Hydrology and Earth System Sciences Discussions

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Comment on hess-2022-208

Anonymous Referee #1

Referee comment on "Influence of vegetation maintenance on flow and mixing: case study comparing fully cut with high-coverage conditions" by Monika Barbara Kalinowska et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2022-208-RC1, 2022

General Comments

The authors have highlighted a need for measurements of hydraulics and mixing at the reach-scale in vegetated channels, and identify vegetation coverage as a key factor. To investigate, dye injections are carried out before and after vegetation cutting and these results are analysed, finding decreasing longitudinal dispersion coefficient with increased coverage. This work is of sound quality, of use to engineers interested in water quality in channels, and is suitable for publication in HESS. I recommend the article for publication with minor revisions.

Specific Comments

On line 198, the authors observe a doubling of discharge and a 3-5 times increase in velocity after the vegetation is cut, suggesting that the flow area has at least halved after cutting. How do water depths compare? Was discharge measured immediately before and after cutting? Is the difference in discharge from reduced cross-sectional blockage area? Or is there possibly some other variation also affecting flow rates, e.g., did it rain recently? Have these possibilities been taken into consideration for the author's proposed U_{NV}/U_{VEG} relationship? I recognize this is difficult to pick apart, but if U has increased by a factor of 2 due to other factors than vegetation cutting, this would impact the slope of the line in Figure 9. While it would not impact the conclusions from the figure, the specificity of the relationship should be further discussed in the text.

On lines 239/244, the authors comment on the unsuitability of scaling longitudinal dispersion with bed shear stress and water depth. Do the authors have any comments on/suggestions for what alternatives might be used instead? The results in Table 1 seem to suggest scaling by mean longitudinal velocity would be suitable, and this is commonly used in literature for uniform vegetation, e.g., Nepf (1999). Considering that velocity may

have been increased by a factor of two independent of vegetation cutting, how would scaling dispersion by velocity change Figure 11?

The authors have not included a data availability statement.

Technical Comments

Section 1: The introduction implicitly links mixing and longitudinal dispersion coefficient, but this link could be made more clear, e.g., by the inclusion of the advection-diffusion equation or by explaining that the longitudinal dispersion coefficient describes a rate of spread in the streamwise direction.

Section 2: Is there any additional description of the vegetation? Species? Stem diameters, density, etc.? The methodology mentions that surface slopes and cross-sectional velocity profiles were recorded, could these be presented or otherwise included with an accompanying data set? (And also include concentration profiles, dispersion coefficients, planform vegetation coverage, channel geometries, etc., in that data set?)

Section 2.4: Did the authors consider optimisation of the routing solution to the advection-diffusion equation as a means of obtaining longitudinal dispersion coefficient? If the sampling frequencies were very low when calculating moments, was the trapezium rule used to increase the accuracy of the integral?

Section 3: Why are the dispersion coefficients presented before the concentration profiles, given that the concentration profiles are used to derive the dispersion coefficients? Consider moving them to Table 2, and placing Table 2 in Section 3.3.

Line 24: Is "On the other hand" needed?

Line 31: "by the very local" is odd wording, suggest just "by local" or "by very local".

Line 32: "demonstrated" should be "have demonstrated".

Line 32: Please clarify "vegetation-induced flow alterations are significantly influenced by plant arrangements" - "vegetation-induced" and "influenced by plant" can be read with the same meaning, e.g., "thing is caused by thing".

Line 45: "unfeasible" should be "infeasible".

Line 115: Please add an explaination of "map algebra".

Line 136: What were the sampling frequencies?

Line 146: Were the leading- and trailing-edge times presented? Were these calculated the same way as for calculating moments (line 165)? Suggest clarifying/removing.

Line 154: Upstream should be “1” and downstream should be “2” to be consistent with Equation 2 and cross-section numbering increasing further downstream (Figure 4).

Line 172-173: Considering plotting variance against travel time. If mixing was complete, this should be a linear relationship, e.g., Rutherford (1994) Figure 4.4. This could be a good complement to Figure 7.

Line 187/Figure 8: Is this figure required? The peak concentrations can be read relatively easily from Figure 6.

Line 194-196: It might be worth commenting that dispersion in natural channels can vary significantly, increasing the challenge of creating these data sets (e.g., Rutherford, 1994, Table 4.2).

Line 206/215/227/Figure 11: Please comment on the limits of applicability of these relationships.

Line 232: Should this be a reference to Figure 11?

Line 273: "pollutants concentration" should be "pollutant concentrations".

Figure 6: Is the y-axis C/C_{max}? A relative concentration of some kind? Please revise the y-axis label.

Figure 6b: Please expand the *x*-axis to make the recorded profiles clearer.

Figures 9 and 11: Consider making the circles for the main vegetation reaches green to be consistent with Figure 10, and similarly adjusting the symbols/colours in Figure 8, etc.

Figure A1: Consider plotting against time since injection on the *x*-axis and plotting the two concentration data on the same axes for a more direct comparison.