

Monitoring in the GAW Network

(GAW = Global Atmosphere Watch)

H.E. Scheel

(hans-eckhart.scheel@kit.edu)

Karlsruhe Institute of Technology (KIT)
Institute for Meteorology and Climate Research (IMK-IFU)
GAW World Calibration Centre for Nitrous Oxide (WCC-N₂O)



**Umwelt
Bundes
Amt** 
Für Mensch und Umwelt

***DEA Workshop "Establishment and Implementation of the National
Reference Laboratory"
Pretoria, 17 February 2011***

Keywords to be addressed:

guidelines, operational monitoring procedures, calibration, reference traceability, technical auditing

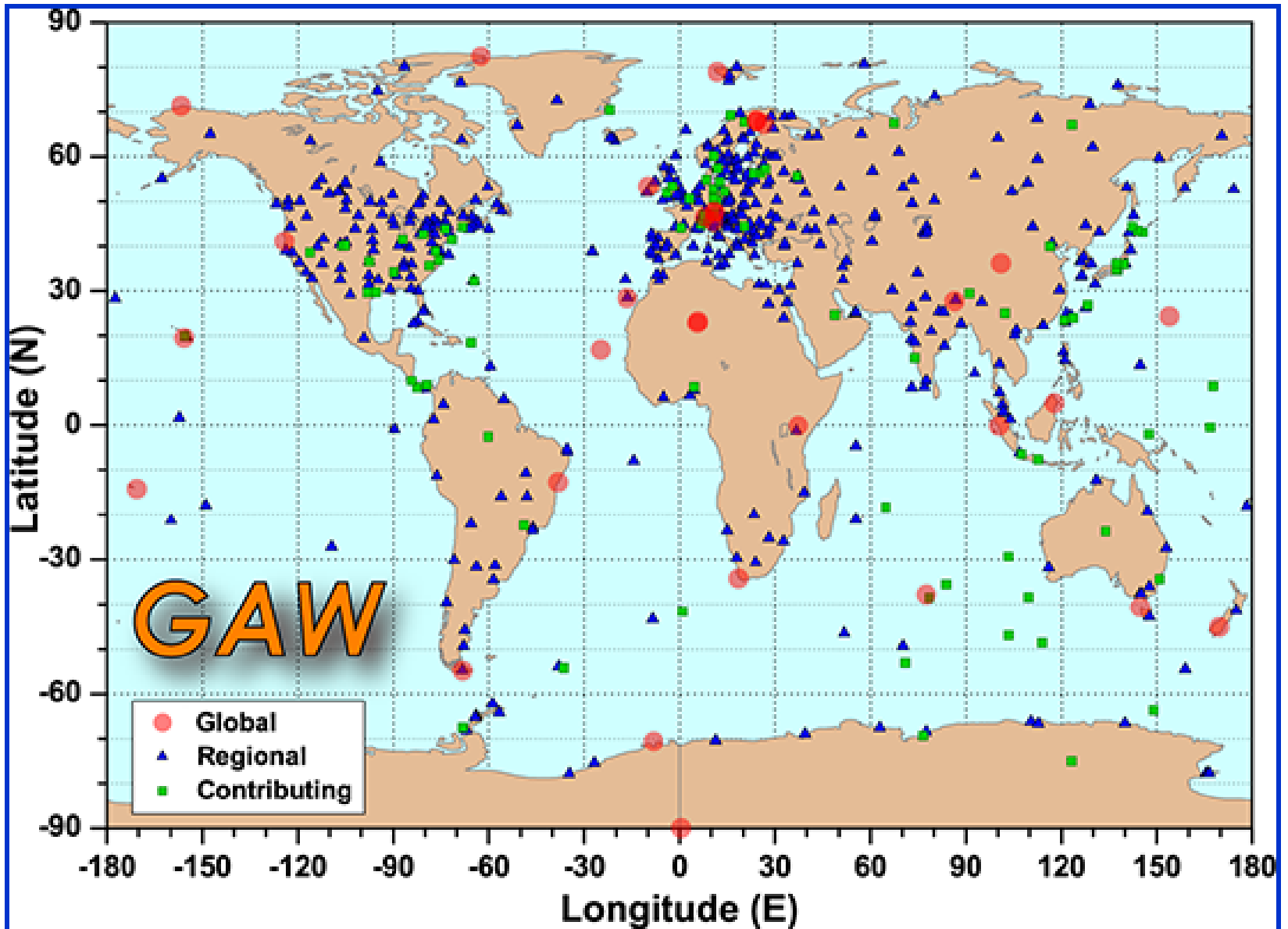
Outline of Talk

- 1. About GAW**
- 2. Role of Guidelines within GAW**
- 3. Concepts of Quality Assurance and Quality Control (QA/QC) in GAW**
- 4. Calibration scales and traceability**
- 5. Auditing**

What is GAW?



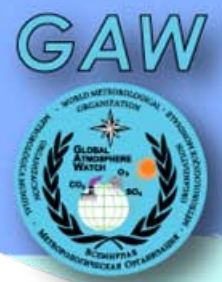
- GAW focuses on global networks for **GHGs, ozone, UV, aerosols, selected reactive gases, and precipitation chemistry**.
- GAW is a partnership involving contributors from 80 countries.
- GAW is coordinated by the Environment Division of WMO/AREP under the purview of WMO Commission for Atmospheric Science (CAS)
- Currently GAW coordinates activities and data from **27** Global stations, **413** Regional stations, and **164** Contributing stations (<http://gaw.empa.ch/gawsis/>)



Source: <http://www.wmo.int/pages/prog/arep/gaw>

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GAW secretariat

Global GAW stations



Within WMO/GAW, work is guided by a series of Strategic Implementation Plans:

WMO/GAW Reports No.

142. Strategy for the Implementation of the Global Atmosphere Watch Programme (2001-2007), A Contribution to the Implementation of the Long-Term Plan (WMO TD No.1077).

156. Addendum for the Period 2005-2007 to the Strategy for the Implementation of the Global Atmosphere Watch Programme (2001-2007), GAW Report No. 142 (WMO TD No. 1209)

