SWAT

Runoff Simulation of Lam Chiang Krai Watershed Using SWAT Model

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SWAT model

SWAT model

R 7 NSE =

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, SWAT model

Abstract

Lam Chiang Krai Reservoir caused a dam to collapse, possibly due to a change of hydrological conditions from its design and the high amount of rainfall due to Tropical Storm Dian Mu causing severe flooding in the Lam Chiang Krai Basin in The simulation that helps to learn the hydrological conditions is another method to support reservoir management plans. This study simulates the runoff entering Lam Chiang Krai Reservoir using the SWAT model together with the analysis of the extreme runoff with different return periods. The results showed that the SWAT model gave the simulated results of the runoff at the relation of R 7 and NSE = compared to the actual data measured at the Lam Chiang Krai Reservoir station. The results of the extreme runoff study use the Log Pearson distribution (type III) for estimating the amount of runoff in the Lam Chiang Krai Reservoir at return periods of , and years. Also, the results of this study can be suggested to prevent dam subsidence and increase the efficiency of Lam Chiang Krai Reservoir in the future.

Keywords Lam Chiang Krai Reservoir, Hydrologic model, Log Pearson distribution (type III), SWAT model

1.

26 2564

6,000

40 135% 27.7

50

(Diànmu

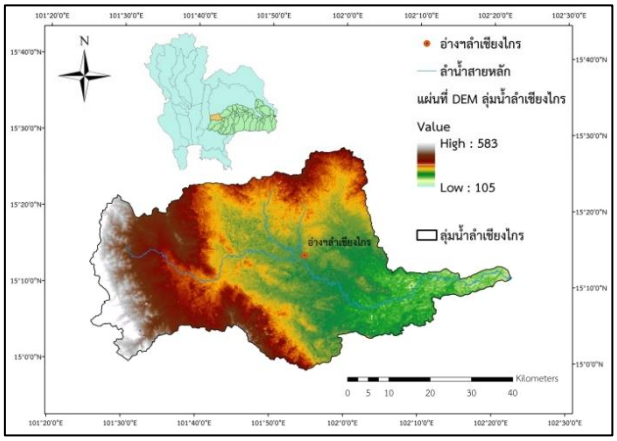
Soil

and Water Assessment Tool SWAT Arnold et al.

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4-6



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2.

SWAT

Soil Series)

44

2.1

10.3 7.2

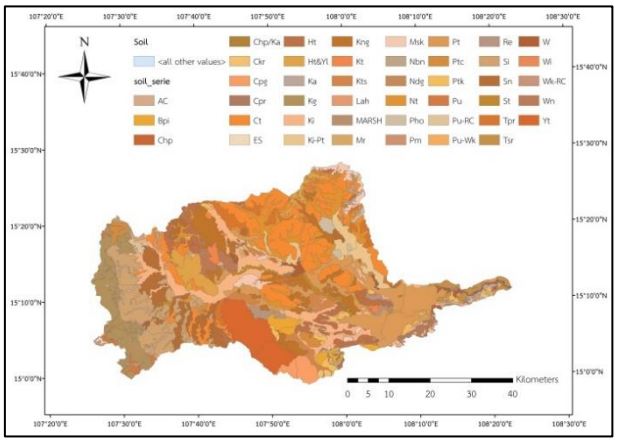
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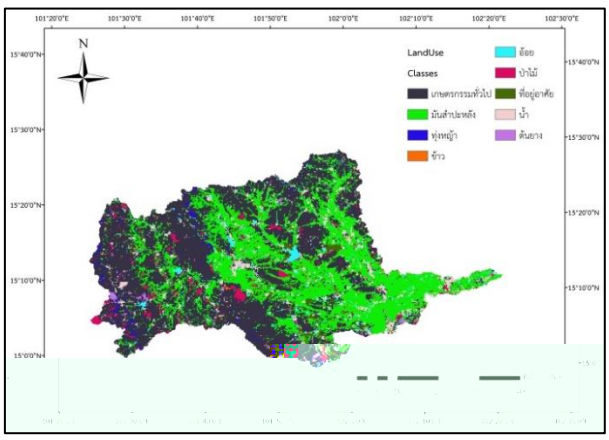
2562

