2019 Darcy Lecture

Wednesday September 11, 2019 at 4 pm
Louis-Guillaume Auditorium F200
Uni Mail, Emile-Argand 11, 2000 Neuchâtel

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Starting from the problem and working backwards

We are looking forward to meeting you on this occasion. For organizational purposes please let us know if you are coming to the Apéro: https://forms.gle/LgZRJRFVUDWWZ5WG6

Abstract

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 behavior 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. Furthermore, the information content of datasets against which they are calibrated is generally low.

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