DA-09-01a_8

Cal/Val & Post-launch Test Sites

March 2 – 5, 2010

Gyanesh Chander

GEO Task: DA-09-01a_8 Lead

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*Work performed under USGS contract 08HQCN0005

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- **Develop a consolidated worldwide Cal/Val test site database and an appropriate subset of CEOS reference standards test sites, based on community agreed criteria**

- **Expand the Cal/Val portal in both content and functionality**

Catalog of Worldwide Test Sites for Sensor Characterization

http://calval.cr.usgs.gov/sites_catalog_map.php

Gyanesh Chander, GEO Task: DA-09-01a_2 Lead

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Scope of Test Sites

- Test sites are central to any future Quality Assurance/Quality Control (QA/QC) strategy
- Test sites provide a convenient means of obtaining information to verify sensor performance
- Test sites are the only practical means of deriving knowledge of biases between sensors
- Test sites allow, at some level, a means of bridging anticipated data gaps caused by lack of measurement continuity, due to lack of co-existent in-flight sensors

Characteristics of Sensors which can Benefit from Test Sites

- Gain
- Stability
- Modulation Transfer Function (MTF)
- Uniformity
- Stray light
- Polarization
- Spectral
- Signal-to-Noise Ratio (SNR)
- Geolocation
- Camera model
- Band-to-band
- Internal Geometry

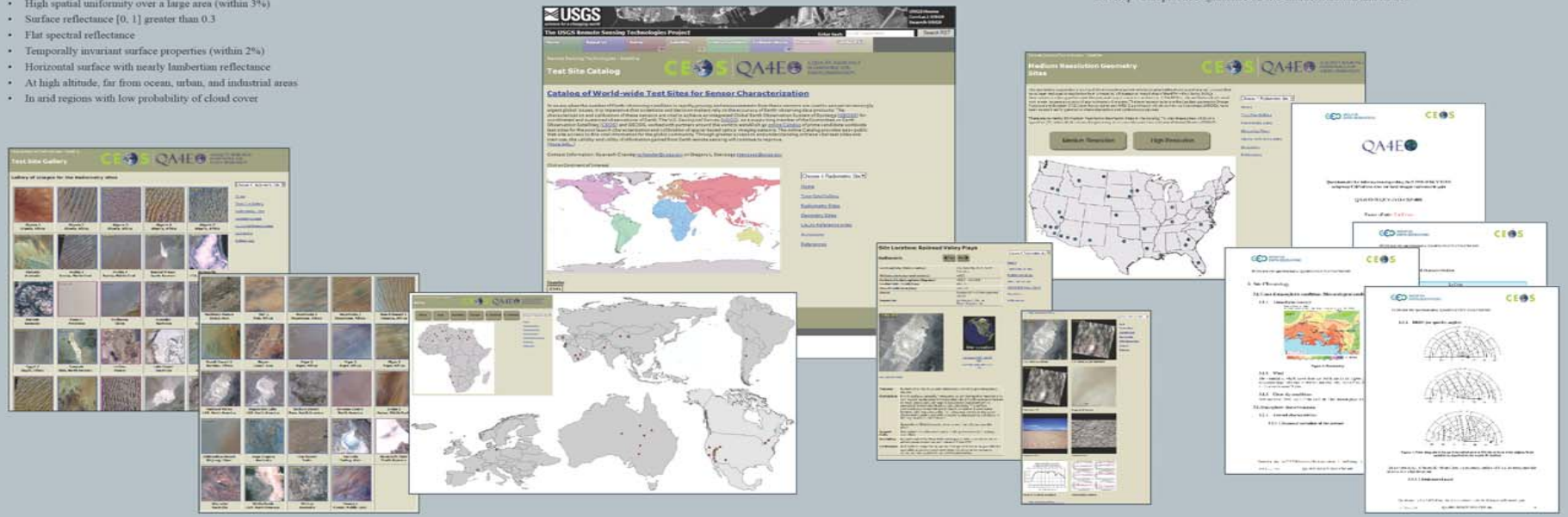
Well-Established Site Selection Criteria for Radiometry Test Sites

- High spatial uniformity over a large area (within 3%)
- Surface reflectance [0, 1] greater than 0.3
- Flat spectral reflectance
- Temporally invariant surface properties (within 2%)
- Horizontal surface with nearly lambertian reflectance
- At high altitude, far from ocean, urban, and industrial areas
- In arid regions with low probability of cloud cover

