Determining Reservoir Properties

Tech ID: 33198 / UC Case 2019-511-0

BACKGROUND

Determining the properties that control fluid flow and pressure migration through rocks is essential for understanding groundwater, energy reservoirs and fault zones. Hydraulic diffusivity is the key parameter that controls pressure migration in reservoirs. There is a need to determine it in situ for energy, groundwater and earthquake applications. Direct measurements of these properties underground generally require expensive and invasive processes such as pumping large volumes of water in or out of the ground. Most current methods rely on either active pumping between wells or proxies such as seismic velocity or the migration time of microseismicity. These conventional methods may change the structure that they are trying to measure and do not resolve variations in space without complex, multiple experiments. Moreover, active pumping is expensive, invasive and sensitive to a limited set of scales, while proxies are difficult to calibrate.

TECHNOLOGY DESCRIPTION

To help address this challenge, investigators at UC Santa Cruz (UCSC), in collaboration with Cornell University, have researched and developed an approach to determining subsurface hydraulic diffusivity at multiple depths through timeseries recordings of passive temperature fluctuations in boreholes. This is primarily achieved by using temperature sensors, a network, and a processing platform that computes a cross-correlation of temperature data over several windows of time and finding the correlation as a function of time lag. This correlation is a unique function dependent on the distance between sensors and hydraulic diffusivity. This functional form is compared with predictions for the sensor spacing allowing the hydraulic diffusivity between the two sensors to be determined. By performing computations for each sensor pair, the system produces estimates of the hydraulic diffusivity as a function of depth and can evaluate the dependence on spatial scale.

APPLICATIONS

- Subsurface characterization

ADVANTAGES

- Uses ambient noise temperature data to infer hydraulic diffusivity
- Passive rather than invasive method to determine subsurface flow properties
- Cheaper and less risky than invasive methods

INTELLECTUAL PROPERTY INFORMATION

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,591,901	02/28/2023	2019-511

Additional Patent Pending

RELATED MATERIALS

- Patrick M Fulton , Emily E Brodsky, Determining hydraulic diffusivity from ambient noise in subsurface flow rate and temperature data, Geophysical Journal International, Volume 234, Issue 3, September 2023, Pages 2000–2006 - 04/12/2023

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OTHER INFORMATION

CATEGORIZED AS

- **Energy**
  - Hydrocarbon
  - Other
- **Environment**
  - Remediation
  - Sensing
- **Engineering**
  - Engineering
- **Imaging**
  - Remote Sensing

RELATED CASES

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