Date 21.09.2018

Application of SLEEP and SWAT models for estimating streamflow with incomplete soil data in Krasioa basin, Thailand

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Contents

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Soils information of Thailand was primarily provided by the Department of Land Development (DLD),

Nevertheless, soil data are available only in the arable land whose slope is less than 35%.

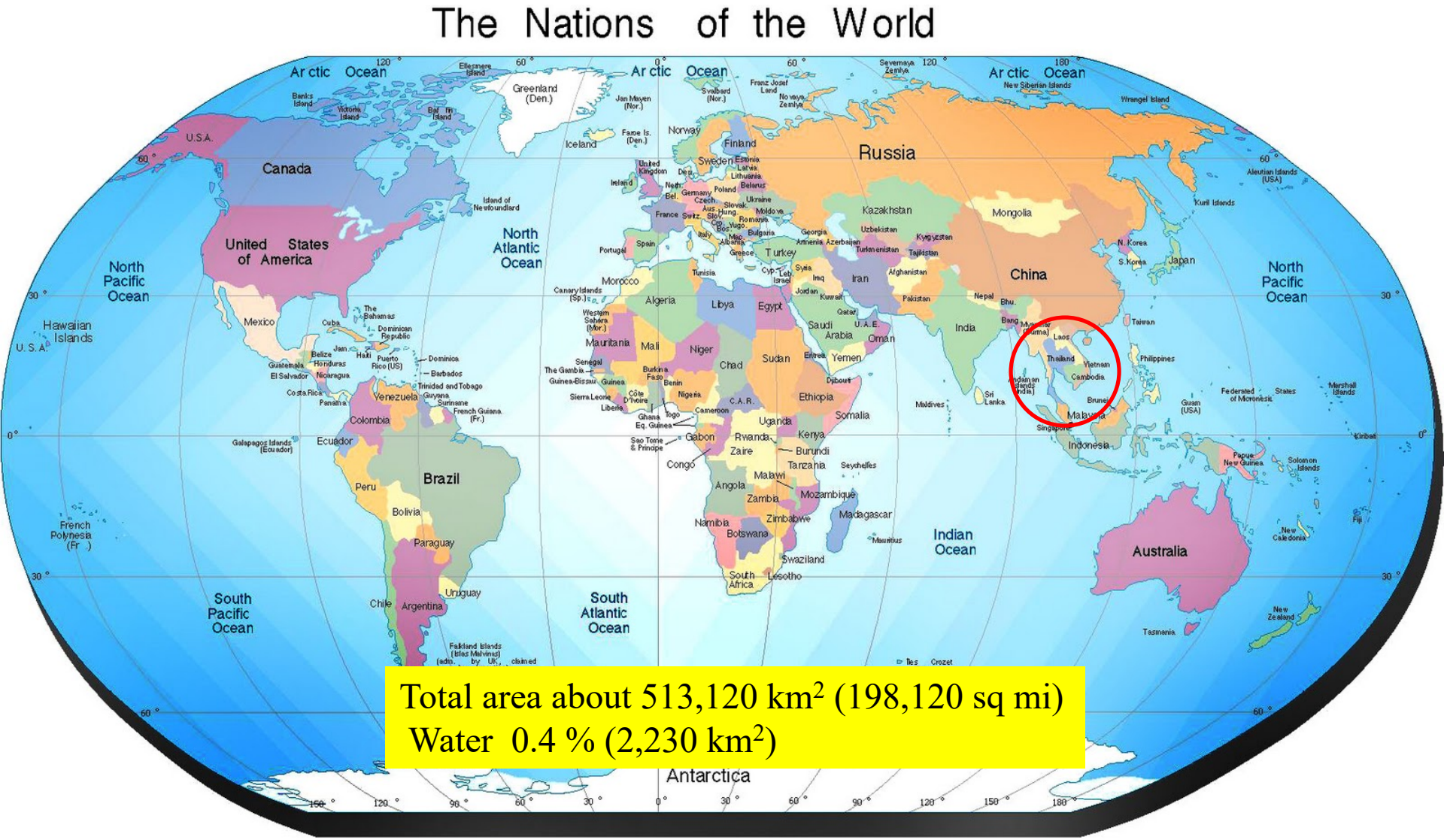
The steep-slope land was generally defined as Slope Complex (SC), there is no other data available

We are interested in know…

"SLEEP tool" can to improve the soil data (Slope Complex, SC) to simulate streamflow by SWAT model. The result will be better?

Soil-landscape modeling by SLEEP was applied to fulfilling the required soil data in hydrologic modeling.

