book reviews

Stochastic Flood Forecasting System. The Middle River Vistula Case Study **edited by Renata J. Romanowicz and Marzena Osuch 2015), GeoPlanet: Earth and Planetary Sciences, ISBN 978-3-319-18853-9, ISBN 978-3-319-18854-6 (eBook), Springer – Cham, Heidelberg, New York, Dordrecht, London, 198 pp.**

The book "Stochastic Flood Forecasting System. The Middle River Vistula Case Study", edited by Renata J. Romanowicz and Marzena Osuch, was published in Springer's *Geoplanet: Earth and Planetary Sciences* Series in 2015. It summarises the achievements of the research project on a "Stochastic flood forecasting system (The River Vistula reach from Zawichost to Warsaw)" that was commissioned by Poland's National Science Centre, NCN, (Contract No. 2011/01/B/ST10/06866), and carried out at the Institute of Geophysics in Warsaw.

The book's five parts concern: (i) Spatial and Temporal Variability of Flow Regime and River Morphology Based on Analytical Studies and Measurements; (ii) Physically Based Modelling; (iii) Lumped Parameter Approximation to Distributed Modelling of River Flow, Distributed Model Emulators and On-line Data Assimilation; (iv) Ensemble Forecasts, Linking Conceptual and Data-Based Models for Flow Forecasting and (v) End-User Interests.

The first part of the book contains four chapters whose titles describe the contents well, i.e. "Land Cover Change in the Middle River Vistula Catchment" by M. Gutry-Korycka, A. Mirończuk and A. Hościło; "Influence of Land-Use and Water Management Practices on Water Levels in the Middle River Vistula" by E. Karamuz, R.J. Romanowicz and M.J. Booij; "On the Run Length in Annual Maximum Flow Series in the Middle Vistula Basin in the Context of Climate Change Impact" by Ewa Bogdanowicz, Witold G. Strupczewski and Krzysztof Kochanek and "Bed Topography and Discharge Measurements in the Świderskie Islands Nature Reserve, River Vistula, Poland" by Robert J. Bialik, Joanna Sziło, Mikołaj Karpiński, Agnieszka Rajwa-Kuligiewicz and Oskar Głowacki. The first two chapters deal, respectively with: (i) catchment geography and land-cover changes during the last 25 years and (ii) long-term changes of the river flow regime, analysed by mathematical modelling based on 50 years of daily flow and water-level records. The third chapter in

turn sees the authors address the issue of nonstationarity, assessing changes in river-flow process, and applying a first-order Markovian model to determine the durations of flood-poor and flood-rich episodes. The last, fourth, chapter of the first part provides information on short-term flow variability, on the basis of detailed flow and bed topography measurements at a single gauging station.

The second part also consists of four chapters, i.e. "Sensitivity and Uncertainty Analysis of Precipitation-Runoff Models for the Middle Vistula Basin" by Marzena Osuch; "Distributed Modelling of Flow in the Middle Reach of the River Vistula" by Krzysztof Kochanek, Emilia Karamuz and Marzena Osuch, "Sensitivity Analysis of the Flow Routing Model for the Middle River Vistula – Multi-method Approach" by Marzena Osuch; and "Influence on Flood Safety of Channel Processes and Vegetation in the River Vistula Valley in Warsaw" by Artur Magnuszewski. In the first and third papers, the authors report on sensitivity and uncertainty analyses of, respectively, (i) rainfall-runoff (HBV) and (ii) flow routing (MIKE 11) models for the catchments studied, detailing the dominant processes. The second paper compares two river flow modeling tools, MIKE 11 and HEC-RAS. The two models are shown to give rise to similar results, but the automated calibration of the MIKE 11 model performs better than the HEC-RAS model with its hand-tuned parameters. The last, fourth, chapter presents the application of a 2D hydrodynamic model, CCHE2D, to the

River Vistula in Warsaw. This work, performed for different scenarios of floodplain maintenance, helps to predict flood conveyance in highly urbanised and vulnerable areas of Poland's capital city.

