The Infrared/Visible Optical Systems (IVOS) subgroup

24th WGCV Meeting, 8-11 November 2005 ESA-ESRIN

Agenda, 16th IVOS Committee Meeting

Day 1, 7.11.2005

=======================

09:00 **Introduction (M. Rast)**

- Welcome
- Objectives of the 16th IVOS meeting

09:15 **Summary of IVOS WS 2004 and the Cordoba meeting (M. Rast)**

- The IVOS WS 2004 programme
- The IVOS input to 23rd WGCV meeting at Cordoba

09:30 **The CAL/VAL portal (P. Goryl)**

10:15 **Coffee Break**

10:45 **How to improve the intercalibration strategy (M. Goldberg)**

11:30 **Discussion (All)**

13:00 **Lunch**

14:00 **Country/Activity report :**

NASA, CNES, Eumetsat, JRC, USGS, JAXA

15:30 **Coffee Break**

16:00 **Activity report:**

NIST, NPL, RAL, DLR and other Agencies/Countries

Day 2, 8.11.2005

=======================

9:00 **Activity report :**

- Intercomparison of MERIS, MODIS and SeaWiFS over Salar de Uyuni (M. Bouvet)

9:30 **Optical instruments onboard calibration diffusers (S. Delwart)**

10:00 **Contributions from the activity reports to the CAL / VAL portal (Working session - Chairman M. Rast)**

- What are the Cal/Val practices strategies required for GEOSS ?
- Required inputs for these practises to be included in the Cal/Val portal

10:45 **Coffee Break**

11:15 **Contributions from the activity reports to the CAL / VAL portal –continued**

- Requirements for interoperability
- Conclusions

13:00 **Lunch**

14:00 **Joint Session with WGCV**

- IVOS findings
- Discussion on IVOS inputs to the WGCV for plenary

17:30 End of meeting

18: 00-19:00 **Ice Breaker**

The objectives of the 16^{th} IVOS meeting are:

a) to start establishing the status of data quality guidelines for optical sensors (mainly imagers) in view of GEOSS

b) to detail the status of current cal/val and data quality procedures/guidelines at instrument level

c) to define the minimum quality requirements of all Agencies and Instrument providers for generic optical imager interoperability relevant for GEOSS

plus – to establish the IVOS Workplan 2006-2009

IVOS Workshop

Workshop on Inter-Comparison of Large Scale Optical and Infrared Sensors
ESA/ ESTEC, Noordwijk
12 –14 October 2004

With a view to the Earth's changing climate a close monitoring of our biosphere on a global level and continuous routine basis has become essential. Large scale satellite sensors are a critical component to ensure reliable and continuous observations for that purpose. It is imperative that observations made by the different sensors are stable over time and consistent across sensor systems, enabling synergistic combination of space-borne data from different sources leading to quantitative global data products derivable from multiple data sources.

The CEOS Working Group on Calibration and Validation and its Sub-Group for Infrared-Visible Optical Systems IVOS have identified the inter-comparison of large scale optical sensors operated by different space agencies as an issue of high priority. As a consequence, the European Space Agency ESA is organising a Workshop with a view to set requirements for future use of consistent global remote sensing data from different satellites that result in operational services.

IVOS Workshop

OBJECTIVE

To present and exchange experiences and knowledge from work on inter-comparing large scale optical sensors at different product level. This will include the evaluation and reduction of calibration bias and the validation of geophysical product uncertainties.

Workshop Recommendation

In order to establish reference datasets to support the understanding of climate change and quality assure operational services by E.O. satellites, data from different sensors and the resulting synergistic data products require a high level of accuracy which can only be obtained through continuous traceable calibration and validation activities.

