Cosc422 Assignment 2

This assignment was focused on expanding the work don in exercise 14 to render a complete realistic looking height-based terrain map. I Implemented a few special features that will be talked about further on. Theses special features allow the terrain map to both look better and be truer to life. I had difficulty implementing a texture mapped sky box for this assignment. Features I implemented include a highlighted shoreline a rising and falling tide and the darkening of water with depth. I used four textures for my terrain to best model my chosen location of mount Kilimanjaro Figure 1. I finally

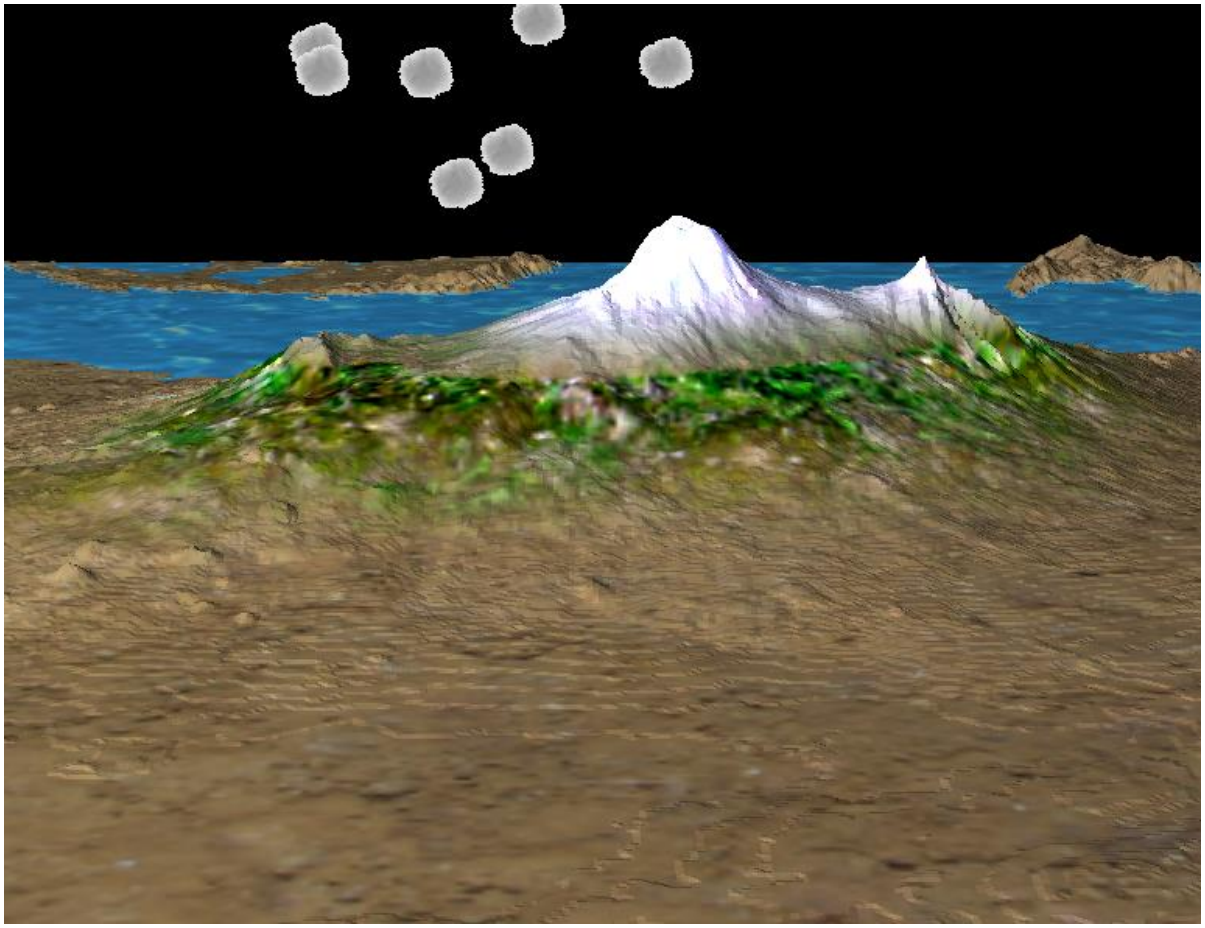

Figure 1: Overall picture of the scene

implemented smoke particles but could not detach them from the camera movement.

Extra Features

Water

For the water I implemented a tide by using equation 1. The tide rises and falls on a tick rate with a

$$y = L_w + m^* \sin(\omega (d + \delta k))$$

Equation 1: wave motion equation

frequency as specified in the geometry shader.

Okoko Anainga 96871851

The next feature to the water can be seen in Figures 4 and 5 both showing darkening of deep water and a highlighted shoreline. I achieve this by finding a depth factor for the water and applying subtracting it from the specular highlights to increase darkness in deep areas.

Figure2: shore highlights and lightness for shallow waters

Figure 3: Reduced specular highlights to show deeper water with a darker tone

For texture blending I decided to choose values that can be set in the Terrain.cpp file for the snow and water then from here blending is applied between all variations of the terrains based on a height factor which contributes to a blended weighting. This is calculated in the geometry shader then passed through to the fragment shader to then computer the colour for each fragment as I did not do vertex normals. Blending can be seen in Figure 4.

