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Geoscientific Model Development
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Supplement of

EGGS-WG: an open source global gridded stochastic weather generator derived from ERA5-Land

Alex Schuddeboom et al.

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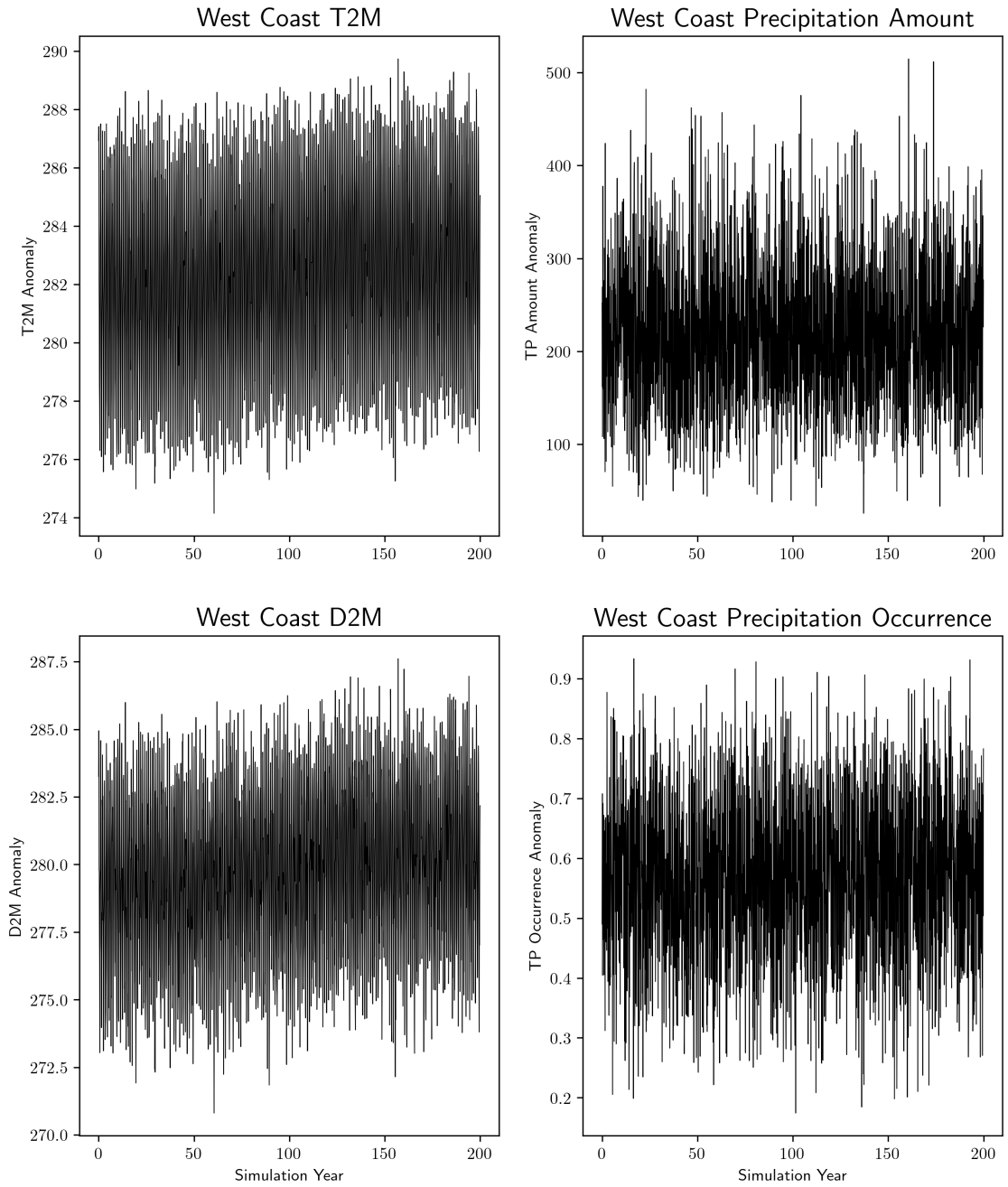


Figure S1. An example 200 year non-stationary simulation starting in 1900 and running to 2100. The subtle changes associated with warming are visible in the slight shift from 1950 to 2020. As expected, the effect of warming is relatively small compared to the natural annual cycle.

