CE-QUAL-W2 Version 3.7
Workshop March XX-YY, 2012 Brasília, Brazil
University of Brasilia

Sponsored by
Department of Civil and Environmental Engineering
Maseeh College of Engineering and Computer Science
and
UnB - Brazilian University / Energy and Environmental Laboratory
ABES / DF - Brazilian Association of Sanitary and Environmental Engineering

Workshop Overview

CE-QUAL-W2 is a longitudinal/vertical, unsteady hydrodynamic and water quality model (see Figure below). This model has been successfully applied in numerous applications, ranging from steeply sloping rivers to deep reservoirs and narrow estuaries. This workshop, presented by Portland State University together with University of Brazilia - UnB - and Brazilian Association of Sanitary and Environmental Engineering - ABES / DF, provides a thorough review of the background of the model's water quality, hydrodynamic, and numerical algorithms; computer laboratory sessions for setting up and running the model; and a day where case studies of CE-QUAL-W2 applications will be presented. This workshop is designed for biologists, hydrologists; geologists; engineers; chemists; city, state, and federal regulators; site planners and project managers; compliance/regulatory program managers for industry; and technical experts. Some technical background and experience in surface water quality problems is presumed. The workshop will be from a Monday to a Friday. Friday will only be half a day. The topics considered on each day consist of the following sections:

• Hydrodynamic modeling: Monday

• Water quality modeling: Monday

• CE-QUAL-W2 governing equations: Monday

• CE-QUAL-W2 model structure: Tuesday

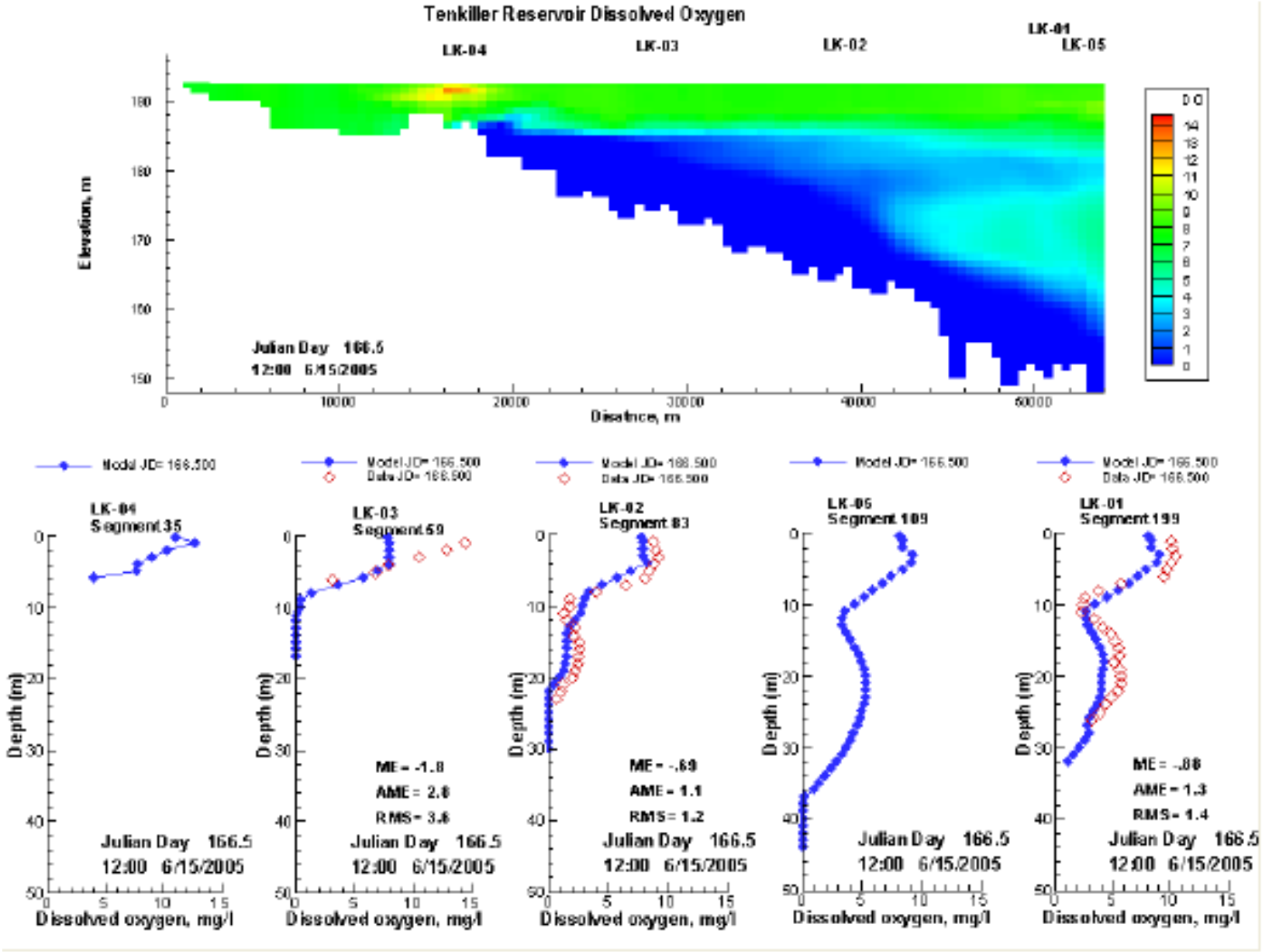
• CE-QUAL-W2 solution algorithms: Tuesday

