AirMonTech

Quality matters: the importance of reference methods and networks

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Data Quality

- **Quality of data must be appropriate for intended use of data**

  AQ research
  AQ compliance measurements

- **Appropriate quality assurance/quality control (QA/QC) system is of prime importance for AQ measurements**

  AirMonTech database provides lot of information

  For compliance measurements, mandatory use of **reference methods (or equivalent methods)** is an important aspect to ensure data quality

Reference methods for regulated air pollutants

▪ SO_2	EN 14212 (2012)	UV fluorescence
▪ NO_2 and NO	EN 14211 (2012)	Chemiluminescence
▪ O_3	EN 14625 (2012)	UV photometry
▪ CO	EN 14626 (2012)	Non-dispersive IR spectroscopy
▪ Benzene	EN 14662;1-5 (2005)	5 chromatographic methods
▪ PAH	EN 15549 (2008)	BaP only, manual method
▪ Pb, Cd, As, Ni	EN 14902 (2005)	Analysis on PM10 filters
▪ Inorganic ions in PM	CEN/TR 16269 (2011)	Analysis on PM2.5 filters
▪ PM10	EN 12341 (1998)	Manual gravimetric method*), **)
▪ PM2.5	EN 14907 (2005)	Manual gravimetric method*), **)
▪ EC, OC	CEN/TR 16243 (2011)	Thermal-optical analysis on filters*)

*) *Conventional reference method*

**) *New combined standard for PM10 and PM2.5 under development (Draft prEN 12341;2012)*

Reference methods for regulated air pollutants

Reference method is more than the measuring principle!

CEN standards also include

–Performance characteristics and minimum required performance criteria for instruments

–Procedures for determination of performance characteristics

–Details on sampling inlet and sampling line

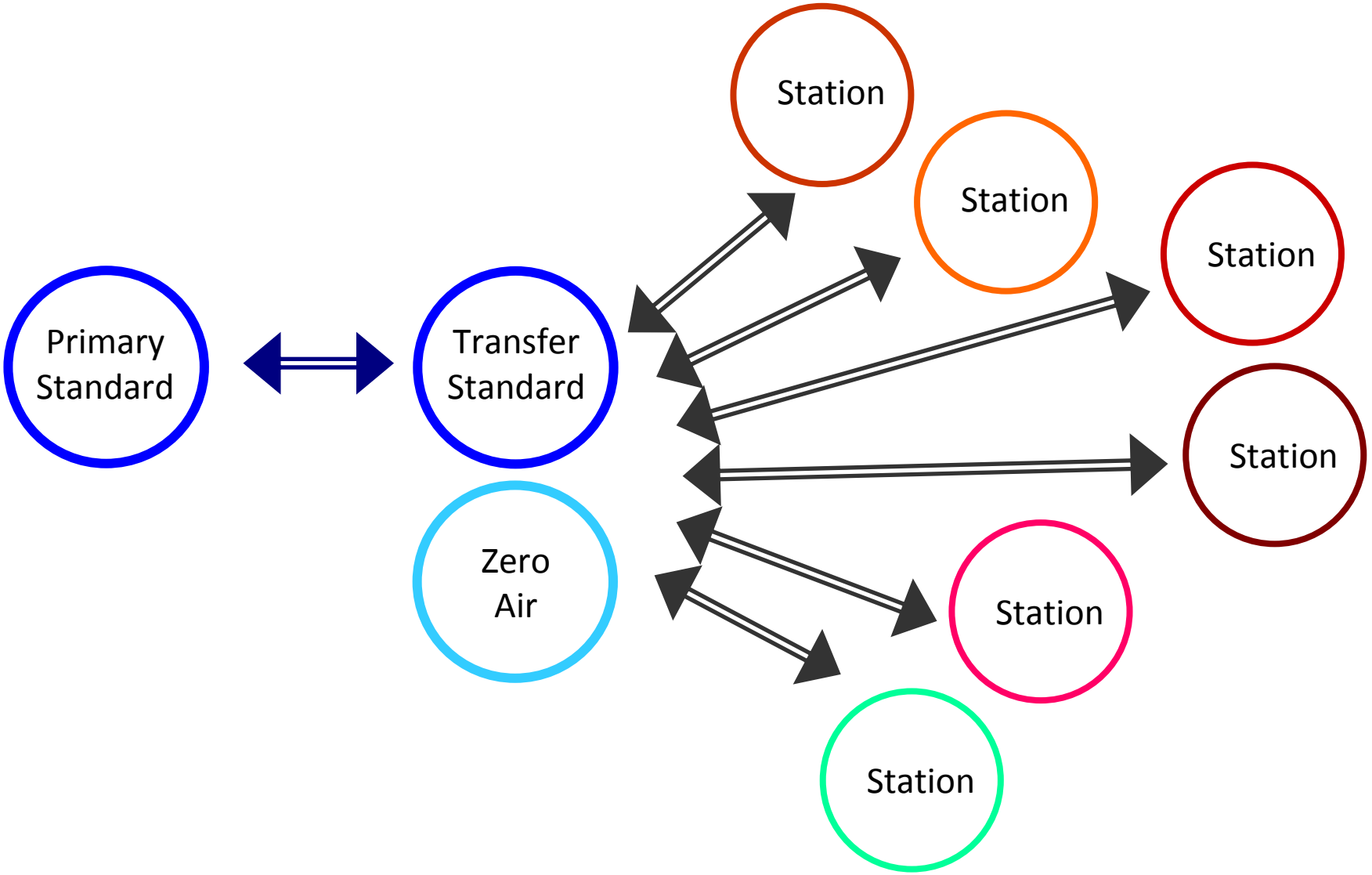
–Procedures for maintenance, checks and calibration in the field

