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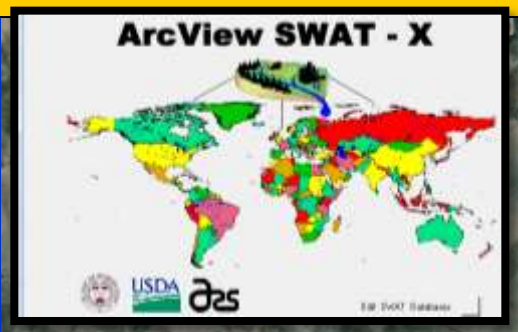
KNU
Kangwon National University
Development of
fully integrated
SWAT-REMM Ver. 2012
w/ auto-calibration
Ji chul Ryu

Contents


I
Introduction

1.1 How to simulate water quality

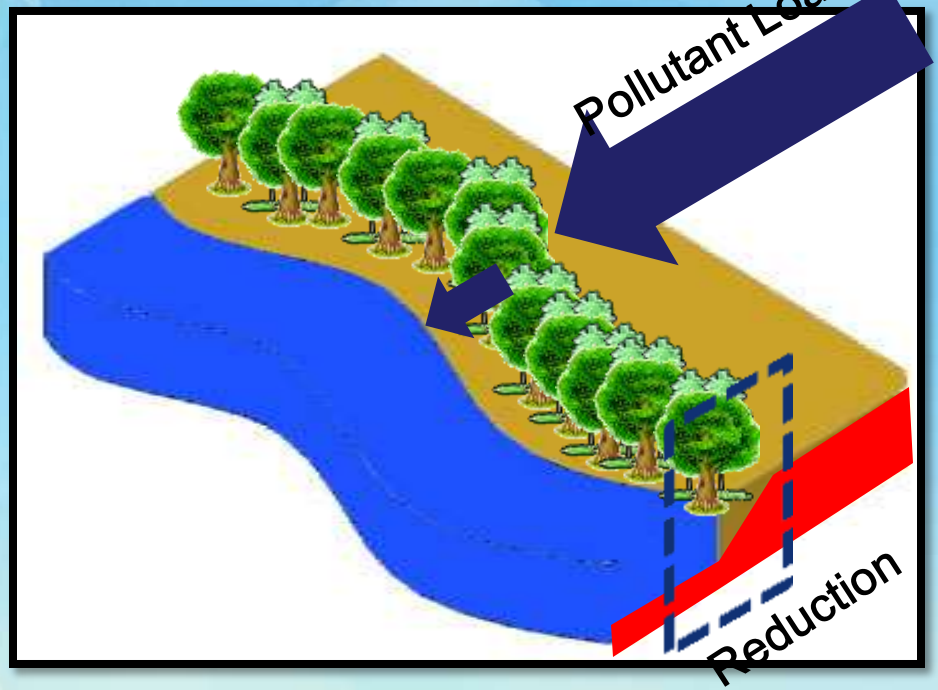
Using SWAT



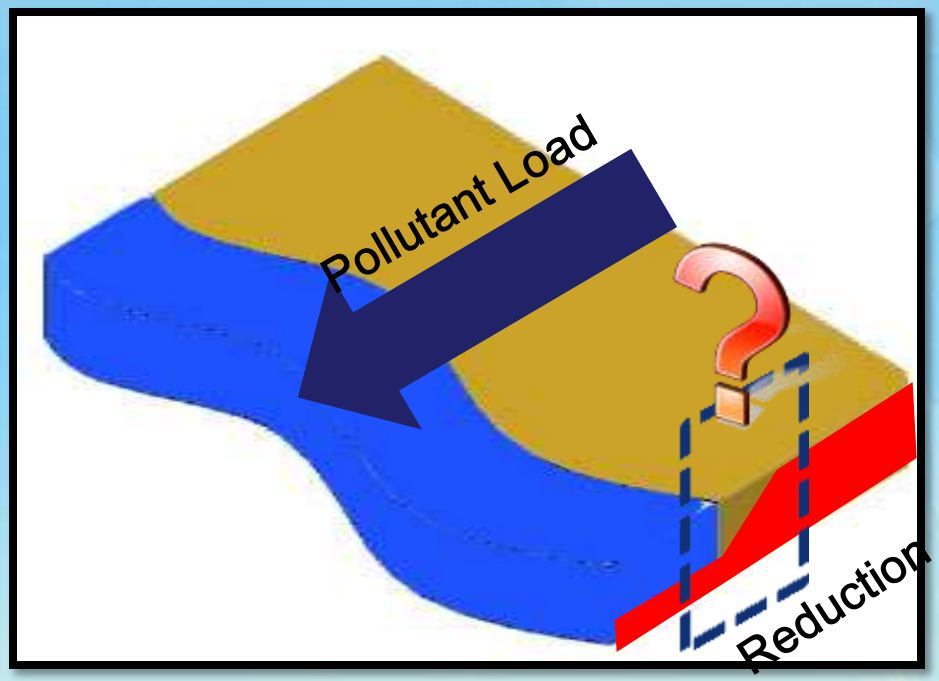
1.2 Riparian Buffer

1. Control the rising water temperature
2. Provide habitat for animal
3. Control the soil erosion
4. Control the NPS pollution