In this context, IVOS recommends to initiate an activity to :

- *–document a reference methodology to predict TOA radiance for which currently flying and planned wide swath sensors can be inter-compared, i.e., define a standard for traceability.*
- *– create and maintain a fully accessible web page containing, on an instrument basis, links to all instrument characteristics needed for inter-comparisons as specified above, ideally in a common format.*
- *– create and maintain a database (e.g.: SADE) of instrument data for specific vicarious calibration sites in a common format delivered by agencies responsible for their instruments. This database should also include site characteristics.*

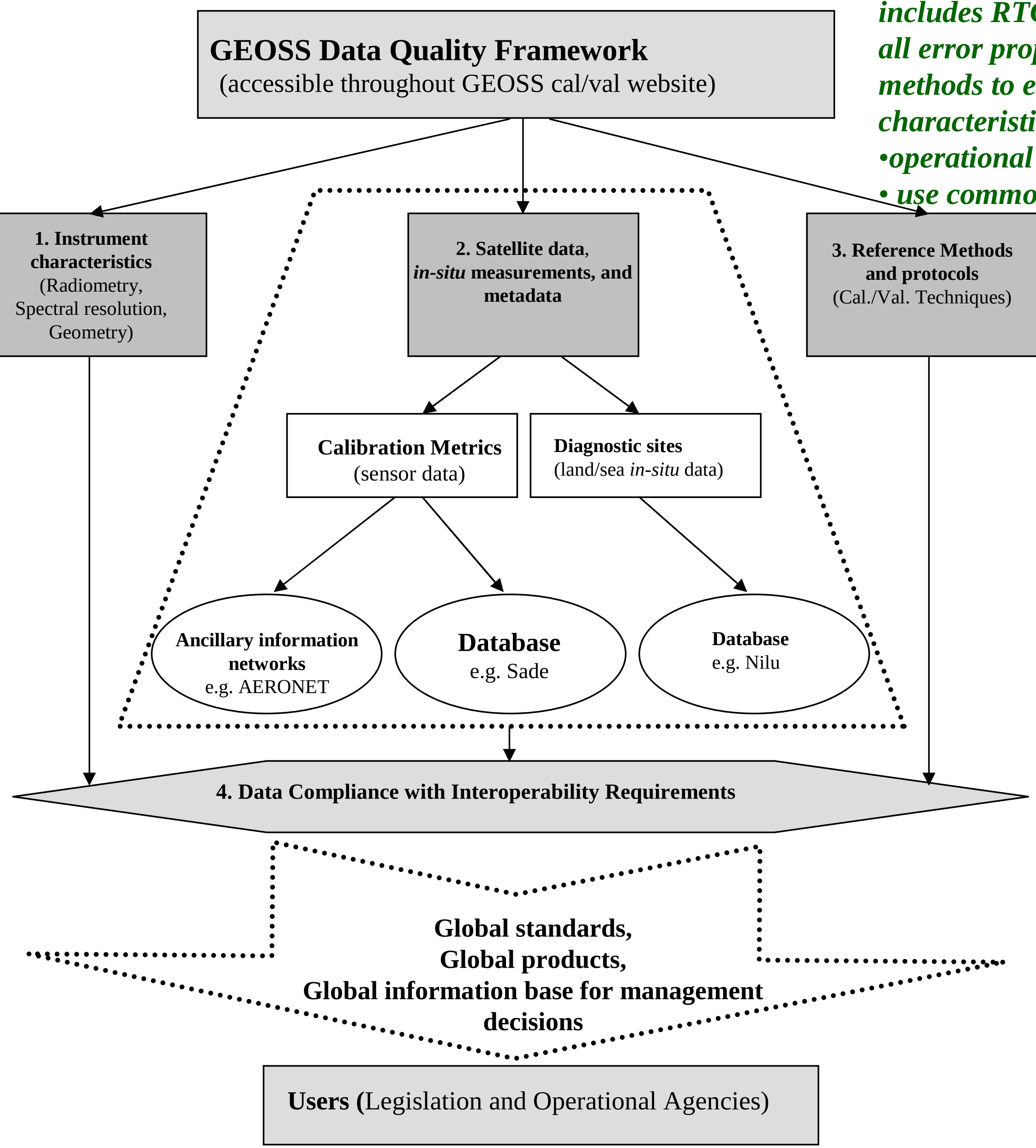
This activity should be supported for an active (implementation) period of 2 years and a maintenance period over 2 subsequent years. An amount of 500 K-euro/$ is estimated to be required for this activity.

Agencies are asked to support this activity by providing appropriate information and data in a timely manner.

