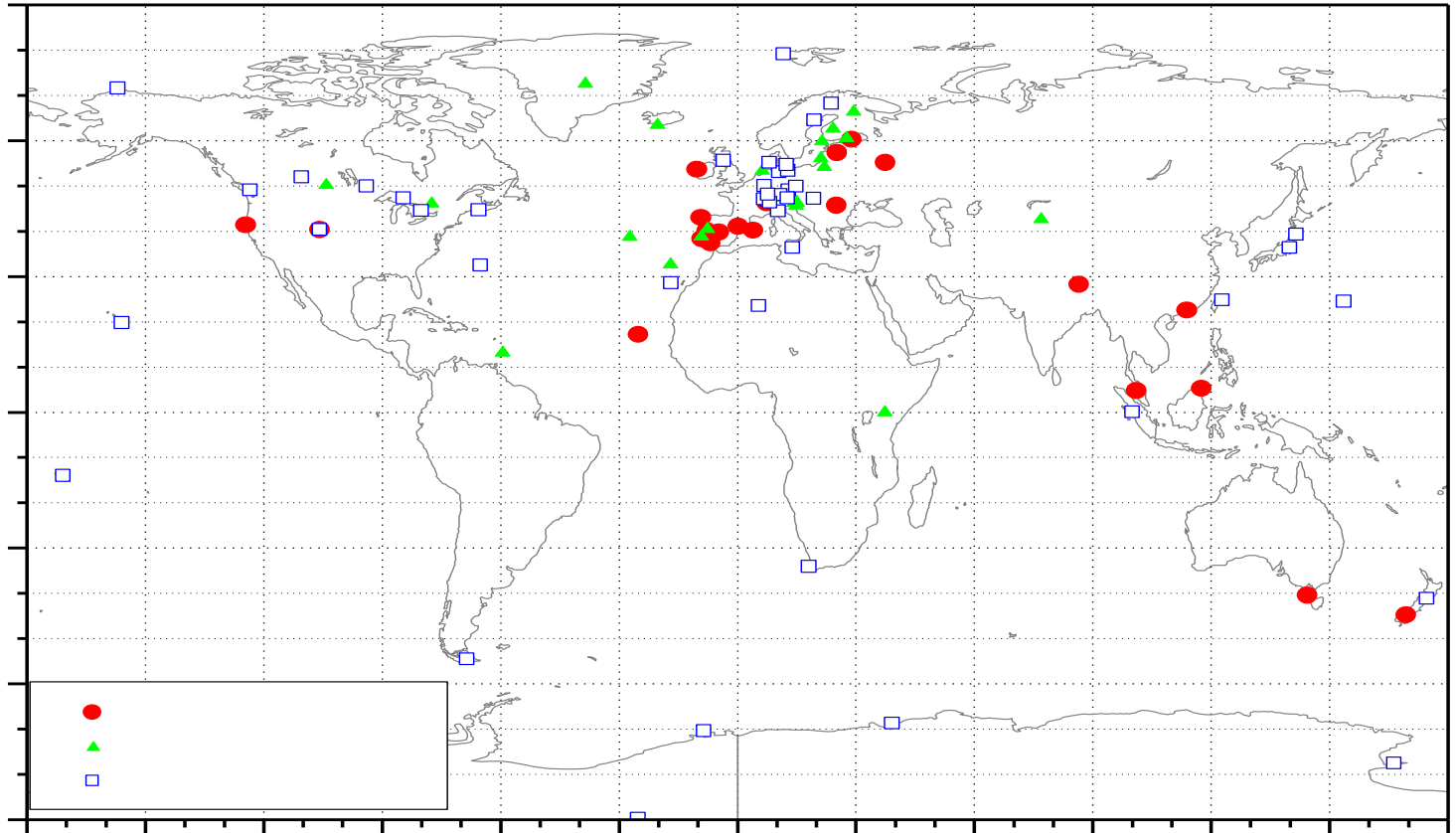


● Network Sites

▲ SHADOZ Sites



Surface ozone observations in GAW





Quality Assurance



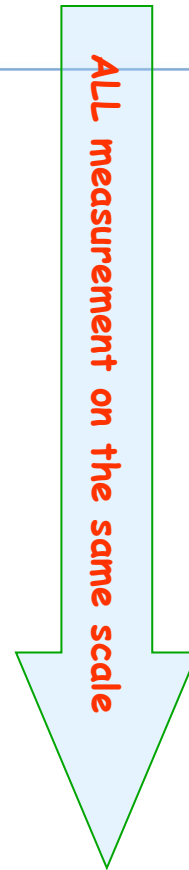
An Observational Network with Global Coverage



