

Interactive comment on “Combining colour parameters and geochemical tracers to improve sediment source discrimination in a mining catchment (New Caledonia, South Pacific Islands)” by Virginie Sellier et al.

Anonymous Referee #2

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Dear Mr. Kuhn, dear authors, thank you for the chance to review this manuscript and your patience with me. I want to apologize for the late review. An unexpected hospitalization kept me from fulfilling my commitment. Please find now my review below. Kind regards and stay healthy!

Comment on “Combining colour parameters and geochemical tracers to improve sediment source discrimination in a mining catchment (New Caledonia, South Pacific Islands)” by Virginie Sellier et al.

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Reviewer #2

The manuscript “Combining colour parameters and geochemical tracers to improve sediment source discrimination in a mining catchment (New Caledonia, South Pacific Islands)” by Virginie Sellier et al. presents a fingerprinting study in the Thio River catchment in New Caledonia using colour and element concentrations individually and combined as tracers, as well as a conventional fingerprinting approach and partial least square regression (PLSR) models based on the entire visible spectrum. The study includes interesting findings, is well described, and fits within the scopes of SOIL (soil and method/ degradation), although I think the soil part could be enhanced in the manuscript (please find detailed comments in the pdf and below). The manuscript represents a statistical approach to compare tracer performance and fingerprinting approaches. Artificial mixture samples help validate results and increases the validity of the paper. Methods are not new but the manuscript elicits well the different results obtained in one catchment and is worth being published after major revision. I attach the pdf with detailed comments (98). Generally, I would encourage to use less parentheses. In quite a few cases I had the feeling there is more information in the parentheses than in the actual sentence. In my opinion it disrupts the reading flow and the information should be included into the text. The general language is well written, since I’m not a native English speaker myself - and I noticed one co-author is - I don’t dare to correct the English except for a few minor occasions where I had the feeling it sounds odd. Please except my apology in case I’m wrong. Abstract: The Abstract mentions the methodological question of the paper and hints a management advice “focus on the contributions of mining tributaries to reduce sediment inputs”, which is not really served at the end and seems obvious knowing mining case studies. I would suggest not distract from the methodological focus of the paper with these “lonely” and obvious statement. Introduction: The introduction seemed to be to be a compromise between a case study, a management advice, and a methodological exploration. I would focus on the latter. The potential extrapolation of the method is repeated in one sentence in Abstract, Introduction and Conclusion. I would suggest stating it once (or twice with

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Abstract) and elaborating a bit more the criteria (comments in the pdf in Conclusion).
Research Area: The lateral and longitudinal sediment connectivity seems crucial for this work and is not well addressed in the chapter nor throughout the manuscript. How can you be sure that the contributions you calculate are not due the effect of different lateral and longitudinal connectivity throughout the sub-catchments instead of different erosion values on the slope? You write about channel banks and alluvial deposits (map) which let me doubt that the connectivity is as good as believed. Please provide information (text, maps, pictures etc.) proofing your point! Furthermore, the whole relevance of the study revolves around erosion and there is not one picture displaying the “extensive erosion processes” you mention. Please give us some insights here.

Methods: Please argue conclusively that your sample size is sufficient for your objectives and the size of the catchment. I would argue that it is not accurate to talk about mining sources and non-mining sources, because you are not sampling sediment sources from mining areas or non-mining areas but you sample mixed sediment samples from tributaries predominantly connected to mining areas or non-mining area - if I understood correctly. so at least for the mining sources you will also have the influence of non-mining areas in the sub-catchment. I have no advanced know-how of the analysis techniques for the sediment samples and the PLSR modelling. Hence, I cannot comment on these elaborations. However, this does not imply that I don't trust the authors explanations. Results and Discussion: I would assume that gully erosion is the dominant erosion for mining areas, whereas non-mining areas with a dense vegetation cover show other processes. Hence, eroded sediments differ, which helps the fingerprinting of course. However, they probably also differ in organic and inorganic carbon content influencing your tracer properties. How was that explored and taken care of? Furthermore, Ca and K is soluble in water. How can it be a conservative tracer in New Caledonia? Please elucidate more on the anthropogenic or natural process that explain the tracer's differences (e.g. K concentrations or colour difference) between mining and non-mining sources? I understand that these are the results of the statistical analysis but please let the reader know about your knowledge of the environment.

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Your argumentation is purely statistical which, as shown for the FDVS-PLSR model, might not always make sense. What processes, geological or paedogenetic background values, etc. are responsible for these differences?! Your manuscript focuses mainly on the characteristic of the geology, which in case of the eroded mining sediments make sense. However, in case of the erosion of the non-mining sites I believe the properties of cover beds and soils should be the focus throughout the chapters, since in this climate you might have meters of soil development and cover beds above the underlying geology (which did not derive from the underlying geology itself but most probably slope upwards) that are actually eroding and NOT the geology itself. It seems that the few non-mining tributaries provide a lot of sediment to dilute the dominantly mining contributions along the River. I wonder how results look when you standardize the contribution by area? Have you tried that?

Conclusion: In my opinion your discussed factors influencing colour and element concentrations are just one out of many possible ones. Please think about other factors that are worth mentioning. Furthermore, your limited criteria (Ni ores and peridotite massifs) for the expansion of the method might work for New Caledonia but it seems not sufficient to extrapolate to the world! Please revise that throughout the manuscript and in the conclusion!

Figures: Please insert in the map figures: - the tributaries' sub-catchments outline is shown, - a light hillshade in the back to get a feeling for the relief, - display the cake diagrams on the right connected to the sample location with lines.

Please also note the supplement to this comment:

<https://soil.copernicus.org/preprints/soil-2020-48/soil-2020-48-RC2-supplement.pdf>

Interactive comment on SOIL Discuss., <https://doi.org/10.5194/soil-2020-48>, 2020.

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