Procedural Generation of Earth-Like Planets

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The purpose of this year's research and development was to add to the accuracy of the previously produced earth-like planets. To accomplish this I have shifted much of the code of the program from Java to GLSL (openGL Shading Language). This allows me to execute code on the GPU, which is able to process information in a highly parallel nature enabling huge amounts of data to be read and written at once. Using GLSL, I have been able to implement per-pixel lighting and coloring. This has two major effects on the program. It allows for more efficient memory usage as a 32 vertices by 32 vertices mesh can be colored and lit as if it were a 1024 vertices by 1024 vertices mesh. This method of lighting and coloring also increases the apparent realism of the terrain as small details can be observed. In addition to this, accurate atmospheric scattering was implemented on the GPU. Using the Mie and Rayleigh phase equations the atmosphere of an earth-like planet is simulated entirely on the GPU. This allows for the atmosphere of such a planet to be viewed from space and the ground. One can model such concepts as global warming with this atmospheric model. To complement these additions, the level of detail system previously displayed has been entirely re-written. Instead of updating one massive vertex-buffer every time a change to the detail is made each quad in the level of detail system is given their own vertex buffer, which can be added to the scene or removed at, will. A user interface has also been implemented in order to give any person the ability to change parameters in real-time. With all of these changes implemented the procedural planets produced by my program have increased in both accuracy and efficiency opening up a wide range of possible uses for the program.