Supporting Information for

Spatiotemporal Heterogeneity in Cascading Snow-Hydrological Responses to Warming and Wetting on the Tibetan Plateau

Xinyun Hu[1], Xin Miao[1,2*], Shangyong Shi[3], Le Wang[1], Yizhuo Li[1], Qing Guo[1], Weidong Guo[1]

[1]School of Atmospheric Sciences, Nanjing University, Nanjing, 210023, China
[2] Frontiers Science Center for Critical Earth Material Cycling, Nanjing University, Nanjing, China
[3] Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, 21218, USA

Correspondence to: Xin Miao (miaoxin@nju.edu.cn)

Contents of this file

Figures S1 to S8

Table S1.

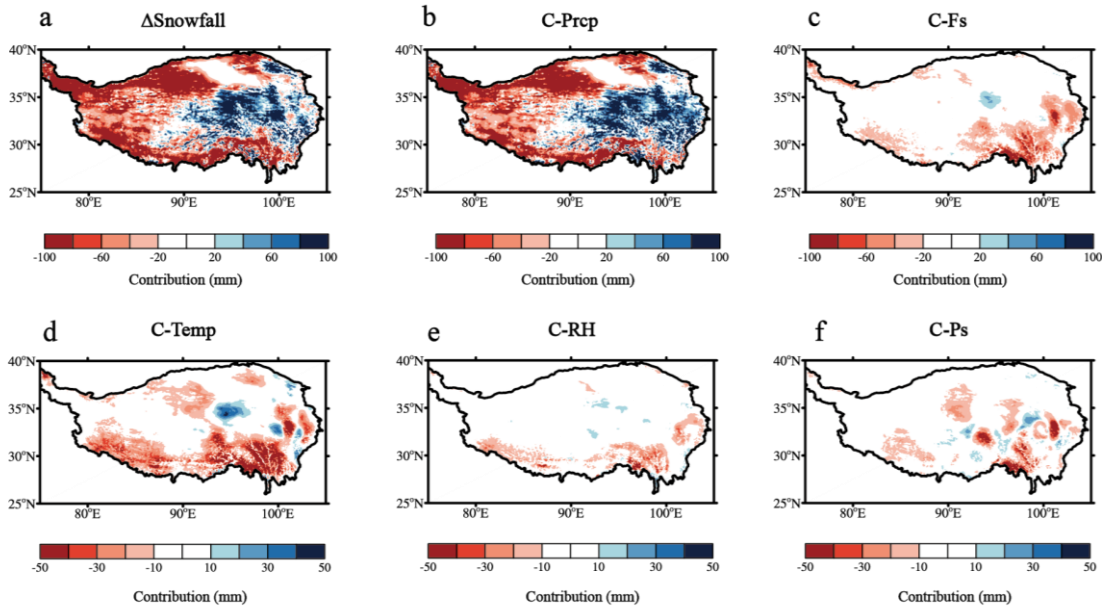


Figure S1: Attribution of snowfall changes during Stage 1 (1966–1984). Spatial patterns of (a-c) the contribution from precipitation (C-Prcp) and snowfall fraction (C-Fs) to changes in snowfall (ΔSnowfall). Then, C-Fs is further decomposed into (d-f) contributions from temperature (C-Temp), relative humidity (C-RH), and surface pressure (C-Ps).