• Data requirements for calibration: Tuesday, Wednesday

• Model calibration: Tuesday, Wednesday

• Computer sessions: Monday, Tuesday, Wednesday, Thursday, Friday

• How to set-up W2 from scratch: Friday


Tenkiller Reservoir Dissolved Oxygen
LK-04
LK-03
LK-02
LK-01
LK-05
Elevation, m
Distance, m
Julian Day 166.5
12:00 6/15/2005
DO
Model JD= 166.500
Data JD= 166.500
LK-04
Segment 35
LK-03
Segment 59
LK-02
Segment 83
LK-05
Segment 109
LK-01
Segment 199
Depth (m)
Dissolved oxygen, mg/l
ME = -1.8
AME = 2.8
RMS = 3.6
ME = -.69
AME = 1.1
RMS = 1.2
ME = -.86
AME = 1.3
RMS = 1.4

The workshop is planned to be held on March, 2012 in the Energy and Environmental Laboratory, Mechanical Engineering Department at Federal University of Brazilia (*Universidade de Brasília, Departamento de Engenharia Mecânica, 70910-900 Brasília.DF*). This room is equipped with projection equipment and individual computer. The workshop will commence each day at 8 am and finish at 4 pm. All participants will receive a certificate of completion by ABES.

The computer sessions have been designed not only to teach the user how to run the model, but also to assist the user to learn more about the code and the limitations and capabilities of the model to solve real-world problems. The computer sessions are everyday of the workshop and include examples in reser-voirs, rivers and estauaries.

We realize that the technical abilities of those in attendance vary significantly. Even though the material will be taught to reach as many as possible, it will be impossible not to use partial differential equations. These equations will be presented (hopefully!) in a format that will make understanding the basic physics, biology, and chemistry comprehensible. This background is necessary to understand the overall model.

Workshop Schedule

The schedule for the workshop is shown in Table below. Workshop schedule.

Table: Workshop schedule

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8-8:30	Registration	Review of Long Lake Example Problem; Water Quality Modeling (continued) and Numerical Solution Scheme	Review of DeGray Workshop Problem CE-QUAL-W2	*Review of Long Lake/Bluestone Example Problems* CE-QUAL-W2 set-up *Computer Lab 5* Wahiawa Reservoir	Application development: *Computer Lab 8*
8:30-9	Welcome/Overview				
9-10	Hydrodynamic Modeling				
10-10:15	**Break**	**Break**	**Break**	**Break**	Break
10:15-12	Hydrodynamic Modeling	CE-QUAL-W2 set-up	CE-QUAL-W2 set-up	*Computer Lab 5* Wahiawa Reservoir	Application development, *Computer Lab 8* Summary
12-1	**Lunch**	**Lunch**	**Lunch**	**Lunch**	**Workshop end**
1-2:15	Water Quality Modeling	CE-QUAL-W2 set-up	*CE-QUAL-W2 set-up* *Computer Lab 3* Long Lake/Croton/Bluestone Reservoirs	*Computer Lab 6* Columbia Slough Computer Lab 7 Spokane River	
2:15-2:30	Introduction to Computer Lab				
2:30-2:45	**Break**	**Break**	**Break**	**Break**	
2:45-4	*Computer Lab 1* Model Bathymetry/Long Lake	*Computer Lab 2* DeGray Reservoir	*Computer Lab 4* Long Lake/Croton/Bluestone Reservoirs	Computer Lab 7 Spokane River	

Lecture Outlines

The following outline is provided to give you an overview of each lecture.

Hydrodynamic Modeling

1. Overview
2. Governing Momentum and Continuity Equations - governing equations used in CE-QUAL-W2, physical significance of each term, assumptions leading to derivation and lim-itations of governing equation
3. Turbulence closure hypotheses (big picture look) – choices in Version 3
4. Auxiliary functions of the hydrodynamic model – internal weirs, weirs/spillways, gates, pipes, selective withdrawal, wind shear, bottom friction, inflow/outflow distributions
5. Parameters required for hydrodynamic calibration

Water Quality Modeling

1. Overview
2. Advective-Diffusion Equation - governing equation used in CE-QUAL-W2 and basic as-sumptions leading to derivation (limitations of governing equation)
3. Source/Sink term: dissolved oxygen, temperature, nutrients, algae, pH, TDS, bacteria (big picture overview for each water quality parameter)
4. Kinetic parameters needed for source/sink terms (specifics)

Numerical Scheme - Momentum Equation and Water Quality Algorithms

1. Numerical scheme for solving the water surface equation (η)
2. Numerical scheme for solving the momentum equation (U, W)
3. Numerical scheme for solving water quality variables (C)

CE-QUAL-W2 setup

Overview of CE-QUAL-W2 – ‘rules of the road’

1. Preparation of input files
   1.1. Bathymetry file
   1.2. Control file
   1.3. Time-varying data files
2. Model calibration
   2.1. Temperature
   2.2. Water quality
3. W2 Control File Inputs
4. W2 Input/Output Files

Case Studies - Computer Laboratory

The computer case studies were carefully chosen to show the capability of the CE-QUAL-W2 modeling platform. The examples used during the workshop are shown in Table below.