LOCATION THAILAND IN THE WORLD

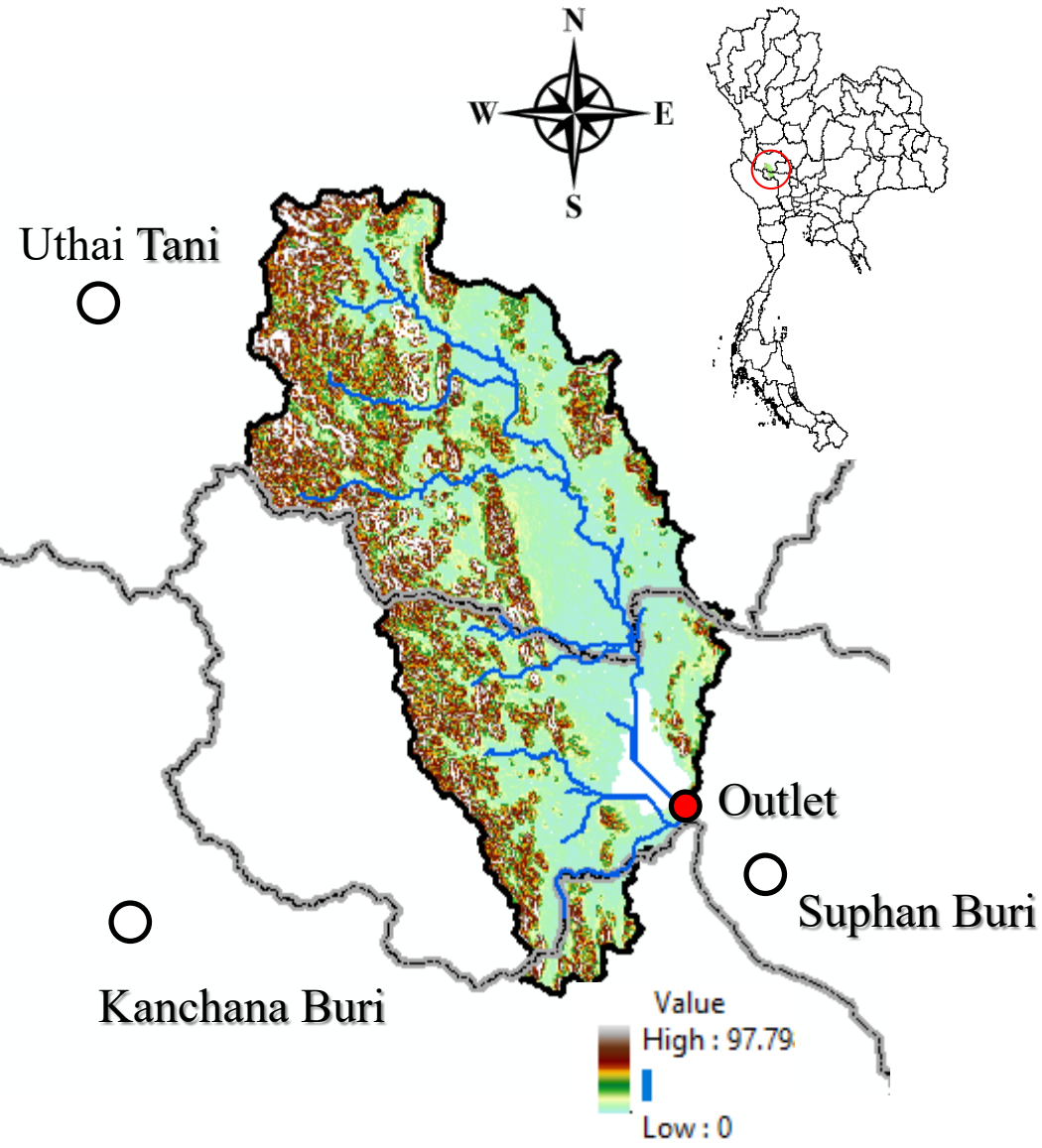


Total area about 513,120 km^2 (198,120 sq mi)
Water 0.4 % (2,230 km^2)

©1994 Magellan Geographix℠ Santa Barbara, CA (800) 929-4MAP

Robinson Projection

STUDY AREA



Krasioa basin, Thailand

The area of basin about 1,327 km^2 . Located in 3 provinces, including Suphan Buri, Kanchanaburi and Uthaithani.

Krasioa River is the origin of mountain in Ban Rai District of Uthai Thani and flows south-east to Dan Chang District of Suphan Buri province.

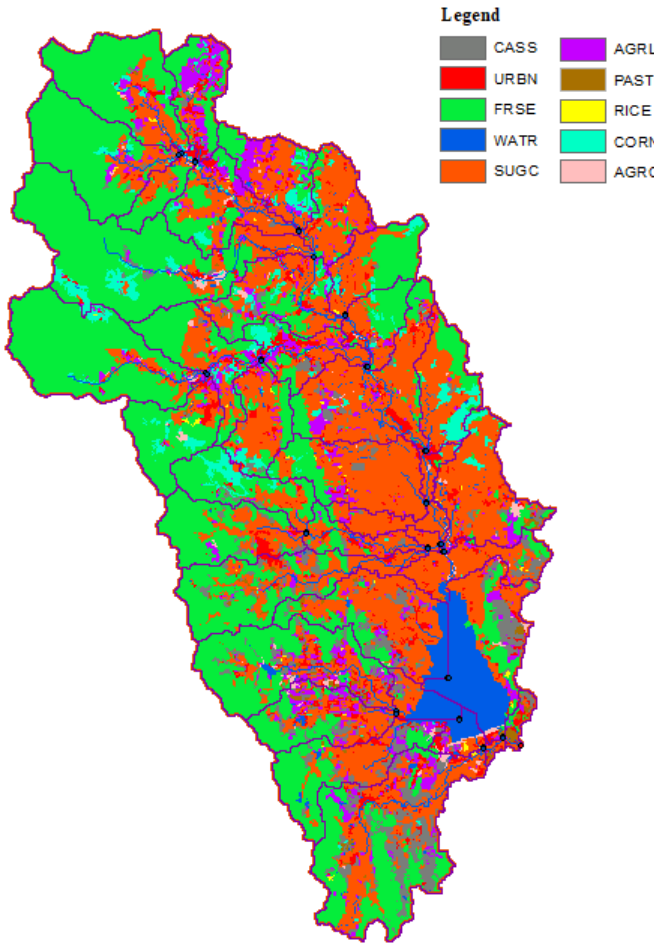
River flows to the south to nearly Dan Chan and to Ban Na Ta Pin. Dan Chang district Suphan buri It starts off into the plain and flows eastward into the Suphan Buri River at Sam Chuk District, Total distance of main river about is 140 km.

DATA

- ✓ **DEM (Digital Elevation Model) pixel size 90 Meters http://www.srtm.csi.cgiar.org**
- ✓ **Climate Data (Daily) included RelativeHumidy, Temperature(Max,Min), Wind Speed, Solar Radiation, from Thai Meteorological Department.**
- ✓ **Rainfall (Daily) from Royal Irrigation Department, Thailand**
- ✓ **Stations Gage and Runoff data from Royal Irrigation Department, Thailand**
- ✓ **Land use from Department of Land Development (DLD), Thailand**
- ✓ **Soils Map and Soils Properties from Department of Land Development (DLD), Thailand**
- ✓ **Stream Line from Department of Water Resource, Thailand**

