EUROAQUAE
Euro Hydro-Informatics and Water Management

Education and Culture
Erasmus Mundus

Professional Practice Reports-Theses

Euro-Aquae Master Course
1st Generation 2004-2006

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The evolution of human activities, in the foreground of climate changes and growing earth population, induces situations more and more complex to manage. The sustainable development of water resources and its management represents today a major challenge. The global aim of management is to avoid or minimize risks of crises in water supply, irrigation, floods, waste water treatment.

In this context, **Hydro-Informatics**, a European concept encompassing progress of modelling technologies and management of capacities, emerges as an essential tool in activities aiming at satisfaction of social and economic requirements.

The main objective of the **Master EuroAquae** is to prepare and train future scientists and engineers in charge of modelling and managing projects in hydro-technologies and environment. These professionals have vocation to assist local, national and international services, and to be involved in consulting activities with private companies.

Supported by the European Commission within **Erasmus Mundus** framework, the EuroAquae consortium awards a *Joint Master of Science (MSc) in Hydro-Informatics and Water Management* from 5 European partner universities.

The Master Course is based on a two-year programme (4 semesters) given to about 40 participants mixing **European and third-country students**. The mobility scheme covers at least 3 locations.

The programme is organized into a pedagogic continuum to provide common knowledge/soft skills (sem.1); acquisition and use of hydro-informatics concepts, methods and tools (sem.2); a thematic specialization: hydro-informatics systems, urban waters management, inland waters management, decision support systems (sem.3); and throughout semester 4, a professional practice or research project finalized by the **production of reports**.

The first graduation ceremony was held in Nice on 6th September 2006: the 1st generation of 16 Alumni received the Joint MSc degree from 5 partner Universities.

The present brochure supplies information on Master Projects-Theses of the 1st generation of graduates: title, summary, name of the institution of the last semester of Professional Practice, names of the Academic Tutor and the Institutional Tutor of each graduate.

Author: **Balaji ANGAMUTHU** | Nationality: India

Master Project Title: **A professional practice in Hydro-Informatics and Water management**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutor: Dr. Caroline McGahey, HR Wallingford, Wallingford, United Kingdom

Abstract:

The drainage system for new development has to be assessed for several measures of sustainability. This required the development of tools to measure for Technical, Environmental, Economical and Social sustainability criteria. Tools such as Hydraulic Performance assessment, Infiltration volume computation model structure and Water quality assessment have been developed in Microsoft Excel Visual Basic for Application to measure the technical sustainability criterion.

During the last few years, the climate change has tremendously influenced the meteorological variables and thus the river flows. 'Effect of climate change on river flows and groundwater recharge: A practical methodology' project required the study of low flows phenomenon in the UK rivers. The relevancy and the quality of the 11 Southern England catchment models have been assessed using the Catchmod software. The quality of the models has been found good.

A legal case in the UK has been concerned with the frequency and nature of flows in the Mymmshall Brook for the period from September 1999 to March 2000. Modelling of the brook has been carried out in ISIS software. The results show that there was a significant flow over a number of times in the brook during that period.

Risk Assessment of Flood and Coastal Defences for Strategic Planning High Level Methodology (RASP HLM) requires the Detailed River Network (DRN) with river centreline to be a continuous network of polylines, digitised in the direction of flow, with nodes at all confluences and bifurcations, and without pseudo nodes. This required the data cleaning exercise to be carried out in the ArcGIS software with appropriate tools to make the DRN data usable in the RASP HLM.

HR Wallingford is the Co-ordinator of the FLOODsite Project. The Project Co-ordination Team there has been assisted on some of their website-related co-ordination tasks. The Document Management System and the Project links databases have been brought up-todate, and review of the user-friendliness of the overall website has been completed.

