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Supplement of

Future changes in the mean and variability of extreme rainfall indices over the Guinea coast and role of the Atlantic equatorial mode

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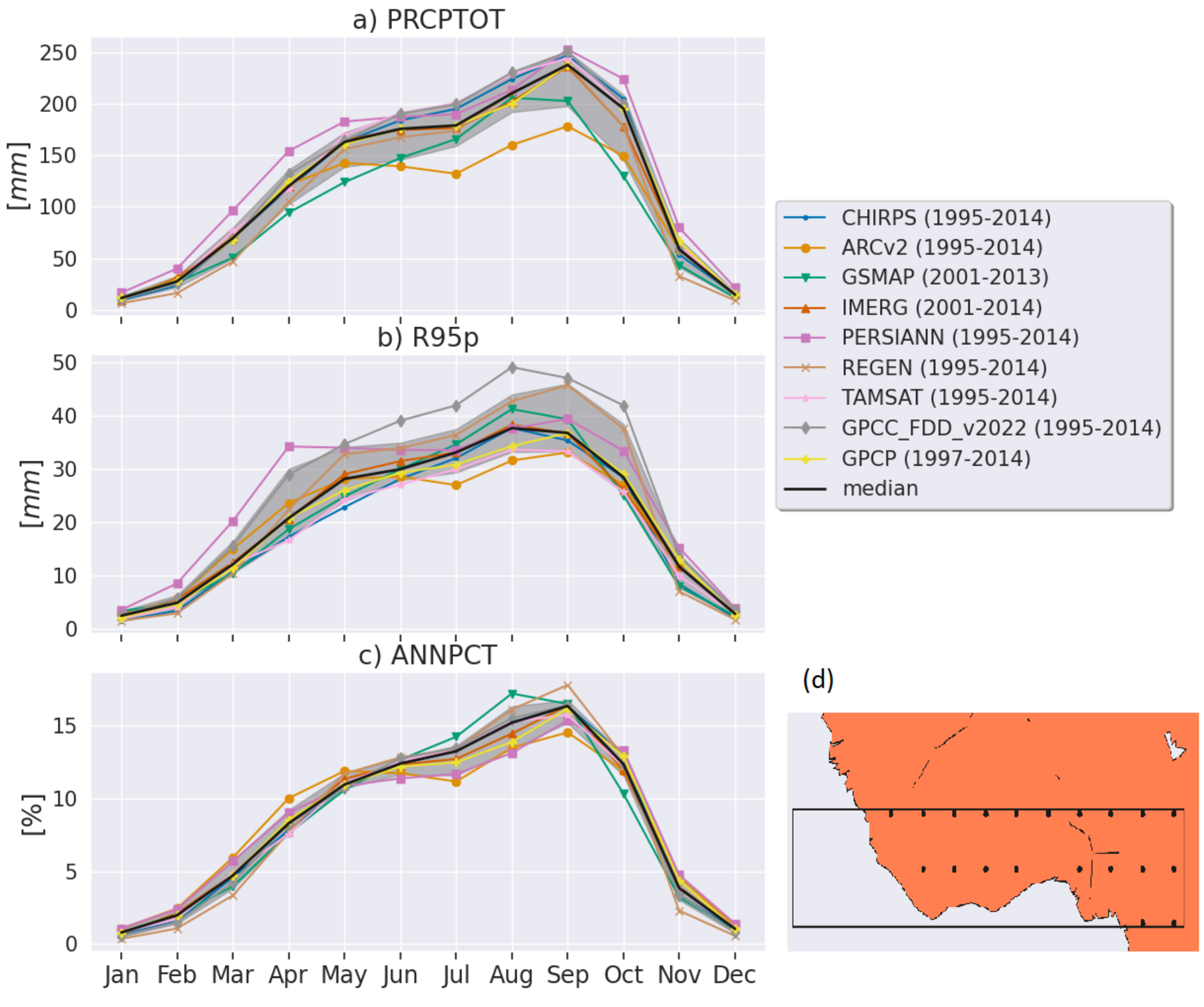

Figure S1. Annual cycle of the (a) total wet day precipitation (PRCPTOT), (b) very wet days precipitation (sum of the daily rainfall over days when the rainfall exceeds the 95th percentile), and (c) contribution of the total monthly rainfall to the total annual rainfall, for nine different observational datasets. The period considered for each dataset is displayed in the legend. The ensemble median of the nine observations is indicated by the black curve. The grey shading shows the 10th to 90th percentile range of the observations. (d) West-Africa region, showing 20 grid points selected to compute the area-average of the three indices over Guinea Coast region (black rectangle).

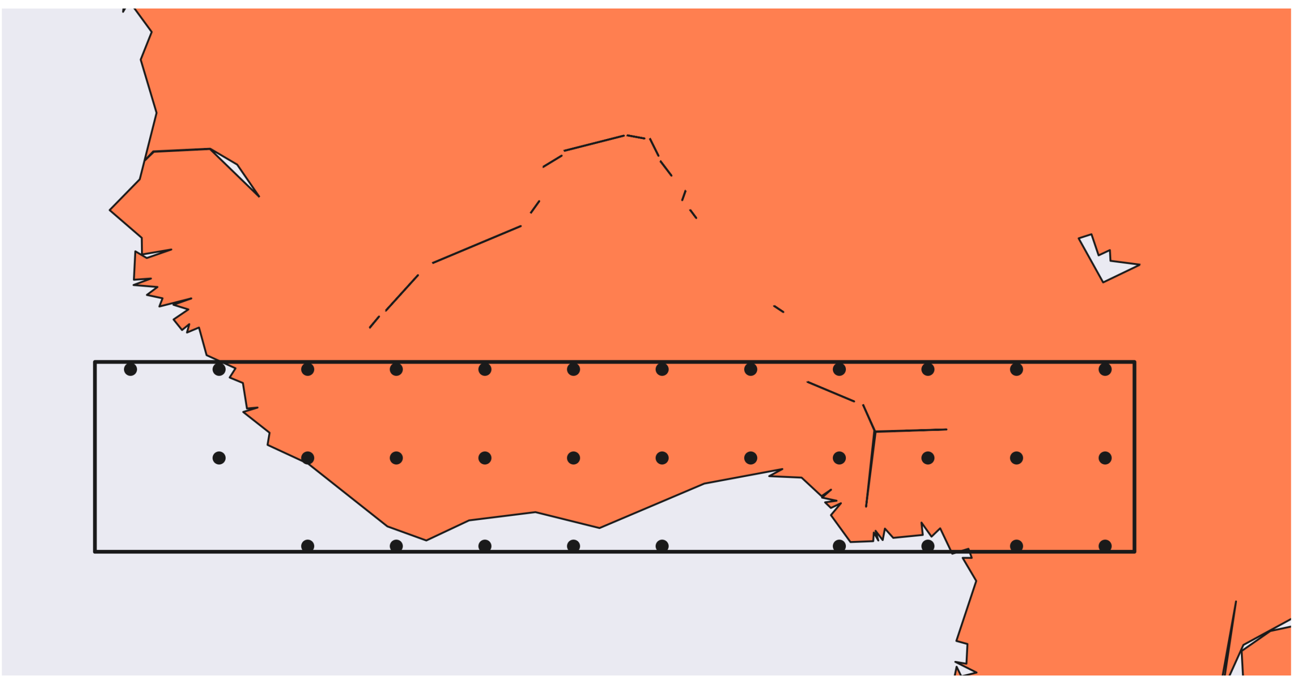

Figure S2. Map of West Africa showing the Guinea Coast region (the black rectangle) and the 32 grid points used when considering an area-average over Guinea Coast.

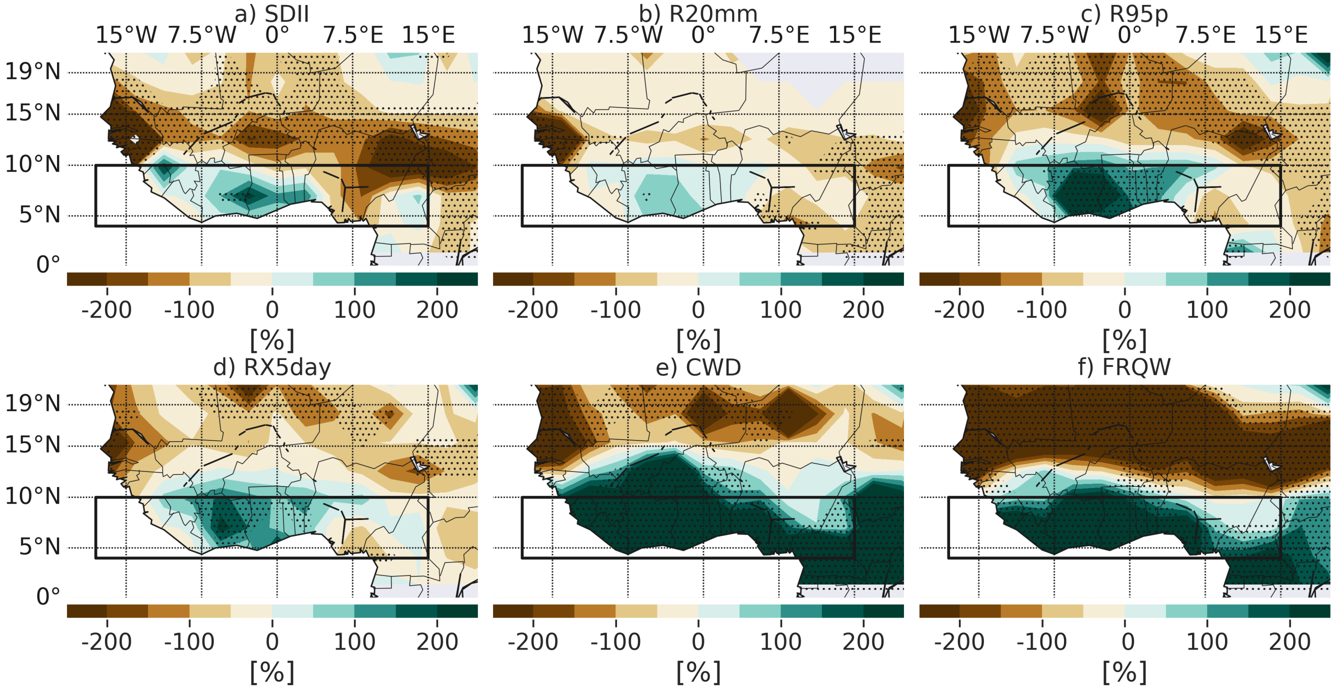

Figure S3. Spatial distribution of the EnsMedian bias percentage relative to the interquartile range of the six observations for the JAS climatology of the extreme rainfall indices over the 1995-2014 period. In total, there are six observations × 24 models = 144 different biases. The stippling indicates regions where two-third of the biases agree on the sign of the EnsMedian of the 144 biases. The black rectangles indicate the Guinea Coast region.

