

# Comparing MODIS standard and the Regional Baltic algorithms for Chl *a* and SST with *in situ* measurements in the Gulf of Riga

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## Motivation:

•Standard algorithm with its present standard parameterization is inappropriate for applications in the Baltic Sea

## Aim:

•Validation of accuracy by comparing MODIS standard algorithms and developed regional Baltic version

## Why satellite?

•A highly consistent time series of near-synoptic and global data for many years  
•Tool for monitoring biological variables

## Why the Gulf of Riga?

•one of the most productive and eutrophied areas of the Baltic Sea  
•shallow, with a max. depth of 60 m  
•represents Case 2 waters



## Bio-optical algorithms:

### MODIS OC3

$$\text{Chl} = 10^{[0.2830 - 2.753R + 1.457R^2 + 0.659R^3 - 1.403R^4]}$$

where  $R = \text{Log}_{10} [R_{551}^{443} / R_{551}^{448}]$

### MODIS BRv

$$\text{Chl } a = 10^{-0.1520 - 3.0558X}$$

where  $X = \text{Log} \left\{ \max \left[ \frac{L_{\text{wn}}(443)}{L_{\text{wn}}(551)}, \frac{L_{\text{wn}}(488)}{L_{\text{wn}}(551)} \right] \right\}$

### MODIS SST

$$y = \text{Slope} * X + \text{Intercept}$$

where Slope = 0.01, Intercept = -300

## Evaluation criteria:

$$\text{MNB} = \text{mean} \left[ \left( \frac{y_{\text{alg}} - y_{\text{obs}}}{y_{\text{obs}}} \right) * 100 \right]$$

$$\text{RMS} = \text{stdev} \left[ \left( \frac{y_{\text{alg}} - y_{\text{obs}}}{y_{\text{obs}}} \right) * 100 \right]$$

$$\text{log\_bias} = \text{mean} \left[ \log \left( \frac{y_{\text{alg}}}{y_{\text{obs}}} \right) \right]$$

$$\text{log\_rms} = \text{stdev} \left[ \log \left( \frac{y_{\text{alg}}}{y_{\text{obs}}} \right) \right]$$

where

$y_{\text{alg}}$  is the bio-optical product estimated from the algorithm,

$y_{\text{obs}}$  is the observed value of the bio-optical quantity (measured *in situ*)

## Results:

Summary of the error analysis based on match-up comparisons between the satellite-derived bio-optical data products (chl *a*, SST) and *in situ* data

Algorithm	MNB	RMS	log bias	Log rms	n
<b>MODIS OC3</b>					
General	184	184	0.31	0.33	102
Coastal Zone	205	227	0.31	0.53	61
Offshore Zone	151	182	0.26	0.35	41
<b>MODIS BRv</b>					
General	65	109	0.10	0.23	102
Coastal Zone	77	113	0.28	0.54	61
Offshore Zone	46	39	0.10	0.20	41
<b>SST</b>					
General	6	7	0.02	0.06	129

Comparisons between chlorophyll concentrations derived from the MODIS/Aqua standard algorithm. Scale 0-50 (mg/m3) was used for MODIS OC3-derived images. Strong spring bloom was detected in earlier May during two observed years over the southern part of the Gulf of Riga. With the end of spring bloom, chl *a* concentration was decreasing until the end of July and the beginning of August, when was noticed well-defined increase of chlorophyll *a* concentration. In autumn period the chlorophyll concentrations were lower then expecting. Black pixels are masked out land and clouds.

Map of SST (°C) distribution for 11th May 2003 derived by using the MODIS/Aqua temperature algorithm. Spring pictures of SST shows us that the southern part of the Gulf warms faster then the area in the north, even though that the area near Saaremaa in south is really shallow. Black pixels mask land and clouds.