1.3 How to simulate riparian buffer in SWAT?



Riparian buffer
in natural

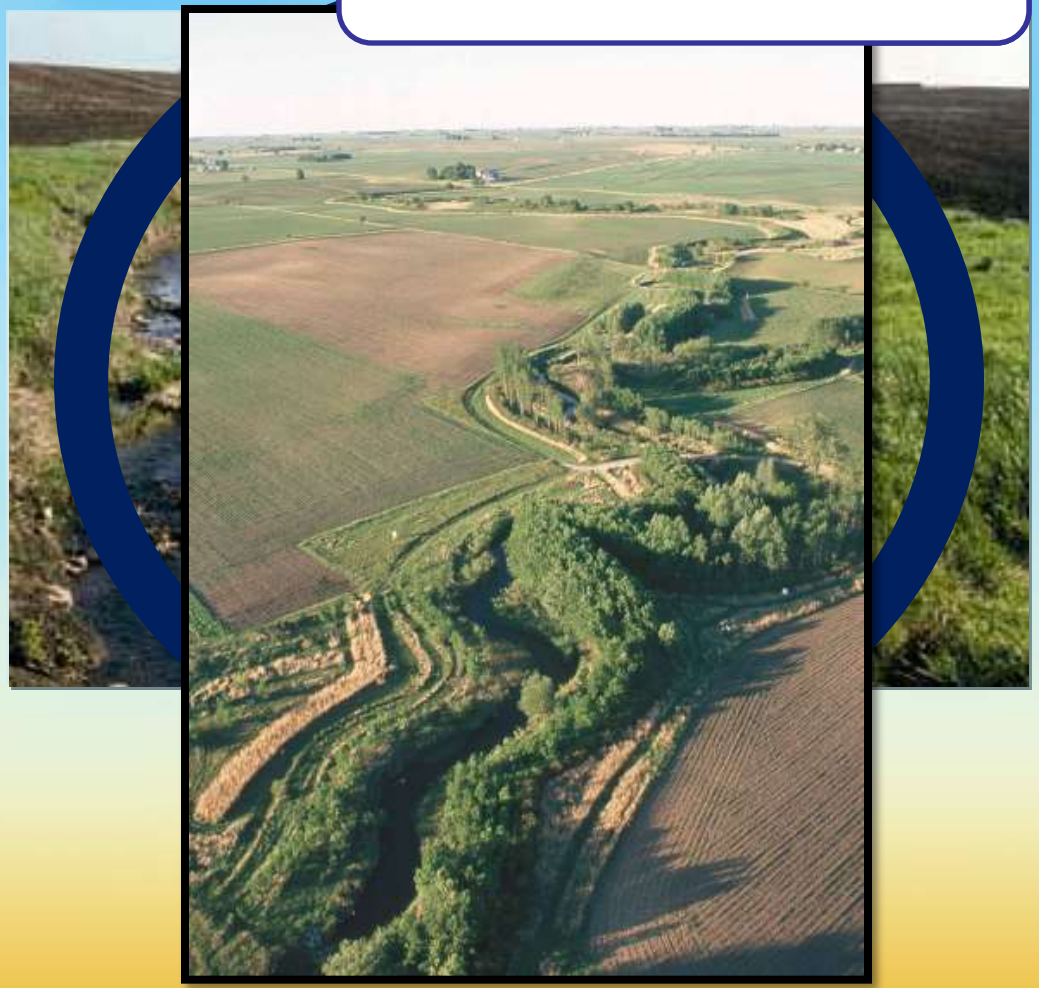


Riparian buffer
in SWAT

1.3 How to simulate riparian buffer in SWAT?

SWAT can NOT

Simulate Riparian Buffer

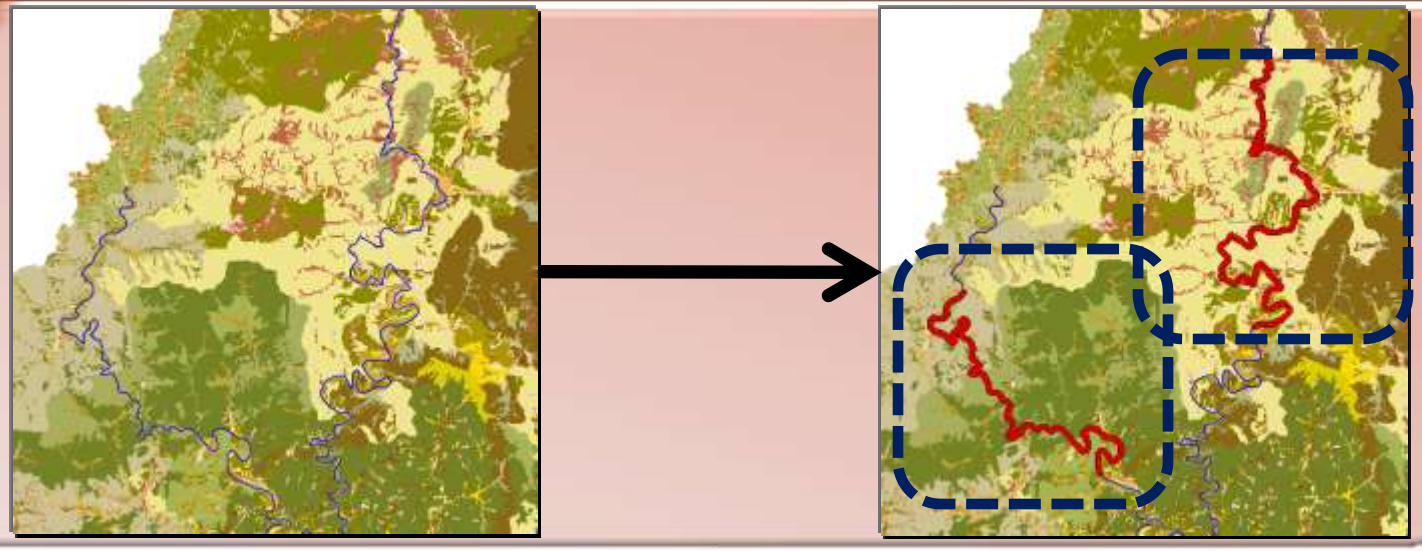


1.4 How to simulate VFS in SWAT?

1 SWAT input variable that pertain to filter strips

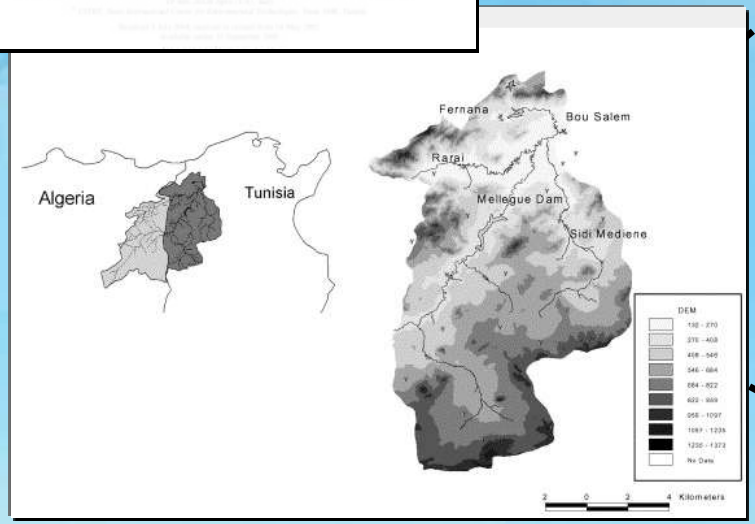
- $$trap_{ef} = 0.367 \cdot \left(width_{filtstrip}\right)^{0.2967}$$
- $$trap_{ef,sub} = \frac{\left(2.1661 \cdot width_{filtstrip} - 5.1302\right)}{100}$$