Table : Workshop example case studies.

Lab #	Modeling area	Case Study	Time	Specific areas
1	Hydraulic Calibration- Bathymetry set-up	Long Lake, Washington	1.25 hours	water surface elevation/ volume balance on a reservoir incorporating seepage, tributary inflow, distributed inflows
2	Numerical accuracy	DeGray Reservoir Arkansas	1.25 hours	Model predictions based on grid resolution and numerical solution scheme
3,4	Temperature calibration	Long Lake, Washington; Croton Reservoir, NY; Massachusetts Bluestone Reservoir West Virginia	3 hours	temperature profiles
5	Water quality management alternatives	Wahiawa Reservoir Hawaii	2 hours	dissolved oxygen, algae, nutrient dynamics
6	Estuary modeling water quality calibration	Columbia Slough Portland, Oregon	2 hours	water quality calibration for estuary (dissolved oxygen)
7	River Shading Example	Spokane River	2 hour	Sloping river channels with periphyton and stream bank shading
8	Application Development	Generic Reservoir	3 hours	Develop all input files for a W2 application

Workshop Instructors

Team Member	Educational background	Overview of Experience	Project responsibilities
Scott A. Wells, P.E.	Ph.D., Cornell University	Almost 100 publications in environmental modeling; analysis and modeling of water quality and hydrodynamics in over 100 lake, reservoir, river, and estuary systems; teaches classes on surface water hydrodynamics/quality and a workshop on water quality and hydrodynamic modeling each summer for the Corps of Engineers Waterways Experiments Station; co-developer of CE-QUAL-W2 Version 3 water quality and hydrodynamic model for reservoir/lake/river systems; involved in International projects such as the modeling of the Dead Sea system in Israel/Jordan and reservoirs in Peru and Guyana.	Lead lecturer

Chris J. Berger, P.E.	Ph.D., Portland State University	Modeled numerous systems including the Tualatin River, Wahiawa Reservoir, Spokane River system, Brownlee Reservoir, Oxbow reservoir, Hells Canyon, Willamette River, Laurance Lake, Cooper Creek Reservoir, and the Columbia Slough system, developer of a new state-of-the-art macrophyte and zooplankton simulation models in CE-QUAL-W2. Experience conducting field work in the Columbia Slough and in other systems. Expertise in algal population dynamics.	Some lectures, computer laboratory

Vanessa Wells	MS, Civil Environmental Engineering, Portland State University, (Dec 2011)	Worked with Water Quality Research Group on analyzing data for stream bed temperature modeling, bathymetric and inflow data for Tolt Reservoir (WA), bathymetric and inflow data for Tenkiller Reservoir (OK); bathymetry for Amaila Reservoir in Guyana; bathymetry and inflow files for Chester Morse Lake WA). Development of temperature and fish bioenergetics models of Chester Morse Reservoir and Cedar River system for impacts of reservoir operations on fish habitat and growth.	Some lectures, computer laboratory

Registration

To register for the workshop please click here. If you have questions, please contact XXXXX for registration and hotel information. She/he can be reached through the XXXXXXXXXX at (+55) 61 XXXX-XXXX (Monday- Friday 8 am-5pm, Brasília Time).

Hotel Information: Logistical Arrangements for the Workshop

Registration/Inscrições:

Acesse o link ____ preencha o formulário e envie. As inscrições somente serão efetivadas mediante o envio da ficha de inscrição e do comprovante de pagamento.

Sócio Profissional (em dia com a Abes)	Sócio Estudante (em dia com a Abes)	Não Sócio Profissional	Não Sócio Estudante
R$ 3,060.00	R$ 2,250.00	R$ 3,400.00	R$ 2,500.00

Notas:

1. Inclui software e material;
2. Inscrições até 31 de janeiro de 2012;
3. Regras de reembolso:
   3.1. 100% notificação recebida antes de 31 de janeiro de 2012;
   3.2. 100% caso o curso não seja sustentável para a data de março de 2012, ou seja, não foi recebido no mínimo 20 inscrições com pagamento.

Cancelamento deve ser realizado por escrito pelo seguinte email XXXX e telefonar para XXXX. Por favor permita que o processo de reembolso seja realizado em aproximadamente de 4 a 6 semanas.

CNPJ : 33.945.015/0012-34