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The dependence of errors in pedotransfer function predictions on spatial scale and location: an analysis using wavelet transforms.

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Pedotransfer functions (PTFs) allow us to predict hard-to-measure properties of the soil, such as the moisture characteristic curve, from more easily or cheaply measured variables such as the particle size distribution. Given the increasing use of PTFs in hydrology we must evaluate their precision, but this must also take account of how they reproduce the spatial variation of the target soil properties. This evaluation must consider (i) the correlation of observations with predictions at different spatial scales, (ii) the reproduction of observed variance at different spatial scales; and, (iii) the spatial pattern of the model error. Further, when there is more than one PTF available, we must be able to choose which is most appropriate for a particular spatial scale in a way that summarizes these considerations.

We report a spatial assesment of four PTFs for soil water-retention and saturated hydraulic conductivity, applied to data on a 5-km transect. We use wavelet analysis to examine how the variances and correlations of the observed and predicted properties vary with spatial scale; and to test the uniformity of these relationships in space. Because of its local and scale-dependent structure, the wavelet transform is particularly suitable for analysing scale-dependence and non-stationarity in the correlation of spatial variables, and provides a basis for inference about these aspects of spatial variation which give insight into PTF performance. We propose a scale-dependent concordance correlation on the basis of which PTFs can be compared and selected for different applications.