

A View Towards the Future of Subsurface Characterization: CAT Scanning Groundwater Basins

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ABSTRACT

The objective of this talk is to promote the idea of basin-scale characterization of the subsurface at high resolution. We contend that high resolution characterization, monitoring, and prediction are the key elements to advancing and reducing uncertainty in our understanding and prediction of subsurface processes at basin scales. In particular, we advocate that tomographic surveying is a more cost-effective, higher resolution and less invasive approach for characterizing field-scale subsurface than traditional site characterization technologies. While a given type of tomographic survey (e.g., hydrological, chemical or geophysical) has its limitations, fusion of different types of information of tomographic surveys can overcome these limitations and maximize the utility of each independent source of information.

A basin is an appropriate scale for many water resources management purposes. We thereby propose the expansion of the data fusion concept to basin-scale characterization. In order to facilitate basin-scale tomographic surveys, different types of passive, basin-scale, CAT scan technologies are suggested that exploit recurrent natural stimuli (e.g., lightning, earthquakes, storm events, barometric variations, river-stage variations, etc.) as sources of excitations, along with implementation of sensor networks that provide long-term and spatially distributed monitoring of excitation as well as response signals on the land surface and in the subsurface. This vision for basin-scale subsurface characterization faces many unprecedented technological challenges and requires interdisciplinary collaborations (e.g., surface and subsurface hydrology, geophysics, geology, geochemistry, information and sensor technology, applied mathematics, atmospheric science, etc.). We nevertheless contend that this should be a likely future direction of subsurface sciences.*