Our commitment
Every year, DHI invests nearly 25% of its human resources into R&D projects. All related to water and the environment, and to develop DHI Software products. This level of commitment allows us to provide our clients with the most technically advanced and user-friendly software tools on the market.

No other family of modeling tools covers such a range of applications – from source to tap, from rainfall to the ocean, DHI Water Resources Software models the world of water.

Develop a partnership
By choosing DHI Software as your modeling standard, you are bringing years of experience to your organization.

Our staff brings experience and a level of expertise that is second to none, whether the project is software development, consulting or technical support.

If you develop, or already have, customized modeling tools, collaboration with DHI Software will guard your investment and secure the future of your modeling resources.

Get up to speed quickly
DHI Software courses target both new users and experienced modelers that need to expand their skills. The courses provide practical skills to make you more efficient and effective. Courses can be arranged on-site or at one of our support centers around the world.
DHI is here to help you
When you choose DHI Software you get state-of-the-art modeling tools with a proven track record in hundreds of consulting and research applications around the world.

Our tools can give you the most reliable results and a competitive advantage.

TAKE ADVANTAGE OF OUR EXPERIENCE

Know your needs
DHI’s Water Resources Software covers the entire range of water-related issues. Several products offer solutions to the same problems, but with slightly different focus.

The most cost-effective package for your application depends on many factors, including your objectives, the project’s temporal and spatial scale, the availability of data, and the project budget. Choosing the right software and modeling approach can make a world of difference.

Simplicity is an art
DHI Software products are generic tools with built-in flexibility. You can develop simple or complex models according to your needs and utilize data as they become available.

WE CAN HELP YOU DESIGN AND DEVELOP THE MOST COST-EFFECTIVE MODEL FOR YOUR APPLICATION

Technical support - when and where you need it
With dedicated support centers in Denmark, the United States and Australia, and local support in more than 30 countries, DHI provides the most comprehensive technical support in the industry.

WE CAN HELP YOU MAKE YOUR MODELING PROJECT A SUCCESS

River Ardeche, France.
MIKE 11 is the worldwide standard for the dynamic modeling of river and channel hydraulics.

UNLIMITED RIVER MODELING

MIKE 11 provides a wealth of capabilities and the most comprehensive approach in river hydrodynamics and environmental river modeling.

It has been proven in hundreds of applications around the world and is the standard tool in many countries.

With the river as a starting point, you can use MIKE 11 for the design, management and operation of rivers and channel systems. Your analysis can be easily expanded to include sediment transport and water quality.

MIKE 11 also allows you to expand your study to include watershed processes with either a simple rainfall-runoff model or a detailed groundwater-surface water model using MIKE SHE.

The combined use of MOUSE and MIKE 11 allows state-of-the-art modeling of sewers and receiving waters.

MIKE 11 is approved by the US Federal Emergency Management Agency (FEMA) for use on projects related to the National Flood Insurance Programme.

MIKE 11 is designed for

• flood risk analysis and mapping
• the design of flood alleviation channels, structures and storage ponds
• the hydraulic design of bridges
• floodplain encroachment analysis
• drainage and irrigation studies
• optimization of river and reservoir operations
• dam break analysis
• real-time flood forecasting
• integrated groundwater and surface water analysis (with MIKE SHE)

and can be used to calculate

• sediment loads in rivers and long-term morphological impacts
• fate and transport of pollutants in 1-layer or 2-layer systems
• the flow, erosion and deposition of cohesive sediments
• salinity intrusion in rivers and estuaries
• water quality impacts of sewage and agricultural runoff, and their effects on the oxygen balance
• eutrophication and oxygen depletion
• water quality conditions in reservoirs including oxygen, temperature and eutrophication
Hydrodynamic module
- solves the complete nonlinear St. Venant equations for open-channel flow
- also includes the diffusive, and kinematic wave approximations
- has a quasi-steady state solver for rapid calculation of long-term simulations
- includes Muskingum and Muskingum-Cunge methods for simplified channel routing
- automatically adapts to subcritical and supercritical flow
- can simulate a wide variety of flow structures including weirs, culverts, bridges and user-defined structures
- allows the flexible operation of flood control and reservoir structures (eg gates and pumps)

Two-layer stratified flow module (MIKE 12)
- simulates flow, transport and combined biological-chemical processes in 2-layer stratified rivers, estuaries and lakes
- includes wind friction, bottom friction and interface friction, interfacial mixing by entrainment, lateral inflows and horizontal density gradients
- allows exchange of heat, salt and pollutants between layers
- allows transfer of heat and long wave/short wave radiation across free surface boundaries

Multi-layer stratified flow module (reservoir/lake)
models the hydrodynamics and water quality conditions in reservoirs and lakes using a multi-layer approach. The module can be used to investigate:
- heating/cooling processes and vertical mixing
- selective withdrawals and reservoir flushing strategies
- vertical oxygen profiles

Rainfall-runoff module
Includes a range of rainfall-runoff models:
- NAM – a lumped, conceptual model for continuous rainfall-runoff modeling
- UHM – a unit hydrograph technique for single storm events and areas where no stream records exist
- SMAP – a monthly soil moisture accounting model, and
- FEH – Flood Estimation Handbook developed by CEH Wallington, UK.

