



Working Group on Calibration and Validation (WGCV): 47

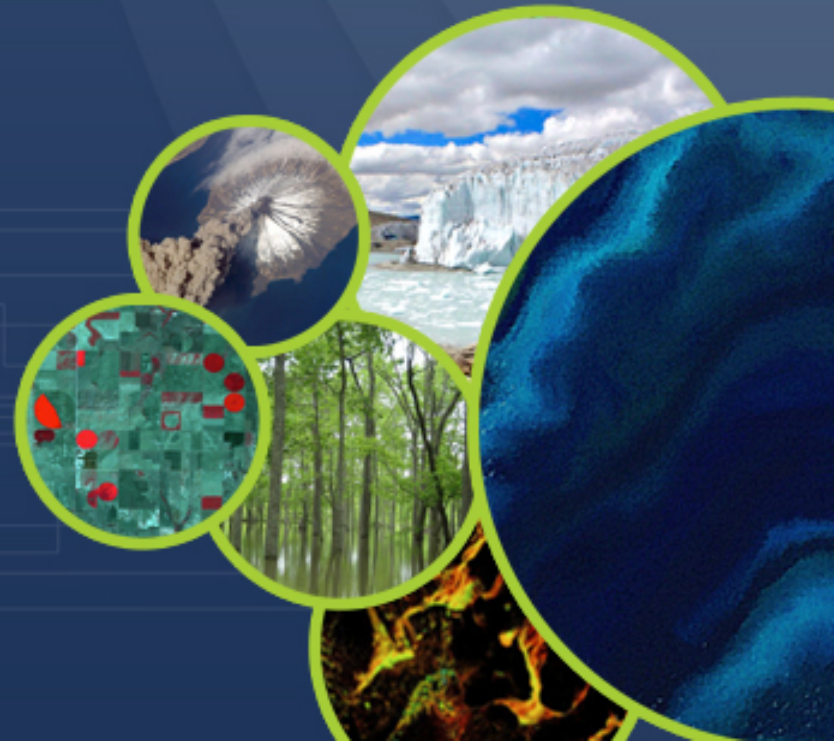
Infrared Visible and Optical Sensors (IVOS) subgroup: report

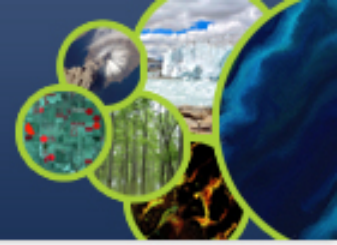
Nigel Fox

NPL (with UKSA support)

WGCV 47

Working Group on Calibration and Validation





- IVOS 31 @ Perth, Australia.
hosted by CSIRO & GA Mar 2019
- Most themes and topics (work-plan
discussed or summarised
- **SI-Traceable Space-based Climate
Observing System (SITSCOS)
workshop (Sep 2019)**
- **Planned IVOS32 @ USGS postponed**
- **Four IVOS (32) virtual meets (Mar 20)**
 - Around 25 attendees to each
 - RadCalNet
 - Cal/Val portal / Comms
 - ARD
 - Terminology



Special Projects/activities:

- **RadCalNet new test-site review**
- **Terminology task team established**
- **ARD commercial sector**
- **(LPV joint Surface Reflectance
comparison/protocol)**
- **PICSCAR**
- **Geo-spatial Quality (MTF)**



CEOS/WGCV/IVOS March 2020

GEO SPATIAL QUALITY ACTIVITY

F. Viallefont-Robinet (ONERA)

ONERA
THE FRENCH AEROSPACE LAB

retour sur innovation

Task group created in 2015 and very active- small but increasing community (particularly commercial sensors)

Working Group on Calibration and Validation

Groups work presented to Commercial sector as part of ARD discussions

LINK WITH ARD

- Geo spatial quality:
 - How much energy is received from the small region pointed by the system ?
 - How large is the blurr ?
 - Knowledge of limits for
 - Selection of uniform area
 - Selection of commun area for several sensors

Important for small calibration sites or validation measurements
→ important for interoperability



ACHIEVEMENTS

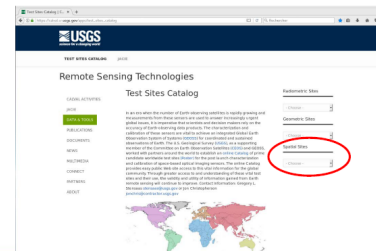
- Field methods survey: information about targets and methods are used to complete a catalog of targets suited for MTF measurement.

