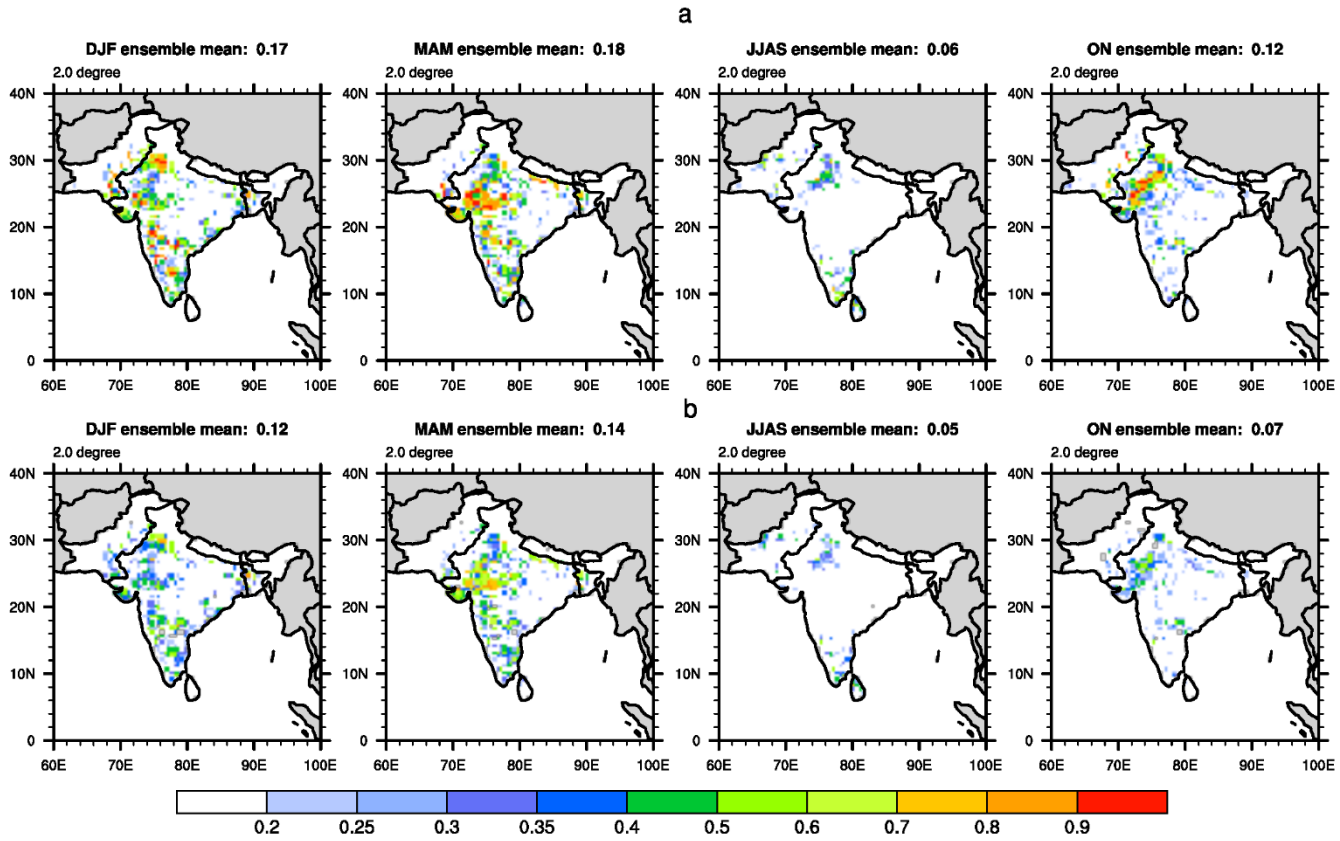
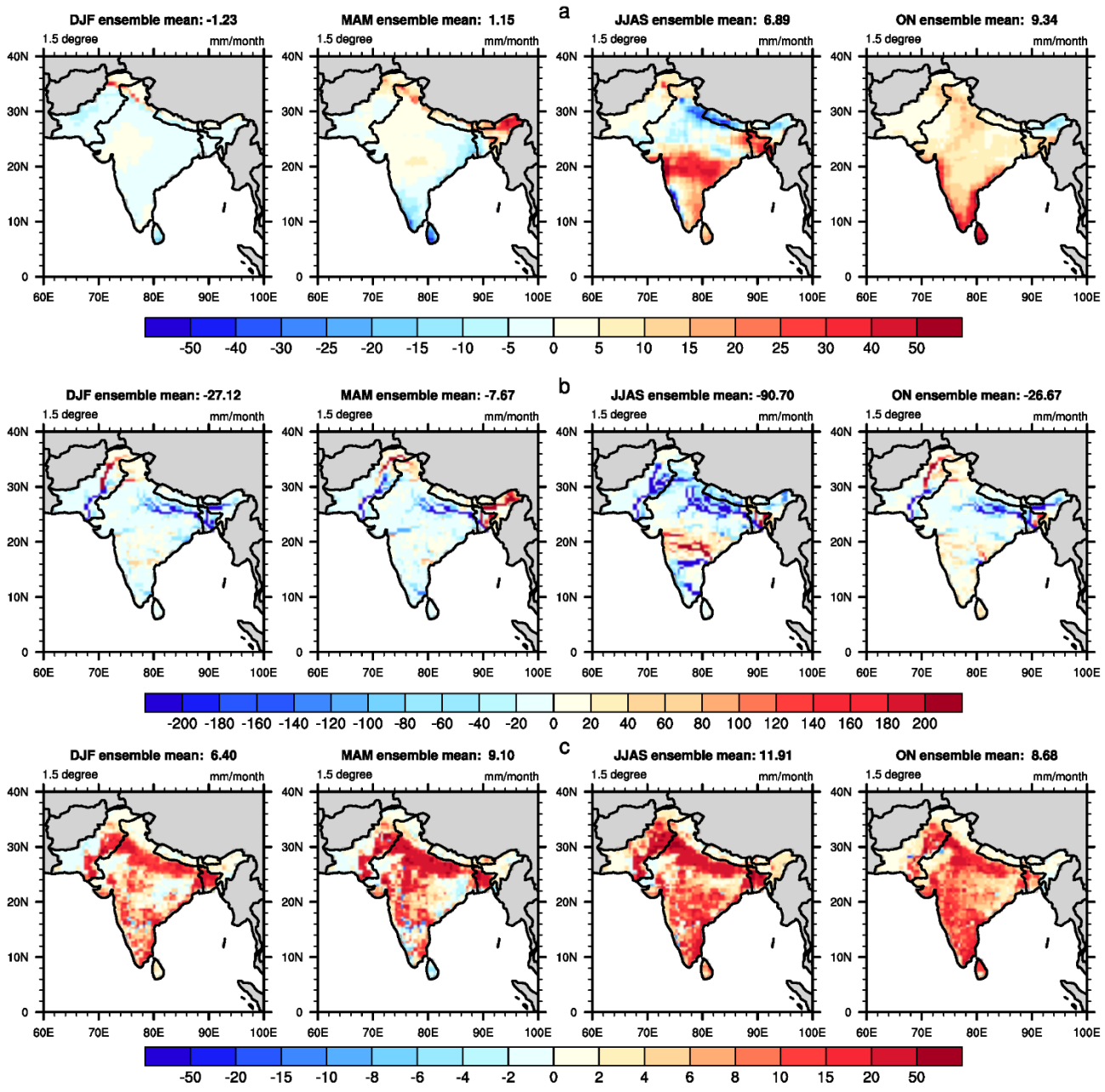
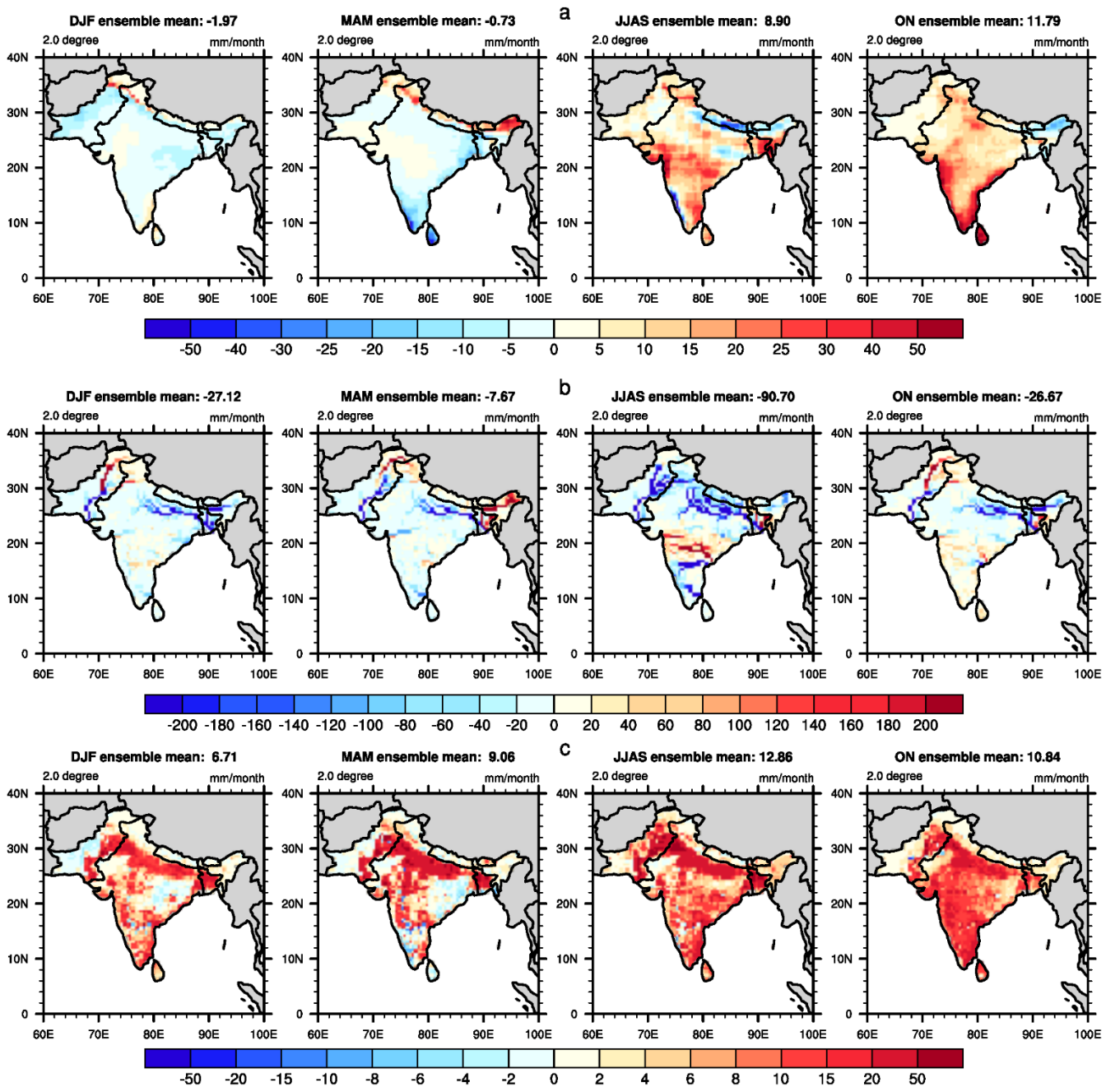


