Level-of-Detail for Terrain Rendering

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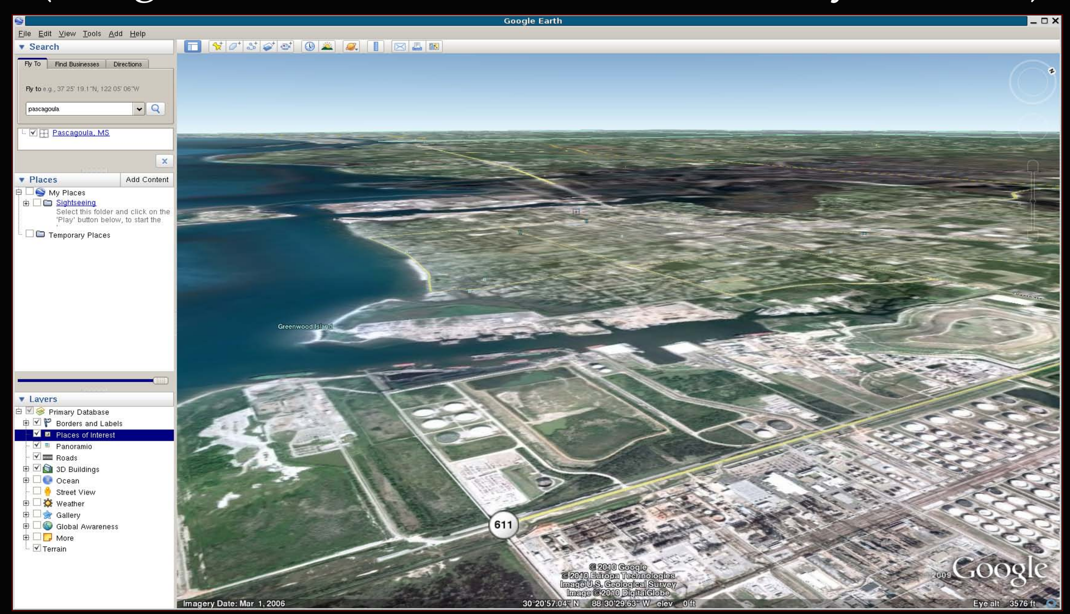
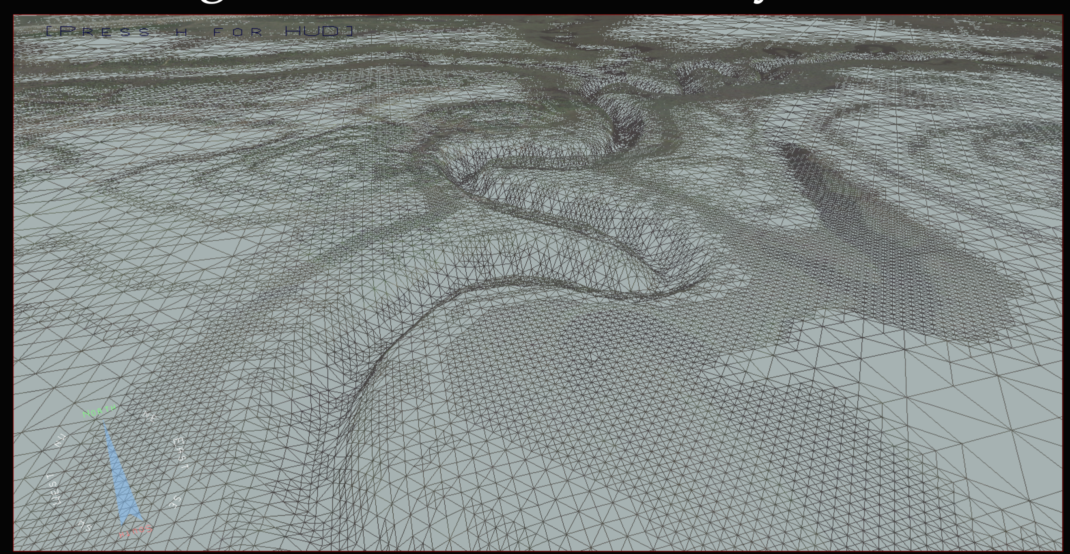


Google Earth rendering of the Pascagoula region of Jackson County, MS.



Wireframe rendering to illustrate the continuous level-of-detail in *libmini*.

Visualization for flood forecasting and monitoring

River flooding is one of the primary causes of weather-related damage to lives and property. The specific goal of this project is the development of visual analytic tools to enable scientists and forecasters to better interpret and distribute hydrologic information. The River Forecast Centers of the NWS put considerable effort into developing methods of disseminating flood information to the public and emergency responders. We are developing an application that will read the output of the HEC-RAS model and display the innundation over a terrain. In this demo, a 5m geo-referenced image has been draped over a 3m DEM of Jackson County, MS .

What is Level-of-Detail (LOD)?

Level-of-Detail (LOD) is a term used to describe the family of techniques used to reduce the geometric complexity of objects being rendered based on heuristics such as distance from the observer, with the greater goal of reducing overall CPU load. There are two main classes of LOD techniques: Discrete LOD and Continuous LOD. In DLOD, simpler model representations are pre-generated and the renderer simply displays one of them. This often creates popping artifacts when models are switched. The CLOD algorithms reduce popping by adaptively simplifying the model based on some criteria such as the observer's position.

