

Supporting Information for "Mesoscale convective systems modulated by convectively coupled equatorial waves"

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Contents of this file

1. Figures S1 to S7

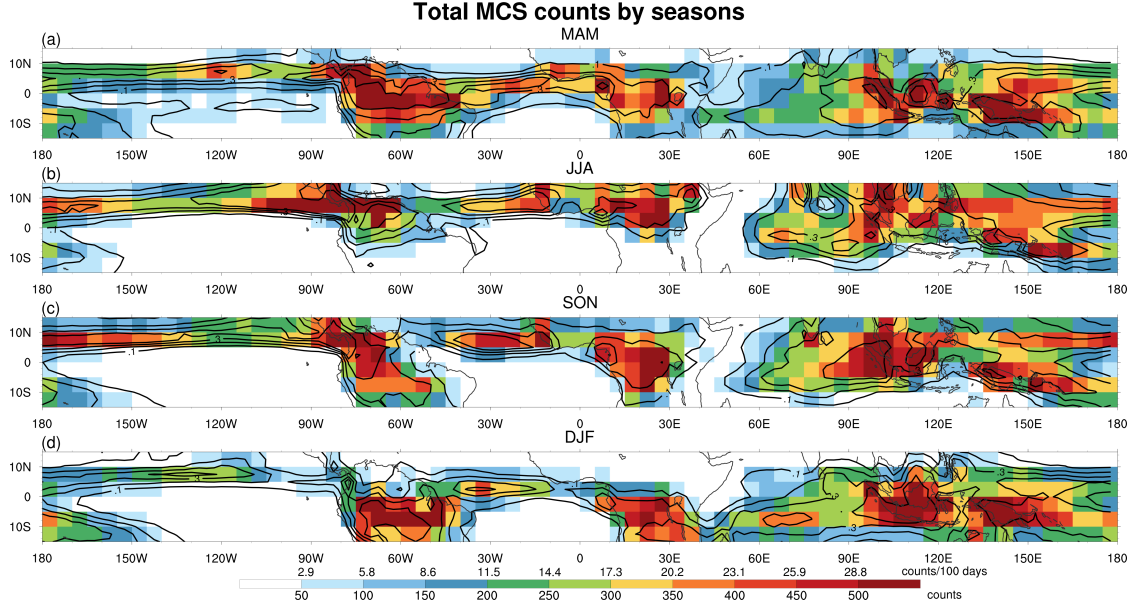


Figure S1. As in Fig. 1a, MCS counts binned in $5^\circ \times 5^\circ$ grid boxes from 2001 to 2019 but for four seasons: (a) MAM, (b) JJA, (c) SON, and (d) DJF. Each MCS is binned by its average lifetime location. Mean seasonal precipitation is contoured at 0.1 mm hr^{-1} .

