Supplementary material for

Developing a new parameterization scheme of temperature lapse rate for the hydrological simulation in a glacierized basin based on remote sensing

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This file contains supplementary tables and figures for

- Calibration parameters for all the six simulation cases
- Runoff and SCA simulation accuracy of all the six cases
- Comparison of daily runoff simulation results from the J2000 model using the traditional TLR scheme (Base Case) and the new TLR scheme (Case 1) for the periods of validation.
- Comparison of monthly snow cover area (SCA) simulations between Base Case and Case 6
- Comparison of daily runoff simulation results between Base Case and Case 6
- Comparison of monthly snow cover area (SCA) simulations between Base Case and Case 1 without consideration of July and August.
- Multiyear average monthly total runoff.
- Comparison of correlation analysis of daily simulation runoff and observation runoff (November–May) results from the J2000 model using the traditional TLR scheme (a and b) and the new TLR scheme (c and d) for the periods of calibration (a and c) and validation (b and d).

Table S1. Calibration parameters in the J2000 hydrological model

Parameter	Description	Normal range	Dimension	Value						
				Base Case	Case1	Case2	Case3	Case4	Case5	Case6
Precipitation distribution										
Trs	base temperature	−5 to +5	°C	0.8	1.6	-0.5	0.9	1.7	1.9	1.8
Trans	parameter range for mixed rain and snow	0–2	°C	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Interception module										
a_rain	interception storage for rain	0–5	mm	2.5	2.4	1	1	2.6	1.1	3.1
a_snow	interception storage for snow	0–5	mm	4.6	4.6	1.1	1.1	4.7	1.2	4.6
Snow module										
snowCritDens	critical density of snow	0–1	%	0.39	0.37	0.38	0.37	0.38	0.39	0.37
snowColdContent	cold content of snow pack	0–1	NA	0	0	0	0	0	0	0
snowBaseTemp	**threshold temperature for snowmelt**	−5 to +5	°C	1.5	1.4	1.4	1.1	1.3	0.8	1.4
snowTfactor	**melt factor by sensible heat**	0–10	NA	4.7	4.8	4.6	4.8	3.4	4.6	4.8
snowRfactor	melt factor by liquid precipitation	0–10	NA	0	0	0	0	0	0	0
snowGfactor	melt factor by soil heat flow	0–10	NA	0.6	0.6	0.6	0.6	0.6	0.8	0.6
Glacier module										
meltFactorIce	**melt factor for ice melt**	0–5	NA	3.4	2.8	3.1	2.9	1.3	1.7	2.1
alphaIce	radiation melt factor for ice	0–1	NA	0.04	0.06	0.05	0.06	0.02	0.04	0.02
kIce	routing coefficient for ice melt	0–50	NA	0.1	0.1	0.1	0.1	0.1	0.1	0.1
kSnow	routing coefficient for snowmelt	0–50	NA	0.1	0.5	0.1	0.2	13	0.1	0.4
kRain	routing coefficient for rainfall–runoff	0–50	NA	0.3	0.2	0.1	0.1	0.3	0.2	0.4
debrisFactor	debris factor for ice melt	0–10	NA	3	5	3	3	3	3	5
glacierTbase	**threshold temperature for snowmelt**	−5 to +5	°C	1.6	1.6	1.4	1.5	1.7	1.7	2.3
Soil module										
soilMaxDPS	maximum depression storage	0–10	mm	5	5	5	5	5	5	5