CEOS Reference Standard Test Sites

- The instrumented sites are primarily used for field campaigns to obtain radiometric gain. These sites can serve as a focus for international efforts, facilitating traceability and cross-comparison to evaluate biases of in-flight sensors in a harmonized manner
- The pseudo-invariant desert sites have high reflectance with low aerosol loading and practically no vegetation. Consequently, these sites can be used to evaluate the long-term stability of a sensor and facilitate cross-comparison of multiple sensors

Online Test Site Catalog



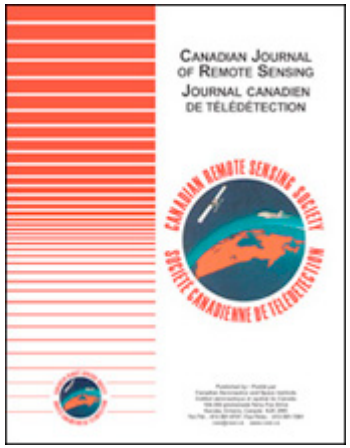
Summary

- The test site catalog provides a comprehensive list of prime candidate terrestrial targets for consideration as benchmark sites for the postlaunch calibration of space-based optical sensors
- The online test site catalog provides easy public Web site access to this vital information for the global community
- The incompleteness of available information on even these prime test sites is an indication that much more coordination and documentation are still needed to facilitate the wider use of calibration test sites in remote sensing

Proposed Future Plans

- Gather complete site characterization data & define core measurements (eg. Instruments)
- Create an operational network of land sites ("Landnet") & develop online data access infrastructure
- Encourage agencies to acquire, archive, and provide data over the CEOS sites
- Integrate the catalog into the CEOS Cal/Val portal
- Establish traceability chain for primary site data
- Develop "best practice" guidance on site characterization and its use

Special issue of the CJRS: “Terrestrial Reference Standard Test Sites for Post-Launch Calibration”



The paper submission deadline for this special issue was February 18, 2010, with a target publishing date of early 2011.

For this edition, the domain of interest is limited to IVOS.

This special journal issue focussed on how test sites provide important and convenient post-launch means of obtaining information to verify the performance of sensors.

Announcement / Annonce

Call for papers
Special issue of the *Canadian Journal of Remote Sensing*

Terrestrial reference standard test sites for post-launch calibration

Guest Editors

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In an era when the number of Earth-observing satellites is rapidly growing, and measurements from these sensors are used to answer increasingly urgent global issues, often through synergistic and operational combinations of data from multiple sources, it is imperative that scientists and decision-makers be able to rely on the accuracy of Earth observation data products. The characterization and calibration of these sensors, particularly their relative biases, are vital to achieving the development of the integrated Global Earth Observation System of Systems (GEOSS) for coordinated and sustained observations of the Earth. This can only be reliably achieved in the post-launch environment through the careful use of observations by multiple sensor systems over common and well-characterized terrestrial targets.

Earth surfaces with suitable characteristics have long served as benchmark or reference standard test sites to verify the post-launch radiometric calibration performance of satellite sensors. Reference standard test sites are a key operational component of the newly established Quality Assurance Framework for Earth Observation (QA4EO). At present, test sites in their broadest sense are the only practical means of deriving knowledge on biases between sensors in all technical domains and provide a convenient means of obtaining information to verify sensor performance. Accordingly, this special journal issue will focus on how reference standard test sites provide important and convenient post-launch means of obtaining information to verify the performance of sensors. For this edition, the domain of interest is limited to infrared, visible, and optical sensors.

The Guest Editors invite submissions that explore topics including, but not limited to, vicarious calibration, radiometric and geometric stability monitoring, land and sea surface temperature, modulation transfer function (MTF), geolocation, signal-to-noise ratio (SNR), band-to-band, stray light, spectral, uniformity, and temporal effects. If you intend to submit a

Appel d’articles
Numéro spécial du *Journal canadien de télédétection*

Sites témoins terrestres pour l’étalonnage post-lancement

Rédacteurs invités

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À une époque où le nombre de satellites d’observation de la Terre augmente sans cesse et alors que les mesures de ces capteurs sont utilisées pour répondre à des problématiques de plus en plus urgentes à l’échelle du globe, la plupart du temps en ayant recours à des combinaisons synergiques et opérationnelles de données de sources multiples, il est impératif que les scientifiques et les décideurs soient capables de compter sur la précision des produits de données d’observation de la Terre. La caractérisation et l’étalonnage de ces capteurs, particulièrement de leurs biais relatifs, sont des éléments essentiels pour assurer le développement du système intégré GEOSS (Système des systèmes mondiaux d’observation de la Terre) pour des observations coordonnées et durables de la Terre. Ceci ne peut être accompli de façon fiable, dans un environnement post-lancement, que par l’utilisation prudente d’observations réalisées à l’aide de systèmes de capteurs multiples au-dessus de cibles terrestres communes et bien caractérisées.

