Developing a Numerical Box Model to Compute Algae Concentration, Year Two

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An excess or depletion of algae can devastate an ecosystem, so understanding the conditions affecting algae growth is essential for preserving a strong ecosystem. A numerical model is an efficient tool to analyze the algae's response to various conditions. The purpose of this research is to develop a simple and efficient numerical box model to calculate the algae concentration (as chlorophyll) in a well-mixed water body. This assumption is reasonable because the well-mixed condition is suitable for algae growth. The primary growth factors, light intensity, water temperature, and nutrient concentration, along with the effects of sediment concentration and water depth on the algae growth were considered. In some cases, measured water temperature data is not available or limited. A water temperature algorithm was developed to predict the water temperature based on the air temperature, solar radiation (or light intensity), wind speed, and relative humidity. The algae and temperature models were validated using data from Beasley Lake in the Mississippi Delta. Sensitivity studies were conducted to analyze the effects of temperature increase due to global warming and the influx of nutrients. The model predicts global warming will cause an increase in water temperature as well as the growth and death rates of algae. On the other hand, increased nutrients increases the algae concentration. In addition, the model’s simplicity and effectiveness allowed an online interface to be developed using Flask, a Python web micro-framework, and SQ-Lite, a lightweight database, allowing users worldwide to implement the model to predict the algae concentration.

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