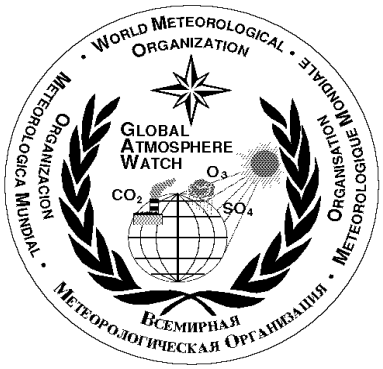
WORLD METEOROLOGICAL ORGANIZATION
GLOBAL ATMOSPHERE WATCH



No. 144

REPORT OF THE SEVENTH SESSION OF THE EC PANEL OF EXPERTS/CAS WORKING GROUP ON ENVIRONMENTAL POLLUTION AND ATMOSPHERIC CHEMISTRY

AND

THE GAW 2001 WORKSHOP

(Geneva, Switzerland, 2-5 April 2001)

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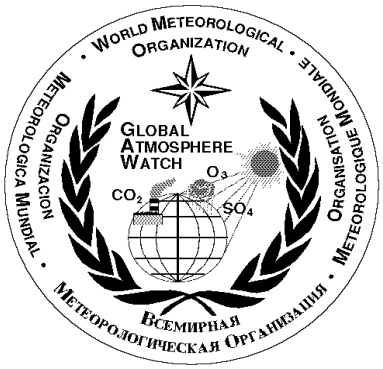

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WMO TD No. 1104

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PART I

Seventh Session of the

EC Panel of Experts/CAS Working Group on

Environmental Pollution and Atmospheric Chemistry

1. OPENING OF THE MEETING

On behalf of the Secretary-General, Professor G.O.P. Obasi, the Assistant Secretary-General of WMO, Dr A.S. Zaitsev opened the Global Atmosphere Watch 2001 Workshop (GAW 2001) and the session of the Executive Panel of Experts/CAS Working Group on Environmental Pollution and Atmospheric Chemistry (the "Panel") on Monday, 2 April 2001 at the Geneva Headquarters of WMO. The list of participants to the Panel session can be found in Annex 1.

Dr Zaitsev, in welcoming the participants, noted that the formal Panel session would immediately follow the GAW 2001 Workshop, and that Panel members were also participants in the workshop discussions. He stressed that even though the GAW Programme had evolved and developed into a system capable of providing credible atmospheric composition information, major issues were still to be confronted. These involved improving overall data quality, availability and management, achieving an optimum GAW network of measuring stations, how best to integrate the satellite and GAW systems to their mutual benefit, and issues concerning enhanced co-operation, communication and capacity building. Dr Zaitsev concluded by acknowledging that the development of GAW over the past decade had been one of WMO's major contributions to the Earth Summits' ideals of sustainable development, and he wished the participants a fruitful and pleasant stay in Geneva.

Dr O. Hov, Chairman of the Panel, responded by also welcoming the participants to Geneva. He indicated that the Panel needed to know how GAW was performing and that the Workshop would provide much of this information. Dr Hov reinforced the reasons for GAW as providing the underpinning to environmental concerns on levels of UV, depletion of stratospheric ozone, air quality and support to the United Nations Framework Convention on Climate Change. He concluded by informing the Panel that a major focus of the session would be on reviewing the draft Strategic Plan for GAW.

2. APPROVAL OF THE AGENDA

The Agenda, as approved, can be found in Annex 2.

3. ISSUES PRESENTED AT THE GAW 2001 WORKSHOP

Under this item, the Panel considered the issues discussed at the GAW 2001 Workshop that had immediately preceded the Panel session. The report of the workshop, including brief summaries of the numerous presentations, can be found as Part II of this document.

Prior to taking up issues reviewed by the six working groups established by GAW 2001 (3.1-3.6), the chair recalled that GAW has now reached a fairly mature stage and provides credible information on atmospheric trace constituents. Its mission now and into the future will be to sustain and improve the existing GAW infrastructure and operations in a resource-poor environment. The Chair concluded by making reference to the Strategic Plan for GAW (see item 4 below) which, he asserted, sets down a series of realistic tasks to further develop the Programme.

3.1 Data management

The issue of whether GAW maintains its momentum to develop into a credible source of atmospheric composition information rests with future progress in enhancing its data management system. The Panel agreed that to accomplish this will require completion of the current GAW Quality Assurance (QA) system. The QA system still lacks a number of world central facilities for some parameters, very few guidelines for QA activities and Standard Operating Procedures (SOPs) have been produced, and there is no documentation concerning system audits.

With respect availability and ownership of GAW data, the Panel were pleased to note that GAW World Data Centres continued to provide free, unrestricted access to their data holdings for

scientific purposes. The Chair pointed out that as environmental data was not specifically addressed in WMO Resolution 40 (Cg-XII) and Resolution 25 (Cg-XIII) on the exchange of weather and hydrological data, the current practices of the Data Centres were to be commended. In order that originators of the data be fully recognized, the Panel recommended that World Data Centres use the following statement:

> "For scientific purposes, access to these data is unlimited and provided without charge. By their use you accept that an offer of co-authorship will be made through personal contact with the data providers or owners whenever substantial use is made of their data. In all cases, an acknowledgement must be made to the data providers or owners and to the data centre when these data are used within a publication".

On the issue of data evaluation and interpretation, the Panel recalled that the mission of GAW is "to make reliable, comprehensive observations of the chemical composition and selected physical characteristics of the atmosphere". To ensure reliability, the measurement protocol contains a number of steps placing the primary responsibility for data quality with the station, and provides for review by the appropriate QA/SAC and WDC. The Panel, therefore, recommended that, to convey this care in measurement to the user, all data points archived should be accompanied by appropriate information on data reliability or uncertainty, preferably in the quantitative form of error limits. The exact form of the reporting of the data and their uncertainty should be the responsibility of the SAGs. In all cases the data should reflect whether the data quality objectives are met.

The Panel noted that the Secretariat, with assistance from the Swiss Meteorological Service, were developing a GAW Station Information System (GAWSIS) designed to provide both the Secretariat/GAW community and users of GAW data with a wealth of information on individual stations. The WDCs and Secretariat were urged to make full use of its potential to identify and assist stations to submit their data, of known quality, to the Data Centres.

3.2 Capacity building

The Panel noted with satisfaction that GAW was been reasonably successful in conducting education and training activities in recent years. The opportunities provided by the implementation of the two GEF projects - addition of six Global stations and the Southern Cone Project - had been fully utilized by the Secretariat. It was recognized, however, that GAW would need to continue its capacity building activities long into the future, and in the face of chronic resource pressures.

The Panel identified three themes relevant to education and training activities by GAW in developing countries. These concern:

(a) Instrument and staff requirements
(b) Funding for capacity building
(c) Scientific co-operation.

With respect to (a) and (c) the Panel noted that scientific and institutional twinning, intercomparisons and workshops were the primary mechanisms available to support instrument maintenance and staff development. In this regard, the Secretariat, the Scientific Advisory Groups (SAGs) and individual station managers all have important roles to play. Although the Secretariat is best placed to organize international intercomparisons and workshops, SAGs and stations are urged to investigate bilateral arrangements with individual scientists or institutions in developed countries. The successful twinning arrangement between Kenya and the Swiss Meteorological Service in operating an ozonesonde station in Nairobi was cited as a good example of this type of collaboration.

To bring funding levels more in line with GAW training requirements the Panel recommended that:

- Developing country stations embark on a programme to raise their national visibility;
- Developing country stations open their facilities to both the international scientific community and data users;
- The Secretariat actively seeks out interested national and international institutions to present them with information on the GAW Programme and needs;
- The Secretariat explores possibilities for obtaining national and European development funds for GAW training.

3.3 GAW network of stations

The Panel reviewed the existing GAW network in light of the scientific requirements and the wishes of WMO's governing bodies that GAW address regional issues.

The Panel noted that, within GAW, Global stations had traditionally received a higher priority than Regional sites. However, measurements at the Regional stations were often more pertinent for governments and regional groupings as they provide information on issues such as toxic emissions and dispersion and air quality. In this regard, the Panel noted with satisfaction that the new Strategic Plan for GAW gives added weight to the operation of Regional stations. It was suggested that a useful function of GAW would be providing an international framework for linking regional networks.

In order to better define the optimum regional GAW network, the Panel recommended the SAGs and the Secretariat undertake an analysis of the existing regional sites and their measurement programmes, and propose amendments to this network based on scientific needs. The Panel suggested that such an analysis should be conducted using station data information from the Data Centre, information provided by the GAWSIS initiative as well as sites' representativeness as determined from satellite maps.

The Panel was informed on current developments with respect to GAW-related activities in the Russian Federation and other countries that were part of the former Soviet Union. In this connection, the Panel supported the view that the WMO Secretariat, the GAW central facilities, SAGs, the Panel itself as well as individual scientists and institutions participating in the GAW activities should be urged to initiate and support the joint "twinning" studies and co-operation with the former USSR countries, with a view to re-establishing their GAW stations.

3.4 Satellites

The Secretariat gave an overview of GAW's developing involvement in the Integrated Global Observing Strategy (IGOS). Following a recommendation from the Panel's previous session, GAW has approached the satellite community to determine their level of interest in joining together to monitor the atmosphere. This resulted in the preparation of a WMO-CEOS document entitled "WMO/CEOS Report on a Strategy for Integrating Satellite and Ground-based Observations of Ozone" (WMO GAW Report No. 140). Based on advice from the IGOS partners, the Panel was informed that WMO/GAW and CEOS were now developing an atmospheric chemistry and ozone theme document (Integrated Global Atmospheric Chemistry Observations (IGACO)) for submission to the IGOS meeting in June 2001. The Panel were requested to provide any comments they had on the draft outline of the Theme to the Secretariat by 27 April 2001. It was suggested that the proposal would need to include exchange measurements in addition to atmospheric composition measurements to be consistent with the new Strategic Plan.

The Panel felt that the GAW community must exploit the possibilities offered by satellite systems to complement GAW measurements. At the same time GAW could benefit satellite operations by providing measurements for ground truth and intercomparison purposes. In this regard, the reactive gases (SO_2, NO_2 and VOCs) were viewed as a group of parameters that stand to benefit most from collaboration between ground based and satellite measuring systems. The Panel therefore strongly recommended the establishment of a SAG for Reactive Gases with membership to include satellite experts.

3.5 Communication of different GAW components

The Panel was fully aware that GAW's organizational and co-ordinating tasks are complex, the workload very demanding and Secretariat resources limited. As a result, good communication between the various components of the system are imperative. Enhanced communication using the latest technologies would, the Panel stated, lead naturally to a more efficient operation and also improved visibility both within and outside the GAW community.

The Panel outlined the elements of a successful communication strategy for GAW, as follows:

1. Encourage all GAW components (SAGs, WDCs, WCCs, QA/SACs, Secretariat) to enhance their level of communication, especially back to the station level by:
   - Improving training opportunities, especially for station personnel, and including the QA/SACs and the WDCs and WCCs in the training sessions
   - Encouraging twinning
   - Encouraging feedback from the WCCs, QA/SACs and WDCs to the stations

2. Produce information that demonstrates the stations are important parts of the network, for example by:
   - SAG data synthesis reports
   - Developing Web site profiles

3. Activate a strong GAW presence in the WMO Regional Association structure, as required

4. Set a high priority on the development of the GAW Web site as a major source of information and communication, and encouraging each component of GAW (e.g. WCCs, WDCs, SAGs, QA/SACs) to establish Web sites providing as much information as possible

5. Develop a method for feedback and recognition through GAW system

6. Encourage international capacity-building funding organizations to include GAW sites when funding new communication equipment and services.

3.6 Co-operation between different programmes and organizations

In its consideration of this item, the Panel noted the large number of international agencies and programmes that share an interest with GAW's responsibilities. The Panel identified collaboration with the European Monitoring and Evaluation Programme (EMEP), IGOS, the International Global Atmospheric Chemistry Project (IGAC), the Commission on Atmospheric Chemistry and Global Pollution (CACGP), the International Ozone Commission (IOC), the World Health Organization (WHO) and the International Atomic Energy Agency (IAEA) as being of particular importance. With regard to the European initiative to use commercial aircraft for sampling the atmosphere, the Panel recommended that GAW investigate the use of such aircraft for atmospheric composition monitoring purposes. It was, however, important to maintain a watching brief on all relevant international programmes to avoid duplication and to focus limited recourses on GAW's core activities.

The Panel discussed at some length possible benefits of GAW collaboration with the Bureau Internationale des Poids et Mesures (BIPM)/National Metrology Institutes. BIPM offered the possibility of serving as a reference standard for reactive gases as well as the possibility of holding joint GAW-BIPM instrument intercomparisons. The Panel concluded that GAW and BIPM could usefully work together in the future, particularly with respect to reactive gases and SAGs that plan to address this issue. At the same time, however, the Panel cautioned on the dangers of unnecessarily changing existing GAW intercomparison and reference standard procedures.

The Panel noted that within the WMO's World Climate Research Programme's Baseline Solar Radiation Network (BSRN), infra-red comparisons are ongoing, while short-wave radiation standards fall within the mandate of WMO's Commission for Instruments and Observations (CIMO). The Panel recommended that the issue of where to locate the long-wave radiation standard be addressed by WMO as a matter of some urgency as well as the BSRN's long-term viability.

4. STRATEGIC PLAN 2001-2007

The Panel carefully reviewed the new GAW Strategic Plan covering the period 2001-2007. It commended all those involved in its preparation, particularly members of the Secretariat and MeteoSwiss, for producing a comprehensive, well-written and clear document setting down the mission, objectives, implementation strategy and tasks for GAW as it moves to consolidate and enhance its programme.

The Panel agreed with its overall format and thrusts and therefore made only minor editorial revisions to the Plan. The importance to governments of toxic emissions/deposition was noted. The Panel recommended that the Aerosol and Precipitation SAGs communicate on the issue of heavy metals and POPs. To better fulfill the mission of GAW, it was recommended that the modelling and observation communities work closely together so that the value of current and archived measurements are properly exploited and assimilated into models.

Subject to these minor changes, the Panel recommended the new GAW Strategic Plan be submitted to the June 2001 session of the WMO Executive Council for final approval.

5. RECOMMENDATIONS AND OBSERVATIONS OF THE PANEL

The Panel made a number of observations and recommendations additional to those found under individual agenda items above. These were:

- The Panel recommended that the Global Atmosphere Watch programme in the WMO Secretariat be strongly supported by Members, particularly since GAW is the only international programme that co-ordinates atmospheric chemistry measurements world-wide.
- That GAW is increasingly recognized as the world system, able to co-ordinate across regional boundaries, to provide information in support of environmental conventions, particularly the Vienna Ozone Convention and the Kyoto Protocol of the Climate Convention.
- GAW and the flux estimation communities need to join forces to assist countries estimate greenhouse gas emissions and sinks.
- The issue of toxics within GAW needs strengthening.
- The new GAW Training and Education Centre (GAW-TEC), funded by the Bavarian government, was welcomed as a major contribution to the GAW programme. The Panel recommended the Secretariat and GAW-TEC quickly develop the Centre's prospectus in light of the training needs of GAW.
- The Panel recommended that meetings of the GAW community be held on a regular basis in view of the success of GAW 2001.
- The current WMO staffing level was considered the minimum to operate a satisfactory GAW Programme and the Panel expressed its view that replacements for retiring staff be found with the minimum delay.
- The Panel recommended that the Secretariat and the GAW community, working together, explore every opportunity to seek resources from national institutes and governments as well as international institutes, agencies and funding mechanisms.

6. CLOSING OF THE MEETING

There being no further business, the Chair thanked the participants for their input to the discussions and closed the session at 16h15 on 5 April 2001.

Annex 1 to Part I

Seventh Session of the
EC Panel of Experts/CAS Working Group on
Environmental Pollution and Atmospheric Chemistry

(Geneva, 4-5 April 2001)

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Annex 2 to Part I

Seventh Session of the
EC Panel of Experts/CAS Working Group on
Environmental Pollution and Atmospheric Chemistry

(Geneva, 4-5 April 2001)

Agenda

1. Opening of the Session

2. Approval of the Agenda

3. Issues presented at the GAW 2001 Workshop

3.1 Data management
3.2 Capacity building
3.3 GAW network of stations
3.4 Satellite activities
3.5 Communications between different GAW components
3.6 Co-operation between different programmes and organizations

4. Strategic Plan 2001-2007

5. Recommendations and Observations of the Panel

6. Closing of the Meeting

PART II

REPORT OF GAW 2001 WORKSHOP

1. PURPOSE OF WORKSHOP

Although WMO's Global Atmosphere Watch programme is more than 10 years old, representatives of its various components, such as World Data Centres, Global stations and Scientific Advisory Groups, had never before met jointly. The advantages of such a joint meeting were widely recognized and the GAW 2001 Workshop was duly arranged in conjunction with the Seventh Session of the Executive Panel of Experts/CAS Working Group on Environmental Pollution and Atmospheric Chemistry.

