Supplementary materials
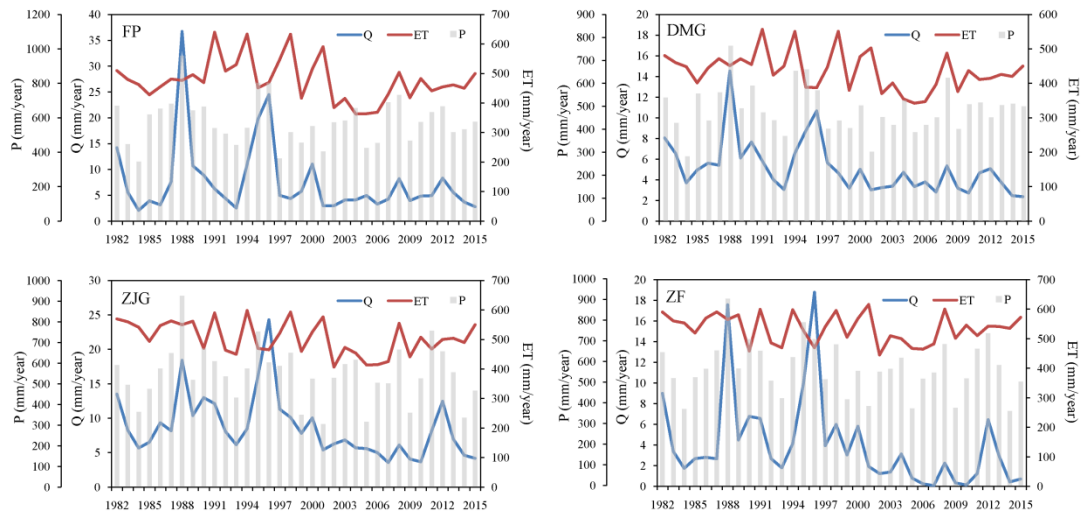
Figure S1 Rainfall, ET, and streamflow in the four catchments of study area.
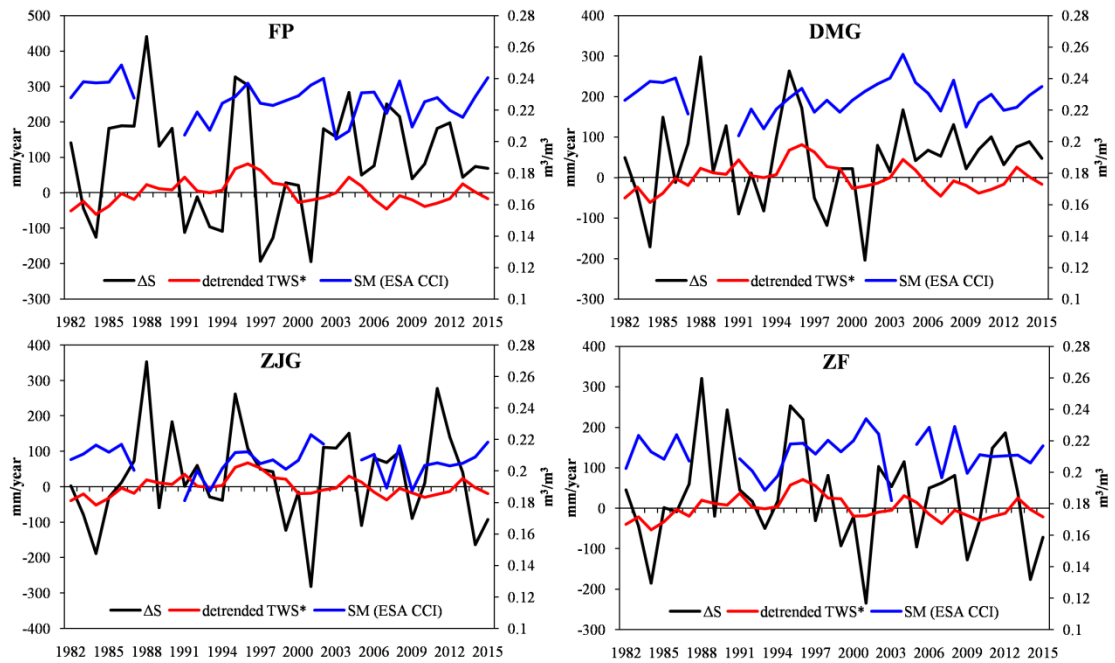
Figure S2 Comparison of water budget (ΔS, unit: mm/year), detrended TWSA (unit: mm/year), and satellite-derived soil moisture (unit: m³/m³).