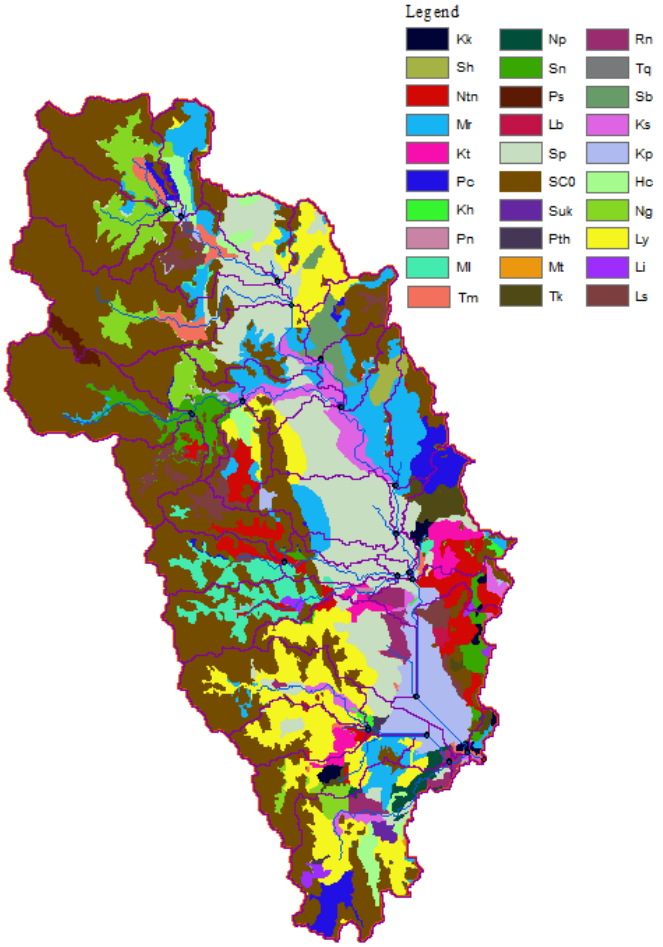
Land use/Soils/Slope Definition

Land Use



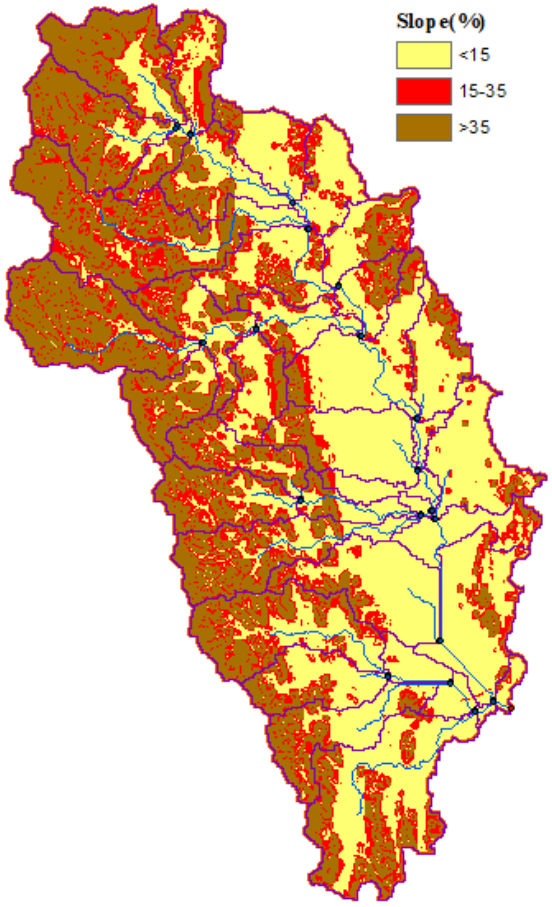
10 Types

Soils



30 Series

Slope



3 Class

SLEEP Tool

SWAT Soil & Water Assessment Tool

SOFTWARE | DOCUMENTATION | WORKSHOPS | CONFERENCES | PUBLICATIONS | DEVELOPERS

SOFTWARE > SLEEP

Soil-Landscape Estimation and Evaluation Program (SLEEP) for ArcGIS 10.1

SLEEP v8 was released March 8, 2016.

DOWNLOAD SLEEP

About

The Soil-Landscape Estimation and Evaluation Program (SLEEP) helps users generate a soil database that is necessary as an input to environmental models. The spatial distribution of soil attributes such as percentage silt, sand, clay, organic content and depth of soil profile varies from one point to another (both in lateral and vertical dimension). It is impractical to measure the soil attributes at each and every point on the earth surface. Spatial interpolation of the measured soil attribute is used to provide continuous representation of soil but there are some limitations owing to the non-uniform distribution of soils over an area. The idea behind the SLEEP tool is to divide a watershed or area into different zones or "facets" based on the average slope parameters, and then derive a model for each facet relating the soil attributes to different terrain and environmental attributes. Further details are presented in (Ziadat et al., 2015).

The SLEEP tool is created as a toolbox to facilitate and speed up the complex process involved in the objective explained above, so that many iterations can be carried out by simple mouse click.

Help

Download the user guide for setup instructions and a tutorial using the SLEEP tool.

Software Requirements

To run the SLEEP tool, ArcGIS 10.1 Service Pack 1 (ArcView license) or later versions of ArcGIS is needed. The Spatial Analyst extension and Arc Hydro Tools are required to run the models (use default installation directories and note that there may be differences between versions that cause issues with the SLEEP toolset, so it is recommended to use the ArcHydro version compatible with the ArcGIS version installed in the machine, a copy of ArcHydro is provided for the ArcGIS 10.1 Service Pack 1 with the installation package).

Download ArcHydro tools from ESRI.

ROSETTA TOOL

An official website of the United States government Here's how you know

USDA United States Department of Agriculture
Agricultural Research Service

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U.S. Salinity Laboratory: Riverside, CA

Research People Salinity Lab Menu

ARS Home » Pacific West Area » Riverside, California » U.S. Salinity Laboratory » Docs » ROSETTA Model

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Related Links

- USSL Publications
- Special Publications
- Models
- Research Databases

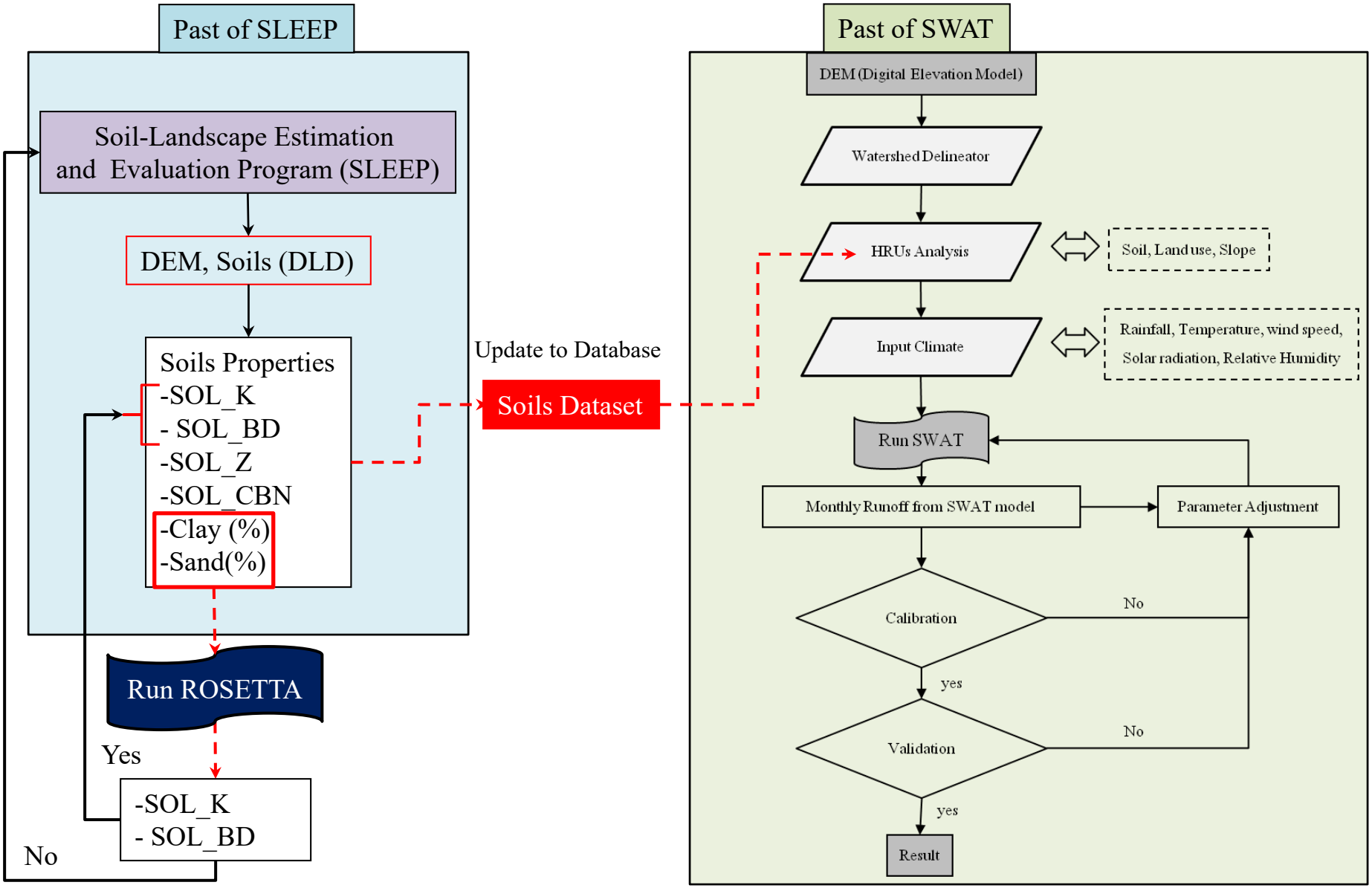
ROSETTA Model

The program, exmples, and manual can be downloaded from the software download area.

