



COMMITTEE ON EARTH OBSERVATION SATELLITES
WORKING GROUP ON CALIBRATION AND VALIDATION

Work Plan 2002 - 2005

Issue 3.1

Amendment Record

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1. Introduction

1.1. BASIS OF THE WORK PLAN

In order to focus the activities of the CEOS Working Group on Calibration and Validation (WGCV) the third issue of the three-year work plan, for the years 2002 - 2005, has been developed by members of the WGCV. The activities outlined in the work plan follow from the actions, guiding principles, and recommendations outlined in the Strategic Plan of the WGCV as well as recommendations from CEOS Plenary.

The third issue of the work plan was discussed and amended at the 18th and 19th meetings of the WGCV. All actions are in support of the fundamental objectives of the WGCV, specifically:

1. **Sensor-specific calibration and validation:** document and establish forums for the assessment and recommendation of current techniques and standards for pre- and post-launch characterisation and calibration and assessment of homogeneity issues associated with long term data continuity.
2. **Geophysical validation:** document and establish forums for the assessment and recommendation of techniques for validation of geophysical parameters derived from Earth observation satellite systems and in the light of CEOS involvement in the developing IGOS.

In addition, all actions identified in the work plan should:

- Improve co-ordination of space missions and ensure they meet user needs.
- Benefit Members and Associates.
- Assist, rather than direct, Member and Associate agencies.
- Be such that the Members and Associates will support the action.

It is expected that additional tasks will be incorporated in future releases of the Work Plan. The WGCV members have agreed to an annual review of the Work Plan, to be conducted during WGCV plenary meetings, to ensure that the critical needs of the international community are being met by the CEOS activity.

The plan will be achieved through WGCV Plenary meetings and the meetings and technical work of the WGCV Subgroups.

The objectives of the WGCV are to enhance coordination and complementarity, to promote international cooperation and to focus activities in the calibration and validation of Earth observations¹ for the benefit of CEOS Members and the international user community. Meeting these objectives will include the promotion of:

- Exchange of technical information and documentation;
- Investigation of possibilities for technical coordination and cooperation for space and ground segments;
- Coordination of calibration and validation campaigns and programs; and
- Optimization and sharing of available facilities, expertise, and resources as appropriate.

¹ Includes cryosphere, hydrosphere, lithosphere, biosphere, and atmosphere.

1.2. SUMMARY OF TASKS AND ACTIVITIES

The work of the WGCV for the next three years has been organised into the following activities:

Activity 1 - WGCV Plenary

Activity 2 - WGCV Subgroups meetings and technical work

Activity 3 - Communication with the Community

Activity 4 - Joint activity between WGCV and WGISS for the establishment of a network of "CEOS Land Validation Core Sites"

Activity 5 - Joint WGCV / ISPRS taskforce on Radiometric and Geometric Standards

2. Activity 1 - WGCV Plenary

WGCV meet in Plenary at least once per year. The meeting provides an opportunity for Members and Associates to review and compare their plans for calibration and validation activities and to identify opportunities and requirements for collaboration.

The WGCV provides a forum for debate and discussion of key cal/val topics and issues.

The WGCV provides a conduit for the flow of information and recommendations between the CEOS Plenary and the Earth Observation data users' community.

The WGCV Plenary provides a forum for discussing recommendations received from the CEOS Plenary and identifying appropriate responses from the calibration and validation community.

The sub groups make formal presentation at the WGCV's meetings. These may include recommendations to the WGCV for action at the working group level, or may include recommendations that the WGCV considers should go forward to the CEOS Plenary for action at the community level. The WGCV itself may also formulate recommendations to the CEOS Plenary.

The WGCV communicates regularly with the other CEOS Working Group on Information Systems and Services (WGISS) and ensures collaboration with WGISS in reacting to CEOS Plenary direction. Communication is also maintained with the ad hoc Working Group on Education and Training (WGEdu).

