GEOLOGIJA *46/2*, 435–438, Ljubljana 2003

GeoHazardView: Interactive presentation of geological hazard maps

K. WAKITA, H. KATO & J. BANDIBAS[1]
[1]Geological Survey of Japan, AIST
1-1-1 Higashi Tsukuba, Ibaraki 305-8567 Japan,
E-mail: koji-wakita@aist.go.jp

Key words: Geological hazard map, GIS, East Asia, Japan

Abstract

This paper presents an interactive method of showing geological hazard maps and other related information using the software developed at the Geological Survey of Japan. The main purpose of the software is to easily provide information about geological hazards. In this paper, the region of interest is East Asia. The software provides a good alternative to viewing geological hazard maps and other related information in paper form. It incorporates spatial and a-spatial data to interactively present the time, locations and extent of occurrence of geological hazards and other related information. Queries for a particular hazard information like number of casualties, magnitude and location of earthquake epicenters, names and locations of volcanoes erupted in a particular year can be easily done. Simulations of the occurrence of a particular geological event like the spread of volcanic ash during major volcanic eruptions can also be shown. The new software is named GeoHazardView.

Introduction

Studying geological hazard is very useful in mitigating the loss of human lives and properties brought about by the occurrence of the phenomena. Geological hazard maps are generally used to provide information about the occurrence of the geological hazards in the past and their potential occurrence in the future. The maps are used by planners and policy makers for national and regional development to minimize the potential waste of resources committed for development and the loss of human lives due geological hazard occurrence.

Information obtained from the conventional geological hazard maps are not always sufficient to provide the users with their data needs. The difficulty of presenting more relevant information in geological hazard maps in conventional paper forms is due to the limited physical space available in this format. Printing more information in this paper maps has the tendency of confusing rather providing more information to the users. Furthermore, these kinds of maps provide little opportunity for the users to make queries for additional information. Geological hazards generally have important temporal attributes. Presenting these attributes in the map, like the sequence of volcanic eruptions in a region or the frequency of the occurrence of earthquake in a particular area during a particular period of

time is very difficult. Presenting these kinds of information very clearly requires the printing of a series of maps.

The conversion of maps into digital format and the linking of the maps' information to other related data in a GIS is very advantageous. Through this, the information on the maps can be easily accessible to policy makers or users for decision making and other application such as education, research and exploration (Champati, 2000). This paper shows a system of presenting geological hazard map in East Asia in an interactive way using a GIS software. The paper version of the map was published in 2002 (Kato, 2002). The software was developed at the Geological Survey of Japan to interactively present geological hazard information and to manage and maintain the geological hazard database. Important information can be easily queried using the software and simulation of important geological hazard phenomena can be easily shown on-screen. The software is called GeoHazardView.

The Software

The GeoHazardView software was written using the Microsoft Visual C++ programming language at the Geological Survey of Japan. The main purpose of the software is to inform the user about geological hazard. It is designed to be user friendly and can be operated in a "straightforward point and click operation". Users who don't have technical knowledge of geology can easily use the software. Considering the dynamic nature of the geological hazard, the software can also be used to manage and update GIS based geological hazard information database.

The types of geological hazard handled by the software are volcanic, earthquake, tsunami and landslide hazards. Figure 1 shows the flowchart of the GeoHazardView software. It shows the major components of the software and the different decision nodes and possible software courses of actions depending on the decision path chosen by the user. The software uses unique database formats for its spatial and a-spatial information. They can however be converted to other formats compatible to the mainstream GIS softwares.

The software uses the geological map of East Asia as the base map. Geological hazard information are spatially referenced together with the map. Spatial queries can also be done using the base map. Important geological hazard symbol displayed over the base map can be easily double clicked to extract more information about the hazard symbol.

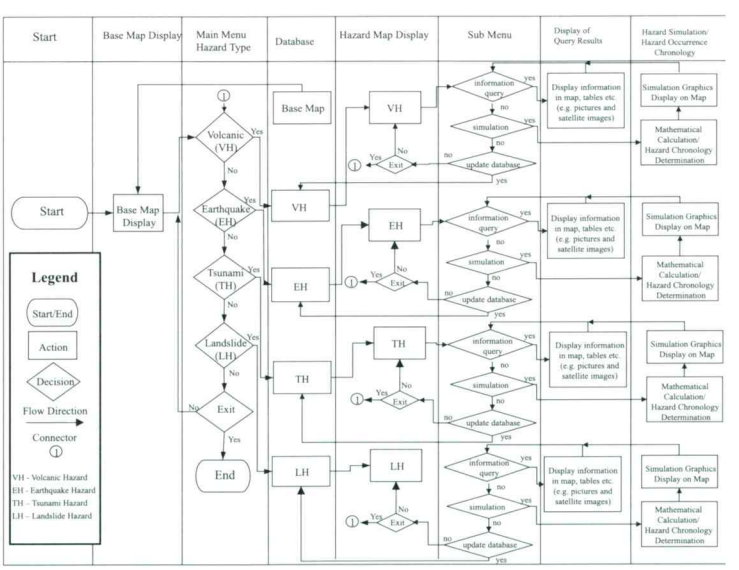

Figure 1. The flowchart of the GeoHazardView software.