MIKE 11 RR:
- allows any combination of models in a network
- allows flexible links to models run independently of MIKE 11
- includes an auto-calibration tool for NAM, based on the shuffled complex evolution (SCE) method
- automatically calculates catchment areas and Thiessen mean area rainfall weights

Cohesive sediment transport module
- includes quasi-2D erosion and deposition
- allows for both instantaneous and gradual erosion
- uses a 3-layer bed description - weak fluid mud, fluid mud, and underconsolidated bed – with separate properties for each layer

Non-cohesive sediment transport module
- includes Engelund-Hansen, Ackers-White, Engelund-Fredsøe, Van Rijn and other models
- feeds back bed resistance and cross-section changes to the hydrodynamic simulation
- outputs transport rates, bed level changes, resistance numbers and dune dimensions
- calculates transport fraction and particle size distribution in graded sediments

The hydrological cycle in the NAM rainfall-runoff model.

The operation of hydraulic structures is an important component in the dynamic modeling of river hydraulics.
Advection-dispersion module
• solves the 1D advection-dispersion equation for dissolved or suspended material
• can accurately calculate very steep concentration gradients
• can model erosion and deposition of cohesive sediments as modified source/sink terms

Water quality module
The environmental package is a suite of submodules, each designed for specific water quality issues, comprising:

WQ:
• BOD/COD-DO relationships (seven levels of model complexity)
• N and P transport (nitrification, denitrification, sorption etc.)
• Retention of N and P in wetlands (plant uptake, denitrification accumulation in peat, etc)
• E.Coli (faecal and total coliforms)

EU:
• Eutrophication (nutrient cycling between 12 model components)
• Phyto- and zooplankton dynamics (Chlorophyll-a, C, N and P)
• Benthic vegetation and detritus
• Oxygen balance

HM:
• Fate of heavy metals
• Concentration in water phase (dissolved and suspended)
• Metal in sediment (pore water concentration, absorbed and accumulated)
• Bioaccumulation (water -> biota)

Flood Forecasting Module
• is a fast, reliable decision support system for real-time flood forecasting
• uses MIKE 11 to predict local flood levels and river discharges based on real-time rainfall, river flow levels and meteorological forecasts
• uses ArcView® GIS for database management and flood mapping
• helps define reservoir control strategies that will reduce or prevent flood damage and avoid unnecessary waste of water resources
• links to external databases
• automatically imports telemetric data

Dam break Module
• models the failure of one or more dams in a river system
• includes 3 modes of failure initiation
• expands breach as a function of time or erosion rate
• includes breach flow and flow over the crest or spillway

MIKE 11 GIS module
is an ArcView® GIS-based interface featuring tools for:
• digitizing and editing river networks
• generating and displaying 3D water surfaces
• flood mapping and depth of inundation contours
• cross-sections and water surface profiles
• flood damage assessments

MIKE 11 FLOOD FORECASTING

Real-time rainfall and flow.
Meteorological forecasts.
Forecasted hydrographs.
Flood maps.

www.mike11.com
EXPAND YOUR FLOOD MODELING CAPACITY

MIKE FLOOD makes it feasible to model flood plains and coastal zones in 2D, while at the same time modeling the 1D river hydraulic system.

MIKE FLOOD allows you to expand your existing MIKE 11 models by:
- adding a 2D flood plain, coastal zone, or other area to your existing 1D model
- replacing your looped and networked 1D flood plain model (pseudo-2D) with a real 2D model
- reusing existing MIKE 11 setups and MIKE 21 setups by adding links between the two

MIKE FLOOD makes all this available in a seamless, integrated and graphical environment, while maintaining the familiar user interfaces to MIKE 11 and MIKE 21.

