REPORT OF WMO MEETING OF EXPERTS ON GAW REGIONAL NETWORK IN RA VI

(Budapest, Hungary, 5-9 May 1997)
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GAW Regional Network in RA VI- Europe - status and needs
1. INTRODUCTION AND OPENING OF THE MEETING

The WMO Meeting of Experts on GAW Regional Network in RA VI was opened at the headquarters of the Hungarian Meteorological Service (HMS) by Dr. Ivan Mersich, President of the HMS. He welcomed those attending the workshop to the HMS and to Budapest and wished them success in their work. He also stated that a tour of the GAW Regional Station at K-Puszta would be arranged later in the week.

On behalf of the Secretary-General, Professor G.O.P. Obasi, Dr. John M. Miller, Chief of the Environment Division, WMO welcomed the participants (see Annex A). In his address, he explained the importance of regional monitoring in Europe (RA VI) and the need to improve all aspects of the GAW regional system. The programme of the meeting is given in Annex B.

Mr. Jan Schaug of the EMEP Chemical Coordinating Centre also welcomed the participants and stated that the continued cooperation between the GAW and EMEP programmes was important for regional monitoring in Europe. The meeting agreed that existing measurement programmes of GAW and EMEP was leading to significant synergies.

2. GAW OVERVIEW

BAPMoN/GO$_2$OS and the development of GAW: A historical perspective. Prof. Erno Meszaros of the University of Veszprem and formally with the HMS was requested, because of his long association with GAW and its predecessor programmes, to give an invited lecture with a historical prospective. He began his lecture by stating that atmospheric chemistry was a relatively new field which began in the late forties. Such pioneers in the field as C. Junge, B. Bolin, C.-G. Rossby, and E. Eriksson realized that the physics and dynamics of the atmosphere could be studied by investigating the chemical composition of the atmosphere. In addition, they began the investigation of the impact of atmospheric deposition on the environment.

Prof. Meszaros stated that by the early sixties the WMO had formed a working group and later an Executive Council (EC) Panel to review activities in atmospheric chemistry. At that point, the networks under the Global Ozone Observing System (GO$_2$OS) and the Background Air Pollution Monitoring Network (BAPMoN) were being formed. By the seventies, a regional network was in place to measure precipitation chemistry, turbidity and total suspended particulate matter. The global stations were then called Baseline Air Pollution Stations. The whole infrastructure that is now a part of GAW was also put in place. In 1978, a training centre was founded at HMS in Budapest where for almost twenty years, training courses were given under Prof Meszaros's direction.

By the eighties, atmospheric chemistry had become a recognized scientific field with a number of well known issues such as acid rain, ozone depletion and the increase of greenhouse gases. Towards the end of the decade, the International Global Atmospheric Chemistry Project was formed under the Commission on Atmospheric Chemistry and Global Pollution within IUGG and was later to become a project of the International Geosphere-Biosphere Programme. In 1989, the EC formed the Global Atmosphere Watch by combining BAPMoN and GO$_2$OS. A further recognition of the field was the presentation of the Nobel Prize for Chemistry to P. Crutzen, M. Molina and S. Rowland in 1995.

In conclusion, Prof. Meszaros stated that atmospheric chemistry has become an important branch of the natural sciences and that a regular monitoring network is needed for further studies. In this light, GAW is of crucial importance for future atmospheric science and mankind.

GAW overview: Dr. Miller gave a brief overview of the GAW programme. The programmes main objective is to coordinate the monitoring and research concerned with the changing composition of the atmosphere. This objective can be broken into two parts: 1) To understand the impact of atmospheric chemistry on climate change; 2) To evaluate the influence of atmospheric chemistry on the environment. The first is related to such issues as greenhouse gases including tropospheric ozone, aerosols and solar radiation. In the second case, acid rain, air quality and radioactivity are topics of interest. Coordinating both the measurements and modelling play an equal part in our
understanding. In RA VI, there has been a network of regional and global stations under the GAW Programme which contribute to our understanding of atmospheric chemistry. A number of stations are also part of the EMEP network. An infrastructure has been established which will be discussed in more detail in the next section.

