AUGMENTED REALİTY SANDBOX (AR SANDBOX) EXPERİMENTAL LANDSCAPE FOR FLUVİAL, DELTAİC AND VOLCANO MORPHOLOGY AND TOPOGRAPHY MODELS

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ABSTRACT

The AR Sandbox is used for making interactive topography models and water by sand. The adjusted lower and bottom levels of the sandbox represents a basin shaped interactively in real time by an elevation color map, topographic contour lines, and simulated water. Water can fill the basin and depth controlled by user interaction which made base level of sand.

The system provides an analogue morphology and environmental model of various types of fluvial, delta and volcano morphology which explains geological concepts such as topography map, water flow, topography and geomorphology. It can shaped either as deltaic morphology (eq. distributary channel, incised valley, fluvial point bar, longitudinal & side bar, braided channel, braided stream, meandering, straight channel) or as volcano morphology, which has a creater, flank, debris apron, tephra blanket and lava field with types of volcanoes soma volcano, caldera, complex volcano, strato-volcano, shield volcano, and pyroclastic model.

The aim of AR Sandbox experimental landscape is to make and change a real-time morphology and topography models and combined augmented reality system to physically create topography. Computer created in real time and used as background for selection of graphics effects and simulations.

Key words : Ar Sandbox, Geomorphology, Fluvial, Delta, Vulcano, Topography

1. Introduction

The universities all around world give attention to the geological modelling and simulations in recent years. Various geomorphological successions such as volcano, fluvial settings have adequately demonstrated analogues give ability to help interpretation of hydrocarbon or land management. The sandbox modeling tools help to understand the morphology that contribute to understand geomorphology and topographic cases with complexity problems. This study attempts to introduce a new experimental method in order to examine fluvial and volcano morphology response to the interactively changing topography. In addition, this method produces topographic and geomorphological features that serve as an analog to better understand surfaces and dimensions and help to assist geomorphology interpretation. Blueprints and software to construct sandbox are released for free and available online (http://idav.ucdavis.edu/~okreylos/) under the GNU General Public License. The software blend of several GLSL shaders to coloring by elevation using customizable color maps and real-time topographic contour lines.

2. Approch

For the simulations we use free softwares released by UC Davis and homemade sandbox equipment including sandbox, 3D camera, projector and computer (Figure 1). The AR Sandbox requires either Linux (preferably Ubuntu or Mint) or OSX® operating system with an average current computer hardware components such as Intel Core i5 CPU, 4 GB of RAM and enough space for OS installation. The display driver has a crucial role in the system and Nvidia video cards can be preferred for their compatible drivers for Linux OS distributions. The software is currently released by UC Davis (USA) (by Dr. Oliver Kreylos) as freeware and includes three components. The Kinect driver package, Vriu and SARndbox softwares. The dimensions of the sandbox is 100x0.75x10cm (LxWxH) (Figure 1). Materials used are mainly composed of mixed fine-grained (quartz, muscovite, plagioclase) sands to a depth of around 10cm. the total weight of the sand is about 200kg.