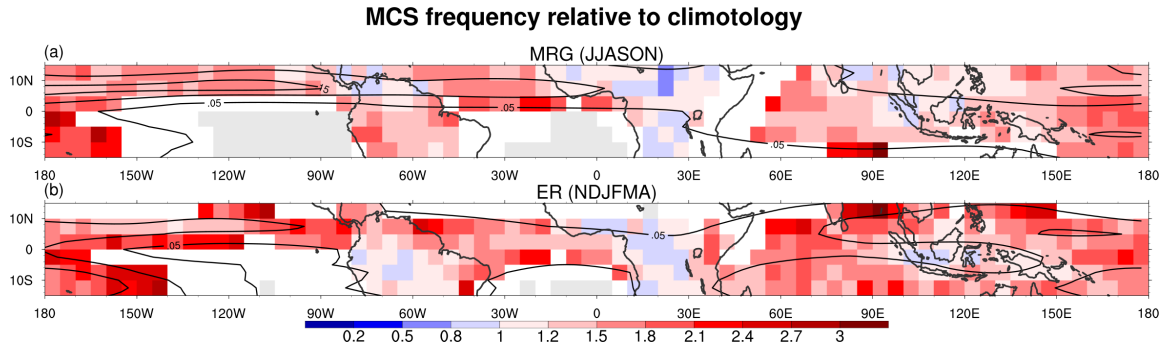


Figure S2. As in Fig. 1b-1d, frequency ratio (R_{freq} , colors) of MCS occurrence relative to climatology when the calculation is conditioned on (a) mixed Rossby gravity waves (MRGs) in JJASON, and (b) equatorial Rossby waves (ERs) in NDJFMA. The mean standard deviation of wave-filtered rainfall in the respective months is contoured every 0.05 mm hr^{-1} with zero lines omitted.