2 Conversion of Land Use to Forest

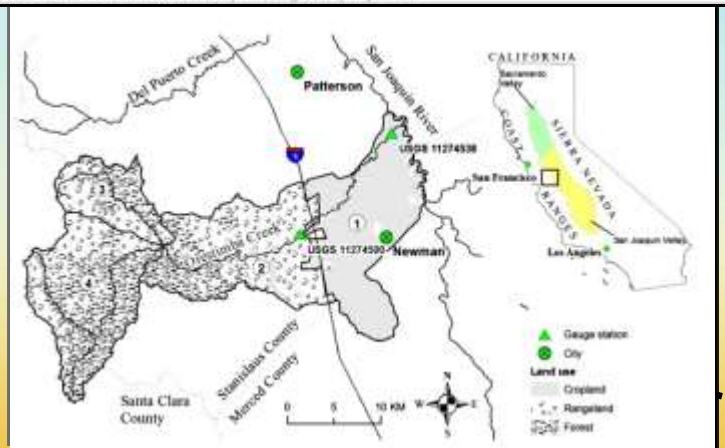
- 

1.5 Simulated water quality using SWAT

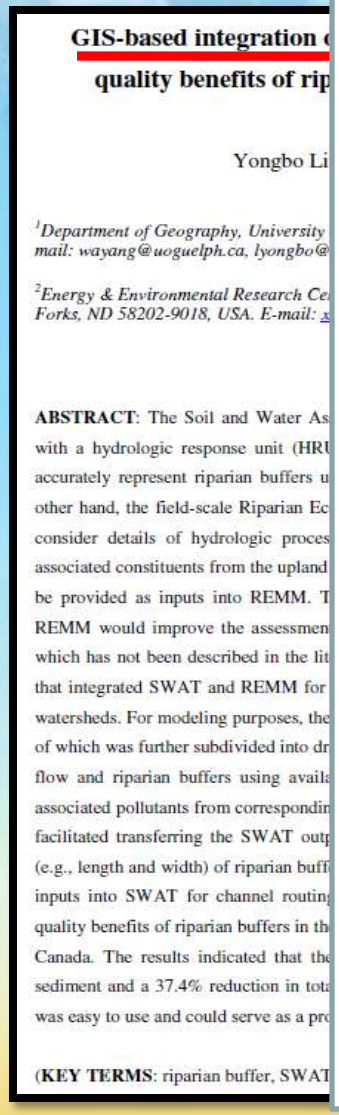
Application of the SWAT model on the Medjerda river basin (Tunisia)



Management-oriented sensitivity analysis for pesticide transport in watershed-scale water quality modeling using SWAT



1.6 SWAT-REMM prototype



GIS-based integration
quality benefits of rip

Yongbo Li

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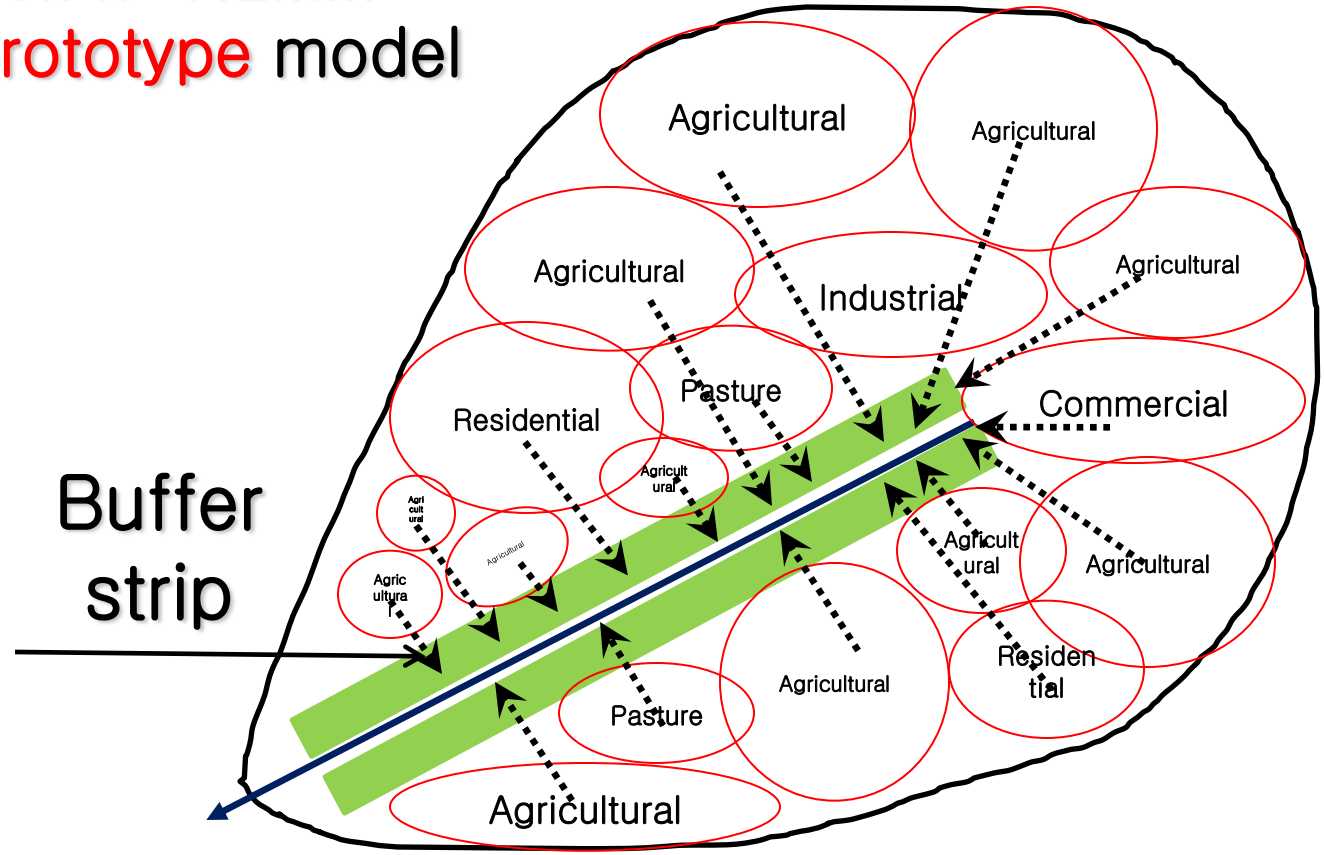
Forks, ND 58202-9018, USA. E-mail:

