CEOS IVOS

report to WGCV 26

Change of chair to N Fox from M Rast May 06

17th IVOS meeting held in Chiang Mai 30 Oct 06

12 attendees

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17th Meeting objectives

- Information exchange on agency and country activities and progress on IVOS activities

- Agree on Sub-group mission and terms of reference in light of GEO
  - Models and algorithms?

- Development and prioritisation of activities (work plan)
  - review of activities outstanding from 16th meeting
    - Comparison Exercise
    - Best practise for data base (web portal)
    - Need for 2nd (follow-on) workshop
    - Establishment, operation and use of cal/val reference test sites
  - New requirements from GEO
    - Data QA strategy
- Agree on Communication
  - IVOS web-site? Public or private
  - Meetings (regularity/association with WGCV etc)

IVOS MISSION statement

Mission

"To ensure high quality calibration and validation of infrared and visible optical data from Earth observation satellites and validation of higher level products"

IVOS Terms of Reference

1. Promote international and national collaboration in the calibration and validation of all IVOS member sensors.

2. Address all sensors (ground based, airborne, and satellite) for which there is a direct link to the calibration and validation of satellite sensors;

3. Identify and agree on calibration and validation requirements and standard specifications for IVOS members;

4. Identify test sites and encourage continuing observations and inter-comparison of data from these sites;

5. Encourage the preservation, unencumbered and timely release of data relating to calibration and validation activities including details of pre-launch and in flight parameters.

