GEO – CEOS Workshop on Quality Assurance of Calibration and Validation Processes

Introduction

Changyong Cao, CEOS/WGCV Chair

Michael Rast, GEO Secretariat

Oct. 2, 2007

CEOS/WGCV provides strong support to GEO tasks

- Established in 1984, CEOS/WGCV is a very successful international technical working group. Our mission is to “ensure long-term confidence in the accuracy and quality of Earth observation data and products” through calibration and validation.

- The GEO Secretariat is the center of international coordination for the worldwide GEOSS effort.

- CEOS/WGCV is committed to support the GEO tasks. This pivotal workshop is a major milestone for us.

GEOSS and Data Quality Assurance

- *The success of GEOSS will depend on data and information providers accepting and implementing a set of interoperability arrangements, including technical specifications for collecting, processing, storing, and disseminating shared data, metadata, and products.* (-- from the GEOSS 10 yr. Implementation plan)

- A critical element of interoperability is **Data Quality Assurance**, because: *Data accessible ≠ Data usable*

- Cal/Val is critical to data quality assurance and data usability

- Data quality assurance (GEO DA-06-02, led by WGCV and IEEE) is a fundamental and cross cutting task for GEOSS

GEO DA-06-02
GEOSS Quality Assurance Strategy

- This task is led by CEOS and IEEE
- "Develop a GEO data quality assurance strategy, beginning with space-based observations and evaluating expansion to in-situ observations, taking account of existing work in this area".

-From the GEO 2007-2009 Work Plan, page 25

DA-06-02 Quarterly Reports

Data Management Task DA-06-02

Task Number	Title
DA-06-02	Develop a GEO data quality assurance strategy, beginning with space-based observations and evaluating expansion to in-situ observations, taking account of existing work in this arena.
Area	
Data Management	
Relevant Committee	
ADC	

Description of the Work to be Performed

To generate high-level products, operational services and research laboratories using data from different Earth observation sensors (space and/or in situ) require measurements whose quality is well characterised and sufficient to produce meaningful products. Accuracy assessment and reporting of measurement uncertainty is essential to assure product consistency and interoperability (e.g. comparison and /or combination). This implies that the instrument calibration and product validation activities need to be continuously monitored and traceable to standards.

Building upon the work performed for space observations by several international groups, such as the CEOS WG on Calibration and Validation and IEEE, the following activities will be performed:

1. Document Earth observation sensors and methods used to derive level 1, level 2 (geophysical) and higher level products
2. Define standards for quality assurance of derived products
3. Create and maintain an internet-accessible information data base containing all information from (1) and (2)
4. Provide/publish reference methods in a readily accessible form and including pre-flight characterisation, vicarious calibration, radiative transfer computation, post-launch activities, calibration sites…etc.
5. Then expand to in situ observations the approach developed for space observations

Output & Deliverables

Documented reports on sensor characterisation and product validation methodologies

