To explore how the TC precipitation analysis would change if actual observed TC tracks were used instead of tracks from ERA5, we used TempestExtremes (Ullrich and Zarzycki, 2017) to create a “hybrid” analysis using IBTrACS (Knapp et al., 2010) for the TC tracks and ERA5 (Copernicus Climate Change Service (C3S), 2017) for the outer TC sizes. For each TC track in IBTrACS from 1985-2014, the ERA5 wind field was used to estimate the storm’s \( r_8 \). Then, any precipitation in the CPC dataset that was within the TC’s \( r_8 \) was recorded as TC-related precipitation. Figures 8, 9, and 10 from the main manuscript were remade using this “hybrid” methodology. Fig. S1 shows the total annual mean precipitation, TC-related annual mean precipitation, and the percentage of annual mean precipitation that is TC-related. Compared to Fig. 8 in the main manuscript, only the second and third panels in the top row have been changed. While the TC-related annual mean precipitation and the TC-related percentage are larger in Fig. S1, as expected since not all observed TCs are strong enough to be tracked in ERA5, the areas where the maxima occur are generally the same. One notable difference is the greater amount of TC precipitation along the Texas coast in Fig. S1. Similar patterns arise when comparing Fig. S2 and Fig. 9 from the main manuscript. As before, the same panels in the CPC row are the only ones that have been changed. The maxima of TC-related Rx5day still occur in North Carolina, Florida, and southeast Louisiana, but the magnitudes
are larger in Fig. S2. The area where the percentage of TC-related Rx5day events is greater than 30% is much larger in Fig. S2 and extends over most of Virginia and North and South Carolina. For Fig. S3 and Figure 10 in the manuscript, the exact values change a bit for the TC-related precipitation and percentage of Rx5day events due to TCs metrics; however, the relative scores of the model configurations remain approximately the same. While the skill scores all get slightly worse (further away from 1) in Fig. S3, all of the VR configurations have comparable scores and still outperform the GLOB configuration. While this analysis shows that using the TCs algorithmically tracked in ERA5 does underestimate reality, it seems more appropriate to directly compare the model configurations to the results in the main text to keep the methodology with TempestExtremes as consistent as possible. The results from this additional analysis do not change the overall findings of this research.

References


Figure 1: CPC, EXT, REF, WAT, and GLOB total annual mean precipitation [mm/yr] (left column), annual mean precipitation from TCs [mm/yr] (middle column), and percentage of the annual mean precipitation that is due to TCs (right column). This CPC precipitation was calculated using the IBTrACS TC tracks instead of those tracked in ERA5 using TempestExtremes, and this figure is a comparison to Fig. 8 in the main text.
Figure 2: CPC, EXT, REF, WAT, and GLOB Rx5day (annual maximum 5-day accumulated precipitation) [mm/yr] (left column), TC-related Rx5day [mm/yr] (middle column), and percentage of Rx5day events due to TCs (right column). This CPC Rx5day was calculated using the IBTrACS TC tracks instead of those tracked in ERA5 using TempestExtremes, and this figure is a comparison to Fig. 9 in the main text.
Figure 3: Metric scores for Total Annual Precipitation, TC-related Annual Precipitation, and Percentage of Rx5day events due to TCs, separated by NCA region (rows) and model configuration (columns). These scores compare each model configuration to CPC. For all metrics, a value of 1 is optimal. Skill score (Skill) indicates poor performance as it gets closer to 0. Pattern Correlation (Corr.) indicates worse performance as it approaches and passes 0. Ratio indicates worse performance as it diverges from 1 in either direction. The CPC data used for these calculations was calculated using the IBTrACS TC tracks instead of those tracked in ERA5 using TempestExtremes, and this figure is a comparison to Fig. 10 in the main text.