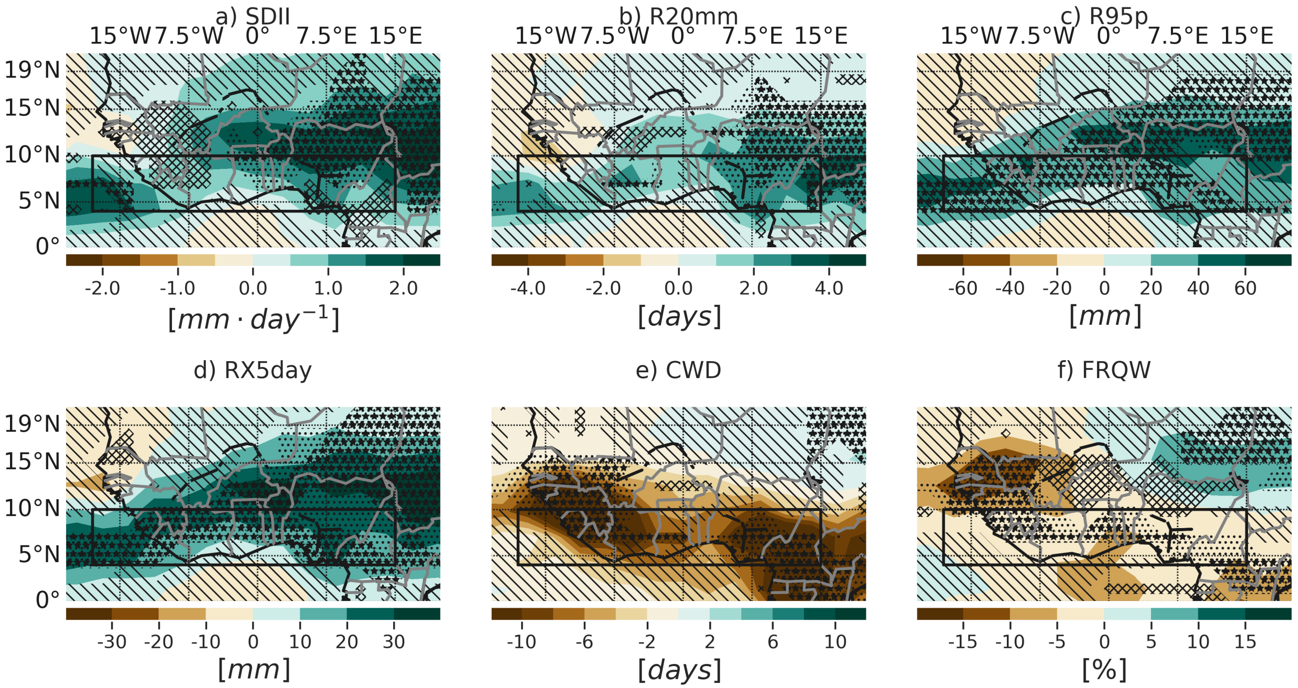

Figure S4. Projected multi-model ensemble long-term median change in the JAS rainfall extreme indices over West Africa, relative to the present-day period (2080-2099 minus 1995-2014). Stippling indicates regions where the change robustly emerges from internal variability (at least 66% of the models show a change greater than the IAV and at least 80% of the models agree on the sign of change); hatching (\) indicates regions where the change is unrobust (fewer than 66% of the models show change greater than the IAV); crossed lines (X) indicate conflicting signals where at least 66% of the models show change greater than the IAV, with less than 80% agreement on the sign of the change. Stars indicate an another approach used in **?**, showing grid points where the forced response is stronger than the internal variability.

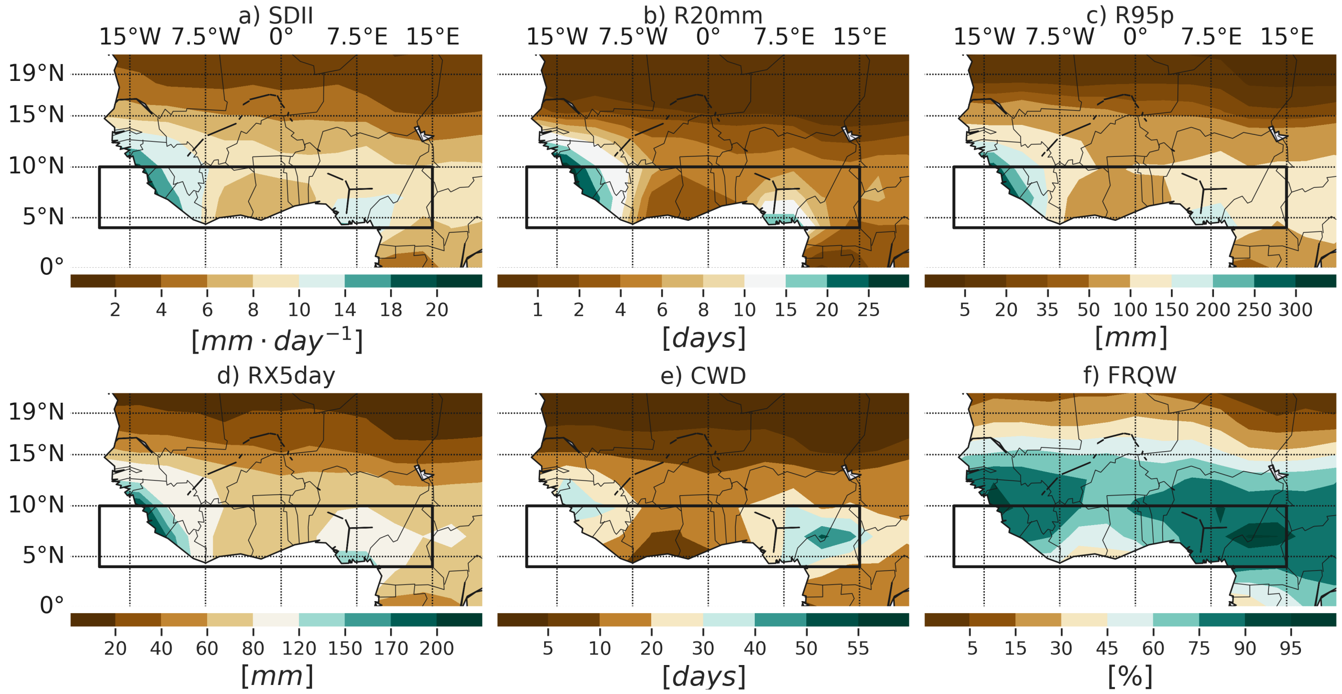

Figure S5. Spatial distribution of the EnsMedian JAS extreme rainfall indices over the 1995-2014 period from six different rainfall datasets. The black rectangles indicate the Guinea Coast region.

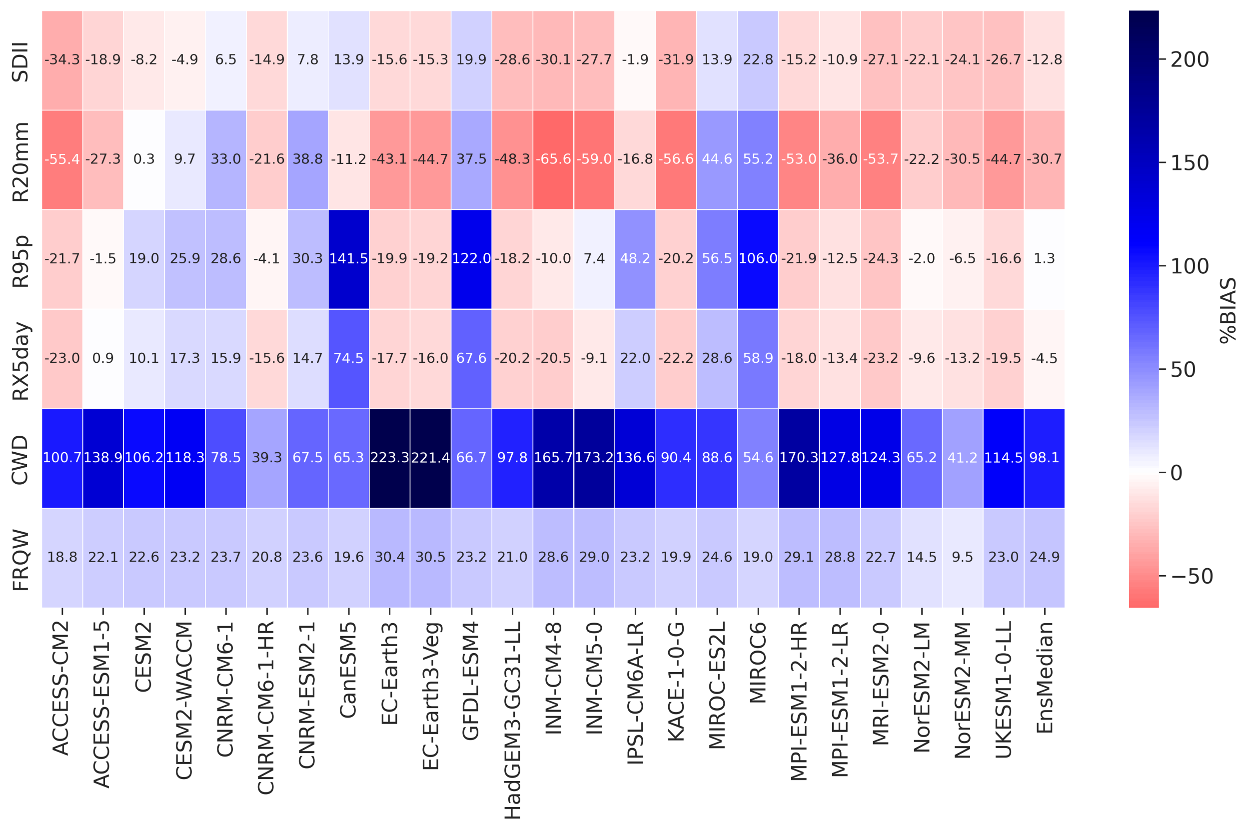

Figure S6. Performance metrics of the individual GCM in representing six different extreme rainfall indices: EnsMedian of %BIAS across six different observations.

