



Subsurface data visualization in Virtual Reality

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Due to their increasing complexity and size, visualization of geological data is becoming more and more important. It enables detailed examining and reviewing of large volumes of geological data and it is often used as a communication tool for reporting and education to demonstrate the importance of the geology to policy makers.

In the Netherlands two types of nation-wide geological models are available: 1) Layer-based models in which the subsurface is represented by a series of tops and bases of geological or hydrogeological units, and 2) Voxel models in which the subsurface is subdivided in a regular grid of voxels that can contain different properties per voxel. The Geological Survey of the Netherlands (GSN) provides an interactive web portal that delivers maps and vertical cross-sections of such layer-based and voxel models. From this portal you can download a 3D subsurface viewer that can visualize the voxel model data of an area of 20×25 km with $100 \times 100 \times 5$ meter voxel resolution on a desktop computer.

Virtual Reality (VR) technology enables us to enhance the visualization of this volumetric data in a more natural way as compared to a standard desktop, keyboard mouse setup. The use of VR for data visualization is not new but recent developments has made expensive hardware and complex setups unnecessary. The availability of consumer of-the-shelf VR hardware enabled us to create an new intuitive and low visualization tool.

A VR viewer has been implemented using the HTC Vive head set and allows visualization and analysis of the GSN voxel model data with geological or hydrogeological units. The user can navigate freely around the voxel data (20×25 km) which is presented in a virtual room at a scale of 2×2 or 3×3 meters. To enable analysis, e.g. hydraulic conductivity, the user can select filters to remove specific hydrogeological units. The user can also use slicing to cut-off specific sections of the voxel data to get a closer look. This slicing can be done in any direction using a 'virtual knife'.

Future plans are to further improve performance from 30 up to 90 Hz update rate to reduce possible motion sickness, add more advanced filtering capabilities as well as a multi user setup, annotation capabilities and visualizing of historical data.