Possibility for evaluating groundwater flow by integrating fluid flow-deformation coupling simulation and geophysical exploration

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Pore pressure changes caused by groundwater flow result in deformation of geological bodies. These processes can be described by what is called poromechanics. Real geological materials possess heterogeneity in their spatial distribution, and hence, it is desirable to develop a new methodology/techniques to take heterogeneous nature into account and quantitatively analyze the physical processes occurring underground. At the same time, this approach provides us a lot of uncertain parameters and it makes difficult for us to assure the uniqueness of our representation.

In this presentation, coupled deformation/fluid flow processes are explained based on the simplest case with the theory of poroelasticity. Then, a new technique to model coupled processes with several different spatial resolutions in a single modeling procedure is presented and a case study is shown. Finally, possibility for integrating geophysical exploration, especially remote sensing techniques, with our model to better evaluate the groundwater flow processes and for efficiently monitor groundwater management will be discussed.