172. WMO Global Atmosphere Watch (GAW) Strategic Plan: 2008 – 2015 (WMO TD No. 1384), 108 pp, August 2008

Currently being edited:

WMO Global Atmosphere Watch (GAW) Strategic Plan: 2008 – 2015, Update for the Period 2012 – 2015.

Most of the recent GAW Reports are available for download as PDF files at <http://www.wmo.int/pages/prog/arep/gaw/gaw-reports.html>

Several Measurement Guidelines (MG) or equivalent documents have been prepared in recent years.

143. Global Atmosphere Watch **Measurements Guide** (WMO TD No. 1073).

146. **Quality Assurance** in monitoring solar **ultraviolet radiation**: the state of the art. (WMO TD No. 1180), 2003.

153. WMO/GAW **Aerosol** Measurement Procedures: **Guidelines** and **Recommendations**. (WMO TD No. 1178)

160. Manual for the GAW **Precipitation Chemistry** Programme (**Guidelines, Data Quality Objectives** and **Standard Operating Procedures**) (WMO TD No. 1251), 186 pp, November 2004.

.
183. **Operations Handbook** – Ozone Observations with a **Dobson Spectrophotometer** (WMO TD No. 1469), 91 pp, March 2009
.

185. **Guidelines** for the Measurement of **Methane** and **Nitrous Oxide** and their **Quality Assurance** (WMO TD No. 1478), 49 pp, September 2009.
190. Instruments to Measure **Solar Ultraviolet Radiation** Part 3: Multi-channel filter instruments (lead author: G. Seckmeyer) (WMO TD No. 1537).
191. Instruments to Measure **Solar Ultraviolet Radiation** Part 4: Array spectroradiometers (lead author: G. Seckmeyer) (WMO TD No. 1538).
192. **Guidelines** for the Measurement of Atmospheric **Carbon Monoxide** (WMO/TD-No. 1551), July 2010.

In general, Measurement Guidelines (MG) leave more flexibility than Standard Operating Procedures (SOP).

Depending on the measurement technique(s), SOPs may be less appropriate than MGs for the work at GAW Global Stations.

Data Quality Objectives (DQO) for GAW Global Stations are driven by scientific needs.