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

**Contributing surface based networks
and remote sensing**

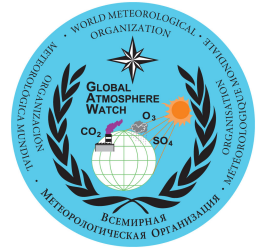
**Contributing Aircraft and Satellite
measurements**



**Integrated observations by means of models
Data products and assessments**



The principles of the GAW QA system



- ✓ Network-wide use of only **one reference standard or scale** (primary standard). In consequence, there is only one institution that is responsible for this standard.
- ✓ **Full traceability** to the primary standard of all measurements made by Global, Regional and Contributing GAW stations.
- ✓ The definition of data quality objectives (DQOs).
- ✓ Establishment of guidelines on how to meet these quality targets, i.e., **harmonized measurement techniques** based on Measurement Guidelines (MGs) and Standard Operating Procedures (SOPs).
- ✓ Establishment of MGs or SOPs for these measurements.
- ✓ Use of **detailed log books** for each parameter containing comprehensive meta information related to the measurements, maintenance, and 'internal' calibrations.
- ✓ Regular **independent assessments** (system and performance audits).
- ✓ Timely submission of data and associated metadata to the responsible World Data Centre as a means of permitting independent review of data by a wider community.



Central Facilities



- Quality Assurance/Science Activity Centres (QA/SACs) perform network-wide data quality and science-related functions.
- Central Calibration Laboratories (CCLs) maintain calibration standards and scales
- World and Regional Calibration Centres (WCCs, RCCs) link observations to World Reference Standards, ensure network comparability through intercomparison campaigns and regular audit, provide training to the stations.
- World Data Centres archive the observational data and metadata, which are referenced in the GAW Station Information System (GAWSIS).



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 ₂ O	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



Products and Services



WDCGG

WMO Global Atmosphere Watch World Data Centre for Greenhouse Gases

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[WDCGG Data
Submission
and
Dissemination
Guide \(PDF\)](#)

Gallery

Images from the latest issue of the WDCGG DATA SUMMARY
(latest issue : WDCGG No.33 March 2009)

[CO2](#)

[CH4](#)

[N2O](#)

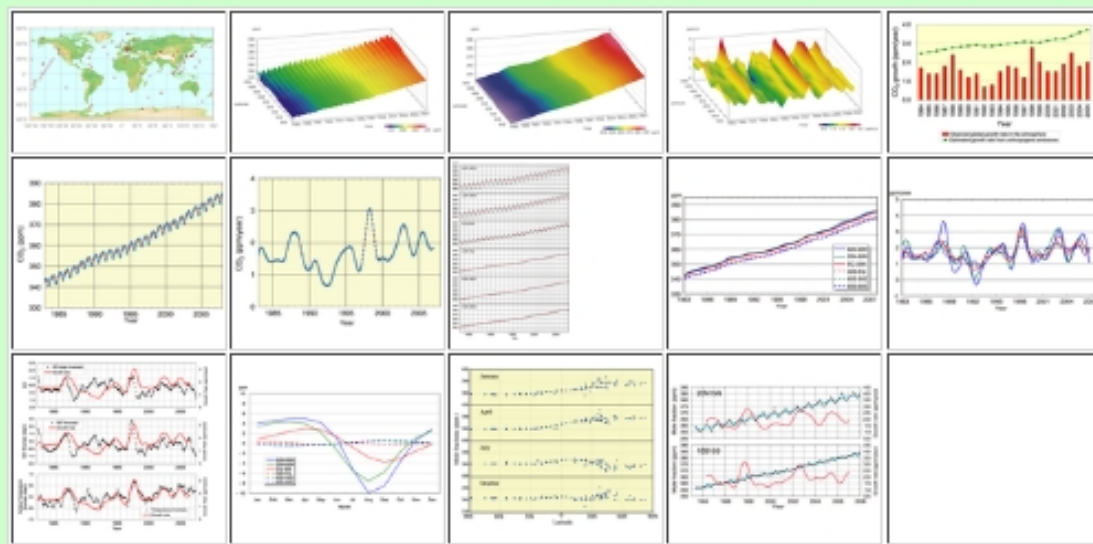
[Halocarbons](#)

[O3](#)

[CO](#)

[NOx](#)

[SO2](#)



This site is maintained by the Japan Meteorological Agency
in cooperation with the World Meteorological Organization
(Created : 2001/07/02 Modified : 2009/09/02)



