Water Quality Modeling
An Overview

Adugna Kebede, NC DWQ

Modeling and TMDL Unit

What is a model?

- A model is a small object usually built to scale, that represents another often larger object.

- A mathematical model is an idealized formulation that represents the response of a physical system to an external stimuli.

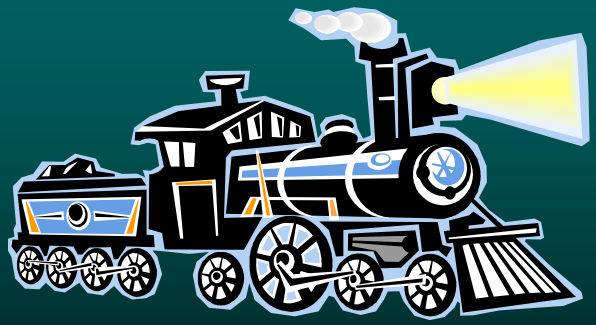
What is a model?

- A theoretical construct,
- together with assignment of numerical values to model parameters,
- incorporating some prior observations drawn from field and laboratory data,
- and relating external inputs or forcing functions to system variable responses

* Definition from: Thomann and Mueller, 1987

Models

- Toys
- Meteorological
- Economic
- Health Risk
- Climate



What is a water quality model?

- A mathematical representation of pollutant fate, transport, and degradation within a water body

OR

- A mathematical representation of the movement of pollutants from land-based sources to a water body

Model Calibration

Calibration: The procedure of adjustment of parameter values of a model to reproduce the response of reality within the range of accuracy consistent with the intended application of the model.

Refsgaard, J,C. and H.J. Henriksen. 2003. Modeling guidelines – terminology and guiding principles, Advances in Water Resources 27, 71-82.

Model Validation

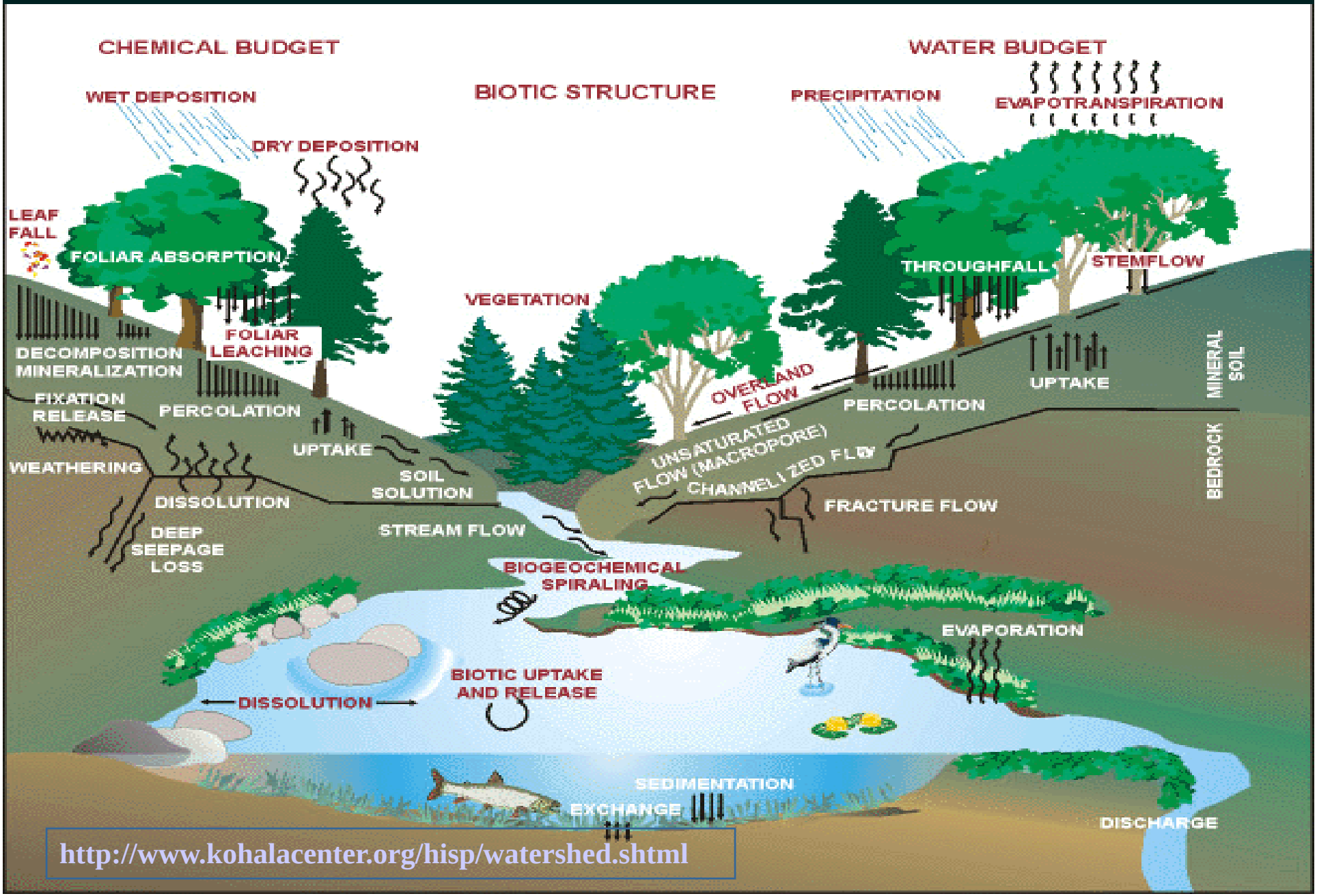
Validation: Substantiation that a model within its domain of applicability possesses a satisfactory range of accuracy consistent with the intended application of the model.

Refsgaard, J,C. and H.J. Henriksen. 2003. Modeling guidelines – terminology and guiding principles, Advances in Water Resources 27, 71-82.

Don’t Mistake a Model for Reality!

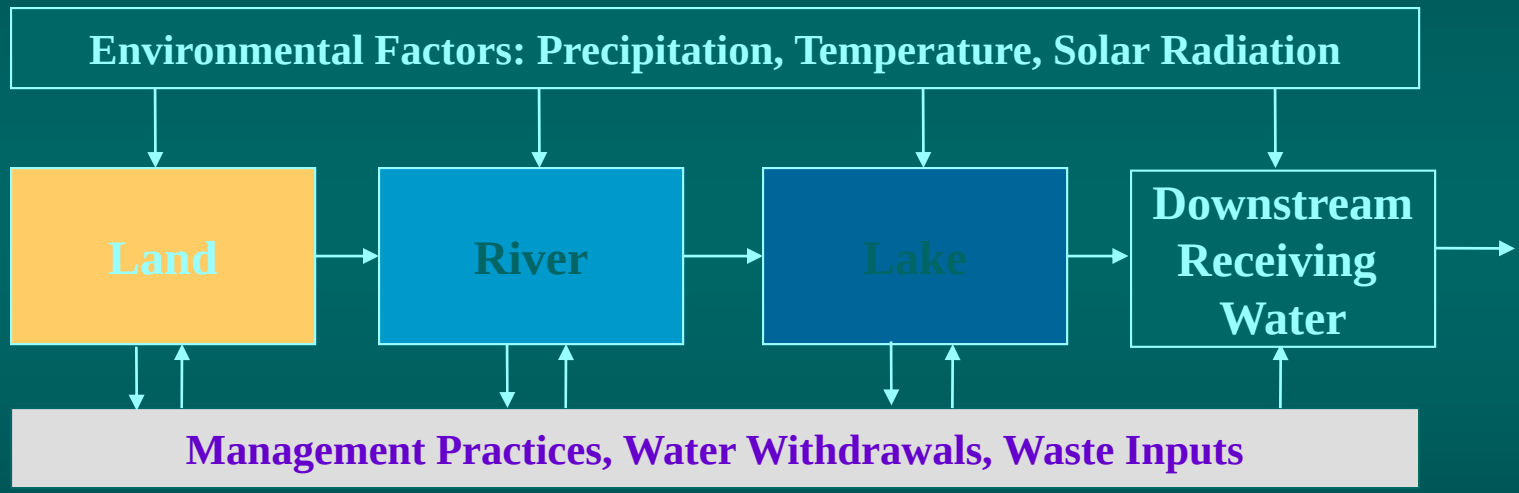
- Models summarize data, provide one line of evidence, and provide an imperfect approximation of reality
- “All models are wrong; some models are useful” [George E. P. Box]

