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Earth Surface Dynamics Discussions

Interactive comment on "High natural erosion rates are the backdrop for enhanced anthropogenic soil erosion in the Middle Hills of Nepal" *by* A. J. West et al.

Anonymous Referee #1

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This paper by West et al. aims to quantify the impact of agricultural activities on erosion rates in the Nepal Middle Hills. The paper provides new data on natural and modern erosion rates for mountainous environments, and adds new and interesting information to the debate on the impact of humans on sediment fluxes.

Overall Comments p. 939, l.25 and following. As land use is one of the factors that affect soil erosion rates in the Nepal Middle Hills, it would be good to have more details on the various land use types that might affect soil erosion processes. In particular, agricultural terraces are known to reduce erosion rates when they are well maintained. Can you give more details on the type of terraces, their maintenance, and the land use characteristics?

p. 940, l.11-15: The authors compare 10Be-derived denudation rates with other erosion measures that were derived from previous studies. To compare these erosion measures directly, there are several methodological hurdles: 1) Spatial scale, as it is known that erosion rates measured at plot scale are not directly comparable with catchment-wide erosion rates (See literature on Catchment Area – Erosion rate relationships); 2) Time interval, as it is also known that erosion rates that integrate over very short time periods lack exceptional events, and often underestimate the average erosion rates, and 3) Methodological constraints, as the sediment rating curves of gauging stations only track suspended sediment load while the 10Be-derived denudation rates include dissolved, and particulate load (transported as suspended and bed load). While the time issue is discussed in the text, the other two issues need more attention.

p. 941 : 10Be production rates. The 10Be production rates were here calculated based on the mean altitude of the basins. 10Be production rates are highly elevation-dependent. In this steep mountainous environment, it would be more thoughtful to use a pixel-based approach to calculate production rates (or to use the median elevation instead of the mean elevation for calculations). What about topographic shielding, and the correction for lower production rates because of topographic shielding?

When comparing 10Be denudation rates with present-day erosion rates, the authors often use the mean values of the present-day erosion rates (e.g. Figure 5, and text). In areas with strong anthropogenic pressure, it is known that erosion rates are often highly skewed (few measures with very high erosion rates). Why not comparing the median values of the erosion rates, to correct for this bias?

Specific Comments p. 938, l. 5-10: The authors state that the human impact on erosion rates can also be quantified by comparing erosion rates before/after agricultural activities. In many environments, such comparison will not hold valid data on the impact of agricultural activities on soil erosion rates. Soil properties change as a result of agricultural land use, and decades of agricultural land use in mountainous environ-

ments often lead to a decrease in soil depth, increase in stoniness, and stone or rock pavement. As such, various studies have shown that soil erosion rates are often lower after a long phase of agricultural land use, because of rock pavements.

p. 941, l. 5-7: Can you give the blank values of the 10Be analyses?

p. 942, l. 10-16: Erosion/Denudation rates are now given in two different units (mm/yr and t/km2/yr). Can you give all the erosion/denudation rates in the same units (e.g. t/km2/yr)? The only exception could be Table 2 where you give the 10Be denudation rates in mm/yr and t/km2/yr.

p. 947, l. 3-9: Soil erosion rates on agricultural terraces are reported to be low. This is somehow expected, as one of the principal aims of these terraces is to form flat surfaces by tillage erosion as to reduce soil erosion in the agricultural plots.

Figure 3: In this figure, the authors compare their results on the Middle Hills in Nepal with previous studies in Sri Lanka by Hewawasam et al. (2004) and Ecuadorian Andes by Vanacker et al. (2007). The comparison is very interesting, but it would be good to make a differentiation according to the type of land use or vegetation cover. The study in the Andes showed that the human impact on erosion rates highly depends on the vegetation cover in the catchments, which was confirmed in a recent study on the Spanish Cordillera (Vanacker et al., 2014). For well-vegetated catchments (under agricultural land use), no clear acceleration of erosion was observed.

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