*Details of detrended TWSA data can be obtained from Li et al., 2021.
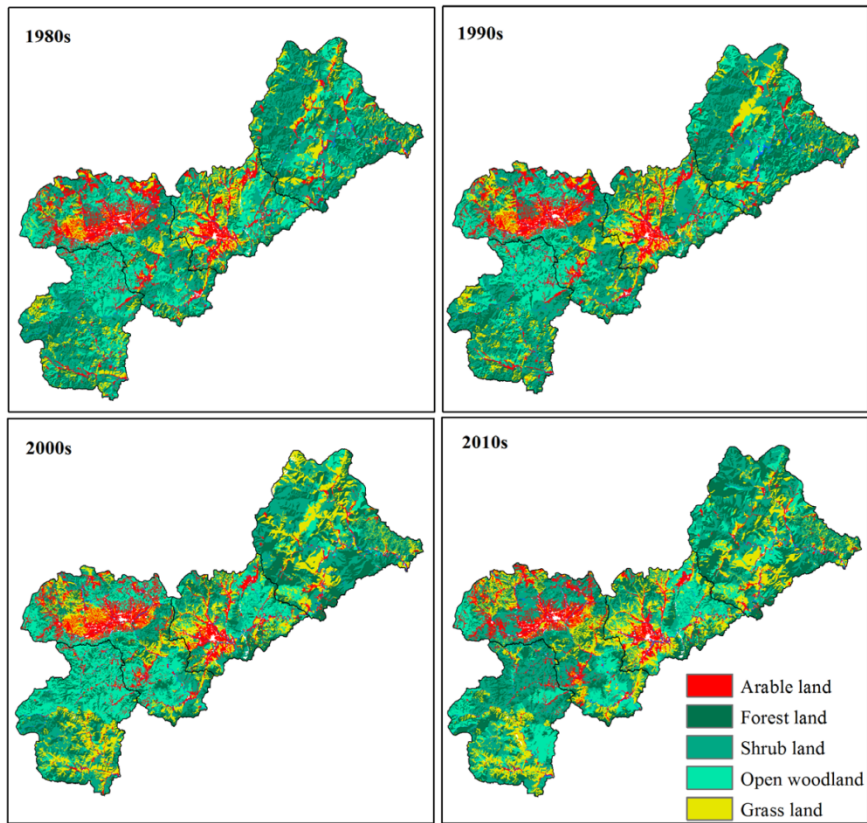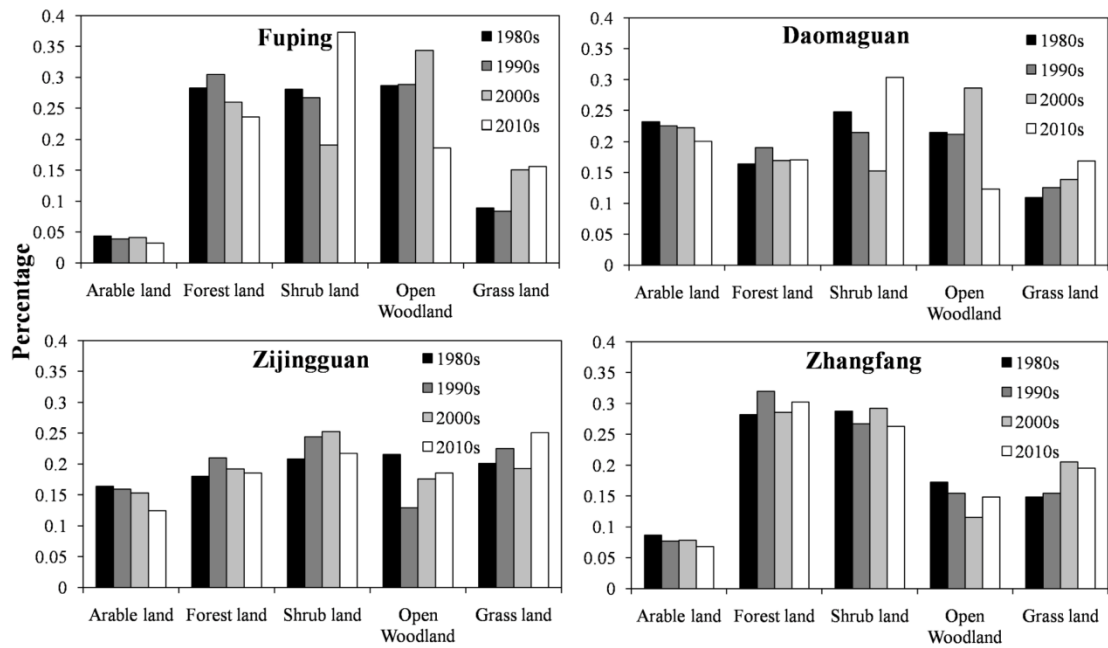
Figure S3 Land use change from 1980s to 2010s

P: 1982-2015

