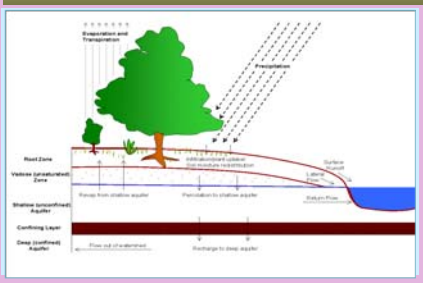
Calibration and Validation of SWAT Hydrological Model for Meki Watershed, Ethiopia

Institute for Technology in the Tropics
University of Applied Sciences Cologne

Lijalem Zeray Abraham[1], Jackson Roehrig[1], and Dilnesaw Alamirew Chekol[2]

INTRODUCTION



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

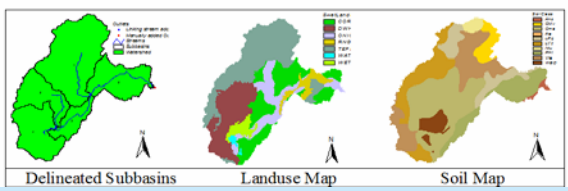
To test suitability of SWAT hydrological model in simulating the hydrological processes of Meki Watershed

METHODOLOGY

Location: Meki Watershed, Central Ethiopia

Gauging Station: Meki Village

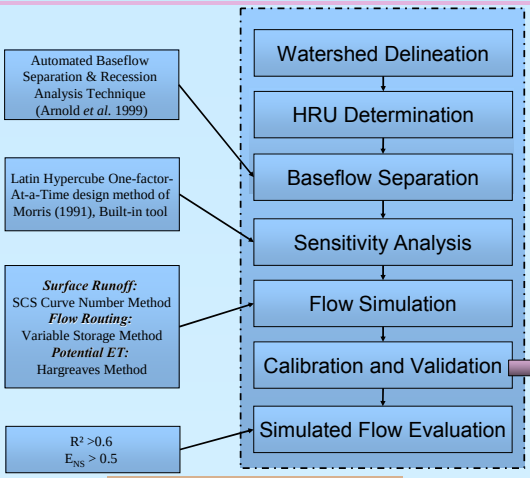
Average Elevation: 2143 m.a.s.l.



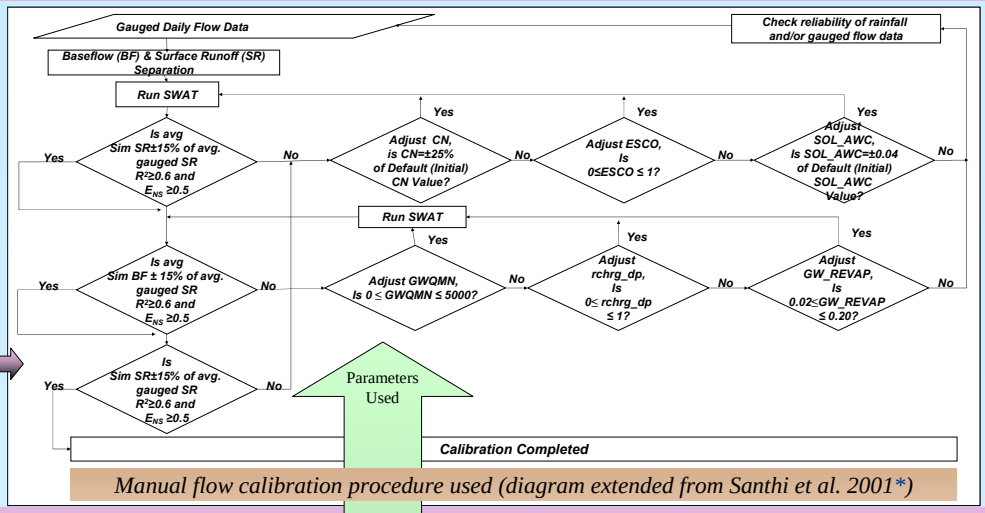
Landuse: Largely agriculture

Area Coverage: 2233 km^2

Major Soils: Eutric Cambisols (CMe) & Eutric Vertisols

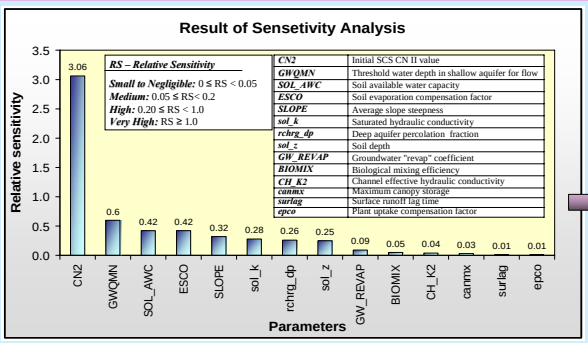


Methodological steps followed



Manual flow calibration procedure used (diagram extended from Santhi et al. 2001)*

RESULTS AND CONCLUSION

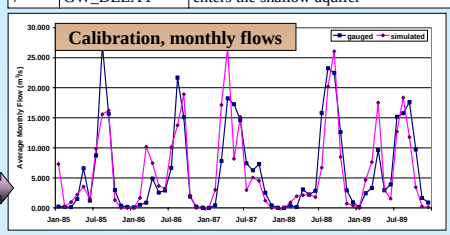


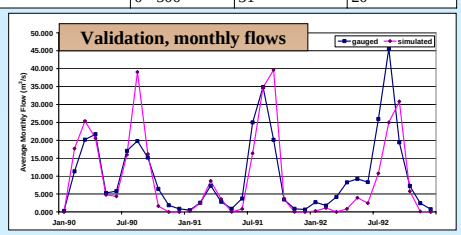
Initial and finally adjusted parameter values of the flow calibration

No.	*Parameters*	*Effect on simulation when parameter values increase*	*Range*	*Intitial Value*	*adjusted value*
1	CN2	increase surface runoff	-25% - +25%	Default/Initial	-25%
2	GWQMN	decrease baseflow	0 – 5000	0.00	10.00
3	ESCO	decrease evaporation	0 – 1	0.95	0.10
4	SLOPE	increases the lateral flow	0 - 0.60	Default/Initial	0.10
5	rchrg_dp	increase deep aquifer recharge	0 – 1	0.05	0.275
6	GW_REVAP	decrease baseflow by increasing water transfer from shallow aquifer to root zone	0.02 - 0.20	0.02	0.15
7	GW_DELAY	increases the time between water exits the soil profile and enters the shallow aquifer	0 - 500	31	20

Calibration and Validation Statistics

	Period (Monthly)	*Standard Error (m^3/s)*		*% Error*	R^2	E_{NS}
		Observed	*Simulated*			
Calibration	1985-1989	7.28	7.03	+2.2	0.84	0.69
Validation	1990-1992	10.85	12.22	-7.6	0.81	0.54





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

1) University of Applied Sciences Cologne, Institute for Technology in the Tropics (ITT), Germany
Author to whom correspondence should be addressed: Lijalem Zeray Abraham (lijalem.zeray@fh-koeln.de or lijalemz@yahoo.com)
2) The United Nations University, Institute For Natural Resources in Africa, Ghana

* **SANTHI**, C., J.G. Arnold, J.R. Williams, W.A. Dugas, R. Srinivasan, and L.M.Hauck, October 2001. Validation of the SWAT Model on a Large River Basin with Point & Non-point Sources, Journal of the American Water Resources Association, Vol. 37, No. 5, 1169-1188pp.