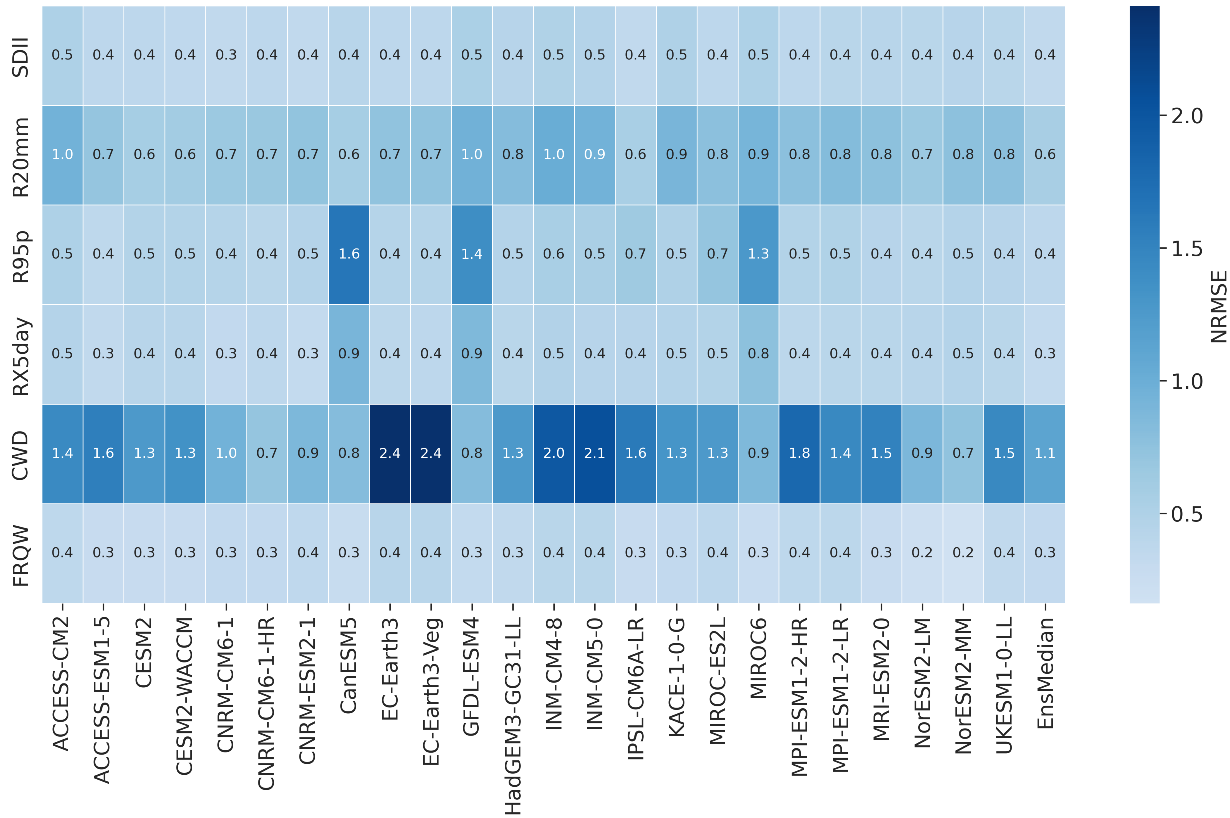

Figure S7. Performance metrics of the individual GCM in representing six different extreme rainfall indices: EnsMedian of NRMSE across six different observations.

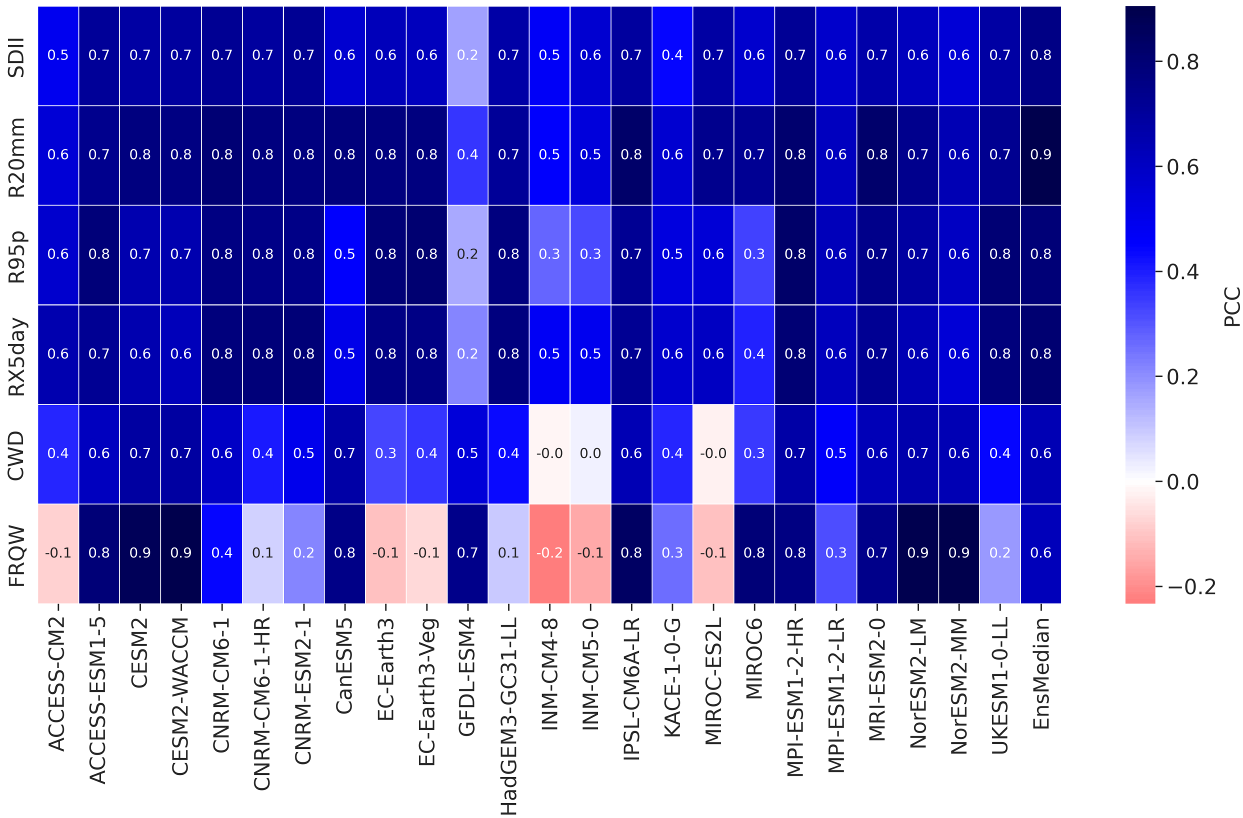

Figure S8. Performance metrics of the individual GCM in representing six different extreme rainfall indices: EnsMedian of PCC across six different observations.

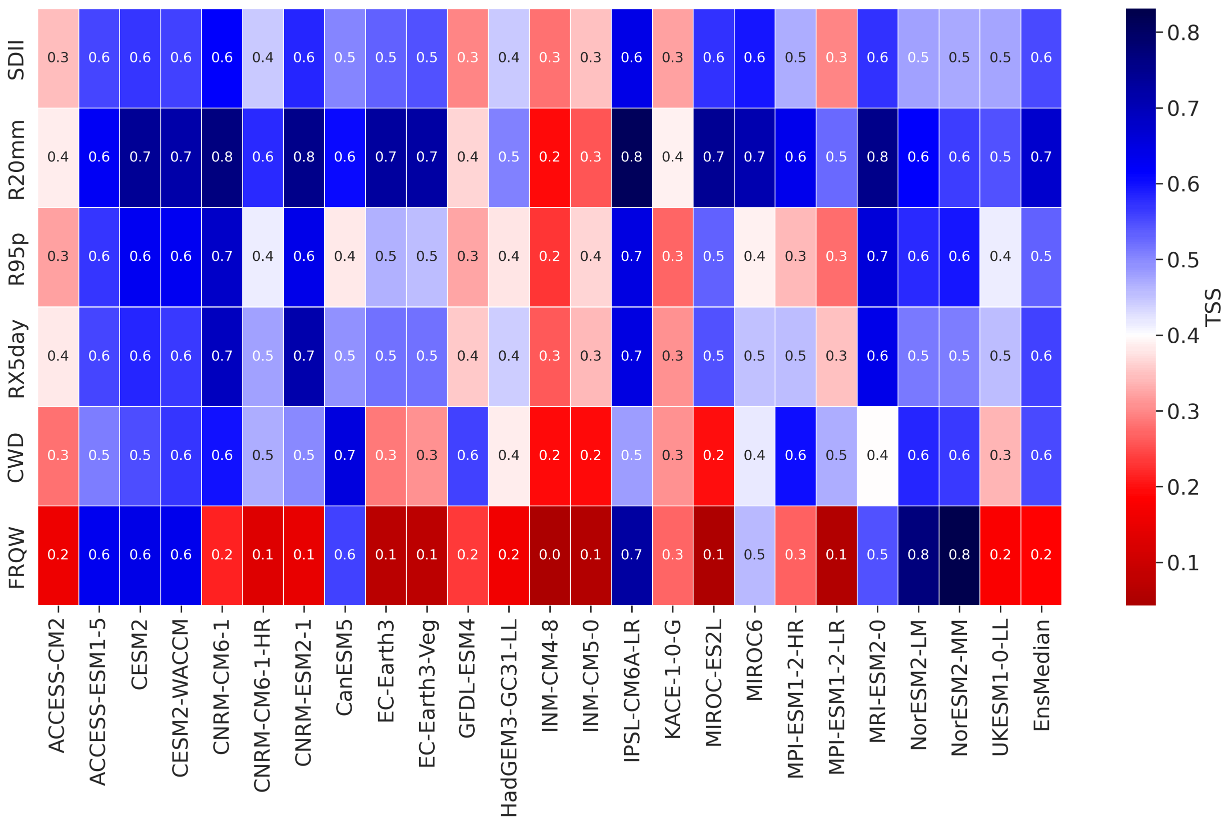

Figure S9. Performance metrics of the individual GCM in representing six different extreme rainfall indices: EnsMedian of TSS across six different observations.