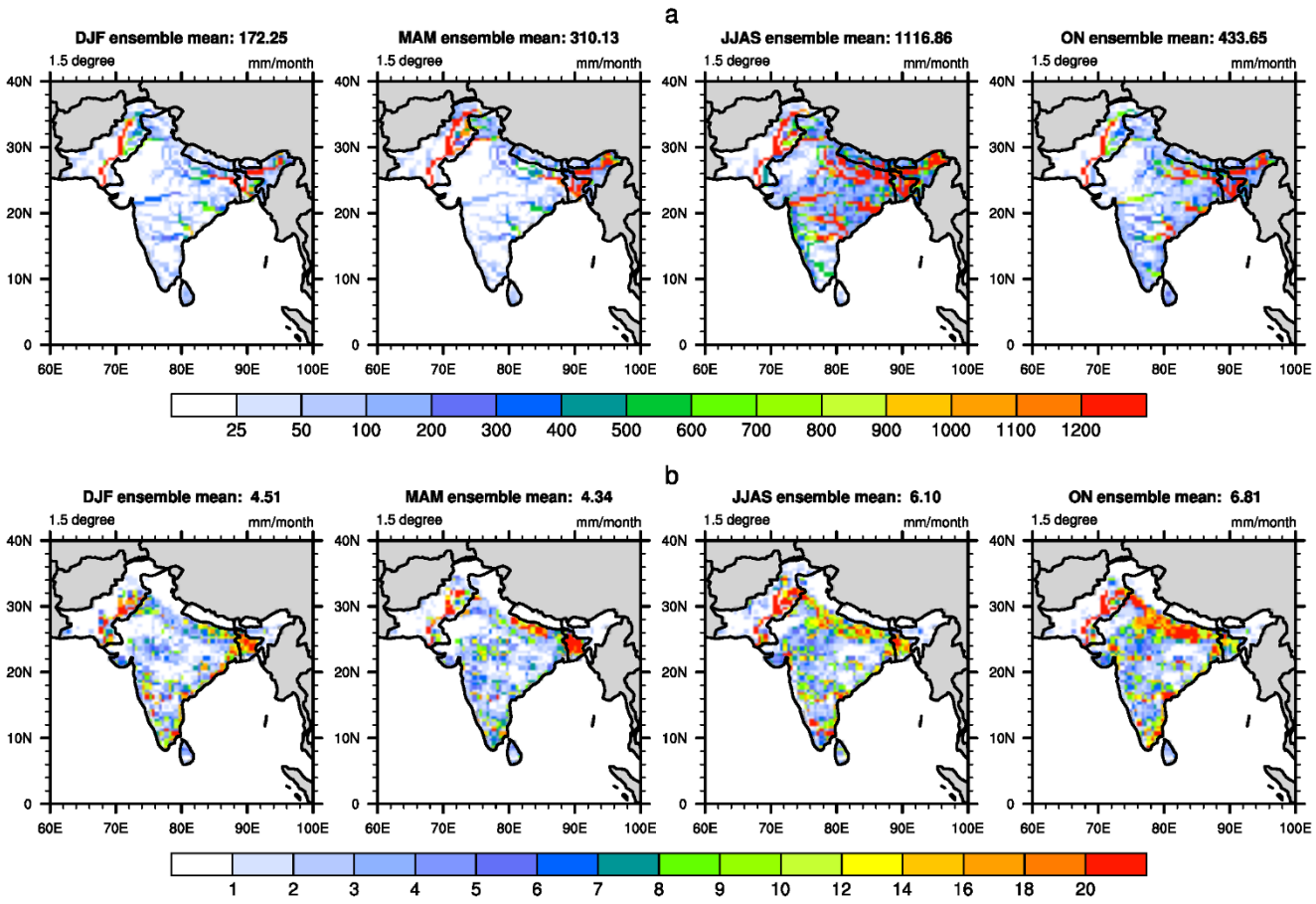
Supplementary Figure 1. Water scarcity (measured as water scarcity index- WSI) in South Asia at 2 ºC temperature increase under RCP 6.0 (a) Seasonal ensemble mean absolute changes in WS at 2 ºC (b) Seasonal ensemble mean absolute changes in WS at 2 ºC compared to pre-industrial period. The ensemble represents the seasonal averaged WS from the individual GHM-GCM combination. WSI is calculated as a ratio of water consumption (mm month^{-1}) to water availability (mm month^{-1}).