Les surfaces terrestres présentant des caractéristiques adéquates ont souvent servi comme repères ou sites témoins pour vérifier la performance de l’étalonnage radiométrique post-lancement des capteurs satellitaires. Les sites témoins sont une composante opérationnelle importante de l’initiative QA4EO (« Quality Assurance Framework for Earth Observation ») récemment mise en place. À l’heure actuelle, les sites tests au sens le plus large du terme constituent en pratique le seul moyen d’obtenir de l’information sur les biais entre les capteurs dans tous les domaines techniques et ces derniers constituent un moyen pratique d’acquisition d’information permettant de vérifier la performance des capteurs. Ainsi, l’objet de ce numéro spécial de la revue sera de montrer comment les sites témoins peuvent constituer une source importante et pratique pour l’obtention d’informations dans le contexte de la vérification post-lancement de la performance des capteurs. Pour cette édition, le champ

Proposed Future Plans

- **CEOS WGCV Sub-groups**
  - Compile a list of consolidated worldwide Cal/Val test sites
  - Compile an appropriate subset of CEOS reference standards test sites

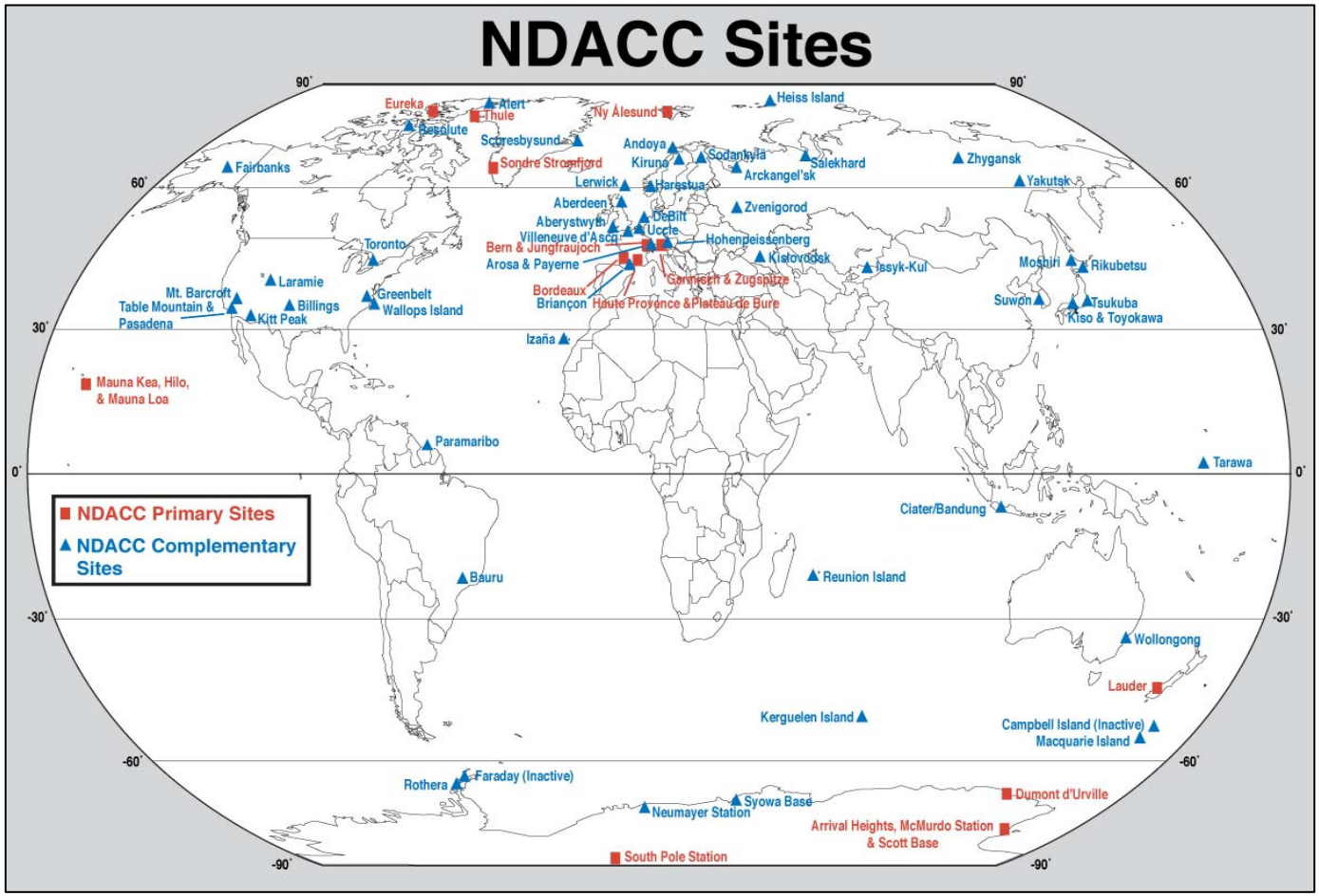
- **Gather complete site characterization data and information**
  - Define core measurements (eg. Instruments)
  - Create an operational network of sites (eg., aeronet, Landnet)