Processes to consider in a model



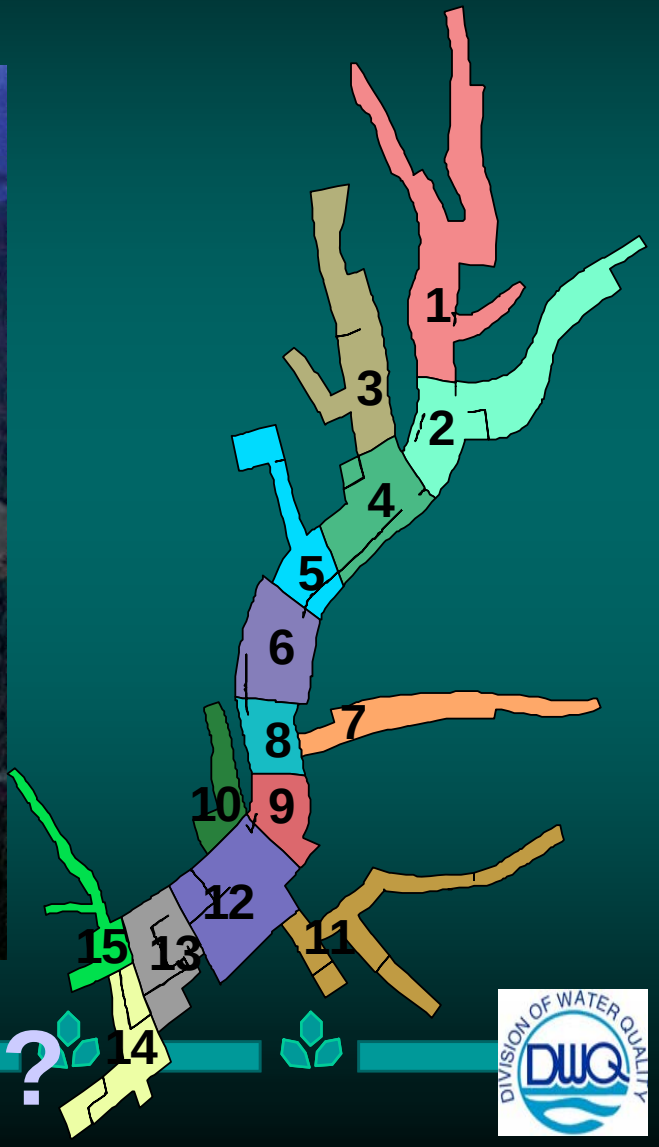
http://www.kohalacenter.org/hisp/watershed.shtml

Modeling System Components



From Jon Butcher, Tetra Tech, Inc

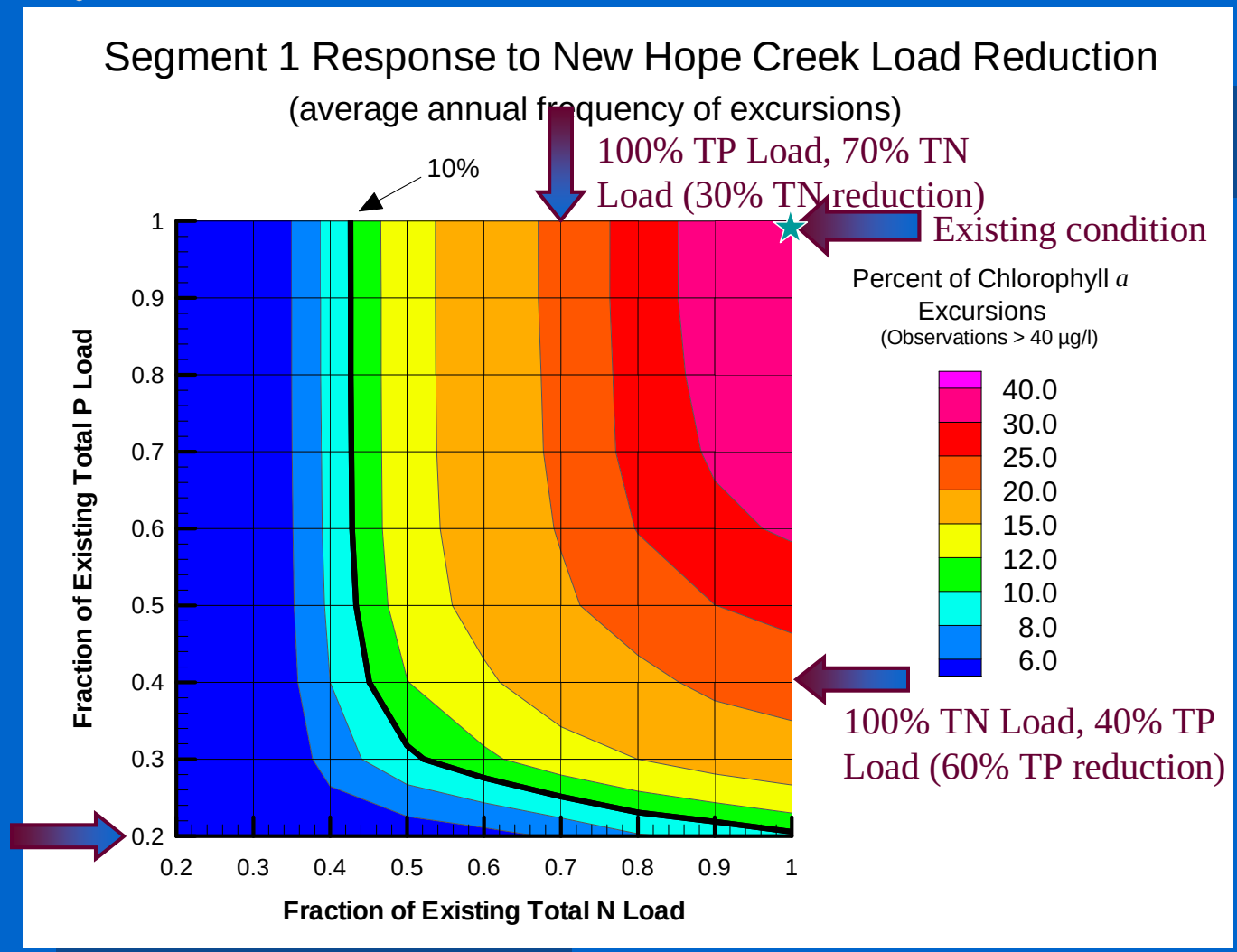
How do you go from this?



To this?

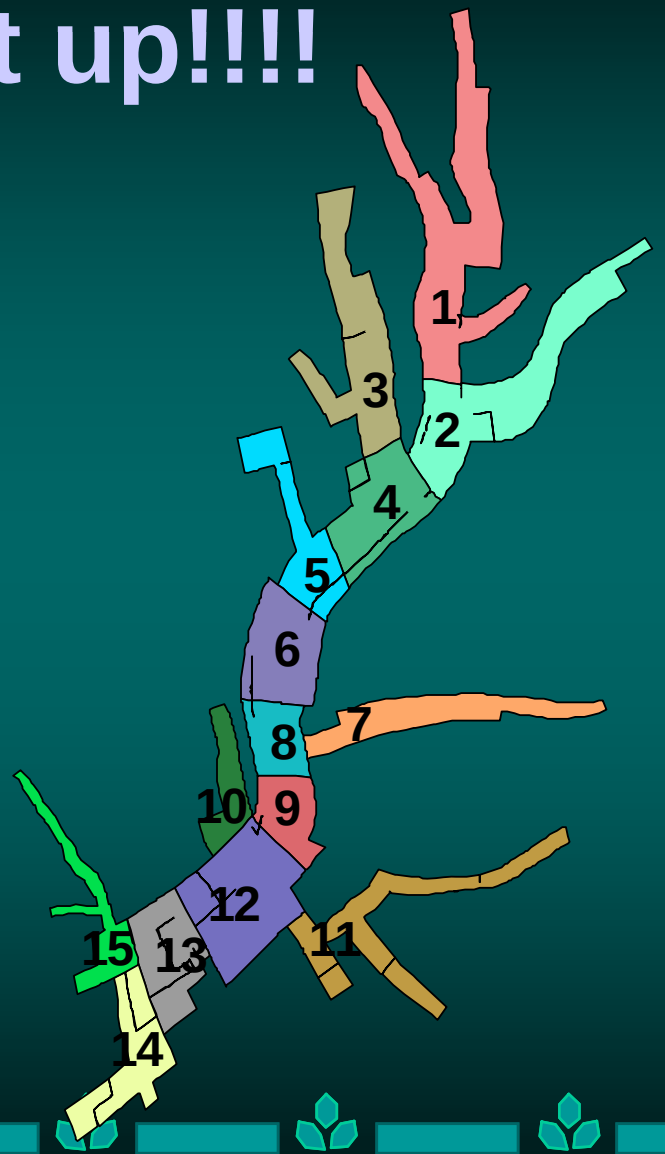
DIVISION OF WATER QUALITY
DWQ

To this?

