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Interactive comment on "Which type of slope gradient should be used to determine flow-partition proportion in multiple-flow-direction algorithms – tangent or sine?" *by* L.-J. Zhan et al.

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Received and published: 14 August 2012

This technical note revisited the multiple flow direction algorithm considering sin instead tan. The authors based their analysis on the deduction of the flow-partition proportion based on hydrogeological theory. This work is potentially interesting but at the same time there are several major critical issues need to be solved. The goals are not fully clear, the analysis of the results is really weak and it cannot be summarized in only a figure (Fig. 2), the analysis on synthetic landscapes is also omitted, and it is not present a comparison with other flow direction algorithms. This paper is not ready for

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publication at this stage. I suggest a rejection and a resubmission. I suggest that the authors will rethink in deep the purpose of this work, then introduce also the comparison with other algorithms and improve the analysis. The idea is not bad, but it needs to be better presented.

Here I summarize only major points and question, I will not focus on minor changes since a resubmitted paper will be totally different.

1) Goal of the work. I have some difficulties to understand the goal of this work. Is for a better interpretation of surface flow? Subsurface flow? Flow in rivers? The main differences among all flow direction algorithms are related to the hillslopes, while in well-defined channels, narrow valleys, the performances tend to be similar. Why introducing equation (2) and (3)?

2) Why consider the only multiple flow algorithm? Why not compare these analyses with other algorithms such as Dinf and D8 (or D8-LTD). Dinf at my eyes, in hillslope environment, perform better than multiple flow, since it is not so dispersive, just a compromise between D8 and Multiple Flow.

3) Analysis of the results. This section is really poor and unsuitable. First of all, the authors, as they rightly reported in the last sentence of the discussion, have to test their results on real and also synthetic landscapes. This is the way that all the authors of flow direction algorithms followed. Fig. 1 and 2 are not enough, and the differences showed in Fig. 2 are nothing without real data, comparison with other algorithms, and statistics. Also an analysis on secondary topographic attributes (such wetness index) should be addressed in order to test any differences in using sin or tan.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 6409, 2012.

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