soilLinRed	**linear reduction coefficient for AET**	0–5		1.4	1.4	1.4	1.4	1.4	1.4	1.4
soilLatVertLPS	**lateral vertical distribution coefficient**	0–10	NA	1.4	1.4	1.1	1.2	1.1	1.1	1.3
soilMaxPerc	**maximum percolation rate to groundwater**	0–100	mm	50	50	50	50	50	50	50
soilConcRD1Flood	**recession coefficient for flood event**	1–10	NA	3	2	2.2	2.2	1.8	2	1.8
soilConcRD1Floodthreshold	threshold value for soilConcRD1Flood	0–1000	NA	300	500	400	450	400	400	550
soilConcRD1	**recession coefficient for overland flow**	1–10	NA	6.5	7	6	6	7.5	6	7.5
SoilConcRD2	**recession coefficient for interflow**	1–10	NA	3	4.5	4.5	4.5	4	6	4.5
Groundwater module										
gwRG1RG2dist	**RG1-RG2 distribution coefficient**	0–5	NA	1.4	1.3	0.9	1	0.8	0.9	1.2
gwRG1Fact	**adaptation factor for RG1 flow**	0–10	NA	0.7	0.9	0.9	0.8	1.1	0.8	0.6
gwRG2Fact	**adaptation factor for RG2 flow**	0–10	NA	1.3	1.3	1.4	1.4	1.5	1.1	1.2
gwCapRise	capillary rise coefficient	0–10	NA	1	1	1	1	1	1	1
Reach routing										
flowRouteTA	**flood routing coefficient**	0–100	NA	56	96	33	76	50	11	11

Table S2. Runoff and SCA simulation accuracy of all cases

			Base Case	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Calibration	Discharge	NSE	0.71	0.76	0.64	0.73	0.73	0.66	0.72
		R^2	0.75	0.82	0.70	0.80	0.78	0.74	0.79
		LSE	0.74	0.82	0.67	0.76	0.77	0.69	0.75
Validation	Discharge	NSE	0.68	0.75	0.63	0.72	0.70	0.67	0.70
		R^2	0.71	0.79	0.68	0.77	0.73	0.70	0.73
		LSE	0.67	0.80	0.64	0.76	0.76	0.71	0.74
	SCA	R^2	0.42	0.50	0.33	0.41	0.47	0.40	0.48
	$\overline{SCA}$	R^2	0.56	0.82	0.54	0.79	0.79	0.86	0.83

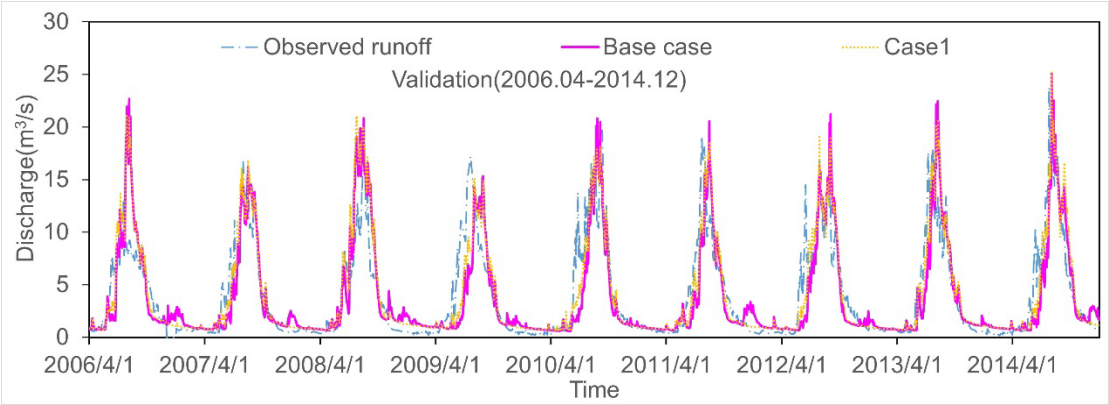

Figure S1. Comparison of daily runoff simulation results from the J2000 model using the traditional TLR scheme (Base Case) and the new TLR scheme (Case 1) for the periods of validation.

