

**Regional algorithms
for the estimation of
chlorophyll and suspended
matter concentration in
the Gulf of Finland from
MODIS-Aqua satellite
data***

doi:10.5697/oc.56-4.737
OCEANOLOGIA, 56 (4), 2014.
pp. 737–756.

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Institute of Oceanology,
2014.

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KEYWORDS
Gulf of Finland
Satellite data
Algorithms
Chlorophyll
Suspended matter

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Received 10 January 2014, revised 21 May 2014, accepted 23 May 2014.

Abstract

Validation of algorithms for the retrieval of concentrations of chlorophyll (Chl) and total suspended matter (TSM) in the Gulf of Finland from satellite ocean colour data was carried out using field measurement data from summer 2012 and 2013. These data included spectral values of the remote sensing reflectance $R_{rs}(\lambda)$,

* This work was funded by the Russian Government (grant No. 11.G34.31.0078) for research under the supervision of the leading scientist at the Russian State Hydrometeorological University.

The complete text of the paper is available at <http://www.iopan.gda.pl/oceanologia/>

Chl and TSM concentrations. Testing of the existing algorithms (OC4v4, OC3M, and the Baltic regional algorithms developed by Polish specialists) showed that all of them overestimated Chl several times. The new regional algorithms were developed on the basis of measured values of $R_{rs}(\lambda)$, Chl and TSM (40 stations in total). Direct comparison of Chl and TSM values, obtained from MODIS-Aqua data with the algorithms developed here, with their in situ values showed reasonable agreement. The spatial distributions of Chl and TSM concentrations were constructed from MODIS-Aqua data. Errors of the atmospheric correction were analysed.

1. Introduction

The aim of our studies is to derive regional algorithms for calculating chlorophyll and suspended matter concentrations in surface waters of the Gulf of Finland from satellite ocean colour scanner data. The Gulf of Finland is strongly influenced by river runoff, primarily from the Neva (2/3 of the total runoff), and this influence is evident not only in the low salinity (< 10 PSU) but also in their optical properties of these waters. The standard algorithms for calculating bio-optical characteristics from satellite ocean colour scanners, designed mainly on the basis of data measured in ocean waters (<http://oceancolor.gsfc.nasa.gov>), do not take into account regional specificity and may give rise to large errors in such waters. Regional algorithms, based on data measured in situ in a given area, are needed (<http://optics.ocean.ru>). Such measurements were carried out in the expeditions organised by the Russian State Hydrometeorological University (RSHU) in the summers of 2012 and 2013.

2. Material and methods

2.1. Study area and stations

The field studies were carried out on the yacht CENTAURUS II during 21–28 July 2012 and 20 July–02 August 2013; 15 stations were set up in 2012 and 26 in 2013. The positions of the station are given on maps showing the spatial distributions of Chl concentration from MODIS-Aqua data on 22 July 2012 and 27 July 2013 derived by a standard MODIS algorithm (Figure 1a,b). According to these maps, Chl values on the most of stations were > 10 and even 20 mg m⁻³. In fact, the Chl concentration, directly measured in the study area, varied from 1.2 to 23.7 mg m⁻³ in 2012 and from 1.6 to 18.6 mg m⁻³ in 2013.

The Secchi depth varied from 1.8 m in the eastern part of the Gulf of Finland near the Neva Bay to 4.0 m in the open part of the Gulf. Station M2 of 26 July 2013 (Figure 1b) was rejected owing to the inconsistency of

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