



Keywords of application domains and functionality

- Aquifer management
- Biodiversity, wetlands, environmental water use
- Cascading reservoirs, reservoir operation
- Climate change impacts, IPCC scenarios
- Conjunctive use (surface and groundwater)
- Data management, environmental and hydrological data bases
- Dynamic water budget modeling
- Farm water management
- Groundwater resources, monitoring, protection
- Hydro-economics. costs and benefits of water supply and satisfied demands
- Hydrometeorology, meteorological forecasts
- Hydrological modeling, routing
- Hydropower generation
- Integrated Water Resources Management (IRWM)
- Inter-basin transfers
- International river basins
- Irrigation water demand, irrigation technology
- Monitoring (flow and quality) and modeling (data assimilation)
- Multi-criteria optimization, cooperative games
- Optimal water allocation
- Rainfall-runoff modeling
- Reservoir management,
- River basin management,
- Trans-boundary international rivers
- Urban water supply
- Waste allocation, treatment optimization
- Water efficiency, water saving
- Water conflicts, water rights
- Water quality, non-point-source pollution
- Water resources management
- Watershed erosion, degradation
- Wastewater treatment
- Wetland management,



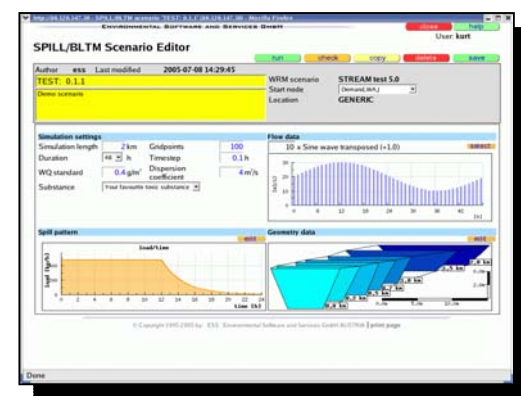
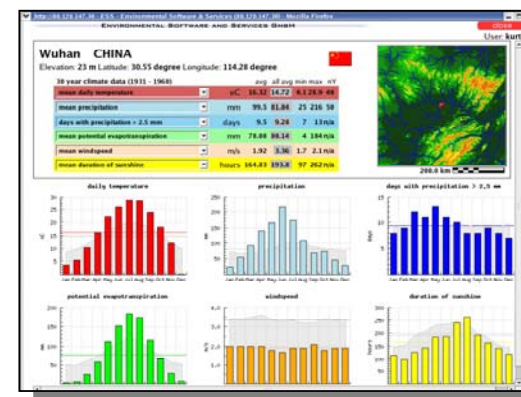
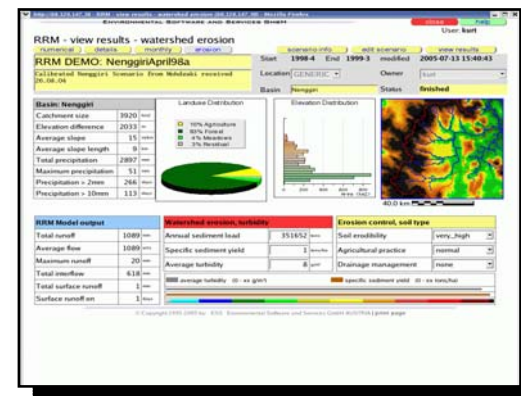
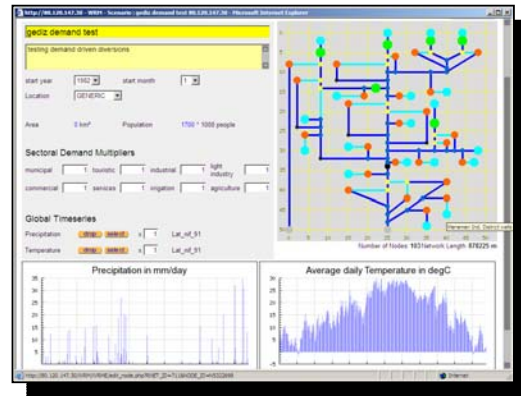
Basic Functionality

WaterWare integrates a set of tool and models within one consistent and easy to use framework.

The major components include:

Data base management for all components of a river basin including monitoring time series. This also includes support for real-time (SCADA) data, and a range of data analysis tools;

- Embedded GIS functionality
- A set of dynamic simulation and optimization models, the base system includes:
 - A dynamic (hourly or daily time step) water resources model, including conjunctive use, with aggregate performance statistics and economic assessment (CBA),
 - A dynamic rainfall-runoff model including soil erosion and turbidity estimates for ungaged sub-catchments, providing input to the water resources model;
 - An irrigation water demand model, providing input to the water resources model and farm-level water management
 - A basin-wide water quality model with economic assessment, linked to the hydraulic results of the water resources model.
- Optional components include:
 - Meteorological forecasts, 3D nested grid dynamic non-hydrostatic (prognostic) models with hourly resolution
 - Automatic calibration for the rainfall-runoff model
 - Multi-criteria optimization component for the water resources model, satisficing approach for supply demand, reliability, and node specific supply;
 - A waste-load allocation and optimization including in-stream benefits of recreational use for the water quality model;
 - A near-field water quality model for accidental spills
 - A 2D groundwater flow and transport model
 - A dynamic land-use change model
 - A rule-based expert system for screening level EIA tasks.
 - A real-time forward chaining expert system framework for operational control applications
 - A set of management tools for data import, configuration, user management, etc.
 - User support tools (CRM) including web-based problem reporting and tracing;
 - On-line user manuals and tutorials including an optional distance learning environment.





These basic tools can be configured for a range of specific tasks and applications including scenario analysis, water allocation optimization, water quality management and waste load allocation, flood forecasting, and the operational control (optimization) of water resources systems.

WaterWare is offered with a complete support package that includes problem analysis, system configuration and customization, data acquisition and import, application building, training, user support, and continuing maintenance and update of the system in close cooperation with the client.

Modes of operation: The WaterWare system can be used

- Interactively for scenario analysis, including model calibration, sensitivity analysis, and direct scenario comparison, and multi-criteria optimization;
- Automatically for continuous monitoring and modeling, now-casting, and scheduled forecasting, and operational control (real-time optimization) within a real-time expert system IC3 framework;
- Automatically for event based operation triggered by user defined external events (monitoring sensors, remote sensing data) e.g., for operational flood forecasting and any combination of modes as required by a particular application.

Technical implementation

WaterWare Release 6.0 is a fully web based client-server implementation. Model and data bases are located at a central server, user access the system locally or remotely through LAN or Internet with a standard web browser or 3G mobile phone as the only client side tool required.

The main WaterWare servers and clients can be located anywhere on the web, on one single machine or a cluster of servers, within an end-user institution facilitating access through the institutional Intranet but also for distributed, remote departments, field offices and users, or with an external Application Service Provider (ASP) that also provides auxiliary services such as data compilation, processing, system configuration, model calibration, data base maintenance and data backup, etc.

Initial configuration and continuing support will be implemented at dedicated high performance servers and a compute cluster at ESS, accessible via a dedicated private (leased) Ether line with 8 Mb bandwidth, accessible unrestricted 7/24.

