Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2017-73-RC2, 2018

Earth Surface Dynamics Discussions
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Interactive comment on "Temporal variability in detrital ^{10}Be concentrations in large Himalayan catchments" *by* Elizabeth H. Dingle et al.

Anonymous Referee #2

Received and published: 27 February 2018

Review Dingle et al.: Temporal variability in detrital 10Be in large Himalayan catchments

Dingle et al. present eighteen 10Be concentrations and denudation rates from modern river sediments, flood plain and terrace deposits along the middle part of the Ganga river. The observed variability in nuclide concentrations and denudation rates is discussed mainly in the light of stochastic sediment input into the river system. The presented model simulations demonstrate that cosmogenic nuclide concentration cannot always be used to determine sediment flux.

General comments:

The manuscript is developed around the cosmogenic nuclide concentrations which

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show a not easy to explain scatter. One problem in comparing these nuclide concentrations is that the nuclide concentrations are derived from spatially and temporally different sediment samples. The spatial variation should be investigated independently from temporal variation with a larger data set pf modern samples from different locations. The temporal variations should then be investigated with a comparison to a modern sample from a comparable location. In addition to this, the situation is further complicated as samples with different deposition ages may be affected by different denudation processes (e.g., glacial- dominated versus landslide-dominated). Therefore, a comparison of all data from modern to deposited river samples is difficult and should be disentangled. Another problem could arise from the comparison of nuclide concentrations rather than denudation rates. Assuming sediment from two catchments with the same denudation rate but different production rates (e.g., two tributaries sampled above their confluence) will have different nuclide concentrations. Even so the catchments are subjected to the same erosion processes the nuclide concentrations are different. Therefore, it would make sense to compare denudation rates rather than nuclide concentrations. Furthermore, a way to go could be that the manuscript is developed around a discussion of the presented model in comparison to Niemi et al., 2005 and Yanites et al., 2009. This discussion could explain nicely why findings in this study are different from others. Furthermore, there should be an attempt to integrated the presented cosmogenic data into the model findings. Would it be possible to select the investigated catchments for model calculations where there are also cosmogenic nuclide data available supporting the model findings? Addressing the above major suggestions could make a stronger manuscript to be published in Earth Surface Dynamics. At the time being, the writing is not very concise and the data treatment not rigorous. The manuscript needs major revision with special attention to details (see suggestions below) before publication in Earth Surface Dynamics can be recommended.

Suggestions for changes:

Title:

Not convinced if this is the right title for this study. The study's strength seems to be more the model simulation than the cosmogenic concentrations. If this title stays then if should be: "Temporal variability of detrital 10Be concentrations in a large Himalayan catchment: the Alaknanda/Ganges river"?

Abstract:

P1, L5: ". . . .Âăconcentrations at the catchment outlet are relatively stable in time". The concentrations are generally invariant over time. In addition, the use of catchment outlet here and in the entire manuscript is somehow misleading. The reader most likely attributes to catchment outlet the delta. This should be clarified. P1, L11-13: Is the doubling of sediment delivery to the Bay of Bengal just during 11 to 7 ka or does the doubling start at ∼9 ka and lasts until present-day? Again, the use of Ganga outlet is misleading.

1 Introduction

P2, L6-10: Simplification of this long sentence would be helpful for the understanding. Furthermore, please make sure of the consistent use of erosion or denudation rates. P2, L12: Would be helpful to clarify what the size of a small catchment is? P2, L25: Wondering why we jump to the Ganga-Brahmaputra delta. This delta is important, but not for the main findings of this manuscript. This paragraph needs to be packaged differently. P2, 28-29: Would this make sense?: ". . . ...major Himalayan river systems has halved due to the reduction in monsoon rainfall since the early Holocene time." P3, L12L: Would it make sense to start this paragraph with a short introduction to the Alaknanda and Ganga rivers? P3, L14: What is meant by "ancient"? P3, L16: " making it the ideal techniques. . . .". What is meant by it? Please be more concise.

2 Study area and context

Would It make sense to split this chapter up in 2.1 Study area and climate and 2.2 Sample information? P3, L26: Would it make sense to state here that the upper Ganga

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catchment or the mountainous part of the catchment is investigated in this manuscript? P4, L2: The use of the abbreviation ISM is not explained. This should happen here. Please also cross-check the consistent use of other abbreviations.

3 Methods

A reorganization of this chapter could clarify the understanding of the method used. A possible way to go could be: 3.1 Sample collection (P5, L15-31) 3.2 Sample preparation (P5, 32 to P6, L14) 3.3 Calculation of denudation rates (P6, L15-24)

Alternatively, if the authors decide to structure the manuscript around the model simulation, the used model should also be described here.

This chapter needs to be treated with care for correct wording, for instance: P6. L13: Different value of half-life than used above. P6, L15-24: How was the glaciation taken into account? How are the shielding factors calculated?

4 Results

Results such as nuclide concentrations and denudation rates should clearly be separated from discussion (e.g. 2nd paragraph in the results should go into discussion). In addition, some results of the discussion addressing the model simulations could come in here if 3 Methods includes the model set up. P6, L26: What is with the third modern river sample? It should be mentioned here too. P7, L9: Is the sample BG1.8 not attributed a depth of 500 cm (see Table 1)?

5 Impact of stochastic inputs on CRN variability and sediment flux estimates

As mentioned above, if could make sense to describe the model simulation in 3 Methods. This would simplify the discussion. The discussion could be arranged in (as a suggestion): 5.1 Discussion of nuclide concentrations and denudation rates 5.2 Findings of model simulations (e.g., all simulations) 5.3 Sources of variability of CRN concentrations 5.4 Suitability of CRN as a proxy for sediment flux in large catchments

Figures:

Fig. 1: It would be helpful to Indicate in the figure what figure the red box refers to. Could the river names be added to this figure?

Fig. 3: Denudation rates to the sample ID would be helpful here. It is difficult to combine Table 1 with this map. Where is the LUP09 sample situated?

Fig. 4: Would it make sense to include also a figure with denudation rate versus age?

Fig. 9: Is the % grain size of the entire sample volume or from the sand/silt/clay volume? What are the references to source material? Y-axis label should be "% sand (gran size <1 mm)".

Fig. 10: Not totally clear what "CRN concentration (% of surface)" means. Could you clarify?

Tables:

Table 1: There is important information missing for the cosmogenic nuclide method. It could make sense to make two tables out of this table: Table 1 including the geomorphic and other information (e.g., column 1 to 9 plus grain size distribution by Dingle et al., 2016) and Table 2 column 10 to 15 plus additional information (e.g., analyzed grain size. production rates, apparent age). It is not clear what the average shielding factor includes. Why to the first eight samples have the same value in the shielding factor?

Table 4: Not sure if I missed something but Is scenario 1 and 2 the same as model A and B in figure 10? Please clarify.

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