3

1	x		
2		61	
3		62	
4		- 63	
5		63	

Digital

Elevation Model DEM) X



Geographic Information

System GIS)

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8

144 2 0

5 HRUs

2 [9]

GIS

SWAT

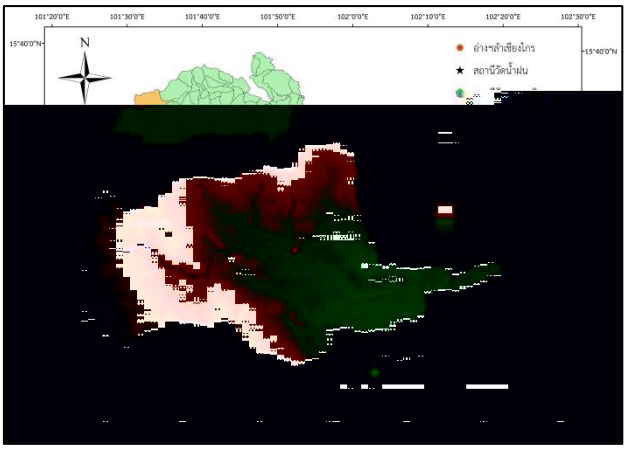
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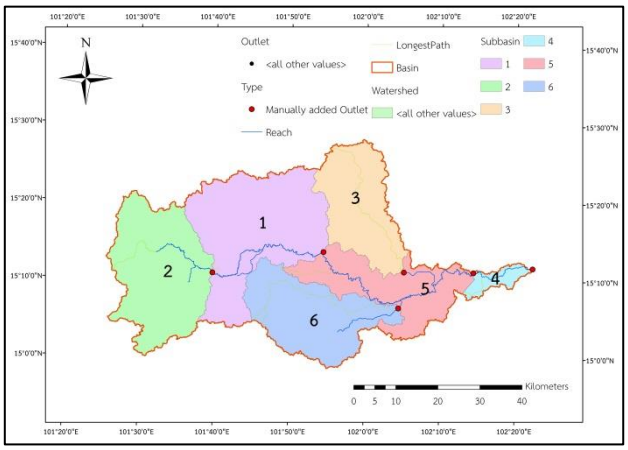
Thiessen Method) [7] 2 959 4.3%

HRUs

HRUs

1	431003		
2	431014		
3	431017		
4	431034		
5	431039		
6	431201		,





SWAT

Weather Generator

SWAT

13 2551-256

2.3

SWAT-CUP Version 5.1.6.2 (SWAT Calibration and Uncertainty Procedures) [10]

2551 256 156

2562

8

[11] 500 SWAT-CUP

Dotty Plots

Objective Function

NSE (Nash-Sutcliffe Model Efficiency Coefficient) Objective Function

Dotty Plot

Dotty Plot SWAT-CUP

Global

2.2 *SWAT*

SWAT ARCSWAT Version

SWAT

(Hydrologic Response Units : HRUs)

% < % [8]

HRUs

HRUs

HRUs

Sensitivity Analysis t-Stat
P-Value
Objective Function
t-Stat
Objective Function
P-Value Objective
Function]
Dotty Plot Global
Sensitivity Analysis