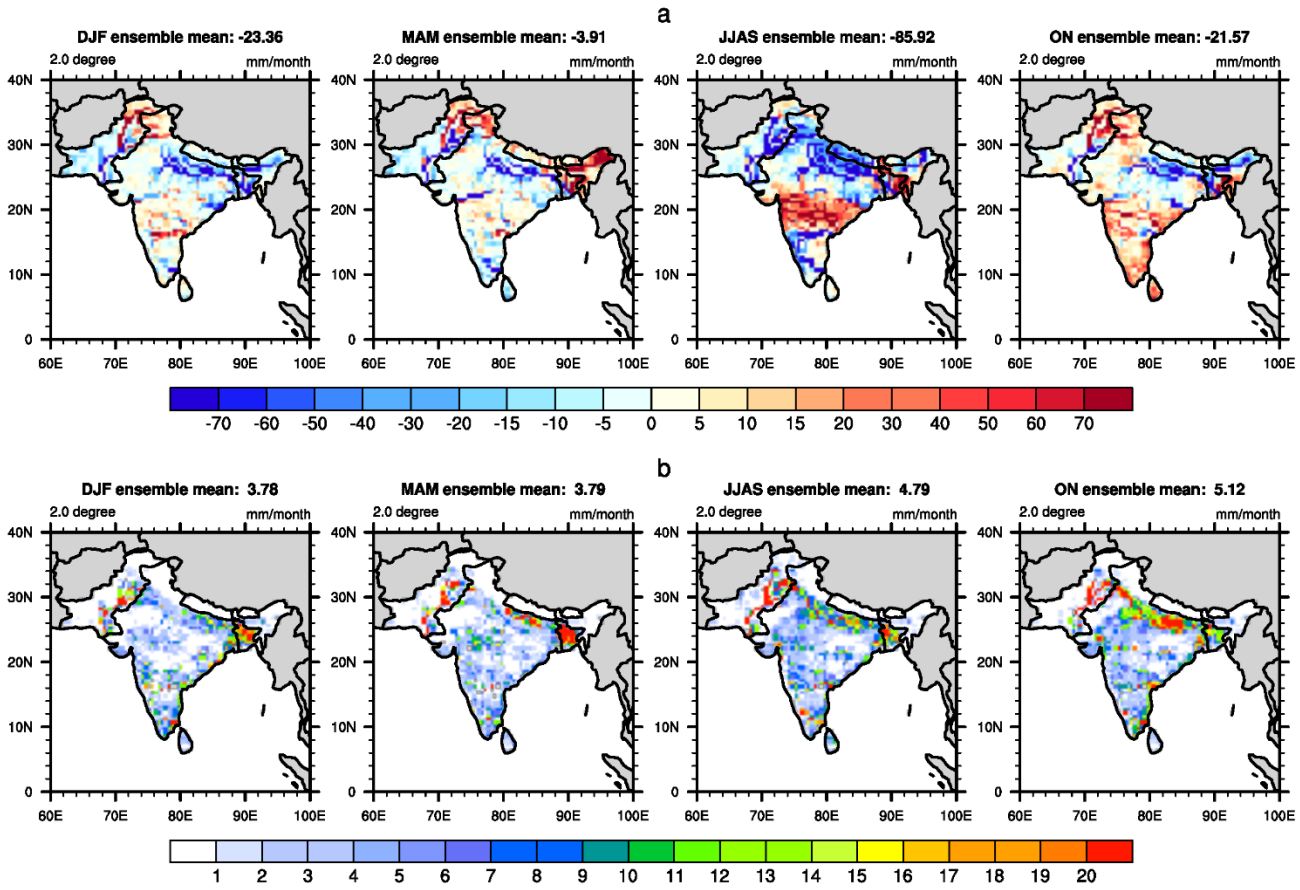
Supplementary Figure 2. The ensemble mean absolute seasonal changes in the hydrological variables in South Asia at 1.5 °C of temperature increase under the RCP 6.0 scenario compared to the pre-industrial period (a) Precipitation (b) Discharge (c) Evaporation. All the variables are represented as an ensemble, averaged over each season (mm month^{-1}) from individual GHM-GCM combinations.



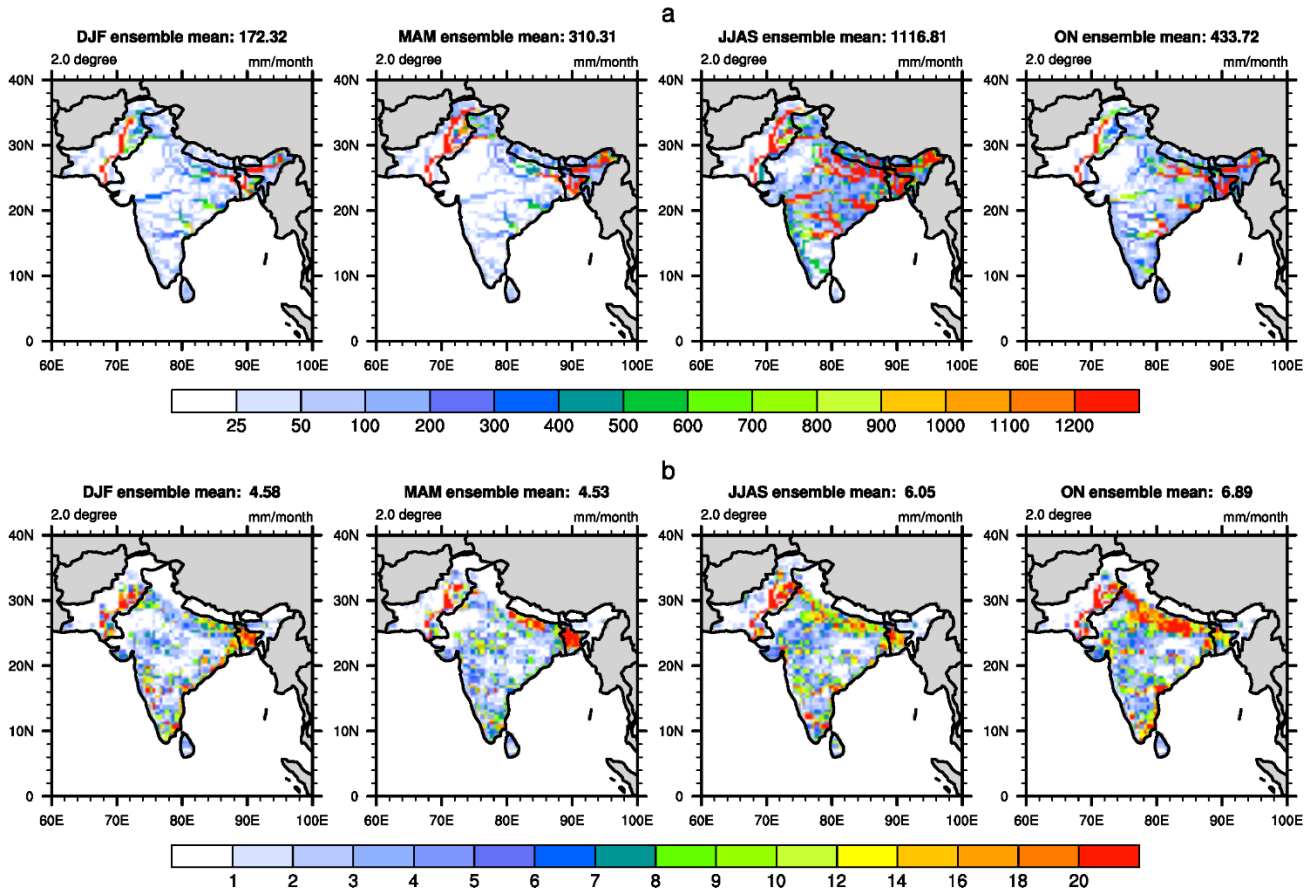
Supplementary Figure 3. The ensemble mean absolute seasonal changes in the hydrological variables in South Asia at 2 °C of temperature increase under the RCP 6.0 scenario compared to the pre-industrial period (a) Precipitation (b) Discharge (c) Evaporation. All the variables are represented as an ensemble, averaged over each season (mm month^{-1}) from individual GHM-GCM combinations.



