Supplementary Material

1 EVENT COINCIDENCE RATES FOR DIFFERENT THRESHOLDS OF STRONG AND WEAK SEASONAL PRECIPITATION

To demonstrate the robustness of our results, we repeat the analysis presented in the main manuscript for seasonal precipitation sums falling below/exceeding a threshold defined by the empirical 30/70% or 10/90% quantiles, respectively. The corresponding significant event coincidence rates between EP/CP El Niño/La Niña periods and outstanding seasonal precipitation sums above (below) the 90th (10th) percentile are shown in Fig. S1 and Fig. S2. Figure S3 and S4 show the same for strong and weak precipitation defined as values above (below) the 70th (30th) percentile and the respective ENSO periods. The arrangements of the panels corresponds to Fig. 2 and 3 in the main manuscript.

We observe that changing the percentile threshold such that only the seasons with the 10% highest or lowest precipitation sums are considered as events yields an expected reduction in spatially coherent coincidences for both El Niño (Fig. S1) and La Niña periods (Fig. S2). However, the dominant large scale patterns, such as reduced rainfall over Indonesia and the Philippines in SON during EP El Niño phases or strong precipitation over North Australia in SON during EP (and less pronounced also for CP) La Niña phases, persist even for such a stricter definition of precipitation events. Generally, we observe that the patterns displayed in Fig. S1 and Fig. S2 are also present in Fig. 2 and 3 of the main manuscript.

Similarly, we observe significant event coincidence rates with the 30% highest and lowest seasonal precipitation sums being considered as events, Fig. S3 and S4. We observe similar patterns as displayed in Fig. 2 and 3 of the main manuscript, but note that the event coincidence rates (especially for the CP phases of El Niño and La Niña) show a tendency to increase. This is because counting less strong or weak signals leads to an increase in the number of precipitation events as compared to the stricter percentile thresholds chosen in the main manuscript. Since the number of ENSO periods is the same for every choice of precipitation threshold, the event coincidence rate is likely to increase with more precipitation events, thus yielding the increased numbers in Fig. S3 and Fig. S4. Generally, we find that the spatial patterns which were observed in Fig. 2 and Fig. 3 of the main manuscript persist also for less rigid definitions of very high and very low seasonal precipitation.

In summary, our results generally vary smoothly with the actual choice of percentile thresholds above and below which seasons are considered as an event according to their respective precipitation sum, and we therefore consider the analysis presented in the main manuscript to be sufficiently robust against its actual choice.

