Chapter 6

Infrastructures for Data in the Context of Flow Forecasting Using Artificial Neural Network Model for Okavango River in Namibia

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ABSTRACT

A number of evolutions on data collection and sharing have been published. Countries have collected data but lack of access and complexity to implement these technologies has limitations. HydroServer Lite a web based server for sharing water data helps to address the need of data sharing and storing in a standard format. Namibia Hydrological Services has no common online system for storing and sharing of water data. This study extends the research on HSL features as data system linked to online ANN forecasting model. This is done by implementing a Namibian HSL using real time connection to the database to operate in real time tools developed to visualize and fill in missing data. Lastly, a model was build using Waikato Environment for Knowledge Analysis. Results of the best model obtained are coded in Hypertext Preprocessor with near real time data to provide continuous forecast. Linking data system for water resource management in a standard format is practical and promising.

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INTRODUCTION

Water is a critical component of the world’s natural resources. It is therefore imperative to understand how much water resources are available and where it is available. Recent extreme events have added an important motivation to the need of better flood and drought management. This requires knowledge on the behavior of hydrological phenomena and nowadays this can be realized by the use of hydrological models which run on water data such as water level and discharge (Albert et al. 2009). Currently, information technology has not been widely applied on the large amount of data that is being produced. Attempts of organizing water data that will help in effective water resource management are not formally archived in a central place in one standardized format, but it is spread over databases at different locations, in different formats. Although water resource managers do have access to this data, the variation in this data makes it difficult to locate the appropriate sources to support water resource management. Researchers spend their time on collecting data and transforming this data instead of scientifically analyzing hydrological models and making the required decisions (Goodall et al. 2008).

Thus, there is a need to build infrastructures to manage, archive and share this data. One such technology is in the context of Cyber infrastructures for hydrological data management. Cyber infrastructures is defined as “a combination of data resources, network protocols, computing platforms, and computational services that brings people, information, and computational tools together to perform science or other data-rich applications in this information-driven world” (Yang et al. 2010). The Consortium of Universities for the Advancement of Hydrological Science (CUAHSI) has developed a Hydrological information system known as the CUAHSI-HI. This university initiative has developed the first standards for the exchange and storage of water data on the internet (Botts et al. 2006, Tarboton et al. 2010). HydroServer Lite (HSL) which is also part of CUAHSI used in this study is a web based system for storing and sharing time series hydrological data using standards. However, although these data management infrastructure is already available for use, it still needs to be further explored, tested and improved to overcome the roadblock for effective water resource management (Kadlec et al. 2011, Kadlec 2014).

Many studies such as those by (Wu et al. 2005, Corzo 2007, Corzo 2009, Hung et al. 2009) relating to ANN in stage forecasting have emerged. These studies claim that ANN has been accepted as a good alternative to forecasting with hydrological and hydrodynamic models. This has been proven in several cases to be superior in terms of accuracy, performance and flexibility. However, in experience of the HydroServer data infrastructures, the development of such models has not been
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