

# **Development of Web-GIS based SWAT Data Generation System**

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Presented by

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**#01. Introduction**

**#02. Objectives**

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**#04. Results**

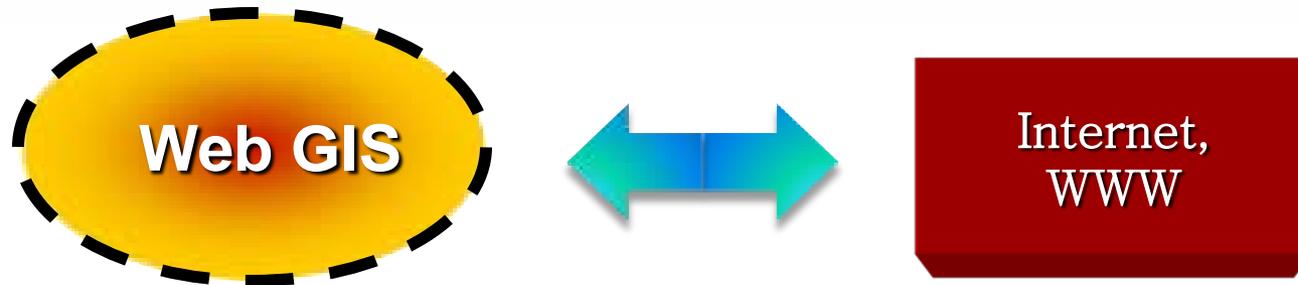
**#05. Conclusions**

## Introduction

- ◆ **The first step for simulating SWAT models**
  - : Collecting watershed topographical and meteorological data**
- ◆ **Traditional manual methodologies**
  - : Time-consuming process**
  - : Human error and cost problems**
  - : Require technical expertise**

## Introduction

- Real time Web-based GIS have risen due to the burdens of input data gathering and processing



- Useful way to serve scattered potential users
- Requires acceptable speed and accuracy
- A large amount of spatial data processing and display
- Overcome network bandwidth limitations to provide acceptable access time

## Objectives

- **Development of Web-based GIS that was developed to support SWAT model operation**