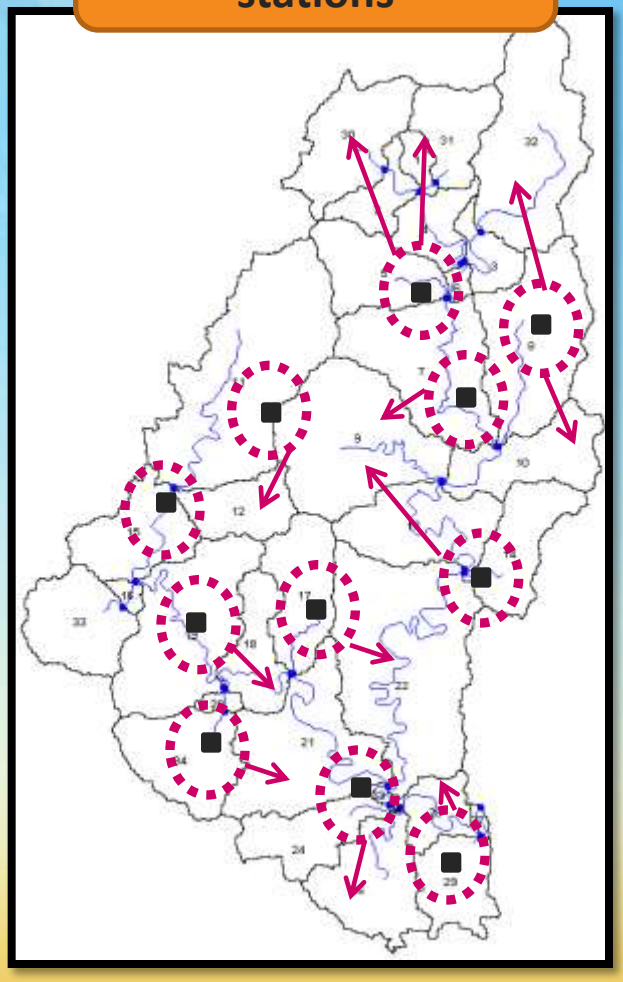
ABSTRACT: The Soil and Water As
with a hydrologic response unit (HRU
accurately represent riparian buffers u
other hand, the field-scale Riparian Ec
consider details of hydrologic proces
associated constituents from the upland
be provided as inputs into REMM. T
REMM would improve the assessmen
which has not been described in the lit
that integrated SWAT and REMM for
watersheds. For modeling purposes, the
of which was further subdivided into dr
flow and riparian buffers using availa
associated pollutants from correspondin
facilitated transferring the SWAT outp
(e.g., length and width) of riparian buff
inputs into SWAT for channel routing
quality benefits of riparian buffers in th
Canada. The results indicated that the
sediment and a 37.4% reduction in tota
was easy to use and could serve as a pr