Which tools use LOD and how do they compare?

Most tools that provide interactive rendering for terrain data-sets use LOD. Examples of such tools would be Google Earth, NASA Worldwind, and ESRI ArcGlobe. The performance of each tool is dependent on its design objective. Google Earth has been designed to be able to stream online data and provide efficient overlays and does well at that. For research setups, Worldwind provides an open-source Google Earth-like interface with more features, while ArcGlobe exposes the whole set of ArcGIS tools.

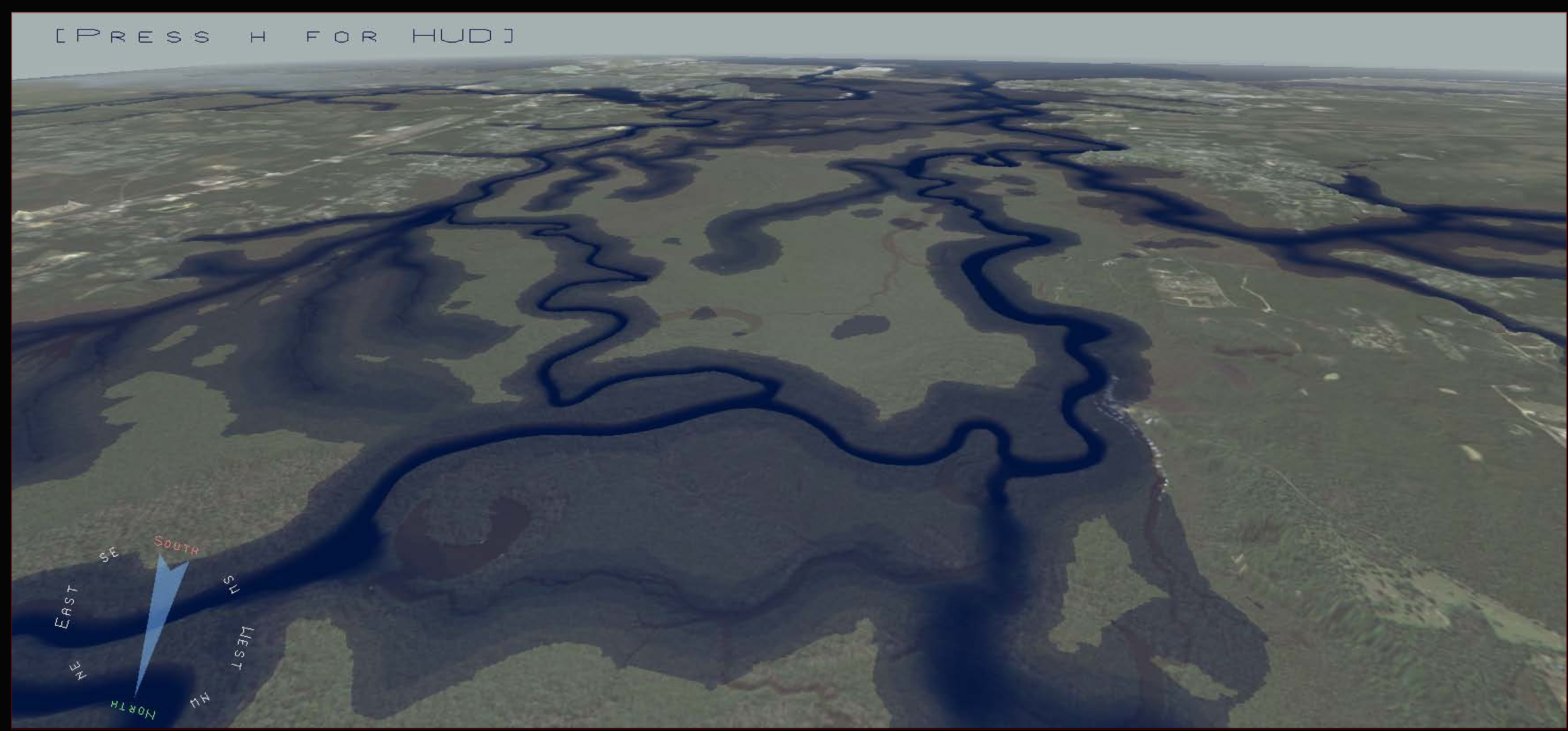
Why use *libmini*?

The library, *libmini*, applies a view-dependent mesh simplification scheme to render large-scale terrain data at interactive rates using a quadtree representation of a height field. The provided API is open-source and can be used with multiple rendering libraries giving maximum control to the developer.

What are the technical challenges?

By far the biggest challenge in terrain rendering is the sheer amount of data. In this case, the resulting tile-set is 5.6 GB in size. Determination of appropriate heuristics to control the level-of-detail is important. Additionally, one must ensure seamless tiling so that cracks do not appear between tiles.

Pascagoula region of Jackson County, MS, rendered using *libmini*.



Demo of an innundation effect. Note that the DEM misses some features.

GRI NGI HPC²

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