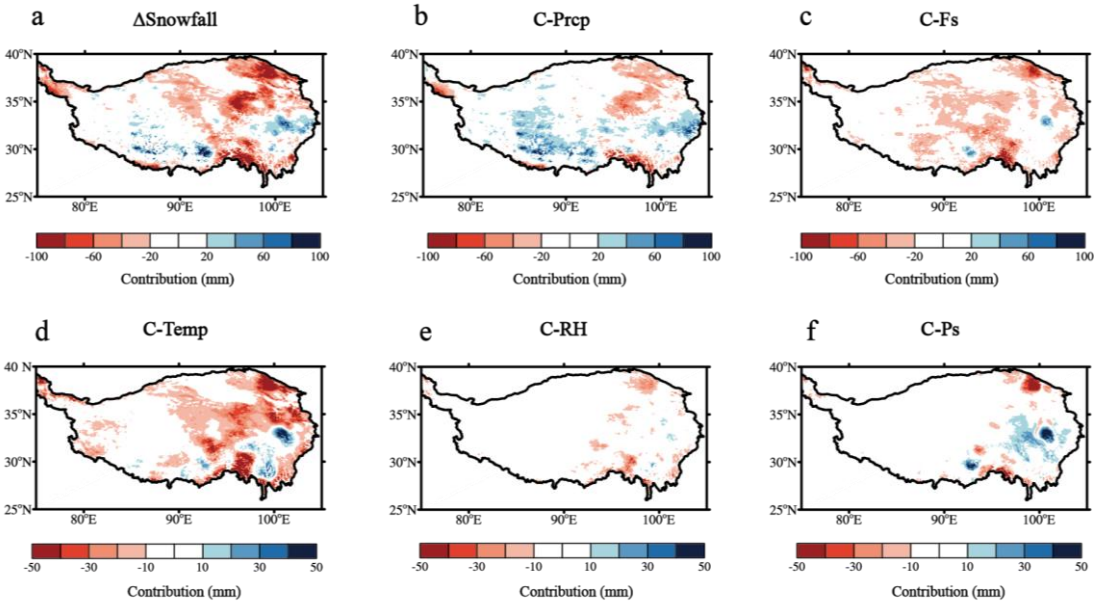
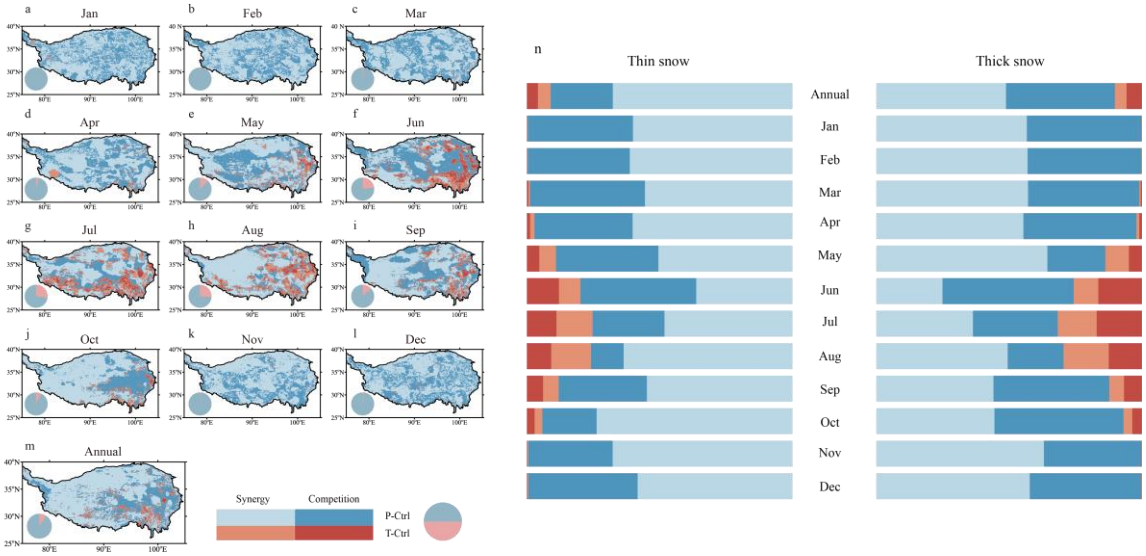