In summarizing the challenges that GAW faces in the future, Dr Miller outlined the following:

- To continue the overall operation of the GAW system in an efficient manner.
- To ensure that both climate change and air quality issues are addressed by GAW.
- To coordinate activities to meet the needs of both developed and developing/newly independent countries.
- To implement the Global and Regional GAW networks on an equal basis.
- To coordinate ground-based, aircraft, ship and satellite measurements in the GAW system.
- To define a GAW aerosol programme
- To promote twinning/partnerships with developing counties
- To implement the Strategic Plan
- To build a strong relationship with the scientific community, policy makers and other clients.

In a final note, Dr. Miller congratulated the Hungarian Meteorological Service for their long record of participation in the GAW programme and its predecessors.

**GAW Strategic Plan:** Mr. Gerhard Müller of the Swiss Meteorological Institute presented an overview of the GAW Strategic Plan of which he is the main author. The Strategic Plan will be the main guide for the GAW programme through the year 2000. The Plan recommended the setting up of ad hoc groups which will help in the coordination of both scientific and logistical activities. These groups include the Operational Support Group (OSG), Scientific Advisory Groups (SAG) (Ozone, Aerosols, Radiation, Precipitation Chemistry and Trace gases) and Observations Group (OG). The full approved text of the plan is found in GAW report No. 113.

**GAW plan for Regional Network in RA VI - Status and Needs:** A brief overview of the pre-meeting document was presented by Ms. Sonja Vidić. A detailed discussion was postponed until late in the meeting. The comprehensive document is presented in Annex C and was extensively used to develop the meeting’s recommendations (see section 7).

3. **GAW INFRASTRUCTURE**

As a further review of the GAW system, presentations were made to inform the participants on the latest status of the infrastructure. This structure is made up of four main parts with the Secretariat as the coordinating organization:

- Quality Science Activity Centres (Germany, Japan and the USA);
- World Calibration Centres (about 12);
- World Data Centres (7);
- World Ozone Mapping Centre (Assessment).

Description of the activities of these GAW organizations can be found in GAW 104, 110, 113, 114 and 116. A more detailed report updating the 1993 review will be available in the near future.

4. **MEASUREMENT ISSUES IN RA VI**

Dr. Laszlo Bozo presented a review of selected aspects of GAW measurement issues in RA VI. He began by describing the sources of pollution that included both natural and anthropogenic. Natural sources are both biogenic and non-biogenic origin whereas anthropogenic emissions come mainly from energy production and industrial activities. In Europe, because of the density of anthropogenic sources they impact the area on a regional basis.
The next important consideration is the lifetime of each pollutant after they are introduced in the atmosphere. These lifetimes are directly related to atmospheric cycles of trace materials and their eventual distribution and deposition locally, regionally and globally. Some examples which were discussed such as ammonia and sulphur cycles in which both natural and anthropogenic sources play a part. It was also mentioned that measuring the solar fluxes would help in our understanding of the photochemical processes so important for the transformation of pollutants. Besides trace gases, aerosols are also an important measurement but require complicated measurement techniques to determine both the physical and chemical characteristics of aerosols.

Dr. Bozo stated that good long-term climate parameters are needed to support and evaluate the pollutant measurements. Further, application of air trajectories and models are important to evaluate pollutant transport and impact on the environment. Dr. Bozo stated that the southeastern part of Europe is the area where more information is needed.

Specifically, the Meeting agreed that GAW could contribute in a positive way to the major environmental issues facing RA-VI, identified as

- Deposition-acidity problems,
- Surface ozone problems,
- Marine pollution (Mediterranean Sea, Baltic Sea, North Sea, Black Sea)
- Desertification by burning of biomass (Mediterranean area)
- Reduction of ozone layer and UV-B consequences
- Climate forcing
- Aerosols
- Toxic substances.

