

## **3 DIMENSIONAL RENDERING IN A DISASTER MANAGEMENT AND METEOROLOGICAL EARLY WARNING SYSTEM PROJECT**

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### **Keywords**

GIS, RABIS, 3 Dimensional Rendering

### **Abstract**

Disaster management is a leading topic having very intense research facilities and wide range of applications in all over the world which can also be supported and rapidly improved with latest technological improvements. The sufficient emphasis on disaster and disaster management has been given during last 10 years in our country. A modern insight in disaster management has been gained by increasing the sense of disaster and bringing the level of understanding to localized and centralized officers in various segments of our country.

In this manner the processes that has to be done before and after the disasters has been determined. Briefly, it is very important to have the necessary information easily and rapidly reachable and usable in order to foresee and reduce the costs of the disasters prior to disasters and in order to act in an organized way after the disasters. In this study, a GIS application RABIS, a system utilized to asses loss of life and physical damages using remote sensing and meteorological early warning systems due to a disaster in territory of Rize provience where we observe landslip and avalanche events very often because of its geographical position, topographical conformation and climate properties is introduced. Thanks to this project, a system managing the disaster and estimation of damages in case of a disaster is provided. This project is also an example study which can be used by ministries, municipalities and governorships for supportive purposes.

In this study, verification of why GIS should be used in disaster management and forming a 3D model using RABIS database based on triangular networks is aimed. Visual representation of these long lasting and difficult studies makes them easliy understandable by large number of people and help to reflect and visualize all kind of topographical changes in an effective way.

### **Introduction**

Natural disasters are very important turning points on society and human life. In recent years, global warming and the greenhouse effects have been felt worldwide as a result of natural disasters and significant increases in violence of natural disasters such as earthquakes, floods, storms, cyclones, landslides, distorted urbanization, water pollution, coastal erosion, forest fires etc. have been observed so the risks and losses of our world are increasing rapidly.

The results of disasters and effects that disasters left on the community are extremely large. Thus today, all sectors make an effort to be successful in the fight against the natural and human origin risks, research on this issue and do not hesitate to make very expensive large investments.

Before the disasters it is extremely important to reduce damage and to be prepared and after the disasters in order to organize the interventions and improving studies of the region that against the risk, it is necessary to access information regular and quickly.

In this context, RABIS(Rize Province Disaster Information and Meteorological Early Warning System Establishment Project) is an example of a disaster management and meteorological early warning system that prepared for Rize province. This system is established by combining current satellite technology like remote sensing and global positioning with cadastre, ground, infrastructure, superstructure and population data.

Three dimensional rendering is used for presentation of the results of the projects all over the world, it has been an indispensable method for the presentations. Already, geographic information systems is used disaster management projects such as RABIS, one of the most important reason of using GIS is the geographic base GIS has. In short, with three dimensional rendering presentation of these long lasting and difficult studies, most saturated aesthetically presentation can be obtained and most accurate visual communication with several sectors can be gotten across.

### **Disaster Management and GIS**

People should aware of reasons, details and results of naturally occurring events in their environment and in case of repetition of these events saving their lives is called Disaster Management (Karakuyu, 2008).

Disaster management is multi-layered and multi-phased process. It has multiple layers because the international organizations, states, local governments, professional chambers, universities, civil society organizations, companies, individuals are located in specific points of the process. It is very progressive because it has the damage reduction, preparation, rescue and first aid, improvement and re-construction phases (Yomralioğlu, 2000).

Disaster management requires performing of multi-faceted researches and evaluation of wide range of data at the same time. Using these data, various possible disaster scenarios, disaster strategies and before and after disaster operations can be planned.