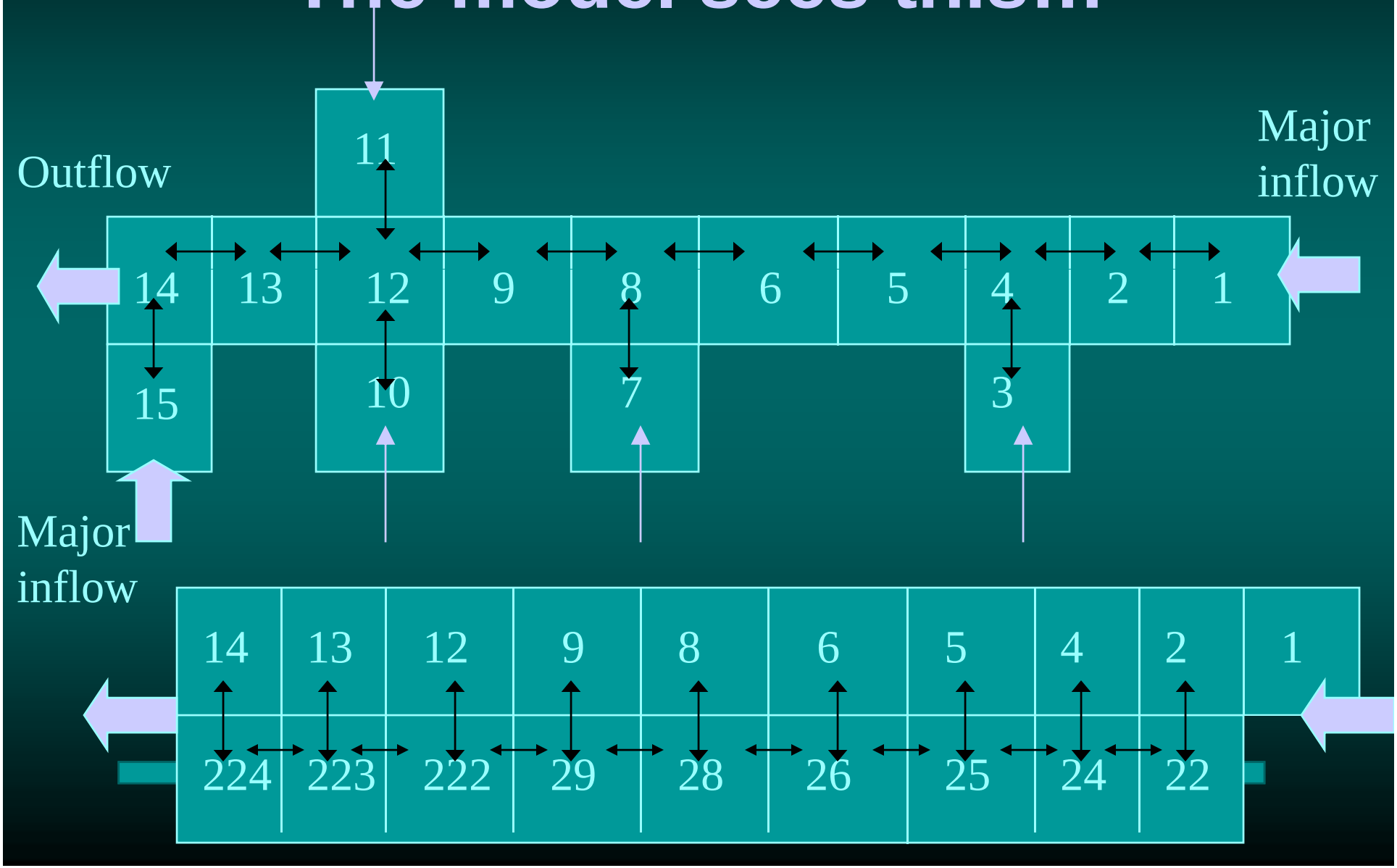

Segment 1 Response to New Hope Creek Load Reduction
(average annual frequency of excursions)
10%
100% TP Load, 70% TN Load (30% TN reduction)
Existing condition
Percent of Chlorophyll a Excursions
(Observations > 40 µg/l)
40.0
30.0
25.0
20.0
15.0
12.0
10.0
8.0
6.0
100% TN Load, 40% TP Load (60% TP reduction)
Fraction of Existing Total P Load
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Fraction of Existing Total N Load

Break it up!!!!

- Lake/reservoir broken into discrete areas or segments
- Spatial distribution of data
- Hydraulic barriers
- Water quality will be predicted in each segment



The model sees this…



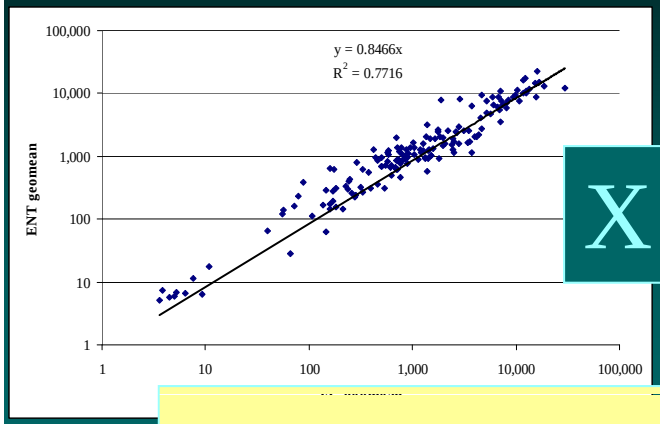
Common Questions Regarding the Use of Models

- Should they be used? Is a model necessary?
- What are the primary waterbody characteristics?
- What are the concentration and response dynamics?
- Which model should I use? - Model selection
- What are the trade-offs between using simple and complex models?
- Which features of the system should the modeling efforts focus on?
- How can modeling results be integrated into the overall assessment and planning framework?
- How can complex model results be effectively transmitted to the public?

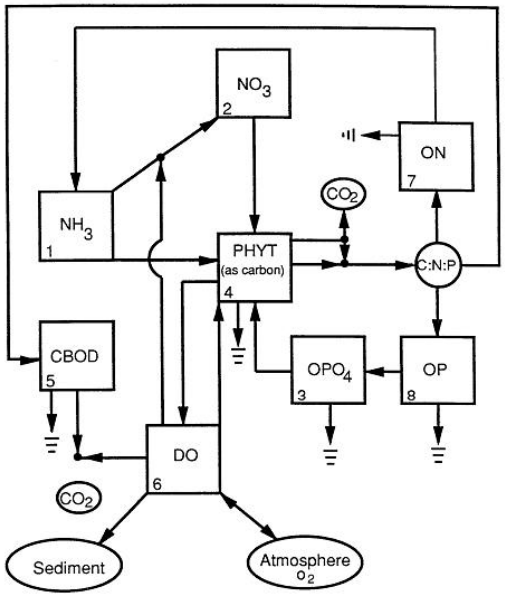
Models can be …

- Emprical
  - Models are based on statistical relationship between parameters of interest and other variables (such as time)
- Deterministic and Mechanistic
  - Models are developed using a combination of physics, chemistry, and statistical relationships. Also called process-based or physically-based models.
- Combination

Model Basis



$X = f(y)$

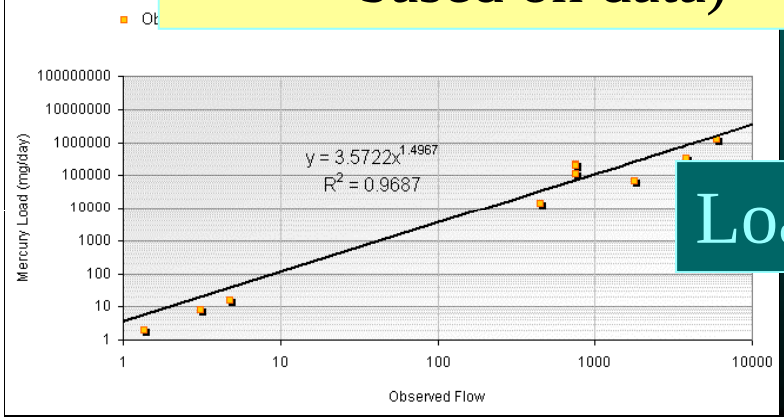


Empirical Formulations

(statistical relationships based on data)