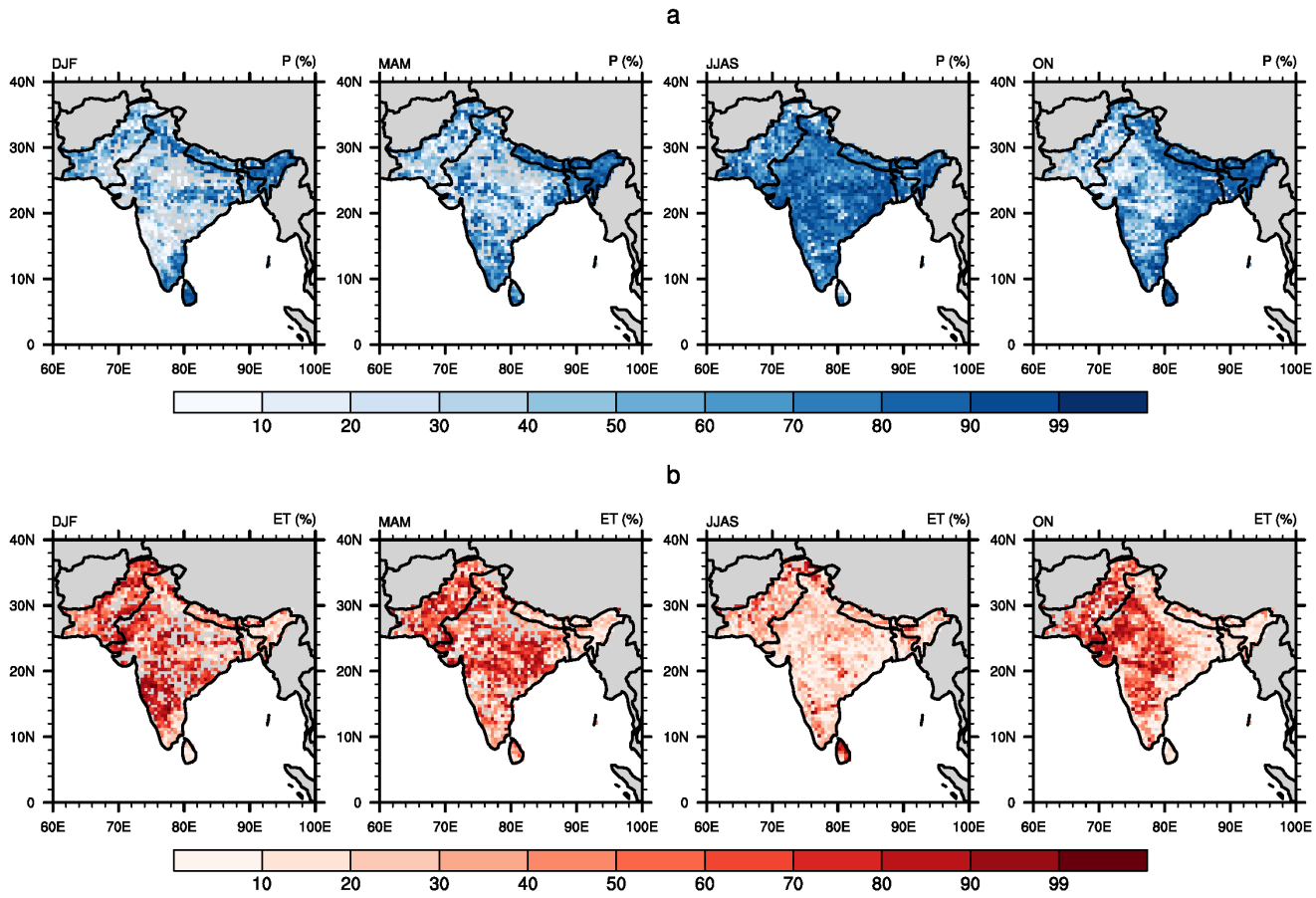
Supplementary Figure 4. Total water availability and water consumption in South Asia at 1.5 °C temperature increase under RCP 6.0 scenario (a) The ensemble mean absolute seasonal water availability **(b)** The ensemble mean absolute seasonal water consumption. All the variables are represented as an ensemble, averaged over each season (mm month^{-1}) from individual GHM-GCM combinations.



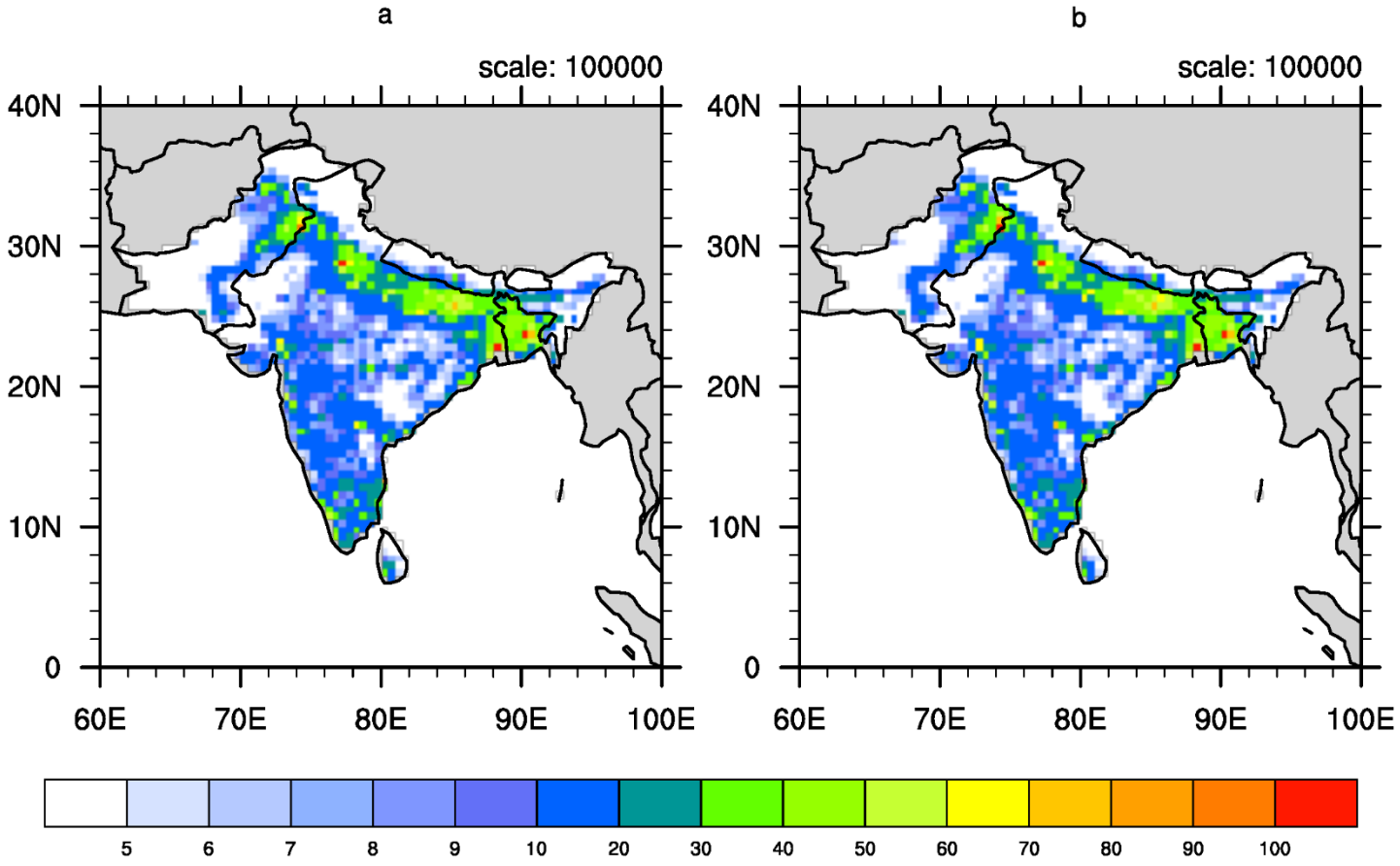
Supplementary Figure 5. Water availability and water consumption in South Asia at 2 ˚C temperature increase under RCP 6.0 scenario (a) The ensemble mean absolute changes in the seasonal water availability compared to the pre-industrial period. (b) The ensemble mean absolute changes in the seasonal water consumption compared to the pre-industrial period. All the variables are represented as an ensemble, averaged over each season (mm month^{-1}) from individual GHM-GCM combinations.



