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Interactive comment on "Evaluating soil erosion and sediment deposition rates by the ^{137}Cs fingerprinting technique at karst gabin basin in Yunnan Province, southwest China" *by* Yanqing Li et al.

Anonymous Referee #1

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General comments Li et al., display an interesting study based on 137Cs activity and soil property measurements carried out in a karst depression in SW China to estimate soil erosion rates along a cultivated catchment's slope and related sediment accumulation rate in its bottom part. The authors only sampled 10 soil cores (nine along 3 hillslope positions and one within the depression). Estimates of soil erosion rates were derived from the soil 137Cs inventories for a limited number of sites using the method published by Zhang et al. (2009). They also carried out a PCA analysis to relate several soil properties (soil pH, total nitrogen - total phosphorus - total potassium

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Discussion paper

concentrations and soil organic matter content) with sediment deposition rates derived from 137Cs activity measurements. The study aims to provide information on land degradation due to soil particle's redistributions (mainly erosion) for policy makers and stakeholders. I think that the paper in its present form raises several major questions.

Specific comments 1) Estimates of soil particle's redistribution rate in a catchment require a reference 137Cs fallout level, estimated to be 942 Bq/m2 in this study. It is assumed that this reference site neither lost nor gained soil particles since the deposition maximum of 1963. Soil cores that display 137Cs inventories above or below this value are then interpreted as accumulation or erosion sites, respectively. Details of the calculation of this reference (average?) value are missing in the paper (i.e.137Cs activity distributions with soil depth, soil densities, plough depth, particle size,. . .). I think that this important information should be reported somewhere in the paper, together with some discussion with respect to a homogenous fallout. On Line 124 in section 2.4, it is mentioned "Reference sample was considered using a bulk sample. . ." but the 137Cs activities of the samples are determined on sieved <2 mm soil fractions. Both may not be comparable?

2) The authors assume that 137Cs accumulation peaked at the 165 cm soil depth (2.38 Bq kg-1) in the bottom part of the catchment (Fig. 3), providing a deposition rate of 2.65 cm yr-1 (and a soil accumulation of 3180 t km-2 yr-1, reported Line 228 by the authors). However another peak can be found just below at 190 cm with approximately the same value (ca. 2.0 Bq kg-1) than at 165 cm soil depth (taking into account the analytical uncertainty). Assuming the same deposition rate, the corresponding date would be 1954 (25 cm / 2,65 cm yr-1 corresponding to ca. 9 yr before 1963). This time period is rather known as the onset of 137Cs fallout than a high fallout deposition year. I think that there is a large uncertainty on the reference 1963 fallout peak position (somewhere between 150-200 cm soil depth?) possibly due to soil particle's mixing if land was cultivated or to a more complex deposition trend including a varying supply of 137Cs-tagged soil particles. Accordingly any deposition rate that can be derived using

this soil depth may be questioned.

3) In the discussion section, the authors mention, on the basis of their 137Cs inventories, that soil erosion is lower in the middle part of the hill slope than in the upper and lower positions (Lines 235-250). I suggest that the authors provide references to support this interpretation (i.e., Ribolzi et al. 2011 - Geomorphology 127, 53-63 or others). It is also worth noticing that a correlation between 137Cs activity and SOM content is assumed (Line 251-258). However the discussion is difficult to follow because the authors do no plot any correlations, only a PCA analysis showing “trends” between soil properties (Fig. 4). I think that graphical plots (i.e., SOM content vs. 137Cs activity in concentration units and/or SOM kg m-2 vs. 137Cs in Bq.m-2) could help the reader to better evaluate the “reality of things”. I think that if such a correlation exists it may not be directly due to 137Cs adsorption by soil organic matter (Line 256) but rather to the fact that soil micro-aggregates contain both organic matter and 137Cs bound to fine clay minerals. On the long term a single process, i.e. erosion, will deplete topsoil horizons in both soil organic matter and particle’s bound 137Cs during soil aggregate breakdown.

Technical comments I think that some improvements should be made for the figures and tables. Line 175 it is mentioned Fig.3 but I think it should rather be Fig.2. Moreover In Fig.2 the reader does not know if average or single values are plotted? In the case of average values, how many values (3 for the 3 soil cores)? Nothing is said about this in the legend. In such a case the SD should also be reported in Fig.2. The title of Table 2 “Variations in 137Cs and soil properties. . .” might rather be “Average variations in. . .” ?

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