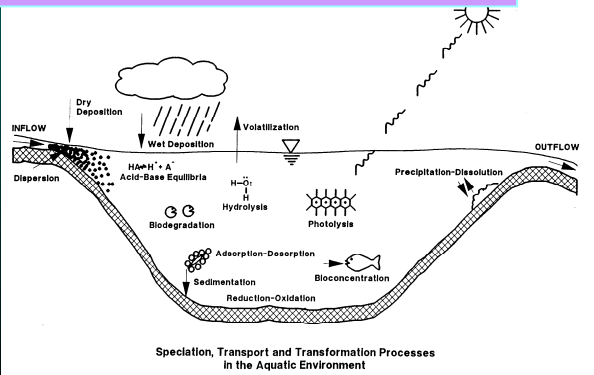
Deterministic Models

(biological, chemical, physical processes)



$Load = \#/acre/yr$

From Jon Butcher, Tetra Tech, Inc



Models vary by type…

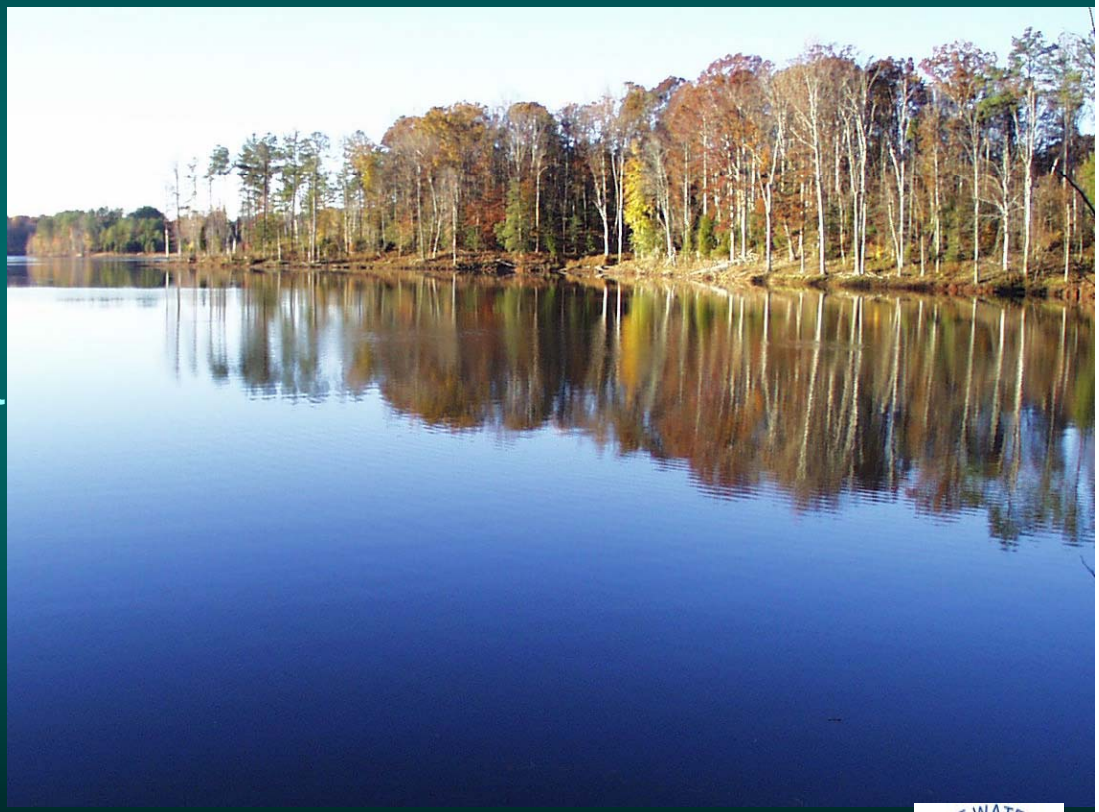
- Receiving water models
  - These models predict what is happening in the receiving waters, e.g., rivers, lakes, estuaries.
- Watershed loading models
  - These models predict what is happening on “land” that results in an export of pollutant to the river, lake or estuary.

Models vary by pollutant…

- Suspended sediment/ Turbidity
- Metals
- Dissolved oxygen
- Nutrients/Chlorophyll
- Organic chemicals (SVOCs, persistent bioaccumulative chemicals)

Models vary by waterbody…

- Rivers
- Lakes
- Estuaries
- Tidal creeks a bays
- Ocean
- Groundwater



Models vary in complexity…

- Simple
  - Long-term average representation of the system. (Typically, an equation) Won't vary in time or space.
- Moderately complex
  - Average representation of the system (monthly, annually). May vary in time or space.
- Complex
  - Daily (or less than daily) representation of the system. Varies in time and space.

Level of Complexity - Landscape Models

- Export Coefficients
  - average annual unit area loads based on landuse type
- Loading Functions
  - simplified erosion and water quality loading combined with basic representation of hydrologic processes
- Dynamic Models
  - mechanistic (process-based), time-variable representation of watershed processes, including hydrology, erosion, and water quality

From Jon Butcher, Tetra Tech, Inc

Level of Complexity - Receiving Water Models

- Steady-state Models
  - fate and transport model that uses constant values of input variables to predict constant results (under a representative condition)
- Quasi-dynamic Models
  - similar to steady-state formulations, but may include diurnal representation
- Dynamic Models
  - mathematical formulation describing the physical behavior of a waterbody and its temporal variability
    - Hydrodynamic - circulation, transport, temperature, deposition
    - Water Quality - nutrients, toxics, pathogens, temperature, etc.

From Jon Butcher, Tetra Tech, Inc

The more complex the model

The more data you need!!!

General ways data is used in modeling

- Model Construction (development)
  - Initial conditions
  - Forcing functions and boundary conditions
- Model Calibration
- Model Verification

TMDLs

- Should attain standards at all points in a listed segment or watershed
- But, impractical to develop separate TMDLs for every stream segment
- Determine key “pressure points” where upstream control needs are most stringent
- Revise, refine, and nest management as necessary

TMDLs

- To summarize:
- TMDL = LC = WLAs + LAs + MOS

- Models are used in Linkage Analysis (Linking Sources to Targets)
- Models are used to determine Loading Capacity, and to separate the Wasteload Allocations (point source) and Load Allocations (nonpoint source)

Protocols for TMDL Development
Suggested TMDL Components

- Problem Statement
- Numeric Targets
- Source Assessment
- Linkage Analysis
- Allocations
- Monitoring/Evaluation Plan (for phased approach)
- (Implementation: Follows the TMDL)

Problem Statement

- Designated uses and impairment
- Geographic setting and scale
- Potential sources
- Potential control options
- Temporal considerations

Numeric Targets

- Select Indicators
  - Applicable numeric or narrative standard
  - Potential measures useful as indicators when numeric standards are not available
- Identify target values
- Compare existing and target conditions

Linking Sources to Water Quality

- Identify cause-and-effect relationships *between selected water quality targets and identified sources*
- Determine level of analysis and method of linkage
- Assess linkages
- Estimate total loading capacity or needed load reduction
- Utilize simulation methods.

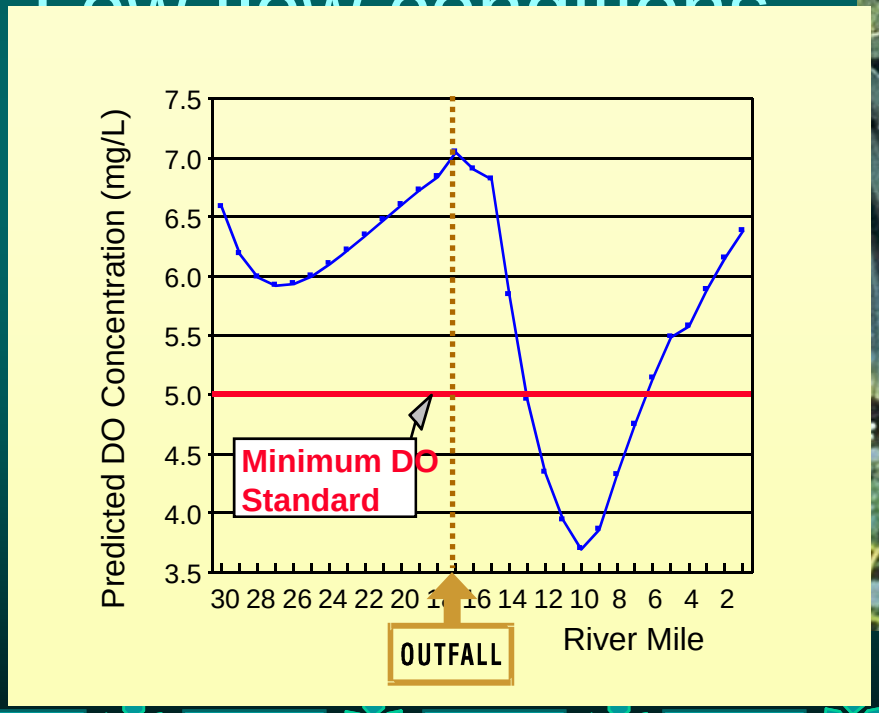
  =Establish overall assimilative capacity and load reduction needed

Linkage Analysis …

- Describe how sources are linked to impairment of designated uses, e.g.
  - erosion of logging roads ->
  - excess fine sediment load ->
  - increased embeddedness of substrate ->
  - poor spawning success of salmonids ->
  - failure to support designated coldwater fishery
- What components of the linkage can be measured and predicted to evaluate control options (indicators)?

