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**Hydrology and Earth System Sciences Discussions**

# *Interactive comment on* "Deriving a global river network map at flexible resolutions from a fine-resolution flow direction map with explicit representation of topographical characteristics in sub-grid scale" *by* D. Yamazaki et al.

**Anonymous Referee #1**

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General comments

The paper proposes to represent drainage directions in global hydrological or river routing models not only by allowing drainage from one cell to one of the neighbouring eight cells but to allow drainage to any cell, which is innovative and interesting. It also presents an innovative method for implementing this idea, a method for automatically deriving such coarse-grid drainage directions from fine-grid flow direction maps. This method also results in supplementary data sets on river channel length, river channel



elevation and fine-grid catchment area of a coarse grid cell. Drainage direction data sets derived by this method have the potential to improve global water modelling. They would allow a more realistic representation of lateral drainage on the land surface, probably without making the programming of routing much more complicated, while an even more realistic catchment-based hydrological modelling appears to require, at the continental or global scale, a rather complex programming.

The presentation of the research, however, needs to be improved. First of all, the use of English should be improved by using a professional editor, as every few lines there is a problematic use of the English language. Second, the authors should include in their discussion of the literature not only methods for deriving river networks at the global scale but also discuss the broad literature on methods at smaller scales where algorithm different from D8 algorithms have already been proposed and applied.

Third, the authors should reference and discuss the global river network data sets of HydroSHEDS (http://hydrosheds.cr.usgs.gov/, http://www.worldwildlife.org/hydrosheds), as also here, a fine-resolution flow direction map (SRTM 3 arc-seconds) was automatically upscaled to a coarse-resolution flow direction map/river network at 5 min resolution. It would be good to compare maps that you produce with your algorithm to the 5 min HydroSHEDS map (the 5 min HydroSHEDS data can be obtained from Bernhard Lehner, McGill University). Fourth, the claim that the resolution of 15 min is the highest available has to be rewritten (see below).

Specific comments

1. I suggest changing the title, as it is difficult to understand (the "explicit representation" is supposed to refer to the derivation of the global river network map but might appear to be a characteristic of the flow direction map; "in sub-grid scale" is not correct).

2. Last sentence of abstract: It is not clear to me how inundated area extent could be

modelled better with your approach. Please explain in the text or delete.

3. p. 5025 line 2: reference for HYDRO1k missing (Lehner, Verdin, Jarvis: "New Global Hydrography Derived from Spaceborne Elevation Data". In: EOS, Vol 89, No. 10, 4 March 2008)

4. p. 5026 lines 24, 25: “B5“, not “B4”

5. Fig. 8: Explain in the text the reasons for the different patterns: 1) in general, 2) it seems as if in 8b and 8c, very small drainage areas of 1 km pixels are not represented.

6. p. 5030, line 10: it would be good to clarify that the drainage direction map of Döll and Lehner included manual corrections. Would it be possible to include a comparison to their 0.5° map with manual corrections in Figure 8?

7. Fig. 5: I suggest exchanging the left and right boxes such that like in Figs. 1 and 3, the fine-resolution presentation is at the right-hand side, and show the fine-res. presentation as a zoom in of the coarse-resolution presentation. Besides, in the fine-resolution presentation please indicate the coarse-grid boundaries, like in Figs. 1 and 3.

8. p. 5030, line 20, p. 5033 line 21: It is not correct to say that the resolution of global river network maps is limited to 30 min, and the resolution of 15 min is the highest among currently available river network maps for the use in global hydrological models. You yourself used Hydro1K and its modification GDBD, which is a global river network map at 1 km, and there is HydroSHEDS, which provides global river networks at 3 arc-sec, 15 arc-sec and 5 min. They all could be used by global hydrological models, and a resolution of 5 min is currently quite feasible at the global scale.

9. p. 5032, line 26 ff.: Please rephrase, the term pilot study does not seem to be correct. I understand that the FLOW approach somehow stands between the normal D8 grid cell approach and the catchment approach. Please explain how flow is related to the catchment approach.



10. Please write a few sentences to answer the following question: What changes in river routing models would be required to use river network maps derived with the FLOW approach?

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 5019, 2009.