Key-Words:

- Drainage systems, hydraulic and water quality assessment, Sustainability Index
- River modelling, discharge, velocity, swallow holes
- Climate change, Catchment models, Low flows, hydrograph, flow duration curve
- River network, nodes, polylines, flow error, flow direction
- Project management, Document management system, Project links, Website review

Author: **Md. ATIQUZZAMAN**

Nationality: Bangladesh

Master Project Title: **Uncertainty Analysis of Urban Drainage Systems in OpenMI Environment**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutor: Dr. Ole Mark, DHI Water & Environment, Copenhagen, Denmark

Abstract:

Uncertainty is a common issue in the design and rehabilitation of urban drainage system. Hence, varying uncertain parameters and studying their effects on the model results are conducted in urban drainage modelling. The parameters contributing uncertainty are hydrological reduction factor, imperviousness, time of concentration, catchment area and initial loss in hydrological model and Manning's number and energy loss coefficients in hydrodynamic model. Precise estimations of these parameters are, however, somewhat cumbersome.

In this study, the combined influence of all hydrological parameters is represented into a single factor called, scale factor. So, for uncertainty analysis, the influence of scale factor and Manning's number on the node water level and link discharge is taken into account. The whole process is done in Open Modelling Interface (OpenMI) platform with urban modeling software, MOUSE/MIKE URBAN. OpenMI is fully integrated in Model Explorer (ME) which generates the parameters values based on popular technique, called Monte Carlo method with Latin Hypercube (LH) sampling technique. In order to cope with usual problem structure, ME is extended with the addition of some more functionality and applied to a real drainage problem. The generated samples from ME are transferred to MOUSE at each time step.

The feedback from MOUSE for certain number of iterations is analyzed and demonstrated graphically in terms of cumulative probability distribution of maximum water level (probability of exceedence curve), longitudinal profile with indication line showing a certain probability of exceedence etc. The reduction of uncertainty due to the calibration of the model is also investigated. Results show that the methodology enhances the decision making process in urban modelling.

Key-Words:

Uncertainty, OpenMI, Monte Carlo, Latin Hypercube, MOUSE, Model Explorer, Urban Drainage, Probability Distribution.

Author: **Anna BOZHKO** | Nationality: Russia

Master Project Title: **Development of SUDS Storages Assessment Tool for Ireland**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutors: Richard Kellagher, Keiran Millard, Steven Wade, HR Wallingford, Wallingford, United Kingdom

Abstract:

Sustainable Urban Drainage System is an alternative way of urban surface water management that tries to overcome disadvantages of traditional sewer networks. SUDS philosophy incorporates an integrated approach to dealing with storm water including evaluation of land use planning, water quality, water quantity, amenity and habitat enhancement issues into the design process.

SUDS is a new concept and many countries are trying to implement it in urban drainage design practices. The main obstacles are usually (legal taking in charge of SUDS units) and lack of professional and public awareness. One of the ways to introduce SUDS practices is to provide a simple tool that help evelopers, local authorities and other stakeholders to apply SUDS for the new developments.

A simplified methodology for evaluation of storage volumes to manage the surface water runoff (interception, treatment, long-term and attenuation) can be combined with effective GIS data management system to help users with identification of topographical, hydrological and geographical characteristics of particular development site. The tool can provide indicative SUDS storage volumes and is suitable to be included at the Master Plan stage of projects.

Key-Words:

Sustainable Urban Drainage Systems, urban hydrology, SUDS storage assessment, Greater Dublin Strategic Drainage Study, XML.

Author: **Jean-Michel CROZET** | Nationality: France

Master Project Title: **Thames Estuary 2100. Flood Risk Management Strategy for London and the Thames Estuary adapting for climate change**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutor: Dr Jon Wicks, Halcrow Group Ltd, Swindon, United Kingdom

Abstract:

Flood risk on the tidal Thames is managed using an extensive system of fixed flood defences together with moveable gated barriers, flood control gates and other gated structures. The key flood defence structure is the Thames Barrier, which prevents tidal flooding in central London. The existing system provides a standard of protection in excess of 1000 years for much of the floodplain including central London.

Climate change, its consequences on sea level, storm frequency and intensity in addition to status of this flood defences and socio-economic pressures might reduce this level of protection with a potentially increasing flooding threat. Thames Estuary 2100 project (TE2100) has been initiated to address these issues and to produce a flood risk strategy up to 2100.

