Fractal topography and residence time distributions

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River topography is famously fractal, and the fractality of the sediment bed surface can produce scaling in solute residence time distributions. Empirical evidence showing the relationship between fractal bed topography and scaling of hyporheic travel times is still scarce. Here, I present results from numerical simulations that relate the scaling exponent of the bed topography to that of the residence time distribution in the bed under different flow conditions. I generated fractal landscapes and used physically based transport models to measure residence time distributions. I found that the fractal properties of the bed topography controlled solute residence time distributions. Overall, these results provide detailed evidence of the coupling between bed topography and anomalous transport scaling in flowing surface freshwater.