3. Activity 2 - WGCV Subgroups

The technical work of the WGCV is carried out by its Subgroups, which are:

- Atmospheric Chemistry Subgroup
- Infrared and Visible Optical Sensors Subgroup
- Land Product Validation Subgroup
- Microwave Sensors Subgroup
- SAR Subgroup
- Terrain Mapping Subgroup

Each Subgroup has its own mandate and action plan, and these are set out in Section 7. Further information on the activities of a particular Subgroup can be obtained from the Subgroup Chair.

4. Activity 3 - Communication with the Community

4.1. OVERVIEW

As part of WGCV's role in providing leadership and co-ordination to ensure data quality and continuity, it is critical that the WGCV maintain an active role in communicating with the entire community of Earth Observation data users and data providers. In this role, communication with researchers and experts, both within CEOS agencies and the worldwide user and research community, is critical. In addition to communication on general calibration and validation related topics, the WGCV has an obligation to communicate specific information to CEOS members and associates.

This will be done through:

- The active maintenance of a WWW site (www.wgcvceos.org) for calibration and validation information and an email distribution list for general cal/val information
- Attendance at, and sponsorship of, conferences and specialist sessions related to calibration and validation topics
- The posting on the WWW of key bibliographies from the WGCV Subgroup chairs
- The inclusion of external experts and representatives of non-CEOS agencies as needed for WGCV-sponsored activities
- Involvement, as appropriate and within the context of IGOS, experts from developing countries
- The encouragement of the dissemination of pre- and post- launch calibration following the launch of a new satellite
- The coordination of information and actions with the CEOS Working Group on Information Systems and Services (WGISS) and the ad hoc Working Group on Education (WGEdu)

4.2. TIMELINE AND OWNERSHIP

The WGCV Secretariat has committed to coordinating the communications task, in particular supporting the active maintenance of a WWW site. This activity will continue throughout the period covered by this work plan. Attendance at, and sponsorship of, conferences and specialist sessions will be supported and encouraged by CEOS Member and Associate agencies and WGCV Subgroups and participants as needed.

Actions

- The CEOS WGCV website will be regularly maintained to provide an up-to-date and complete information source.
- WGCV participants have agreed to keep the secretariat informed of any news, calendar events, or new websites that should be advertised on the CEOS WGCV web pages.

- Key bibliographic references selected by the subgroup chairs will be posted on the website
- The WGCV Newsletter will be issued via the website.
- Case studies illustrating the work of WGCV and its subgroups will be developed, and posted on the website.
- Each WGCV plenary meeting will include a special session on a technical aspect of calibration or validation to serve as a focus for information exchange.
- Regular information about WGCV activities will be provided to WGISS and WGEdu representatives.
- As needed, the CEOS WGCV chair will contact CEOS members to request greater availability of pre- and post- launch calibration information and data to the community.

4.3. DETAILS

The WGCV's terms of reference and strategic plan outline several activities that ultimately relate to improved, proactive communication with the global community of EO data users and providers.

WWW Site

A WGCV site on the WWW provides focus for communicating information related to data and instrument quality and consistency for both CEOS Members and the global community. The WGCV web pages are located at www.wgcvceos.org.

Newsletter

Newsletters providing information on contributions of the WGCV and its subgroups to cal/val issues will be produced and disseminated via the WGCV website. The frequency of publication depends on contributions from WGCV members.

Case studies

Case studies illustrating the activities of WGCV and its subgroups will be developed and updated.

Build Key Bibliographic References

Chairs from the six subgroups have agreed to request inputs from their members and compile a bibliographic reference set. The references should be categorised by topic based on categories deemed appropriate by the subgroup Chairs. These bibliographic references will then be hosted on the web site by the Secretariat and will be reviewed and updated annually as needed by the subgroup chairs.

WGCV Mailing List

An email distribution list of WGCV members, affiliate representatives and observers will be maintained by the Secretariat for use in working group administrative activities and is available on request.

Identify Key Conferences

As part of leading the exchange of information on calibration and validation it is critical that the WGCV and its subgroups attend key conferences and encourage and sponsor sessions on special topics in calibration and validation. All such conferences and sessions will be noted in the WGCV website calendar.