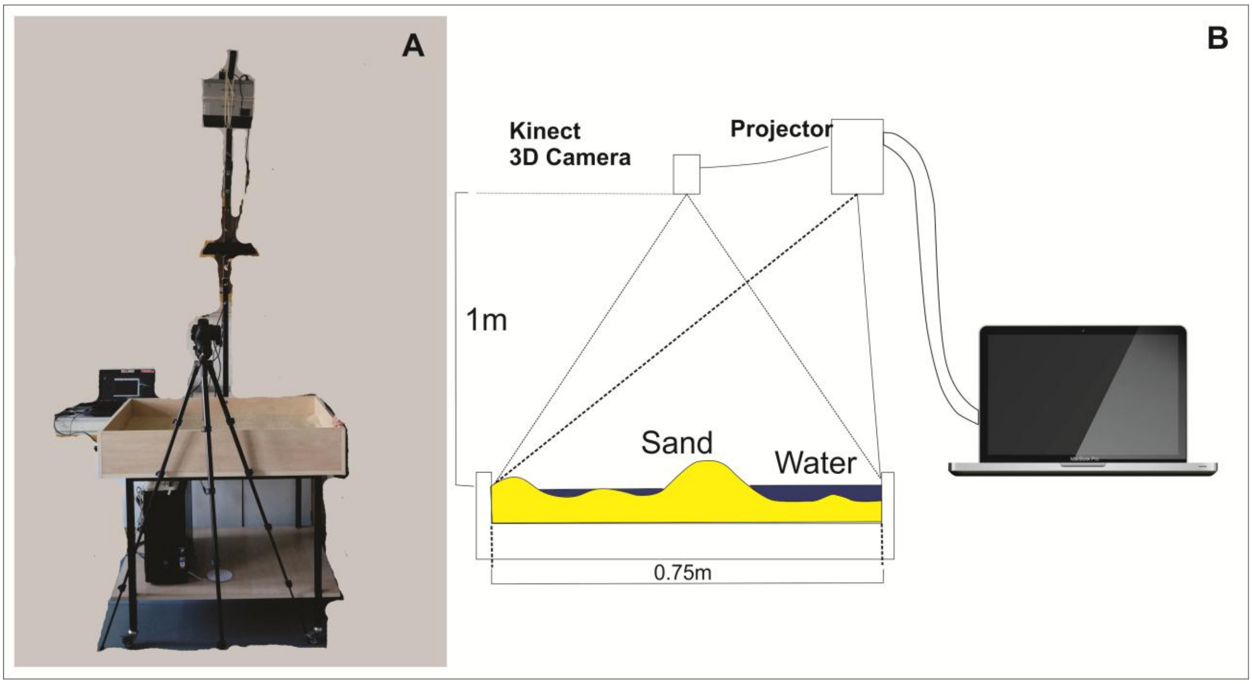

Figure 1. The AR sandbox equipment

3. AR Sandbox for Fluvial Experimental Landscape

Teaching and learning alluvial, fluvial and volcano settings, which occur over large spatial scale, in earth science is better with the visualization of processes. Model and hands-on augmented reality sandbox help geology student to interactively create topographic models by shaping real “kinetic” sand. Software of AR sandbox make a real time by the projection of a color elevation map and contour lines which precisely match sand topography that working a closed loop of a Microsoft Kinect 3D camera® and data projector. Other objects (such as a hand or other) is detected at a specific elevation above sand to make virtual rain looks as a blue color on the surface and a flood simulation (based on Navier-Stokes equations), where water follows across the landscape (Reed et al. 2014). AR Sandbox experiment has been successfully applied to several fluvial deltaic morphology analogues (eq. distributary channel, incised valley, fluvial point bar, longitudinal & side bar, braided channel, braided strem, meandering, straight channel) as shown in (Figure 2) and (Figure3). It process of modeling run in ± 3 hours with taken photo and timelaps video. The model experiment demonstrate morphology and topography dominantly controlled by slope and response of base-level changes.

