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WGCV - 18

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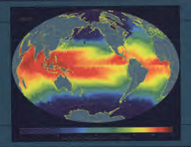
WGCV - 19



For more information on the CEOS WGCV visit the group s website at: www.wgcvceos.org.

esa

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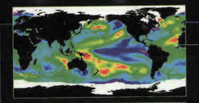
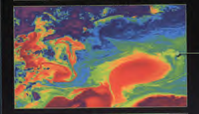
Committee on Earth Observation Satellites

Earth Observation Products

CEOS

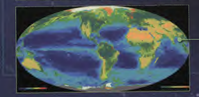


CNES - CLS



ERS - ATSR1 - RAL (UK)

CCRS RADARSAT



SEAWIFS NASA GSFC

Working Group

Calibration & Validation

WGCV

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Calibration and Validation

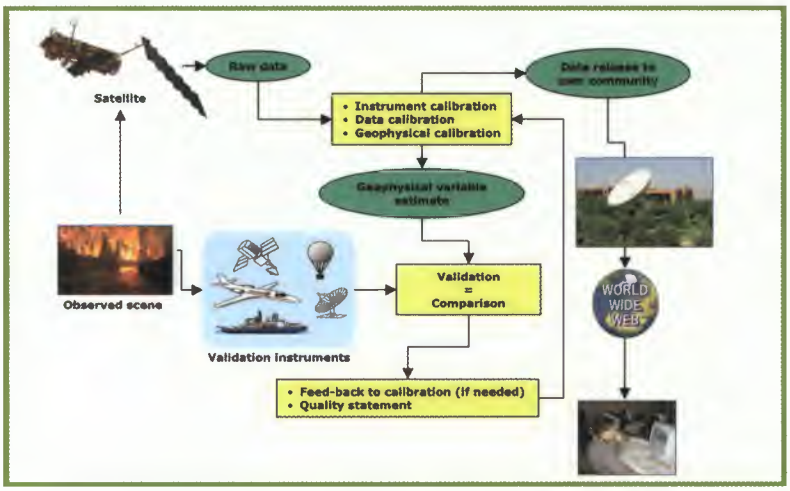
Calibration

The process of quantitatively defining the system responses to known, controlled signal inputs

Validation

The process of assessing, by independent means, the quality of the data products derived from the system outputs

Calibration and validation considerations will affect the long term credibility of any satellite dataset. Without calibration that uses primary or secondary standards, and fundamental engineering and scientific methods, the data may be, at best, qualitative or may provide only an index of the geophysical parameter being derived. Validation is usually a measure of how well the derived product from a given sensor describes a given geophysical parameter as measured by independent means.



The most effective satellite sensors are those that have good pre- and post- launch calibration, supported by rigorous surface and "in situ" programmes, to ensure the quality of the products on a continual basis. Only after calibration and validation can changes in a series of products be confirmed as either a change in the instrument or a change in the environment.

Calibration and Validation

Working Group on Calibration & Validation

CEOS
Committee on Earth Observation Satellites

Synthetic Aperture Radar Subgroup

Mission

To foster high quality calibration and validation of airborne and spaceborne Synthetic Aperture Radar for remote sensing purposes.

