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Interactive comment on "Slope–Velocity–Equilibrium and evolution of surface roughness on a stony hillslope" *by* Mark A. Nearing et al.

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Reply to Dino Torri

Thank you for these comments on the paper. They are much appreciated.

Thanks for the suggestions on the literature and discussion points. The reference to Foster et al. was helpful in stressing the point about non-mobile rill beds showing dependence to slope gradient. We added to the Introduction: "Note that, for example, Foster et al. (1984) conducted velocity studies on a full-scale, fixed-bed fiberglass model of a "rill" and found that velocity was related to slope steepness by the power of 0.48. Flow velocity was more sensitive to slope steepness than it was to flow rate for the fixed bed rill in that experiment."

Also, we added a discussion about the exponents as follows: "One is tempted to compare the exponent determined from this experiment (Eq. 3) to exponents from previous work on rill flow velocities. However, it should be noted that Eq. 3 uses unit discharge while rill flow experiments typically reported relationships using total discharge (e.g., Eq. 2). Because of the complexity and variability in flow on interrill areas, it is not clear that a direct comparison of these values is entirely valid or robust. Nonetheless, under the specific conditions of this experiment, since width is a constant, then the use of total discharge for these data would also result in an exponent of 0.696 (see Eq. 3), though the equation would have a different linear coefficient. This is greater than values previously reported for rill studies, including a value of 0.294 determined by Govers (1992), 0.459 determined by Nearing et al. (1999), and 0.39 reported by Torri et al. (2012)."

I would have liked to refer to the equation by Abrahams and Parsons (1990) as listed in the Torri paper (2012), but I had a slight problem with that. The Torri et al. paper reported that Abrahams and Parson calculated an exponent of 0.137. The Abrahams & Parsons paper reported a relationship between velocity and Reynold's number, which includes a flow depth term, with an exponent of 0.137. I went through the math using the two equations in the Abrahams paper shown in Fig 1 (one for flow depth and one for velocity) and made substitution of v for Re, and came up with an exponent of 0.159. This value might be possible to use, but I am a little uncomfortable doing that since they did not report (as far as I could see) a relationship between velocity and discharge directly. Perhaps I am misunderstanding something in these results.

The channel width paper is interesting (Nachtergaele et al), but I did not find a convenient way to work it into the discussion.

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