(**KEY TERMS**: riparian buffer, SWAT

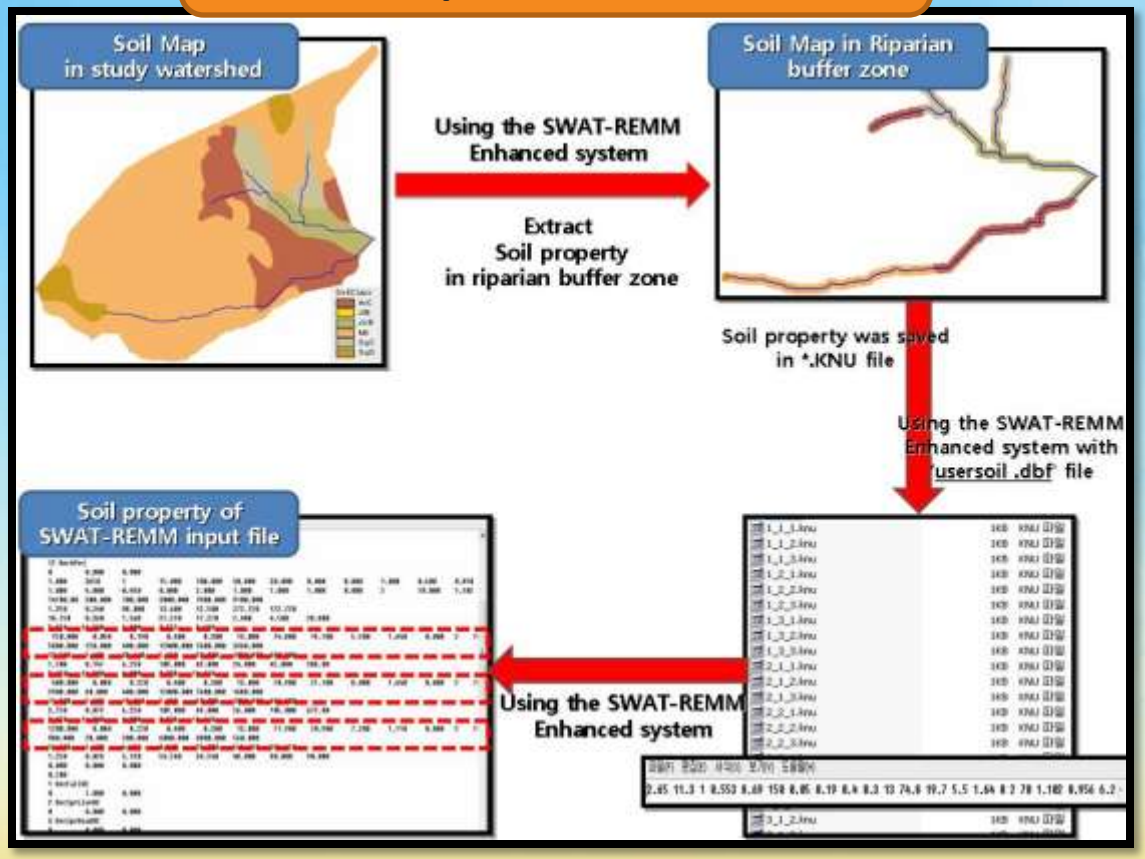


1.7 SWAT-REMM ver. 2010

Multiple weather stations



Reflection of soil properties at riparian buffer



1.8 How to calibrate water quality using SWAT-REMM prototype??

Manually

OR

Automatically

Objectives of Study

for Auto-Calibration in current SWAT-REMM

Limitations

- the riparian buffer should be specified along the reaches in every catchment in the watershed
- Current SWAT-REMM was NOT fully integrated

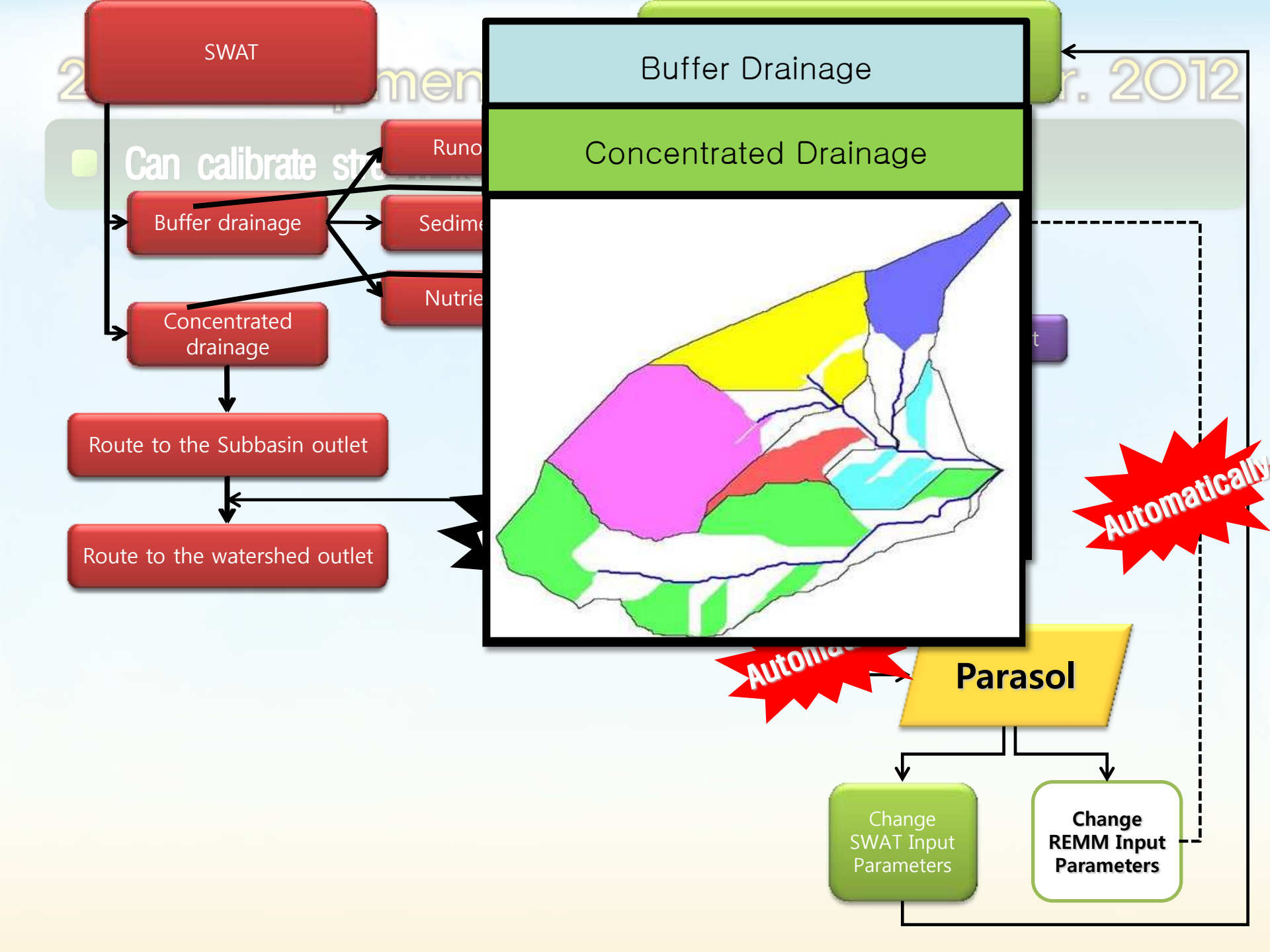
Additions

- Enable simulation of riparian buffer at user designated watershed
- Develop automatic REMM input module through modification of SWAT engine
- Develop the REMM background run module
- Develop the auto-calibration module by adding REMM input parameters with Parasol