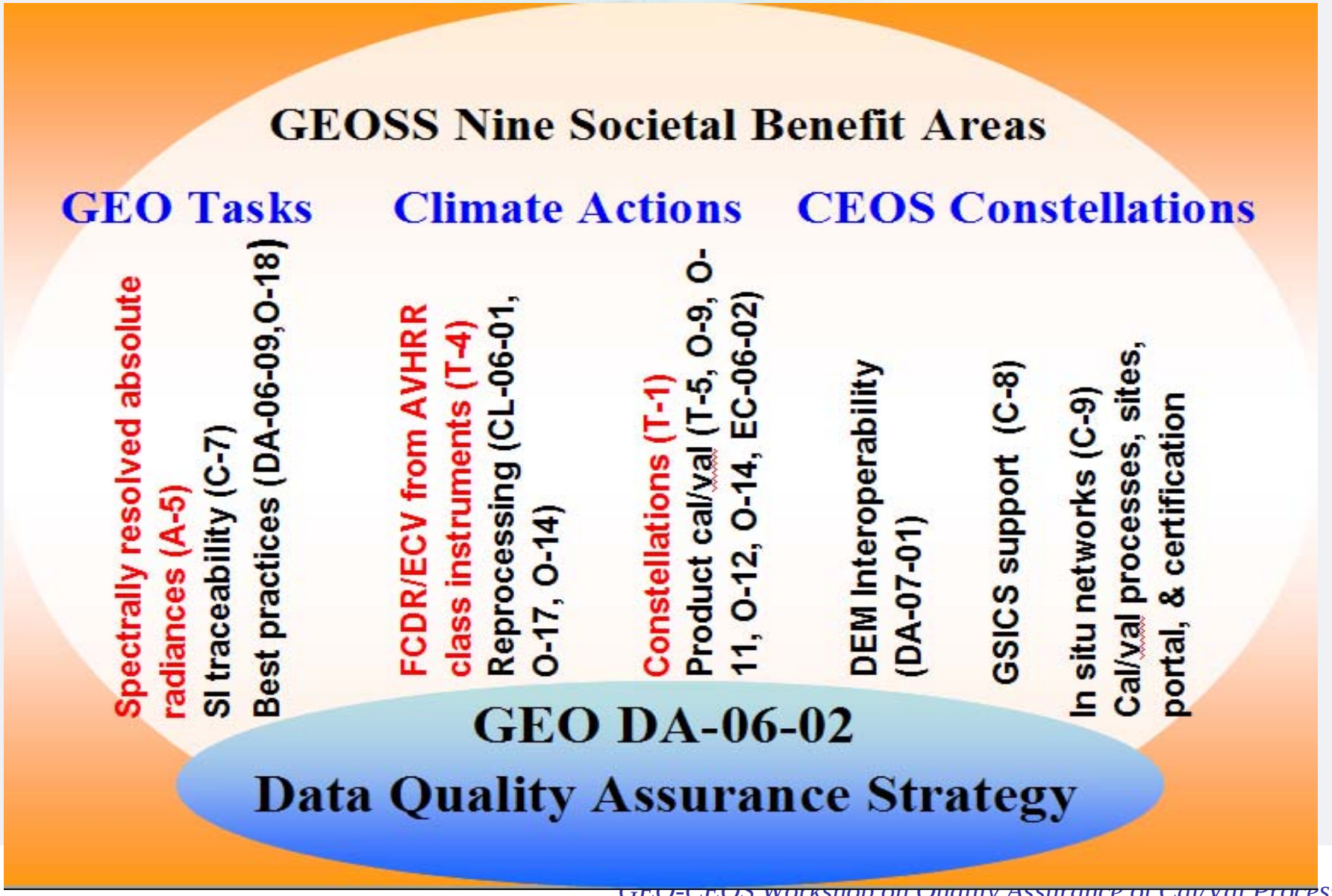
Standards for data quality assurance

Data bases for sensor data, for in situ data

Led by Dr. Stephen Ungar

of Cal/Val Processes

GEO DA-06-02 is fundamental and cross-cutting



CEOS Plenary Recommendation

WGCV recommendation to the CEOS 20th Plenary

- **Joint WGCV-25/WGISS-21**
  Request/Recommendation: Request CEOS endorsement of a joint GEO/CEOS Workshop on Cal/Val Processes (to be held in October 2007 at the GEO Secretariat in Geneva). Recommend CEOS encourage continued support by appropriate members to address issues associated with the operationalization of capabilities developed by the CEOS WTF and the ESA Cal/Val Portal.

What can we do together on Cal/Val QA as an international effort ?

Pre-launch

Mission Requirements
- Instrument performance specifications

Design/Build/Test
- Industry lead with Gov. oversight and Standard lab participation
- ISO certification

Post-launch

On-orbit verification
- **Onboard calibration**
- **Vicarious calibration**
  - Cal/val sites
  - Lunar calibration
  - Intersatellite
  - Cross platform

Longterm monitoring
- Longterm drift
- Degradation

Product validation

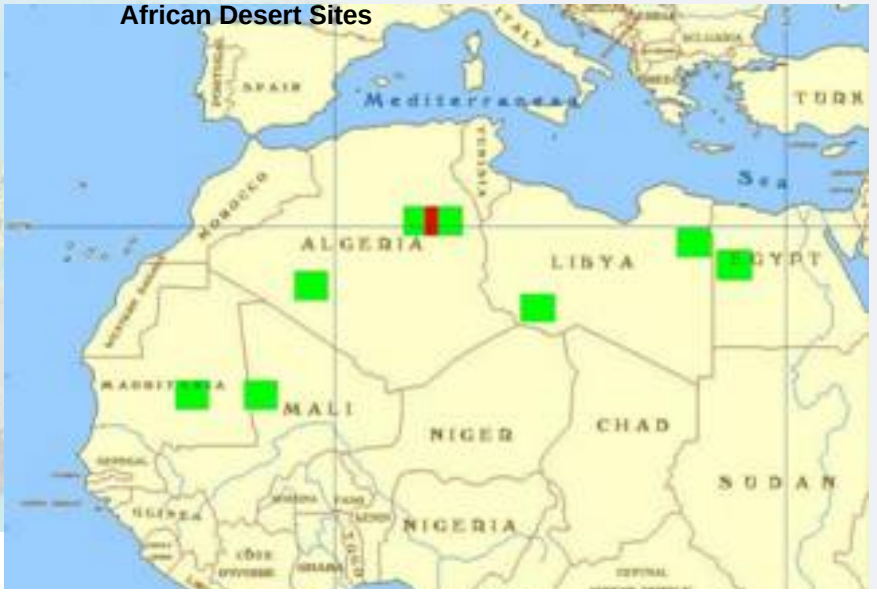
Re-calibration

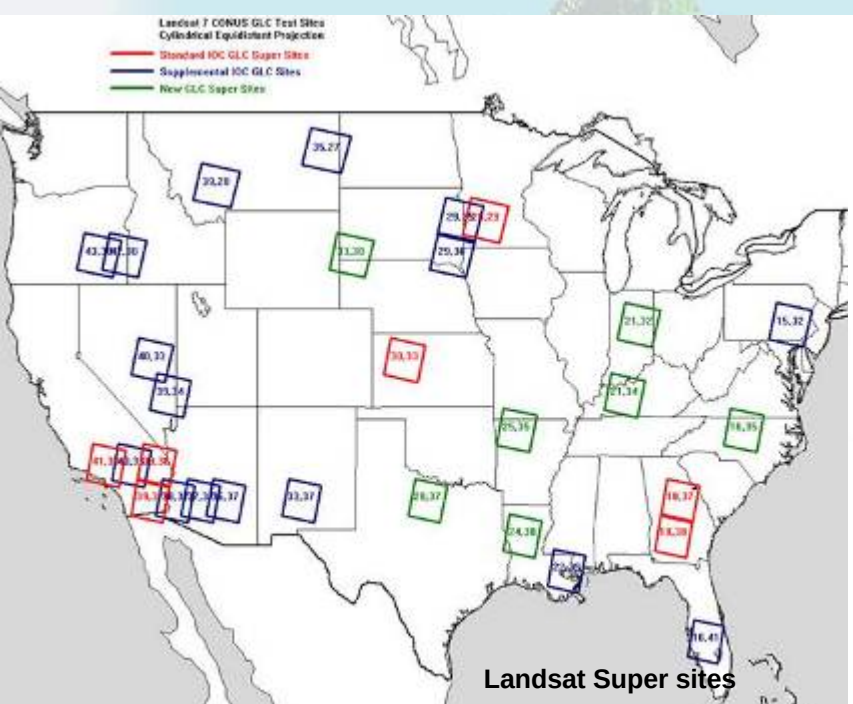
On-orbit standards & traceability (TRUTHS, and others)