WMO World Data Centre for Greenhouse Gases
c/o Japan Meteorological Agency
1-3-4, Otemachi, Chiyoda-ku
Tokyo 100-8122, Japan

Tel: +81-3-3287-3239



Annual Greenhouse Gas Bulletins

WMO
Greenhouse Gas Bulletin
 The State of Greenhouse Gases in the Atmosphere
 Based on Global Observations through 2009

Permafrost, which contains organic carbon, and methane (CH₄) clathrates are two large northern reservoirs of carbon that are susceptible to the effects of climate change. A rapidly warming high-latitude region has the potential to release large quantities of CH₄ into the atmosphere from these carbon reservoirs, which would provide a strong positive feedback on climate. The map shows Arctic soil organic carbon content (top) or maps from the permafrost soil-organic-carbon content. Riccardo Frazzetta, UNEP GRID-Arendal.

Measurements from the Global Atmosphere Watch (GAW) network show increased global CH₄ from 2007 to 2009 after nearly a decade of no growth. The GAW stations in the Arctic region that perform methane measurements and submit their data to the GAW World Data Centre for Greenhouse Gases are shown as dots on the map above. Data from two stations are shown in the graphs. Each reflects regional and large-scale influences of emissions. The sharp increase in 2007 on the left is linked to the area's proximity to large wetlands and local meteorological effects, while the increase shown on the right is more gradual. Nations contributing to the GAW Programme are expanding CH₄ measurements globally to help scientists understand the processes governing CH₄ emissions.

Executive summary

The latest analysis of observations from the WMO Global Atmosphere Watch Programme shows that the globally averaged mixing ratios of carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) reached new highs in 2009, with CO₂ at 385.8 ppm, CH₄ at 1803 ppt and N₂O at 322.5 ppb. These values are greater than those in pre-industrial times (before 1750) by 38%, 158% and 19%, respectively. Atmospheric growth rates of CO₂ and N₂O in 2009 are consistent with recent years, but are lower than in 2008. After nearly a decade of no growth, atmospheric CH₄ has increased during the past three years. The reasons for renewed growth of atmospheric methane are not fully understood, but emissions from natural sources (from northern latitudes and the tropics) are considered potential causes. The NOAA Annual Greenhouse Gas Index shows that from 1990 to 2009, radiative forcing by all long-lived greenhouse gases increased by 27.5%, with CO₂ accounting for nearly 80% of this increase. The combined radiative forcing by halocarbons is nearly double that of N₂O.

World Meteorological Organization
 No. 6: 24 November 2010
 Global Atmosphere Watch

Bulletin 1 (March 2006) CO₂ global distribution

Bulletin 2 (November 2006) CH₄ global distribution

Bulletin 3 (November 2007) NOAA's Carbon Tracker model

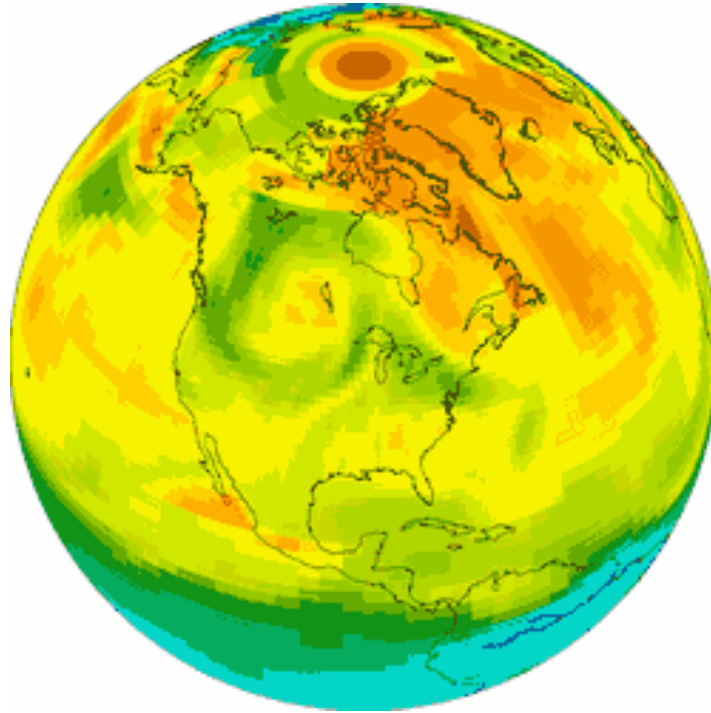
Bulletin 4 (November 2008) Montreal Protocol

