Using magnetic resonance imaging for experimental analysis of fine-sediment infiltration into gravel beds

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Sedimentologists recognize that development of a fine-resolution, truly three-dimensional analytical tool is essential if the internal structure of an opaque material is to be examined. This paper therefore seeks to: (i) test the viability of magnetic resonance imaging for sedimentological research; and (ii) investigate fine-sediment infiltration into gravel beds. The results of six experiments are analysed quantitatively using ImageJ post-processing software. Data indicate that magnetic resonance imaging-based measurements of particle axes and volumes are comparable with standard laboratory techniques. Furthermore, the technique permits visualization and analysis of differences in the pattern of fine-sediment infiltration (median particle diameter, d) into a framework of gravel (median particle diameter, D). Data clearly illustrate a siltation process for samples of D/d = 34 and a sealing process for samples of D/d = 7 where the seal is restricted to a depth equal to 2D. This pore-scale visualization is valuable to the understanding of hydraulic–sediment–habitat interactions.

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