Supplementary Material

Scatter plot runoff and sediment concentration for Anjeni

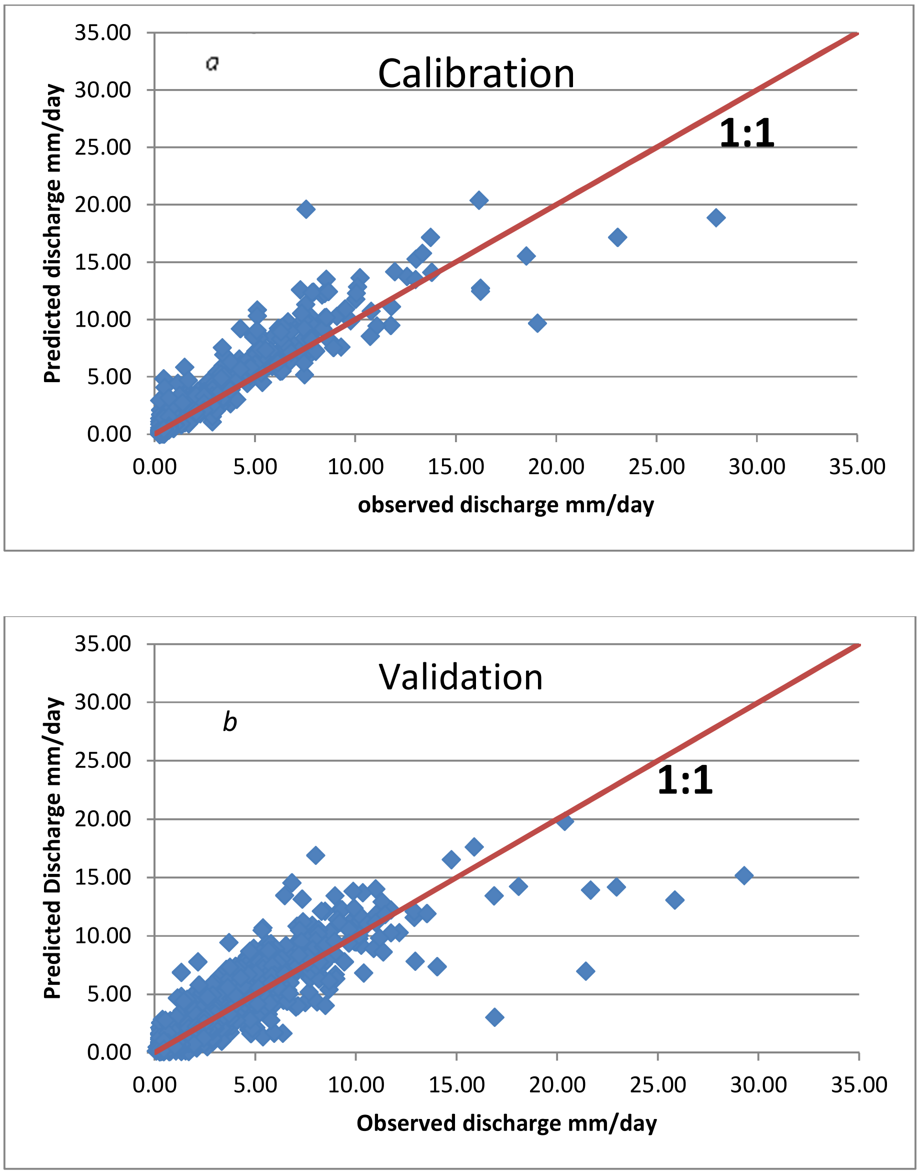

Fig. S1 Comparison of predicted and observed daily stream flow with the 1:1 line (a) for calibration period (b) for validation period

