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Hydrology and Earth System Sciences Discussions

Interactive comment on "Technical Note: Automatic river network generation for a physically-based river catchment model" *by* S. J. Birkinshaw

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Reply to anonymous referee.

I would like to thanks the referee for going through and thinking about the Technical Note in detail. This sort of feedback is always valuable.

COMMENT 1: A TRIVIAL PROBLEM

When I started doing this I thought it was a trivial problem. I tried several methods and each of them had a problem and I came to the conclusion it is not a trivial problem.

The method suggested by the referee was one of the ones I tried. It worked in many cases but I found examples where it did not work. See for example in Figure 1. I have tried to be precise in following the referee's method but it can clearly be seen that the "edge network" is not connected. It is possible that ways could be found to overcome this problem but I tried and eventually gave up on this method.

COMMENT 2: THE SOLUTION IS FLAWED

This method has now been applied on over 30 river catchments. In each case it has produced a river channel network that corresponds closely with that seen on available maps. It is therefore a method that works and it is correct that it should be published. It is possible there are other methods that are better or this method could be improved. However, this does not invalidate this method.

a) The referee does not like the use of the D4 algorithm. As stated at the end of Section 3 (p3243, L10) a D4 algorithm was chosen as flow in SHETRAN is restricted to its four neighbours. I agree with the reviewer that it is possible to get some distortion. But the aim of the method is to get a reasonable approximation of the actual stream network. The text (p3240, L21) states this is only a prototype simulation, if the user is unhappy with the generated network it is possible to change it manually.

b) The referee does not like the location of the selected river channel (edge). In point 5(a) in the text (P3241, L25) the edge with the lowest elevation neighbour was selected. It was a bit arbitrary which edge to select and it seemed sensible to select the edge with the lowest elevation neighbour. Clearly the channel does not stay at its lowest edge neighbour as it goes downstream. But the important point is that it produces a connected river channel network. Again if the user is unhappy with the generated network it is possible to change it manually.

c) The referee thinks that parallel channels will be produced. The referee is incorrect here, it is impossible to produce parallel channels longer than that seen in Figure 2f (i.e two grids long). In fact Figure 2f is a special case and in general you do not get any

parallel channels. For example, in the algorithm if a new channel is approaching an existing channel it will automatically connect with it (the rule of maximum connectedness, 5(b), P3242 L10). If as in 5(c) a channel is initiated that is parallel with the existing one, again it will connect to the existing one. If as in 5(c) the main channel turns a corner you will get a parallel channel two grids long.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 3237, 2010.

A) Elevations

122	130	126	113	125
115	112	118	110	120
122	108	114	107	115
120	104	103	102	100
110	107	105	106	107

Flow direction	edge added
N	E
NW	E & N
W	N
SW	N & W
S	W
SE	W & S
E	S
NE	S & E

B) Flow accumulations using a D8 algorithm

0	0	0	0	0
0	2↓	0	3↓	0
0	4↘	0	6↘	0
0	3→	10→	13→	24→
0	0	0	0	0

C) Edge network using anonymous referee's method

0	0	0	0	0
0	2	0	3	0
0	4	0	6	0
0	3	10	13	24
0	0	0	0	0

Fig. 1. Anonymous referee's method for channel network generation