Wavelet power spectrum (percentage of energy for each wavelet coefficient)
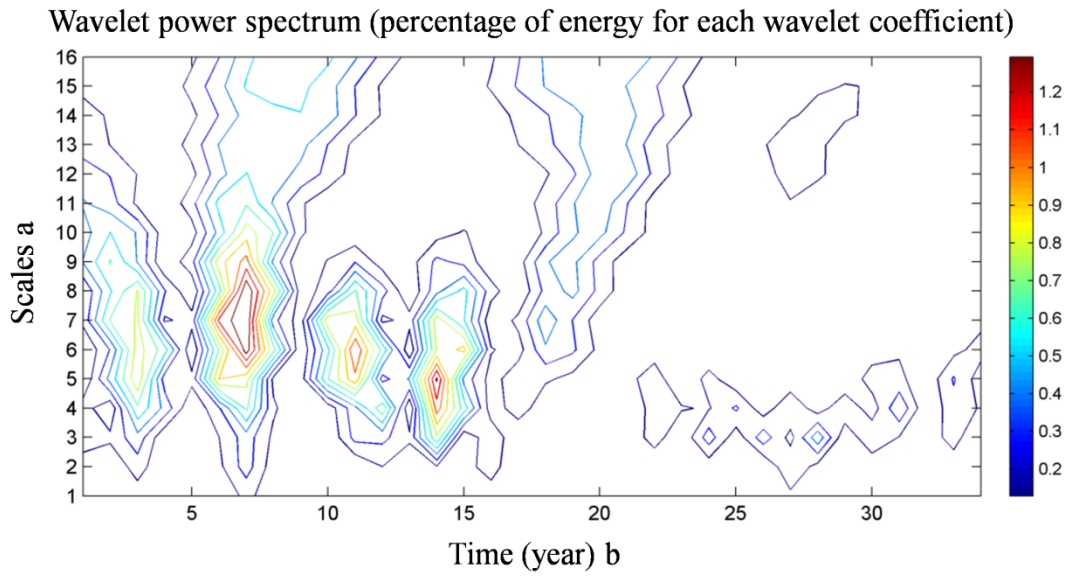
Figure S4 Wavelet analysis of rainfall in the period of 1982-2015. The rainfall is the average of four catchments.
