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Combination of singularity maps to enhance faint geochemical anomaly detection

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Multifractal methods and singularity mapping are currently among the most used methods to target and identify geochemical anomalies. Singularity maps provide an important method able to target faint anomalies. Search for buried and concealed ore deposits are increasingly subject to investigation, as they likely provide faint surface geochemical signals which are difficult to detect and separate from background noise [1]. One major difficulty with singularity mapping as applied to uncharted areas as a tool for geochemical exploration is the inability to validate the detected faint anomalies and provide a reference frame for their relevance. This was attempted with simulated data by determining and using thresholds to extract meaningful anomalies from a high background noise environment, and subsequently applied to a large stream sediment dataset covering the Iberian Pyrite Belt (IPB) in SW Portugal and Spain [2]. While the retrieved anomalies may point to potential buried mineralized sources whose surface distribution is likely controlled by regional tectonic structures developing at depth, a large uncertainty still persists in these results as they are based in single element mapping. However, other elements showed an overlap of faint anomalies in several places which indicates that the overall results are promising and can be improved by combining different singularity maps. Using a large number of simulated datasets with several correlated variables can thus provide statistical significance to the obtained results. While the foremost application to be presented is to previous datasets including the IPB but also to whole-rock geochemistry surface covering of the world-class Panasqueira W-Sn deposit [2, 3], this approach aims at providing a mean to incorporate multiple source information beyond geochemical exploration analyses, while also exploring adequate machine learning algorithms.

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