RC 2 – Response

General comment:
We thank the reviewer for the positive and constructive feedback, and for the careful reading of our manuscript. We also thank the reviewer for the suggestions on additional references and discussion points.

Grain size of suspended sediment:
We have added a more detailed description of the grain size of suspended sediment in Section 2.4. As measured by laser diffraction (Malvern Mastersizer), the sediment is dominated by silt-sized particles (median d50 ≈ 20–30 μm), with only a small clay fraction (<2 μm) of ~6–7%. This indicates that most of the sediment lies within the 2–63 μm "glacial flour" fraction typical of glacially produced sediment. We have added a discussion in Section 4 on the implications of this for the application of the method in other environments, where careful selection of target minerals and a focus on well-mixed fluvial sediments may help mitigate potential biases.

Biases related to differential grain-size production:
We agree that preferential production of sediment grains by lithology and process is an important consideration. We have clarified in the manuscript (Section 2.4 and Section 4) that glacial processes produce a significant proportion of fine silt-sized particles ("glacial flour"), and that this is consistent across lithologies in our catchment. We also discuss that differences in grain-size production between lithologies could influence the representativeness of suspended sediment and that this limitation is relevant to all sediment fingerprinting approaches. In our dataset, the focus on primary rock-forming minerals in selected tracer minerals and the limited amount of chemical weathering reduce the potential bias, but we acknowledge that in other catchments or under different erosion regimes, grain-size effects could be more pronounced.

Minor comments:
- We have added the suggested reference: Fryirs and Gore (2013, Geomorphology, 193, 112–121) in the introduction discussing different existing sediment tracing approaches. Indeed, this work is relevant as it also applies XRD-based fingerprinting to suspended sediments. Our approach differs in several key aspects: we use binned "raw" XRD data rather than proprietary software outputs (Fryirs and Gore use the "PANalytical HighScore Plus" software), which reduces costs and simplifies data processing. Furthermore, whereas Fryirs & Gore focus on source contributions, their resulting map remains spatially discrete (showing the cluster locations) and they do not produce spatially explicit erosion rate maps, which is the main output of our inversion methodology.
- We clarified that storage and transport effects represent the main limitations of our method, as is the case for many fingerprinting approaches (l. 29).

- Two parts have been added in the abstract to highlight the findings.

We thank the reviewer again for the helpful comments, which have allowed us to improve both the clarity and completeness of the manuscript.