2.4

SWAT-CUP
Version Sequential Uncertainty Fitting
version SUFI

51 58
9 6

R Coefficient of Determination), NSE Nash-Sutcliffe Model Efficiency Coefficient) PBIAS (Percent Bias) 12,13,14

$$R^2 = \left(\frac{\sum_{i=1}^{n}(O_i - \bar{O})(P_i - \bar{P})}{\sqrt{\sum_{i=1}^{n}(O_i - \bar{O})(P_i - \bar{P})}} \right)^2 \quad (1)$$

$$NSE = 1 - \left(\frac{\sum_{i=1}^{n}(O_i - P_i)^2}{\sum_{i}^{n}(O_i - \bar{O})^2} \right) \quad (2)$$

$$PBIAS = \frac{\sum_{i=1}^{n}(O_i - P_i)}{\sum_{i=1}^{n}(O_i)} \times 100 \quad (3)$$

i , n , O_i
, $\bar{O}$, P_i
$\bar{P}$

SWAT-CUP
Uncertainty)
Prediction Uncertainty, PPU)
PPU

Latin Hypercube Sampline) [12,14
PPU SWAT-CUP
p-Factor r-Factor p-Factor
PPU r-Factor
PPU 12,14
p-Factor = r-Factor
p-Factor
r-Factor
p-Factor r-Factor
p-Factor r-Factor
14 SWAT-CUP
Best Simulation Parameters)
Objective Function

2.5

Log Pearson Type III
Distribution) [15,16] U.S Water Resources Council

Q_i Log Q_i

$$\text{Log mean} = \overline{\log Q} = \frac{\sum_{i=1}^{N}\log Q_i}{N} \quad (4)$$

$$\text{Log standard deviation} = S_{\log Q} = \sqrt{\frac{\sum_{i=1}^{N}\left[\log Q_i - \overline{\log Q}\right]^2}{N-1}} \quad (5)$$

$$\text{log skew coefficient} = G_{\log Q} = \frac{N\sum_{i=1}^{M}\left[\log Q_i - \overline{\log Q}\right]^3}{(N-1)(N-2)\left(S_{\log Q}\right)^3} \quad (6)$$

Q_{Tr} Tr

$$\text{Log}Q_{Tr} = \overline{\log Q} + K_{Tr}\left(S_{\log Q}\right) \quad (7)$$

K_{Tr} Skew Curve Factor
K_{Tr}
G_{logQ} Tr $LogQ_{Tr}$
Q_{Tr}

3.

3.1

SWAT-CUP

p-Factor r-Factor
. NSE 82
r-Factor 1.5
95PPU
4 14] p-Factor
0.70
95PPU 14]
NSE 0.50
4
[13,14]

3 SWAT

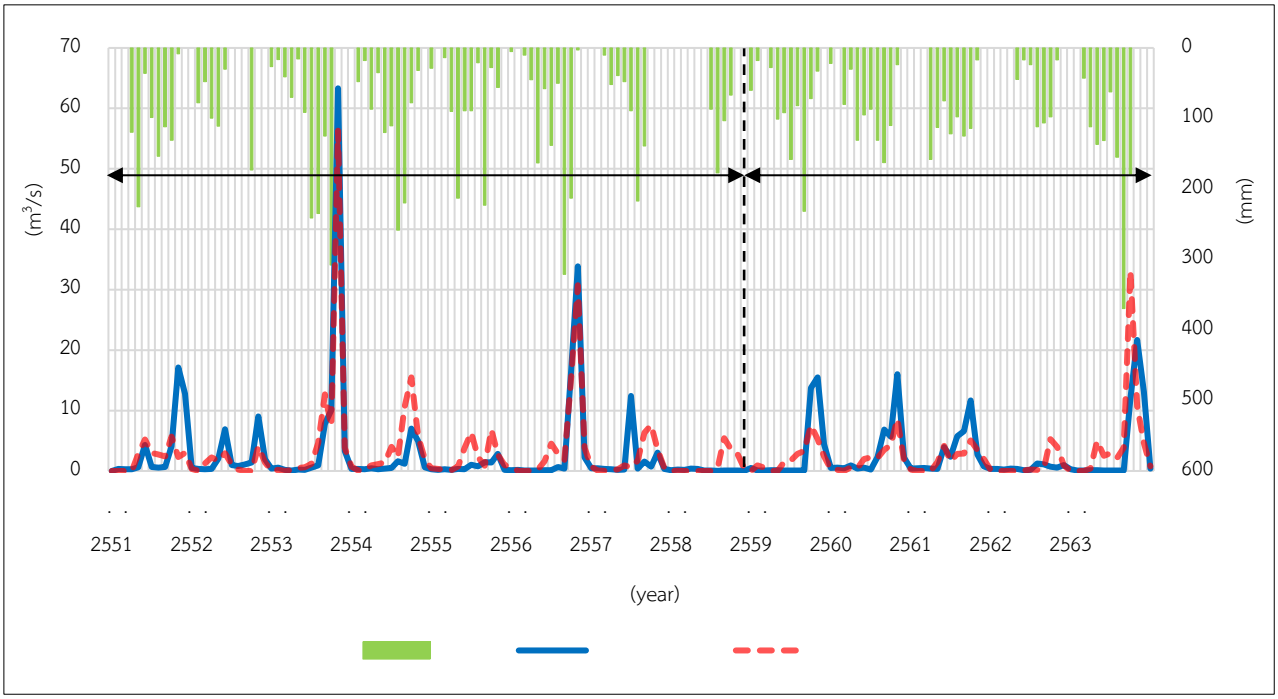
	51 58	59	51
R^2	0.82	0.37	0.72
NSE	0.82	0.25	0.71
PBIAS	-14.56	5.1	-7.01