–…

Use of reference method helps to assure the reliability and comparability of air quality measurements

Note: Use of reference method is no guarantee for high-quality data

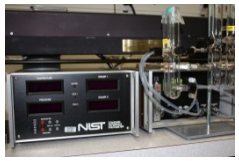
Air quality measurements – traceability chain and calibration



Air Pollution Monitoring Technologies for Urban Areas

Air quality measurements – traceability chain and uncertainty components

EMPA Materials Science & Technology

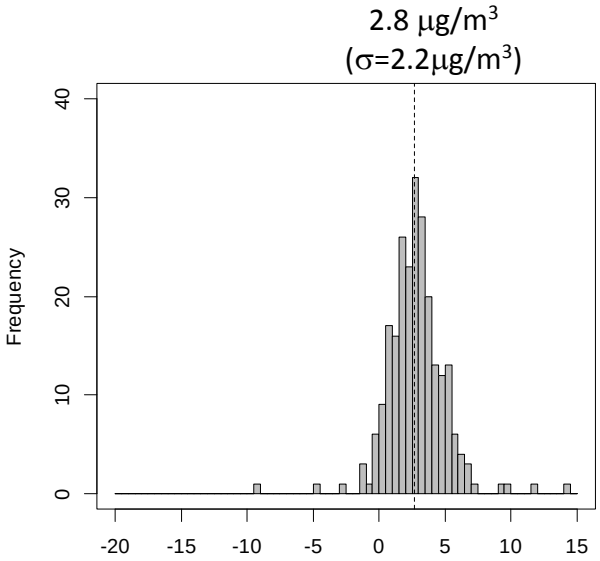
	primary standard	transfer standard	analyzer	air inlet
NO_x, CO, SO_2, VOCs, CO_2 etc.				
O_3				

uncertainty components

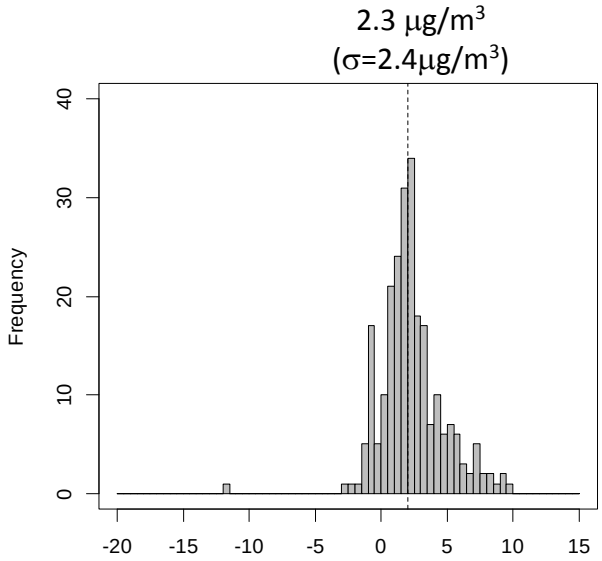
- primary standard
- transfer standard
- zero air
- repeatability
- noise
- drift (zero)
- drift (span)
- linearity (deviation from calibration function)
- dependence on pressure changes
- dependence on temperature changes
- interferences (H_2O and others)
- sampling effects (e.g. losses)