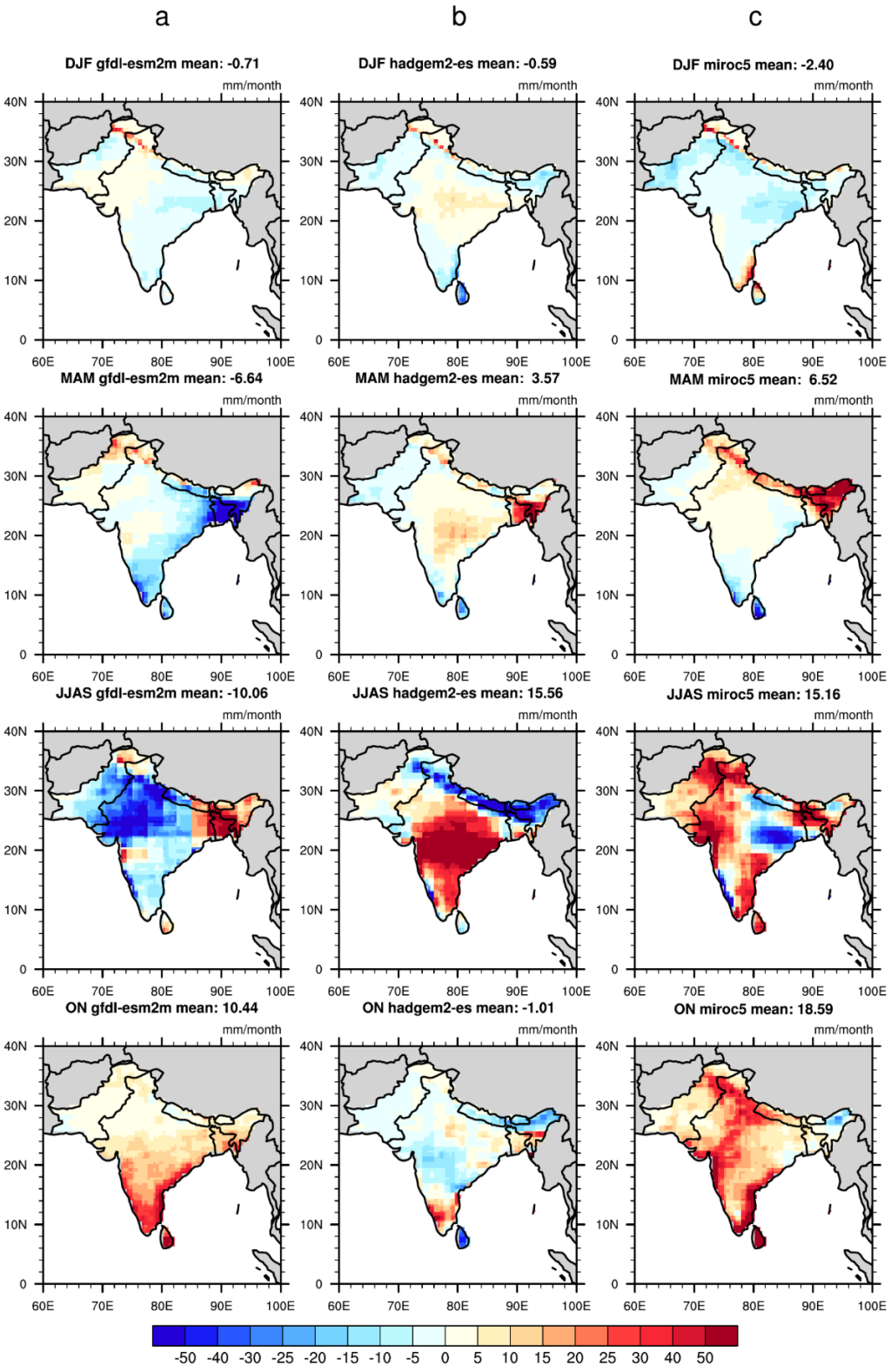
Supplementary Figure 6. Total water availability and water consumption in South Asia at 2 °C temperature increase under RCP 6.0 scenario (a) The ensemble mean absolute seasonal water availability **(b)** The ensemble mean absolute seasonal water consumption. All the variables are represented as an ensemble, averaged over each season (mm month^{-1}) from individual GHM-GCM combinations.



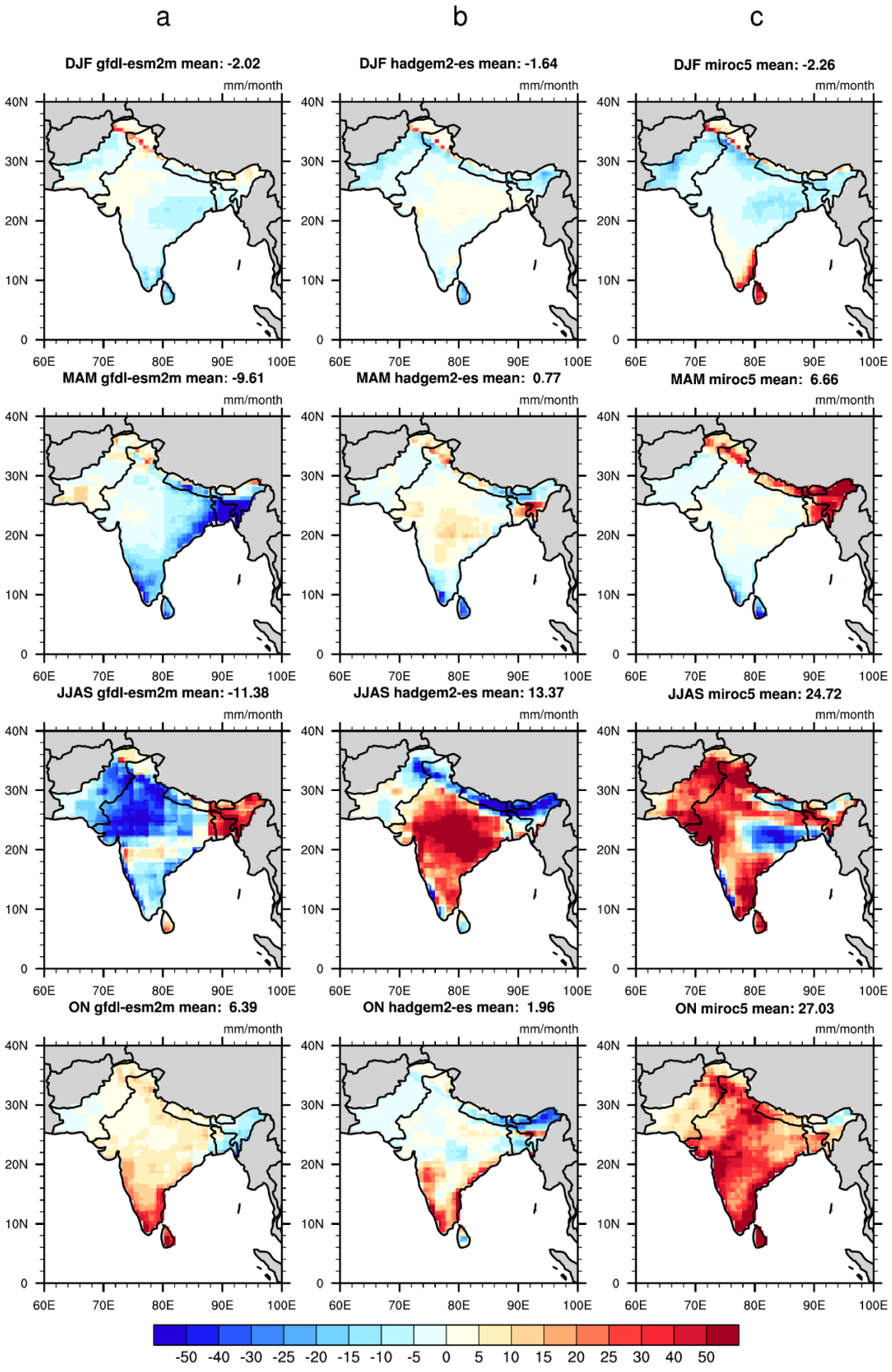
Supplementary Figure 7. Contribution of precipitation and ET on WS in South Asia as derived from regression analysis at 2 °C of temperature increase under RCP 6.0 scenario (a) Spatiotemporal control of precipitation on WS. **(b)** Spatiotemporal control of ET on WS.



