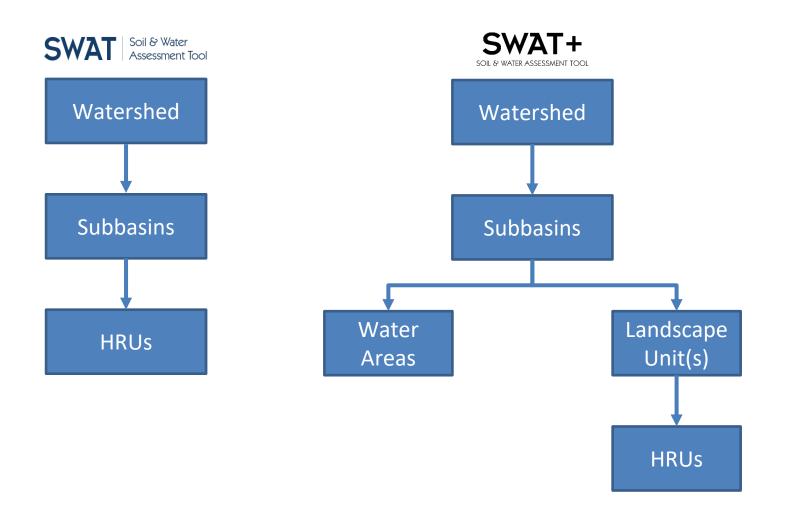
Exploring the sensitivity of upland – floodplain – stream connectivity in SWAT+

Katrin Bieger, Jeff Arnold, Mike White, David Bosch, Peter Allen 2018 International SWAT Conference Brussels, Belgium September 20, 2018

Introduction

- Incorporating concepts of hydrologic connectivity in watershed models potentially improves their process representation and predictive capability
- SWAT+ modular structure facilitates this
- Most basic units of a watershed: uplands and floodplains

Watershed delineation



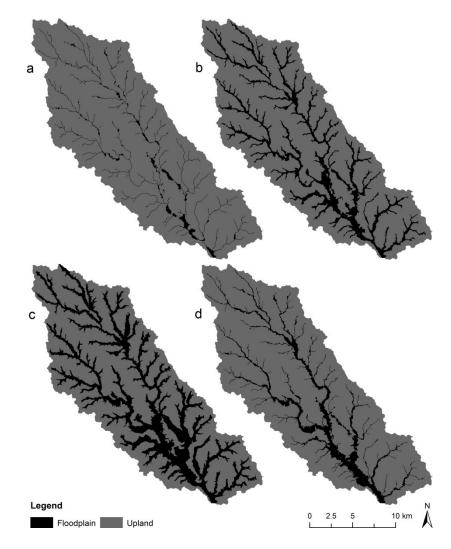
Landscape units

- Differences in hydrologic properties
- Runoff routing across the landscape

Delineation methods:

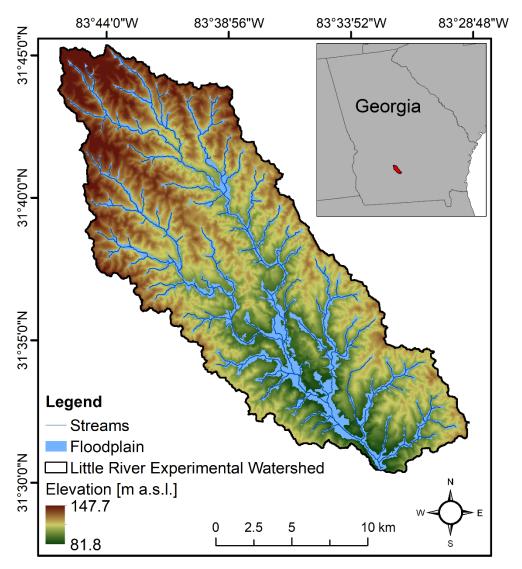
- a) Topographic Wetness Index (Beven and Kirkby, 1979)
- b) Slope Position(USDA Forest Service, 1999)
- c) Uniform Flood Stage (Williams et al., 2000)
- d) Variable Flood Stage (Nardi et al., 2006)

Rathjens et al., 2016. Delineating floodplain and upland areas for hydrologic models - A comparison of methods. Hydrological Processes 30(23):4367-4383.