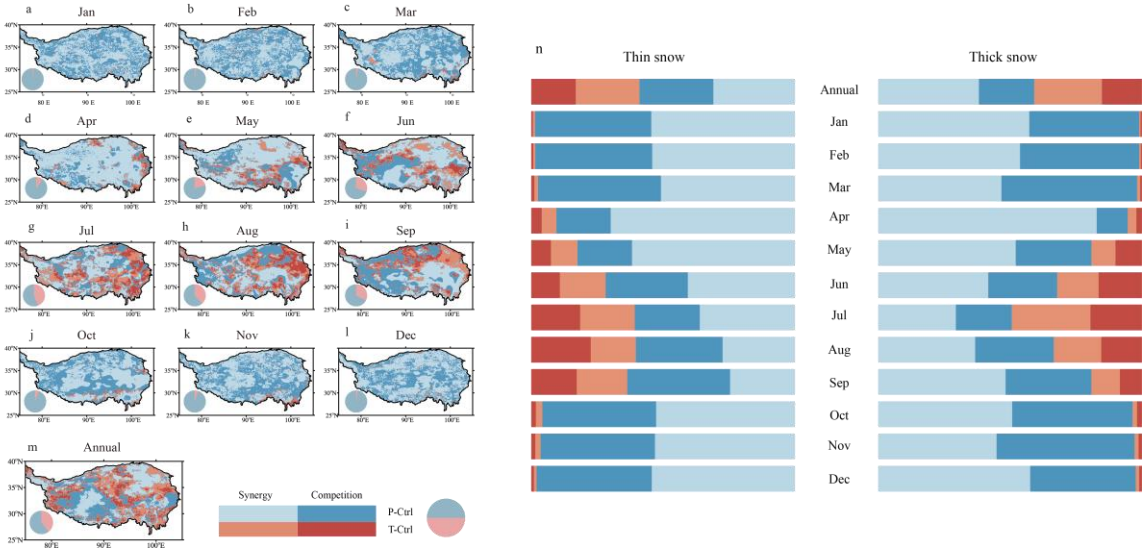


