SPEAKER ABSTRACTS/BIOGRAPHIES

Management, Analysis, and Optimization of Groundwater Data

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Bob Tipping

Minnesota Geological Survey

MGS Datasets Related to the County Geologic Atlas Program, Part A: Geology

Abstract

Since 1982, County Geologic Atlases (CGAs) have provided maps and databases essential for improved management of groundwater and surface water. A complete geologic atlas consists of Part A constructed by the Minnesota Geological Survey (MGS) and focused on geology and the County Well Index, and Part B constructed by the DNR Eco-Waters division and focused on hydrology. This talk presents map and data elements of the Part A –"container" portion of the atlas; current and future surface and subsurface geologic mapping methods and associated databases are reviewed, along with illustrations of data formats useful for both technical and educational applications.

Biography

JOB TITLE: Senior Scientist – Minnesota Geological Survey
JOB DESCRIPTION: My job is a combination of applied research and outreach. Research interests include groundwater-surface water interaction, aquifer characterization, groundwater chemistry, and GIS applications to help address geologic and hydrogeologic problems. My outreach tasks include teaching, serving on technical advisory boards and responding to public inquiries about anything Minnesota groundwater-related.
EDUCATION: B.A. History, Carleton College; M.S. Geology, University of Minnesota; Ph.D. Water Resources Science, University of Minnesota

OTHER:

Licensed professional geologist,
Member, Minnesota Ground Water Association

ABOUT THE MINNESOTA GEOLOGICAL SURVEY:

The Minnesota Geological Survey is a unit of the Newton Horace Winchell School of Earth Sciences in the University of Minnesota. The Survey is the University outreach center for the science and technology of earth resources in Minnesota. The Survey conducts basic and applied earth science research, conveys that information to the public through publications and service activities, and promotes earth science education. Minnesota is its exclusive focus.

Todd Petersen
Minnesota Department of Natural Resources,
Division of Ecological and Water Resources

DNR Datasets Related to County Geologic Atlas Program, Part B: Hydrogeology

Abstract

County Geologic Atlas Part B reports describe the hydrogeologic setting, water levels, chemistry, pollution sensitivity, and use of aquifers within a county. The reports are made using standard datasets and standard data collection and interpretation methods.

The reports are built using geologic data from the Part A atlas, soils data from the Natural Resource Conservation Service (NRCS), water level and well construction data from the County Well Index (CWI), and groundwater chemistry data. Most of the water chemistry data are collected for the project, but historical data from counties or other state agencies are used when appropriate.

The Part B atlas reports also incorporate water-level data from the DNR Observation Well Network and precipitation data from the DNR Precipitation Observer Network. Lake level data from the DNR Lake Gage Network are used when appropriate. Water use data from high-volume users with a DNR appropriation permit are gathered from the MNDNR Permitting and Reporting System (MPARS) database. Aquifer properties are gathered from aquifer test data compiled by the DNR and the Minnesota Department of Health.

Standard methods are applied to create a water-table elevation map, a depth to water table map, and potentiometric surface maps of selected buried sand and gravel aquifers and bedrock aquifers. A pollution sensitivity map of the near-surface materials is constructed from soil and surficial geology data. The sensitivity rating is based on the estimated travel time for water to travel from the land surface to a depth of 10 feet below land surface, the assumed depth of the water table. Pollution sensitivity maps of buried sand and gravel aquifers and the bedrock surface are created using the Cumulative-Fine-Grained-Sediment (CFGS) method.

The DNR data and the County Atlas reports and procedures are available on the DNR website.

Biography

Todd Petersen is a hydrogeologist with the Minnesota Department of Natural Resources (DNR). He is the Data Manager for the Hydrogeology and Groundwater Unit in the Ecological and Water Resources Division. Todd has a B.S. in Geology from the University of Minnesota and an M.S. in Geophysics from Cornell University and over 30 years of experience in hydrogeology and geophysics.

