Table S1. Evaluation indexes of APSIM-COTTON model simulation results in Aral

	Dry matter-leaf weight	Dry matter-stem weight	Dry matter-boll weight	Dry matter-open boll weight	LAI	Buds number	Bolls number	Open bolls number
R^2	0.4977	0.9017	0.8036	0.987	0.8338	0.7762	0.7097	0.9368
RMSE	3.2542	2.9578	11.2159	2.1804	0.5980	1.5960	0.8277	0.9759
NRMSE	0.3702	0.3014	0.7400	0.1009	0.2333	0.2695	0.2	0.4085

R^2 is the determination coefficient; RMSE is the root mean square error; NRMSE is the relative root mean square error.

Table S2. Evaluation indexes of APSIM-COTTON model simulation results in Wangdu

	Dry matter-total weight	Dry matter-leaf weight	Dry matter-stem weight	Dry matter-boll weight	LAI	Height	Bolls	Open bolls
R^2	0.9937	0.8833	0.8635	0.9538	0.7234	0.8103	0.7059	0.9849
RMSE	193.1381	219.4410	502.2122	688.1290	0.6812	269.9656	23.8967	4.5918
NRMSE	2.2359	0.2186	0.3227	0.3799	0.4484	0.4349	0.5002	0.8266

R^2 is the determination coefficient; RMSE is the root mean square error; NRMSE is the relative root mean square error.

Table S3. The variation and rate of change of maximum and minimum temperature at the three sites.

	Scenario	Time	Aral	Wangdu	Changde
		Baseline	19.17	18.8	21.27
Maximum temperature (°C)	SSP1-2.6	2030	1.25(6.51%)	1.14(6.05%)	1.41(6.65%)
		2050	1.61(8.4%)	1.57(8.34%)	1.97(9.25%)
		2070	1.69(8.79%)	1.69(8.97%)	2.09(9.83%)
		2090	1.66(8.68%)	1.69(9.01%)	2.1(9.88%)
	SSP2-4.5	2030	1.18(6.16%)	1.02(5.43%)	1.27(5.97%)
		2050	1.79(9.34%)	1.55(8.22%)	2.01(9.47%)
		2070	2.32(12.12%)	2.05(10.93%)	2.67(12.57%)
		2090	2.71(14.13%)	2.48(13.21%)	3.09(14.55%)
	SSP3-7.0	2030	1.17(6.12%)	0.8(4.23%)	1.07(5.04%)
		2050	1.93(10.05%)	1.51(8.01%)	1.89(8.9%)
		2070	2.87(14.99%)	2.28(12.11%)	2.9(13.65%)
		2090	3.91(20.4%)	3.16(16.82%)	4(18.81%)
	SSP5-8.5	2030	1.31(6.81%)	1.16(6.15%)	1.44(6.77%)
		2050	2.34(12.19%)	2.01(10.68%)	2.55(11.99%)
		2070	3.55(18.5%)	3.09(16.42%)	3.88(18.23%)
		2090	5.03(26.25%)	4.22(22.45%)	5.4(25.41%)
Minimum temperature (°C)		Baseline	3.94	8.05	13.89
	SSP1-2.6	2030	1.19(30.21%)	1.49(18.53%)	1.21(8.68%)
		2050	1.58(40.01%)	1.98(24.58%)	1.6(11.5%)

		2070	1.67(42.28%)	2.14(26.51%)	1.74(12.5%)
		2090	1.61(40.7%)	2.06(25.6%)	1.71(12.27%)
	SSP2-4.5	2030	1.2(30.44%)	1.47(18.28%)	1.14(8.22%)
		2050	1.82(46.23%)	2.18(27.07%)	1.74(12.55%)
		2070	2.36(59.93%)	2.75(34.19%)	2.26(16.26%)
		2090	2.72(68.85%)	3.27(40.58%)	2.64(18.97%)
	SSP3-7.0	2030	1.2(30.55%)	1.28(15.86%)	1(7.22%)
		2050	2.03(51.46%)	2.23(27.69%)	1.71(12.3%)
		2070	2.98(75.65%)	3.28(40.74%)	2.59(18.61%)
		2090	4.04(102.41%)	4.44(55.17%)	3.56(25.59%)
	SSP5-8.5	2030	1.35(34.34%)	1.61(19.97%)	1.31(9.45%)
		2050	2.37(60.19%)	2.77(34.42%)	2.24(16.13%)
		2070	3.62(91.78%)	4.17(51.8%)	3.4(24.47%)
		2090	5.11(129.48%)	5.67(70.43%)	4.71(33.87%)

Table S4. The variation in solar radiation and precipitation at the three sites.

