Copernicus

SENTINEL 2

Mission Performance Centre

CS GROUP

ARGANS

esa

European Commission

SENTINEL-2 AND LANDSAT8 RADIOMETRY INTERCOMPARISON USING RADCALNET DATASET AND DIMITRI-TOOLBOX

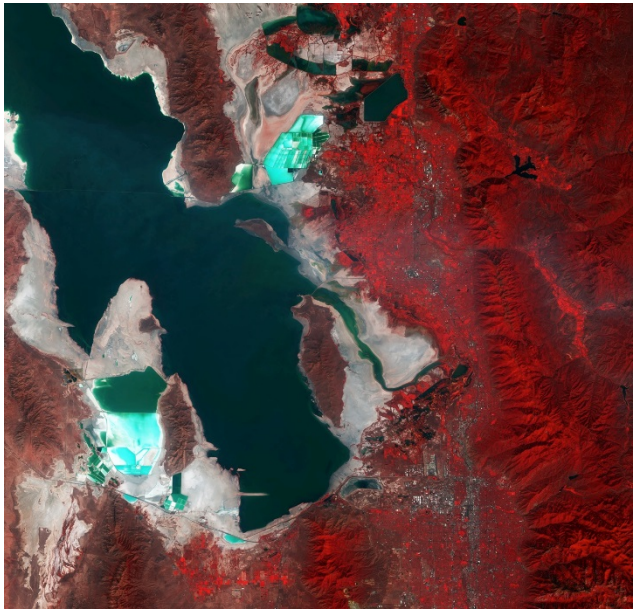
B. Alhammoud, C. MacKenzie-ARGANS; S. Clerc-ACRI-ST; C. Quang-CS-Group; B. Berthelot- Magellium;
R. Q. Iannone- Rhea-Group; V. Boccia-ESRIN; M. Bouvet-ESTEC

calcon
www.calcon.sdl.usu.edu

CS ACRI ST ARGANS elecnor deimos gmv AIRBUS DEFENCE & SPACE ThalesAlenia Space IGN ONERA Telespazio A Finmeccanica/Thales Company DLR

OBJECTIVES

- Validation of the Radiometry calibration and temporal monitoring of Sentinel-2/ MSI performance
- Sensor-to-sensor inter-comparison (e.g. LANDSAT-8/OLI)



Credit: Copernicus Sentinel data (2015)/ESA, CC BY-SA 3.0 IGO

AGENDA

- Overview of the datasets
- Methods & Tools
- Results
- Conclusions

Banks peninsula NZ; as seen by S2A/MSI
Courtesy to J. Jackson (S2MPC)

SENTINEL 2

Mission Performance Centre

OVERVIEW OF THE DATASETS

OVERVIEW OF THE DATASETS: RADCALNET

RadCalNet | CEOS Committee on Earth Observation Satellites | Bahjat Alhammoud

Welcome to the Radiometric Calibration Network portal

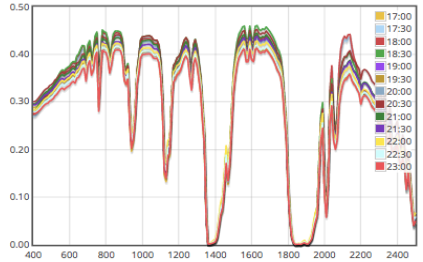
The portal provides access to all RadCalNet datasets, allowing users to visualize and download data acquired by the four instrumented reference test sites.

- University of Arizona's site at Railroad Playa, Nevada, USA,
- AIR's site at Baotou, China,
- the CNES site at La Crau, France,
- the ESA/CNES site in Gobabeb, Namibia,
- the new AIR sandy site at Baotou, China.

Text format, defined in:
R2-RadCalNetRequirements-DataFormatSpecification_V10.pdf
hyperlink download all data

- 30 minute intervals
  9 am to 3 pm local time
- Nadir view only
- 10-nm intervals
  (400-2500 nm)

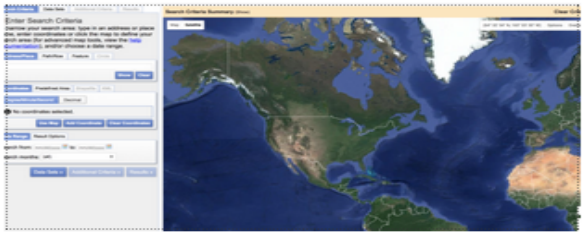
Last output data
RVUS00_2021_147_v03.04.output



(More details in Bouvet et al. 2019: https://doi.org/10.3390/rs11202401)

OVERVIEW OF THE DATASETS: SENTINEL-2/LANDSAT8

Collection 1 Data Access



Landsat Collection data products are available to download at no charge from EarthExplorer.