Field Methods Survey

Test sites catalog



https://calval.cr.usgs.gov/apps/test_sites_catalog



FOR USE

- Find location and info about targets for MTF assessment on the catalogue site:
https://calval.cr.usgs.gov/apps/test_sites_catalog

- Find methods description to assess MTF using
Comparison of MTF measurements using the edge method and a reference dataset

FRANÇOISE VIALLEFONT-ROBINET, DENNIS HELDER, RENAUD FRAISSE, A. BERGH, DONGHAN LEE, and SÉBASTIEN SAUNIER

Optics Express Vol 26, Issue 26, 33625-33648, 2018

<https://doi.org/10.1364/OE.26.033625>

- Test your MTF assessment using edges
<http://calvalportal.ceos.org/mtf-reference-dataset>

FUTURE WORK

- Catalog update
- MTF assessment with lunar images
- Interest for other metrics, particularly those included in the GIQE
- Recommendation/understanding of the NIIRS in order to harmonize its use
- Suggestions and participants are welcome !

RER

FWHM

SNR



ACHIEVEMENTS

- 2018: paper published and reference dataset created

Shared data for MTF measurement

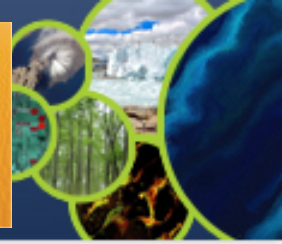
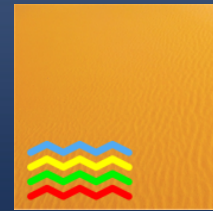
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MTF measurement comparison

Reference dataset

<http://calvalportal.ceos.org/mtf-reference-dataset>

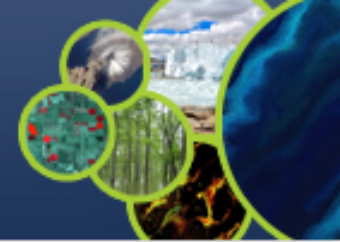
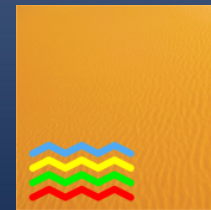




Pseudo invariant sites used for Rad L1 Cal/comparison/monitoring

Work-plan

- Bi-monthly community Telecons/webex to discuss methods and how to establish/compare (BRDF, Atmosphere, surface spectral reflectance)
 - Organise comparison exercises to assess community state of the art
- CNES established draft web 'portal'
 - Hosted on/via CalVal portal
 - Good practises on how to use
 - Repository of observations
 - Repository of comparison results
 - Characteristics of PICS and tools for users
- NPL & CNES to consider how to evaluate Uc
- Goal to establish a TOA 'Radiance simulator'



Site characteristics

Algeria3

Algeria5

Libya1

Libya4

Mauritania1

Mauritania2

Open simulation tools

View PICSCAR Exercises

View calibration over Libya4

Pseudo invariant calibration sites have been widely and successfully used on-orbit radiometric trending of optical satellite systems for more than 20 years. At the IVOS 27 meeting in November 2015, a new initiative was established to facilitate coordination and help prioritize research on PICS and their usage for the benefit of the EO community as a whole.

A roadmap has been set up at IVOS 28 in March 2017 where the subjects have been identified and priorities given to:

- PICS's BRDF characterization
- Spectral characterization
- Atmosphere properties
- Temporal stability
- Combining multiple sites calibration results
- Revisiting the sites

This portal contains general and detailed information about 6 PICS. It provides also a tool simulate the reflectance normalized to nadir. Please register to have access to the document.

Newsletter

2019/03/26 - Please note that the next PICSCAR meeting will be held in CSIRO/Perth on March 26th, 2019.

2018/02/07 - On going activity : [PICSCAR intercalibration exercise](#).

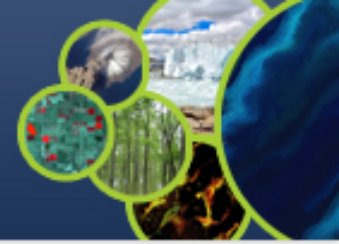
- Exercise 1: Intercalibrating S2A and Landsat 8. Sentinel 2 should be the reference sensor.
- Exercise 2: Intercalibrating MERIS and MODIS Aqua for a 10 years period. MERIS should be the reference sensor.
- Exercise 3: Assessing the BRDF of the site to normalise MERIS TOA reflectance to the following geometry using BRDF model for the following geometry: SZA = 30°, VZA = 0°, relative azimuth angle=0.

Please see the invitation letter to get the instructions and data.