2 FIGURES

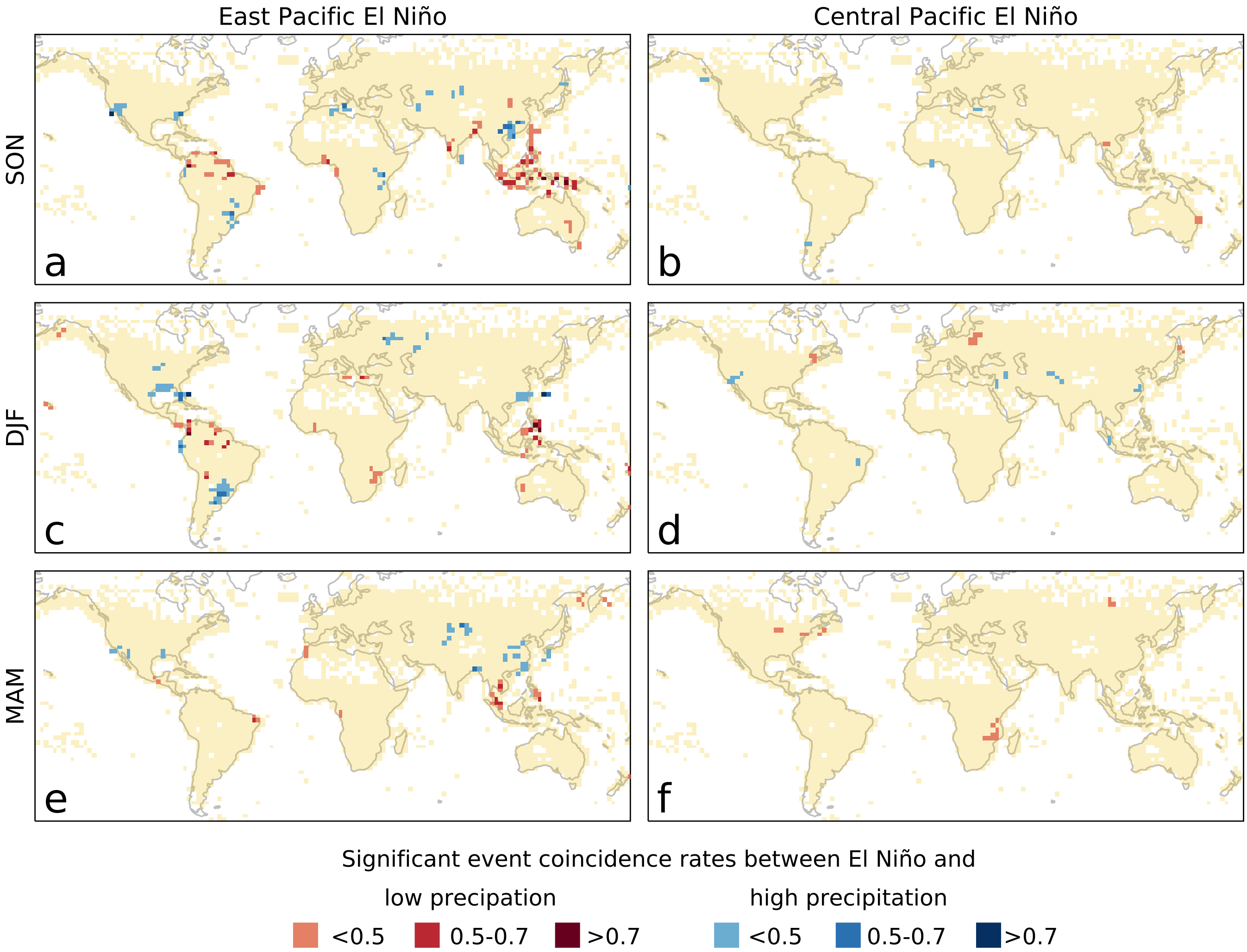

Figure S1. Same as Fig. 2 of the main manuscript but for strong (weak) precipitation events defined as values that exceed (fall below) the 90th (10th) percentile of each individual time series.

