



The
Geological
Society

MAKING THE MOST OF RECENT ADVANCES IN GROUNDWATER MODELLING

University of Birmingham's Edgbaston Park Hotel & Conference Centre,
including The 2019 Darcy Lecture - Dr. John Doherty
10am - September 19th, 2019

Groundwater modelling is changing rapidly. New modelling codes, uncertainty analysis, the ability to more closely represent geological detail and incorporate finer resolution are all changing how we build and use groundwater models for aquifer management and decision support. This meeting will demonstrate the progress and of these changes from the perspective of the hydrogeological community as a whole. Critically, we will consider whether, as groundwater modellers, we are using these recent advances to improve our ability to answer the key groundwater management questions.

Modelling advances, design change and operating under uncertainty are interlinked topics. The in-progress changes in our industry make this the ideal time for contemplating improvement in method. This meeting will showcase a range of initial experience in these early days of the new modelling paradigm. It is an opportunity to consider groundwater modelling from a different perspective and to discover the best and worst of

these recent advances. Hosted by the Groundwater Modellers' Forum, the meeting includes a range of recent experiences of new modelling advances. Each talk demonstrating completed models from 2018-19, highlighting how they enhance hydrogeological assessments and their learning outcomes.

In addition, this year we have the unique opportunity to host the 2019 Darcy Lecture. John Doherty runs the company Watermark Pty in Australia and is an expert at the international forefront of decision support in uncertain groundwater systems. He is also the developer of the widely applied PEST suite. His message is very relevant, practical and timely in this period of modelling change.

As in previous years, the talks will be complimented by a Modellers' Fair which will further showcase recent advances in groundwater modelling. The conference is geared towards the broader hydrogeological community, with less of an emphasis on technical development details.

STARTING FROM THE PROBLEM AND WORKING BACKWARDS



Dr. John Doherty

Many groundwater models are commissioned and built under the premise that real-world systems can be accurately simulated on a computer - especially if the simulator has been “calibrated” against historical behaviour of that system. This premise ignores the fact that natural processes are complex at every level, and that the properties of systems that host them are heterogeneous at every scale. Models are, in fact, defective simulators of natural processes.

The laws of uncertainty tell us that a model cannot tell us what will happen in the future. It can only tell us what will NOT happen in the future. The ability of a model to accomplish even this task is compromised by a myriad of imperfections that accompany all attempts to simulate natural systems, regardless of the superficial complexity with which a model is endowed. This does not preclude the use of groundwater models in decision-support. However, it does require smarter use of models than that which prevails at the present time.

It is argued that, as an industry, we need to lift our game as far as decision-support modelling is concerned. We must learn to consider models as receptacles for environmental information rather than as simulators of environmental systems. At the same time, we must acknowledge the defective nature of models as simulators of natural processes, and refrain from deploying them in a way that assumes simulation integrity. We must foster the development of modelling strategies that encapsulate prediction-specific complexity supported by complexity-enabling simplicity.

Lastly, modellers must be educated in the mathematics and practice of inversion, uncertainty analysis, data processing, management optimisation, and other numerical methodologies so that they can design and implement modelling strategies that process environmental data in the service of optimal environmental management.