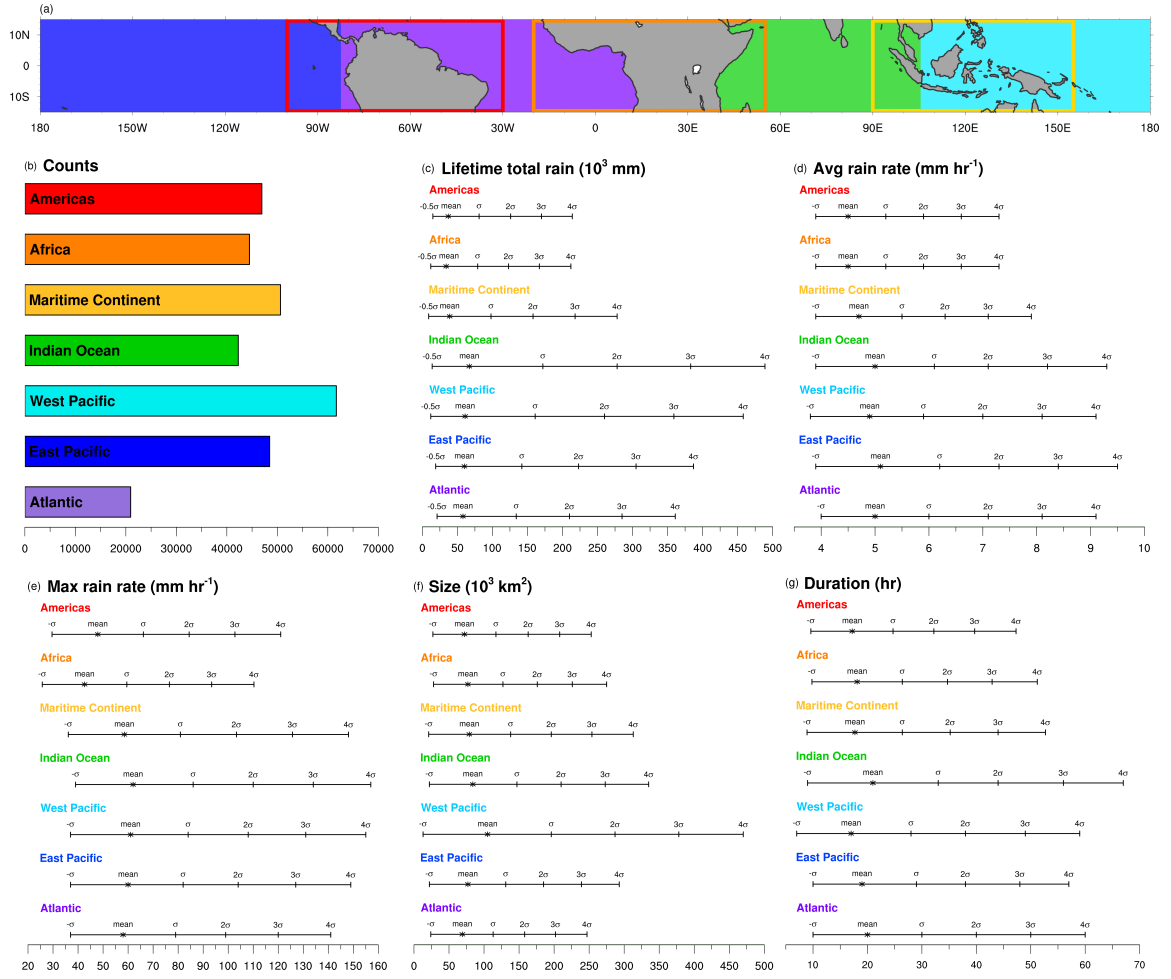


Figure S3. (a) Delineated regions for (b) total MCS counts and (c)–(g) physical quantities of MCS characteristics corresponding to the Z-scores. In (a), boxes denote land regions where all quantities are calculated only over land: the Americas (red), Africa (orange), and Maritime Continent (yellow). Shaded areas show oceanic regions where all values are calculated only over the ocean: Indian Ocean (green), West Pacific (cyan), East Pacific (blue), and Atlantic (purple). In (b), MCS counts are calculated in each region during 2001–2019. In (c)–(g), distributions of physical values are shown in terms of the mean (*) and standard deviation (σ). Lifetime total rain has a unit of 10^3 mm, average rain rate mm hr^{-1} , maximum rain rate mm hr^{-1} , duration hr, and size 10^3 km^2 .

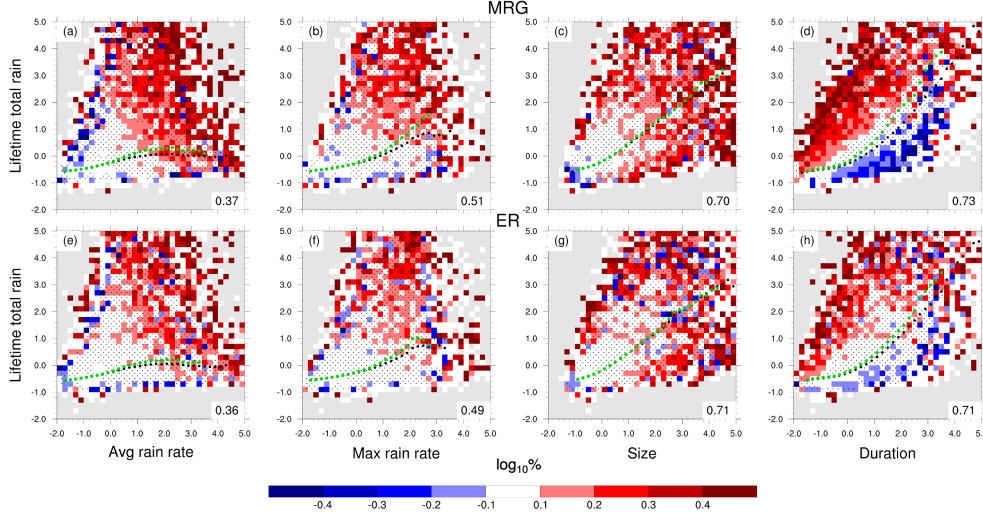


Figure S4. As in the bottom 3 rows of Fig. 2, change of pdfs from all-MCS ones when MCSs are conditioned on (a–d) MRGs, and (e–h) ERs. The first column shows pdfs for average rain rate vs. lifetime total rain; the second maximum rain rate vs. lifetime total rain; the third size vs. lifetime total rain; the fourth duration vs. lifetime total rain. Colors show the \log_{10} percentage change from all-MCS pdfs. Numbers on the lower-right corner of each panel denote the correlation coefficient between the two variables for MCS conditioned on CCEWs. Black dots denote the median of lifetime total rain binned by the four characteristics in the x-axis for all MCSs and green dots mark the same median but for CCEW-conditioned MCSs. Stippling shows signals that are statistically *not* significant from the all-MCS pdf at the 95% interval estimated using 1000 times random sampling. Gray shading indicates bins with zero MCS occurrence.

