Supplement of Hydrol. Earth Syst. Sci., 24, 945–966, 2020
https://doi.org/10.5194/hess-24-945-2020-supplement

Hydrology and Earth System Sciences
Open Access
EGU

Supplement of

Temperature controls production but hydrology regulates export of dissolved organic carbon at the catchment scale

Hang Wen et al.

Correspondence to: Li Li (lili@engr.psu.edu)

S1. Estimation of groundwater flow Q_G. Based on estimation in Li et al. (2017), groundwater estimates were refined first by calculating average groundwater fluxes in wet and dry periods using the conductivity mass balance hydrograph separation (Lim et al., 2005) via the online Web-based Hydrograph Analysis Tool (WHAT) (https:// engineerg.purdue.edu/~what). The groundwater influx was further refined by capturing the peaks of stream DOC concentration, especially under low discharge periods.

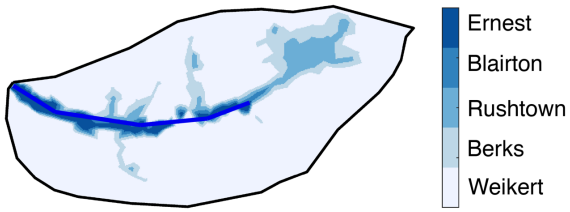

Figure S1. Spatial distribution of soil series at Shale Hills.

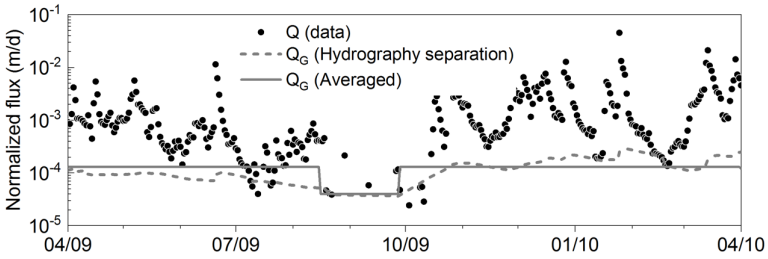

Figure S2. Temporal dynamics of field discharge (dots), groundwater flow Q_G estimated from WHAT (dash line), and corresponding averaged Q_G in the wet and dry periods (solid line).

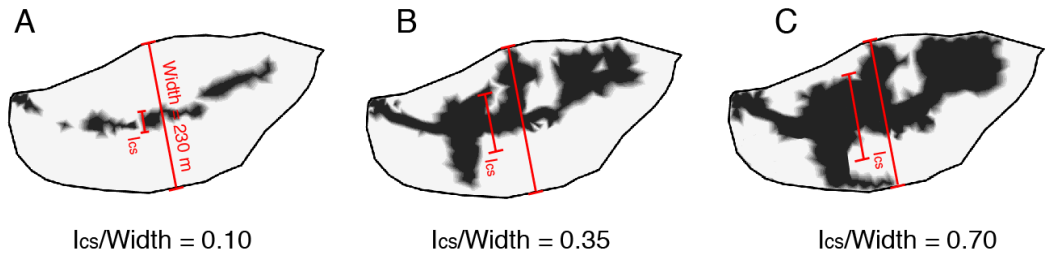

Figure. S3. Maps showing conditions with different hydrological connectivity l_{cs}/Width, including (A) 0.10, (B) 0.35, and (C) 0.70.