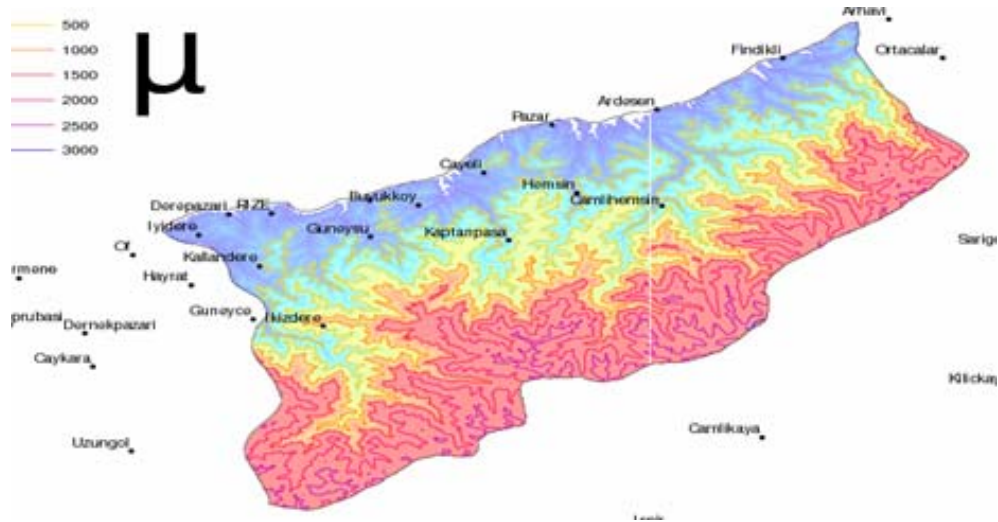
GIS allows both scientific researches concerned any type of disaster and planning of disaster management using a wide range of data at the same time. Also it takes into consideration data relations and it can get any multi-dimensional analysis on these dataset. Composing visual data from a data base management system that has an opportunity to access urban and geographical data very rapidly, is very important for using GIS in disaster management. By the help of this established data base system cities' entire inventories and geographic structure can be seen on maps. With this system disaster scenarios can be created and situation that will occur after the disaster can be seen on the maps. According to scenarios and simulations, necessary precautions can be taken and people are going to prepare themselves for possible disasters.

Updating whole data structures continuously is a very important advantage of using GIS in disaster management. Thus, in stead of limited number of disaster scenarios with the data have not been updated, continuously have been updated scenarios can be used in disaster management by the help of GIS. Also, the results can be seen immediately and people can take the necessary urgent decisions. If 3 dimensional rendering data can be obtained from these data base systems, decision makers can use these 3D visualizations for contemplating the risky region according to topology and inventories before any disasters occur. For instance in a flood scenario (caused by heavy rain or breaking down of a dam), the buildings that have damage risk can be determined by decision makers. Similarly, in a landslaid scenario buildings having damage risk can be identified. Accurate and timely decision is very important to minimize loss of life and property. Therefore, now our world whenever disaster management comes to mind, immediately GIS comes to mind too.

## Rize Province Disaster Information and Meteorological Early Warning System Establishment Project (RABIS)

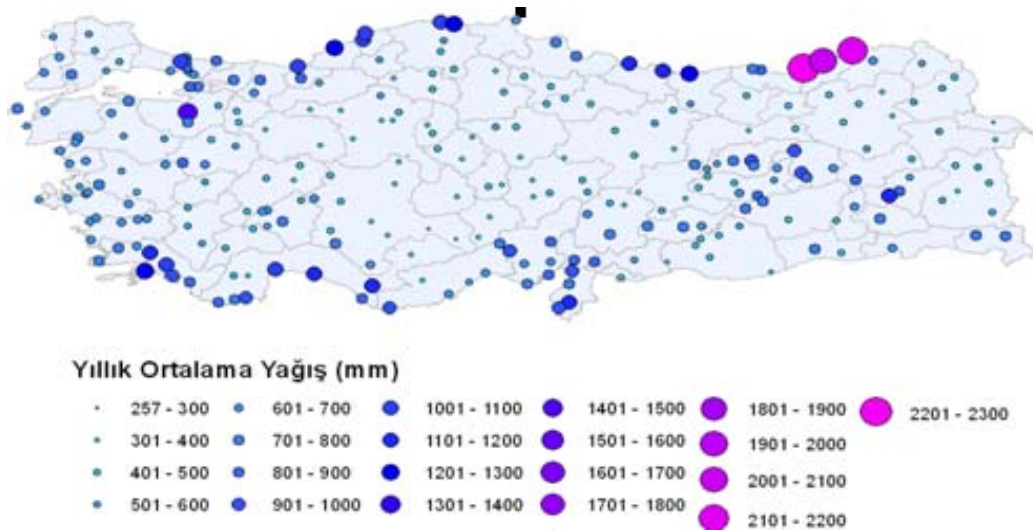
Rize Province is located in the Eastern Blacksea coast. The surface area is 3920 km<sup>2</sup> and in the Rize Province there are eleven districts (Figure 1).