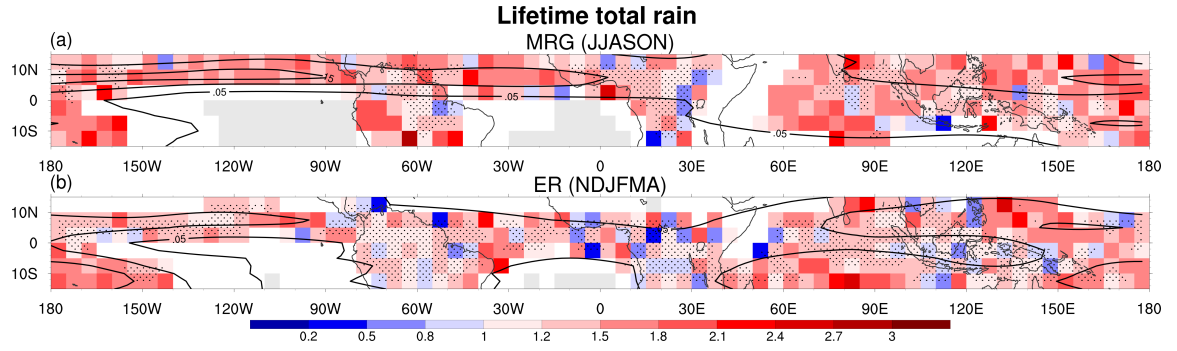


Figure S5. As in Fig. 3a–b, risk ratio (R_{risk}) for extremely high lifetime total rain but for (a) MRGs, and (b) ERs. Mean standard deviation of wave-filtered rainfall in the respective 6 months is contoured every 0.05 mm hr⁻¹. Stippling marks statistically *not* significant regions at the 95% interval estimated using 1000 times random sampling. Grid boxes accumulating less than 100 counts of MCSs over the respective 6 months during 2001–2019 are plotted white and those with no MCS occurrence gray.