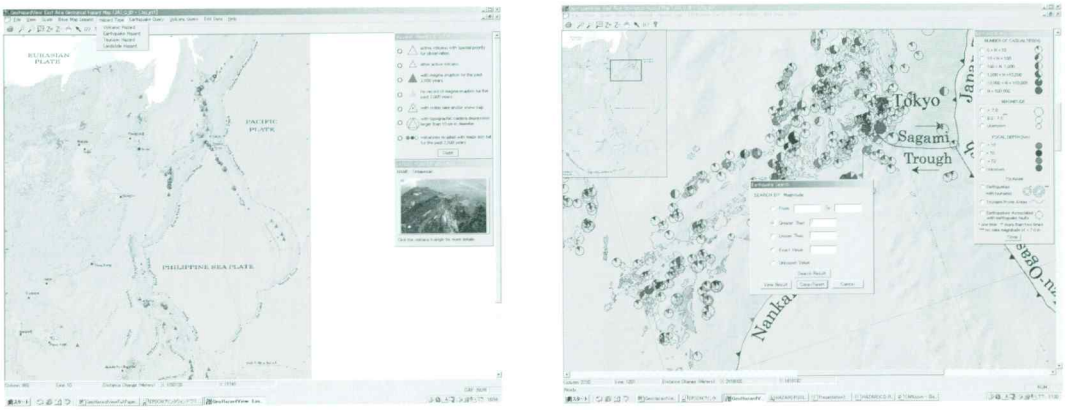

Figure 2. GeoHazardView in volcanic hazard mode.

User Interface

The user interface of the software is typical of a GIS software running under Windows operating system as shown in Figure 2. The tool bar includes buttons to control the zoom factor, zoom box and panning of the hazard map. The choices for the geological hazard types, information queries and other important features of the software can be found on the menu bar. The legends of the hazard maps are also interactive. Figure 2 shows the volcanic hazard map. The figure shows an interactive legend where symbols on the legend can be clicked to show the locations of the volcanoes on the map represented by the symbol. Viewing the simulation of the ash distribution from the major volcanic eruptions in the region can also be done using the legend. The picture of a volcano can also be viewed by pointing the mouse on the volcano's location on the map. Double clicking the location will result in the display of the information of the volcano including its enlarge picture and satellite image if they are available.

Information Queries

Interacting with the geological hazard database is possible using the software. Queries for a particular hazard information like number of casualties, magnitude and location of earthquake epicenters, names and locations of volcanoes erupted in a particular year can be easily done. Search parameters can be defined using search dialog boxes to extract the needed information in the database. The result of the query can be readily shown on the map and pictures and satellite images can be viewed on-screen. Figure 3 shows an example of a dialog box used for extracting information in the geological hazard database. The figure shows the search for earthquake epicenters with magnitude greater than 7.00. The result of the operation will be shown on tables and the earthquake epicenters will be highlighted on the hazard map. The date of hazard occurrence query is also possible using the software. Through this, the location of the hazard occurrence on the map in a chosen date will be highlighted.

Hazard Occurrence Chronology

One of the most important features of the GeoHazardView software is its capability to show the geological hazard occurrence chronology on the spatial context. It can be set to automatic mode to continuously show locations of hazard occurrence in a chosen range of years in the past. The continuous increment of years will also show changes of the locations of the hazards on the map. The speed of the hazard occurrence chronology show can also be adjusted. Figure 4 shows an example of the show. The volcanoes erupted on the year 1821 are highlighted on the hazard map. The detailed information about the volcanoes that erupted on that year can be easily

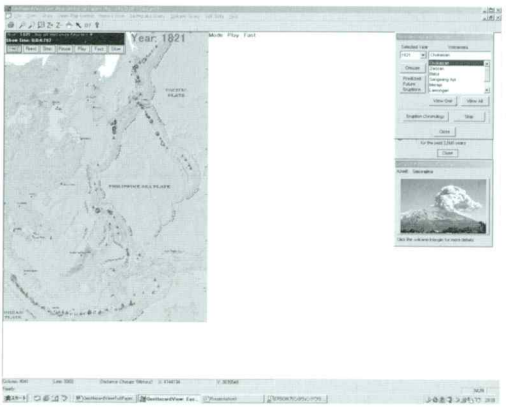

Figure 3. Querying geological hazard information in GeoHazarView.

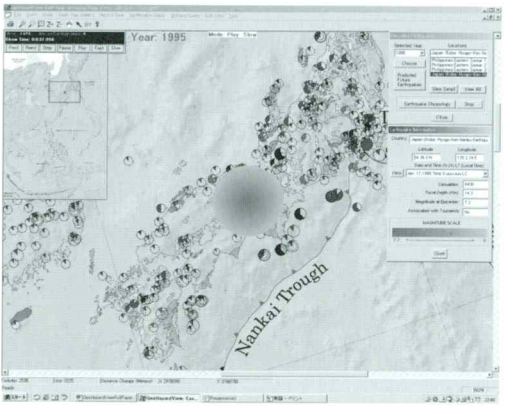

Figure 4. Geological hazard occurrence chronology show.

viewed by choosing the volcano on the list on the dialog box on the right side of the screen. The Figure also shows the epicenter of the Kobe earthquake on January 17, 1995. The details of the earthquake information including the earthquake magnitude scale are shown on the dialog box on the right side of the screen.

Summary

The interactive presentation of the geological hazard map using GeoHazardView software provides a good alternative of viewing geological hazard maps and other related information in paper form. The ease by which geological hazard information can be obtained and the ability of the system to present information in the spatial context makes the software very useful to a wide range of users. It can be an important source of information for land use planners and policy makers and a good teaching material for elementary and high school science classes. The software will be continuously improved adding additional important features in its future versions.

References

Champati, R.P.K. 2000: GIS in geoscience. GIS Development. – Online resource: http://www.gisdevelopment.net/magazine/gisdev/2000/may/gisg.shtml.

Kato, H. 2002: Eastern Asia Geological Hazard Map. Geological Survey of Japan, AIST.