

## Reply on RC1

Malcolm Aranha et al.

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Author comment on "Rare earth elements associated with carbonatite–alkaline complexes in western Rajasthan, India: exploration targeting at regional scale" by Malcolm Aranha et al., Solid Earth Discuss., <https://doi.org/10.5194/se-2021-108-AC2>, 2022

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### Response to RC1

*We thank Reviewer 1 for the positive and constructive review and insightful comments and suggestions. We have addressed all comments and acknowledge that this has led to significant improvement of the manuscript.*

- **This is a thorough and detailed study. The main strength of the study is the rigorous approach towards identifying all the relevant features from various datasets. However, such a data pre-processing workflow could also add artifacts or cause identification of same features multiple times. Given the lack of Figures representing input data or the final identified features, it is difficult to understand and relate geophysical signals to the extracted features.**
- *Response: It is true that data-pre-processing workflows could result in the addition of artefacts. However, the use of a conjunctive operator (the fuzzy AND) in the first stage FIS for combining the various features extracted from the geophysical and topographic datasets ensured that only those features that were consistently present in all derivative maps were used as inputs for the prospectivity modelling. We think that this step had minimized artefacts as the features that are present in all different datasets are less likely to be artefacts. Further, as explained in section 6, pages 14-15, lines 266-273, the uncertainty likely to be introduced by pre-processing was taken into consideration while allocating confidence values.*
- **The scale and resolution of the primary data is quite wide-ranging, therefore one question that arises is how these were integrated together while maintaining adequate balance between extracting information from the datasets but at the same time keeping a non-subjective and quantitative check on introduction of stochastic uncertainties. Data inconsistencies is a common issue in prospectivity mapping studies, but here there seems to be one-to-two-orders of differences in the spatial resolution of the input datasets, so the magnitude of artifacts could easily increase accordingly. Moreover, the spatial resolution of the predictors maps and prospectivity mapping is not provided in the manuscript.**

- *Response: We agree that there are one-to-two-orders of difference in the spatial resolution of the datasets, particularly between gravity and magnetic datasets. However, as discussed in our response to Comment 1 above, we think that the use of features that are common across different datasets likely minimised artefacts caused by the scale variations.*
- *A grid-cell size of 3 km was used for both, predictor maps and prospectivity modelling. The grid-cell size was a trade-off between high-resolution magnetic data and low-resolution gravity data. Also, it is approximately the average size of carbonatite-alkaline complexes in the study area. We thank the reviewer for pointing out this omission in the original manuscript. This has now been added in the revised manuscript (Section 5, page 10, lines 192-197).*
- **Table 4 contains a lot of repetition and needs to be simplified. The full form of the acronyms used in Table 4 are not provided in the manuscript. Most are standard acronyms such as RTP (Reduced to Pole), but to conform to the norms of scientific writing, as a suggestion, it would be useful to define all the acronyms, either in the table as footnotes or in the text.**
- *Response: We thank the Reviewer for the comment and suggestions. We agree that the original Table 4 was cluttered and contained redundant information because of repetitions. Table 4 (and other tables) have been revised and simplified, and the repetition of information has been minimized. The acronyms have been provided with their full forms. Some of the tables (Tables 1 and 6A, B and C of the original manuscript) have been moved to the appendix on the suggestion of Reviewers 2 and 3. This has improved the readability of the paper.*
- **Several predictor maps are used more than once in the modelling procedure as shown in Table 5 and Table 6. Will this not increase the influence of such predictor maps in the results? The question is should they be really considered more than once, because spatially they are the same? From Section 5 it seems that the objective of using three FIS was to progressively reduce the area of exploration, but if large-scale features of a previous FIS are used in the next FIS, then how does this influence the results?**
- *Response: Thank you for posing this question. Some of the predictor maps were used more than once in the modelling because these maps provided evidence for more than one targeting criteria. For example, the 'distance to rift' map is used to proxy for the extensional setting and the associated mantle plume in the FIS for delineating the prospective fertility/geodynamic settings. The same map is used as a proxy for fluid pathways in the second FIS for demarcating the favourable transport architecture. Wherever a predictor map is used for more than one component, different parameters are used for the fuzzy membership functions for each component. This has now been clarified in Tables 3 and 4.*
- *Moreover, the use of conjunctive operators (fuzzy AND and fuzzy PRODUCT) in both first and second stage FISs ensured that minimum of the influences of all inputs would be propagated to the output prospectivity map. This is also the reason why, unlike the weights-of-evidence or Naïve Bayesian classifiers, the FIS approach is not significantly affected by conditional dependencies in the input datasets.*
- **Overall, the research is well-implemented and concisely presented in the manuscript. Results are rationally evaluated and discussed.**
- *Response: Thank you for the exhaustive review and the insightful comments.*

Please also note the supplement to this comment:

<https://se.copernicus.org/preprints/se-2021-108/se-2021-108-AC2-supplement.pdf>