<https://picscar.magellium.com/>

Accessible through CEOS Cal/Val Portal

Working Group on Calibration and Validation



RadCalNet



remote sensing



Communication

RadCalNet: A Radiometric Calibration Network for Earth Observing Imagers Operating in the Visible to Shortwave Infrared Spectral Range

Marc Bouvet ^{1,*}, Kurtis Thome ², Béatrice Berthelot ³ , Agnieszka Bialek ⁴ ,
Jeffrey Czapla-Myers ⁵, Nigel P. Fox ⁴, Philippe Goryl ⁶, Patrice Henry ⁷, Lingling Ma ⁸,
Sébastien Marcq ⁷, Aimé Meygret ⁷, Brian N. Wenny ⁹ and Emma R. Woolliams ⁴ 

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⁵ College of Optical Sciences, University of Arizona, Tucson, AZ 85721, USA; jscm@optics.arizona.edu

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⁹ Science Systems & Applications, Inc., 10210 Greenbelt Road, Lanham, MD 20706, USA;
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Received: 18 September 2019; Accepted: 14 October 2019; Published: 16 October 2019

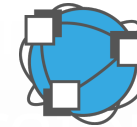
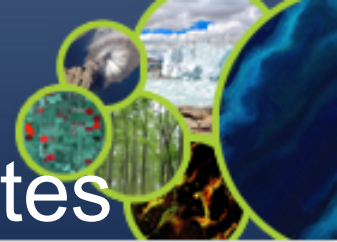


- Progressing well (although shut down for 4 months due to covid!)
- Reprocessing of all Data (collection V3) to account for improvements e.g. spectral sampling/ Aerosol type)
Now available (July 1)
- Better comms on portal
- Faster data / 1500 more days of data
- (March) 416 registered users increasing ~ 50 per 4 months
- Anticipate two additional sites in 2021
Dunhuang & Pinnacles

Working Group on Calibration and Validation

RadCalNet

acceptance process for new sites



RadCalNet

Set up Site

Register Interest



Submission



RadCalNet

G1 – Site Selection

G2 – Site Characterisation

G3 – Site Instrumentation

R1 – Membership Criteria

Letter of Intent

G4 – Uncertainty Analysis

G5 – Peer review process

R2 – Data Specification

45 days' data

Site Questionnaire

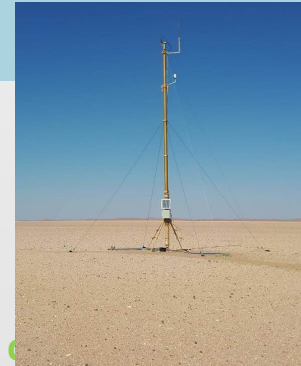
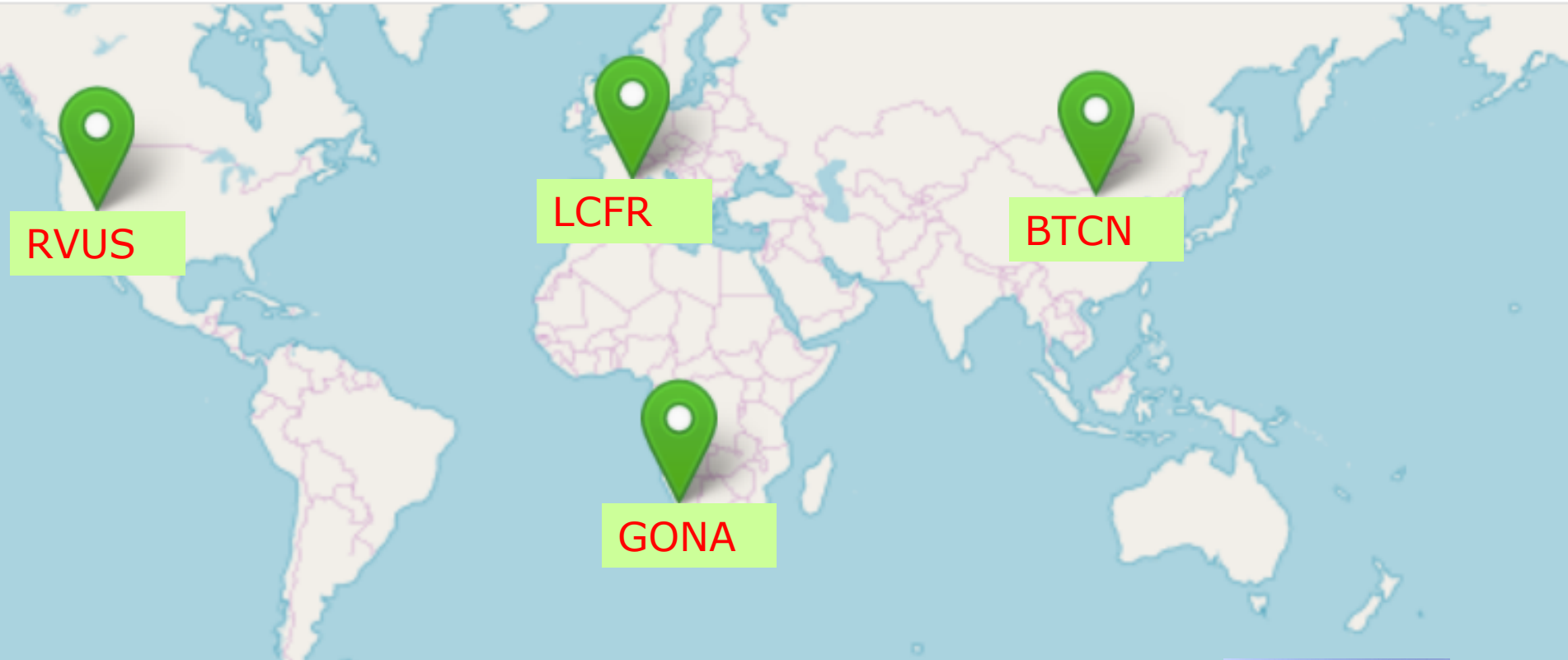
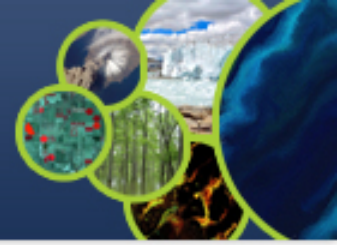
Site Uncertainty Statement

