Hydrol. Earth Syst. Sci. Discuss., 7, C1913–C1916, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C1913/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Effect of DEM resolution on SWAT outputs of runoff, sediment and nutrients" *by* S. Lin et al.

Anonymous Referee #3

Received and published: 20 August 2010

General:

The paper investigates the influence of different cell size on the output of the SWAT model on a forested watershed in China for three different datasets. It concludes that all three different elevation datasets are delivering similar results within an error range of 10%.

Detailed criticism:

1)My major concern for this paper is the use of an uncalibrated model for the different model runs across different resolutions. First, in general no results with respect to the single runs is shown. How well is the runoff matched with existing observations of flow,

how well is the TN matched with measured nitrogen. This has to be shown at least somehow, otherwise we see here only a running a model exercise with one different model parameter.

2)As SWAT is not calibrated and run with its defaults values, it might not be that the default parameters are valid for the given spatial and temporal domain.

3)This is especially important as the curve number for the slope parameter might need to be adjusted with respect to the different resolution used in the paper. The authors identified correctly the change of the slope with respect to the resolution; however this already has been know. The results of the authors are a mixture of effects of DEM resolution as well as the parameters of the uncalibrated model reaction to that, thereby given way to a non linear behavior. In the reviewers opinion, one feasible approach to tackle that problem would be to calibrate the model on data from the first two years using an objective procedure (e.g. use PEST for non linear parameter estimation) for each single resolution; run the model with the calibrated parameter set on all three years and compare the third year results with respect to again the base line run (which also needs to be calibrated). Thereby the interaction effects can be minimized and a 'cleaner' DEM resolution effect be observed.

4)The reviewer ask himself against which parameters and how the model has been calibrated -> Nash-Suthcliff, correlation, discharge measured, TN measured ? If not calibrated at all, this would really be a show stopper as said in Q1.

5)As the watershed contains 96% of forest, the reviewer explicit ask for the validity of the TP results made in the paper. Phosphorus is mainly taken away by plants as well as erosion; erosion in a forest area is almost negligible, and compute by (extended)USLE, so to get that correct is rather questionable. This is valid as well for Fig4c+d.

6)My second major concern is the use/creation of the DEM in general.

6.1.Input DEMs: Starting with the DLG, the question remain how the TIN has been

produced, which software and which parameters have been used in the generation of the TIN (What is the horizontal and vertical accuracy of the contour lines ?).

6.2.Input DEMs: GDEM is know to have severe artifacts (sinks and artifical mountains) due to the DEM merging process (I would assume that the figure1 e and f have been swapped and that we see some serious artifacts in the hill shade). How have artifacts been treated ? Sink filling, breaching ? The effective resolution of the DEM is in the range of 90-120m due to the missing ortho rectification of the single scenes (see Literature). How does that influence the results ? BTW, the GDEM dems have been created from the Band 3N and Band 3B!!! (see Reuter et al, 2009, A FIRST ASSESSMENT OF ASTER GDEM TILES FOR ABSOLUTE ACCURACY, RELATIVE ACCURACY AND TERRAIN PARAMETERS, IEEE IGARSS 2009, Cape Town)

6.3.Interpolation routines: As data from the CSI and NASA server are in geographic projection, the reviewer wonders how the interpolation has been performed specifically for the SRTM 90m resolution results. Results in Figure 4c+d are showing quite some outliers from the almost linear decrease with resolution with see for SRTM/DLG/GDEM. Related to that is the question what the effective scale from your terrain is ? At which frequency do you observe the river/ridge network. This might also help to explain why we see the strongly varying results in Fig 3b. A possible assumption is that the specific frequency is around 30 (small scale) or 80-90m as the RE minimizes there. However, the strongly varying results for GDEM are a complete puzzle.

6.4.Interpolation routines: The question remains open how and by using which software the different meshes have been generated. What was the reason to choose these specific series ?

6.5.Interpolation routines: The reviewer wonders what the information content of a 5m DEM out of a 90m DEM is ? Can you please comment on that. If the authors would have used some downscaling procedure using auxiliary data (streamnetwork, satellite data), they might have observed a bit different results. (see Hengl et al, 2008)

7)With respect to the results reported in Table 1, why is the variance of RE of the field slope length always zero. This can not be, if the other parameter change as they do. Reach slope of GDEM is also interesting as this is the only parameter and the only time where the range of the RE is larger than the usually twice as high DLG5 RE range. Is that an indicator for the artifacts in the GDEM ? The variance as a parameter does not really tell a lot as it might change with the Mean of the parameter, is there another parameter like Standard error more useful in reporting the change of SWAT output with respect to dem resolution.

Smaller detailed points to be fixed.

Fig4 , a+b The reviewer suggests that you change/break the Y-scale so some results can be visualized. For the current display, nothing is to be seen (ntbs) there. Fig3 c+d (ntbs). Fig2 a+c. (d as well)

P4422L25 IMHO, SWAT2005 does adjust for CN, you have to specify it before inputing the management file.

Table 1, column 5 can be removed as it only contains ZEROS.

Table 1, rename Remax-min to Var(Re) or Range

Rework all figure and table titles, so they are understandable from the figure text alone.

Fig1 title replace 'shaped terrain' with 'hillshade'

Fig1 e+f swapped figures ?

P4415L22 rename ASTER30m in ASTER 1 arc second, SRTM90m into SRTM 3 arc second. There is no Version 4 of SRTM, the latest released version from NASA is version 2, CIATs version numbering for the release is V4.1 to be correct !!!

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 4411, 2010.