Year: 1999
Version: 1.0
(requires 32-bit Windows)

Index

METHODOLOGY(Over view)



This project will have 2 part of Methodology included:

Part 1 (SLEEP Tool: Predictions soil properties)

- Development of regression model based on soil-landscape approach by SLEEP model for predicting the missing data on soil properties.

-Soils pedo-transfer function using by Rosetta for found information on soil properties from SLEEP tool.

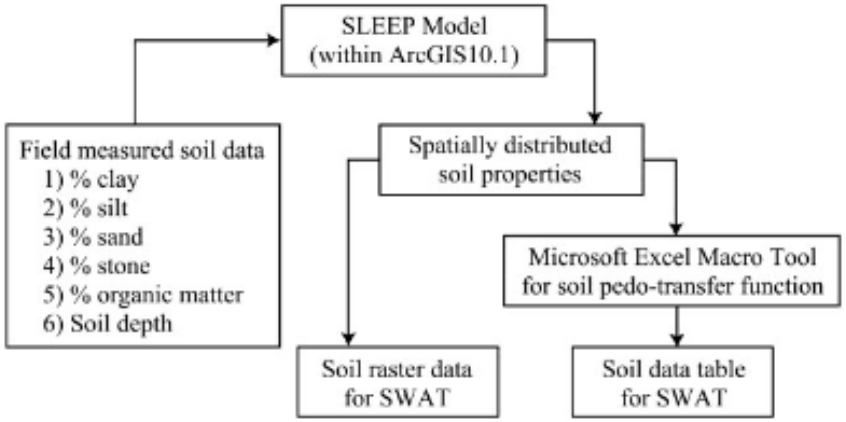
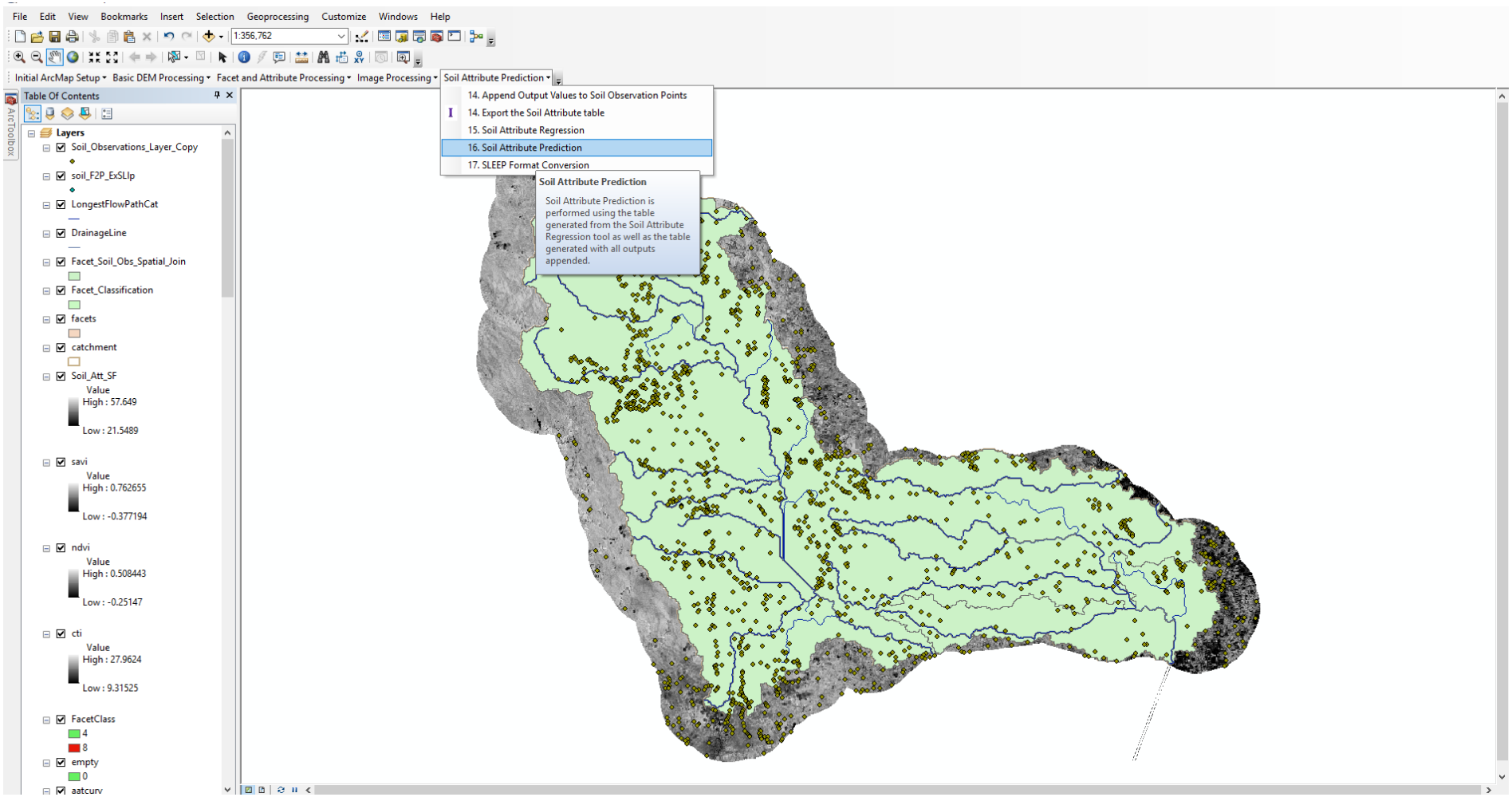
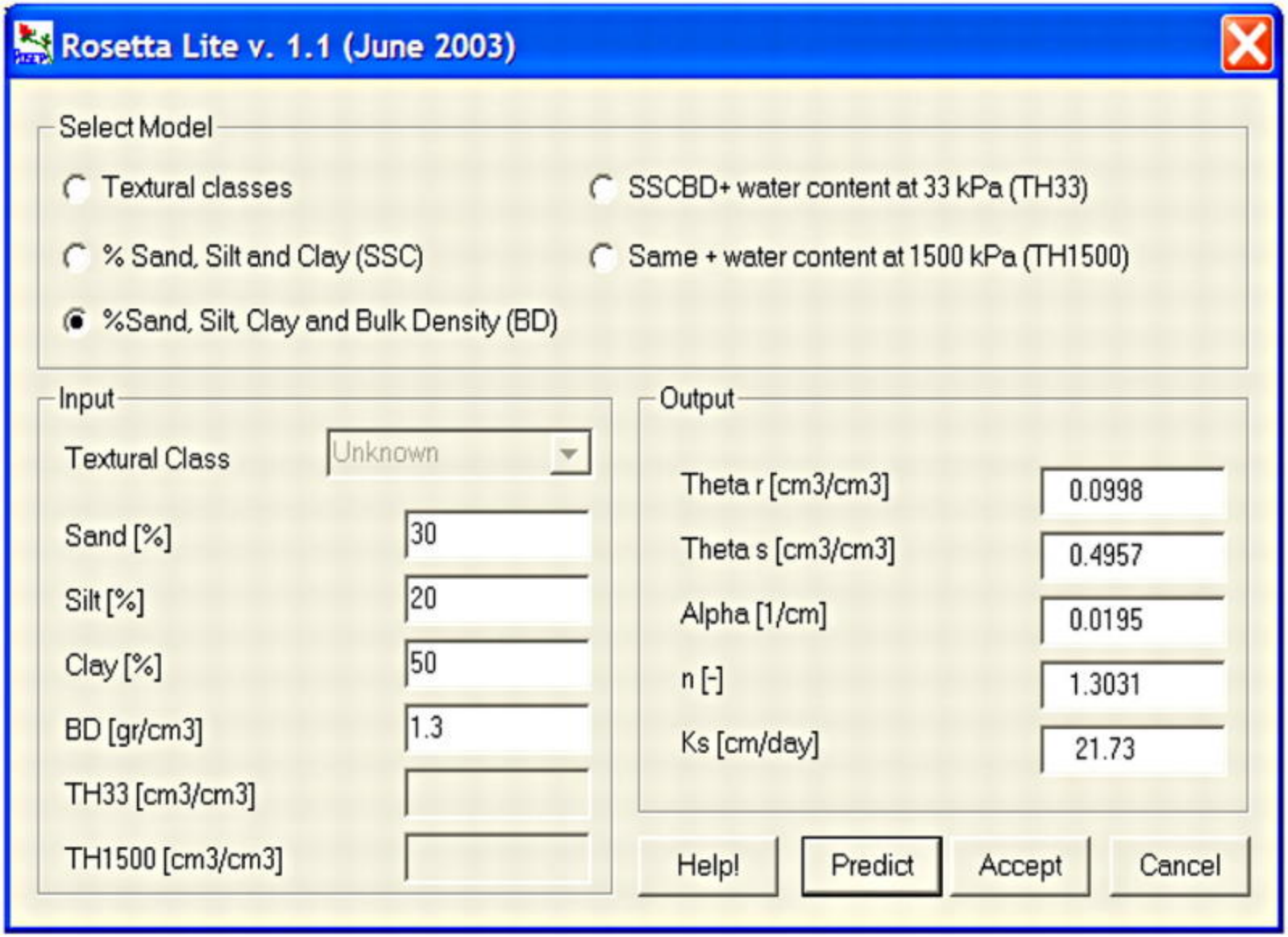