Bulletin 5 (November 2009) Importance of CO₂

Bulletin 6 (November 2010) Methane and permafrost



Key issues/ connections

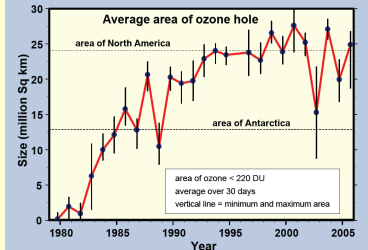
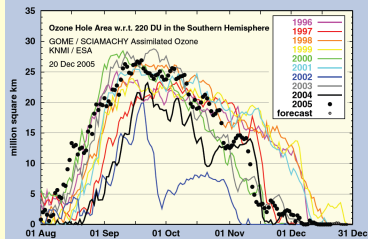


<http://www.esrl.noaa.gov/gmd/ccgg/carbontracker/>

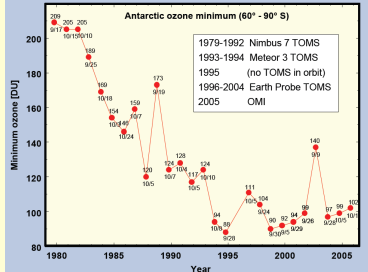
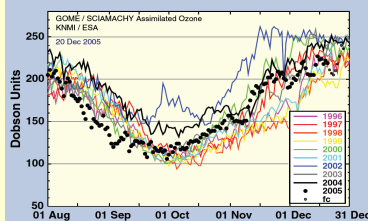
WMO Antarctic Ozone Bulletins

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

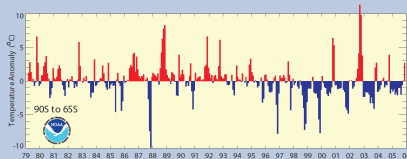
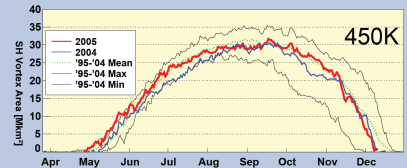
Ozone hole area



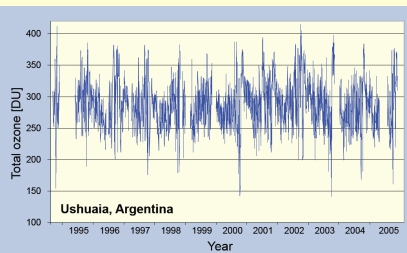
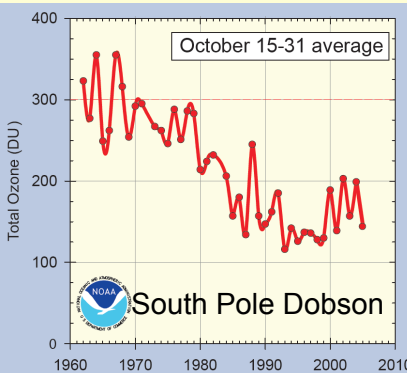
Minimum ozone



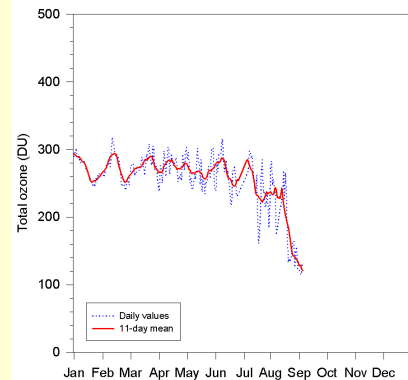
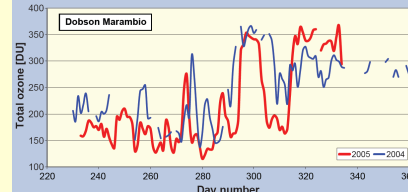
Meteorology