Use MIKE FLOOD to simulate
- coincident river and storm surge flooding in coastal areas
- the detailed flooding pattern on flood plains in terms of flow velocities and water levels
- water exchange between channels, canals and adjacent flood plains, ponds, reservoirs, lakes, etc
- flood waves in channels and on flood plains associated with a dam embankment failure

MIKE FLOOD features relevant tools for flood plain and storm surge analysis including:
- a comprehensive hydraulic structures package
- an efficient flooding and drying facility
- a fast and robust solution technique
- GIS integration for spatial and temporal analysis
- supercritical flow solutions
- dam and embankment failure analysis tools
MIKE SHE puts science into practice

With MIKE SHE you can simulate all the major processes in the land phase of the hydrological cycle. No other tool can trace water and pollutants from the ground surface, through the soil and groundwater, and back into the surface water.

With MIKE SHE you can perform integrated studies with seamless couplings of different processes.

Your tool of choice, when groundwater and surface water are closely linked

A wealth of application opportunities

- 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

Impressive flexibility

- includes both simple and advanced process descriptions to maximize computational efficiency
- has a flexible modular structure that allows you to include only the necessary processes
- easily links regional and local scale models

MIKE SHE is versatile

- can be linked to ArcView® for advanced GIS applications
- includes alternate process descriptions for different applications
- includes an interface to MODFLOW and MODFLOW-HMS

MIKE SHE is a state-of-the-art system for integrated dynamic modeling of groundwater and surface water systems
.... and easy to use
MIKE SHE has a new state-of-the-art user interface that:
• links to your original data rather than importing the data
• includes a dynamic data tree that gives you a precise overview of all your data
• has automatic data and model verification routines
• allows sophisticated output, including animations

MIKE SHE user interface
• advanced tools for:
  - manipulating time varying data
  - model calibration
  - water and mass balance analysis
• ArcView® tools for:
  - the spatial analysis of borehole and cross-section data
  - time series data
  - linking to and exporting ArcView® shape files

MIKE SHE features
• evapotranspiration
  - Kristensen and Jensen model
  - 2-layer water balance for wetlands
• 2D overland flow
  - diffusive wave (finite difference)
  - kinematic wave (semidistributed routing)
• 1D channel flow (MIKE 11)
  - fully dynamic and high order fully dynamic formulations
  - diffusive and kinematic wave
  - Muskingum routing
  - control structures (including user-defined)
  - quasi-2D flooding
• 1D unsaturated flow
  - Richards’ equation
  - gravity flow
  - 2-layer water balance for wetlands
  - groundwater flow
  - 3D saturated groundwater flow (finite difference)
  - linear reservoir routing (lumped, conceptual)

More features
• macropore flow and transport
• dual porosity (fracture) flow and transport
• crop growth/nitrogen cycle analysis (DAISY GIS)
• particle tracking
• irrigation module
• water quality module
  - advection-dispersion
  - sorption-degradation
  - geochemistry – PHREEQC
  - biodegradation – kinetic and nonkinetic
• GeoEditor for building 3D geological models in ArcView® GIS

MIKE SHE represents each of the three main hydrologic processes and their dynamic interaction (surface flow, unsaturated zone flow, and groundwater flow) as well, or better than all other codes reviewed.

With respect to the thirteen criteria, MIKE SHE earned the highest ranking.

Technically, or scientifically, the Review Team believes that MIKE SHE is the superior model.
West Consultants, Gartner Lee Ltd, and Aqua Terra Consultants, 2001, Scientific Review of the Integrated Hydrologic Model ISGW/CNTB121

The above evaluation reports are available at http://dhisoftware.com/mikeshe/Download/External_Evaluations/index.htm
MIKE BASIN
is a versatile management planning tool that is fully integrated with ArcView® GIS. It is a comprehensive river network modeling system for water allocation/water rights and environmental studies.

SIMPLE AND EASY TO USE, YET POWERFUL

Minimal data requirements
all major hydrological processes are included, but the process descriptions have been kept as simple as possible

Intuitive
simple processes and process relationships can be explained and easily demonstrated at public meetings

Fast simulations
takes seconds, which means that you can analyze many scenarios, optimize your system, or quickly answer ‘what if…’ questions

ArcView® based
river networks can be quickly generated from existing GIS data, edited with familiar GIS tools, and then the results can be visualized as overlays

Dynamic
adds a new temporal dimension to GIS. Thus, dynamic simulations can be viewed in GIS and saved as videos for public presentations

Use MIKE BASIN to
solve allocation problems
analyze and ameliorate shortage situations
improve reservoir operations
explore conjunctive use of groundwater/surface water
analyze irrigation performance
solve multi-criteria optimization problems
find cost-effective measures for water quality compliance

MIKE BASIN features
automatic catchment delineation from DEMs
local and global priority algorithms for water allocation
very flexible simulation of reservoirs
detailed hydropower simulation
diversions and optional Muskingum routing
irrigation and crop demand calculations
water supply simulation, including trends
rainfall-runoff modeling
broad-scale water quality modeling, including coupled decay (DO, BOD, NO3, NH4, E.coli, P, COD, ‘wild card’)
GIS tools for information management and visualization
a link to Excel for optimization
a link to Access for report generation
output to many file formats, including shape files, AVI movies, Access databases and HTML

www.mikebasin.com
MIKE 21C is unique in its capabilities for studying rivers with complex bed sediment movements. It works with a curvilinear finite difference grid that is easy to generate, and can be automatically updated as plan form changes in the river take place.