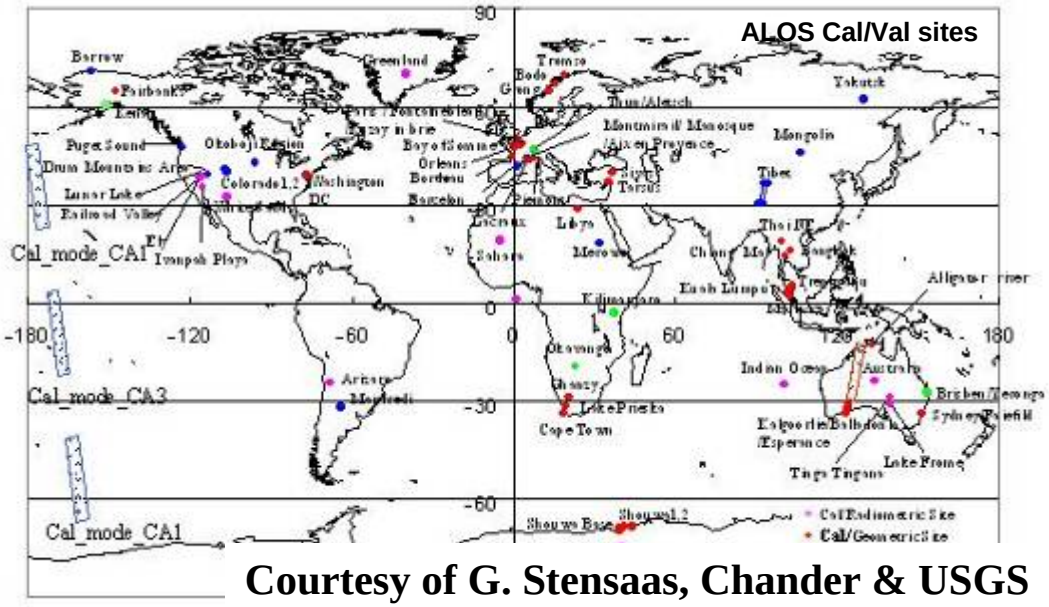
-Guidelines & framework
-Cal/Val sites
-Data access policy
-Cal/Val portal
-Best practices
-Harmonization
-Other

