

CAS Actions for WMO Quality Management Framework

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Purpose of Document and Major Decision(s) Requested

This document provides a summary of the CAS Actions for WMO Quality Management Framework

APPENDIX: Quality Assurance in the GAW Programme

References: WMO Global Atmosphere Watch (GAW) Strategic Plan: 2008-2015, GAW Report No. 172

Summary of Activity

The GAW quality assurance (QA) system impacts all aspects of atmospheric chemistry observations, including training of station personnel; assessment of infrastructures, operations and the quality of observations at the sites; documentation of data submitted to the WDCs; and improvement of the quality and documentation of legacy data at the WDCs.

The following recent activities have contributed towards GAW quality management:

- Publication of GAW Reports:
 - 171: A WMO/GAW Expert Workshop on Global Long-Term Measurements of Volatile Organic Compounds (VOCs)
 - 174: World Data Centre for Greenhouse Gases Data Submission and Dissemination Guide
 - 175: The Ninth Biennial WMO Consultation on Brewer Ozone and UV Spectrophotometer Operation, Calibration and Data Reporting
 - 176: The Tenth Biennial WMO Consultation on Brewer Ozone and UV Spectrophotometer Operation, Calibration and Data Reporting
- Publication of the joint WMO-COST booklet "A Practical Guide to Operating Broadband Instruments Measuring Erythemally Weighted Irradiance"

- Two two-week training courses held at the GAW Training and Education Centre in Germany for GAW station operators and managers
- The GAW-VOC/CCQM-GAWG Workshop, 7-9 July, EMPA, Switzerland. GAW-VOC station audits and network intercomparison experiments were reported upon at the meeting. The GAW VOC community confirmed that there is agreement on the need for establishing Central Calibration Laboratories (CCL's), this is to be done with National Metrological Institutes (NMI's). For handling the complex GAW-VOC target compound set, the chemical species have been divided into subsets. Each subset will be handled by a distinct NMI. It was agreed that each compound group should be covered by at least two NMIs with at least one being responsible for providing standards.
- Station audits and calibrations were continued (by Switzerland for reactive gases and by Canadian experts for Brewer instruments)
- A regional calibration centre was established for UV in Europe at Physikalisch-Meteorologisches Observatorium Davos (PMOD), Switzerland.

Part of the future work plan includes defining a quality management system for GAW to meet the requirements of the WMO Quality Management Framework.

Several GAW reports can be considered for the development of joint ISO/WMO technical standards.

Quality Assurance in the GAW Programme
Excerpt from the GAW Strategic Plan, pages 28-32

QUALITY ASSURANCE (QA)

Current Status

The GAW quality assurance (QA) system impacts all aspects of atmospheric chemistry observations, including training of station personnel; assessment of infrastructures, operations and the quality of observations at the sites; documentation of data submitted to the WDCs; and improvement of the quality and documentation of legacy data at the WDCs.

The *primary objectives* of the GAW QA system are to ensure that the data in the WDCs are consistent, of known and adequate quality, supported by comprehensive metadata¹, and sufficiently complete to describe global atmospheric states with respect to spatial and temporal distribution.

The *principles* of the GAW QA system apply to each measured variable and encompass

- Full support of the GCOS Climate Monitoring Principles [WMO, 2003a].
- Network-wide use of only one reference standard or scale (primary standard). In consequence, there is only one institution that is responsible for this standard.
- Full traceability to the primary standard of all measurements made by Global, Regional and Contributing GAW stations.
- The definition of data quality objectives (DQOs)².
- Establishment of guidelines on how to meet these quality targets, i.e., harmonized measurement techniques based on Measurement Guidelines (MGs) and Standard Operating Procedures (SOPs)³.
- Establishment of MGs or SOPs for these measurements.
- Use of detailed log books for each parameter containing comprehensive meta information related to the measurements, maintenance, and 'internal' calibrations.

¹ *Metadata is information on methods and instruments, calibrations, calculation methods, etc. Metadata is essential for data quality assurance and assessment, and proper data use.*

² *DQOs define qualitatively and quantitatively the type, quality, and quantity required of primary data and derived parameters to yield information that can be used to support decisions. In particular, DQOs specify tolerable levels of uncertainty in the data, required completeness, comparability and representativeness based on the decisions to be made.*

³ *An SOP is a written document that is officially approved by the relevant SAG and that details the method for performing a certain operation, analysis, or action by thoroughly prescribing techniques and steps involved. Recognizing the diversity – even for similar methods – of measurement equipment and set-ups, the SAGs have preferred to establish Measurement Guidelines rather than SOPs in the past. Measurement Guidelines recommend techniques and even instrumentation, but are less detailed in comparison to SOPs.*

The responsibility of the various partners in GAW for the implementation of the GAW QA system (Figure 2 and Figure 4), are mainly specified in their respective terms of reference (Chapter 2). The following responsibilities emphasize the aspects specifically related to quality assurance:

Joint Scientific Steering Committee (JSSC) of OPAG-EPAC

- Develop guidelines to improve the consistency, effectiveness and efficiency of the GAW programme.
- Identify, understand and manage the processes and organizations involved in IGACO as a holistic system.
- Structure the GAW QA system to achieve its objectives in the most effective and efficient way.
- Establish clear responsibility and accountability for participation of Partners in the GAW programme.
- Seek political and community support for recommendations.