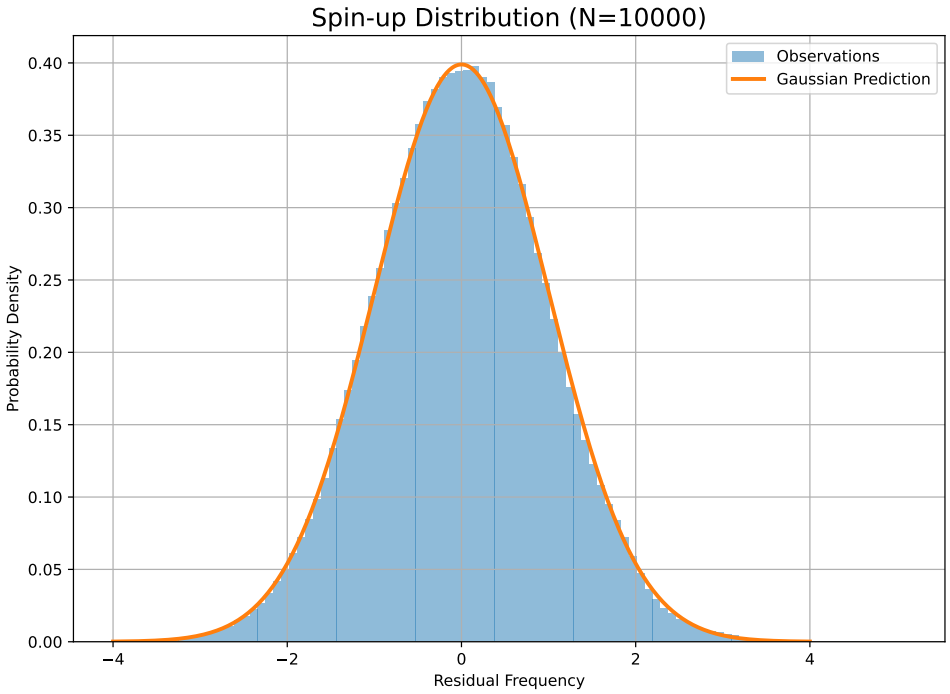


Figure S2. Distribution of temperature residuals for 10000 different spin-up simulations.

