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Hydrology and Earth System Sciences Discussions

Interactive comment on "Accurate stream extraction from large, radar-based elevation models" *by* M. Metz et al.

M. Metz et al.

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Thank you for for detailed comments and suggestions. We agree with most of your comments would like to clarify a few aspects.

General comments

1. We agree and the text will be revised accordingly

2. We agree and the text will be revised accordingly

3. Regarding reference points, their location and method of collection is described in 7/13-28. The landforms recorded by the reference points were described as follows:

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Interactive Discussion

Discussion Paper

"The GPS measurements included a larger proportion of points acquired in mountainous regions along smaller rivers, while most of the points digitized from Landsat imagery were located along larger rivers in flood plain and coastal plain landscapes." We will provide more detail on GPS point collection. Figure 7 shows two typical examples.

4. We used Landsat TM5 bands 3,4,5 at their native resolution of 30 m in a false color composite with R,G,B = 4,5,3 which nicely separates vegetation from waterbodies. The scene we used was LT50120542000087XXX02. The types of streams digitized were larger rivers in flood plain and coastal plain landscapes. We forgot to specify what we meant with "larger rivers": up to 4 pixels wide in Landsat TM5. We have only digitized streams where a channel or channel center was easy to identify and therefore excluded e.g. braided or anabranching rivers and lakes.

5. GPS points were collected along clearly identifiable perennial rivers (to be added to the manuscript) at the locations given in 7/17-18, but we will provide more detail. GPS positionally accuracy is described in 7/16.

6. Although there is some overlap between GPS points and points digitized from Landsat, GPS points are tendentiously located further upstream than points digitized from Landsat which include rivers in low gradient floodplains (7/22-25).

7. Benchmark data on anticipated processing times are hardware dependent. This may go into the manual of r.watershed, if we can get hold of reference data for a representative collection of hardware (probably outdated in 2 years time). Processing time increases now near linear which, for a given hardware configuration, allows for an estimate of processing times for larger datasets using smaller sample datasets.

8. We could describe in more detail why we think (expect) that traditional sink filling provides less accurate results. The study area was characterized by both mountainous and coastal plain landforms, additionally large parts are covered by triple canopy tropical forest, some parts were cultivate land. Therefore we expect that our results are applicable elsewhere, although the differences may be less pronounced in easier

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terrain, e.g. with moderate slope and low, uniform vegetation cover.

Specific comments

Title: We agree and the title will be revised accordingly

2/18 "GPS": Described in 7/16, we will add more information on the nature of the GPS reference points.

4/8 "new generation of watershed tasks": processing very large datasets at ever higher resolution

4/15 "I/O": to be replaced with disk input/output

4/26 We agree and the text will be revised accordingly

5/26 We agree and the text will be revised accordingly

6/2-4 We agree and the text will be revised accordingly

6/5 "gaps in the dataset filled": to be precise, grid cells for which no elevation data were available were interpolated. All other grid cell values with valid elevation data (not nodata) were preserved, together with the geometry of the raster grid. The impact of gap-filling should be identical for all tested methods: surface flow can not be routed through or accumulated across nodata cells and will therefore stop at nodata cells. Interpolating elevation values for nodata cells will allow surface flow accumulation methods to continue across these cells. Therefore we regarded gap filling as a necessary pre-processing step in order to achieve more realistic flow accumulation and stream network extraction independent of the method used.

6/10 "SRTM DEM was then resampled to 30m resolution": This was first of all done for reasons of comparability, to get a resolution "in the middle" between IFSARE and SRTM by decreasing the IFSARE resolution by a factor of 3 and increasing the SRTM resolution by a factor of 3. Benefits of increasing the grid resolution are visible on hillslopes, particularly when using some MFD accumulation method, and more pro-

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nounced valley bottoms for narrow and steep valleys (a characteristic of regularized spline tension).

7/13 and 9/10: Hopefully answered as response to General Comments 3. to 6.

9/12-14: We thought it helpful for the reader to provide some numbers. Even if it is no surprise that the location of stream networks improved with increasing DEM resolution, the actual improvement might be of interest in order to put the performance of the different methods into context.

9/15: See comment to anonymous referee #1, 6.a and the cited reference Watershed Concepts (2006)

10/3-4: We agree and the text will be revised accordingly

10/9-10: Increasing the resolution of the SRTM DEM did improve the location of stream networks, see 3.4

10/11-12 "smaller rivers in mountainous regions": small in this context means up to 30m wide. The errors of location accuracy were more similar in low-gradient floodplain areas than in terrain with some relief, see results 3.2. The effects and artifacts created by sink filling were more drastic in terrain with some relief, illustrated in Figure 6.

11/5-6: We agree and the text will be revised accordingly

11/2-14: We agree and the text will be revised accordingly

11/19: We agree and the text will be revised accordingly

11/27 "relatively flat landscape": to be replaced with "flood plain and coastal plain landscapes"

12/1-2: We agree and the text will be revised accordingly

12/6-7: Reference to be included

12/8-10: References on the potential of surface interpolation with RST to be included

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Table 2: It is unclear to us which figures are spurious. The positional accuracy for GPS points is given in 7/16, the positional accuracy of points digitized from Landsat imagery will be added in 2.3

Fig. 1: The intention of this figure is to show the study area and the distribution of reference points across the study area, not to show the exact location of reference points along streams. For this we would need to add another figure.

Fig. 2: We agree and the text will be revised accordingly

Fig. 6: This is the rule for terrain with some relief. The river course is an exemplary stream segment extracted from the sink-filled SRTM DEM at 30m. New figure legend: "Example for the impact of sink filling along a section of a river course extracted from SRTM 30m. Along this section...".

Fig. 7: We agree. The intention of this figure is to show stream network patterns typical for sink-filling, namely shifted confluences and straight lines. The second sentence is to be rephrased and moved to the beginning.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 3213, 2010.