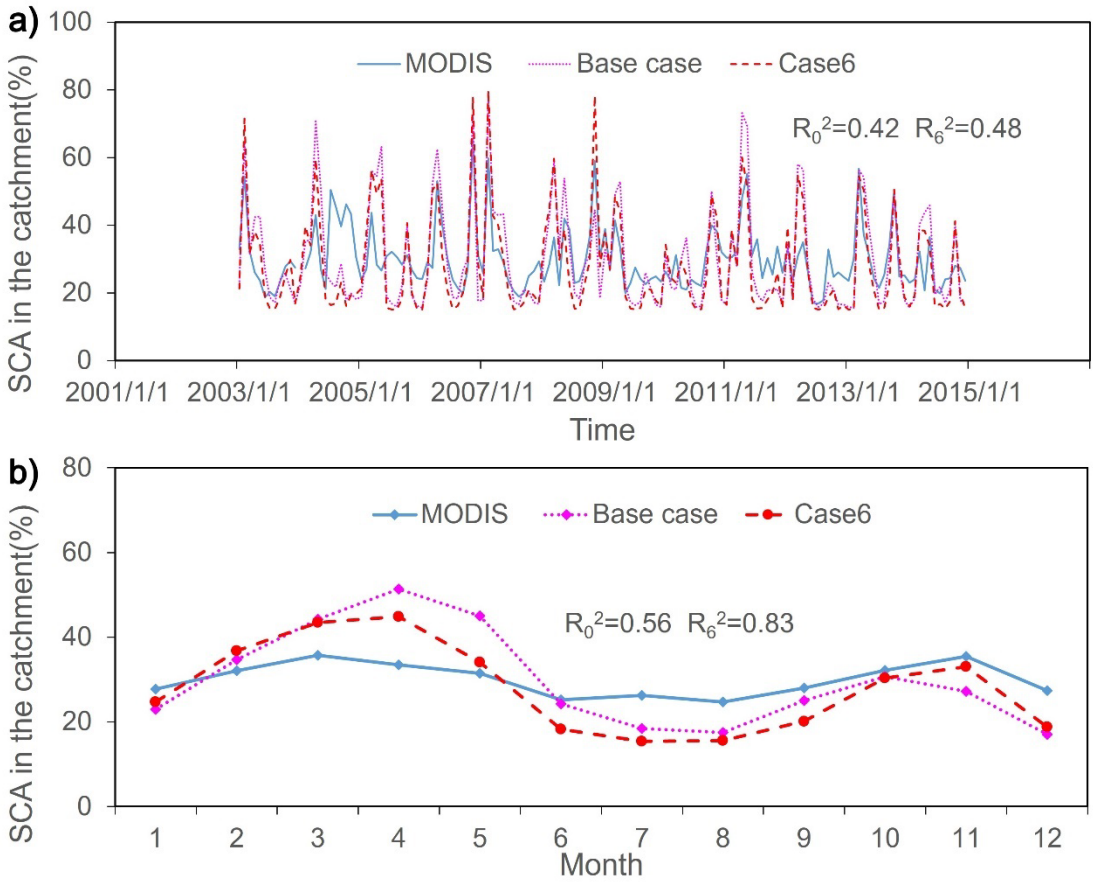

Figure S2. Comparison of the year-to-year monthly (a) and the multiyear-average monthly (b) snow cover area (SCA) simulated from the J2000 model driven by the TLRs from the traditional scheme (Base Case) and the new scheme (Case 6) during the period of 2003-2014. R_0^2 and R_6^2 are the R-squared values of Base case and Case 6, respectively.

