Remote Sensing of Environment

Distinguishing cyanobacteria from algae in optically complex inland waters using a hyperspectral radiative transfer inversion algorithm

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Abstract

A hyperspectral inversion algorithm was used to distinguish between cyanobacteria and algal blooms in optically complex inland waters. A framework for the algorithm is presented that incorporates a bio-optical model, a solution for the radiative transfer equation using the EcoLight-S radiative transfer model, and a non-linear optimization procedure. The natural variability in the size of phytoplankton populations was simulated using a two-layered sphere model that generated size-specific inherent optical properties (IOPs). The algorithm effectively determined the type of high-biomass blooms in terms of the relative percentage species composition of cyanobacteria. It also provided statistically significant estimates of population size (as estimated by the effective diameter), chlorophyll-a (chl-a) and phycocyanin pigment concentrations, the phytoplankton absorption coefficient, and the non-algal absorption coefficient. The algorithm framework presented here can in principle be adapted for distinguishing between phytoplankton groups using satellite and in situ remotely sensed reflectance.