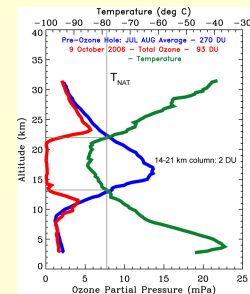
Station climatology



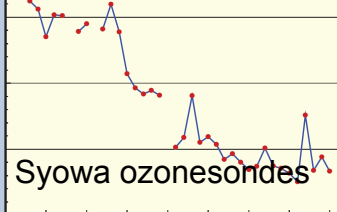
NRT Station data



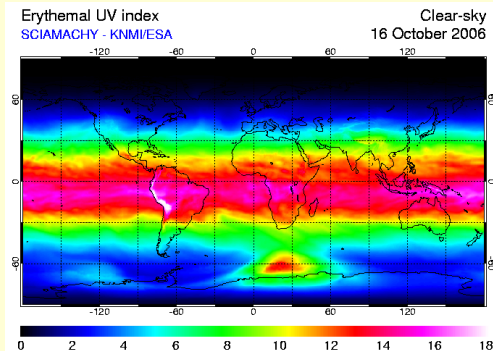
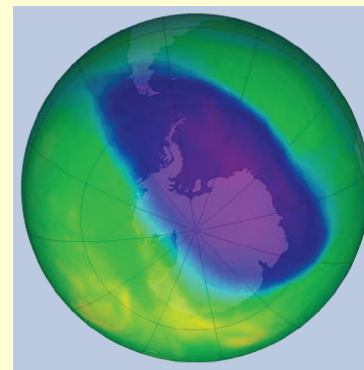
Sonde data



Average (September-November)