Reference method: Important for data comparability

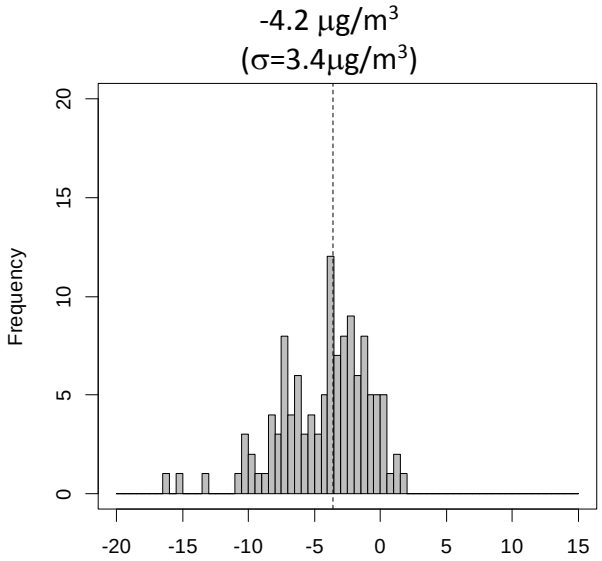
Daily PM10 – difference between automated techniques and gravimetric method according to EN 12341



BAM – PM10 grav



TEOM FDMS – PM10 grav

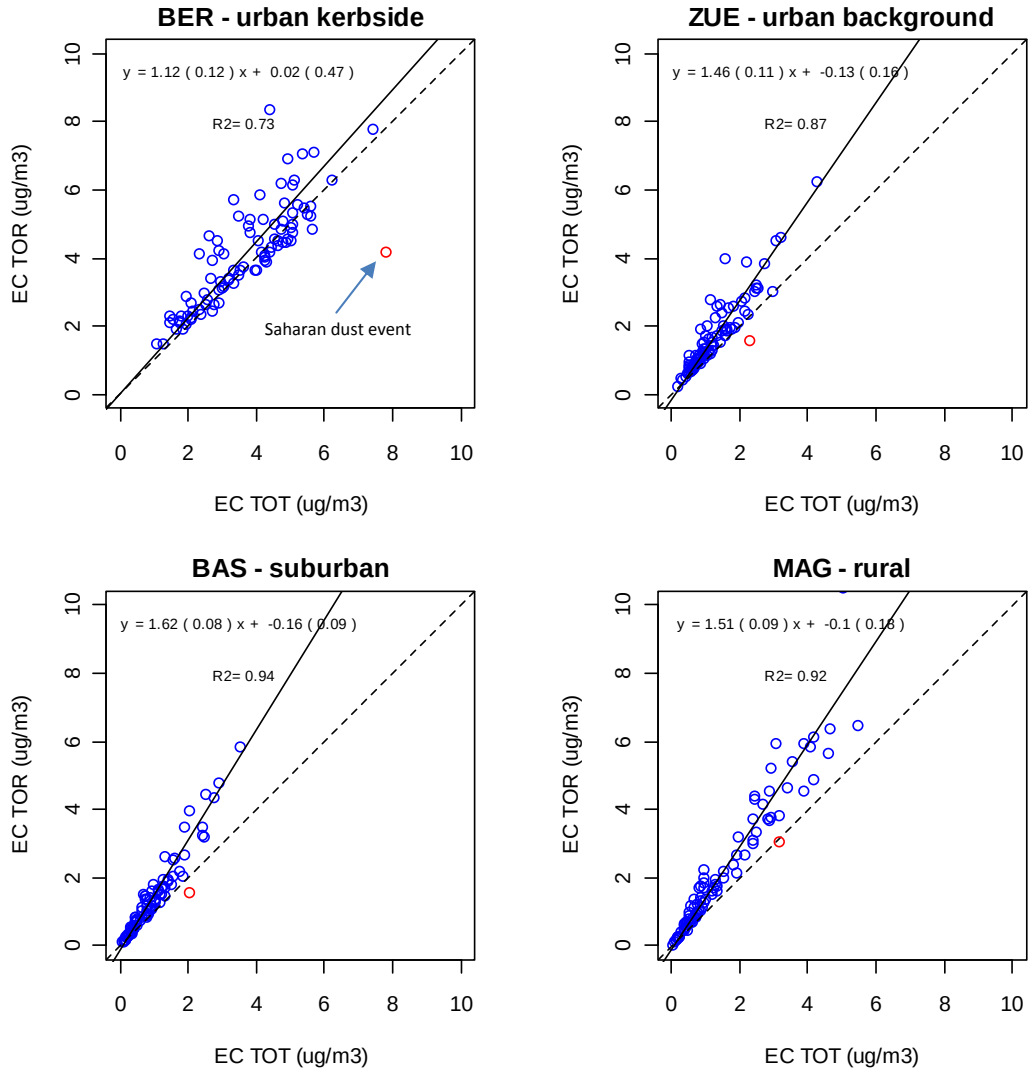


PM10 opt – PM10 grav

⇒ Systematic differences can be corrected based on parallel measurements with reference method (demonstration of equivalence)

Reference method: Important for data comparability

Elemental carbon (EC): Thermal-optical reflectance (TOR) vs. Thermal-optical transmission (TOT) method, same temperature protocol (EUSAAR 2)



Data Quality Objectives (DQOs)

–Minimum required data quality is typically defined by data quality objectives (DQOs)