- : using Web-GIS capability for map browsing**

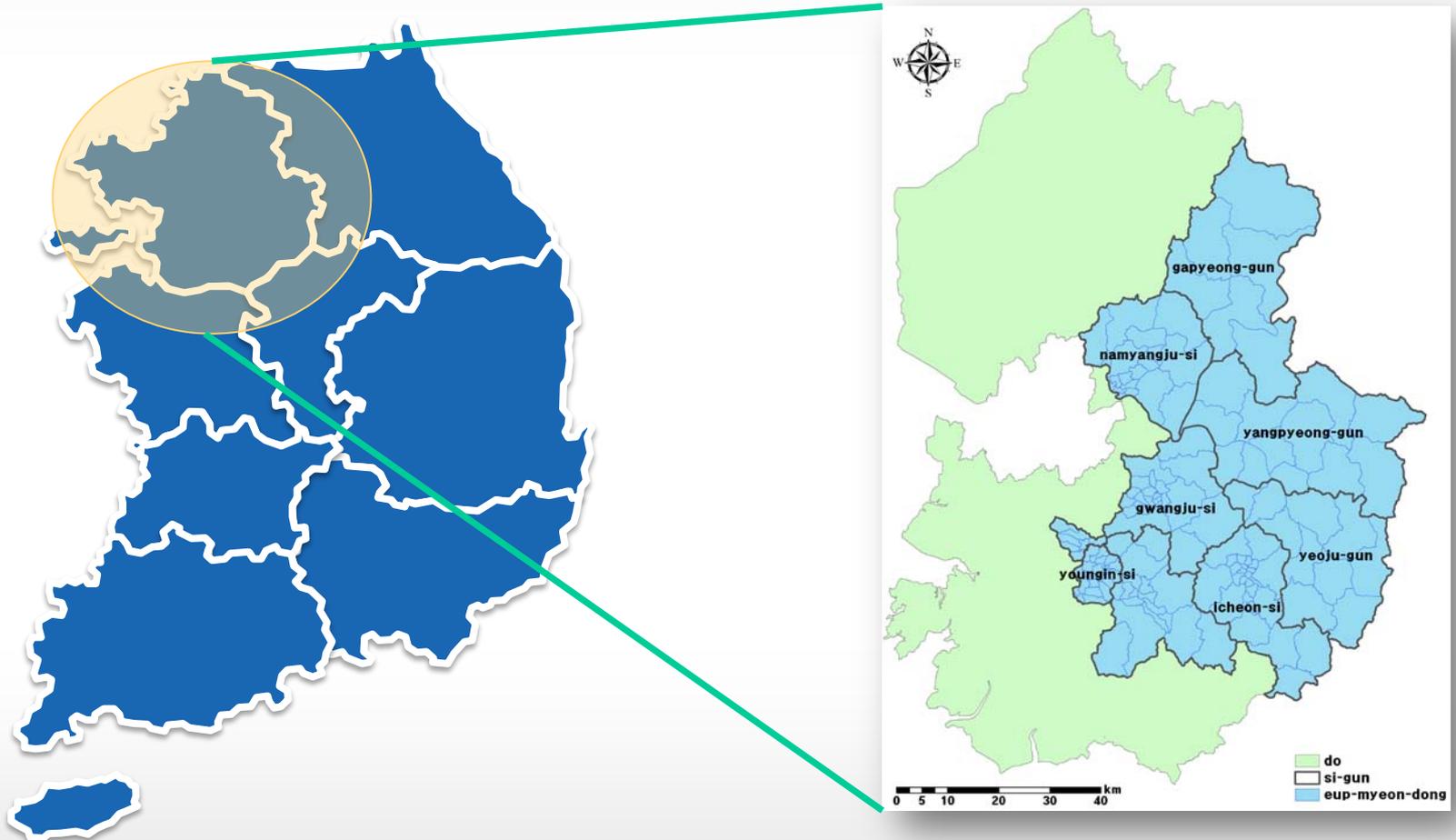
- : online watershed delineation**

- : topographical (spatial) and meteorological data extraction in real time**

# Study Area

## Study location map

- Seven counties and watersheds around Paldang lake in Korea



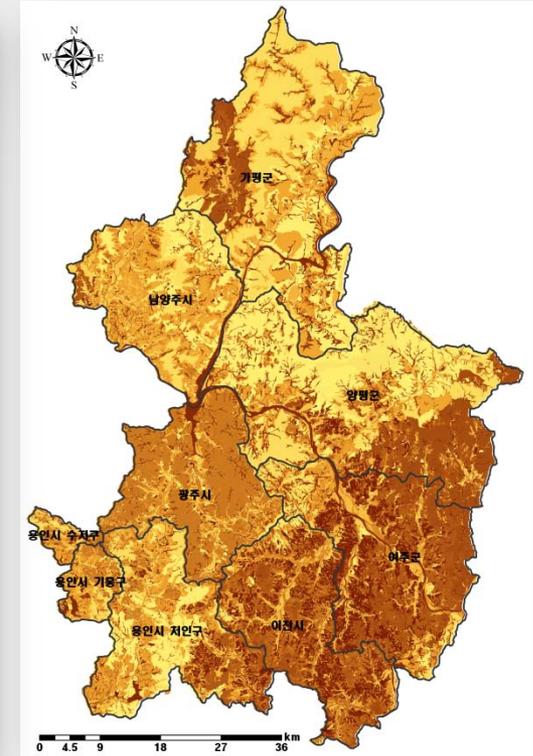
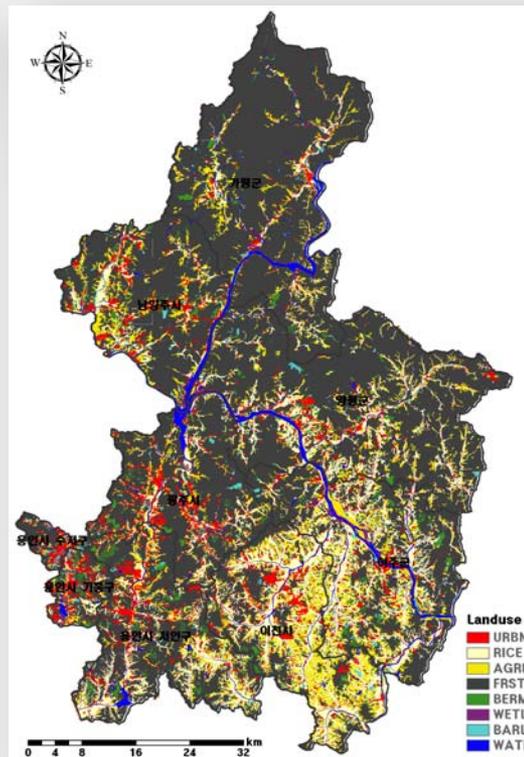
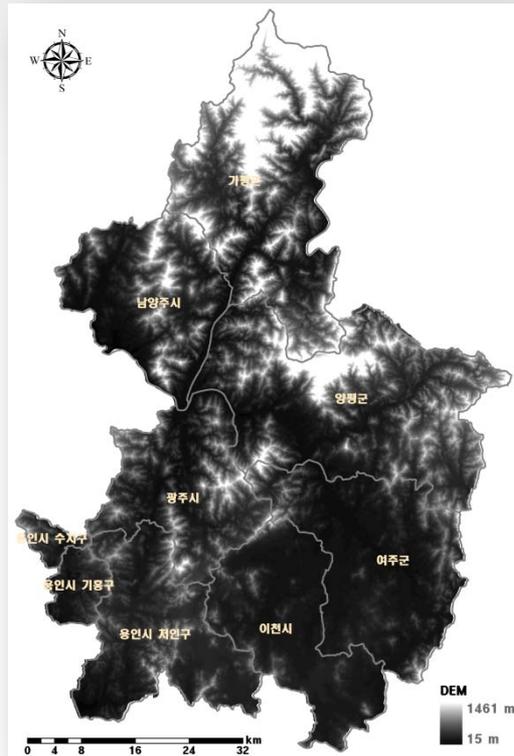
# Data preparation

