SHORT INSTRUCTION FOR THE USE OF THE LANDSCAPE EVOLUTION MODEL EROS

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This document describes the necessary steps to setup, prepare and run the Eros model and visualize its outputs from within Matlab. The interface is composed of 9 m-files, of which only `eros_template.m` is intended to be modified by the user. The functions `erosinfo.m` and `erosanimation.m` are used to display results and `frames2gif.m` creates a movie that can be played independent of the Operating System. All other m-files work in the background. For a detailed description of the model itself consult Davy et al. (2000; 2009; 2017).

Test platforms:

- Win 10 64-bit, AMD Ryzen 7 2700X Eight-Core Processor 3.70 GHz, Matlab R2017a

- Win 10 64-bit, Intel Core i7-3770 Quad-Core Processor 3.70 GHz, Matlab R2019b

1 Setting up Eros and running the example experiment

1. Download program and extract files

2. Add files in the mfiles-folder to the Matlab path

3. Open `eros_template.m` , scroll to line ~53 and change directory to where the bin-folder resides

4. Change directory to `ProjectFolder` and run `eros_template.m` . This executes the example experiment of a flat, inclined slope (~5 minutes computation time on Ryzen 7, ~10 min on i7)

5. Change directory to the folder where the results were written to e.g.,
   `Results\inflow(10).initial_sediment_stock(0.1).sediment_threshold(4)`

6. Use `erosinfo.m` to show some variables written during model execution, e.g.:

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- `doc erosinfo;` shows a list of variable options
- `B = erosinfo(topo);` plots the average elevation as a function of time
- `B = erosinfo(all);` shows all relevant data in 3-by-3 subplots.

7. With `erosanimation.m` you may:

- `B = erosanimation(water);` show a 2d-animation of water flow and store the frames in `B`,
- `B = erosanimation('sediment','mode','average');` show mean sediment thickness evolution,
- `B = erosanimation(topo,mode,movie3);` show a 3d-animation of topographic evolution.

8. The function `frames2gif.m`:

- `frames2gif(B,filename.gif,0.1);` saves an animated gif from frames in `B` created with `erosanimation.m` with a delay between frames of 0.1 seconds.

9. To access an individual output file type:

- `F = grd2GRIDobj(filename_with_extension);`

2   Prepare inputs for real topography and run model

1. With the function `eros_template.m` you can define:

- the topography (.alt),
- the source/sink grid (.rain),
- the sediment thickness distribution (.sed),
- the water discharge on the topography (.hum),
- a map of erodibilities (.erode),
- and a map of Manning coefficients (.manning).

Note that only the first two inputs are required and the others are optional. All grids need to have the same number of rows and columns. Further, `eros_template.m` lets you:

2. change model parameters, output directory/name and the variables to write,

3. write argument files for Eros.exe and

4. start execution of Eros from within Matlab.

References

Davy, P., Crave, A., & Beaulieu, D. (2000). Upscaling Local-Scale Transport Processes in Large-Scale Relief Dynamics. *Phys. Chem. Earth*, 25(6), 533-541.

Davy, P., & Lague, D. (2009). Fluvial erosion/ transport equation of landscape evolution models revisited. *Journal of Geophysical Research*, 114, 1-16.

Davy, P., Croissant, T., & Lague, D. (2017). A precipiton method to calculate river hydro-dynamics, with applications to flood prediction, landscape evolution models,and braiding instabilities. *Journal of Geophysical Research: Earth Surface*, 122, 1491-1512.