Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2018-75-RC2, 2019


Earth Surface Dynamics Discussions

# *Interactive comment on* "Fluvial boulder transport controls valley blocking by earthflows in the California Coast Range, USA" *by* N. J. Finnegan et al.

**Anonymous Referee #2**

Received and published: 2 January 2019

Finnegan et al. present two case studies of valley blocking and boulder transport at two earthflows that occur in the Franciscan complex of California. They compare two sites, one near San Jose, where earthflows impinge on rivers with small upstream contributing areas and one on the Eel River, which occurs where the upstream contributing area is larger. The main difference between the two sites, is that boulders delivered by the earth flow block the valleys and generate considerable upstream aggradation at the San Jose site, but at the Eel River site, the channel is not blocked, despite evidence for the delivery of coarse boulders to the channel. The authors then assess thresholds of motion for boulders measured from satellite imagery and use stream gage data to compare the relative mobility of the boulders at the two sites. The con-



clusion that valley width influences blocking susceptibility has important implications for understanding how hillslope processes influence bedrock river incision, which has implications for how relative base-level fall is transmitted through catchments. In my opinion the manuscript makes a nice contribution and is appropriate for Earth Surface Dynamics. However, I have several comments regarding the analyses that should be addressed in a re-submission:

1. I agree with the comments by Referee Prancevic, who suggested a different approach for quantifying the threshold for motion. Costa (1983, GSA Bulletin) briefly summarizes how when assessing the motion of the largest particles in a channel, the relative roughness of the bed differs than for transporting the median bedload, etc., and such effects can be further considered in the manuscript.

2. Regarding the mobility of the boulders (e.g., (p. 11, line 24); if the boulders are mobile in a 2-yr recurrence flood, and presumably there have been many such floods (and larger floods) since the boulders were deposited, why are they still spatially co-located with the earthflow toes? It would be useful to provide a broader characterization of the spatial occurrence of boulders at each earthflow. For example, are they only present within the earthflow-influenced reach, or are they also located downstream as would be expected from fluvial transport?

3. I realize the scope of the manuscript is a case study comparison of the two sites, but it would be useful to further document blocking at small drainage area at other sites, as this is the main conclusion of the manuscript. Given the extensive earthflow observations generated by some of the co-authors for the Eel River watershed, it may be possible to assess blockage as a function of drainage area by either by inspection of available imagery or via measurements of floodplain width where suitable topographic data are available. A plot of the proportion of earthflows that block rivers as a function of drainage area could be informative, for example.

4. In the discussion of controls on blocking (p. 11), particle jams are noted as a possible

mechanism. It is difficult to discern from figures 13 and 14, but are the boulders actually touching one another? Whether they touch or not seems relevant to the arguments (e.g., force chains).

Editorial comments: P. 1 Line 17: replace “stream gages” with “stream gage data” P. 1 Line 18 and 20: replace “top” with “largest” P. 2 Line 9: year missing from citation (same citation in reference list is also missing co-authors) P. 3 Line 1: add a few words: . . .exploit “discharge data from” USGS. . . P. 3 Line 20 units are not consistent throughout; m/a here but m/yr elsewhere. P. 5 first paragraph: To be consistent with the rest of the text, keep the order the same, present Arroyo Hondo first, then the Eel River. P. 5 Line 20: Combine this sentence with the previous paragraph to avoid a one-sentence paragraph. P 8 Lines 9 and 13: USGS gage websites/numbers are already given, so this is repetative. P. 14 Line 14: extra “)” P. 14 Line 18: change “period” to “periodic”

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