The GAW 2001 Workshop was held in WMO Headquarters from 2 to 4 April 2001 and benefited from the presence of members of the EC Panel. A list of participants is reproduced in Annex I.

2. WORKSHOP PRESENTATIONS

The Workshop programme (Annex 2) was designed to allow all major components of the international GAW infrastructure to briefly outline their activities and challenges. Overviews of the Scientific Advisory Groups (SAGs), calibration and QA/SAC activities, GAW World Data Centres and of selected GAW Global stations were given. The programme included talks on the new GAW station directory GAWSIS, training at GAW-TEC, and the GAW Strategic Plan. Also the activities of some other institutes/programmes were presented. All available presentations of the Workshop can be found in Annex III.

2.1 *Strategic plan*

Mr G. Müller (MeteoSwiss) gave a short history of the preparation of the first and second GAW Strategic Plans. The second Plan, covering the period 2001-2007 is a product of a wide consultation process involving the entire GAW community. Dr Müller briefly described the contents of the second Strategic Plan, highlighted the main achievements of GAW since its inception, discussed the critical issues facing GAW, and outlined GAW's main strategic goals and overall implementation strategy.

Mr Müller thanked all those present at the Workshop for their important input into the development of the Plan and informed them that the Executive Council Panel of Experts/CAS Working Group on Environmental Pollution and Atmospheric Chemistry were to review and recommend approval of the Plan at its session immediately following the Workshop. Mr Müller's presentation is included in Annex III.

3. WORKSHOP DISCUSSIONS ON MAJOR ISSUES

The Workshop was also designed to allow interaction between participants in working sessions. They addressed six issues facing GAW, namely:

- Data handling and use
- Satellite activities
- Co-operation between different programmes and organizations
- GAW network of stations
- Capacity building
- Communication between different GAW components.

These break-out sessions were required to develop a set of recommendations addressing issues concerning the performance of the GAW programme on a broad scale. The recommendations were subsequently reviewed by plenary sessions of all participants.

3.1 Data handling and use

Chair: Julian Wilson Rapporteur: Ed Hare

This breakout group examined the following issues with respect to data flow:

- How can we improve the availability, quality and use of GAW data?
  - Data evaluation and interpretation
  - Data reporting procedures for participating stations
  - How can we make data more attractive to the research end of the measuring community?
- Data ownership
- Should a station keep its GAW status if data is not reported?

The workshop plenary expressed the following views:

1. Audit summaries of instrument calibrations and station visits should be made available.

2. The SAG and WDC Precipitation Chemistry will survey the community and return their results to the EC-Panel.

3. GAWSIS should be used as a tool of evaluating data quality.

4. Recommend the acceptance of the GAW data statement (see para. 3.1.2).

5. Recommend that the WMO Secretariat contact each agency/station if the GAWSIS station questionnaire is not returned by a specific time.

6. WDCs should make a clear distinction between reporting and non-reporting stations.

7. Recommend WDC Managers to consider at their upcoming meeting how GAW data can best be made more attractive to the research community.

8. It was accepted that the WDC catalogue should reflect all stations, GAW and others.

3.2 Satellite activities

Chair: Peter Hofer Rapporteur: Kazuto Suda

The group discussed the needs in the satellite community for ground based measurements and how GAW could fulfill these requirements.

The workshop plenary expressed the following views:

1. Collect existing and prospective activities concerning ground truthing within the GAW programme.

2. Use the satellite maps to find suitable stations for ground truthing and the placement of new stations

3. Invite satellite specialists to participate in SAGs when appropriate.

4. The effort to establish a SAG for Reactive Gases is appreciated.

5. The GAW community should exploit the possibilities offered by satellite systems to complement GAW measurements while GAW could benefit satellite operators by providing measurements for ground truth and intercomparison purpose.

3.3 Co-operation between different programmes and organizations

Chair: John Gras Rapporteur: Jörg Klausen

The group reviewed how to effectively combine guidelines and procedures with organizations and programmes external to WMO and how to avoid duplication of activities.

The Workshop plenary expressed the following views:

1. That GAW support establishment of bilateral agreements between selected Russian stations (AMAP) and US/Canadian stations and suggests submission of these stations to the GAW network.

2. Continuation and strengthening of the exchange of observers between programmes at appropriate levels (e.g. EC Panel, steering bodies, SAGs …..).

3. The issue of a permanent location for an international Infrared Radiation Standard be considered by the EC Panel. (BSRN-GAW link and long term viability).

4. NHMSs should be made aware that GAW recognizes the important contribution of BSRN to the GAW objectives and encourages the continuation of the contribution.

5. The EC Panel should keep abreast of developing programmes of mutual benefit to GAW in IGAC and EUROTRAC (noting that GAW already recognizes and appreciates existing links to IGAC and EUROTRAC).

6. National contacts need to be encouraged to actively improve co-ordination of GAW-related activities within their countries.

7. Possible benefits from a future role of BIPM/NMIs as a member of SAG Reactive Gases (RG) should be explored. BIPM/NMIs offer:

   To serve as a reference standard for reactive gases;
   To serve as members on SAG RG;
   To tie into GAW inter-comparisons and for GAW to tie into BIPM/NMIs inter-comparisons.

8. On-going efforts, by the Secretariat, to secure funding from GEF and other funding avenues to support GAW need to be continued.

3.4 GAW network of stations

Chair: Wolfgang Fricke Rapporteur: Rick Artz

The breakout group examined the needs for the measurements of the different atmospheric components and where are the critical gaps in the existing GAW network. In addition, the group looked at ways to promote activities at regional stations as well as how to determine when a station should lose its GAW status.

The Workshop plenary expressed the following views:

1. The Data Centres should provide information on the existing data base including the station names and availability of data for recent periods.

2. It is recommended that other SAGs make a list like the Aerosol SAG indicating where and for what purpose sites should be added.

3. A review the present network of Regional sites should be made, with respect to the status, purpose, operation and instrumentation according to the new Strategic Plan. The Panel should invite meteorological services and other institutions associated with GAW to provide personnel (seconded experts) and financial support for short periods of time to work with the GAW Secretariat to perform this review.

4. Stations should be set up for satellite ground truthing purposes. Site representativeness should be determined using satellite maps.

5. SAGs should be asked which topics (other than health) could be promoted in light of the Strategic Plan in order to improve the operation and increase the visibility of Regional stations. What questions should different regional stations address?

6. The group recommends that the Panel accept the Russian proposal concerning initiation and support of co-operation with the former USSR countries, with a view of re-establishing their GAW stations and to support establishment of GAW national centres. In this context, reporting of national GAW activities to the Secretariat on a routine basis could be helpful.

7. Stations sometimes avoid reporting data because of perceptions of inadequate data quality. Data which meet defined data quality objectives are acceptable because their quality has been established. However, data which do not meet data quality objectives should be flagged by the QA/SACs.

3.5 Capacity building

Chair: Osvaldo Barturen Rapporteur: Wilson Kimani

The breakout group on GAW training and education reviewed a number of issues regarding capacity building initiatives. These were:

- How can capacity building and instrument maintenance in developing countries be promoted?
- What are the needs of the station personnel and how can these be met?
- How to arrange effectively short term one-to-one training and long term training at, e.g., local universities?
- How to find funding for activities? Joint proposals?
- How to promote the writing of joint publications for peer-reviewed journals?

The Workshop plenary expressed the following views:

1. Capacity building and instrument maintenance in developing countries be promoted by:

    - Scientific and Institutional twinning
    - Intercomparison campaigns, workshops, and meetings (present meeting)
    - Sustainable infrastructure to support minimum capacity
    - Station initiatives

EC Panel is to recommend to the host countries to honour their commitments

2. Meeting the needs of the personnel by:

    - Short-term training (one-on-one with Twinning partner, GAW-TEC)
    - Long-term training (meetings, workshops, etc.)
    - Contacting SAGs with special requests

3. Finding funding for activities by:

   - Visibility-advertising the GAW capabilities in the developing countries
   - Effective twinning partnership and collaborators
   - Opening station facilities to scientific community and data users

   EC Panel to recommend that the national institutions be approached for possible sources of funds

4. Promoting the writing of joint publications for peer reviewed journals through both the SAGs and scientific twinning mechanisms which, in turn, would improve the visibility of twinning

3.6 Communication between different GAW components

Chair: Bob Vet Rapporteur: Brigitte Buchmann

The group discussed ways to improve communication between the various GAW components such as between stations, stations and QA/SACs, and so on. Meeting the needs of one GAW component by the others was also discussed.

The Workshop plenary expressed the following views:

1. All GAW components (WDCs, WCCs, QA/SACs, SAGS, Secretariat) are encouraged to enhance their level of communication, especially back to the station level. In practical terms, this means:

   - improve training opportunities, especially for station personnel, including the QA/SACS and the WDCs and WCCs in the training sessions
   - encourage twinning
   - encourage feedback from the WCCs, QA/SACs and WDCs to stations

2. Produce more information that demonstrates to the stations that they are important parts of the network

   - SAG data synthesis reports
   - Web site profiles

3. Activate a strong GAW presence in the WMO Regional organizational structure

   - Encourage GAW presence and participation in Regional Meetings
   - Suggest rapporteurs for all WMO Regions from the GAW community

4. Set a high priority on the development of the GAW Web site as a major source of information and communication. This includes:

   - Encouraging the Secretariat to give very high priority to developing and maintaining a highly effective and current Web site (hiring of contractor or staff)
   - Implementing a direct GAW domain name to provide higher visibility, such as www.gaw.ch
   - Encourage each component of GAW (e.g., WCCs, WDCs, SAGS, QA/SACs) to establish Web sites providing as much information as possible

5. To strengthen the Secretariat, specifically:

   - Add scientific staff
   - Add a Web master

6. Recommend that GAW 2001 recognize the positive work of all GAW components

   - Develop a method for feedback and recognition through GAW system,
   - GAW award system (Secretariat)

7. Encourage funding organisations to include GAW sites when funding new communication equipment and services.

4. CLOSING OF THE WORKSHOP

Prior to formally closing the Workshop, Dr O. Hov, chairman of the closing plenary, thanked the Secretariat for successfully arranging the Workshop and the participants for their important input into crucial issues facing GAW in the future. In his view, he continued, the Workshop had concluded that:

- GAW was becoming a real entity as it develops and matures;
- The world wide web could provide substantial benefits for many GAW activities;
- Although GAW's programme could be encyclopaedic, it needs to be more realistic and focus on its main priorities;
- GAW should examine all avenues to reach its goals and not limit itself to station networks. For example, it could look at ways of using commercial networks to sample the atmosphere; and
- A strong Secretariat is vital to its future development.

Dr Hov declared the Workshop closed at 15h00 on 4 April 2001.

GAW 2001 Workshop

(Geneva, 2-4 April 2001)

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Annex 2 to Part II

GAW 2001 Workshop

(Geneva, 2-4 April, 2001)

Workshop Programme

Monday, 2 April

1. Opening of Workshop

09.00 Opening of the workshop
Frédéric Delsol, Director, AREP Department
Alexandre Zaitsev, Assistant Secretary-General, WMO
Øystein Hov, EC Panel chairman

09.15 Overview of GAW and workshop objectives, John Miller

2. Overviews of Scientific Advisory Group activities
Chairman: Øystein Hov

09.30 Aerosol (Urs Baltensperger)

09.45 Greenhouse gases (Kim Holmen)

10.00 Ozone (Mike Proffitt for Ivar Isaksen)

10.15 Precipitation chemistry (Rick Artz)

Coffee break and group photograph 10.30 – 11.00

11.00 UV (Ann Webb for Paul Simon)

11.15 GURME (Liisa Jalkanen for Greg Carmichael)

11.30 Discussion on SAGs

3. Overview of calibration and QA/SAC activities

11.40 QA/SAC Japan (Kazuto Suda)

11.50 QA/SAC Switzerland (Peter Hofer)

12.00 QA/SAC USA (Volker Mohnen)

12.10 QA/SAC Germany (Werner Rudolf)

Lunch 12.20 – 13.20

13.20 Activities at PMOD/WRC (Werner Schmutz)

13.40 Calibration and standardization activities at BIPM (Ed de Leer)

13.50 Discussion on calibration and QA/SAC activities

4. Overview of selected GAW Global station activities
Chairman: Volker Mohnen

14.10 Cape Point (Ernst Brunke)

14.20 Pallas/Sodankylä (Yrjö Viisanen)

14.30 Izana (Emilio Cuevas)

14.40 Cape Grim (John Gras)

14.50 Ushuaia (Osvaldo Barturen)

15.00 Bukit Koto Tabang (Hery Harjanto)

15.10 Mt Kenya (Wilson Kimani)

15.20 Mt Waliguan (Tang Jie)

Tea/coffee break 15.30-16.00

16.00 GAW station directory (Joerg Klausen)

16.10 Discussion on GAW Global station activities

5. Overviews of GAW World Data Centre activities

16.30 Ozone and Ultraviolet Radiation (Ed Hare)

16.40 Surface ozone (Øystein Hov)

16.50 Radiation (Anatoly Tsvetkov)

17.00 Greenhouse gases (Kazuto Suda)

17.10 Precipitation (Tim Coleman)

17.20 Aerosol (Julian Wilson)

17.30 Discussion on Data Centres

17.45 Discussion on today's sessions

18.00 Adjourn for the day

Tuesday, 3 April
Chairman: John Miller

9.00 Overview of GAW Strategic Plan (Gerhard Müller)

9.30 Training and education at GAW-TEC (Gerhard Enders)

9.40 Overview of BSRN (Atsumu Ohmura)

9.50 JRC activities related to GAW (Diana Rembges)

Break into working groups on:
- Data handling
- Satellite activities
- Cooperation between different programmes and organizations

Lunch 12.00 – 13.00

13- 14 Continue WG

14- 17 Plenary on WG items
Chairman: Urs Baltensperger

17.30 Reception hosted by WMO

Wednesday, 4 April
Chairman: Øystein Hov

09.00 Break into working groups on:
- Capacity building
- GAW network of stations
- Communication between the different GAW components

Lunch 12.00 – 13.00

13.00 Plenary on WG items

14.30 Wrap-up discussion

15.00 Closure of meeting

Workshop Presentation Summaries

Activities of the Aerosol SAG

Urs Baltensperger, Chairman Aerosol SAG

Overview

The Aerosol SAG was founded in 1997 (at that time still named Aerosol and Optical Depth), and has since then had 4 meetings in San Francisco, Wengen, Boulder, and Galway. The group covers the chemical and physical properties of aerosols including optical depth. The GAW aerosol programme objective is to determine the spatio-temporal distribution of aerosol properties related to climate forcing and air quality up to multidecadal time series (see new Strategic Report). The group has 11 members and is structured in the following subgroups:

- General sampling considerations: Alfred Wiedensohler
- Chemical measurements and mass: Shao-Meng Li
- Optical depth: Claus Fröhlich/Christoph Wehrli
- Lidar: Horst Jäger
- CN, CCN concentrations and size distribution: John Gras
- Aerosol optical properties: John Ogren
- Data management and archiving Julian Wilson

Gerry Jennings, Tadahiro Hayasaka and Liisa Jalkanen are additional members of the SAG, contributing to the subgroups mentioned above. Claus Fröhlich has recently retired from the directorship of PMOD/WRC in Davos and only works part-time for the Institute. He is still a member of the SAG and is in charge of the optical depth activities, but most probably, Christoph Wehrli from the same institute will take his place later this year.

Major current activities include:

- The completion of a report on aerosol procedures, which reflects the structure of the subgroups mentioned above
- The construction of a template for data submission to the World Data Centre in Ispra (a joint effort with a project of the European Commission, “Synthesis of Integrated Global Aerosol Data Sets, SINGADS”, coordinated by Julian Wilson), in close collaboration with the GAW station data base activities of WMO
- The gathering of information from the GAW sites on the parameters being measured
- The deployment of the 12 Precision Filter Radiometers (PFRs) provided by the Swiss government for measuring aerosol optical depth

Achievements, products

In order to comply with the objective mentioned above, a broad list of aerosol parameters is required which should be submitted to the World Data Centre for Aerosols in Ispra. The SAG has agreed on the refined list, which now comprises the following parameters (in alphabetical order):

- Cloud condensation nuclei concentration
- Cloud condensation nuclei spectra
- Hygroscopic growth
- Light absorption coefficient
- Light scattering coefficient
- Mass (carbonaceous material)
- Mass (major inorganic components)
- Mass (other chemical components)
- Mass (total aerosol)
- Number concentration
- Optical depth
- Size distribution (chemical species)
- Size distribution (mass)

- Size distribution (number)
- Vertical distribution (lidar or other methods)

The SAG recommended the locations to deploy the 12 Precision Filter Radiometers (PFRs) provided by the Swiss Government for measuring aerosol optical depth (AOD). The first three instruments were delivered to Mauna Loa (Hawaii), Hohenpeissenberg (Germany), and Mace Head (Ireland) and are currently in operation. Negotiations for further placement of instruments are being conducted with Ny Alesund (Spitsbergen), Izana (Tenerife), Bukit Koto Tabang (Indonesia), Regina (Canada), Ryori (Japan), Irkutsk (Russia), and Alice Springs (Australia). No final decision has been made for siting the final two instruments, but locations in Africa and South America are being considered.