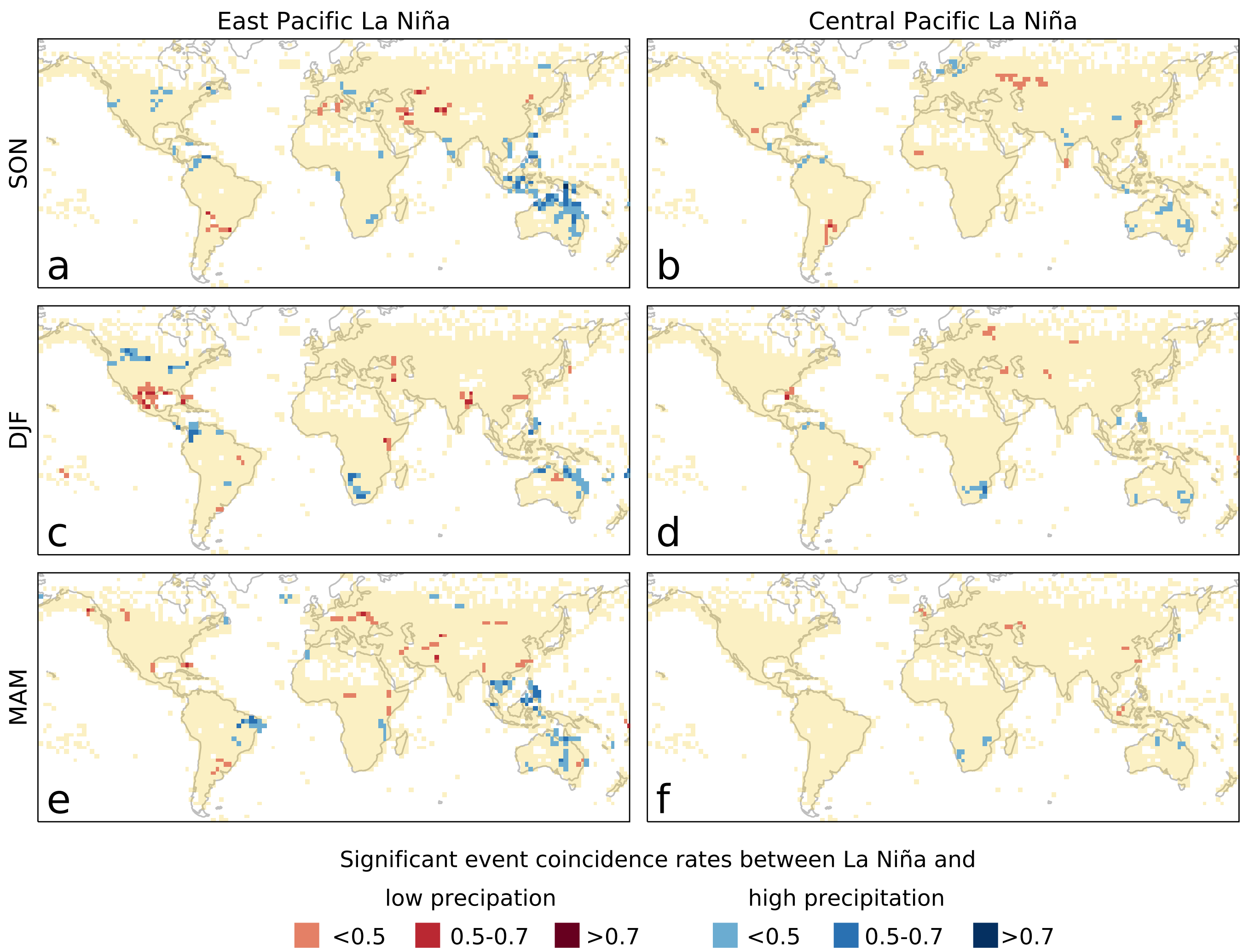

Figure S2. Same as Fig. S2 for La Niña periods.

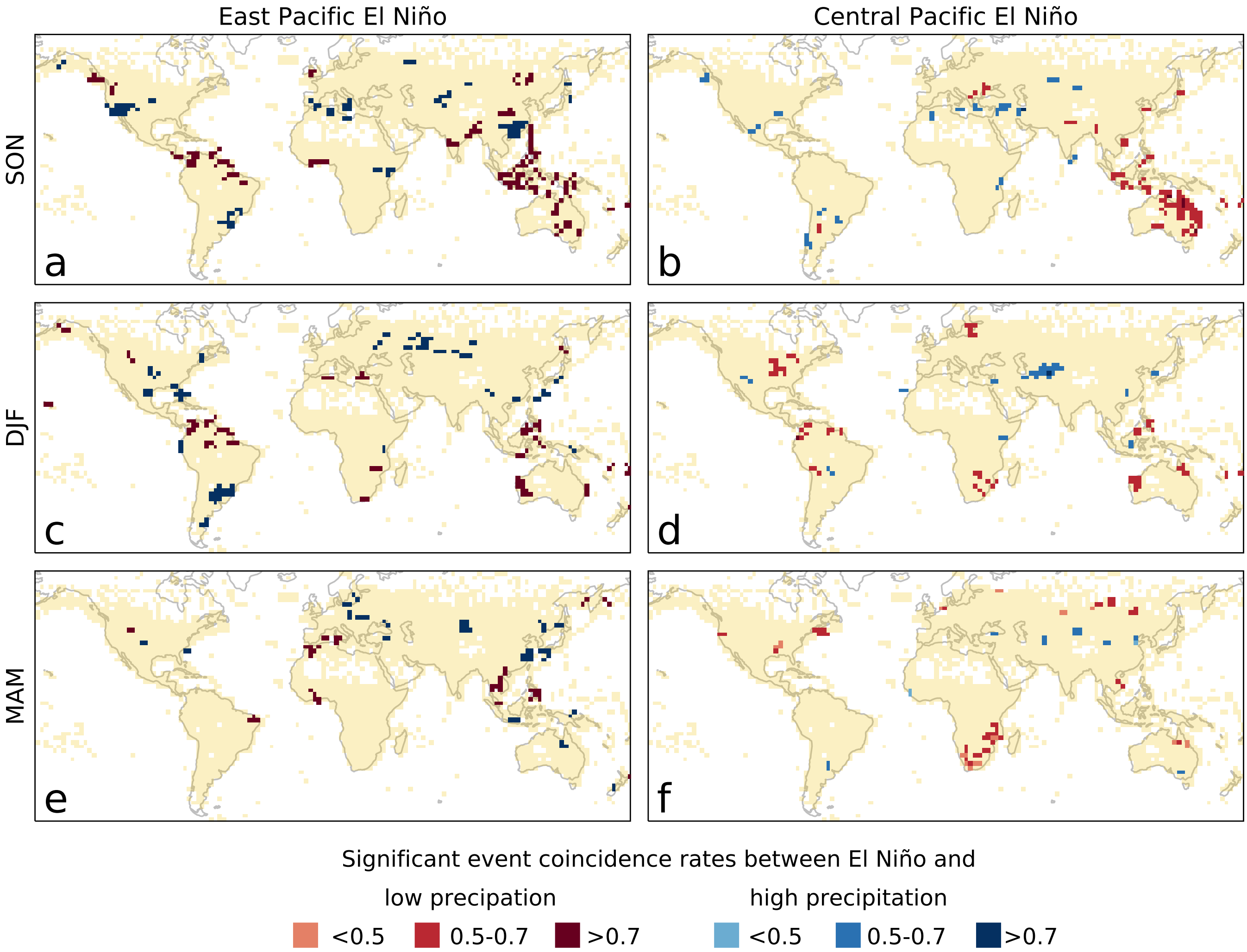

Figure S3. Same as Fig. 2 of the main manuscript but for strong (weak) precipitation events defined as values that exceed (fall below) the 70th (30th) percentile of each individual time series.

