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Earth Surface Dynamics Discussions

Interactive comment on "Storm-triggered landslides in the Peruvian Andes and implications for topography, carbon cycles, and biodiversity" *by* K. E. Clark et al.

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General comments:

The central aim of this manuscript is to measure landslide-derived organic carbon fluxes out of the Kosnipata catchment in the eastern Andes. The authors computed these fluxes from the size of landslides, which they mapped using annual satellite images over the period 1988-2012, and the abundance of organic carbon in the material eroded by the landslides, which they estimated from new measurements of organic carbon stocks in soils and vegetation. These measurements took considerable effort: The authors analyzed a large number of satellite images and dug a large number of

soil pits to estimate organic carbon stocks and fluxes. Their analysis implies that landslides in the Kosnipata basin have been responsible for large fluxes of organic carbon out of the catchment, with roughly three quarters of the flux coming from soil carbon and the rest from vegetation. These measurements are likely to be of interest because organic carbon fluxes from continents to the oceans are an important link in Earth's carbon cycle, and because the extent to which these fluxes are influenced by large erosional events is not well known. These new measurements are the manuscript's greatest strength.

I have a few suggestions for strengthening the manuscript. Most importantly, I suggest adding an explanation for how the landslide-derived fluxes were calculated. At present, the organic carbon fluxes are reported in section 4.4 without an explanation for how they were calculated. An important aspect of this is landslide thickness: How did the authors estimate the thickness of eroded material in each of the landslides? Landslide thickness is required to estimate the mass of soil eroded in each landslide, which in turn is required to compute the organic carbon flux as the mass of the eroded soil multiplied by the organic carbon concentration in the soil. Additional text that describes this would also provide a basis for reporting uncertainties on the organic carbon stocks and fluxes, which the manuscript currently lacks and would benefit from.

In addition, I suggest adding a section that describes the connectivity of the mapped landslides to the channel network. What fraction of the landslide-mobilized material made it to the channel network? This connectivity can vary substantially among regions. The authors briefly mention this issue in other studies on p. 656, but the manuscript does not explain how they estimated what fraction of the landslide material actually reached the channel network.

Lastly, it would be useful to provide more descriptions of the soil pits, perhaps in the supplementary material. Specifically, it would be useful to see maps that show where the soil pits were dug, and profiles on organic carbon concentrations in each pit. These would put the calculations of organic carbon fluxes in context, by showing how repre-

sentative the soil pits are likely to be of the catchment as a whole.

In summary, this manuscript presents some new estimates of landslide-derived organic carbon fluxes based on an extensive series of new measurements. I believe that the manuscript would be strengthened by considering the issues I listed above, which I believe the authors could address in a moderately revised version of the manuscript. Below I list more a few more suggestions for improving the manuscript.

Line-by-line comments:

p. 633, lines 10-11: This states that "landslides may completely turn over hillslopes every ∼1320 years". This is strictly true only if landslides occur in every part of the catchment (do they?), and if landslides do not recur in the same place until the entire catchment has been resurfaced. By Figure 2 it looks as if some portions of the catchment did not experience any landslides during the observation period. I'd suggest rephrasing this slightly to reflect that.

p. 636, line 11: What does spp stand for in the units for species richness? I suggest defining that here.

p. 641, lines 23-25: It would be useful to specify in the text not only that the carbon stocks estimated in the present study differ from those in previous studies, but also to state that these estimates are bigger, and to quantify how much bigger.

p. 644, line 8: It would be appropriate to cite some older papers here, especially Zhang and Montgomery, 1994, Water Resources Research, v. 30, p. 1019-1028.

p. 647, lines 2-3: Is this a lot of carbon or a little? I suggest providing context for these numbers here by comparing them to carbon stocks in other places. Also: What are the uncertainties on these values? That would be a valuable quantity to report for the carbon stocks (and for other quantities too), because it'll aid comparisons to future studies.

p. 647, lines 7-11: These fluxes are likely to be conservative because they implicitly

assume that landslides are the only means of conveying organic carbon to the channels. How much carbon is eroded to the channel network by other processes (e.g., soil creep)?

p. 648, lines 13-14: I was a little confused by the wording in this sentence. Instead of writing "where RI_i is the return time for a year characterized by the landslide magnitude of year i", I suggest replacing it with something like, "where RI_i is the return interval for the ith largest landslide in the record."

p. 650, line 11: Angle of repose pertains strictly to granular material, so I'd suggest replacing "angle of repose" with something like "hillslope angles consistent with the strength of the local bedrock".

p. 661, line 10: For the editors: the doi link appears to be broken.

p. 686, Figure 11: This is a busy figure, and the individual panels are quite small, which makes them difficult to read. Could this be split into multiple figures? Also: What is shown in panel c? The caption's only description of panel c is a reference to Figure 10, but it would be more helpful to state what it is directly here.

Interactive comment on Earth Surf. Dynam. Discuss., 3, 631, 2015.