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Spatial data analysis of geogenic contamination in streamwater geochemistry

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Geochemical soil and stream water data are important to investigate the relationship between the environment and health. Regional geochemistry databases are increasingly being used to determine geogenic contamination to provide baseline environmental assessments. An inherent assumption is that geochemical data represent absolute abundances. However, because of the compositional nature of geochemical data due to the closed or constant sum problem, univariate geochemical elements cannot be compared directly with one another. As a result, any interpretation based on them is vulnerable to spurious correlation problems. This has implications for baseline quality documentation to determine health risk. Single component threshold values may not be the most appropriate way to calculate baseline maps and risk evaluation. A paradigm shift in thinking is advocated for the production of baseline thresholds and WHO guidelines. An alternative approach is presented emphasizing opportunities for using compositional data analysis, through the use of log-ratio and log-contrast approaches, for environmental monitoring and risk assessments for human health. Case study examples are shown based on a regional streamwater geochemical dataset and renal disease data.