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Development of methods for flood analysis and response in a Web-GIS for disaster management

In this thesis, two methods were developed for a web-based GIS to make the spatial perspective of flood disaster risk reduction and response accessible. Flood disaster can cause major disruption to the street network, which further affects the emergency services and evacuation work in finding the safest and fastest routes. Thus, a method for dynamic street network analysis was developed and implemented into a Web-GIS for disaster risk management, for demonstrational and testing purposes. The dynamic routing calculations were performed within a PostgreSQL database using OpenStreetMap data as the street network, and polygons defining the areas with floods or other obstructions. Testing was performed for the relative server response time by measuring the response for an increasing amount of equally sized polygons as flooded areas. The results indicated that the method performed in a suitable way for a web environment.

A second method aimed at analysing affected areas from a fluvial flood was also developed. Since the intention was to perform the flood modelling within a Web-GIS client, the focus of this method was to develop and utilize algorithms with low time complexity. Thus, a sequenced flat-surface modelling was created for calculating the water-increase of a sloping watercourse. Performance of the method was further assessed through implementation into the Web-GIS client, where the results indicated on a high performance in terms of time and accuracy.

Throughout this thesis the relevance of the developed methods was put into the context of current international and Swedish flood disaster risk management. While much of the work in the developed world revolves around building infrastructural resilience, the developing world finds itself disproportionately vulnerable to natural hazards, and thus in larger need of methods for disaster response. The methods developed in this thesis were extra relevant to users with a low GIS experience working with disaster risk reduction and response in flood prone areas.

Keywords: Physical geography, Web-GIS, Dynamic street network analysis, Fluvial flood analysis, Flood disaster response

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