Water Quality in urban lakes: from continuous monitoring to forecasting. Application to cyanobacteria dynamics in Lake Enghien (France)
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To cite this version:
Talita Silva, Brigitte Vinçon-Leite, Bruno J. Lemaire, Briac Le Vu, Catherine Quiblier, et al.. Water Quality in urban lakes: from continuous monitoring to forecasting. Application to cyanobacteria dynamics in Lake Enghien (France). European Geosciences Union General Assembly 2011, Apr 2011, Viena, Austria. 2011. hal-00674652

HAL Id: hal-00674652
https://hal-enpc.archives-ouvertes.fr/hal-00674652
Submitted on 27 Feb 2012

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Proliphyc Project

The Proliphyc project has developed a continuous in-situ monitoring system for cyanobacteria in freshwater ecosystems. It consists in a measurement buoy equipped with meteorological sensors and immersed probes to measure water quality parameters (see Fig. 1). This system is able to provide a long-term, high-frequency monitoring of lakes and reservoirs. Data set obtained can be used in order (Le Vu et al., 2010):

1) To build lake status indicators for daily, seasonal and annual water quality assessment and for comparison with other water bodies;
2) To collect surveillance data series to observe the general patterns of the aquatic ecosystem and to assess long-term changes;
3) To feed a statistical short-term forecasting model for early warning of cyanobacteria blooms;
4) To validate a deterministic model of cyanobacteria dynamics which may highlight the factors controlling blooms.

Study site: Lake of Enghien-les-Bains

In 2009, such monitoring system was implemented in Lake Enghien-les-Bains (Paris suburbs, France, see Fig. 2 and Table 1). Lake Enghien is an urban shallow lake that plays a significant role in the stormwater management of its watershed by storing up to 100,000m³ of rainwater. The lake receives wastewater discharges from inappropriate connections in the stormwater network. This input results in a deterioration of the water quality and the lake is frequently affected by cyanobacteria blooms of Planktothrix agardhii, a potentially toxic cyanobacterium (Quiblier et al., 2008).

Water quality indicators

The time series can be used to infer indicators of cyanobacteria biomass, useful for lake management strategies. Three indicators, built from the raw time series, were proposed for Lake Enghien (see Fig. 3):

- Water temperature and oxygen saturation rate associated to daily maximal cyanobacteria concentration;
- Cyanobacteria daily variation rate

Cyanobacteria modelling

The coupled model DYRESM-CAEDYM (DYCQD) was used for deterministic simulation of cyanobacteria dynamics in Lake Enghien. DYRESM is a one-dimensional numerical model for predicting the vertical distribution of temperature in lakes and reservoirs (Imenot, 2007). It was coupled to CAEDYM, the aquatic ecosystem model to simulate cyanobacteria dynamics (Hamilton and Schladow, 1997). The structure of DYCQD coupled model is shown on Fig. 4.

References


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Acknowledgements: This work is part of the Proliphyc project (Monitoring System of Plankton Blooms Applications to Cyanobacterial funded by the ANR-PRICCOOD program. We wish to acknowledge SARBE and Enghien municipality for their support.

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