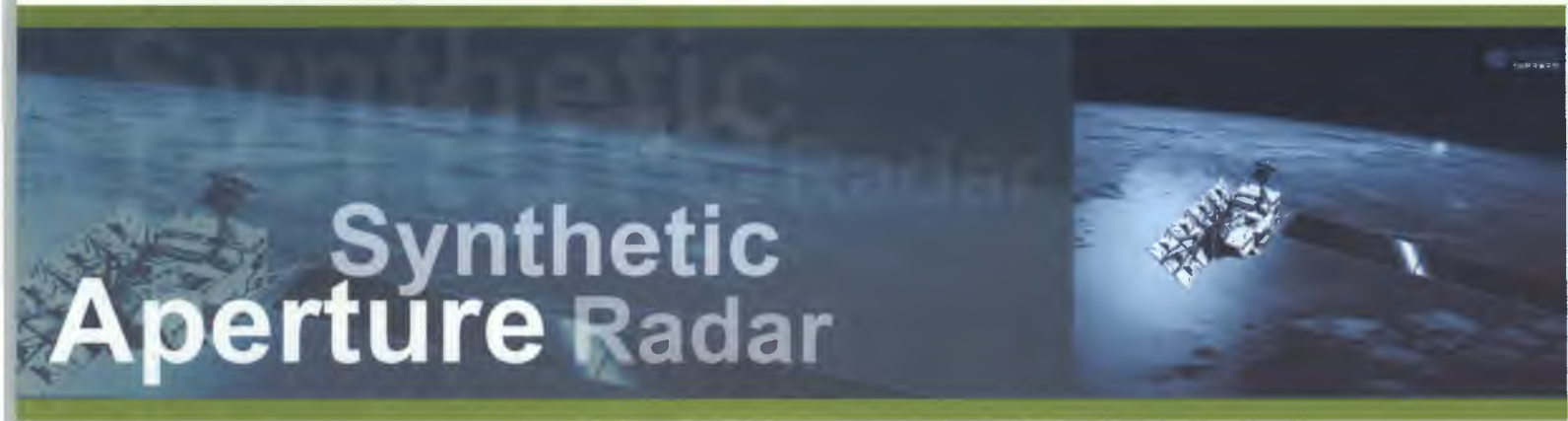
Objectives

- To facilitate international cooperation and coordination in Synthetic Aperture Radar cal/val activities by sharing information on sensor development and field campaigns.
- To promote accurate calibration and validation of Synthetic Aperture Radar through standardisation of terminology and measurement practices.
- To provide a forum for discussion of current issues and for exchange of technical information on evolving technologies related to Synthetic Aperture Radar cal/val.

New challenges in cal/val SAR

The advent of polarimetric and interferometric Synthetic Aperture Radar, such as ALOS PALSAR, ENVISAT SAR, Radarsat-2 SAR and high precision polarimetric airborne SARs, pose new challenges in the calibration and validation of Synthetic Aperture Radar. Operational use of SAR for environmental monitoring (forest, biomass, surface deformation, etc.) is of key interest.

PALSAR, an L-band polarimetric spaceborne SAR onboard ALOS, will be launched in 2004 by **NASDA, Japan** (left) ASAR, a C-band multi-polarisation SAR onboard ENVISAT, will be launched in 2002 by **ESA** (right)



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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

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

TXR & RSMAS BB in the laboratory (left) and at sea with the DAR011 (right)
Courtesy: NIST, University of Miami, CSIRO

Infrared and Visible Optical Sensors

Earth Observation Calibration and Validation

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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

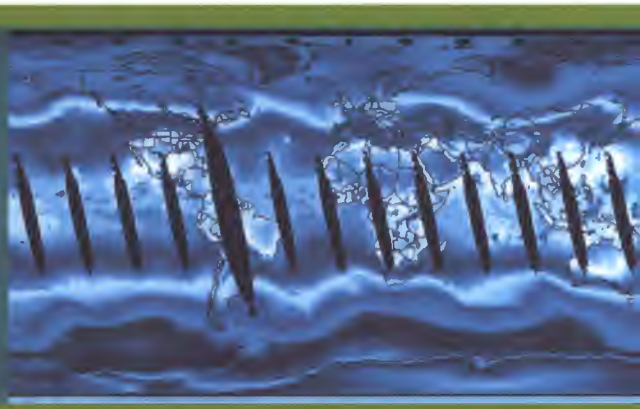
- To facilitate international cooperation and coordination in microwave sensor cal/val activities by sharing information on sensor development and field campaigns.
- To promote accurate calibration and validation of microwave sensors, through standardisation of terminology and measurement practices.
- To provide a forum for discussion of current issues and for exchange of technical information on evolving technologies related to microwave calibration and validation.

New challenges in cal/val radiometry

The advent of polarimetric and interferometric radiometers in space, such as the US Windsat and the European SMOS, pose new challenges in the calibration and validation of microwave radiometers. Not only the vertical and horizontal brightness temperatures, but also the mixed correlation between the two have to be calibrated and validated.

Limb correction for the across-track scanning microwave radiometer:
Raw brightness temperature from AMSU (left)
Brightness temperature corrected for the limb effect (right).
Courtesy: University of Alabama, USA

Microwave Sensors



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Calibration and Validation

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Land Product Validation Subgroup

Mission

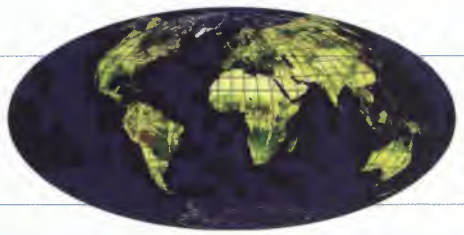
To foster quantitative validation of high level land products derived from remote sensing data in the solar reflective and thermal infrared wavelengths.

Objectives

- To increase the quality and economy of land product validation by developing standards and protocols for field sampling, error budgeting, data exchange and product evaluation.
- To facilitate international cooperation and coordination in validation activities by sharing information on instruments, analyses and field activities.
- To provide a forum for discussion of current issues and for exchange of technical information on efficient approaches to global validation.

Challenges in land product validation

The 21st Century ushered in a new era for satellite remote sensing with the operational generation of diverse global land products. Science based on these products requires that their uncertainties be quantified and documented throughout mission lifetimes. The Land Product Validation (LPV) subgroup is helping to build a framework for consistent, cost-effective and sustained validation by the international scientific community, including field experts, algorithm developers and product users.