4 SWAT-CUP

1:R_CN2.mgt	0.018	-0.020	0.020
2:V_ALPHA_BF.gw	0.273	0.000	1.000
V_GW_DELAY.gw	255.500	0.000	500.000
V_GWQMN.gw	4375.000	0.000	5000.000
A_SOL AWC(..).sol	0.254	0.000	2.000
R_ESCO.hru	0.328	0.100	0.350
R_CH_N rte	0.518	0.000	0.800
8:R_SLSUBBSN.hru	45.700	10.000	150.000

2559-2563 3 7
SWAT R^2
NSE 0.70

PBIAS %



7

3.2

SWAT

m s m s

m s

5

		m s	Log Q m s	(log Q - Avg (log Q))^2	(log Q - Avg (log Q))^3
1		88.22	1.946	1.375	1.612
2		66.03	1.820	1.096	1.14
3	2	61.76	1.791	1.036	1.054
4		44.39	1.647	0.764	0.668
5	2551	27.48	1.439	0.444	0.295
6	2559	26.47	1.423	0.422	0.274
7	2560	26.04	1.416	0.413	0.265
8	2555	25.82	1.412	0.408	0.26
9	2561	23.72	1.375	0.363	0.218
10	2557	21.66	1.336	0.317	0.178
11	2552	14.94	1.174	0.161	0.06
12	2558	12.83	1.108	0.112	0.03
13	2	11.18	1.049	0.076	0.02

SWAT

$\overline{\log Q} = 0.5822$, $S_{\log Q} = 0.7630$,

$G_{\log Q} = 1.0398$ (Q_{Tr})

(Tr) 25, 50 100

6 , ,

Tr	K_{Tr}	$K_{Tr} \times S_{LogQ}$	Avg (log Q) (m^3/s	Q_{Tr} m s	Q_{Tr} mcm
25	2.034	1.552	2.325	211.29	
50	2.525	1.927	2.700	500.68	
100	2.996	2.286	3.059	1,145.87	

K_{Tr} 6 Frequency Factors K for Gamma and log-Pearson Type III Distributions

S_{LogQ} Avg (log Q) Q_{Tr}

, m s,

m s , m s

4.

SWAT

CN ,

SOL_AWC CH_N2

R^2 = 0.72 NSE = 1

PBIAS

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15 13

Log Pearson Type III Distribution) ,

SWAT mcm

, mcm mcm

mcm

mcm

SWAT

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[16] SWAT

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