Observation Quality Management Systems

CIMO/WIGO Exploratory Workshop

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Scope

- Workshop and focus on improving quality
- Linking ISO Quality Management & Measurements
- Traceability
- Quality issues
- Summary
Workshop Objectives

• To explore mechanisms for improving the quality of surface-based observations through standardization of calibration, maintenance, and operational (algorithms etc) procedures, as a WIGOS Standardization initiative.

• 2. To explore mechanisms for ensuring optimal communication of such standardized procedures to Members, as a WIGOS Capacity Development initiative.
What is meant by Quality in the workshop context?

• If an organisation uses a *quality framework* will it improve the ‘quality’ of the surface-based measurements?

• If an organisation has an *Regional Instrument Centre* will the organisation improve the ‘quality’ of the surface-based measurements?
Quality Frameworks

- ISO
  - ISO 9001 – certification
    - Management
    - Governance
    - Process reproducibility
  - ISO 17025 – accreditation
    - Quantity
    - Technical Capability
    - Providence
    - Traceability
- ISO Guide to Uncertainty
Measurement System

Typical Measurement System

- User requirements
- Design
- Build
- Measurement
- Assurance/Control
- Release
- Feedback/Insight
Typical Measurement System – ISO equivalents

• User requirements – ISO 9000/9001 - Manual
• Design - ? (ISO 9004)
• Build - ? (ISO 9001)
• Measurement - ? (ISO 17025?)
• Assurance/Control - ? (ISO 9001)
• Release to users – ISO 20000
• Feedback/Insight/Audit – ISO 19011, 9001
WMO influences on a Measurement System

Typical Measurement System – ISO equivalents

• User requirements – WMO Programmes
• Design – WMO Commissions & members
• Build – WMO Commissions & members
• Measurement – WMO Commissions & members
• Assurance/Control – WMO Commissions
• Release to users – WMO Commissions & members
• Feedback/Insight/Audit – WMO Commissions
Other influences on the Quality

- Availability of meta data
- Performance monitoring
- Training and education
- Asset management
- Lessons learned from failures and successes
Objective: Achieve measurement of the Quantity

$[\text{Quantity}] = [\text{Measureand}] = [\text{Calibration(Measurement Model)}] \times [\text{Signals}]$

Traceability: The property of the result of a measurement or the value of the standard whereby it can be related to stated references usually national or international standards through and unbroken chain of comparisons all having stated uncertainties.
The Balancing Act

• Competing requirements
  • Real Time Forecasting (incl aviation, hydro)
  • NWP (High Res, Global)
  • Atmospheric chemistry
  • Time series
  • Climate reports
  • Climate forecasting
  • Internally traceable time data series
  • Traceable climate data series

*Each have different purposes and very likely different quality definitions.*
WMO Traceability
Consistency of Definitions?

- **CIMO**

The property of the result of a measurement or the value of the standard whereby it can be related to stated references usually national or international standards through and unbroken chain of comparisons all having stated uncertainties.

- **GAW**

The whole chain of data acquisition, processing and quality assurance can be traced back to the time of measurement.
Possible mechanisms for demonstrating improvement of quality:

The time it takes to demonstrate that each measurement is fit for purpose.

Estimate of uncertainty for each observation

Corollary:

The level of quality is inversely proportional to the time it takes to prove each measurement is fit for purpose.

Uncertainty lets the user decide on quality.
Quality Description Issues

- Very few WMO data systems allow for uncertainty as part of a measurement (GAW maybe the exception?)
- ISO GUM revision move to probability distribution functions
- Most remote sensing systems have complex measurements
- Measurement or a product (e.g. vertical profiles using a combination of radiosonde, GPS, satellite) who is responsible?
Summary

- ISO quality management system - a key foundational tool for the meteorological community - ISO 9001 & 17025

- WMO community particularly CIMO and the RICS provides the key processes for measurement, that can be integrated into a quality management system with a strong focus on the quantity.

- Dilemma for WMO is the way a quantity translates into multiple purposes and different quality requirements, from weather to climate

- The complexity of remote sensing and the technology in defining a uniform measure.