Using Ground Penetrating Radar to Monitor Transient Unconfined Aquifer Response to Pumping

Details

Meeting	2008 Fall Meeting
Section	Hydrology
Session	Integration of Hydrological, Geophysical, and Geochemical Monitoring, Modeling, and Inversion to Support Remediation and Environmental Decision Making III
Identifier	H51M-06
Authors	Thoma, M J*, Center for Geophysical Investigation of the Shallow Subsurface - Boise State University, 1910 University Dr., Boise, ID 83725, United States Malama, B, Center for Geophysical Investigation of the Shallow Subsurface - Boise State University, 1910 University Dr., Boise, ID 83725, United States Bradford, J H, Center for Geophysical Investigation of the Shallow Subsurface - Boise State University, 1910 University Dr., Boise, ID 83725, United States Barrash, W, Center for Geophysical Investigation of the Shallow Subsurface - Boise State University, 1910 University Dr., Boise, ID 83725, United States Johnson, B, Center for Geophysical Investigation of the Shallow Subsurface - Boise State University, 1910 University Dr., Boise, ID 83725, United States Hinz, E, Center for Geophysical Investigation of the Shallow Subsurface - Boise State University, 1910 University Dr., Boise, ID 83725, United States Murray, S, Center for Geophysical Investigation of the Shallow Subsurface - Boise State University, 1910 University Dr., Boise, ID 83725, United States
Index Terms	HYDROLOGY [1800] Groundwater hydraulics [1828] Hydrogeophysics [1835]

Abstract

Using an integrated geophysical and hydrological modeling approach along with a field test, we investigate the use of ground penetrating radar (GPR) to monitor the drawdown response of a heterogeneous, unconfined aquifer to pumping. The pumping test was conducted at the Boise Hydrogeophysical Research Site (BHRS) where we have access to an unconfined aquifer that is known to have laterally varying transmissivity. Previous hydrogeophysical investigations at the site indicate that the aquifer consists of five hydrostratigraphic units of fluvial deposits of sand and cobbles. A highly (hydraulically) conductive sand channel occurs at the top of the aquifer in the southwest portion of the wellfield and extends to a maximum depth of about five meters from land surface. Less conductive units are present in the northeast of the wellfield and extend to the southwest beneath the sand channel. During the experiment conducted in July 2008, the aquifer was pumped at a constant rate of Q = 50 gpm, and the transient drawdown response was monitored with repeated GPR measurements and soundings using electric tapes. The response of the aquifer was also simulated using a three-dimensional finite element code developed at Boise State University. The simulated aquifer response shows significant asymmetry in the cone of depression around the pumping well, in agreement with the results obtained during the field test using GPR. The results indicate that GPR can be used as a non-invasive method for monitoring unconfined aquifer response to pumping. And, unlike traditional methods of monitoring aquifer responses (piezometers or observation wells), the use of GPR may provide additional insight into processes such as the transient

response of the capillary fringe given the high sensitivity of GPR to changes in moisture content above the water table.

Cite as: Author(s) (2008), Title, *Eos Trans. AGU, 89*(53), Fall Meet. Suppl., Abstract H51M-06