9/12/2018

Little River Experimental Watershed (LREW)



Area: 334 km²

Average annual precip: 1208 mm Average temperature: 19.1°C Average streamflow: 2.95 m³/s

Gently sloping uplands Broad, wooded floodplains

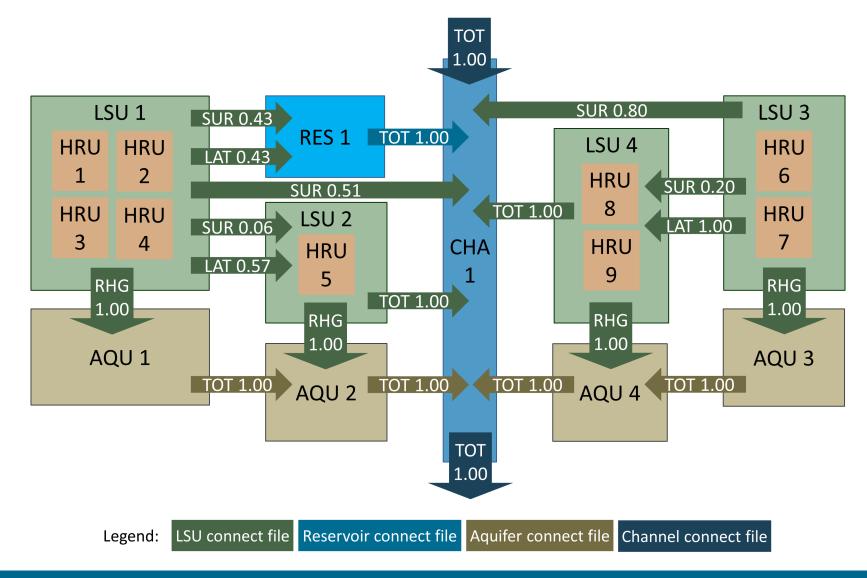


SWAT+ connect files

Define gravity-controlled connections between different spatial objects within a watershed

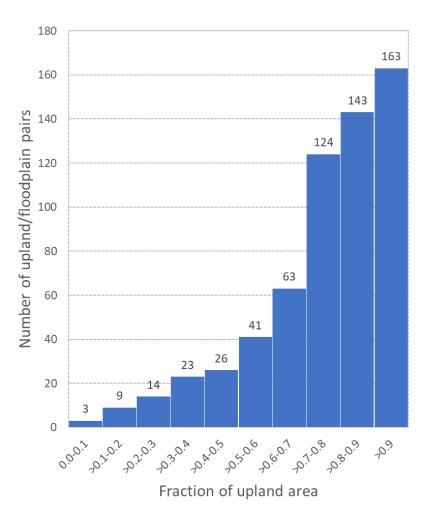
Column name	Description
OUT_TOT	Total number of objects receiving runoff from this object. The following four columns are repeated accordingly.
OBJ_TYP	The type of the receiving object (e.g., LSU, channel, reservoir, aquifer).
OBJ_ID	The ID of the receiving object.
HYDRO_TYP	The type of hydrograph to be sent to the receiving object (e.g., surface runoff, lateral flow, recharge).
FRAC	The fraction of the hydrograph to be sent to the receiving object. Fractions of the same hydrographs can be sent to multiple receiving objects as long as the fractions add up to 1.

Connectivity

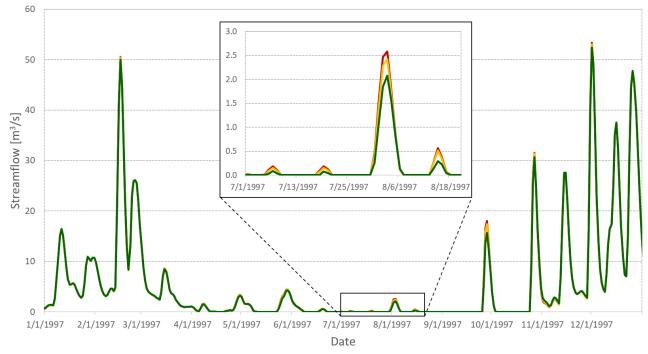


Scenarios

Scenario	Description		
70CHA/30LSU	70% of surface runoff generated in		
	the upland areas are sent directly to		
	the channel, 30% to the floodplain		
30CHA/70LSU	30% of surface runoff generated in		
	the upland areas are sent directly to		
	the channel, 70% to the floodplain		
VAR_RATIO	For each pair of upland and		
	floodplain, the ratio of channelized		
	overland flow and sheet flow is		
	calculated based on the relative size		
	of the upland and floodplain area		

