Monthly Progress Report

Project: Improving visual quality of synthetic terrains using weathering simulation

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Last month, I could translate erosion code to GPU code. However, it did not produce expected results. The reasons are due to reported problems: packing data and PIX debugging tool.

This month, I have been able to solve these problems and write GPU code which produced reasonable eroded terrains. In the later part, I will show some examples. The followings are solutions to the above problems:

- Packing data: in previous method, I used D3DFMT_A16B16G16R16 data format to pack all data in a pixel including height values, sediment, fluid amounts and velocity fields. However, this 64 bits are really not enough to produce accurate values which made the erosion look not nice. I could have switched to D3DFMT_A16B16G16R16F floating point or D3DFMT_A32B32G32R32F IEEE data format but they were not enough too. Luckily we could use Multi Render Target to return up to four textures from the Pixel Shader. Therefore, currently I am using 2 textures as an output and as an input to the pixel shader:

  Material: (Texture 1)

Height	Fluid	Sediment	Precomputation values

  Velocity: (Texture 2)

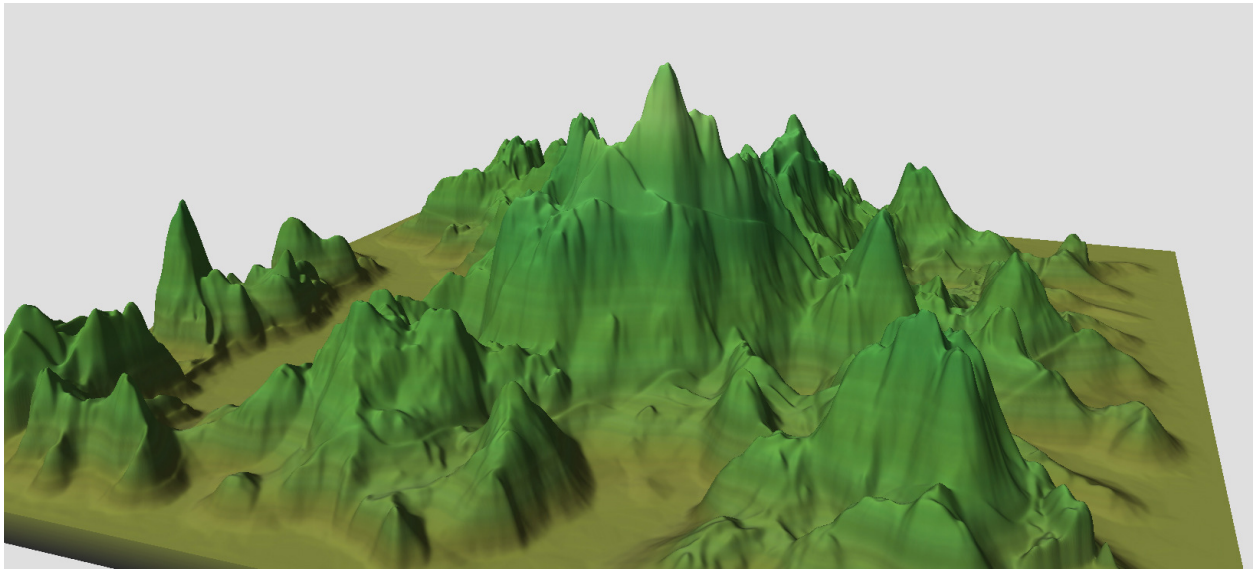
Velocity.x	Velocity.y	Velocity.z	Precomputation values

  I am trying to save the data under D3DFMT_A16B16G16R16F floating point format as it requires less memory although D3DFMT_A32B32G32R32F gives more accurate values.