Figure 1 Flow chart showing the process of generating a SWAT user-soil database using SLEEP software in ArcGIS 10.1 in combination with the Microsoft Excel macro Tool

Feras M Ziadat et al.

Soil predicted from SLEEP tool

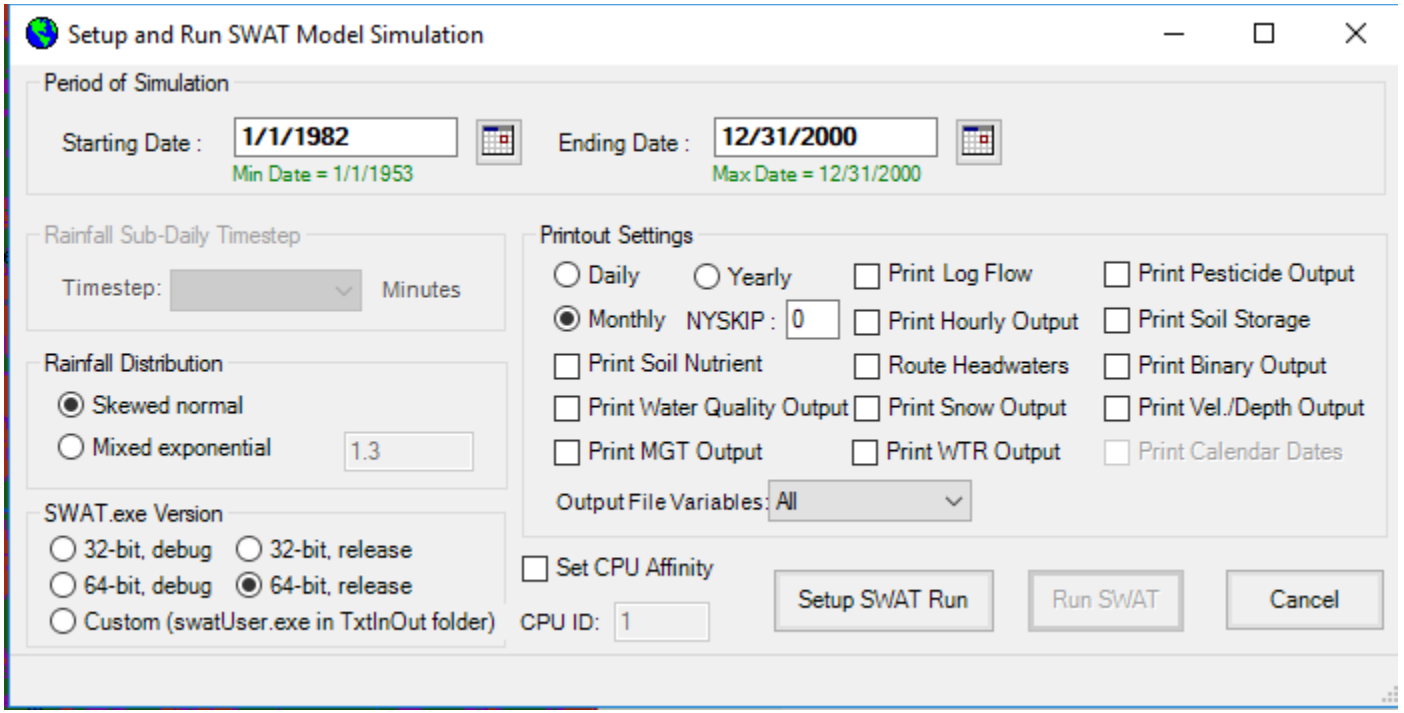



Rosetta Lite v. 1.1 (June 2003)
Select Model
Textural classes
% Sand, Silt and Clay (SSC)
%Sand, Silt, Clay and Bulk Density (BD)
SSCBD+ water content at 33 kPa (TH33)
Same + water content at 1500 kPa (TH1500)
Input
Textural Class
Unknown
Sand [%]
30
Silt [%]
20
Clay [%]
50
BD [gr/cm3]
1.3
TH33 [cm3/cm3]
TH1500 [cm3/cm3]
Output
Theta r [cm3/cm3]
0.0998
Theta s [cm3/cm3]
0.4957
Alpha [1/cm]
0.0195
n [-]
1.3031
Ks [cm/day]
21.73
Help!
Predict
Accept
Cancel