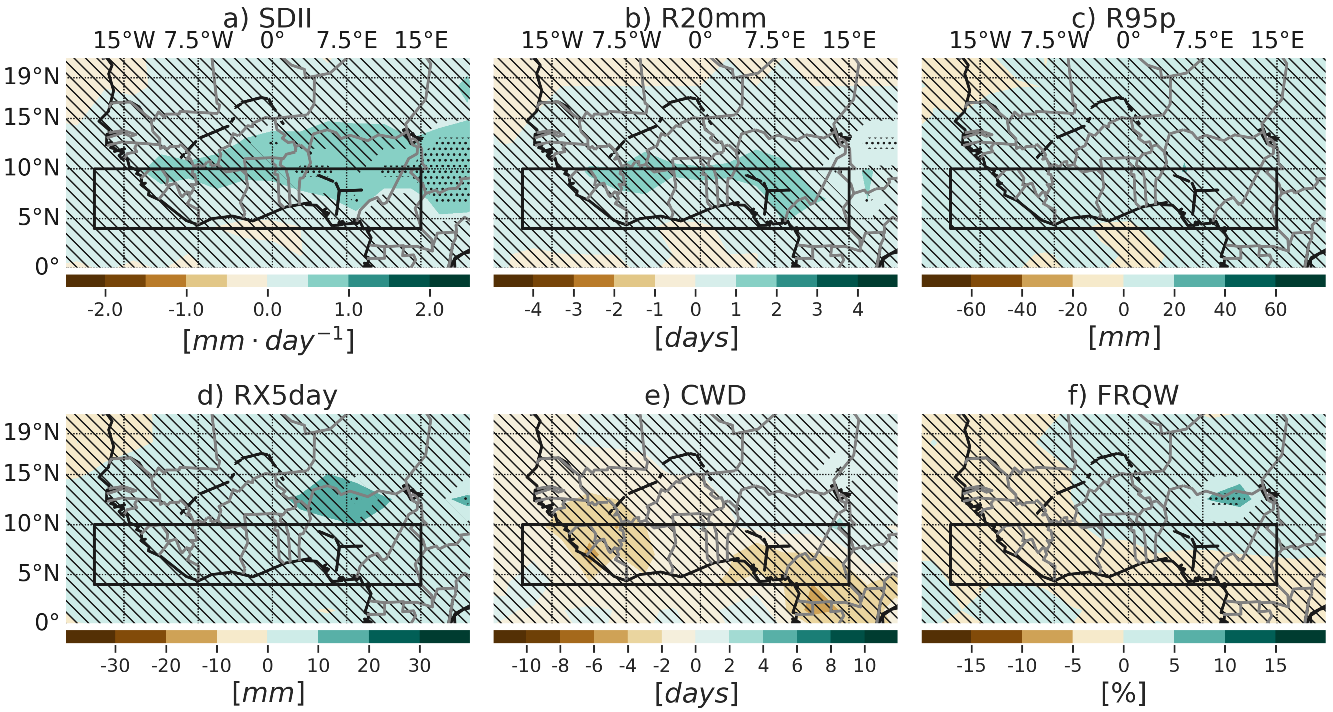

Figure S10. Projected multi-model ensemble near-term median change in the JAS rainfall extreme indices over West Africa, relative to the present-day period (2021-2040 minus 1995-2014). Stippling indicates regions where the change robustly emerges from internal variability (at least 66% of the models show a change greater than the IAV and at least 80% of the models agree on the sign of the change); hatching (\) indicates regions where the change is unrobust (fewer than 66% of the models show change greater than the IAV); crossed lines (X) indicate conflicting signals where at least 66% of the models show change greater than the IAV, with less than 80% agreement on the sign of the change.

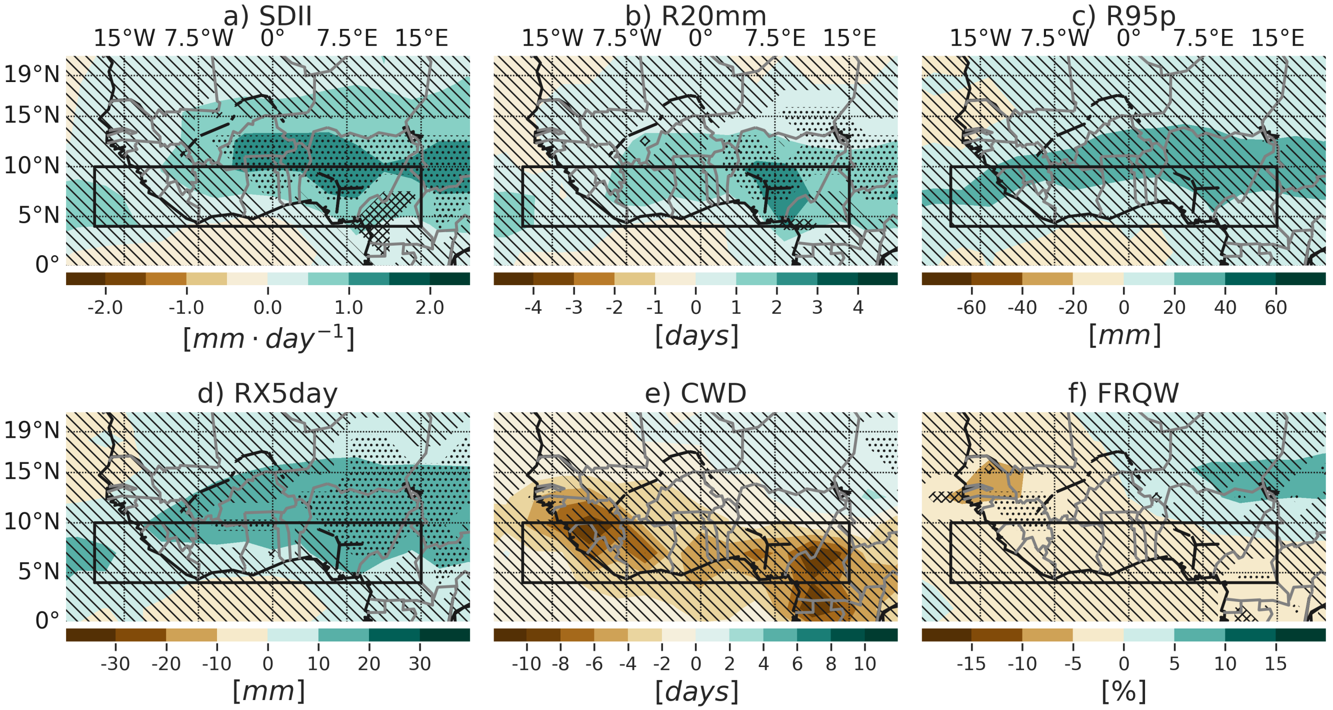

Figure S11. Projected multi-model ensemble mid-term median change in the JAS rainfall extreme indices over West Africa, relative to the present-day period (2041-2060 minus 1995-2014). Stippling indicates regions where the change robustly emerges from internal variability (at least 66% of the models show a change greater than the IAV and at least 80% of the models agree on the sign of the change); hatching (\) indicates regions where the change is unrobust (fewer than 66% of the models show change greater than the IAV); crossed lines (X) indicate conflicting signals where at least 66% of the models show change greater than the IAV, with less than 80% agreement on the sign of the change.