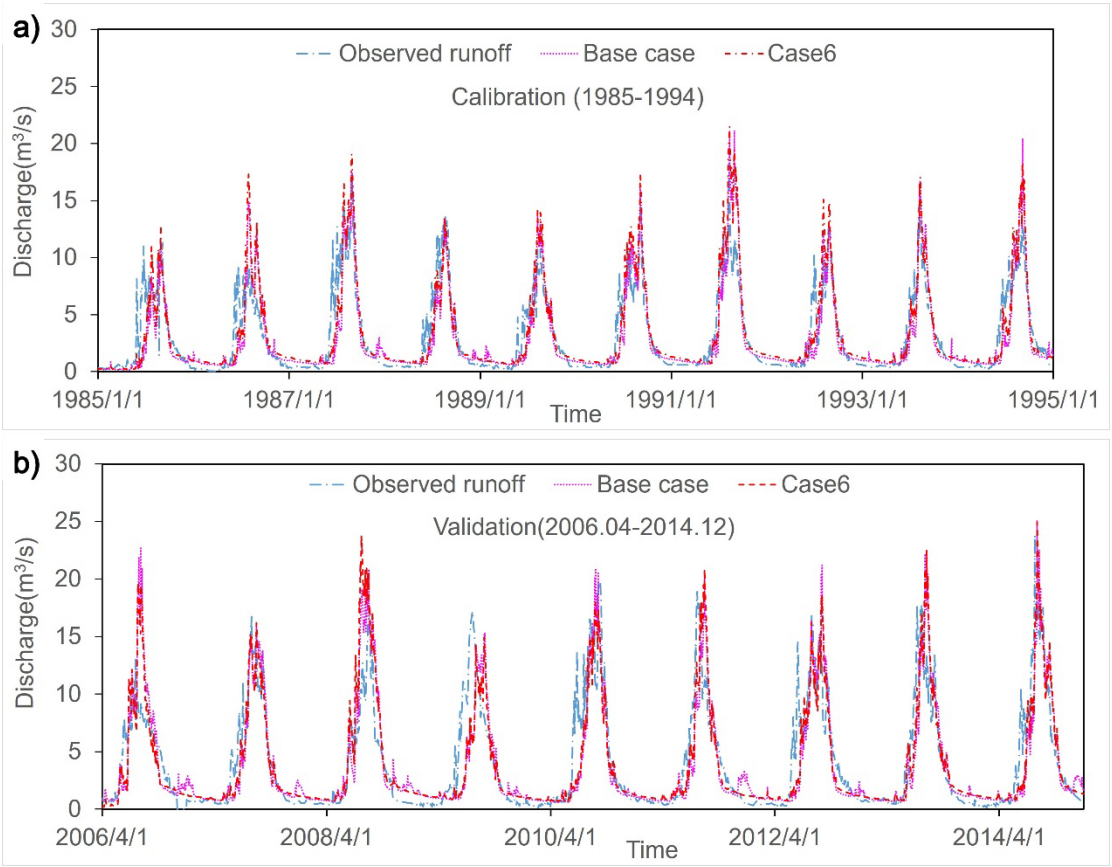

Figure S3. Comparison of daily runoff simulation results from the J2000 model using the traditional TLR scheme (Base Case) and the new TLR scheme (Case 6) for the periods of calibration (a) and validation (b).

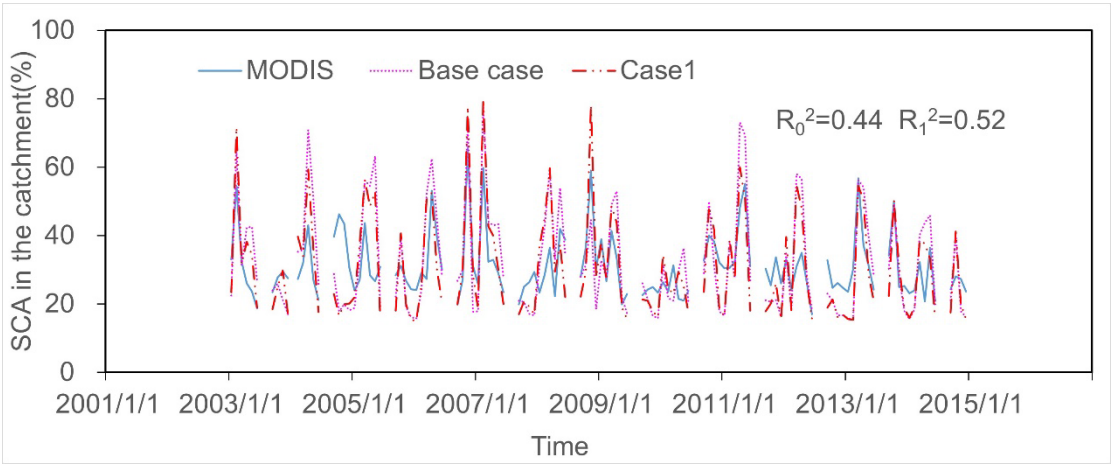

Figure S4. Comparison of monthly snow cover area (SCA) simulations between Base Case and Case 1 without consideration of July and August.

