EnMAP Spectral and Radiometric Calibration

D. Marshall Ingram¹,*, K. Alonso², S. Baur³, M. Bachmann⁴, B. Gerasch¹, M. Habermeyer⁴, S. Holzwarth⁴, M. Langheinrich¹, M. Pato¹, R. de los Reyes¹, M. Schneider¹, P. Schwind¹, H. Witt¹, E. Carmona¹ and EnMAP Team

¹ German Aerospace Center (DLR), Remote Sensing Technology Institute, Weßling, Germany
² RHEA Group c/o European Space Agency (ESA), Frascati, Italy
³ OHB-System AG, Weßling, Germany
⁴ German Aerospace Center (DLR), German Remote Sensing Data Center, Weßling, Germany

*David.Marshall@dlr.de

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EnMAP Onboard Calibration

1. **OBCA-Radiometric Stability** Lamp calibration with white spectralon sphere, frequency: weekly

2. **OBCA-Spectral** Spectral calibration with doped spectralon sphere, frequency: 2 weeks

3. **Absolute Radiometric** Sun calibration with sun diffuser, frequency: monthly

4. **Linearity Calibration** with LEDs in front of focal plane, frequency: monthly

5. **A. Shutter Calibration Mechanism** Deep Space calibration, frequency: monthly

5B. **B. Shutter Calibration Mechanism** dark measurement, frequency: before and after every image acquisition
Radiometric Calibration Measurements: April – December 2022
First Calibration Measurements

- OBCA-Radiometric Lamp
- OBCA-Spectral
- Linearity
Change in Calibration Measurements

- OBCA-Radiometric Lamp

- OBCA-Spectral

- Linearity
Degradation Distribution Pattern

- Degradation map from OBCA-Radiometric Lamp in VNIR HG
- Percentage change from May – November 2022
Absolute Radiometric Calibration Coefficients

- **VNIR Radiometric Calibration Coefficients**
  - **SWIR Radiometric Calibration Coefficients**

- **VNIR Response Non Uniformity**
  - **SWIR Response Non Uniformity**

- **VNIR Gain Matching**
  - **SWIR Gain Matching**
Dynamic Coefficients

Due to fast degradation in VNIR sensor, calibration tables used in L1B processing could become outdated quickly

Solution: model VNIR RNU and radiometric behaviour with „Dynamic Coefficients“ from an exponential-polynomial function

Dynamic Coefficients are used between April – December 2022 rather than coefficients in calibration tables

\[ \text{Coefficient}^{RNU/CC} = A e^{Bx} + Cx^3 + Dx^2 + Ex + F \]

\( X \) is days from 1st April 2022
Radiometric Calibration Measurements: January – September 2023
Change in Calibration Measurements

- OBCA-Radiometric Lamp
- OBCA-Spectral
- Linearity
Change in Degradation per Day

- Degradation per day calculated from OBCA-Radiometric, OBCA-Spectral and Linearity measurements
- Large values during Commissioning Phase (-0.05% per day)
- Values decreasing over time
- Approximately zero degradation now (with some variability)
- Cause still unknown
- Total loss around 10%
Calibration Coefficients

**VNIR Radiometric Calibration Coefficients**

**SWIR Radiometric Calibration Coefficients**

**VNIR Response Non Uniformity**

**SWIR Response Non Uniformity**

**VNIR Gain Matching**

**SWIR Gain Matching**
Spectral and Dark Calibration Measurements: April 2022 – September 2023
Spectral stability

- Good spectral stability: within requirements (0.5 nm VNIR, 1.0 nm SWIR)
- 6 spectral updates during mission (4 during Commissioning, 1 after outage, 1 for SWIR band swap)
- Good Dark Signal stability
  - Average change close to 0 DN
## Summary

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<td>Degradation (10%)</td>
<td>Stable</td>
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<td>Changes due to degradation, dynamic coefficients used</td>
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