Sentinel-2/MSI:

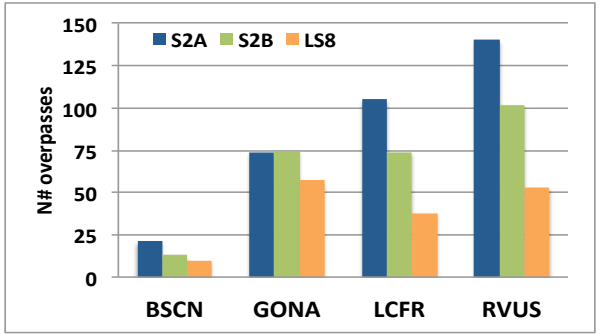
L1C: TOA reflectance + Metadata + AUX-data

13 bands VNIR/SWIR

LANDSAT-8/OLI:

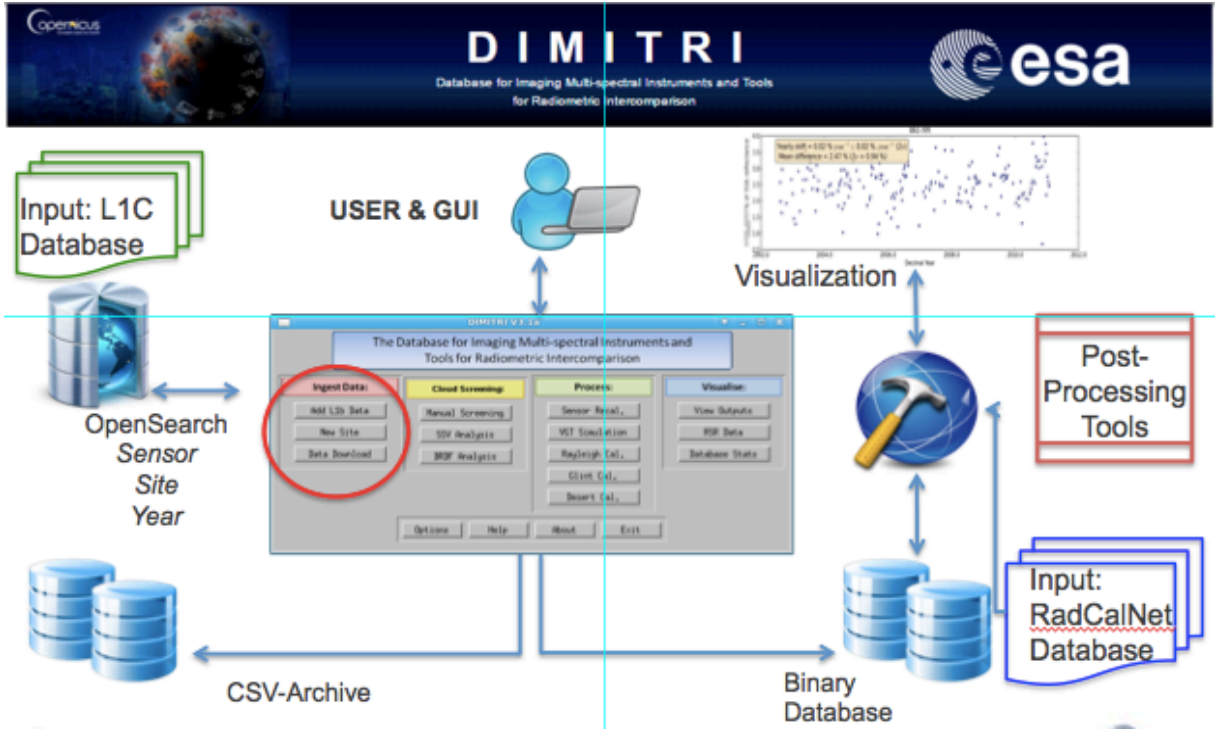
L1TP: TOA reflectance + Metadata

8 bands VNIR/SWIR

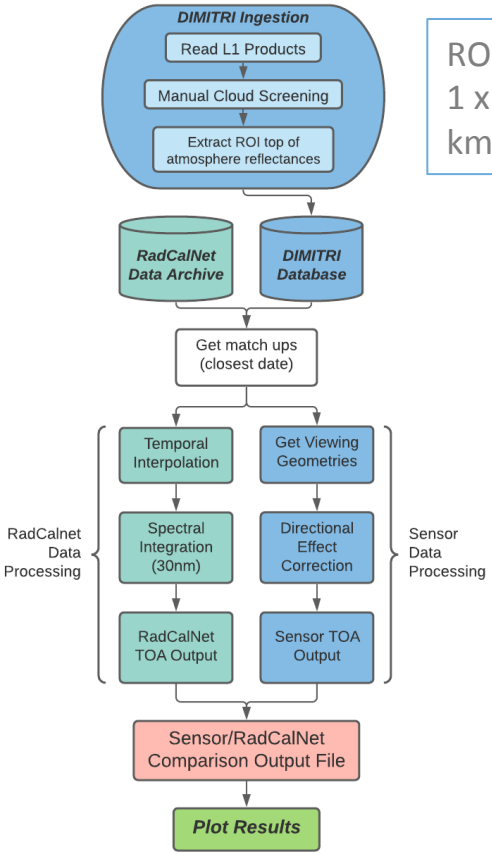


METHODS AND TOOLS

METHODS AND TOOLS: DIMITRI-TOOLBOX



https://dimitri.argans.co.uk/



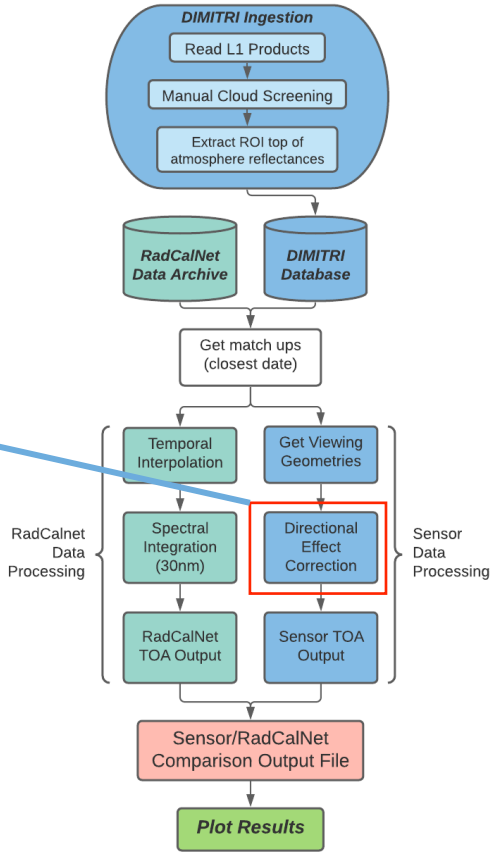
ROIs: 1 x 1 km^2

➔ Directional-effects Correction
(following *Jing et al. 2019*)

