Hydrologic Modeling Inventory
Model Description Form

JUNE, 1999

Name of Model: **MOUSE - Urban Drainage and sewer model**

Model Type:

MOUSE is a comprehensive modeling system for analysis of urban drainage and sewer systems including links to GIS.

Model Objective(s):

MOUSE simulates spatial variations in flows, water levels, sediment transport and pollution in pipes and open drains. MOUSE can be used for the prediction of hydraulic deficiencies, overflow sites, flood inundation areas, effect of real-time control, etc.

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Model Structure or Mathematical Basis:

MOUSE HD simulates water level and flow variations in pipe and channels. The water levels and flows are resolved on a variable grid adapting to the physical network.

Type of basins: MOUSE is developed for simulating flows, water quality and sediment transport in urban drainage system
Size of basin: MOUSE has no limitations on the size of model area or number of input elements to be included in the simulation. MOUSE is applicable to branched and looped networks
Nature of simulation: MOUSE uses a continuous type of simulation. The time period defined by the user can comprise either single of multiple events, up to several years.
Components represented in model formulation: Channel flow
Type of equations: The complete non-linear equations of open channel flow (Saint Venant) is solved numerically between all grid points at specified time interval for given boundary conditions
Mathematical formulation of model components: MOUSE is a deterministic mathematical modeling tool.

In addition to the fully dynamic description (complete set of non-linear Saint Venant equations) a choice of simplified flow descriptions is available. These are diffusive wave, kinematic wave and quasi-steady state.

Model Parameters:

The Rainfall runoff model: Main parameters are contributing area and hydrological losses
The Hydrodynamic model: main parameter is friction roughness.
The Advection Dispersion and Water Quality models, the parameters involved are: Concentrations, Temperature, dispersion coefficients, Oxygen processes
The Sediment Transport model, the parameters comprise: Sediment grain size, Shear stress, porosity, Specific density of sediments, kinematic viscosity, transport rates

Spatial Scale Employed in the Model:

Small to large multiple catchments (several thousands of square feet to hundreds or thousands of acres).
Lumped simulation of surface flow with allowance for up to several thousands subcatchments and input hyetographs (rain gages)
Up to 15000 channels/pipes may be simulated by the dynamic wave routing.

Temporal Scale Employed in the Model:

Single-event or continuous simulation; both modes have an unlimited number of automatically adaptive time steps

Input Data Requirements:

See Model Parameters. Flow routing data is usually obtained from topographic maps, aerial photos, and drainage plans. Input data can be assembled in spread-sheet format (e.g. Microsoft Excel) and imported into MOUSE.

Computer Requirements:

MOUSE is available in the Microsoft Windows (Win95, Win98, WinNT) environment. Minimum computer requirements are Pentium processor, 32 MB RAM, 100MB hard disk space.

Model Output:

MOUSE produces output for a large number of variables with a user defined time interval. Default output from a MOUSE simulation comprise:

- water levels and river flows (Hydrodynamic model),
- concentrations of each defined component (Advection Dispersion and Water Quality models),
- sediment transport and bed levels (Sediment Transport model)

In addition to the above, user-selected variables can be produced as output. Examples are: Velocity, Water surface gradient, Flow Area, Flow Width, Hydraulic Radius, Bed Resistance, Conveyance, Froude number, Volume, Timestep, Flooded (surface) area and Mass error.

Model output can be presented as user selected timeseries, longitudinal profiles, Q-h series and/or water level in in any section. Results of one or more simulations can be presented for comparison and results can be displayed in a synchronised way, i.e. viewing a plan view together with a longitudinal profile and one or more time series plots and Q-h relation plots – all from the same simulation and shown on the screen synchronised in time.

Parameter Estimation / Model Calibration:

In MOUSE the user can specify all hyrdological and hydraulic parameters both as global and as local values.

Model Testing and Verification:

MOUSE has been extensively tested using data and measurements from different urban drainage systems. An additional verification of the applicability of MOUSE is evidenced by the wide spread use of the model worldwide, and the fact, that several authorities worldwide has selected MOUSE as the one and only accepted modelling package to apply when carrying out investigations and simulations within their authority.

Model Sensitivity:

In MOUSE the spatial (and temporal) variation of pipe roughness (Manning's M, Manning's n or Colebrook no.) is the most important parameter to adjust when calibrating the hydraulic model.

Model Reliability:

MOUSE is widely accepted by the public, regulatory, and consulting sectors for both precipitation-runoff and hydraulic system analyses. With good parameter estimation, the model can predict hydrologic results with reasonable accuracy. Calibration is essential for modeling water quality. Output is repeatable if using the same. Slight differences may appear when switching from one version of MOUSE to another. These differences are usually the result of improvements to mathematical subroutines.

Model Application / Case Studies:

MOUSE has been applied worldwide in a large diversity of projects including design and planning of a wide range of civil works such as urban drainage, urban flood protection, overflow relief programs, RTC schemes, etc.
A few key references for case studies with MOUSE: Los Angeles Sewer Dept., Milwaukee Metropolitan Sewerage District, City of Mongomery, Alabama, City of Edmonton, Alberta Canada, Sydney Australia, Buenos Aires Argentina, Sao Paulo and Rio de Janeiro Brasil.

Documentation:

User manual and Quick Guide to getting started is offered together with an extensive On-line Help system. Additionally, a Technical Reference 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

technical staff can be obtained through our Software Support Centre via telephone hotline, fax or the Internet (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:

MOUSE offers the possibility of linkage with ESRI's ArcView GIS package for model simplification and result presentation.

Through linkage with the DHI's river model MIKE 11 it is possible to perform integrated modelling tasks where interaction of urban drainage and river waters are dynamically simulated.

Since its establishment in 1964, DHI has a provided a continuing, long-term commitment to the research and development of reliable and useable modeling software. DHI offers a broad range of software tools and services, which support investigation, design, operation and maintenance tasks ranging from urban drainage hydraulics, to broad scale flood studies to offshore and coastal hydraulics.

As an independent research and consulting organisation, DHI supplies knowledge, technology and advisory services for the provision of safe and reliable infrastructure with sustainable and environmentally sound development.

Information about MOUSE is available on http://www.dhi.dk/mouse, which also describes current and planned developments, current installations etc. A demo version can be downloaded from the above web site.