Linkages to External Groups and Experts

Participation by specialists in many areas of data and instrument calibration and validation is important for WGCV success. Rather than expand the membership of CEOS and/or the WGCV and its subgroups, it was agreed that experts should be invited to participate in WGCV activities as needed, particularly for special sessions and conferences. WGCV representatives in many cases only represent their own interests within an agency and all participants are asked to pass on information about WGCV activities to others within their institution.

Invited experts should include EO research scientists, specialists in data applications and specific geographic regions. In addition the WGCV may specifically call upon appropriate CEOS associates to assist. The need to involve experts from developing countries that do not have CEOS representation is particularly important where validation activities are concerned. Funding and travel restrictions may make it difficult for regional experts to participate, but efforts should be made to involve them in subgroup meetings and special sessions.

Invited expert participants will be chosen based on speciality regardless of whether they represent commercial or governmental organisations.

Pre-launch Information

Though it is the responsibility of CEOS Members to provide standardised calibration information following the launch of a new satellite, the WGCV has agreed to provide a forum for raising concerns from the community. Any issues related to insufficient availability of pre- and post- launch calibration information should be raised with the WGCV, and the WGCV chair will contact the appropriate CEOS Member. In addition, the CEOS secretariat will, upon request, seek to identify the official contacts for calibration information for newly launched satellites.

Co-ordinate with WGISS and WGEdu

The WGCV is not responsible for submitting specific user requirements or datasets to WGISS or WGEdu. However, the WGCV should provide information on WGCV activities to WGISS and WGEdu members for their information. In addition, any specific requests for review or help from WGISS and WGEdu will be welcomed by the WGCV secretariat and forwarded to the appropriate individuals.

5. Activity 4 – Joint activity between WGCV and WGISS for the establishment of a network of “CEOS Land Validation Core Sites”

5.1. OVERVIEW

Collaboration with the Working Group on Information Systems and Services (WGISS) has been ongoing. This joint WGCV / WGISS activity aims to provide web-based access and value-added formatting / geo-registration of Earth Observation remote sensing (and other) data over a set of “core” validation sites in support of global land product inter-comparison activities. This activity was initially proposed at CEOS plenary in 2001, and to WGISS-13 and WGCV-18.

5.2. **TIMELINE AND OWNERSHIP**

The scope of this project, is to utilise, or develop, WGISS tools such that the Science Team's needs are met for information systems and services. The WGCV has identified a need for a GIS/web based interface to access "CEOS Core Sites" data, starting with sites where LAI inter-comparison work will be done, thus supporting the LPV inter-comparison, which can feed into IGOS, GTOS and the GOFC biophysical component. It is proposed that the first phase of this activity addresses the requirements of five test sites and provides a common user interface to the multi-agency data sets that exist for each site. These data will be made available on-line in a common, user-specified, file format and projection.

5.3. **DETAILS**

Instigated by the WGCV, the project will initially focus on establishing an access prototype for distributed EO data, *in situ* data, and test site validation databases. This first phase will last from October 2002 until October 2003. The initial objective during Phase 1 is to represent sites and data associated with the EOS core sites and VALERI, i.e. Barton Bendish (UK), Mongu (Zambia), Harvard Forest (USA), BOREAS Northern study area (Canada), and Uardy (Australia). Satellite data acquired thus far includes MODIS, Landsat ETM+, SPOT HRV and VEGETATION.

6. Activity 5 – Joint activity between WGCV and ISPRS on radiometric and geometric standards

6.1. **OVERVIEW**

The joint ISPRS / WGCV taskforce on radiometric and geometric standards was established after it was noted that Earth observing sensor parameters are specified and quoted in a disparate way, whilst the extraterrestrial community a standard format. Proper use, understanding and intercomparison of sensor parameters depends on clear and unambiguous definition.

6.2. **TIMELINE AND OWNERSHIP**

A special session on this joint WGCV / ISPRS activity was held at both WGCV-18 and WGCV-19. The WGCV chair also gave a presentation at the ISPRS meeting in Hanover, Germany, in September 2001. The joint taskforce kick-off meeting is planned for 11 November in Denver, USA, and will be chaired by Manfred Schroeder, DLR.