- **Encourage agencies to acquire, archive, and provide data to the Cal/Val community over CEOS reference standard test sites**
  - Develop online calibration data access infrastructure
  - Create tools to identify the potential co-incident image pairs (NASA SEO)
  - Organize local, regional, national, and international field campaigns

Proposed Future Plans

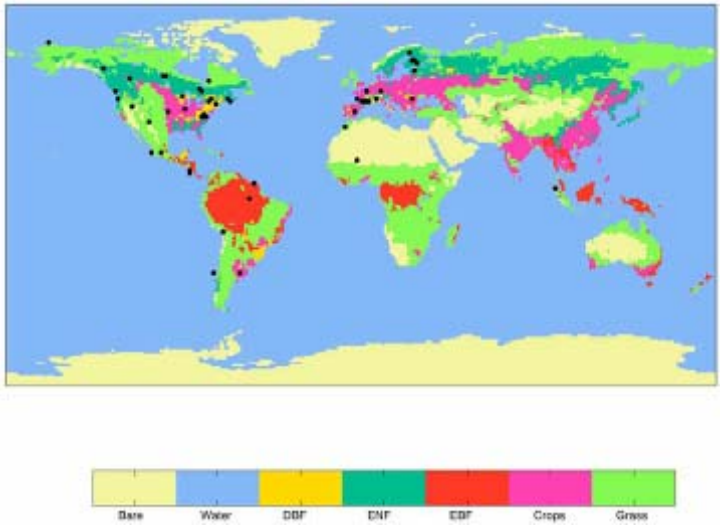
- **Establish traceability chain for primary site data & “best practice” guidance on site characterization and its use**
- **Continue to improve vicarious calibration methodologies;**
- **Develop recommended guidelines and certification mechanisms for meeting calibration standards;**
- **Endorse and advocate compliance with calibration standards.**

Atmospheric Chemistry (AC)



Land Product Validation (LPV)

- **CEOS Benchmark Land Multisite Analysis and Intercomparison of Products (BELMANIP) - http://lpvs.gsfc.nasa.gov/**



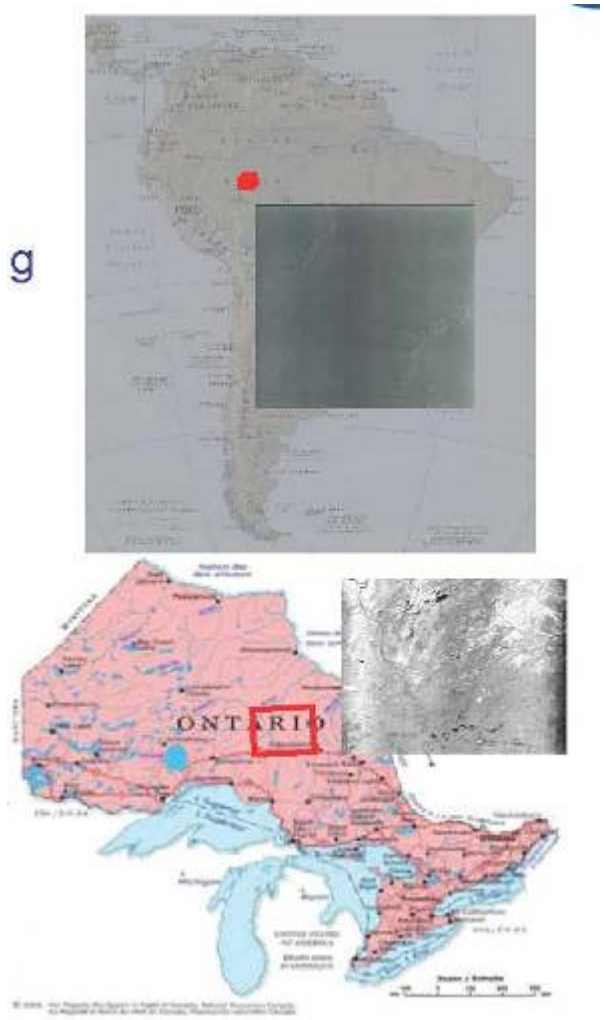
- **Map of sites covered by the groups represented in this paper (given on a global map of dominant surface types in each 1 x 1 cell (bare soil, water bodies, deciduous broadleaf forest, evergreen needleleaf forest, evergreen broadleaf forest, crops, grass)**

