International Ocean Colour Science Meeting 2013

Satellite Instrument Pre- and Post-Launch Calibration

Tuesday 7th May 2013, Darmstadt, Germany

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The perfect OCR Mission ?

- **A perfect instrument (system)**
  - noise, polar, stray-light, spectral response, variation with field-of-view

    → **unrealistic or too expensive**
- **A perfect characterization**
  - Pre-flight : full characterization
  - In-flight : complete on-board device

    → **unrealistic or too expensive**
- **A perfect situation**
  - no evolution, no issues, everything as expected

    → **unrealistic (from experiences)**

Context

- Knowledge of the instrumental radiometric behavior is crucial for OC applications
  - because the signal of interest is roughly 10% of the TOA signal
  - very challenging accuracy : 0.5% on the TOA reflectance
  - that's not only 0.5% on calibration, but for the total of all contributors

    → challenging

- Experience and feedback from past/current OCR missions
  - Lessons learnt from individual past/current mission
  - Also feedback from cross-comparison, or cross-validation

Context

- IOCCG Report#13 Mission Requirements for Future Ocean-Color Sensors
  - Multi-agency discussion and consensus
  - State of the art report / recommendations
- Need for international/common effort
  - CEOS OCR-VC Virtual Constellation : whitepaper from the INSITU-OCR
  - Calibration Task force
  - other example : GSICS

Characterization keynotes

- **Pre-launch characterization according Report#13**
  - Absolute calibration (radiance/reflectance)
  - Relative calibration
  - Spectral characterization (inc. rejection)
  - Straylight characterization
  - Polarization
  - Linearity, dynamic, SNR
  - Temperature and offsets
  - Registration, MTF

Characterization vs Calibration

- Radiometric behavior of the instrument
  - Ex: link the input radiance I to the measured digits X

$$X_{lp}^{a} = \left(\frac{Es}{\pi}.G.t\right).A.T^{a}.g_{lp}^{a}.SL_{Xlp}^{a}.NL.\left[P1_{lp}^{a}.I^{a} + P2_{lp}^{a}.Q^{a} + P3_{lp}^{a}.U^{a}\right] + SL_{\Sigma Xlp}^{a} + C_{lp}$$

Absolute Calibration

Equalization Variation in fov

Straylight Correction (proportional)

Non-linearity correction

Polarization correction

Straylight Correction (additive)

Dark current correction

- Several characterizations need to be done (before cal) in order to

1/ obtain a quantity that is simply proportional to the input radiance

2/ guarantee the general radiometric quality

Characterization keynotes

- **Post-launch characterization according Report#13**
  - Ideally all pre-launch characterization → as if unrealistic
  - Usually more « validation » if not characterization
  - Calibration adjustment always required
    - vicarious adjustment for level-2 but need level-1 consistency/accuracy first
  - Trending is crucial

- **Additional aspects**
  - Be prepared to the unexpected (lessons learnt from MODIS)
  - About the interest to provide cross-comparisons or validation approaches
    - On-board = very useful, but also need validation

Planning

14:45-14:50 Introduction
14:50-15:00 OCM-2 calibration and characterization
15:00-15:10 MERIS calibration and characterization
15:10-15:20 OLCI calibration and characterization
15:20-15:30 GOCI calibration and characterization
15:30-15:40 MODIS calibration and characterization
15:40-15:50 SGLI calibration and characterization

15:50-15:55 *Break*

15:55-16:05 GSICS
16:05-16:15 IOCCG Calibration Task Force
16:15-17:15 Discussion on future cooperation
Summary