There are two chapters in the third part, entitled "Stochastic Semi-distributed Flood Forecasting System for the Middle Vistula Reach" and "Stochastic Transfer Function Based Emulator for the On-line Flood Forecasting", each of which was authored by Renata J. Romanowicz and Marzena Osuch. These papers from the co-editors prove to be very central to the issue in the book's title. In the first paper, we are informed about a semi-distributed stochastic flood forecasting system that offers predictions in association with estimated confidence limits. However, since available real data did not suffice, work with a stochastic transfer function-based emulator is what is described in the second chapter of the third part, with the aim of short-term online flow forecasts being obtained.

The sole chapter in the fourth part is thus "Adaptation of the Integrated Catchment System to On-line Assimilation of ECMWF Forecasts", by Adam Kiczko, Renata J. Romanowicz, Marzena Osuch and Florian Pappenberger. This details the first attempt made in Poland to achieve online assimilation of ECMWF forecasts in hydrology, allowing the authors to extend the forecast lead time for the Biala Tarnowska catchment (in fact in the Upper Vistula Basin, i.e. beyond the spatial area defined in the book title). The authors used medium-range probabilistic weather forecasts from the European

Stochastic Flood Forecasting System. The Middle River Vistula…

177

Centre, as well as online observations of temperature, precipitation and water levels.

The last, fifth, part also consists of a single chapter: "Social Aspects in Flood Risk Assessment" by Dorota Rucinska. This addresses the important social dimension, yet the fit with the title of this part of the book "End-User Interests" is not immediate.

Altogether, the book has 12 chapters, non-uniformly distributed. As will be clear from the aforementioned, the three last parts together comprise just four chapters. There are 19 contributing authors, with the editors of key importance among them, given that Marzena Osuch authored or co-authored six papers (and was the sole author on two), while Renata Romanowicz authored or co-authored four papers (and was the first author on two). There are also two non-Polish co-authors of truly international standing, i.e. Florian Pappenberger and M. J. Booij. Overall, this is nevertheless a highly collaborative volume, with most papers under joint authorship, and only four chapters having a single author.

The novelty of the approach reported on in the book lies in the way it integrates a number of different hydrological modelling tools, including distributed, lumped parameter, deterministic and stochastic models that can be run separately or in parallel. The proposed system has a modular structure, including models describing rainfall-runoff and snow-melt processes for tributary catchments and the transformation of a flood wave within the reach. The study integrates different aspects of flow forecasting at different temporal and spatial scales, including catchment-scale rainfall-runoff modelling and flow routing modelling approaches.

This book aims to raise interest in and motivate further research in the area, as well as to raise awareness of the need for a stochastic approach to flood forecasting, and to stimulate similar approaches in Poland and elsewhere. However, if this were truly the case, the authors would be expected to make every effort to demonstrate convincingly the tangible practical advantages of the approach. In particular, comparisons of the performance of existing and proposed approaches would be of considerable interest. The editors state that the floods on the River Odra in 1997 and on the River Vistula in 2001 and 2010 serve as examples of the limitations of a purely deterministic, defensive approach to flow modelling. However, this is a somewhat vague statement requiring explanation. It is well known that many weaknesses of the flood management system can indeed be distinguished, particularly with reference to Poland's 1997 and 2001 floods. It is likewise clear that flood risk management would be an important remedy. What is not immediately obvious, however, is the value of stochastic forecasting in this particular context. If the editors feel the stochastic approach would indeed have allowed for reduced flood damage in Poland's benchmark floods of 1997, 2001, and 2010, and if they were to prove this convincingly, then that would be a very interesting finding of vast practical importance.

The title of the book sounds rather narrow and technical, while the book is in fact of far broader content, covering a range of problems related to stochastic flow forecasting, and taking account of the stochastic aspects of risk assessment. A wealth of useful material, of interest to those involved in flood forecasting and modelling is thus conveyed, and a contribution also made to improving our understanding of hydrology across a large part of Poland.

Zbigniew W. Kundzewicz
Institute for the Agricultural
and Forest Environment
Polish Academy of Sciences, Poznań,
Poland