$$\rho^{c}_{i,\lambda} = \frac{\rho^{r}_{\lambda} \times \rho^{MSI}_{i,\lambda}}{a_{\lambda} \times x + b_{\lambda}}$$

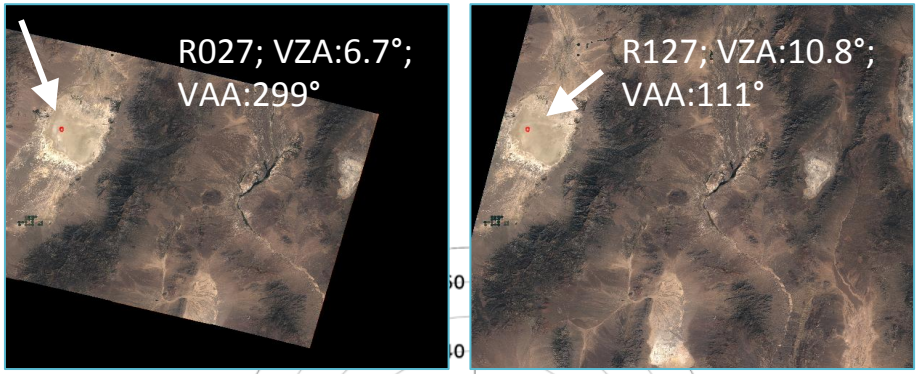
Where $x = \sin\theta_z \cos\theta_a$

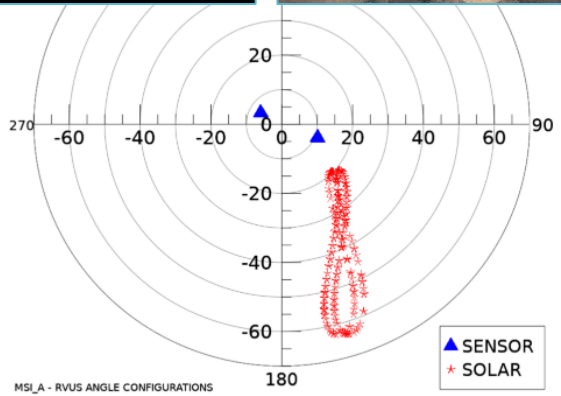
$$Ratio\ (\lambda) = \frac{\rho^{TOA}_{S2}(\lambda)}{\rho^{TOA}_{RCN}(\lambda)}$$

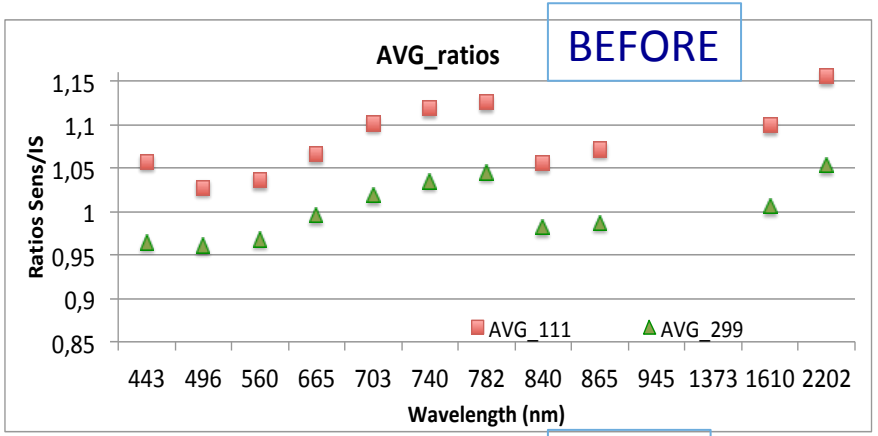


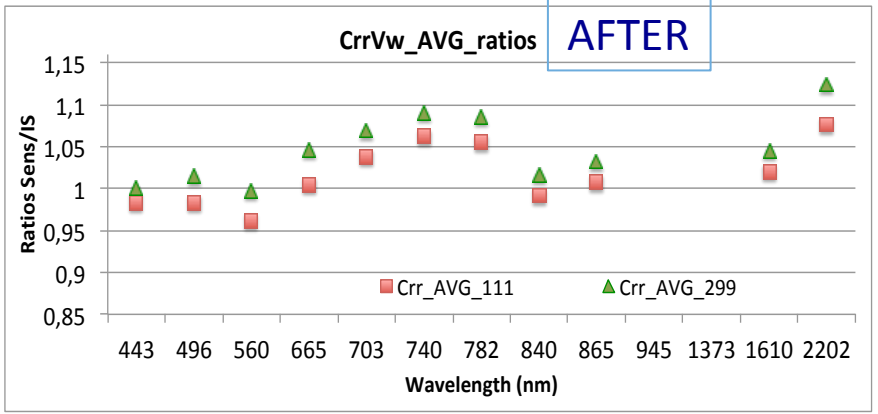
➔ Example: **S2A/MSI over RVUS in**

(Alhammoud et al. 2019 @ IEEE-Xplore)





