Cd and Ni are greatly accumulated in top soils. Correspondingly, from depth to top, Fe, Zn and Hg also accumulated, whereas Cu and As are depleted although Cu of HACM modes and As of SCM (simple continuous multifractal) in both deep and top soils. For other indices, including B, Cl, Br, C, F, Ga, I, K, La, Ca, Mg, Na, Nb, pH, Si, Sb, Rb, V, Y, and Zr, the behaviours of them in top soils are similar to those in deep ones. From the results above, it could be concluded that those elements accumulated gradually from deep to top soils are affected a lot by anthropogenic factors and those depleted much may be related more to the geological background of the areas. And especially the results got from the three kinds of spatial methods in environment assessment are in agreement with one another.

Key words fractal; multifractal; geostatistics; environmental assessment

Linking historical smelter emissions across Humberside (UK) to enhanced soil metal concentrations using geostatistics and preserved environmental samples

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Background: Analysis of human malignancies on Humberside (UK) in 1984 showed an increased risk close to the site of the local smelter. Geochemical survey data for Pb and Sn in soil collected soon after the smelter closed showed elevated concentrations relative to local background levels, and a strong spatial trend related to the prevailing wind direction. No historical emission data existed and evidence associating the smelter with the putative soil contamination plume was considered equivocal. In this work we test the hypotheses that: a) historical data can be used to estimate the excess quantities of Pb and Sn in the soil; b) tree bark & attic dust can act as historical archives of particulate deposition; c) geochemical and mineralogical information assist in linking the source of the metal and the historical contamination plume. Methodology: Using the wider soil survey data, we subtracted soil median background concentrations for three parent material types outside the region of deposition from those samples within it. We then constructed a statistical model of metal deposition from these data. Excess metal concentrations were mapped by lognormal universal kriging with parameters for the trend and residuals modeled simultaneously using residual maximum likelihood. Tree bark and attic dust samples collected at increasing distance and in different directions from the smelter were then analyzed by SEM. This enabled the identification and characterization of heavy metal particulate populations in the tree bark and attic dust samples with respect to relative particle numbers, size, chemistry and shape. Results: Maps of excess heavy metals in soil suggest that they were deposited up to 24 km to the NE of the smelter by the prevailing wind. We estimated total excess metal in the soil to a 40 cm depth over the area of deposition to be 2500 t of Pb and 830 t of Sn. The dusts and tree bark samples contained particulates whose size, shape and composition were consistent with emissions from a Sn smelter. Bulk chemical analyses showed that Sn and associated elements declined with distance from the smelter stack in a manner analogous to the soil survey data. Conclusions: This study supports our hypotheses and provides evidence on the magnitude and distribution of historical metal contamination that could aid any subsequent epidemiological study.

Key words human health; soil; geostatistics; emission; heavy metal

Spatial and temporal distribution of polycyclic aromatic hydrocarbons in fine-grained sediments of the East China Sea

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The nearshore mud area along the Changjiang (Yangtze River) estuary and the coast of Zhejiang and Fujian provinces, and the distal mud area to the southeast of Cheju Island, Korea are the modern accumulative centers, thus, being the "sinks" of pollutants such as Polycyclic Aromatic Hydrocarbons (PAHs) in the East China Sea (ECS). PAHs of surface sediment samples from the mud areas of