A joint EMEP/WMO workshop was held in Interlaken in November 1999, where a closer collaboration between the two organisations was welcomed by both sides. The newly founded Task Force on Measurements and Modeling (TFMM), co-chaired by EMEP and WMO, was assigned to designate 5 to 10 joint "superstations".

Challenges, problems

- The establishment of a World Calibration Centre (WCC) for the long list of aerosol parameters continues to be a problem. It was, therefore, decided to distribute this task between two different institutions. The Institute for Tropospheric Research in Leipzig has agreed to host the WCC for the physical parameters. A host for the WCC for the chemical parameters still must be located.
- There are no generally accepted procedures available for some of the parameters in the above list. Research is therefore urgently needed in order to fill this gap.
- None of the Global sites perform the full suite of measurements listed above, with only very few stations performing more than half of the measurements. Capacity building and fund raising are therefore important priorities in order to achieve the goals of the GAW aerosol programme.

Plans for the near future

Within the year 2001 the following goals should be reached:

- Completion of the aerosol procedure report
- Construction of a template for the aerosol parameters
- Final decision on the placement of the 9 remaining PFRs

The next SAG meeting will take place in October 2001. The gathering of the information on the aerosol measurements at all GAW sites will extend into the year 2002. In the same year, the deployment of all 12 PFRs should be completed. This will indicate the end of the trial phase, which should then be critically evaluated.

All future activities should contribute to the strategic vision of the aerosol programme over the next 5-10 years as prepared by SAG:

- All of the key aerosol parameters / geographical regimes will be represented within the network of stations that are carrying out a comprehensive list of aerosol parameters, according to the GAW aerosol protocols.
- We are well on the way to understanding the spatial and temporal variability of the aerosol in the regions represented by GAW sites.
- We will have established new sites/stations in regions that are not currently represented by GAW aerosol global stations
- We will have strong links established between GAW aerosol and data user communities involving climate modeling, air quality modeling, satellite observation programs
- Vision for regional air quality
    a. GAW data will be used for regional air quality model validation and studies
    b. Partnerships will have been established with other interested organizations such as WHO for defining and implementing regional programs

GAW Scientific Advisory Group for Ozone

Michael H. Proffitt

The GAW SAG for ozone first met in June 1998 in Geneva, the next year in Crete, and last year immediately before the Quadrennial Ozone Symposium in Sapporo, Japan. Composition is based upon the current needs of the programme for ozone as approved by the EC Panel for GAW. Currently there are 11 members including the Chairman, Prof Ivar Isaksen. The Group includes experts on Dobson and Brewer column ozone observations, surface ozone measurements and calibrations, satellite ozone measurements, ozone LIDAR, ozone sondes, modelling, and archiving/mapping of ozone data. Therefore, membership represents a balance of interests in the GAW ozone activities

As with all of the SAGs, the actions recommended by the ozone SAG change year to year, and the current recommendations from the Third Meeting of the GAW Scientific Advisory Group for Ozone follow:

1. Dobson spectrophotometer intercomparisons should be performed in each of the regions I (Africa), II (Asia), III (South America) and V (South West Pacific) so that each region has one every 3 or maximum 4 years. Intercomparisons in Regions II and V should be performed as soon as possible.
2. Expand the monitoring network of Umkehr observations through training both of Dobson and Brewer operators and provide to the operators of both systems algorithms for analysis of these data. This can be accomplished at least in part through the regional calibration centres during inter-comparisons.
3. SOPs for ozonesondes must be established as soon as possible. The JOSIE campaigns should result in recommended SOPs that could be tested on a comprehensive inter-comparison of ozonesonde operation procedures flown on a single balloon.
4. The ozonesonde network should be expanded in the Southern Hemisphere and tropics.
5. Special effort should be given to enhance the ground based global network by microwave and LIDAR techniques where local infrastructure is sufficient.
6. Submission format for surface ozone must be established, and should not include the parameters SOx and NOx that are the responsibility of WDCGG.
7. Submission of ozone data to the GAW data centres from all sources including SHADOZ and NDSC should be strongly encouraged.
8. Data exchange should be expanded particularly through the use of the internet. It is highly desirable to establish a single web site that provides information to link all GAW data that is relevant to ozone.
9. Capacity building in developing countries must be a very high priority. Training centres and central facilities should provide enhanced training and instrument replacement parts to stations in developing countries.
10. Hold a workshop on the needs of the modelling community for ozone data from GAW, including optimal distribution, frequency and required accuracy for the measurements.
11. The GAW programme should continue to seek co-operation and co-ordination with satellite ozone monitoring programmes.

Progress on most of these recommendations has been made. The ozone programme continues to be at the foundation of GAW activities within the Secretariat as evidenced by the following activities:

A. Inter-comparisons and calibrations of Dobson spectrophotometers have continued to be a high priority for GAW. The first Dobson inter-comparison ever held in South America was held late in 1999 and the first for Africa was held in Pretoria, South Africa in 2000. In addition, the new Regional Dobson Calibration Centre at Hohenpeissenberg started full operation in 2000.
B. Standard operating procedures (SOPs) for ozone sondes is getting closer to reality with the completion of the chamber inter-comparisons in Julich during 2000. A meeting of experts will be conducted during May 2001 in Geneva to evaluate the chamber inter-comparison

results and to make recommendations on SOPs. It is expected that a test of these SOPs will be made on a single large balloon carrying a variety of sonde preparations during 2002.

C. Funds for calibration of the Russian filter instruments were provided during 2000.
D. Membership and attendance of the Secretariat at the annual meetings of the NDSC Steering Committee and the SPARC Scientific Steering Group.
E. A proposal “Capacity building for detection of stratospheric ozone recovery in developing countries” has been written and distributed to various national and international agencies. The initial response to this proposal has been very favourable from UNEP, US Department of State, NASA, NOAA, and in December 2000 it was endorsed by the Bureau of the 5th Meeting of the Conference of the Parties to the Vienna Convention for the Protection of the Ozone Layer.

If this 5 year proposal is funded, it will assure that the GAW programme in developing countries will continue to grow, and it will help to fulfil many of the needs as recommended by the ozone SAG.

Overview of Activities of the UV SAG

Ann Webb, Liisa Jalkanen and Paul Simon

Following the recommendations by the WMO/EC XLVI and the WMO Meeting of Experts on UV-B Measurements, Data Quality and Standardization of UV Indices, Les Diablerets, July 1995, the EC Panel of Experts/CAS Working Group on Environmental Pollution and Atmospheric Chemistry recommended at its meeting in 1995 the establishment of a WMO ad hoc Scientific Steering Committee (SSC, now SAG) on UV monitoring, the first GAW SAG, with the following terms of reference:

- to act as a focal point for the UV measurements and monitoring programmes,
- to co-ordinate UV instrument calibration,
- to promote instrument intercomparison,
- to promote the comparison, use and integration of measurements and models,
- to develop, in co-operation with the WMO World Ozone and UV Data Centre, requirements for UV data, and organize the data archiving and data distribution system,
- to implement, in co-operation with Quality Assurance/Scientific Activity Centres, a QA/QC programme,
- to advise, in ad hoc, the EC Panel on UV related research, as deemed necessary,
- to promote understanding and development of the specifications of user requirements for UV data,
- to promote communication within the diverse UV community.

The SAG UV consists presently of Paul Simon (chair), Anne Kricker, Sasha Madronich, Norio Hayashi, Gunther Seckmeyer, Petteri Taalas, David Wardle, Betsy Weatherhead, Ann Webb, Christos Zerefos (EC Panel representative) and Liisa Jalkanen (WMO Secretariat).

The SAG UV has met 6 times, the last meeting was in Geneva in April 1999. The 7th meeting will be held in 2001.

Activities since the last SAG meeting

- *Meeting of sub groups*

- Instrument subgroup meeting was held in Lauder, New Zealand 16-18 November 2000.
- Quality Assurance/Quality Control group will meet 26-27 April 2001 in Manchester.

- Reports

GAW Reports 95, 100, 112, 120, 126, 127, 128 have been already published.

- Instrument working group (WG):
  Part 1: Spectral Instruments report has been sent to print.
  Part 2: Broadband Instruments draft is ready, is being updated.
  Part 3: Multi-channel Instruments report first draft is ready.
- Quality Assurance/Quality control WG
  Quality control has been published as GAW report 126.
  Quality assurance: previous draft to be updated and completed in Manchester, for submission to SAG.
- Data submission to the World Data Centre: available on web.
- Modelling: intercomparison experiment held in Boulder will be published in peer reviewed journals

- Other reports
  - WMO supported the broadband intercomparison that was held in Thessaloniki, Greece 13-23 September 1999. A.Bais et al, Report of the LAP/COST/WMO intercomparison of erythemal radiometers, GAW report 141.
  - In connection with the above intercomparison, STUK in Finland has produced a report comparing results from the 1999 intercomparison with the WMO/STUK intercomparison of 1995. This will be printed as Annex to Report 141, but in its own covers.

- General GAW reports
  - GAW Strategic Plan for 2001-2007 has a section on Solar radiation, mainly UV.
  - The GAW Guide is being updated and has sections on Solar and UV radiation.

- Web site

  The UV Web site has been updated with the help of a consultant. The address is http://titan.srrb.noaa.gov/UV/left.html

- User community
  - A survey of the UV data user community needs has been made.
  - A presentation on the WMO SAG UV activities was given at the Photobiology conference in San Francisco July, 2000.
  - Producer-user discussions – dialogue between the physicists and biologists – in a workshop on standardisation is planned in conjunction with the European Society for Photobiology Conference, Sept 2001, Lillehammer, Norway.

- The information on networks is being updated, some new data exists on the web site.

- UV Index
  - A WHO-WMO-ICNIRP UV Index meeting was held in Munich, 4-6 December, hosted by ICNIRP. The UV Index booklet will be edited according to results from this workshop, with the lead responsibility at WHO.
  - The last meeting of the Management Committee of the COST 713 action "UVB Forecasting" was held at WMO Secretariat 15-16 March 2001, co-sponsored with MeteoSwiss.

- Intercomparison exercises: next to be held in Boulder, Colorado by SRRB in June 2001.

- European Reference laboratory

  A 3 year EU project will begin in September 2001, under which a reference travelling instrument and supporting laboratory for spectral instruments will be established at the Joint Research Centre of European Commission at Ispra, Italy, for Europe. There are preliminary plans to continue this effort on the European scale beyond the contract period as a JRC service, and discussions include potential services for other instruments. This would be in co-operation with WMO.

The work of the SAG UV has been supported by WMO and the UV Monitoring and Assessment Program Panel (UMAP).

GAW Precipitation Chemistry Science Advisory Group (PC-SAG)

Progress Report -- 30 March 2000

Richard S. Artz, Chair, PC-SAG

The GAW Precipitation Chemistry SAG (PC-SAG) has convened four times beginning in February of 1998. To date, the SAG has prepared an internal strategic planning document which is being used to improve the GAW precipitation chemistry program. To improve the quality of global data, the PC-SAG has undertaken to revise the standard operating procedures of the GAW precipitation chemistry network including all on-site, laboratory, data management and quality assurance aspects of the measurement system. The new procedures are to be documented and distributed in a new GAW precipitation chemistry operating manual in the very near future. All of these changes are being made in accordance with GAW policy to take the lead in producing strict data acceptance criteria, clear procedures, and effective feedback for nations and stations wishing to make precipitation chemistry measurements.

To date, the SAG has had a number of achievements worth noting:

- We have established a PC-SAG web site. Basic information such as the history and mission of the SAG, a list of SAG members, and information about laboratory intercomparisons is included.
- We have made a number of alterations to the annual laboratory comparison that began in 1978. Beginning in 2001, the program will be conducted twice each year. Trace sample measurements will be eliminated, but will instead be coordinated through Jan Schaug at EMEP. Intercomparison results will be made public and incorporated into the database at the World Data Centre for Precipitation Chemistry. Laboratories must participate in the intercomparisons in order for their respective station data to be included in the GAW data base.
- Because we have strengthened requirements for participation in the intercomparisons, we are working with the QA/SAC and the Illinois State Water Survey to make test samples more relevant to participating laboratories. In addition to the current low pH samples, higher pH samples and samples more indicative of marine regions are being prepared.
- A second interlaboratory comparison has been instituted in cooperation with the U.S. Geological Survey to quantify bias and precision in sample chemistry. Only seven laboratories participate in this program – but each laboratory analyzes 104 samples on an annual basis. At present, the Illinois State Water Survey in the U.S., the Meteorological Service of Canada, the Ontario Ministry of the Environment, the Acid Deposition and Oxidant Research Center in Japan, and the Norwegian Institute for Air Research laboratories participate in this program.
- We are working closely with the World Data Center for Precipitation Chemistry to develop a data submission standard. It is our intention to eventually provide interactive access via the web to the WMO/GAW precipitation chemistry database, both to deposit data from the various GAW precipitation networks, and to provide data downloads for research activities.

The SAG has a number of urgent projects that should be funded:

- We would like to provide standard reference materials (SRMs) to requesting laboratories.
- We would like use global position system receivers to clearly identify the locations of each of the 201 precipitation chemistry stations in GAW.
- Visitations to GAW stations are necessary to improve sample quality. This need is particularly acute for new stations and for stations in developing countries.
- Training programs should be developed for station and laboratory operators in developing countries.
- Sample preservation testing should be completed. As reduced nitrogen issues become more important globally, it will be necessary to assure high quality ammonium measurements.
- A guidance document for measurement of dry deposition is critically needed.
- There are a number of additional issues that are raised in the draft GAW Strategic Plan.

The SAG has several critical problems that must be addressed for progress to continue:

- Funding for the QA/SAC Americas is extremely tenuous. A method must be found to stabilize this activity.
- Progress with the development of the precipitation chemistry guidance document has been much slower than originally anticipated. We had hoped to table a near final product at the GAW 2001 meeting. However, we have been slowed by contractor problems (early in the process), internal obligations of SAG members which preclude the constant attention this effort requires to bring it to completion, and by many legitimate issues that require extensive discussion to resolve. Issues involving sample collection, appropriate analytical methodologies, and sample stability occupy much of our time. And of course, budgets are very tight.

Members of the PC-SAG include the following:

Mr. Richard Artz
U.S. NOAA Air Resources Laboratory

Dr. Karin Acker
Brandenburg Technical University of Cottbus**,** Germany

Mr. Van C. Bowersox
U.S. Illinois State Water Survey, United States

Mr. Tim L. Coleman
State University of New York at Albany, United States

Dr. Hiroshi Hara,
National Institute of Public Health of Japan

Dr. Alexey Ryaboshapko
Russian Institute of Global Climate and Ecology

Dr. Jan Schaug
Norwegian Institute for Air Research

Dr. Alexandre V. Soudine
World Meteorological Organization

Mr. Robert Vet
Meteorological Service of Canada

GURME SAG

Greg Carmichael and Liisa Jalkanen

The thirteenth World Meteorological Congress (May 1999) concurred with actions taken by the Executive Council and the Commission for Atmospheric Sciences to establish the GAW Urban Research Meteorology and Environment (*GURME*) project. The *GURME* project builds upon GAW's long-standing efforts, its expertise in the development of guidelines for the establishment and operation of measurement programmes, and its experience in coordination and training functions related to atmospheric environmental problems.

The *GURME* project recognises that NMHSs have a critical role to play in the study and management of urban environments, and that for many NMHSs this role will be expanded in the future. While the expanded roles will follow different paths, they will be centred on the traditional activities related to meteorological monitoring, forecasting, and modelling (both meteorological and chemical) and their application to air quality problems. *GURME* is aimed towards facilitating such activities by enhancing the capabilities of NMHSs to handle the meteorological and air quality aspects of urban pollution, both in research and operational modes.