Development

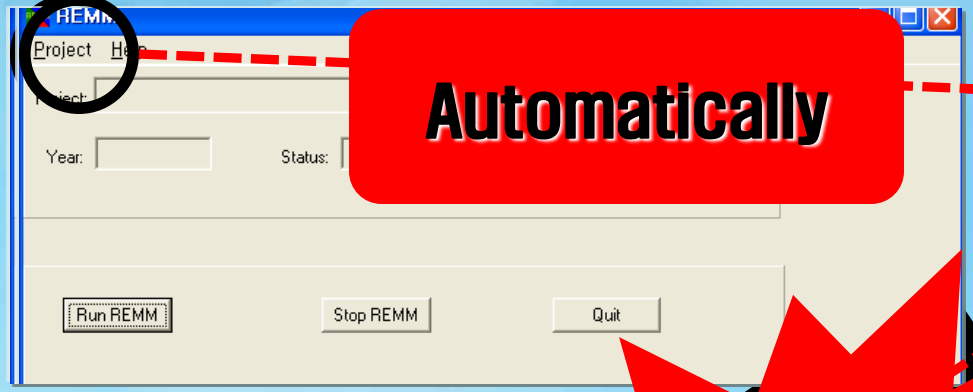
SWAT-REMM ver. 2012


II
Methodologies


SWAT
Buffer Drainage
Concentrated Drainage
Runo
Sedime
Nutrie
Buffer drainage
Concentrated drainage
Route to the Subbasin outlet
Route to the watershed outlet
Automatically
Parasol
Change SWAT Input Parameters
Change REMM Input Parameters

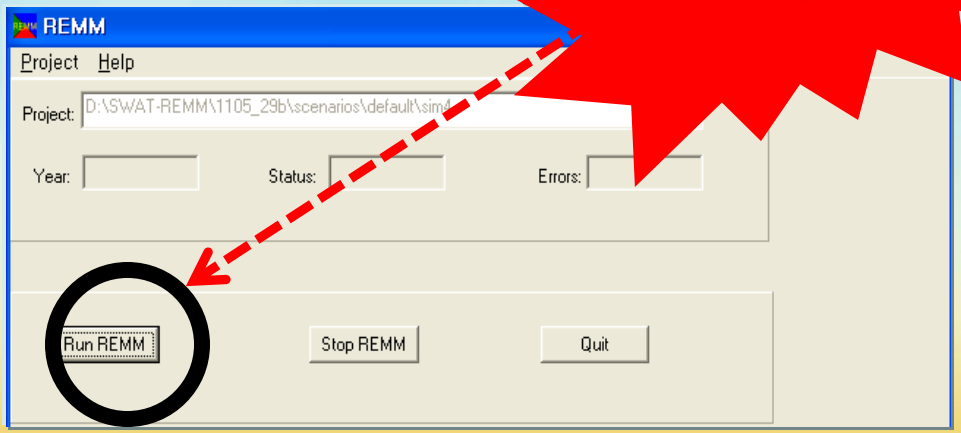
2.1 Development of SWAT-REMM ver. 2012

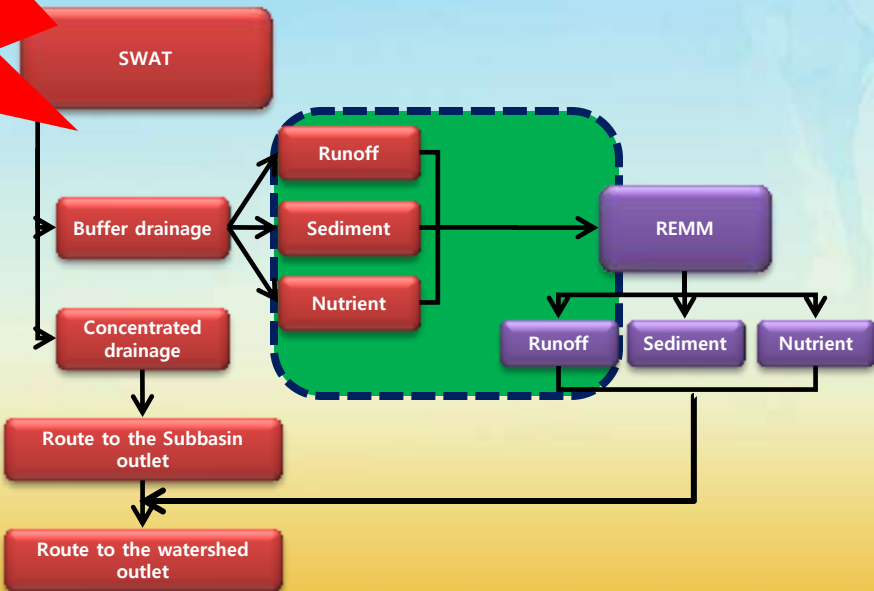
- Simulation of REMM in SWAT-REMM ver. 2012



Automatically

Using background module





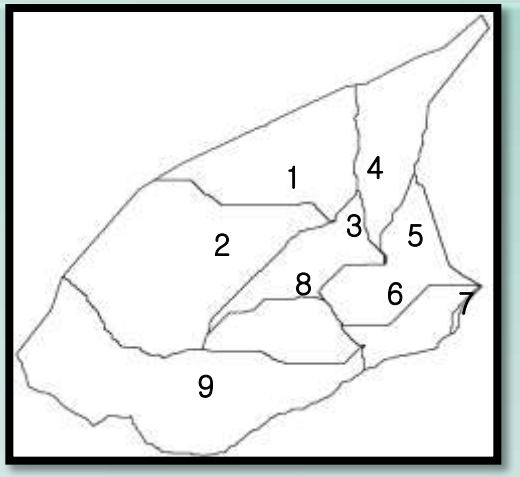
2.2 Application of SWAT-REMM ver. 2012

Study area

2.2 Application of SWAT-REMM ver. 2012

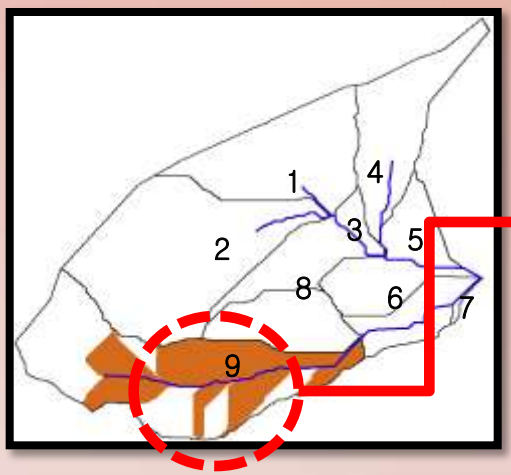
Scenarios of Auto-calibration

Scenario 1.

