

Supplemental Material

For Alexander, M. A., J. D. Scott, K. Mahoney, J. Barsugli, 2013: Greenhouse Gas Induced Changes in Summer Precipitation over Colorado in NARCCAP Regional Climate Models. *J. Climate*.

Includes Table S1 and five figures: S1 – S5

Table S1. Pattern correlation values between the eight models and observations for the climatological mean precipitation during JJA over the Colorado region. The area-averaged precipitation is removed prior to computing the correlations. Yellow shading denotes the highest correlations between model pairs, the upper right and lower left portions of the correlation matrix are identical.

Centered Pattern Correlations for JJA Prec over CO

	CCSMrcrm	CGCM3crcm	HADCMhm3	CCSMwrfg	CGCM3wrfg	GFDLam2	GFDLrcm3	CGCM3rcm3	Livneh(OBS)
CCSMrcrm		0.95	0.45	0.71	0.65	0.66	0.75	0.73	0.66
CGCM3crcm	0.95		0.44	0.76	0.65	0.62	0.85	0.86	0.76
HADCMhm3	0.45	0.44		0.69	0.69	0.73	0.56	0.46	0.56
CCSMwrfg	0.71	0.76	0.69		0.95	0.84	0.82	0.78	0.78
CGCM3wrfg	0.65	0.65	0.69	0.95		0.86	0.68	0.63	0.62
GFDLam2	0.66	0.62	0.73	0.84	0.86		0.65	0.54	0.61
GFDLrcm3	0.75	0.85	0.56	0.82	0.68	0.65		0.98	0.87
CGCM3rcm3	0.73	0.86	0.46	0.78	0.63	0.54	0.98		0.85
Livneh(OBS)	0.66	0.76	0.56	0.78	0.62	0.61	0.87	0.85	

