Remote Software

This document briefly presents the hydrological and hydraulic modeling software available on the University of Nice Server with Remote Desktop Connection.

Note that the Server provides ArcGIS9 applications with Spatial Analyst and 3D Analyst extensions, ArcHydro tools, and MS Office 2003.

For further documentation, please see:
http://www.hydroasia.org/jahia/Jahia/op/edit/lang/en/pid/6287

WATER RESOURCES SOFTWARE 2

URBAN SOFTWARE 10

Version 2007

WATER RESOURCES SOFTWARE

MIKE 11 – River and Channel Hydraulics

MIKE 11 is a one-dimensional hydrodynamic software package including a full solution of the Saint-Venant equations, plus many process modules for advection-dispersion, water quality and ecology, sediment transport, rainfall-runoff, flood forecasting, real-time operations, and dam break modeling.

The software can simulate flow and water level, water quality and sediment transport in rivers, irrigation canals, reservoirs and other inland water bodies. It is an engineering tool with capabilities provided in a modular framework.

It can be applied on numerous applications - from simple design tasks to large forecasting projects including complex structure operation policies. It allows you to integrate your river and floodplain modeling with watershed processes, detailed floodplain representation, sewer systems and coastal processes. MIKE 11 offers links to groundwater codes.

Application Areas:

- Flood risk analysis and alleviation design
- Real-time flood forecasting
- Dam break analysis
- Optimization of reservoir and canal gate / structure operations
- Ecological and water quality assessments in rivers, reservoirs and wetlands
- Real-time water quality forecasting and pollutant tracking
- Sediment transport and river morphology
- Salinity intrusion in rivers and estuaries
- Integrated surface water and groundwater and water analysis

MIKE 21 – River Hydraulics and Morphology

MIKE 21 is a 2D modeling tool for the simulation of free surface flow and sediment transport in lakes, estuaries, bays and coastal areas. It incorporates a varying size mesh design with hydrodynamic and morphological technology. The modeling system consists of a number of modules relevant to sediment and morphology studies in rivers:

- Hydrodynamic model
- Advection-dispersion model
- Sediment transport model
- Bed form/flow resistance model (small-scale morphology)
- Bank erosion model
- Large scale morphological model

The model components can run simultaneously, thus incorporating dynamic feedback from changing hydraulic resistance, bed topography and bank lines to the hydrodynamic behavior of the river.

Application Areas:

- Flow and sediment transport pattern in river channels and on flood plains
- Bank erosion and bend scour in meandering channels
- General erosion and deposition, constriction and confluence scour
- Development of new channels (channel bifurcation) and bars
- Morphological impact of river training works

MIKE FLOOD – Integrated 1D - 2D Flood Modeling

MIKE FLOOD is a dynamically linked one-dimensional and two-dimensional flood modeling package. The tool is assembled from components taken from MIKE 11 and MIKE 21, and enhanced with new features which are targeted specifically towards modeling of floods. This combination ensures a maximum of flexibility by allowing users to model some areas in 2D detail, while other areas can be modeled in 1D. The tool provides an efficient coupling between river / floodplain or between the sea and inland waterways / bays / lagoons.

It extensively utilizes GIS for automated model development and flood mapping. It enables to present results by GIS integration for spatial and temporal analysis.

MIKE FLOOD enables to model floodplains and coastal zones in 2D, while at the same time also modeling the 1D river hydraulic system and allows to:

- Add a floodplain, coastal zone, or other 2D area to an existing MIKE 11 model
- Replace your looped and networked 1D floodplain model (pseudo-2D) in MIKE 11 with a real 2D model
- Re-use existing MIKE 11 setups and MIKE 21 setups by adding links between the two

MIKE FLOOD is especially relevant to floodplain and storm surge analysis. This is due to:

- Comprehensive hydraulic structures package
- GIS integration for spatial and temporal analysis
- Supercritical flow solutions
- Dam and embankment failure analysis tools

MIKE SHE – Integrated Surface Water and Ground Water Modeling

MIKE SHE is an integrated hydrological modeling system which covers the entire land phase of the hydrological cycle. Thus it is not just a three-dimensional, numerical groundwater model, but also includes numerical models for overland flow, unsaturated flow, solute transport, agricultural practice, evapotranspiration, etc. MIKE SHE is by default coupled to MIKE 11 and can also be coupled to MOUSE for urban applications.