Microwave Sensors Subgroup (MSSG)

- **Sandy desert (e.g. Sahara)**
  - Deep penetration depth, temporal stability of the Tb, underground structure TBD
- **Rocky/mixed desert (e.g. Gobi)**
  - Shallow penetration depth, azimuthal effects and vegetation
- **Rainforest (Amazon)**
  - Volume scatter, effects of rain cells on the canopy equivalent moisture TBD
- **Stable ocean areas**
  - Effects of the wind/salinity at L-band TBD
- **Antarctica**
  - Dry atmosphere, large penetration depth & temporally stable, low azimuthal anisotropy

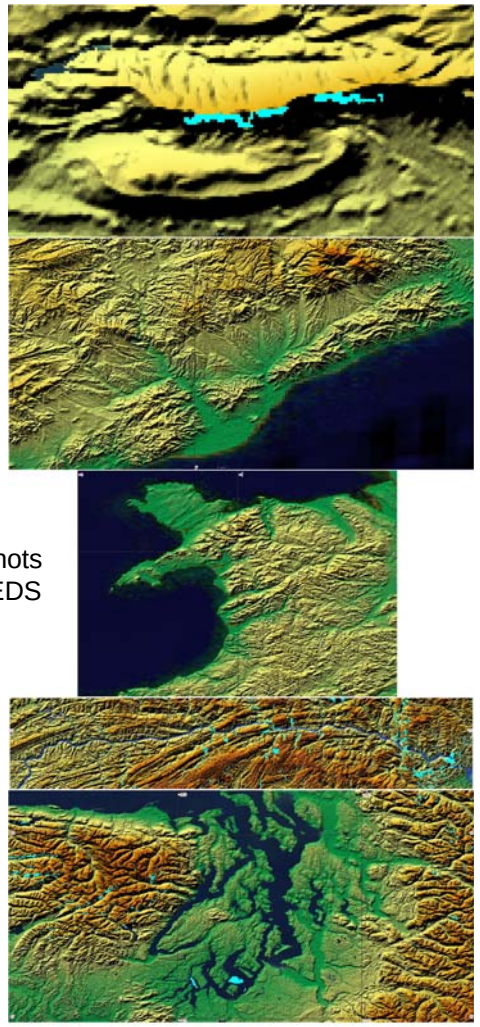
Synthetic Aperture Radar (SAR)

- **International Amazon Rainforest Site**
  - A CEOS radiometric calibration reference site
  - Data routinely collected and analyzed for calibration monitoring of SAR satellites including RADARSATs
  - Radiometry of the site remains stable
- **Canadian Boreal Forest Site**
  - Radiometric characterization completed at C-band using RADARSAT-1 data
  - Site seasonally dependent
  - Can be used as a complimentary site to the Amazon but with reduced radiometric accuracy
- **Calibration Transponder Sites**
- **Dome C?**



Terrain Mapping Subgroup (TMSG)

- **Montagne Sainte-Victoire**
  - France referred to as Aix-en-Provence
  - 5.528-5.685ºE, 43.502-43.560ºN
  - mixed arable, forest, limestone
- **Barcelona, Spain**
  - 1.5-2.75ºE, 41.25-41.82ºN
  - urban, mixed arable, forest
- **North Wales,**
  - UK3-5ºW, 52-53.5ºN
  - urban, pasture, forest
- **Three Gorges, China**
  - 108.252-111.302ºE, 30.638-31.229ºN
  - forest, arable, limstone shales
- **Puget Sound, WA, USA**
  - -121.397 to -123.897ºW, 46.364-48.864ºN
  - forest, urban, wetlands



N.B. screenshots from ICEDS extracts