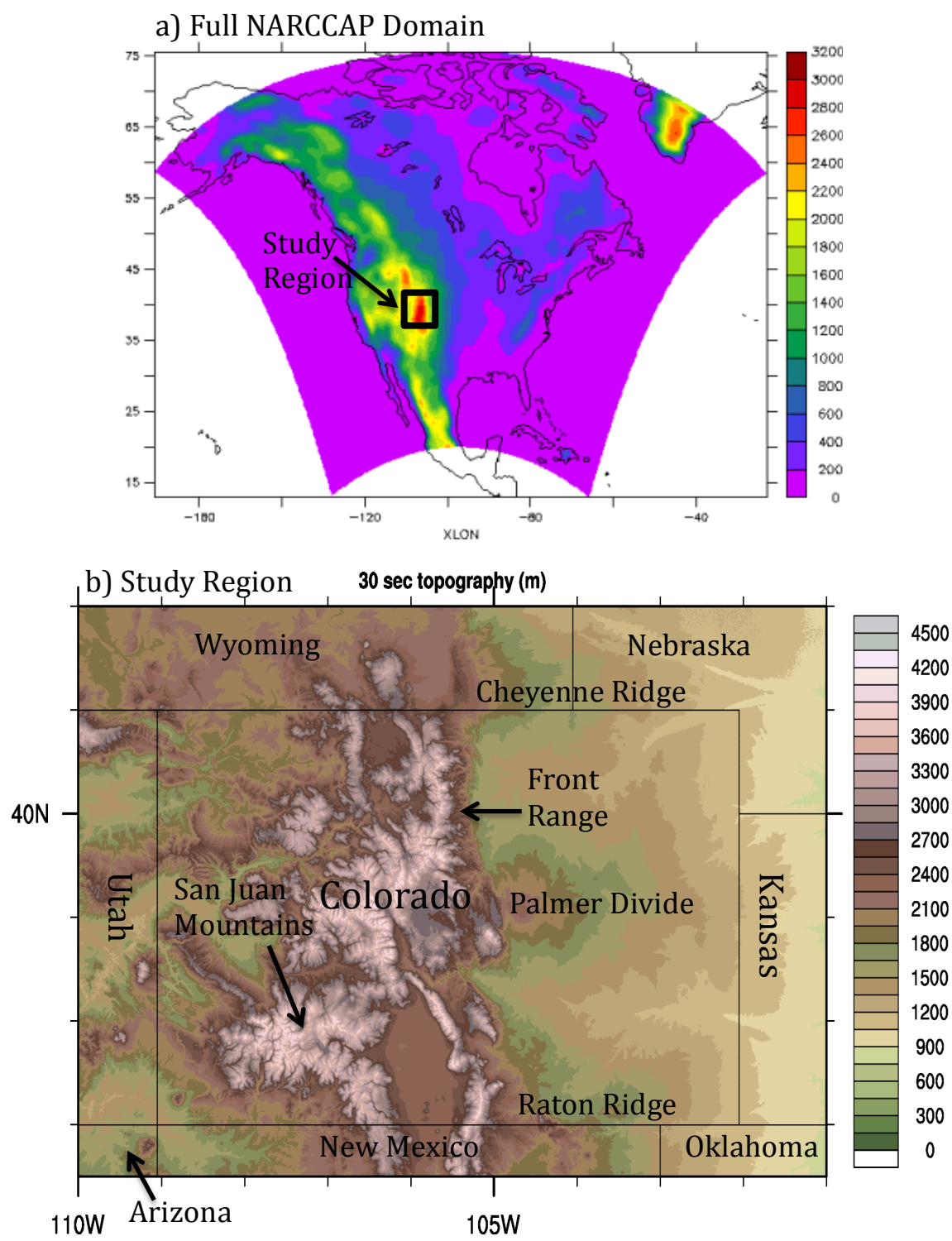


Fig. S1: Topography in a) Full NARCCAP Domain and b) Study region. Region of study: state of Colorado, USA and the border areas of the surrounding states. Note: resolution of the models is much coarser than as shown in b).

JJA Precip averaged over Colorado

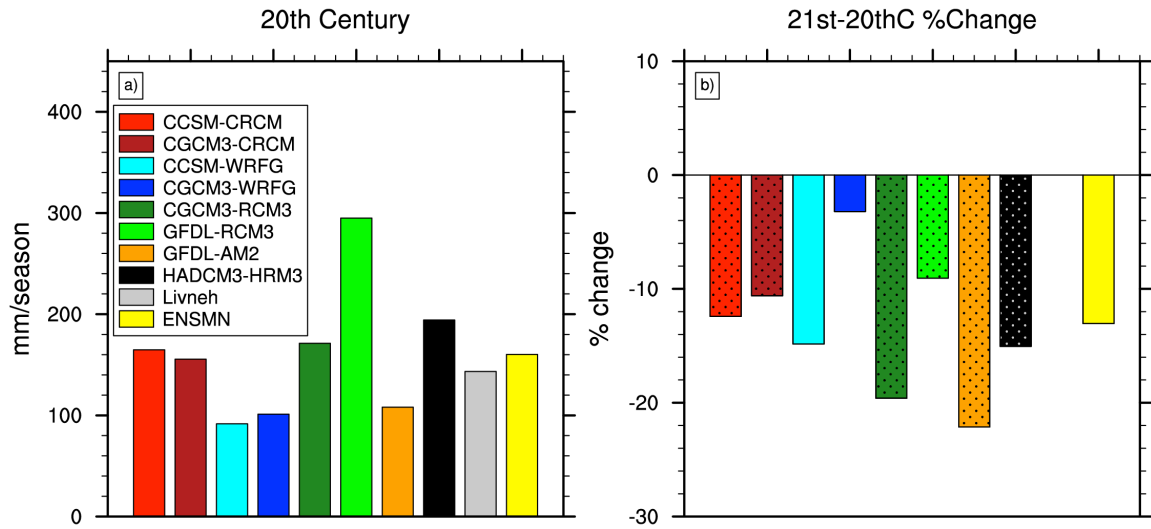


Fig. S2. As in Fig. 2, but with the 21st-20th century precipitation shown as a percentage change. Precipitation (mm) averaged over Colorado and the border areas of the surrounding states for a) 20th century (1969-2000) and b) 21st (2041-2070) minus the 20th century percentage change in precipitation for the 8 NARCCAP simulations and their ensemble mean (ENSM). The observed value for (1969-2000) from the Livneh data set is also shown in (a), while the 21st-20th century values that are significant at the 95% level as determined by Monte Carlo method based on 1000 resamples are stippled in (b).

