Hydrol. Earth Syst. Sci. Discuss., 7, C3222–C3225, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C3222/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Large-scale runoff generation – parsimonious parameterisation using high-resolution topography" *by* L. Gong et al.

Anonymous Referee #2

Received and published: 27 October 2010

Overall evaluation

Minor revision

Major comments

This paper presents a novel approach to derive storage-capacity distribution from high-resolution topographic data, and describes issues and details on how to use the TRG algorithm within the existing large-scale hydrological model. I like the idea to construct storage-capacity distribution from the topographic-index distribution in a way to reflect the sub-grid scale variability of topography into the resulting storage-capacity distribution. This should be way better than using curve fitting or calibration techniques

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

to optimize model parameters that produce smaller error statistics normally based on streamflow observations and simulations – in this case, we don't know for sure whether or not we are getting physically meaningful storage-capacity distribution at least in the sense of reflecting sub-grid scale heterogeneities into it to a degree possible. The TRG algorithm is more parsimonious than the original VIC model, being less subject to the equifinality problem. The TRG algorithm and its hydrological application results followed by discussions presented in this paper can be useful to modelers working on developing large-scale hydrological models. This paper merits publication in this journal after minor revision based on specific comments and technical corrections given below.

Specific comments

1. Authors use the word "baseflow" at multiple places in the text. I suggest replacing it with "subsurface flow" wherever it improves clarity. For example, in lines 17-19 at page 6618, authors explain how they relaxed TOPMODEL assumption. In my understanding, TOPMODEL produces subsurface stormflow during the rainfall event which may not be equivalent to "baseflow" as used in the text.

2. At line 7 in page 6623, "excess rain falling on saturated area will generate fast runoff." I wonder if the VIC model using the TRG algorithm has a modeling component that produces subsurface stormflow through the seepage face of the saturated area. If not, authors may want to comment on this in the text.

3. In the last paragraph of section 5.3 (lines 9 to 22 at page 6630), authors explain nonlinearity of runoff generation as a function of different storage-capacity distributions. Theoretically, their explanation is correct. However, in my opinion, the size of saturated area will be generally smaller than say 30% of drainage area in the cases of both actual model simulations and reality. This means that the comparative interpretation of runoff generation mechanism using different storage-capacity distributions in Fig. 9 should be highly focused on the lower value range of storage capacity. Authors may

HESSD

7, C3222–C3225, 2010

consider producing another figure showing the time series of saturated area and runoff with which authors can explain the different consequences of using different storage-capacity distributions.

4. It is unclear to me but it looks like authors used satellite-based precipitation data for Willamette and Eel River basins (see section 3.2). Satellite-based precipitation data should be in very poor quality and also corrupted with a big bias causing large systematic over- or under-estimation compared to the gauge rainfall. If so, the model simulation results may be just reflecting rainfall uncertainty, and calibrated model parameters are largely biased to compensate the error and bias present in the precipitation data. Authors may want to comment on this in the text. Also suggested is the inclusion of long-term annual precipitation, runoff and potential evaporation for all three basins.

5. In section 4.3 and Fig. 7, if I understood correctly, authors did not carry out any validation tests. Calibration results shown in Fig. 7 and description in section 4.3 are not sufficient enough to prove the good performance of the TRG algorithm. To discuss the actual performance of the TRG algorithm vs that of the VIC algorithm, authors may consider implementing validation tests and present validation results followed by discussions in the text.

Technical corrections

1. line 17 page 6614: TGR -> TRG 2. line 8 page 6615: challenge -> problem 3. line 16 page 6615: Semi-distributed models -> because this paper borrows ideas from the TOPMODEL, I am not sure if authors meant “distribution function models”, not “Semi-distributed models.” 4. line 10 page 6620: Eq. (4) -> Eq. (3) 5. In Eq. (6), Dmax -> Dmax* 6. In Eqs. (8) and (9): explain all symbols used in these equations in the sentence right below these equations. 7. line 4 page6623: a a -> a 8. In Table 1: explain all symbols in the caption. 9. In Fig. 1: explain all symbols in the caption. 10. line 2-3 page 6616 & reference: Manabe’s (1969), but in the reference 1965. 11. line 2 page 6625: Hughes and Gammon, 1987 is missing in the reference. 12. line 3 page

HESSD

7, C3222–C3225, 2010

6625: Parsons et al., 1970 is missing in the reference 13. line 4 page 6626: Beven and Binley, 1992 is missing in the reference 14. lines 20-21 page 6635: “Srinivasan, R. and Engel, B.: Effect of slope prediction methods on slope and erosion estimates, Appl. Eng. Agric., 7, 779–783, 1991.” -> this reference was not cited in the text.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 6613, 2010.