Editorial: Understanding changing climate and environment and finding solutions

This special issue contains selected papers from the 10th International Conference on Hydroinformatics (HIC2012) held at Hamburg University of Technology, Germany, in July 2012 bringing together about 350 participants from 43 different countries to discuss and advance the latest developments in hydroinformatics.

The main theme of this conference was 'Understanding Changing Climate and Environment and Finding Solutions' with the aim of assessing the impact of these changes on our aquatic environment and on developing suitable adaptation and mitigation measures. Recent natural disasters such as devastating floods occurring frequently all over the world have demonstrated how vulnerable our Earth is, with its ever rapidly growing urbanization, to changes in climate and environment, and the limitations of our engineering tools to protect society and the environment.

Finding solutions to these challenging problems was discussed by scientists, engineers, software developers, practitioners, and stakeholders from public, private and federal organizations. We saw considerable progress in all eight conference topics: advances in physically based modelling methods; data-driven modelling, soft computing and model optimization; remote sensing, digital and sensor technology; early warning systems and disaster mitigation; real-time control and decision support systems; climate change impacts; knowledge and data management and models interoperability; and education, public awareness and socio-economic aspects.

The opportunity to publish an extended version of their papers after a successful peer review has been offered to authors of outstanding contributions, and finally we can present 18 papers from various fields. Seven papers deal with modelling water distribution systems using optimization and statistical methods, four with surface waters and catchment hydrology, three with data management and data-driven modelling and another three with different hydroinformatics fields.

In this special issue, there is a strong emphasis on modelling water distribution systems using optimization and statistical methods with seven contributions. Massari *et al*. (2014) present an algorithm to detect partial blockages in water pipeline system networks by means of pressure transient measurements and estimations of the diameter distribution based on a stochastic successive linear estimator which quantifies the associated uncertainties. A hydraulic model to evaluate the potential energy recovery in a water distribution network with private tanks when using pumps as turbines has been developed by Puleo *et al*. (2014). They use the Global Gradient Algorithm and Monte Carlo Analysis and apply their model to a real case study in Palermo, Italy. Darvini (2014) compares different probability distributions of random parameters to assess the reliability and performance of a water distribution network. The author accounts for the mechanical failure of network components, the spatial and temporal variation of the water demand and the uncertain distribution of the pipe roughness. The development of an Adaptive Locally Constrained Genetic algorithm using a heuristic approach to design a water distribution network with least costs is described by Johns *et al*. (2014). They demonstrate the superiority of their new algorithm when compared to standard genetic algorithms and solutions from the literature. McClymont *et al*. (2014) develop a novel hyper-heuristic approach using Genetic Programming to evolve mutation operators for Evolutionary Algorithms which are specialized for a bi-objective formulation of optimizing the design of water distribution networks. The authors demonstrate the performance of their new approach in an experiment with many mutation operators. The paper by Sanchez *et al*. (2014) describes an integrated cellular automata evolutionary-based method for evaluating future scenarios such as urban growth and the consequent expansion of urban drainage networks. They use two techniques, agent-based modelling and raster

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operations within ArcGIS, and apply their model to a case study in Birmingham, UK. Hong *et al.* (2014) address water distribution for open channel irrigation networks which are faced with increasing constraints on water resources and changing demand patterns. The authors use an optimization method to find a fair solution accounting for various hydraulic operation scenarios and various constraints when applying it to a canal network in France.

Four papers are related to surface waters and catchment hydrology. Shrestha *et al.* (2014) report on the coupling of five different models with OpenMI for simulating water quantity and quality including the dynamics of *E. coli* to evaluate the ecological functioning of River Zenne in Belgium. They found that model integration with OpenMI is useful; however the calculation time remains significant. In the paper by Simons *et al.* (2014) the Hydroinformatics Modelling System is presented. It is a robust Finite-Volume Method-based model implemented in an object-oriented framework being suitable for a wide range of classical and 'new' application fields of shallow water flows. Its performance is demonstrated for different test cases such as a flash flood and rainfall-runoff in a small alpine catchment. Dumedah & Coulibaly (2014) use evolutionary data assimilation to estimate streamflow in gauged and ungauged watersheds. Applying their model to several watersheds in Ontario, Canada, their findings show a high degree of commonality in model parameter values such that members of a given gauged or ungauged watershed can be estimated using members from another watershed. A comparison of neural network based hydrological models with alternative modelling approaches is carried out in the paper by Dawson *et al.* (2014). A partial derivative, relative sensitivity analysis method is presented to evaluate the physical legitimacy of the models. Investigating flood predictions in rural catchments the superiority of neural methods is demonstrated and, therefore, they are preferable for transferring into ungauged catchments.

Another three contributions deal with data management and data-driven modelling. Taylor *et al.* (2014) explain WaterML2.0, an open standard for hydrological time series data exchange, which has been developed in a collaboration of the Open Geospatial Consortium (OGC) and World Meteorological Organization (WMO). Various hydroinformatics details are explained and various advantages are emphasized by, for example, applying it to hydrological flood forecasting. In the paper by Deng *et al.* (2014) the development of a web-based and user-friendly decision support system for beach managers and beachgoers is explained. Multiple linear regression methods are combined with water quality monitoring, prediction of bacteria counts and GIS to deliver real-time predictions. The system has been successfully tested and applied to beaches in Louisiana, USA. Kamel *et al.* (2014) apply remote sensing to improve modelling of fine sand dynamics in a Dutch coastal zone. Satellite data are used to thoroughly calibrate and validate the Delft3D-WAQ model of the southern North Sea. Based on sensitivity and uncertainty analyses prediction intervals of the fine sand dynamics have been carried out. Through comparison with *in situ* measurements the model accuracy has been improved near the Dutch coast.

Finally, there are four further papers from different hydroinformatics fields. Mair *et al.* (2014) have improved the performance of parallel methods for urban water management. Performance tests were carried out on a set of real-world case studies. The authors found that the speedup depends on the system size and the time spent in critical code sections. In the paper by Nohara & Hori (2014) the potential of long-term stochastic inflow predictions is analyzed for improving reservoir operations considering droughts and uncertainties. Monte Carlo methods and stochastic dynamic programming are chosen and their model is applied to a reservoir basin in Japan. Arnone *et al.* (2014) investigate the suitability of artificial neural networks for mapping landslide susceptibility. Different strategies within a Multi-Layer Perceptron network are analyzed. The model is applied to a small basin in Northeastern Sicily, Italy, where a number of slope failures have been documented over the years and its performance is evaluated using specific metrics. Finally, Abbott & Vojinovic (2014) open the horizon of hydroinformatics praxis for serving of social justice. They refer to several own and other publications and they point out that the possibilities strongly depend on the countries, that is, the degree of democracy and free society.

Overall, the members of the International Organization Committee of HIC 2012 wish you much fun reading the papers!

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