Figure 1: Rize province. (Şahin, 2007)



Eastern Blacksea Region of Turkey has more rainfall than other regions and in this region 25 natural disaster has occurred since 1929. In these disasters that mostly flood and landslide, 655 people have lost their lives. In the region disasters occurred generally in May-June and October-November months in the last three years and generated 206 million USD loss (Şahin, 2007).

Figure 2: Turkey rainfall. (Şahin, 2007)



From Figure 2 can be seen that Rize is the most rainy province in Turkey. In this context, to minimize human losses and property damage in the province it is a fact that hidrometeorologic disaster management was needed.

In RABIS Project, GIS, remote sensing and early warning system are used to against the possible disasters that affect the human loss and material damage in Rize.

The purposes of the RABIS are planning the emergency preparation, implementation and management of disasters and in case of any disaster the system will be used for forecasting damage by the help of modern satellite technology and information systems. Furthermore, RABIS can be used as a decision support system by the ministries, governorships and municipalities at any time. In this respect, RABIS is a sample application for Turkey as a GIS based data information and disaster management system was applied to model Rize. In RABIS project it was also aimed to design a harmonious and regular information system that will be used for disaster planning and management of Rize which include both districts of Rize and other provinces around Rize.

Determining residential areas especially buildings in villages of Rize is extremely important for RABIS project. In case of occurring natural disasters like floods and landslide, the risky region must be identified, specially in the settlements of risk identification are crucial for this study.

Figure 3: high resolution satellite images(Şahin, 2007)



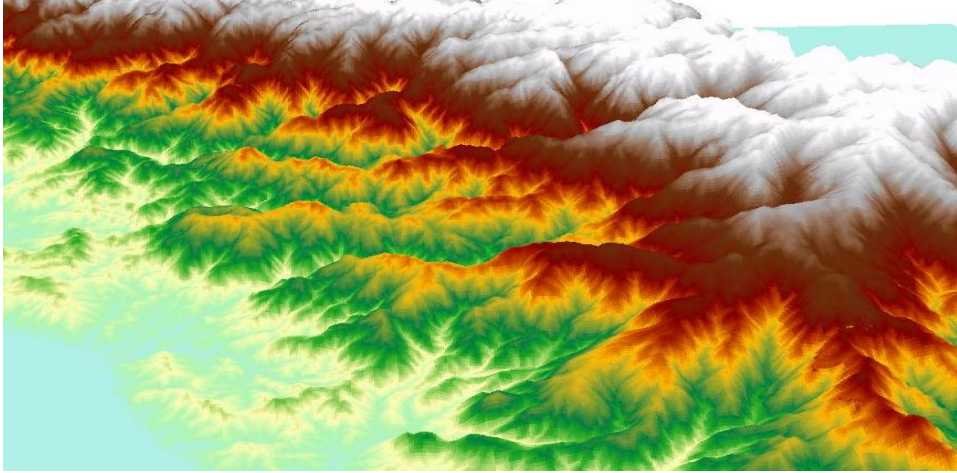
By using high resolution satellite images the location of some buildings like scattered settlements in villages can be determined easily and authorities can take precautions about the risks.(Figure 3).