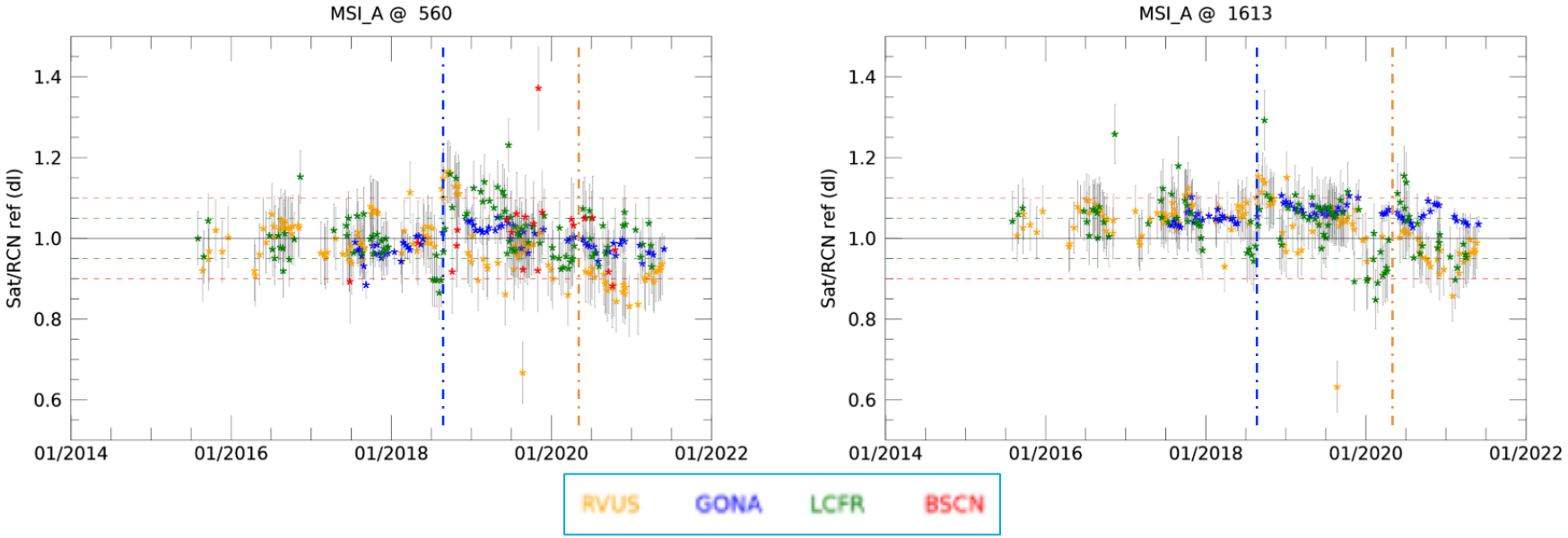




RESULTS WITH CORRECTED DATA

RESULTS: MSI-A

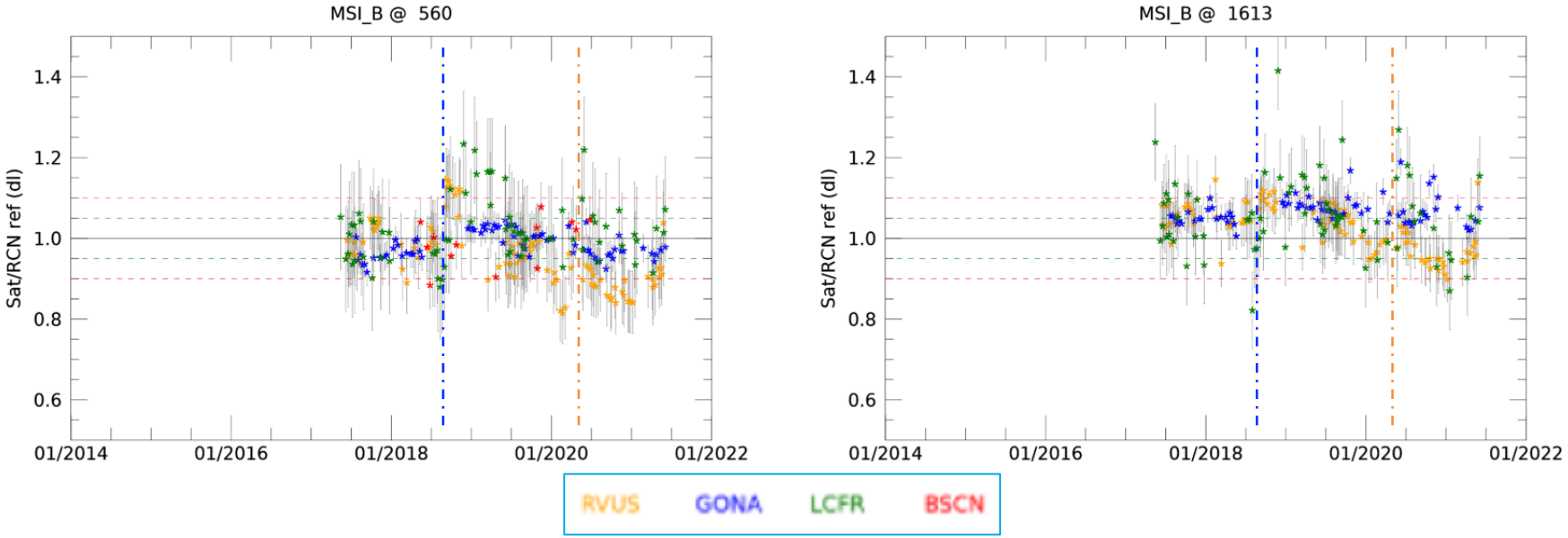
➔ Ratio of sensor TOA-reflectance to RadCalNet TOA-reflectance



