

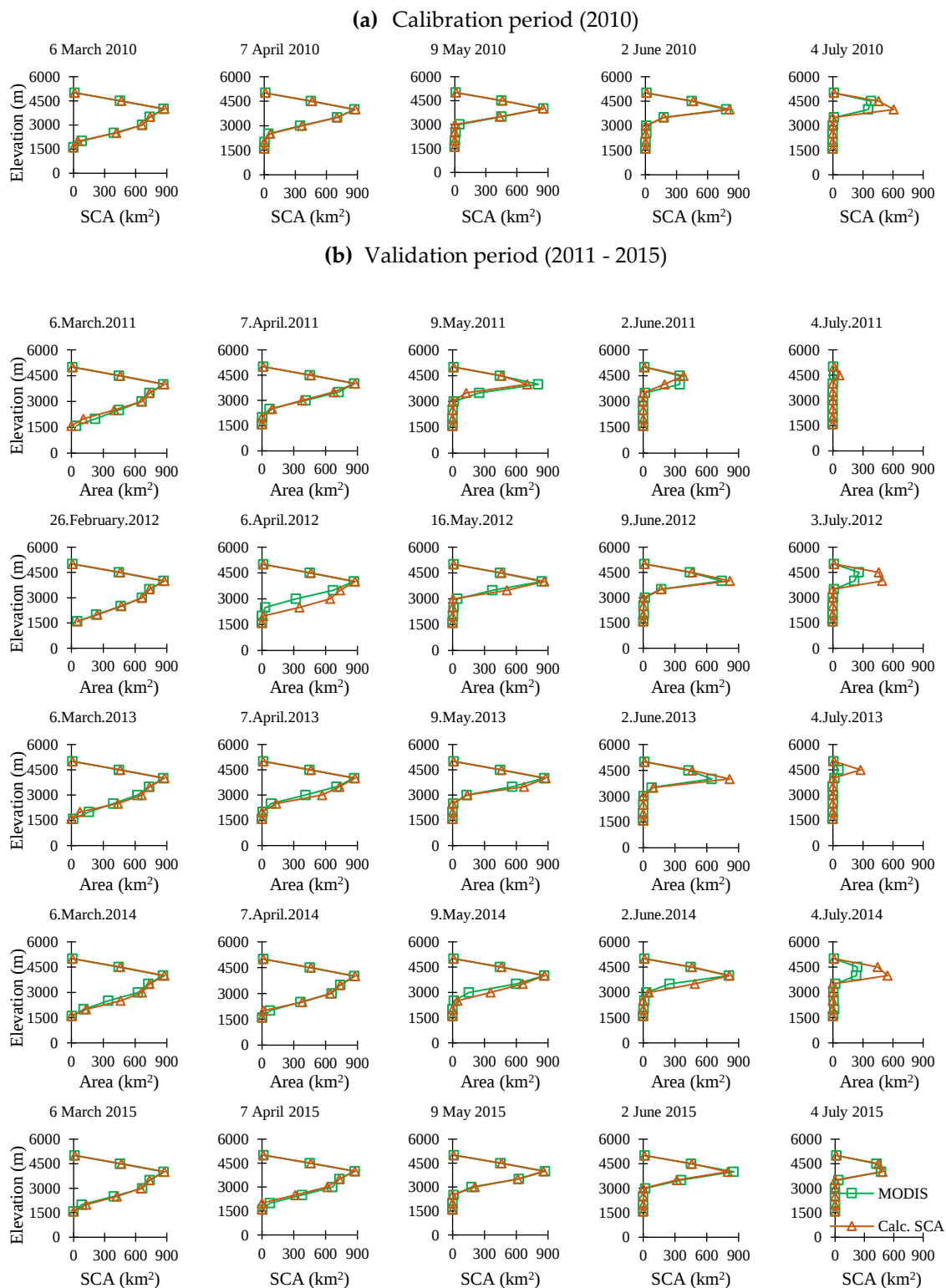


Figure S1. Zone-wise comparison between MODIS observed and simulated SCAs during the (a) calibration and (b) validation periods.

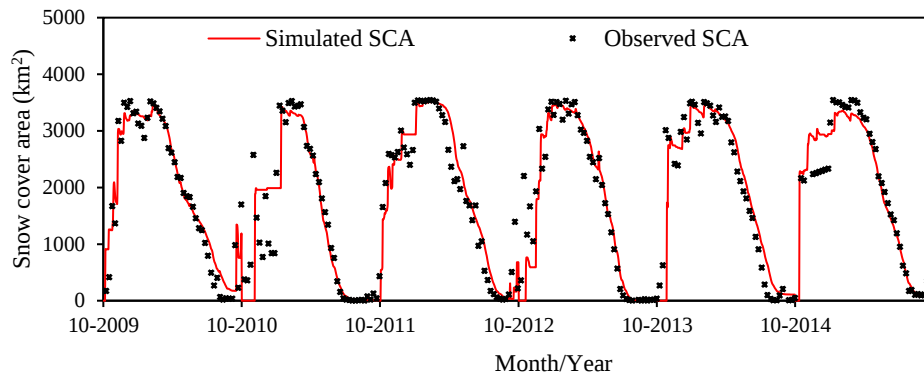


Figure S2. Basin-wide daily SCA simulated by the SM compared with the MODIS observed SCA during the calibration and validation periods.