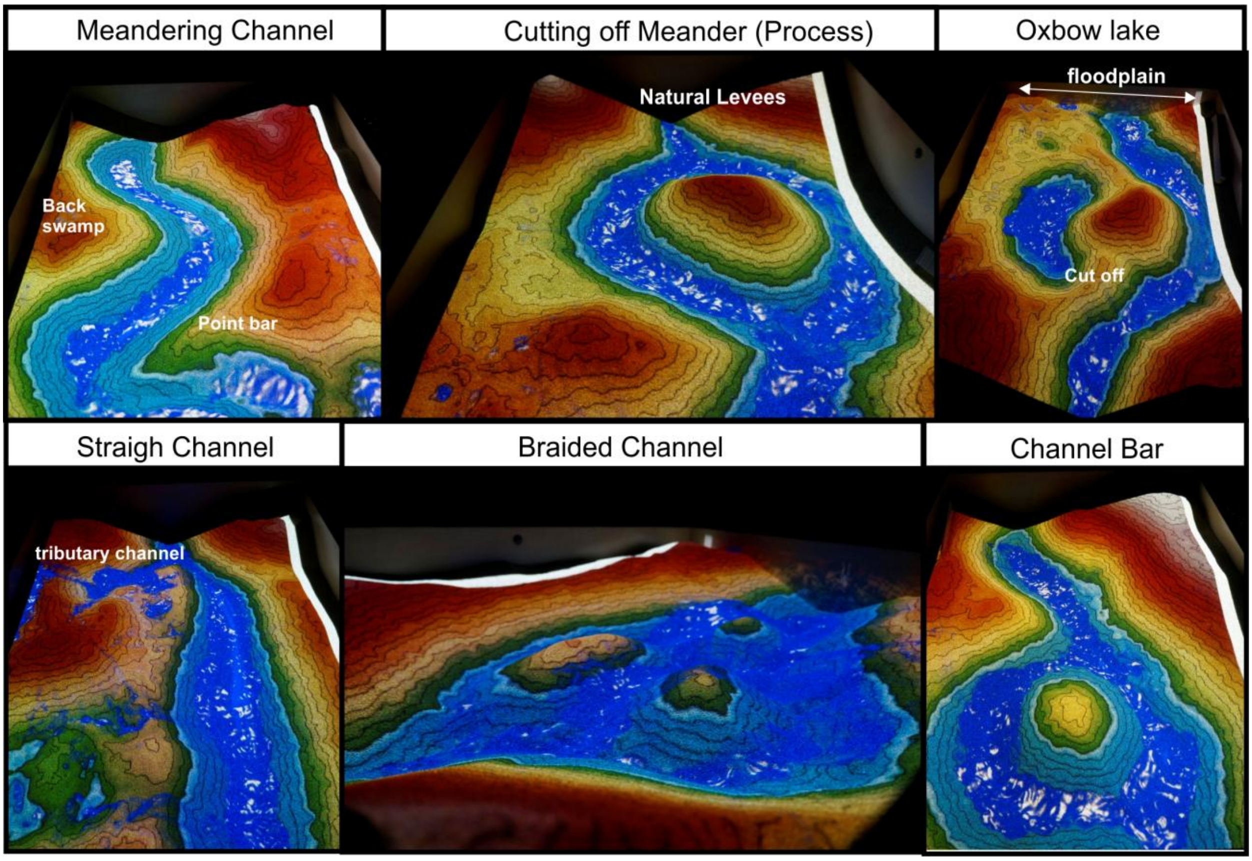

Figure 2. Different landscape modeling of the fluvial setting by AR sandbox.

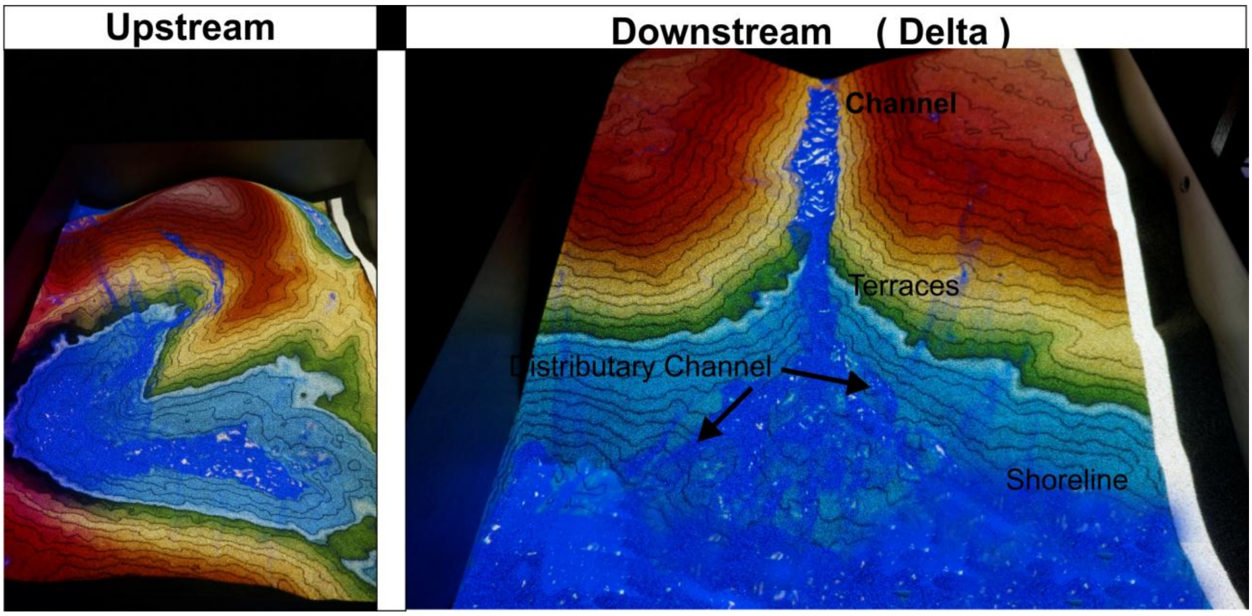

Figure 3. The upstream and downstream modeling of the fluvial setting by AR sandbox.