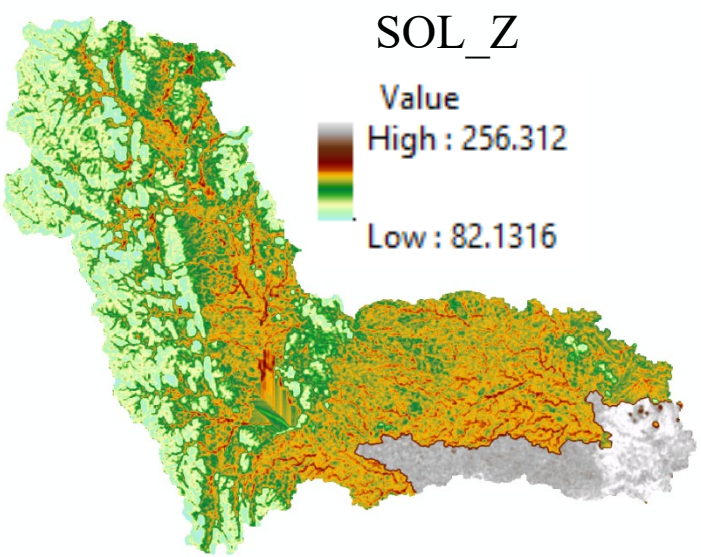
The study have 2 part of Methodology included:

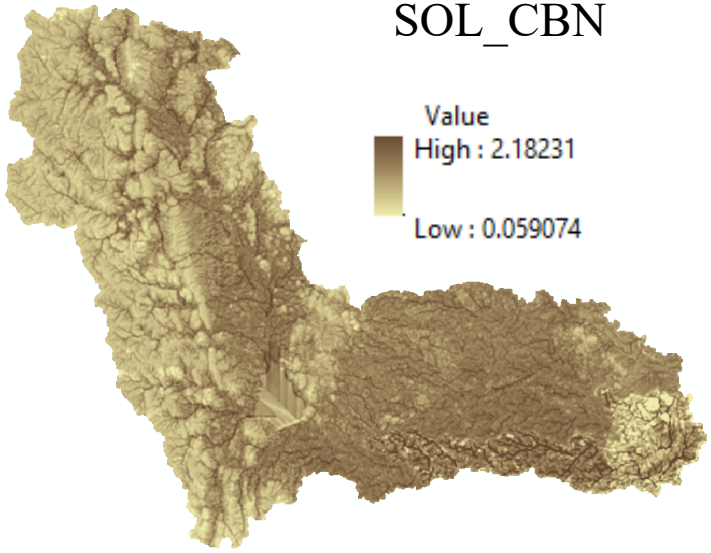
Part 2 (SWAT model: Assessments Runoff)

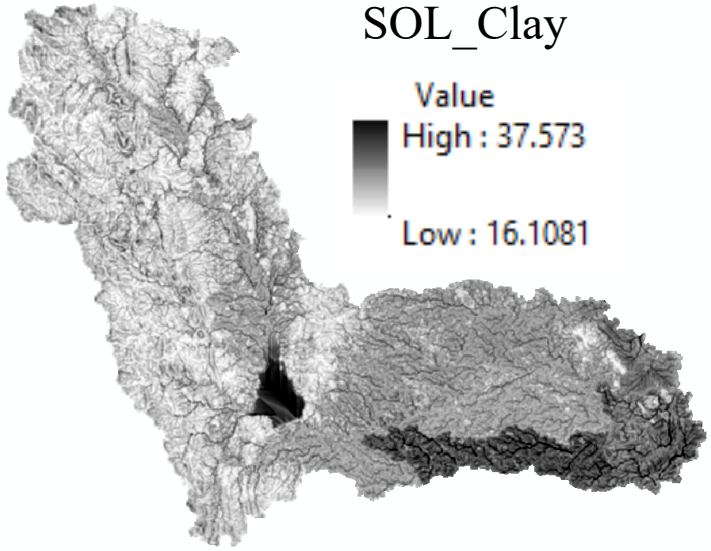
- Evaluation performance of model on streamflow estimation of Krasioa basin from physical soil properties, predicted by SLEEP, included soil depth, fraction of soil particles (clay, sand, organic matter) by SWAT model