5. REVIEW OF GAW ACTIVITIES IN RA VI

A considerable amount of time was spent during the meeting reviewing the GAW programmes in the countries represented. Selected summaries of country reports presented at the meeting are available as an informal report from the WMO Secretariat. Countries represented included Austria, Bulgaria, Croatia, Czech Republic, Former Yugoslav Republic of Macedonia, Finland, France, Germany, Greece, Hungary, Ireland, Latvia, Netherlands, Norway, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Switzerland, Turkey, Ukraine and Yugoslavia.

6 INTEGRATED PLAN FOR THE GAW REGIONAL NETWORK

After the presentations by the country GAW programmes, discussions began concerning the question of regional monitoring and what does it mean. Before an integrated plan could be discussed a number of basic issues had to be clarified. The first issue was what are the responsibilities of the Global Atmosphere Watch. Secondly, the issue of what is a GAW Regional station vis-a-vis a global station.

Firstly, the GAW system is the world-wide coordination of measurement, research and assessment of atmospheric chemistry and related physical parameters. All activities must in a large part be the responsibility of the WMO Member Countries. The WMO Secretariat provides the focal point and leadership by which Member countries can participate in the programme. GAW is not a regulatory or funding agency.

The responsibilities of the WMO Members who participate in GAW can be listed as follows:

- Provide GAW sites with facilities and personnel on a long-term basis;
- Measure, assess and publish GAW parameters for their country based on the guidance of the WMO GAW Technical Regulations;
- Support by national funds all activities related to GAW in their country;
- On a voluntary basis, support GAW-wide infrastructure activities such as QA Science Activity Centres, GAW World Data Centres and World Calibration Centres;
- Provide information and data to the WMO on the national GAW Programme;
- If applicable, act as partners (twinning) for developing country programmes.

Secondly, considerable discussion took place on the definition of Global and Regional stations. Though these two terms have been used for years in GAW, there is certainly an overlap between the two types of stations depending on the parameter that is being considered. Subsequently, the Meeting agreed on the following criteria to distinguish between the types.

Global Stations and Regional stations

Traditional concept

Station classification based on location, levels of atmospheric constituents, suite of measurements and usefulness and application of data collected.

Global station - remote, low (background) levels of pollutants, representative of a large atmospheric regime and multi-faceted instrumentation and large number of measured parameters. Data applied to global issues (i.e. greenhouse warming and global ozone depletion).

Regional station - less remote, medium levels of pollutants, sometimes downwind of pollution sources, measurements can be extrapolated to only a few 10's of kilometres, limited suite of measurements. Data applied to regional issues and/or transport and deposition (i.e. photo-chemical transformations and cross country transport).

Other possible classification criteria for GAW station:

Data

Classification of individual parameter measured at each station according to representativeness (global or regional). Possible to have a coexistence of regional and global measurements at same station. i.e. total ozone measurements (global) and aerosol measurements (regional).

Quality of data (parameter) measured based on calibration, QA/SAC alliance, connection to global standards and comparability.

Archival of data - without archival of data, no classification given to station.

Mission

Whether major purpose is to respond to a regional network for a particular parameter assessment (regional station) or to determine global budgets, sources and sinks (global station).

Activities

If the data are utilized for publications, research analyses and assessment reports, a GAW station would be classified as one type A. If the data were utilized for monitoring and archiving only, a second classification would be considered.
7. RECOMMENDATIONS

For WMO Secretariat:

- To prepare more promotional and motivational GAW publications and fact sheets to garner national support (in all official WMO languages).
- To request WMO Member countries to designate a GAW focal point.
- National reports of GAW activities be solicited and published for the purpose of surveying the status of GAW activities in Region VI.
- The Secretariat provides RA VI Permanent Representatives with a framework for the preparation of national reports on GAW activities.
- To encourage cooperation within RA VI GAW programme, regular meetings should be held to monitor progress and to develop the programme.
- To provide specific GAW expertise to address commitment for national operational support on a case by case basis.