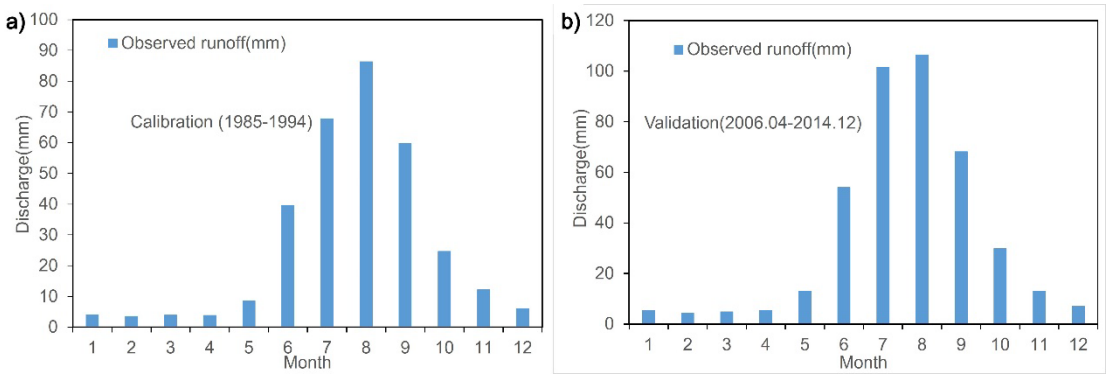

Figure S5. Multiyear average monthly total runoff.

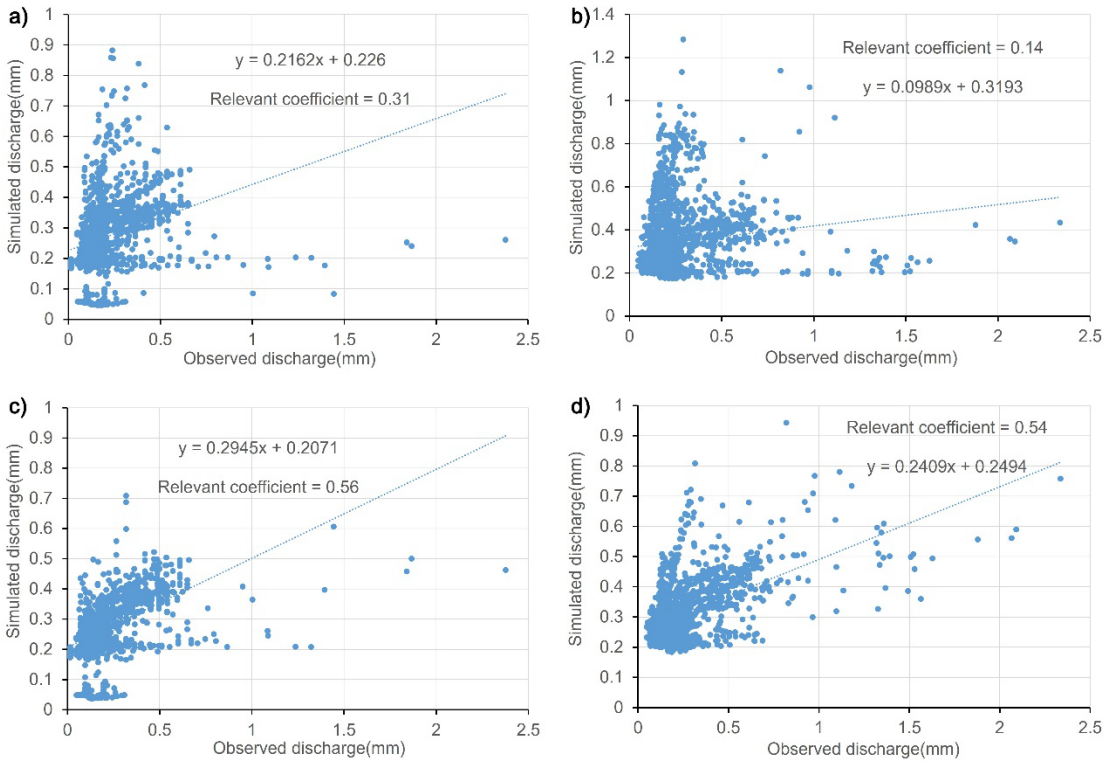

Figure S6. Comparison of correlation analysis of daily simulation runoff and observation runoff (November–May) results from the J2000 model using the traditional TLR scheme (a and b) and the new TLR scheme (c and d) for the periods of calibration (a and c) and validation (b and d).