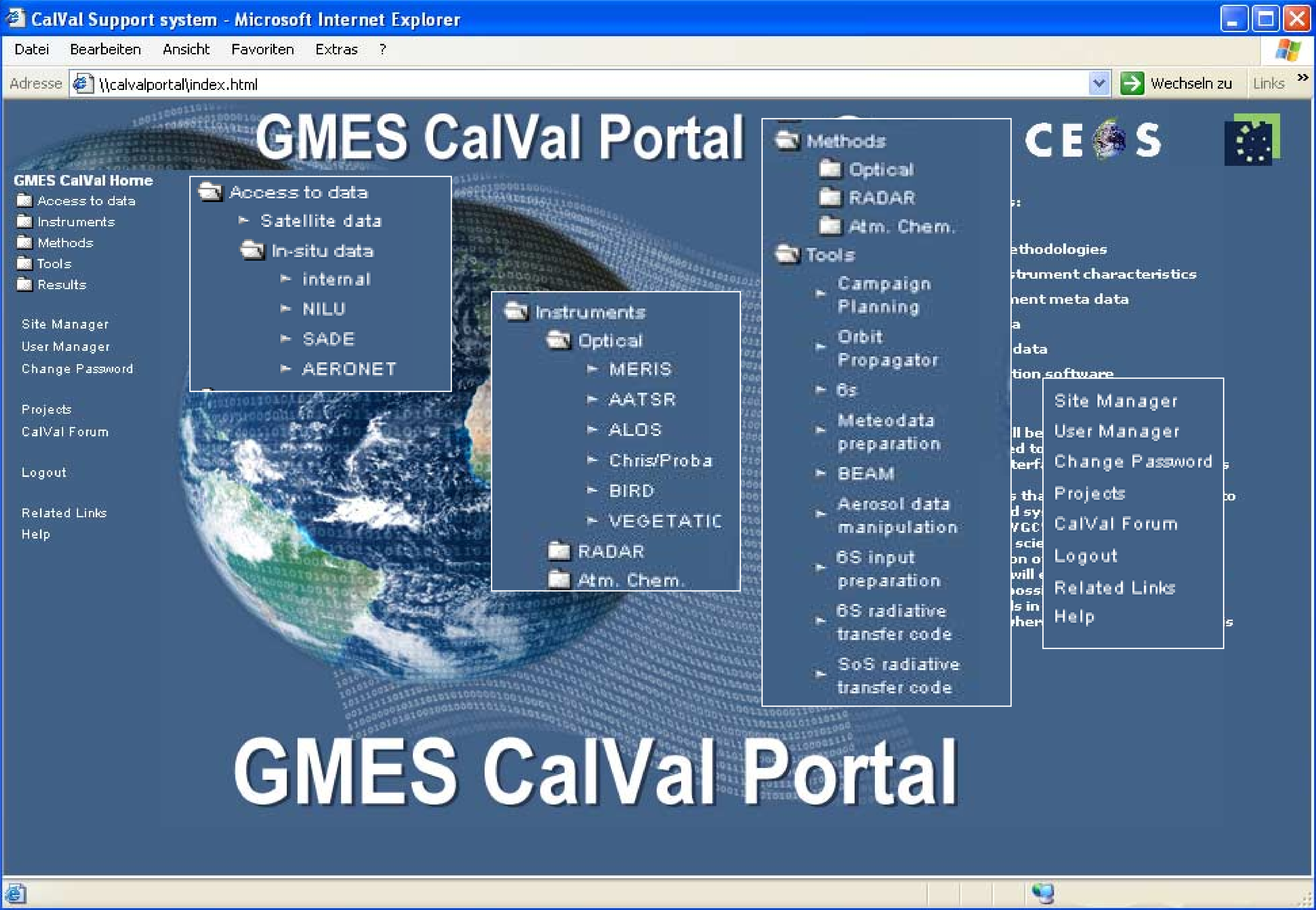
Cal/Val and data quality assessment framework system elements

