

Table S1. The differences in annual mean temperature and precipitation based on WFD and meteorological observations during 1961-2001.

River	Annual precipitation			Annual mean temperature		
	OBS(mm)	WFD (mm)	Difference (%)	OBS(°C)	WFD(°C)	Difference (°C)
Shiyang	246.1	282.1	14.6	5.2	2.7	-2.5
Chaobai	570.7	476.5	-20.0	9.2	5.1	-4.1
Huaihe	917.6	898.7	-2.1	14.9	14.8	-0.1
Fujiang	906.0	894.6	-1.3	16.5	15.6	-0.9

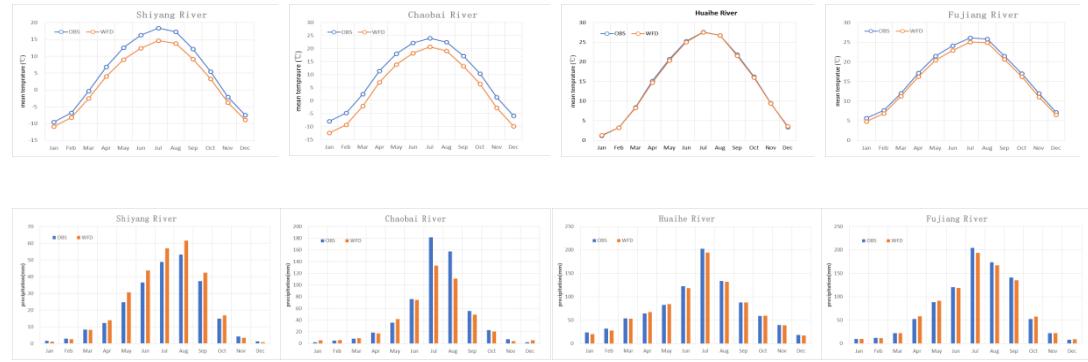


Figure S1. The differences in monthly mean temperature and monthly precipitation based on WFD and meteorological observations during 1961-2001.

Table S2. The agreements in annual mean, maximum and minimum temperature, and mean annual precipitation based on WFD and downscaling climate data from five GCMs for during 1961-2001 for the four river basins.

River	GFDL-ES	HadGEM2-ES	IPSL-CM5A-LR	MIROC-ESM-CHEM	NorESM1-M
	Difference in mean annual temperature (°C)				
Shiyang	-0.01	-0.03	0.02	-0.00	-0.03
Chaobai	-0.01	-0.02	0.08	-0.03	-0.01
Huaihe	-0.01	0.01	0.07	-0.03	-0.05
Fujiang	0.31	0.31	0.36	0.33	0.29
River	Difference in mean annual maximum temperature (°C)				
Shiyang	0.00	0.07	0.04	0.02	0.04
Chaobai	0.02	0.10	-0.02	0.00	0.02
Huaihe	0.07	0.13	0.03	0.01	0.06
Fujiang	0.24	0.29	0.25	0.23	0.27
	Difference in mean annual minimum temperature (°C)				
Shiyang	-0.01	0.03	0.01	-0.01	0.01
Chaobai	-0.03	0.08	-0.02	-0.01	0.00
Huaihe	0.00	0.05	-0.05	-0.07	-0.04
Fujiang	0.37	0.41	0.39	0.34	0.35
River	Difference in mean annual precipitation (%)				
Shiyang	14.8	7.8	13.3	6.3	5.2

Chaobai	9.7	8.2	9.1	8.0	6.3
Huaihe	4.9	5.4	5.3	3.9	4.8
Fujiang	11.0	5.6	8.7	10.4	7.2

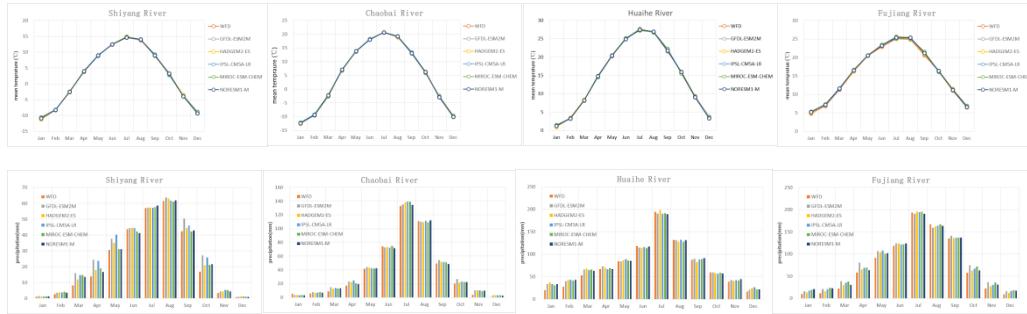


Figure S2. The agreements in monthly mean temperature and mean precipitation based on WFD and downscaling climate data from five GCMs for during 1961-2001 for the four river basins.