Examples:

For a detailed description of DQOs for CH_4 and N_2O along with guidance for the measurements see:

GAW Report No. 185:
Guidelines for the Measurement of Methane and Nitrous Oxide and their Quality Assurance

Similarly, for CO see:

GAW Report No. 192.
Guidelines for the Measurement of Atmospheric Carbon Monoxide

GAW Report No. 185

GAW Reports at:

<http://www.wmo.int/pages/prog/arep/gaw/gaw-reports.html>

Guidelines for the Measurement of Methane and Nitrous Oxide and their Quality Assurance



World
Meteorological
Organization
Weather, Climate, Water
WMO/TCO - No. 1478





Need for quality control

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- Detect small trends (through DQO)
- Detect small spatial gradients
- Ensure long-term stability of observations
- Data comparability (on the same scale)

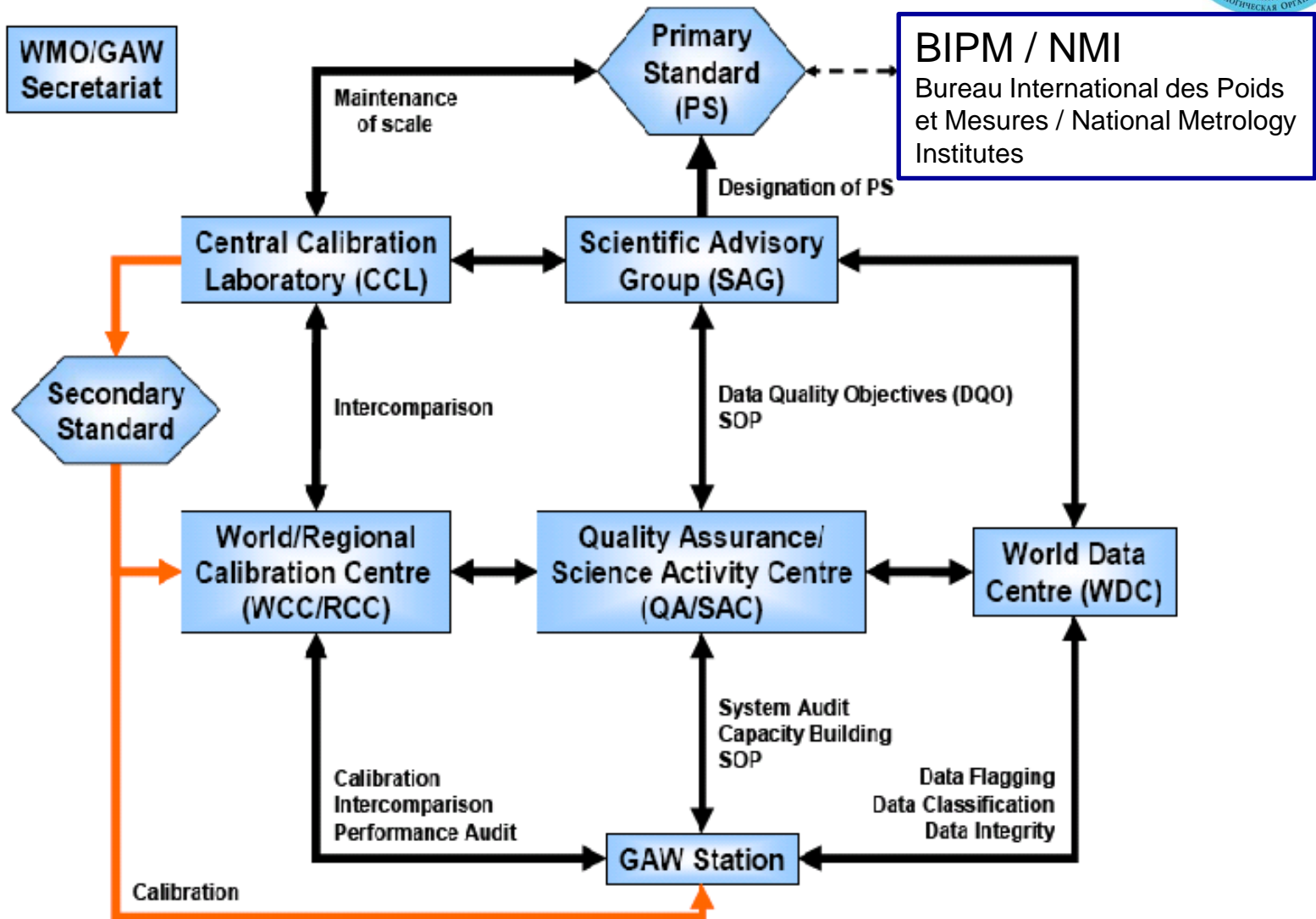
comparability: comparability of measurement results that are metrologically traceable to the same reference

