Ocean Science
Discussions

Interactive comment on "Remote sensing of chlorophyll in the Baltic Sea at basin scale from 1997 to 2012 using merged multisensor data" *by* J. Pitarch et al.

Anonymous Referee #2

Received and published: 17 November 2015

General comments

The manuscript provides the first long time remote sensing chlorophyll data for the Baltic Sea. There is a good reason why such analysis have not been undertaken before – simply the chlorophyll-a algorithms do not provide accurate enough concentrations to make such analysis reasonable. It has been shown by several authors (cited in the manuscript) that the blue-green ratios (like the OC4) do not work in the Baltic Sea. Mainly because the reflectance signal in the blue band is not determined by chlorophyll-a, but CDOM. The results of this study confirm these findings as the highest correlation coefficient found for all tested algorithms is $R2=0.44$. Therefore, the whole following

analysis seems a bit artificial to me.

Detailed comments

Being familiar with unpublished (yet) results from different countries around the Baltic Sea it is hard to say whether universal chlorophyll algorithm for the Baltic Sea is feasible. Studies on the specific inherent optical water properties show that optical properties of the spring bloom assemblages are very different compared to cyanobacteria in summer. Therefore, two sets of chlorophyll retrieval algorithms may be needed. These are results for the open parts of the Baltic Sea. Other studies show that absorption and backscattering coefficients (determining the reflectance) differ by order of magnitude between rocky granite shores (Sweden, Finland) and sandy shores (Russia, Estonia, Latvia, Lithuania, Lithuania, Poland, Denmark). Third study (also unpublished) shows that the correlation between the OC4v6 and chlorophyll is close to zero even if reflectances created by HydroLight model (i.e. free from atmospheric correction problems, glint, sensor noise, etc.) are used. So, it is really hard to believe that the algorithm used in this study will ever produce reasonable results for the Baltic Sea. In the conclusions the Authors state themselves (like tens of authors before) that green to red bands have to be used in order to get reasonable chlorophyll-a estimates.

On page 8 the Authors discuss problems related with vertical distribution of phytoplankton biomass. During most of the year this should not be an issue as top 10-20 m is mixed. However, vertical distribution becomes a huge issue during the period of cyanobacterial dominance. Unlike other phytoplankton cyanobacteria can regulate their buoyancy and (in calm weather) tend to be at the depth most optimal for them. It has been shown before (Kutser et al. 2008) that vertical distribution of cyanobacteria has significant impact on the reflectance i.e. the same biomass distributed differently in the water column produces very different reflectance.

Findings in the page 15 are contradictory to what was proposed by Kahru et al. (1993). Not the elevated temperature causes blooms (how it can be elevated?) but bloom

absorbs solar radiation and heats the water.

I obviously cannot agree with the last conclusion that the analysys provides a good confidence level about ocean colour retrieval over the Baltic Sea.

I recommend the Authors to read biological literature about the phenology of the Baltic Sea phytoplankton, what kind of concentrations of chlorophyll-a have been actually observed in the Baltic Sea during different bloom periods and how this matches/contradicts with their findings. There is plenty of literature available for the Baltic Sea.

Cyanobacterial blooms in the Baltic Sea have been known for large mats (scum) floating on the water surface. These mats may be several centimetres thick and cover areas of 200 000 km2 (Kahru and Elmgren 2014). These issues have not been discussed at all. If standard processing chains are used then the scum pixels are masked out as errors whereas the algorithms cannot cope with "terrestrial" reflectance (high NIR) in the middle of the sea. If these pixels are masked out then what kind of chlorophyll dynamics we discuss here at all?

_____

Interactive comment on Ocean Sci. Discuss., 12, 2283, 2015.