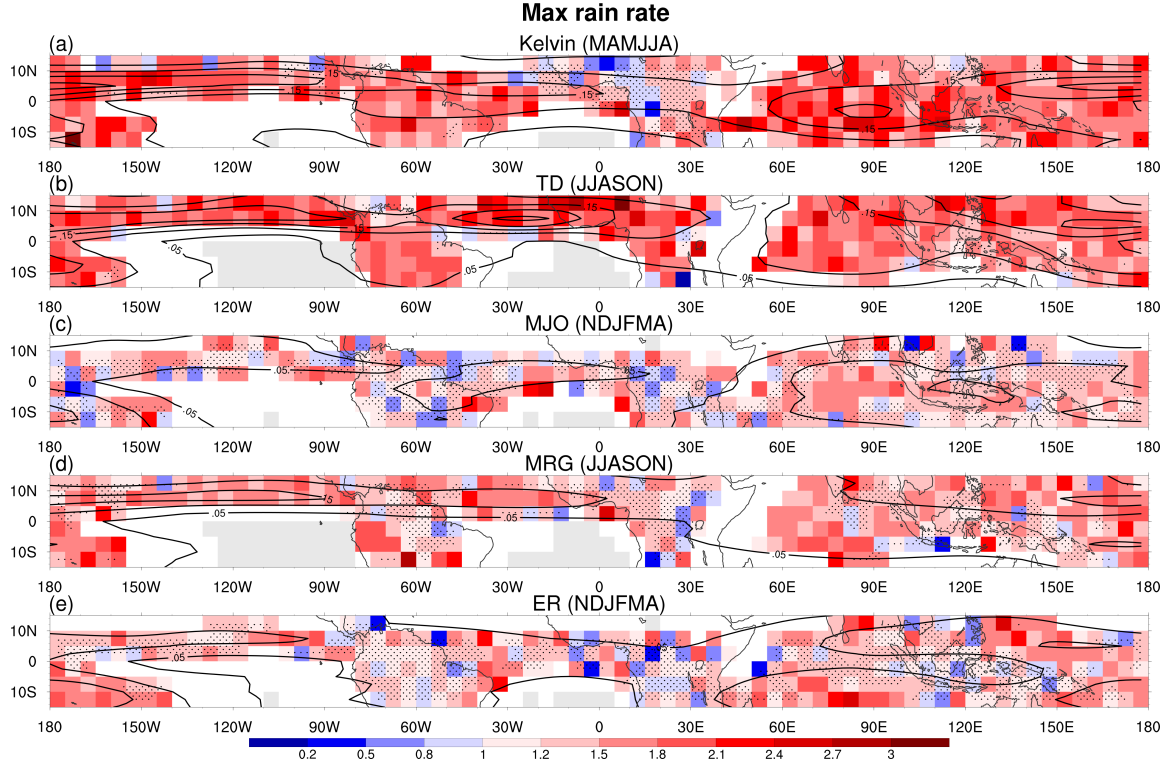


Figure S6. As in Fig. 3a–b, but risk ratio (R_{risk}) for extreme maximum rain rate for (a) Kelvin waves, (b) TDs, (c) the MJO, (d) MRGs, and (e) ERs. Mean standard deviation of wave-filtered rainfall in the respective 6 months is contoured every 0.05 mm hr⁻¹. Stippling marks statistically *not* significant regions at the 95% interval estimated using 1000 times random sampling. Grid boxes accumulating less than 100 counts of MCSs over the respective 6 months in 2001–2019 are shaded white and those with no MCS occurrence gray.

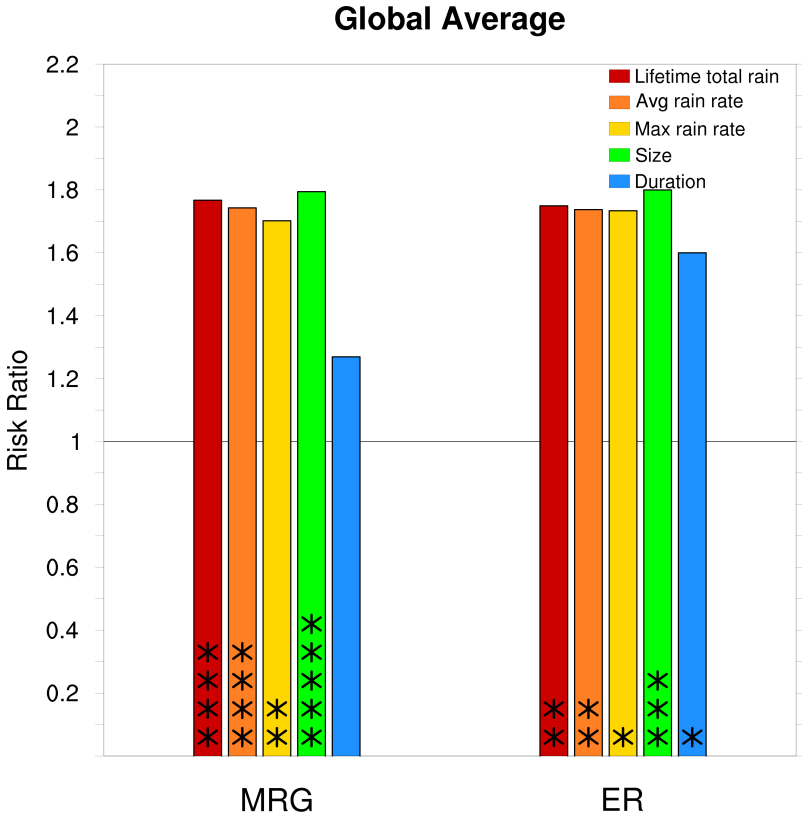


Figure S7. As in Fig. 3d, but global average R_{risk} for MRGs and ERs over the tropics where the risk ratio is statistically significant at the 95% interval. Asterisks indicate how prevalent statistically significant signals are. Each asterisk represents 10% of the grid boxes in the global tropics. The legend shows different flavors of extreme MCSs in various colors.