



A QUALITY ASSURANCE  
FRAMEWORK FOR  
EARTH OBSERVATION

# Overview of progress towards a data quality assurance strategy to facilitate interoperability

**WGCV – May 27<sup>th</sup>, 2009**



# Overview

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- Origin of QA4EO and current status
- What QA4EO is ...and what is not
- Key Guidelines of QA4EO
- Future implementation and governance



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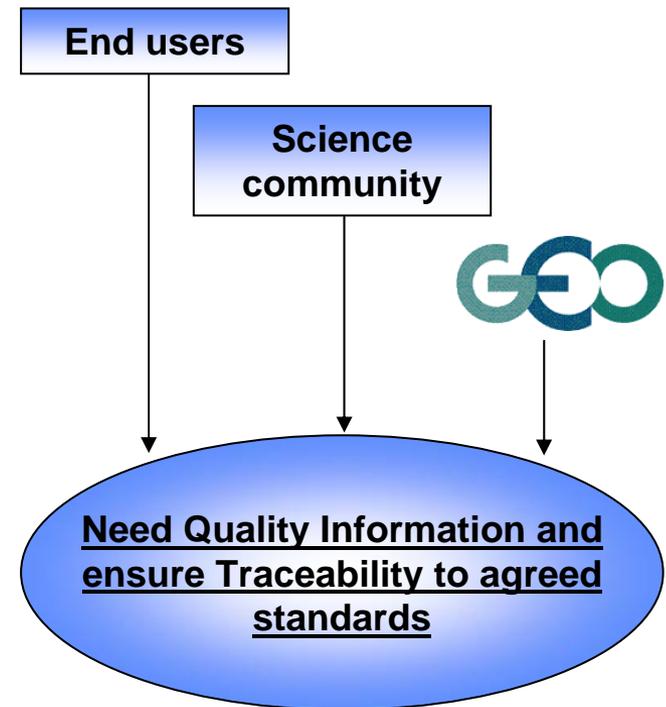
# Origin of QA4EO

EO end-users → need to access **quality information** (eg accuracy and precision) on the products they use

Scientific community and Value-adding Comp. → maintain the **traceability of all processing steps** (i.e. from acquisition to delivery) to allow:

- 1) error propagation,
- 2) reprocessing,
- 3) development of new products,
- 4) multi sensor inter-calibration,
- 5) long-term studies, etc.

GEO → Data shall be Available/Accessible and Suitable/Reliable. Overall intent to **maximise interoperability**. A specific task (DA-06-02) to develop a **“GEOSS Quality Assurance Strategy”**.



**Maximise the correct APPLICABILITY and INTEROPERABILITY**

# 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.

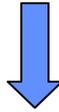
# Origin of QA4EO

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Committee on Earth Observation Satellites (CEOS)  
Working Group on Calibration and Validation (WGCV)

- Coordinate, standardise, advance cal/val of EO missions and their data.
- “space arm” of GEO

Prioritised task DA-06-02 in its implementation plan  
and facilitating its development



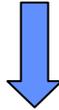
## ***DA-06-02\_2 Data QA Framework and Guidelines:***

- 1) Develop and deliver a consensus documentary framework and guidelines on cal/val for data quality control/assurance and best practices;*
- 2) Develop a consolidated worldwide cal/val site database to be included in the CEOS cal/val portal;*
- 3) Further expand the cal/val portal in both content and functionality.*

# Origin of QA4EO

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To perform that GEO task, **CEOS WGCV** proposed two workshops



Geneva October 2007



*Guiding principles*

- *Hosted by GEO secretariat*
- *45 participants*

*In conclusion, the workshop participants enthusiastically endorsed the outcomes as a milestone towards achieving the GEOSS goal of harmonising the quality assurance processes. The first step towards harmonisation across the global EO Cal/Val community is the development of a dedicated CEOS WGCV Cal/Val portal. This will facilitate the implementation of these activities on behalf of GEOSS.*



# Origin of QA4EO

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Gaithersburg May 2008

→ *Establishing an operational framework*

- *Hosted by NIST*
- *60 participants*

*Quality Control / Assurance and Best practice Guidelines  
on Calibration & Validation Processes  
.A Documentary Framework.*