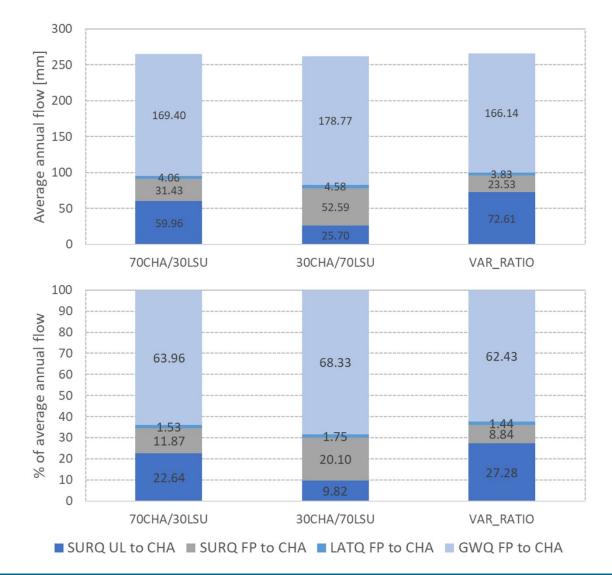


Streamflow



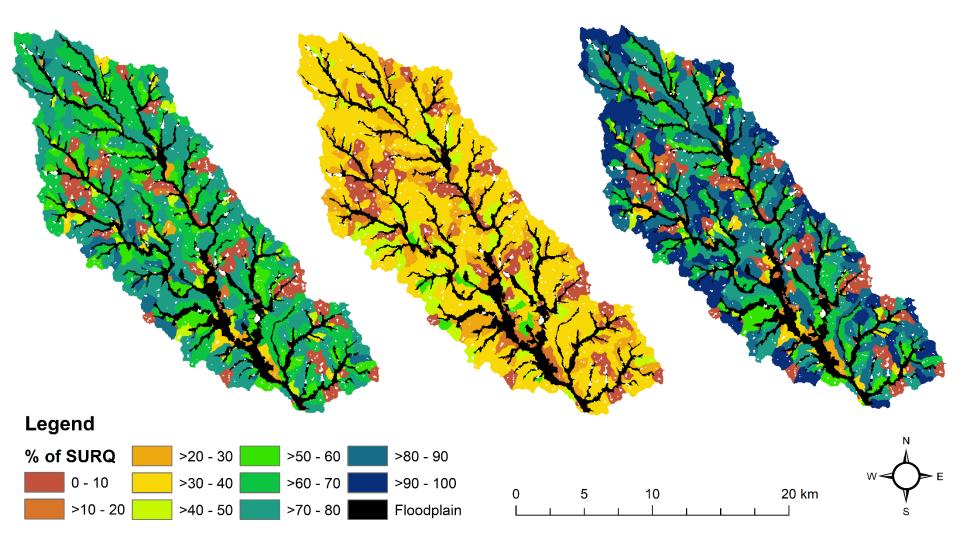
		70CHA/30LSU	30CHA/70LSU	VAR_RATIO
Calibration	NSE	0.89	0.89	0.89
	R ²	0.90	0.90	0.90
	PBIAS	5.21	5.88	4.92
Validation	NSE	0.83	0.83	0.83
	R ²	0.83	0.83	0.83
	PBIAS	0.93	1.88	0.58

