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Calibration and Validation of SWAT Hydrological Model for Meki Watershed, Ethiopia

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INTRODUCTION



Location: Meki Watershed, Central Ethiopia

SWAT is a physically based, continuous time and a public domain hydrological model. The ArcView integrated SWAT interface, AVSWAT, provides a user friendly GUI. The model has been tested in different tropical watersheds and reported to be able to well explain watershed hydrological processes. To benefit from its free accessibility and good modeling capability, this model has been tested for the Ethiopian condition.

OBJECTIVE

To test suitability of SWAT hydrological model in simulating the hydrological processes of Meki Watershed

METHODOLOGY

Gauging Station: Meki Village

Average Elevation: 2143 m.a.s.l.



Landuse: Largely agriculture

Area Coverage: 2233 km²

Major Soils: Eutric Cambisols (CMe) & Eutric Vertisols



RESULTS AND CONCLUSION

							_								
Result of Sensetivity Analysis									Initial and finally adjusted parameter values of the flow calibration						
3.5								No.	Parameters	Effect on simulation when paramet	er values increase	Range	Intitial Value	adjusted value	
3.06	RS – Relative Sensitivit		N2 Initial S WQMN Thresho	Initial SCS CN II value Threshold water depth in shallow aquifer for flow				1	CN2	increase surface runoff		-25% - +25%	Default/Initial	-25%	
3.0 T	Small to Negligible: $0 \le RS < 0.05$ Medium: $0.05 \le RS < 0.2$ High: $0.20 \le RS < 1.0$ Very High: $RS \ge 1.0$		OL_AWC Soil ava SCO Soil eva	Soil available water capacity Soil evaporation compensation factor Average slope steepness Saturated hydraulic conductivity Deep aquifer percolation fraction Soil depth Groundwater "reup" coefficient Hodopical mixing efficiency Hodopical mixing efficiency				2	GWQMN	decrease baseflow		0 - 5000	0.00	10.00	
2.5 -			LOPE Average					3	ESCO	decrease evaporation		0 - 1	0.95	0.10	
isu 2.0 -	ruy mga no = no		hrg_dp Deep ac					4	SLOPE	increases the lateral flow		0 - 0 60	Default/Initial	0.10	
8 8 1 F	G	W_REVAP Ground					5	rchrg dp	increase deen aquifer recharge		0 1	0.05	0.275		
			H K2 Channe					5	icing_up	merease deep aquiter reenarge		0 - 1	0.05	0.275	
8 10-		0	mmx Maxim	m canopy storage				6		decrease baseflow by increasing w	ter transfer from				
x	0.6 0.42 0.42	si ej	rlag Surface co Plant up	aptake compensation factor			Tγ		GW_REVAP	shallow aquifer to root zone	quifer to root zone		0.02	0.15	
0.5 -		0.32 0.28 0	.26 0.25			0.01				increases the time between water e	tits the soil profile and				
0.0				0.05 0.04	0.03 0.01			7	GW_DELAY	enters the shallow aquifer	•	0 - 500	31	20	
CN2	CN2 GWOMN SOL_AWC ESCO ESCO ESCO ESCO ESCO ESCO ESCO ESC								Calibration, m	onthly flows	50.000 Valid	ation, monthl	ly flows	■ gauged → simulated	
Calibration and Validation Statistics								Se 15.000			8 30.000	A			
	Period	Standard	l Error (m ³ /s)					₩ ₩ ₩ 10.000 1		20.000 20.000					
	(Monthly)	Observed	Simulated	% Error	R^2	E _{NS}		Avera			10.000				
Calibration	1985-1989	7.28	7.03	+2.2	0.84	0.69		5.000	W M		5.000	-			
Validation	1990-1992	10.85	12.22	-7.6	0.81	0.54		0.000 Ja	n-85 Jul-85 Jan-86 Jul-86	Jan-87 Jul-87 Jan-88 Jul-88 Jan-89 Jul-89	0.000	I-90 Jan-91	Jul-91 Jan-92	Jul-92	

The results showed that SWAT is able to simulate the hydrological characteristics of the Meki watershed very well. Hence, the model can be used for further hydrological studies in the watershed



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