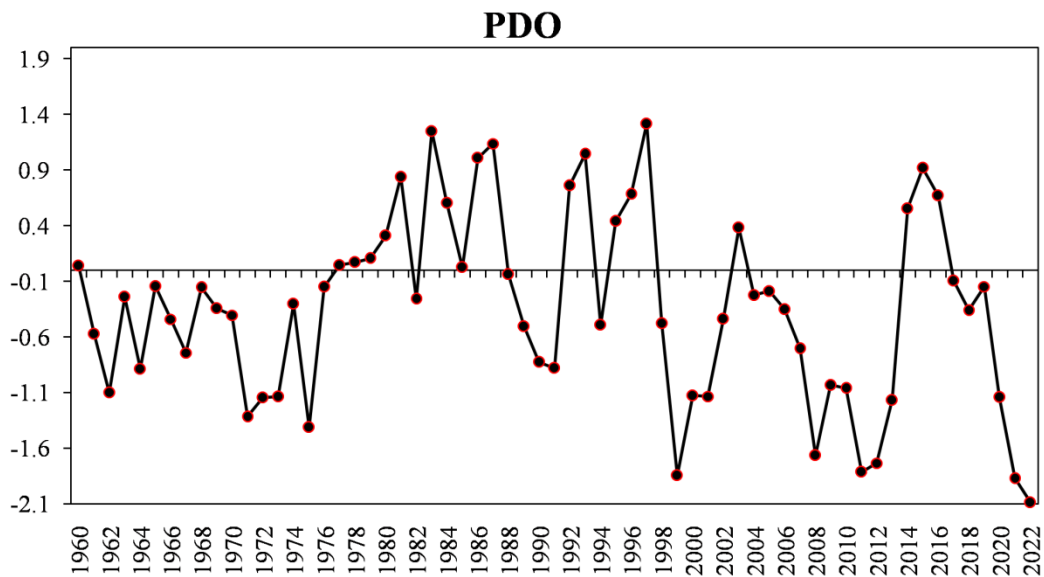
Figure S5 The PDO Index from 1960 to 2022. The index was downloaded from website of https://www.ncdc.noaa.gov/teleconnections/pdo/

DMG
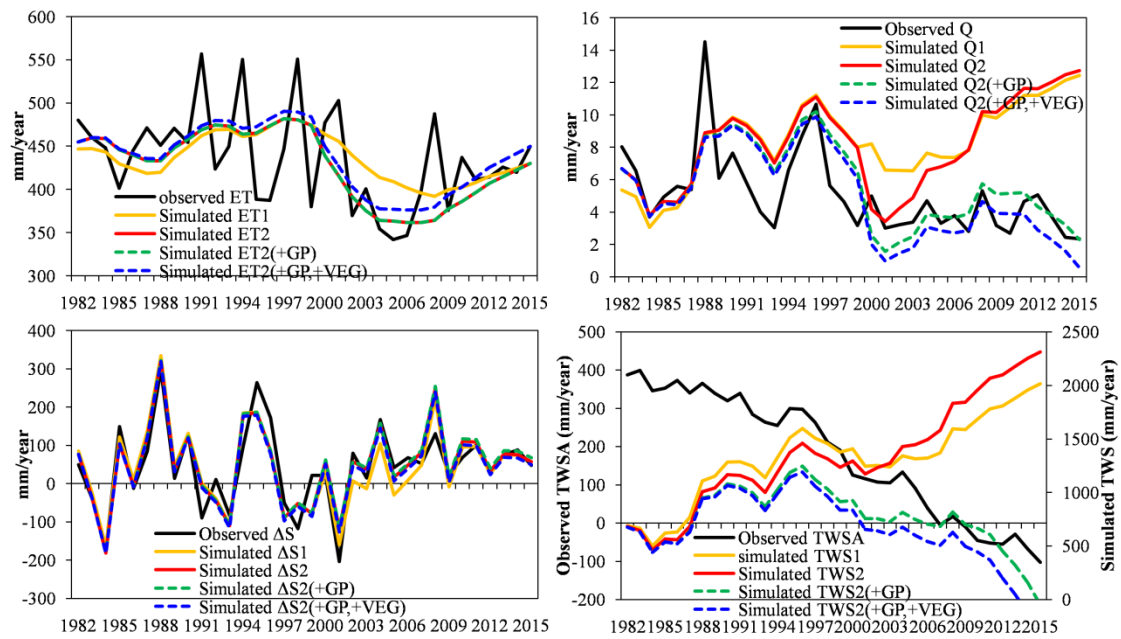
Figure S6 Observed and simulated evapotranspiration (ET), streamflow (Q), water budget (ΔS) and total water storage (TWS) using system dynamics approach for the DMG catchment. Yellow and red lines indicate the simulation without human intervention (GP=0 and VEG=0), with respectively fixed and varying desired soil moisture (ESMS). Green dashed line indicates simulation with groundwater