



Integrated hydrological and water quality model for river management: A case study on Lena River



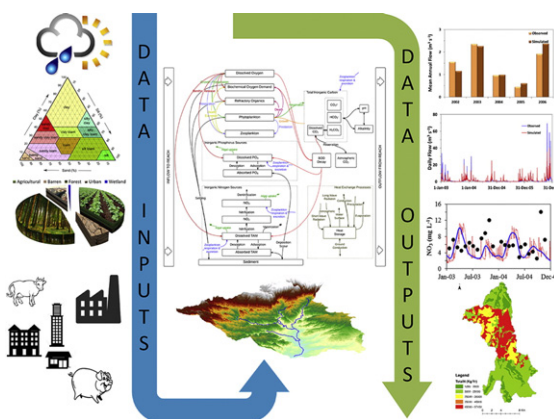
André Fonseca*, Cidália Botelho, Rui A.R. Boaventura, Vítor J.P. Vilar**

LSRE – Laboratory of Separation and Reaction Engineering, Associate Laboratory – LSRE/LCM, Department of Chemical Engineering, Faculty of Engineering of the University of Porto, Portugal

HIGHLIGHTS

- An integrated hydrological and water quality model for river management is presented.
- An insight into the pollution sources occurring in Lena River is addressed.
- Nonpoint pollution sources are a serious threat to overall water quality of Lena River.
- Fecal coliform levels were consistently high in Lena River.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 29 January 2014
Received in revised form 22 March 2014
Accepted 23 March 2014
Available online 16 April 2014

Editor: Simon Pollard

Keywords:

Water quality modeling
HSPF model
Nonpoint source pollution
Maximum daily loads
Lena River

ABSTRACT

The Hydrologic Simulation Program FORTRAN (HSPF) model was used to assess the impact of wastewater discharges on the water quality of a Lis River tributary (Lena River), a 176 km² watershed in Leiria region, Portugal. The model parameters obtained in this study, could potentially serve as reference values for the calibration of other watersheds in the area or with similar climatic characteristics, which don't have enough data for calibration. Water quality constituents modeled in this study included temperature, fecal coliforms, dissolved oxygen, biochemical oxygen demand, total suspended solids, nitrates, orthophosphates and pH. The results were found to be close to the average observed values for all parameters studied for both calibration and validation periods with percent bias values between –26% and 23% for calibration and –30% and 51% for validation for all parameters, with fecal coliforms showing the highest deviation. The model revealed a poor water quality in Lena River for the entire simulation period, according to the Council Directive concerning the surface water quality intended for drinking water abstraction in the Member States (75/440/EEC). Fecal coliforms, orthophosphates and nitrates were found to be 99, 82 and 46% above the limit established in the Directive. HSPF was used to predict the impact of point and nonpoint pollution sources on the water quality of Lena River. Winter and summer scenarios were also addressed to evaluate water quality in high and low flow conditions. A maximum daily load was calculated to determine the reduction needed to comply with the Council Directive 75/440/EEC. The study showed that Lena River is fairly polluted calling for awareness at behavioral change of waste management in order to prevent the escalation of these effects with especially attention to fecal coliforms.

© 2014 Elsevier B.V. All rights reserved.

* Corresponding author. Tel.: +351 936168204.

** Corresponding author. Tel.: +351 918257824; fax: +351 225081674.

E-mail addresses: andrerd@gmail.com (A. Fonseca), vilar@fe.up.pt (V.J.P. Vilar).

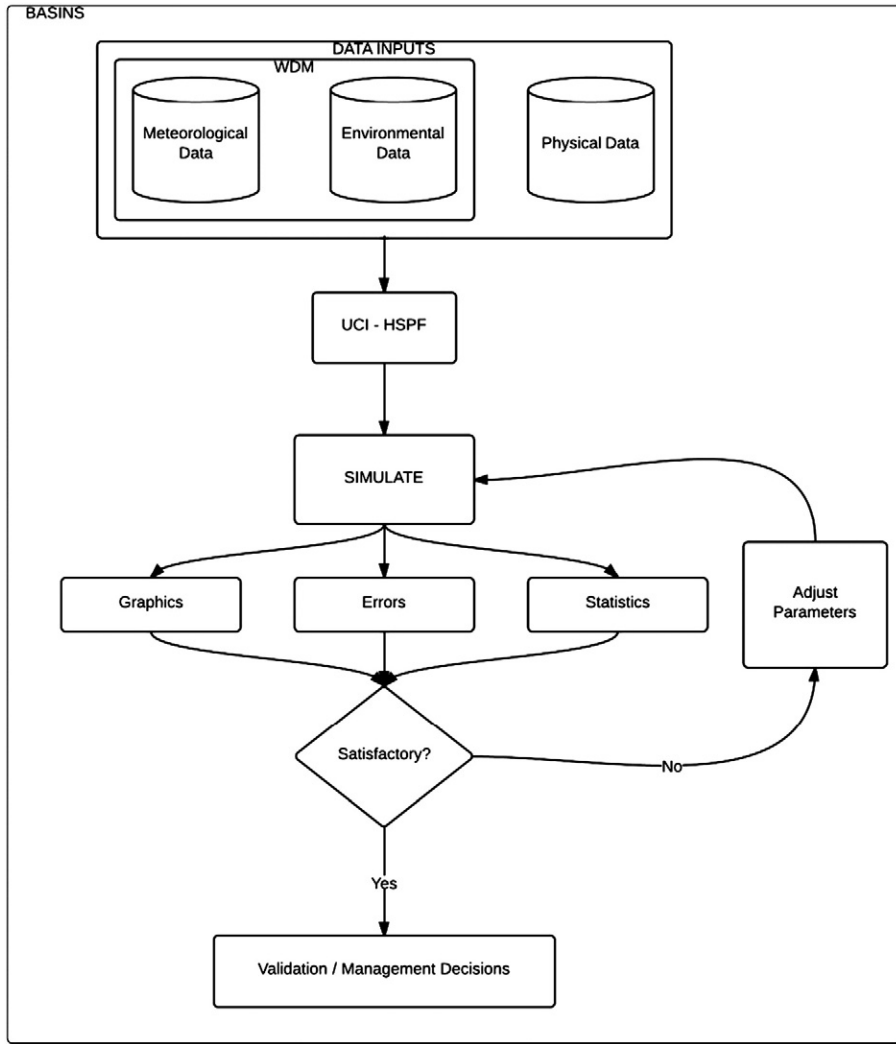


Fig. 1. HSPF calibration steps.



Fig. 2. Lis River basin, Leiria, Portugal.

Download English Version:

<https://daneshyari.com/en/article/6330456>

Download Persian Version:

<https://daneshyari.com/article/6330456>

[Daneshyari.com](https://daneshyari.com)