

Comments by the editor

This is a nice manuscript, and I am satisfied that the authors have addressed the comments from the first round of reviews and adapted the manuscript accordingly. Upon re-reading, there was one point that I wasn't clear on in the revised manuscript. On lines 202-203, referring to data excluded based on the chi-squared distances, it states that 91% of the model runs were excluded. Is this really correct? Effectively this means the model is failing to converge in 91% of the Monte-Carlo simulations? I imagine (hope) this is a typo. If not a typo, as a minimum it warrants a clearer explanation of what is going on and potentially a more significant re-think. It won't make a significant difference to the conclusions of the manuscript, but it is important to get right.

Thank you for going through the manuscript again and pointing out this lack of clarity. The 91% was not a typo. The large number of runs that do not enter in the estimate of the parameters for the mixing model is due to our "brute-force" approach to the modelling without any optimization. With each iteration, we pick groups of endmembers from the entire possible space without consideration of results from previous iterations. Because the endmember space is large, many runs do not fit the data within the chosen threshold of $\chi_{total}^2 \leq 1$. Model efficiency and the number of iterations that fit could be increased by implementing an optimization method, such as the one presented by Moon et al. [2014], but that should not alter the results fundamentally.

In order to clarify this section, we now write: The uncertainty in these parameters was estimated from all Monte Carlo runs that fit the data within a threshold of $\chi_{total}^2 \leq 1$ (on average 9% of runs). The high number of runs above the threshold of $\chi_{total}^2 > 1$ is linked to our approach of picking groups of endmembers independently for each Monte Carlo iteration from the entire endmember space (see example in Fig. A2) without an optimization (e.g. Moon et al., 2014).

We also include a new figure (Figure A2) that attempts to illustrate this approach.

References

Moon, S., C. P. Chamberlain, and G. E. Hilley (2014), New estimates of silicate weathering rates and their uncertainties in global rivers, *Geochim. Cosmochim. Ac.*, 134, 257-274, doi:<http://dx.doi.org/10.1016/j.gca.2014.02.033>.