Figure Captions

Figure 7. *Relationship between MSSTG and Niño3 rainfall for (a) observations (b) piControl (c) 4×CO$_2$, and (d) G1. A solid black horizontal line indicates a threshold value of 5 mm day^{-1}. See text for the definition of extreme, moderate, and total El Niño events. A single (double) asterisk indicates that the change in frequency, relative to piControl, is statistically significant at 99 % (95 %) cl. Numbers with a ± symbol indicate s.d. calculated with 10,000 bootstrap realizations. Following Cai et al. (2014), a non-ENSO related trend has been removed from the rainfall time series.*

Figure 15. *BJ feedback (µ; 10^{-2} Nm^{-2}/^{o}C) for (a) piControl (b) 4×CO$_2$, and (c) G1. The value with ± sign indicates s.d. of µ after 10,000 bootstrap realizations. An asterisk indicates statistical significance at 99 % cl. Mean change in ocean temperature, (d) 4×CO$_2$-piControl, and (e) G1-piControl. The black box shows the area averaging region for upper ocean temperature, and the black line shows the lower layer used for calculation of stratification as a difference of upper and lower layer. Stipples indicate grid points with statistical significance at 99 % cl using a non-parametric Wilcoxon rank-sum test.*

Figure S1. *ENSO diversity and nonlinear relationship between PCs. First monthly principal pattern, EOF1, for (a) ERA5 and (b, c) piControl. Second monthly principal pattern, EOF2, for (d) ERA5 and (e, f) piControl. DJF EP pattern for (g) ERA5 and (h, i) piControl. DJF CP pattern for (j) ERA5 and (k, l) piControl. The nonlinear relationship between PC1 and PC2 for (m) ERA5 and (n, o) piControl. The blue box indicates the Niño3 (Niño4) region in a-c, and g-I (d-f and j-l). The left and the middle panel shows EOF analysis over the 41 years of ER5 (1979-2019) and piControl. The right panel shows EOF analysis over 990-year of piControl.*

Figure S3. *Histogram of MSSTG for piControl, 4×CO$_2$, and G1 for all samples (a) and for extreme El Niño events. The values are plotted at the centre of each bin with an interval of 0.5 ^{o}C. Blue, red, and green vertical lines indicate climatological mean values of MSSTG under piControl (1.38 ^{o}C), 4×CO$_2$ (-0.15 ^{o}C), and G1 (1.25 ^{o}C), respectively. H = 1 indicates that the shift in the mean is statistically significant at 99 % cl using a non-parametric Wilcoxon rank-sum test.*

Figure S5. *Relationship between MSSTG and quadratically detrended Niño3 rainfall for (a) observations (b) piControl (c) 4×CO$_2$, and (d) G1. The solid black horizontal line indicates a threshold of 5 mm day^{-1}. A single (double) asterisk indicates that the change in frequency, relative to piControl, is statistically significant at 99 % (95 %) cl. Numbers with a ± symbol indicate s.d. calculated with 10,000 bootstrap realizations. Following Cai et al. (2014), a non-ENSO related trend has been removed from the rainfall time series. Events are classified as: Extreme (Niño3 rainfall > 5 mm day^{-1} and MSSTG < 0), moderate (Niño3 rainfall > 5 mm day^{-1} and MSSTG > 0), weak (Standardized Niño3 SSTs > 0.5 ^{o}C and Niño3 rainfall < 5 mm day^{-1}), total is sum of extreme, moderate, and weak events.*

Figure S6. *Relationship between MSSTG and linearly detrended Niño3 rainfall for (a) observations (b) piControl (c) 4×CO$_2$, and (d) G1. The solid black horizontal line indicates a threshold of 5 mm day^{-1}. A single (double) asterisk indicates that the change in frequency, relative to piControl, is statistically significant at 99 % (95 %) cl. Numbers with a ± symbol indicate s.d. calculated with 10,000 bootstrap realizations. Following Cai et al. (2014), a non-ENSO related trend has been removed from the rainfall time series. Events are classified as: Extreme (Niño3 rainfall > 5 mm day^{-1} and MSSTG < 0), moderate (Niño3 rainfall > 5 mm day^{-1} and MSSTG > 0), weak (Standardized Niño3 SSTs > 0.5 ^{o}C and Niño3 rainfall < 5 mm day^{-1}), total is sum of extreme, moderate, and weak events.*

Figure S8. *Histogram of Niño3 rainfall for piControl, 4×CO$_2$, and G1. The values are plotted at the centre of each bin with an interval of 1 mm day^{-1}. Blue, red, and green vertical lines indicate climatological mean values of Niño3 rainfall under piControl (2.9 mm day^{-1}), 4×CO$_2$ (9.8 mm day^{-1}), and G1 (3.2 mm day^{-1}), respectively. H = 1 indicates that the shift in the mean is statistically significant at 99 (95) % cl for 4×CO$_2$ (G1) using the non-parametric Wilcoxon rank-sum test. The grey vertical line show threshold of 5 mm day^{-1}.*

Figure S9. *Histogram of ZSSTG anomalies for (a) all samples, (b) extreme El Niño events only, and (c) extreme La Niña events only. The values are plotted at the centre of each bin with an interval of 0.5 ^{o}C. In a blue, red, and green solid vertical lines indicate climatological median ZSSTG under piControl (0.07 ^{o}C), 4×CO$_2$ (-1.54 ^{o}C), and G1 (-0.28 ^{o}C), respectively, for all samples. In b, blue, red, and green dashed vertical lines indicate climatological median ZSSTG under piControl (-1.83 ^{o}C), 4×CO$_2$ (-1.71 ^{o}C), and G1 (-1.96 ^{o}C), respectively, for extreme El Niño events. In c, blue, and green dashed vertical lines indicate climatological median ZSSTG under piControl (1.37 ^{o}C) and G1 (1.52 ^{o}C), respectively, for extreme La Niña events. H = 1 indicates that using a non-parametric Wilcoxon rank-sum test, the shift in the median is statistically significant at 99 (95) % cl in a (b). H = 0 means that the shift in the median is not statistically significant. The ZSSTG is defined as the difference between SST in the Maritime continent (5° N-5° S; 100° E-126° E) and eastern equatorial Pacific (Niño3 region: 5° N-5° S, 150° W-90°W). The anomalies are calculated relative to piControl.*

Figure S10. *Histogram of ZSSTG anomalies for (a) all samples and (b) extreme La Niña events only. The values are plotted at the centre of each bin with an interval of 0.5 ^{o}C. Blue, red, and solid green lines indicate climatological median ZSSTG under piControl (-0.14 ^{o}C), 4×CO$_2$ (-1.37 ^{o}C), and G1 (-0.40 ^{o}C), respectively, for all samples. Blue, red, and green dash-dotted lines indicate climatological median ZSSTG under piControl (0.84 ^{o}C), 4×CO$_2$ (-0.03 ^{o}C), and G1 (0.72 ^{o}C), respectively, for all La Niña events. In b, blue, red, and green dashed lines indicate climatological median ZSSTG under piControl (1.52 ^{o}C) and G1 (3.35 ^{o}C), respectively, for extreme La Niña events. H = 1 indicates that the shift in the median is statistically significant at 99 % cl using the non-parametric Wilcoxon rank-sum test. The ZSSTG is defined as the difference between SST in the Maritime continent (5° N-5° S; 100° E-126° E) and central equatorial Pacific (Niño4 region: 5° N-5° S, 160° E-150° W) (Cai et al., 2015). The anomalies are calculated relative to piControl.*