EN Official Journal of the European Union

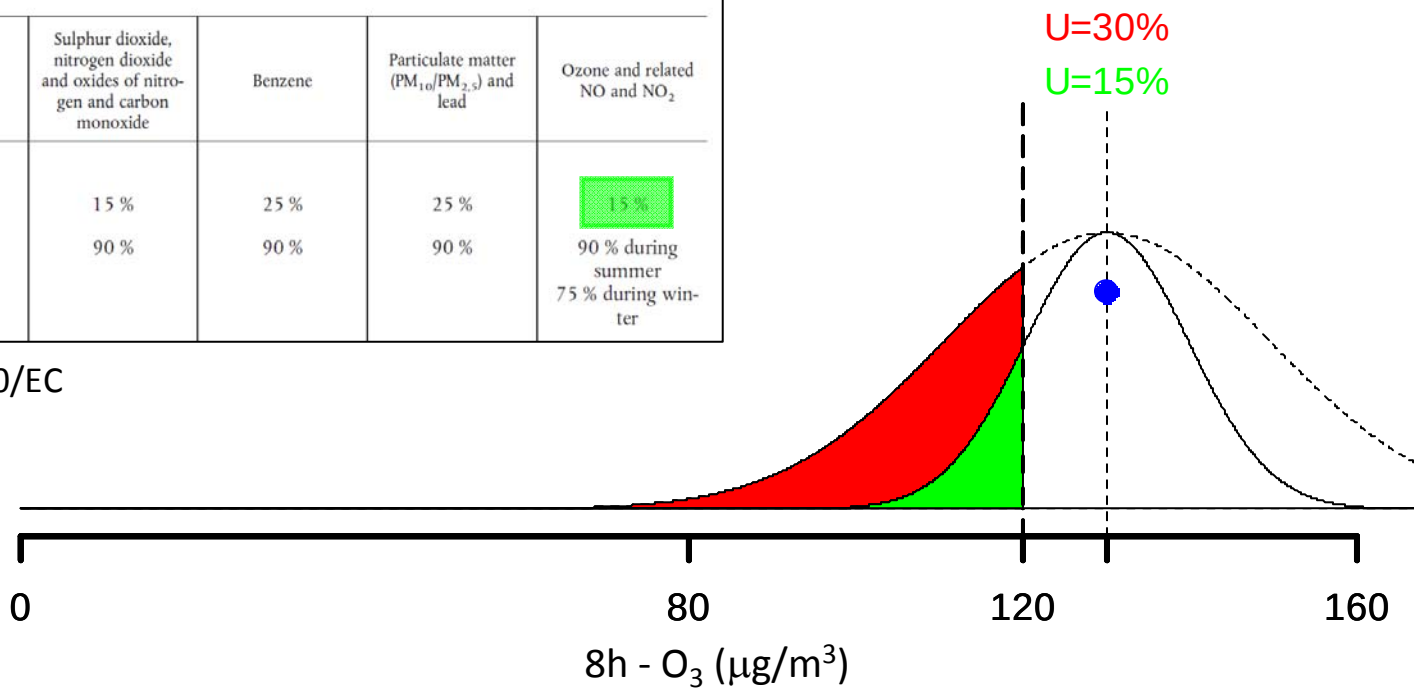
ANNEX I

DATA QUALITY OBJECTIVES

A. **Data quality objectives for ambient air quality assessment**

	Sulphur dioxide, nitrogen dioxide and oxides of nitrogen and carbon monoxide	Benzene	Particulate matter (PM_{10}/$PM_{2.5}$) and lead	Ozone and related NO and NO_2
Fixed measurements (1)				
Uncertainty	15 %	25 %	25 %	15 %
Minimum data capture	90 %	90 %	90 %	90 % during summer 75 % during winter

Directive 2008/50/EC



comparison excercise – e.g. Elemental Carbon (EC)

European Commission

JRC TECHNICAL REPORTS

Results of the first EC/OC comparison exercise for EU National Air Quality Reference Laboratories (AQUILA)