Country / Agency Reports

ESA

JRC

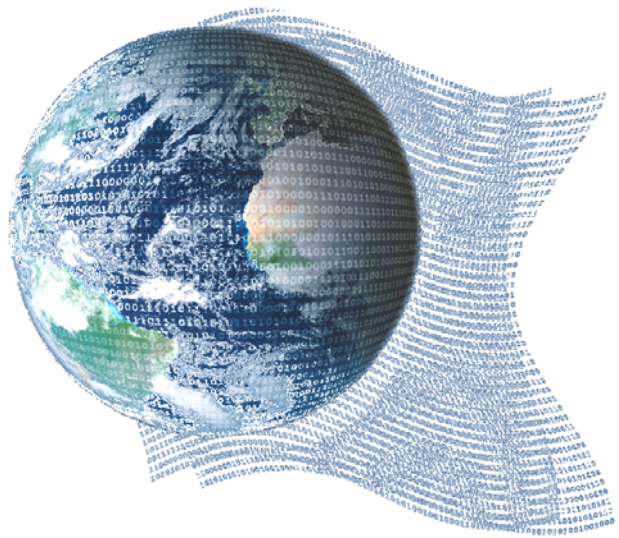
NOAA

NIST

NPL

USGS

EO CalVal Portal



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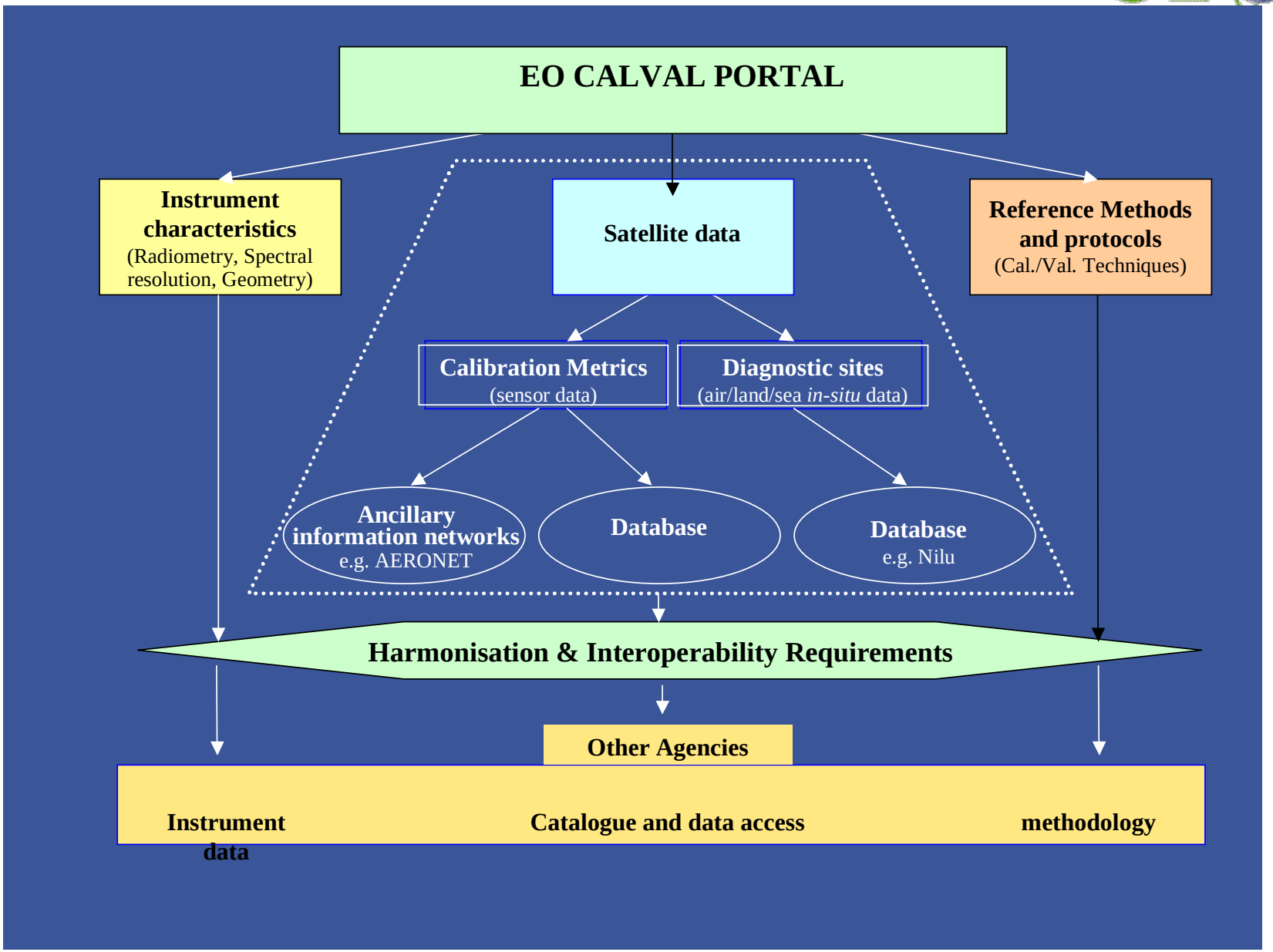
EO CALVAL PORTAL
Instrument characteristics
(Radiometry, Spectral resolution, Geometry)
Satellite data
Reference Methods and protocols
(Cal./Val. Techniques)
Calibration Metrics
(sensor data)
Diagnostic sites
(air/land/sea in-situ data)
Ancillary information networks
e.g. AERONET
Database
Database
e.g. Nilu
Harmonisation & Interoperability Requirements
Other Agencies
Instrument data
Catalogue and data access
methodology

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A short overview of the

Radiation transfer Model Intercomparison (RAMI)

initiative of the Joint Research Centre

J-L. Widlowski & the RAMI participants

October 2006,Ispra, Italy

Institute for Environment and Sustainability

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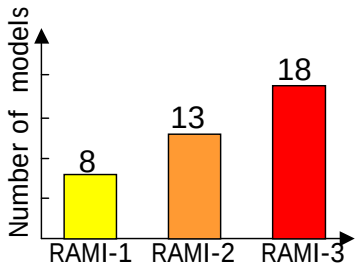
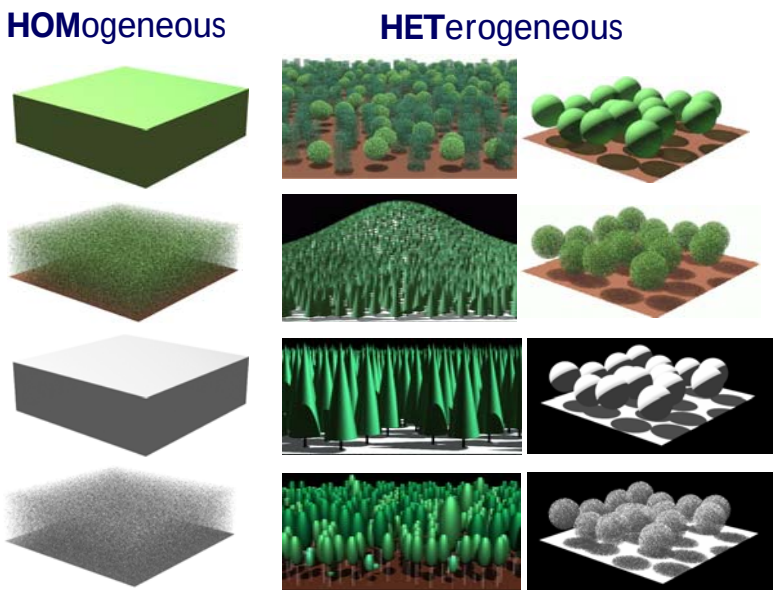
RAMI Evolution

