The correct construction of fractional Brownian motion and its effect on solute transport

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Abstract. Since the late 1980's, various subsurface material properties, such as hydraulic conductivity (K) and permeability have been shown to follow a fractal scaling. In particular, fractional Brownian motion (fBm) is an attractive model for K because its self-similar structure allows it to account for the evolving scales of heterogeneity seen in aquifers. fBm has been used as a K model in numerous solute transport in heterogeneous media studies, however in nearly every instance the algorithms used only create approximations of true fBm's and are in particularly poor at small lags. We present the correct methodology for using self-affine fractal to model K and highlight the downfalls of using the approximate algorithms. Results are also presented which demonstrate the differences in solute transport predicts when using a true fBm vs. an approximate fBm.

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