Peer review by RadCalNet Technical WG

Recommendation to CEOS WGCV

Approval by CEOS WGCV RadCalNet Review Panel

Working Group on Calibration and Validation



Recommendation to WGCV to accept the 'Baotou Sandy Site' (BSCN) into RadCalNet

All documentation and reports are at

<https://forum.radcalnet.org/t/baotou-sandy-site-formal-review-where-the-files-are/244>




RadCalNet site questionnaire: QA4EO-WGCV-RadCalNet-BSCN-Q-v1



RadCalNet sandy site description

CEOS Reference: QA4EO-WGCV-RadCalNet-BSCN-Q-v1

Name of site: Baotou sandy site

Point of contact:

Name: Lingling Ma

Affiliation: Academy of Opto-Electronics, Chinese Academy of Science

Address: No 9, Deng Zhuang South Road, Haidian District, Beijing, China 10094

Tel: +86-10-82178646

Email: llma@aoe.ac.cn




RadCalNet Uncertainty Statement: QA4EO-WGCV-RadCalNet-BSCN-U-v1

Uncertainty Analysis Statement – Baotou Sandy Site

Author(s): L. L. Ma, E. R. Woolliams, C. H. Dai, Y. G. Zhao, N. Wang, Y. K. Liu, L. Li

Date: 2020/1/22

Purpose of Note

Include the following statement, changing Baotou site as required:

This note describes the uncertainty analysis which has been undertaken for the BOA reflectance provided from Baotou sandy site. The method of uncertainty derivation is provided along with a statement of typical uncertainty levels associated with the data. Note that these are the uncertainties associated with BOA reflectance only and Top-of-Atmosphere (TOA) uncertainties are derived centrally by NASA Goddard. All uncertainties quoted are standard uncertainties, i.e. at the $k=1$ level.

Site Description and Processing

The Baotou Site Description

1) General information

The Baotou site is located at the Ming'an township, Urad Front Banner, Bayanxun prefecture, Inner Mongolia Autonomous Region, China. The Daqing mountain is to the north, while the Wula Mountain is to the south and the city of Baotou is about 50 km away from the Baotou site. The geographic coordinate of the permanent target area in the site is 40.85°N, 109.6°E and the overall Baotou site extends over a region up to 35 km along the east-west axis, and 16 km along the north-south axis, with total area 292.5 km² and is about 1270 m above sea level (Figure 1). A series of targets and infrastructure has been built in the Baotou site to provide effective support for sensor aerial test flight, satellite sensor on-orbit calibration and performance evaluation, and remote sensing (RS) product validation (Li et al., 2015).




