Geochronology Discuss., referee comment RC2
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Comment on gchron-2022-5

Claire E Lukens (Referee)

Referee 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-RC2, 2022

Ott et al. provide a solid theoretical framework for addressing weathering biases in denudation rate studies using soluble target minerals. This work expands on established literature that has been focused largely on insoluble minerals, and provides transparent, adaptable, and publically-available code that implements their approach. This work is timely, and includes a paired nuclide approach that should be useful for expanding into understudied landscapes. The manuscript is well-written, and the figures are (mostly - see below) clear and helpful.

Re: Ignoring radioactive decay: How did you determine what was “acceptable” for the residence time thresholds given here? Is this the time over which ignoring decay would introduce a 5% error? More error than the analytical error? It feels a bit nitpicky, but being a bit more specific about what is deemed acceptable will help others implementing your code decide if ignoring radioactive decay is acceptable in their particular system. Especially for 36Cland 14C systems, decay could be worth considering in many systems. Adding it to the code seems like a relatively straightforward thing to implement, and would make the approach broadly applicable across a wider range of settings, including weathering studies outside of active tectonic settings. I certainly don’t see adding decay to the code as a requirement for publication at this time, but it would be good to be clear about how big the impacts are for studies at the edges of the “acceptable” ranges given here.

The discussion on possible grain size effects was very interesting. It makes sense to me that even without any grainsize-dependent sediment transport, size reduction of grains

due to weathering and the associated range of particle residence times could introduce a relationship between particle size and CRN concentration. What's not clear from this conceptual framework is whether this effect will be large enough to worry about given all the other assumptions and sources of error. I'd love to see a full-blown model treatment to evaluate the possible magnitude of grain size effects in the context of other sources of error, but that's certainly beyond the scope here.

Minor comments:

In figure 5, it would be helpful to define X_R/X_B in the caption, especially for readers who are skimming figures before they get into the meat of the text (or readers like me who get easily lost in variable alphabet soup when I'm tired)

Line 285: "regolith is relatively thick (200 g/cm^2)" – I assume from the units that this is an attenutation length, not a regolith thickness?

Figure 6: because the examples here use different nuclides, it would be easy to readers to be confused about the different between the scenarios. Just looking at the figure, it's easy to assume that scenario 1 is for 10Be, scenario 2 is for 36Cl, and scenario 3 is for both. Either 10Be or 36Cl would give the same result in (a), correct? You might consider just using 36Cl as the example in both (a) or (b), or hammering home that point in the caption.

Lines 374-375: "finding the denudation rate with the maximum nuclide concentration" and in the next sentence: solving for the maximum denudation rate – I'm confused, won't these be opposite (high CRN concentration = low denudation rate). Do you mean minimum D here? The notation around D_{Nmax} is also a bit confusing, since it's a low denudation rate with "max" in the subscript. I think I understand why it was notated that way, but this section required super close reading to make sure I didn't get lost.

There are a few minor typos and formatting things annotated in the attached PDF.

Please also note the supplement to this comment:
https://gchron.copernicus.org/preprints/gchron-2022-5/gchron-2022-5-RC2-supplement.pdf