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Using Local Moran's I to identify contamination hotspots of rare earth elements in urban soils of London

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Highlights

- Local Moran's I is used to identify contamination hotspots of REEs in urban soils.
- Several areas in London soils had elevated concentrations of Ce, La, Nd, Sc, Sm, Yb and Y.
- Soil parent material was the natural factor leading to enrichment of REEs in some areas.
- Possible anthropogenic sources include fertilizer, industries activities and vehicular emission.

Abstract

Rare earth elements (REEs) in urban soils are receiving more attention because of their increased use in modern technology. Up to now, there is little information about the spatial patterns of REEs and their influencing factors in urban soils. In this study, based on the British Geological Survey "London Earth" geochemical survey data containing a total of 6467 soil samples collected from the urban area of London, the spatial distributions of Ce, La, Nd, Sc, Sm, Yb and Y, and their influencing factors were investigated. The element Sc is included in this study as related element. Urban samples were collected at a depth of (0 to 20 cm), and total concentrations of 48 chemical elements were determined in the < 2 mm size fraction of the topsoils using X-ray Fluorescence Spectrometry (XRFS). Spatial clusters and spatial outliers were identified using the index of local Moran's I, showing elevated concentrations of REEs in the northwest, northeast and southern parts of the study areas while all the 7 REEs exhibited generally similar spatial patterns: high values were mainly located in soils over Alluvium, Glacial till and Clay-with-flints deposits, demonstrating the close relationships between REEs and the lithology. Meanwhile, hotspot analysis revealed high values of REEs in public parks, private golf clubs, wetlands and agricultural lands especially in Hillingdon, Enfield, Brent, Harrow, Croydon and Bromley. Soil parent material was identified as the primary source for larger spatial patterns of natural origin, while smaller spatial patterns were associated with anthropogenic sources