Groundwater Modelling
Impact Assessment Tools

Groundwater is an important resource for irrigators and town water suppliers, accounting for nearly a third of the water used in Australia. NICTA is developing tools and techniques to improve the understanding of how groundwater flows and how it responds to varying usage scenarios.

Groundwater, which exists under the surface of the earth in geological structures is pumped out as part of the coal seam gas extraction process to allow the gas to move more freely. Large coal mine developments can also impact the existing flow regimes of groundwater systems.

There is often sparse information about how groundwater flows and uncertainty in what the ultimate effects of pumping out deep water will be on water levels and other water users.

Project Background

NICTA's Machine Learning Research Group is developing techniques to improve the understanding of and quantify how groundwater flows and how it may respond to varying usage scenarios.

Licences to extract groundwater are required by all users. These can be traded between users if it can be demonstrated that the new pumping location will not have an adverse impact on groundwater system and the supply of existing users.

What is the technology?

Understanding the uncertainty in how groundwater will flow first requires gaining an understanding of the geology of the area and how water is getting into and moving through the system.

NICTA's Groundwater Impact Assessment Tools process different datasets that already exist about the groundwater system, such as geological structure and measured water levels in the sub-surface.

By processing this data with the NICTA algorithms, results can quantitatively describe what is physically and geologically plausible.

NICTA's unique approach

Globally, the impact on groundwater systems from various extraction uses is becoming increasingly important. NICTA is making the analysis of these complex hydrogeological systems more flexible as it can handle different types of uncertainty that originate from different sources.

The project has developed tools for characterising the uncertainty in the important bulk hydraulic properties of geological units based on known depositional history and measurements from rock samples collected from boreholes. In addition, techniques have been developed to incorporate this into large scale dynamic flow simulations to characterise the uncertainty in impacts at a regional scale.

The project has delivered web-based assessment tools including a geospatial data portal and visualisation system.
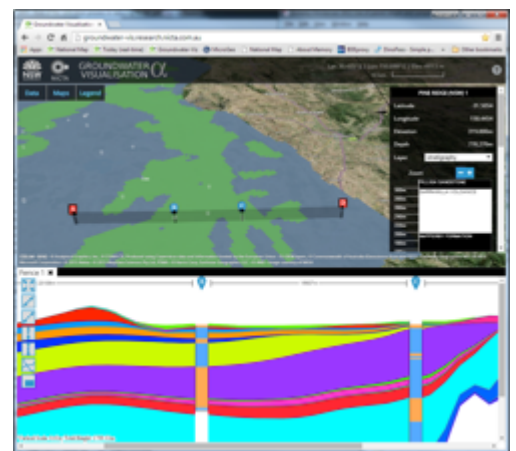
Interactive groundwater data portal and visualisation system to allow easy exploration and comparison of different datasets and models. Specifically shown is a model cross-section and interpreted data from bore drill logs.

A computer generated realisation of one of the many possible ways that rocks could be arranged in a channelized fluvial deposit such as the Digby Formation within the Gunnedah Basin. In this case there are two rock types, but one is made transparent for visualisation. A hydrogeologist may construct a mental image of this and then use their experience to guess how water might flow through the rocks. In our system, we generate thousands of realisations and compute how water flows through each one. All these results are used to estimate how water may flow through the formation, explicitly capturing uncertainty

Collaborators

NSW GOVERNMENT | Department of Primary Industries

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The Groundwater Modelling project is part of the Environment Business Team, developing leading edge predictive analytics and spatial visualisation tools for improved environmental resource management.

Research Excellence in ICT
Wealth Creation for Australia

Leading the Way

NICTA is Australia's Information and Communications Technology (ICT) Research Centre of Excellence, driving innovation through high quality research, research training, commercialisation and contract research.

NICTA has the largest concentration of ICT researchers in Australia. Our research focuses on use-inspired basic research that benefits industry, the community and the national interest.

Since NICTA's inception in 2002, NICTA has built strong research capability in:
• Software Systems
• Mobile Systems
• Machine Learning
• Computer Vision
• Optimisation.

Our Business Teams are the market focus of our research capabilities:
• Broadband and the Digital Economy
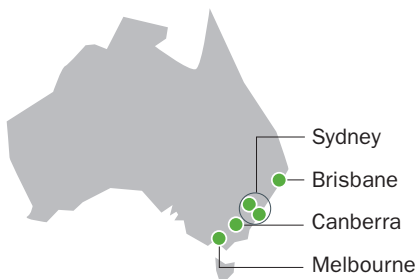• Infrastructure, Transport and Logistics
• Security
• Environment.

NICTA researchers work on Business Team projects supported by:
•   An Engineering and Technology Development Team
•   IP, Legal and other professional support.

Our work as a world-class research institute and Centre of Excellence in science and innovation brings together many of Australia's and the world's top ICT researchers. NICTA provides them with the facilities and support they require, making imagination to impact a reality.

NICTA's unique approach fosters and develops ICT research. We work closely with both industry and other research institutions to solve problems and make breakthroughs in ICT with real impact. NICTA's focus on use-inspired research means our projects have direct relevance to the challenges faced by business, government and individuals around the world. The result is breakthrough technologies that provide commercial opportunities and have a positive impact on Australia's export earnings.

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