*The title was later changed to:*

*A **Quality Assurance Framework**  
For  
Earth Observation*

**QA4EO**



# Operational framework:

## Principles and scope

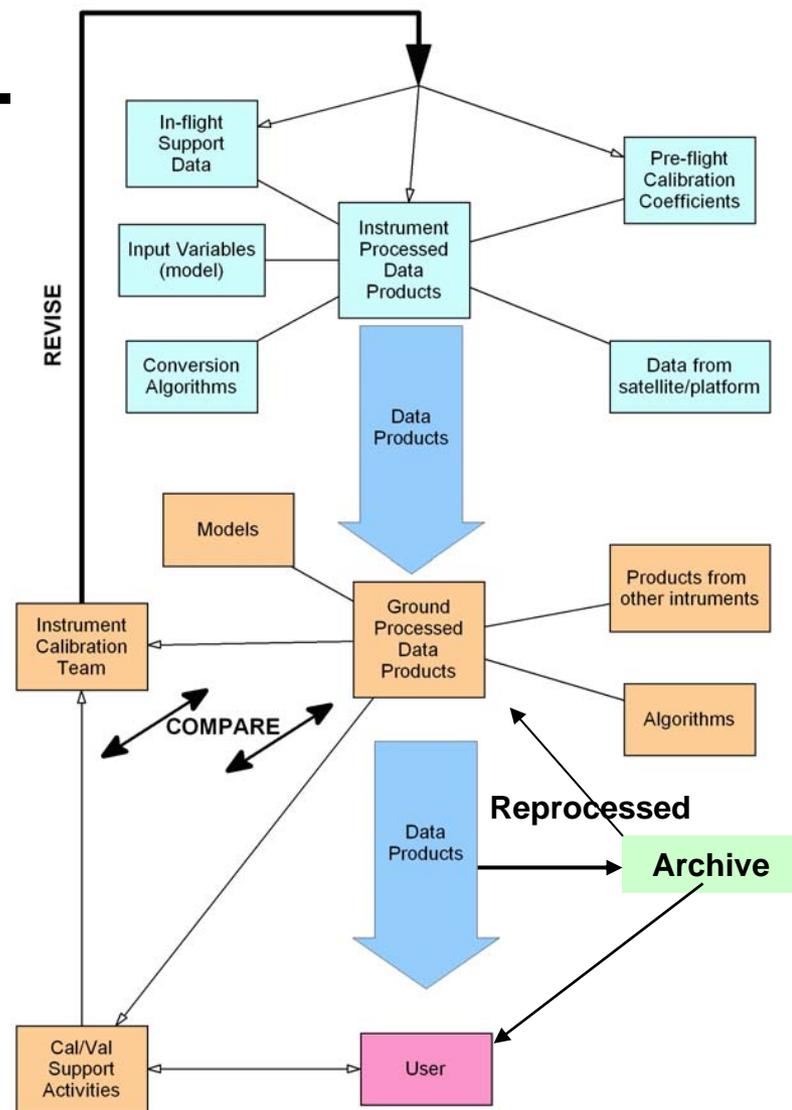
This framework in the context of data and derived products is dependent on the successful implementation of two principles:

- **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

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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:

- **Data Quality,**
- **Data Policy** *and*
- **Communication & Education**

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



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# 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



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# Data Policy

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*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*

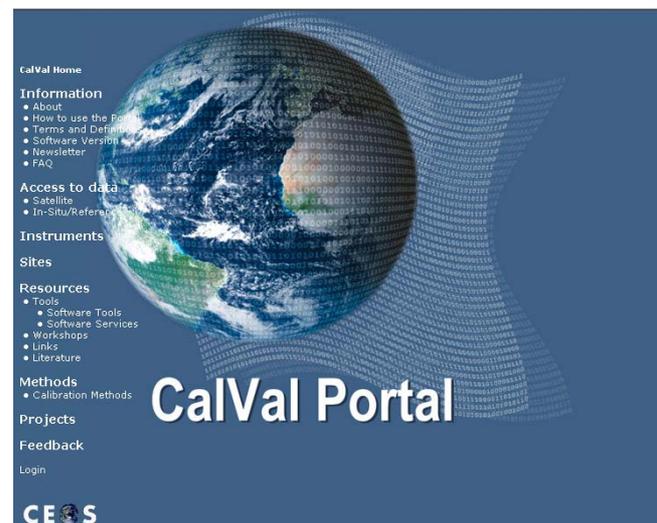
**Guidelines are based on the adoption of existing “best” and commonly used practises**