	Scenario	Time	**Aral**	**Wangdu**	**Changde**
Radiation（$MJ \cdot m^{-2}$）		Baseline	15.92	13.63	10.84
	SSP1-2.6	2030	-0.05(-0.34%)	0.35(2.59%)	0.64(5.89%)
		2050	0.04(0.23%)	0.99(7.23%)	1.27(11.72%)
		2070	0.12(0.77%)	1.19(8.74%)	1.36(12.54%)
		2090	0.26(1.63%)	1.3(9.56%)	1.49(13.75%)
	SSP2-4.5	2030	-0.26(-1.62%)	-0.12(-0.91%)	0.18(1.69%)
		2050	-0.26(-1.61%)	0.28(2.05%)	0.66(6.08%)
		2070	-0.19(-1.21%)	0.61(4.47%)	1.14(10.54%)
		2091	-0.15(-0.95%)	0.88(6.45%)	1.34(12.35%)
	SSP3-7.0	2030	-0.45(-2.85%)	-0.94(-6.87%)	-0.53(-4.92%)
		2050	-0.63(-3.97%)	-1.03(-7.54%)	-0.52(-4.78%)
		2070	-0.68(-4.29%)	-0.89(-6.50%)	-0.22(-1.99%)
		2090	-0.73(-4.56%)	-0.7(-5.17%)	0.08(0.7%)
	SSP5-8.5	2030	-0.37(-2.33%)	0.05(0.39%)	0.32(2.98%)
		2050	-0.38(-2.38%)	0.2(1.50%)	0.69(6.41%)
		2070	-0.43(-2.7%)	0.34(2.49%)	1.05(9.73%)
		2090	-0.5(-3.13%)	0.37(2.74%)	1.49(13.71%)
Precipitation（mm）		Baseline	55.3	548.6	1324.2
	SSP1-2.6	2030	5.34(9.64%)	96.29(17.55%)	97.01(7.33%)
		2050	6.81(12.3%)	130.17(23.73%)	164.07(12.39%)
		2070	10.46(18.91%)	129.57(23.62%)	233.32(17.62%)
		2090	8.66(15.65%)	124.73(22.74%)	219.64(16.59%)
	SSP2-4.5	2030	7.94(14.36%)	85.3(15.55%)	71.29(5.38%)
		2050	12.55(22.68%)	142.81(26.03%)	108.3(8.18%)
		2070	14.89(26.91%)	139.68(25.46%)	117.52(8.87%)
		2090	20.64(37.3%)	147.3(26.85%)	212.17(16.02%)
	SSP3-7.0	2030	8.96(16.19%)	106.9(19.49%)	42.06(3.18%)
		2050	17.52(31.66%)	121.44(22.14%)	70(5.29%)
		2070	20.89(37.75%)	178.19(32.48%)	150.27(11.35%)
		2090	23.58(42.61%)	222.28(40.52%)	224.79(16.98%)
	SSP5-8.5	2030	7.94(14.35%)	100.77(18.37%)	95.07(7.18%)
		2050	16.96(30.66%)	152.72(27.84%)	175.84(13.28%)
		2070	25.1(45.36%)	207.95(37.91%)	237.72(17.95%)
		2090	25.48(46.06%)	278.65(50.79%)	284.67(21.5%)

