

Mathematical Geosciences

Stream sediments pollution: a compositional baseline assessment of the Caveira mine, Portugal

--Manuscript Draft--

Manuscript Number:	MATG-D-23-00023	
Full Title:	Stream sediments pollution: a compositional baseline assessment of the Caveira mine, Portugal	
Article Type:	S.I. : Geostatistics Applied to Environmental Applications	
Keywords:	Caveira mine; Pollution; Compositional Pollution Indicator (CPI); Sequential Gaussian Simulation; Probability map	
Corresponding Author:	Teresa Albuquerque, PhD Instituto Politecnico de Castelo Branco Castelo Branco, Castelo Branco PORTUGAL	
Corresponding Author Secondary Information:		
Corresponding Author's Institution:	Instituto Politecnico de Castelo Branco	
Corresponding Author's Secondary Institution:		
First Author:	Teresa Albuquerque, PhD	
First Author Secondary Information:		
Order of Authors:	Teresa Albuquerque, PhD	
	Rita Fonseca, Ph.D	
	Joana Araújo, Master	
	Natália Silva, Master	
	António Araújo, Ph.D	
Order of Authors Secondary Information:		
Funding Information:	Fundação para a Ciência e a Tecnologia (UIDB/00681/2020 and UIDB/04683/2020)	Not applicable
Abstract:	<p>A high concentration of Potentially Toxic Elements (PTEs) can affect ecosystem health in many ways. It is therefore essential that spatial trends of pollutants are assessed and controlled. Two questions must be addressed when quantifying pollution. How to define a non-polluted sample? And, how to reduce the problems' dimensionality. Since the concentration of chemical elements is compositional, as the attributes vary together, a compositional approach was used. A novel Compositional Pollution Indicator (CPI) based on Compositional Data (CoDa) principles such as sparsity and simplicity as properties, was computed. A dataset of 33 stream-sediment samples was collected from within 0 to 10 cm depth, in a grid of 1Km x 1Km, and twelve chemical elements were analyzed. Concentrations, reaching 3.8% Pb, 750µgg-1 As and 340 µgg-1 Hg, were obtained near the mine tailings. The methodological approach implied the geological background selection in terms of a trimmed subsample that can be assumed as non-pollutant (Al and Fe) and the selection of a list of pollutants based on expert knowledge criteria and previous studies (As, Zn, Pb, and Hg). Finally, a sequential stochastic Sequential Gaussian Simulation was performed on the new CPI. The results of the performed a hundred simulations are summarized through the mean image maps and the probability maps of exceeding a given statistical threshold, and, thus, allowing the characterization of the spatial distribution and associated variability of the CPI. A better understanding of the trends of relative enrichment and PTEs' fate is discussed.</p>	