This report relates this project, the notions, the methodology, the tools used to address these issues.

Key-Words:

River Basin Management, Flood Risk Strategy, Climate Change.

Author: **Rudi HERMAN** | Nationality: Indonesia

Master Project Title: **Integration Of 1D and 2D Model to Analyze The Impact Of Different Catchments**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutors: Maria Vikstrom, Lars Goran Gustafsson, DHI Water & Environment, Gothenburg, Sweden

Abstract:

The flood assessment of urban flooding become more important because of complexity of problem that could emerge afterwards. The simulation of runoff over the surface and the connection to the sewer netwotk are one of the most crucial for each computation of the flood impact assessment. The traditional computation are relied on the use of fully-dynamic branched one-dimensional (1D). These models are able to accurately predict flood levels and discharges inapplications where the basic assumptions of 1D flow remain valid. Difficulties can arise, however, in urban areas where the flow paths on the floodplain can become complex due to the incidence of man made structures such as houses, roadways, bridges, embankments and levee banks, etc. In particular, problems arise where the analysis is required at a level of detail involving flows around individual buildings and structures where a branched 1D model is limited in its capacity to accurately represent the resulting complex flow paths.

With respect to flooding impacts, this last requirement has resulted in the need for assessment of effects, in terms of water level changes, down to 1cm or less in accuracy. To assess impacts to such precision, particularly on large projects, requires consideration of localised effects on a very fine scale. This level of precision can only be achieved through the use of a fully two-dimensional (2D).

The coupling of 1D model and 2D model become more reliable to achieve a goal for urban flood protection. And its become more important especially if it was consider the damage that left after flood. For this rason therefore the evaluation of the impact of pervious and impervious area will brought the new idea urban flood impact assesment.

Key-Words:

1D and 2D models, Hydrological Modelling, Hydrograph, Flood Protection.

Author: **Alan KERROUX**

Nationality: France

Master Project Title: **1D modelling of the Seine river for flood forecasting**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutor: Céline Stretta, DHI Water & Environment, Nantes, France

Abstract:

Flood forecasting is a recent rising technology. The experience and feedback earned from years of numerical modelling have made it possible for the models not only to model past events and possible scenarios, but also to make previsions using real time data acquisition, with adjunction of specific modules.

These modules are already developed by DHI into a suite of integrated tools enabling these features. The Mike11 modelling software now has the possibility to be the base of such a forecasting system, and DHI already has few experiences on operational flood forecasting worldwide.

Now this experience is going to be used on a particular area of interest, the Seine upstream of Paris. Floodings are particularly damageable when it comes to capitals, explaining the high expectations of the client, the DIREN (Direction of Environment) of the region Île de France.

This case study can be the base of understanding the constraints and requirements of a one dimensional modelling approach, but specifically oriented on the flood forecasting. It can also lead into critical analysis of feasibility of a flood forecasting system and its quality assessment, in terms of hypothesis taken and necessary simulations.

Key-Words:

Hydraulic Modelling, Hydrological Modelling, Hydrograph, Flood Forecasting, Flood Prevention.

Author: **Loïc LAUREAU**

Nationality: France

Master Project Title: **TUFLOW MODELLING of the Hull Catchment Flood Management Plan and the Corby Sustainable Development**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutor: Laura Baird, Halcrow Group Ltd, Hampton Peterborough, United Kingdom

Abstract:

Today, with the Water Framework Directive, it is essential to undertake water cycle strategies and management at a catchment scale in the United Kingdom and in a sustainable manner. Indeed, the Environmental Agency plays a key role to lead and assist the different people involved in such schemes, in order to reach the objectives fixed.

To be efficient, the different stakeholders can use common tools, which can simplify a lot the understanding of some problems. In flood management, some modeling softwares like iSIS have been used for a long time and will continue to be required in order to work efficiently in this very specific market.

In this report, I will roughly speak about the TUFLOW 2D modeling software used for two different projects that represent quite well the type of work that a hydraulic modeler can be involved in and for which I had the opportunity to experience: the Hull Catchment Flood Management Plan at the Market Weighton Canal and the Water Cycle Strategy of Corby.