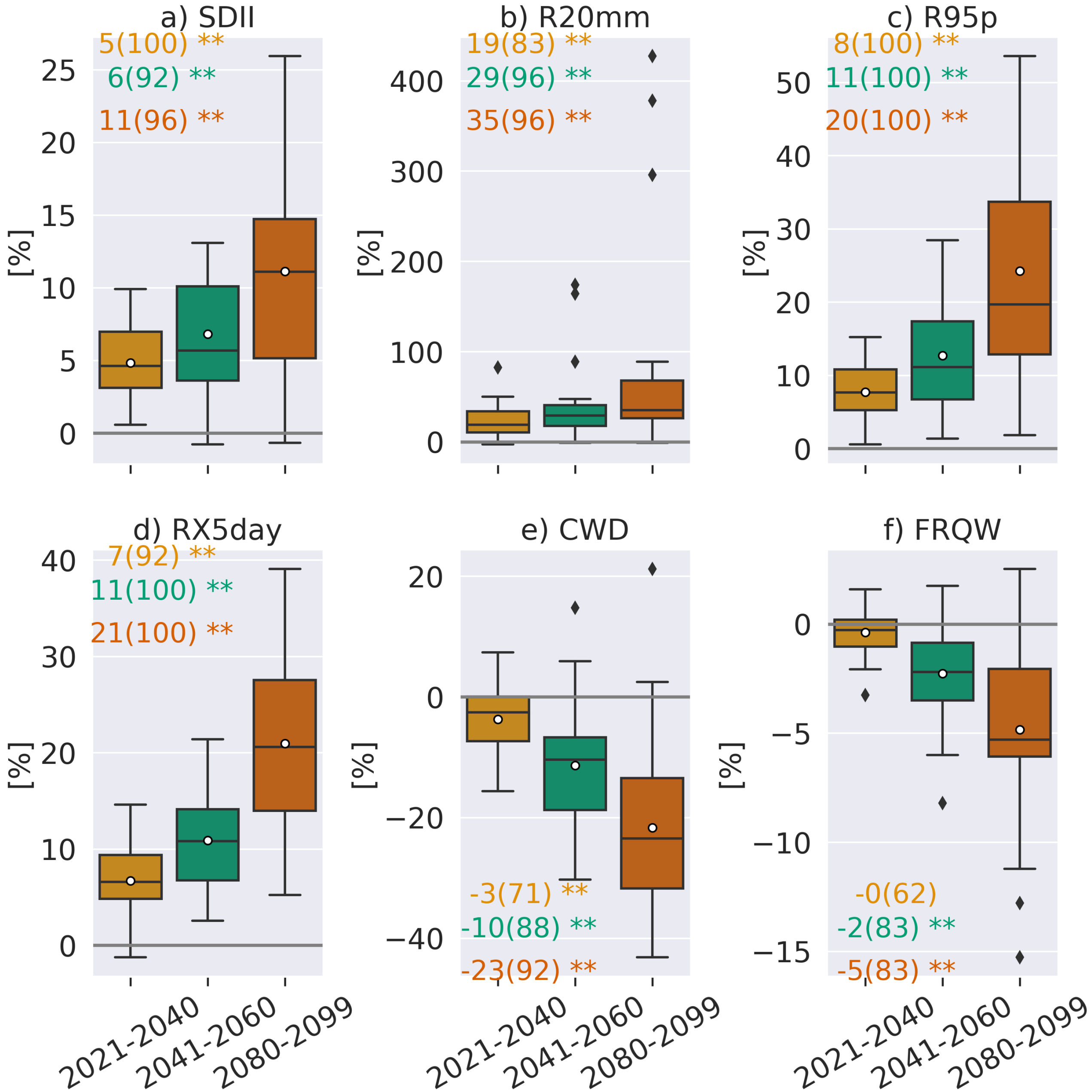

Figure S12. Boxplots of the average of the near-term, mid-term and long-term percentage of changes (relative to the present-day period) in the mean of the rainfall extreme indices over the Guinea Coast. Each boxplot represents the distribution of 24 GCMs. Outliers are indicated by the black marks (losanges). The median (mean) value of each distribution is indicated with a black horizontal bar (a white circle). In each panel, the median value of the change percentages (and the percentage of agreement in parentheses) are indicated for each period, with the same color as the associated boxplot. The two stars indicate more than two-third agreement on the sign of the EnsMedian change among the 24 GCMs. The percentage of changes are computed at each grid point before performing the averages over Guinea Coast.

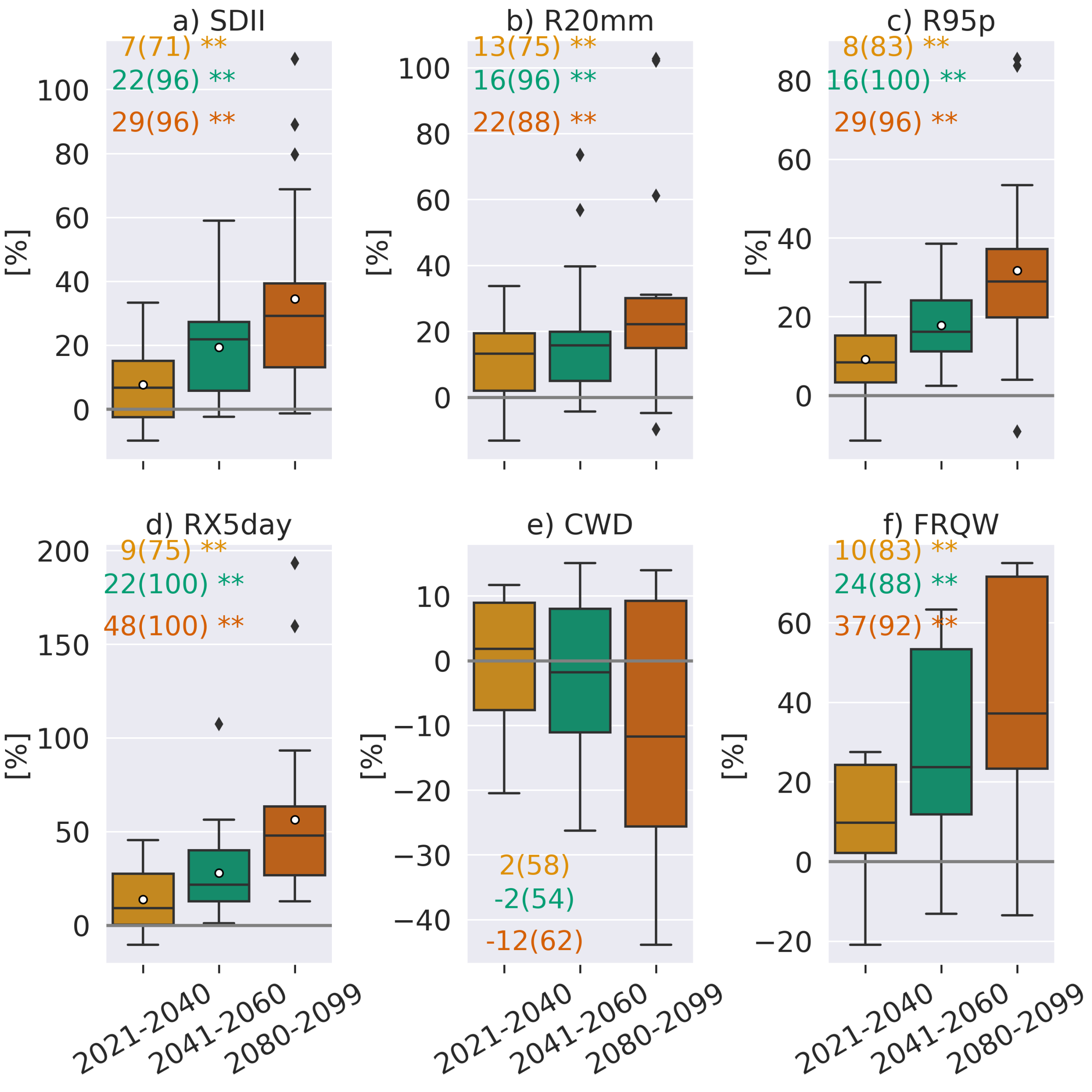

Figure S13. Boxplots of the average of the near-term, mid-term and long-term percentage of changes (relative to the present-day period) in the standard deviation of the rainfall extreme indices over the Guinea Coast. Each boxplot represents the distribution of 24 GCMs. Outliers are indicated by the black marks (losanges). The median (mean) value of each distribution is indicated with a black horizontal bar (a white circle). In each panel, the median value of the change percentages (and the percentage of agreement in parentheses) are indicated for each period, with the same color as the associated boxplot. The two stars indicate more than two-third agreement on the sign of the EnsMedian change among the 24 GCMs. The percentage of changes are computed at each grid point before performing the averages over Guinea Coast.

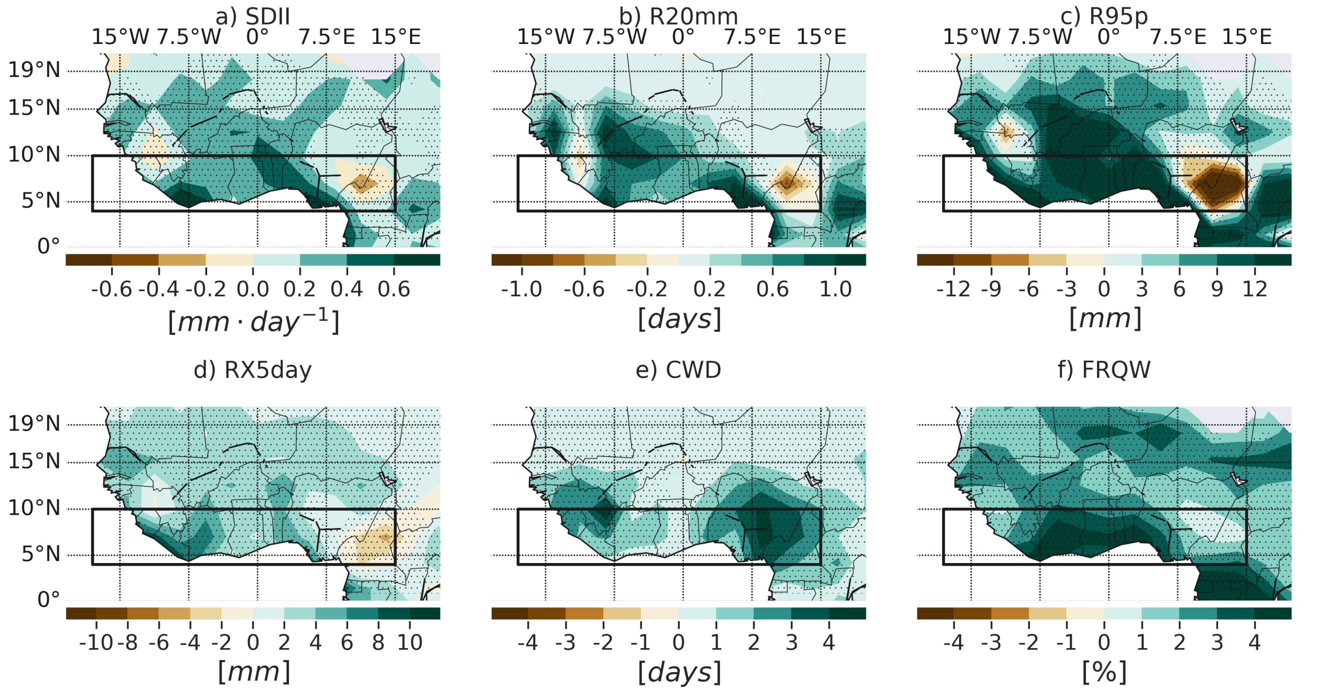

Figure S14. EnsMedian of the JAS observed rainfall extreme indices (from six different sources) regressed onto the standardized JAS AEM SST index (from HADISST dataset) over the 1995-2014 period. The stippling represents grid points where at least 4 data agree on the sign of the regression coefficient. The black rectangles indicate the Guinea Coast region.