Justin Blum
Minnesota Department of Health,
Division of Environmental Health,
Drinking Water Protection Section

History of Aquifer Testing in Minnesota, Present Practice and Future Directions

Abstract

The first documented test in Minnesota was performed on a well at Camp Ripley in 1946. From that time, tens of thousands of tests of varying qualities have been conducted. Most have been single-well production tests. The better documented tests with observation wells were conducted by the USGS and MDNR into the 1970's for water resource and well interference investigations. From that time, other groups have participated in gathering these data for the purposes of contamination investigation, and drinking water protection. Occasionally, tests have been performed for the more exotic goals of underground gas, heat, or treated water storage. In 1992, a list of 470 existing tests in the files of the USGS and MDNR was assembled by the MDH to support groundwater flow modeling for drinking water protection. This inventory has been expanded over the years to include approximately 1500 unique tests. Current efforts to effectively manage this information is being led by the MDNR with the development of an "Aquifer Test Database." One future direction of aquifer testing will be modeling of the MDNR water use dataset. Bring out your tests. Don't let the data die in your files!

The DNR data and the County Atlas reports and procedures are available on the DNR website.

Biography

Justin Blum is currently working as a Hydrologist with the Minnesota Department of Health in wellhead protection. He has worked in Minnesota state government for over 30 years and in consulting for 8 years before that. He has BA and MS degrees in Geology from the University of California. Most of the things that Justin has worked on over the years as an "early adopter;" ground water flow modeling, GPS, GIS, have been taken over and done better by others. The only subject area [not yet] thoroughly disrupted is aquifer test analysis and Justin has plans for that.

Jason Moeckel
Glen Champion
Ian Chisholm
Minnesota Department of Natural Resources,
Division of Ecological and Water Resources

Groundwater Thresholds and Modeling Impact

Abstract

The DNR is charged with managing water resources to assure an adequate and sustainable supply for multiple uses. Minnesota has a modified riparian water law system, in which landowners have the right to make reasonable use of the abutting surface waters or the groundwater beneath their land, as defined and regulated by the water appropriation permitting program. The water itself is a public trust resource, and the state grants the right to water beyond personal use – above 10,000 gallons per day or one million gallons per year – through water appropriation permits. In recent years, it has become increasingly clear that Minnesota's water resources, while abundant in many areas, are not unlimited. Increasing demands on both surface water and groundwater supplies can cause negative impacts to the ecosystems and riparian uses of streams, lakes, and wetlands. While water levels fluctuate naturally throughout the year and across multiple years, water appropriations can result in lower water levels, significantly reducing stream flows and more frequently putting fish, wildlife, plant communities and riparian uses at risk.

In response to Laws 2015, chapter 4, article 4, the DNR prepared Report to the Minnesota State Legislature: Definitions and Thresholds for Negative Impacts to Surface Waters, which was released in January 2016. This "Thresholds Report" recommends how thresholds for impact to surface water should be defined in statute and rule. This three-part talk will present an overview of the findings of the Thresholds Report, the ecological data on which the Thresholds Report is based, and a case study of how DNR is applying the findings of the Thresholds Report using groundwater flow modeling.

Biographies

Jason Moeckel is currently the Manager for the Inventory, Monitoring and Analysis Section of the Division of Ecological and Water Resources at the Minnesota DNR. This section is responsible for collecting and analyzing information about Minnesota's water and biological resources to inform management decisions. Jason previously managed Minnesota's premier trout streams in Southeastern Minnesota, and served as Statewide Fisheries Operations Supervisor. Jason has a MS in Resource Conservation from the University of Montana, and BS in Environmental Studies from San Jose State University. Favorite recreational pursuits include: fishing and hunting trips in the Boundary Waters Canoe Area, gardening, and coaching youth sports.

