Supplementary Material

S1 Spatial Variations in Annual Precipitation

Table S1. Corresponding years for different categories of runoff

Categories	Standard (P%)	Corresponding years
especially high flow years	P≤12.5%	1998-2000, 2008
high flow years	12.5%<P≤37.5%	1990-1991, 2001-2004, 2010, 2016, 2017
normal flow year	37.5%<P≤62.5%	1985, 1987-1988, 1996, 2005, 2007, 2011, 2013-2014
low flow years	62.5%<P≤87.5%	1984, 1989, 1993, 1995, 1997, 2006, 2009, 2012, 2015
especially low flow years	P>87.5%	1983, 1986, 1992, 1994

Figure S1 shows that the general trend of precipitation in the midstream section of the Yarlung Tsangpo River gradually increased from west to east, with insignificant changes in precipitation in the north–south direction. This distribution of precipitation is attributed to the fact that the precipitation in the midstream section of Yarlung Tsangpo River basin mainly originates because the warm and humid airflow from the Bay of Bengal in the Indian Ocean is obstructed by the Himalayas and other mountain ranges; the Yarlung Tsangpo River Grand Canyon is the largest channel in the region, within which water vapor rises to form precipitation [5,54]. The precipitation in the Gyatsa to Nuxia section was typically approximately 1000 mm in especially high flow years, high flow years, normal flow years, low flow years, and especially low flow years. Precipitation in the area above Gyatsa was typically 600–800 mm in especially high flow years. Precipitation near Nimu, Lhaze, and Yangcun was below 600 mm, and precipitation in the uppermost area of the basin was below 400 mm. Precipitation in the region from Gyatsa to the west during high flow years was typically 400–600 mm, with precipitation near Lhasa reaching 600–800 mm and that in the region above Lhaze being below 400 mm. This was attributed to the fact that the warm and humid airflow during high flow years along the water vapor channel of the Yarlung Tsangpo River Grand Canyon was lower than that in especially high flow years, so the precipitation in the middle and upper reaches during the high flow years was less than that during especially high flow years. For the same reason, the spatial distribution of precipitation in normal flow years was roughly similar to that in high flow years, except that the precipitation near Lhasa was typically lower, at to 600–800 mm, and the precipitation in the area above Lhaze was typically below 400 mm. For low flow years, precipitation in the area above Xigaze and the nearby areas as well as the areas near Yangcun was below 400 mm. Precipitation in the area west of Gyatsa in especially low flow years was basically below 400 mm.

