

综合评述

湖泊生态系统动力学模型研究进展

刘永 郭怀成 范英英 王丽婧

北京大学环境学院, 北京 100871

收稿日期 2004-7-21 修回日期 2004-10-2 网络版发布日期 接受日期

摘要

从系统分析在湖泊生态系统动力学研究中的作用出发,对湖泊生态系统的动力学建模过程、方法和软件等进行了总结.在此基础上,综述了国内外湖泊生态系统动力学模型的发展.从1960年代至今,湖泊生态系统动力学模型从简单的零维模型发展到复杂的水质-水动力学生态综合模型和生态结构动力学模型,如LakeWeb模型.中国的湖泊生态系统动力学模型研究始于20世纪80年代,主要集中在滇池、太湖、东湖和巢湖等富营养化严重的湖泊以及其他水体.目前,已经开发一些软件用于湖泊生态系统动力学模拟,主要有CE-QUAL-ICM、WASP、AQUATOX、PAMOLARE、CAEDYM等,以及用来模拟湖泊能流的软件ECOPATH.湖泊生态系统动力学模型还在监测、数据共享和模型结构、参数选取和不确定性分析等方面存在不足,需在今后的研究中加以改进.

关键词 [湖泊,生态系统动力学,模型](#)

分类号

Research advance on lake ecosystem dynamic models

LIU Yong, GUO Huaicheng, FAN Yingying, WANG Lijing

College of Environmental Sciences, Peking University, Beijing 100871, China

Abstract

Starting with the role of system analysis in lake ecosystem research, this paper summarized the tentative procedures and softwares for studying the dynamics of lake ecosystem. There are several main stages in modeling the dynamics of lake ecosystem, namely, problems identification, mathematical formulation, computation, validation, sensitive analysis, calibration, and verification. In the modeling, selecting temporal and spatial scales is essential but complex. Since 1960s, a rapid progress has been made in modeling the dynamics of lake ecosystem, being developed from simple zero-dimension models to complex ecological-aquatic-hydrodynamic ones, among which, exergy was applied popularly as an objective function in modeling. In this paper, LakeWeb and LEEDS (Lake Eutrophication, Effect, Dose, and Sensitivity model) were analyzed as examples. In China, the development of lake ecosystem dynamic models could be traced back to 1980s, and most of them were focused on Lake Dianchi, Lake Taihu, Lake Chaohu and Lake Donghu. Some softwares such as CE-QUAL-ICM, WASP, AQUATOX, PAMOLARE and CAEDYM were developed to simulate lake ecosystem dynamics, among which, CE-QUAL-ICM is more suitable for long and narrow water bodies. WASP consists of three parts, i.e., DYNHYD, EUTRO, and TOXI. AQUATOX is an ecological risk model, and the parameters are mainly calibrated in U.S.A, which has limited its further application in China. The software ECOPATH for simulating the energy flows in lakes was also described in this paper. There are still many shortages in the lake ecosystem dynamic models, e.g., the lack of sufficient monitoring data for validation, insufficient consideration of uncertainties and the role of bacteria, and inconsistent relationship with watershed changes. The uncertainties are mainly from the intrinsic uncertainties in aquatic ecosystem, in modeling, in parameters selection, and also in forecast and application. Setting up long-term monitoring and data sharing mechanism, using interpolation to make data more densely, introducing objective functions, dealing with uncertainties, and constructing watershed-lake ecosystem dynamic model could be the available ways for overcoming the shortages.

Key words [Lake](#) [Ecosystem dynamics](#) [Modeling](#)

扩展功能

本文信息

- ▶ [Supporting info](#)
- ▶ [PDF\(726KB\)](#)
- ▶ [\[HTML全文\]\(0KB\)](#)
- ▶ [参考文献](#)

服务与反馈

- ▶ [把本文推荐给朋友](#)
- ▶ [加入我的书架](#)
- ▶ [加入引用管理器](#)
- ▶ [复制索引](#)
- ▶ [Email Alert](#)
- ▶ [文章反馈](#)
- ▶ [浏览反馈信息](#)

相关信息

- ▶ [本刊中 包含“湖泊,生态系统动力学,模型”的 相关文章](#)
- ▶ [本文作者相关文章](#)
- [刘永 郭怀成 范英英 王丽婧](#)

DOI:

通讯作者