Key-Words:

Hydraulic 2D Modelling, 1D/2D link, Unit Hydrograph, rainfall-runoff method, flood estimation, broad scale model, drainage system.

Author: **Laurent POUGET** | Nationality: France

Master Project Title: **Comparison and investigation of different approaches in 2D flood modelling**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutor: Peter Larsen, DHI Water & Environment, Madrid, Spain

Abstract:

Usually when a floodplain is studied the modeller has got several choices for representing in the best way what could happen in reality. Often the consequences of favouring one of those choices are not well-known, and results can be misconceived without even knowing it.

This work investigates the effects of several aspect of two dimensional floodplain modelling, namely the spatial discretization, the types of bridge models and the bed resistance. For this purpose, several hydraulic simulations were performed and compared, for a test channel and a real floodplain.

The results show that changing the cell size from 2m to 8m will not modify the water depth and speed in a significant way in the flooded area.

Concerning the bridge models, the backwater differences between all the methods available in Mike Flood are inferior to one meter. However, this also means that we can have a real difference in the flood effect between two methods chosen on both sides of this range.

Increasing the bed resistance in the river and the floodplain, it can be observed that the flood become more important. The water depth rises in the whole area, whereas the flow speed modification depends on the zone.

Key-Words:

Hydraulic Modelling, Two Dimensional Model, Spatial Discretization, Bridge Backwater, Bed Resistance.

Author: **Natalia RATNIKOVA** | Nationality: Russia

Master Project Title: **Modelling of Combined Sewer Systems: Detailed Drainage Master Plan of Prague, Detailed Drainage Master Plan of Tábor**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutor: Mirek Tesarik, DHI Hydroinform a.s., Prague, Czech Republic

Abstract:

Urban Drainage Master Plan is a large scale project based on an integrated approach to drainage of urbanized area as a whole. It is carried out for the purposes of assessment, maintenance, design and further development of a drainage system.

The projects “detailed Drainage Master Plan of the north part of Prague” and “Master Plan of the Tabor city”, I was involved in during the professional practice in DHI Hydroinform a.s. Prague, exemplify the combined sewage system (CSS) modelling.

Modelling of CSS can be roughly divided in 4 phases where the data collection and data processing requires the biggest efforts and time.

In large scale models as many actions of the modelling process should be automated as possible. That, in another hand, should not cause an accuracy lost in a model.

In the study of the part of Tabor city the different approaches to hydrological parameters such as size of contributing areas and percentage of impervious areas are applied and from practical point of view it can be concluded that simplifying the modeling process in comparison with time it saves in some cases can be reasonable.

Key-Words:

CSS – combined sewer systems, CSO – combined sewer overflow, Sewershed, Catchment.

Author: **Guillaume TAMAGNAN** | Nationality: France

Master Project Title: **Catchment Flood Management Plans Approach in England and Wales**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutor: Mike Cope, Halcrow Group Ltd, Swindon, United Kingdom

Abstract:

This thesis presents some political and technical issues about flood management method developed in United Kingdom with the recently undertaken Catchment Flood Management Plan process.

The analysis is also based on the examples of the New Forest CFMP and the Test and Itchen CFMP, committed to Halcrow by the Environment Agency.

It will describe the different steps of a CFMP process, mainly regarding the socioeconomical issues caused by flooding, and the long-term process view of a CFMP.

Key-Words:

Flood Prevention, Future scenarios, Flood impact.

Author: **Marion TERMINET** | Nationality: France

Master Project Title: **Hydrological and hydraulic studies for the crossing of the DARDAILLON EST by the "Nîmes – Montpellier" high-speed rail line project**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutor: Gilles Gatimel, INGEROP, Water and Environment, Bourges, France

Abstract:

Infrastructures are more and more developed in our society due to a development of communication and an increase of population. Their development can induce environment issues and damages especially for water resources.