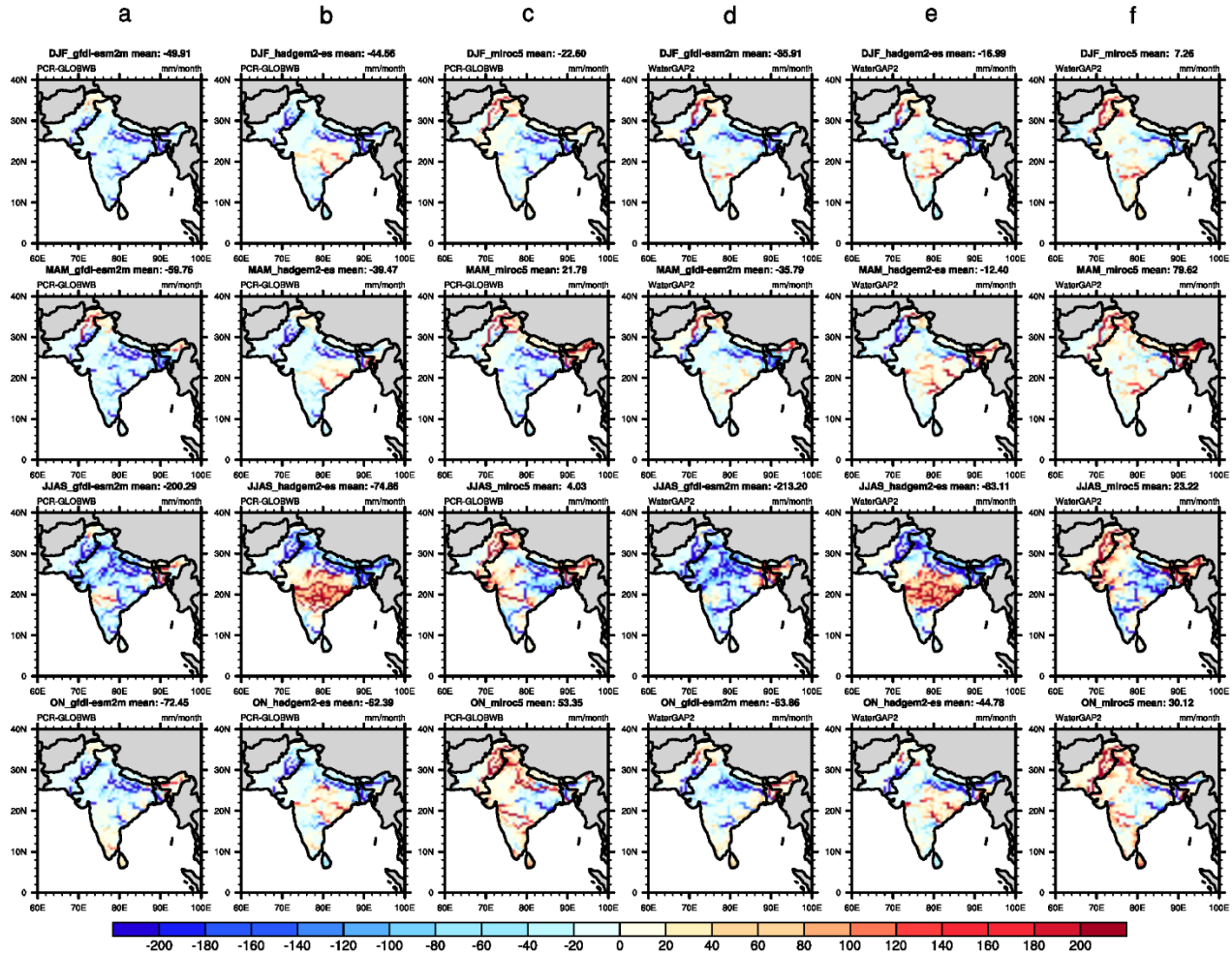
Supplementary Figure 8. Projected increase in the South Asian population under SSP2 scenario (a) Spatial distribution of the population at 1.5 °C temperature increase above pre-industrial levels (**b)** Spatial distribution of the population at 2 °C temperature increase above pre-industrial levels. The population projections correspond to the central year of the 31-year mean corresponding to the individual GCM temperature threshold as shown in table S3.



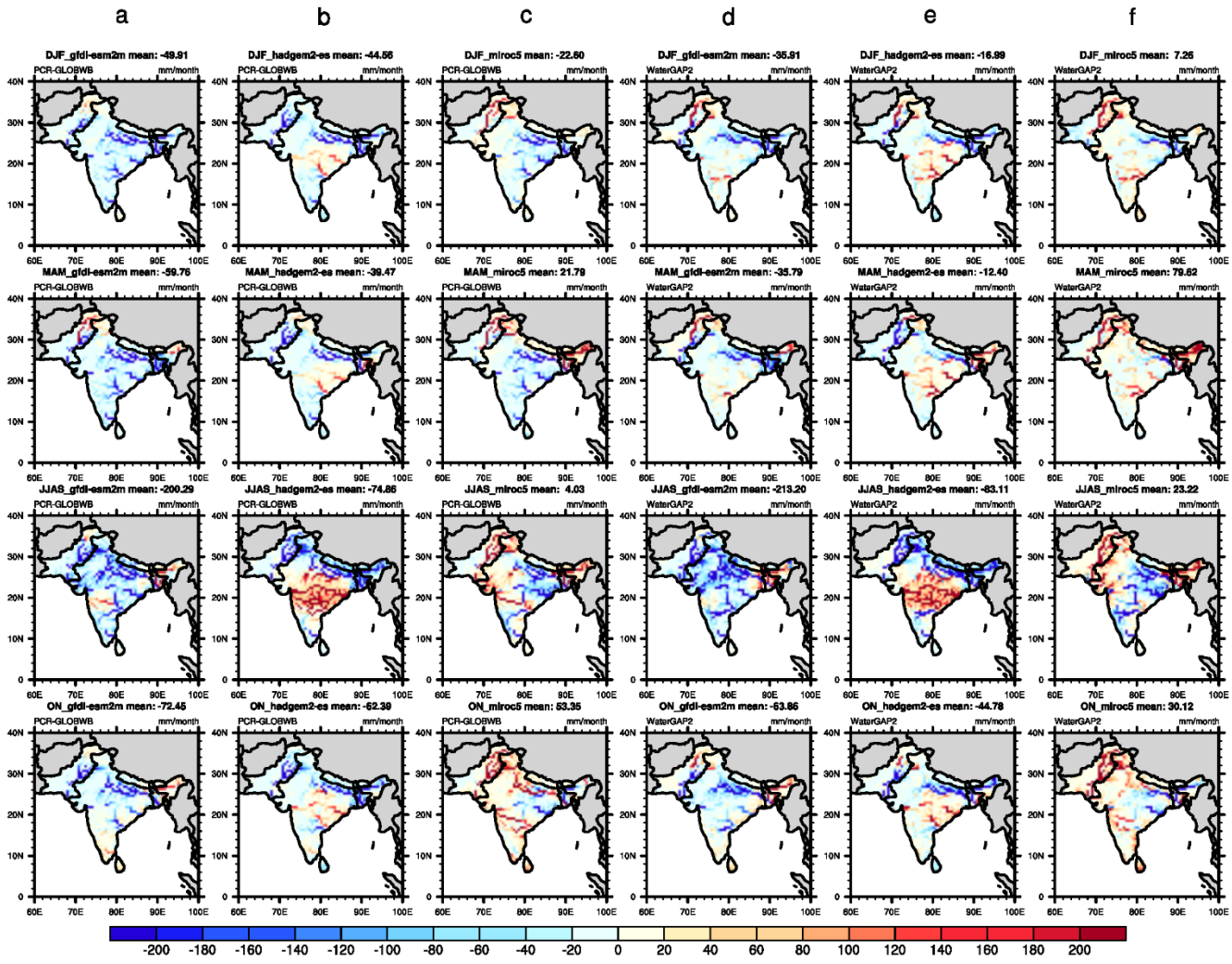
Supplementary Figure 9. Seasonal changes in precipitation from the individual GCMs (vertical panels; a-c) projected for 1.5 ^{0}C temperature increase under the RCP 6.0 compared to the pre-industrial period (a) GFDL-ESM2M (b) HadGEM2-ES (c) MIROC5. All the variables are averaged over each season (mm month^{-1}).