For EC Panel:

- To recommend the appointment of a regional rapporteur for GAW, setting out draft terms of reference.
- To develop more regional centres within RA VI to facilitate twinning, training, calibrations, QA/SAC and the transfer of technology for maintenance, data acquisition and repairs.
- Where appropriate, encourage different national monitoring networks to cooperate closely with the GAW system, provided that the data/observations are appropriate and can meet operating GAW criteria for quality and representativeness.
- Encourage harmonization and utilization of common activities of different programmes in the region (EMEP, ICP’s, MEDPOL, etc)
- Work to develop a system of exchange/contribution of instruments, spare parts and other equipment.

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ANNEX A

WMO Meeting of Experts on GAW Regional Network in RA VI
Hungarian Meteorological Service Headquarters
(Budapest, Hungary, 5-9 May 1997)

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ANNEX B

WMO Meeting of Experts on the GAW Regional Network in RA VI
Hungarian Meteorological Service Headquarters
(Budapest, Hungary, 5-9 May 1997)

Meeting Programme

MONDAY, 5 May

09:00  Welcome address
       Director of the Hungarian Meteorological Service
       World Meteorological Organization
       European Monitoring and Assessment Programme

Overview

Chairperson:  L. Bozo

09:30  BAPMoN/GO_{2}OS and the development of GAW
       A historical perspective (Meszaros)
       GAW overview (Miller)

10:30  Coffee

11:00  GAW Strategic Plan - Scope and Goals (Müller)
       Discussion of GAW Plan for Regional Network in RA VI - Status and Needs (Vidic)

12:00  Lunch

Session I: GAW Infrastructure

Chairperson: J. Santroch

13:00  Overview of GAW infrastructure (Miller)
       Quality Assurance Science Activity Centres (Martini)
       World Calibration Centres (Hofer)
       World Data Centre (Miller)
       World Ozone Mapping Centre (Balis)
       EMEP CC (Schaug)

16:00  Celebration of 127 years of the Hungarian Meteorological Service

TUESDAY, 6 May

Session II: Measurement Issues in RA VI

Chairperson: J. Schaug

09:00  Overview of measurement needs in RA VI (Bozo)
       - Precipitation Chemistry
       - Aerosols and Aerosol Chemistry
       - Trace Gases
       - Ozone
- UV Radiation
- Trace Metals
- Meteorology and Climate Data
- Transport, Deposition and Modelling
- Other

10:30 - 11:00 Coffee

Session III - Review of GAW Activities in RA VI

Chairperson: G. Müller

11:00 Review of National Activities and Geographic Distribution - Round Table Reports and discussion by Participants
- Precipitation Chemistry
- Aerosols and Aerosol Chemistry
- Trace Gases
- Ozone
- UV Radiation
- Trace Metals
- Meteorology and Climate Data
- Transport, Deposition and Modelling
- Other

12:00 Lunch

13:30 Session III (Cont.)

15:30 Coffee

18:00 End of Session

Welcome dinner hosted by the President of the Hungarian Meteorological Service

WEDNESDAY, 7 May

Chairperson: J. Miller

09:00 Session III (cont.)

10:30 Coffee

Session IV: Integrated Plan for the GAW Regional Network

Chairperson: S. Vidić

11:00 Discussion of how present and future RA VI GAW regional activities contribute and relate to GAW Draft Plan and EMEP/WMO activities

12:30 Lunch

13:30 - 17:00 Visit to K-puszta, GAW Regional Station, Labs.
THURSDAY, 8 May

Chairperson: B. Mendonca

09:00  Session IV (cont.)
      Discussion of draft document
      Small working groups to write reports on Session I-IV

12:30  Lunch

13:30  Plenary to consolidate all recommendations, write draft report

16:30  Final Plenary and summary of the meeting and draft report

17:30  Close of formal meeting

FRIDAY, 9 May

Small informal working group to complete report as needed, day of travel.

*****
The document below was prepared by S. Vidic and distributed to the participants before the meeting. As a working paper, it gives a good overview of the many issues discussed during the workshop. It is hoped that the recommendations presented here and in the main report can implemented to improve the RA VI GAW Regional network and associated EMEP station system.