CEOS Cal/Val Sites

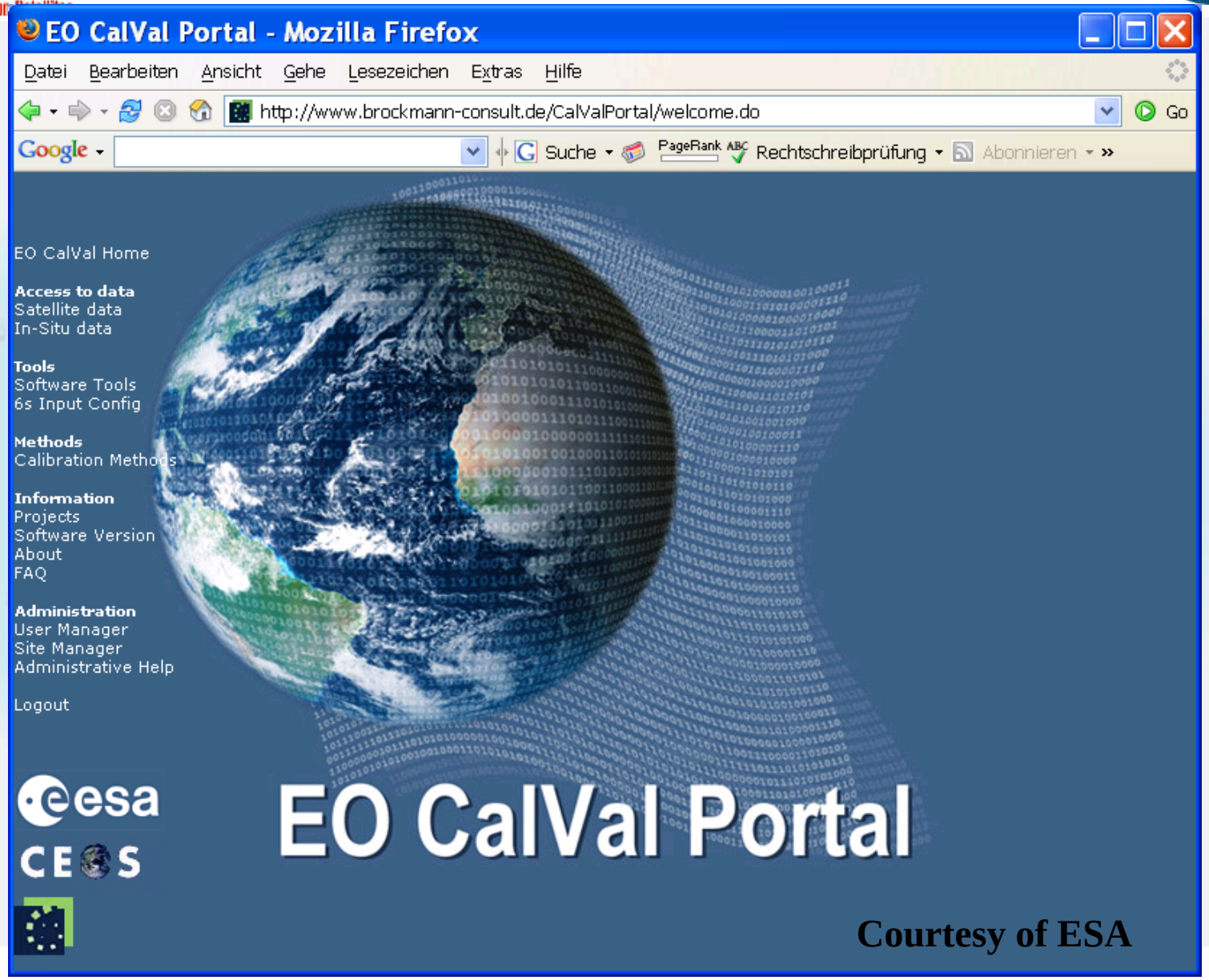
- World-wide Cal/Val Sites for
  - Monitoring various sensors
  - Cross calibration
  - Integrated science applications
- Prime Sites for data collection
  - Site description
  - Surface Measurements
  - FTP access via Cal/Val portals
- Supports GEO Tasks







Cal/Val Portal



Workshop Objectives

- "To identify and scope key elements needed to develop and implement a data quality assurance strategy as required by GEO task DA-06-02"

- Discussion Topics:
  - **Cal/Val processes and quality assurance:** what can be done for each segment in the process?
  - **Cal/Val sites:** what's the criteria, type, characterization, classification, access policy, synergy with WTF?
  - **Cal/Val data access:** data access policy.
  - **Methodology, guidelines, best practices.**
  - **Harmonization & standardization of quality control and Cal/val processes:**
    - Traceability across missions, and between agencies.
    - **"Traceability** requires the establishment of an unbroken chain of comparisons to stated references each with a stated uncertainty" -- *NIST*
  - **CEOS certification:** what to certify, process, sites, or techniques? Certified vs. endorsed.
  - **Cal/Val portal:** content, and relationship to GEO web portal.
  - **Implementation strategy:** recommendations, shared resources and responsibilities, lead by example.

- Expected outcome:
  - Consensus and Recommendations on standards
  - Guidelines and framework for data quality assurance
  - Plans, actions & milestones
  - Report to the CEOS Plenary &Workshop report
  - Way forward

Thank you !

- Thank Pascal Lecomte of ESA, and GEO secretariat Michael Rast for initiating and sponsoring the workshop, and their longterm commitments to this GEO task,
- Thank Stephen Ungar for leading this GEO task and coordinating the quarterly reporting,
- Thank Marie-Claire and the session chairs for their hard work organizing the workshop,
- Thank all for participating.

Backup slides

WGCV and GEOSS 9 SBAs

Agenda

Tuesday 2 October	Wednesday 3 October	Thursday 4 October
• Welcome • Introduction	Satellite and *in situ* cal/val data access	Harmonisation of quality information
Lunch		
Cal/val site characterisation & certification	Methodology and guidelines for cal/val	• Discussion and future • Wrap up

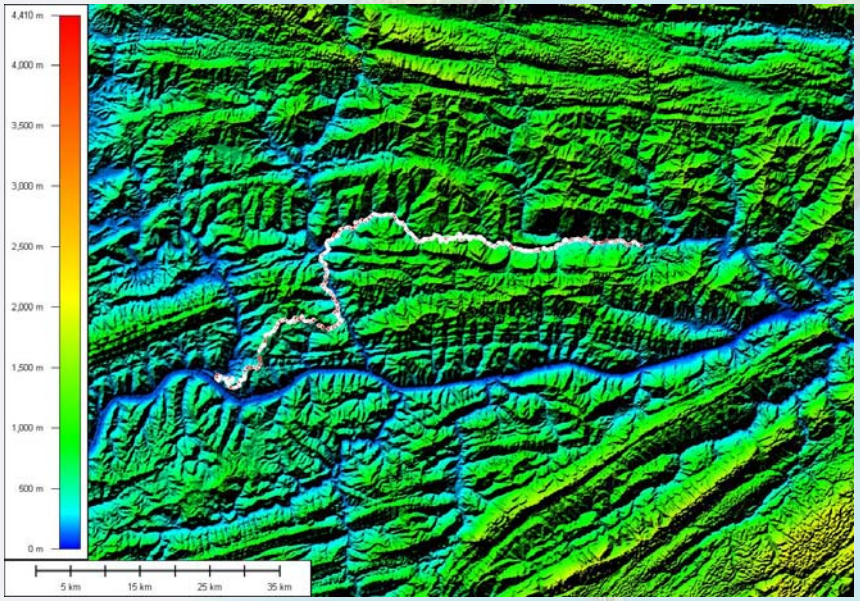
For more details, see slides from Marie-Claire Greening and Pascal Lecomte