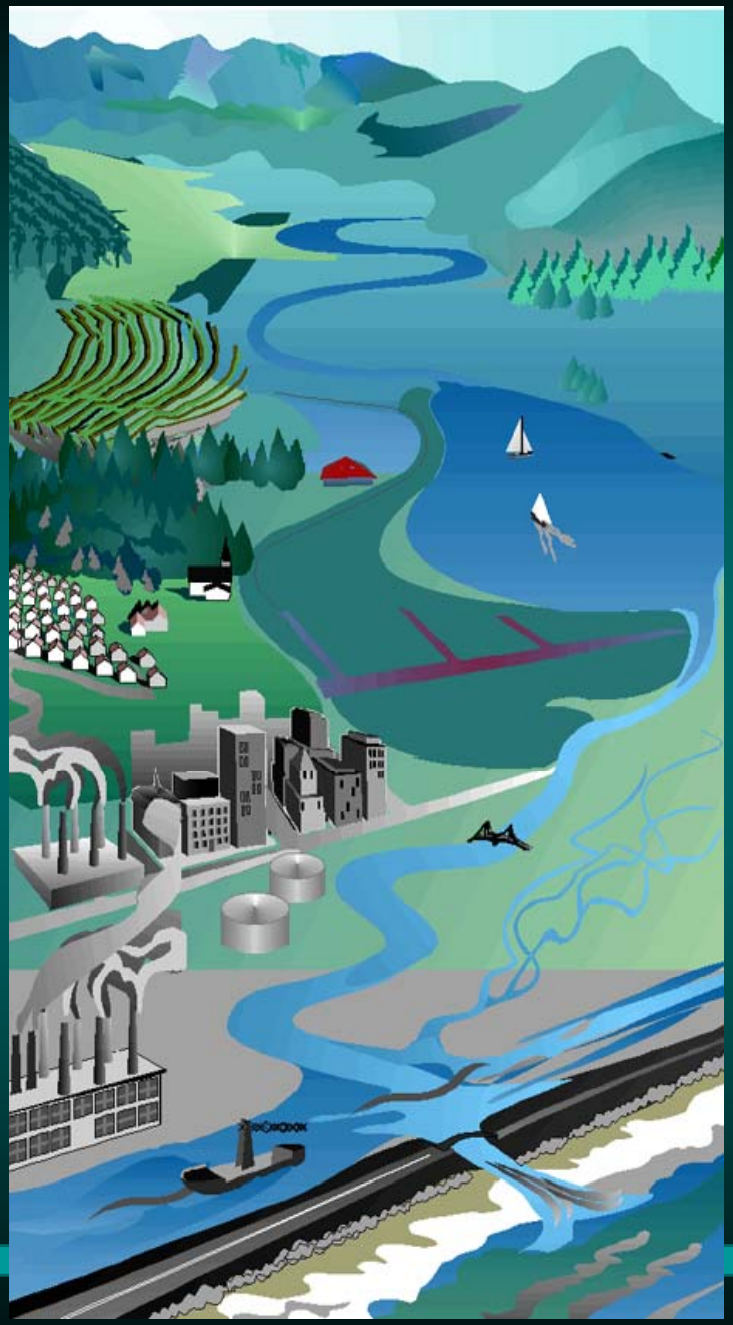
A Typical Point-Source Modeling Problem

- Steady-state
- Low flow conditions



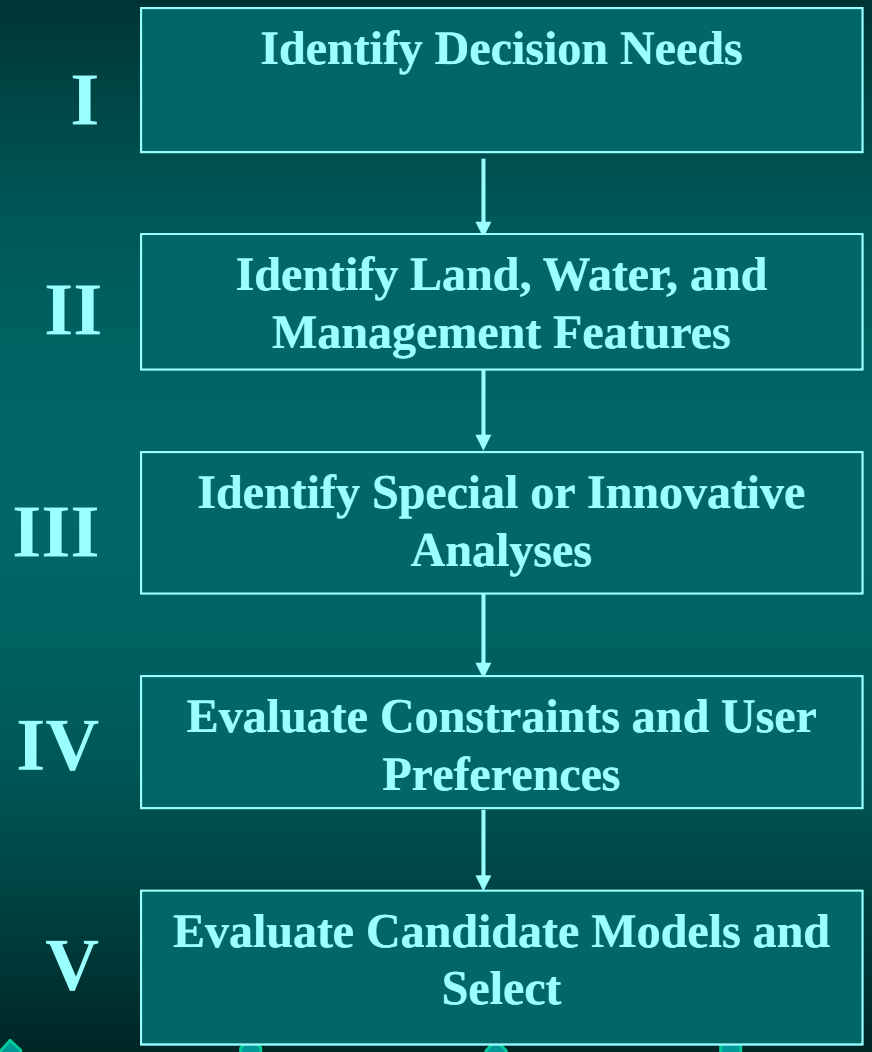
From Jon Butcher, Tetra Tech, Inc

A Typical Watershed-Scale Problem



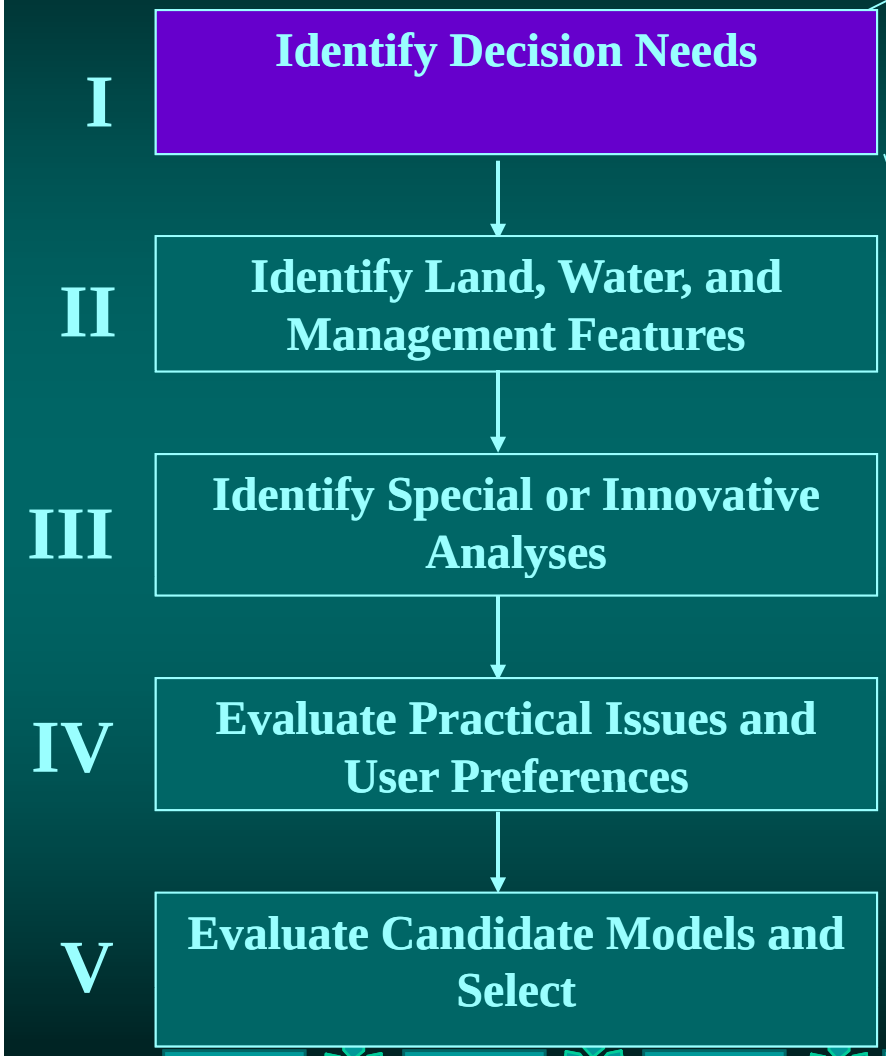
From Jon Butcher, Tetra Tech, Inc

Model Selection Process



From Jon Butcher, Tetra Tech, Inc

Model Selection Process



- ***Indicators relevant to management decision***
  - Compliance with numeric and narrative standards
  - Load of pollutant
  - Conc. of pollutant
  - Secondary impacts
- ***Critical Condition vs. Continuous Simulation***

From Jon Butcher, Tetra Tech, Inc

Model Selection Process

I **Identify Decision Needs**

II **Identify Land, Water, and Management Features**

III **Identify Special or Innovative Analyses**

IV **Evaluate Constraints and User Preferences**

V **Evaluate Candidate Models and Select**

- ***Waterbody type***
  - River
  - Lake
- ***Watershed Uses & Sources***
  - Rural
  - Urban
  - Forest
- ***Management Techniques***
  - Stormwater ponds
  - Operations
  - Flow management

From Jon Butcher, Tetra Tech, Inc

Model Selection Process

I **Identify Decision Needs**

II **Identify Land, Water, and Management Features**

III **Identify Special or Innovative Analyses**

IV **Evaluate Constraints and User Preferences**

V **Evaluate Candidate Models and Select**

- ***Special processes that are not typically included in models***

From Jon Butcher, Tetra Tech, Inc

Model Selection Process

I **Identify Decision Needs**

II **Identify Land, Water, and Management Features**

III **Identify Special or Innovative Analyses**

IV **Evaluate Constraints and User Preferences**

V **Evaluate Candidate Models and Select**

Model Specific Features

- Ease of use
- Time to apply
- Difficulty
- Availability
- Credibility
- Data needs
- Software capabilities

User Specific Preferences

- Trained staff
- Available experts
- Available data
- Time/schedule
- Resources/financial considerations

From Jon Butcher, Tetra Tech, Inc

DIVISION OF WATER QUALITY DWQ

Modeling Process

Phase I

- Modeling Approach Development
- Data Collection (historic, field monitoring)
- Model Input Preparation and Configuration

Phase II

- Calibration
- Validation
- Verification

Phase III

- Analysis of Alternatives

Selecting a model framework

- Model framework
  - Data availability
  - Watershed characteristics
  - EPA guidance (e.g., Nutrient TMDL Protocol)
  - Experience (personally and as a unit)
  - Schedule
- For nutrient response models, must select one of the following:
  - **EUTROMOD, BATHTUB, CE-QUAL-W2, EFDC, WASP**

NRM: Frameworks differ by…

- Spatial variability:
  - Models entire lake as one unit; No spatial variability. (EUTROMOD)
  - Models different parts of the lake; some spatial variability. (BATHTUB, CE-QUAL-W2, WASP, EFDC)
- Temporal scale of output
  - "Growing season" output only (EUTROMOD, BATHTUB)

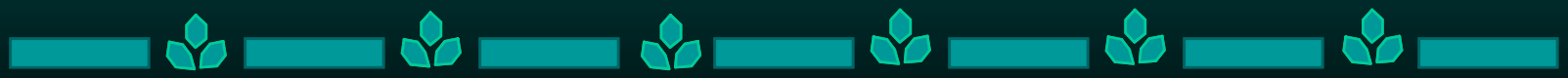
Frameworks differ by… Cont.

- Temporal scale of output
  - Daily output (CE-QUAL-W2, EFDC, WASP)
- Ability to evaluate effect of water movement
  - Hydrodynamic components (CE-QUAL-W2, EFDC)
- Complexity……

Summary