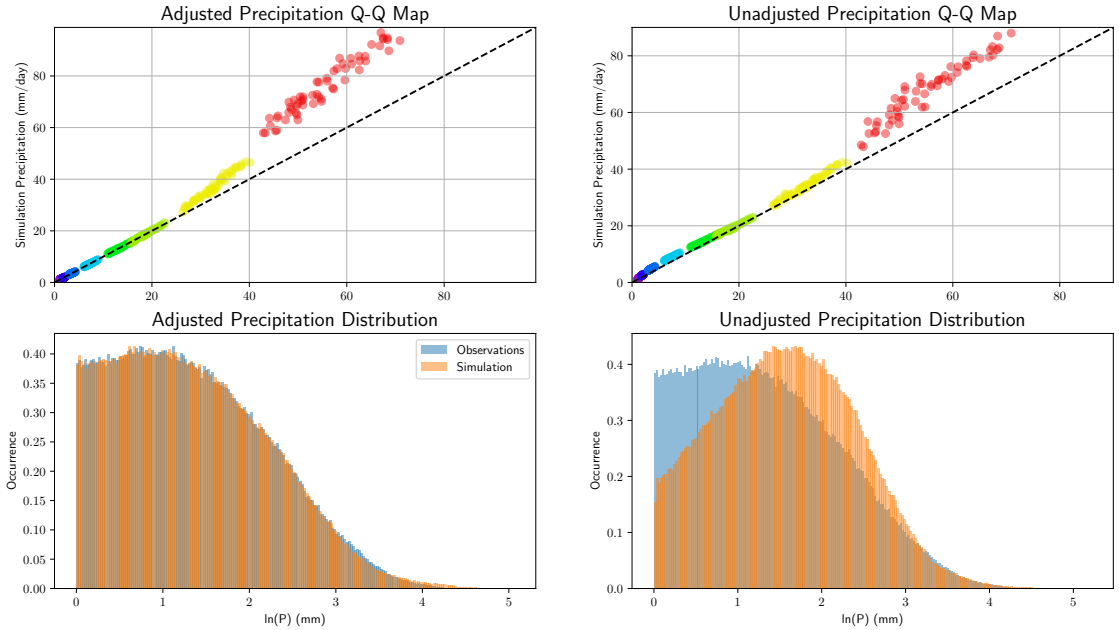


Figure S3. Comparison of the Q-Q and full distribution plots between the adjusted and unadjusted precipitation data over the Canterbury region.

