

Chapter 95

Disaster Management and Virtual Globes: A High Potential for Developing Countries

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ABSTRACT

Today, the added value of geoinformation for crisis management is well known and accepted. However, experiences show that disaster management units on local administrative levels in the developing world often lack the use of Geographic Information Systems for analysing spatial interrelations and making their own maps. Various studies mention the shortage of financial resources, human capacity, and adequate knowledge as reasons for that. In recent years publically available virtual globes like Google Earth™, Microsoft® Bing™ Maps 3D or Nasa World Wind enjoy great popularity. The accessibility of worldwide high resolution satellite data, their intuitive user interface, and the ability to integrate own data support this success. In this chapter, the potential of these new geospatial technologies for supporting disaster preparedness and response is demonstrated, using the example of Google Earth™. Possibilities for the integration of data layers from third parties, the digitization of own layers, as well as the analytical capacities are examined. Furthermore, a printing module is presented, which supports the production of paper maps based on data previously collected and edited in Google Earth™. The efficiency of the proposed approach is demonstrated for a disaster management scenario in Legazpi, a Philippine city exposed to several natural hazards due to the vicinity to Mayon volcano and the annually occurring typhoons in the region. With this research, current technological trends in geospatial technologies are taken up and investigated on their potential for professional use. Moreover, it is demonstrated that by using freely available software general constraints for using GIS in developing countries can be overcome. Most importantly, the approach presented guarantees low cost for implementation and reproducibility, which is essential for its application in developing countries.

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INTRODUCTION

Reliable information is an essential prerequisite for crisis-related decision making and effective disaster management. Today, the added value of geoinformation for crisis management in the form of a map is well known and accepted. Visualising information on a map makes it more understandable than spreadsheets or reports. Maps – often based on satellite imagery – are used to provide updated information in the aftermath of a natural disaster. Applications include amongst others situation assessment, evacuation planning, damage assessment, reconstruction monitoring, as well as risk and vulnerability analysis (Voigt et al., 2007). The provision of maps supports efficient decision making and hence is an important part of effective disaster response. The map providers are typically highly specialised organisations dealing with geoinformation issues or national civilian or defence mapping authorities. The move from reactive map provision to more anticipative systems, based on preparatory mapping of ‘hotspots’ is consistently discussed within the geo-related disaster community. This can be achieved by enhancing capacities in affected countries in using geospatial information to support the full disaster management cycle. This is for example the mission of the United Nations Platform for Space-based Information for Disaster Management and Emergency Response - UN-SPIDER (2010). However, the use of Geographic Information Systems (GIS), the software that is typically used for map making is still not widely implemented in humanitarian organisations nor at local or regional disaster management authorities, not only in developing countries (ISIS, 2003; Verjee, 2007).

Several reasons are brought up in this context: high investment cost is often mentioned as constraint for using GIS effectively (Tanser & le Sueur, 2002). This can partly be invalidated. Today decreasing costs of hardware and mass storage facilitate the use of information technologies. Due to a large community, the development of open

source geospatial tools has increased in recent years. Nevertheless, their use leaves a number of obstacles, which might be poor documentation, the need for training, and difficulties of configuring or extending open source solutions. An important factor, which must not be forgotten, is the high cost of data (Curron, 2006; Tanser & le Sueur, 2002). Both, commercial datasets and the acquisition and digitization of data by the end user might be substantial expense factors especially with increasing accuracy of the data. The more accurate data are available the better can be the decisions drawn on the basis of this data. Another reason not conducive for the implementation is the comprehensive knowledge required to use today’s GIS packages. According to Curron (2009) the humanitarian community is slow in adapting new technologies due to the fact that technology is not their main focus and they have failed to identify how these technologies can save their resources.

In recent years geographic information technologies made great progress also influenced by the development and provision of virtual globes, such as Google Earth™, Microsoft® Bing™ Maps 3D, Nasa World Wind or ArcGIS® Explorer. Even if their options for geospatial analysis are limited, their introduction influenced the GIS domain, and brought it forward from exclusive, expensive, and technocratic tools towards geospatial information platforms available for non-geospatial experts and due to their availability free of charge to the mass market (Miller, 2006; Sui, 2008). The integration and accessibility of worldwide high resolution satellite data, their intuitive user interface, and the ability to integrate own data combined together with a high performance support their success.

In this paper, we propose a novel, free of cost, GIS concept to support disaster management in developing countries based on virtual globes, in particular Google Earth™. We analyse its capacities and constraints with regard to data collection and analysis. For the implementation of the concept, we integrate additional freely available third party tools for KML analysis. We

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