GAW Regional Network in RA VI – EUROPE
Status and Needs

1. INTRODUCTION

Assessment of air pollution requires us to find an ecologically effective and economically efficient solution to these problems that confronts countries of the world with a challenge of global dimensions.

While few straightforward air pollution problems are well understood and can be resolved at present, the global community has a generation of less manageable problems. There is a general fear of the consequences to smaller regions that are especially vulnerable to global change through man’s influence on the quality of the natural environment. It is recognised that assessment and policy actions undertaken to cope with these problems rely on scientific input, based on high-quality, strategically oriented observations, and research related to the particular issues.

Hence the establishment of proper environmental observation systems is the only effective way to ensure systematic gathering of data world-wide, with comparable and clearly defined measuring criteria, co-ordinated data processing and quality assurance, so there can be a distribution of available information to the identified users. This complex task has to be tackled jointly by countries, international organisations and scientific community.

For over three decades, an active environment measurement programme in Europe has been co-ordinated through WMO's Global Atmosphere Watch and its predecessors. The GAW Global and Regional network and monitoring programme has focused on the changing composition of the atmosphere and its impact on climate and the environment.

In the endeavour to contribute in resolving these problems GAW has pursued two main objectives:

- To serve as and early warning and forecasting system for changes in the background chemical composition and related physical characteristics of the atmosphere which have direct or indirect effects on climate, ultra violet-B radiation, the ozone layer, the oxidising capacity of the atmosphere and terrestrial and marine ecosystems, and
- To document, detect and understand such changes.

GAW activities that support these objectives include:

- Measurements at participating stations
- Chemical analysis of samples at participating laboratories,
- Co-ordinated quality assurance programme,
- Data archiving and publication,
- Capacity building through training and technical co-operation and
- Monitoring of the operation of the entire system.
Corresponding to the requirements for data on the chemical composition and related physical characteristics of the atmosphere two categories of GAW stations – GLOBAL and REGIONAL – have been identified. The global stations focus on the measurement of a broad spectrum of variables related to the issues of global scale and importance: climate change, stratospheric ozone depletion, tropospheric ozone increase and changes in the oxidising capacity of the atmosphere. Regional stations are established to provide measurements primarily to help assess regional aspects of global environmental issues and atmospheric environmental problems in various regions or countries, namely: acidic wet and dry deposition, the long-range transport of pollutants, biogeochemical cycles, exchange of pollutants between the atmosphere and sea, biomass burning, biogenic sources and sinks of greenhouse gases and others.

Though the criteria for setting up a limited number of global stations world-wide – with extensive measurement programme (not more than 20–30) are stringent with high requirements in many aspects – in conceptual sense they seem to have tackled a more clearcut problem than it is the case with the stations of regional character.

Variety of problems have emerged in connection with the concept of REGIONAL stations. Their measurement programme, as defined in various documents:

- Be more flexible with regard to frequency and spacing of the various observations, and generally less intensive,
- Address the regional approach required in global change research,
- Be appropriate to the temporal and spatial requirements of the specific issues addressed,
- Satisfy regional needs of individual countries, and finally,
- Be of relevance to national issues of individual countries.

Such a demanding list of tasks of such a conceptual nature imposes a number of problems of practical nature as well as some confusion with regard to priorities when number of individual stations, declared as regional, are to be joined into a common, Regional network. This is not a new problem, since many of regional issues were outlined at various expert meetings in a last few years. Thus, as it was recommended, the area most needing co-ordination and harmonisation of activities was WMO Region VI (Europe) where there are numerous GAW activities and other related programmes such as EMEP, MedPol, EEA.

Based on the above, the overall aim of the meeting is to evaluate the present status and strategy of the GAW Regional Network and to propose strategic changes in order to meet the various requirements from EMEP, WMO, and other international bodies.