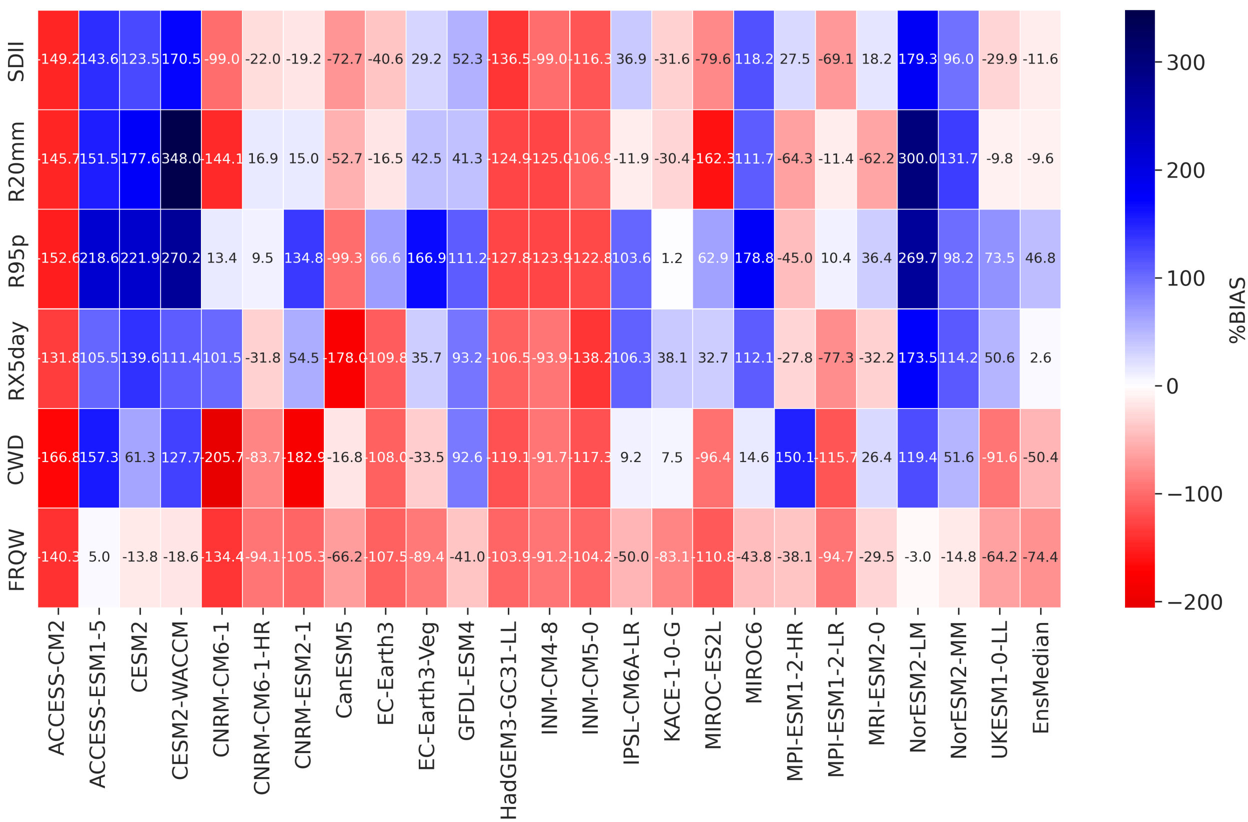

Figure S15. Performance metric of the individual GCM and the 24 GCMs EnsMedian in representing six different extreme rainfall indices: median values of %BIAS across six different observations.

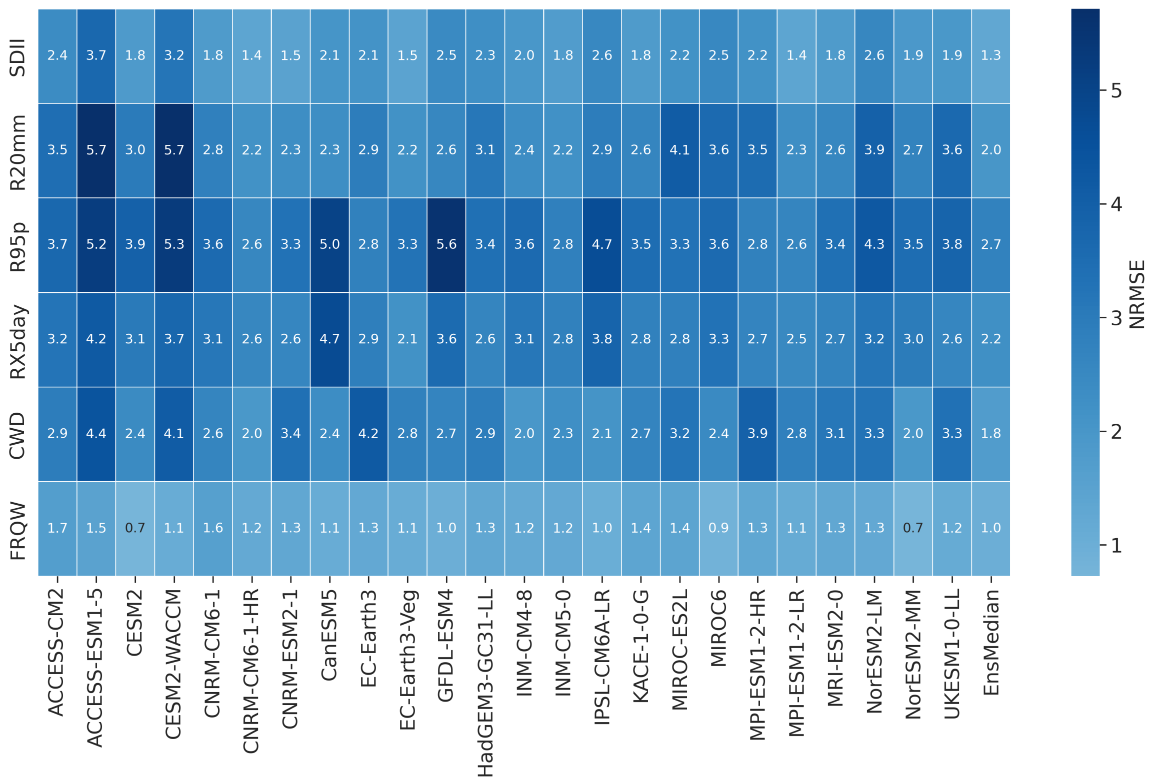

Figure S16. Performance metric of the individual GCM and the 24 GCMs EnsMedian in representing six different extreme rainfall indices: median values of NRMSE across six different observations.

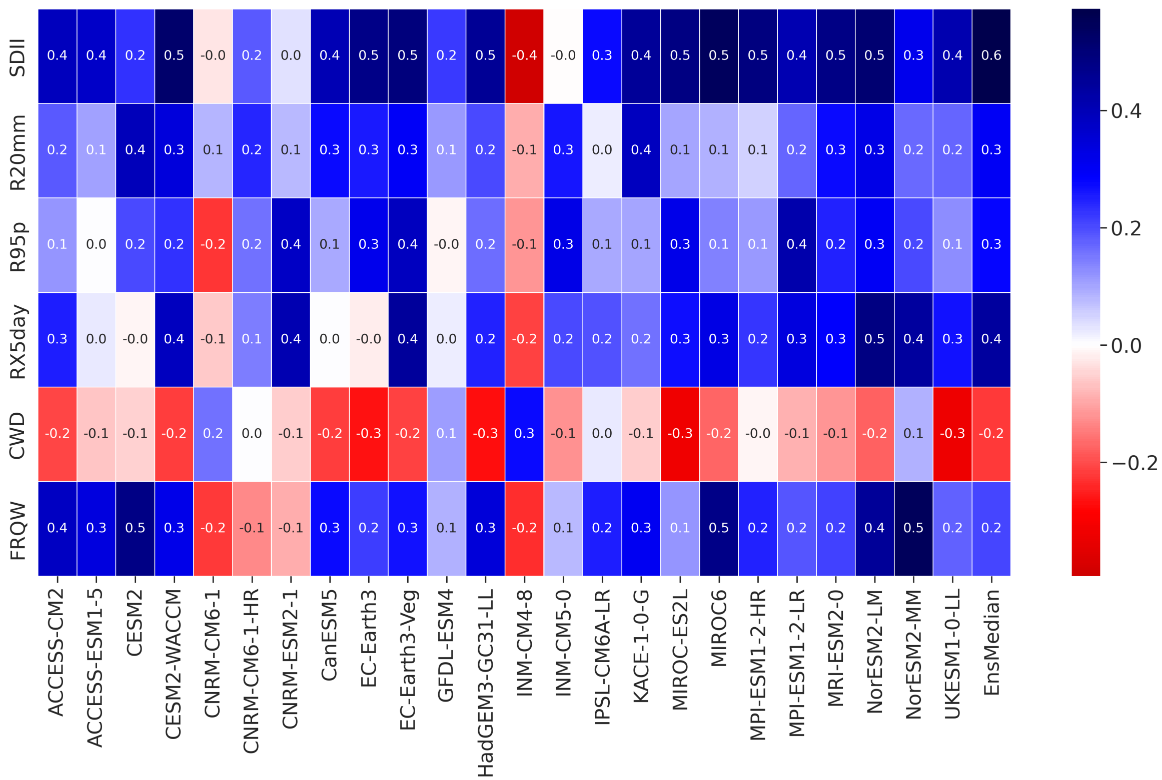

Figure S17. Performance metric of the individual GCM and the 24 GCMs EnsMedian in representing six different extreme rainfall indices: median values of PCC across six different observations.

