Abstract

Author(s)	Klaus Joehnk, Tapas Biswas, Janet Anstee, Philip Ford, Nathan Drayson, Gemma Kerrisk

Title

Detection of algal blooms using in-situ hyperspectral reflectance and early results of forecasting

Description

To test a monitoring and forecasting service of toxic algal bloom in Lake Hume, we investigated bio-optical properties, stratification and blue-green algae bloom formation by combining in-situ sampling, remote sensing technology with hydrodynamic and algal growth models. For the first time, we used a low-cost remote sensing in-situ HydraSpectra instrument, which exploits the spectral reflectance signals emanating from algal-dominated waters and then correlated them to Chlorophyll-*a* (Chl-*a*) concentration and cell counts. A three-band algorithm for Chl-*a* index was found to be well correlated with HydraSpectra derived cell counts. In future this device has the potential to determine species composition based on their reflectance structure as opposed to current use of a single pigment (Chl-*a*) as a marker in retrieving cyanobacteria abundance.

The water temperature stratification and the mixing layer structure of Lake Hume was well simulated by a one-dimensional, vertical Lake model (LAKEoneD) during bloom periods. The temperature profile during the lakes cooling phase (end of blooms season) was not well represented by the 1-D model due to large inflows into the lake with cooler water, pointing to the need for a 3-D model for such situations.

Under different water levels in the lake, simulations of deep mixing of cells showed a risk of the downstream flow of high amounts of cyanobacteria through hydropower and irrigation outlets of the dam when the water level falls below specific thresholds. Furthermore, first results with a cyanobacteria forecast model based on cell counts derived from continuously measured reflectance data showed good promise for cyanobacteria forecasting. It requires the combined use of high-resolution water temperature profiles, HydraSpectra reflectance data and a well calibrated hydrodynamic modelling tool to quantify the mixing dynamics of the lake which determines variations of surface cyanobacteria concentration in the pelagial.