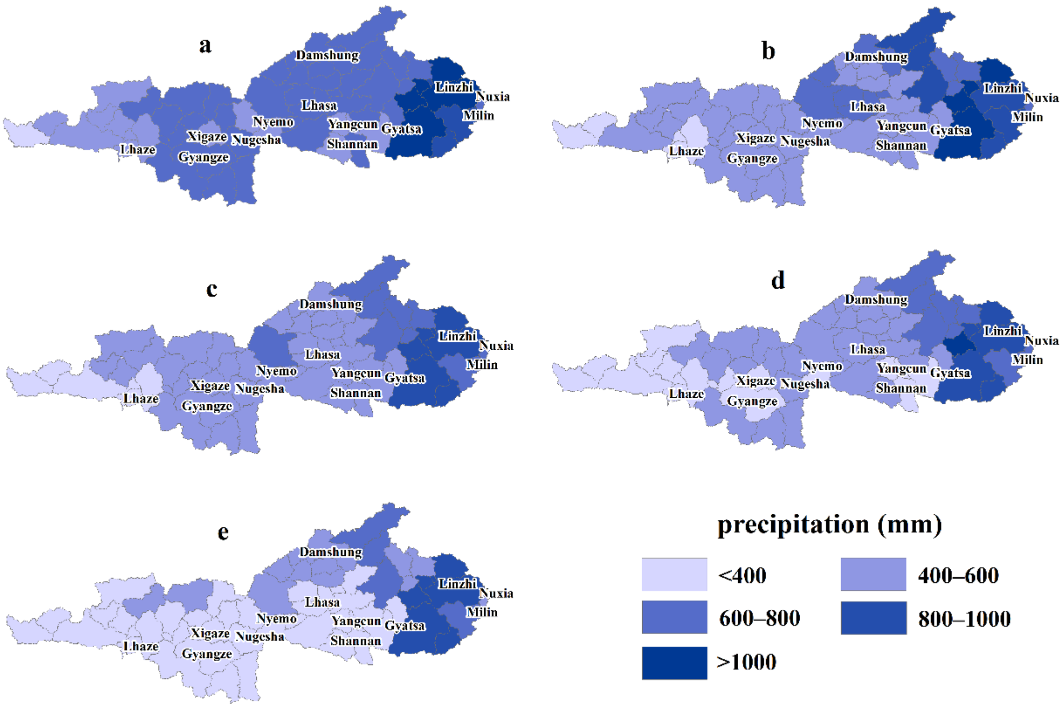

Figure S1. Spatial variations in annual precipitation (mm) in (a) especially high flow years, (b) high flow years, (c) normal flow years, (d) low flow years, and (e) especially high flow years.

S2 Spatial Variations in Annual Evaporation

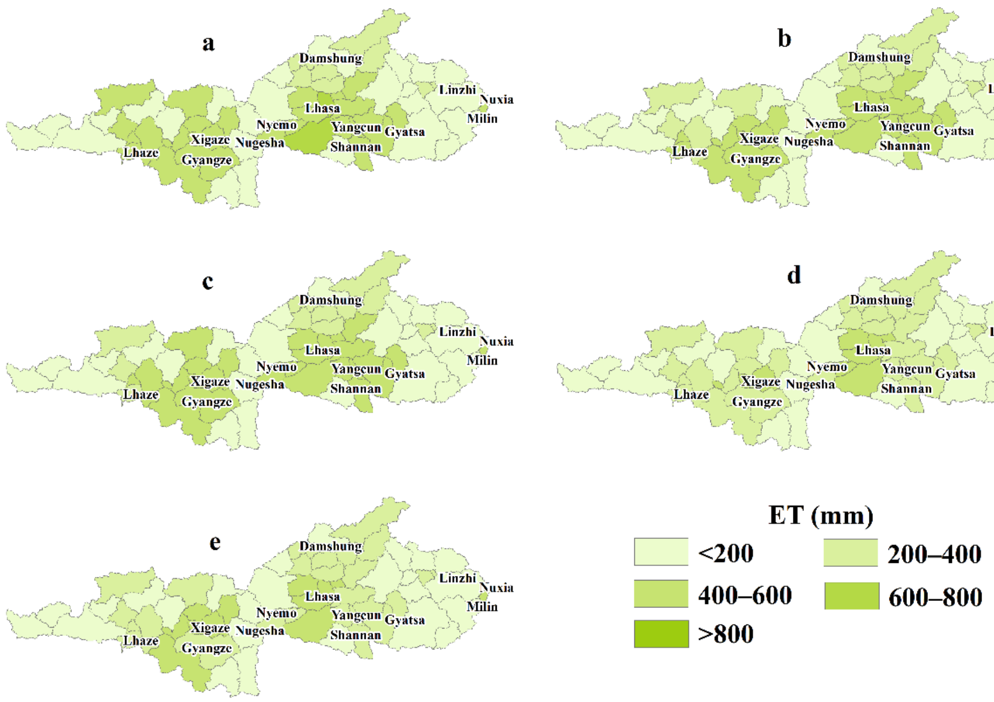

Figure S2 Spatial variations in annual evaporation (mm) in (a) especially high flow years, (b) high flow years, (c) normal flow years, (d) low flow years, and (e) especially high flow years.