Lorenza Emblico, Fabrizia Cavalli,
Theo Hafkenscheid and Annette Borowiak

2012

Report EUR 25213 EN

Joint Research Centre

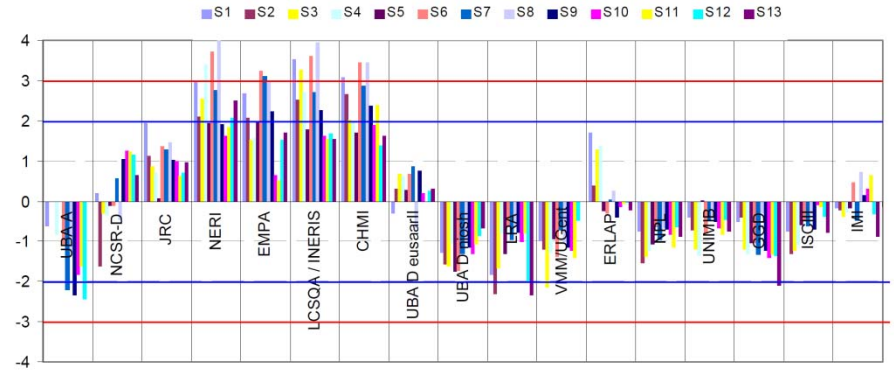
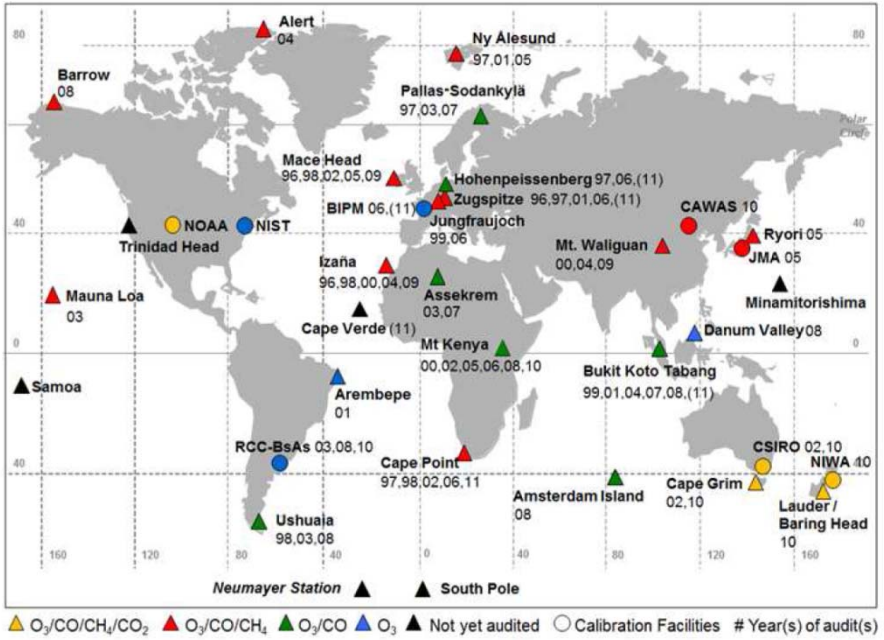
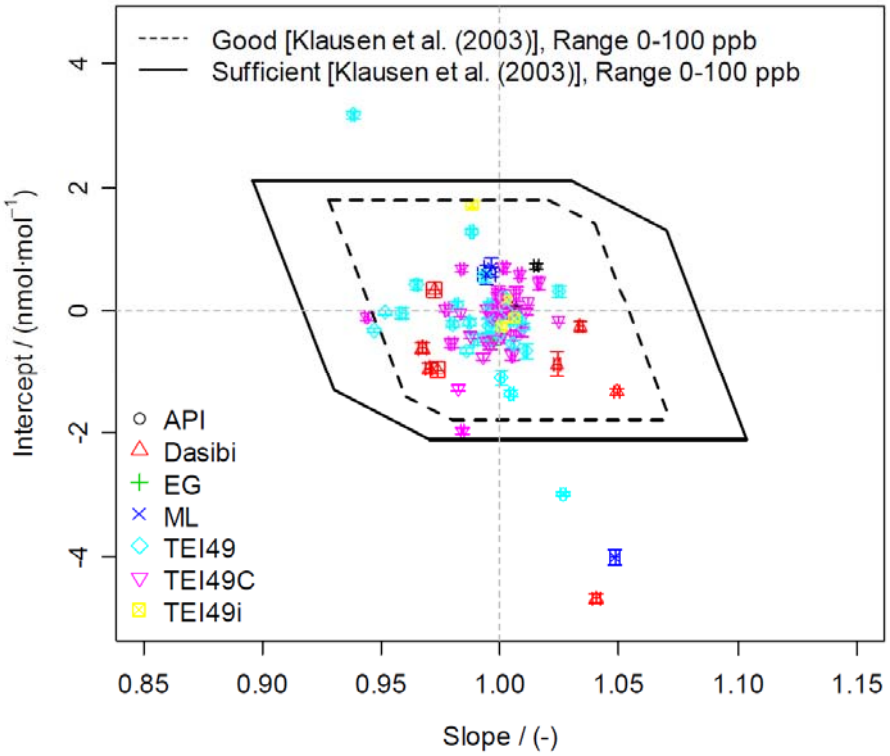


Figure 3. EC z-scores for DQO 40%. Regardless of analytical protocol, EC measurements comply with DQO 40%.

However, if separate calculations of the assigned values are made for NIOSH and EUSAAR2 data, also EC z-scores comply with the 25% DQO (Figure 4).

O3 – station audits within GAW (WMO) (performed by WCC-Empa)





Summary

- **Data quality matters!**
- Not highest possible data quality (accuracy, precision) but adequate for intended use
- Appropriate QA/QC system required for any AQ measurements (see e.g. CEN standards and **AirMonTech database**)
- Use of reference methods according to CEN standards is an essential aspect of QA/QC
  - ensures comparability of data
  - supports uncertainty estimation
- Intercomparison excercises are very valuable for evaluation of performance of AQ measurements

Thank you!

Acknowledgements

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Bulk deposition sampler at NABEL-Site Rigi-Seebodenalp (Photo: Stefan Bugmann, Empa)

Reference method: Important for data comparability

Hourly NO_2 – difference between CLD with photolytic converter and CLD according to EN 14211