



Forecasting Cyanobacteria Cell Counts for Inland Water: A Hybrid Approach

Oral

Modeling, Early Warning and Forecasting

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This study develops a short-term forecasting framework for cyanobacteria bloom formation in Australian inland freshwater systems by incorporating in-situ observations, emerging hyperspectral remote sensing, and coupled hydrodynamic and algal growth models.

On three Australian lakes with different limnological conditions, the distribution of a buoyant cyanobacteria species was simulated using an algal growth model driven by forecasted meteorological conditions and a one-dimensional k-epsilon turbulence hydrodynamic model that represented temperature stratification and mixing dynamics. To enhance model accuracy, cyanobacteria cell counts were re-initialized daily using estimates derived from hyperspectral reflectance data based on a linear relationship between hyperspectral cyanobacteria indices and simulated cell count values. The novel approach demonstrates the viability of short-term forecasting for cyanobacterial blooms.

Simulations of cyanobacteria concentrations captured the dynamic mixing processes within the lakes, characterized by daily near-surface accumulation followed by redistribution driven by wind-induced turbulence or nocturnal cooling. Accurate estimation of cyanobacteria surface concentrations at sub-daily timescales necessitates the integration of high-resolution water temperature profiling,

hyperspectral reflectance measurements, and hydrodynamic modeling to quantify mixing dynamics. This comprehensive study improves risk assessment for cyanobacterial blooms and supports informed water management strategies, contributing to AquaWatch Australia's initiative to establish an integrated ground-to-space national water quality monitoring system to support water management with accurate data and predictive forecasting.

Palabras Clave

(1) Cyanobacteria Bloom Forecasting, (2) Hybrid Modelling, (3) AquaWatch.

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