The initial membership to the taskforce comprises the ISPRS WG (Chair ISPRS WG I/2, Co-Chair ISPRS WG I/2, Chair ISPRS WG I/1, Co-Chair ISPRS WG I/1, ISPRS TCP) and WGCV representatives from the standard laboratories (NIST,NPL) and from the WGCV subgroups.

Actions

- Collect terms and standard procedures used to describe the radiometric and geometric performance of Earth observing sensors,
- Identify ambiguity and confusion within these terms and standard procedures, and recommend solutions,

- Recommend a list of terms and standard procedures,
- Prepare a document which sets out terms and radiometric and geometric standard procedures for describing EO sensors,
- Communicate and consult widely with the user community.

7. Subgroups

7.1. SAR SUBGROUP

Mission

To foster high-quality synthetic aperture radar imagery from airborne and spaceborne systems through precision calibration in radiometry, phase, and geometry, and validation of higher level products.

Objectives

- (a) To act as a forum for international technical interchange on the evolving methodologies, techniques, and equipment of SAR calibration and validation.
- (b) To determine standard definitions and calibration-validation requirements for synthetic aperture radar imaging systems.
- (c) To support changes in CEOS formats and user products as appropriate.
- (d) To facilitate international cooperative programs in the calibration and validation of SAR systems.
- (e) To educate the SAR community.

Action Plan

The major activity of the SAR subgroup in recent years has centred on the annual meetings. This is expected to continue. In the 2002 meeting, it was agreed to set up calibration and validation reference sites (to include both natural and man made targets) for the purposes of providing an easily accessible source of reference calibration data to data providers, showing the mutual compatibility between different SAR systems, and demonstrating the total quantitative and qualitative quality of SAR data. The 2003 meeting of the SAR subgroup should focus on the problem of full polarimetric SAR calibration, both establishing requirements and techniques.

7.2. MICROWAVE SENSORS SUBGROUP

Mission

To foster high quality calibration and validation of microwave sensors for remote sensing purposes. These include both active and passive types, airborne and spaceborne sensors.

Objectives

- (a) To facilitate international cooperation and co-ordination in microwave sensor Cal/val activities by sharing information on sensor development and field campaigns.

- (b) To promote accurate calibration and validation of microwave sensors, through standardization of terminology and measurement practices.
- (c) To provide a forum for discussion of current issues and for exchange of technical information on evolving technologies related to microwave sensor cal/val.

Action Plan

The plan of action for the Subgroup is based on spaceborne microwave sensors. The Subgroup is concerned mainly with passive sensors at the present; however, it is envisioned that there will be a gradual increase of attention to active sensors, especially towards the end of the three-year period of this plan. The Subgroup will approach its objectives by starting from currently operating sensors, such as those flying aboard the DMSP and NOAA platforms, and extending to the next generation of sensors. A focal point will be sensors aboard the EOS platforms of ESA, Japan, and the United States, as there will be both active and passive sensors covering a large part of the microwave spectrum.

7.3. INFRARED AND VISIBLE OPTICAL SENSORS SUBGROUP

Mission

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

Objectives

- (a) To promote international and national collaboration in the calibration and validation of all IVOS and, thus, to assist in the improved application of data from satellite sensors.
- (b) To address all sensors (ground based, airborne, and satellite) for which there is a direct link to the calibration and validation of satellite sensors.
- (c) To identify and agree on calibration and validation requirements and standard specifications for IVOS.
- (d) To identify test sites and encourage continuing observations and intercomparison of data from these sites.
- (e) To encourage the timely and unencumbered release of data relating to calibration and validation activities including details of pre-launch and in flight parameters.

Action Plan

After a period of inactivity, the IVOS subgroup is revitalised, and improving, its membership. The subgroup plan to review the ongoing activities of CEOS member agencies and institutions. Opportunities for coordination / cooperation will be actively sought. Recommendations with respect to solar irradiance, radiative transfer codes, and protocols for calibration and validation will be devised and put forward. The subgroup will meet at least once each year.