Table S6. The agreements in mean annual runoff and evapotranspiration based on WFD and downscaling climate simulation from 5 GCMs for during 1961-2001 for the four river basins.

River	GFDL-ES	HadGEM2-	IPSL-CM	MIROC-ES	NorESM1-M
	M2M	ES	5A-LR	M-CHEM	
Difference in mean annual runoff (%)					
Shiyang	16.2	25.3	16.6	14.4	12.7
Chaobai	-19.3	21.5	0.5	-9.1	-2.3
Huaihe	-7.2	23.7	9.3	6.3	3.8
Fujiang	-6.2	-16.7	6.3	0.0	-4.3
River					
Difference in mean annual evapotranspiration (%)					
Shiyang	-3.3	-37.7	-4.7	-19.8	-17.6
Chaobai	12.4	-0.5	6.6	7.5	3.2
Huaihe	-1.8	-8.1	0.8	3.2	4.8
Fujiang	15.5	13.4	4.7	11.7	12.7

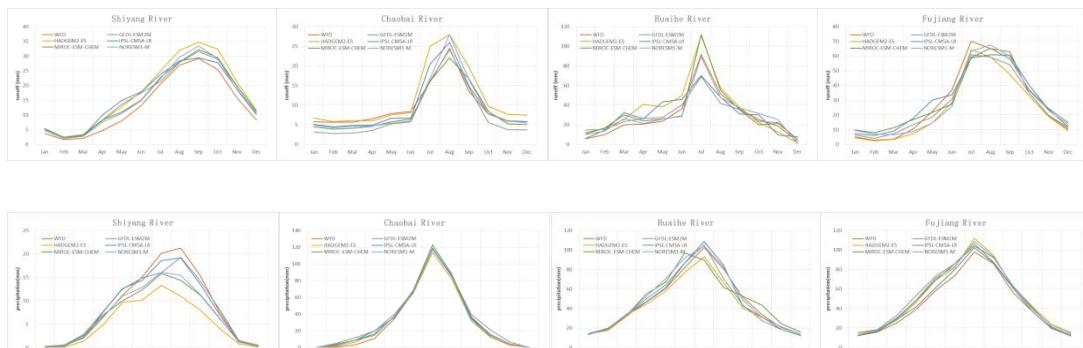


Figure S3. The agreements in simulated mean monthly runoff and mean monthly evapotranspiration based on WFD and downscaling climate data from 5 GCMs during 1961-2001 for the four river basins.

Table S5. The mean of middle-year of the 30-year samples for all GCMs under RCPs and under 1.5°C or 2°C global warming scenarios.

threshold	RCP2.6	RCP4.5	RCP6.0	RCP8.5
1.5°C	2029	2030	2032	2025
2.0°C	×	2049	2053	2038

Table S3. Sensitivity results for pre-define parameters by SWAT for the four river basins

Rank	Shiyang River	Chaobai River	Huaihe River	Fujiang River
1	ALPHA_BF	CN2	CN2	CN2
2	GWQMN	ALPHA_BF	GWQMN	ESCO
3	TIMP	GW_DELAY	RCHRG_DP	SOL_AWC
4	CN2	ESCO	ESCO	CANMX
5	SMTMP	GWQMN	SOL_AWC	GWQMN
6	SOL_AWC	CH_N	GW_REVAP	RCHRG_DP

Table S4. Definition of identified sensitive parameters in SWAT hydrological model for the four river basins

Parameters	Definition	Processes
ALPHA_BF	Baseflow recession constant (days)	Groundwater
CANMX	Maximum canopy storage (mm H ₂ O)	Runoff
CH_N	Manning coefficient value	Channel
CN2	SCS runoff curve number for moisture condition II	Runoff
ESCO	Soil evaporation compensation factor	Evaporation
GW_DELAY	Delay time for aquifer recharge (days)	Groundwater
GW_REVAP	Groundwater “Revap” coefficient (days)	Groundwater
GWQMN	Threshold water level in shallow aquifer for base flow (mm)	Soil
RCHRG_DP	Deep aquifer percolation coefficient (fraction)	Groundwater
SMTMP	Threshold temperature for snow melt (°C)	Snow
SOL_AWC	Soil available water capacity (mm/mm soil)	Soil
TIMP	Snow temperature lag factor	Snow