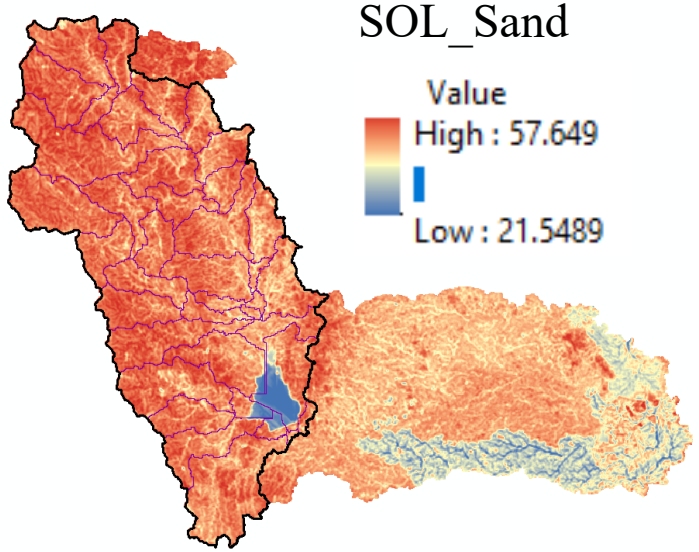


Part 1: The SLEEP Tool









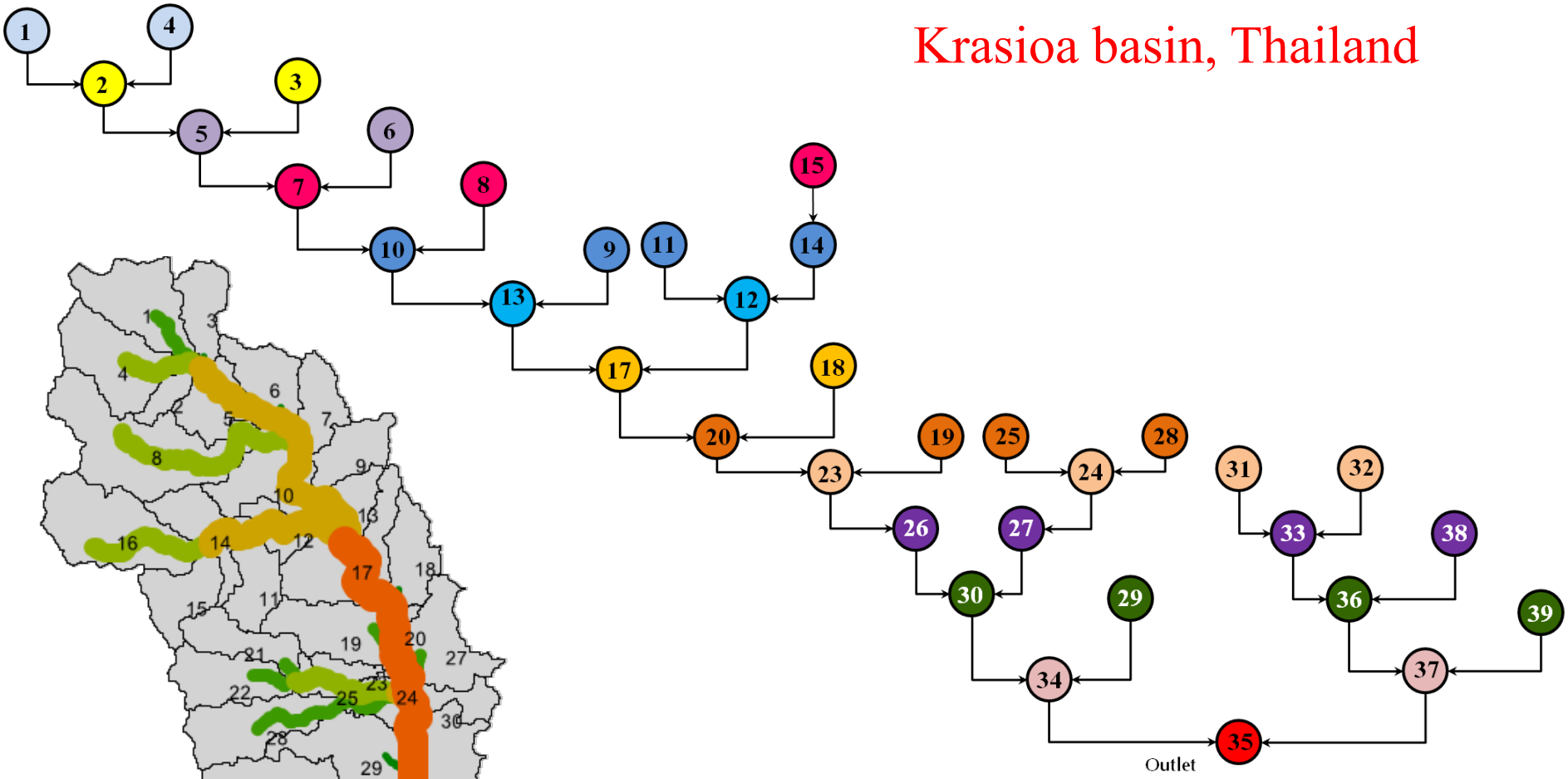
RESULTS OF SOILS PROPERTIES

Part 1: SLEEP Tool: Compare table Soil(DLD) & Soil(SLEEP)

NO.	SNAM	TEXTURE	SOL_Z		SOL_BD		SOL_AWC		SOL_K		SOL_CBN		CLAY		SAND	
			DLD	SLEEP	DLD	SLEEP	DLD	SLEEP	DLD	SLEEP	DLD	SLEEP	DLD	SLEEP	DLD	SLEEP
1	Hc	SL	160	144	1.6	1.54	0.14	0.15	124.8	150	1.75	1.809	11.8	11.8	60.4	45.32
2	Hd	SIC	70	63	1.4	1.46	0.11	0.13	4.6	12	1.79	1.849	54	26.7	2.3	22.34
3	Kh	SL	110	99	1.6	1.54	0.14	0.15	124.8	300	1.33	1.389	6.5	6.5	73.5	51.23
4	Kk	C	20	18	1.4	1.46	0.11	0.13	4.6	3.8	1.65	1.709	84	37.57	3.7	23.74
5	Koy	SIL	190	171	1.5	1.52	0.2	0.19	25.9	14	2.86	2.919	15	33.1	1.5	21.54
6	Kp	L	170	153	1.6	1.54	0.14	0.15	526.8	381	0.89	0.949	9.7	19.8	51.8	51.8
7	Ks	L	300	270	1.6	1.54	0.15	0.17	25	167	3.22	2.157	17.5	13	42.5	42.5
8	Kt	SCL	190	171	1.6	1.54	0.14	0.15	124.8	88	0.53	0.355	29.9	26	53.2	53.2
9	Lb	C	230	207	1.4	1.46	0.16	0.18	6.1	2.6	4.73	3.169	62	32	5	25.04
10	Lh	SL	160	144	1.6	1.54	0.12	0.15	22.7	300	0.73	0.489	14.7	16	76.8	52.13
11	Li	SIC	110	99	1.5	1.52	0.14	0.15	3.7	18	3.81	2.553	40.8	24	9.2	29.24
12	Ls	CL	100	90	1.6	1.54	0.13	0.16	8.8	140	1.2	0.804	27	28	43	43
13	Ly	CL	200	180	1.4	1.46	0.11	0.13	4.6	160	1.62	1.085	22	15	42.6	45
14	Ml	C	190	171	1.4	1.46	0.11	0.13	4.6	8.5	1.99	1.333	50.2	29	19.3	39.34
15	Mr	SL	120	108	1.6	1.54	0.14	0.15	124.8	46.6	0.94	0.630	15.5	16	69.1	48
16	Mt	SL	120	108	1.6	1.54	0.14	0.15	124.8	11.1	1.05	0.704	15.6	22	59.3	59.3
17	Ng	S	150	135	1.6	1.54	0.14	0.15	124.8	180	0.36	0.241	1	11	89.5	57.64
18	Np	SIC	200	180	1.5	1.52	0.14	0.15	3.7	7.9	1.41	0.945	46.1	28	3.2	23.24
19	Ntn	SIL	100	90	1.5	1.52	0.2	0.19	25.9	15.5	2.11	1.414	22.5	26	14	34.04
20	Pc	C	120	108	1.5	1.52	0.14	0.15	3.7	2.2	2.1	1.407	84.6	33	2.3	22.34
21	Ph	SICL	140	126	1.4	1.46	0.16	0.18	6.1	6.6	1.24	0.831	30.5	24	21	41.04
22	Pn	L	140	126	1.6	1.54	0.13	0.16	8.8	13	0.85	0.570	15.9	33	40.8	40.8
23	Ps	LS	50	45	1.6	1.54	0.14	0.15	526.8	330	0.98	0.657	7.1	18	80	56
24	Pth	SCL	150	135	1.6	1.54	0.15	0.17	25	17.5	0.51	0.342	15	21	44	44
25	Rn	SIL	110	99	1.5	1.52	0.2	0.19	25.9	12.12	0.38	0.255	2.5	3.9	45.3	45.3
26	Sa	SICL	120	108	1.4	1.46	0.16	0.18	6.1	5	1.53	1.025	34.7	33	12.9	32.94
27	Sb	C	240	216	1.4	1.46	0.11	0.13	4.6	13.3	0.86	0.576	55	23	12.3	32.34
28	**SC0**	**SL**	**100**	**90**	**1.5**	**1.52**	**0.12**	**0.15**	**125**	**8**	**0**	**0.059**	**10**	**19**	**60**	**8.4**
29	Sh	LS	250	225	1.6	1.54	0.14	0.15	526.8	420	0.36	0.241	1	16.11	82	30.4
30	Sn	SIL	40	36	1.5	1.52	0.2	0.19	25.9	2.7	1.48	0.992	25.5	25.5	20.5	40.54
31	Sp	SL	110	99	1.6	1.54	0.14	0.15	124.8	308	2.8	1.876	5.1	5.1	75.1	75.1
32	Suk	SL	260	234	1.6	1.54	0.14	0.15	124.8	297	0.27	0.181	4.5	20.1	73.7	53
33	Tk	L	210	189	1.6	1.54	0.15	0.17	25	4.4	1.67	1.119	18.8	25.44	44.4	44.4
34	Tm	LS	280	252	1.6	1.54	0.14	0.15	526.8	120	0.79	0.529	9.4	29.1	67.8	46
35	Tq	C	110	99	1.4	1.46	0.11	0.13	4.6	12.5	4.83	2.174	47	7.2	20.5	40.54