Links to different Agencies

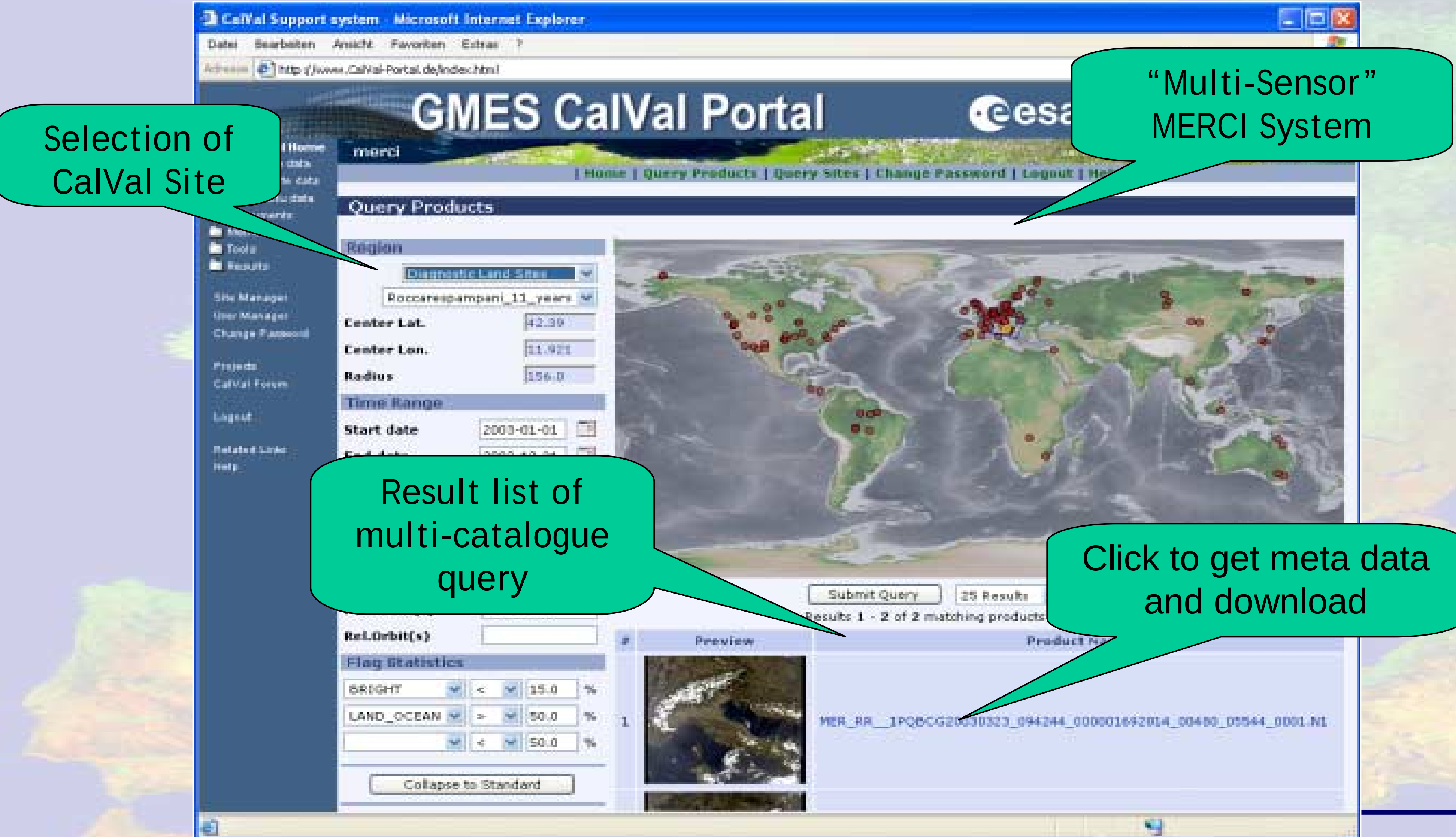
includes RTC procedures and all error propag. models and methods to establish QA characteristics. Use:
•operational processor(by all)
• use common data format