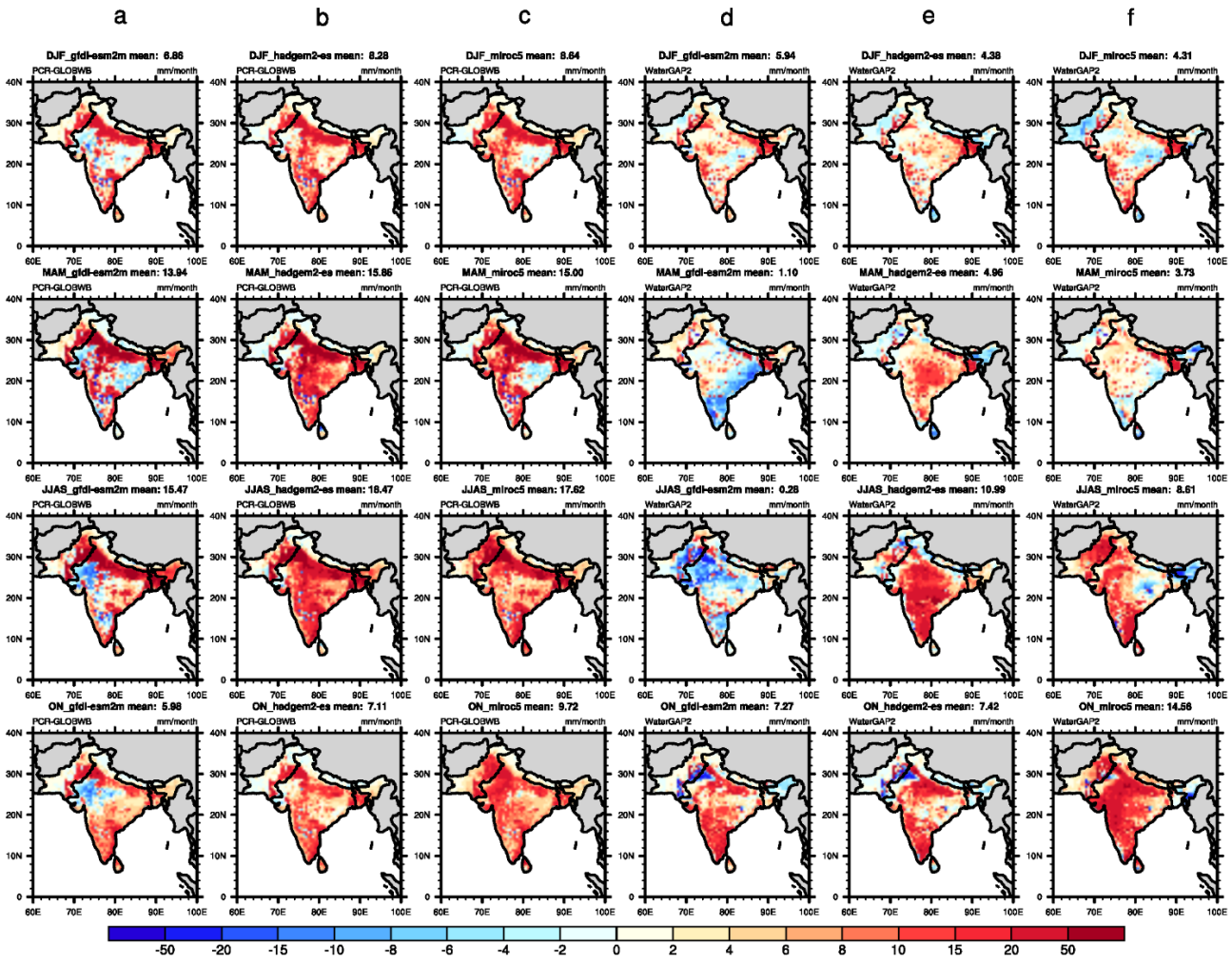
Supplementary Figure 10. Seasonal changes in precipitation from the individual GCMs (vertical panels; a-c) projected for 2 ^{0}C temperature increase under the RCP 6.0 compared to the pre-industrial period (a) GFDL-ESM2M (b) HadGEM2-ES (c) MIROC5. All the variables are averaged over each season (mm month^{-1}).



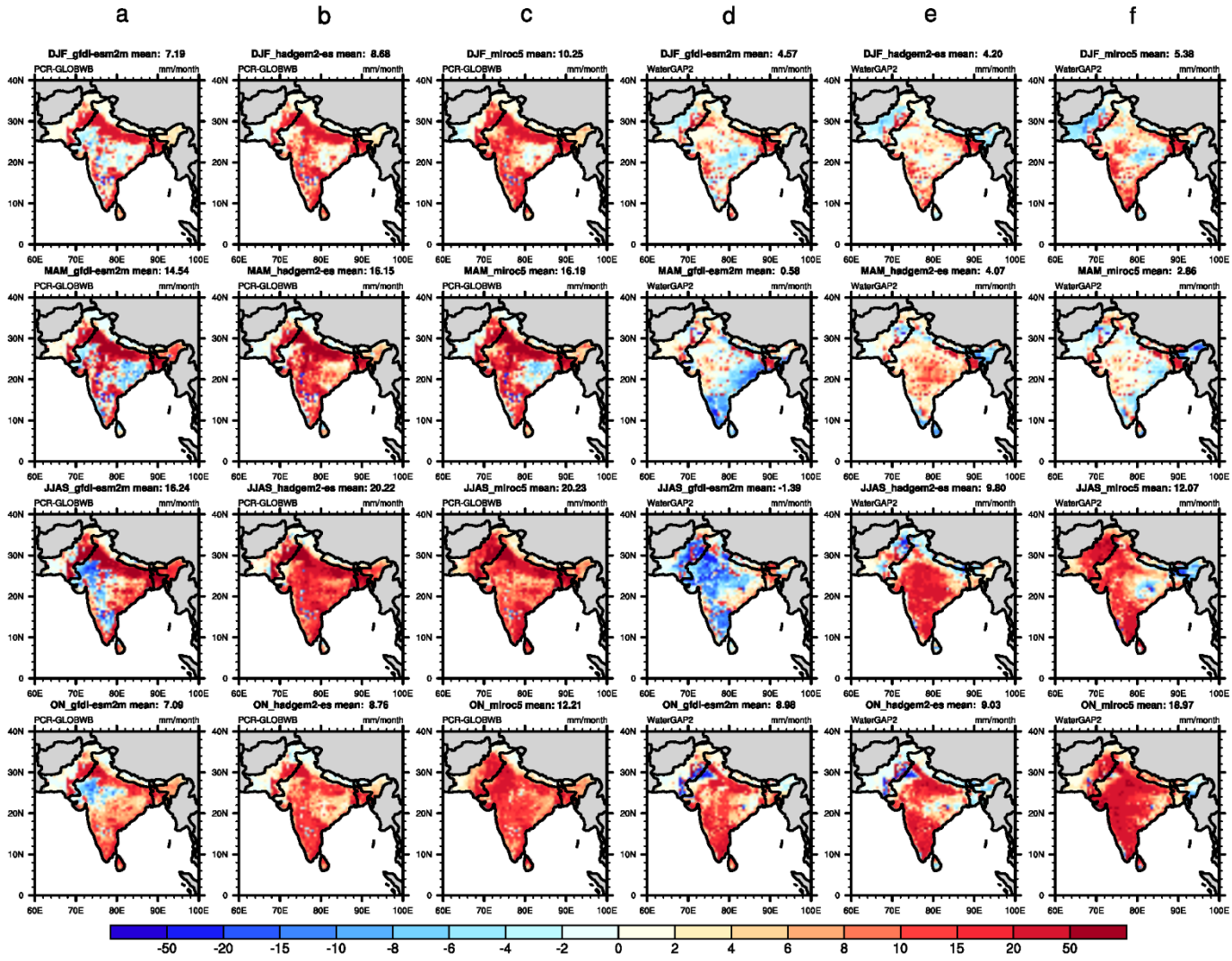
Supplementary Figure 11. Seasonal change in discharge from the individual GCMs-GHMs (vertical panels; a-f) projected for 1.5 °C temperature increase under the RCP 6.0 compared to the pre-industrial period (a) GFDL-ESM2M- PCR-GLOBWB **(b)** HadGEM2-ES- PCR GLOBWB **(c)** MIROC5- PCR-GLOBWB **(d)** GFDL-ESM2M- WaterGAP2 **(e)** HadGEM2-ES-WaterGAP2 **(f)** MIROC5- WaterGAP2. All the variables are averaged over each season (mm month^{-1}).