WGCV leads GEO DA-06-02

- WGCV (Working Group on Cal/Val), WGISS (Working Group on Information Systems & Services), and WGEdu (Working Group on Education) are the three working groups under CEOS (Committee on Earth Observation Satellites)
- CEOS has become the space arm of GEO and GEOSS
- WGCV has six subgroups: Atmospheric Composition, Infrared Visible Optical Sensors, Land Product Validation, Microwave, Synthetic Aperture Radar, and Terrain Mapping
- WGCV is one of the best assets of CEOS. Through cal/val, WGCV and the six subgroups contribute greatly to the GEOSS 9 societal benefit areas (SBAs)

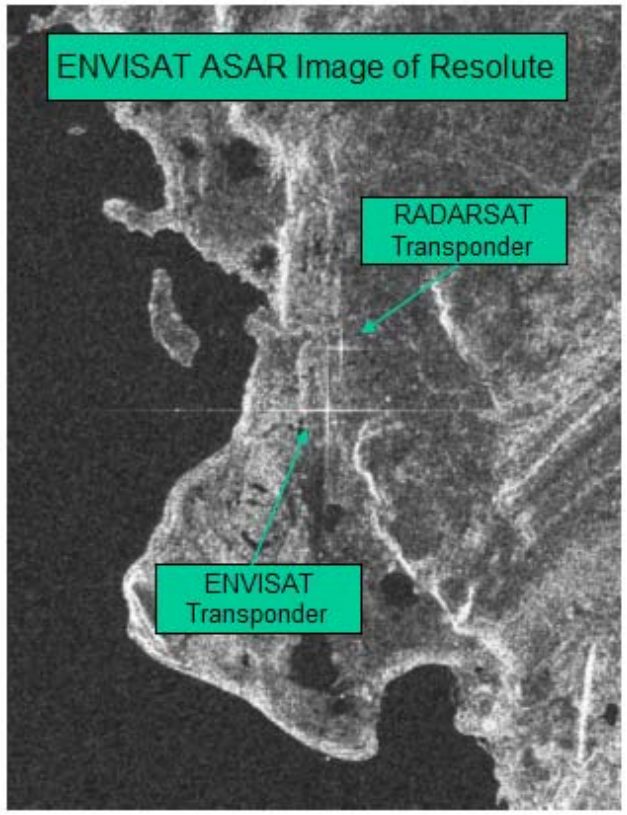
Cal/Val and GEOSS SBA- Disaster

Height assessment campaign: SRTM + ASTER 30m DEMs to support GEO DA-07-01



Courtesy of Prof. Jan-Peter Muller & Terrain Mapping Subgroup

Calibration transponder sites



Courtesy of Dr. S. Srivastava & SAR Subgroup

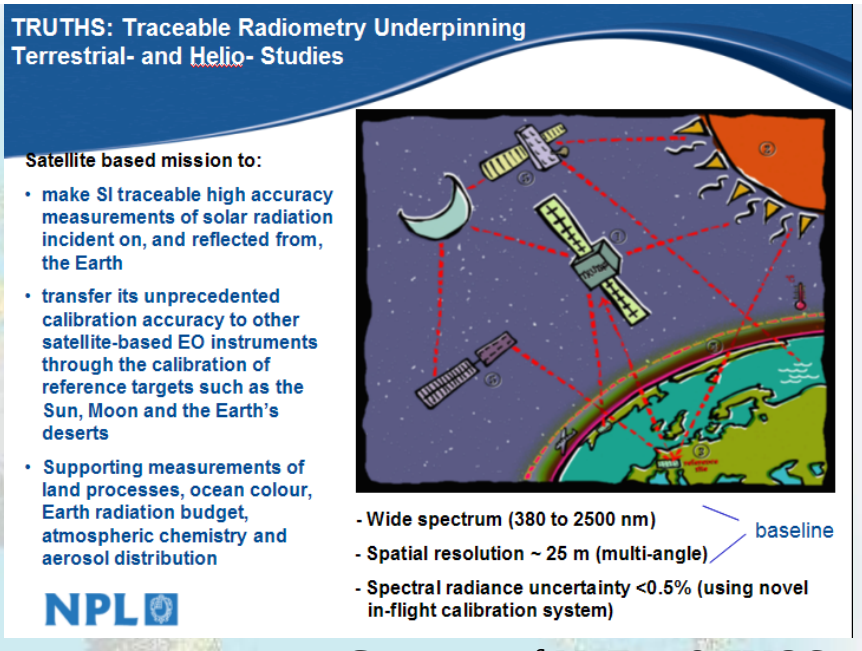
Calibration and GEOSS SBA- Climate

- *Global climate change detection is "a daunting task" (George Ohing),*

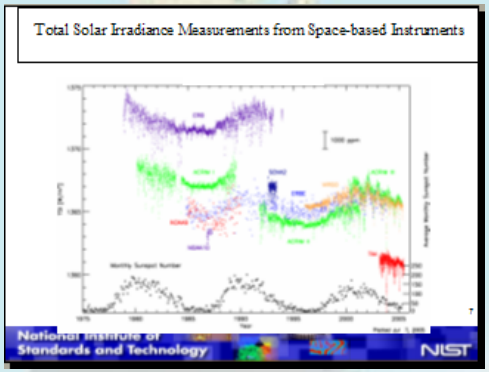
- *Calibration stability requirements for temperature is on the order of 0.1 K per decade; albedo on the order of a few percent per decade,*