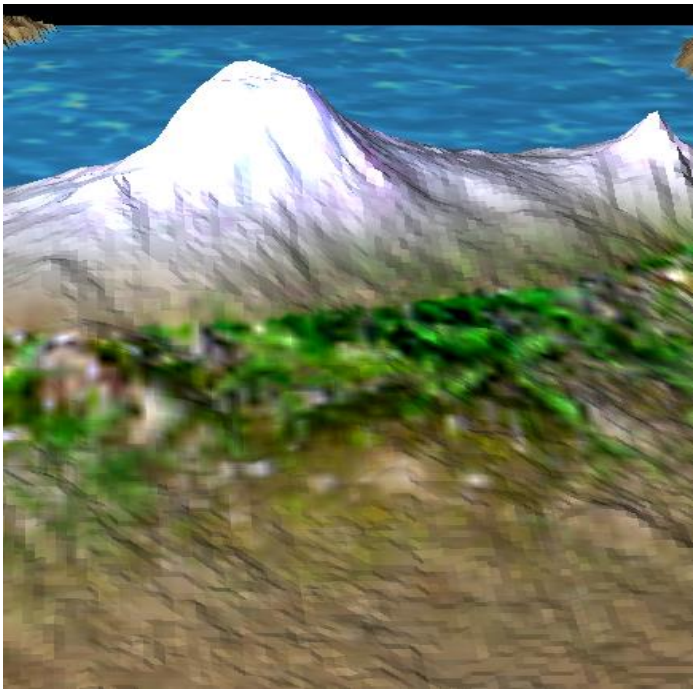

Figure 4: Blending of textures as heights change

Sky box and particles

These two features I struggled to implement. Functionally I have particles of smoke working properly however I could not figure out how to detach them from moving with the camera and stay in one place above the mountain Figure 1. The sky box I really struggled with and left the code in despite it not working I would appreciate feedback on where I have gone wrong with this. This was an implementation based on Learn OpenGL [1].

Removing cracking

The final feature was to remove cracking. Originally, I couldn't see cracking, but it did show up eventually as shown in Figure 5. Cracking was removed as shown in Figure 6 by using an adjusted

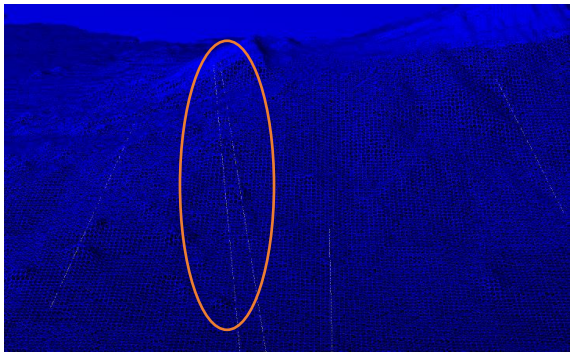

Figure 5: Cracking highlighted in the circle

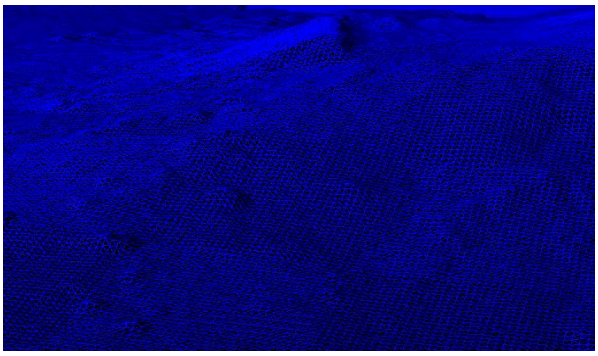

Figure 6: Fixed cracking

method for calculating the level of detail. For the 4 outer levels compared to inner levels.

Controls

For the scene I implemented basic controls:

- Space ' ' to go from wireframe to solid fill and back
- Arrow keys as specified in the instructions to turn the camera and move in the direction with up and down.
- Finally, I added height movement with the up and down page buttons this gives an arial view as shown in Figure 7.

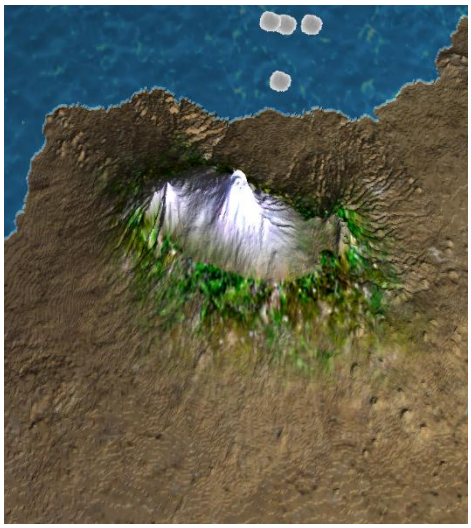

Figure 7: Arial view from max height

Conclusion

This assignment was very enjoyable and being able to better understand terrain generation is exciting. I found this assignment to be easier than the first assignment to get initially working but found extra features to be more challenging. I would like to have been able to keep working on the sky box and get it working as I felt as though it was very close to being complete. Also figuring out how to have to particles in a static location would be better to the scene overall. If I was to complete this again, I would like to do it with procedural terrain instead of a height map [2]. I think this is a very good skill to have for open map game development.

References

[1] J. d. Vries, Learn OpenGL - Graphicss Programming, Kendall and Welling, 2020.

[2] Mapzen, “Tangram: Open-Source OpenGL Maps,” Mapzen, 2023. [Online]. Available: https://tangrams.github.io/heightmapper/#1.04167/-35.1/-423.9. [Accessed 09 2023].