Geochronology Discuss., author comment AC1
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Reply on RC1

Richard F. Ott et al.

Author comment on "Cosmogenic nuclide weathering biases: corrections and potential for denudation and weathering rate measurements" by Richard F. Ott et al., Geochronology Discuss., https://doi.org/10.5194/gchron-2022-5-AC1, 2022

We thank the reviewer for the feedback and constructive comments that will improve the manuscript. We agree with the reviewer that including radioactive decay will make the study more widely applicable and will include decay into the revised manuscript and associated codes. The nuclide build-up equations with radioactive decay are harder to follow compared to the no-decay version. We will therefore keep the no-decay equations in the main text and add all equations with decay as a supplement.

The revised version will also include a brief discussion of the mixing assumption and the expectations in a no mixing setting. In addition, we will explain in more detail the role and derivation of the grain mass weathering constant k.

Regarding the comments on Line 183-185. The average residence time of a parcel of rock always has to be equal or longer than the average grain residence time of soluble minerals in a **homogeneous** bedrock. In case where there is only erosion (i.e., no chemical weathering), both residence times will be equal. In a case where we have the same denudation rate but it is partitioned into 50% erosion and 50% chemical weathering, mass is removed at the same rate as in the no weathering case, but the mechanical removal of grains by erosion is 50% slower. This behavior would also occur if the regolith were not mixed, but weathering took place throughout the regolith. The fact that in Eq.8, a grain will never fully weather away is just a consequence of using a weathering law, where the mass loss is proportional to grain mass. In a low denudation, high weathering scenario, this would lead to some very small grains that have been sitting in the regolith for a long time. We agree that, in reality, many of these grains will fully dissolve instead of becoming infinitesimally small, but for capturing the general behavior of grain size effects on the average regolith nuclide concentration, this does not matter because they do not contribute a significant mass to the regolith.

We also thank the reviewer for their line-by-line comments. These are insightful and will be incorporated into the manuscript during the revision process.

We will detail our responses to these and other points in our line-by-line responses to both reviewers that will be posted with our revised submission.