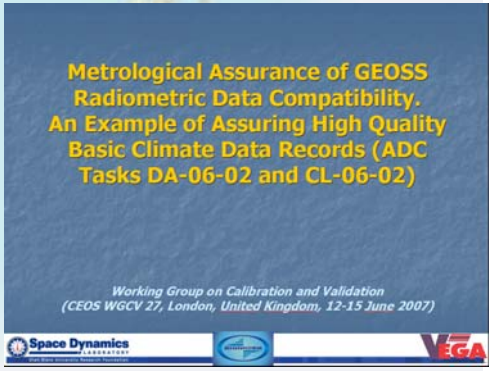
- *These requirements are challenging the current state-of-the art in cal/val, as well as instrumentation,*

- *Benchmark missions such as "TRUTHS" are essential for climate change detection.*



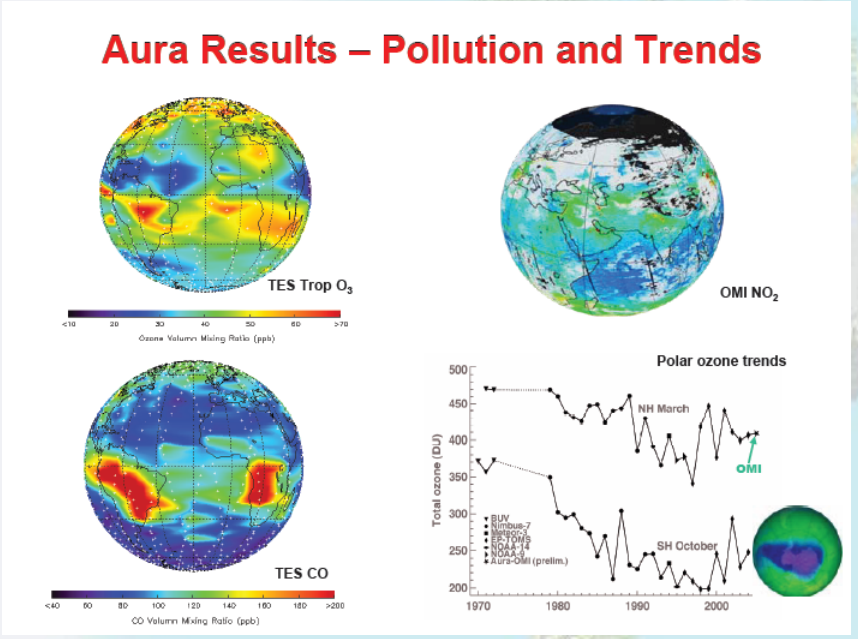
Courtesy of N. Fox & IVOS





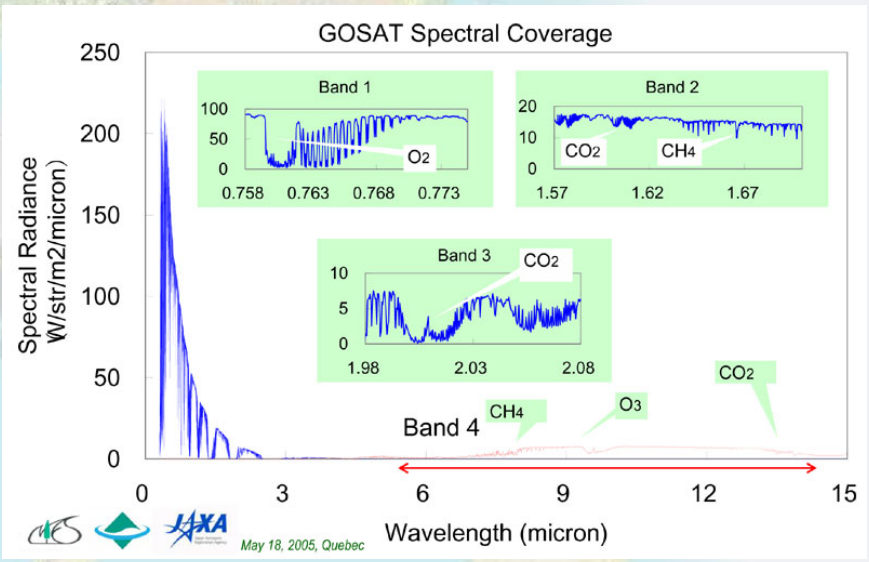
Courtesy of our Russia colleagues

Cal/Val and GEOSS SBA - Health & Energy



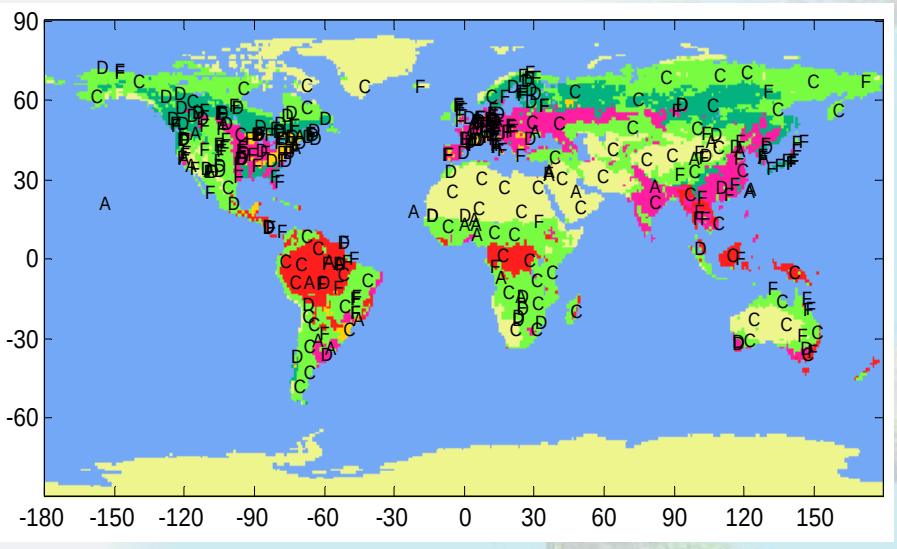
Courtesy of E. Hilsenrath & ACSG

Greenhouse gases Observing SATllite (GOSAT)