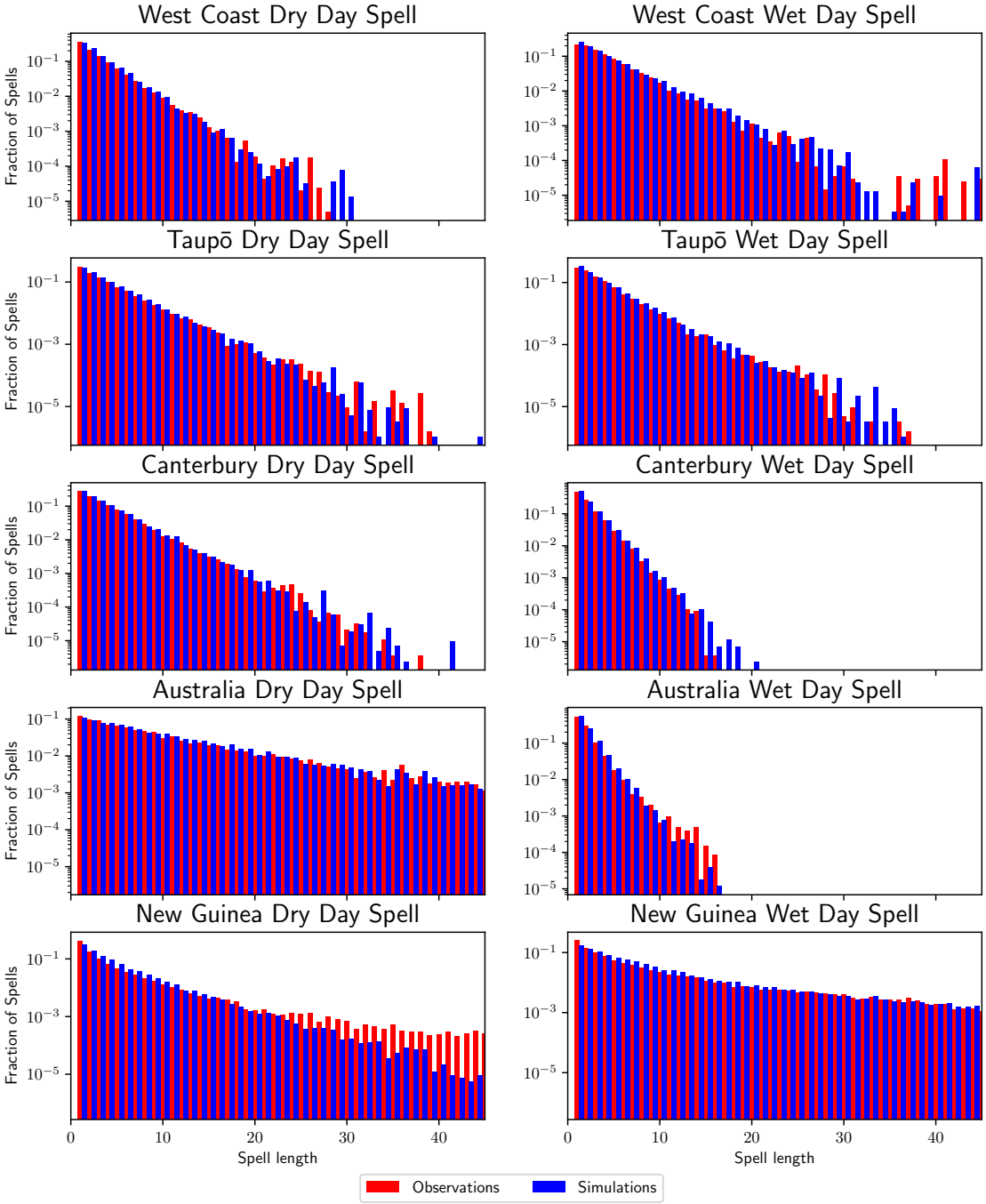


Figure S4. The wet and dry day precipitation spells for the both the simulations and observations over all five of the analysed domains. This is a logarithmic version of the linear version in the main paper.

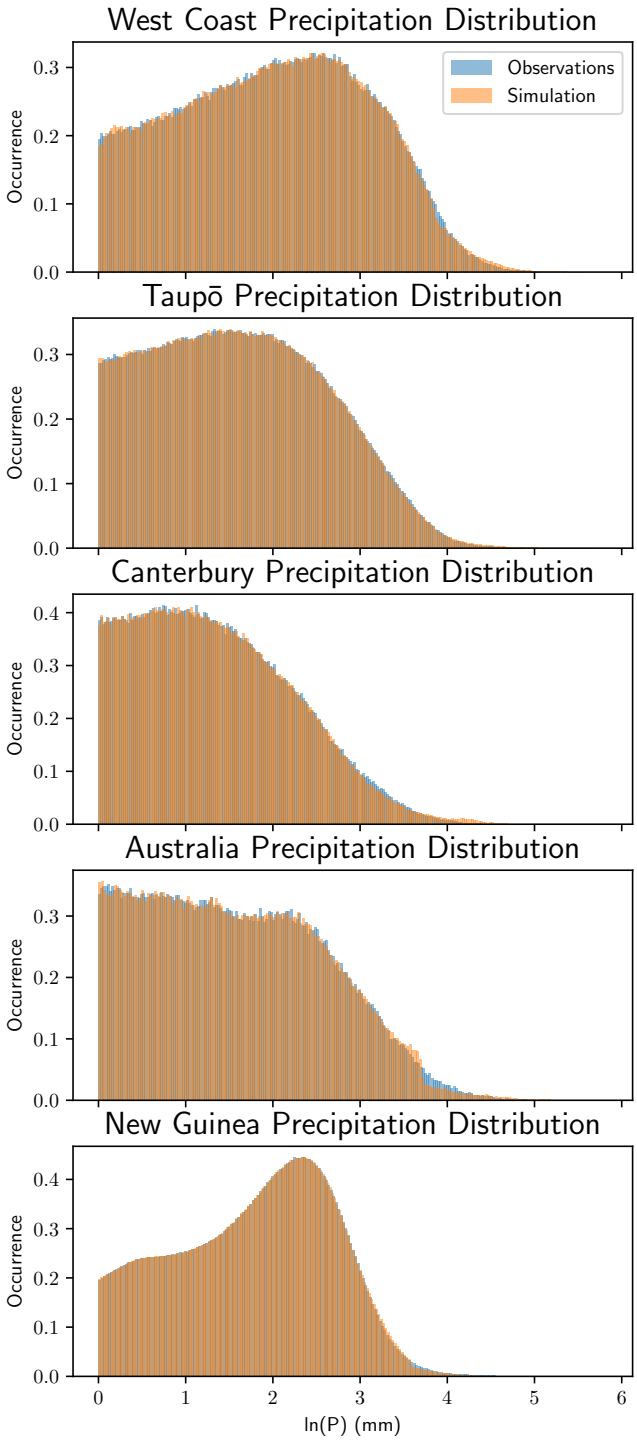


Figure S5. Distribution of the daily precipitation values in the simulations and observations over all five simulation domains. Note values less than 1 mm/day are not possible in the simulation so have been removed from the observational data.