Application Areas:

- Distributed rainfall-runoff modeling
- Surface water impact from groundwater withdrawal
- Conjunctive use of groundwater and surface water
- Wetland management and restoration
- River basin management and planning
- Environmental impact assessments
- Aquifer vulnerability mapping with dynamic recharge and surface water boundaries
- Groundwater management
- Floodplain studies
- Impact studies for changes in land use and climate
- Impact studies of agricultural practices including irrigation, drainage and nutrient and pesticide management with DAISY

MIKE BASIN – River Basin Management in GIS

MIKE BASIN is a tool for addressing water allocation, conjunctive use, reservoir operation, or water quality issues. It couples the power of ArcGIS with comprehensive hydrologic modeling to provide basin-scale solutions. It provides simulation result visualization in both space and time.

For hydrologic simulations, MIKE BASIN builds on a network model in which branches represent individual stream sections and the nodes represent confluences, diversions, reservoirs, or water users. Technically, it is a quasi-steady-state mass balance model, however allowing for routed river flows. The water quality solution assumes purely advective transport; decay during transport can be modeled. The groundwater description uses the linear reservoir equation.

Application Areas:

- Water availability analysis: conjunctive surface and groundwater use
- Infrastructure planning: irrigation potential, reservoir performance, water supply capacity, waste water treatment requirements
- Analysis of multisectoral demands: domestic, industry, agriculture, hydropower, navigation, recreation, ecological, finding equitable trade-offs
- Ecosystem studies: water quality, minimum discharge requirements, sustainable yield, effects of global change. Regulation: water rights, priorities, water quality compliance

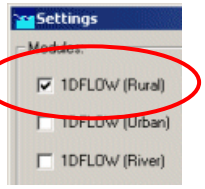
MIKE Animator – 3D video-generating tool

MIKE Animator is a video-generating tool for presentation of results from water modeling applications. It is possible to work with result data from MIKE 21. MIKE Animator enables to view model areas and simulation results in a 3D environment.

MIKE Animator is thus a tool for facilitating the communication of results from hydrodynamic and environmental model applications, that allows:

- Creating realistic 3D perspective scenes
- Viewing model areas and model simulations of flows and related processes in 3D
- Interactively controlling view points and flight paths
- Producing professional fly-through animations

SOBEK-Rural



SOBEK-Rural is a tool for modeling irrigation systems, drainage systems, natural streams in lowlands and hilly areas. Applications are typically related to optimizing agricultural production flood control, irrigation, canal automation, reservoir operation, and water quality control. SOBEK-Rural can also answer questions about increased pollution loads in response to growing urbanization. SOBEK-Rural can offer support for effective planning, design and operation of new and existing water systems.

The software calculates the flow in simple or complex channel networks, consisting of thousands of reaches, cross sections and structures. All types of boundary conditions can be defined, as well as lateral inflow and outflow, using time series or standard formulae. For more detail, the rainfall run-off process of urban areas and various types of unpaved areas can be modeled, taking into account land use, the unsaturated zone, groundwater, capillary rise and the interaction with water levels in open channels.

The graphic display superimposes the network over a GIS or aerial photo map of the area so that canals, reservoirs, weirs, pumping stations, treatment plants, urban and rural areas can be seen at a glance.

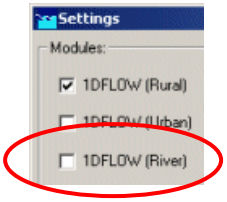
SOBEK-Rural incorporates four modules:

- Hydrodynamics
- Hydrology
- Water Quality
- Real-Time Control

Application Areas:

- Drainage and flood protection
- Long-term and real time operation of multiple reservoirs
- Real-time control and automation of canal system
- Irrigation construction, rehabilitation, modernization

SOBEK-River



SOBEK-River is a tool for simple and complex river systems and estuaries. It simulates the water flows, the water quality and morphological changes in river systems, estuaries and other types of alluvial channel networks. The networks can be branched or looped. SOBEK-River is able to work with complex cross-sectional profiles consisting of various sub-sections.