- **RAMI-1** (1999):
  - Turbid medium and discrete
  - Solar domain + purist corner
- **RAMI-2** (2002):
  - Topography + true "zoom-in"
- **RAMI-3** (2005):
  - Birch and conifer scene
  - Heterogeneous purist corner





60-70% of all canopy RT models have participated in RAMI

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RT model intercomparison

Issues:

- In general there is **no absolute 'truth' available!** Model results cannot be evaluated against some reference standard
- Laboratory data are not suitable as reference due to incomplete knowledge of exact experimental conditions.

Solutions:

- Model results can be compared *against each* other to document their relative differences.
- Model results can be compared over *ensembles* of test scenarios to establish trends/behaviours in their performance.
- Careful inspection/verification of an ensemble of model results may lead to the establishment of the "*most credible solutions*" as a surrogate for the "truth".

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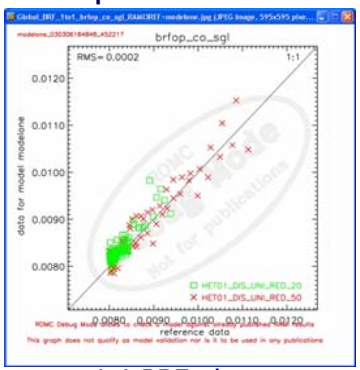
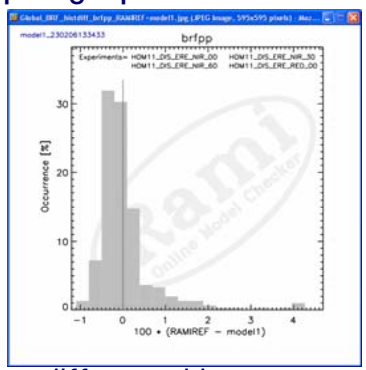
RAMI Achievements (cont.)

Examples of ROMC output graphs:



1:1 BRF plots



difference histograms

RAMI-3 established a **reference data set** and developed the RAMI On-line Model Checker (ROMC) to allow for continuous, *automated model evaluations.*

RAMI Online Model Checker (ROMC)

http://romc.jrc.it

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National Environmental Satellite, Data, and Information Service

NOAA Report

CEOS - IVOS 17

October 30, 2006

Chiang Mai, Thailand

Changyong Cao

NESDIS

National Oceanic and Atmospheric Administration

IVOS

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National Environmental Satellite, Data, and Information Service

Summary

- NOAA/NESDIS is actively involved with Global Space-Based Inter-Calibration System (GSICS) to inter-calibrate satellite instruments.

- Supported the ASIC^3 Workshop to build a roadmap for On-Orbit Calibration traceability and Standards.

- NOAA and NIST formed a partnership to promote high accuracy satellite measurements traceable to international standards.

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National Environmental Satellite, Data, and Information Service

GSICS Calibration Support Segments (CSS)

- The GSICS Calibration Support Segments (CSS) will be carried out by participating satellite agencies, national standards laboratories, major Numerical Weather Prediction (NWP) centers, and national research laboratories. CSS activities are:

  - ✓ **Earth-based reference sites,** such as stable desert areas, long-term specially equipped ground sites, and special field campaigns, will be used to monitor satellite instrument performance.
  - ✓ **Extra-terrestrial calibration sources,** such as the sun, the moon, and the stars, will provide stable calibration targets for on-orbit monitoring of instrument calibration
  - ✓ **Model simulations** will allow comparisons of radiances computed from NWP analyses of atmospheric conditions with those observed by satellite instruments
  - ✓ **Benchmark measurements** of the highest accuracy by special satellite and ground-based instruments will help nail down satellite instrument calibrations

- WMO, CGMS, satellite agencies, national standards institutes, national data centers, major NWP centers, and national research laboratories will carry out the GSICS.

