Computer Graphics

Project Report

Group members :

Mikael Morales Gonzalez	234747
Charles Parzy Turlat	250628
Volodymyr Loyko	271690

Final Report

1) List of features

- Improved noise function
  We implemented two others noise functions, hybrid and ridged multi-fractals. We finally decided to use ridged multi-fractals since it gives us a more realistic result.

- Improved terrain normals
  Seeing that the result given by dFdx() and dFdy() wasn't providing an accurate result. We used finite differences by comparing the elevation of each neighboring pixels in the height map.

- Smooth textures transition
  Initially, transitions were abrupt. To improve it, we are calculating a gradient between each neighboring textures.

- Water terrain
  We decided to add a water terrain at a fixed height and whenever it goes below the actual height map, we added transparency to provide a more realistic result and avoid having water below a mountain.

- Waves
  The displacement of the vertices in the water mesh are determined using a gerstner wave function, where the direction and the wavenumber of each wave in the function is calculated using a simplex noise function.

- Water colors
  To get a more realistic effect, we darkened the water depending on the depth of the seabed.

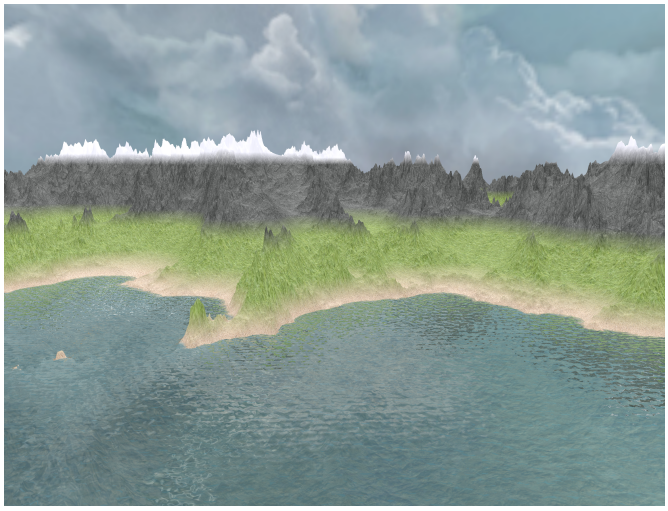
- Water reflection
  We added water reflection. We are reflecting the terrain and the skybox depending on the water depending on the camera position.

- Distortion of reflections
  To simulate distortions of reflections that are happening in the real world, we are applying some transformations to modify the reflections by taking in account waves.

2) Screenshots

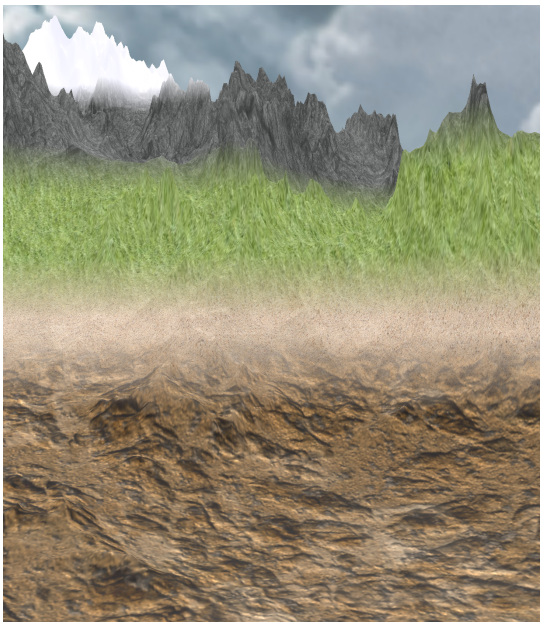
a) Distortion and reflections

To simulate the correct effect of reflections of the environment on the water, we are distorting the reflections. The result looks much more real.



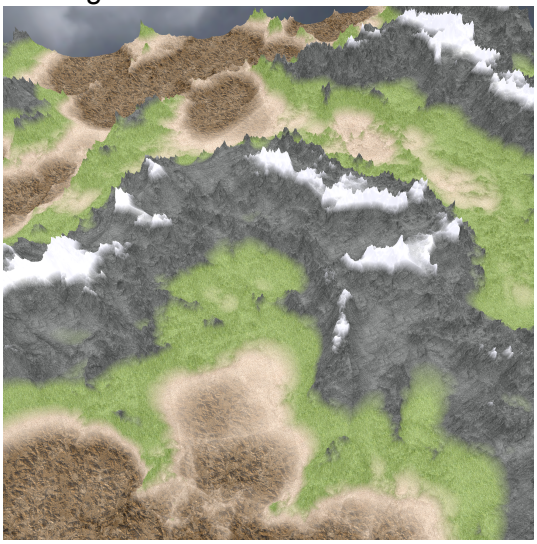
b) Ridged multifractal

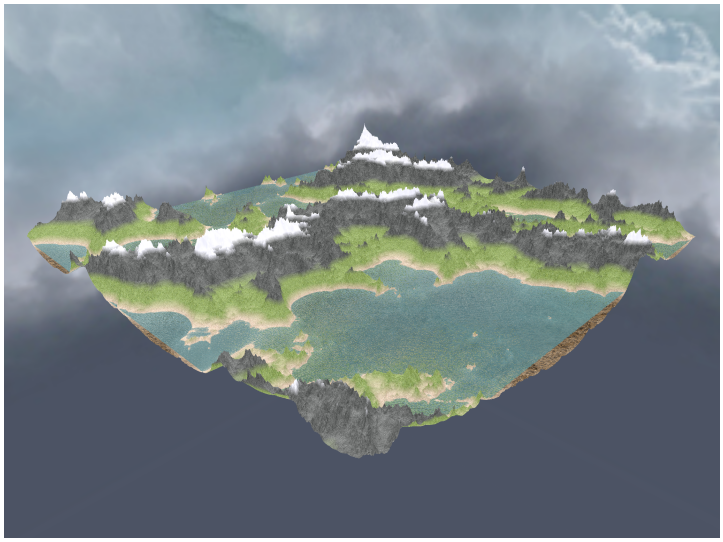
By using ridged multifractal's method, it allows us to control the frequency of the noise function. This provides sharpest mountains, hence a more realistic result.



c) Textures and gradients

As you can see textures are merged together in a realistic way. Indeed, we used a gradient to merge the texture between them.





3) Workload

The workload has been equally split up between the three members of the group. Everyone participated into the the mandatory parts of the project, and then each member worked individually on extras features.

4) Repository

Link to the GitHub repository: https://github.com/cparzy/Computer-Graphics-Project.git

5) Video

Link to the video (on Youtube) : https://youtu.be/vbTUd-wTCmk

6) Ressources

Procedural fractal terrains
https://www.classes.cs.uchicago.edu/archive/2015/fall/23700-1/final-project/MusgraveTerrain00.pdf

Noise functions (used for the 4D simplex noise)
https://gist.github.com/patriciogonzalezvivo/670c22f3966e662d2f83

Water simulation
http://developer.download.nvidia.com/books/HTML/gpugems/gpugems_ch01.html

OpenGL documentation
https://www.khronos.org/registry/OpenGL-Refpages/gl4/