SI-Traceable Satellite (SITSat) Task Group

(supported by WGCV and GSICS members)

Contributors: SITSat Task Group

Medhavy Thankappan

AC-VC19 / ACSG Joint Meeting

Brussels, 24-27 October 2023

CEOS
Committee on
Earth Observation Satellites

GSICS
Global Space-based
Inter-Calibration System

Background

Achieving Satellite Instrument Calibration for Climate Change (ASIC³)

Report of a Workshop Organized by

National Oceanic and Atmospheric Administration
National Institute of Standards and Technology
National Aeronautics and Space Administration
National Polar-orbiting Operational Environmental Satellite System-Integrated Program Office
Space Dynamics Laboratory of Utah State University

At the National Conference Center, Lansdowne, VA, May 16-18, 2006

Edited by George Ohring

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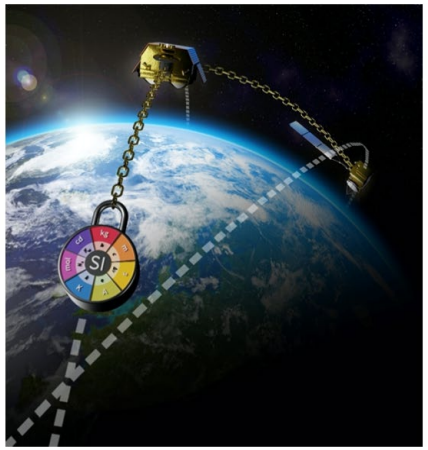
2007

Strategy Towards an Architecture for Climate Monitoring from Space

CEOS GSICS

SI-Traceable Space-based Climate Observing System:
a CEOS and GSICS Workshop
National Physical Laboratory,
London, UK,
9-11 Sept. 2019

SITSCOS Workshop Report



Editors: Nigel Fox, Tim Hewison, Greg Kopp, Bruce Wielicki

International activities around SI-Traceable data for Climate Monitoring from Space, including plans to launch SITSats

What is a SITSat ?

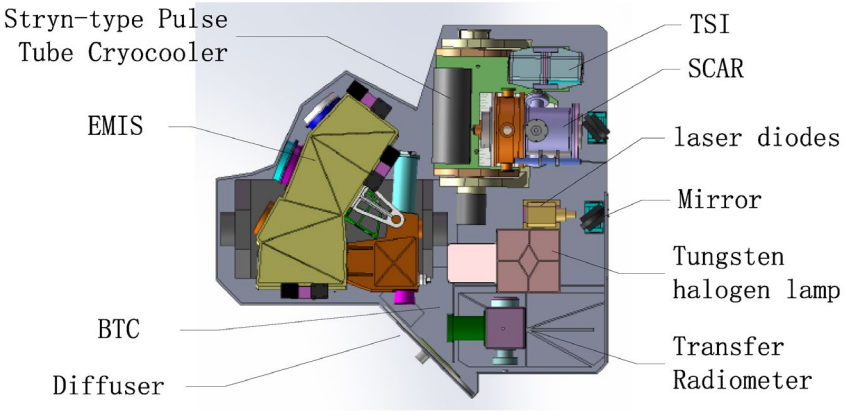
A SITSat is a satellite-based sensor which can provide and verifiably evidence, in a fully open and transparent manner, all significant contributions to the uncertainty of its measurements, traceable to the international system of units, SI, at the location and time from where they are made. In addition, this uncertainty must be at a level that is considered by the community to be of 'Fiducial reference' quality, i.e., that for a defined spectral domain/application it can be considered 'state-of-the-art' and able to unequivocally serve as a reference for similar measurements from other sensors. The uncertainty of a SITSat should be expected to reach or at least approach that required for key climate science objectives such as those identified in the "SI-Traceable Space-based Climate Observing System: a CEOS and GCICS Workshop" (https://doi.org/10.47120/npl.9319). When used as a reference a SITSat would be expected to have a measurement uncertainty of <0.5 compared to that of its non-SITSat peers.

Note:
1/ If used as a reference, the method used to compare with other sensors and its associated uncertainty to SI, should also be fully documented and evidenced.
2/ The nominal threshold uncertainty to be considered a SITSat for a particular type of measurement/application may increase or reduce over time commensurate with scientific consensus, currently this requires 2-10x improvement over current sensors. Although desirable in the long-term, it is not essential to have a SITSat for all applications and sensor domains and thus the assignment of the classification to a sensor should only be made when the maturity and technology of a particular domain justifies it.
3/ A SITSat peer group would constitute ALL sensors making similar measurements (e.g., spatial and spectral range)

