

Sentinel-3 SLSTR VIS and SWIR Channel Vicarious Calibration Adjustments

Sentinel-3 Mission Performance Centre

Introduction

This document provides recommended adjustments to the SLSTR VIS and SWIR channels Level-1 radiometric data.

The proposed vicarious adjustments are based on analysis of vicarious calibration results from different groups including:

- RAL Space for the MPC comparisons with AATSR and MODIS-A over desert sites.
- CNES assessment using the SADE/MUSCLE vicarious calibration system.
- Radiative Transfer Modelling of the Libya-4 desert site by Rayference.
- University of Arizona comparisons against in-situ field measurements of the Railroad Valley Playa RadCalNet site.

A detailed description of the results and analysis is provided in [1] which is available via the Sentinel-3 online document library [2].

Correction Factors

Table 1: VIS-SWIR Calibration Adjustment Factors Based on Vicarious Calibration analysis. Note S4 is not included because the vicarious calibration techniques do not extend to this band.

Nadir View

	S1	S2	S3	S5	S6
Correction	0.97	0.98	0.98	1.11	1.13
Uncertainty	0.03	0.02	0.02	0.02	0.02
Input Analysis	UoAz Rayference CNES	UoAz MPC (RAL) Rayference CNES	UoAz MPC (RAL) Rayference CNES	UoAz MPC (RAL) Rayference CNES	UoAz MPC (RAL) Rayference CNES

Oblique View


	S1	S2	S3	S5	S6
Correction	0.94	0.95	0.95	1.04	1.07
Uncertainty	0.05	0.03	0.03	0.03	0.05
Input Analysis	Rayference CNES	MPC (RAL) Rayference CNES	MPC (RAL) Rayference CNES	MPC (RAL) Rayference CNES	Rayference CNES

Note: Uncertainty estimates are at k=1.

The correction is applied by simply multiplying the radiance values in the level-1 products with the correction factors presented in Table 1. I.e. using:

$$L1_Radiance_Corrected = L1_Radiance \times Adjustment_Factor$$

There are separate correction factors for the nadir and oblique views. For channels S5 and S6, the same correction factor should be used for the A and B stripe images.

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These corrections apply to all view zenith angles.

Limitations

The corrections are calculated for S3A but are equally applicable to S3B because S3B has been harmonised to S3A during the commissioning phase [3]. Residual differences (<1%) between S3A and S3B after harmonisation have yet to be applied.

The corrections are mainly derived from bright desert surfaces. Application to dark surfaces is to be further evaluated: e.g. some evidence that residual non-linearity exists from the tandem analysis, which have yet to be corrected for. An analysis is in progress to align the non-linearity corrections.

Long term drift effects are not accounted for. However, analysis over stable reference targets suggests that the long-term stability is very good with drift rates <0.3% per year observed. A separate correction for drift based on the long-term trend analysis will be provided.

Uncertainties in the calibration factors are derived from the variances of the different analysis methods and are the best estimate at the time of writing.

References

[1] Smith D., "Assessment of Visible and Short Wavelength Radiometric Calibration using Vicarious Calibration Methods", 2020, Sentinel-3 MPC project document - S3MPC.RAL.TN.010

[2] Sentinel-3 on-line document library <https://sentinel.esa.int/web/sentinel/user-guides/sentinel-3-slstr/document-library> - accessed 10-July-2020

[3] S3-RP-RAL-SL-125 Sentinel 3B SLSTR RAL Phase E1 In-Orbit Commissioning Report