The meeting will address the following issues:

- Review the present state of the GAW Regional Network in RA VI,
- Evaluate the GAW's relationship with other European programmes,
- Outline the critical problems within the GAW regional programme and its relation to other international programmes,
2. GENERAL OVERVIEW OF PRESENT STATUS – GAW ACTIVITIES IN RA VI

The last survey of the implementation of the GAW measurement programme was conducted by WMO Secretariat in 1993 and updated to 31 December 1993 (GAW Report No. 99: Status of the WMO Global Atmosphere Watch Programme). The number of countries reporting monitoring activities with at least one established (but not necessarily active station) in WMO Region VI – Europe are:

<table>
<thead>
<tr>
<th>Country</th>
<th>Reported No. of GAW stations</th>
<th>No. of EMEP stations (1994)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>3</td>
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<tr>
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</tr>
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</tr>
<tr>
<td>Bulgaria</td>
<td>8 – not active</td>
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<tr>
<td>Croatia *</td>
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<tr>
<td>Denmark</td>
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<td>3</td>
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<tr>
<td>Finland</td>
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<td>4</td>
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<tr>
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<tr>
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<td>13</td>
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<td>Greece</td>
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<tr>
<td>Latvia *</td>
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<tr>
<td>FYR of Macedonia *</td>
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<tr>
<td>Netherlands</td>
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<td>Russian Federation *</td>
<td>23</td>
<td>4</td>
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<tr>
<td>Slovak Republic *</td>
<td>4</td>
<td>4</td>
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<tr>
<td>Slovenia *</td>
<td>1</td>
<td>– (1)</td>
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<tr>
<td>Spain</td>
<td>5</td>
<td>6</td>
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<td></td>
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<td>Turkey</td>
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</tbody>
</table>

* newly independent countries
There are 33 (73%) European countries reporting more than 150 stations measuring different parameters:

Number of countries reporting making measurements of:

- Precipitation chemistry: 30
- Atmospheric gases: 20
- O₃: 24
- SO₂: 15
- NOₓ: 16
- CO₂: 9
- CH₄: 6
- CFCs: 4
- N₂O: 3
- Aerosols: 30
- Turbidity: 10
- Radiation: 5

With exception of few, most countries participate both, WMO–GAW and EMEP monitoring programmes.

REGIONAL ISSUES ADDRESSED BY GAW MONITORING NETWORK based on the GAW report No. 71 on desirable practices and distribution of GAW Regional stations

As stated in the Report, major environmental issues listed for RA VI – Europe are:

- Deposition–acidity
- Tropospheric ozone
- Marine pollution (Mediterranean, Baltic sea, Northern Sea)
- Desertification, forest burning (Mediterranean)
- Total ozone, haze, deposition processes, methane (Arctic)

GAW MEASUREMENTS

For GAW Regional measurements, list of following desirable parameters is given:

- precipitation chemistry, wet and dry deposition *
- surface ozone *
- black carbon *
- reactive gases (SO₂, NOₓ, VOCs, CO₂) *
- meteorological parameters *
- radiation (visible, UV–B)
- methane
- carbon monoxide
- aerosol composites
- total ozone, vertical profile

* measurements to be given highest priority

EXISTING GAW INFRA–STRUCTURE FOR REGIONAL NETWORK

- WMO Secretariat
- National Monitoring Networks through a designed National Contact Persons for GAW
- Education and Training (through individual financial support)
- Equipment Donation (developing countries)
• Desemination of Information and Reports
• Scientific Meetings and Conferences

EXISTING GAW INFRA–STRUCTURE FOR GLOBAL NETWORK

• WMO Secretariat
• GAW Principal Investigator for each station
• Quality Assurance Science Activity Centres (standards, QA/QC programmes, training)
• Instrument Calibration Centres, intercalibrations
• World Data Centres (archive, data provision to users, basic analysis)
• General Scientific Guidance and Support (observations, modelling and data analysis)
• General Technical Guidance and Management (for newly established stations)
• Established Principles of Good Operational Practice
  (twinning and technical assistance, regular meetings and exchange of experience, individual training, expert visits, co–operation with other scientific and monitoring programmes)

