Supplementary information:

Impact of Land Use Changes and Global Warming on Extreme Precipitation Patterns in the Maritime Continent

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Supplementary information: contains 5 Figures.

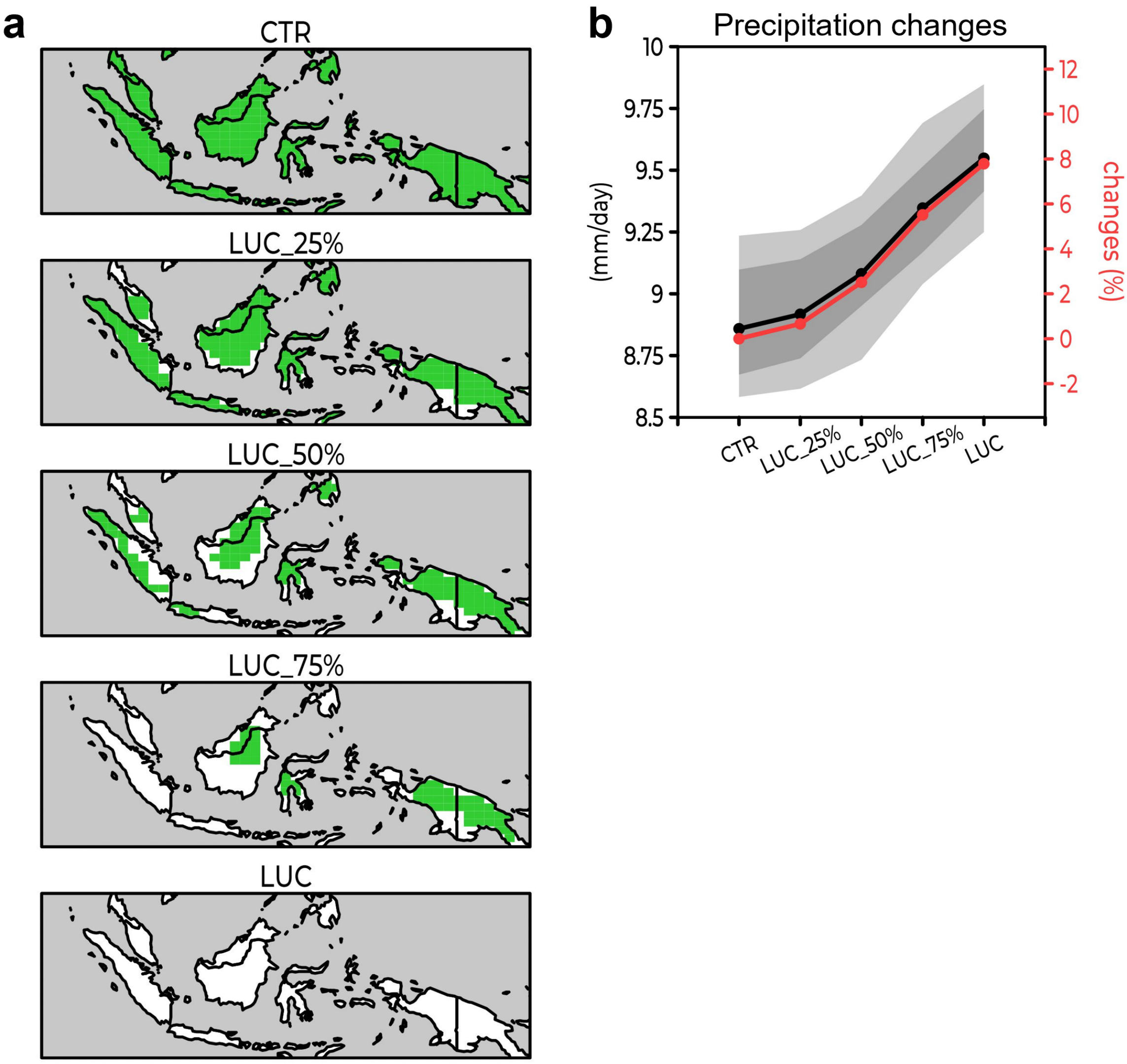

Fig. S1: Sensitivity for precipitation in land use changes (LUC) scenarios. (a) The sensitivity analysis for the 55-year land use changes experiment includes one control run (CTR) and deforestation simulations for areas covering 25% (LUC_25%), 50% (LUC_50%), 75% (LUC_75%), and 100% (LUC). (b) The monthly mean precipitation changes (black line) in the Maritime Continent, area-averaged over 55 years, are depicted. The red line indicates the percentage changes in monthly mean precipitation. The shallow gray shading indicates the 90th and 10th percentiles, while gray shading represents the 75th and 25th percentiles.