Priority areas include the need to improve mesoscale models to support air pollution forecasting and the need to include air pollutants by expanding measurements under the GAW programme. In addition to issues related to modelling and measurements, the important area of information technology has also been identified, with the need to successfully produce, distribute and utilise data products.

The *GURME* SAG consists of the following persons: Greg Carmichael (chair), Leong Chow Peng, Paul Mason, Zwang Zhu and Liisa Jalkanen. The SAG has met twice, December 1999 and August 2000.

Main activities in *GURME*:

- *GURME* questionnaire was sent out to all NMHSs; 88 replies were received with 93 % interested in becoming more involved in urban meteorology and air quality activities

- Workshops were held in Nov-Dec 1999 in Beijing and in Moscow. The meetings were attended by a total of 100 national experts from 30 countries and WHO. The workshops followed a similar format with expert presentations and national reports on a wide range of urban environment topics including meteorological/pollution measurement programmes, meteorology and forecasting, modelling and meteorological information systems required to protect the urban environment and populations. The respective pilot projects were also discussed. The Beijing workshop gave recommendations for the activities in *GURME*.

- Urban pilot projects will be a very important part of *GURME.* These exist now in Beijing and Moscow. It is envisaged that such pilot projects will serve as models for NMHSs on how to go about establishing urban activities.

- A major focus is on developing urban-environmental forecasting capabilities at NMHSs by providing guidelines on available models and conducting inter-comparisons of these models, and organising workshops on forecasting tools, their uses and limitations. First of a series of Forecasting Workshops was held in Kuching, Malaysia in August 2000. In the workshop information was put together on 1) what kind of tools are available 2) what is needed for the models (computer requirements, internet access, input data, data inventories, personnel etc) and for countries just starting in this field 1) what is relevant for them 2) what are the objectives for activities in urban areas 3) short/long term needs 4) facilities and present capabilities.

- Passive samplers (small, inexpensive, with no need for calibration or electricity, easy to deploy, providing time integrated and continuous samples) are being used for urban measurements. The passive sampler project (see *GURME* web site) has been extended to include urban sites; by now 20 cities, more can be added.

- *GURME* will pursue linkages with national, regional and international programmes and agencies in addition to other related WMO programmes such as WWRP, the World Climate Programme's Climate and Human Health project and CIMO. When feasible, projects will be collocated and mutually supporting.

- The WMO and WHO have and continue to have strong links. The WHO cooperates mainly with national environmental agencies. Holding common workshops and publishing common guidelines for measurements is foreseen as the major activities. WHO has participated in the Beijing and Kuching meetings.

- As implementation, the capacities of NMHSs in urban environment matters will be developed by a variety of means such as twinning relationships, training seminars and expert visits.

- The WEB site will be the core of *GURME*, it already contains e.g. meeting reports and project descriptions and is being developed further at
  http://www.cgrer.uiowa.edu/people/carmichael/GURME/GURME.html

WMO Quality Assurance/Science Activity Centre (QA/SAC) for Asia and the South-West Pacific

Kazuto Suda

The Quality Assurance/Science Activity Centre (QA/SAC) for Asia and the South-West Pacific was established at the Japan Meteorological Agency (JMA) in October 1995, as one of the three QA/SACs within the framework of the WMO Global Atmosphere Watch (GAW) programme. The objectives of the QA/SACs are to oversee the quality of the data produced under GAW. The Japanese QA/SAC emphasizes activities, on the one hand, in the Asia and the South-West Pacific and, on the other hand, in the parameters of carbon dioxide (CO_2), methane (CH_4), and total ozone. The QA/SAC Japan is well located between the Eurasian continent and the Pacific for regional activities and also benefit from being colocated with the WMO World Data Centre for Greenhouse Gases (WDCGG) for parameter-specific activities. Since the commencement of its operation, the QA/SAC for Asia and the South-West Pacific has developed its activities in the two core directions mentioned above. The major activity areas of QA/SAC Japan are (1) site visit and exchange of experts with GAW stations in the region, (2) organization of regional workshops and seminars, and (3) calibration and intercomparison of standards and scales used for GAW measurement in the region. In order to support scientifically the activities of QA/SAC Japan, an advisory group of experts was established in 1999. The group consists of Japanese experts from universities, research institutes, and the JMA and meets biannually. The following are summaries and outcomes in the above three areas.

1. Site visit and exchange of experts with GAW stations

An expert of the JMA visited the Chinese GAW Baseline Observatory at Mt. Waliguan, Qinhai Province, China in November 1999. He made discussions with experts from the China Meteorological Administration (CMA) on the observation of greenhouse gases, in particular the quality assurance and management of observation data and data reporting to the WMO WDCGG. Agreements were reached between the CMA and JMA on future cooperative activities on greenhouse observation.

In the same month, another expert of the JMA visited the Korea Meteorological Administration (KMA) and its new GAW Regional Station at Anmyondo. During his visit to the Republic of Korea, the Korean and Japanese experts agreed on future cooperation in GAW observation, including the management of greenhouse gas observation data.

An expert from the Issyk-Kul Station in Kyrgyztan visited the JMA for cooperative research in January/February 2000. He made discussions with experts of the JMA on greenhouse gas monitoring programmes, quality control of greenhouse gas monitoring data, improvement of data quality and cooperative activities in the future.

In June 2000, two Korean experts visited the JMA including the GAW regional station at Ryori. They discussed further technical cooperation in the monitoring of a variety of GAW parameters, including greenhouse gases, ozone and aerosols.

An expert of the JMA visited the Cape Grim Baseline Air Pollution Station in Tasmania, Australia in January 2001. Discussions were made on monitoring programmes at Cape Grim, including data handling and calibration, by the experts of the JMA, the Bureau of Meteorology (BoM), and the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

In February/March 2001, an expert from the CMA visited the JMA for cooperative research on quality assurance and analysis of GAW measurement data including greenhouse and ozone observations. In particular, he made discussions with JMA's experts on model development for quality assurance and analysis and on future cooperation in the East Asia.

2. Regional workshops and seminars

International seminars on ozone observation were held in Tokyo during the year of 1996 in International Workshops on Ozone Observation in Asia and the Pacific Region (IWOAP I and II) sponsored by the Ministry of Transport (MOT) of Japan, JMA, and WMO. The seminars were attended by experts from China, India, Japan, Malaysia, Pakistan, the Philippines, the Republic of Korea, the Russian Federation, Singapore, Thailand, and WMO.

In February 1998, the International Seminar on Monitoring Network for Greenhouse Gases in Asia and the Pacific Region was held in Tokyo under the sponsorship of MOT, JMA, and WMO. Experts from Australia, China, Indonesia, Japan, and the Republic of Korea discussed greenhouse gas observations in the region and improvement of the data quality. They adopted a statement on the current status and future plans for monitoring greenhouse gases, including CO_2 and CH_4. In February 1999, the JMA, cosponsored by MOT and WMO, held the Second International Seminar on Monitoring Network for Greenhouse Gases in Asia and the Pacific Region in Tokyo. Experts from China, Indonesia, Japan, and the Philippines, Viet Nam, and WMO discussed greenhouse gas observations in the region and enhance the regional observation network. At the end of the seminar, they summarized the present status and future prospect of the regional observation network of greenhouse gases, including CO_2 and CH_4.

3. Calibration and intercomparison of standards and scales

In 1996 and 1997, the QA/SAC Japan organized a regional intercomparison of CH_4 reference gases, in which governmental organizations and research institutes of Hong Kong, Japan, and the Republic of Korea participated. The QA/SAC Japan also plans another regional intercomparison for the GAW stations in China, the Republic of Korea, and Japan. The reference gas will be shipped in the first half of 2001.

One of the secondary standard Dobson ozone spectrophotometers has been maintained by JMA's Aerological Observatory at Tsukuba. In 1996, intercomparisons were organized, in cooperation with NOAA, between this standard and the spectrophotometers of China, India, the Republic of Korea, Malaysia, Pakistan, the Philippines, and Thailand.

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QA/SAC and WCC for Surface Ozone, Carbon Monoxide and Methane

Brigitte Buchmann, Peter Hofer, Jörg Klausen, Christoph Zellweger

PART I – QA/SAC

Goals: The QA/SAC for surface ozone, carbon monoxide, and methan was established in March 2000. General goals include

- To support and audit the quality control system of GAW sites to ensure that reliable surface ozone, carbon monoxide, and methan data are available at the GAW World Data Centers.
- To support the distribution of the data to the scientific community and to encourage their use.
- To support the GAW Rapporteur of WMO RA VI (Mr. Gerhard Müller).

Organization: Dr. Peter Hofer (head)
Dr. Jörg Klausen (project leader)

Achievements: Major activities so far were

- To develop a database called GAWSIS for the management of information applicable to all GAW stations,
- To support the rapporteur of WMO RA VI in revising the GAW Strategic Plan,
- To establish the measurement technique for methane at EMPA,
- To begin the organisation of a technical workshop for the GAW community of WMO RA VI.

Challenges/Problems:

- To co-ordinate activities between existing QA/SACs, and to develop a common 'philosphy',
- To promote the use of the internationally accepted ISO vocabulary with regard to measurement uncertainty and QA within GAW,
- To find resources to enhance network-wide training and co-operation, particularly in countries in transition

Future Activities: The large scope of QA/SAC responsibilities and the limited resources make it necessary to focus activities on a few selected tasks. For 2001, these include to

- update the GAW Station Information System (GAWSIS) with current information about global and regional (WMO RA VI) stations,
- support the publication of GAWSIS as an interactive tool on the internet,
- survey the data flow from GAW stations to World Data Centers, to identify deficiencies and to suggest solutions,
- continue organization of a technical workshop for WMO RA VI,
- document the traceability chain for both methane and carbon monoxide measurements.

PART II – WCC

Goals: The main task of the WCC is to improve and harmonise the quality of surface ozone, carbon monoxide and methane measurements and thus to ensure that GAW data quality objectives are met. This includes in particular

- to trace back the measurements to the designated primary standard of the GAW network
- to carry out system and performance audits at the global GAW sites
- to conduct on-site training and to offer workshops.

Organization: Dr. Brigitte Buchmann (head)
Dr. Christoph Zellweger (project leader)

Achievements:

- Since establishment of the WCC in 1996, 18 system and performance audits at 13 sites have been performed.
- The results of these intercomparisons show that the data quality objectives for the ozone measurements range from fairly good to excellent.
- Due to on-site trainings subsequent audits at one site led to improvements of the data quality and harmonisation of the measuring technique.

Challenges/Problems:

- Harmonisation of CO – scale is needed
- The results of CO intercomparisons have to be re-analysed in light of the adjusted CMDL CO scale.

Future Activities:

- To conduct system and performance audits at global GAW stations not visited yet.
- To provide additional on-site training especially for the stations recently established.
- To evaluate CO instruments based on different measurement principles that are being used at GAW sites with respect to suitability for GAW purposes (detection limit, measurement uncertainty).

QA/SAC AMERICAS

Operated by
Atmospheric Sciences Research Center (ASRC)
University at Albany, N.Y.

Supported by
NOAA-ARL (Lead Agency), DOE and EPA

The QA/SAC-Americas has global responsibility for the GAW parameter PRECIPITATION CHEMISTRY.

For this parameter, the QA/SAC Americas has established and now operates the World Calibration Center (WCC) and the World Data Center (WDCPC). The Reference Standard for precipitation chemistry is prepared by the Illinois State Water Survey, Champaign IL, USA (NIST traceable) who also supplies the QA/SAC-Americas with certified artificial precipitation samples that are required for the annual quality assurance checks of all GAW analytical facilities responsible for measuring precipitation chemistry.

Data Quality Objectives (DQOs) have been established for precipitation chemistry measurements and will be published in a GAW report in 2001. Standard Operating Procedures (SOPs) have been established for precipitation chemistry measurements in general and will also be published in a GAW report in 2001.

The QA/SAC works closely with the SAG for Precipitation Chemistry and Deposition.

There are currently over 130 analytical laboratories who receive the annual artificial precipitation samples for quality assurance checks. Not all laboratories participate in this qa-activity mandated by GAW. The GAW precipitation chemistry network comprises more than 200 stations, most of which are in Europe (EMEP) and North America. The QA/SAC-Americas co-operates with the new Acid Deposition Monitoring Network in East Asia (EANET) which currently involves ten countries. The number of precipitation measurement sites is insufficient in South America, Africa and in many parts of Asia. Furthermore, there are inconsistencies in the sampling instrumentation and the sampling protocols around the world.

GAW precipitation chemistry data are archived at the GAW World Data Centre for Precipitation Chemistry (WDCPC). Historical GAW data have been quality assured (to the extent possible given the lack of historical quality control information) but the quality of these data has been generally insufficient for broad use by the scientific community. New data are being added to the WDCPC continuously and a World Wide Web site has been established to facilitate timely data submission and data access.

Despite obvious achievements of the GAW precipitation chemistry and deposition activities, some problems await solutions. There is growing global concern with regard to atmospheric deposition of heavy metals and persistent organic pollutants (POPs). These problems will be jointly addressed with the GAW Scientific Advisory Group on Precipitation Chemistry (SAG PC) which was established in 1998.

Planned additional activities for the 2001-2002 time frame include:

- To improve GAW precipitation chemistry measurements through the implementation of new SOPs, including improved measurement methods and QA/QC and more consistent laboratory performance, and through harmonization of measurements conducted globally by various regional and national programmes.

- To enhance the timely submission and distribution of GAW precipitation chemistry data through use of the World Wide Web and to promote the use of these data both for scientific and pollution control purposes.
- To stimulate and support the establishment of additional precipitation chemistry monitoring sites in data sparse and newly industrialising regions of the world through interested regional and national organizations.

The QA/SAC-Americas has <u>regional</u> responsibility for the GAW Parameter UV-RADIATION (Americas).

The QA/SAC-Americas co-operates with the UV: Scientific Advisory Group on UV radiation (SAG UV); responsible for all types of UV radiation measurements. DQO's and SOP's are in preparation (parts are presented in WMO reports Nos. 125, 126). A regional Calibration Centre for UV is beeing established for the Americas at the Surface Radiation Research Branch of NOAA's Air Resources Laboratory, Boulder, CO. USA (SRRB). This facility has performed the initial calibration and operator training of broad band radiometers for the Southern Cone project, where 12 UV measurement stations were set up in South America. These instruments now operate for three years and must be recalibrated.

Progress has been slow due to several factors: At present, a wide range of instruments to measure UV radiation are deployed throughout the Americas including spectroradiometers, broad band UV-detectors and multi-channel narrow band radiometers. DQO's, SOP's and QA-procedures must be worked out jointly with the SAG-UV and instrument specifications must be established for each type of instrument to be deployed at GAW stations. Resources must be made available to the SRRB in order to assume ist role as a permanent Calibration Center for UV-radiation. It is generally agreed that the UV-radiation measurements are not fully operational, and the QA/SAC-Americas continues it's preparatory work towards the implementation of operational structures for quality control and quality assurance.

The QA/SAC-Americas, jointly with the QA/SAC-Germany, has the lead responsibility for developing closer co-operation with the Committee on Earth Observing Satellites (CEOS) towards developing an Integrated Global Observing Strategy (IGOS).

The first phase of this activity has been completed and the assessment and recommendations have been published in the GAW Report No. 140 („WMO/CEOS Report on the Integration of Satellite and in-situ Measurements of Ozone") and in the WMO Bulletin (Volume 50, No. 1, January 2001). A proposal is currently prapared to expand this activity and to establish an IGOS-P Theme: *Integrated Global Atmospheric Chemistry Observations* (*IGACO*). This proposal with WMO as lead agency will be considered by the IGOS Partners at their June 1, 2001 meeting in Paris.

SOUTH AFRICA's GLOBAL ATMOSPHERE WATCH ACTIVITIES

Ernst Brunke

1. Overview

South Africa's (SA) Global Atmosphere Watch (GAW) activities comprise the Cape Point (CPT) Global Station, coupled with the Baseline Surface Radiation Network (BSRN) site at De Aar and two ozone stations, which are part of the GO3OS network for column ozone situated at Irene, south of Pretoria and at Springbok in the North-western Cape Province. In the late 1970s the Council for Scientific and Industrial Research (CSIR) and the German Max Planck Institute (MPI), Mainz, initiated a joint trace gas research program at CPT, starting out with CO and Freon-11. The programme has been progressively expanded, with 19 atmospheric parameters now being monitored on a continuous basis. In 1995 a new spacious laboratory was inaugurated. Two years later (1997) the CPT programme was transferred from the CSIR to the South African Weather Bureau (SAWB). During all these years, close scientific co-operation with our German twinning partners (initially MPI, and from 1986 onwards IFU, Garmisch) has been maintained.

