



Myo Aye Khin (Autor)
Complexity regulation and the inversion of environmental hydrological distributed models

Khin Myo Aye

**Complexity regulation and
the inversion of environmental
hydrological distributed models**



Zentrum für Entwicklungsforschung
Center for Development Research
University of Bonn
ZEF Bonn

<https://cuvillier.de/de/shop/publications/2019>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen, Germany
Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: <https://cuvillier.de>

TABLE OF CONTENTS

1	INTRODUCTION	1
2	DERIVATION OF A SIMPLE NONLINEAR RAINFALL-RUNOFF MODEL	5
2.1	Equation of water balances	5
2.2	Derivation of a simple nonlinear rainfall-runoff model	7
2.3	Model simulation.....	13
3	PROPERTIES OF THE NONLINEAR SIMPLE RAINFALL-RUNOFF MODEL	15
3.1	Continuity of the functions for storage and runoff	16
3.2	Uniqueness of minimum values of maximum storage within the range..	21
3.3	Study of the penalty function of the maximum storage	54
3.4	Conclusion	58
4	THE INVERSION OF THE NONLINEAR SIMPLE RAINFALL-RUNOFF MODEL	59
4.1	Introduction	59
4.2	Inversion of a simple nonlinear rainfall-runoff model	60
4.3	Minimization algorithm	61
4.3.1	Initialization of a simplex	61
4.3.2	Movements of a simplex	62
4.3.3	Condition of convergence	64
4.3.4	Optimum value	64
4.4	Numerical experiments	65
4.4.1	Experiments for a system of reservoirs having the same maximum storage	66
4.4.2	Experiments for a system of reservoirs having different maximum storages	73
4.5	Conclusion	85
5	COMPLEXITY CONTROL	86
5.1	The k-fold cross-validation method	86
5.2	Algorithm for the k-fold cross-validation method	87
5.3	Numerical experiments on the k-fold cross-validation method	88
5.3.1	Experiments on the k-fold cross-validation method without noise ...	88
5.3.2	Experiments on the k-fold cross-validation method with different noise levels	92
5.4	Conclusion	101

6	CONCLUSIONS AND SUGGESTION FOR FURTHER INVESTIGATIONS	102
6.1	Conclusions	102
6.2	Suggestion for further investigation	103
7	REFERENCES	104
8	APPENDICES	107
8.1	Appendix to Chapter 2	107
8.1.1	Flow diagrams for the forward model	107
8.1.2	Annotated code of the forward model	107
8.2	Appendix to Chapter 4	111
8.2.1	Flow diagrams for the inversion of the nonlinear rainfall-runoff model	111
8.2.2	Annotated code for the inversion of the nonlinear rainfall-runoff model	117
8.2.3	Detail results for the inversion of the nonlinear rainfall-runoff model	128
8.3	Appendix to Chapter 5	164
8.3.1	Flow diagrams for the cross-validation of the nonlinear rainfall-runoff model	164
8.3.2	Annotated code of the algorithm for the application of the cross-validation of the nonlinear rainfall-runoff model	166