- Modeling is undertaken to serve a decision need
- Simple and complex, deterministic and empirical models all have their roles in TMDL development
- Design the modeling process based on the problem (Questions to answer), Information Needs, and data (resources) avialability
- Models are used to determine Loading Capacity, and to separate the Wasteload Allocations (point source) and Load Allocations (nonpoint source) in the TMDL Process

Some Useful Websites for TMDL Modeling



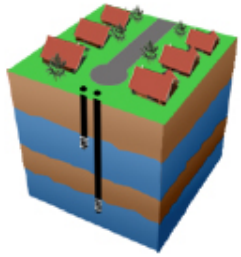
Exposure Assessment Models

Groundwater
Surface Water
Food Chain
Multimedia

Tools & Data
All Products

The EPA Center for Exposure Assessment Modeling (CEAM) was established in 1987 to meet the scientific and technical exposure assessment needs of the United States Environmental Protection Agency (U.S. EPA) as well as state environmental and resource management agencies. CEAM provides proven predictive exposure assessment techniques for aquatic, terrestrial, and multimedia pathways for organic chemicals and metals.

Groundwater Models

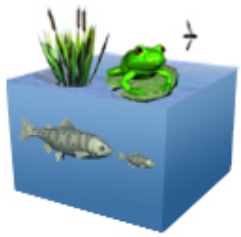


Groundwater models quantify the movement of subsurface water and provide inputs to subsurface contaminant transport models. Simulation provides insight into groundwater and contaminant behavior and quantitative assessments for environmental decision making.

Surface Water Models

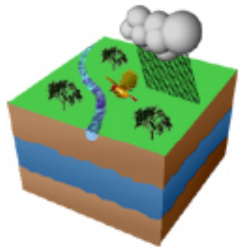
By modeling contaminant movement and concentration in lakes, streams, estuaries, and marine environments, researchers can better understand how exposure to contaminants affects aquatic environments.

Food Chain Models



Contaminated aquatic and terrestrial environments typically result in the bioaccumulation of chemicals within all trophic levels of an ecosystem. Software models provide tools for tracking the movement of contaminants through food chains and for estimating chemical impacts on exposed biota.

Multimedia Models



Contaminants may travel through the atmosphere, soil, surface water, and the organisms that inhabit these media. The multimedia approach to exposure modeling quantifies the impacts of contaminants as they travel through more than one of these environments.

Ecosystems Research Division

ERD Home
About ERD
Watershed/Water Quality Modeling Technical Support Center
Environmental Management System
EPA Center for Exposure Assessment Modeling
Research Abstracts
Research Areas
Opportunities
Staff
Publications
Software
Visitor Information
Education
For KIDS

Home | Technical Support | Tools | Training

Welcome to the Watershed and Water Quality Modeling Technical Support Center. The mission of the Center is to provide assistance to EPA Regions, State and Local Governments, and their contractors in the implementation of the Clean Water Act. The Center which is part of EPA's Office of Research and Development (ORD) is committed to providing access to technically defensible tools and approaches that can be used in the development of Total Maximum Daily Loads (TMDL), waste load allocations, and watershed protection plans. The Center will reach out to experts throughout EPA and States to bring technical expertise to the Center.