- **Common metadata content and its linkage with data sets**
- **Domain harmonised formats for Cal/Val data exchange**
- **“code of practise” for Cal/Val data providers & users**

# Communication and Education

*‘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) (<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



# Status on May 27<sup>th</sup>, 2009

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- All developed documents peer-reviewed by representatives from the different cal/val communities
- approved by WGCV (plenary meeting in Oct. 2008)
- endorsed by CEOS (22nd CEOS plenary November 2008)
- A thorough review has been made by GSICS (Global Space-Based Inter-Calibration System). A new version is almost ready
- A Guide to the guidelines has been issued



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# What is QA4EO

# ...and what is not

## 10 “key guidelines”

that respond to 3 guiding principles for generic processes and activities (Data Quality – Data Policy – Comm. & Edu.)

The “key guidelines” will lead to more detailed technical procedures developed by experts and individual organisations

It also includes coordinated comparisons for inter-calibration efforts

...not a certification body

...not a set of standards for QC/QA activities and processes

...not a framework developed with a top-down approach

# 3 Guiding Principles

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## 1) 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**.

## 2) Data Policy

Cal/Val data must be **freely and readily available / accessible / useable**. This necessitates that **all Cal/Val data and associated support information (metadata, processing methodologies, QA, etc.) is associated with the means to effectively implement a quality indicator**. In return, the provider must be consistently acknowledged.

## 3) Communication and Education

All stakeholders must have a **clear understanding** of the adequacy of the information, which should be **accessible through a single portal** and should be **fully traceable to its origins**.



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# 10 Key Guidelines

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the Key Guidelines may evolve in time and refinements could be applied

e.g. Recent contribution and review by Global Space-Based Inter-Calibration System (GSICS) and WMO.

Cal/Val Portal: <http://calvalportal.ceos.org/>



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# Detailed procedures and activities

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QA4EO encourages the development of more detailed documents (following the key guidelines) on technical procedures and activities by appropriate technical experts and individual organisations

QA4EO-WGCV-IVO-CLP-001 T. Stone Use of the Moon for in-flight calibration stability monitoring

QA4EO-CEOS-IVO-CLC-001 N. Fox Protocol for the CEOS WGCV Comparison of techniques and instruments used for surface IR radiance/brightness temperature measurements

Their endorsement and encouragement will lead to **improved coordination between agencies** and a **common-set of well-established procedures**

They will also represent a **guidance for newcomers**

**A QA4EO User Guide is under review**

# Compliance and Implementation

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Compliance is a **long-term objective** that requires efforts and strong coordination at an international level

It requires **activities from different perspectives and at different levels** to respond to the 3 guiding principles on Data Quality, Data Policy, Communication and Education.

Both a **top-down and a bottom-up** approach must be followed simultaneously in order to **close the gap between the high level QA4EO guidelines and their practical applicability.**

The overall implementation mechanism can be divided into three main aspects: **practical, policy and financial.**

# QA4EO Implementation & Governance

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- **QA4EO Implementation Workshop**

Chaired by GEO

Organised by GSICS and CEOS WGCV

September 29<sup>th</sup>, October 1<sup>st</sup>, in Antalya Turkey

[marie-claire@greeningconsulting.co.uk](mailto:marie-claire@greeningconsulting.co.uk)

- QA4EO is in the **Agenda** for **GEO Plenary** meeting in November



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# Summary

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- Maximise **APPLICABILITY & INTEROPERABILITY** of data through **QUALITY INFORMATION and TRACEABILITY**
- The key guidelines have been established. Subsequent procedures and “best practises” are now being written.
- QA4EO and will be evolved as necessary also to take account of any additional specific requirements of the wider GEOSS community.
- Implementation Achievements and Governance will be presented in GEO/GSICS/CEOS WGCV September meeting



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