Supplementary Figure 12. Seasonal change in discharge from the individual GCMs-GHMs (vertical panels; a-f) projected for 2 °C temperature increase under the RCP 6.0 compared to the pre-industrial period (a) GFDL-ESM2M- PCR-GLOBWB **(b)** HadGEM2-ES- PCR GLOBWB **(c)** MIROC5- PCR-GLOBWB **(d)** GFDL-ESM2M- WaterGAP2 **(e)** HadGEM2-ES-WaterGAP2 **(f)**MIROC5- WaterGAP2. All the variables are averaged over each season (mm month^{-1}).



Supplementary Figure 13. Seasonal change in evapotranspiration from the individual GCMs- GHMs (vertical panels; a-f) projected for 1.5 °C temperature increase under the RCP 6.0 compared to the pre-industrial period (a) GFDL-ESM2M- PCR-GLOBWB **(b)** HadGEM2-ES-PCR GLOBWB **(c)** MIROC5- PCR-GLOBWB **(d)** GFDL-ESM2M- WaterGAP2 **(e)** HadGEM2-ES-WaterGAP2 **(f)** MIROC5- WaterGAP2. All the variables are averaged over each season (mm month^{-1}).



Supplementary Figure 14. Seasonal change in evapotranspiration from the individual GCMs- GHMs (vertical panels; a-f) projected for 2 °C temperature increase under the RCP 6.0 compared to the pre-industrial period (a) GFDL-ESM2M- PCR-GLOBWB **(b)** HadGEM2-ES- PCR GLOBWB **(c)** MIROC5- PCR-GLOBWB **(d)** GFDL-ESM2M- WaterGAP2 **(e)** HadGEM2-ES-WaterGAP2 **(f)** MIROC5- WaterGAP2. All the variables are averaged over each season (mm month^{-1}).

	Water Scarcity Grade	Winter (DJF)		Pre Monsoon (MAM)		Monsoon (JJAS)		Post Monsoon (ON)	
		Population (millions)	Percentage of the total population	Population (millions)	Percentage of the total population	Population (millions)	Percentage of the total population	Population (millions)	Percentage of the total population
Bhutan	SWS	0	0	0	0	0	0	0	0
	MWS	0	0	0	0	0	0	0	0
Bangladesh	SWS	0	0	0	0	0	0	0	0
	MWS	0	0	0	0	0	0	0	0
India	SWS	14	6	17	7.4	3.6	1.5	8	3.6
	MWS	14	6.2	12	5.2	3.7	1.6	8.	3.6
Pakistan	SWS	1	5.5	0.56	3	0.65	3.6	2	11.4
	MWS	1	5.0	0.48	2.6	1	6.0	1	6.2
Nepal	SWS	0.75	6.6	0.63	5.5	0	0	0	0
	MWS	0	0.0	0.67	5.9	0	0.0	0	0.0
Sri Lanka	SWS	0	0	0	0	0	0.5	0	0
	MWS	0	0.0	4.7	0.0	0	1.0	0	0.2
South Asia	SWS	16	5	18	6	4	1.5	10.5	3.7
	MWS	15	5.3	13	4.6	4.8	1.7	9.5	3.3
	Total	**31**	**10.3**	**31**	**10.6**	**8.8**	**3.2**	**20**	**7**

Supplementary Table 1 shows the seasonal distribution of South Asian population (in millions) and the percentage of the total population under various WS categories in the preindustrial period. SWS refers to severe water scarcity, MWS refers to moderate water scarcity, and the total water scarcity is the sum of SWS and MWS.

	Water Scarcity Grade	Winter (DJF)		Pre Monsoon (MAM)		Monsoon (JJAS)		Post Monsoon (ON)	
		Population (millions)	Percentage of the total population	Population (millions)	Percentage of the total population	Population (millions)	Percentage of the total population	Population (millions)	Percentage of the total population
Bhutan	SWS	0	0	0	0	0	0	0	0
	MWS	0	0	0	0	0	0	0	0
Bangladesh	SWS	51	28.4	38	21.2	0	0	1.8	1
	MWS	30	16.6	31	17	6	3.5	9	5
India	SWS	504	30.6	541	32.9	114	6.9	241	14.6
	MWS	218	13.3	222	13.5	137	8.3	222	13.5
Pakistan	SWS	72	25.2	53	18.5	29	10.2	64	22.9
	MWS	30	10.3	20	6.9	33	11.4	28	10
Nepal	SWS	1	2.8	1	2.8	0	0	0	0
	MWS	0	0	0	0	0	0	0	0
Sri Lanka	SWS	0.61	3.5	0.54	3.1	2.78	16.1	0	2
	MWS	0.52	3	0.6	3.5	1.4	8.3	0.47	2.8
South Asia	SWS	629	29	634	29	146	6.7	307	14.2
	MWS	278	12.8	274	12.6	177	8	259	12
	TWS	**907**	**41.8**	**908**	**41.6**	**323**	**14.7**	**566**	**26.2**

Supplementary Table 2 shows the seasonal distribution of the South Asian population (in millions) under various WS categories at 2 ºC temperature increase under RCP 6.0 and SSP2 climate and population projections. SWS refers to severe water scarcity, MWS refers to moderate water scarcity, and the total water scarcity is the sum of SWS and MWS. The population projections correspond to the central year of the 31-year mean corresponding to the individual GCM temperature threshold as shown in table S3.

GMT (RCP60)	GFDL	MIROC5	HadGEM2
0.5 ^{0}C	1989	1996	1999
1 ^{0}C	2016	2023	2014
1.5 ^{0}C	2056	2052	2032
2^{0}C	2076	2071	2050

Supplementary Table 3 shows the year in which the 31-year running mean of global mean temperature crosses the given thresholds for each GCM under RCP 6.0. projections. SSP2 population projections for similar years were used.