N#	340	319
AVG	0.993	1.040
STD	0.072	0.064

RESULTS: MSI-B

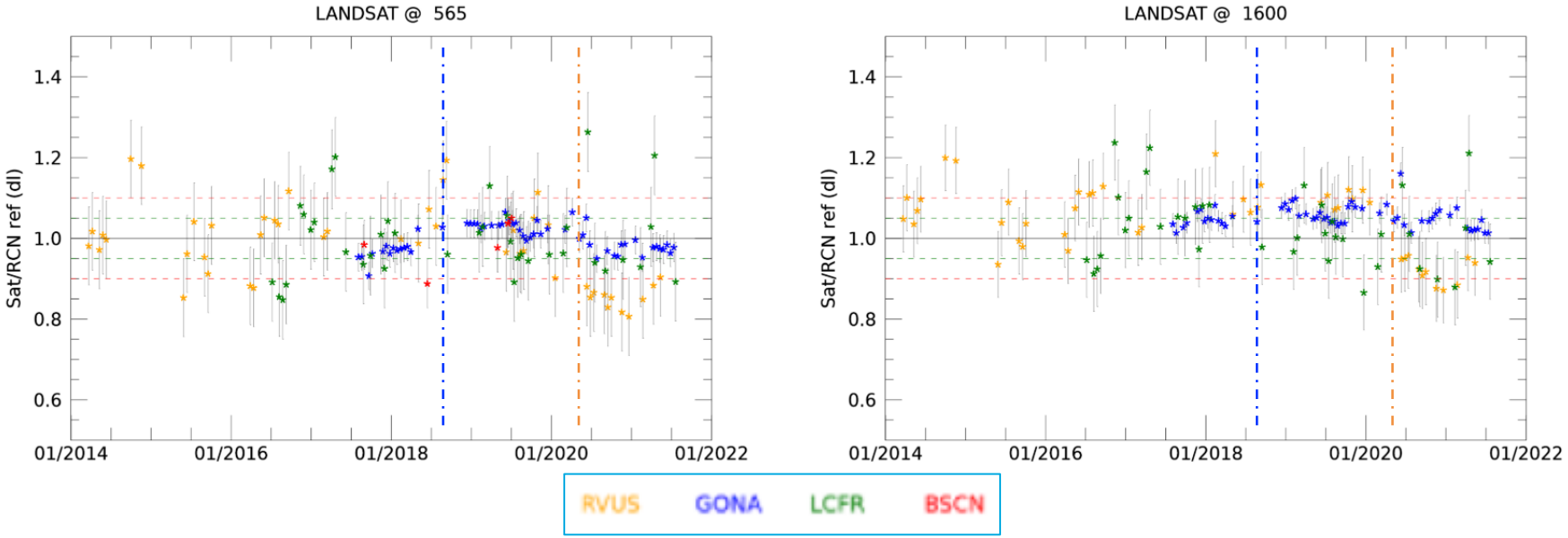
➔ Ratio of sensor TOA-reflectance to RadCalNet TOA-reflectance



N#	264	251
AVG	0.988	1.050
STD	0.094	0.068

RESULTS: OLI

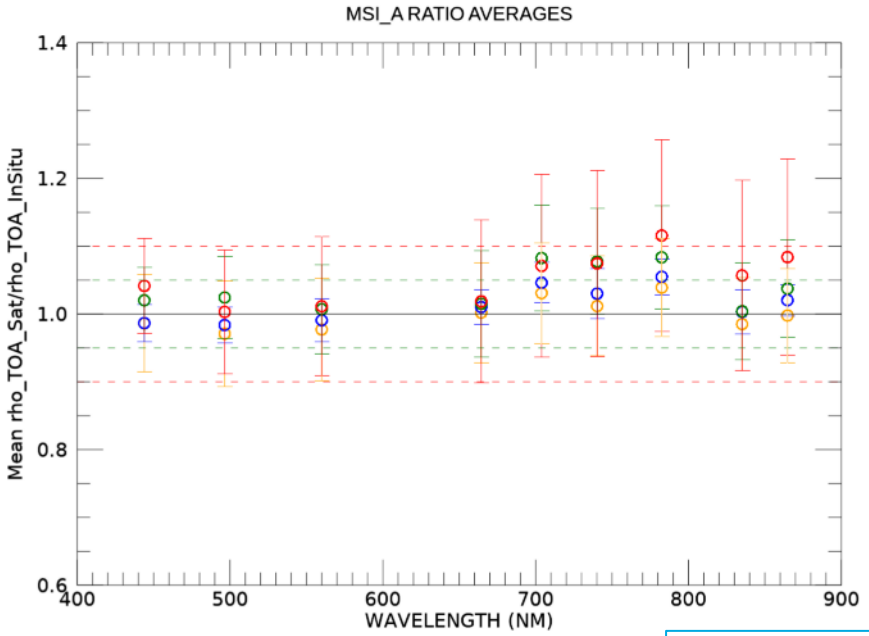
➔ Ratio of sensor TOA-reflectance to RadCalNet TOA-reflectance