compatibility: difference of any pair of values from different measurement results (should be) smaller than some chosen uncertainty of that difference

Conceptual framework of the GAW quality system



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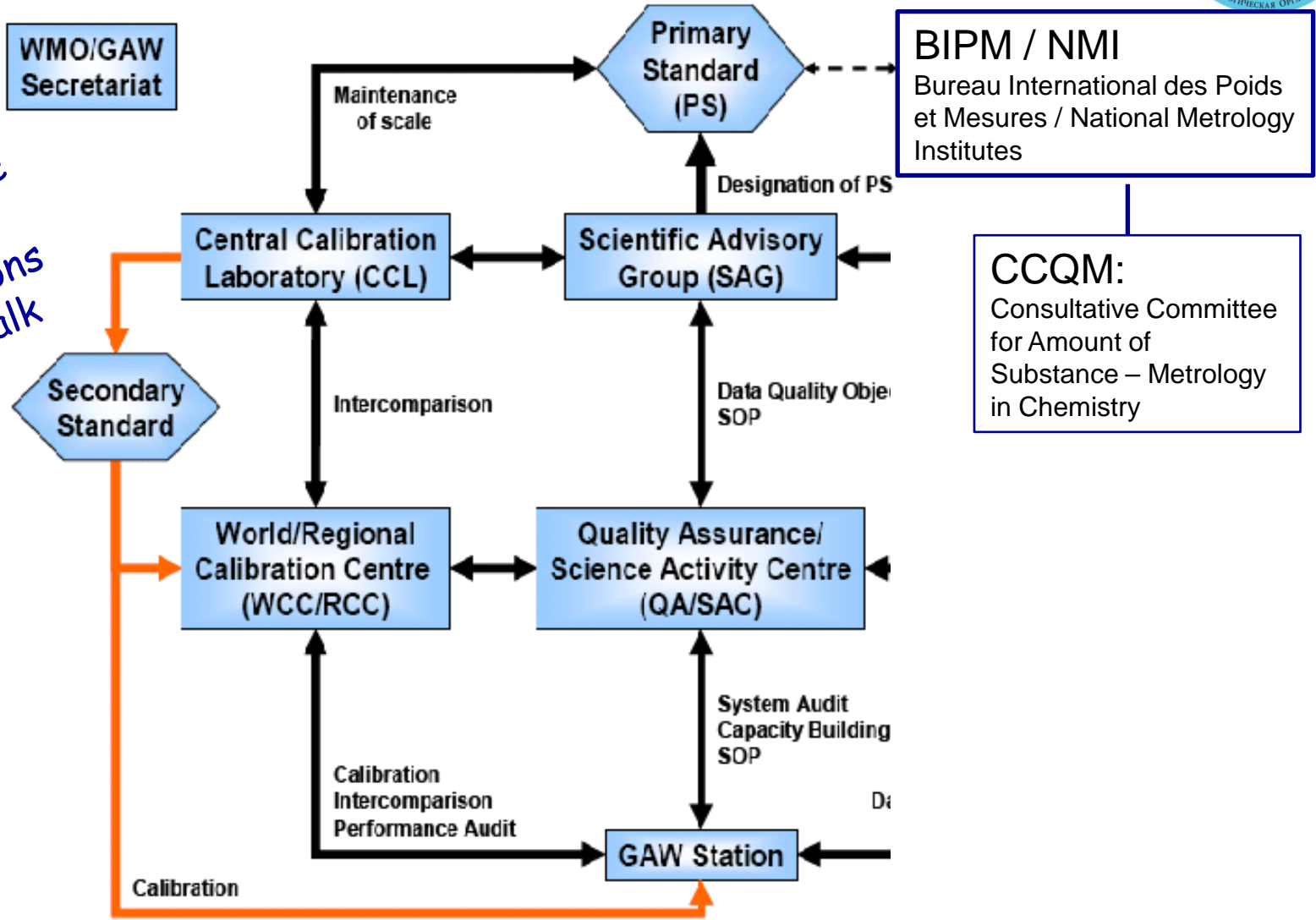