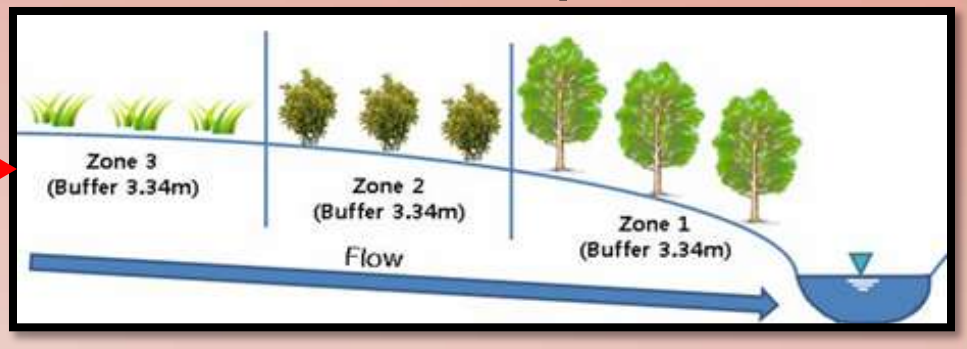


Without Riparian buffer

Scenario 2.



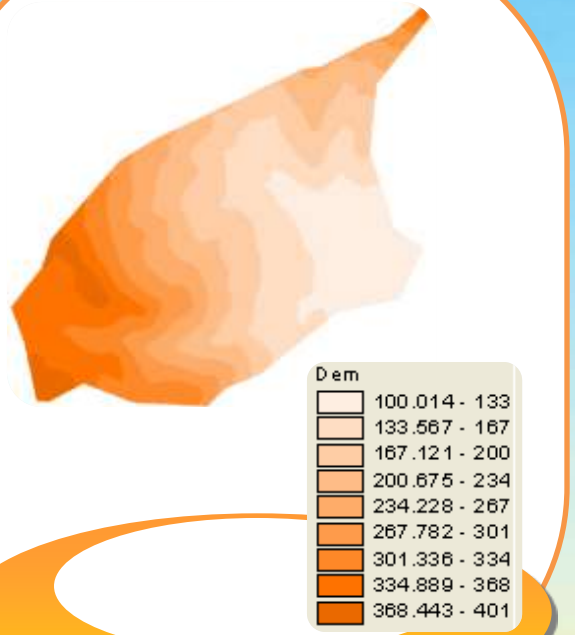
Established Riparian buffer



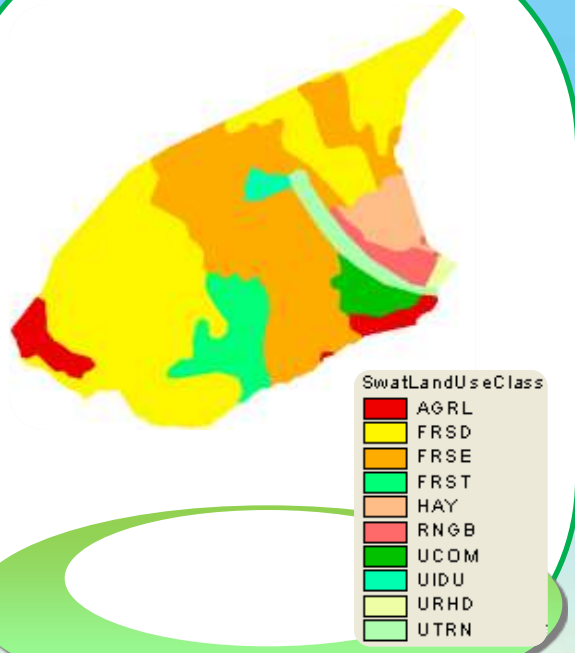
2.2 Application of SWAT-REMM ver. 2012

SWAT input data

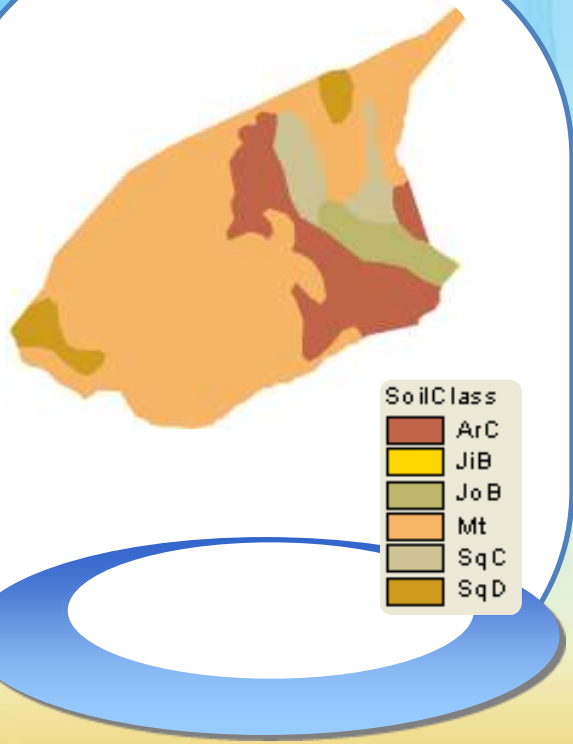
DEM



Landuse

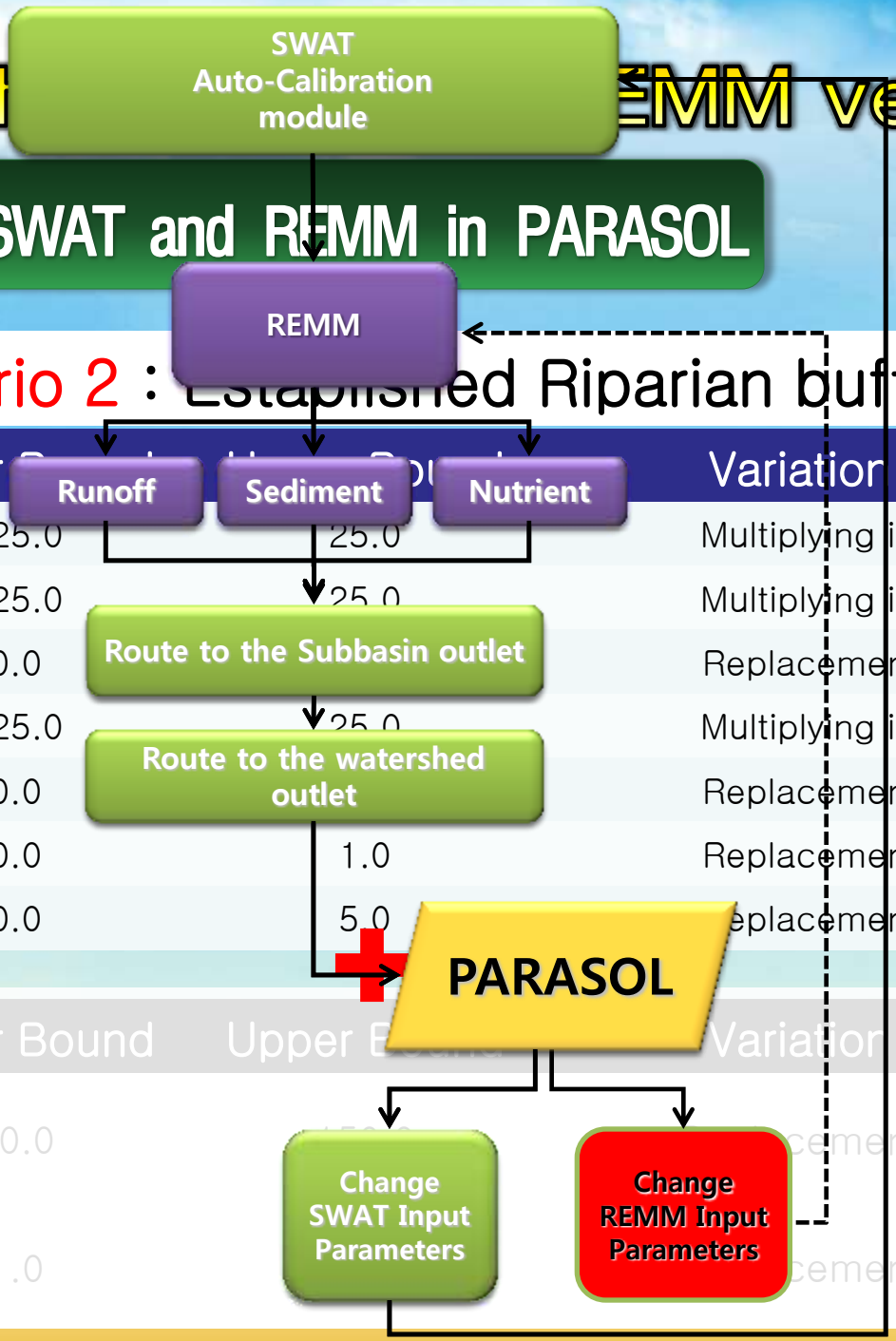


Soil



2.2 Applicat … EMM ver. 2012

Parameters of SWAT and REMM in PARASOL



Scenario 2 : Established Riparian buffer

SWAT	Lower Bound	Upper Bound	Variation Method
Slsubbsn	-25.0	25.0	Multiplying initial value
Slope	-25.0	25.0	Multiplying initial value
Gwno3	0.0		Replacement by value
Cn2	-25.0	25.0	Multiplying initial value
Gwqmn	0.0		Replacement by value
Alpha_Bf	0.0	1.0	Replacement by value
Slsoil	0.0	5.0	eplacement by value

REMM	Lower Bound	Upper Bound	Variation Method
Maximum Root Depth	50.0		cement by value
Maximum Leaf Area Index	1.0		cement by value

III Results

3-3. Results

R^2 and NSE

Scenario 1 Without riparian buffer

Stream flow : R^2 = 0.97 NSE = 0.67

Total Nitrogen : R^2 = 0.64 NSE = 0.55

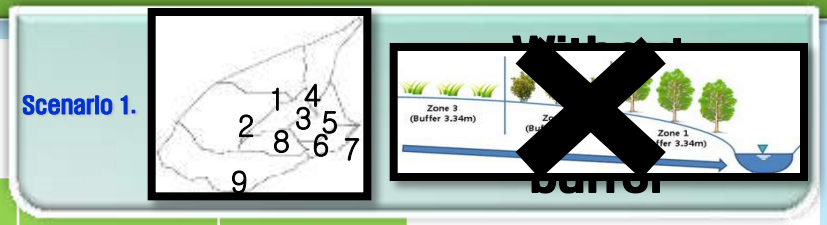
Scenario 2 With riparian buffer

Stream flow : R^2 = 0.30 NSE = 0.278

Total Nitrogen : R^2 = 0.11 NSE = −99888.132

3-2. Results

Best parameters



Scenario 1 Without riparian buffer

Slsubbasin	Slope	Gwno3	Cn2	Gwqmn	Alpha_bf	Slsoil
