Using NIR and SWIR wavelengths for turbid water corrections:
the SIMEC Environment Correction
and
in-situ evidence of non-zero reflectance

Els Knaeps, Sindy Sterckx, Dries Raymaekers, Kevin Ruddick
(MUMM), Ana Dogliotti (IAFE)

Presented at Workshop on atmospheric correction of ocean color satellite data in coastal waters:
Algorithms and uncertainties; 13-14 June, 2012 Wimereux, France

SIMEC Environment Correction Background

A “similarity” NIR reflectance spectrum is defined by normalization at 780 nm (Ruddick et al., 2006).

-> can be used to detect and correct adjacency effects

SIMEC application to airborne data

SIMEC application to MERIS: inland lakes

Lake Trasimeno (Italy)

Knaeps, E., S. Sterckx, K. Ruddick, C. Giardino, B. Proceedings of Ocean Optics XX, 2010

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SIMEC Background: Workflow

- Atmospheric correction (Modtran-based)
- AOT from land targets or sun photometer readings
- Ignoring adjacency effects
- Normalization at 780 nm
- Deviations from the NIR similarity spectrum = measure of the magnitude of the adjacency effect.
- Iteratively calculate contributing background until agreement with NIR similarity spectrum
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SWIR potentially interesting!
- Because of pure water absorption and atmospheric windows

Pure water absorption coefficient (Pope & Fry, 1997; Aus et al., 1993)

SWIR potentially interesting!
- For atmospheric correction and TSM retrieval

SWIR potentially interesting!
For atmospheric correction and TSM retrieval

- Clear and turbid waters: SWIR black pixel assumption
  (Wang and Shi, 2007; Gordon and Wang, 1994)
- Extreme turbid waters: new atmospheric correction $\leftrightarrow$ TSM retrieval
  (saturation at shorter wavelengths?) (Shi and Wang, 2009)

BUT

- Only little knowledge available
- Instrumentation lacking
  - To measure IOPS in the SWIR
  - To measure water reflectance in the SWIR

Intercomparison of ASD and TRIOS water reflectance measurements;


TSM concentration (mg L$^{-1}$)

Simulations with Hydrolight and SIDPS from the Scheldt

APEX water reflectance spectra
CONCLUSIONS

- Black pixel assumption invalid for Scheldt estuary. A significant increase in reflectance was observed between 950 and 1150 nm where pure water absorption has a local minimum.
- SNR and atmospheric influences do not seem to alter these findings.

**WARNING** when using the SWIR black pixel assumption for atmospheric correction

- Need for an adjusted atmospheric correction for highly turbid waters. (Incorrect use of the black pixel assumption in atmospheric correction can lead to an overestimation of the aerosol contribution and a significant underestimation of the derived water reflectance.)

- Correlation of water reflectance with TSM concentration.

- Suggest that spectral bands beyond 1000 nm contain information on the concentrations of optical constituents.

SEASWIR: REMOTE SENSING OF TURBID WATERS IN THE SHORT WAVE INFRARED

- Determine the variability of marine reflectance in SWIR
- Analyze the effects misapplication of the SWIR black pixel assumption
- Provide information for exploitation of SWIR bands on the next generation of ocean colour sensors

- Scheldt (Belgium) up to 400 mg l\(^{-1}\)
- Yangtze (China) up to several g l\(^{-1}\)
- La Plata (Argentina) up to 400 mg l\(^{-1}\)
- Gironde (France) up to several g l\(^{-1}\)