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Interactive comment on “Short communication: Multiscalar drag decomposition in fluvial systems using a transform-roughness correlation (TRC) approach” *by* David L. Adams and Andrea Zampiron

Anonymous Referee #2

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General comments:

The manuscript describes and discusses a potentially useful new technique to assess flow resistance in natural channels and particularly in gravel-bed streams. The novel method proposes to estimate the relative contribution of different physical scales of river bed topography to the total drag. To do so, a transform-roughness correlation (TRC) approach is used, based on a wavelet transform and a correlation of different elements of the bed structure with a roughness metric. The approach is applied to two different sets of flume experiments, one reproducing a pool-riffle morphology and the

other a step-pool morphology.

General considerations that lead to the proposition of this new approach were reported in a recent paper of the first author (Adams, 2020a). The manuscript appears to be an attempt to apply this approach to “natural” gravel-bed channels as reproduced in flume experiments. Although the main results appear to provide some support for further exploring the suitability of this new approach, some ideas in the manuscript are not explained clearly enough or in sufficient detail, and some elements would warrant additional discussion in my view.

1. In the present study, only one single longitudinal profile is analysed. Although it is mentioned that “multiple streamlines (parallel or even intersecting) could be employed”, I think that this aspect should be discussed in more detail. For example, how much would the results be affected by selecting different streamlines? How representative is a single streamline for the flow conditions averaged over the cross-section?

2. Frequent reference is made to the study of Forooghi et al. (2017), but for readers unfamiliar with this study it is not always clear what is meant exactly or what meaning for example the term “effective slope” had in this cited study (see also my specific comment below to L160-178). Therefore I suggest to provide some more information on this important background study.

3. The application of the TRC approach to the two different sets of flume experiments as illustrated in Figure 9 appears to result in a somewhat better flow resistance prediction than more traditional approaches (reduced root-mean-square error when using the k*_s,pred roughness measure as compared to using the sigma_z measure), if the measure k*_s,pred really refers to the application of the new TRC approach. However, it is not clear how k*_s,pred was calculated, this needs to be clarified.

4. It is known from other studies on flow resistance in gravel-bed streams that the presence of large wood on the streambed can substantially alter the total resistance, and that particularly in such a situation using sigma_z as compared to using e.g. a

characteristic grain size such as D84 improves flow resistance calculations. Can you speculate if and how using the TRC approach could further improve flow resistance calculations in such settings?

5. I see one potentially interesting further application of the TRC approach with regard to the question of stress partitioning in gravel-bed streams which is one important approach to improve bedload transport predictions in these channels (e.g. Ancey, 2020, JHR, part 2, https://doi.org/10.1080/00221686.2019.1702595). Some discussion of this aspect would be welcome.

Specific comments:

Figure 1b): indicate which line refers to grain and form wavelength

L160-178: In the process of selecting an appropriate correlation between roughness measures and elements of the wavelet analysis, the authors refer to the study of Forooghi et al. (2017) who used a variable called "delta" (a measure of the diversity of roughness peak heights), and report that "effective slope is approximately proportional to drag in the range 0 < ES < 0.35". It is not clear whether the authors also determined "delta" or not. Furthermore, in eq. (2) a critical value of delta = 0.35 is used to separate the two ranges, whereas later in the text a (critical) value of 0.35 is associated with ES (L172). This is all somewhat confusing and requires clarification.

Figure 4: If the vertical dashed line is meant to indicate Dmax, it should plot at 0.008 m (L102).

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