SOBEK-River works with the following modules:

- Hydrodynamics
- Morphology
- Water quality

Application Areas:

- Flood protection, flood-risk assessment
- Water pollution studies
- Estuaries with fresh and salt water
- Sand mining, sediment and morphology studies
- Navigation

URBAN SOFTWARE

MOUSE – Waste Water and Storm Water

MOUSE is an engineering software tool for the simulation of hydrology, hydraulics, water quality and sediment transport in urban drainage and sewer systems.

The MOUSE **Pipe Flow** Model carries out computation of unsteady flows in pipe networks. The computation is founded on an implicit, finite difference numerical solution of the basic 1D, free surface flow equations (Saint-Venant). The implemented algorithm has a self-adapting time step, and it provides solutions in multiplying connected branched and looped pipe networks. Free surface and pressurized flows are described within the same basic algorithm, which ensures a smooth and stable transition in all situations. The complete nonlinear flow equations can be solved for user-specified or automatically supplied boundary conditions. The Pipe Flow Model enables the description of a variety of pipe network elements and flow phenomena:

- Flexible cross-section database, including standard shapes
- Circular manholes
- Detention basins
- Overflow weirs
- Pump operations
- Flow regulation
- Constant or time variable outlet water level
- Constant or time variable inflows into the network
- Non-standard headlosses at manholes and basins
- Depth-variable friction coefficients
- Variable time-step

The MOUSE **Surface Runoff** Module includes three types of surface runoff computation:

- Time-Area Model
- Kinematic Wave Model
- Linear Reservoir Model

and different hydrological levels for the description of the urban catchment surfaces. This means that the surface runoff computations can be adjusted according to the amount of available information. The models run with proven default hydrological parameters, which can be adjusted for better accuracy. The computed hydrographs are used as input to the MOUSE Pipe Flow model.

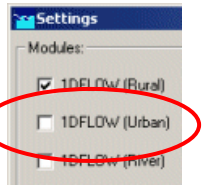
MIKE NET – Water Distribution Networks

MIKE NET is an engineering software package for the simulation of steady flow and pressure distribution, extended period simulation of hydraulic and water quality behaviour within drinking water distribution systems.

MIKE NET uses the EPANET 2.0 numerical engine and is applicable for simulations of:

- Node demands
- Fire flows / fire hydrant analysis
- System head curves
- Reservoir characteristics
- Water age
- Chlorine concentrations / decay
- Path and concentration of pollutants

SOBEK-Urban



SOBEK-Urban is a modeling tool for simple or extensive urban drainage systems consisting of sewers and open channels. SOBEK-Urban allows designing new urban areas or analyzing and improving existing ones. It enables to find out what measures will prevent drainage congestion, street flooding and water pollution from sewer overflows. The return period of street flooding and sewer overflows can be analyzed using long time series of rainfall data or storm events.

The models help to find out how the performance of the urban drainage system can be improved by a better operation of the pumps gates and weirs. The impact of treatment plants and sewer overflows on the receiving water can be analyzed by combining everything into one model.

SOBEK-Urban models the rainfall run-off process for various types of paved and unpaved areas. It doesn't matter whether the urban drainage system consists of open channels and sewer pipes, storage tanks and reservoirs. Street flow can also be modeled.

The application handles all kinds of cross sections, control structures and any network configuration (branched and looped). SOBEK-Urban offers virtually any real-time control option for pumps, weirs and gates in the urban system.

The graphic display superimposes the network over a GIS or aerial photo map of the area so that sewer pipes, manholes, canals weirs and pumping stations can be seen at a glance.

SOBEK-Urban consists of three modules:

- Hydrodynamics
- Hydrology
- Real-Time Control

Application Areas:

- Determination of urban drainage capacities, including treatment plants
- Assessment of sewer overflow frequency
- Design of detention basins
- Real-time control of urban drainage systems
- Environmental study on receiving waters

Sources:

http://www.dhigroup.com

http://www.sobek.nl