INORTH CAROLINA STATE UNIVERSITY





We are developing a module where museum visitors investigate geomorphic and land-use scenarios through a landscape evolution model. Visitors use touchscreen computers to select simplified inputs for the CHILD model. These scenarios provide relatable experiences to visitors, an opportunity to educate them upon the science behind the scenarios, and the purpose and limitations of models. We will first develop the framework of the module to be able to accept scenarios and its inputs, including digital elevation models, such that others can contribute scenarios. This module is early in its conception, thus we will present our initial framework with the intent to elicit feedback from the community.

Intended audiences

The public: Science musuems with interac-

tive, inquiry-based exhibits are becoming more common, such as the Visual World Investigation lab shown to the right.



Students in introductory courses: Science labs can use the program to investigate a topic and how models can be integrated with the scientific method. Computer models that

facilitate student investigations can improve learning in undergraduate geoscience labs (figure to the right; Lyons et al., 2012).



Program contribution

Interfaces for landscape evolution models are designed for non-experts as education tools commonly using scenario-based exercises, such as the Web-based Interactive Landform Simulation Model (WILSIM, 2013). Currently, a program that incorporates real landscapes does not exist. Our interface, "Earth Surface Modeler" presents investigations conducted by researchers upon real landscapes represented in the model. Our experiences working with the public and undergaduate students has lead us to believe that this authenticity will heighten interest in the geosciences and models. The Channel-Hillslope Integrated Landscape (CHILD) model includes many parameters from which scenarios related to recent geoscience research can be created (Tucker *et al.*, 2001).



Users select the scenario that interests them from a menu. Sceneraios are included with the program and created by educators.

Text that exaplains the scenario, how it can be investigated with the model, and how results can be evaluated.

After the model is completed, a time-series animation is played. In this scenario, each animation frame will display the topography every 10 years that resulted from the user's inputs.

Landscape Evolution Models as a Public Education Tool

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Interface of "Earth Surface Modeler"

Scenarios present simplified, well-defined Earth surface topics. Interface elements adjust to meet the needs of scenarios. Touch and mouse inputs are accepted.





Rainfall in Raleigh

Scenario introduction

Star and

The Neuse River ir North Carolina is among the top-ten nost-endangered U.S. river systems ichland Creek in Raleigh (a tributary of the Neuse River) is highly impaired. shown in the map to the right.

Vhat is causing impairment of The causes of river impairment in

other rivers have been attributed (1) The effects of urbanization². Buildings and road pavement de-

- creases the water that can infiltrate into the ground. More water flows into streams, which increases incision. (2) Sediment originating from historic millponds may be an addi
- tional, often unrecognized source³. : Simulate strea incision above the potenti dam location shown in the
- map to the right. Can you produce a stream profile that is similar to the present-day stream profile Do your results indicate that one of the hypotheses appear more likely?



-) Select variable values that may produce a stream profile similar to the observed profile. (2) Run the model by pressing the "Begin the trial" button.
- (3) Adjust the variable values until the modeled profile is similar to the observed profile.
- American Rivers, 2007. http://www.americanrivers.org. Jacobson RB, Coleman DJ, 1986. Stratigraphy and recent evolution of Mar iedmont flood plains. American Journal of Science 286: 617-63 Walter RC, Merritts DJ, 2008. Natural Streams and the Legacy of Water owered Mills: Science 319: 299–304



1 New scenarios can be created by educators using this window with knowledge of variable meaning and basic geomorphology.



2 Sliders limit variable values to a range that is relevant to the scenario. Pressing the blue button provides information about the variable. Model processing begins once the "Begin the trial" button is pressed.

> Model output graphs or statistics. In this scenario, this panel provides users an evaluation of thier trial.

Raleigh, NC, USA,





Upcoming Work

This program will be designed with the following characteristics to maximize its contribution:

Approachable: The python programming language is used due to its relatively simple syntax.

Expandable: Educators can devise a scenario by indicating a description, the variables users can adjust, and the range in which users can adjust variables.

Open source: The interface code will be freely available to download and modify.

Portable: Model executables will be packaged with interface files so that the program can be easily distributed.

Questions to be addressed:

How can we best simplify scenarios and models for our audiences' understanding while maintaing scientific accuracy?

What other audiences may be interested in this program? Online courses?

What models other than the CHILD model are well-suited for this program?

Program development:

Compile CHILD model MATLAB files for integration with the Earth Surface Modeler interface.

Complete Interface.

Develop scenarios.

Test the product with musuem visitors at the Visual World Investigation lab.

References

Lyons N.J., Ryker K., McConnell D., 2012. Realtime assessment of student progress in the lab: The isostasy model example. GSA National Meeting, November 4-7, 2012, Charlotte, NC.

WILSIM, 2013. Web-based Interactive Landform Simulation Model (WILSIM). www.niu.edu/landform. Accessed 3/12/2013.

Tucker, G.E., Lancaster, S.T., Gasparini, N.M., and Bras, R.L., 2001. The Channel-Hillslope Integrated Landscape Development (CHILD) Model, in Landscape Erosion and Evolution Modeling, edited by R.S. Harmon and W.W. Doe III, Kluwer Academic/Plenum Publishers, pp. 349-388.