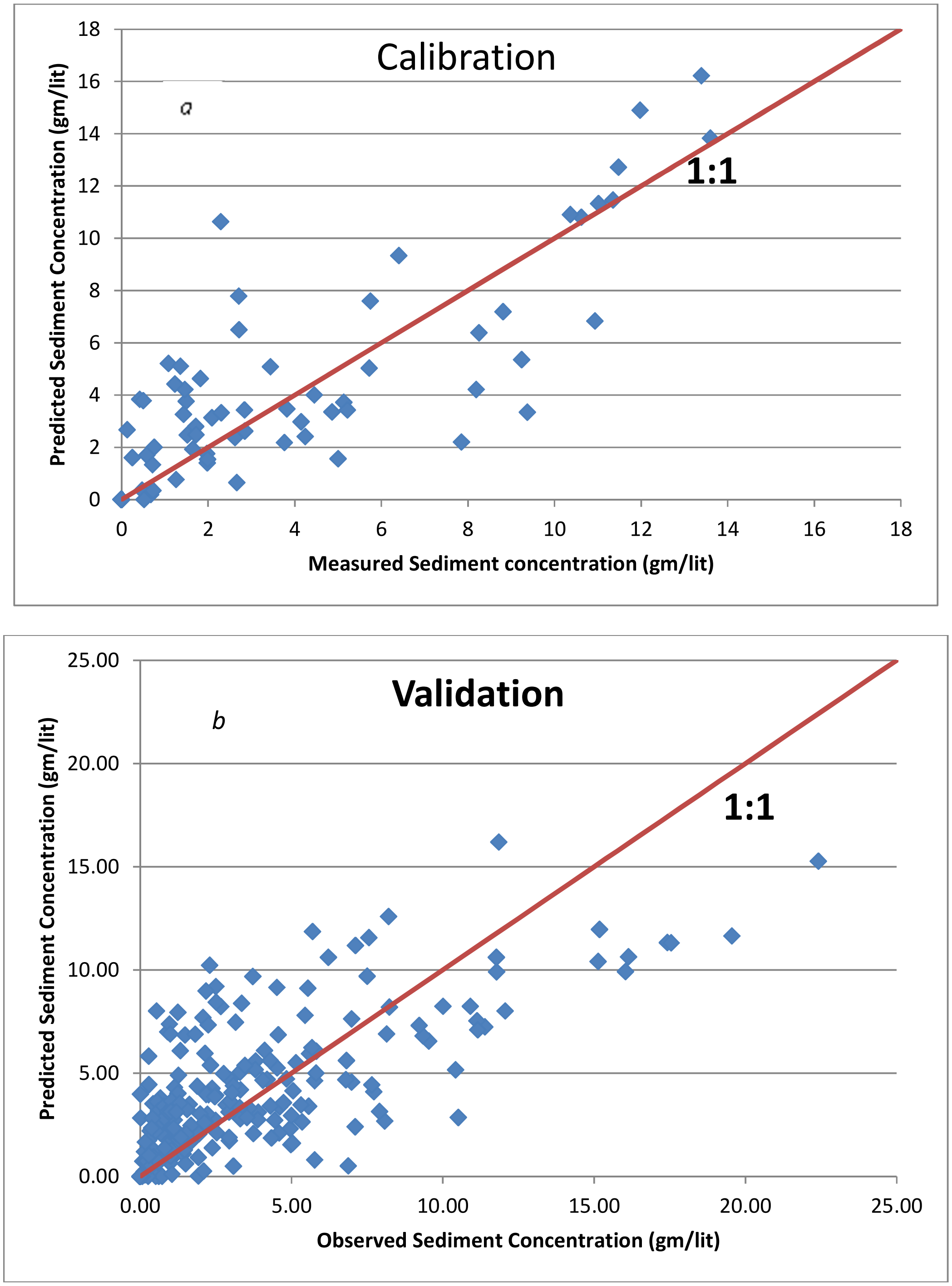

Fig. S2 Comparison of predicted and observed daily sediment concentration with the 1:1 line (a) for calibration period (b) for validation period

