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Earth Surface Dynamics Discussions

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Interactive comment

Interactive comment on "Tracking the ^{26}Al/^{10}Be source-area signal in sediment-routing systems of arid central Australia" *by* Martin Struck et al.

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Response to Reviews Struck et al. - Tracking the 10Be-26Al source-area signal in sediment-routing systems of arid central Australia

Here we respond to referee comments and provide explanations of our revisions. We thank the referees for their constructive and supportive suggestions. We have by and large followed them all. Referee comments are marked RC plus a sequential number. Our responses are marked R and keyed to page P and line L. Our response to all referee and short comments is also attached as a pdf document.

Referee #1 (Comments to the author):

RC1 - Cosmogenic isotopes, such as 10Be, have been used as tracers for sediment

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Discussion paper

routing at various temporal and spatial scales since the early 2000'ds. for example, in the Mojave Desert, in the Great Smoky Mountains, in the Negev desert. The authors should acknowledge this use and compare their conceptual results to previous ones.

R1 - Agreed, cosmogenic isotopes have been used very widely as tracers for sediment routing, and so any citation list must be selective. In addition to the pioneering studies (i.e., McKean et al., 1993; Bierman and Steig, 1995; Brown et al., 1995; Granger et al., 1996), we had already listed what we regard as a couple of highly innovative studies (i.e., Heimsath et al., 2005 and Anderson, 2015). To these we have now added some notable field-based studies: Nichols et al. (2002); Matmon et al. (2003); and Jungers et al. (2009). (P.2 L.21) The source-to-sink conceptual framework used in this MS links with our accompanying paper (Struck et al., 2018, GSAB) that deals with the hillslope system. Based on these two substantial field studies (including 117 10Be and 26Al measurements), we have placed our conceptual results firmly in the context of previous work by proposing two limit cases in which source-area nuclide inventories are modified or not by the sediment-routing system. We have then considered and discussed numerous controls pertinent to our field sites that might govern such variations.

RC2 - The formation of desert pavements (Gibber) as described by Wells in 1995 and then demonstrated by Matmon et al., (2009) implies high Al and Be concentrations as well as ratios. The authors should include and consider that.

R2 - We have now cited the two key studies noted above in the following: 'Long residence times and slow hillslope evolution arise from the lack of fluvial incision associated with widespread base-level stability and the long-lasting development of stony soil mantles, also known as desert pavement (Mabbutt, 1977; Wells et al., 1995, Fujioka et al., 2005, Matmon et al., 2009).' [P.4, L.32 – P.7, L.1] In our previous paper (i.e., Struck et al., 2018), we examine the sediment production and age dynamics of desert pavements developed on hillslopes by measuring 10Be and 26Al at three separate sites in the western Eyre Basin. In our Supplementary Table A3, we reproduce the nuclide data from Struck et al. (2018). This shows gibber samples with very high 10Be abundances (up to 5.4 M atoms g-1) and 26Al abundances (up to 18.7 M atoms g-1), as suggested by the reviewer and consistent with the key studies by Wells and Matmon among others. However, we find rather low 26Al/10Be ratios at two of the three hillslope sites, with samples that plot well below the steady-state erosion island. We propose some new explanations for these findings that stem from extremely slow denudation and we refer the reviewer to our other paper for details. Here, our aim is to draw together our knowledge of source-area nuclide inventories established in that previous paper with inventories we measured in the fluvial systems downstream.

RC3 - Please write 26Al-10Be when referring to the isotopic inventories and 26Al/10Be when referring to the isotopic ratios.

R3 - To clarify the issue further, we have modified the text to 10Be-26Al when referring to the nuclide inventories and the nuclide signal in general, and we now use 26Al/10Be only when referring specifically to the nuclide ratio.

RC4 - In regard to assumption ii about the discontinuity of sediment delivery. The discontinuity of sediment delivery is generally on an annual or decade scale. This temporal scale is obviously much shorter than the time scale measured by cosmogenic isotopes. Thus, in terms of cosmogenic isotopes the delivery of sediment is continuous. The authors should address this point.

R4 - The sediment flux is indeed continuous on the timescale integrated by 10Be and 26Al. We have now changed text in three places to correct this misconception regarding the 10Be-26Al source-area signal: i) We have removed reference to the discontinuity of sediment flux in the Abstract (P.1, L.15) and the Conclusions (P.25, L.19). ii) We have also removed reference to the discontinuity due to ephemeral stream-flows at the end of the Discussion (P.24 L.18), but we have kept the section regarding fluvial-aeolian interactions, as follows: 'Especially in dryland river systems, atmospheric inputs are typically part of a long-term history of fluvial-aeolian mass exchange (Bierman and Caffee, 2001; Bierman et al., 2005; Vermeesch et al., 2010; Davis et al., 2012). As described above, aeolian dune fields can host particles with notably longer exposure histories and burial timescales >1 m.y. (Fujioka et al., 2009; Vermeesch et al., 2010), and there is much observational evidence of fluvial-aeolian interactions in the western Eyre Basin.' (P.24, L.23-26).

Please also note the supplement to this comment:
https://www.earth-surf-dynam-discuss.net/esurf-2017-76/esurf-2017-76-AC1-supplement.pdf

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