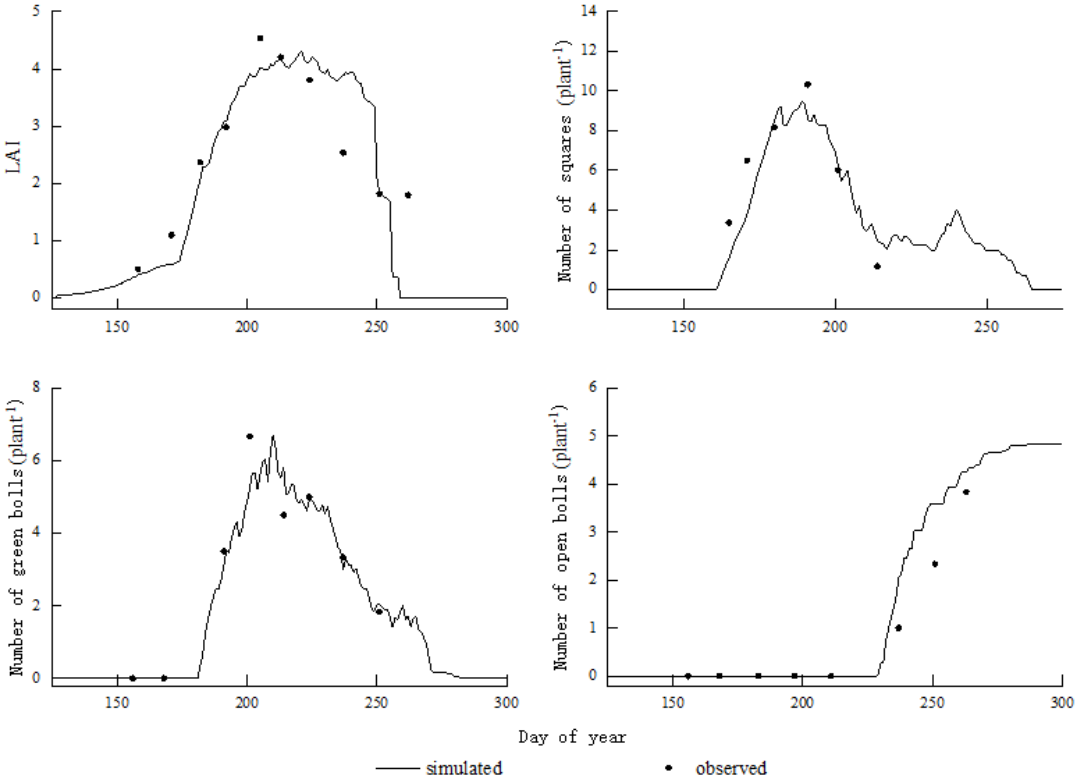


Figure S1. Verification of cotton cultivar "K7" LAI, squares, bolls and open bolls in Aral