This report deals with a hydraulic study concerning the Dardaillon Est river. This study is realized because of the rail line project Nîmes-Montpellier in South of France, in Mediterranea. The objective of this study is to well dimension hydraulic works in order to evacuate water flows, which cross the project, with the minimum of impacts on hydraulic actual state (or even no impacts).

A model is built with CARIMA to simulate initial hydraulic state of the river basin at the project crossing. To create this model, data collection and definition are needed: field trip investigation, topographic data definition and survey, hydrological study to define peak flooding discharges and hydrographs to inject in the model, etc. Specific hydrological methods are used because of the Mediterranean context.

An introduction about CARIMA software is given: its possibilities, its based equations, its functioning and its limits. Then, the building of the model to simulate the hydraulic initial state of the study area is explained. After, calibration and validation tasks are realized. And then, floods with different return periods are simulated and results are analyzed before to conclude on the actual diagnostic of water flows in Dardaillon Est river basin, close to the project.

This report regroups a lot of methods in hydrology and hydraulic that can be used for the problematic of infrastructure projects and water management.

Key-Words:

Dardaillon Est, CARIMA, Hydrology, Hydraulic, Initial state modelling, Infrastructures projects and water management, Mediterranean context.

Author: **Keiko YAMAGATA** | Nationality: Japan

Master Project Title: **Investigation of Hydrological Model Structures with Spatial Distributed Precipitation for Streamflow Simulation**

Academic Tutor: Prof. Philippe Gourbesville, University of Nice Sophia- Antipolis, France

Institutional Tutor: Michael B. Butts, DHI Water & Environment, Copenhagen, Denmark

Abstract:

This study has assessed the performance of distributed hydrological modelling and semi-distributed modelling for the streamflow simulation in a watershed using the radar-based estimates of the precipitation. The Distributed Model Intercomparison Project (DMIP) was formulated by the US NOAA National Weather Service to evaluate the capability of distributed models versus lumped models and the effect of the spatial variability of the precipitation estimates from the radar on basin response.

This project concluded that although the lumped model performed better than distributed models in most cases, some calibrated distributed models can outperform a calibrated lumped model. However, the project highlighted further topics and problems to be investigated. NWS proposed the second phase of DMIP (DMIP2) to answer the unresolved questions and study further comparison in more hydrologically complex basins or in a forecasting environment. New radar-based precipitation estimates which have been reanalyzed are provided with additional years, since the DMIP1 was considered hampered by the quality of the precipitation and the small number of significant events in the validation period.

Based on the DMIP2, this study was carried out in the Blue River basin 1) to evaluate the applicability of new conceptual representation of MIKE SHE, 2) to assess the benefits of the re-analyzed radar estimates of precipitation, 3) to investigate which spatial elements of hydrological model benefits most from distributed modelling and 4) to evaluate the grid-based schemes of MIKE SHE and investigate alternative schemes. Several different model structures were selected in MIKE SHE and MIKE 11 and calibrated to the observed discharge at the basin outlet. Simulations with the different structures were demonstrated and the results were compared with the observed discharge.

First, the conceptual subcatchment based model was found to perform as well as the grid-based model. Besides, NAM model, which is also a deterministic conceptual model accounting for the water content in up to 4 different storages, performed well. Second, a smaller grid size for the grid-based model did not improve the simulation due to the fact that the representation of the surface flow assume the water moves as a grid size sheet flow and even if the grid is 100 m, this movement is not physically correct. An alternative distributed representation for the overland flow is required to describe the process properly. Third, the comparison of the station-based rainfall input with the grid-based rainfall input of high resolution was disturbed by the quality of the data from the rain gauges.

Further study is needed to determine which level of the spatial distribution is efficient in order to simulate the streamflow at the outlet with the distributed model. The tests were carried out only for the calibration period and the simulations have to be run for the validation period as well to confirm the performance of the models.

Key-Words:

Distributed Hydrological Modelling, Radar Precipitation, DMIP , Streamflow Forecasting.