Conceptual framework of the GAW quality system



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Previous page with modifications for this talk



CCQM:
Consultative Committee for Amount of Substance – Metrology in Chemistry

Calibration scales:

Historically, individual institutes maintained their scale for trace gas measurements, notably GHGs.

In recent years comparisons with **CIPM**-related institutions (**International Committee for Weights and Measures**)

April 2010: **CIPM Mutual Recognition Arrangement**

The World Meteorological Organization (WMO) has become the second intergovernmental organization to join the [CIPM MRA](#).

→ **Climate change - WMO signed the CIPM MRA!**

The "[WMO-BIPM Workshop on Measurement Challenges for Global Observation Systems for Climate Change Monitoring: Traceability, Stability and Uncertainty](#)" was held from 30 March to 1 April 2010, at the WMO headquarters in Geneva, Switzerland, under the chairmanship of Prof. Andrew Wallard (BIPM) and Dr Wenjian Zhang (WMO).

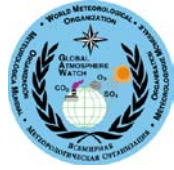
At the occasion of the Workshop, **the World Meteorological Organization (WMO) joined the CIPM MRA**. The signing ceremony took place on 1 April 2010, when Michel Jarraud, Secretary General of the WMO, signed the Arrangement on behalf of the WMO.

WMO-BIPM Workshop on Measurement Challenges for Global Observation Systems for Climate Change Monitoring: Traceability, Stability and Uncertainty
30 March-1 April 2010