Figure 1: Location of the Baotou site, showing the useable flight airspace in red box

Template Version 0.1

January 2020







RadCalNet Site Review Report

Baotou Sandy Site (BSCN)

CEOS Reference: QA4EO-WGCV-RadCalNet-SR-BSCN

Version: 1.0

Date: 3 February 2020

Produced by the RadCalNet Technical Working Group

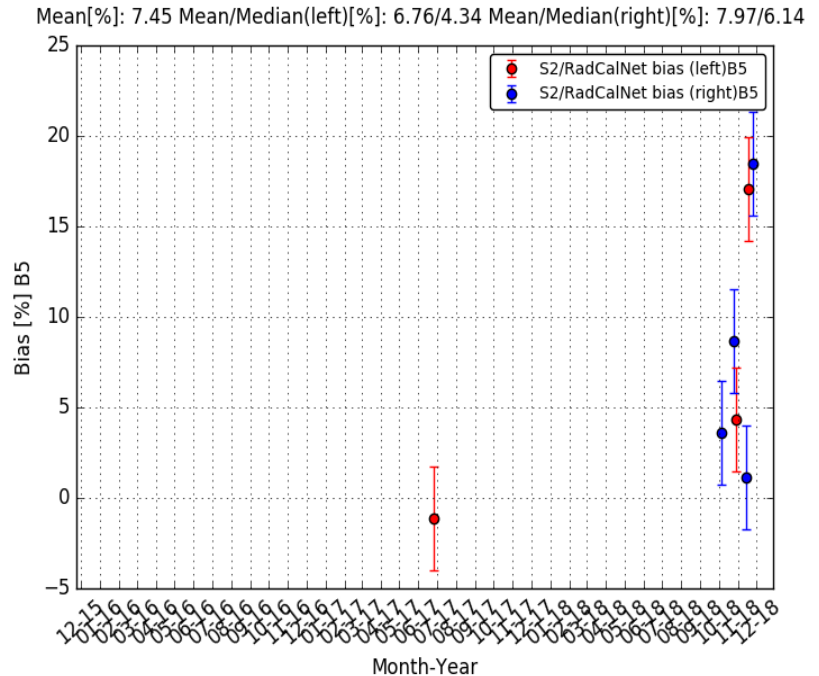
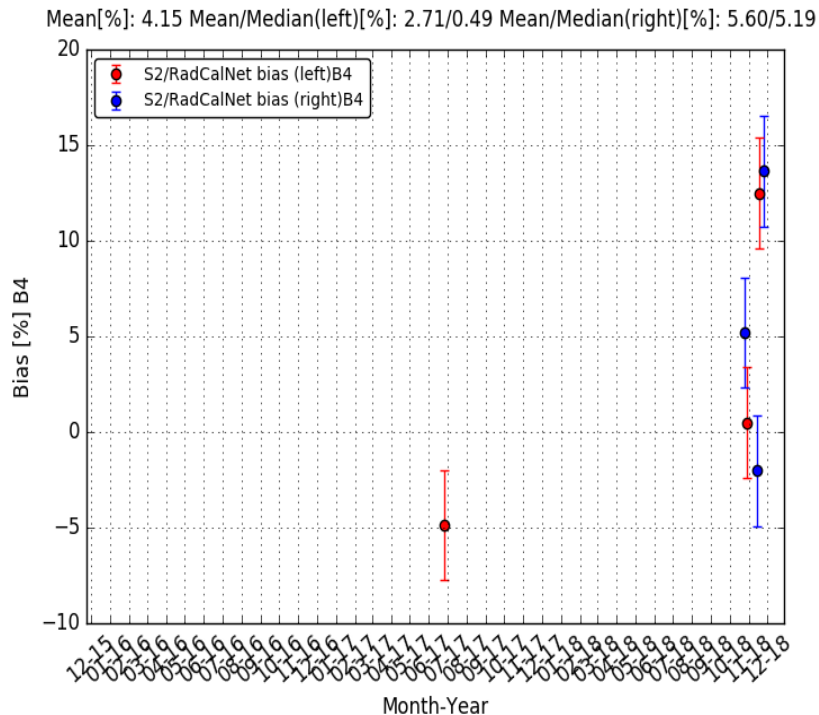


03 March 2020

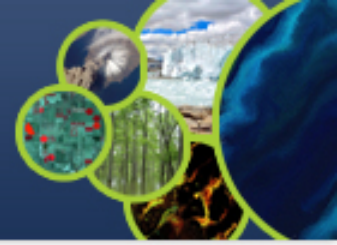
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Site technically reviewed (2 iterations) lead E Woolliams (NPL) & endorsed by WGCV RadCalNet review panel **Working Group on Calibration and Validation**