Figure S2: Similar as Figure S2 but for Stage 2 (1985–1999).



25 **Figure S3: Dominant contribution on snowfall variability during Stage 1 (1966–1984).** Distribution of controlling factors (precipitation and temperature) influencing (a-l) monthly and (m) annual snowfall variations with (n) comparisons between thick and thin snow.



30 **Figure S4: Similar as Figure S4 but for Stage 2 (1985–1999).**

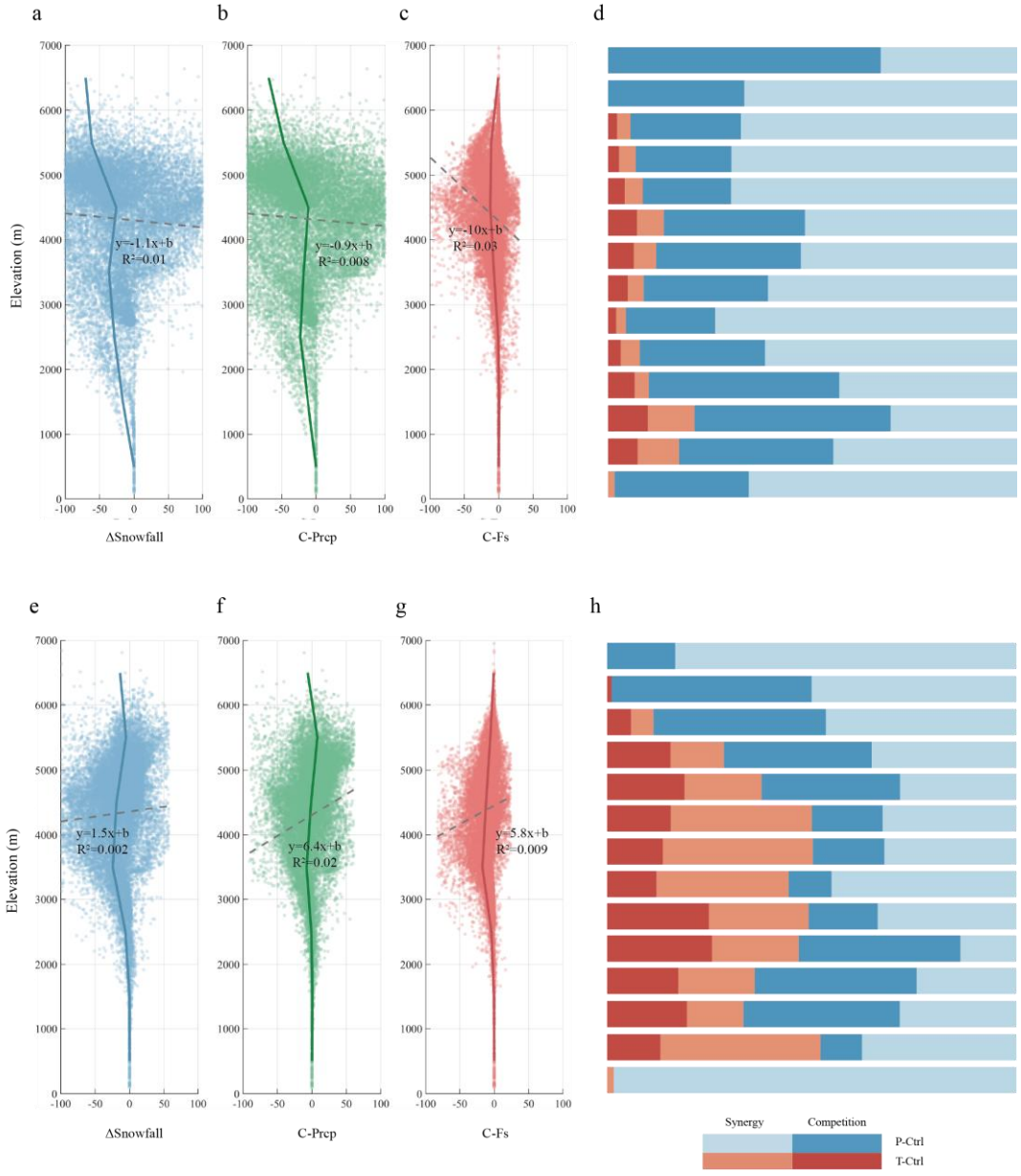


Figure S5: Elevation-dependent contribution of snowfall changes. (a-c) Contributions from precipitation (C-Prcp) and snowfall fraction (C-Fs) to changes in snowfall (ΔSnowfall) as functions of elevation. Additionally, compare (d) dominant contribution regimes at different elevations during Stage 1 (1966–1984), and (e-h) the corresponding results for Stage 2 (1985–1999).