MIKE 21C is the tool of choice in many environmental impact assessments. With MIKE 21C you can simulate detailed bed level changes, bank erosion, scouring, shoaling and other plan form changes associated with construction work and other changes in the hydraulic regime.

MIKE 21C predicts:
- stream bank erosion
- bend scour, constriction scour, confluence scour and general scour
- channel formation and closure including bifurcations
- shoaling, point bar, and alternating bar formations
- graduation of sediment (armoring, coarsening of river bed, etc)

Use MIKE 21C to design:
- protection schemes against bank erosion and bed scour measures to reduce or manage shoaling
- alignments and dimensions of navigation channels for minimizing maintenance
- hydraulic structures – provides flow velocities and depths.
- restoration plans for optimal environmental habitats in channel-flood plain systems
- monitoring networks based on morphological forecasting in morphologically active rivers

MIKE 21C features:
- the fully dynamic 2D St. Venant equations
- a parameterized 3D description of helical (secondary) flow in the river bends
- an advection-dispersion module for transport of dissolved and suspended matter that includes both time and phase lags
- profile functions for the flow velocity and concentration of suspended sediment
- separate bed load and suspended load models that include the influence of lateral bed slope on the bed load direction
- non-cohesive sediment transport with and without feedback to the hydrodynamics and with single or multi-fraction (graded) sediments
- the dynamic calculation of bed level, alluvial resistance and bank erosion using fully dynamic, quasi-steady, or steady hydraulic models
Language support
Many DHI Software products are available in several languages. Please check www.dhisoftware.com for details regarding the availability of DHI Software products in languages other than English.

Hardware and software requirements
All DHI Software products are PC tools working under the Windows operating systems. All products are equipped with state-of-the-art Graphical User Interfaces.

Support and maintenance
The DHI Software products include comprehensive documentation: a Short Introduction and Tutorial, a User Guide, a Reference Manual and an online help system. The products come with a 12-month warranty which includes hotline support and a free version update. Extended support and updates are available by subscription to an inexpensive maintenance programme.

Regional support centres in Europe, North America and Australia provide hotline technical support in all time zones. Local support centres in many countries provide support in a wide range of languages.

User groups and conferences
User groups of DHI Software exist and meet frequently in many countries. Global user conferences that gather hundreds of users from all over the world are arranged at regular intervals.

Training and courses
Courses are offered regularly at locations in Europe, North America and Australia/New Zealand. Courses can be arranged on request at other locations. For detailed information on courses and schedules, please consult www.dhi.dk/courses.

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Photos:

DHI Software

is the brand name for quality computational models and hydroinformatics systems applicable to the solution of engineering and environmental problems related to water. DHI offers the following products:

• MIKE 11 - for modeling inland surface waters such as rivers, channels, estuaries and reservoirs, flows, flooding, water quality and sedimentation

• MIKE 21 - 2D modeling of free-surface flow, water quality, sediment and waves in rivers, estuaries, coastal waters and seas

• MIKE 3 - 3D modeling free-surface flows and water quality in estuaries, coastal waters and seas

• LITPACK - integrated modeling of littoral processes and coastline kinetics

• MIKE BASIN - GIS-based decision support tool for Integrated water resources management and planning

• MIKE View - results presentation tool for MOUSE, MIKE SWMM, MIKE NET and MIKE 11

• MIKE SHE - integrated hydrological modeling of the entire land phase of the hydrological cycle

• MIKE FLOOD - 1D and 2D hydrodynamic modeling and storm surge studies

• MOUSE - for modeling hydrology, hydraulics, water quality and sediment transport in urban drainage and sewer systems

• MIKE NET - for modeling water distribution systems. Based on the EPANET numerical engine

• MIKE SWMM - for modeling urban hydrology, wastewater and stormwater networks. Based on the EPA SWMM numerical engine

• EFOR - for modeling the processes inside wastewater treatment plants

• MIKE INFO Coast - GIS-based information management tool for coastal systems

• MIKE Animator - advanced animations of DHI Software model results

• MIKE C-MAP - a general tool for extracting depth data and tidal information from electronic sea charts