Performance of MERIS products in Lake Victoria

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Outline of the presentation

- Background for the work and Lake Victoria
- Available field data from the Lake
- Quality control of field data
- MERIS product performance in Lake Victoria
- Summary
Background of the work in Lake Victoria

- The ESA MERIS Lake Project
- National (Norway) LakeColour project
- In the ESA MERIS project there was no NN training of processors for the Lake
- Used the Case2R 1.0 and EUT 1.0 patched with the newest AC net NN3
- The training of EUT processor are based on Eutrophic Lakes in Spain
Lake Victoria

- 68,000 km²
- Altitude 1000 m
- Eutrophic Lake
- High concentration of cyanobacteria (*Anabena* sp., *Microcystis* sp.)
- Floating water plants (*Hyacint*)
In situ data from Lake Victoria

- Dataset "Source of water quality parameter data on the entire Lake Victoria" from 2005 was used in the MERIS Lake project.
- Data provided by Leon Schouten, (Infram BV)
The Lake Victoria Fisheries Organisation data set

- Chl-a fluorescence
  - Sensordata, SeaBird with a wetlab fluorimeter
  - Chl-a_fl versus HPLC or Spectrophotometric
  - Chl-a_fl as proxy for Chl-a
- Turbidity
  - Sensordata, YSI instrument
  - Correct calibration of the sensor
  - Conversion of turbidity to TSM
- Secchi Disc Depth
  - Assuming done according to good practice
In situ data from Murchison Bay in 2003 and 2004 used for quality control


Quality control of the Chl-a fluorescence
The Chl-a_HPLC vs. Secchi Disc Depth
Quality control of the Chl-a fluorescence
The Lake Victoria data included

![Graph showing the relationship between Secchi Disc Depth (m) and Chl-a_HPLC or Chl-a_Fluorescence (mg/m3).](image-url)
Quality control of the turbidity data

SSD, LVFO = 2.456*Turbidity\(^{-0.4016}\) \(R^2 = 0.75\)

SSD, Sørensen = 3.379*Turbidity\(^{-0.6761}\) \(R^2 = 0.82\)

Lake Victoria, LVFO 2005.
Norwegian Waters, Sørensen, 1993
Cyanobacteria blooms are dominated by Anabena sp. and Microcystis sp.

TOA spectra from Pins in Itome Bay
Water plants can cover large areas

- Water plants can cover large areas and cause validation problems. Photo from Murchison Bay (Sørensen)

- Example from Nyanza Gulf where water plants are observed will probably influence some of the validation stations

- TOA spectrum on station 32
Resuspension of sediments (particles, algae detritus) or particles from land?
Comparison of the TSM product
EUL 1.0 + AC NN3 + L2_Invalid flag
(some coast station included and
TSM= 1.45*Turb., Sørensen and TSM= 1.02*bTSM, Okullo)
Comparison of Z90_max versus Secchi Disc Depth
Data from 2002-2007 (Ex L2-invalid flagg and Coast)
(EUT processor version 1.0 with the newest AC net NN3)

Z90_max = -0.42 * SSD - 0.81, R^2 = 0.70

Expected/theoretical SSD vs Z90_max relation
Comparison of Z90_max versus Secchi Disc Depth - Case2R 1.3 and only 2005

\[ Z90_{\text{max}} \text{ EUL} = -0.981 \times \text{SSD} + 0.469 \quad R^2 = 0.93 \]
Z90_max product in Lake Victoria
July 7. 2004

- Based on the EUT 1.0 NN3 giving probably under-estimating the Z90_max with approx. a factor 2.
Performance of the Chl_conc product
EUT 1.0 + AC NN3
Performance of the Chl_conc product
MERIS Lake project C2R 1.3 2005 data

Chl_conc = 1.602* Chl-a_Fl - 3.13  \( R^2 = 0.92 \)

Red dots are Chl-a in situ values
Black dots are calculated from Secci Disc Depth

Chl-a (mg/m\(^3\)), Measured as Chl-a fluorescence
Chl-Conc averaged for Aug./Sept. 2005
Based on the C2R 1.3 processor in the ESA Lake project

• Preliminary data which needs to be verified
• The C2R 1.3
Summary

- Lake Victoria has high and variable phytoplankton concentration making the validation difficult.
- The available datasets from the area are limited in size and variables and do not follow any validation protocols.
- Quality control of the in situ data shows that they can be used as proxies for some of the variables, but the results must be used carefully.
- For Z90_max the results showed reasonably good correlation with the Secchi Disc Depth, but expected values are too low for the EUT 1.0 NN3.
- For Z90_max for 2005 data using C2R 1.3 showed better agreements and illustrate the importance of a corrected trained NN.
- The TSM has very few data points, but we can not conclude that it product are out of range.
- For Chl_conc there had also limited number of data points. The EUT 1.0 NN3 did not resolve the expected values. The Case2R 1.3 showed better results with the limited number of data available.
- For all variables more validation data is needed new training of NN.