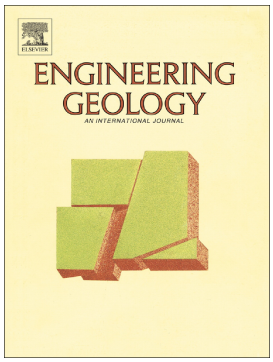

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Scale effect on hydraulic conductivity and solute transport: small and large-scale laboratory experiments and field experiments

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Highlights

- Hydraulic conductivity increases with scale for the same measurement condition.
- Dispersivity increases with sample height following exponential functions.
- Partition coefficient increases with sample support following linear functions.
- The scale effect obtained can be explained by the soil heterogeneities.
- To improve predictions reliability and accuracy, scale effect should be considered.

Abstract

Hydraulic conductivity (K), dispersivity (α) and partition coefficient (K_d) can change according to the measurement support (scale) and that is referred as scale effect. However, there is no clear consensus about the scale behavior of these parameters. Comparison between results obtained in different support of measurements in the field and in the laboratory can promote the discussion about scale effects on K, α and K_d, and contribute to understanding how these parameters behave with the change in the scale of measurement, the main objectives of the present paper. Small and large-scale laboratory tests using undisturbed soil samples and field experiments at different scales were performed. Results show that for the same measurement condition K, α and K_d increase with scale, in all studied magnitudes. Caution should be taken when using K, α and K_d values in numerical models with no concern about the scale effect. The lack of consideration of the difference of scale between field and laboratory measurements and numerical model may compromise the reliability of the predictions and misrepresent the responses.