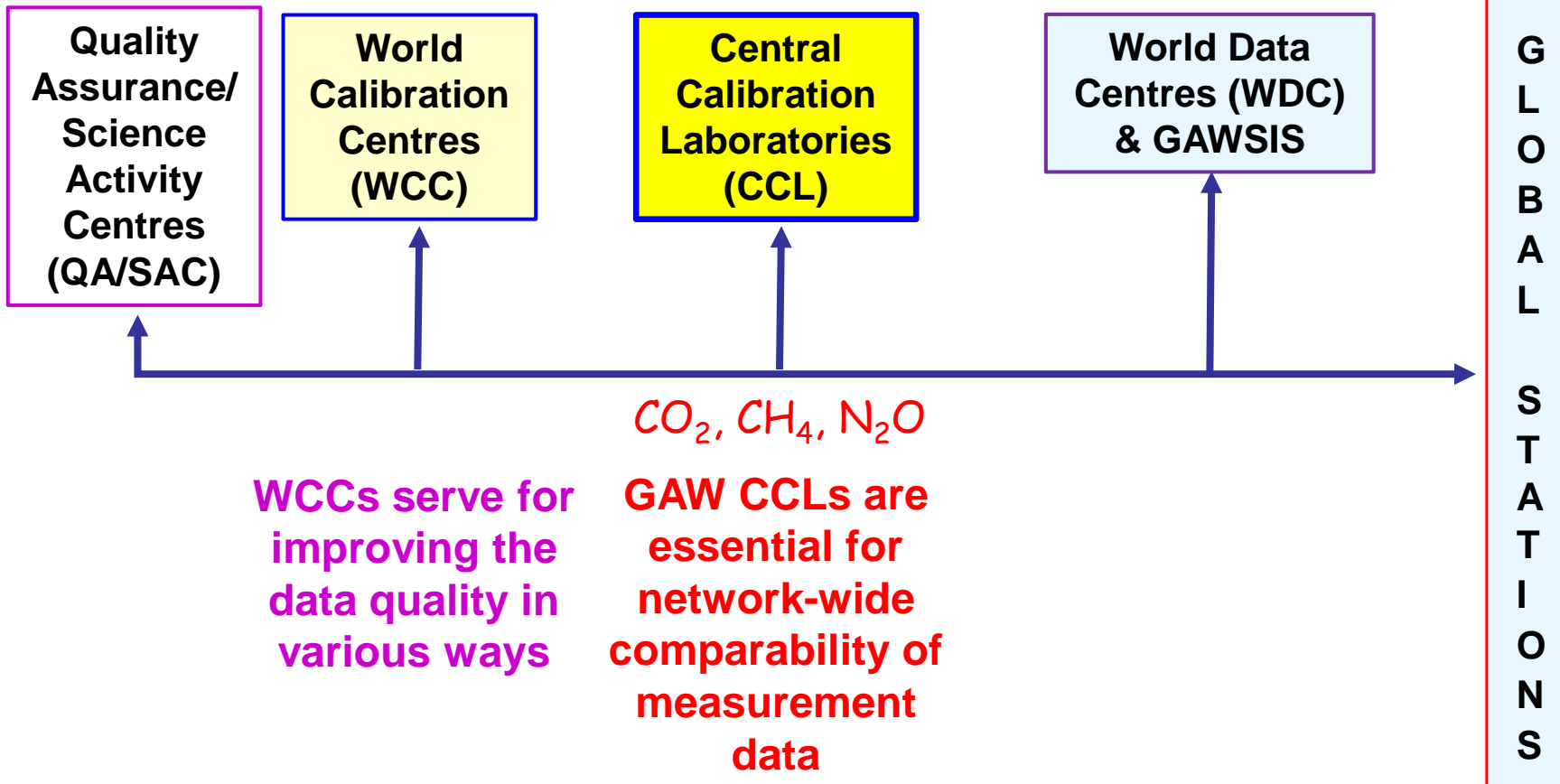
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