+ 25%	- 25%	3.1	-22.8%	27.1	0.4	4.9

Scenario 2 With riparian buffer

Slsubbasin	Slope	Gwno3	Cn2	Gwqmn	Alpha_bf	Slsoil	Maximum Root Depth	Maximum Leaf Area Index
+10.9%	-25%	5.6	-11.55%	1499.2	0.6	5.0	130.52	14.881

Ⅳ Conclusion

4. Conclusions

1 Development of SWAT-REMM ver. 2012

- Can be simulated riparian buffer at user designated watershed
- Can be calibrated flow and water quality automatically

2 Application of riparian buffer in SWAT

- Many swat applications to the watershed with riparian buffers without using SWAT-REMM system need to be re-inves tigated.
- Canopy scenario at riparian buffer could be simulated with SWAT-REMM 2012

3 Auto-calibration of stream flow and water quality

- SWAT-REMM auto-calibration module, developed in this study, can be efficiently used to determined best SWAT and REMM parameters for watershed with riparian buffers.

4 Future study

- In the near future we will extend SWAT-REMM auto-calibration capabilities to consider other REMM input parameters.
- We will develop simple module to estimate pollutant load from buffer drainage by clipping HRU map with buffer drainage boundary
- By 2012 we will develop new SWAT-REMM in open source MAP-WINDOW platform !!!

Thank you
for Your Attention !!

Contact us ☺

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