SI-Traceable Satellite (SITSat) Task Group

(supported by WGCV and GSICS members)

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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, *metrologically 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 (ideally SI) - ‘QA4EO’
  - Small comprehensively evaluated uncertainties
    - Allowing ‘stability’ criteria for climate to be robustly tied to invariant reference (SI)

❖ ‘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, comprehensive/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’
Rationale for Task Group

❖ Recognition, visibility of the new class of Instrument 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
  - How and what to present as Uncertainty/SI-traceability evidence (standardized content and/or format)

❖ Develop a **roadmap** (whitepaper) of what a SITSat enabled observing system looks like

❖ **Data sharing** based on a systems approach
  - Common (interoperable?) reporting/archive grid for climate? (Spectral/spatial)
  - Common Grid for S2S calibration?
  - Format – what info to report and how?
  - Mirrored data stores/access?
  - Minimal set of common ‘targets’ (comparison/gap filling etc)

❖ **Communications strategy** for awareness raising / key messages / utility for observing system / integrated multi-SITSat observing system
FIDUCEO-like – TRUTHS Radiance

Fiduceo like analysis of end to end traceability and uncertainties – an exemplar for other missions

‘effects table’ for each error source
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<thead>
<tr>
<th>Task Group Members</th>
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Thank you