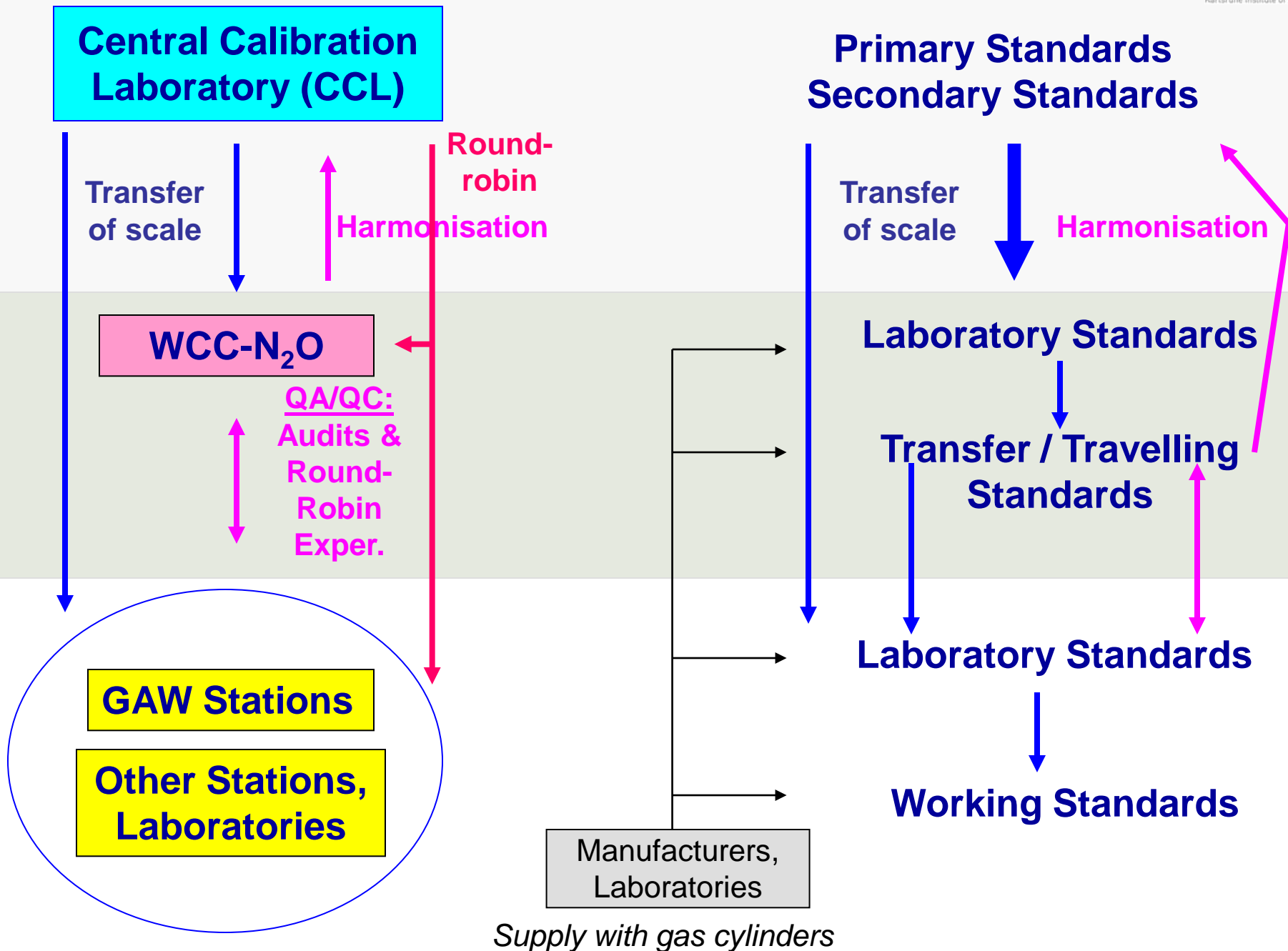
<http://www.bipm.org/en/cipm-mra/>