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National Environmental Satellite, Data, and Information Service

Achieving Satellite Instrument Calibration for Climate Change (ASIC^3)

- **ASIC^3 workshop was held at the National Conference Center in Virginia, May 16-18, as a follow-up to the 2002 Workshop.**

- **To formulate a national roadmap for developing calibration systems that will enable us to monitor long-term global climate change.**

- **Established goal for satellite-based climate monitoring system:**

  Design of climate observing and monitoring systems must ensure global, long-term climate records that are of *high accuracy, tested for systematic errors on-orbit, and tied to irrefutable international standards* such as those maintained in the U.S. by the National Institute of Standards and Technology.

Two overarching recommendations:

- Conduct satellite benchmark missions to create irrefutable records and calibrate other satellite sensors
- Establish a U.S. Joint Center for Satellite Instrument Calibration (JCSIC)

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NIST Report

CEOS - IVOS 17

October 30, 2006

Chiang Mai, Thailand

Raju Datla

Optical Technology Division

National Institute of Standards and Technology

LUSI (LUnar Spectral Irradiance)

A New Program to Reduce the Uncertainty in the Absolute Lunar Spectral Irradiance

Steven Lorentz[1], Allan Smith[2], Howard Yoon[3] and Raju Datla[3]

in collaboration with

Bob Barnes[4], Hugh Kieffer[5], Dave Pollock[6],
Ray Russell[7], Tom Stone[8] and Joe Tansock[9].

1. NIST Contractor (L-1)
2. NIST Contractor (Jung R&D)
3. NIST
4. GSFC Contractor (SAIC)
5. Celestial Reasonings
6. UAH
7. Aerospace Corp.
8. USGS
9. SDL

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Going Beyond ROLO — Goals of LUSI

- A higher spectral resolution model of the lunar spectral irradiance (and reflectance)
  - Wavelength range: 320 nm to 2500 nm
  - Spectral resolution **1 nm to 4 nm**
  - Uncertainty (k=1) **GOAL <1 %**
    - Should be achievable using NIST SIRCUS facility for end to end calibration.
  - **Instrument design and stability are key to achieving this uncertainty goal.**
  - **Retrievable instruments for both balloon and mountain top are critical!**

- A minimum data set covering multiple lunations to collect a range of phase and libration angles.
  - **Ideally, most observations from Mauna Kea—altitude 4 km, stable air, low aerosols**
  - Focus on atmospheric “window” bands
  - Correct for residual attenuation—Spectral instrument will help
- Use balloon data to validate atmospheric corrections and spectrally extend the model through absorption bands
  - Plan 2 flights per year minimum

- Additional opportunities exist for measurements of the lunar thermal-IR spectral irradiance—The technology is available and the balloon flights afford the opportunity

Seeking Partnership of CEOS/IVOS Members for Moon Calibration Effort

First of all this task should be an international endeavor as it benefits all earth remote sensing VIS/NIR instruments from space.

Partnership for Multiple Observations from Multiple sites:

Other coordinated full moon measurements from other parts of world will help build confidence on the absolute accuracy.

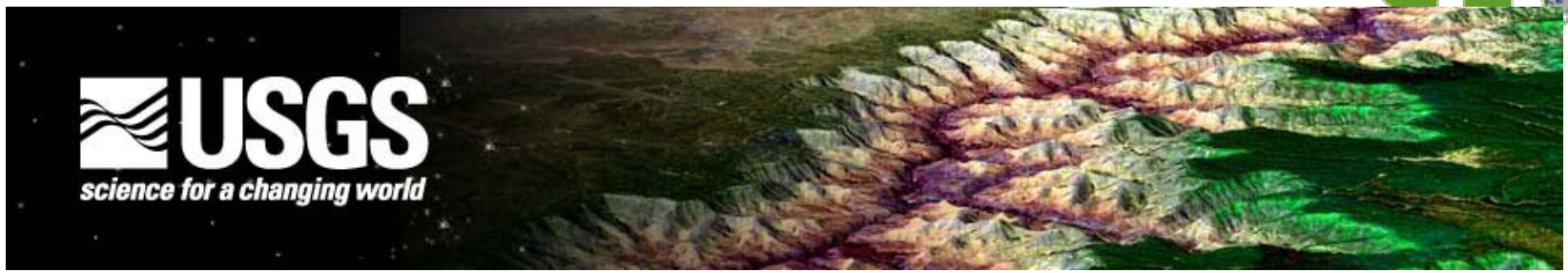
- Need Mountain top sites as high as possible (3 km or above). Mauna Kea (4 km) in Hawaii is ideal but hard to get because of competition from astronomers.
- Full moon capturing balloon flights and/ or high altitude airplane observations.
- Participate in windows of opportunity in future space efforts. Example: TRUTHS or other scientific satellite missions.