4. AR Sandbox for Volcano Experimental Landscape

The volcano morphology was created by hand (eq.creater, flank, debris apron, tepra blanket and lava field,) as shown in (Figure 4) and (Figure 5). Types of volcanoes (Simkin and Siebert, 1994) has created and compared with analogue models (eq. Soma volcano, caldera, complex volcano, strato volcano, shield volcano, and pyroclastic model). It process of modeling ran in ± 3 hours with taken photo and timelap video. The model experiment demonstrates morphology and topography dominantly controlled by volcano activity, slope and topographic change (Figure 4, 5).

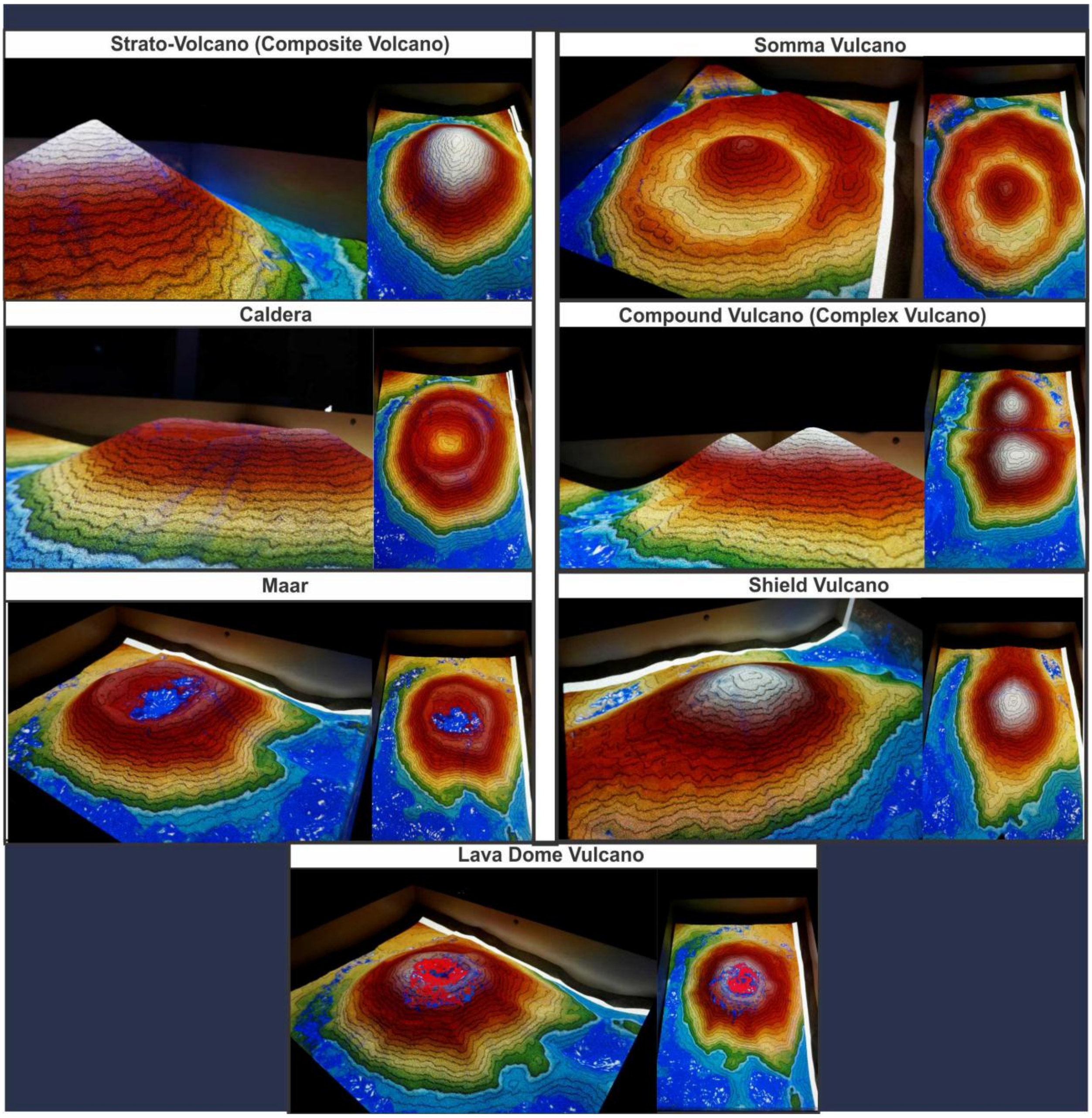

Figure 4. Different volcano settings modeled in AR sandbox.