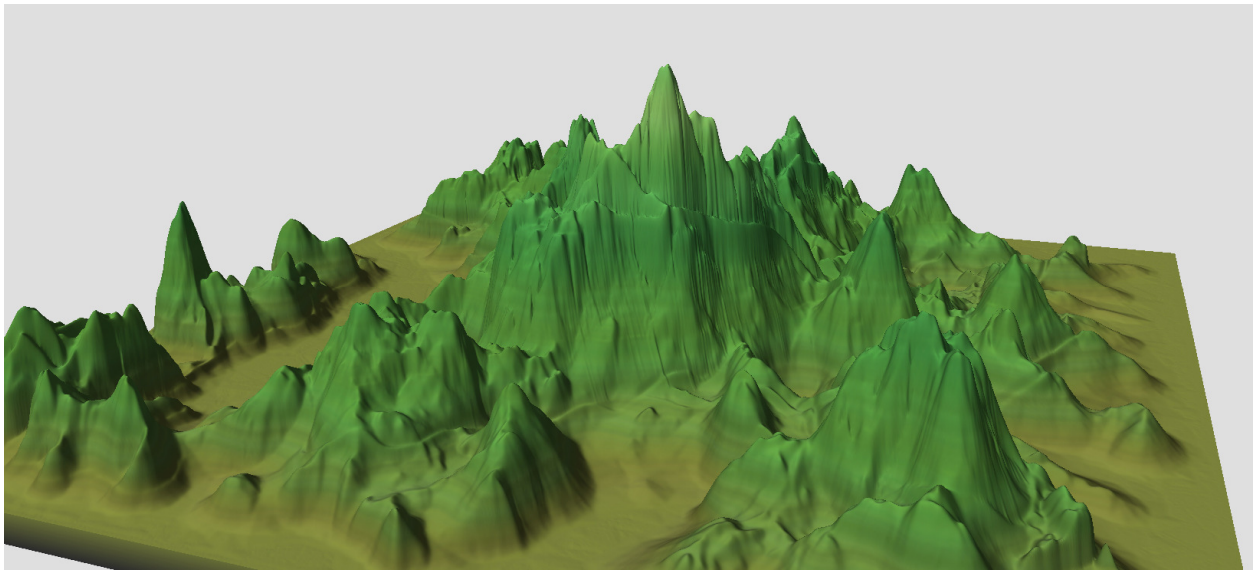
- Using PIX: PIX is an uneasy tool to debug GPU program. I was not able to use PIX to debug my HLSL program as it kept crashing due to complex HLSL code. The only way I can debug is to rewrite the reverse erosion algorithm in C++ and after make sure that this reverse erosion algorithm work well; I can port to GPU code.

Up to now, the GPU takes around 16 seconds to erode 1024x1024 terrains while World Machine takes more than 20 seconds. I am trying to tune the parameters so that it can run on 2048x2048 terrains and produce better results.

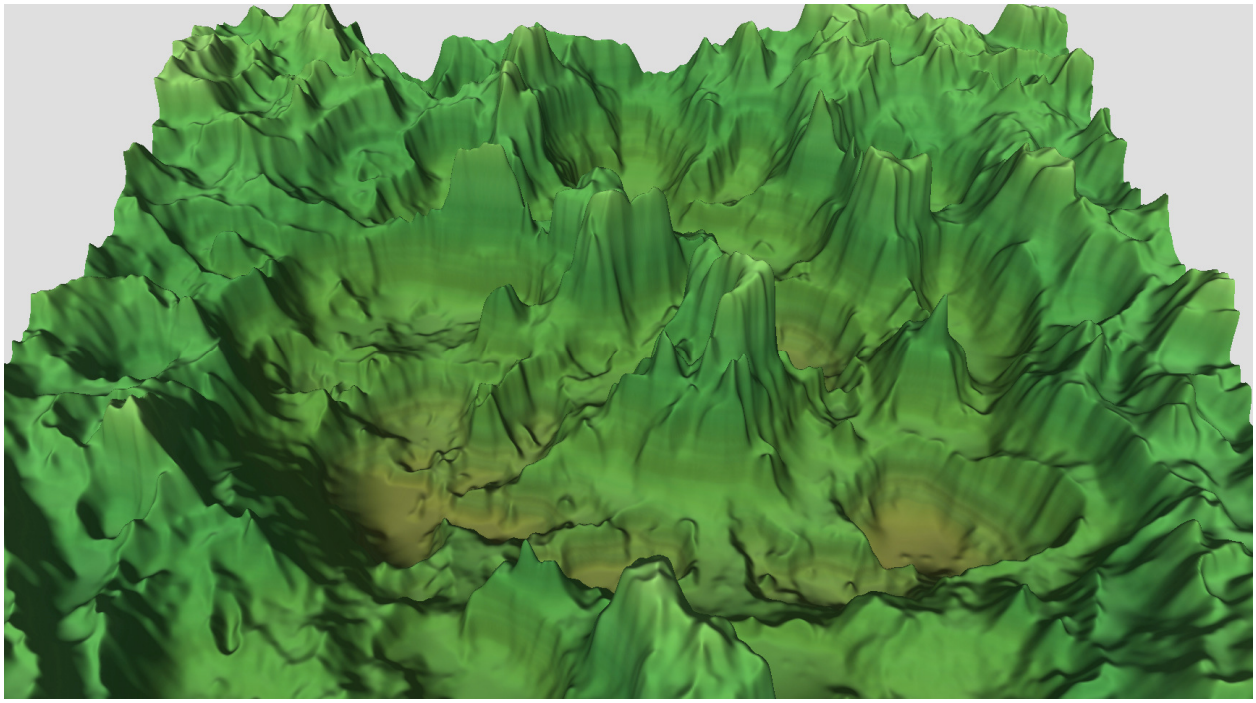
Followings are two eroded terrains which were run by GPU code:



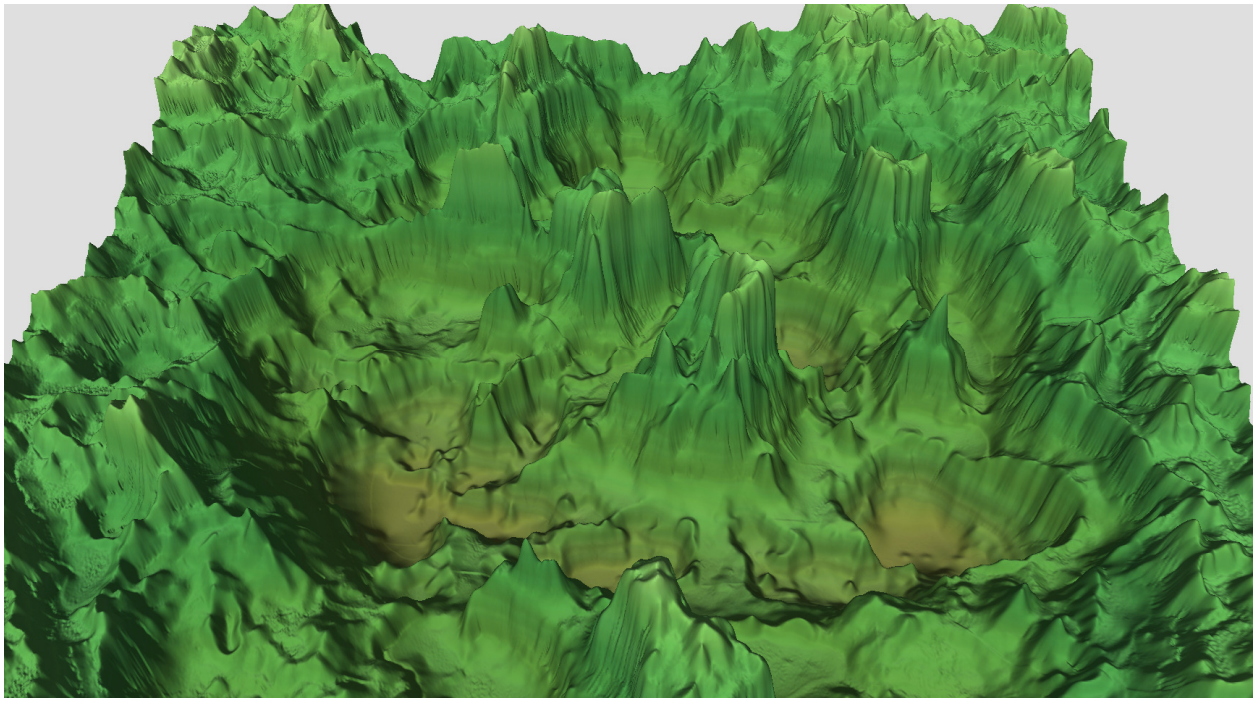
Original Mexico Terrain



Eroded Mexico Terrain



Original Sedona Terrain



Eroded Sedona Terrain