

Development of a Topological Structure of 3D Data for the Analysis of Geological Models and Its Integration into Geographical Information System for the Geotechnical Natural Risk Management

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SUMMARY

The need for a preventive action on hazards of all types with which environment is faced has never been as great as it today. The knowledge of the risks is the base of all prevention. Indeed the geological and geotechnical factors constitute determining elements which can cause strong risks in urban environment. The local interventions for the prevention and the reduction of the risks on the populations and the vulnerable zones can be facilitated by a good knowledge of the urban territory. Various systems of geological and geotechnical cartography were developed since about thirty years, but with a limited success. Part of the difficulties comes from three-dimensionality from geological information. Moreover, the urban environment is complex, even by considering only its physical aspect. It is already much on the surface, it is more still in-depth for it, taking into account the progressive development of a true underground town planning. The traditional charts and plans give only very badly an account of this complexity. The failure of the geotechnical maps in the Seventies is clearly showed. Thus the comprehension of the phenomena relating to the geological and geotechnical risks depends to the clarified description of these elements. Geological information is for a great part "a localized information".

The study of the geotechnical risk consists of the analysis of several geological data of the surface, subsurface and especially the basement. This leads us to speak about a 3D modeling of the geological information which not describe only of the surface (plainer localization) and the subsurface (altimetry localization) but rather of the basement (depth). The potentialities of space analysis and modeling of the phenomena that offers the Geographical information systems make it possible to work out draft agreements with the geological and geotechnical constraints of the natural environment. The geomatic answers relatively well certain of these needs like that to build three-dimensional geological models. However, the geomatic systems (such as the GIS) are not adapted to the explicit management of the topological relations being expressed in a 3D universe in basement.

The representation of the elements of structural geology such as drillings, faults, stratigraphic Log..., clash with problem of structure of geometrical topology adopted by the geographical information system. Thus the analysis of these elements to be able to make the decisions in geological term of risk becomes more and more complicate. With this intention, the

construction of a geological model is necessary. Geological modeling is defined as being the whole of the mathematical methods which make it possible to model in a unified way the geometry and the physical properties of the geological objects. For several reasons, the construction of this kind of model represents a great challenge. For example, the geometrical shapes of the geological objects are much more irregular than are to it the objects built by the man. This study aims to presenting a first approach for 3D geometrical modeling of the geological data for their space integration within a GIS. It is necessary to represent the various relations between the geological data to model, the different possible analysis between them in order to be able to create a preventive system for risk management.

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