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Glen Champion is a hydrologist with the Hydrogeology and Groundwater Unit at the Minnesota DNR, working in the Groundwater Management and Groundwater Technical Analysis programs. Prior to joining the DNR, Glen worked in the Incident Response Unit at the Minnesota Department of Agriculture, as a hydrogeologist for consulting firms, and as a contract hydrologist at the North Central River Forecast Center of the National Weather Service. Glen has a M.S. from the University of Wisconsin-Madison and a B.S. from the Florida State University, both in Geology. He is a licensed professional geologist in Minnesota.

Ian Chisholm is currently the Supervisor for the River Ecology Unit with the Inventory, Monitoring and Analysis Section of the Division of Ecological and Water Resources at the Minnesota DNR. He has worked for over 28 years within the DNR to develop the understanding and management of stream systems. Ian has a MS in Fisheries Science from the University of Wyoming, and a BS in Water Management and Fisheries Management from the University of Wisconsin – Stevens Point.

Andrew Leaf
U.S. Geological Survey –
Wisconsin Water Science Center

Data Worth Analysis for Optimizing Data Collection for Groundwater Models

Leaf, Andrew T.,[1] Fienen, M.N, 1 White, J.T.[2] and Hunt, R.J.[1]
1) U.S. Geological Survey – Wisconsin Water Science Center
2) U.S. Geological Survey - Texas Water Science Center

Abstract

Because data collection is typically resource intensive, there is often interest in stretching monitoring resources to the fullest extent possible. An underappreciated capability of groundwater models is the capacity to estimate cost-benefit tradeoffs of data collection. Linear-based data worth analysis is computationally efficient and can identify locations and types of new measurements that would most reduce uncertainty in a hydrologic model forecast. Data worth can be computed for both model input parameters and observations of the system state that constrain model parameters through the calibration process. In either case, data worth is ultimately based on a reduction of uncertainty in the model parameters that drive the forecast, propagated to forecast uncertainty via parameter sensitivities. Parameters may include any aspect of the model that can be systematically adjusted; forecasts of interest can include any output of the model. Moreover, the primary strength of the method is that the value measured at the hypothetical observation is not required for data worth analyses, only the sensitivity of the hypothetical observation to changes in model parameters. This sensitivity is a standard output of parameter estimation codes like PEST and PEST++. This presentation will review the basic theory behind linear-based data worth analysis, present a case-study of its application, and discuss available tools, future approaches, and challenges of this powerful technique.

Biography

Andrew Leaf is a hydrologist at the USGS Wisconsin Water Science Center, where he works on hydrologic modeling studies throughout Wisconsin and the greater U.S. He received his bachelor's from Gustavus Adolphus College, and M.S. degrees in Hydrogeology and Water Resources Management from UW-Madison. He worked in the environmental consulting field in Seattle and has been with the USGS since 2012.

Adam Janzen
Barr Engineering Company

Geospatial Analysis for Optimization at Environmental Sites

Abstract
Geospatial analysis can be utilized in multiple ways to optimize activities at environmental sites. Examples include avoiding redundant data collection, improving quantity estimates, and demonstrating that remediation goals have been met. Geospatial analysis is based on the spatial relationships between nearby data points, which are not accounted for in traditional statistical analysis. This presentation will provide an overview of how geospatial methods work and examples of optimization applications.

Biography
Adam Janzen, PE is an environmental engineer at Barr Engineering Company in Minneapolis. He is one of the trainers for ITRC's "Geospatial Analysis for Optimization at Environmental Sites" web-based training and was a contributing author to the companion ITRC GRO-1 guidance document. At Barr he has helped clients optimize sampling networks using geospatial methods and presented a paper describing an automated optimization approach at the MODFLOW and More 2013 conference. His work at Barr primarily involves groundwater flow modeling with typical applications of wellhead protection, mine dewatering, water supply, and contaminant fate and transport. Adam earned a bachelor's degree in civil and environmental engineering from the University of Illinois at Urbana-Champaign in 2008 and a master's degree in civil and environmental engineering from Princeton University in 2010.