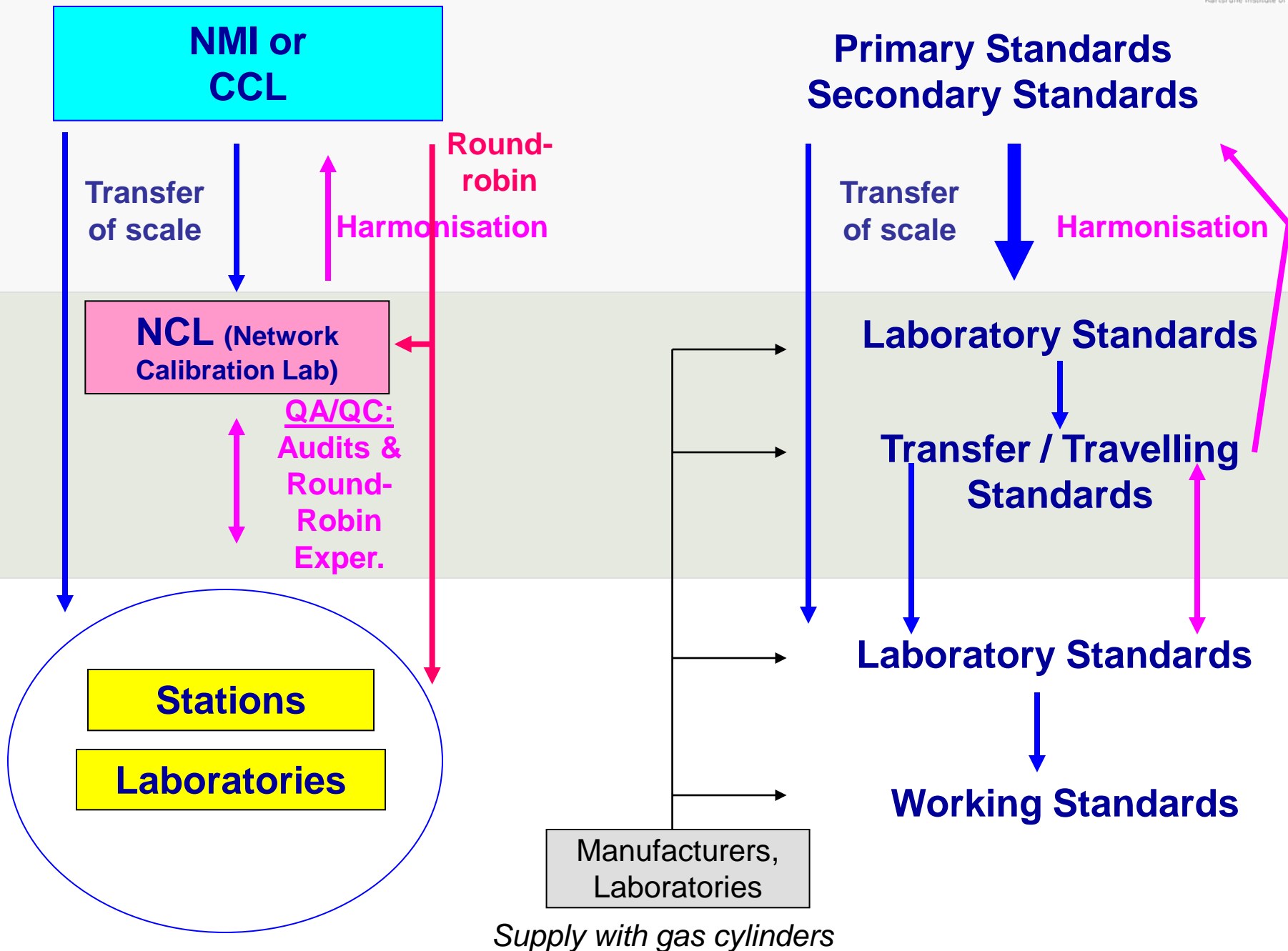


Global Atmosphere Watch (GAW)

GAW Central Facilities:








Tasks of CCLs

Terms of Reference, GAW Report No. 172, p.15

- Host in the long term (many decades) the GAW primary standard and scale for a particular variable.
- Serve the needs of the other quality assurance facilities and activities of GAW.
- Prepare or commission laboratory standards required by the GAW network members for calibration purposes.
- Supply well-calibrated air to GAW analytical laboratories as needed for conducting inter-comparisons (in collaboration with the World or Regional Calibration Centres).

Tasks of WCCs

Terms of Reference, GAW Report No. 172, p.16

- Development of quality control procedures
- Maintaining laboratory and transfer standards that are traceable to the standard scale
- Conducting performance and system audits at stations 
- Conducting round-robin experiments (intercomparisons) and participation in international intercomparisons
- Providing training and long-term technical help for station scientists and technicians
- To assist members operating GAW stations to link their observations to the GAW primary standard

System audit: generally defined as a check of the overall conformity of a station with the principles of the GAW QA system. It involves an assessment of the station siting, infrastructure, organization, operation, etc.

Performance audit: voluntary check for conformity of a measurement where the audit criteria are the Data Quality Objectives (DQOs) for the specific parameter. The audit involves ensuring the traceability of measurements to the Standard Scale.

Adopted from GAW Report No. 172, p. 28.

Depending on the parameter(s), instruments for on-site comparisons are employed.

In particular, for trace gases (GHG, CO, VOC), travelling standards in high-pressure cylinders are used.

Audits (N₂O): Summary of findings

Examples

- A too small concentration range was covered by the standard(s) available at the site.
- Differences between station calibration scale and WCC ⇒ Further intercomparisons necessary.
- Insufficient separation between peaks CO₂, N₂O and SF₆ in the gas chromatogram: Rather complex issue due to wide variety of GC configurations.
- Laboratory safety: High-pressure cylinders not secured

IN SUMMARY: The more recent N₂O audits show better results than the earlier ones. An overall progress towards the goals of GAW is evident.

The GAW QA system recommends the adoption and use of internationally accepted methods and vocabulary to describe uncertainty in measurements (GAW Report No. 172).

To promote the use of common terminology, a web-based glossary has been developed.

WMO/GAW Glossary of QA/QC-Related Terminology

Version 1.0 2010-09-14

Version 0.4 2007-04-26 (for comparison only - no longer recommended)

Editors: J. Klausen, H.-E. Scheel and M. Steinbacher

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<http://gaw.empa.ch/glossary/glossary.html>

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- SECTION 4 - Properties of Measuring Devices
- SECTION 5 - Measurement Standards
- ADDITIONAL TERMS FOR GAW

Explanations & Recommendations

References

Thank you!

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Acknowledgement: WMO GAW for a number of slides
used in this presentation
(Authors: Oksana Tarasova, Liisa Jalkanen and Leonard Barrie,
Atmospheric Environment Research Department)