The first column ozone measurements (Dobson #89) were made at Pretoria during the late 1960s until early 1970s, which unfortunately were only resumed again in 1989 as a result of neglected instrument conditions and lack of ozone interest. During 1995 a second Dobson (#132) was purchased and a measurement programme started at Springbok. ECC-Ozonesondes were launched at Irene on weekly basis from 1990-1993. This also included participation in the international Southern African Fire Atmosphere Research Initiatives (SAFARI_92, 94 and 2000).

From 1998 onwards the work became part of the NASA Southern Hemisphere ADditional OZonesondes (SHADOZ) program. One of the highlights has been the first all Africa WMO Regional Dobson spectrophotometer intercomparison in Pretoria during March-April 2000. In 1999, efforts from the BSRN programme and WMO resulted in the commissioning of the new BSRN station at De Aar in the southern Karoo. The solar radiation parameters being measured at De Aar comprise short wave global (direct and diffuse) as well as down-welling long wave radiation and UVB measurements.

Since 1992 the SAWB also established a UVB-Solar Light Model 501 network currently comprising six stations around the country. The network functions primarily as a public information service in terms of health hazards and the forecasting of UV levels.

The present measuring programme at CPT includes CO_2, CH_4, N_2O, CO, surface O_3, five halocarbons, solar radiation, and standard meteorological parameters. A programme for wet precipitation began in 2000. Radon measurements were started in 1999, with technical support from ANSTO (Australia). In addition, there are co-operative programmes for radionuclides (Environmental Monitoring Laboratory (EML), New York), passive sampling (Swedish Environmental Research Institute (IVL) and University of Potchefstroom), and for total gaseous mercury (IFU). ^{85}Kr had been sampled from August 1985 till October 1997 (Bundesamt Zivilschutz, Freiburg, Germany).

The GAW team now comprises seven staff members, including meteorologists, chemists and a data technologist. Since March 1, 2001, they form a sub division of the new Climate Systems Division of the SAWB.

2. Achievements / Products

Data (hourly means) have been gathered for CO (21 years), a suite of halocarbons (20 years), CH_4 (18 years), N_2O (19 years), surface O_3 (17 years) and CO_2 (8 years). At CPT, several equipment upgrades have taken place over the years. In 1988 a PC-based system for data acquisition and instrument control was installed, which was replaced by a more advanced system in 1999 (software developed at IFU). More powerful data processing as well as data storage onto CD at the site was introduced in recent years. The original MPI CO analyser was replaced in 1989 by a commercial instrument (RGA3, Trace Analytical). In 1994, CPT participated in correlative CO measurements for NASA's MAPS space shuttle missions. CO intercomparisons with NOAA CMDL and audits for O_3 and CO by the World Calibration Centre for Surface Ozone and CO were conducted. The scientific output comprises international journal publications, involving authors from South Africa, Germany, USA and others, as well as conference presentations.

For public information, GAW activities and climate change issues are presented at an information centre at Cape Point in the form of posters and PC slide shows.

3. Challenges / Problems

Over the years the availability of funding and qualified staff has governed the status and progress of the various GAW activities in SA. Financial restrictions have hampered the acquisition of advanced instrumentation and more primary standards.

Since the various GAW activities constitute a rather specialised research effort in SA, technical and "know-how" support can mostly only be obtained from abroad, which is costly and often cumbersome.

The submission of data to the WMO World Data Centres (WDCs) such as WOUDC, BRSN Zürich is in the process of being streamlined and attended to. Nonetheless, trace gas and other atmospheric data from the SA GAW have been made available to several research institutes for modelling and other studies on request. Our data submission endeavour has been held back by individual formatting requirements.

4. Plans for the near future

For CPT it is planned to purchase an oil-free compressor for preparing working standards with an "ambient air mix". In addition, another set of primary standards (CO, CO_2, CH_4 and N_2O) will be ordered from NOAA CMDL.

The modification and improvement of analytical apparatus will remain an ongoing priority. Depending on finances, it is envisaged to acquire a LOFLO CO_2 analyser. Efforts are currently underway on linking the UVB biometer network to the SAWB's website for the provision of real time information to the public. The proper archiving of GAW data also into the SAWB Climate Database System will be addressed towards the end of the year.

Our GAW activities may be extended with further Norwegian and German bilateral research efforts at the South African Antarctic base SANAE. Commencing with surface ozone measurements and upgrading the meteorological measuring capability is being planned for the 2001/2002 over-wintering period.

All in all, with the new internal organisational changes, the SA GAW will endeavour to continue its tasks within the WMO GAW community.

Acknowledgements

Technical and know-how support for the CPT project from our IFU twinning partner, especially H.E. Scheel, at Garmisch, Germany, is being greatly appreciated. We are also indebted to the CSIR, who managed and supported the CPT project since its beginning until 1997.

Pallas-Sodankylä GAW Global Station Activities in Finland

Yrjö Viisanen, Juha Hatakka, Jussi Paatero, Tuula Aalto, Tuomas Laurila, Hannele Hakola, Esko Kyrö*

The Finnish (GAW) station Pallas-Sodankylä has been operating since 1994. Upper-air soundings, climatological and other meteorological measurements are made at the Sodankylä observatory (67°22' N, 26°39' E), and tropospheric air composition and related boundary layer meteorological measurements at Pallas-Ounastunturi National Park. The distance between the two sites is about 125 km. The measurement program was divided between these two sites because of the unsuitable location of the Sodankylä Arctic Research Centre (near a town, inside inversion layer during winters) for the tropospheric air composition measurements.

Monitoring sites at Pallas-Ounastunturi National Park are locally and regionally characterized with a very limited number of pollution sources. Population density in the scale of hundreds of kilometers is less than 2 persons/km^2 and the nearest center of population, Muonio, with 2500 inhabitants, is located at 19 km distance from the measuring sites. CO_2 and other climatically active species are measured at the top of Sammaltunturi (67°58'N, 24°07'E,), which is a fjeld (arctic hill) located about 300 m above surrounding terrain and 560 m above the sea level (a.s.l.). The top of the fjeld is treeless and the sparse vegetation consists mainly of mosses and lichens. Treeline is located about 100 m below the station. Forest consists of mixed species, mainly Scots pine (*Pinus sylvestris*), Norway spruce (*Picea abies*) and downy birch (*Betula pubescens*). Wetland areas and lakes can also be found in few kilometers distance. Sammaltunturi belongs to a chain of fjelds extending from south to north, the highest top reaching 800 m a.s.l. There are measuring stations situated in top of Laukukero (68°04'N, 24°02'E, 765 m a.s.l.), Matorova (68°00'N, 24°14'E, 340 m a.s.l.), and near lake Pallasjärvi (68°01'N, 24°10'E, 303 m a.s.l.) all in less than 10 km distance from Sammaltunturi.

Pallas region is located near the northern limit of the boreal zone. Mean temperature of the year is -1.6°C, but during winter temperature can drop below -30°C and during summer rise above +20°C. The ground is covered with snow from October to May. The sun is continuously below horizon from December 9 to January 3 and above horizon from May 26 to July 18. Wind direction in Pallas is dominantly southwestern during autumn and winter and eastern during spring and summer.

We have purchased our own primary standards for the greenhouse gases CO_2, CH_4 and CO from the NOAA CMDL labs in Boulder. We have also extended the aerosol measurement programme with a nephelometer (light scattering properties of aerosols) and with parallel aerosol size distribution measurements at Sammaltunturi and Matorova with DMA/CPC (Differential Mobility Analyzer / Condensation Particle Counter).

New measurement station for climatically active species at Sammaltunturi is under construction and the building should be ready at the end of June 2001. The new building will have 120 m^2. This gives us enough space to extend continuous measurement programme, and also space for short-term intensive measuring campaigns. The greenhouse gas programme will be extended with continuous carbon monoxide and methane measurements during summer 2001.

Species	**Instrument or measurement method**	**Sampling frequency**	**Location**
Surface O_3	Two Dasibi ozone meters	Continuous	S
SO_2	Thermo Environmental Instruments 43 S	Continuous	S
CO_2, N_2O, CH_4	Glass flask samples	1/week	S
CO_2	Li-Cor Infra-red gas analyzer	Continuous	S
VOCs	850-ml stainless steel flasks	2/week	S
Sulphate	Filter	Daily	M
SO_2	Impregnated filter	Daily	M
Nitrate + nitric acid	Filter + Impregnated filter	Daily	M
Ammonium + ammonia	Impregnated filter	Daily	M
Heavy metals	Filter	Weekly	M
Mercury, particulate	Filter (with IVL)	Weekly	M
Mercury, gaseous	Goldtrap (with IVL)	2 days/week	M
POPs	Filter + polyurethane foam (with IVL)	1 week/month	M
Condensation nuclei			
D_a >10nm	TSI CPC model 3010	Continuous	S
D_a >0.3µm	TSI Laser Particle Counter	Continuous	S
Particle size distribution 10-450nm	DMPS-Differential mobility Analyzer with TSI CPC 3010	Continuous	S,M
Black carbon (BC)	Aethalometer (Magee Scientific)	Continuous	S
Radon-222	Aerosol beta activity measurement	Continuous	S,M
Radon-222	Accumulation chamber, alfa counting (with EML)	Continuous	S
Dose rate	Eberline ionisation chamber	Continuous	M
Electrical conductivity	Gerdier-cylinder	Continuous	M
Surface weather parameters	Vaisala MILOS500+sensors	Continuous	S,M,L,P
Solar Radiation			
Global irradiance	Kipp & Zonen pyranometer CM11	Continuous	S
$J(NO_2)$	Radiometer (Meteoroloogie Consult GmbH)	Continuous	S
Precipitation Chemistry			
pH, conductivity, major ions	Bulk collector	Weekly	M
Heavy metals	Bulk collector	Monthly	M
Mercury	Bulk collector (with IVL)	Monthly	M
POPs	Bulk collector + polyurethane foam (with IVL)	1 week/month	M

Table: Measurement scheme at Pallas region. Location: S=Sammaltunturi, M=Matorova, L=Laukukero, P=Pallasjärvi. IVL=Swedish Environmental Institute, Gothenburg, Sweden. EML=Environmental Measurements Laboratory, DOE, USA.

GAW Activity Summary at the Izaña Observatory (INM, Spain)

The Izaña Observatory (IZO), managed by the Instituto Nacional de Meteorología (INM, Spain), is located in the Tenerife island (The Canary Islands) at 28º18'N, 16º29'W, 2360 m a.s.l The observatory is situated on the top of a mountain plateau on the dorsal ridge that crosses the island. The ground in the vicinity of Izaña is loosely covered with light volcanic soil. The vegetation in the surrounding area is sparse, consisting mainly of broom. The Observatory is normally above a temperature inversion layer, generally well established over the island (between 1200 and 1800 m a.s.l.), so free from local anthropogenic source influences. The sky is usually free of clouds resulting to be extremely clean and suitable for radiation measurements.

1. Overview

History
In 1981, Dr. Schmitt and Dr. Balschtrusch, commissioners by the Deutscher Wetterdienst (Germany), initiated studies on the capability of Izaña as a Background Atmospheric Pollution Monitoring Network (BAPMoN) station. In July 1984 a joint Hispano-German agreement was signed for the installation of a BAPMoN station at the Izaña Meteorological Observatory. The BAPMoN program was initiated during this year.

Staff and internal organisation
8 researchers (including the Director: data management and science)
4 observers working shifts at the Observatory
1 observer for ozonesoundings and meteorology
1 electronic/computer technician + 1 technician for maintenance works
1 financial officer + 3 assistant officers in the administrative section
3 PhD students

The working subgroups are the following:

- Director
- Administrative section (4)
- Observer's team (4)
- Technician's teams (2)
- Ozone and UV Group (3 + 3 PhD students)
- Aerosol and Radiation Group (3)
- Carbon Cycle Group (2)
- Meteorology Group (1)

2. Achievements, products

Measurement program
The measurement programs are summarised in the next table:

- INTA; Instituto Nacional de Técnica Aeroespacial (Spain)
- CSIC; Consejo Superior de Investigaciones Científicas (Spain)
- IMK; Forschungszentrum Karlsruhe (Germany)
- NOAA/CMDL; Climate Monitoring & Diagnostics Laboratory-National Oceanic and Atmospheric Organitation" (USA)
- MPI; Max Planck Institute of Mainz (Germany)

Collaborative programs are highlighted in grey

Type of observation	Instrument/tool	Institution	Record starts in
Meteorology (cont) PTU+wind soundings (2/day)	T, P, RH, wind synoptic station/automatic station Väisäla receiver (RS-80) Digicora MW11	INM INM	1912/1984 1958 (digital record since 1978)
Tropospheric meteorology computation (meteorological fields, back-trajectories…)	HIRLAM (ECMWF) 0.5ºx0.5º model	INM	1998
Isentropic back-trajectories in the stratosphere	ECMWF model with Knudsen's algorithm	INM	April 1998
in-situ CO_2 (cont)	NDIR Siemens (SCRIPS +NOAA standards, round robins)	INM	June 1984
in-situ CH_4 (cont)	Dani + Varian GC's (NOAA standards)	INM	June 1984
in-situ CO (cont)	Trace analytical GC (NOAA standards + EMPA audit)	INM	October 1998
in-situ surface O_3 (cont)	Dasibi + TECO-49C UV-absorb. analysers (EMPA audit)	INM	June 1987
in-situ size distribution of sub-micron particles (cont)	SMPS-TSI	INM	February 1997
in-situ size distribution of particles above 1 micron (cont)	GRIMM	INM	March 2001
in-situ Saharan dust	Filters/Hi Volume samplers	CSIC	March 2001
in-situ PCB'c	Filters/Hi Volume samplers	CSIC	May 1999
in-situ carbon isotopes in CO	Bags samples (1/week)	MPI	1997
in-situ CO, CO2, CH4 and isotopes	Flask samples (1/week)	NOAA-CMDL	1991
in-situ carbon isotopes in methane	MgNa samples (1/week)	Heidelberg Univ. (Germany)	1984
Global, diffuse and direct radiation (cont)	Kipp&Zonen CM-11 and NIP Eppley	INM	1992
Total-sky images (every 10')	YES total-sky camera	INM	January 2001
Global UV narrow-band channels (305, 312, 320, 340 and 380 nm) +PAR (cont)	NILU-UV	INM	August 1999
Total O3 (about 40 observations per day)	Brewer MARK II#33 and MARK III#157 (calibrated once a year against international AES reference) NDSC standards	INM	May 1991
UV (290-360 nm, 0.5 nm step). (bout 30 scans per day)	Brewer MARK II#33 and MARK III#157 (1000W NIST traceable lamps)	INM	May 1991
UV (290-400 nm, 0.5 nm step). (about 40 scans per day)	Bentham-DM150 (1000W NIST traceable lamps)	INM	August 1999
Umkehr profiles (2/day)	Brewer MARK II#33 and MARK III#157.	INM	January 1992
Ozone vertical profiles (1/week)	ECC-A5 and ECC-A6 NDSC	INM	November 1992
NO2, O3 column (twilight)	Scanning UV-VIS spectrometer (EVA)	INTA	January 1993
NO2, O3 column (twilight)	Photodiode array UV-VIS Spectrograph (RASAS) NDSC intercompared	INTA	December 1998
Optical depth @ 368, 500 and 778 nm. (cont) Optical depth @ 368, 414, 499, 608, 664, 859 y 938 nm (cont)	PMOD/WRC Sunphotometer Rotating Shadowband Radiometer	INM INM-Univ. Miami	1994 Feb-96 / April 2000
Column amounts of H2O, HDO, N2O, CH4, CFC-12, O3, NO, NO2, HNO3, CLONO2, HCL and HF (2-3 days per week)	Fourier-Transform-Spectrometer BRUKER IFS 120M	IMK	February 1999

Last achievements

- New organisation. After July 2000 the Izaña Observatory depends directly on the General Director of INM.
- In July 2000 is inaugurated the headquarters of IZO in new facilities at Santa Cruz city.
- Special budget for IZO. In January 2001 IZO initiates the management of its own annual budget.
- A new computer network is implemented at IZO facilities (headquarters and Observatory). New computers have been acquired for IZO: a SUN WorkStation under UNIX-Solaris as the main server, one Alfa station (under LINUX Debian) for mathematical computation, ten PC servers under LINUX, and more than twenty PC under LINUX and Windows-2000. The Observatory is linked to the IZO's headquarters with a point-to-point data line. IZO' headquarters is linked with the INM's headquarters in Madrid with a frame-relay data line.
- A new station at sea level ("Punta del Hidalgo" light-house) is operated by IZO. This an excellent site representative of clean marine boundary layer conditions which could become a complementary GAW station at sea level. At present surface ozone and meteorology are measured on a continuous basis.
- Quality assurance activities have been promoted: CO2-CH4 round robin from NOAA/CMDL; surface ozone and CO audits from EMPA; acquisition of new world standards for CO_2, CH_4 and CO; acquisition of 1000W traceable lamps for UV program; annual calibration of total ozone against the AES reference Brewer.
- NDSC program joint. Total ozone (INM), ozonesoundings (INM), UV-VIS (INTA) and FTIR (IMK) programs have been accepted by the NDSC during 2000.
- A special 4WD van (9 seats) and a light van (8 seats) have been acquired for IZO during 2000.
- IZO has set up the Spanish Brewer network (six Brewer spectrophotometers). This network is managed in real-time providing UV and ozone data to INM's headquarters. The Brewer#33 formerly at Izaña station is now installed at sea level on the roof of the Izaña's headquarters at Santa Cruz de Tenerife.
- An ozone and UV index (UVI) forecasting model has been implemented at IZO, providing H+24 UVI forecasts for Spain (1ºx1º) on a daily basis.
- IZO manages a network based on NILU-UV narrow band radiometers for UV, PAR cloud optical depth and ozone determination in Antarctica (at the Argentinean stations of Ushuaia, Marambio and Belgrano) since January 2000. This network is linked to the UV-VIS (total ozone and NO2) network of INTA (the same stations).