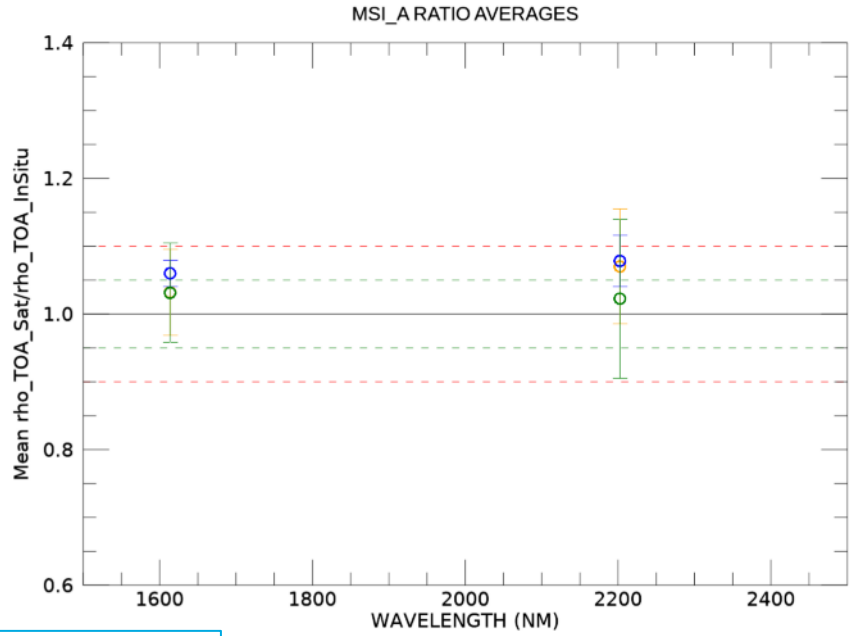


N#	158	148
AVG	0.991	1.038
STD	0.096	0.082

RESULTS: SENTINEL-2A

➔ Ratio of sensor TOA-reflectance to RadCalNet TOA-reflectance

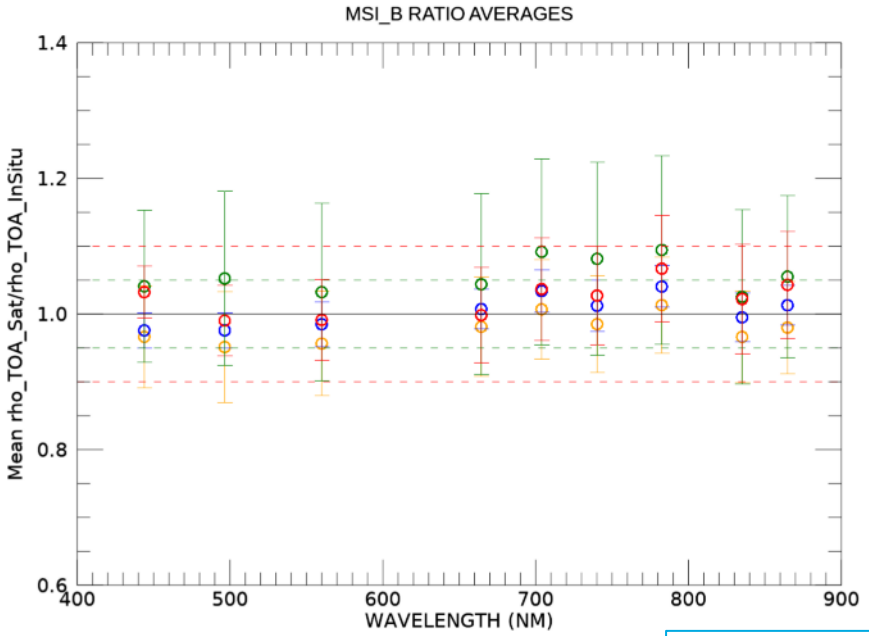


