Technology and Groundwater: Reinforce the Basics

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Disruptive technologies in the field of groundwater

groundwater exploration

groundwater monitoring

groundwater abstraction

overall groundwater management
DT 1: datalogger for piezometric monitoring - Insights from continuous data

Data source: ACIAR Project on Improving Groundwater Management to Enhance Agriculture and Farming Family Livelihoods in Pakistan
Groundwater management, including exploration, development, conservation, monitoring... it's all about having a conceptual model and test it!, and test it! and test it!, and test it!
DT 2: Downhole CCTV – A must for water well commissioning and for diagnostic
DT 3: Understanding the importance of global terrestrial constraints and fracture orientation while exploring discontinuous aquifers
DT 4: Stochastic versus deterministic groundwater flow models - enhanced approach of groundwater flow

CDF (cumulative distribution function) of the total calculated discharge
DT 5: Use of derivative for pumping test interpretation and identify groundwater flow models

(a) Theis model: confined ideal aquifer
(b) Unconfined, or double porosity aquifer
(c) Confined aquifer with a no-flow boundary
(d) Confined aquifer with a constant head boundary
(e) Leaky aquifer: Hantush and Jacob (1955) model
(f) Single well test with well-bore storage and possibly skin effects
(g) Single vertical fracture having an infinite conductivity: (Gringarten et al. 1974)
(h) General Radial-Flow model with n < 2
(i) General Radial-Flow model with n > 2
(j) Single well test with well-bore storage, infinite acting radial flow and constant head boundary
DT 6: Electrode cable measurement for exploring the depth of the fresh/saline groundwater interface

Sealed probe in boreholes converting the overall electrical resistivity into fluid conductivity

\[ U = \frac{R(\text{roche, eau})}{K} \times t \]
Take away message

• Managing groundwater resource is all about conceptual models

• Because this resource is invisible, understanding groundwater behavior requires combining a variety of indirect methods

• Methods combine the most standard field surveys with the most innovative AI technique and are still evolving