3. OTHER EUROPEAN MONITORING AND RESEARCH PROGRAMMES

REGIONAL ISSUES ADDRESSED BY EMEP MONITORING PROGRAMME

• Long–range transboundary transport of air pollutants (LRTAP)
• Monitoring and Modelling of acidic deposition and ozone concentrations over Europe

EMEP MEASUREMENTS

Basic
• atmospheric gases (SO₂, NO₂, O₃)
• particles (SO₄²⁻)
• gases + particles (HNO₃ (g)+NO₃⁻(p), NH₃ (g) + NH₄⁺(p))
• precipitation chemical composition

Enhanced (at small number of sites) and planned in the future
• light hydrocarbons C₂–C₇
• ketones and aldehydes (VOCs)
• heavy metals
• persistent organic pollutants

EMEP MONITORING PROGRAMME INFRA–STRUCTURE

• National Monitoring Networks as data providers
• National Responsible Contact Persons
• National Quality Assurance Officers
• Chemical Co-ordination Data Centre (general guidance, manuals, advice, inspection)
• Meteorological Synthesizing Centres (emission data, modelling, calculations)
• Annual progress meetings
• Targeted workshops (co-ordinated or co-sponsored by WMO–GAW)
• Instrument calibrations, co–located measurement experiments

HELCOM, PARCOM, MEDPOL – MARINE POLLUTION PROBLEMS
(Helsinki, Paris, Barcelona Convention)
4. IDENTIFIED PROBLEMS WITHIN GAW REGIONAL MONITORING PROGRAMME

General considerations and issues for discussion

Some general problems arise from the fact that GAW Regional monitoring network has never been organised in similar method as the Global network. WMO countries were asked to declare–nominate some of their stations with environmentally relevant observation programmes to GAW Regional monitoring programme. Measurement programmes of these stations have been accepted without any serious review or discussion.

The advantage of this approach was that better information has been obtained with regard to activities conducted in each country, and contact persons – scientists involved in these activities were identified. This was particularly important for developing countries, where most environmental monitoring activities were/are concentrated around Meteorological services and Institutes. Guidance obtained through BAPMoN was valuable at that time and helped building awareness and infrastructure in many WMO member countries in a more or less co-ordinated way.

From our present stand point and knowledge it is obvious that the idea was not sufficient to support the system by quality assured data that would serve the purpose and goals of regional monitoring programme. Therefore, an enormous effort has been done in early 1990s to organise and assure the system that would provide data of high quality from selected sites located around the globe (GAW global monitoring programme). The whole system was created in support of high quality, assured data provision for benefits of scientific community, policy makers and mankind.

At the same time this particular effort has produced some important side effects:

1. It brought to a daylight in the most transparent way, the full complexity of the monitoring system build-up, including its high cost with regard to infrastructure, equipment, technical skill and dedication needed,
2. It became painfully obvious that our Regional monitoring network is in bad shape – even though in some European countries this might not be the case – and needs harmonised action to be improved to serve its goals and purpose,
3. It served as a vehicle to accelerate specific activities in some other relevant international environmental monitoring and scientific programmes and
2. It stressed gaps, existing between developed and developing countries, especially in dealing with consequences of environment injuries and problems, most of developing countries have not been responsible for.