7.4. TERRAIN MAPPING SUBGROUP

Mission

To ensure that characteristics of digital terrain models produced from Earth Observation sensors at global and regional scale are well understood and that products are validated and used for appropriate applications.

Objectives

- (a) To develop specifications for the generation of 'standardised terrain surface products with known accuracy' from similar sensing systems in the context of data continuity.
- (b) Specify evaluation methods and statistics which give transparent information about the quality and heritage of terrain models.
- (c) To update the current dossier of test sites and identify new sites, particularly to satisfy the cal/val requirements of future missions and generally improve access to validation data sets.
- (d) To prepare recommendations for the establishment of a global ground control point network.
- (e) To consider how orbit validation could be developed.
- (f) To keep an up to date record of the current status of sensors which produce data for terrain mapping and of the DEMs available.
- (g) To produce a DEM requirements document with a science rationale, taking into account the output from SRTM.

Action Plan

The objectives will be achieved through the following activities:

- (a) Liaise with CEOS Members and Associates activities, especially the IGOS in order to determine the DEM requirements of the user community to ensure that cal/val procedures are in place to satisfy that need.
- (b) Collaborate with other groups to ensure that common activities are co-ordinated and enhanced by collaboration.
- (c) Hold one meeting a year to review progress, plan future action and discuss results.

7.5. LAND PRODUCT VALIDATION SUBGROUP

Mission

To foster quantitative validation of higher-level global land products derived from remote sensing data and relay results so they are relevant to users

Objectives

- (a) To work with users to define uncertainty objectives
- (b) To identify and support global test sites for both systematic and episodic measurements (WGCV / WGISS Test Facility)

- (c) To identify opportunities for coordination and collaboration
- (d) To develop consensus “best practice” protocols for data collection and description
- (e) To develop procedures for validation, data exchange and management (with WGISS)

Action Plan

The objectives will be achieved through a series of topical workshops focussing on specific land product validation issues, co-chaired by community experts. Initial programmatic focus will be on the GOFD priorities of Fire validation, Fine resolution land cover change products, and Biophysical products (such as LAI and Albedo). Support to the IGOS-P Terrestrial Carbon theme will also be a focus. Collaboration between other CEOS working groups and their subgroups will also be sought. A joint WGCV / WGISS test facility on CEOS core test sites for land parameter validation is already in its first phase. This phase involves the survey of five globally distributed sites from October 2002 – October 2003. Collaboration with industry is also very much a focus for the subgroup.

7.6. ATMOSPHERIC CHEMISTRY SUBGROUP

Mission

To ensure accurate and traceable calibration of remotely-sensed atmospheric chemistry radiance data and validation of higher level products, for application to atmospheric chemistry and climate research.

Objectives

- (a) To promote international collaboration and technical exchange to ensure the efficient use and maintenance of calibration/validation resources required for atmospheric chemistry missions
- (b) To verify accurate scientific products by encouraging an end-to-end approach to the calibration and validation of Level 1 and Level 2 data products, and any subsequent re-calibration and reprocessing
- (c) To ensure that validation sensors are calibrated to traceable national standards, with documented statements of accuracy and repeatability
- (d) To encourage interaction between calibration scientists and data users to enable a better understanding of data uncertainties and user requirements
- (e) To recommend a network of validation sites and to encourage continuous observation and quality control of data through the use of standard procedures and inter-comparison
- (f) To develop comprehensive data validation methods that employ ground, aircraft, balloon, and satellite measurements and data assimilation with chemical transport models
- (g) To specify a comprehensive, consistent and quality-controlled multi-mission validation database in an accepted format and employing user-friendly tools

Action Plan

The membership of the subgroup will be completed by including relevant agencies and organisations who are not yet represented. The subgroup will initiate and support the process of approaching agencies, through CEOS, for partial sustained support for ground validation networks and the maintenance of these networks between missions. Data validation archival and retrieval for the long term and across present and future mission applications is seen as very important and this will be actively pursued. The subgroup will meet regularly to review and coordinate upcoming validation activities, discuss results and pursue its main objectives. These objectives will be reviewed and updated as required.