Hydrol. Earth Syst. Sci. Discuss., 9, C29–C35, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C29/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Climatic and geologic controls on suspended sediment flux in the Sutlej River Valley, western Himalaya" *by* H. Wulf et al.

H. Wulf et al.

hendrik.wulf@uni-potsdam.de

Received and published: 29 January 2012

Dear Referee,

Thank you for sending your comprehensive review in such a timely manner. We appreciate your thoughtful comments and suggestions.

Concerning your general comments:

1.) "The study does a nice job of showing that some rainstorms throughout the monsoon season do not affect sediment concentrations in the streams, but in this case I was still left wondering why that was. The authors do note that this may be related to rainstorm intensity but do not develop that theme very much, resulting in a mystery."

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

- We agree that this point remains unsettled. However, our current dataset do not allow us to tease the different factors controlling the rainfall-sediment-relationship apart. We attempt to shed more light on this relationship by adding to page 555, line 18:

- "Unfortunately, our data do not allow a better constrain on the suspended sediment sources. Likewise, the TRMM based identification of daily rainstorms does not provide more detailed information on their peak or mean rainfall intensities. While we see that some of the rainstorms that follow particularly strong rainstorms result in lower suspended sediment concentrations in the fluvial system, this is not a universal relationship. Our initial hypothesis that rainstorms during the later monsoon season are resulting in overall lower suspended sediment concentration did hold true either. This may be related snow- and ice melting, which contribute additional suspended sediment during the later monsoon season."

2.) "The figures are generally very nice and high quality and help the reader understand the paper. I was only unsure about the reverse axis plotting of some proxies, such as high rainfall plotting down in Figure 6 and 8, which makes sense graphically but is counterintuitive at first reading."

- We understand the initial confusion introduced by the reverse axis plotting. However, this style of representation offers a better usage of the available space, which helps to better understand the relations of both variables given by the two y-axes.

3.) "I was slightly concerned about the choice of the Ganvi catchment as being typical of the Frontal region because even on the authors' own diagram it looks like the Ganvi is located right at the edge of the frontal zone rather than firmly within that. I think that the data bear out the preferred interpretation but the choice still seems a little odd.

- We appreciate the concern raised by the referee. Therefore, we clarify the description of the geographic location of the Ganvi catchment in more detail on page 545, line 25. "The Ganvi catchment is part of this region, although it is located in close proximity to the Himalayan Crest region (Fig. 1). Because of its geographic position, it receives

HESSD
9, C29–C35, 2012

substantial runoff from rainfall (ca. 60%) and snow melt (ca. 40%), which is corroborated by mean annual snow cover of 26%. Despite being set back somewhat into the orogen, the Ganvi catchment receives substantial annual rainfall amounts (ca. 0.8 m/yr)."

4.) I was a little confused and concerned about the rock strength in the Tethyan Himalayan Sequence and the opposite observation made by this study and that by Craddock et al. (2007). Agreed there is a lot of variability in the Tethyan Himalaya but if both studies covered a wide area then I would have expected a similar result. I tend to agree that the Tethyan Himalaya have lower rock cohesive strength and more erodability which is consistent with the observaitons made here about their contribution to the sediment.

- To underline the lithological differences in both areas we add at page 559, line 16. "Despite the fact that both surveys cover a wide area, we emphasize the pronounced along strike variation in sedimentary rock types in the Tethyan Sediments between the western and central Himalaya. For example, the Tethyan Sediments in the Spiti Valley are characterized by early-to-mid Phanerozoic fossils (Draganits et al. 2001) and have generally seen lower-grade metamorphic processes than the Tethyan sediments in central Nepal (Rowley 1996)."

- References:

(1) Draganits, E., Braddy S.J., Briggs, D.E.G (2001): A Gondwanan coastal arthropod ichnofauna from the Muth Formation (Lower Devonian, northern India): Paleoenvironment and tracemaker behavior , Palaios, 16, 2, 126-147.

(2) Rowley, D. B. (1996), Age of initiation of collision between India and Asia: A review of stratigraphic data, Earth and Planetary Science Letters, 145(1-4), 1-13

- Furthermore, we can only speculate about differences in climate, elevation, porosity, as well as physical and chemical erosion and their impact on the rock cohesive

HESSD

9, C29–C35, 2012

strength.

Concerning your technical comments:

Page 544, line 10 – reliable should be “reliably”

- As suggested, we exchanged “reliable” with “reliably”.

Page 544, line 14 “as increasing temperatures” should be “because increasing temperatures”

- As suggested, we exchanged “as” with “because”.

