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Geoscientific Model Development Discussions

Interactive comment on "r.sim.terrain: a dynamic landscape evolution model" *by* Brendan Alexander Harmon et al.

Anonymous Referee #2

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This paper describes a new landscape evolution model, r.sim.terrain, that runs in the GRASS GIS environment. The authors claim that this model simulates the dynamics of landscape evolution, and particularly gully formation, using any of three different models of overland flow and sediment detachment/transport/deposition. This is a potentially useful simulation model because of its high resolution, potential to simulate erosion/deposition in several different ways, potential to simulate short-term but significant landscape events like gullying, and operation within a widely used, open source GIS environment.

Unfortunately, it is difficult to evaluate the performance of the model for a number of reasons. The text has detailed descriptions of the underlying theory behind many components of the overall simulation model (section 2) but does not indicate how these

relate to one another. While there are many colorful figures of landscape evolution results, there is no representation of the model itself (e.g., UML or other flow-chart-like visualization)–nor is there much in the way of narrative description of how the model actually works to combine the described elements.

Section 3.2 describes several experimental runs with the simulation model. These experiments are summarized in Table 3. However, we have no quantitative information about the results of the experiments. There is no information about whether each experiment was run only once or repeated–or whether repetition is needed or not because each parameter setting produces or does not produce only one outcome. Although the simulation is situated in a realistic setting based on digital data from Ft. Bragg, NC, the rationale for some of the parameterizations are not given, particularly the important rainfall settings. These might be completely reasonable, but the authors should indicate if these are based on empirical rainfall data or have another basis (e.g., extreme values to test the model sensitivity).

The authors have collected detailed, time series, LiDAR and orthophoto data from the test area represented in the simulation. But they make no attempt to compare the simulation experiments with these data in any quantitative sense. Rather they give only brief, subjective assessments of model behavior. It would seem rather easy to compare the model with the empirical data to see which experiments are better or worse fits and in what ways.

Finally, I downloaded and installed r.sim.terrain into GRASS and tried to run it. I strongly commend the authors for making the model code and test data available. This is critically important for research based on modeling like this paper.

I installed r.sim.terrain into the most current version of GRASS according to the directions in the manuscript (i.e., using g.extension). Unfortunately I ran into several problems that made testing the the model impossible. First, there is a link to the test dataset in the model online help, but this link does not work. Using information in the

paper, I was able to go to the GitHub site and poke around until I found the test data set and installed it into my GRASS data directory. I then followed the steps in the tutorial to simply see how it ran–thinking to compare the different overland flow and erosion/deposition methods, and time series vs. event. The command given to test the model failed initially because it was missing the rather critical "elevation" argument. So I added that. Then it started but rapidly bombed with errors related to the time series part. I copy these below. So I never did get it to run.

In sum, I think this can be a valuable simulation environment and contribution to the GRASS GIS geospatial modeling toolset. However, the authors need to do a better job of explaining how the model works and not just the conceptual components included in the model. They also need to provide more information about the four experiments performed and their parameter settings. They need to provide some quantitative evaluation of the model results, including comparison with the empirical data they have collected. Finally, they need to fix some probably minor but annoying bugs in the code available for evaluation. I simply can't give a recommendation to publish a paper about code that does not run.

==== command and errors below =====

r.sim.terrain -f runs=event mode=simwe_mode rain_intensity=50.0 rain_interval=120 rain_duration=10 walkers=1000000 detachment_value=0.01 transport_value=0.0001 manning=mannings runoff=runoff elevation=fortbragg_elevation_10m_2012@PERMANENT

100%

100%

100%

100%

100%

100%

100%

WARNING: Overwriting space time raster dataset <elevation_timeseries> and unregistering all maps

WARNING: Overwriting space time raster dataset <depth_timeseries> and unregistering all maps

WARNING: Overwriting space time raster dataset <erdep_timeseries> and unregistering all maps

WARNING: Overwriting space time raster dataset <flux_timeseries> and unregistering all maps

WARNING: Overwriting space time raster dataset <difference_timeseries> and unregistering all maps

Gathering map information...

ERROR: Unable to insert dataset <fortbragg_elevation_10m_2012@PERMANENT> of

type raster in the temporal database. The mapset of the dataset does not match the current mapset

Traceback (most recent call last):

File "/Users/cmbarton/Library/GRASS/7.7/Modules/scripts/r.sim.terrain", line 2698, in <module> main()

File "/Users/cmbarton/Library/GRASS/7.7/Modules/scripts/r.sim.terrain", line 607, in main elevation = dynamics.rainfall_event()

File "/Users/cmbarton/Library/GRASS/7.7/Modules/scripts/r.sim.terrain", line 1903, in rainfall_event overwrite=True)

File "/Applications/GRASS-7.7.app/Contents/Resources/etc/python/grass/script/core.py", line 440, in run_command return handle_errors(returncode, returncode, args, kwargs)

File "/Applications/GRASS-7.7.app/Contents/Resources/etc/python/grass/script/core.py", line 342, in handle_errors returncode=returncode)

grass.exceptions.CalledModuleError: Module run None t.register –o -i maps=fortbragg_elevation_10m_2012@PERMANENT type=raster input=elevation_timeseries increment=120 minutes start=2000-01-01 00:00:0

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