Author: **Rodrigo CONCHA JOPIA** | Nationality: Chile

Master Thesis Title: **An Approach to Urban Dual Drainage using EPA SWMM 5.0**

Academic Tutor: Prof. Manuel Gomez, Technical University of Catalonia, Barcelona, Spain

Abstract:

Different processes occur when a heavy rain falls over urban areas. On the catchments, surface runoff is produced and moves through different surfaces. Normally surface runoff reaches the street gutters producing the street flow along it. In gutters, a portion of the street flow is diverted into sewer system through street grating inlets. If sewer system does not have sufficient capacity to convey high flows, then the water could escapes from sewer system through manholes and inlets to street system. This extra volume of water will interact with surface flow, modifying water depths and flows over the street. The interaction between surface flows and sewer flows through the flow exchange produced at street inlets and manholes is known as Urban Dual Drainage.

In this thesis two different methodologies of modelling of a simple dual drainage system are developed and applied on. Both methodologies are carried out using EPA SWMM 5.0 software.

One of them is a simple decoupled methodology, which considers the drainage system as two non-linked networks. The other one, which represents the drainage system as just one network, is made up of two different methods to simulate the flow exchange between the surface drainage system (streets) and the stormwater sewer system.

The results are showed and discussed, and final conclusions are presented.

Key-Words:

Dual Drainage, Dynamic Wave, Flow Exchange, Sewer system, Street flow, Surcharge, SWMM 5.

Author: **Georgina CORESTEIN** | Nationality: Argentina

Master Thesis Title: **Numerical-experimental comparative study of the overland flow in a street intersection**

Academic Tutors: Prof. Manuel Gomez, Ernest Bladé, Martí Sanchez, Technical University of Catalonia, Barcelona, Spain

Abstract:

The continuous growing of urbanized areas and the rise of the density of buildings in existing cities, has led to the increment of flooding problems. These problems appears, as is well known, because of the decrement of pervious areas, the increment of overland flow volume and the reduction of surface roughness, among others. It is, thus, quite common that the urban drainage system becomes under-dimensioned and pipes capacity is exceeded. As a result of this situation, streets, which are designed to conduct just a small amount of water, usually that generated by the rain that falls on top of them, have to deal with considerable discharges which can produce water depths and velocities in the overland flow that might represent an important risk for people, vehicles and goods.

The overland flow in urban streets can be considered as one-dimensional but with a flow aspect ratio (top width over water depth) around 50 or more, while a usual canal or river flow show usually an aspect ratio between 5 and 10. When two o more streets arrive to a street crossing, the flow in the intersection shows complex flow patterns. A twodimensional methodology can be applied to get a better approach to this process.

Moreover, the flow pattern inside this intersection area influences the flow distribution on the outlet streets. The knowledge and understanding of the behaviour of the flow for these cases is one of the keys of the process of improvement of the urban drainage systems/models to represent the street flow on the surface of our cities. Under the umbrella of these considerations this works attempts to present a numerical-experimental comparative study of the flow in streets crossings. The study focussed on conditions of subcritical flow regime and, in particular, investigates in particular velocity fields and water depth maps.

The following document outlines the tasks performed as part of the EuroAquae Master Thesis. A revision of the previous studies, theoretical and experimental, is presented in first term; then the characteristic of the devices/models are explained as well as the planning of the tests and simulation respectively. Afterwards the obtained results are shown and critically discussed. Finally the conclusions are stated.

The experimental tests were carried out in an existing device of the Scaled Model Laboratory belonging to the Hydraulic, Maritime and Environmental Engineering Department of the Polytechnic University of Catalonia (Laboratori de Models Reduïts – DEHMA). This scale model was built for the PhD studies of Leonardo Nanía (Nanía 1999). Because one of the aims of this study was to obtain experimental velocity fields; velocities measurement was necessary. To do these measures, it was used an acoustic Doppler velocimeter which is available from the FLUMEN group of the Hydraulics Department (DEHMA).

The numerical study was done using the software called CARPA (Cálculo en Alta Resolución de Propagación de Avenidas) this software simulates unsteady free surface flow.

Key-Words:

Urban Water, Street flow, street junction, Numerical-experimental, Subcritical flow, Flood Prevention.

