Three dimensional Geological Modeling Using Geological Information of Vietnam

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In Southeast Asian area, the environmental problems such as land subsidence, flooding occurs by heavy rain, traffic problem and groundwater pollution have been increasing in recent years. This main reason is rapid urbanization and population increase. Regarding the mitigation and prevention of the environmental issues of urban area, it is important to prepare and analyze with the geological information. For the solution of these issues, it is necessary to provide the geological information accurately and effectively. The 3D (three-dimensional) geological model is an important geological information generated as a result of geological analysis based on the fundamental field survey data and the knowledge of the geologist. The method of 3D geological modeling based on the logical model of geological structure has been developed by Masumoto et al. (1997) and Shiono et al. (1998), and its actual visualization 3D geological modeling has been proposed by Masumoto et al. (2004) using GRASS GIS and Yonezawa et al. (2004) using Visual Basic program Geomodel2000.
In this study, we generate the DEM using the elevation data. DEM is a digital representation of ground surface topography and the most important element of topographic analysis. And, we analyzed the borehole data for the well construction of Hanoi city. Finally, we constructed the 3D geological model of Hanoi city and visualized it using GRASS GIS.
Research area is the center part of Hanoi city, the capital of Vietnam, the environmental problems have been increasing in recent years. The main reason is rapid urbanization and water control. The urbanization of Hanoi city has a relationship with the geological urban transformation as a landfill historically.
The 3D geological model is composed the DEMs of the geological boundary surfaces and the logical model. The spatial distribution and the relation of geological units are expressed in the logical model based on the fundamental field data and the knowledge. Thus the logical model of geological structure and the boundary surface are calculated for the visualization of 3D geological model. The outline of constructing of 3D geological model is as follows.
We can verify the logical consistency from the stratigraphic correlation and generate the geological event using the classify and arrange module (Shiono et al., 1998; Iwamura et al. 2008). It is calculated from the recursive definition proposed in Yonezawa et al. (2005). The logical model of geological structure is constructed by this event using the logical modeling module. Each geological boundary surface DEM is estimated using BS-Horizon method by Nonogaki et al. (2008). In geological function module, 3D geological model is constructed virtually using the logical model and DEMs. In this study, the data of logical model and each DEM of geological boundary are outputted from GRASS GIS of FOSS4G, the 3D geological model can be expressed using the visualization tool NVIZ of GRASS GIS.
The 3D geological model is provided as 2D and 3D visualization. We displayed a geological cross section of the 3D geological model. Future work is needed to identify the actual geological structure of Hanoi city to compare the 3D geological model.

Keywords: DEM, Borehole Data, Logical Model of Geological Structure, 3D geological model, Vietnam

