How variable is Australian Soil Texture: A multiscale fractal analysis

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Optimal land management decisions in agronomic, ecological or anthropological contexts can be improved by inclusion of spatially explicit soil information at relevant scales. However provision of this information at such scales using traditional (soil survey) methods is often impractical or prohibitively expensive. Attempts to bridge the gap between the information required and the information available have included development of geostatistical tools for changing soil map scale (i.e. extent, grid-cell resolution and prediction support). Useful application of these tools depends upon our understanding of how soil variability will change with scale. Studies which investigate this question, have tended to focus on small areas with particular biophysical characteristic. There is a need to develop a more general understanding of the spatial scaling behaviour of soil properties. This should improve the development of spatially explicit deterministic soil models and to improve soil survey design by providing a priori information on the likely distribution of soil properties.

This work uses a large legacy dataset to investigate the effect of scale on the spatial variability of soil texture. We calculated experimental variograms at scales ranging from continental to field. We fit power curves to the modelled variograms and calculated the Hausdorff Besicovictch Dimension we obtained a unitless measure of variability which allowed us to compare variability between scales and between soil properties.

- Variability increases with depth across all scale (down to 60cm).
- Around 50 percent of total variability is realised in first 10 km
- Calculation of fractal dimension suggests partial self similarity
- Fractal Dimension was still decreasing at finest resolutions: implies that increasing resolution further may resolve variability.