

## **USING HARMONIC HYDRAULIC TESTS TO ESTIMATE FRACTURED BEDROCK PROPERTIES AND PREDICT LOCAL HETEROGENEITY**

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Harmonic hydraulic tests involve creating a sinusoidal pressure wave in one well and observing the phase shift and attenuation of the signal in another well. These tests have been developed to estimate aquifer properties. One advantage harmonic tests have over traditional pumping tests is that harmonic tests produce zero net discharge. This is important in fractured bedrock aquifers where low effective porosity leads to a large area of influence that averages hydraulic properties. Spatial averaging leads to errors in transport models where highly conductive pathways are missed. Harmonic testing was conducted in a single fracture within a fractured sandstone aquifer in Altona, New York. A sinusoidal oscillating head was produced at multiple frequencies in one well and measured in four nearby monitoring wells. Hydraulic diffusivity, the ratio of transmissivity to storativity, was calculated by fitting the observation well heads to the hydraulic diffusion equation. Apparent hydraulic diffusivity decreased with increasing period according to a power law. It is hypothesized that the single fracture exhibits dual porosity hydraulic behavior as water is conducted primarily along flow channels but stores water in less conductive areas of the fracture. The change in apparent hydraulic diffusivity may be a response to the time available for water to exchange between flow channels and the surrounding fracture.