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Wisconsin Water Science Center

Capabilities Summaries

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Wisconsin Water Science Center, Middleton, Wisconsin

Surface- and Ground-Water Monitoring

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Surface Water and Ground Water Monitoring

The USGS Wisconsin Water Science Center (WI WSC) office in Middleton, Wisconsin has significant expertise monitoring quantity and quality of surface-water and ground-water systems.

Surface-Water Quantity Monitoring

Continuous streamflow data are collected and computed using traditional and state-of-the-art acoustic methods and the data are posted on the web in real time. These data are used for flood forecasting and emergency flood response, understanding and modeling hydrologic systems, defining flood plains for planning developments, designing and operating hydroelectric, flood control, water supply, and wastewater facilities, designing and sizing bridges and culverts, managing lakes and wetlands, abating and preventing pollution, determining trends in floods and low-flows, and determining the occurrence and distribution of water.

Surface-Water Quality Monitoring

Water samples are collected to describe occurrence and distribution, trends, and modeling of certain pollutants and their relationships between natural factors, land use and water quality, and the relationship between ecological responses and water quality. The WI WSC has developed innovative monitoring capabilities associated with PCB, organics, virus, and pathogens sampling as well as in the areas of flow-composite auto sampling, small plot agricultural sampling, and urban source area sampling.

Ground-Water Quantity Monitoring

Water levels are collected from a statewide monitoring well network to provide information to determine water-level trends and their relationship to water use, climate changes, and land-use changes, and to support modeling efforts to support water use and water availability needs.

Ground-Water Quality Monitoring

Water samples are collected for describing occurrence, distribution and trends of naturally occurring compounds and certain pollutants and their relationships to natural and anthropogenic factors.

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Ground-Water/Surface-Water Modeling

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Ground-Water and Surface-Water Modeling for Science Support

The USGS Wisconsin Water Science Center (WI WSC) staff have extensive experience in ground-water and surface-water modeling for decision making. The WI WSC uses industry-standard approaches as well as the latest high-end modeling technologies to address local-, watershed-, and regional-scale water resources issues. The experience of the staff emphasizes application of the best technologies available, and has employed a variety of commercial and research codes. The WI WSC has experience with system characterization modeling as well as tailoring modeling tools to specific water resource or ecologic questions. Currently, the WI WSC is involved in projects on a local, regional, and national scope, with cooperators both inside and outside of the USGS. The experience of the WI WSC in this field is evidenced by over 50 peer-reviewed scientific journal articles and USGS reports. Specific areas of expertise include:

Ground-Water-Flow Modeling

The WI WSC focuses on applying state-of-the-art finite-difference (MODFLOW) and analytic element (GFLOW) models to water resources questions. The WI WSC staff have experience with high-end ground-water modeling tools such as sophisticated packages for MODFLOW (LAK, SFR, UZF, GWM), Stochastic MODFLOW and MODPATH, and the Lake and Stream Elements for GFLOW. Emphasis is placed on providing model results in user-accessible formats using two-dimensional and three-dimensional visualization tools such as ModelViewer and ArcView. Both shallow and deep ground-water systems have been simulated in steady-state and transient models.

Coupled Ground-Water/Surface-Water Modeling

The WI WSC work has often explicitly incorporated ground water and surface water as a "single resource"; thus coupled simulation of both systems is needed to answer many water resources problems. The WI WSC has experience with continuous simulations of watershed flow systems using surface-water codes such as MMS and PRMS, and with coupling results of these codes to ground-water simulations using MODFLOW. WI WSC projects have also served as a primary testing ground for the soon-to-be-released USGS code GSFLOW, which couples the surface-water code PRMS to the ground-water code MODFLOW. Staff are also collaborating with the author of the MODFLOW2005 Local Grid Refinement package to develop a tutorial in a setting that highlights the package's ability to improve simulation of the effects of pumping wells near streams.

Transport and Fate Modeling

WI WSC staff have expertise in contaminant simulations that ranges from reactive transport modeling (MT3D, RT3D) to PCB transport models for numerous river systems throughout the state. WI WSC staff have also contributed to model framework development for codes such as EPA's IPX model framework, designed for use in evaluating contaminated sediments.

Model Calibration and Prediction

The WI WSC has extensive experience with calibration and prediction tools such as the parameter estimation codes PEST and UCODE. Due to this experience, WI WSC staff have served as technical resources for model calibration for researchers in and out of the USGS. The WI WSC has a state-of-the-art 10-machine parallel computing array that is dedicated to model calibration and prediction uncertainty evaluations.

Modeling in support of hydroecological studies

The field of hydroecology is relatively new and rapidly evolving, and has become important for linking the underlying hydrologic system to the biota that society holds important. The WI WSC is working with Federal, State, and academic collaborators to develop tools and approaches for characterizing hydrologic systems in ways that are appropriate for ecological investigations and decision making. The WI WSC work has ranged from applications using ground-water/surface-water modeling to understand virus transport to drinking water wells to identification of gaining and losing stretches of streams for stream invertebrate investigation. This work is facilitated by the interdisciplinary strengths of the USGS.