GAW Secretariat

- Implement the recommendations of the JSSC OPAG-EPAC.
- Establish clear responsibility and accountability for managing key activities.
- Oversee and document the work of the SAGs and other GAW Central Facilities.
- Ensure that the information flow within GAW is timely, sufficiently accurate and reliable.

Scientific Advisory Groups

- Establish DQOs for each assigned parameter.
- Develop and approve Measurement Guidelines and SOPs.
- Provide guidelines and recommendations for achieving the DQOs and implementing the SOPs.
- Develop and approve methods to trace observations to the WMO primary standard.
- Promote training and twinning in developing countries.
- Critically review GAW services and products.

Quality Assurance/Science Activity Centres

- Follow the SAGs' guidelines and recommendations and assist the SAGs' in establishing Measurement Guidelines and SOPs.

GAW Stations

- Adopt and follow the GAW Measurement Guidelines and SOPs and identify the need for such documents where these are missing.
- Establish quality control procedures by following the guidelines of the responsible QA/SAC and WCC.
- Practice quality control of all parameters and identify questionable data residing at WDCs.
- Submit data in a timely manner and no later than one year after data collection to the responsible WDC so as to allow further analysis and comparison with other stations.

Goals

- Define a quality management system for GAW to meet the requirements of the WMO Quality Management Framework and to consider the development of joint ISO/WMO technical standards.
- Complete the GAW organizational structure (i.e., SAGs, Central Facilities) and harmonise the GAW QA procedures across parameters and station types.
- Increase the frequency of instrument calibrations and inter-comparisons at Global stations and explore other means of ensuring the traceability to the WMO primary standard of measurements made at Regional and Contributing stations.
- Build alliances between and among Global and Regional stations (scientific and technical co-operation, twinning), and twinning between individuals (scientists, station personnel).
- Develop and implement methods for ensuring the traceability of remote sensing equipment, both ground- and satellite-based, to the WMO primary standard.
- Continue to improve the quality and interoperability of data sets residing at the GAW World Data Centres.
- Define and harmonize the core and extended metadata set for GAW observations.

Implementation Strategy

- Task 0.1 Appoint a quality manager as part of CAS to (a) document the process structure of GAW (GAW core and support responsibilities and management processes); (b) define and describe the core processes (data stream/flow, support and management processes); (c) prepare a quality management manual.
(Secretariat – 2009)
- Task 0.2 Follow-up on the ICTT QMF recommendations on the review of GAW technical documents.
(GAW representative in ICTT-QMF – ongoing)
- Task 0.3 Establish DQOs for GAW chemical and UV radiation variables where they are still missing.
(SAGs, QA/SACs, Secretariat - 2010)
- Task 0.4 Identify and, where feasible, establish SAG sub-groups, WCCs/RCCs and CCLs/primary standards for the variables not currently covered.
(SAGs, QA/SACs, Secretariat - ongoing)
- Task 0.5 Develop measurement guidelines and, when appropriate, SOPs for a prioritized list of variables.
(SAGs, QA/SACs, WCCs - ongoing)
- Task 0.6 Identify the need for, seek funding support for and establish regional calibration and training centres for selected GAW variables.
(Secretariat, QA/SACs, SAGs - ongoing)
- Task 0.7 Provide training and workshops for GAW measurement personnel with emphasis on building capacity and partnerships for developing countries while simultaneously improving the quality of data provided by all GAW stations.
(Secretariat, QA/SACs, WCCs - ongoing)
- Task 0.8 Approach Members to report traceability chains and internal quality control measures relevant to the measurement programmes of all stations in their country and document this in GAWSIS and the respective WDCs.
(Secretariat, QA/SACs – 2010)

- Task 0.9 Assess the quality of data residing at the WDCs, and identify and reject questionable data.
(QA/SACs, WDCs, SAGs – 2009, then ongoing)
- Task 0.10 Continue to improve methods for data quality checks of newly submitted data at the WDCs using statistical tools and expert judgement.
(WDCs, QA/SACs, SAGs – ongoing)
- Task 0.11 Establish guidance documents detailing the methods for ensuring traceability of remote-sensing equipment to the GAW primary standards.
(SAGs – 2010)
- Task 0.12 Generalize the guidelines for GAW system audits to include all GAW variables.
(QA/SACs, WCCs - 2009)
- Task 0.13 Intensify the involvement of GAW in WMO Expert Teams dealing with the definition and implementation of data formats and metadata profiles.
(Secretariat, QA/SACs, WDCs – ongoing)
- Task 0.14 Upon consultation with the SAGs, update the Technical Regulations Volume 1 B.2 Global Atmosphere Watch (GAW) [WMO, 1992] and contribute to the planned Volume 4 on Quality Management Framework.
(Secretariat – 2009)
- Task 0.15 Develop, maintain and promote the use of the web-based glossary on GAW QA/QC-related terminology.
(SAGs, QA/SACs, Secretariat – ongoing)
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