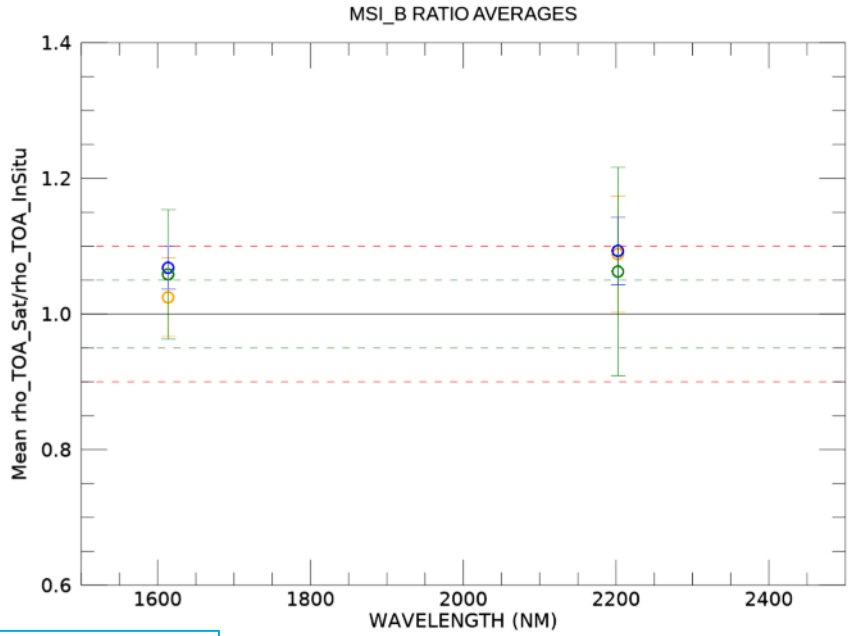


RVUS GONA LCFR BSCN

RESULTS: SENTINEL-2B

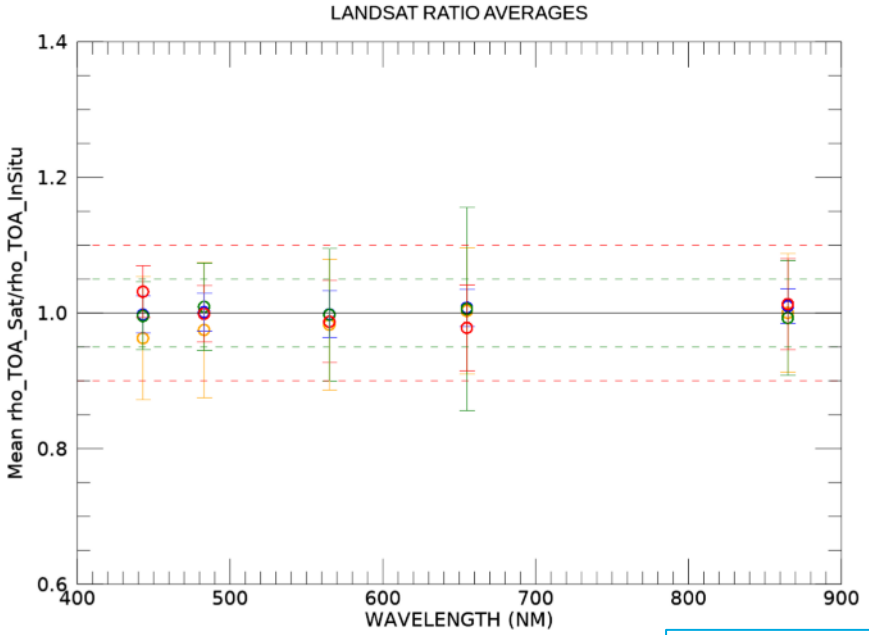
➔ Ratio of sensor TOA-reflectance to RadCalNet TOA-reflectance

