Abstract

In this dissertation, optical remote sensing methods are used for the assessment of algal blooms, i.e., the phenomenon of increased biomass of phytoplankton, in the Baltic Sea. The main focus is put on the summer algal blooms, as they are potentially harmful to the marine ecosystems and the economy of the Baltic Sea region, and therefore their monitoring is of large interest.

Remote sensing reflectance spectra measured using modern, hyperspectral optical sensors in the waters of the Gulf of Gdansk have been studied. The obtained results have been used to develop the first local algorithms for remote estimation of the cyanobacterial biomass, from phycocyanin concentration. The algorithms have also been adapted to be used with data acquired with spaceborne sensors, such as MERIS and OLCI, making large-scale mapping possible. The algorithms have been developed based on two different methods: using analytical functions and Pricipal Component Analysis, with cross-validation R^2 of 0.73 and 0.89, respectively.

In the latter part of the thesis, it has been shown using the model Hydrolight-Ecolight 5.2 that it is possible to identify the dominant cyanobacterial species in a controlled environment using the characteristics of the remote sensing reflectance spectra of each species. For the development and calibration of the proposed model, unique remote sensing reflectance spectra measured in lab for the three most common species in the Baltic Sea have been used: *Nodularia spumigena*, *Aphanizomenon flos-aquae*, and *Anabaena* sp. On the basis of the shape and height of the modelled remote sensing reflectance spectra, it is concluded that largest dissimilarity can be observed between 560 and 660 nm and the use of the similarity index makes the determination of the dominant cyanobacterial species possible, provided that a reference spectrum is available.