Optical water type guided selection of algorithms for global remote sensing of lake biogeochemical properties

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E. Spyarakos et al.: Relations between biogeochemical and inherent optical properties in inland waters.
Credits to: Plymouth Marine Laboratory and H2020-TAPAS project

Lyme Bay - Cambodian flood plain
Algorithms tested: 28 for Chla; 13 for TSM; 11 for PC and 10 for $a_{CDOM}(440)$
(Bootstrap validation on the performance measures):
• No single algorithm performed consistently well
• Most algorithms showed an improvement in their performance when they were re-parameterised for LIMNADES dataset
• Some algorithms performed well for several OWTs (e.g. Gons, Rrs708:Rrs665, QAA)
• All tested algorithms performed poorly for some specific cases (e.g. low Chla, high CDOM waters)
• All algorithms showed an improvement in their performance when they were retuned at each OWTs
MERIS Calimnos match-ups

Atmospheric correction

Polymer, Scape-M, CoastColour, Fub, Boreal Lakes, Megs

3x3 sigma-filter cloud OR cloud shadow OR snow_ice OR Glint (Idepix)

Standardisation of Rrs and OWT-membership function

Constituent Retrieval (Chla, TSM, CDOM, PC)

Quality flags

Constituent Retrieval

FLH, C2R, BL, EUL etc.

Scores

Ground data
Chla (>1M spec or HPLC from ~2000 inland water systems), TSM (8760 from ~500 water systems), CDOM (2000 from 78 inland water systems), PC (532 from 48), in-situ Rrs (>3000 from 250)

Input from initial in-situ validation to screen out poorly performing algo.

Validation flow chart
Evaluation of atmospheric correction processors against \textit{in situ} Rrs

- 400 $R_{rs}^{\lambda}$ matchups, 20 lakes
- Evaluating MEGS8.1, FUB, C2R Lakes, CoastColour, SCAPE-M, Polymer

\textbf{CoastColour, 3x3 pixel window}  \hspace{1cm} \textbf{Polymer, 3x3 pixel window}
Chla retrieval

**OWT-guided blended Chla**

- **scm_CHLA**
- **poly_CHLA**
- **labor_CHLA**
- **cc_CHLA**

<table>
<thead>
<tr>
<th>Slope</th>
<th>Correlation r</th>
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<tbody>
<tr>
<td>Normalised score</td>
<td>Normalised score</td>
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### The processing chain

<table>
<thead>
<tr>
<th>Water type family</th>
<th>OWT guided Chla algorithms</th>
<th>OWT guided TSM algorithms</th>
<th>OWT guided CDOM algorithms</th>
<th>PC algorithms</th>
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<tr>
<td>4</td>
<td>7</td>
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</tbody>
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GloboLakes Sites

1. Bear Lake, USA

2. Lake Nicaragua, Nicaragua

3. Lake Rukwa, Tanzania

4. Tonle Sap Lake, Cambodia

5. Lake Balaton, Hungary

6. Lake Kasumigaura, Japan

7. Lake Wellington, Australia

"1000+1" Lakes
Performance

In-situ Lake median +/- se
Calimnos v103 MERIS OWT guided algorithms

+- 7 days match up Chla v103
R^2=0.62, slope=0.82, intercept=1.16, n=350

Lough Neagh, Northern Ireland

Calimnos v103 MERIS OWT guided algorithms
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