## Operational requirements of input data for SWAT

Data classification	Data description	File format
geodatabase table	SWAT database	access file
tables and text files	watershed inlet location table	dBase
	usersoil (attribute of soil texture)	dBase or ASCII
	userwgn (attribute of meteorological station)	
	land use lookup table	
	soil lookup table	
spatial data sets	DEM	ESRI grid format
	land use	ESRI grid format or shapefile
	soil texture	
	user-defined watersheds	shapefile
weather data sets	weather generator data (location of meteorological station)	dBase
	daily precipitation data table	dBase or ASCII
	temperature data table	
	relative humidity data table	
	solar radiation data table	
	wind speed data table	

# Digital maps constructed for the system development

## ◆ (a) DEM, (b) land use map, (c) soil map



Data set	Source	Items
DEM	1 : 25,000 NGIS digital map	altitude
land use	National Geographic Information Institute land use	8 land use categories <sup>1)</sup>
soil texture	generated from Rural Development Administration soil map	184 soil texture categories <sup>2)</sup>
weather data	Korea Meteorological Administration	mean temperature, precipitation, wind velocity, relative humidity, sunshine duration

1) URBN, RICE, AGRL, FRST, BERM, WETL, BARL and WATR (land use class of SWAT)

2) AnC, AnD, ArB, ArC, BcB, BcC2, SuB, SuC, YjB, YjC, YI etc. (soil class of SWAT)

# Generation of SWAT input data sets from the system

## ◆ The weather data collection system

- From the Korean Meteorological Administration web site

(<http://www.kma.go.kr>)

- Real-time daily weather data (\*.dbf)

: precipitation, mean temperature,  
wind velocity, sunshine duration,  
relative humidity