NPL/UK activities relevant to CEOS

Nigel Fox
Quality of Life Division

Oct/Nov 06

IVOS



USGS Report to the CEOS IVOS 17th & WGCV 26th Meeting

Dates: Oct 31 – Nov 03, 2006

Gyanesh Chander*, John Dwyer – SAIC/EROS/USGS

Greg Stensaas – EROS/USGS

U.S. Department of the Interior

U.S. Geological Survey

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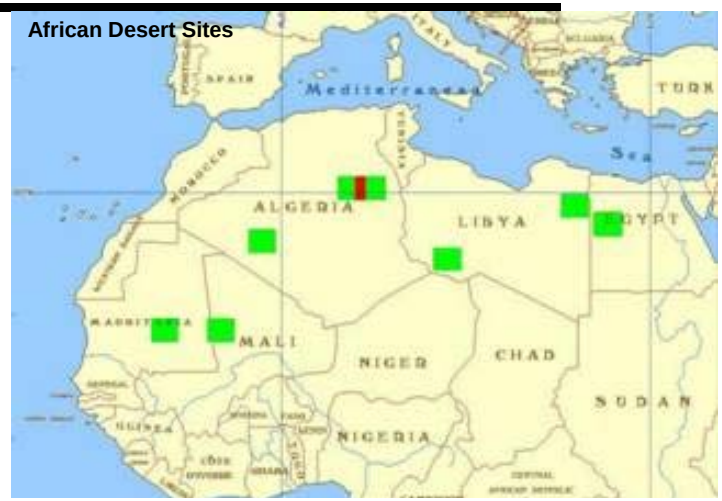
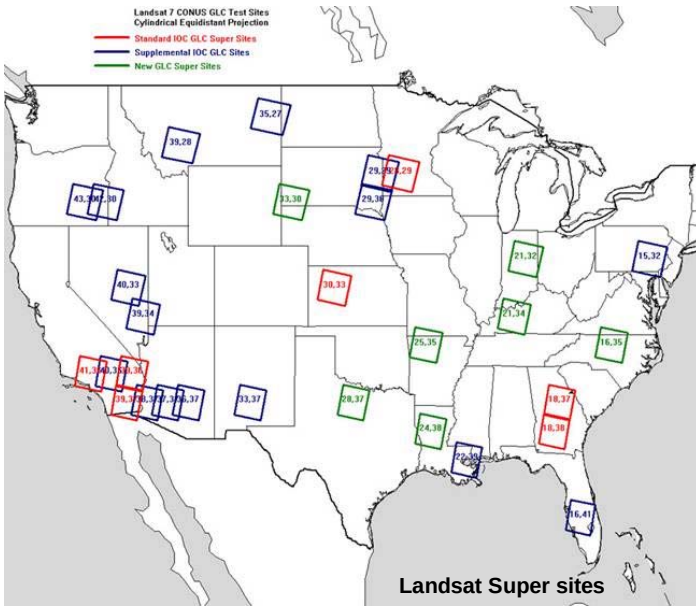
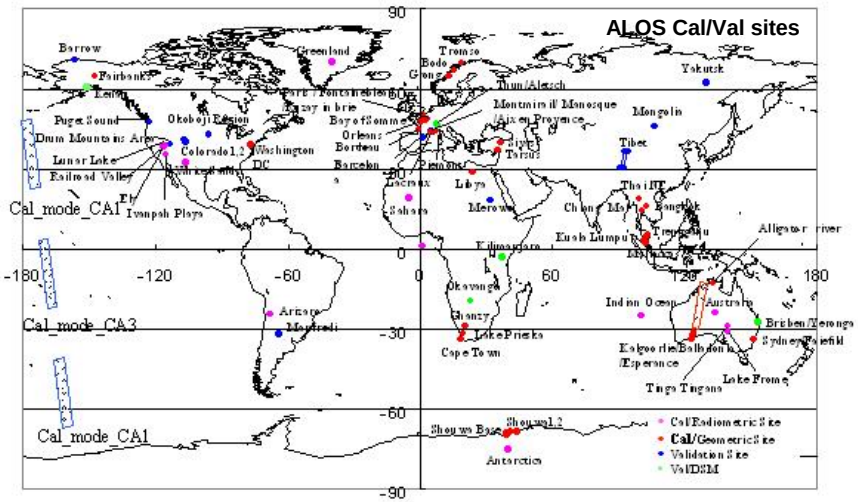
CEOS Calibration-Validation Sites