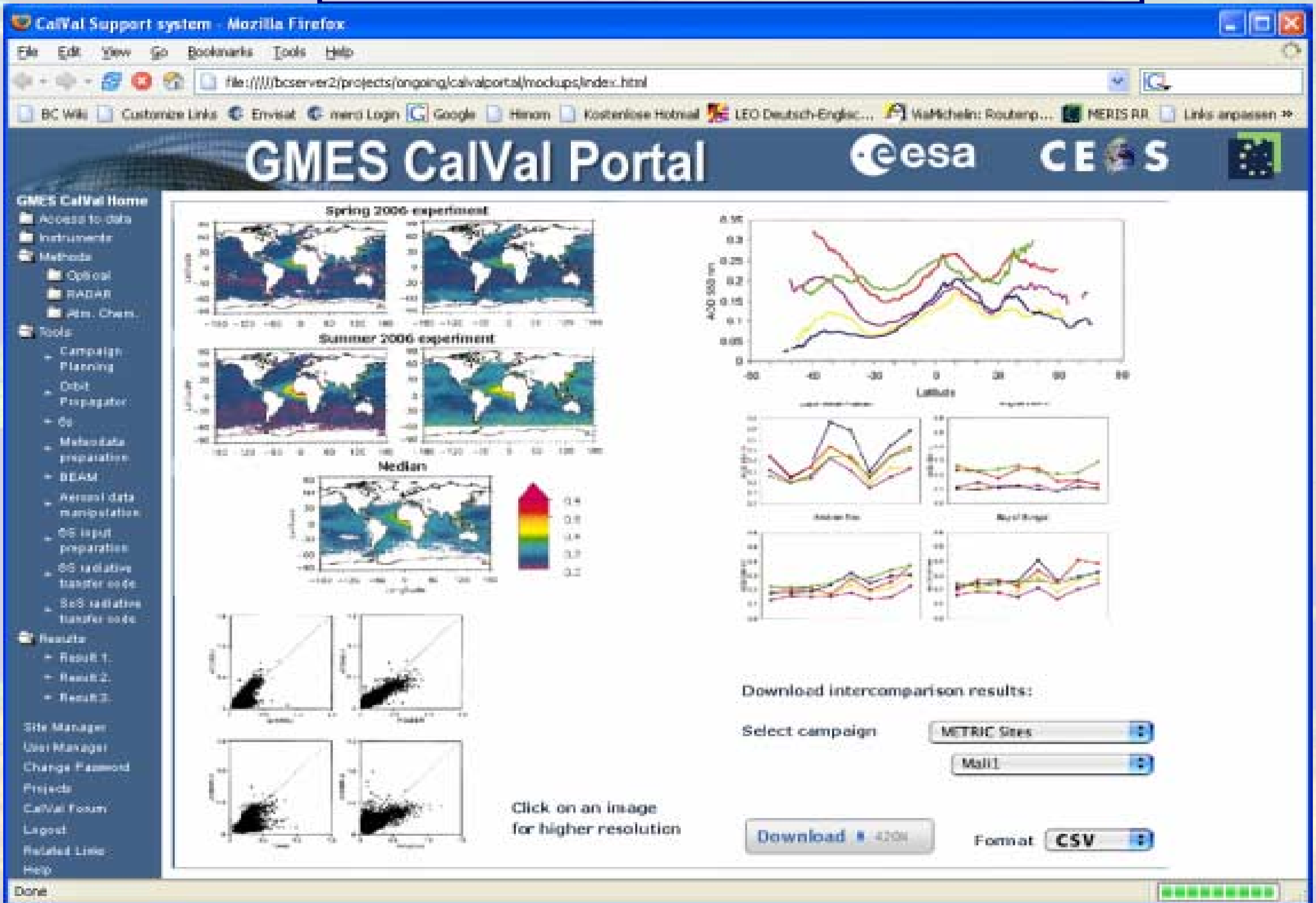
for data combination and merging


CalVal Support system - Microsoft Internet Explorer
Datei
Bearbeiten
Ansicht
Favoriten
Extras
?
Adresse
\\calvalportal\index.html
Wechseln zu
Links
GMES CalVal Portal
CEOS
GMES CalVal Home
Access to data
Instruments
Methods
Tools
Results
Site Manager
User Manager
Change Password
Projects
CalVal Forum
Logout
Related Links
Help
Access to data
Satellite data
In-situ data
internal
NILU
SADE
AERONET
Instruments
Optical
MERIS
AATSR
ALOS
Chris/Proba
BIRD
VEGETATIC
RADAR
Atm. Chem.
Methods
Optical
RADAR
Atm. Chem.
Tools
Campaign Planning
Orbit Propagator
6s
Meteodata preparation
BEAM
Aerosol data manipulation
6S input preparation
6S radiative transfer code
SoS radiative transfer code
Site Manager
User Manager
Change Password
Projects
CalVal Forum
Logout
Related Links
Help
GMES CalVal Portal

Access to EO Data



Communication of Results



IVOS

Elements of Satellite System Calibration

To allow accurate retrieval of geophysical parameters that meet mission goals it is essential that a comprehensive calibration strategy is built into the system throughout the mission lifetime from initial concept to end-of-life. Ideally instruments must meet thresholds for spectral coverage and resolution, and radiometric performance (accuracy, precision and long-term stability). Instruments meeting these thresholds can be used to anchor instruments that do not;

The building blocks for a calibration / validation system shall include:

- **(1) On-board calibration devices (e.g., black bodies, solar diffusers) where appropriate**
- **(2) Extensive pre-launch calibration tests to properly characterize instruments and ensure calibration traceable to SI standards**
- **(3) Sustained post launch activities including:**
  - **(1) In situ measurements of the state of the surface and atmosphere (e.g., the Cloud and Radiation Test-bed (CART) site, aircraft instruments with SI traceable calibrations)**
  - **(2) Intercomparison with other satellite observations across the range of spatial and spectral scales**
- **(4) Radiative transfer models that enable comparison of calculated and observed radiances both for pre-launch and post-launch CAL/VAL activities**
- **(5) Data archive and documentation:**
  - **(1) Maintain long term open access to archives, accessible, possibly through ‘CAL/VAL portals’**

(1) Onboard calibration devices:

- **(1) Should be concept proven and characterized**
- **(2) Should be traceable to SI units**
- **(3) The witness samples should be kept**

(2) Pre-launch activities:

- **(1) Full instrument cycle test (including instrument and environment modeling) to ensure every element is traceable to SI standards where possible**
- **(2) All calibration data and procedures should be documented and kept**

(3) Post launch requirements include:

(1) Vicarious calibration of ground sites with temporally and spatially stable surface characteristics and generally clear skies, and where possible, observations of the sun, moon, and stars, are useful for characterizing calibration drifts of VIS and NIR instruments. If appropriately calibrated from benchmark instruments in space these can be used as reference standards.

(2) Space-based benchmark observations, with required accuracy, spectral coverage and resolution and traceable to international standards as “gold” standards for validation and inter-calibration of other satellite sensors.

(3) Permanent reference sites and dedicated campaigns to collect in situ measurements of the state of the surface and atmosphere. All instruments used for in-situ measurements should calibrated and traceable to SI standards.

(4) Satellite inter-calibration from simultaneous and collocated observations:

- Simultaneous observations from collocations between a LEO and all GEO sensors have also been demonstrated and can be used as a means to inter-calibrate GEO satellites. Conversely, an instrument with high accuracy, precision and stability in GEO orbit can be used as a means to inter-calibrate all LEO sensors;
- Collocated high spectral resolutions observations are important for validating and vicariously calibrating broader band radiometers

(4) Benchmark Radiative Transfer Models for all sensors must be documented, maintained and openly available.

Elements of Satellite System Calibration

(5) Data archive and documentation:

- All pre-launch instrument data must be archived with metadata and be freely and openly exchanged
- Consistent common file format and projection information or tools to perform related processing
- All collocated observations for satellite inter-calibration must be archived with metadata and be freely and openly exchanged
- Special cal/val campaigns using aircraft and ground-based measurements are encouraged and resulting data must be archived with metadata and be readily accessible
- Space Agencies should share responsibility in providing required sub-samples of satellite observations needed for inter-calibration. This data needs to be easily accessible and free

All the information provided should be end-user oriented. All delivered products should have associated with them a statement of uncertainty and its associated level of confidence