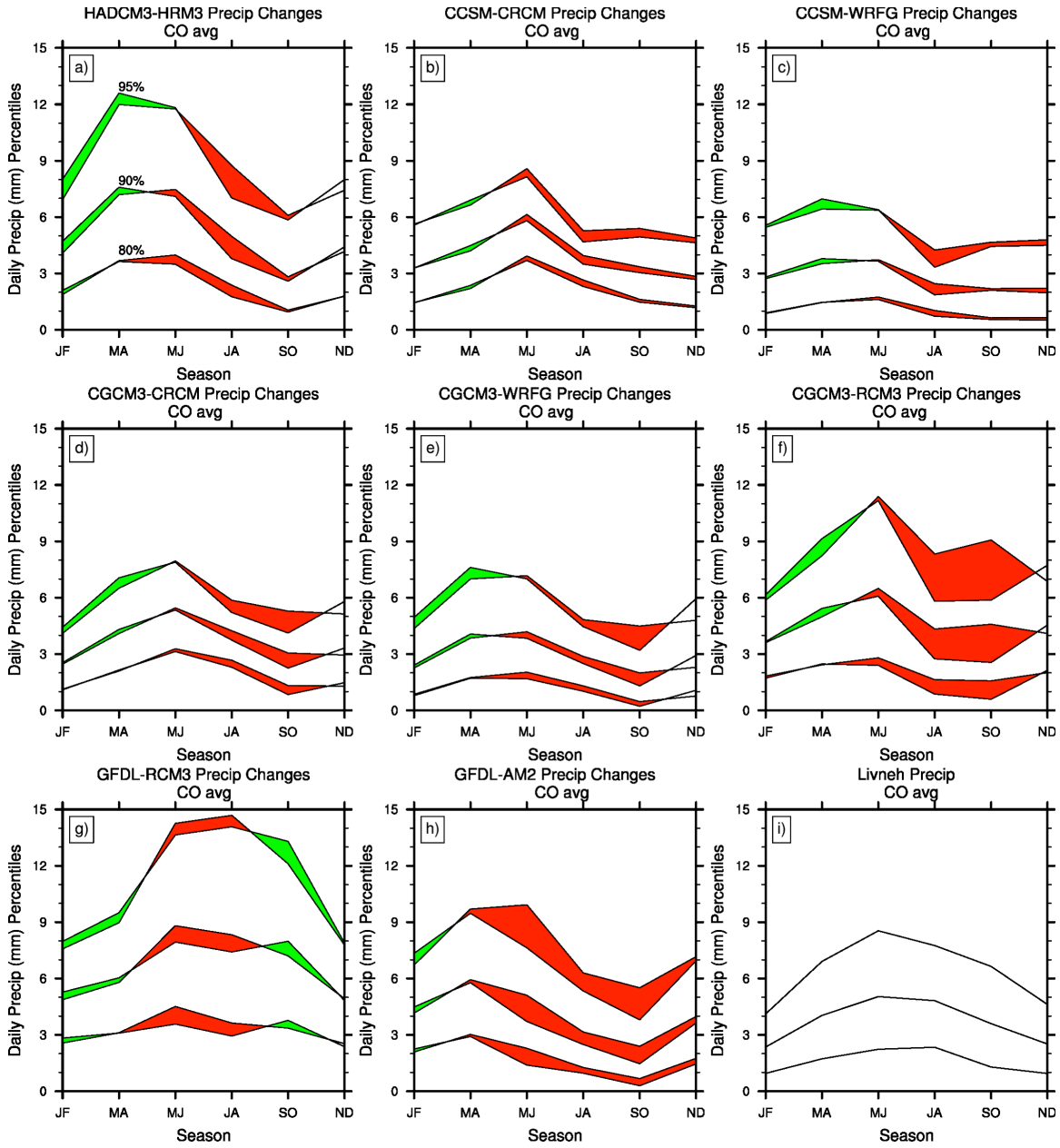


Fig. S3. Bi-monthly precipitation amounts (mm d^{-1}) from (a-h) NARCCAP simulations over Colorado for the 20th and 21st century where the difference between them is shaded: green if the 21st > 20th century (wetter future) and red if the 20th > 21st century (drier future). Precipitation amounts are shown for the 80, 90, and 95 percentiles. (i) Corresponding values from the Livneh data set in the 20th century.

