# A spatial assessment of mercury content in the European Union topsoil

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Mapping of surface soil Hg concentrations, a priority pollutant, at continental scale is important in order to identify hotspots of soil Hg distribution (e.g. mining or industrial pollution) and identify factors that influence soil Hg concentrations (e.g. climate, soil properties, vegetation). Here we present soil Hg concentrations from the LUCAS topsoil (0-20 cm) survey including 21,591 samples from 26 European Union countries (one sample every 200 km 2 ). Deep Neural Network (DNN) learning models were used to map the European soil Hg distribution. DNN estimated a median Hg concentration of 38.3 $\mu$g kg $-1$ (2.6 to 84.7 $\mu$g kg $-1$ ) excluding contaminated sites. At continental scale, we found that soil Hg concentrations increased with latitude from south to north and with altitude. A GLMM revealed a correlation (R 2 = 0.35) of soil Hg concentrations with vegetation activity, normalized difference vegetation index (NDVI), and soil organic carbon content. This observation corroborates the importance of atmospheric Hg 0 uptake by plants and the build-up of the soil Hg pool by litterfall over continental scales. The correlation of Hg concentrations with NDVI was amplified by higher soil organic matter content, known to stabilize Hg in soils through thiol bonds. We find a statistically significant relation between soil Hg levels and coal use in large power plants, proving that emissions from power plants are associated with higher mercury deposition in their proximity. In total 209 hotspots were identified, defined as the top percentile in Hg concentration (>422 $\mu$g kg $-1$ ). 87 sites (42% of all hotspots) were associated with known mining areas. The sources of the other hotspots could not be identified and may relate to unmined geogenic Hg or industrial pollution. The mapping effort in the framework of LUCAS can serve as a starting point to guide local and regional authorities in identifying Hg contamination hotspots in soils.
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