There are currently no Training Workshops Scheduled.

For additional information and course announcements please visit the Training section of this website or contact Tim Wool, 404-562-9260, or Bob Ambrose, 706-355-8334.

WASP Version 7.0 is NOW available for Download

Technical Support Center Highlights:

- Completed an Environmental Fluids Dynamics Code (EFDC) workshop held on June 20-24, 2005 at the Atlanta Federal Center, US EPA Region 4, Atlanta, GA. The workshop was attended by 56 participants from State, EPA Regions, EPA ORD, Local Government and private consultants.
- Completed 3-Day Organic Chemical Modeling Workshop at the Maryland Department of the Environment (Region 3).
- Provided technical review of temperature TMDL developed for river in New Jersey for EPA Region 2.
- Developed mercury TMDLs for EPA Region 4 for the following river basins in Georgia: Ogeechee, Canoochee and Brier Creek.
- Provided one day workshop to the California Environmental Modeling Forum in Sacramento, CA (Region 9)
- Provided a week long training session on the Water Quality Analysis Simulation Program (WASP) in Baton Rouge, LA. This workshop was co-sponsored by the Louisiana Department of Environmental Quality. The workshop was attended by twenty participants from Federal, State, local governments, consultants from the US and Canada.
- Member of Technical Advisory Group for PCB TMDL Development on the Potomac River. Assisting in the planning and development of monitoring strategy, model selection and application, (Region 3).
- Providing technical assistance on the review and model application of three dimensional hydrodynamic and water quality model for the Savannah River/Harbor Dissolved Oxygen TMDL, Georgia (Region 4).

Click here for Center fact sheet (PDF, 2 pp., 733 KB, about PDF)

Click here for TMDL fact sheet (PDF, 2 pp., 697 KB, about PDF)

Date Last Modified: September 20, 2005

U.S. Environmental Protection Agency

BASINS: Better Assessment Science Integrating Point & Nonpoint Sources

BASINS Home
Basic Information
Downloads
Order CDs
Documentation
Frequent Questions
Training
Listserver
Other Tools, Utilities, & Features
Metadata
Related Links

A Powerful Tool for Managing Watersheds

A multi-purpose environmental analysis system that integrates a geographical information system (GIS), national watershed data, and state-of-the-art environmental assessment and modeling tools into one convenient package.

Download BASINS 3.1 - This release includes additional links to water quality models as well as a new data user interface tool with access to national data layers.

Basic Information about how the tool is useful for multi-purpose environmental analysis.

Download the latest version of the model, GIS application, updated system files, data, and tutorial.

Order CDs from our publication center.

Documentation including user manuals, case studies, and technical notes.

Frequent Questions about applicability, data, models, and technical issues.

Training in the form of live classes and downloadable lectures and exercises.

Listserver acts as a forum for discussion and technical support. Join the Listserv and search the archives.

Other Tools, Utilities, & Features to be used with basins.

Metadata describing the content, quality, condition, and other characteristics of environmental data.

Related Links within and outside EPA.

Water Quality Standards | TMDLs

Databases

Publications
- Technical Reports
- Technical Notes
- Technical Notes Companion
- Journal Articles
- Bulletins
- Conference
- Other Reports

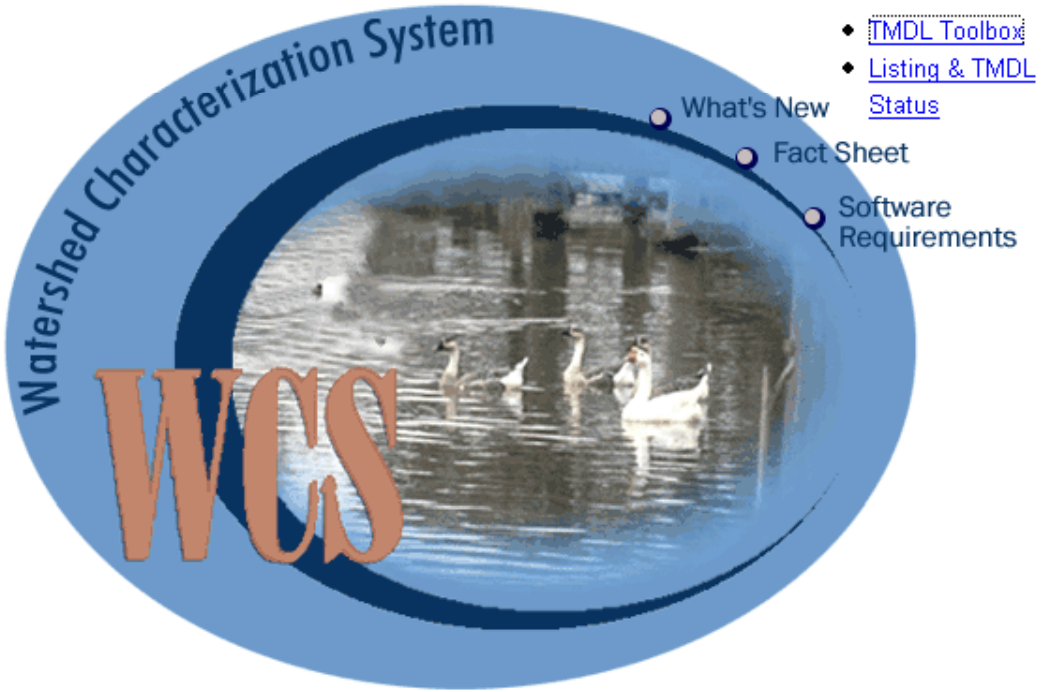
Fact Sheets
- Research
- Project
- ERDC

Models
- Aquatic Plant
- Dredged Material
- Health Risk Assessment
- Landfill
- Water Quality
- Other

Information Systems

Water Quality Models

Model	Application Programs	Description	Download Self-extracting, Executable files	Download Document Files
Reservoir Water Quality Models: (Info) **POCs:** **1. Dottie Tillman** **2. Thomas Cole** **3. Barry Bunch**	**1. CE-QUAL-R1** (Info) (readme.1st)	One-dimensional (vertical) reservoir water quality model	Download currently for U.S. Army Corps of Engineers use only	View on-line or download part1.exe and part2.exe
	2. CE-QUAL-W2 (Info) (readme.1st)	Two-dimensional, vertical-longitudinal, hydrodynamic and water quality model	Download currently for U.S. Army Corps of Engineers use only	
	3. TWQM (readme.1st)	Computes the steady-state, longitudinal distribution of water quality downstream of a reservoir	twqm.exe	
(Info) (Y2K Compliance) **POCs:** **1. Dave Soballe**	**Bathtub, Flux, Profile** (Info)	**Bathtub** Steady-state water and nutrient balance calculations in a spatially segmented hydraulic network which accounts for advective and diffusive transport and nutrient sedimentation **Flux** Program allows estimation of tributary mass discharges (loadings) from sample concentration data and continuous flow records	simptech.exe (DOS Version) bathtub.exe (Windows Version 6.1) (Self-Extracting Archive File)	



- TMDL Toolbox
- Listing & TMDL Status

The Watershed Characterization System (WCS) is an Arcview-based system designed to provide users tools and an initial set of watershed data for characterizing and thereby understanding their watersheds. It can be used to assist users complete the watershed characterization phase required in developing Total Maximum Daily Loads (TMDLs). This may include the following: ·

- Characterization of the physical and hydrologic properties of the watershed, such as soil, land use, elevation, climate, and stream flow.
- Evaluation of ambient water quality conditions, including inventory of monitoring

NWISWeb Water Data

- Real-Time Data

WaterWatch - *Current Streamflow Conditions*

- Floods and High Flow
- Drought
- Monthly Streamflow
- Ground Water

About WRD

Contact Us

Science Topics

Students & Teachers

Recreation

Partnerships

Additional Sources of

Water Resources Applications Software

Ground Water || Geochemical || General Use || Statistics & Graphics

Water-Resources Applications Software

USGS Surface Water Software

Computer systems for which software distribution packages have been compiled are shown in parentheses following the software name; abbreviations used are defined as follows:

DOS - IBM-compatible PC, 386 or higher with math coprocessor
DG - Data General AViiON DG/UX
Linux - Red Hat 6.1 for i386
Mac - Macintosh
SGI - Silicon Graphics Indigo
Sun - Sun SPARCstation Solaris
Win - Microsoft Windows 3.x, 9x, or NT/2000

Obtaining documentation and reports - Information about the availability of electronic and (or) print versions of USGS reports and documentation not included with the software distributions.