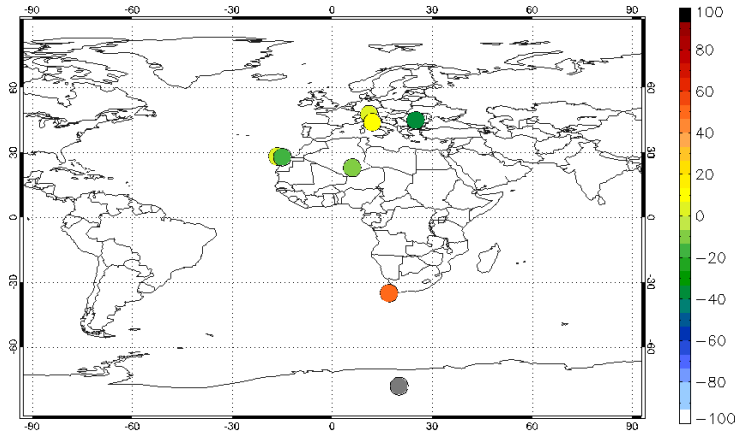
Satellite data + model data



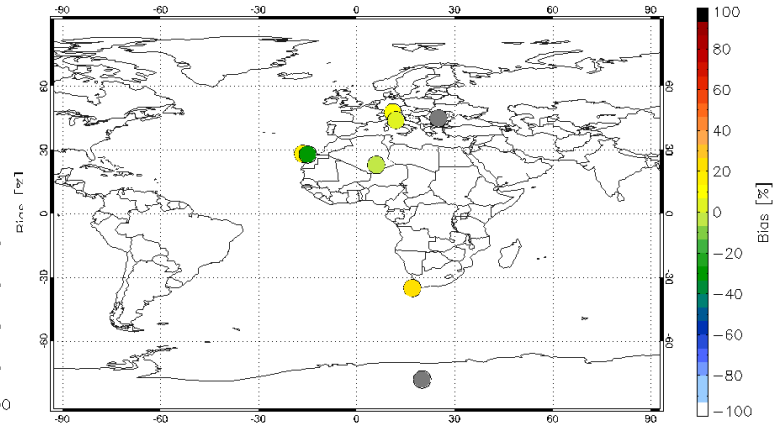


Collaboration with MACC project

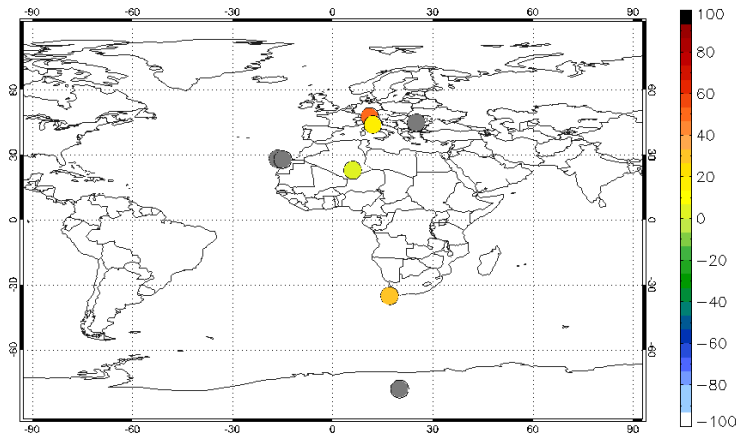
IFS-ez2m: CO₂ Bias in Jan–Mar 2008



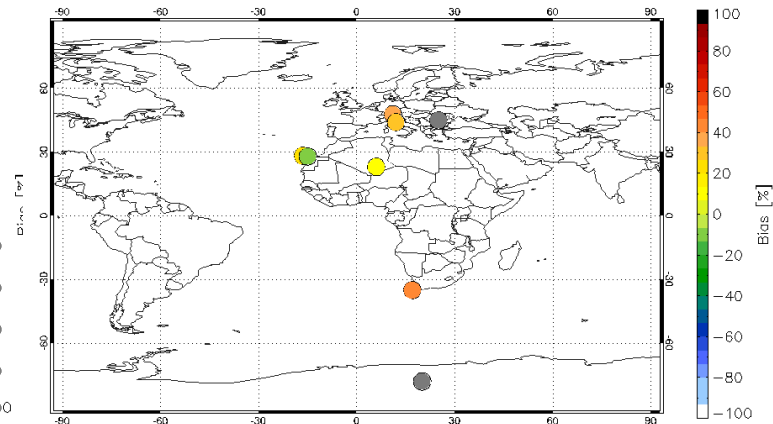
IFS-ez2m: CO₂ Bias in Apr–Jun 2008



IFS-ez2m: CO₂ Bias in Jul–Sep 2008



IFS-ez2m: CO₂ Bias in Oct–Dec 2008





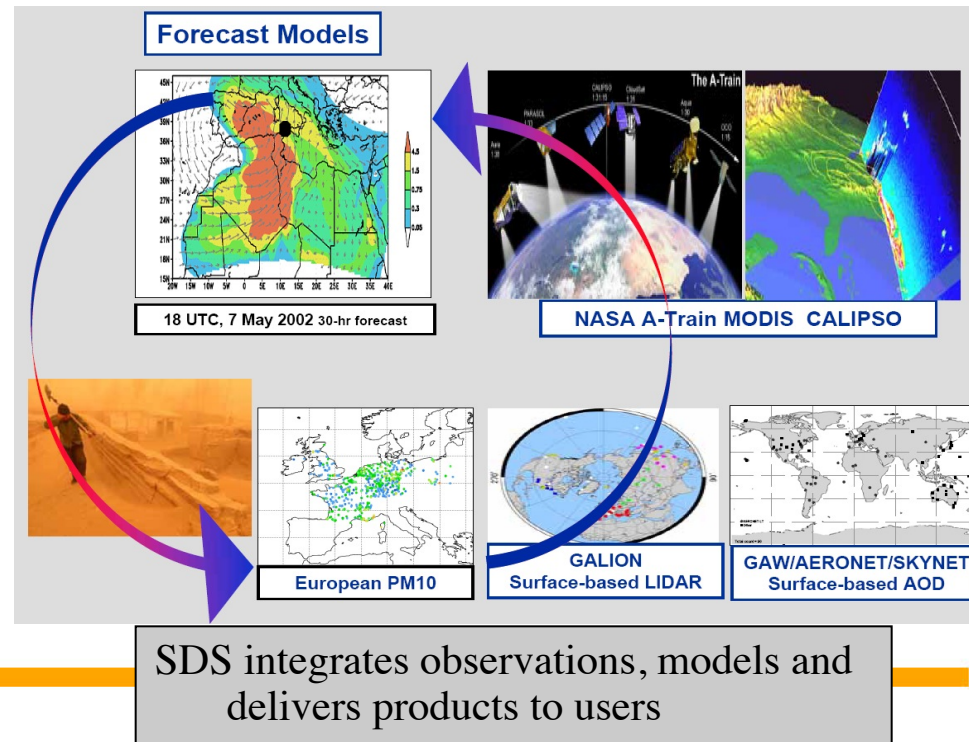
The WMO Sand and Dust Storm Warning, Advisory and Assessment System (SDS-WAS)

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

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

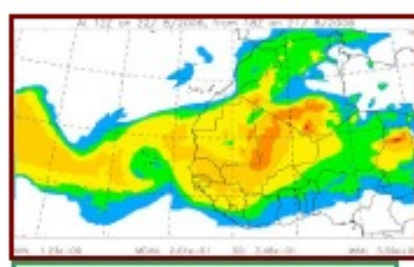
SDS-WAS

- 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
- Joint GAW and WWRP initiative