Refereed- publications in 2000

- M. Gil, O. Puentedura, M. Yela, E. Cuevas, *Observations of NO2 and O3 columns by visible spectroscopy during the eclipse of February 26, 1998*, J. Geophys. Res., Vol. 105, No. D3, p. 3583, 2000.
- Kentarchos, A., G.J. Roelofs, J. Lelieveld, E. Cuevas, *On the origin of elevated surface ozone concentrations at Izana Observatory during the last days of March 1996: a model study*, Geophys. Res. Lett., Vol. 27, 22, 3699-3702, 2000.
- Diaz, J.P., Expósito, F.J., Torres, C.J., Carreño, V., Redondas, A., *Simulations of the UV Levels with the Presence of Mineral Aerosols*, J. Geophys. Res., Vol 105, No. D4, pp. 4979-4991, February 27, 2000.
- Sancho, J.M., E. Cuevas, J. Rodríguez, *Long-term changes in tropospheric and stratospheric temperature profiles over Tenerife*, World Weather, 50 years of Forecasting, WMO, 2000.
- Barend L. van Drooge, C.J. Torres,S. Ribes, J.O. Grimalt, E. Cuevas, *Polychlorinated biphenyls in the subtropical troposphere of the eastern North Atlantic*, accepted in Environmental Science and Technology, 2000.
- *Cuevas, E., M. Gil, J. Rodríguez, M. Navarro, K. P. Hoinka, Sea-land total ozone differences from TOMS: The GHOST effect, submitted to JGR, September 2000.*

Projects during 2000

- REVUE Project ("*REconstruction of Vertical ozone distribution from Umkehr Estimates*"); EC contract ENV4-CT95-0161.
- STREAMER Project ("*Small Scale Structure Early Warning and Monitoring in Atmospheric Ozone and Related Exposure to UV-B Radiation*"); EC contract ENV4-CT98-0756.
- TRACAS project ("*TRAnsport of Chemical species Across the Subtropical tropopause*"); EC contract ENV4-TC97-0546.
- "*Global mass balance of persistent semi-volatile organic compounds: An approach with PCB as an indicator*"; EC contract ENV4-CT97-0638.
- Proyect "*Investigación de las Interrelaciones de los Niveles de Radiación UV con las propiedades radiativas de los aerosoles atmosféricos y las nubes*"; CICYT Climate National Program contract CLI97-0453.
- Project "*Medida y Modelización de la distribución espacio-temporal de la irradiancia solar ultravioleta en España*"; CICYT Climate National Program contract CLI97-0345-05.
- RACRUV Project ("*Red Antártica para la vigilancia y Caracterización de la Radiación UltraVioleta*"); CICYT Antarctic National Program contract ANT98-0179.

3. Challenges-Problems

- Data handling and data submission to the different WMO world data centers, NILU and NDSC.
- Communication with other GAW stations.
- WMO-GAW web page.
- Reduction of the 24-hour observer team.

4. Plans for the near future

- Three new national funded projects, in collaboration with INTA and La Laguna University, are initiated in January 2001.
- Installation of two new sun-trackers (by the end of March 2001)
- Installation of a new WRC Precision Filter Radiometer (by April 2001)
- New data acquisition and evaluation software for Ushuaia station (by May 2001)
- Replacement of the FTIR (IMK) by a newer instrument.
- Automation of synoptic observations/SYNOP code submission (by July 2001)
- Regional center for Surface ozone calibration set up in Buenos Aires in cooperation with EMPA (by September 2001)
- Acquisition of new NOAA CO_2 world standards(by September 2001)
- Initiate AOD and spectral UV measurements at sea level, on the roof of the IZO headquarters at Santa Cruz de Tenerife (by October 2001).
- New building. The main building of the Izaña Observatory, including the observation tower is presently renovated. For this reason all the instrumentation was moved to a provisional measurement site, about 100 m south of the old location, from April 10th, 2000 to early 2002. All the instruments are now installed inside the air conditioned building. The residence will not be available till the renovated building is again in operation. The renovated Observatory will have a new 6-floor tower (26 m above the ground) with a surface of 186 m^2 per floor. The available space in the main building, for the residence, kitchen and offices, will be of 1100 m^2. The works will finish by the end of 2001.
- Measurement automation / fully remote controlled from IZO headquarters (by the end of 2001).
- Scientific agreement with La Laguna University to officially incorporate scientists of the University in the measurement/scientific programs of IZO.
- Data submission process completion to World Data Centers (by the end of 2001, early 2002)
- English version of the IZO web page (by early 2002).
- Installation of a tropospheric aerosol lidar at sea level (by July 2002).

GAW collaborations
CO working tanks for Ushuaia station ?
Cooperation with the Assekrem-Tamanrasset GAW station concerning Saharan intrusions
Cooperation with the WRC concerning the new world AOD network.

The Cape Grim Program

J.L. Gras

Overview. The Cape Grim program was established by the Australian Government to monitor and study global atmospheric composition. It is a joint responsibility of the Bureau of Meteorology and the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The station is designated by WMO as a Global Atmosphere Watch (GAW) Global Observatory, and is Australia's major input to GAW.

Measurements in what was to become the Australian Baseline program, started in the mid 1970s at several Tasmanian sites, and at Cape Grim on the north western tip of Tasmania (40° 41' S,144° 41' E) in 1976. A permanent station was approved in 1978, with construction commencing in 1980. The completed facility was officially opened in 1981. A telecommunication tower was installed in 1985 and air-sampling inlets at the 70 m level installed on the tower in 1986. Operating costs for the Cape Grim Station are provided by the Australian Government, through the Bureau of Meteorology. The program operates under a multi-level structure comprising a Management Group (Bureau of Meteorology and CSIRO) and a Working Group comprising the Station Officer in Charge (OIC), management group representatives and the Lead Scientists for the individual scientific programs (currently 10). There are six permanent staff who provide the administrative, information technology and technical services, and manage the day-to day running of the program. Currently there are two part-time, temporary staff who assist with operations and research at the station. The OIC is responsible for the overall integrity of the monitoring program. The Cape Grim program comprises a range of core programs, each carried out under the direct responsibility of the relevant Lead Scientist. The present list includes 14 core programs, some of which are currently in review (indicated **).

CO_2
C isotopes O_2/N_2
Halocarbons, nitrous oxide
CH_4, CO, H_2
Tropospheric O_3 & nitrogen oxides
Multiphase atmospheric chemistry
Particles & (precipitation chemistry & hi. vol**)
Radon**
Spectral radiation
Passive radiation
Remote sensing of clouds**
Meteorology/climatology
Air archive
Cape Grim Overflights**

In addition, pilot and cooperative programs are included as part of the overall scientific program. Currently, pilot projects include FTIR instrument development, measurement of phytoplankton-derived alkyl nitrates and aerosol transport remote sensing. A wide range of national and international projects is carried out where the main scientific direction is from outside the Cape Grim program but the work is seen as mutually beneficial.

Achievements. The primary output of the Cape Grim program is high-quality, long-term atmospheric composition data, as a data archive. There is also an extensive series of "Baseline" reports that include program and data summaries and scientific reports developed using Cape Grim data (Baseline 1976 to Baseline 97-98). Cape Grim also holds an (open) annual scientific meeting where results are presented and discussed. An essential component of the Cape Grim philosophy has been a close linking between the measurements and an active research program

that uses the collected data. Output from this component includes an extensive list of publications in peer-reviewed journals, presentations at international fora and advice to government and input to international bodies such as IPCC. Other valuable products include an extensive air and aerosol filter archive.

Notable achievements have resulted across the range of scientific programs and these include multi-decadal records of many species including several that are globally unique such as carbon isotopes and CCN concentration, as well as a decadal record of vertical profiles of various gases including O/N ratios. Other important findings include, for example, identification of the peak in ozone-depleting substance concentration, and the integration of species measurements allowing a 20-year record of OH radical concentration to be determined, revealing trends and inter-hemispheric differences. The detection of surface level sunrise ozone depletion has only been possible because of the long-term high-precision baseline record. Establishment of the air archive and flask intercomparison programs are important technical achievements, the former allowing determination of new atmospheric species or the application of new measurement methods, the latter revealing otherwise undetected errors in network measurements and leading to a new calibration strategy. Other achievements include use of observation data to determine global sources and sinks of a number of species such as CO_2, CH_4, CFCs etc.

Challenges, problems, & plans for the near future. The main challenge for the Cape Grim program is to maintain a viable and active program that efficiently addresses the needs of its stakeholder - funders, the Australian community, government and the international scientific community. As in the past, this will be best served by providing accurate data relevant to political decisions that need to be made in response to changing climate and/or atmospheric environment, nationally and through international treaties, as well as satisfying international obligations, particularly the Australian contribution to the Global Atmosphere Watch. Maintaining adequate resources to satisfy the evolving program is an on-going issue.

Scientifically there are compelling reasons to move beyond surface, point-based measurements. The atmosphere needs to be understood through its depth, and the scales represented by models need to be matched by measurements. Expanding resources to meet this challenge will be difficult. Numerous areas need better understanding. One of these, that is relevant to the marine atmosphere, is air-sea exchange. New techniques involving multi-species analyses such as volatile organics and aerosol offer alternate avenues for understanding sources and atmospheric processes. Expanding or modifying programs to follow these leads requires a continuing process of evolution.

For the Cape Grim program there are some specific issues. The past very strong synergistic relationship between CSIRO and the Bureau of Meteorology within the Cape Grim program, potentially renders it vulnerable to shifting roles and priorities of these organisations over multi-decadal time scales. Ageing of staff and succession also become issues in long-running programs. Continuing efforts are made to expand the input of scientific expertise.

Technical issues still exist in some programs with international data inter-comparability and a lack of designated suppliers of standards e.g. CFCs needing improvement. Finally, an ongoing issue is the difficult step of getting data validated and into the database.

THE GLOBAL GAW STATION AT USHUAIA

Osvaldo Barturen

1. General information

Station staff:

- Osvaldo Barturen
  Chemical engineer, SMN
- Sergio Luppo,
  Chemical engineer, Government of Tierra del Fuego
- Alfredo M. Pereyra,
  Chemical engineer, Ushuaia City Hall
- Marcelo Sosa,
  Meteorological observer, SMN
- Erica Piccaluga
  Meteorological observer, SMN
- Adrián Silva
  Meteorological observer, SMN
- Lilian Riebel
  Technician, Government of Tierra del Fuego

2. Station programme

Measuring activities at the Station:

TOTAL OZONE
SOLAR RADIATION
UV-B RADIATION
CARBON MONOXIDE
TROPOSPHERIC OZONE
FLASK AIR SAMPLING
METEOROLOGY

3. General description

Ushuaia GAW Station coordinates are 54º 49' S latitude and 68º 19' W longitude. Its location, near the Antarctic vortex places it in a preferential location for monitoring the "ozone hole" phenomena and other associated parameters.

The main building is located on the shores of the Beagle Channel in Punta Pinguino, W-SW of Ushuaia Peninsula and 20 m from the edge of a cliff. The station is 18 m above sea level. It is upwind from Ushuaia city and the prevailing winds are S-SW.

The station contains a laboratory with equipment for continuous measurement of surface ozone, carbon monoxide, and black carbon (discontinued), a solar radiation laboratory, a meteorological office, two offices, a kitchenette and toilets. Solar radiation sensors, an automatic met. station and air intakes can be found on the roof above the principal laboratory. The total area of the station's main building is 150 m^2. The Dobson spectrophotometer is mounted in a separate building at the rear of the station.

A walk-in sampling tower was erected on Isla Redonda island, 54º 51' 81 S and 69º 28' 55 W, 17 km from the station. Aerosols and flask sampling programmes are carried out there. The island was chosen in order to have a clean sampling point, avoiding polluted air intrusions occasionally observed at the station.

4. History

- 29 December 1992: Agreement Servicio Meteorológico Nacional – Government of Tierra del Fuego.
- 24 March 1994: Start infrastructure in Ushuaia Peninsula.
- 4-16 September 1994: First Ushuaia Measuring Intensive (FUMI)
- 4-25 November 1994: Second Ushuaia Measuring Intensive (SUMI)
- 25 November 1994: Official Start.

Most of the instruments were received, installed and began measuring during those periods. Staff were trained during these initial activities.

After two years of functioning, most of the initial problems were solved. Remaining issues were overcome with collaboration from different supporting agencies suggested by WMO.

We would like to thank two special persons that are no longer with us for their important participation with our station, Com. Jaime Wilkinson and 1st Lt. Gabriel Karamanian. We are going to miss them.

5. Achievements

In spite of policies, budgeting and unexpected problems, the Ushuaia GAW Station is operating 365 days per year and maintaining a complete measuring record.

We are fortunate in having very qualified staff and the general feeling is that we are capable of doing more.

6. Challenges, problems

The major inconvenience we can see is a lack of funds. This fact not only affects the obvious management activities but also has direct implications on staff morale.

We also need more twinning to maintain the training level of our staff, refresh their knowledge and develop new ideas.

7. Plans for the near future

Our plans involve maintaining our achievements, and improving them if possible.

Several agencies are interested in our Station.

In the near future we will install two GCs for monitoring CFC's, HCFC's, and other species, with help from Dr Jim Elkins (NOAA).

We look at our future with faith, and we are sure that with the necessary support we will accomplish our plans.

Thank you very much.

The Global GAW Station Bukit KotoTabang, Sumatra, Indonesia

Hery Harjanto and Nurhayati

1. Overview

The Global GAW station Bukit Kototabang (Indonesia) was first established in 1993, and became officially operational on 7 December 1996. Located at a remote area in Sumatra very close to the equator (0^0 12' 07"N; $100^0$19' 05"E), the station is designated as a site to measure the characteristics of the main chemical constituents in the equatorial region. The surroundings of the station, which is situated on top of a hill at 864.5 m above sea level, are mainly tropical forest vegetation types. The closest distance to the western coastline is approximately 40 km. Prevailing winds are south to southeast (December-May) or from north to northwest (June-November).

At present, observations made at the GAW station Bukit Kototabang, comprise continuous measurements of aerosols (PM 2.5), radiation (global, diffuse, RG-8 and UV-B), reactive gases (NO_2, SO_2), near-surface ozone, polyaromatic hydrocarbon (PAH), black carbon, rainwater chemistry and surface meteorological parameters. There are 9 key people involved in the operation of the station including a station coordinator, operators for each instrument and technicians. The list of measured parameters, name of instruments, measurement frequency and associated contact persons is presented in the following table.

Table 1. Measurements made at the Global GAW station Bukit Kototabang.

Parameter type	Instrument	Frequency of measurement	Contact Persons
Aerosol	Aerosol sampler	weekly	Yasri, Nasrullah.
Radiation	Pyranometers	hourly	Herizal
SO_2 , NO_2	Passive samplers	weekly	Yasri
Surface O_3	UV-photometric analyzer	hourly	Budi Suhardi, Carles
PAH, Black carbon	PAH-meter, aethalometer	hourly	Imam Prawoto
Rainwater	Rainwater sampler	daily	Kaharudin, Tuti Mulyani
Meteorological parameters	Thermo-hygrograph, barograph, anemograph, evaporimeter, pluviograph.	daily	Carles, Darmadi, Yasri.
Boundary layer Radar data	Boundary layer radar	daily	Imam, Nasrullah, Carles, Yasri
Total column ozone	Ozone sonde	daily	Kaharudin, Darmadi

2. Achievements/Products

The sampling operation of the measurements of parameters listed in Table 1 has been carried out at the station since October 1995. Preliminary results of the measurements have been shared and presented in a number of seminars and conferences, both national and international. Data exchange and collaboration have occurred with some world activity centers for primary standard, QA/SAC and for calibration purposes. For instance, the UV-radiation data have been submitted to the UV-Radiation Research Branch of NOAA's, Air Resources Laboratory, Boulder, Co, USA for primary standardization, while the analytical results of rainwater samples are sent to the World Data Centre for Precipitation Chemistry in Albany, NY, USA for quality assurance.

