



# Utilization of Water Quality Modeling and Dissolved Oxygen Control in River Tungabhadra, Karnataka (India)

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## Abstract

In an attempt to produce a reliable source of water, the water quality model—QUAL2KW—was put to through calibration and validation tests. This model was implemented in the river Tungabhadra of India. This worked quite well for the project at hand but showed certain irregularities. Different Quality Management methods exist currently and for this project, their impact in DO concentrations were examined based on: 1) The ability to augment the flow; 2) The ability to oxygenate the source and; 3) The ability to modify pollution loads. With the impacts realized, the study helped us understand that local oxygenation is effective when considering the increment of DO levels. There was also the understanding that a combination of the factors (flow augmentation, pollution load modification and source oxygenation) is a necessity as far as the minimum DO concentrations must be realized. With this quality model results, there is confidence that the implementation of the QUAL2KW model will be an appropriate choice for future river water quality policies.

## Subject Areas

Civil Engineering, Environmental Sciences, Hydrology

## Keywords

Water Quality, Dissolved Oxygen Control, QUAL2KW, Tungabhadra River

# Modeling And Control Of River Quality

**Lauren Gardner**



## **Modeling And Control Of River Quality:**

**Modeling and Control of River Quality** Sergio Rinaldi,1979      **Principles of Surface Water Quality Modeling and Control** Robert V. Thomann,John A. Mueller,1987 This book teaches the fundamentals and principles which underlie the mathematical modeling techniques used to analyze the quality of surface waters The text first provides an overview of the different bodies of water in which water quality problems need to be addressed before examining specific problems that occur across all bodies of water      **Modeling Water-resource Systems for Water-quality Management** R. G. Willey,1996      **Water Quality Modeling** Wu-Seng Lung,2021-06-24 This volume to discussing the various aspects of estuarine water quality modeling Topics considered include fundamental principles estuarine mass transport BOD DO and eutrophication model kinetics kinetics on toxicants and sediment water interactions The book also discusses mixing zone modeling and how to integrate estuarine hydrodynamic and water quality models Many case studies demonstrating successful model applications are discussed      **Modeling, Control and Optimization of Water Systems** Thomas Rauschenbach,2015-12-14 This book provides essential background knowledge on the development of model based real world solutions in the field of control and decision making for water systems It presents system engineering methods for modelling surface water and groundwater resources as well as water transportation systems rivers channels and pipelines The models in turn provide information on both the water quantity flow rates water levels of surface water and groundwater and on water quality In addition methods for modelling and predicting water demand are described Sample applications of the models are presented such as a water allocation decision support system for semi arid regions a multiple criteria control model for run of river hydropower plants and a supply network simulation for public services      **River Water Quality Model** P. Reichert,Dietrich Borchardt,Mogens Henze,Wolfgang Rauch,P. Shanahan,Laszlo Somlyody,Peter A. Vanrolleghem,2001-08-31 This Scientific and Technical Report STR presents the findings of the IWA Task Group on River Water Quality Modelling RWQM The task group was formed to create a scientific and technical base from which to formulate standardized consistent river water quality models and guidelines for their implementation This STR presents the first outcome in this effort River Water Quality Model No 1 RWQM1 As background to the development of River Water Quality Model No 1 the Task Group completed a critical evaluation of the current state of the practice in water quality modelling A major limitation in model formulation is the continued reliance on BOD as the primary state variable despite the fact BOD does not include all biodegradable matter A related difficulty is the poor representation of benthic flux terms As a result of these limitations it is impossible to close mass balances completely in most existing models These various limitations in current river water quality models impair their predictive ability in situations of marked changes in a river s pollutant load streamflow morphometry or other basic characteristics RWQM 1 is intended to serve as a framework for river water quality models that overcome these deficiencies in traditional water quality models and most particularly the failure to close mass

balances between the water column and sediment To these ends the model incorporates fundamental water quality components and processes to characterise carbon oxygen nitrogen and phosphorus C O N and P cycling instead of biochemical oxygen demand as used in traditional models The model is presented in terms of process and components represented via a Petersen stoichiometry matrix the same approach used for the IWA Activated Sludge Models The full RWQM1 includes 24 components and 30 processes The report provides detailed examples on reducing the numbers of components and processes to fit specific water quality problems Thus the model provides a framework for both complicated and simplified models Detailed explanations of the model components process equations stoichiometric parameters and kinetic parameters are provided as are example parameter values and two case studies The STR is intended to launch a participatory process of model development application and refinement RWQM1 provides a framework for this process but the goal of the Task Group is to involve water quality professionals worldwide in the continued work developing a new water quality modelling approach This text will be an invaluable reference for researchers and graduate students specializing in water resources hydrology water quality or environmental modelling in departments of environmental engineering natural resources civil engineering chemical engineering environmental sciences and ecology Water resources engineers water quality engineers and technical specialists in environmental consultancy government agencies or regulated industries will also value this critical assessment of the state of practice in water quality modelling Key Features presents a unique new technical approach to river water quality modelling provides a detailed technical presentation of the RWQM1 water quality process model gives an informative critical evaluation of the state of the practice in water quality modelling and problems with those practices provides a step by step procedure to develop a water quality model Scientific Technical Report No 12

