

Spatial distribution of trace metals in soils of southwestern France

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Soils are critical environments and interface of rock, air and water. They are subject to anthropogenic pressure such as soil amendments, pesticides or atmospheric deposition leading to input of trace metals. As result they may disturb soil ecosystem through the intoxication of microbiota, flora and fauna and expose human to the ingestion of toxic pollutants.

In France, a national soil monitoring network (RMQS: Réseau de Mesures de la Qualité des sols) was developed since the early 2000's. The network is build on a 16×16 km systematic grid covering the whole territory and enables assessment of 11 trace metals contamination (Cd, Co, Cr, Cu, Mo, Ni, Pb, Tl, Zn, As, Hg). Our aim is to determine concentrations, spatial distribution trends and origin of selected trace metals (As, Cd, Cu, Ni, Cr, Pb) by using the soil network on a regional scale. 356 surface soil samples were collected from the RMQS inside the Nouvelle Aquitaine administrative region (90 293 km²). Exploratory data analysis, multivariate analysis and geostatistics were used to identify trends in spatial variability and origin of the elements. Geographic Information System (GIS) databases have been crossed to establish maps and identify the possible origin of contamination.

Boxplots showed anomalies for all studied trace metals. Cu, Cd and As have the highest numbers of anomalies. Results from principal component analysis indicated strong correlation between Ni, Cr, Fe and clay content, supporting a geogenic origin of Ni and Cr. Spatial correlation was assessed and modeled with variograms. GIS maps showed a strong relationship between Cu anomalies and soil with a vineyard occupation, As and Pb anomalies with mining activities, Cd anomalies with Jurassic limestone bedrock.