S3 Future Precipitation and Temperature

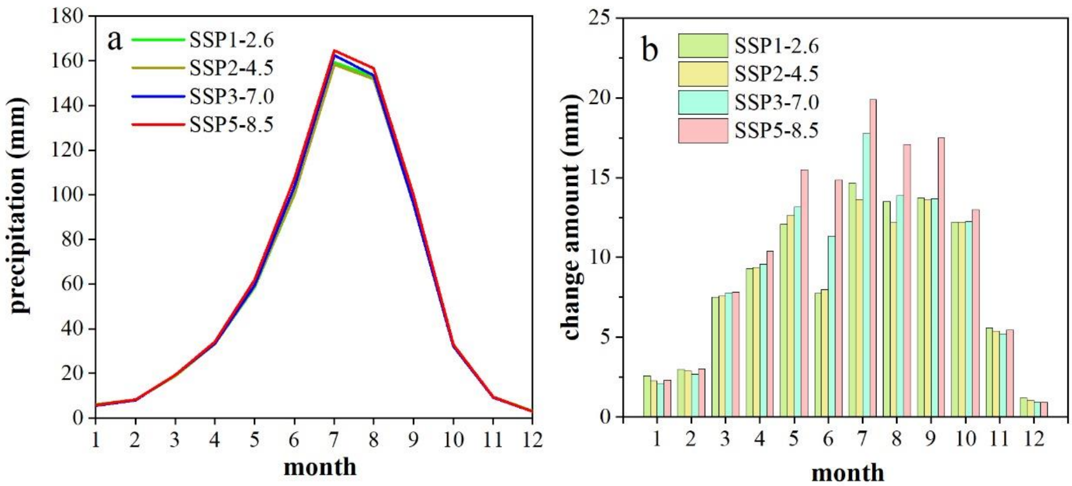

Figure S3 Monthly precipitation for the 2020–2100 period (a) and monthly precipitation variation compared with the baseline period (1983–2017) (b) in the study area under different scenarios.

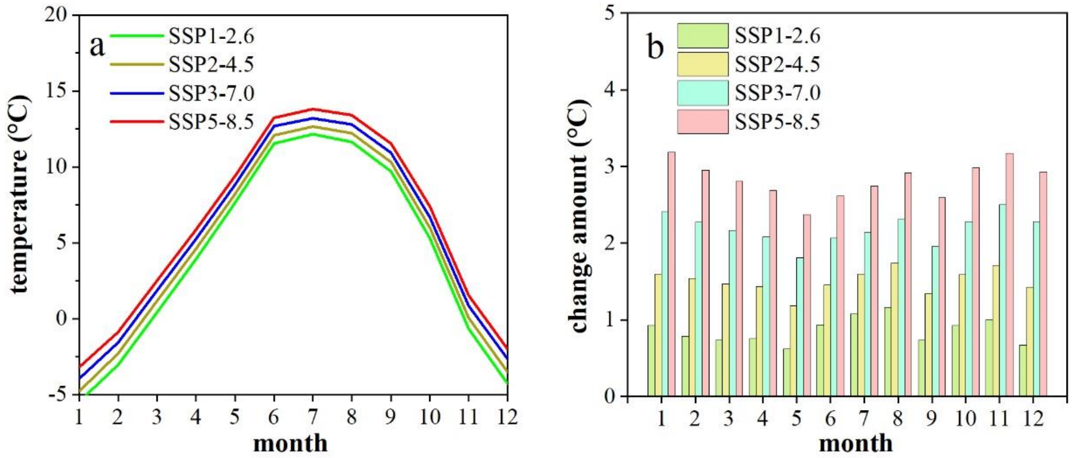

Figure S4 Monthly temperature for the 2020–2100 period (a) and monthly temperature variation compared with the baseline period (1983–2017) (b) in the study area under different scenarios.

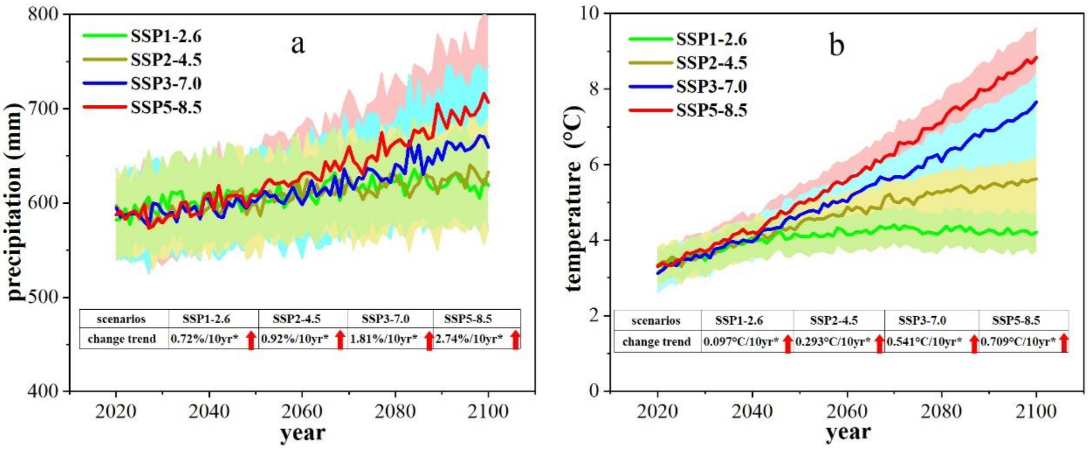

Figure S5 Annual precipitation (a) and temperature (b) in the study area for the 2020–2100 period under different scenarios.