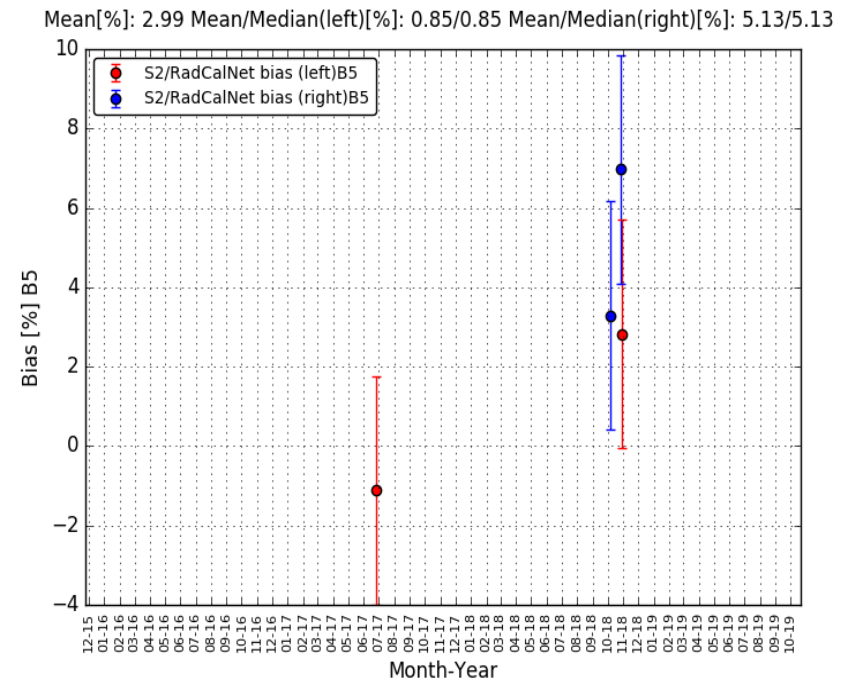
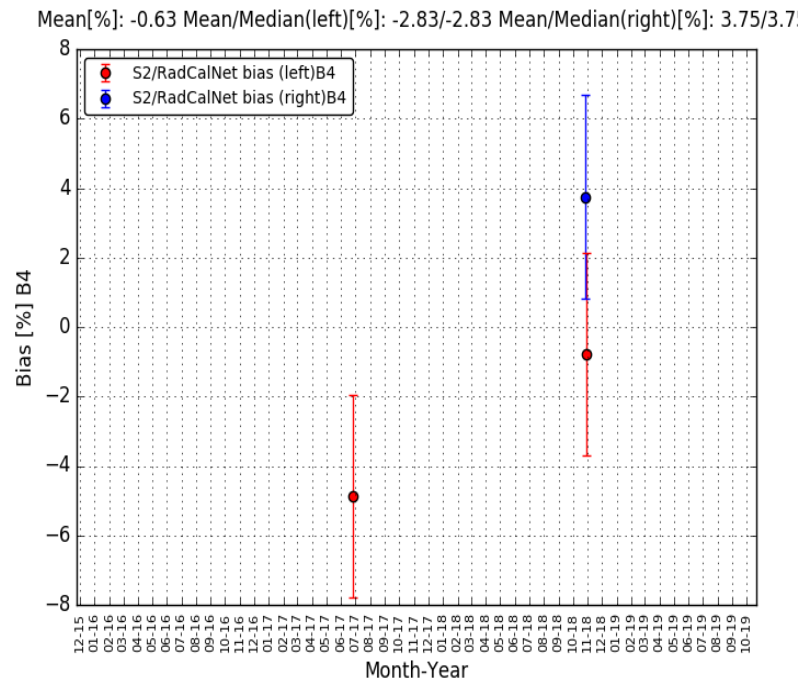
First comparison with Sentinel-2



Original comparison results with Sentinel 2 for B4 (left) and B5 (right). This showed differences of ~12 % / 18 % between BSCN and Sentinel 2.