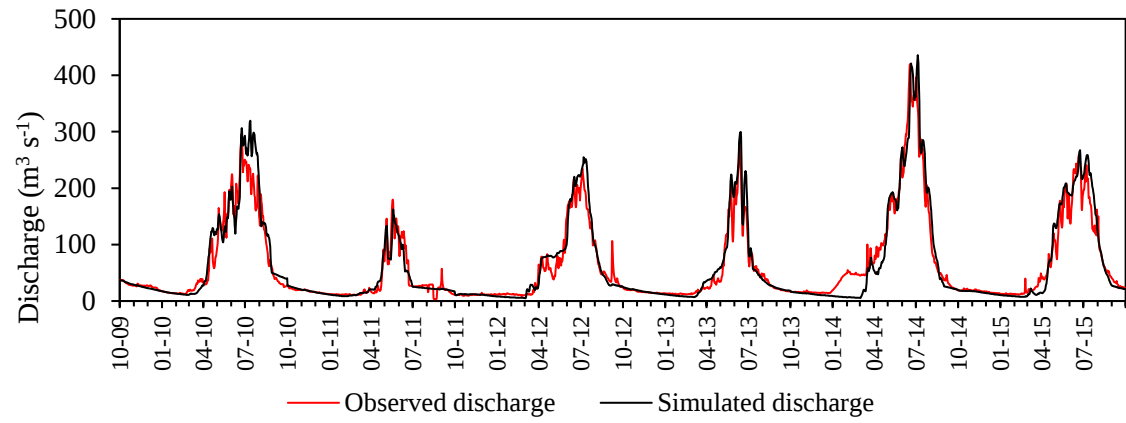


Figure S4. Times series of daily observed discharge and discharge simulated by using simulated SCA values during the calibration and validation periods.

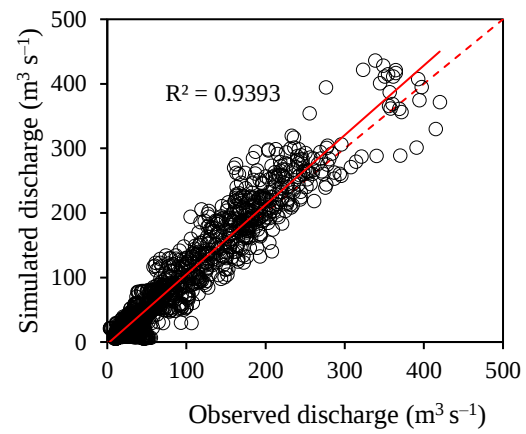


Figure 5. Scatter plot between observed daily discharge and daily discharge simulated with the SRM; the solid and dashed lines corresponds the regression and 1:1 line, respectively.

Table S1. SM parameters used for current and future simulations.

SM parameters
Critical temperature (°C)
Degree-day factor (cm °C ⁻¹ d ⁻¹)
Precipitation gradient (m ⁻¹)
Temperature lapse rate (°C 100 m ⁻¹)

Table S2. SRM parameters and variables used for current and future simulations.

SRM parameters		SM parameters
Runoff coefficient for snow	Rainfall Contributing Area (RCA)	Temperature (°C)
Runoff coefficient for rain	Recession coefficient	Precipitation (Cm)
Critical temperature (°C)	Time lag (h)	Snow cover (%)
Degree-day factor (cm °C ⁻¹ d ⁻¹)	Temperature lapse rate (°C 100 m ⁻¹)	

Table S3. Optimized DDF and PG values in each elevation zone in the study area.

[illegible]

Table S4. Zone-wise parameter values used in applying SRM for runoff simulation.

Parameter	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F	Zone G	Zone H	
	(1593– 2000)	(2001– 2500)	(2501– 3000)	(3001– 3500)	(3501– 4000)	(4001– 4500)	(4501– 5000)	(5001– 5694)	
Lapse rate (°C 100 m ⁻¹)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	
T _{crit} (°C)	0	0	0	0	0	0	0	0	
DDF (cm °C ⁻¹ d ⁻¹)	0.3	0.3	0.3	0.6	0.9	0.9	0.9	0.9	
Lag time (h)	6	18	18	18	18	18	18	18	
Cs	September– March	0.15	0.15	0.15	0.15	0.15	0.15	0.2	0.2
	April– August	0.3	0.3	0.35	0.35	0.45	0.5	0.6	0.6
Cr	September– March	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	April– August	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
RCA	October– February	1	1	0	0	0	0	0	0
	March– September	1	1	1	1	1	1	1	1
Xc	September– February	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
	March– August	0.75– 1.08	0.75– 1.08	0.75– 1.08	0.75– 1.08	0.75– 1.08	0.75– 1.08	0.75– 1.08	0.75– 1.08
Yc	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	

Cs, snowmelt runoff coefficient; Cr, rainfall runoff coefficient; RCA, Rainfall contributing area; Xc and Yc, Recession coefficient.

Table S5. Performance of the SRM in simulating river discharge during the calibration and validation periods.

Hydrological year (October–September)	SRM efficiency		
	Volume difference (D _v %)	Nash-Sutcliffe coefficient (NS)	Root mean square error (RMSE m ³ s ⁻¹)
Calibration			
2009–2010	–8.98	0.87	26.8
2010–2011	1.96	0.91	10.7
Validation			
2011–2012	–6.45	0.92	17.4
2012–2013	–10.1	0.91	16.1
2013–2014	6.85	0.92	28.5
2014–2015	–4.26	0.93	19.4