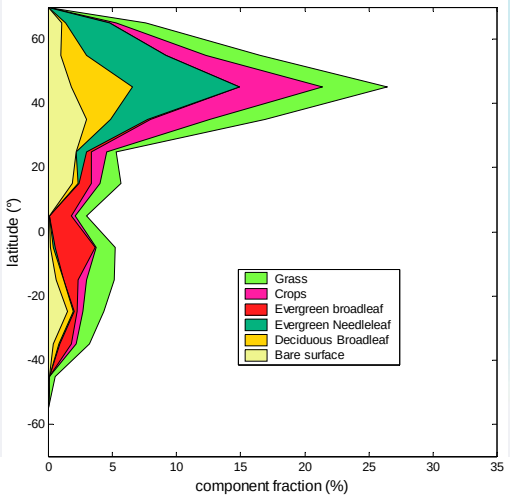


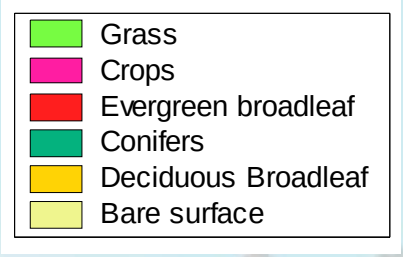
Courtesy of Murakami & JAXA

Cal/Val and GEOSS SBA
- Ecosystems, Agriculture, & Biodiversity

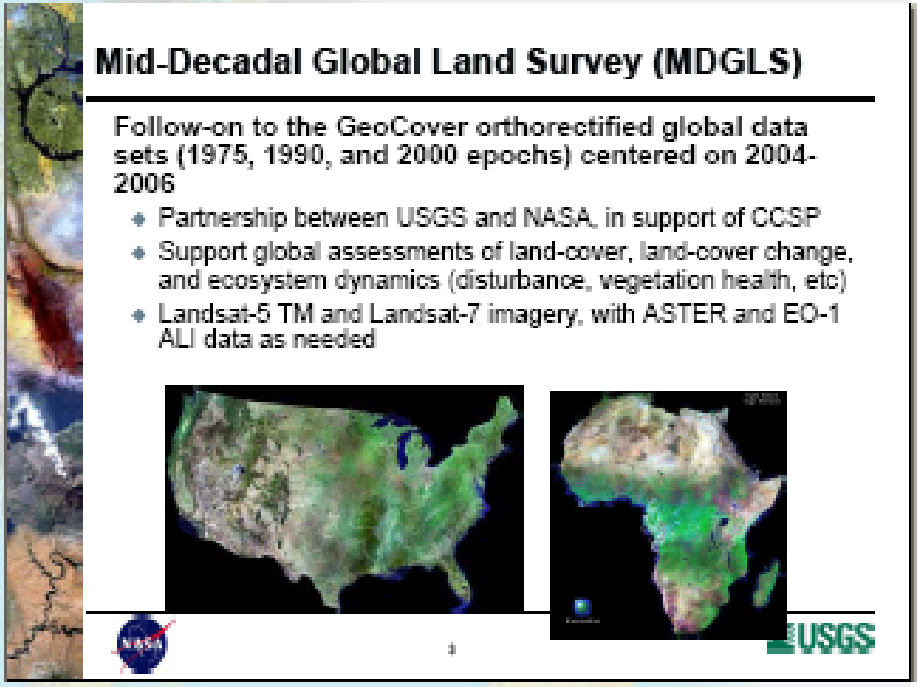


397 sites representing the variability over surface types and latitudes





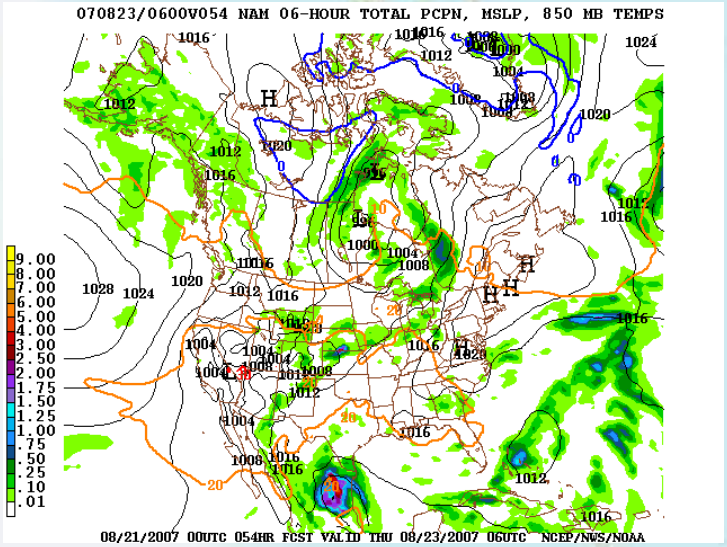
Courtesy of F. Baret and LPV



Courtesy of NASA & USGS

Cal/Val and GEOSS SBA - Weather & Water

- Prerequisite for Satellite Data Assimilation in NWP: no radiance bias is allowed.



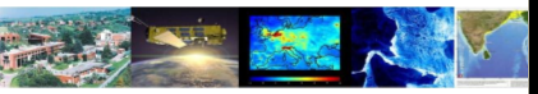
SMOS cal/val will improve weather forecast

Courtesy of C. Buck & Microwave Subgroup

New Programs & Initiatives

esa

GMES Space Component
Sentinel-1, -2 and -3

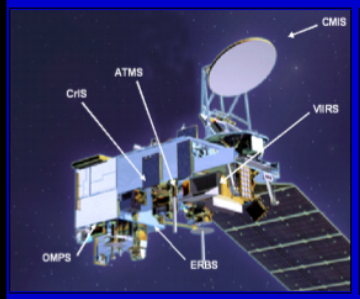


Peter G. Edwa
GSC Space Segment Programme Mana
ESTEC, Noordw

European Space Agency
Agence spatiale européenne

NATIONAL POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITE SYSTEM

NPOESS Satellite and Sensors
[Pre-Nunn-McCurdy Baseline]

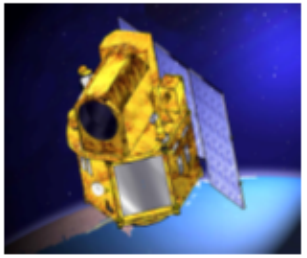


	1330
VIIRS	X
CMIS	X
CrIS	X
ATMS	X
SESS	X
OMPS	X
ADCS	X
SARSAT	X
TSIS	
ERBS	X
ALT	
APS*	
SS	X
	Ear
	Aft

NPOESS 1330 Configuration

Single Satellite Design with Common Sensor Locations and "
Allows Rapid Reconfiguration and Easy Integrati

THEOS Mission



- Mass: 750 kg.
- Orbit: Sun Synchronous
- Altitude: 822 km.
- Repeat Cycle: 26 days
- Mean Local Time: 10.00 a.m.
- Payload:
  - Panchromatic telescope
  - Multi-spectral camera
- On-board Memory: 51Gb
- Mission Data: X-band Link
- TT&C: S-band Link
- Attitude Orbit Control and Orbit Determination:
  3-axis stabilized, Star Tracker, Gyro, GPS, Magnetic Torque, Sun Sensor
- Design Life Time: 5 Years