SCHEMATIC DIAGRAM BASIN SYSTEM

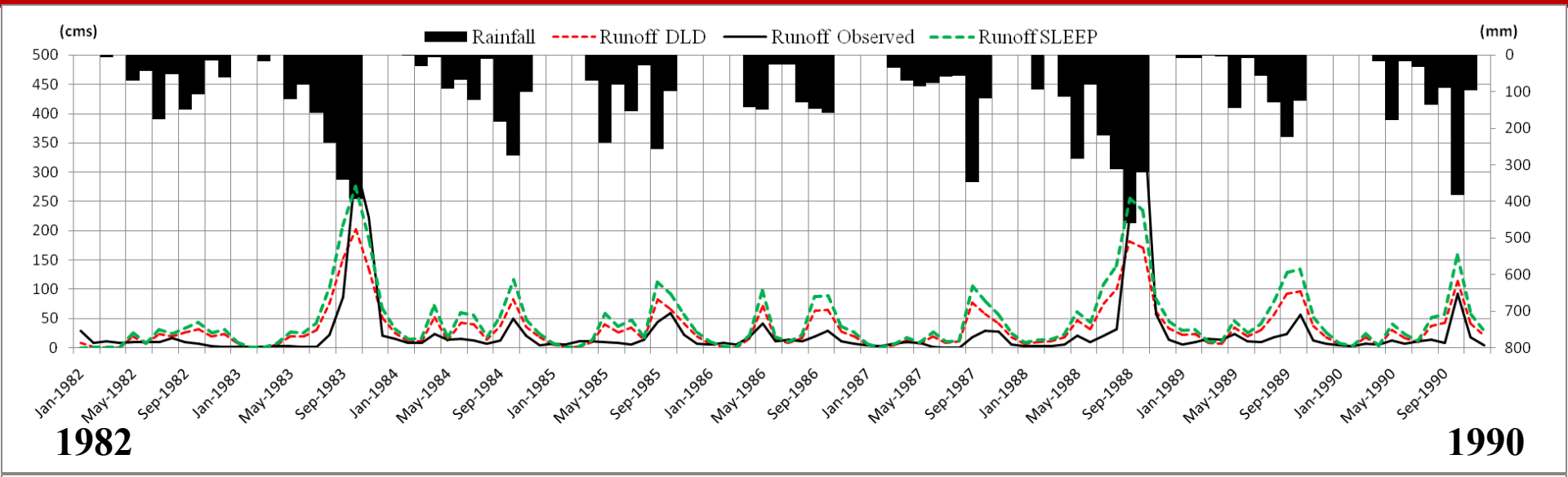
Krasioa basin, Thailand

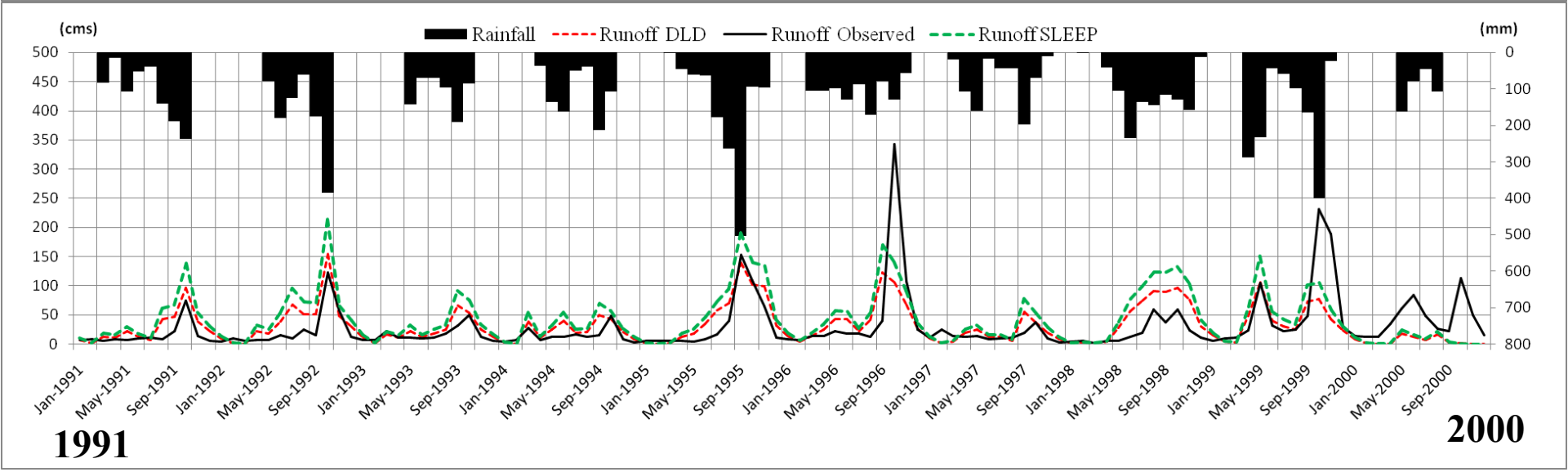


Watershed Delineation

39 Sub basin

CORRELATION THE RESULTS WITH OBS. DATA





Output from Soils DLD Given NSE =0.38

Output from Soils SLEEP Given NSE =0.46

SLEEP tool could provide consistent information on soil properties. The predicted soil properties from SLEEP tool improved also the performance of SWAT model for reservoir inflow estimation in Krasioa basin.

I will Test in another area for check results

If Ok, I will continue to…

Calibration and validation model

Thank you