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A new method for detecting, quantifying and monitoring diffuse contamination

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A new method is presented for detecting and quantifying diffuse contamination at the regional to continental scale. It is based on the analysis of cumulative distribution functions (CDFs) in cumulative probability (CP) plots for spatially representative datasets, preferably containing >1000 samples. Simulations demonstrate how different types of contamination influence elemental CDFs of different sample media. Contrary to common belief, diffuse contamination does not result in exceedingly high element concentrations in regional- to continental-scale datasets. Instead it produces a distinctive shift of concentrations in the background distribution of the studied element resulting in a steeper data distribution in the CP plot.

Via either (1) comparing the distribution of an element in top soil samples to the distribution of the same element in bottom soil samples from the same area, taking soil forming processes into consideration, or (2) comparing the distribution of the contaminating element (e.g., Pb) to that of an element with a geochemically comparable behaviour but no contamination source (e.g., Rb or Ba in case of Pb), the relative impact of diffuse contamination on the element concentration can be estimated either graphically in the CP plot via a best fit estimate or quantitatively via a Kolmogorov-Smirnov or Cramer vonMiese test. This is demonstrated using continental-scale geochemical soil datasets from Europe, Australia, and the USA, and a regional scale dataset from Norway. Several different datasets from Europe deliver comparable results at regional to continental scales. The method is also suitable for monitoring diffuse contamination based on the statistical distribution of repeat datasets at the continental scale in a cost-effective manner.