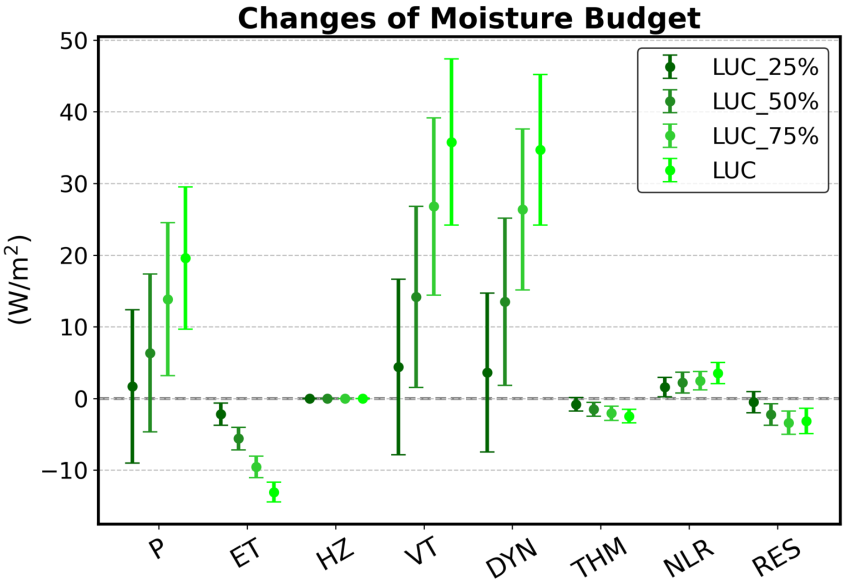

Fig. S2: Diagnosing all components of moisture budget under land use changes (LUC) scenarios. The area-averaged daily-scale changes in the moisture budget across the Maritime Continent from deforestation simulations at four levels: 25% (LUC_25%), 50% (LUC_50%), 75% (LUC_75%), and 100% deforestation (LUC), compared to the control run. Analyzed components include precipitation (P), latent heat flux (ET), horizontal moisture advection (HZ), vertical moisture advection (VT), dynamic component (DYN), thermodynamic component (THM), nonlinear processes (NLR), and residual terms (RES). The error bar means the one standard deviation between the simulated years.

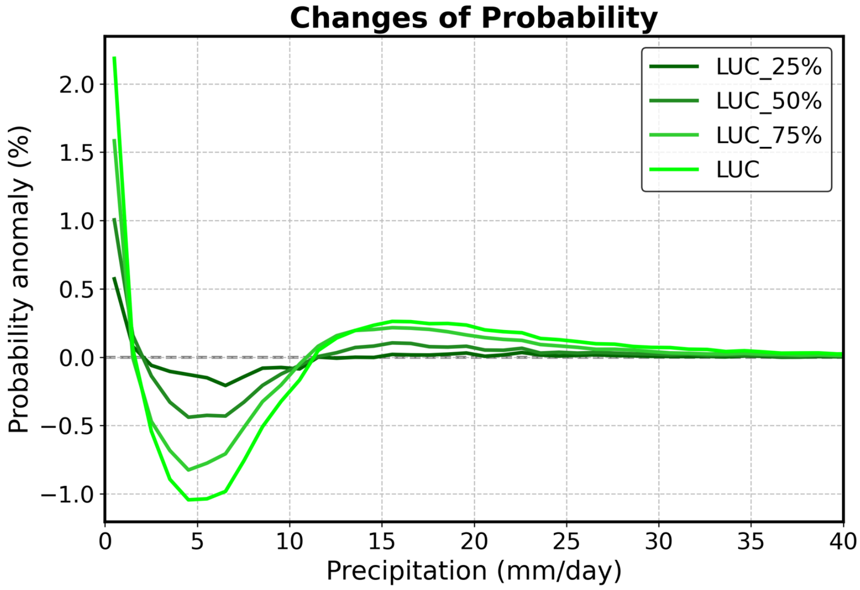

Fig. S3: Land use changes (LUC) result in extreme precipitation changes. The alterations in the probability distributions of precipitation under various deforestation scenarios 25% (LUC_25%), 50% (LUC_50%), 75% (LUC_75%), and 100% (LUC) forest loss are presented as relative probabilities in comparison to the control run.

