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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.

Anonymous Referee #1

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This is a useful paper for all those interested in erosion processes in the Himalaya and other active mountain chains and a paper that I feel will have a significant impact for erosiona studies. The study draws together a compilation of climatic and hydrological data that allows links to be drawn between weather/climate cycles and the transport of sediment from the mountains to the flood plains and beyond. The conclusion that 30% of the sediment flux is caused by the heaviest rainstorm is important and confirms the notion that these events are critical to the sediment flux process. The study is also significant in showing that modern erosion in the western Himalaya is most pronounced in the frontal ranges, where monsoonal rainfall is high. This trend was inferred from earlier work on clastic provenance since the Last Glacial Maximum but not demonstrated in the modern mountains. Not only is the work of scientific geological interest, but also its implications for damming and water management are of great societal and financial

concern.

I appreciated the authors demonstrating things that seem to make sense but which are not well backed by data, such as their proof that the higher the river discharge then the higher was the sediment concentration. Likewise, showing that periods of peak sediment concentration can be traced throughout the Sutlej River is important for showing rapid sediment flux through the river rather than sediment being ponded in a restricted area. The observation that the storm-driven flood transport is especially important going further north into the rain shadow of the mountains is important for understanding how sediment from these regions can be mobilized into the main river system and in turn this tells us what sort of climate favors erosion of the Tethyan Himalaya as opposed to the Lesser or Greater Himalaya. 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. 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.

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.

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

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yield.

Technical comments

Page 544, line 10 – reliable should be “reliably” Page 544, line 14 “as increasing temperatures” should be “because increasing temperatures” 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. 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. Page 546, line 12 - The Higher Himalaya - The Greater Himalaya is more appropriate as a contrast with the Lesser 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 foreland basin. Page 548, line 14 – TRMM - Explain this abbreviation Page 548, line 15 - temporal resolution of 3 h - Is h the abbreviation of hour? Is that right? Not hr? Page 550, line 18 - nivo-glacial runoff regimes - I do not know what nivo-glacial means. Can you explain? Page 551, line 19 - 7 days - Whole numbers up to ten are normal spelt out. 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. Page 555, line 23 - Gangotri and Dokriani Glacier, western Himalaya - Can you show these locations on your maps? Page 557, line 4 - falls in form of rain - Better to be rephrased “falls in the form of rain”. Page 557, line 9 - Parechu River – Call out map figure to show where this is. Page 558, line 1 – Likely an underestimation - Can you explain better why that would be? I don’t understand the logic. 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 . . ..” Page

Figure 9 – The boxes around the figures seem unnecessary

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