- **World-wide Cal/Val Sites for**
  - Monitoring various sensors
  - Cross calibration
  - Integrated science applications
- **Prime Sites for data collection**
  - Site description
  - Surface Measurements
  - FTP access via Cal/Val portals







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USGS Recommendations

- **Coordinate and provide world-wide Cal/Val sites**
  - Coordinate and provide ground control points
  - Coordinate and plan vicarious calibration field campaigns
- **Maintain a fully accessible Cal/Val portal to provide**
  - instrument characteristics of current & future systems,
  - seamless access of Cal/Val site data for users
  - database of in-situ data, documentation of best practices
  - Info regarding co-incident imagery
- **Reinvigorate IVOS subgroup**
  - Workshop at ESA ESTEC (2004) was a great success!
  - Coordinate and schedule regular communication between IVOS sub-group members
  - Members provide monthly Cal/Val Status on action items
- **Update CEOS WGCV IVOS web pages with membership information, IVOS presentations, and technical links**

Development of Work plan in context of GEO data quality strategy

ESA study Objectives

1. Establish a baseline specification of QA /QC tools and procedures needed to ensure implementation of “best practise” for operations of future sensors/missions in the “multi-mission” environment.
    - Via analysis of existing missions
    - To meet needs of applications as specified by users
    - Appropriate adoption/adaptation of practises of non EO industrial sector
2. Identification of a set of (if possible) generic “quality reporting indicators” and/or a means of “certification” of data products and their production, appropriate to the needs of their application and those of all stakeholders in the EO sector – data producer and user.

For all sensor types: Optical, SAR, AC, Microwave and ground segment

NPL CLS BAE SYSTEMS logicaCMG serco VEGA

IVOS NPL

Study Progress: Issues from review of existing System

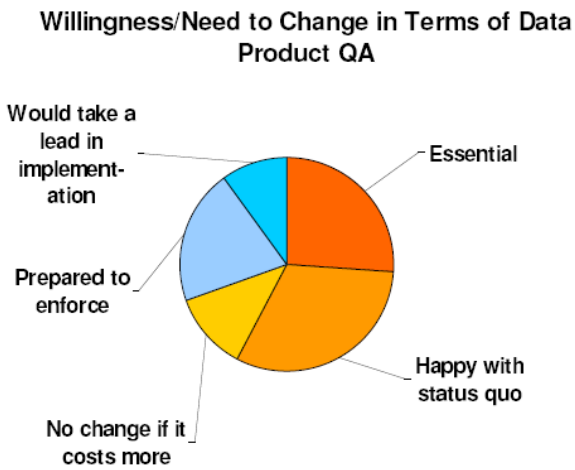
- **documentary evidence:** ***accessibility, level of detail, regularity of update, independent review***

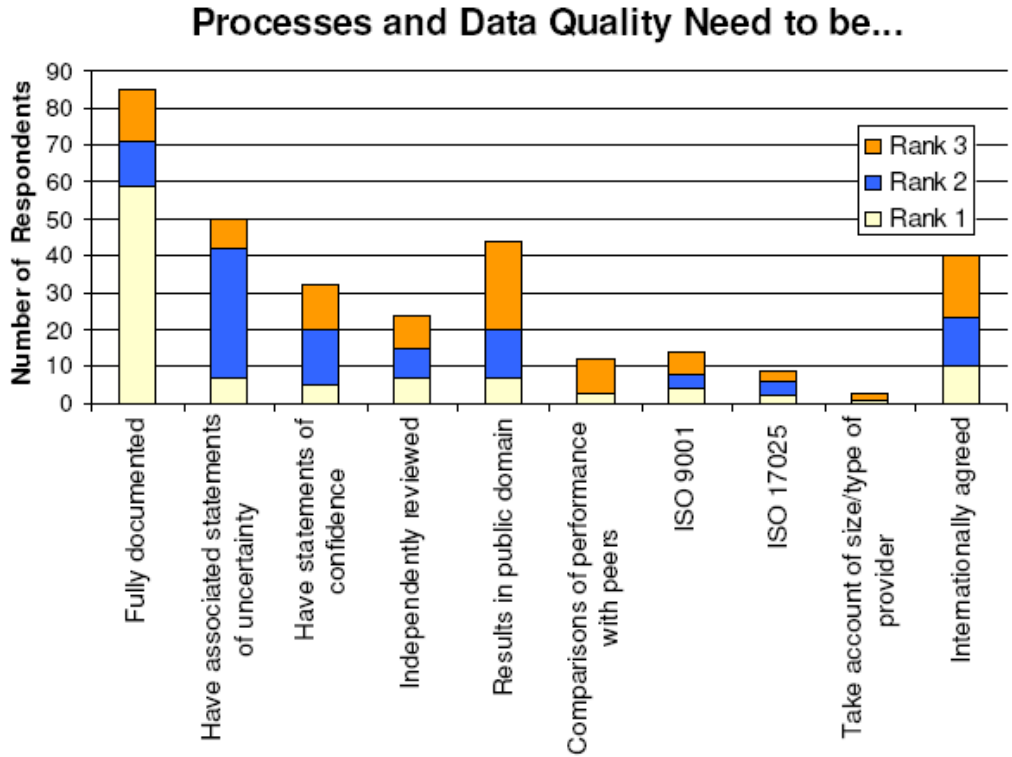
- **More formality in post launch cal/val:**
  - ***defined protocols,***
  - ***evidence of traceability,***
  - ***international reference sites/networks,***
  - ***multi-sensor requirements***
  - ***Post mission maintenance***