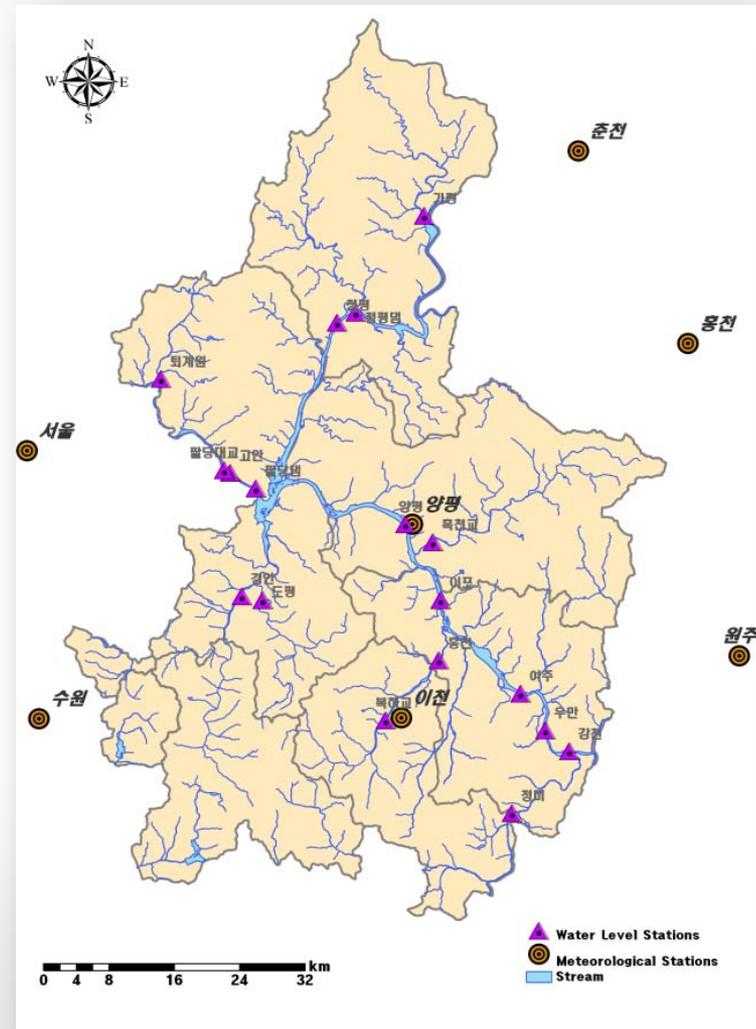
## ◆ SWAT database

- Attribute file of soil map

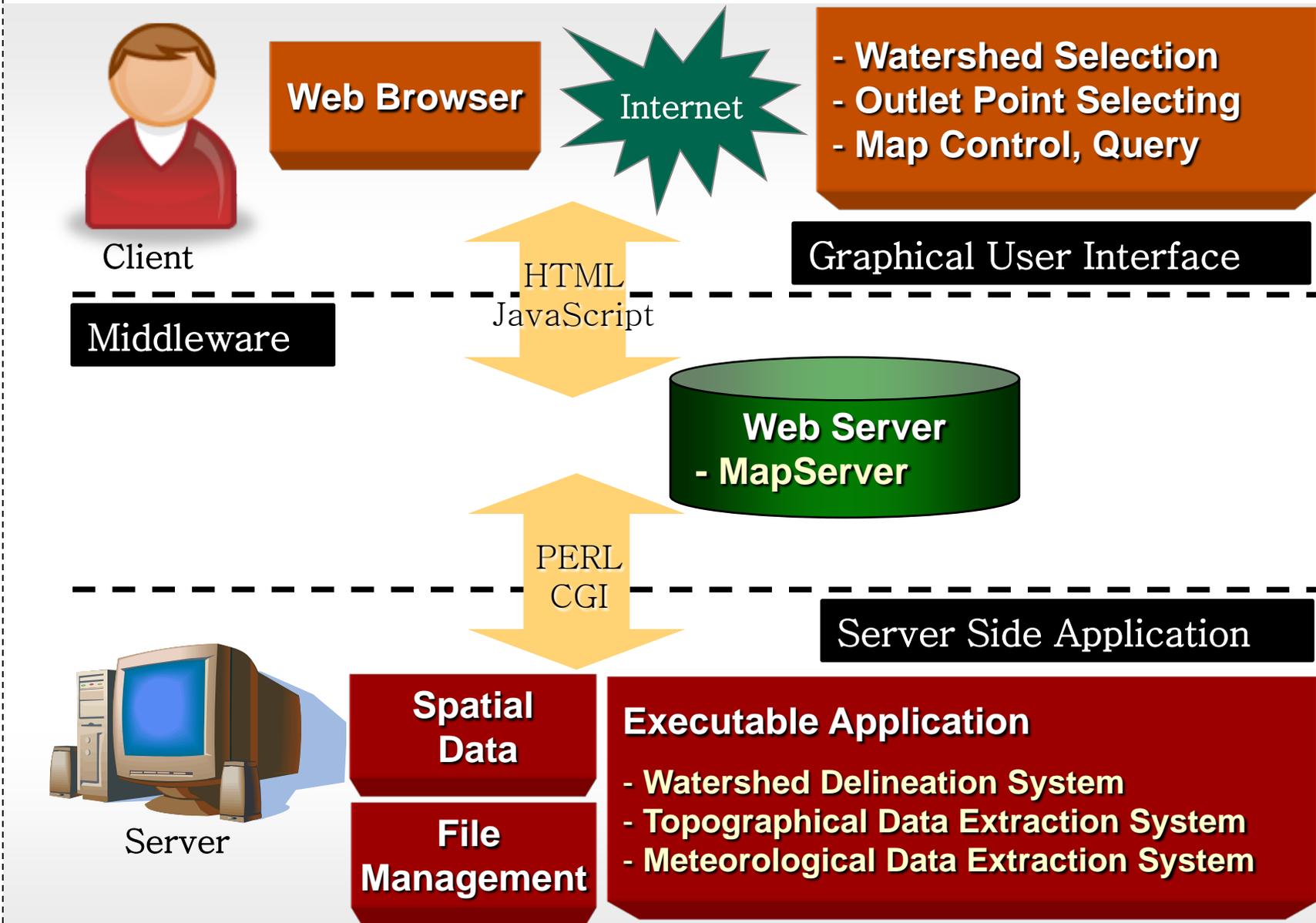
: user soil

- Attribute file of weather station

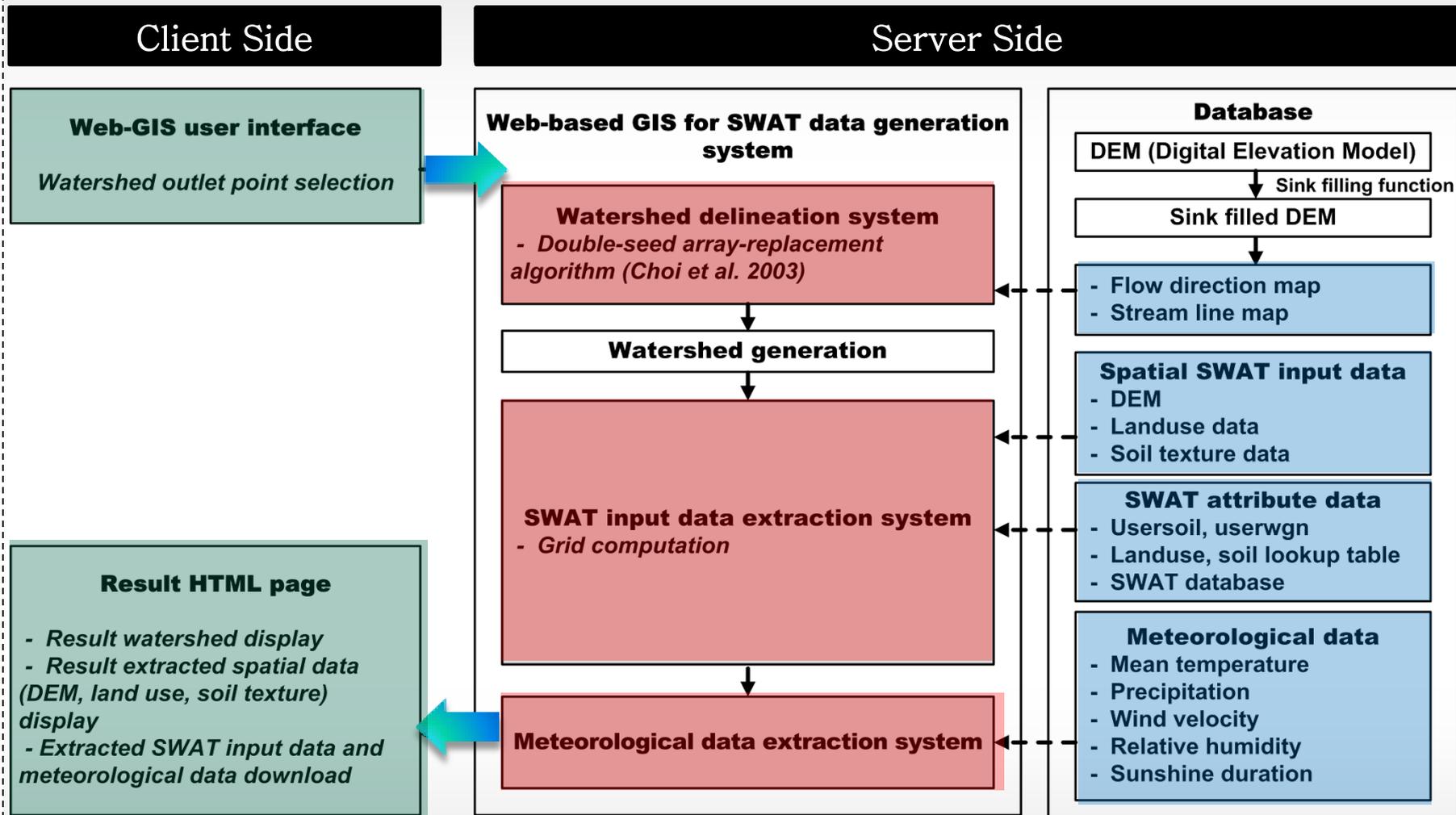
: user wgn



# System outline



# Detail description of the Web-GIS for SWAT data generation system



# Graphical user interface of the SWAT data generation system

- URL : [http://ruralwater.snu.ac.kr/16\\_swat/index\\_swat.html](http://ruralwater.snu.ac.kr/16_swat/index_swat.html)

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## SWAT Input Data Generation System

"Integrated Laboratory Rural Systems Engineering"

**Select Background**

No Background ▼

**Select Layers**

- 행정경계도 (1 checked)
  - 행정구역 음면도
- 유역 · 하천도 (2 checked)
  - 대권역
  - 중권역
  - 표준유역
  - 하천 (vector)
  - 하천 (raster)
  - 하천 & 저수지
- 기상관측도 (1 checked)
  - 기상측후소
  - 티센망
- 기타지도

+ - Pan Full Dist Que WD

**Reference Map**

**Map Reference**

Map Scale	1 : 580300
Click x, y	Map coordinates 236930 , 448977
Map Extent	175517 , 387563 298343 , 510390

[Google Map](#)