Water balance

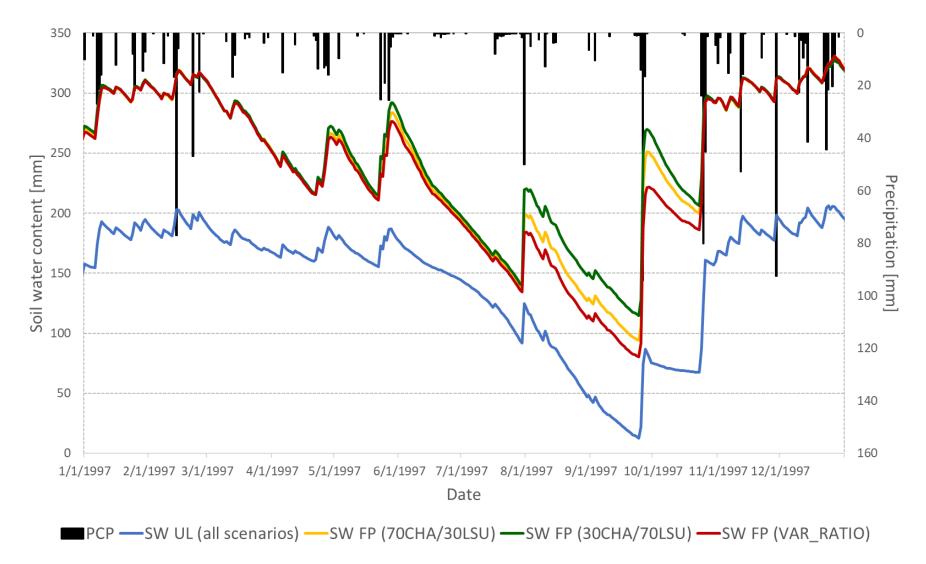


Bieger et al.

Surface runoff



Soil water content



Conclusion

• Small differences in streamflow, but different representation of runoff source areas

• Crucial for identification of critical source areas and simulation of buffering function of floodplain



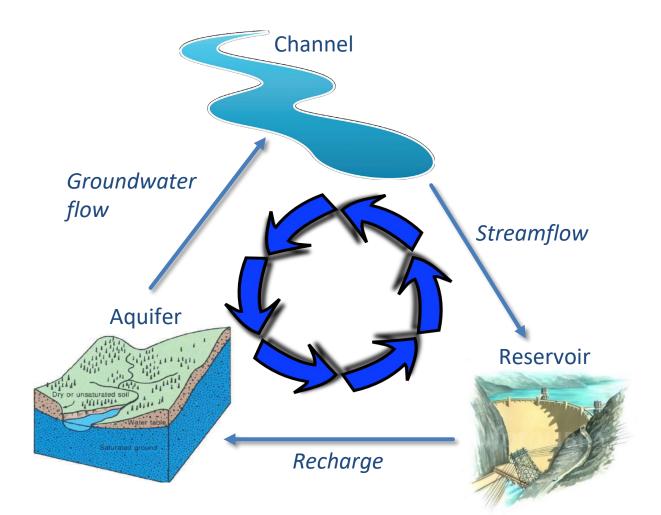
K. Bieger, J.G. Arnold, H. Rathjens, M.J. White, D.D. Bosch, P.M. Allen, M. Volk, and R. Srinivasan Introduction to SWAT+, a completely restructured version of the Soil and Water Assessment Tool Journal of the American Water Resources Association 53(1):115-130



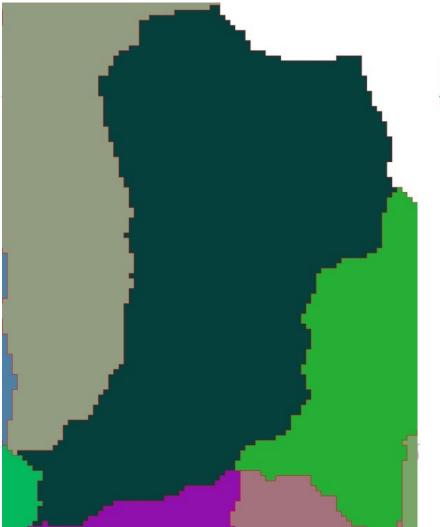
kbieger@brc.tamus.edu

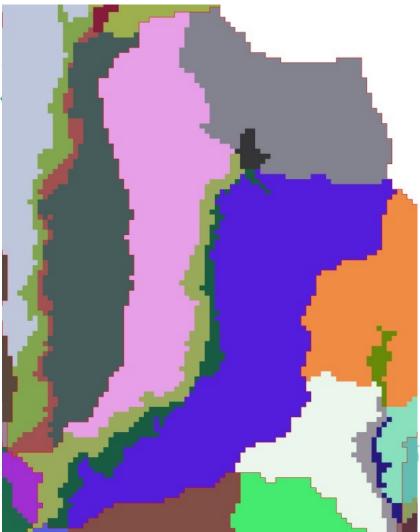
Spatial connections

Infinite loop



2 SWAT+ setups





Landscape units

- Hydrologic landscape units are
 o elements of a (sub)watershed
 o defined to account for landscape position and processes
- Two landscape units
 O Upland and floodplain
 O Different hydrologic properties and processes (slope, storage, sediment processes)

