NPL
National Physical Laboratory

# A quality Assurance Framework for Earth Observation

## Requirement

The Group on Earth Observations (GEO)'s Global Earth Observation System of Systems (GEOSS) must deliver comprehensive "knowledge / information products" worldwide and in a timely manner to meet the needs of its nine "societal themes".

This will be achieved through the synergistic use and combination of data derived from a variety of sources (satellite, airborne and in situ) through the coordinated resources and efforts of the GEO members.

Achieving this vision requires the establishment of an operational framework to facilitate interoperability and harmonisation.



## Operational framework: Principles and scope

This framework, in the context of data and derived products, is dependent on the successful implementation of two principles:

- Accessibility / Availability
- Suitability / Reliability

And the means to efficiently communicate these attributes to all stakeholders.

Its scope encompasses the whole EO sector:

- All sensor types & operational domains
- Data collection
- Processing (Level 1 to Level n)
- Distribution

## Operational framework: Structure

To enable these principles to be implemented in an harmonised manner, the Committee on Earth Observation Satellites (CEOS), the space arm of GEOSS, following discussion at two international workshops of Cal/Val experts, has established a quality assurance (QA) framework.

This framework consists of a set of operational guidelines derived from "best practices" for implementation by the community.
These guidelines have been collated into three theme areas:

1. ***Data Quality***
2. ***Data Policy***
3. ***Communication & Education***

Each theme has an overarching "guiding principle" towards achieving interoperability with a minimal set of "key guidelines" to aid harmonisation.

## Data Quality

All data and derived products must have associated with them a Quality Indicator (QI) based on documented quantitative assessment of its traceability to community agreed reference standards. This requires all steps in the data and product delivery chain (collection, archiving, processing and dissemination) to be documented with evidence of their traceability.

Traceability: property of a measurement result relating the result to a stated metrological reference through an unbroken chain of calibrations of a measuring system or comparisons, each contributing to the stated measurement uncertainty (ISO guide 99:2007)

- Guidelines are generic in scope to cover all data-related "activities".
- Provide guidance (and indicative template) on how to establish a QI and means to obtain and document associated evidence.

  – **Content / writing of a "procedure"**
  – **Validating models & Algorithms**
  – **Selecting "Reference standards"**
  – **Evaluating Uncertainties**
  – **Organising and analysing comparisons**
  – **Evidence of traceability**

**Implementation**

Following the key guidelines within QA4EO should allow all stakeholders to have confidence in any assigned Quality Indicator (QI). These guidelines may evolve and/or be added to with time.

Where appropriate, sensor- or application- specific guidelines may be endorsed by CEOS on behalf of the community to facilitate harmonisation.

- The structure / content of these additional guidelines should follow that of the Key guidelines
- Ideally based on agreed "mature" best practise
- Are not necessarily unique

To facilitate "bias correction" and pre- and post- mission data continuity, a set of CEOS-endorsed "reference standards" and associated operational guidelines are being established to meet the needs of specific sensors and applications. Such Reference standards will probably include:

  – **Amazon Rainforest**
  – **The Moon**
  – **Specific set of deserts and playas**
  – **Atmospheric monitoring stations**
  – **Vegetated validation sites**
  – **Standard datasets**

## Data Policy

The data must be freely and readily available / accessible / useable in an unencumbered manner for the good of the GEOSS community, for both current and future users. This necessitates that all Cal/Val data and associated support information (metadata, processing methodologies, Quality Assurance, etc.) is associated with the means to effectively implement a Quality Indicator. In return, the data provider must be consistently acknowledged.

Guidelines are based on the adoption of existing "best" and commonly-used practises

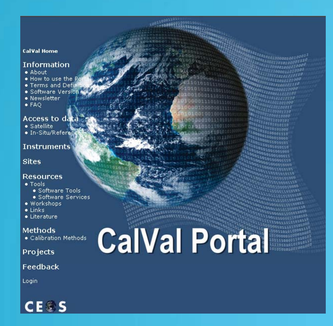
- Common metadata content and its linkage with datasets
- Domain harmonised formats for Cal/Val data exchange
- "Code of practise" for Cal/Val data providers & users

## Data Quality

Interoperability requires all stakeholders to have a clear understanding of the adequacy of the information that they are accessing and using for their specific application, i.e. its "fitness for purpose". The evidence for this clarity will be accessible through a single portal (http://calvalportal.ceos.org) and will be fully traceable to its origins. The traceability and interoperability process must be understandable by any appropriately trained individual throughout GEOSS and efforts must be made to encourage the wider usage of information and facilitate the training of GEOSS users.

- Dictionary of terminology
- Maintenance / evolution & utilisation of a Cal/Val Portal for all EO sensor domains

http://calvalportal.ceos.org




## Summary & Status

- The QA4EO set of "key guidelines" are currently being finalised following discussion at the Washington Workshop in May 08.
- The guidelines will be presented for endorsement to CEOS, to address GEO task DA-06-02, in November 08 and subsequently recommended for use throughout the GEO community.
- An implementation strategy to encourage worldwide use and (if required) potential evolution to meet any additional specific needs of data providers, for example those related to in situ measurements, is now under development.

CEOS GEO QA4EO A QUALITY ASSURANCE FRAMEWORK FOR EARTH OBSERVATION

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