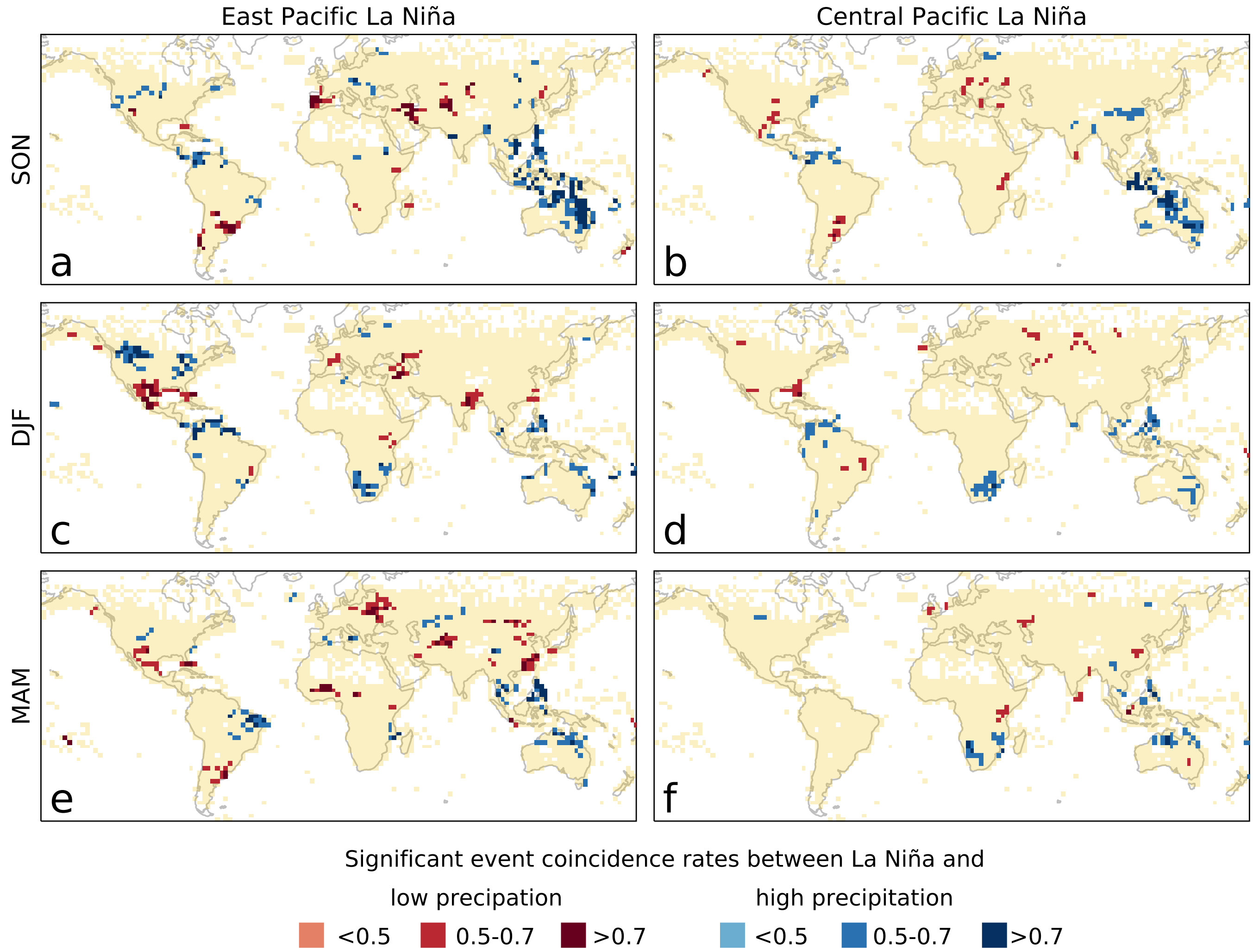

Figure S4. Same as Fig. S3 for La Niña periods.