In addition, the establishment of the station has encouraged national and international scientists to conduct a number of joint research collaborations, or to spend some time at the site to study the behavior of atmospheric constituents in the equatorial region. In the near future, with the assistance of several international bodies, operational activity at the station will be supplemented with measurements of CO_2, CO, N_2O and aerosol optical depth.

3. Challenges/Problems

Based upon the cooperation between BMG (the Meteorological and Geophysical Agency), BPPT (Agency for the Assessment and Application of Technology) and LAPAN (National Aeronautical Space Agency), a boundary layer radar (BLR) and an earth atmospheric radar (EAR) have been set up adjacent to the GAW site. The operation of the two radars is expected to contribute to understanding the chemical and physical processes in the atmosphere which can affect the depletion, transformation, lifetimes and transport of pollutants within the maritime Southeast Asian region. However, these additional activities conducted by two other institutions means more people working in the immediate area around the GAW site, and this could be a threat for changing the environment. Therefore, efforts have to be made to keep the area clean and free from anthropogenic pollutants.

Another problem facing the site is that local people (mostly farmers) have used the small access road to the station to develop the area. Local authorities have been asked to help raise the people's awareness of the need to keep the surrounding area of the station unchanged.

Progress of China Global Atmosphere Watch Baseline Observatory

TANG Jie, YAO Ping, YANG Zaoming, ZHANG Xiaochun

The opening and subsequent operation of the China Global Atmosphere Watch Baseline Observatory (CGAWBO) since September 1994, has been a great success for WMO's leadership, a painstaking fruit for the nation's concern and an excellent example of international cooperation. However, in accordance with the well known Chinese saying, this great success is only the first step in a long march of ten thousand miles. To keep the CGAWBO operational and reliable for decades to come is a mission in which there will be many difficulties, more so than even those during the establishment of CGAWBO. Nevertheless, the successful operation of the CGAWBO has continued over the past 7 years, thanks to the leadership of the China Meteorological Administration and with international help. A brief review of achievements follows below.

I. Routine Measurements

In the first 7 years of CGAWBO, two teams consisting of local technicians (operators) and scientists (principal investigators) in Beijing, respectively, have been established and have gradually gained experience. To keep the routine on-site measurement programme running smoothly and of high quality, a complete and rational regulation system has been set up and improved progressively since 1994 with emphasis on instrument maintenance and data management. Many measures have been taken for carrying out the regulations such as: targeting point system, mutual checking and education system, and periodical evaluation/training system. A system of a two-level QA/QC procedure for data was also set up both on-site by operators and in the central laboratory by the principal investigators. In order to improve data management, a high quality data base is under construction both on site and in the central laboratory in Beijing. To coordinate the work of the two teams, annual joint meetings have been conducted since 1995.

Frequent internal auditing by the Chinese principal investigators and international auditing have played important roles with respect to QA/QC activities in CGAWBO. Up to this time, the CGAWBO has received considerable auditing from WMO authorized institutions. In addition, CGAWBO twice took part in the CO_2 Round Robin inter-comparison and achieved good results both times. The data, having passed through the QA/QC procedures in CGAWBO, are reported to individual WMO GAW Data Centres.

II. Research Programme

Research activities related to baseline monitoring in the CGAWBO are not only considered as an application of the observed data, but also are considered as a cornerstone of capacity building and vital to the long term development of the Observatory. Thus, how to better integrate the research activity with routine measurements has been one of the priority tasks in CGAWBO. Through the relationship with the Chinese Academy of Meteorological Sciences (CAMS), many national research programmes and an international project have been conducted at the Observatory. In this regard, CGAWBO has taken part in 8 national level research projects, 2 provincial level research projects and one international research project. These research projects both assisted personnel training and data interpretation in CGAWBO. In addition, more than 20 papers related to CGAWBO monitoring results have been published at home or internationally.

III. Capacity Building and International Cooperation

Capacity building is also a high priority task of the CGAWBO, not only for efficient operations, but also for the long term development of the Observatory.

In the CGAWBO, on site training is the primary tool for capacity building for the operators when scientists visit the site from both home or international institutions. In addition, an on-the-job course in CMA provided the opportunities for one member of staff to finish college study and for two staff members to take master degree courses. International exchange is also an important and effective way for capacity building for the Observatory.

IV. Repairing and Upgrading the Facility

CGAWBO experienced difficulties with both the building and power system in 1997-1999. During this period, CGAWBO was still able to maintain operational running and collected data to the extent conditions would allow. Taking almost three summer seasons, reconstruction of the old building and power supply system were finished to a standard better able to withstand the mountain climate and meet the needs for observations.

CGAWBO is still young in the global GAW family, learning from her own experience and the experiences of other stations. CGAWBO will certainly meet more challenges and now is much more confident to face the future after being through the successes and the difficulties in the past 7 years.

MOUNT KENYA GLOBAL ATMOSPHERE WATCH STATION

Wilson Kimani

1. Introduction

Kenya agreed to host the GAW Mount Kenya station in 1993. The donor community provided a fully instrumented containerized station together with a training component. Kenya's contribution included the ground infrastructure such as electricity, access road, staff and communication. Kenya Meteorological Department (KMD) is the lead local agency.

The country took 6 years (1993-199) to reach the start-up phase. This undue delay resulted from such difficulties as:

1. Rough mountain terrain and the accompanying harsh weather hampered the quick laying of the infrastructure.
2. Economic hardship and low annual budgetary provisions to KMD often dictated the pace of the project implementation.
3. Policy requirements from stakeholders, such as passing electricity over private land, and the writing of the Environmental Impact Assessment, were not resolved expeditiously.
4. Indecision by the Power Company to contract out the power line construction delayed the work for two (1996-1998) years.

The implementation phase was thus slow but progressive. The local agency displayed much enthusiasm and willingness to support the project as far as the available resources could allow.

1.1 Personnel

There are 6 station operators including the Station Manager who is also the Country Contact Person. Of the six, two are electronic technicians (Diploma level) and the rest are meteorologists (Graduates and post-graduates). These are the same key personnel who operate the ozone soundings. All the staff participated in the station and instrument set-up. They have a basic knowledge of the station operations. The one-on-one training, such as the experienced in the ozone sounding, is completely lacking.

1.2 Station Activities

The main environmental monitoring programme is to sample background air that is representative of a large geographic area in the free tropical mid-troposphere. The complete programme has surface ozone and pressure, total and diffuse radiation, precipitation, aerosols, greenhouse gases, and meteorology as the core parameters. The operations of the Aethalometer and the Grab Sampler are uncertain until now. The instruments have not been tested yet. The DCP-meteosat link has not yet been established. The orientation of the aerial is suspect. Otherwise the communication between the data logger and the DCP is well established.

The normal station activities, as well as the staff training, have been adversely affected by the unstable power supply. The problem apparently lies with poor workmanship by the contractor. The Power Company is rectifying the faults as they occur.

The station operations started in December 1999 but there are too many data gaps due to the frequent power failures. It is for this reason that the available station data has not been relayed to the respective World Data Centers.

2. Achievements

We consider the construction of the station containers at site and the power line to the station as the major achievements realize at the station. Equally worthy of note is the focussed determination of the GAW staff in keeping the station going amidst serious logistical problems. The GAW station is gradually gaining recognition from our national Universities, schools and colleges. The recognition has been achieved through articles in the Kenya Meteorological Society's quarterly publication (The Weatherman) which is widely subscribed by schools. Publicity of the GAW activities in Kenya is also channeled through lectures that are given to students and other visitors to KMD.

It is instructive that the present organizational structure of the KMD has an Environmental Section that solely deals with matters related to GAW. Various governmental arms are also gradually appreciating the importance of the environmental activities that are being undertaken by the Department. The Nairobi ozone sounding station was last year (World Ozone Day, 16 September) honoured by the National Environmental Secretariat and UNEP for the progressive work in support of the UNFCCC other related conventions.

3. Challenges

Planned visits to the station have often failed due to unforeseen circumstances. The major problems are the unstable power supply, transport, and the uncertain station budget. The challenge here is to make the station operate continuously and manage to make the planned weekly visits.

There are also some ambiguous aspects of the station's monitoring programme itself. It is not yet clear where the grab and precipitation samples will be taken for analysis. It is not known which laboratory will analyze what sample. In conjunction with the selection of the laboratories, modalities should be put in place for shipment of the samples. This aspect needs to be clearly outlined as there are financial obligations involved.

Similary it is uncertain Kenya Wildlife Service will be manage to keep the entire Sirimon Route (access road to the station) in motorable conditions throughout the year. The track is generally impassable during the seasonal rains. A strong vehicle can make a half journey between Moses Camp and the station in dry conditions. Otherwise delivery of any material to the station is manual.

4. Future Plans

The proposal is to deploy some of the GAW staff to a base near Nanyuki. This will be possible only when the Department will be able to procure a Land Rover. This commitment is now reflected in the 2001-2002 financial year.

The other alternative is to provide the Nanyuki meteorological observatory with a 4-wheel drive vehicle which would be used to climb to the station by the GAW staff whenever they are in Nanyuki. Travel from Nairobi would ordinarily entail public transport if no delicate or large provision is being taken to the station.

World Ozone and Ultraviolet Radiation Data Centre (WOUDC)
Summary of Activities

Edward W. Hare

Overview

The WOUDC is solely operated and funded by the Experimental Studies Division of the Meteorological Service of Canada (MSC) - formerly Atmospheric Environment Service (AES), Environment Canada and is located in Toronto. The WOUDC began as the World Ozone Data Centre (WODC) in 1960 and produced its first data publication of *Ozone Data for the World* in 1964. In June 1992, the AES agreed to a request from the WMO to add ultraviolet radiation data to the WODC. The Data Centre has since been renamed to the World Ozone and Ultraviolet Radiation Data Centre (WOUDC) with the two component parts: the WODC and the World Ultraviolet Radiation Data Centre (WUDC).

The WOUDC data sets include total column ozone, vertical profile data from ozonesondes, lidar and the Umkehr technique, legacy surface ozone data, spectral, multi-band and broad-band UV data. There are over 110 registered Agencies within the archive which is comprised of approximately 350 ozone and 80 UV monitoring stations which is a combined total of just over 400 independent stations. The temporal range of the data is from the late 1950s until present. One station, Arosa, CHE has total ozone data dating back to 1926.

Primary Personnel

David I. Wardle (Scientific Authority)
Edward W. Hare (Manager)

Major Contributors

Edward J. Carty (Database and software support)
Vitali E. Fioletov (Trends scientist)

Associations within WMO-GAW

The WOUDC is part of the WMO-GAW SAGO3, SAGUV and the World Data Centre Managers sub-groups. The WOUDC chairs the UV working group on Data Management that reports to the SAGUV and a Brewer Sub-committee that reports to the SAGO3.

The WOUDC also initiated the formation of the ad hoc sub-committee on Umkehr data algorithms and analysis and also provides the Brewer Data Management System (BDMS) as an off-site archive for Level 0 Brewer data.

Beginning in September 2000, the WOUDC began producing near real-time total ozone maps in conjunction with the WMO-GAW Northern Hemisphere Ozone Mapping Centre (NHOMC).

Current activities

- Accepting data submissions on a weekly basis which has been increased from the bi-monthly schedule of only two years ago
- Continued QA and revision tracking of data sets
- Maintaining the WOUDC web and ftp sites which include on-line access to meta-data and the data file archive
- Production of reports and the annual data archive CD-ROM
- Production of daily total ozone maps based on near real-time data (in conjunction with NHOMC)
- Continuing SAG activities related to QA and submission and presentation of data

Achievements and value added products

- The first CD-ROM release of the publication "*Ozone Data for the World"* (ODW) for the year 1999. This was formerly published in printed form as the "Red-book". The ODW-CD1 is the second CD released by the WOUDC. The first was released in 1996
- File re-formatters and QA tools for data originators and data clients
- Weekly updates of the data archive
- Release of the new web and ftp sites based on the new method of data submission and the new data file format called extended Comma Separated Values or extCSV
- Time series of the differences between WOUDC ground-based station data and NASA-GSFC TOMS plots. This is a value added data product
- Release of the UV Guide-book and soon to be released Ozone Guide-book (i.e. awaiting endorsement by the SAGO3)
- Several campaigns have added important data sets to the WOUDC: the NASA-Langley PEM-Tropics-A, PEM-Tropics-B and the NASA-GSFC SHADOZ ozonesonde data along with the European CUVRA UV data

Challenges, Issues and Problems

- Inconsistent or delinquent data submission
- Data centres becoming "Information centres" due to the increased use and exposure from the Internet, therefore requiring the site to be "browser friendly"
- The data centre being obliged to act on issues ranging from data submission schedules to poor quality data
- Need better communication and interaction from the community, especially trends panels and major stakeholders who use the data inventory
- Better linkages with other data centres
- Need more UV and ozonesonde coverage. There are still agencies that outright refuse to submit the data to the WOUDC

Near future

- Better web and ftp tools to assist in the delivery and presentation of data
- Better QA tools to assist data originators Better linkages with other data centres
- Foster linkages with other data centres to reduce cross over and redundancy

World Radiation Data Centre Activity

Anatoly V. Tsvetkov

Overview

The World Radiation Data Centre (WRDC), located at the Main Geophysical Observatory in St. Petersburg, Russian Federation, serves as one of the WMO centres specialized in surface solar radiation data collected at over 1200 measurement sites throughout the world network. This centre was established in accordance with Resolution 31 of the eighteenth session of the WMO Executive Committee in 1964.

The WRDC centrally collects, archives and publishes radiometric data from the world to ensure the availability of these data for research by the international scientific community. Data recorded at national radiometric stations are archived at the WRDC encompassing the following characteristics: *Global and diffuse solar radiation, downward atmospheric radiation, sunshine duration, direct solar radiation (hourly and instantaneous) and net total radiation (total radiation balance), net terrestrial surface radiation (upward), terrestrial surface radiation (upward), reflected solar radiation and spectral radiation components (as instantaneous spectral irradiance)*. Some of these characteristics are very important for estimating the transparency of the atmosphere and corresponding turbidity. Long-term changes and short-term variability of atmospheric transparency at GAW sites together with short-wave solar radiation, such as global and diffuse components, are needed for monitoring of climate change.

Major present activity

At the present time, the WRDC database contains sets of submitted world network data processed and published. It may be accessed via the WRDC web-site. As soon as new measurements are received and processed, they are added to the WRDC archive. This archive currently contains all available data for 1964 -1997.

Since 1964 WRDC has been publishing the bulletin “Solar Radiation and Radiation Balance Data. The World Network”. This bulletin is distributed to National Meteorological and Hydrological Services (NMHSs) and other institutions participating in the international data exchange under the WMO. These Bulletins containing current data tables and other important information about changes in observations are produced in Word format.

Updated quality control procedures developed at the WRDC are very helpful in making supplementary control of data flows. As a rule, the data assessment involves correspondence with countries – participants in data exchange.

Solar radiation data (hourly totals) on direct (normal), global, diffuse and spectral (RG8 filtered) components are now submitted from two GAW stations located in Algeria (Tamanrasset) and Argentina (Ushuaya) and data tables with corresponding graphs are presented on the WRDC web-site. http://wrdc.mgo.rssi.ru. For the time being the data was preprocessed at the NREL with flags and file formats prepared in accordance with WRDC conventions.

Achievements

Now the WRDC web-server has downloaded data tables of two GAW stations: Tamanrasset, Algeria and Ushuaya, Argentina. The subsets of hourly and daily data for four measured parameters (direct, global, diffuse and spectral) cover the periods 1994-1999 and 1994-2000, respectively. For a preliminary snapshot of the data in gif-format, graphs are prepared at the WRDC. It helps to overview all data with a user friendly interface.

Challenges, problems

It is obvious that the data stored in the WRDC data base and archive should be reliable. The GAW site managers are in possession of all necessary instruments for validation procedures of solar radiation data and transfer to the WRDC. Experience at the WRDC shows that errors and uncertainties may occur. The procedures for quality control at WRDC cannot be comprehensive and should be considered as supplementary, but effective. The recent practice of communication between the WRDC and NMHS data managers has given positive feedback with respect to quality assessment. Clearly described procedures of quality control at sites to better understand the causes of errors, are required.