Brandenburgische Technische Universität Cottbus

Author: **Omid KHAJEH MAHABADI**	Nationality: Iran
Master Thesis Title: **Geothermal Simulation for the City of Berlin**	
Academic Tutor: Prof. Dr.-Ing. K.-P. Holz, Brandenburg University of Technology, Cottbus, Germany Institutional Tutor: Prof. Dr.-Ing. Stavros Savidis, GuD Consults, Berlin, Germany	

Abstract:

Heat withdrawal from and injection into sediments using heat pumps leads to underground temperature variations and consequently the creation of warm or cold plumes around a borehole heat exchanger. The focus of this research project is to demonstrate the influence of groundwater flow (in different soil types) on the above-mentioned plumes. This is achieved through a parameter study on a model consisting of only one borehole in five different soil types and four flow regimes.

Moreover, the impact of industrial heat withdrawals where the number of installations could rise up to 20is also studied. The effects of soil layering on temperature distributions are also investigated.

The simulations point out the significance of the hydraulic parameters of the sediments, as well as flow regimes, the number and configuration of boreholes, and soil layering.

The concept of virtual collaboration and the relevant ICT tools used are also discussed in the report.

Key-Words:

Geothermal Simulation, Groundwater Flow, Heat Transport, Coldness plumes.

Author: **Denis QUATRELIVRE** | Nationality: France

Master Thesis Title: **Flood management in Tisza River basin planning, with regards to the Water Framework Directive**

Academic Tutor: István Ijjas, Budapest University of Technology and Economics, Budapest, Hungary

Institutional Tutor: Péter Bakonyi, VITUKI Environmental Protection and Water Management Research Institute, Budapest, Hungary

Abstract:

The overall objectives of this thesis is to study, collect and assess the best practices for the restoration of floodplains in the Hungarian Tisza basin. In the first part I tried to overview the background of the second Vásárhelyi flood protection plan, and see if it can fit the European requirements and recent views on flood management. It is clear that this plan is a real improvement compare to the past policy in that matter. To a flood protection system by floodplains instead of full levees solution, the plan adds consideration for ecosystems, and becomes a complex project covering different aspects. The European community has a complete policy in this matter through the Water Framework Directive (WFD), and, if the text is approved, the proposal on the assessment and management of floods. One of the main issues of this thesis was to assess how the New Vásárhelyi Plan (NVP) complies with the WFD.

The WFD defines the concept of a good status of waters. Through this «good status of waters», we get a goal, and indirectly we can define ecological functions and actions needed to reach this goal. As a general idea the WFD, similarly to various ecologist organizations, suggests the restoration of wetlands. In Hungary, the floodplain like it was before the first Vásárhelyi plan cannot be given back to nature. But the NVP allows a reasonable possibility to do so, and in such a way can increase significantly the ecological potential of the Tisza basin.

As a result of this general approach, we can see that it is necessary to consider notions which appear to not be so easy to define like the minimum regimes of waters and socioeconomic aspects. Both of them bring us to a so called «human system» in literature, and contain, in themselves, a subject to a thesis. Taking this into account, we point out the necessity of a sustainable management plan for the floodplain. This plan will give a clear view of the role of the floodplain and its required ecological functions. These functions may induce the necessity of a permanently or intermittently maintained wetland within the floodplain, defined as ponds in the thesis.

Hence, an other main issue of the thesis is to show what are the important points to consider, implementing such ponds in floodplains, by defining the requirements to perform the study and a procedure to follow, with the help of a case study. Such a study requires to consider hydrodynamic characteristics of the wetland for the pond itself, and the whole floodplain as retention reservoir during its inundation, for flood control purpose. This is done by the use of hydroinformatics tools, on which a sample application is also presented. These results showed the high hydrodynamic complexity of such systems, to be then taken into account in detailed ecological investigation.

Key-Words:

Ecology, floodplains, hydrology, flood river basin management plan, numerical model, Tisza, Szamos, Kraszna, simulation, waste waters, wetlands.