Sensitivity analysis for Anjeini

The model was fitted visually and not according to any particular statistics. The most sensitive parameter is the fractional areas that produce runoff and recharge. Increasing the recharge area by 30% (or 15 % of the total area), the NS efficiency decreases from 0.8 to 0.63. For a 30% decrease of the recharge area, the NSE efficiency remained the same, i.e., 0.8. A 15% increase in saturated runoff area resulted in a NS efficiency of 0.46, and a 50% increase of degraded areas from the total area resulted in a NS efficiency of 0.07. The reason for the sensitivity is that the overall water balance is not met. Moreover changing recharge areas to runoff areas resulted in peak runoff occurring earlier (Tesemma et al., 2010). As expected the N-S efficiency is insensitive to variation in the amount of water that can be stored in the root zone because the magnitude of the storage affects only the first runoff events after the rains have started. Since it rains often during the rainy season, the watershed soils remain near full capacity, and the total size of the storage affects the amount of recharge or runoff only minimally. This will not be the case for temperate climates where large storms are more infrequent. Finally, the model is not greatly dependent on the subsurface flow parameters. Testing has shown that when changing the parameters by a factor of two the baseflow tail is affected. Since the deviations are small the N-S efficiency stays the same but the relative mean square error and the visual appearance is affected.

Table S1: Sensitivity analysis of hydrologic parameters

Parameters	**Values**	**NSF**	**Parameters**	**Values**	**NSF**
A1	0.02	0.8	**Smax in A3**	100	0.8
A1 +10%	0.022	0.8	**Smax in A3 +10%**	110	0.8
A1+20%	0.024	0.8	**Smax in A3+20%**	120	0.8
A1+30%	0.026	0.8	**Smax in A3+30%**	130	0.8
A1-10%	0.018	0.8	**Smax in A3-10%**	90.91	0.8
A1-20%	0.017	0.8	**Smax in A3-20%**	83.33	0.8
A1-30%	0.015	0.81	**Smax in A3-30%**	76.92	0.8
A2	0.14	0.8	**IF**	10	0.8
A2 +10%	0.154	0.8	**τ* +10%**	11	0.81
A2+20%	0.168	0.77	**τ* +20%**	12	0.81
A2+30%	0.182	0.76	**τ* +30%**	13	0.81
A2-10%	0.127	0.81	**τ* -10%**	9.091	0.8
A2-20%	0.117	0.81	**τ* -20%**	8.333	0.79
A2-30%	0.108	0.82	**τ* -30%**	7.692	0.78
A3	0.5	0.8	$t_{½}$	70	0.8
A3 +10%	0.55	0.77	**t½ +10%**	77	0.8
A3+20%	0.6	0.71	**t½ +20%**	84	0.8

A3+30%	0.65	0.63	**t½ +30%**	91	0.8
A3-10%	0.45	0.81	**t½ -10%**	63.64	0.8
A3-20%	0.42	0.81	**t½ -20%**	58.33	0.81
A3-30%	0.38	0.8	**t½ -30%**	53.85	0.81
Smax in A1	200	0.8	**BSmax**	20	0.8
Smax in A1 +10%	220	0.8	**BSmax+10%**	22	0.8
Smax in A1+20%	240	0.8	**BSmax+20%**	24	0.8
Smax in A1+30%	260	0.8	**BSmax+30%**	26	0.8
Smax in A1-10%	181.8	0.8	**BSmax-10%**	18.18	0.8
Smax in A1-20%	166.7	0.8	**BSmax-20%**	16.67	0.8
Smax in A1-30%	153.8	0.8	**BSmax-30%**	15.38	0.8
Smax in A2	10	0.8			
Smax in A2 +10%	11	0.8			
Smax in A2+20%	12	0.8			
Smax in A2+30%	13	0.8			
Smax in A2-10%	9.09	0.8			
Smax in A2-20%	8.33	0.8			
Smax in A2-30%	7.69	0.8			

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