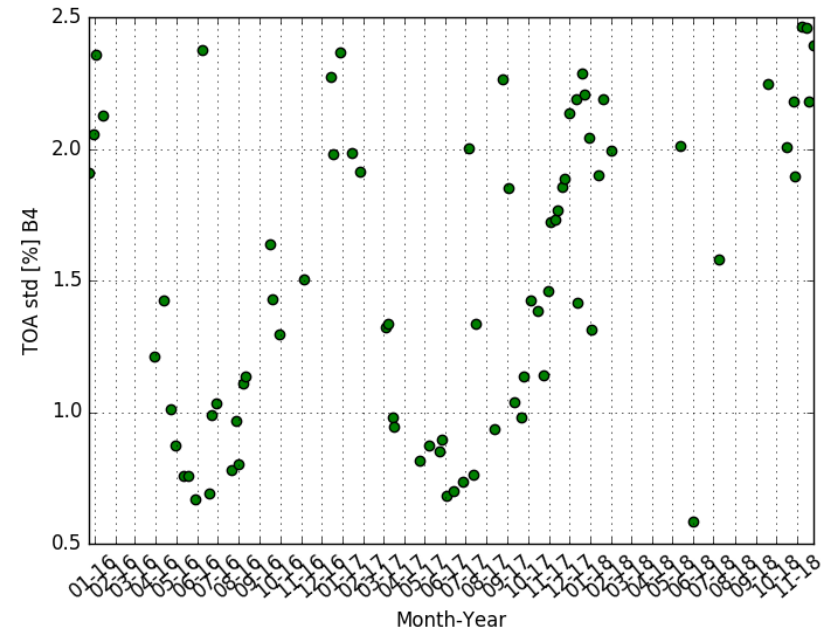
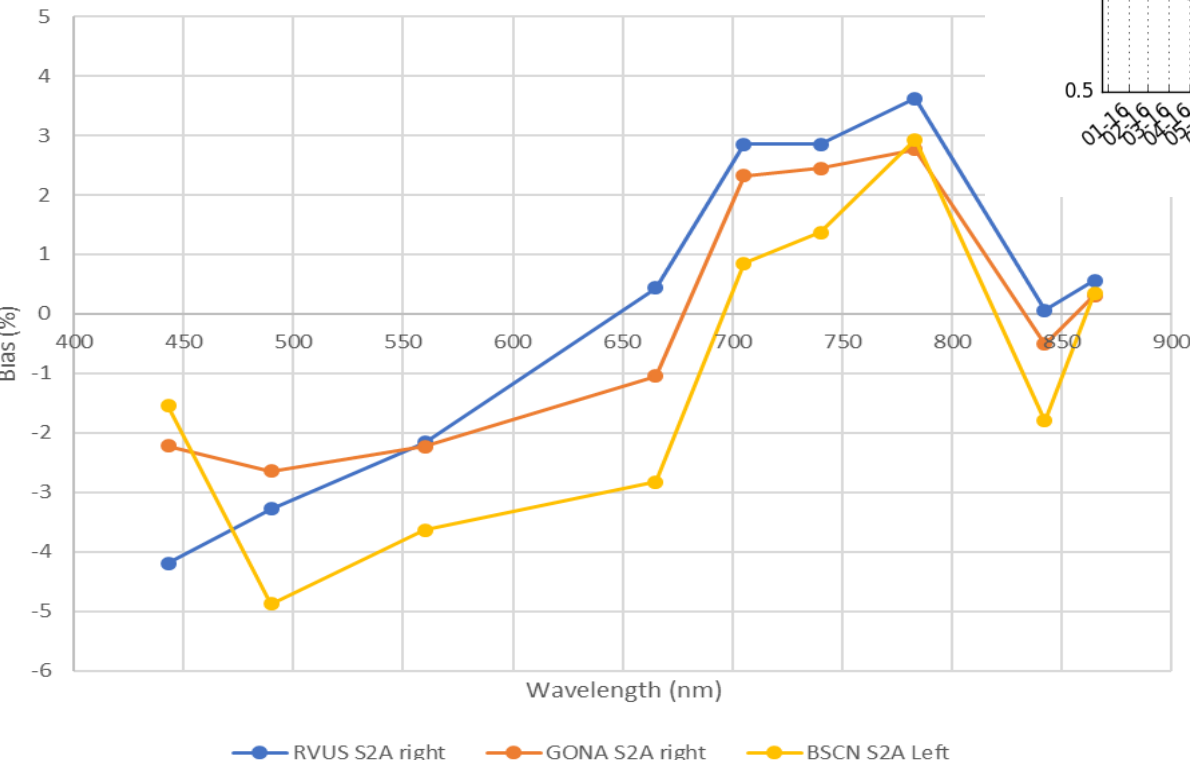
Surface Spectrometer subject to temperature effects – correction and improved screening implemented



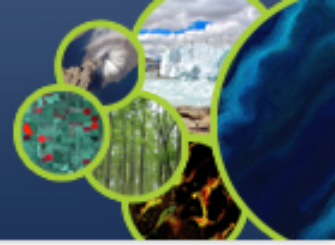
**Second Comparison results with Sentinel 2 for B4 (left) and B5 (right).
Review against site requirements**



BSCN comparison to RVUS and GONA



Some seasonal variation in uniformity (StDev) required some additional uncertainty



- The CEOS WGCV Test Site Admissions' Panel recommends to accept the Baotou sandy site as part of RadCalNet while continuing performing comparisons to the Sentinel-2 data (as the number of matchups gathered for this new site is still limited)."
- May need to adopt assessment processes to improve efficiency – a proposal being developed