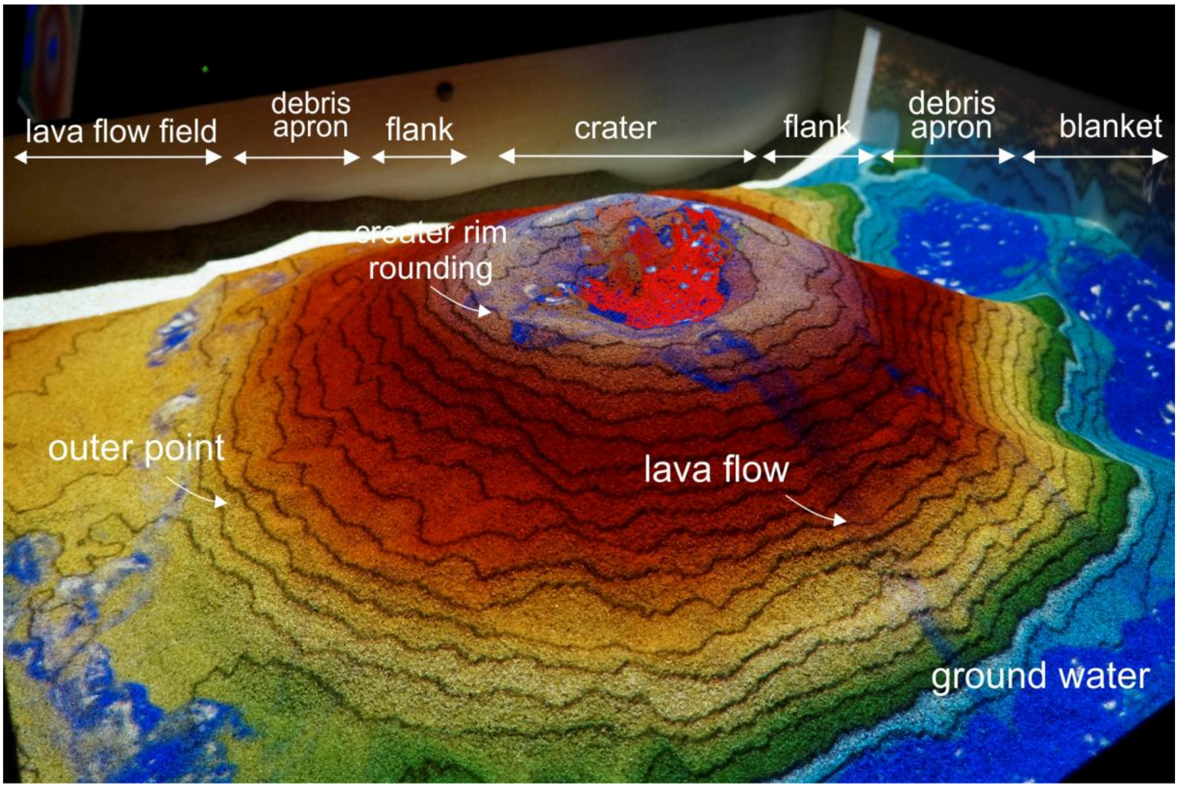

Figure 5. The geomorphological modeling of a volcano setting by AR sandbox.

5. Conclusions

By using the AR sandbox, we easily model the different fluvial and volcano settings, which affects the understanding of these setting in earth science concepts such as geomorphology and topography. The AR sandbox modeling helps to show and observe the steady or changing geological settings for the users and yields good comprehension and imagination of user to build a model which a cheap, fast and efficient tools to explain and understand complex fluvial and volcano systems.

6. Acknowledgments

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7. References

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