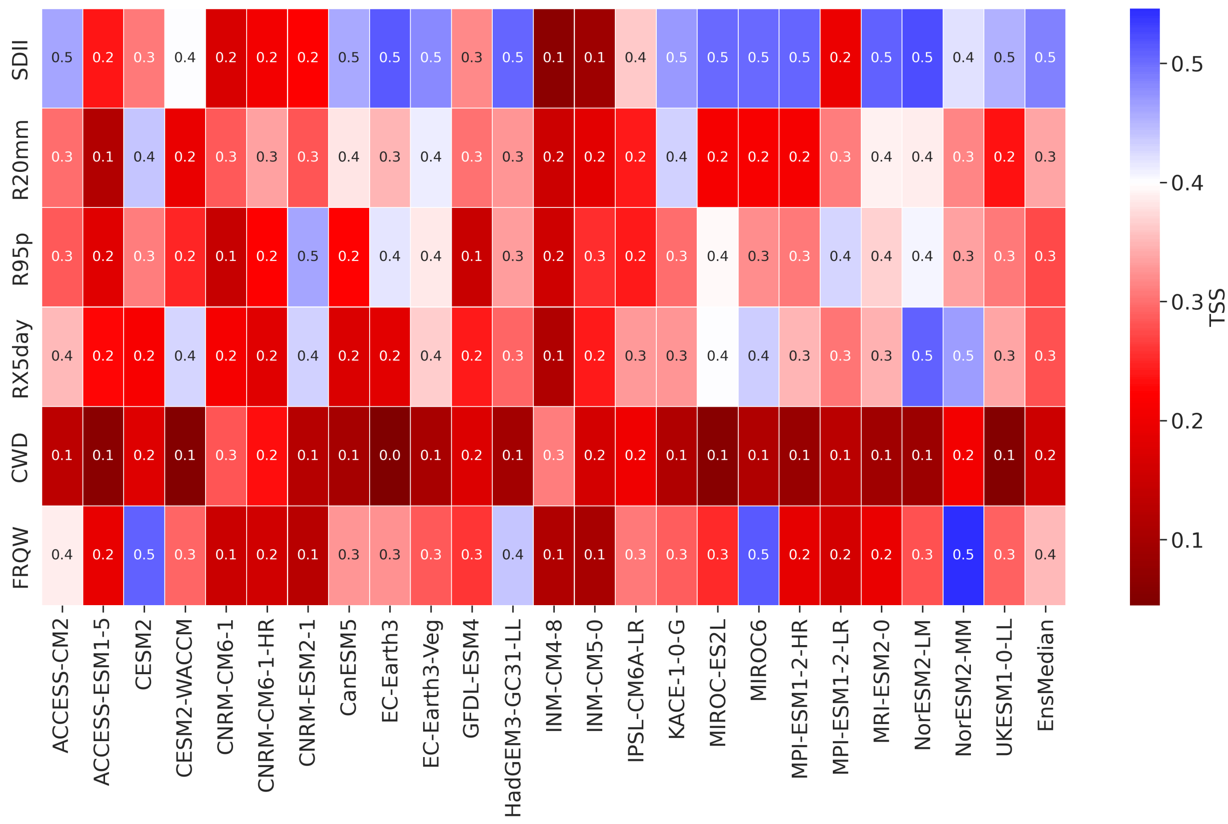

Figure S18. Performance metric of the individual GCM and the 24 GCMs EnsMedian in representing six different extreme rainfall indices: median values of the TSS across six different observations.

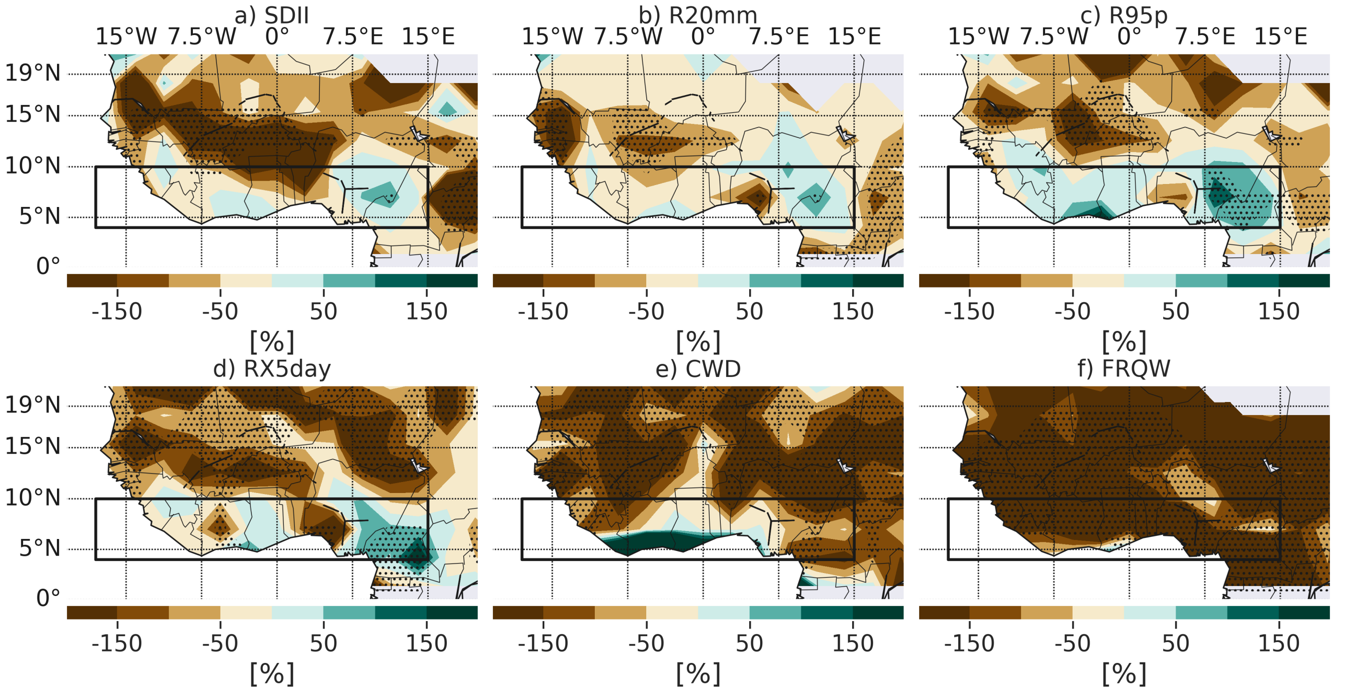

Figure S19. Spatial distribution of the EnsMedian bias percentage relative to the interquartile range of the six observations patterns for the JAS regression patterns of the extreme rainfall indices related to one standard deviation of the Atlantic equatorial mode SST index over 1995-2014. In total, there are six observations $\times$ 24 models = 144 different biases. The stippling indicates regions where two-third of the biases agree on the sign of the EnsMedian of the 144 biases. The black rectangles indicate the Guinea Coast region.

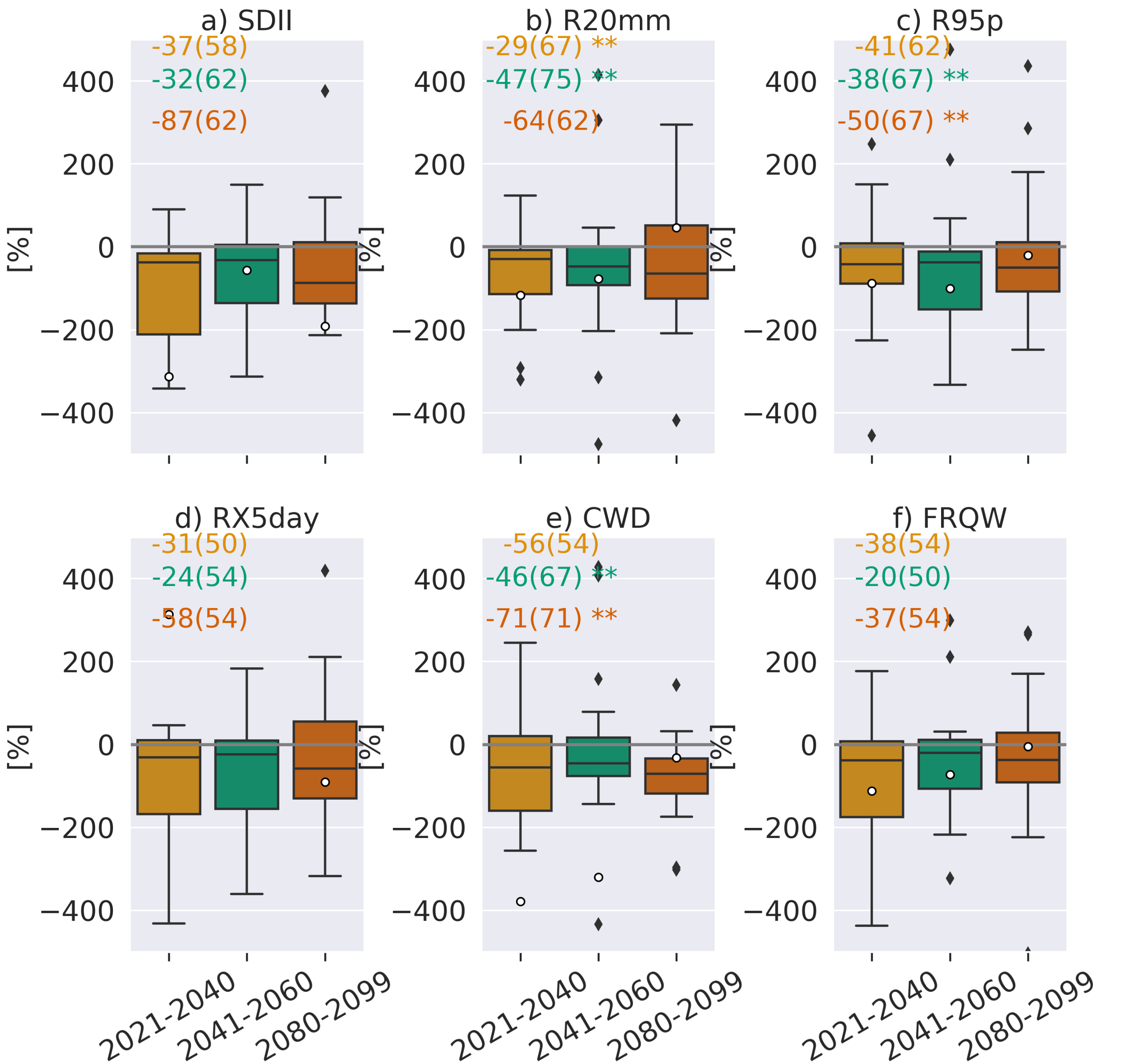

Figure S20. Near-term, mid-term and long-term percentage of changes in the Guinea Coast area-average of the JAS extreme rainfall responses to one standard deviation of the JAS AEM index. Each boxplot represents the distribution of 24 GCMs. Outliers are indicated by the black marks (losanges). The median (mean) value of each distribution is indicated with a black horizontal bar (a white circle). In each panel, the median value of the change percentages (and the percentage of agreement in parentheses) are indicated for each period, with the same color as the associated boxplot. The two stars indicate more than two-third agreement on the sign of the EnsMedian change among the 24 GCMs. These changes are computed from the average of the regression coefficients over Guinea Coast for each period.