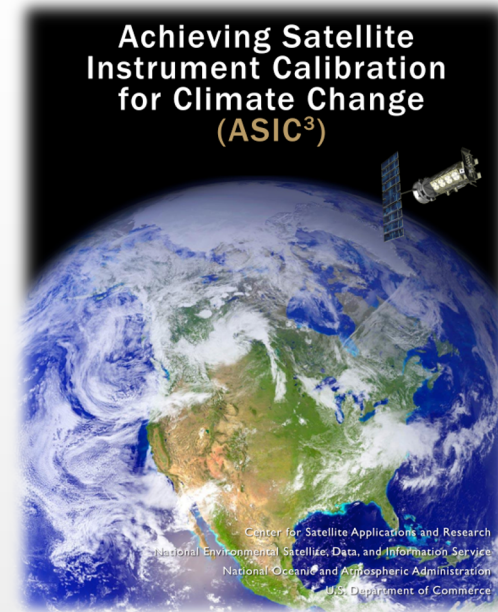
- **Goal**
 - Quantify benefits and requirements of a space-based climate observing system
- **Logistics**
 - Hosted by the UKS at National Physical Laboratory in London, UK
 - 9-11 September 2019
 - 100 attendees (international)

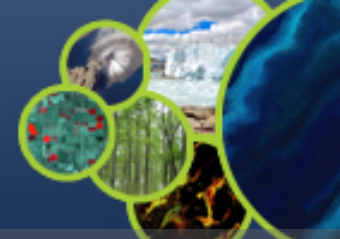
SOC: Nigel Fox, Tim Hewison, Greg Kopp,
Bruce Wielicki, Xiuqing Hu

Organized by (GSICS) and (CEOS-WGCV)



- **Key Questions**
 - What is the interplay between stability, overlap, and absolute calibration?
 - What are the measurement requirements?
 - Direct measurements/Reference Calibration
- Will become the final overview and report of workshop with input solicited from all attendees and other international researchers
- Spans: solar reflective, thermal IR, Microwave
- **Intent:** Solicit endorsements from agencies (GSICS, CEOS, GCOS, GEO, space agencies, etc.)
 - To be incorporated as input to their vision documents
- Organizing committee writing high-level front-end overview



*remote sensing*

an Open Access Journal by MDPI

Special Issue

The Needs and Path Toward an SI-Traceable Space-based Climate Observing System

Special Issue Editors:**Dr. Bruce Wielicki** NASA Langley Research Center, USA**Dr. Greg Kopp** University of Colorado, USA**Dr. Tim Hewison** European Organisation for the Exploitation of Meteorological Satellites, Germany**Dr. Nigel Fox** National Physical Laboratory, UK**Dr. Xiuqing Hu** National Satellite Meteorological Center, China**4.118**

Impact Factor

44_{days}

Article Processing Time

IMPACT
FACTOR
4.118**18**_{days}Submission to
First Decision**4**_{days}Acceptance to
publication

This *Special Issue* aims to present a community strategy on the benefits and consequential specifications of a space-based climate observing system along with a roadmap to implementation.

Submission Deadline: 15 December 2019**Website:**

https://www.mdpi.com/journal/remotesensing/special_issues/Space-based_COS



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IVOS team broadly like the new structure and keen for it to be seen and used as a vehicle to provide information

Test-site pages are generally good and easier to follow

Link throughs to other sites e.g. RadCalNet, PICSCAR

Portal needs to be more visible on CEOS webpages

Possible interest in a discussion forum (but needs to be monitored and answered)

Content needs to be updated

- Suggestion and plan to establish an editorial board with rolling 2 or 3 month membership to encourage content refresh



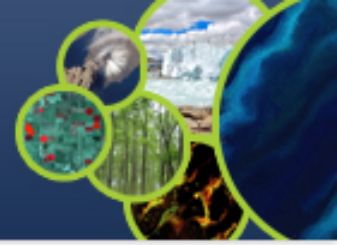
Comparisons and Community practises – post launch cal/val

CEOS Surface Temperature comparisons ~ 5 yrly

- FRM4STS 4th CEOS exercise 2016 (Miami 4)
- Start to plan for next 2021/22

CEOS Ocean Colour radiometers

- FRM4SOC – 1st CEOS exercise 2017
- FRM4SOC (2) 2nd CEOS exercise 2021/22



- IVOS active team expanding (good global coverage- agency and industry)
- Thematic projects working effectively with motivated champions:
- COVID has been a delay to progress and comms
- Many collaborations with GSICS and supporting VCs
- Keen to revitalise and use Cal/Val portal as the community interface
- Work to support Commercial ARD sector and LSI-VC in terms of relevant requirements
- Working towards integration of Cal/Val methods (weighted by uncertainty) to develop optimal Strategies for interoperability and prospect of space-based reference sensors
- Still need to engage and bring on-board some agencies