- ANNIE (DOS/Sun) - Version: 4.1 last updated 2002/02/25 Interactive Hydrologic Analyses and Data Management
- BRANCH (DOS/DG/Sun) - Version: 4.3 last updated 1997/06/05 Branch-Network Dynamic Flow Model
- BSDMS (DOS/DG) - Version: 2.1 last updated 1996/03/01 Bridge Scour Data Management System
- CAP (DOS/DG/SGI/Sun) - Version: 97-08c last updated 1999/11/15 Culvert Analysis Program
- CGAP (DOS/DG/Sun) - Version: 3.5 last updated 1995/10/06 Channel Geometry Analysis Program
- DAFLOW (DG) - Version: 1.2 last updated 1996/11/04 Streamflow routing in upland channels or channel networks
- DR3M (DOS/DG) - Version: 2.1 last updated 1996/03/01 Distributed Routing Rainfall-Runoff Model--version II
- FEQ (DOS/DG) - Version: 9.98 last updated 2005/05/31 Full EQuations Model
- FESWMS-2DH (DG) - Version: 1.10.DG1 last updated 1995/06/07 Finite-element surface-water modeling system for two-dimensional flow in the horizontal plane
- FOURPT (DG/Sun) - Version: 95.01 last updated 1995/09/06 An unsteady, one-dimensional, open-channel flow model
- GenScn (Win) - Version: 1.0 last updated 1998/08/14 GENeration and analysis of model simulation SCeNarios


http://www.brc.tamus.edu/swat/
Go
Soil & Water Assessment Tool
SWAT
Home
SWAT Team
Contact Us
Links
Software
Documentation
Publications
Education
Applications
Support
Job Postings
Welcome to the Official SWAT Web Site
SWAT is a river basin scale model developed to quantify the impact of land management practices in large, complex watersheds.
What's New
New 2005 BASINS-SWAT training schedule available
Register for the beginner and advanced workshops now, seats are available!
View pictures and presentations from the 3rd International SWAT Conference
Have a Question About SWAT?
Visit our forums and user group
Read the SWAT fact sheet
SWAT is a public domain model actively supported by the USDA Agricultural Research Service at the Grassland, Soil and Water Research Laboratory in Temple, Texas, USA.
Read Disclaimer

WEPP Software

Water Erosion Prediction Project

The Water Erosion Prediction Project (WEPP) model is a process-based, distributed parameter, continuous simulation, erosion prediction model for use on personal computers running Windows 95/98/NT/2000/XP. The current model version (v2004.700) available for download is applicable to hillslope erosion processes (sheet and rill erosion), as well as simulation of the hydrologic and erosion processes on small watersheds. Included in the download package is the WEPP model (version 2004.700), WEPP Windows interface (April 2005), CLIGEN climate generators (versions 4.3 and 5.22564), documentation and example data.

Documentation

Overview of Soil Erosion
WEPP Model v2004.700 Release Notes
WEPP Model Documentation
WEPP Publications Bibliography List
Agricultural Research magazine article on WEPP
WEPP Windows Frequently Asked Questions
WEPP Windows Interface Tutorial

Downloads

Download WEPP for Windows (April 2005)

September 14, 2004 WEPP Model (2004.700)
This is only the FORTRAN model, no user interface or data is included.

Soil Data

Soil parameter inputs for WEPP are based on 1992 SOILS-5 data. The install package includes soil archive files for each state. These archives can be used with the WEPP Windows Interface by selecting the **Tools** menu and then **Soil Archive Program.**

Climate Data

Example CLIGEN breakpoint data file
Breakpoint Climate Generator
CLIGEN Information

Cligen parameter files for about 2600 stations in the US are included in the install package.

Management Data

Example managements for agriculture, rangeland and forest are included in the install package.

Upcoming WEPP Workshops

Related Software

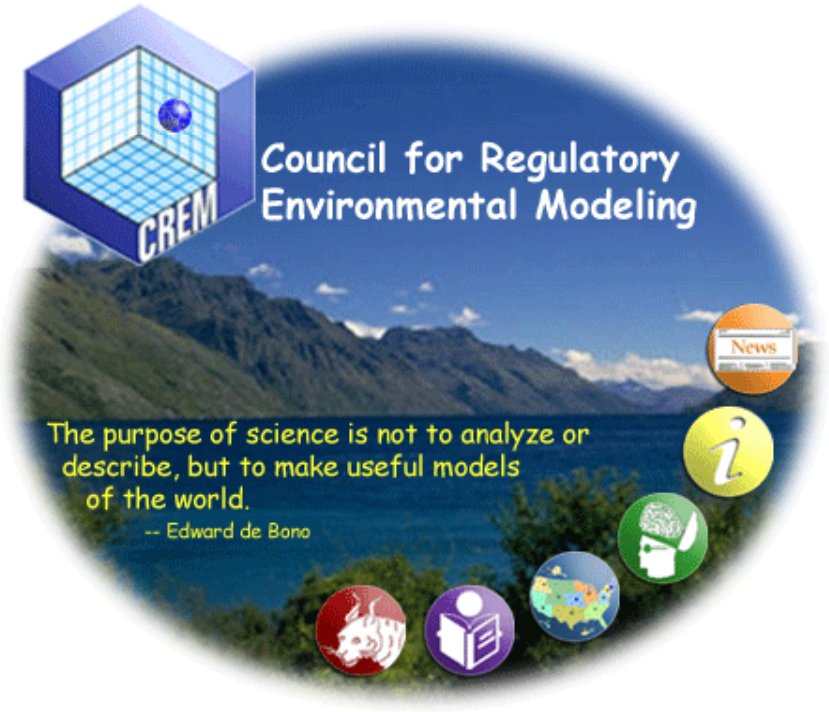
A Web browser interface to WEPP model. Run WEPP simulations without having to download the software, simulations are run on servers at the

U.S. Environmental Protection Agency

Regulatory Environmental Modeling

What's New
About CREM
Models Knowledge Base
Regional Seminars
Library
Related Links

EIMS Archive
Environmental Glossary
Modeling Glossary
Comments & Suggestions



Modeling Groups at EPA

- Air Fate, Exposure, and Risk
- Atmospheric
- Economic Enforcement
- Exposure Assessment
- Pesticide Water
- Regulatory Air
- Subsurface
- Vehicle Emissions
- Water Quality
- Watershed and Water Quality

Related Links

- Public Symposia on Environmental Models: The Science and the Law EXIT disclaimer
- Office of Research and Development
- Office of Science Policy
- System of Registries
- Environmental Information Management System
- Science Inventory
- IRIS
- Science Policy Council
- Risk Assessment Forum

Additional Information

- EPA Researchers
- Peer Review Program

Models Knowledge Base Facts

- The Models Knowledge Base currently contains 105 models.

What's New
About CREM
Models Knowledge Base
Regional Seminars
Library
Related Links

EIMS Archive
Environmental Glossary
Modeling Glossary
Comments & Suggestions

Models Knowledge Base

The Models Knowledge Base is an inventory of EPA's environmental models. It contains information about model use (What are the requirements?, How can it be obtained?, and How is it used?) and model science (What is the scientific basis for the model?, How was the model developed?, and Was the model evaluated?). The modeling community is encouraged to provide feedback about the Models Knowledge Base and its models.

Inclusion of a specific model in this Models Knowledge Base is not an endorsement for its use. Models that do not appear in this Models Knowledge Base may also be appropriate for use. EPA recommends that models should only be used for the particular application for which they were designed and only after they have been appropriately evaluated. EPA expects the Models Knowledge Base to be a useful tool for environmental modelers and managers. Decisions about the suitability of a specific model that is included in this Models Knowledge Base for a particular application should be made in consultation with experienced model users (viz. EPA staff, EPA contractors, or staff of other agencies), as necessary.

EPA's Council for Regulatory Environmental Modeling (CREM) developed this Models Knowledge Base at the request of the EPA Administrator (February 2003) (PDF 82 KB, 2 pages, info about PDF). This draft Models Knowledge Base is being reviewed by an independent panel of experts established by EPA's Science Advisory Board. Following this independent review, the CREM intends to make any appropriate changes to the Models Knowledge Base and to ask for public comments on the resulting final product through a Federal Register Notice.

Environmental Models currently available

Back to Top

This Models Knowledge Base includes some of the most frequently used environmental models at the Agency. In the future, this set of models will be expanded.

There are several tools by which users can search for models of interest:

- Listing of all available models

Questions?

Adugna Kebede

NCDWQ – Modeling & TMDL Unit

1617 Mail Service Center

Raleigh, NC 27699-1617

(919) 733-5083 ext. 515

adugna.kebede@ncmail.net