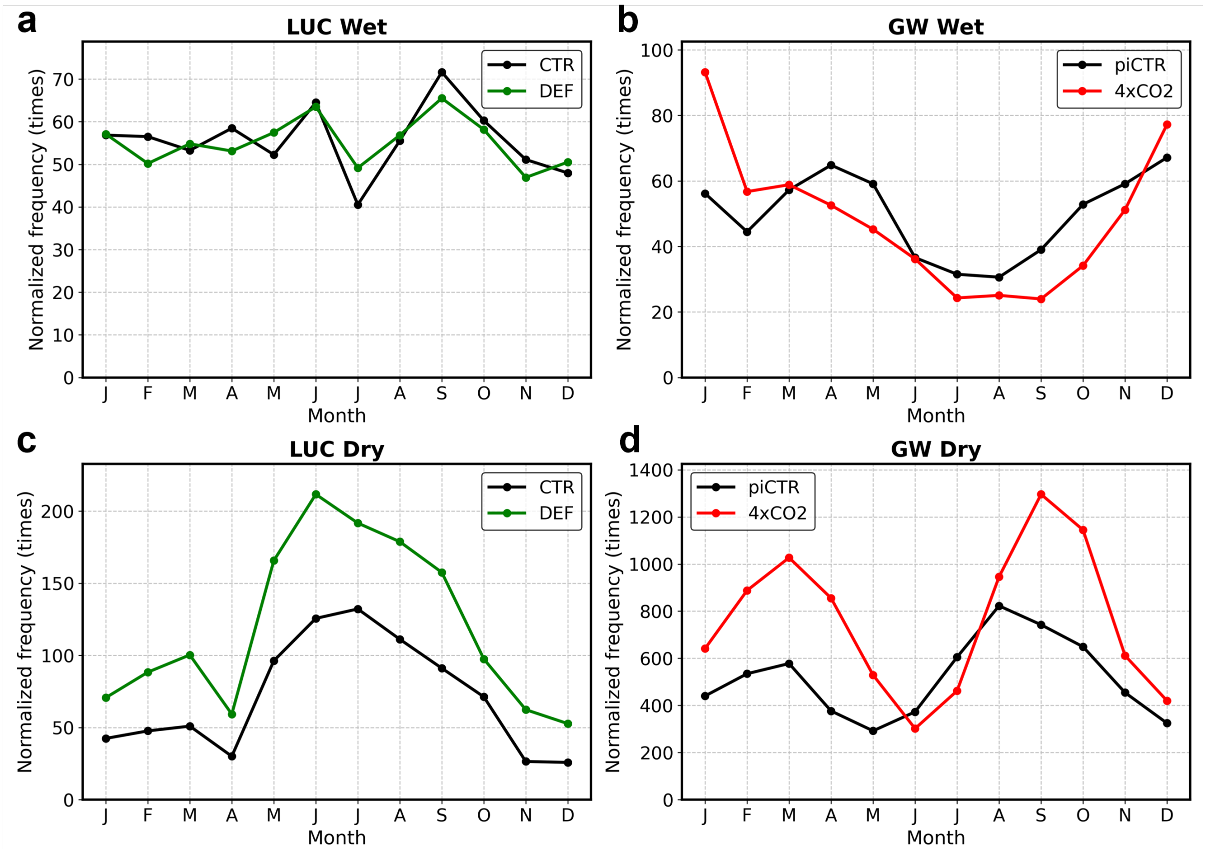

Fig. S4: The frequency of wet and dry events by month under land use changes (LUC) and global warming (GW) scenarios. (a) and (b) depict the frequency of wet events (exceeding the 99th percentile of precipitation intensity) for each month, while (c) and (d) show the frequency of dry events (0-0.1 mm/day). Panels (a) and (c) correspond to land use changes (LUC), and panels (b) and (d) relate to global warming (GW) scenarios, all focusing on the Maritime Continent. Each panel presents data from experimental (DEF and 4×CO2) and control runs (CTR and piCTR), with all calculations normalized to the average number of events per month over all years.

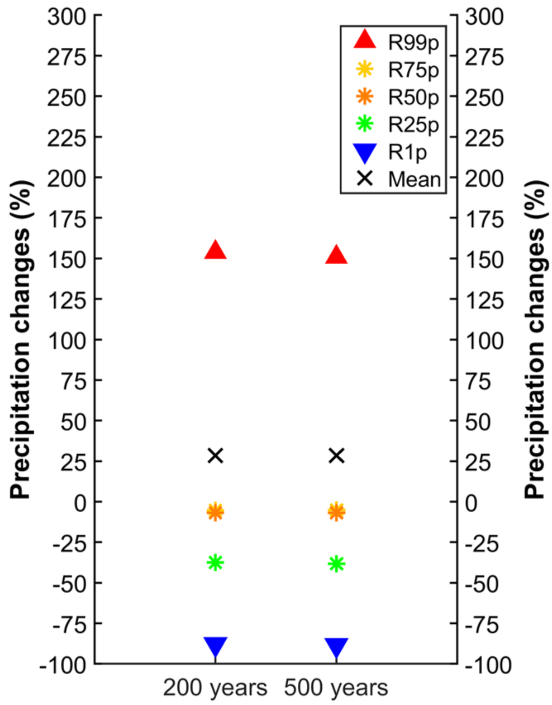

Fig. S5: Comparison of precipitation changes between the 200 years and 500 years' periods in the global warming scenario. The precipitation changes in global warming simulation, relative to the preindustrial control run, were examined for both the last available 200 years and the last available 500 years. Similarities in percentile changes between the two periods were observed, suggesting that the results are insensitive to the length of the period. Therefore, for our analysis in this study, we utilized the last available 200 years.