- **Identification of and reuse of "best practise"**

- **Overarching framework for QA**
  - ***high level guidelines***
  - ***consistent "certification" / approval process***

Need and Desire for data product QA





- **Fully documented**
- **uncertainty statements**
- **public visibility**
- **Internationally agreed**

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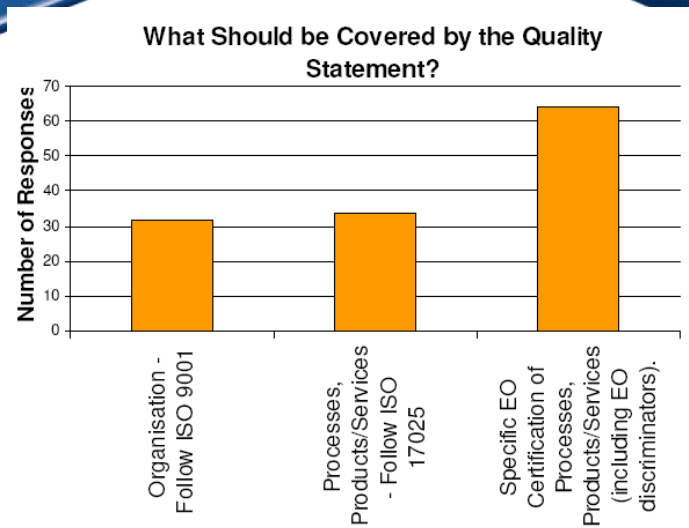
Quality certification/guarantee



"We need specific quality assessments for each type of product (driven by independent experts)."

"Products should be fully traceable in terms of error propagation but at the same time expressed in a clear manner that is understandable to non-EO experts and it should not be hidden in a morass of accompanying documents. Accompanying quality information should not make the product too large to use easily."

"Ultimately the accuracy of product is most important - I am unaware which ISO this might fall under."

"Ancillary supporting data used (not necessarily EO data) also needs assessment in relation to classification schemas."