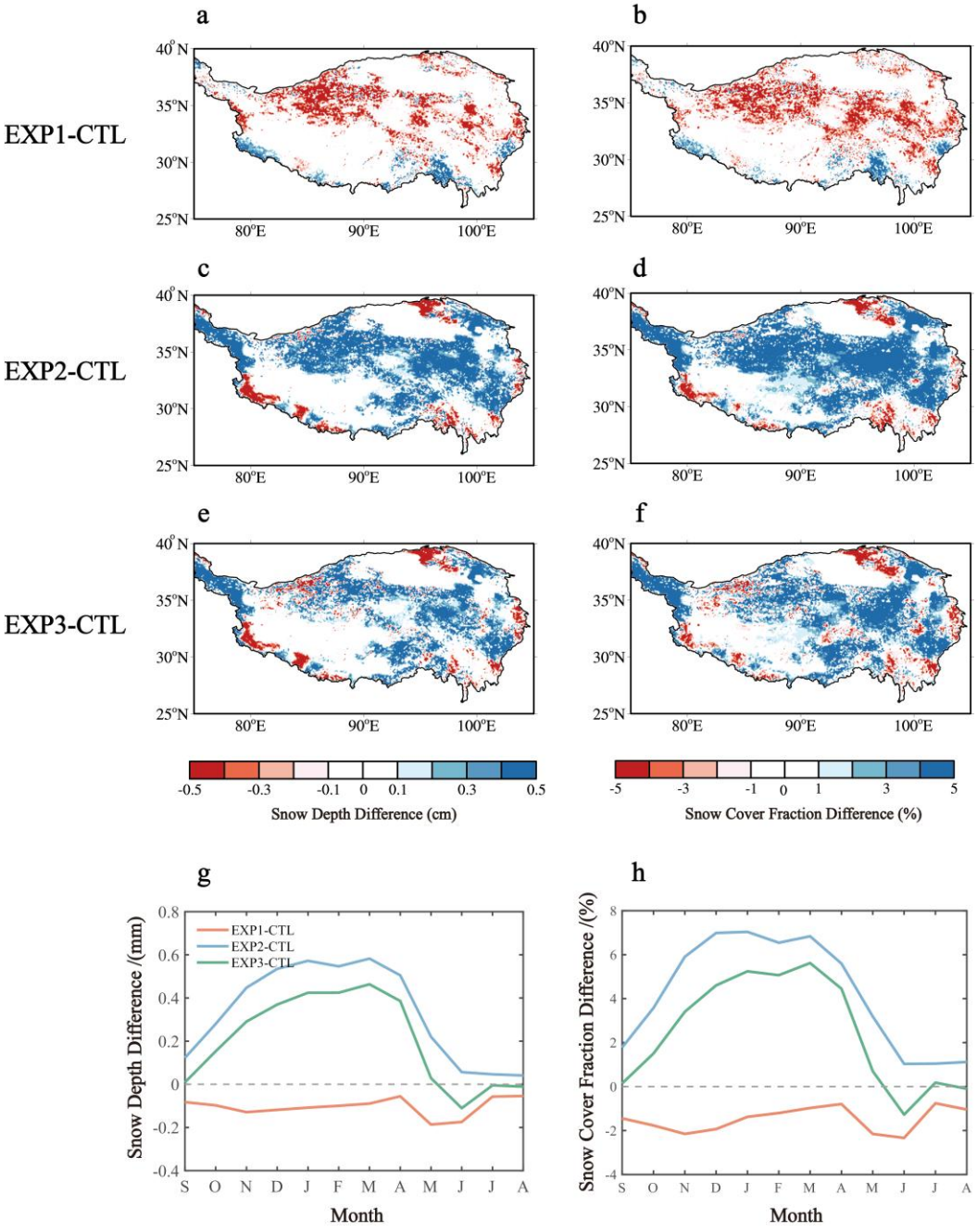


Figure S6: Snow process responses under different warming-wetting scenarios during Stage 3 (2000-2020) over the Tibetan Plateau. Spatial distributions of differences in annual mean (a, c, e) snow depth (SD) and (b, d, f) snow cover fraction (SCF) between the (a-b) warming experiment (EXP1), (c-d) wetting experiment (EXP2), (e-f) warming-wetting experiment (EXP3), and the control experiment (CTL). as well as (g-h) corresponding intra-annual circulation trends.