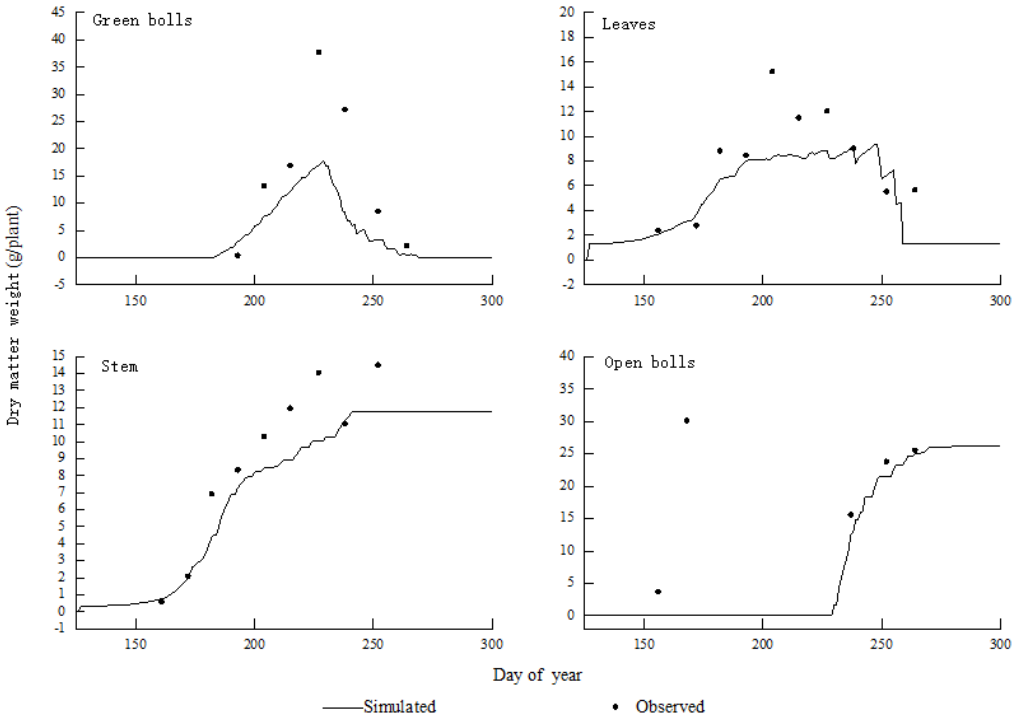


Figure S2. Verification of cotton cultivar "K7" dry matter weight in Aral

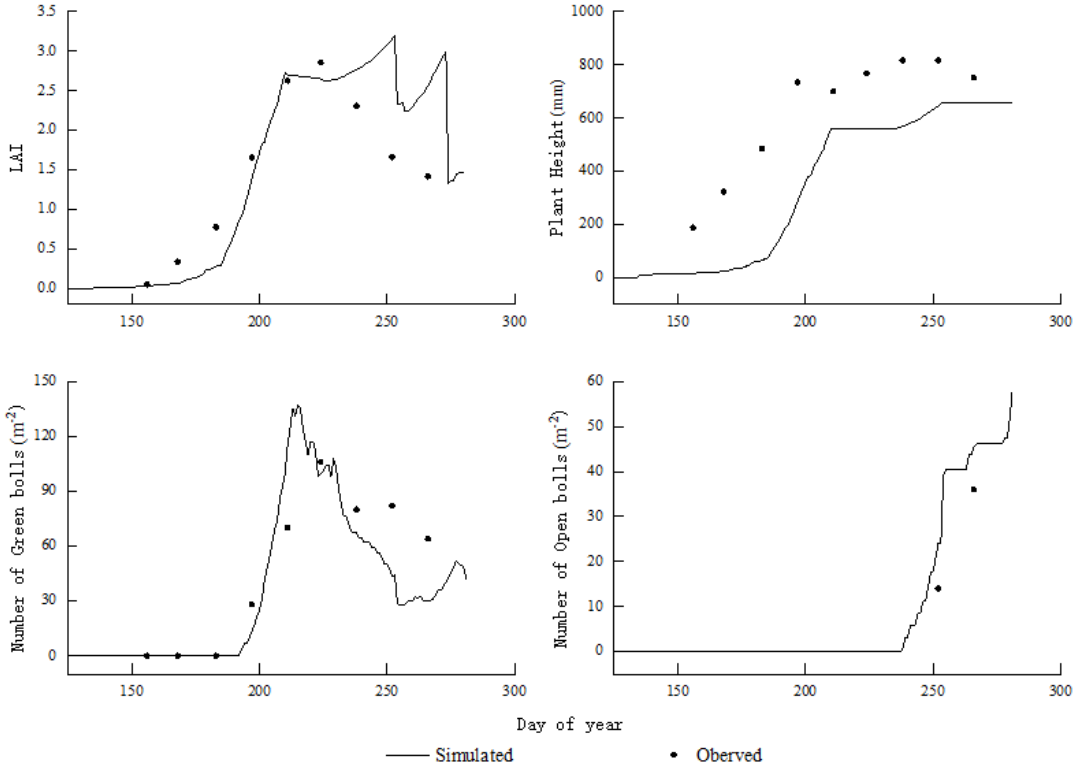


Figure S3. Verification of cotton cultivar "Zhongzhimian 2" LAI, plant height, squares and open bolls in Wangdu

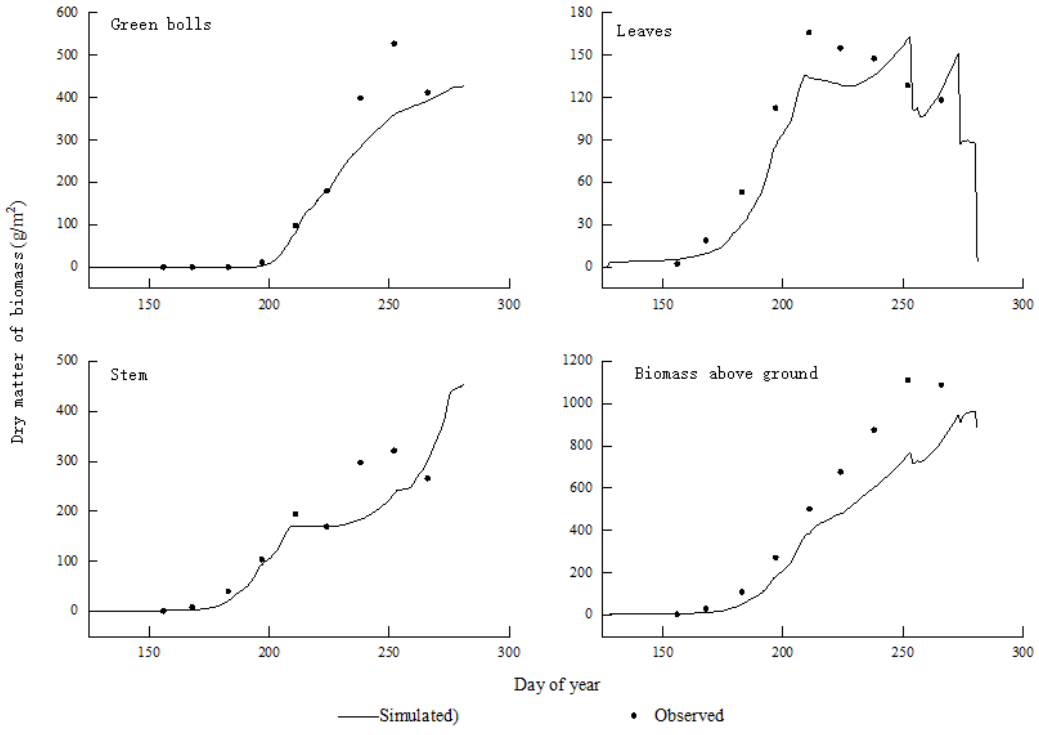


Figure S4. Verification of cotton cultivar "Zhongzhimian 2" dry matter weight in Wangdu