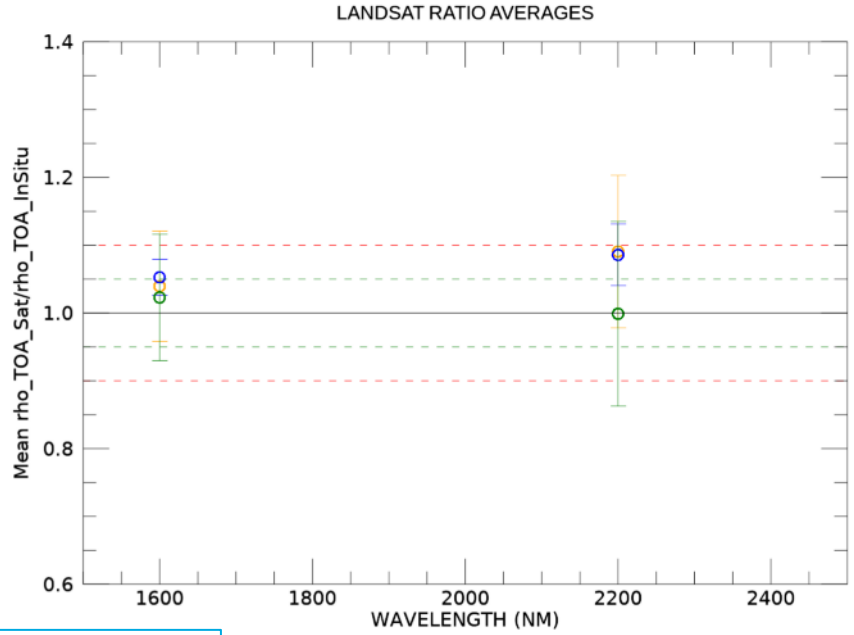




RESULTS: LANDSAT-8

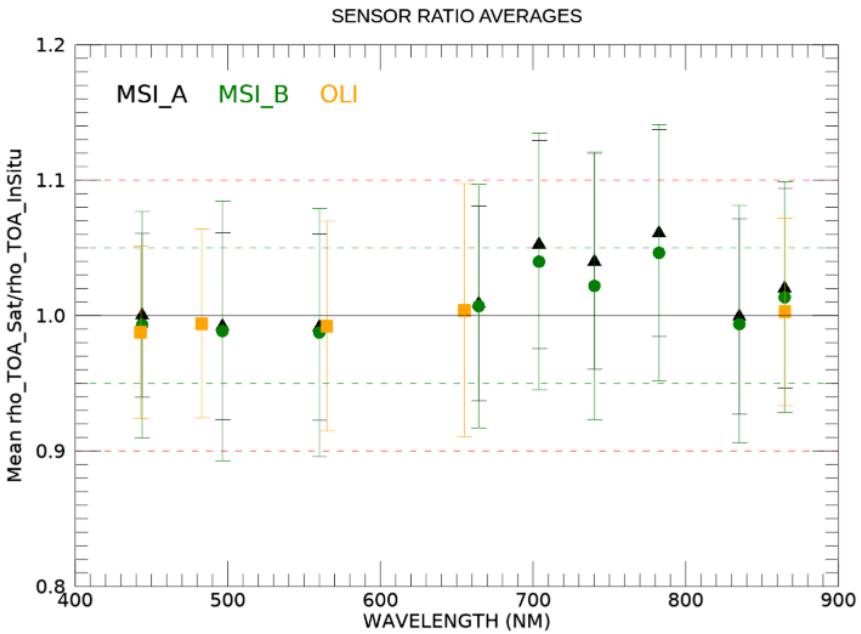
➔ Ratio of sensor TOA-reflectance to RadCalNet TOA-reflectance

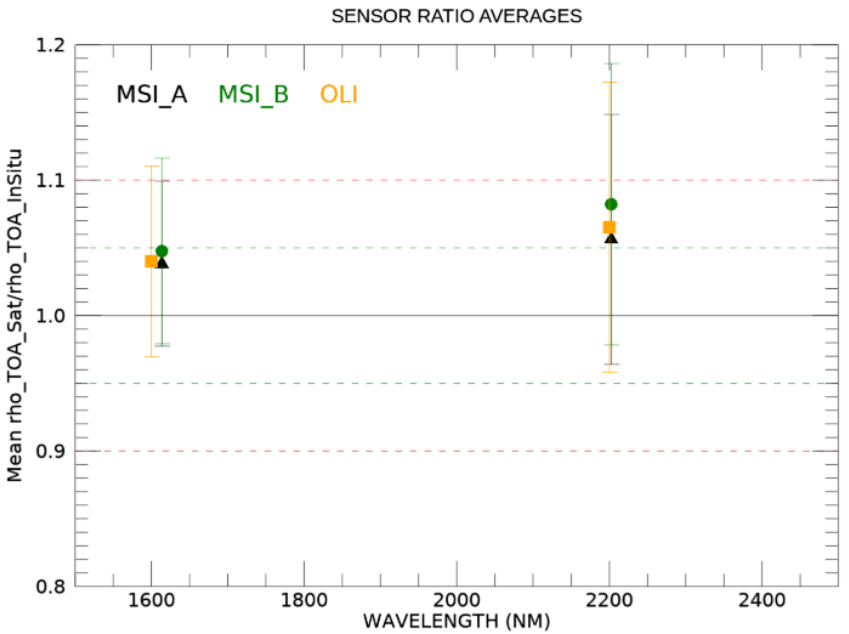




RESULTS: SENTINEL-2 VS LANDSAT-8

➔ Ratio of sensor TOA-reflectance to RadCalNet TOA-reflectance





The analysis of about 750 overpass from RadCalNet over BSCN, GONA, LCFR and RVUS show:

- A directional effect is obvious at both sites (LCFR and RVUS)
- The correction of the directional effect improves the results over the individual orbits by about 5%
- The average ratios has been improved by about 1%.
- Good consistency over the four sites for the three sensors (<5%)
- Good consistency between Sentinel-2 and LANDSAT-8 (<1.5%)

Next steps:

- To apply site-BRDF models where available

➔ For more details:

remote sensing

MDPI

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]

remote sensing

MDPI

Article

Evaluation of RadCalNet Output Data Using Landsat 7, Landsat 8, Sentinel 2A, and Sentinel 2B Sensors

Xin Jing *, Larry Leigh, Cibele Teixeira Pinto and Dennis Helder

IEEE JOURNAL OF SELECTED TOPICS IN APPLIED EARTH OBSERVATIONS AND REMOTE SENSING

Sentinel-2 Level-1 Radiometry Assessment Using Vicarious Methods From DIMITRI Toolbox and Field Measurements From RadCalNet Database

Bahjat Alhammoud, Jan Jackson, Sebastien Clerc, Manuel Arias, Catherine Bouzinac, Ferran Gascon, Enrico G. Cadau, Rosario Q. Iannone, and Valentina Boccia


Copernicus
SENTINEL 2
Mission Performance Centre
GROUP
ARGANS
esa
European Commission
Thank you for lestning!
Thanks to:
S2MPC-team and DIMITRI-team for their support
RadCalNet-team for providing the dataset
balhammoud@argans.co.uk
ACRI ST
ARGANS
elecnor deimos
gmv
AIRBUS DEFENCE & SPACE
ThalesAlenia Space
IGN
ONERA
Telespazio
A Finmeccanica/Thales Company
DLR