CEOS WGCV 27 Meeting : 12th – 15th June 2007 : National Physical

1. JAXA Earth Observation plan
Timetable of the JAXA earth observation missions

EORC

Targets	~2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Disaster monitoring & Resources management	[Optical imager] MOS-1, ADEOS (87~95) (96~97)				ALOS/PRISM AVNIR2						ALOS F/O Optical				
	[Optical imager, SAR] JERS-1 (92~98)				ALOS						ALOS F/O SAR				
					ALOS/PALSAR						[Disaster				
Global warming & Water cycle observation	[Precipitation radar] PR (97~)														
water cycle					TRMM/PR						GPM/D				
	[Microwave radiometer] MOS-1 (87~95)				ADEOS-II/AMSR						GCOM-W1/				
					Aqua/AMSR-E						[Wind, SST				
Global climate change	[Optical imaging radiometer] MOS-1, ADEOS (87~95) (96~97)										[Vegetation, aerosol, cloud				
					ADEOS-II/GLI						GCOM-				
	[Cloud profiling radar]										[Cloud and Ae				
												Ear			
Greenhouse gases	[Spectrometer] ADEOS/ILAS (96~97)				ADEOS-II/ILAS-II										
							GOSAT				[CO2 Methane]				

Mission status: On orbit | Approved plan | Research | Extension

中国科学院空间科学与应用研究中心

I.1 Introduction to China's Earth Observation Programs with Spaceborne Microwave Sensors

- China's Earth Observation Sa
  - FY-Series
  - HY-Series
  - HJ-Series
  - ZY-Series

Global Space-based I
Calibration System (G

Mitchell D. Goldber
GSICS Exec Panel Chair
NOAA/NESDIS
Chief, Satellite Meteorology and Climato

Backup slides

- Quality assurance related issues

Some Relevant Quality Assurance Elements

- Mission requirement
- Performance requirement
- Cal/val plan
- Algorithm Theoretical Basis (ATBD)
- ISO certification (ISO 17025 and ISO 9001)
- Meta Data
  - Quality reporting and flags
- Other …