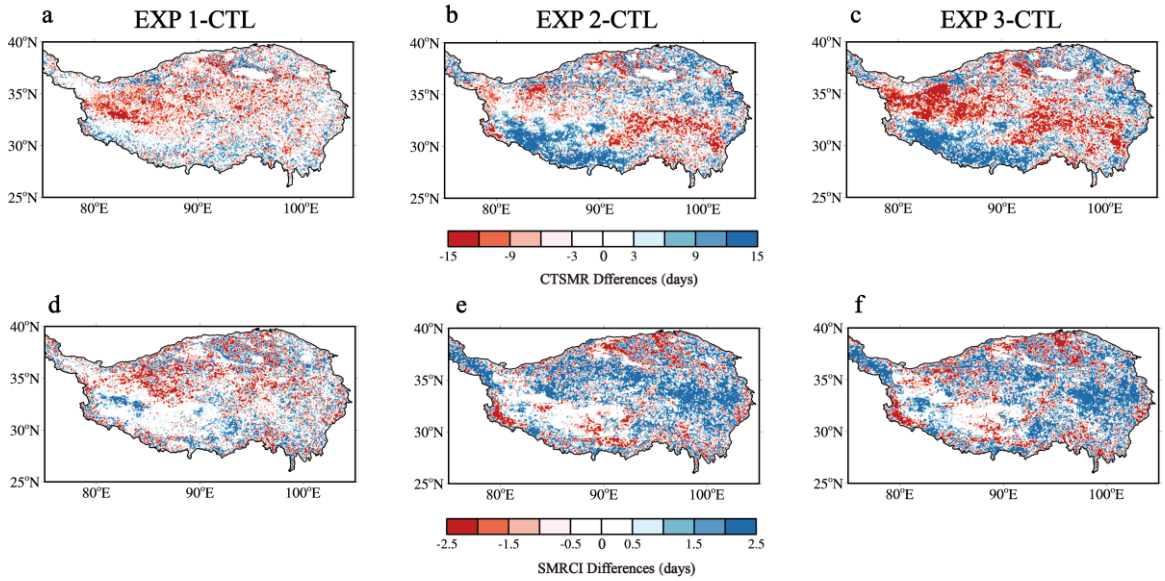


Figure S7: Seasonal variations in snowmelt runoff under different warming-wetting scenarios during Stage 3 (2000-2020) over the Tibetan Plateau. Spatial distributions of differences in annual mean (a–c) center timing of SMR (CTSMR) and (d–f) SMR concentration index (SMRCI) between the (a, d) warming experiment (EXP1), (b, e) wetting experiment (EXP2), (e, f) warming–wetting experiment (EXP3), and the control experiment (CTL).

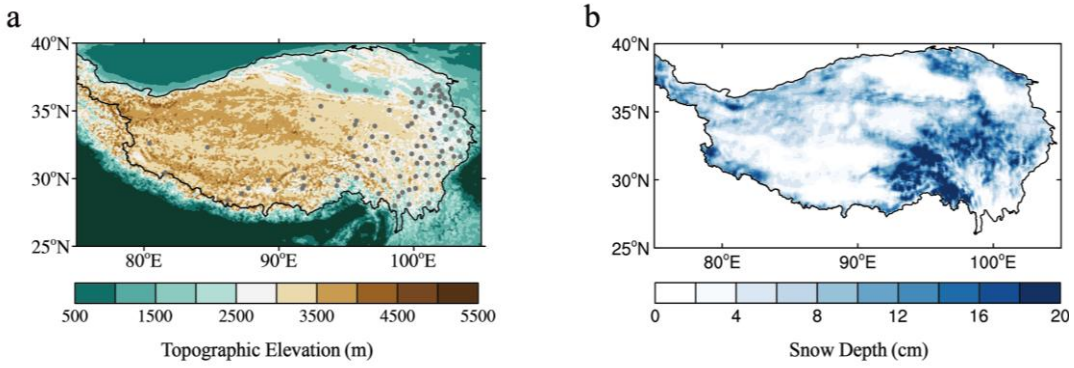


Figure S8: Topographic and snow-climate background over the Tibetan Plateau (TP). Spatial distributions of (a) elevation and (b) annual mean snow depth.

Table S1: The trends of different meteorological factors in three stages.

	Precipitation (mm/year)	Temperature (℃/year)	Snowfall (mm/year)	Snowfall Fraction (-/year)
Stage 1	-1.97	0.019	-2.605	-0.0029
Stage 2	0.37	0.034	-1.013	-0.0018
Stage 3	1.66	0.030	0.402	-0.00052