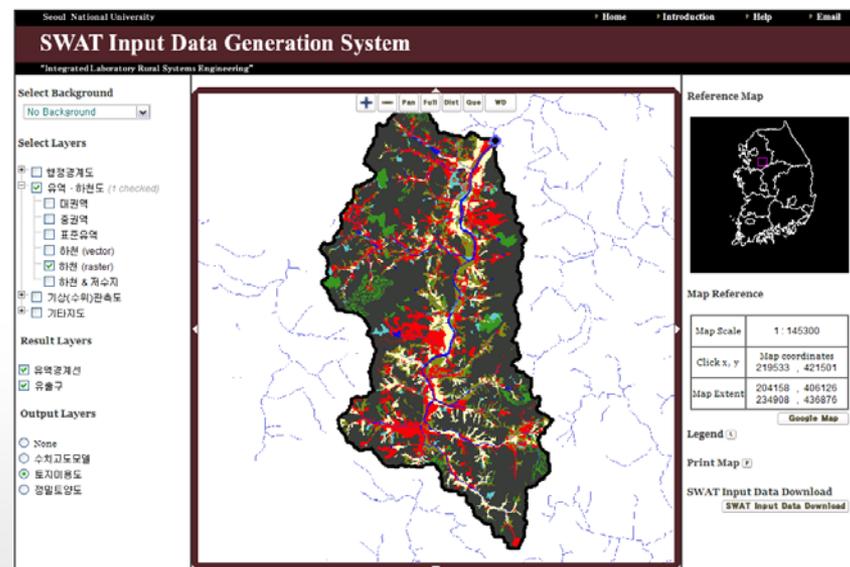
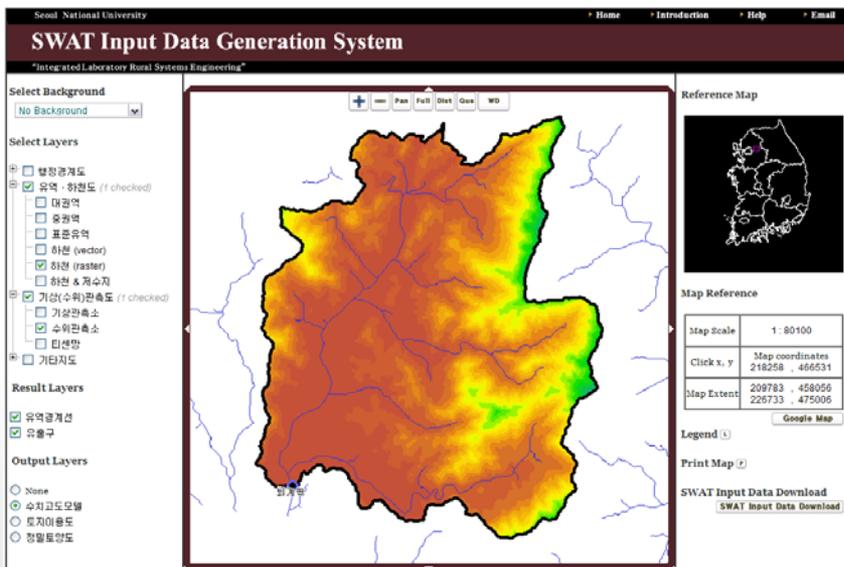
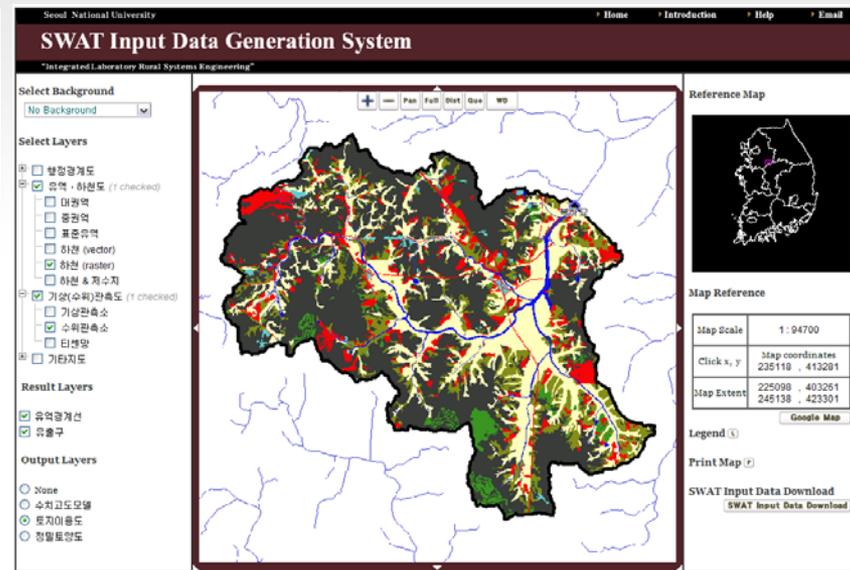
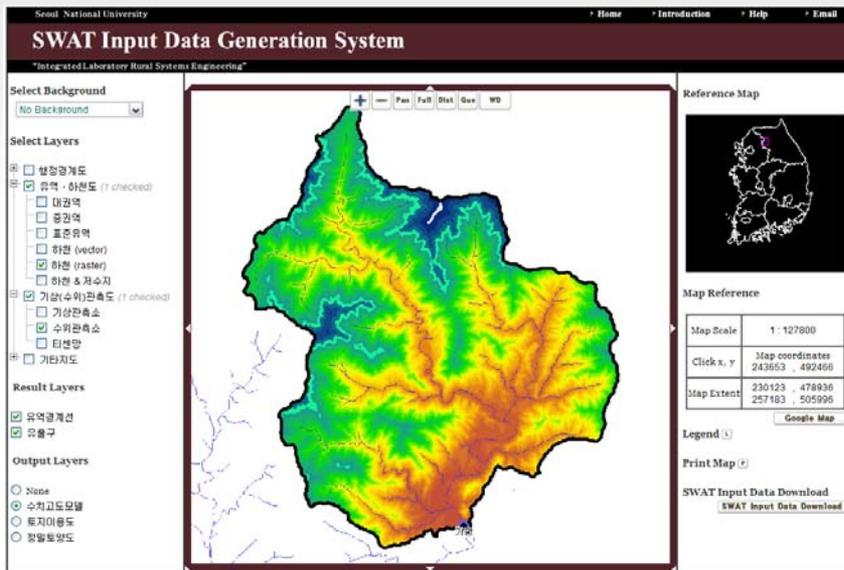
**Legend** [L]