Plans for the near future

In the near future the WRDC should take the following steps:

1. Download new information about GAW sites to WRDC web-server;

2. Develop a list of conventional solar radiation measuring stations located near GAW sites;

3. Prepare a letter to representatives of national networks to extend solar radiation data submission to the WRDC and send this letter to the WMO for approval.

4. Continue discussions with GAW Data Centre managers to elaborate, in particular, formats for solar radiation components such as instantaneous irradiation and present estimates of atmospheric transparency (turbidity) for GAW sites on the WRDC web-server.

World Data Centre for Aerosols

Julian Wilson

Overview

The GAW World Data Centre for Aerosols (WDCA) was formally established at the Environment Institute of the Joint Research Centre of the European Commission, in 1994, following an exchange of letters between the Director General of the JRC and the Secretary General of WMO.

At that time the GAW aerosol program was in its infancy, and no recommendations on which measurements of aerosol parameters to make, or best practice for operating procedures were available. We therefore started as a low key activity focused on identifying what historical data were available, within and outside GAW, and trying to second guess the recommendations of the aerosol scientific advisory group (SAG Aerosol), which was set up in 1997, in deciding how best to archive the data.

Now that the scope and design of the GAW aerosol program has been defined by SAG Aerosol, our activities are focused on adapting it's archiving strategy to meet the needs of the aerosol program, and developing the tools to manage the data. The WDCA is managed and operated by Julian Wilson (julian.wilson@jrcit) on a part time basis, supported by external contract support (e.g. University College Dublin, Meteorological Service of Canada (MSC)).

Achievements

- WDCA has established data submission procedures with 9 of the 16 global GAW stations, and circa 10 regional stations. Thank you to all contributors.
- As a contribution to the WCRP/IGAC Comparison of Sulfate Aerosol Models (1996-1998), WDCA constructed a data set of observations of sulfur species (non-sea salt sulfate, MSA, DMS; and SO_2 for the period 1993-1995, from circa 40 sites. The sites were characteristic of either the periphery of source regions, or high altitude, or remote regions, or were along N-S Atlantic and Pacific transects. This data set was also used in the most recent IPCC climate change assessment.
- We have developed, with help from MSC, a data exchange template for the key aerosol parameters. This not only facilitates data submission, but also data use, metadata standardisation and quality assurance (QA). The template follows the NARSTO data exchange standard, which is increasingly used in the non-GAW world. It thus integrates the GAW aerosol data into a much larger community of aerosol measurements.
- We have developed, again with help from MSC, a suite of QA tools for data that uses the data exchange template.
- We are co-ordinating an EU funded project on the synthesis of aerosol data sets form different sources (SINGADS), together with EMEP MSC-W, MSC, University College Galway, and the Paul Scherrer Institut.

Problems and Challenges

- We have not established contact and organised data submission from all GAW stations making aerosol measurements.
- The GAW aerosol program is a relatively small part of global aerosol measurement activities. It needs to improve its visibility and relevance. Our challenge is to make the WDCA a reference point for global aerosol data.
- Potential contributions to the aerosol program of GAW more commonly come from research organisations, (Universities, national research centres etc) than is the case for the other GAW parameters. These contributors typically have difficulty in submitting aerosol data to WDCA on

the understanding that it is freely available to users, as their research and funding depends upon their involvement in the use of their data. The acceptance of data with restrictions on its use (Acknowledgement in publications, joint authorship etc) would be a great help in improving data submission to WDCA.

The Future

- We will establish contact and organise data submission from all GAW stations making aerosol measurements. The new data exchange template will help the stations a lot in this matter.
- We will be actively participating in activities (AAAR special symposium on global aerosol climatology, AEROCOM (follow up to COSAM) etc), that increase the visibility of the data coming from the GAW aerosol program.
- We will continue to develop links with non-GAW aerosol measurement programs.
- We hope to take advantage of the GAWSIS initiative to develop a web based searchable catalogue of our archives.

WMO World Data Centre for Greenhouse Gases (WDCGG)

April 2001

SUDA Kazuto
Atmospheric Environment Division
Japan Meteorological Agency

The World Data Centre for Greenhouse Gases (WDCGG) was established at the Japan Meteorological Agency (JMA) in October 1990 to make collection and distribution of data on the concentrations of greenhouse (CO_2, CH_4, CFCs, N_2O, etc.) and related (CO, NO_X, SO_2, VOC, etc.) gases in the atmosphere and the ocean. The WDCGG collects data from the GAW observing network, research organizations, and other cooperative programmes such as the flask sampling programme of the National Oceanic and Atmospheric Administration (NOAA).

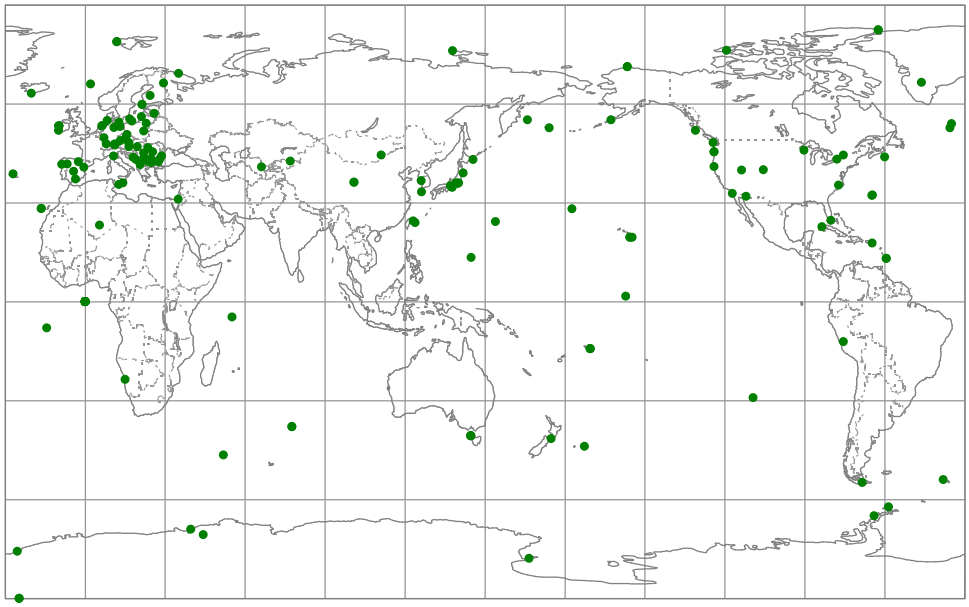
Data contributors report their data according to the format in the “Data Reporting Manual of the WMO WDCGG” (WDCGG No. 1). As of December 2000, 180 stations in 45 countries have contributed observational data for greenhouse and related gases to the WDCGG.

Number of Reporting Stations to the WDCGG as of December 2000

Species \ Region	I	II	III	IV	V	VI	Antarctica	Ship Aircraft	Total
CO_2	9	21	4	19	12	29	7	11	112
CH_4	7	12	3	22	10	18	6	17	95
N_2O		4		3	2	5		1	15
CFCs		2		3	2	5		1	13
CCl_4		1		3	2	4			10
CH_3CCl_3		1		3	2	4			10
$CHCl_3$				2	2	1			5
CO	4	6	1	14	7	14	3	2	51
VOCs						1			1
NO_2				1		35			36
NO						7			7
NOx						6			6
NOy						2			2
SO_2						37			37
Total	**9**	**22**	**4**	**26**	**15**	**71**	**10**	**23**	**180**

The WDCGG makes periodical publication of "WDCGG Data Report", "WDCGG CD-ROM", "WDCGG Data Catalogue" and "WDCGG Data Summary". The "Data Report" presents monthly and annual means and the “CD-ROM” contains hourly, daily, monthly and annual means of concentrations of greenhouse and related gases. Also recorded is information on contact persons, methods of measurement and calibration at the observation stations. The "Data Catalogue" provides an index of existing data along with procedures for data access. It also includes information on site environment, measurement procedures, and calibration

techniques. The "Data Summary" is designed to describe analytical results on the past and present conditions of gas concentrations on local, regional, and global scales. These publications are distributed on a regular basis to the Permanent Representatives of the WMO Members, data contributors, and other relevant organizations and individual researchers. They are also offered free of charge upon request if the data are used for non-profitable purposes.



Location of Reporting Stations to the WDCGG as of December 2000

The WDCGG also provides part of data and products with its web site. At present, the WDCGG is in the process of improving the web site so that the users can obtain measurement data and relevant information, i.e. metadata, with on-line search and plot functions. It is planned that the printed publication except the “Data Summary” will be discontinued and the measurement data and relevant information will only be distributed by CD-ROM or via internet. The “Data Summary” and CD-ROM will be published and mailed to the users annually.

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The GAW Station Information System

Jörg Klausen and Peter Hofer

Goals: The project GAWSIS (GAW Station Information System) was launched in April 2000 with the aim of providing an overview of the GAW measurement network and establishing a platform that should

- allow the Secretariat to keep information about the GAW network up-to-date more easily than was possible in the past
- facilitate scientific exchange and collaboration between stations by providing information about activities of other stations
- provide data users with an overview of the GAW network and point them to available data
- provide an entry point for researchers interested in placing an experiment at a GAW stations

Implementation: GAWSIS was implemented as a relational database using the software Microsoft Access 97. It is currently available as a desktop application. A relational database makes it possible to extract structered information from a series of lists dynamically using SQL statements. The information collected within GAWSIS covers the categories listed in Table 1. Parameters currently supported directly by the GAW program are listed in Table 2.

Table 1. Overview of type of information collected in GAWSIS

Category	Explanation
Station	• geographic and climatic setting • general description of station and surroundings • activity status • accessibility and
Contacts	• name, affiliation, contact information etc. of individual • function for/at station and within GAW • measurement parameters for which contact is responsible
Measurements	• detailed meta information about measurement program • analytical methods, instruments • available time series

Achievements: The database structure and the graphical user interface were developed and implemented during 2000, and all information available in written form at the Secretariat has been added to the database. The existing GAW questionnaire was completely re-designed as an integral part of GAWSIS. It was sent to all global GAW stations early in 2001.

Future Activities: (in co-operation with the Secretariat and other interested parties) At least a sub-set of GAWSIS will be made publicly available on the internet. Information about regional, contributing, and associated GAW stations needs to be completed. All information published needs to be updated on a regular basis. These tasks need to be co-ordinated with the Secretariat, the WDCs, and others.

Acknowledments: Dr. Hal Kibby (US EPA), Dr. Aki Virkkula (FMI), Dr. Julian Wilson (JRC Ispra), Dr. Mike Proffitt (WMO). This project is supported by MeteoSwiss and WMO.

Table 2: Parameters currently supported by GAW

Parameter Type	Parameter
Aerosol	• Cloud condensation nuclei concentration • Cloud condensation nuclei spectra • Hygroscopic growth • Light absorption coefficient • Light scattering coefficient • Mass (carbonaceous material) • Mass (major inorganic components) • Mass (other chemical components) • Mass (total aerosol) • Number concentration • Optical depth • Size distribution (chemical species) • Size distribution (mass) • Size distribution (number) • Vertical distribution
Archived Sample	• Integrated air samples
Greenhouse Gas	• CFCs • CH4 • CO2 • HCFCs • HFCs • N2O
Meteo	• Aerological soundings • General • Humidity • Precipitation • Pressure • Temperature • Trajectories • Wind direction • Wind speed
Ozone	• Surface ozone • Total column • Vertical profile
POP	• General
Precipitation	• Acidity/Alkalinity • Anions (inorganic) • Anions (organic) • Cations • Electric conductivity • Inorganic ions • pH • Trace metals
Radio Nuclide	• Beryllium (Be-7) • C isotopes of CO2 • Krypton (Kr-85) • Lead (Pb-210) • Radon (Rn-222)
Reactive Gas	• CO • NMHC • NO • NO2 • Noy • SO2 • VOC
Solar Radiation	• Diffuse irradiance • Direct irradiance • Global irradiance • IR • UV Broadband • UV Multiband • UV Spectral

GAW-2001: The Strategic Plan 2001-2007

Gerhard Müller

The **first edition of the Strategic Plan**

- was published in 1997 (GAW Report No.113)
- gave opportunity to participants to learn a lot by its implementation although not all goals were met
- has been recognised by the WMO Congress as an evolving document, with the need to be modified with changing conditions and with operating experience.

The **second edition of the Strategic Plan**

- is based on the decisions of Congress-13 in 1999
- covers the years 2001-2007
- describes detailed implementation steps for the years 2001-2004
- addresses GAW specialists, professional GAW bodies and other interested scientists.
- has been reviewed in its entirety by the Panel.

Main Achievements after 12 years of programme

- about **80 WMO member countries** are currently participating
- 22 Global Stations are in operation, including the new GEF stations
- about 10 countries provide services by **central facilities**:
  - 4 Quality Assurance/Science Activity Centres (QA/SACs) perform a network-wide quality review
  - 10 World Calibration Centres, assisted by Regional Calibration Centres, provide calibration standards, instrument calibrations and training to the stations
  - 7 World Calibration Centers, offer data archiving and distribution functions
- about **300 GAW stations**, mostly concentrated in WMO Regions II, IV, and VI, are known
- some associate stations of the Network for Detection of Stratospheric Change (NDSC), the Baseline Surface Radiation Network (BSRN), and the European Monitoring and Evaluation Programme (EMEP) contribute to GAW
- **space-based observations** offer a partial solution for global coverage of certain measurements
- 6 **Scientific Advisory Groups** (SAGs) organise and co-ordinate GAW activities in a parameter-oriented way.

Critical Issues

- GAW represents in its broadness and complexity an almost **encyclopedic nature** where it is difficult to identify state-of-the-art and progress. It is a challenge to find realistic approaches and set clear priorities.
- GAW depends on the **participation of a small number of countries and leading scientists**. If they reduce their contributions or drop out, the programme will be severely affected.
- GAW is an endeavour with **week internal bonds and without line management**. Neither the Panel nor the Secretariat at WMO can guarantee systematic operational leadership.
- **Funding is in limited supply** particularly in developing countries. Some of them have trouble to keep alive their operational infrastructure and to enhance their scientific capacity.

The **rationale** for GAW is given by the effects of the increasing influence of human activity on the global atmosphere, as

- depletion of the stratospheric ozone layer and increase in tropospheric ozone
- acid deposition
- rising carbon dioxide and methane concentrations
- changes in the radiative balance of the earth-atmosphere energy system

by the need to

- understand the complex mechanisms of both natural and anthropogenic atmospheric change
- improve the understanding of the interactions of the atmosphere with the ocean and the biosphere
- provide reliable scientific data and information for national and international policy decision makers.

The **mission** of GAW is to

- make reliable, comprehensive observations of the chemical composition and selected physical characteristics of the atmosphere on global and regional scale
- provide assessments and early warnings of atmospheric change
- predict future atmospheric states the atmosphere
- serve as chemistry component of the Global Climate Observing System (GCOS).

Main Strategic Goals 2001-2007

- Expand measurements programme for better geographical and temporal coverage and for near real time monitoring capability
- Complete the quality assurance/quality control (QA/QC) system.
- Improve availability of data and promote their use
- Improve communication and co-operation between all GAW components and with the outside community
- Implement and clarify changing roles of GAW components
- Maintain present and solicit new support and collaborations for the GAW programme
- Promote capacity building in developing countries
- Promote and co-ordinate activities in atmospheric urban environment (GURME).

Implementation Strategy 2001-2004

- Stabilise operations at the present stations and extend measurements in regions with insufficient coverage, especially in the Tropics, the Southern Hemisphere and in continental areas, and continue capacity building efforts
- Evolve GAW into a three-dimensional global observation network - through the integration of surface-based, aircraft, satellite and other remote sensing observations
- Acquire and distribute only data of high and known quality – through establishing data quality objectives and standard operating procedures for all measurements
- Use intensively the potential of the World Wide Web as means of communicating GAW information, exchanging data and managing GAW activities
- Expand the user base – by providing easy access to the data and by promoting data applications in the field of modelling and scientific assessments
- Build up an analysis and prediction capability at GAW facilities in co-operation with the scientific research community
- Expand the support base - by enlisting the support of the world's best researchers and institutes in GAW activities, and by working closely with the National Meteorological and Hydrological Services

- Strengthen GAW leadership. Organise regular review meetings with participation of the “key players” in order to control the development of the programme.

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GLOBAL ATMOSPHERE WATCH REPORT SERIES

1. Final Report of the Expert Meeting on the Operation of Integrated Monitoring Programmes, Geneva, 2-5 September 1980

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81. Report of the Second Meeting of Experts to Assess the Response to and Atmospheric Effects of the Kuwait Oil Fires, Geneva, Switzerland, 25-29 May 1992 (TD No. 512)

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