Radiometric Validation of *Sentinel-3*

by

Kevin Ruddick, Dmitry Van Der Zande and Quinten Vanhellemont

(RBINS, ODNature, REMSEM)
Radiometric Validation of Sentinel-2

by

Kevin Ruddick, Dmitry Van Der Zande and Quinten Vanhellemont

(RBINS, ODNature, REMSEM)
Radiometric Validation of PROBA-V!

by

Kevin Ruddick, Dimitry Van Der Zande and Quinten Vanhellemont

(RBINS, ODNature, REMSEM)
Multi-mission context for sediment transport (not exhaustive!)

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Standard Water Products exist

RBINS/ACOLITE multi-mission atmospheric correction
RBINS multi-mission approach

L1 data (some L2)

Atmospheric Correction (+vicarious calibration?)
ACOLITE for high res
BEAM/SEADAS for med res

Validation
In situ matchups
Intersensor comparison

Thematic Exploitation
Images, time series,
multitemporal composites,
higher level products, etc.

Users
(EU water quality reporting, environmental protection,
sediment transport, ecosystem modellers, etc.)
ACOLITE

• ACOLITE atmospheric correction software for Landsat-8 publicly released in 2014
• RBINS in-house versions for Landsat-5, Pléiades, PROBA-V

ACOLITE/S2 public release at ESA Living Planet [Quinten Vanhellemont]


Sample PROBA-V imagery: 1/3
(Top Of Atmosphere)

Belgian coastal waters 2015-10-02
TOA “RGB”
Sample PROBA-V imagery: 1/3
(ACOLITE Atmospheric Correction)

Belgian coastal waters 2015-10-02
Atmospherically Corrected water reflectance (RED)
Sample PROBA-V imagery: 2/3
(Top Of Atmosphere)

La Plata estuary
2015-09-18
TOA “RGB”
Sample PROBA-V imagery: 2/3 (ACOLITE Atmospheric Correction)

Proba-V SWIR band very useful!

La Plata estuary
2015-09-18
Atmospherically Corrected water reflectance (RED)
Radiometric Validation: learning from MERIS

10 years of MERIS validation data

• Lesson learned by RBINS/MUMM:
  For radiometric validation don’t make seaborne cruises, use continuously operating autonomous instruments

[MERIS 3rd reprocessing data validation report, ACRI, 2012]
Data courtesy of PIs (D. McKee, K. Ruddick, D. Siegel, S. Kratzer) and AERONET-OC PIs (G. Zibordi, G. Schuster, S. Kratzer, B. Gibson), matchup using MERMAID
NASA/AERONET-OC network (currently 15 sites inc 2 BE)

• Belgium is 2nd only to USA for in situ radiometric validation capacity

NASA/JRC-led network [Zibordi et al, 2009]
• NASA calibration of instruments
• RBINS purchase, deployment, operation and daily data transmission
• NASA NRT data processing and distribution
Close-up on Belgium

More info at ESA Living Planet [Dimitry Van der Zande]

Thanks to CPOWER support

Thanks to Afdeling Kust support

Belgian waters and the location of the two new AERONET-OC sites. RGB composite from Landsat-8 on 8.9.2014 at 10:40 UTC
Example of data (yesterday)

(Not much sun)
Example of Validation (Landsat-8)

Zeebrugge site

- AERONET-OC data used to validate Landsat-8 atmospheric correction

**Figure 4** Normalised water-leaving radiance spectra from Landsat-8/OLI and the Aeronet-OC station at MOW1, left to right, 2014-03-16, 2014-04-01 and 2014-04-17. OLI spectra are plotted for the VR2014 (solid black) and VR2014-SWIR (dashed red) processing. The vertical bars on the OLI spectra denote the range between the 10th and 90th percentile within a 17x17 pixel box around the matchup pixel, corresponding to the spatial variability in a ~0.5 km pixel. Level 1 Aeronet-OC data is plotted, the closest matchup (t_5) in solid blue line, and the second closest matchup (t_1) in the dashed blue line.

Spectral bands: AERONET-OC vs Satellites

Optimal spectral band-shifting algorithms under development ...

More info at ESA Living Planet [Dimitry Van der Zande]
Future developments: hyperspectral?

BE?/HYPERNET-OC

AERONET-OC
CIMEL SEAPRISM instrument
412-440-500-531-555-670-870-1020nm
(5/19 S3/OLCI bands… PROBA-V bands are shifted and wider)

BE?/HYPERNET-OC
TRIOS/RAMSES instrument
Hyperspectral 350-900nm
⇒ All bands, all sensors
⇒ No band-shift/widening errors
Future developments: international network of in situ backscatter sensors?

- BE-RBINS/ARG-IAFE (A. Dogliotti) project

Underwater optical backscatter
Two angles: 90° and 135°
Anti-fouling shutter
+Data logger, transmission, etc.

For validation of Suspended Particulate Matter and turbidity products from OLCI, Sentinel-2, Landsat-8, Pléiades, MODIS, VIIRS, SEVIRI ... and PROBA-V
[See poster by Ana Dogliotti at ESA-Living Planet 2016]
## Multi-mission context for sediment transport (not exhaustive!)

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CONCLUSIONS

• Radiometric validation most efficient from autonomous, continuously operating instruments (AERONET-OC)

• Multi-mission validation! (also A/C and exploitation)

• Belgium is 2nd best-equipped country in world for radiometric validation over water

• BE AERONET-OC sites: 1. Turbid, 2. Clear water, 3…?

• RBINS suggests upgrade to hyperspectral international network (“HYPERNET-OC”)

• Also development of optical backscatter network (“TURBINET”)

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The End