

BATHTUB

Model Uses BATHTUB is a steady-state water quality model that simulates eutrophication-related water quality conditions in lakes and reservoirs.

Major Categories Water Quality

Subject Knowledge Level
Intermediate

Minor Categories Nutrient Production

Technical Difficulty Level
Intermediate

Model Type Physical Model

Geographic in Nature?
no

Abstract

BATHTUB is a steady-state water quality model that simulates eutrophication-related water quality conditions in lakes and reservoirs. Eutrophication can be defined as the nutritional enrichment of water bodies leading to an excessive production of organic materials by algae and/or aquatic plants.

BATHTUB performs steady-state water and nutrient balance calculations for spatially segmented hydraulic network such as lakes and reservoirs, which accounts for advective and diffusive transport, and nutrient sedimentation. BATHTUB predicts eutrophication-related water quality conditions (total phosphorus, total nitrogen, chlorophyll-a, transparency, and hypolimnetic oxygen depletion) using empirical relationships derived from assessments of reservoir data.

There are two supporting programs: FLUX and PROFILE. FLUX allows estimation of tributary nutrient loadings from sample concentration data and continuous flow records. PROFILE facilitates analysis and reduction of in-lake water quality data.

Future Developments

Unknown

Model Limitations

Applications of BATHTUB are limited to steady-state evaluations of relations between nutrient loading, transparency and hydrology, and eutrophication responses.

Short-term responses, responses to variables other than nutrients and effects related to structural modifications cannot be explicitly evaluated.

Model Features

- Nutrient and water balances in a segmented hydraulic network.
- Nutrient sedimentation.
- Algal (chlorophyll) response to flushing, light and nutrient concentration.
- Hypolimnetic oxygen depletion

Required Data Types

BATHTUB:

- Watershed characteristics
- Water and nutrient loads
- Lake or reservoir morphology
- Observed lake or reservoir water quality data are desirable.

Model Outputs

BATHTUB

- Tabular and/or graphic displays of segment hydraulics
- Water and nutrient balances
- Predictions of nutrient concentrations
- Transparency
- Chlorophyll-a concentrations

FLUX Requires grab sample concentration data and continuous (e.g., daily) flow records

PROFILE requires vertical profiles of water quality data collected at one or more sample stations throughout the period of interest.

- Oxygen depletion
- Statistics relating observed and predicted values are provided

FLUX - Graphic and tabular displays allow users to evaluate input data and calculation results. Mass loads, and associated error statistics (CV) are provided as input to BATHTUB.

PROFILE - Graphic and tabular displays allow users to evaluate and summarize lake or reservoir water quality data. Mixed-layer water quality summaries (means) and hypolimnetic oxygen depletion rates, and associated error statistics (CV) are provided as input to BATHTUB.

Source

- 1) U.S. Army Engineer Waterways Experiment Station (WES)
- 2) Department of Civil and Environmental Engineering, Old Dominion University

Source (URL)

- 1) <http://www.wes.army.mil/el/elmodels/emiinfo.html>
- 2) <http://www.cee.odu.edu/model/bathtub.php>

Hardware Requirements

MS DOS; PC Compatible

Supported Platforms			
DOS	<input checked="" type="checkbox"/>	UNIX	<input type="checkbox"/>
Windows	<input type="checkbox"/>	Macintosh	<input type="checkbox"/>

Software Requirements

Supporting programs FLUX and PROFILE facilitate estimation and nutrient loading and water quality conditions, respectively

Cost, Licensing and Availability

Model is free and can be downloaded at <http://www.wes.army.mil/el/elmodels/index.html#wqmodels> or <http://www.cee.odu.edu/model/bathtub.php> . Please contact WES for requesting a user manual: (601) 634-3659