SITSats in Development

CLARREO PATHFINDER - NASA

TRUTHS - ESA



LIBRA - CMA

Motivation for SITSats

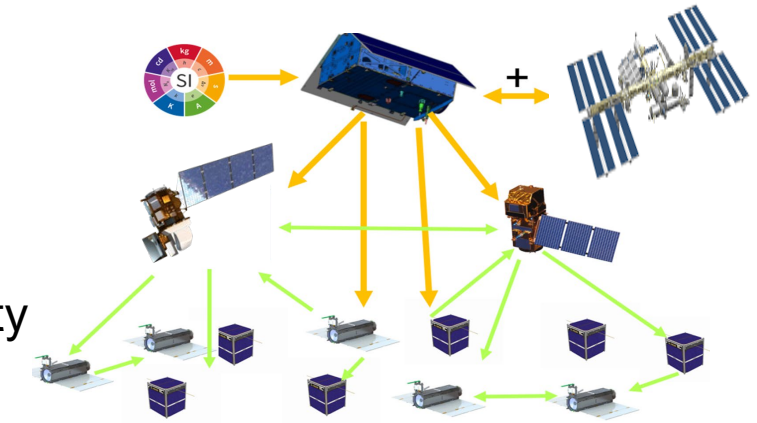
- Desire for ‘Reference/Fiducial’ data that enable unequivocal change detection in relatively short time-scales and mitigate ‘data gaps’ (*particularly for climate*)
  - Robust, transparent quantified evidence of traceability to a reference - ‘QA4EO’
  - Small comprehensively evaluated uncertainties

- ‘System of systems’ Integrated EO data, interoperable/harmonised knowledge of/removal of biases
  - ARD
  - SI-Traceability provides unambiguous trust, space agency agnostic, longevity

- New space – reliance on post-launch calibration, no on-board calibration
  - Reduced cost, complementary observations (*temporal/spatial coverage*)
  - Level playing field, maximal utilisation of investments and assets

- CEOS/GSICS initiatives to establish international references and SI-Traceability
  - Coherent, flexible, reliable anchor to well-established methods
  - Mimics calibration methodologies of all terrestrial ‘industries’
  - Provides a clear label of a specific sensor property but generic to ‘application’

Space-based Intercalibration



SITSat Task Group

- A Task Group to consider the coordination strategy for SITSats was proposed at WGCV-51 (October 2022) and endorsed by CEOS Plenary 2022
- Consensus in WGCV for Task Group to be a joint initiative with GSICS
- Initial tasks: Develop ToR, Objectives, Membership, Lead(s), Work Plan, Outputs / Deliverables
- Agree on a clear definition of criteria that constitute a SITSat *(independent of technology/domain, property of the sensor not necessarily its application)*
- Use ‘well-defined’ examples in the Solar reflective domain as a starting point

Rationale for Task Group

- Recognition, visibility of the new class of sensor to senior levels in space agencies & EO community
  - Noting at least 3 SITSats are currently under-development from different continents

- Similar to CEOS-VCs – coordinate, where appropriate, to facilitate commonality of purpose (shared vision)
  - Maximal utilisation of resources
  - Continuity of ‘service’ (data, coordination of launches)
  - Internationally integrated ‘users’, data source agnostic tools
  - Advocacy from an international ‘multi-agency’ perspective
  - Lessons learnt – enabling new missions/agencies
  - Value > sum of parts

- Establish an agreed minimal set of definitions and principles to distinguish SITSats and their utilisation
  - Independent of application domain or technology

- Seek to build a common user/customer base, transcending individual missions
  - Value/necessity for achieving GEOSS ‘fit for purpose’ solutions to needs of climate & society

Task Group Objectives

- Establish clear definitions of what constitutes a SITSat and the minimal requirements needed to evidence this status
- Serve as a forum for agencies developing/planning SITSat missions to share experiences and knowledge
- Discuss collaboration opportunities, joint cal/val activities, campaigns, and data sharing
- Provide an opportunity for mission coordination, gap analyses, efficient tasking, and acquisition planning
- Facilitate coordination on technical topics, reporting of uncertainty and traceability information, interoperability, and methods of dissemination
- Aim for a systems-based approach along the lines of a CEOS Virtual Constellation, rather than missions being developed and operated in isolation

Task Group Deliverables

- Establish a clear definition of what constitutes a SITSat and minimal requirements needed to evidence this status
- Develop a roadmap (whitepaper) of what a SITSat enabled observing system looks like
- Data sharing based on a systems approach
- Communications strategy for awareness raising / key messages / utility for observing system / integrated multi-SITSat observing system

Progress on Task Group Actions

- Developed draft Terms of Reference for SITSat Task Group (May 2023)

- Focussed SITSat session at WGCV-52 (June 2023)
  - Reviewed: team motivation, objectives, leads
  - Discussed: initial tasks, priorities, approach
  - Endorsed: Terms of Reference
  - Action: Call for Task Group members

- Kick-off teleconference of SITSat Task Group members (October 2023)
  - SITSat definition agreed by members
  - Set of initial tasks, priorities and deliverables outlined
  - Co-leads based approach for sharing work proposed
  - Meeting mode / frequency discussed

- Co-leads for the SITSat Task Group will provide regular reports at WGCV and GSICS meetings as appropriate

Task Group Members

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Thank you

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