Stochastic Modelling of Hydrologic Systems
In this PhD project several stochastic modelling methods are studied and applied on various subjects in hydrology. The research was prepared at Informatics and Mathematical Modelling at the Technical University of Denmark. The thesis is divided into two parts. The first part contains an introduction and an overview of the papers published. Then an introduction to basic concepts in hydrology along with a description of hydrological data is given. Finally an introduction to stochastic modelling is given. The second part contains the research papers. In the research papers the stochastic methods are described, as at the time of publication these methods represent new contribution to hydrology. The second part also contains additional description of software used and a brief introduction to stiff systems. The system in one of the papers is stiff.

Conditional parametric models for storm sewer runoff

Journal: Water Resources Research
Volume: 43
Issue number: 5
ISSN (Print): 0043-1397
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.1 SJR 2.383 SNIP 1.553
Parameter estimation in stochastic rainfall-runoff models

A parameter estimation method for stochastic rainfall-runoff models is presented. The model considered in the paper is a conceptual stochastic model, formulated in continuous-discrete state space form. The model is small and a fully automatic
optimization is, therefore, possible for estimating all the parameters, including the noise terms. The parameter estimation method is a maximum likelihood method (ML) where the likelihood function is evaluated using a Kalman filter technique. The ML method estimates the parameters in a prediction error settings, i.e. the sum of squared prediction error is minimized. For a comparison the parameters are also estimated by an output error method, where the sum of squared simulation error is minimized. The former methodology is optimal for short-term prediction whereas the latter is optimal for simulations. Hence, depending on the purpose it is possible to select whether the parameter values are optimal for simulation or prediction. The data originates from Iceland and the model is designed for Icelandic conditions, including a snow routine for mountainous areas. The model demands only two input data series, precipitation and temperature and one output data series, the discharge. In spite of being based on relatively limited input information, the model performs well and the parameter estimation method is promising for future model development.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Mathematical Statistics
Authors: Jonsdottir, H. (Intern), Madsen, H. (Intern), Palsson, O. P. (Intern)
Pages: 379-393
Publication date: 2006
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Hydrology
Volume: 326
Issue number: 1-4
ISSN (Print): 0022-1694
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.89 SJR 1.745 SNIP 1.759
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.708 SNIP 1.771 CiteScore 3.54
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.679 SNIP 2.005 CiteScore 3.45
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.71 SNIP 1.997 CiteScore 3.36
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.924 SNIP 2.016 CiteScore 3.38
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.753 SNIP 1.858 CiteScore 3.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.784 SNIP 1.714
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.018 SNIP 1.835
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.922 SNIP 1.758
Assessment of serious water shortage in the Icelandic water resource system

Water resources are economically important and environmentally extremely vulnerable. The electrical power system in Iceland is hydropower based and due to the country's isolation, power import is not an option as elsewhere in Europe. In the hydropower system, a water shortage is met by flow augmentation from reservoirs. The management of these reservoirs is a human intervention in a natural flow and therefore necessarily limited by environmental regulations.

During a heavy drought, the available water storage in the reservoir may not be sufficient to cater for the demand and consequently there will be a shortage of electrical power. This is politically acceptable as long as it only touches heavy industries but not power deliveries to the common market. Empty or near empty reservoirs cause power shortage that will be felt by homeowners and businesses, until spring thaw sets in and inflow to the reservoirs begins. If such a power shortage event occurs, it will cause heavy social problems and a political decision making will follow. It is commonly agreed, that management methods leading to such a disastrous event as a general power shortage in the whole country, are not acceptable. It is therefore very important to have mathematical tools to estimate the risk of water shortage in the system when searching for the best management method. In view of the fact that the subject is to estimate the risk of events that have to be very rare, i.e. with large recurrence time, stochastic simulation is used to produce synthetically run-off records with adequate length, in order to estimate very rare droughts. The method chosen is to make the run-off series stationary in the mean and the variance and simulating the resulting stationary process. When this method is chosen, future trends in the run-off from climate change and glacier reduction can easily be incorporated in the model. The probabilities of extreme droughts are calculated and their frequencies are compared to theoretical distributions. (c) 2005 Elsevier Ltd. All rights reserved.

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Mathematical Statistics
Authors: Jonsdottir, H. (Intern), Madsen, H. (Intern)
Pages: 420-425
Publication date: 2005
Main Research Area: Technical/natural sciences

Publication information
Journal: Physics and Chemistry of the Earth (Print)
Volume: 30
Issue number: 6/7
ISSN (Print): 1474-7065
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
A grey box model describing the hydraulics in a creek

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Mathematical Statistics
Authors: Jonsdottir, H. (Intern), Jacobsen, J. L. (Intern), Madsen, H. (Intern)
Pages: 347-356
Publication date: 2001
Main Research Area: Technical/natural sciences

Publication information
Journal: Environmetrics
Volume: 12
Issue number: 4
ISSN (Print): 1180-4009
Ratings:
A Grey Box Model for the Hydraulics in a Creek

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling
Authors: Jonsdottir, H. (Intern), Jacobsen, J. L. (Intern), Madsen, H. (Intern)
Publication date: 1998

Host publication information
Projects:

**Stochastic Dynamic modelling of Oxygen**

Department of Informatics and Mathematical Modeling  
Period: 01/04/1997 → 08/02/2007  
Number of participants: 7  
Phd Student: Jonsdottir, Harpa (Intern)  
Supervisor: Eliasson, Jonas (Ekstern)  
Pálsson, Olafur Petur (Intern)  
Main Supervisor: Madsen, Henrik (Intern)  
Examiner: Poulsen, Niels Kjølstad (Intern)  
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Olsson, Gustaf (Ekstern)

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Project: PhD