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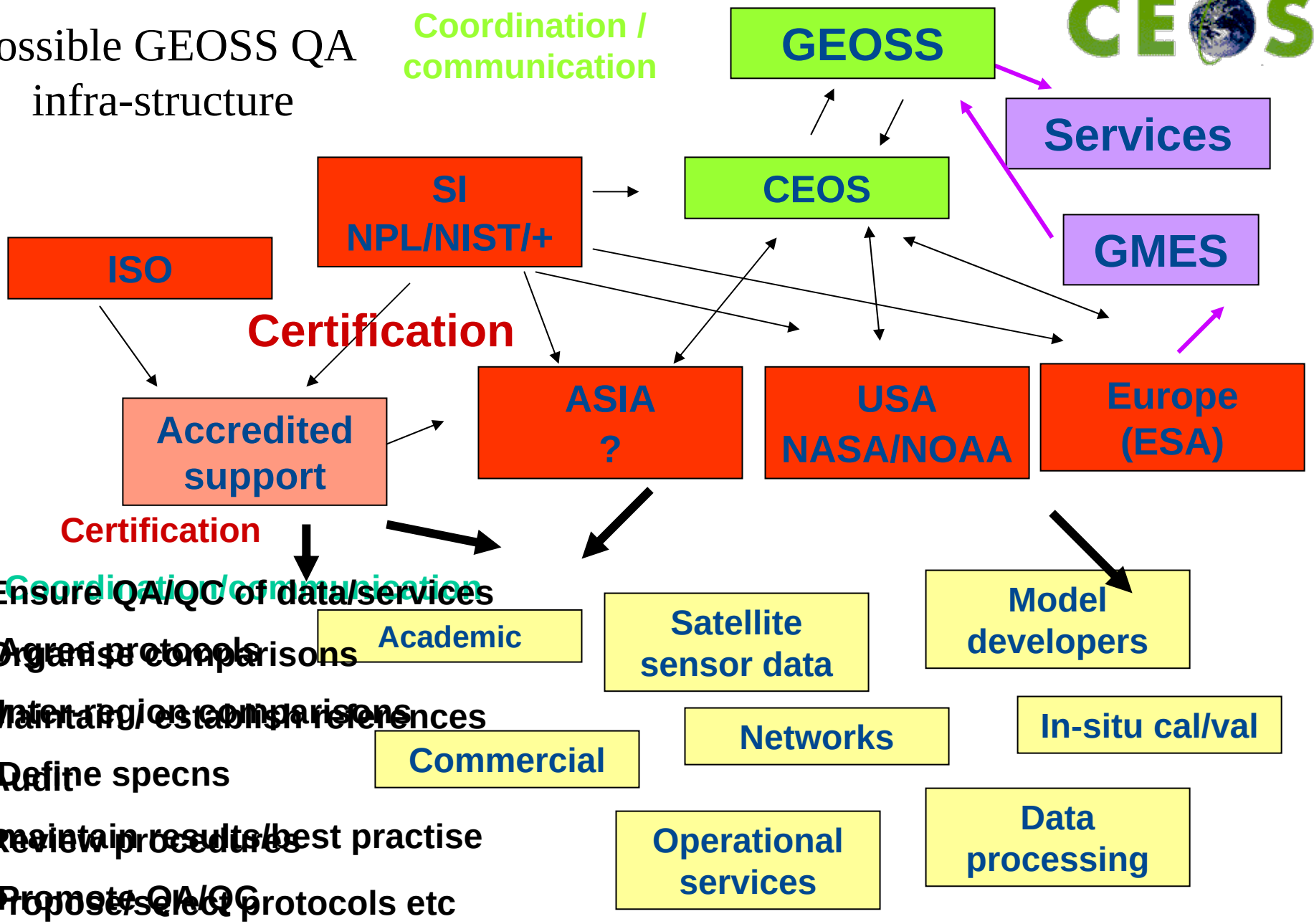
Possible GEOSS QA infra-structure



Certification bodies should be independent of activities

Work Plan

Identify a set of CEOS "certifiable" reference cal/val test sites

- Utilise existing pre-cursor activities of IVOS/USGS/ESA

- Define set of essential criteria e.g. homogeneity, size, reflectance, accessibility, level of maintenance …

- Request data/list from CEOS members (GEO auspices)

- Categorise / classify sites for "CEOS certification"

Lead: USGS inconjunction with ESA **Completion:** Autumn 07

Establish best practise for calibration/validation (target of intercomparison) (site characterisation and sensor comparisons)

- Education of community

- Understanding of sensor biases / inter-team consistency of activities

- CEOS members to identify contacts for key in-situ teams groups and sensor cross calibration

- Collate existing documents of "best practise" to discuss/contrast differences

- Review of Cross-comparison protocols and add guidance from NPL/NIST

- Encourage existing planned activities – communicating outputs to IVOS members – Goal of comparison in ~ 5 yr timeframe

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Work Plan continued

- **Communication of QA Relevant data**
  - **Acknowledge intended use of "CEOS" Web Portal**
  - **IVOS information first to populate**
  - **Recognise issues**
    - **Maintenance and updating of links and information**
    - **QA of inputs**
    - **Define format**
  - **Discuss at WGCV**
  - **Lead ESA Input IVOS members USGS +**

IVOS operational logistics

- Establish password protected document store and workspace
- Update of intro page on WGCV website
- Encourage attendance through development of key policy items
- Consider bi-annual “conference/workshops” linked to existing meetings