Therefore

- Existing GAW Regional monitoring programme for Europe ought to be revised and harmonised with respect to its purpose, relevant issues and specific goals,
- At present, there is no “structure” in GAW that might support, harmonise or supervise monitoring activities at regional scale. Organised management of the network activities should be established,
• Programme oriented versus country oriented approach should be introduced as a principle for regional and global issues,
• Coherent monitoring network in which all components would be clearly defined should emerge,
• Scales of the problem and actual needs with regard to geographical coverage on a component by component basis should be specified,
• Areas with insufficient coverage with regard to the specific component should be identified,
• Benefits of GAW–Regional programme for both developed and developing countries should be emphasised,
• Data usage and users should be identified at all levels, national, regional and global,
• Levels of co–operation between different countries should be anticipated and proposed, i.e. the idea of twinning, co–operation between stations operating under similar conditions, etc.,
• Duplication of work with respect to other monitoring programmes in the region should be avoided in favour of strengthening the programme(s)
• National monitoring programmes should be discussed and reviewed in connection with the relevance of the measurements undertaken for particular national and/or regional environmental issues,
• Specific problems that appear in different countries reflecting on the monitoring strategy or activities in general should be identified and elaborated,
• Measures to overcome existing problems in number of developing countries or countries in transition should be suggested,
• Only data of known quality should be produced,
• If there is a problem to obtain data of known quality from certain parts of the network, actions should be planned and undertaken to solve the problems,
• Time span in which specified measures could be undertaken or realised, should be defined,
• Overall scientific, technical and operational guidance should be available where and when needed,
• Targeted educational and training programmes should be established on a case by case basis,
• A guidance and advisory pool with regard to monitoring planning such as personnel training and education, instrument and maintenance costs, etc. should be provided to the participating countries with less experience,
• Manuals, protocols, standard operating procedures from countries with well established monitoring networks and large experience should be provided to those who do not have well defined monitoring system,
• Exchange of experience through regular programme evaluation and round table discussion of actual issues should be established,
• Scientific information, peer reviewed papers or reports, concerning data analysis, evaluation and general usage should be available to the members, especially from developing countries,

It is hard to expect that this meeting will resolve these many undefined and open questions. Therefore, a smaller group of scientists from both, developed and developing countries should be formed to address and elaborate on the main issues that might help in regional monitoring management task.

After discussion of all relevant issues, each member country representative should evaluate its national network, monitoring sites and parameters, with regard to the criteria and conclusions made at this meeting and meetings that are following.
Conclusions

Regional monitoring network and information obtained should serve the countries participating in the monitoring efforts. Monitoring itself is a very demanding, time consuming and expensive task if we want to produce data of use for the community so that it benefits from gathered information. Hence, data collection by itself is not and should not be sufficient for the participating countries. Their participation in data analysis, synthesising, modelling and interpretation should be endorsed and encouraged through joint scientific projects organised under umbrella of WMO–GAW programme. This approach would serve as a good example for mutual work, scientific exercise, and training at the same time. Another benefit from this point is that major improvements in monitoring performance can be achieved only if data producers have the opportunity to analyse and evaluate their data in a broader environment, learning from the others and sharing their knowledge with them. Organised scientific workshops, with the goal of active learning, with exchanging, discussing and generalisation of results would bring a new level of quality into the whole WMO system, particularly GAW.

Look to the Future

The evolving political and environmental situation in central and Eastern Europe provides an opportunity for an important step forward. There are several considerations that should be recognised:

- Central and Eastern European countries have both immediate and long–term environmental problems that require attention more than can be offered by existing monitoring activities (e.g. trace metal deposition in some areas).
- The problems of these countries transcend the constraints of national boundaries. Hence, there is need to merge data sets from independent national monitoring networks into a coherent data base on which international negotiations might be based.
- The existing infrastructure is limited, and needs upgrading. Not only must the monitoring capability in each country be improved, but also the scientific research resource necessary to interpret the data obtained and guide national policy–makers.
- The environmental problems of greatest concern are regional in nature—sulphur dioxide in some areas, acidic deposition in others, ozone, etc. These issues overlap, and cannot be considered independently.
- Some developed countries have had considerable experience, but this experience cannot be automatically exported to Central and Eastern European situations without risk. The procedures and experiences of others must be used as a basis for detailed consideration and selective implementation.
- A measurement programme that is tailored to answer the most important environmental questions in central and eastern Europe is necessarily a program requiring integration of monitoring and research, and collaboration among the various disciplines involved.
- What is required? The current situation requires a coherent regional programme to bring all countries up to an agreed minimum level of capability, while also ensuring
  (a) Adequate quality of the data obtained,
  (b) Cost–effective application of the most appropriate technology, and
  (c) Improved interaction with existing international programmes.

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