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RAINFALL - RUNOFF MODELING FOR UNGAGED BASINS IN CENTRAL VIETNAM

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RAINFALL-RUNOFF MODELING FOR UNGAGED BASINS IN CENTRAL VIETNAM

by

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Engineering.

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ABSTRACT

Longterm hydrologic data (such as Streamflow, Rainfall, etc.) is of vital importance in the analysis, design and planning of any type of water resources project. In Central Vietnam as in other developing regions, few streams are gaged i.e. provided with a recording system. For large numbers of ungaged streams there is commonly no provision for recording data.

The NAM model was first applied in Thubon basin of Quangnam - Danang province, Central Vietnam. For the purpose of predicting the continuous runoff at ungaged basins, initially the model was applied at Thubon gaged basin as a "reference" one. Then, the model was calibrated and verified in order to gain the best fit between the computed and observed hydrographs. The verification of the calibrated NAM model was carried out also to another small basins Tamky and Lung which are located in the same region as Thubon. The rainfall and streamflow records of Lung basin have recently been gaged at the basin outlet and its data was used to validate the model.

After the calibration, the model was applied to ungaged basins (which are Truong, Khang, Lung, Tranh, and Namnim basins) without calibration by transferring calibrated parameter values of a gauged basin after being adjusted according to the area characteristics of the ungaged basin. Sensitivity analysis of some parameters was also carried out to investigate the effect of these parameters on the model simulation and to increase the efficiency of the calibration process.

It was found that prospects of model's applicability to daily streamflow estimation is promising in Quangnam - Danang province, Central Vietnam and the model is inevitably a good engineering tool for the prediction of annual discharge. It can be used as a tool for water resources investigations in small basins.

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LIST OF SYMBOLS

A	=	Basin area (km^2)
CK_1	=	Time constant for routing interflow (hrs)
CK_2	=	Time constant for routing overland flow (hrs)
$CKBF$	=	Time constant for routing baseflow (hrs)
CK_{IF}	=	Time constant for interflow (hrs)
CQ_{OF}	=	Overland flow runoff coefficient
C_{smelt}	=	Snow melt coefficient (mm/°C/day)
D	=	Coefficient of determination
E_{pan}	=	Pan evaporation
E_{piche}	=	Piche evaporation
ET_p	=	Potential evapotranspiration
$GWLBF_o$	=	Maximum groundwater depth causing baseflow (m)
$GWLBF_1$	=	Groundwater depth for unit capillary flux (m)
K	=	Empirical coefficient of crop seasons
K_p	=	Pan evaporation coefficient
L	=	Soil moisture content in root zone (mm)
L_{max}	=	Maximum water content in root zone (mm)
N	=	Number of days
OF	=	Overland flow depth (mm/hour)
P_n	=	Excess water (mm)
P_s	=	Amount of melting water (mm/day)
Q_{ol}	=	Lowest observed discharge (m3/s)
Q_{oi}	=	Daily observed discharge (m3/s)
Q_{op}	=	Peak observed discharge (m3/s)
$\bar{Q}_o$	=	Mean daily observed discharge (m3/s)
Q_{sl}	=	Lowest simulated discharge (m3/s)
Q_{si}	=	Daily simulated discharge (m3/s)
Q_{sp}	=	Peak simulated discharge (m3/s)
$\bar{Q}_s$	=	Mean daily simulated discharge (m3/s)
R^2	=	Correlation coefficient
RE	=	Relative error (%)
REP	=	Relative error of peak discharge (%)
RQ_o	=	Range of observed discharge (m3/s)
RQ_s	=	Range of simulated discharge (m3/s)
$STDQ_o$	=	Standard deviation of the observed flows (m^3/s)
$STDQ_s$	=	Standard deviation of the simulated flows (m^3/s)
Sy	=	Specific yield of groundwater reservoir
TOF	=	Root zone threshold value for overland flow (mm)
TIF	=	Root zone threshold value for interflow (mm)
TG	=	Root zone threshold value for groundwater recharge (mm)
U	=	Soil moisture content in surface storage (mm)
U_{max}	=	Maximum water content in surface storage (mm)