

**Texas A & M University and U.S. Bureau of Reclamation  
Hydrologic Modeling Inventory  
Model Description Form**

**JUNE, 1999**

**Name of Model:**

MIKE BASIN

**Model Type:**

MIKE BASIN is a general multi-purpose river network model for river basin management and planning. The model uses ArcView GIS as Graphical User Interface, and fully utilizing a number of GIS procedures, including catchment delineation etc.

**Model Objective(s):**

The purpose of MIKE BASIN is the simulation of natural inflows, multiple multi-purpose reservoir operation and water right allocation in river basins based on a prioritized water accounting procedure. It allows for conjunctive use of surface water and ground water. An extension to the basic module includes water quality simulation based on point and non-point sources.

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**Model Structure or Mathematical Basis:**

1. The model has been developed for river basins with mixed land use accounting for water allocation simulation for agricultural and urban water supply.
2. It is applicable for river basins at any size ranging from small systems to large scale international river basins. It can incorporate several river basin allowing for Inter basins transfer schemes.
3. It is a continuous-time based model and has no limit in terms of length of simulation period.
4. The principal processes it represent are: watershed runoff (given as input), river flow processes (with or without routing) ground water (linear reservoir approach, complete water balances for reservoirs including rainfall/evaporation on lake surface), and water quality of runoff and river flow.
5. The model performs a simple water accounting procedure for each node and between nodes taking into account possible routing mechanisms

Please see the HMI web page: <http://www.usbr.gov/hmi>  
Forms are available in Text file, HTML, MS Word and WordPerfect formats  
This effort is being conducted by River Systems & Meteorology Group: <http://www.usbr.gov/rsmg>

6. MIKE BASIN can be characterized as a conceptual, distribute and deterministic modeling system

### **Model Parameters:**

MIKE BASIN has a number of model parameters that need to be specified:

1. River routing parameters (Muskingum)
2. Reservoir characteristics
3. Diversion conditions
4. Ground water storage and routing parameters
5. WQ parameters

### **Spatial Scale Employed in the Model:**

MIKE BASIN can simulate river basins of any size. The river network is described by a node-branch (arcs) system. Watersheds can be attached to individual nodes representing the runoff from each watershed.

### **Temporal Scale Employed in the Model:**

The model is a continuous-time based model allowing any user defined time intervals. Normally the model is applied on daily or monthly time step, but any ratio of those can be applied. MIKE BASIN is flexible with respect to time interval specifications of individual time series. These do not necessarily correspond to the computed time interval, and the possibility of recycling is also available.

### **Input Data Requirements:**

River system layout (directly digitized or based on GIS layer)

Withdrawal locations; Reservoir locations

*For each branch:*

Watershed area; Unit naturalized runoff (time series); Muskingum routing parameters (optional)

*For each withdrawal point:*

Time series of demands for water supply; Percentage of ground abstraction; Return flow ratio

Time series of withdrawal for irrigation; Percentage ground abstraction; Return flow ratio; Linear routing coefficient

Time series of withdrawal for hydropower (only for reservoirs): Installed effect; Tail water level; Machine efficiency

Location of return flow or discharge points

*For each reservoir:*

Initial water level; Operational rule curves; Stage-area-volume curve; Pool allocations (optional); Time series of rainfall and evaporation on the reservoir surface

Linkages to users (optional)

Linkages to upstream nodes (optional)

Priorities of water delivery

Conveyance losses

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*For each channel diversion:*  
Diversion characteristics

**Computer Requirements:**

MIKE BASIN runs within ArcView utilizing a fully Windows integrated Graphic User Interface under Windows 9x or Windows NT. It requires a Pentium 90 MHz or more processor with a minimum of 32 MB RAM and 1GB hard disk.

**Model Output:**

MIKE BASIN produces, at required user specified time intervals, inflows in all nodes, reservoir water levels/storage and delivery to water rights including specification of shortages. It produces also monthly tables for each node/user including basic statistics. It can display with colors the conditions throughout the system at any point in time, and animate the conditions for a specified time period.

**Parameter Estimation / Model Calibration:**

The model is calibrated against observed river gaging and reservoir water levels. The main purpose of calibration is the estimation of naturalized inflows from watersheds and river routing parameters.

**Model Testing and Verification:**

MIKE BASIN has been used in numerous projects under a variety of climatic and man-made conditions. It is well-proven.

**Model Sensitivity:**

The model requires predefined naturalized runoff. These can be computed in the model by calibration the simulated river inflows to gaged river data. The river routing parameters may be particular important for large river systems when using daily time intervals.

**Model Reliability:**

The MIKE BASIN has been widely used around the world and is accepted in the public and consulting community as a reliable water allocation model. The model is currently used in US by a number of consulting companies, and is specifically used by North Carolina Department of Water Resources for e.g. IBT processes in the Cape Fear River basin.

**Model Application / Case Studies:**

Outside US it has been used in Europe, Asia, Australia, Africa. Prominent Water Authorities applying the model includes the Mekong River Commission and the Zambezi River Authority. In the Czech Republic a MIKE BASIN model has been established at national scale for assessing nation-wide water quality impacts from waste water treatment plant investments.

**Documentation:**

The MIKE BASIN has a user manual in hard copy. Comprehensive on-line screen help is available.

In addition, DHI offers a comprehensive system of technical support through its dedicated Software Support Centre. 24 hour assistance from DHI's highly trained

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technical staff can be obtained through our Software Support Centre via telephone hotline, fax or the Internet ([software@dhigroup.com](mailto:software@dhigroup.com)). As a part of License Service Agreements DHI software users are updated regularly with software developments via newsletters and Internet broadcasts.

**Other Comments:**

MIKE BASIN runs under GIS environment, which provides a number of significant advantages compared to pure windows-based systems. The development of the node-branch systems and the connections between nodes/reservoirs and various user demand points (water rights) are done directly with on-screen editing in ArcView GIS. Information about MIKE BASIN is available on <http://www.dhi.dk/mikebasin>, which also describes current and planned developments, current installations and examples of recent applications. A demo version can be downloaded from the above web site.