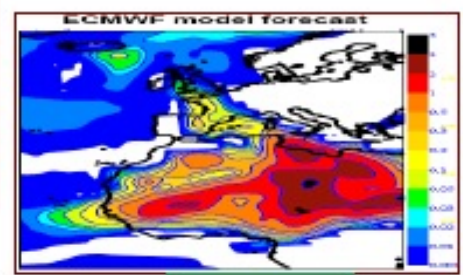




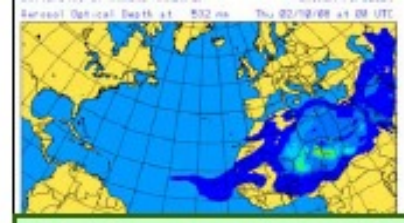
METEOFrance



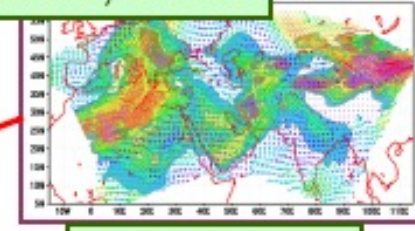
UK MET OFFICE



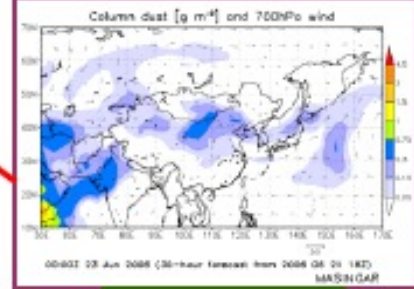
ECMWF



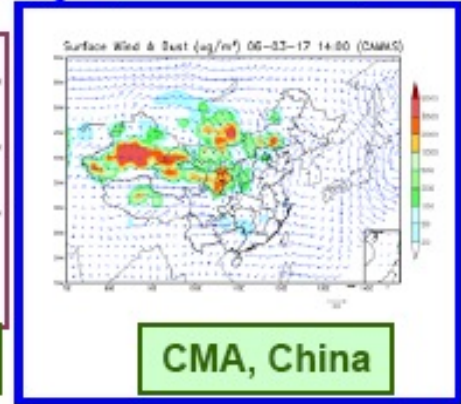
U of Athens, Greece



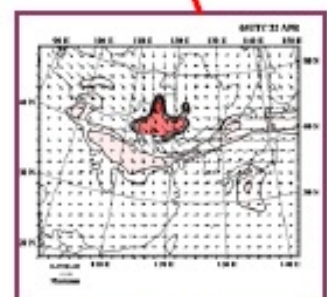
METU, Turkey



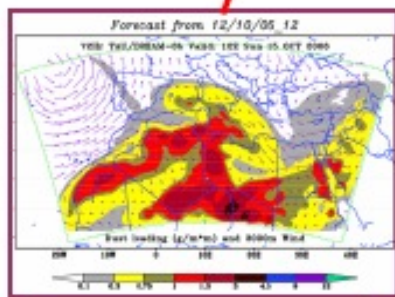
MRI, Japan



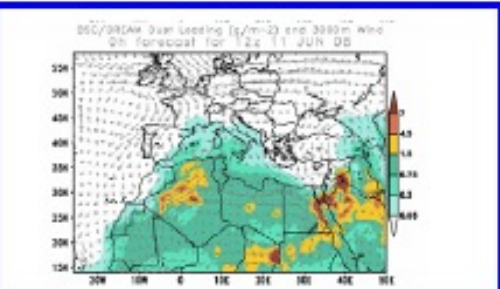
CMA, China