Country/Activity reports

NASA
Report on MODIS on-orbit calibration and characterisation status and activities

CNES
Report on POLDER-3 on PARASOL calibration status, vicarious calibration activities, inter-sensor calibration, SPOT-4 calibration over Dome-C, Improvements of the SADE database

Eumetsat
Report on on calibration status of Meteosat operational series (MOP-7)/ vicarious calibration over desert and sea and use of MSG-SEVIRI to model MOP uncertainties

JRC
Presentation of MODIS/MISR/Meteosat surface albedo intercomparison.
Presentation of comparison between MODIS, SeaWIFS and MERIS derived FAPAR products

Country Reports ctd.

USGS

Report on status of Landsat 5 calibration and Landsat 7 scanline correction

JAXA

Presentation of current and future JAXA missions and report on ALOS PRISM and AVNIR-2 as well as the GCOM instruments. Establishment of JAXA response to the 17 points on inter-calibration strategy system by M. Goldberg.

NIST

Report on the Workshop organised by NIST in July 2005 on uncertainties in extra-terrestric total solar irradiance, proposed Lab inter-comparison of TSI radiometers at NIST, irradiance comparisons of cryogenic radiometer with TSI radiometers

NPL

Reviewing error sources on field spectrometers, NERC field 35-channel spectral goniometer currently under development. Returning interest in TRUTHS in the UK. CCPR recommendations on importance of SI traceable measurements to monitor climate change.

Country Reports ctd.

RAL
Status of VNIR calibration of AATSR, products validation and overall cal/val philosophy.
Long-term stability assessments and AATSR – MERIS inter-comparison.

DLR
MOS mission terminated, Calibration home-base for APEX is under construction.

NOAA
Presentation of requirements on satellite data for NWP models, requirements for VIS/NIR inter-calibration and related results from AVHRR and MODIS inter-comparison. Report on the Concept and strategy for a global space-based Inter-Calibration System (GSICS)

Presentations on:

- *inter-comparisons of wide-swath sensors over the Salar de Uyuni and*
- *MERIS onboard calibration diffusers and their degradation*

12th IVOS observation to be discussed at 13th IVOS

CEOS IVOS highlights the growth in number of optical satellite sensors, and the diversity of their spectral and spatial characteristics. It notes that these sensors have been deployed, to meet the needs of both scientific and commercial applications and that the near "operational nature" of data provision from such sensors means that increasing reliance is put on the integrity and reliability of EO data, by governments, international agencies and the commercial sector.

It further notes:

- that much of this data will soon be the result of, synergistic combination of the products from more than one instrument and often more than one agency.
- that difficulties associated with both pre-flight calibration and more importantly "transference into orbit" means that unacceptably large biases between instruments (even on the same platforms) regularly occur requiring significant corrections to be applied.
- existing strategies for in-flight calibration can provide good long-term stability but not necessarily absolute accuracy, which is required to establish a reference baseline for long-term climate change studies and to secure such records for future generations.

12^{th} IVOS observation to be discussed at 13^{th} IVOS ctd.

It therefore recommends: that CEOS develops a collaborative inter-agency programme/mission to establish a set of SI traceable standard radiometric reference targets viewable by space based EO sensors to unequivocally quantify and remove biases between optical sensors.

Such targets would probably include the Moon, Sun and a number of ground sites used by existing missions.

Traceability to SI and the assignment and maintenance of a high accuracy radiometric value could be obtained through the support of a dedicated mission (such as TRUTHS), recently proposed to ESA EEOP.

Interoperability

- Ensure that the satellite instrument, diagnostic site- and methodology entries/data can be used for the synergistic combination and merging of data from different optical sensors/sources, allowing the harmonization of (operational) data products and the establishment of higher level information products such as global maps and time series (from different sensor outputs) to meet the operational service requirements to be fulfilled in the framework of the GEOSS Themes.

- Differences in information products are known to exist owing to different observation techniques or system characteristics and different observing conditions (e.g. atmospheric influence). It will have to be ensured that these differences are understood and documented. Therefore the availability of means/procedures (including normalization) to combine/merge co-related information products from different systems has to be ensured.