### Three Dimensional Rendering In A Disaster Management and Meteorological Early Warning System

With three dimensional rendering, almost all sectors of industry's products and project details can be modeled, also the texture, color, lighting techniques can reveal all details on a realistic basis. In addition to this, three dimensional rendering technology proved superiority to the old fashioned models and other methods. Three dimensional rendering can be prepared rapidly and any requested changes can be done on the model easily. Moreover, three dimensional rendering allows the descriptive and realistic presentation in the beginning of the projects or at the end of processing. Construction business, real estate dealing, architecture, interior design, dentistry and medicine are some example areas using three dimensional rendering.

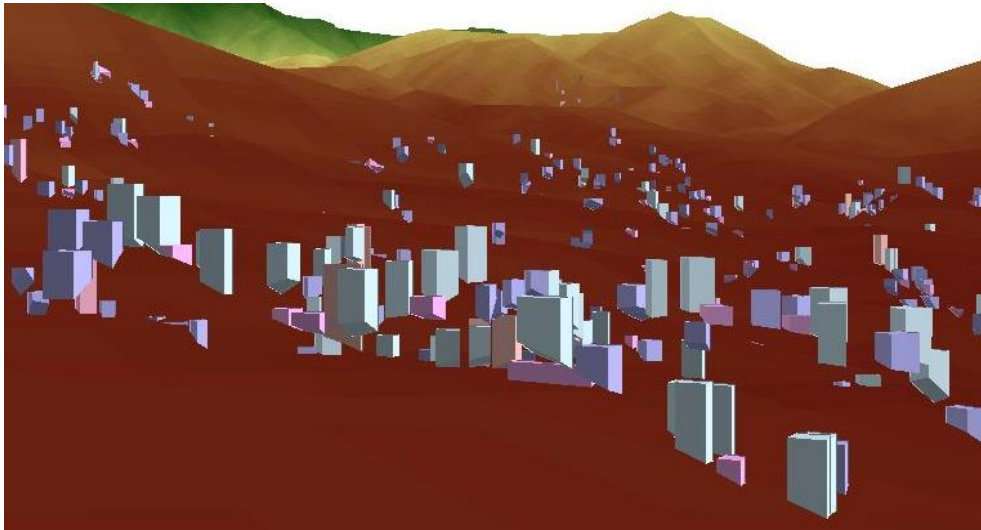
Geographical Information Systems are used in RABIS, because it has geographic base that allows any time to the visual expression. From various public institutions and land origin data was collected for RABIS and by using several different programs the three dimensional rendering of Rize Province were prepared. In this study NETCAD-GIS and ArcGIS softwares were used when preparing the three dimensional rendering. Both softwares have special three dimensional modul (Net3D and ArcScene). Firstly, three dimensional topography of Rize Province was obtained (Figure 4).

Figure 4: Mountains of Rize



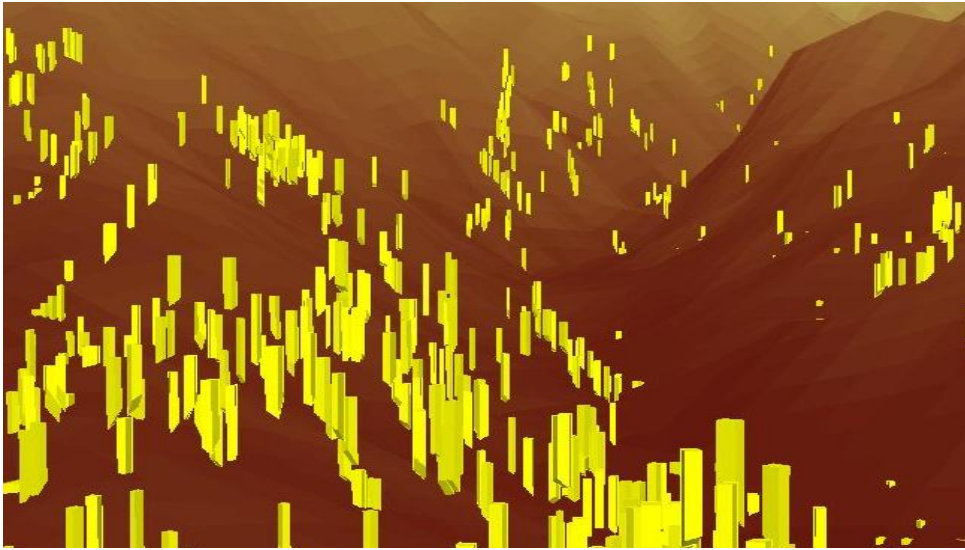
In this study only topographical data and buildings data were used for determining the risky regions. Using triangulation and building data of Rize Province, locations of buildings can be identified which have the landslide and flood risk. When modeling it is possible to appoint to each building a different color. Also buildings which have equal height can be arranged in the same group, so each building's height can be identified according to its color(Figure 5).