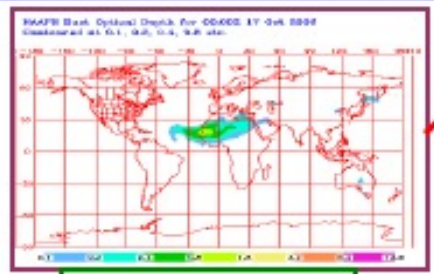
KMA, S. Korea



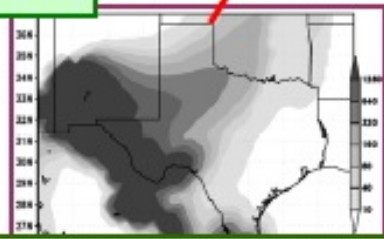
Tel Aviv U, Israel



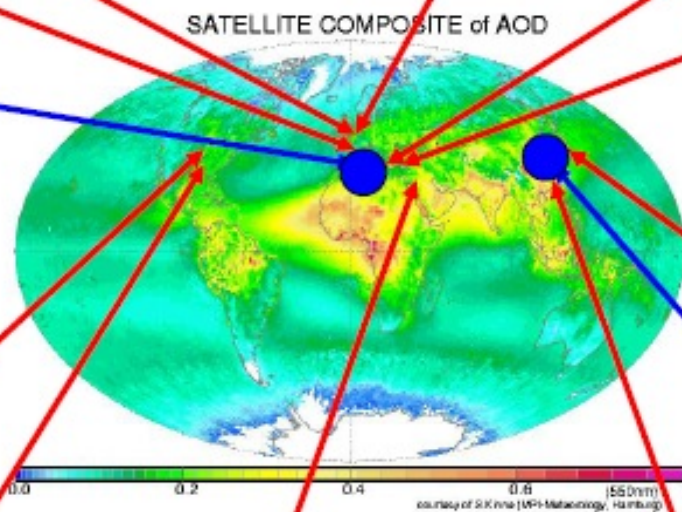
BSC-AEMET-CSIC, Spain



US Navy, USA



Joint U of Arizona and U of Mexico, USA

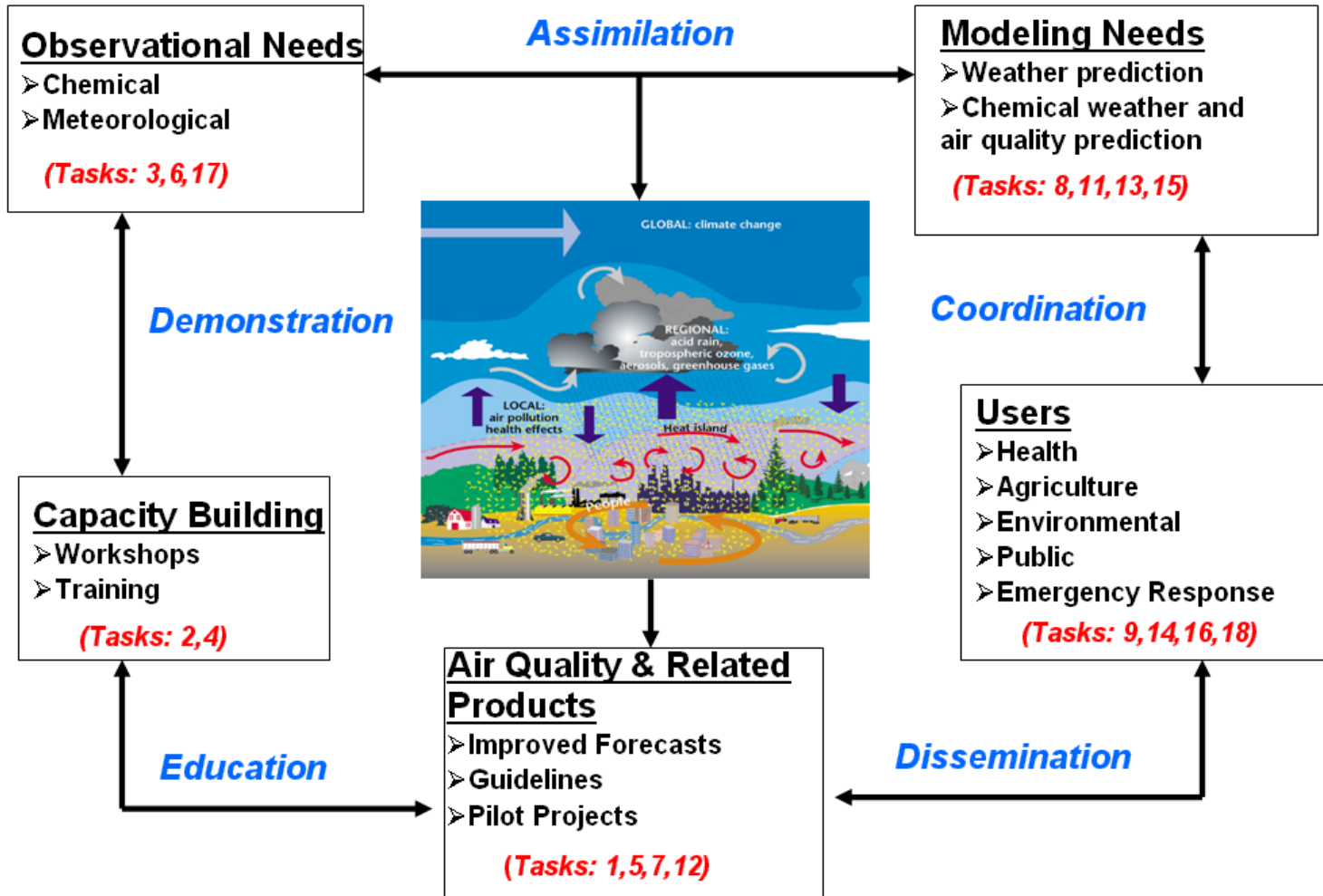


SATELLITE COMPOSITE of AOD



GAW Urban Project

GURME Tasks For The Strategic Planning Period 2008-2015





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