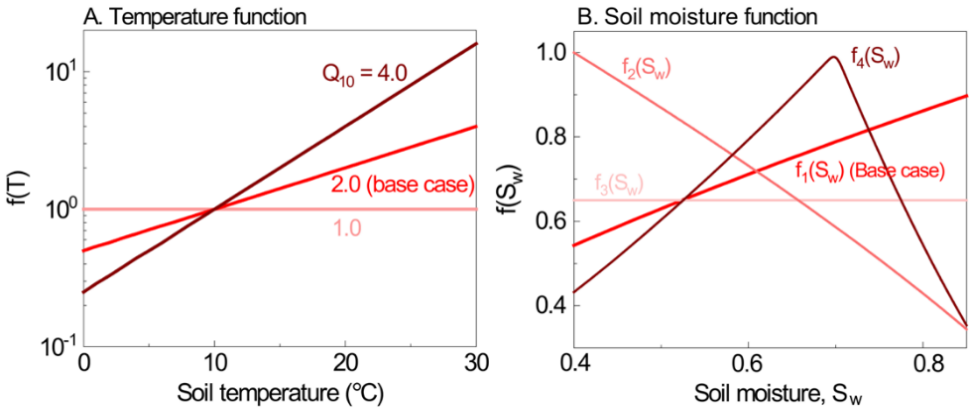

Figure. S4. Sensitivity analysis for (A) the temperature function and (B) the four soil moisture functions used to calculate local DOC production rate (Eq. (2)-(5)). The four soil moisture functions represent increase, decrease, constant, and threshold behavior, respectively.

Table S1. Soil parameters. Listed values are the a priori (uncalibrated) parameter values. All parameters in this table are calibrated using an optimization algorithm.

Parameter	Description	Soil type					Source
		Weikert	Berks	Rushtown	Blairton	Ernest	
K_{infV}	Vertical saturated hydraulic conductivity of infiltration layer (m/s)	9.1	15.2	9.8	1.5	8.3	(Lin, 2006)
K_V	Vertical saturated hydraulic conductivity (m/s)	1.6	1.9	1.1	0.7	3.7	(Lin, 2006)
K_H	Horizontal saturated hydraulic conductivity (m/s)	1.2	1.0	2.3	3.0	7.0	(Lin, 2006)
$\boldsymbol{\phi}$	Porosity (m^3/m^3)	0.37	0.40	0.42	0.41	0.49	(Lin, 2006)
$\boldsymbol{\phi_r}$	Residual porosity (m^3/m^3)	0.05	0.05	0.05	0.05	0.05	(Lin, 2006)
$\boldsymbol{\alpha}$	Van Genuchten soil parameter (m^{-1})	8.80	6.45	6.50	5.34	5.82	(Lin, 2006)
$\boldsymbol{\beta}$	Van Genuchten soil parameter (-)	1.24	1.21	1.26	1.26	1.22	(Lin, 2006)
$f_{mac,V}$ and $f_{mac,H}$	Vertical and horizontal area fraction of macropores (m^2/m^2)	0.01					Empirical (Shi et al., 2013)
D_{mac}	Macropore depth (m)	1.0					Empirical (Shi et al., 2013)
$K_{mac,V}$	Vertical macropore hydraulic conductivity (m/s)[a]	100 K_{infV}					Empirical (Shi et al., 2013)
$K_{mac,H}$	Horizontal macropore hydraulic conductivity (m/s)[a]	1000 K_H					Empirical (Shi et al., 2013)

a. Soil horizontal macropore hydraulic conductivity and soil vertical macropore hydraulic conductivity are assumed to be 1000 and 100 times their corresponding soil matrix conductivities, respectively.

Reference

Li, L., Bao, C., Sullivan, P. L., Brantley, S., Shi, Y., and Duffy, C.: Understanding watershed hydrogeochemistry: 2. Synchronized hydrological and geochemical processes drive stream chemostatic behavior, Water Resour Res, 2017.

Lim, K. J., Engel, B. A., Tang, Z. X., Choi, J., Kim, K. S., Muthukrishnan, S., and Tripathy, D.: Automated Web Gis based hydrograph analysis tool, what, Journal of the American Water Resources Association, 41, 1407-1416, 10.1111/j.1752-1688.2005.tb03808.x, 2005.

Lin, H.: Temporal stability of soil moisture spatial pattern and subsurface preferential flow pathways in the shale hills catchment, Vadose Zone J, 5, 317-340, 10.2136/vzj2005.0058, 2006.

Shi, Y. N., Davis, K. J., Duffy, C. J., and Yu, X.: Development of a Coupled Land Surface Hydrologic Model and Evaluation at a Critical Zone Observatory, Journal of Hydrometeorology, 14, 1401-1420, 10.1175/jhm-d-12-0145.1, 2013.