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Interactive comment on "Morphodynamics of river bed variation with variable bedload step length" *by* A. Pelosi and G. Parker

R. Schumer

rina@dri.edu

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This is a nice manuscript describing the effects of thin-tailed non-locality on bedload transport. The main goal is to compare the flux and entrainment forms of the exner equation when there is the possibility of non-local "steps". The mathematical development leads to the demonstration that when particle jumps are a large fraction of the experimental domain there can be straight bed profiles- something that is often observed in experiments. The mathematical development appears to be correct . The figures support the text well, though see my comment below about how figure references are incorporated into the text. I would like to see more enlightening figure captions.

Major comment: I think this manuscript will pack more of a punch if it is put in context of previous non-local studies. Specifically, this manuscript focuses on the transient,

pre-asymptotic transport that is observed in lab studies while the focus of others has been asymptotic PDEs. Is it true that the flux form is asympotic (continuum) while the entrainment form is a discrete model that can converge in some limit to the to the flux form . . ..or more to the point of this paper. . . will have solutions that resemble the flux form solutions pretty quickly if the step lengths are short enough with respect to the domain that you can add a bunch of steps up and start to converge to the continnum distribution (???) Perhaps this is obvious to those who know the entrainment and flux equations well, but as someone from the probability PDE world, this was not initially obvious. A few sentences that describe this would help readers like me. Also things like: on lines 277 and 278 I'm not sure that it is true that the flux form coincides witht the non-local form, I think it is the reverse. When the steps are small compared with the domain length, you get to add a number of steps so that pretty quickly the entrainment solution resembles (converges to) the flux solution. In this case, the exponential non-locality goes away quickly a la the central limit theorem.

Minor comments: Lines 52-56: The motivation for use of heavy-tailed pdfs is that the non-locality is preserved in the limit. The continuum equations that govern asymptotic transport properties (ADEs, fADEs, etc) are of interest in many applications, where anomalous transport persists indefinitely (or over our observational timescales). Only when jumps or waits are heavy tailed do nonlocal aymptotic continuum equations play a role.

line 118: saying a pdf has a mean step length is awkward. Maybe just remove "step length"

line 131, add r>0 and 1/r_bar>0

define density on line 145 instead of 148

line 281 spelling of "slope"

line 285 spelling of "the"

line 352 extra period

line 357 need a space between of and non

This is a style issue- I think the results would be easier to read if you discuss the results and parenthetically reference the appropriate figures within your story. Right now, you layout what your figures are with no discussion, which makes me go and look at the figures with no context and I have to figure out what their point is. Then there is another paragraph where you tell me what the results are. As reader, I would prefer that you start discussing the results and send me to a figure to support a point in your story as it comes up so that I know how to interpret the figure. If you prefer to describe the figures before the discussion, then more descriptive captions would help.

Interactive comment on Earth Surf. Dynam. Discuss., 1, 1097, 2013.