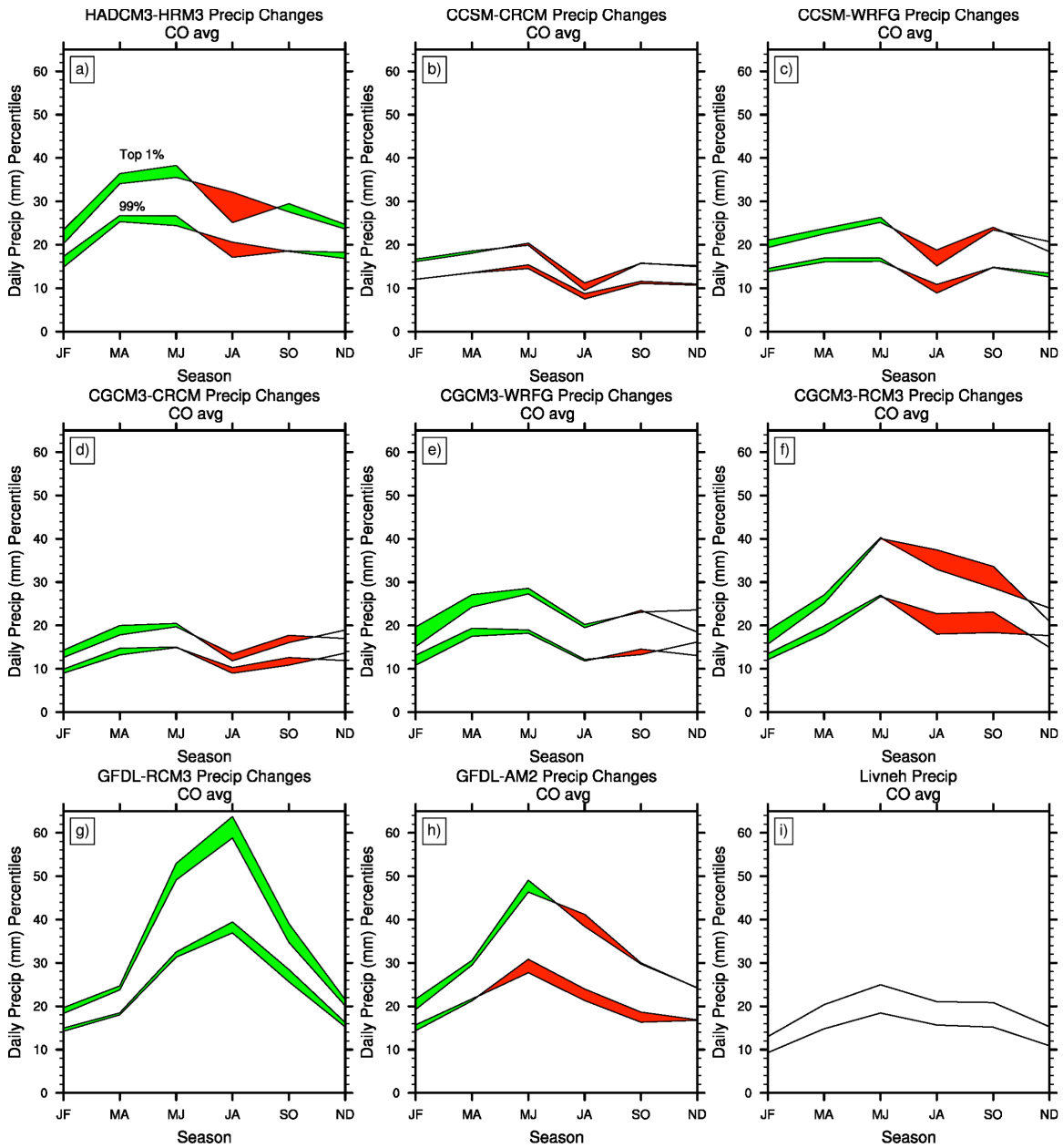
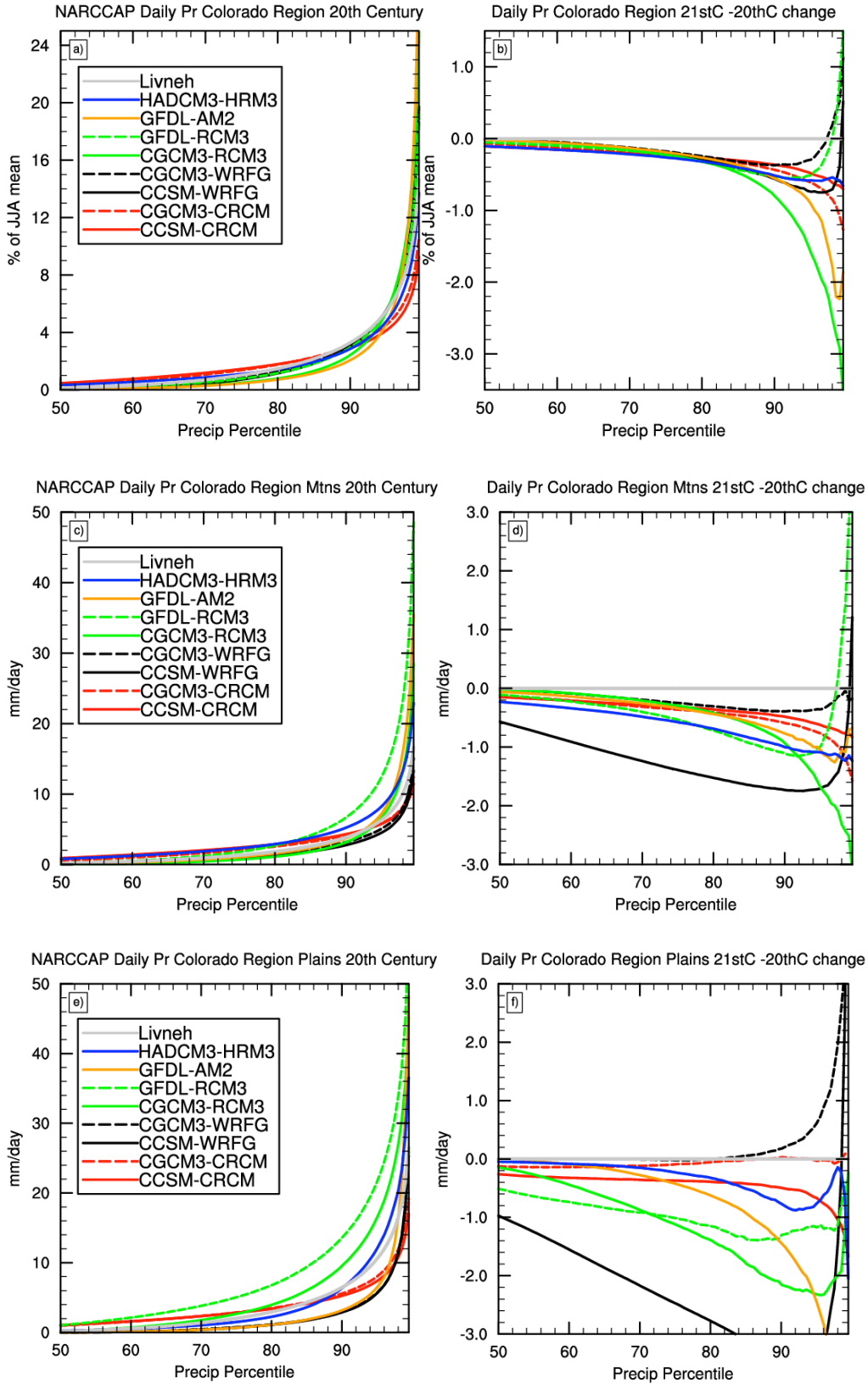


Fig. S4. As in Fig. S3 but the precipitation amounts are shown for the 99 percentile and the average of the top 1% (30 cases).



As in Fig. 5 (see full caption below).

Fig. S5. The domain average of the daily precipitation amount in each grid square shown as a function of the percentile (%) during JJA for the NARCCAP simulations and the Livneh data during the 20th century period in the left column and NARCCAP 21st – 20 century simulations in the right column. a) and b) are for the grid values normalized by the mean JJA precipitation and presented as a ratio of the mean; c) & d) are for the grid squares in the wetesrn portion of our domain including the mountains and Front Range and e) and f) are for the plains region located in the northeast corner of our domain. The two subdomains used here included grid squares within the “Southern Rockies” and “Central Plains” regions, respectively, as defined by Bukovsky (<http://www.narccap.ucar.edu/contrib/bukovsky/>).