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Web-based hydrological modeling system for flood forecasting and risk mapping

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Mechanism of flood forecasting is a complex system, which involves variable controlling factors including climate condition, drainage attributes, land use/cover types, ground water recharge/discharge and runoff behaviors. The application of flood forecasting model require the efficient management of large spatial and temporal datasets, which involves data acquisition, storage, and processing of modelling input, as well as manipulation, reporting and display of model results. The extensive datasets usually involve multiple organizations, but no single organization can collect and maintain all the multidisciplinary data. The possible usage of the available datasets remains limited primarily because of the difficulty associated with combining data from diverse and distributed data sources. Difficulty in linking data and analysis tools and model is one of the barriers to be overcome in developing real-time flood forecasting and flood risk prediction system. The current revolution in technology and online availability of spatial data, particularly, with the construction of Canadian Geospatial Data Infrastructure (CGDI), a lot of spatial data and information can be accessed in real-time from distributed sources over the Internet to facilitate Canadians' need for information sharing in support of decision-making. This has resulted in research studies demonstrating the suitability of the web as a medium for implementation of flood forecasting and flood risk prediction. Web-based hydrological modeling system can provide the framework within which spatially distributed real-time data accessed remotely to prepare model input files, model calculation and evaluate model results for

flood forecasting and flood risk prediction.

This paper will develop a web-base hydrological modeling system for on-line flood forecasting and flood risk mapping in the Oak Ridges Moraine (ORM) area, southern Ontario, Canada. First, historical data for the past several decades (river gauging, precipitation, ground water, census, land use change) will be used to model the relations among the stream runoff, precipitation and hydrological-geographical features for each basin. The hydrological model will be applied to predict river runoff using the precipitation data. Then, this web-base hydrological modeling system will use the flow data (flood depth, duration of flooding, flood wave velocity and rate of rise of water level), DEM, land use data and statistical data (population, dwelling, average income) and basin descriptor such as average slope, urbanized area ratio in basin and basin area to analyze the flood vulnerable areas for flood risk mapping. This system has a multitier architecture consisting of presentation, business logic, and data tiers. The presentation tier is the interface for users to interact with system, users can submit request for information services from presentation tier, and it also can be used as the system client viewers for accessing geographic data and analysis results. Business tier will cope with the requests from presentation tier. The components in the business tier, including web server, application server, metadata server, geodata server and spatial analysis and model analysis server, are used for handling requests and modelling analysis. Web server will transfer the requests to application server. Geodata services will access real time data remotely, automatically cope with data heterogeneities problems for model analysis, statistical analysis and spatial analysis. Geoprocessing services will run hydrological model analysis and statistical model for r flood forecasting and risk mapping. The data tier includes all available distributed data sources from different organizations.