**Print Map** [P]

**SWAT Input Data Download**

[SWAT Input Data Download](#)

# Extracted spatial data for the four different watersheds With delineated watershed containing DEM and land use



# Download page for the extracted SWAT input data Including spatial and weather data

## SWAT (Soil and Water Assessment Tool) Input Data Download

### 1. SWAT Database 도움말

SWAT MDB File (.mdb)	Usersoil File (.xls)	Userwgn File (.xls)
<a href="#">Swat MDB file</a>	<a href="#">Usersoil file</a>	<a href="#">Userwgn file</a>

### 2. Input GIS Data 도움말

Data Classification	ASCII GRID File (.asc)	Data File (.dbf)
GIS 좌표 파일		<a href="#">Coordinates file</a>
수치고도모델 (DEM)	<a href="#">DEM ASCII file</a>	
토지이용도	<a href="#">Landuse ASCII file</a>	<a href="#">Landuse DBF file</a>
토양도	<a href="#">Soil ASCII file</a>	<a href="#">Soil DBF file</a>

### 3. Weather Data 도움말

Data Classification	Data File (.dbf)
기상관측소	<a href="#">Weather Generator Data DBF file</a>
강수량	<a href="#">Rainfall Data DBF file</a>
온도	<a href="#">Temperature Data DBF file</a>
상대습도	<a href="#">Relative Humidity Data DBF file</a>
일조시간	<a href="#">Solar Radiation Data DBF file</a>
풍속	<a href="#">Wind Speed Data DBF file</a>

Start Year	End Year	Download
===년도===	===년도===	<input type="text" value="검색"/>

### 4. Watershed and Outlet GIS Data

Data Classification	Shape File (.shp)	Dbf File (.dbf)	Shx File (.shx)
Watershed Line	<a href="#">Watershed SHP file</a>	<a href="#">Watershed DBF file</a>	<a href="#">Watershed SHX file</a>
Outlet	<a href="#">Outlet SHP file</a>	<a href="#">Outlet DBF file</a>	<a href="#">Outlet SHX file</a>

# Application of ArcSWAT using extracted SWAT data

### Watershed Delineation

**DEM Setup**

C:\Program Files\ArcSWAT\ArcSWAT\ArcSWAT\ArcSWAT\test5\Watershed\Grid\LandUse1

DEM projection setup

Mask

Burn In

**Stream Definition**

DEM-based

Pre-defined streams and watersheds

DEM-based

Flow direction and accumulation

Area: (139 - 27720) 554,391 (M)

Number of cells: 6160

Pre-defined Watershed dataset

Stream dataset

Stream network

Create streams and outlets

**Outlet and Inlet Definition**

Subbasin outlet

Inlet of draining watershed

Point source input

Add by Table

Edit manually

**Watershed Outlet(s) Selection and Definition**

Whole watershed outlet(s)

Cancel selection

Delimitate watershed

**Calculation of Subbasin Parameters**

Reduced topographic report output

Calculate subbasin parameters

Add or delete reservoir

Number of Outlets: 41

Number of Subbasins: 41

### Land Use/Soils/Slope Definition

Land Use Data | Soil Data | Slope

**Land Use Grid**

C:\Program Files\ArcSWAT\ArcSWAT\ArcSWAT\ArcSWAT\test5\Watershed\Grid\LandUse1

Choose Grid Field

VALUE

OK

LookUp Table

Table Grid Values ----> Land Cover Classes

**SWAT Land Use Classification Table**

VALUE	Area(%)	LandUseSwat
1	11.67	URBN
2	7.84	RICE
3	8.61	AGRL
4	64.53	FRST
5	3.00	BERM
6	0.30	WETL
7	2.06	BARL
8	1.93	WATR

Reclassify

Create HRU Feature Class

Create Overlay Report

Overlay Cancel

### Land Use/Soils/Slope Definition

Land Use Data | Soil Data | Slope

**Soils Grid**

C:\Program Files\ArcSWAT\ArcSWAT\ArcSWAT\ArcSWAT\test5\Watershed\Grid\LandSoil1

Choose Grid Field

VALUE

OK

**Options**

Name

Strmid-Name

SSid

Strmid

Strmid-Seqn

LookUp Table

Table Grid Values ----> Soils Attributes

**SWAT Soil Classification Table**

VALUE	Area(%)	Name
3	0.38	AiB
4	0.92	AcC
5	0.01	AdD
11	0.03	BeB
13	0.15	BpB
14	0.03	BqB
16	0.13	CgC

Reclassify

Create HRU Feature Class

Create Overlay Report

Overlay Cancel

### Weather Data Definition

Relative Humidity Data | Solar Radiation Data | Wind Speed Data |  
Weather Generator Data | Rainfall Data | Temperature Data

Load US or custom weather database to continue

US Database

Custom Database

Locations Table: D:\temp\paldang\weather\_data\wgnstations.dbf

### Setup and Run SWAT Model Simulation

Period of Simulation

Starting Date: 1-1-2005

Ending Date: 12-31-2007

Simulate Forecast Period

Rainfall Sub-Daily Timestep

Timestep: Minutes

Forecast Period

Starting Date: Number of Simulations:

Rainfall Distribution

Skewed normal

Mixed exponential

1.3

Printout Settings

Daily

Monthly

Yearly

NYSKIP: 0

Print Soil Chem Output

Print Pesticide Output

Print Log Flows

Print Hourly Output

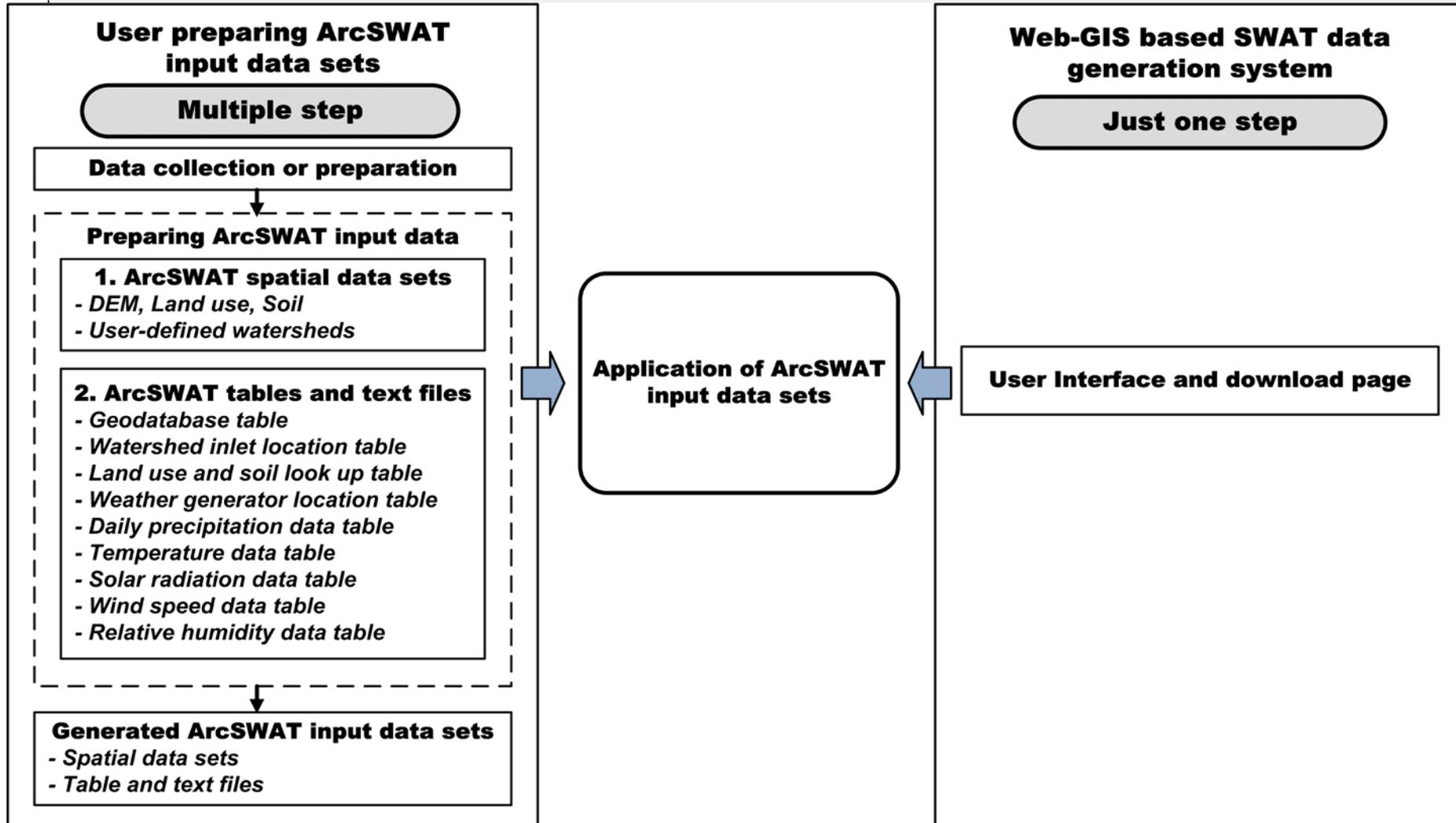
Print Soil Storage

Limit HRU Output

Deposition File:

Setup SWAT Run Run SWAT Cancel

# Comparison of application of ArcSWAT input data sets between preparing ArcSWAT input data and Web-GIS based SWAT data generation system



## Conclusions

- The system for Web-based GIS SWAT data generation that can be operated in real-time through the Internet was developed.
- The system is comprised of
  - Watershed Delineation System
  - Topographical Data Extraction System
  - Metrological Data Extraction System



Useful to users who are willing to operate SWAT models for the various watershed management purpose in terms of spatial and weather data providing and preparing

**Thank you for your attention**  
**Questions and Comments?**

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