pumpage (GP), which increased at an exponential rate. Blue dash line is the simulation with GP and vegetation change (VEG) which is increasing at a linear rate.

ZJG
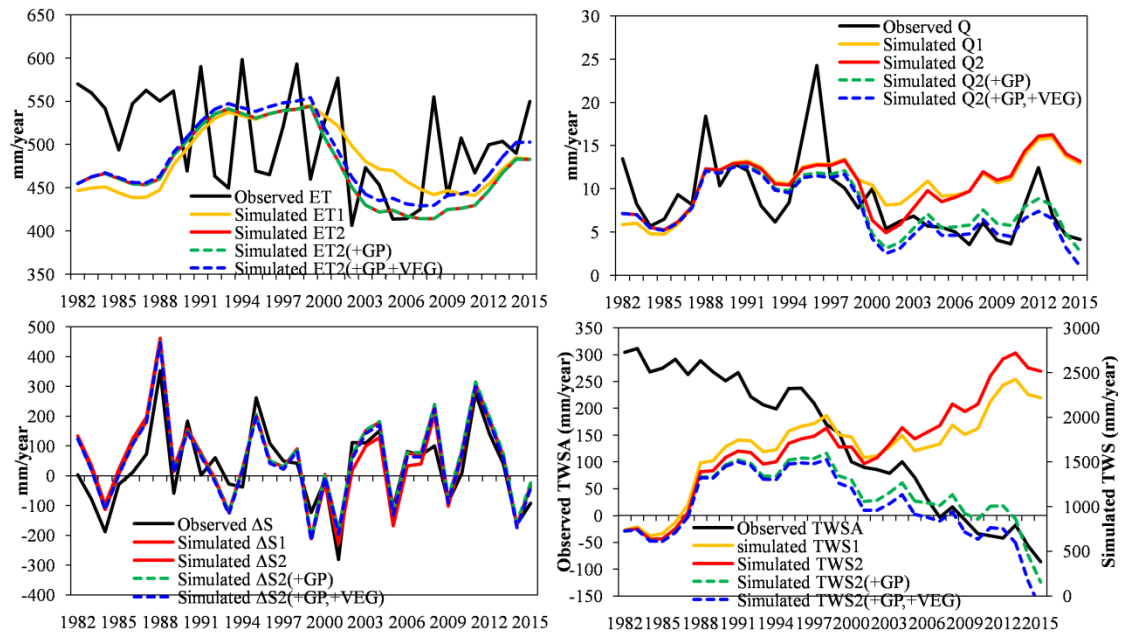
Figure S7 Same as above but for ZJG catchment

ZF
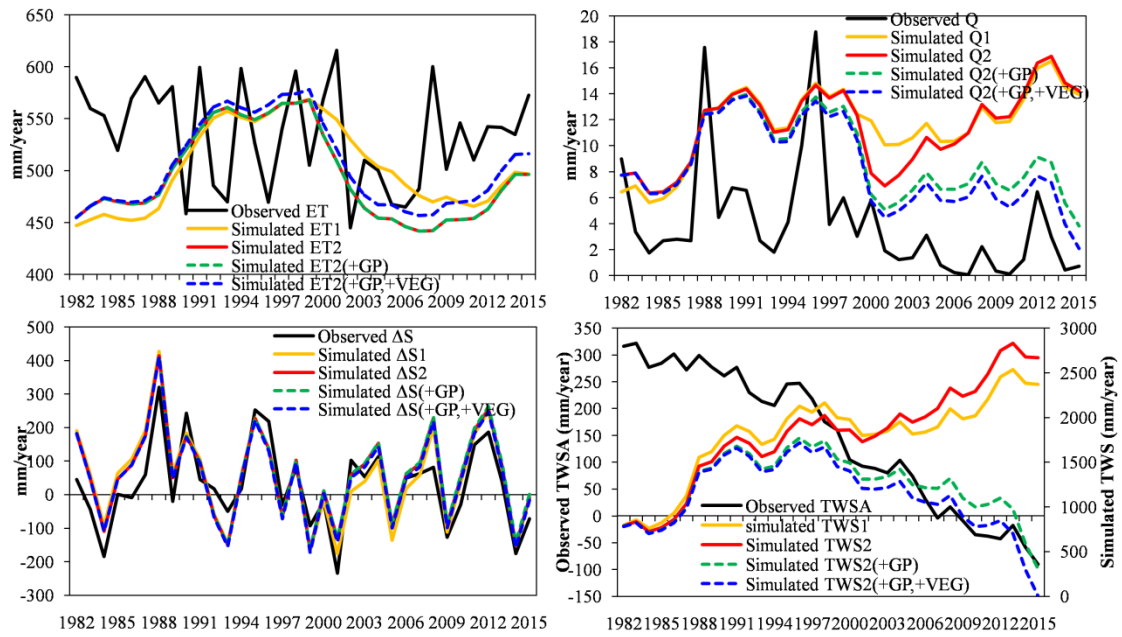
Figure S8 Same as above but for ZF catchment

Table S1 Details of 22 Global Climate Models (GCMs) applied in the study

No.	Short Name	Full Name	Institute	Country
1	ACC1	ACCESS-CM2	CSIRO-ARCCSS-BoM	Australia
2	ACC2	ACCESS-ESM1	CSIRO	Australia
3	BCC	BCC-CSM2-MR	BCC	China
4	Can1	CanESM5	CCCMA	Canada
5	Can2	CanESM5-CanOE	CCCMA	Canada
6	CNR1	CNRM-ESM2-1	CNRM-CERFACS	France
7	CNR2	CNRM-CM6-1	CNRM-CERFACS	France
8	CNR3	CNRM-CM6-1-HR	CNRM-CERFACS	France
9	ECE1	EC-Earth3-Veg	EC-Earth-Consortium	EU
10	ECE2	EC-Earth3	EC-Earth-Consortium	EU
11	FGOA	FGOALS-g3	CAS	China
12	GFD	GFDL-ESM4	NOAA-GFDL	USA
13	GISS	GISS-E2-1-G	NASA-GISS	USA
14	INM1	INM-CM4-8	INM	Russia
15	INM2	INM-CM5-0	INM	Russia
16	LPSL	IPSL-CM6A-LR	LPSL	France
17	MIR1	MIROC6	MIROC	Japan
18	MIR2	MIROC-ES2L	MIROC	Japan
19	MPI1	MPI-ESM1-2-HR	MPI-M	German
20	MPI2	MPI-ESM1-2-LR	MPI-M	German
21	MTIE	MRI-ESM2-0	MIR	Japan
22	UKES	UKESM1-0-LL	MOHC	UK