*A Selected Annotated Bibliography on the Analysis of Water Resource Systems*, 1969 *Proceedings of Stormwater and Water Quality Model Users Group Meeting, January 31-February 1, 1985* Thomas O. Barnwell, 1985 **Water Quality Modeling** Steven C. McCutcheon, 1990-01-05 This fascinating work is divided into two main sections Part I reviews the basic principles of water movement in channels and the mass balance approach common to most models It also covers the practical usefulness model peer review and guidance on model selection and calibration Part II discusses flow simulation and prediction of time of travel dye tracing and mixing heat balance and temperature modeling and reaeration and volatilization This interesting easy to read volume includes comprehensive reviews for the use of fluorescent water tracing dyes longitudinal dispersion evaporation and wind speed functions prediction of saturation concentrations of dissolved oxygen and reaeration coefficients This book furnishes the reader with appendices which provide a synopsis of available computer models and gives a comprehensive listing of methods used to measure flow rates in rivers tributaries and pipes and channels introducing wastewaters into streams This volume is a valuable indispensable reference for all researchers instructors students in advanced environmental modeling courses and practicing engineers Water Quality Models Used by the Corps

of Engineers ,1987      *A Selected Annotated Bibliography on the Analysis of Water Resource Systems* Water Resources Scientific Information Center,1975      **A Selected Annotated Bibliography on the Analysis of Water Resource Systems** Daniel P. Loucks,1973      **Selected Water Resources Abstracts** ,1991      Optimization of Urban Wastewater Systems using Model Based Design and Control Carlos Alberto Velez Quintero,2020-11-25 A considerable amount of scientific evidence has been collected leading to the conclusion that urban wastewater components should be designed as one integrated system in order to protect the receiving waters cost effectively Moreover there is a need to optimize the design and operation of the sewerage network and wastewater treatment plant WwTP considering the dynamic interactions between them and the receiving waters This book introduces a method called Model Based Design and Control MoDeCo for the optimum design and control of urban wastewater components The book presents a detailed description of the integration of modelling tools for the sewer the wastewater treatment plants and the rivers The complex modelling structure used for the integrated model challenge previous applications of integrated modelling approaches presented in scientific literature The combination of modelling tools and multi objective evolutionary algorithms demonstrated in this book represent an excellent tool for designers and managers of urban wastewater infrastructure This book also presents two alternatives to solve the computing demand of the optimization of integrated systems in practical applications the use of surrogate modelling tools and the use of cloud computer infrastructure for parallel computing      Modeling Discharge, Temperature, and Water Quality in the Tualatin River, Oregon Stewart Rounds,Tamara M. Wood,Dennis D. Lynch,1999      Water Quality Modelling, Forecasting and Control P. G. Whitehead,P. E. O'Connell,1984      **A Dynamic Water-quality Modeling Framework for the Neuse River Estuary, North Carolina** Jerad Bales,Jeanne C. Robbins,1999      *Formulation and Use of Practical Models for River-quality Assessment* Walter G. Hines,1975      **The Rivers Handbook** Peter P. Calow,Geoffrey E. Petts,2009-07-08 Fast changing legislation and increasing environmental awarenesswithin the non scientific community demands that the modernapproach to the management of rivers and water resources should bebased on a sound understanding and application of the scientificand ecological principles that underlie freshwater processes Intwo volumes The Rivers Handbook offers an expert andexhaustive insight into the principles methods and tools of modernriver management always within an integrated and environmentallyacceptable framework This second volume develops the principlesand philosophies expounded in the first volume into the managementsphere organizing the approach around problems diagnosis andtreatment A fully comprehensive reference to sound methods of modernriver management The ideal information resource for all river managers      *Comprehensive Water Quality and Purification* ,2013-09-24 Comprehensive Water Quality and Purification Four Volume Set provides a rich source of methods for analyzing water to assure its safety from natural and deliberate contaminants including those that are added because of carelessness of human endeavors Human development has great impact on water quality and new contaminants are emerging every day The issues of sampling

for water analysis regulatory considerations and forensics in water quality and purity investigations are covered in detail Microbial as well as chemical contaminations from inorganic compounds radionuclides volatile and semivolatile compounds disinfectants herbicides and pharmaceuticals including endocrine disruptors are treated extensively Researchers must be aware of all sources of contamination and know how to prescribe techniques for removing them from our water supply Unlike other works published to date that concentrate on issues of water supply water resource management hydrology and water use by industry this work is more tightly focused on the monitoring and improvement of the quality of existing water supplies and the recovery of wastewater via new and standard separation techniques Using analytical chemistry methods offers remediation advice on pollutants and contaminants in addition to providing the critical identification perspective The players in the global boom of water purification are numerous and varied Having worked extensively in academia and industry the Editor in Chief has been careful about constructing a work for a shared audience and cause

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