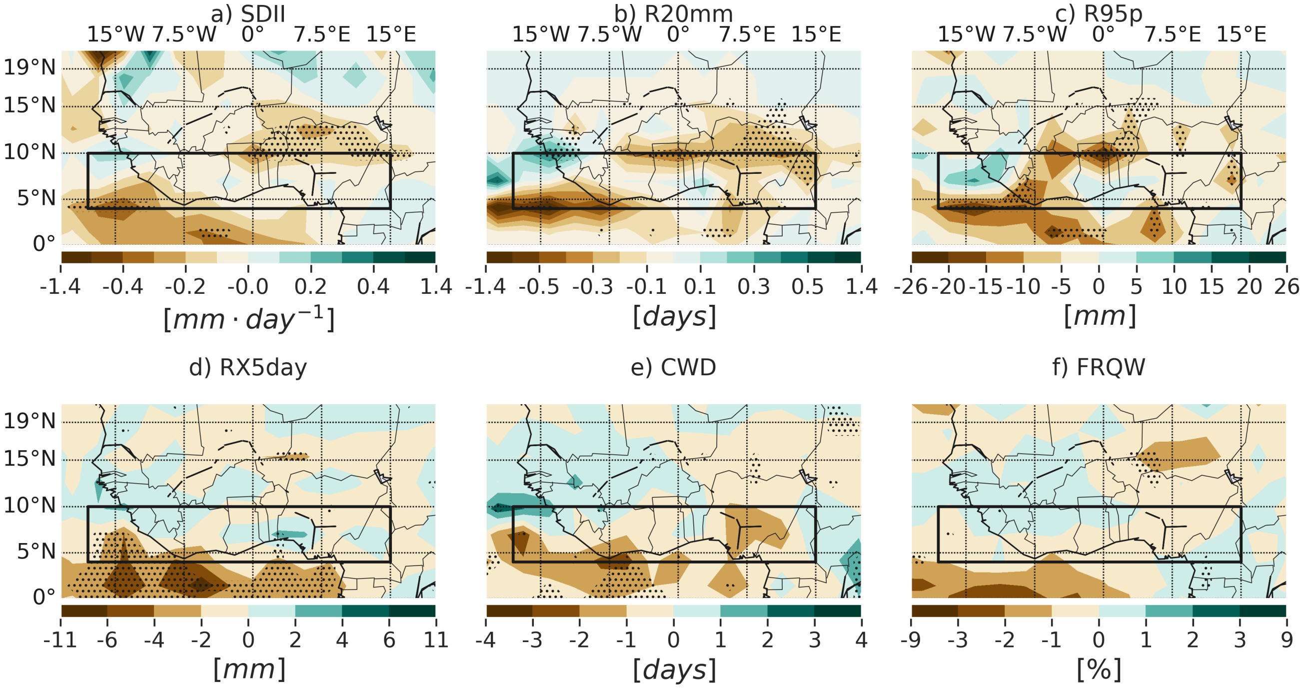

Figure S21. Near-term changes in the regression patterns of the JAS extreme rainfall indices associated with the standardized JAS AEM SST index (2021-2040 minus 1995-2014). The stippling indicates grid points where two thirds of the models agree on the sign of the change.

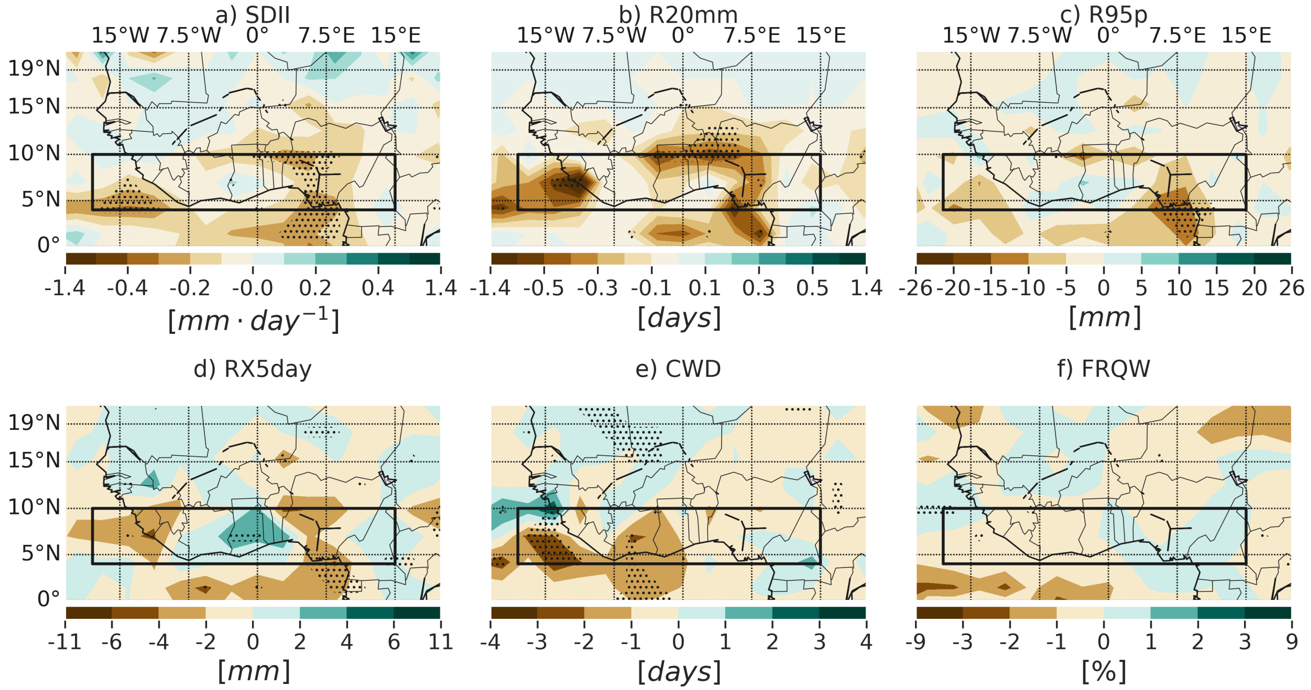

Figure S22. Mid-term changes in the regression patterns of the JAS extreme rainfall indices associated with the standardized JAS AEM SST index (2041-2060 minus 1995-2014). The stippling indicates grid points where two thirds of the models agree on the sign of the change.

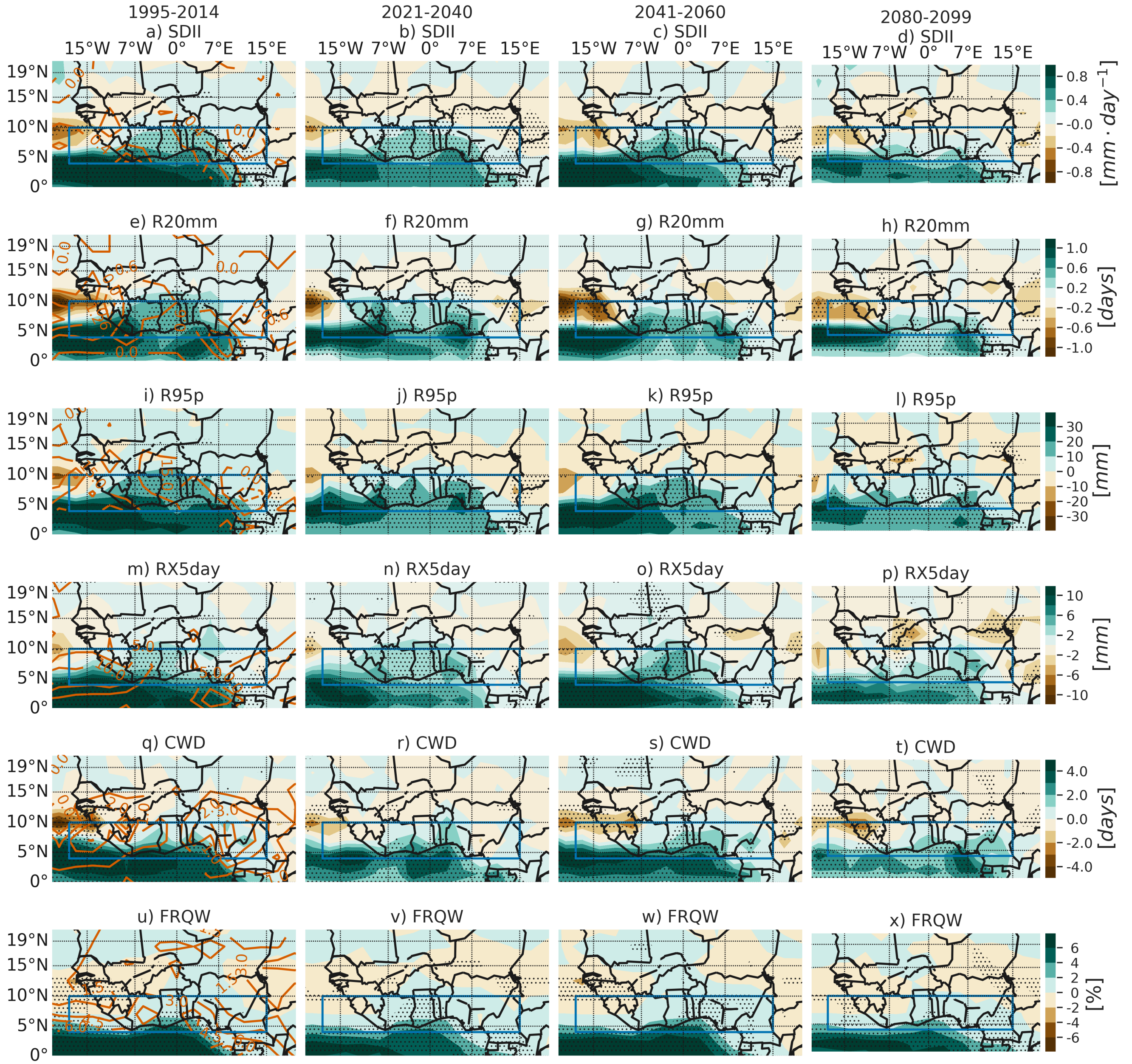

Figure S23. Maps of the JAS rainfall extreme indices regressed onto the standardized JAS AEM SST index over the 1995-2014, 2021-2040, 2041-2060 and 2080-2099 periods. The stippling represents grid points where two thirds of the models agree on the sign of the EnsMedian regression coefficient across 24 GCMs. Contours in the 1995-2014 panels indicate the multi-observation median values of the regression coefficients from six different rainfall datasets. The blue rectangles indicate the Guinea Coast region.