Page 545, line 5 – Zhada basin - Show on a map and call out the figure. A proper name should be capitalized, i.e., Zhada Basin. Likewise for Mount Kailash.

- As suggested, we exchanged “Zhada basin” with “Zhada Basin” and “Mount Kailash range” with “Mount Kailash Range”

- Page 545, line 5 refers to the location of the Zhada Basin (Fig. 1, Sutlej River subcatchment number 5)

Page 545, line 8 – “400 m a.s.l.– above sea level, asl”. Be consistent. Sometimes you use a.s.l. with periods and sometimes without.

- As suggested, we exchanged the two occurrences of “asl” with “a.s.l.” at page 545, line 8 and line 10.

Page 546, line 12 - The Higher Himalaya - The Greater Himalaya is more appropriate as a contrast with the Lesser Himalaya.

- In the central Himalaya the appropriate contrast to the Lesser Himalaya is the Greater Himalaya. However, in the western Himalaya (where our study area is located) this unit is termed Higher Himalaya. Therefore, we keep using the term “Higher Himalaya”.

Page 546, line 23 – the Sub-Himalaya foreland basin – Strictly speaking the Sub-Himalaya are the remains of the older foreland basin rather than being the modern

HESSD

9, C29–C35, 2012

foreland basin.

- As suggested, we don't refer to the Sub-Himalaya as a "foreland basin" and deleted this term at page 546, line 23.

Page 548, line 14 – TRMM - Explain this abbreviation

- As suggested, we provided the full mission name: "TRMM (Tropical Rainfall Measuring Mission)".

Page 548, line 15 - temporal resolution of 3 h - Is h the abbreviation of hour? Is that right? Not hr?

- During the HESS typesetting process our initial description of "hours" was edited to "h". I now inserted a comment to make sure that the use of "h" instead of "hr" is correct.

Page 550, line 18 - nivo-glacial runoff regimes - I do not know what nivo-glacial means. Can you explain?

- As suggested, we added and explanation: "nivo-glacial (i.e. dominated by snow- and glacial melt) runoff regime"

Page 551, line 19 - 7 days - Whole numbers up to ten are normal spelt out.

- As suggested, we spelled it out "seven".

Page 552, line 18 - suspended sediment concentration (SSC) – This abbreviation was already defined and does not mean to be again. This paper tends to over-use abbreviations, which make it harder to follow the argument for the general reader.

- As suggested, we deleted the reintroduction of "suspended sediment concentration (SSC)" and replaced it with it abbreviation "SSC".

- We also agree with the referee, that abbreviations can disrupt the flow of the manuscript and should be reduced to a minimum. Therefore, we spelled out the previous abbreviations of SSL, SSY, and FSC in the manuscript text. Some abbreviations

HESSD

9, C29–C35, 2012

describing the geological units and faults (e.g. MCT, LHCS, . . .) are only used in figures (e.g. Fig.1 and 10) and explained in their respective captions and in the text, in order to keep these figures simple and make efficient use of space. Other abbreviations like SSC, MODIS, TRMM are used frequently throughout the manuscript and known to a large audience.

Page 555, line 23 - Gangotri and Dokriani Glacier, western Himalaya - Can you show these locations on your maps?

- As suggested, we indicated the location of both glaciers in Figure 1A

Page 557, line 4 - falls in form of rain - Better to be rephrased “falls in the form of rain”.

- As suggested, we rephrased “falls in form” to “falls in the form” at page 550, line 10 and page 557, line 4.

Page 557, line 9 - Parechu River – Call out map figure to show where this is.

- As suggested, we indicated the Parechu River and the location of the landslide-blocked lake in Figure 1A and refer to on page 557, line 10.

Page 558, line 1 – Likely an underestimation - Can you explain better why that would be? I don’t understand the logic.

- We deleted the additional information "likely and underestimation" and inserted behind the sentence of the boundary conditions on page 558, line 4: “These boundary conditions suggest an even higher daily average SSC that is likely to exceed our suspended sediment load estimate." Page 558, line 20 - are highly efficient to erode these layered and densely fractured metasedimentary rocks – should be rephrased “are highly efficient at eroding these layered . . . .”

- As suggested, we changed “highly efficient to erode these” to “highly efficient at eroding these”.

Page Figure 9 – The boxes around the figures seem unnecessary

HESSD
9, C29–C35, 2012

- We can understand that the boxes next to the figure axis may seem too much. However, these boxes help to distinguish the upper two plots in A from the lower part B and are intended to guide the reader to through its context. Therefore, we rather keep the boxes as they are.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 541, 2012.