Figure 5: Same height in the same color group



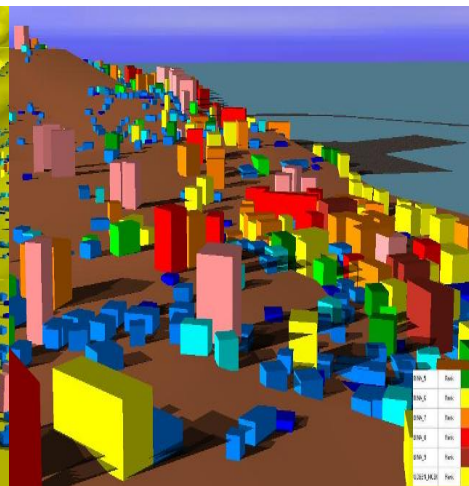
In three dimensional rendering, if it is wanted height of all of the buildings can be exaggerated or side coating can be added. Thus, buildings and topology can be distinguished between easily (Figure 6).



Figure 6: Exaggerated buildings

In disaster information systems, three dimensional rendering facilitates users' work (understanding the system) and leads to follow topological changes of areas and urban features depending on stored or updated data.

Because of its visual advantages all kinds of authorities can use three dimensional rendering as a decision support tool in disaster management like other operational areas have used. Moreover, three dimensional rendering is an indispensable method of presentations of projects' results in all over the world (Figure 7.a and Figure 7.b).

Figure 7.a Rize ProvinceFigure 7.b Rize Province

### **Conclusion And Recommendations**

In this study, the importance of disaster management has been reviewed. Why do the disaster management systems prefer GIS and what are the benefits of GIS have been looked over. Also, RABIS has been introduced as Turkey's first disaster management and meteorological early warning system and using RABIS data some three dimensional rendering studies of Rize Province have been done. At the end of the there dimensional rendering, the model was a kind of Rize model and has all the visual features of Rize. This study's further enhanced version can be done by using of the satellite imagery, so the obtained model will be more realistic and the users can visit streets or villages around Rize Province without travelling to the city.

As long as natural or human origin disasters become, disaster management will always be as a needed system that saving human life and reducing property damages. Turkey have a wide range of disasters, so the system that handle management of disasters and reduction of disaster losses has been needed not only Rize, at all provinces of Turkey it should be established. Three dimensional rendering can be used as a visual assistant for disaster management and meteorological early warning systems like it has been used several current subjects.

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### **Author Biography**

Senem Bilir has double bachelor degrees of Civil Engineering and Geomatic Engineering, also she has master degree of Geomatic Engineering from Istanbul Technical University. In 2007 she studied “Investigation of GIS Applications in Earthquake Damage Estimation and Conducting These Studies to the Projects of HAZTURK (Hazard Turkey) and MAEViz” as graduation project of Geomatic Engineering Undergraduate Program. One year later, she studied “Detailed Investigation of Construction Process of Purification Foundations and Examination of An Example Structure Builbed by Istanbul Water and Drainage Admisnistration (ISKI)” as graduation project of Civil Engineering. Finally, she made her master thesis in the area “3 Dimentional Rendering in a Disaster Management and Meteorological Early Warning System by Using ArcGIS and NETCAD.