Earth Surf. Dynam. Discuss., 2, C221–C225, 2014
www.earth-surf-dynam-discuss.net/2/C221/2014/

Earth Surface Dynamics Discussions

Interactive comment on "Dynamics and mechanics of tracer particles" *by* C. B. Phillips and D. J. Jerolmack

Anonymous Referee #2

Received and published: 30 July 2014

The paper deals with the mobility and displacement length of marked particles in gravel and boulder bed channels, which is a very relevant topic of high interest for geomorphologists, engineers and ecologists. The field data are hardly won, the analysis are well performed, and the paper is well written. I think that the paper will be of interest for the readers of ESURFD, and I suggest to accept it after minor revision. Specific comments are as follows:

- I have a certain concern on the use of data gathered from Bisley 3, on which only 50 RFID were installed. It is definitely useful to include these data on some of the analysis, but it seems to me that a full description of limitations and potential errors in managing such limited dataset should be given, in order to avoid some interpretations looking too speculative.

- I think that the introductory chapters (1 and 2) could be substantially shortened. It is indeed important to give credits to previous works and present the theoretical framework on which the data are later analysed. However, it seems to me that crucial information accounts for half of the text more or less. For instance, the introductory text on pg431 (rows 1 to 22) could be shortened to half, as the general description of the tracer techniques and advantages of using of RFID tracers. The text at page 433 seems all relevant to me, but the second half of page 434 could be shortened for example. Most of chapters 2.2 and 2.3 could be shortened as well.

- Pg 433, row 28. As you've presented the formulas for calculating shear stress (pg 434, row 10), I would also write explicitly how the shear velocity was calculated. I would basically move here the formula that is now at page 441, row 6.

- Pg 434, rows 14-17. Why it's important for your field application that particle scale framework holds for laminar flow as well? Do you expect or did you observe laminar flow in your field site?

- Chapter 3. I think the description of the surveys of longitudinal profiles could be shortened by half, as the quantification of slope is not so critical in the study. Instead, I would say something more on the correlation between long-term gauging data and short-term measurements in the study segments, and on the range of discharges measured during the short-term water stage measurements.

- Pg439, row 7: How did you calculate flow resistance?

- Pg 439, row 11: Because a single grain size was used, I can agree that 150 tracers are enough to describe the movement of sediments. However, if compared with the amount of RFID tags used in previous studies (see for example table 1 of Bradley and Tucker 2012) 150 tracers appears to be quite a few, and this is especially true for the 50 tags used in Bisley 3. Could you better justify that the number of pit tags are enough for the objectives of the study? Or otherwise discuss a little on how a larger population of tags could have changed the results?

- Pg 439, row 15. In general, I understand that working with a single grain size equal to D50 of the bed is easier, but how representative is that in a poorly sorted bed? Could you better justify this experimental choice?

- Pg 439, rows 26-29. Recovery rates are very high, whereas in literature smaller percentages are reported (e.g. Lamarre and Roy 2008, Liebault et al 2012). It would be interesting to have a little discussion about it. Is it due to the reduced transport distance and relatively low magnitude of floods surveyed?

- Pg 440, row 13. It would be interesting to know how many tags were recovered on the bed surface and how many were buried (if the sediments were coloured, the first would be seen in the bed, whereas the latter would be detected by the antenna but not visible on the bed). Being able to demonstrate that most of the tracers were on the bed surface would reinforce the hypothesis that they moved under partial-transport conditions.

- Pg 441, row 7. Why not testing the specific stream power as well? As pointed out by Ferguson (2005, Geomorphology), critical stream power is in fact unaffected by form resistance (as it is instead the shear stress), thus I guess you could more easily compare data provided by the two study sites.

- Pg 441, row 26. The method also implies that U*c is the same at the beginning and end of each flood event, which may not be the case (see for example fig 3 in Rickenmann 1997, ESPL). Long tails on falling limb of hydrographs can, in fact, affect very much the values of I*.

- Pg 442, rows 14-20. I think this could be deleted or at least shortened.

- Pg 442, row 21. It is not so straightforward to me that the intercept on figure 5 should necessarily identify the critical shear stress. It seems to me that figure 5 shows the degree of partial transport experienced by tracers. According to Wilcock and McArdell (1997, WRR), for a certain grain class in an heterogeneous bed, partial transport cor-

respond to a condition in which some grains are transported, and some are immobile. Looking at figure 5, if all grains are immobile f = 0, if they all move (full mobility) then f = 1. The trend showed by Figure 5 could thus be associated to a certain line of figure 3a in Wilcock and McArdell 97 for example. In the same paper, Wilcock and McArdell 97 associated the degree of partial transport to incipient motion. They report that incipient motion is related to certain percentage of sediment entrainment (that would be your f I guess) depending on grain size. I would suggest trying to apply their approach for better supporting the identification of the critical shear stress from data showed on Figure 5.

- Pg 443, row 11. I would use magnitude-frequency rather than frequency-magnitude.

- Pg 443, pg 28. It would actually be interesting to compare the identified shear stresses for partial transport and full mobility with previous values available in literature. There are not many field evidences, but you could find some interesting values and reference if you go back to Lisle et al (2000, WRR) or Mao and Surian (2010, geomorphology).

- Pg 444, row 17. I don't fully understand the need of normalizing transport distance by grain size if all tracers were approximately of the same size (as stated at page 439, row14).

- Pg 445, row 2. Here I would try to better justify why the intercept is meant to identify the threshold stress.

- Pg 445, row 17. Data showed on figure 9 could be somehow related with recent mean transport distance plotted versus the excess of cumulative stream energy as recently done by Schneider et al. (2014, JGR)? Could the slope of regression lines be compared for example?

- Pg 447, row 15. Because the tracers were more or less of the same size, how relevant is this analysis considering that the actual grain size curve of the bed is much wider than the grain size of the tracers? The analysis is definitely of interest, but I think that

the interpretation here tends to be speculative. Could you further stress the potential limitations on this interpretation?

- Pg 449, row 16. I'm left wondering if, really, bedload movement as single step lengths is necessarily coincident with bedload under partial transport conditions. Could partial transport occur when particles are moving with multiple steps and rests? Could it depend on the duration of overthreshold discharge as well?

- Pg 450, row 27. Could the presence of pools explain this as well? Biron et al (2012, RRA) could be a useful reference to be cited here.

- Pg 451, row 9. If the Bisley 3 is a step-pool, boulder stream, the D84 is probably not a good descriptor for flow resistance, as form resistance could play a crucial role in energy dissipation. I would suggest to use a different formula or approach to do the analysis. Are results obtained using the Rickenmann and Recking (2011) formula's comparable?

Interactive comment on Earth Surf. Dynam. Discuss., 2, 429, 2014.