GIS & GIS DATA STRUCTURES FOR GEOLOGICAL APPLICATIONS

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ABSTRACT

Geographical data is a subset of spatial data in which entities can be referenced to particular locations in 3D space and time. Computerised Geographic Information Systems (GIS) have been developed to handle the capture, query and visualization of data stored in spatial databases. Complex spatial analytical modeling is, however, limited with the current crop of commercial GISs. One important reason for this is their choice of inappropriate data models which require complex processing (repair logic) to formulate/represent common knowledge of spatial phenomena, their occurrence, mutual interaction, and spatio-temporal development. Geological applications are examples of those that are least amenable to solutions using static 2.5D GISs. These applications often deal with explicit 3D objects and are concerned with the objects' evolution (albeit in geological time!)

3D GISs, with data structures based on (regular) hierarchical space tesselation, and their extensions to 4D provide a 'natural' way for modeling geographic (and geologic) phenomena. Using basic space time primitives (chrono voxels) the link between GIS and spatial analytical models based on finite elements can readily be achieved. This paper reviews the importance of a spatial data model for accurate geographic knowledge representation. Hierarchical data structures are described and conclusions are drawn as to their usefulness for selected geological applications.