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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



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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.



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What is meant by Quality in the workshop context?



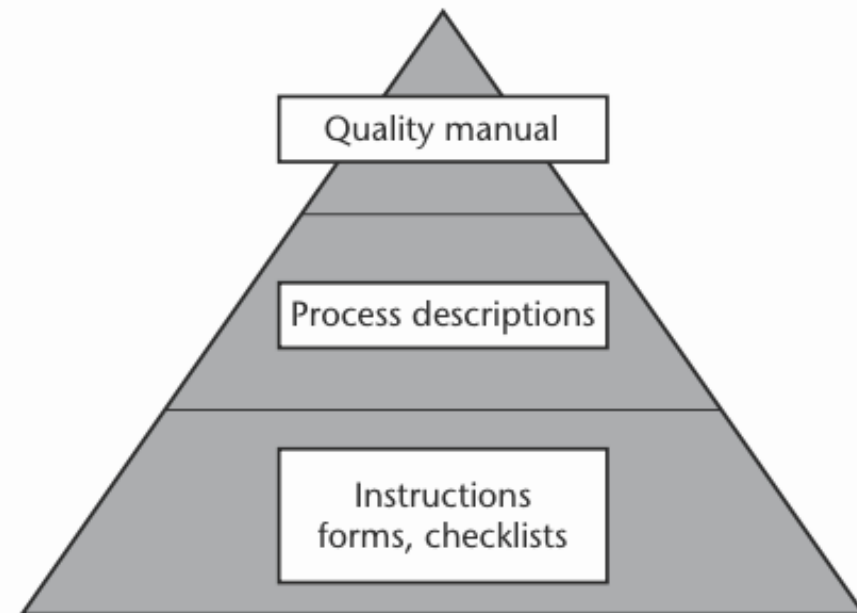
- If an organisation uses a *quality framework* will it improve the ‘quality’ of the surface-based measurements?
- If an organisation has an *Regional Instrument Centre* will the organisation improve the ‘quality’ of the surface-based measurements?



Quality Frameworks



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



ISO influences on a Measurement System



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



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Basic Measurement Equation



[Quantity]

= [Measurement]

= [Calibration(Measurement Model)]x[Signals]

Objective: Achieve measurement of the Quantity

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*.



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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.



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Improving Quality



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.



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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 measurement and data processing chains
- Measurement or a product (e.g. vertical profiles using a combination of radiosonde, GPS, satellite) who is responsible?



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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 and.