The EOS MODIS daily Leaf Area Index (LAI) product
Courtesy NASA

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Terrain Mapping Subgroup

Mission

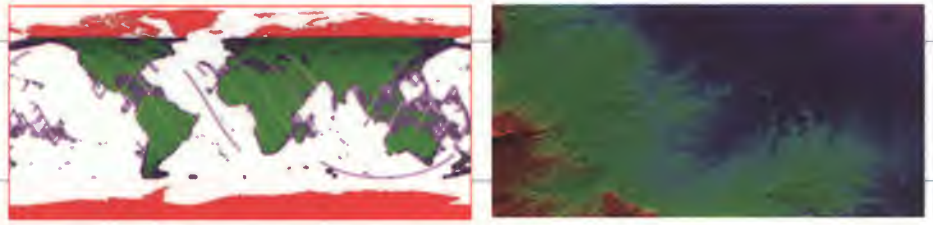
To ensure that characteristics of digital terrain models produced from EO sensors are well understood and that products are validated and used for appropriate applications.

Objectives

- To develop specifications for the generation of standardised terrain surface products with known accuracy from similar sensing systems. Also to specify evaluation methods and statistics that give transparent information about the quality and heritage of terrain models.
- To develop a dossier of terrain mapping validation sites covering a wide variety of different surface types with ground truth datasets to permit effective error determination.
- To develop and promote the creation of a global set of ground control points and areas to be used for geocoding and validation of land products.

New challenges in terrain mapping

There are an increasing number of global terrain mapping systems such as the ESA ERS tandem mission, the NASA SRTM and the forthcoming NASA ICESAT and VCL. These provide challenges and opportunities for geometric and radiometric correction of EO data, as well as scientific applications within, for example, IGOS projects or Global Observation of Forest Cover (GOFC) project.



NASA Shuttle Radar Topography Mapping (SRTM): Global coverage showing number of passes (left), False colour hill-shaded view of first DEM product (right). **Courtesy: JPL, UCL**

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Atmospheric Chemistry Subgroup

Mission

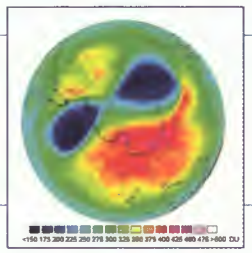
To ensure accurate and traceable calibration of remotely-sensed atmospheric chemistry radiance data and validation of higher level products, for application to atmospheric chemistry and climate research.

Objectives

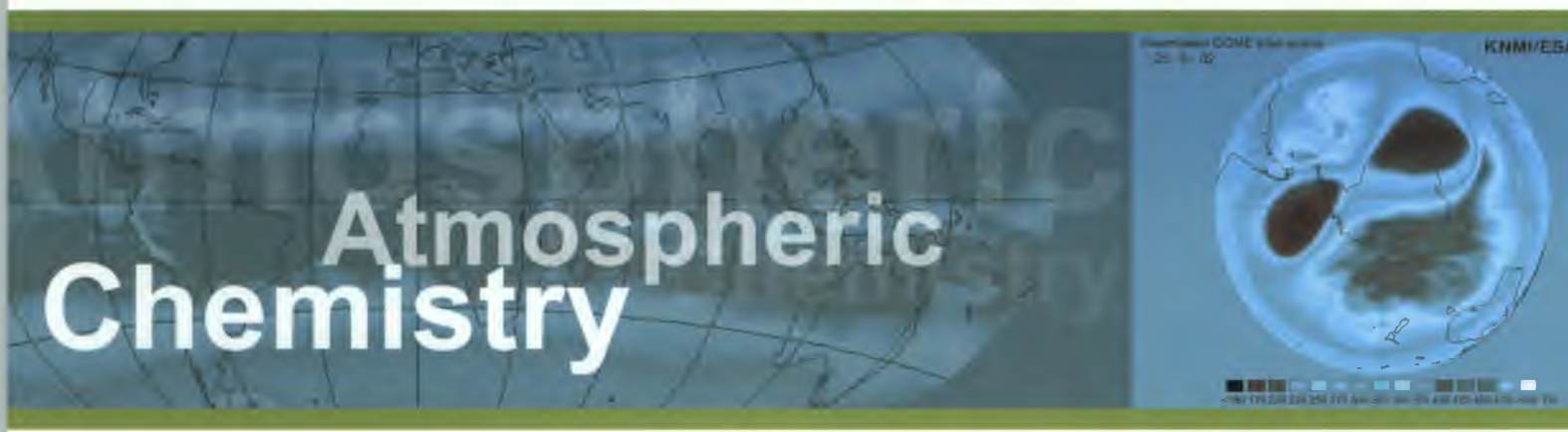
- To promote international collaboration and technical exchange to ensure the efficient use and maintenance of calibration/validation resources required for atmospheric chemistry missions.
- To verify accurate scientific products by encouraging an end-to-end approach to the calibration and validation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

New challenges

The next two decades will see fourteen missions carrying 28 atmospheric chemistry instruments for research and operational observations for ozone change, air quality and climate. Validation of these data sets are needed for consistency in order to make informed policy making decisions protecting the environment.



Assimilated
GOME total ozone
25 - 9 - 02
Courtesy: KNMI/ESA



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