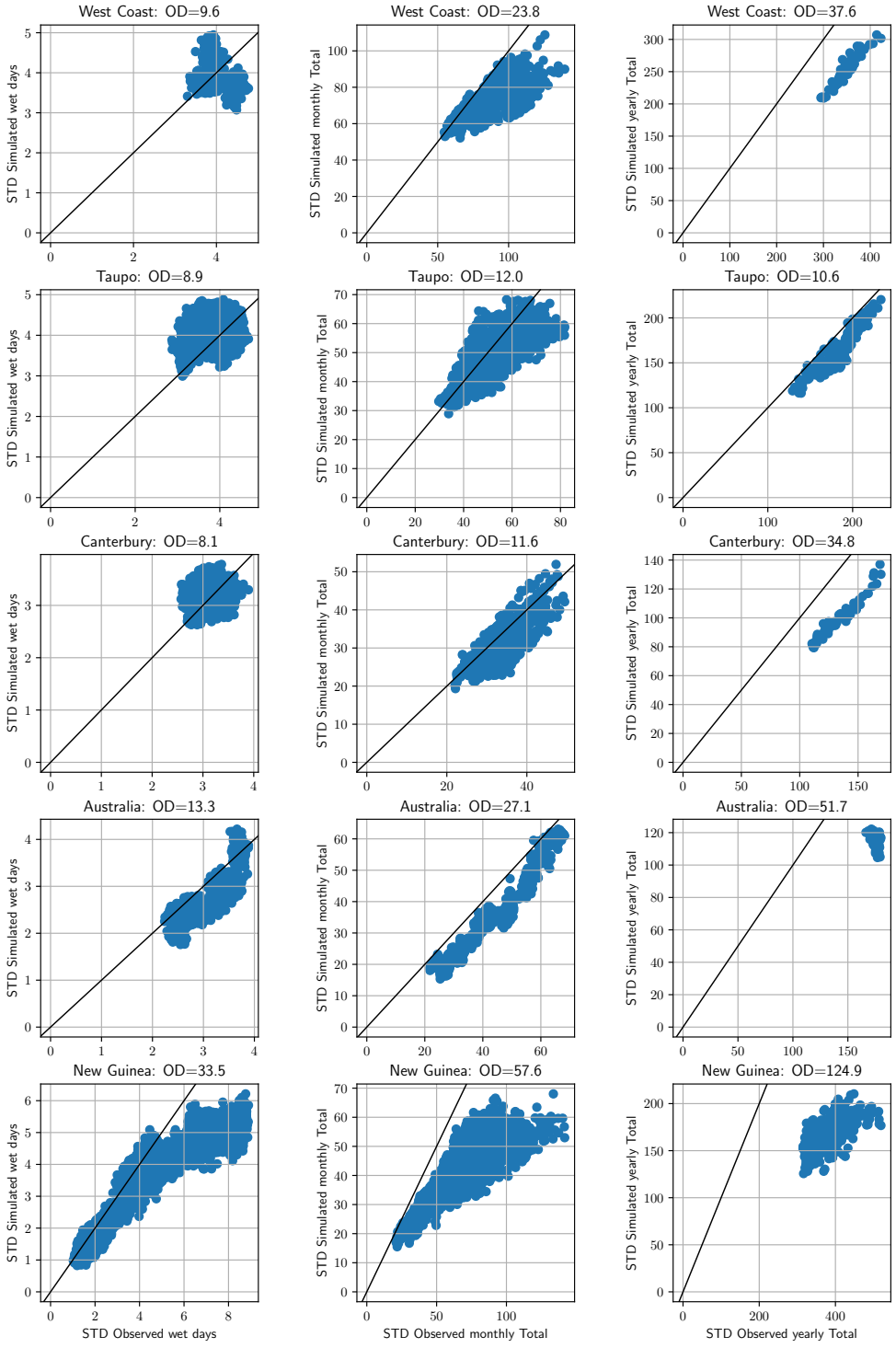


Figure S6. Observed and simulated standard deviations in monthly wet days, monthly accumulated rainfall and yearly accumulated rainfall for all the 5 defined analysis regions. The over dispersion value is included in the titles of each of the subfigures. Note unlike traditional over-dispersion values we have chosen to sum these as absolute values.

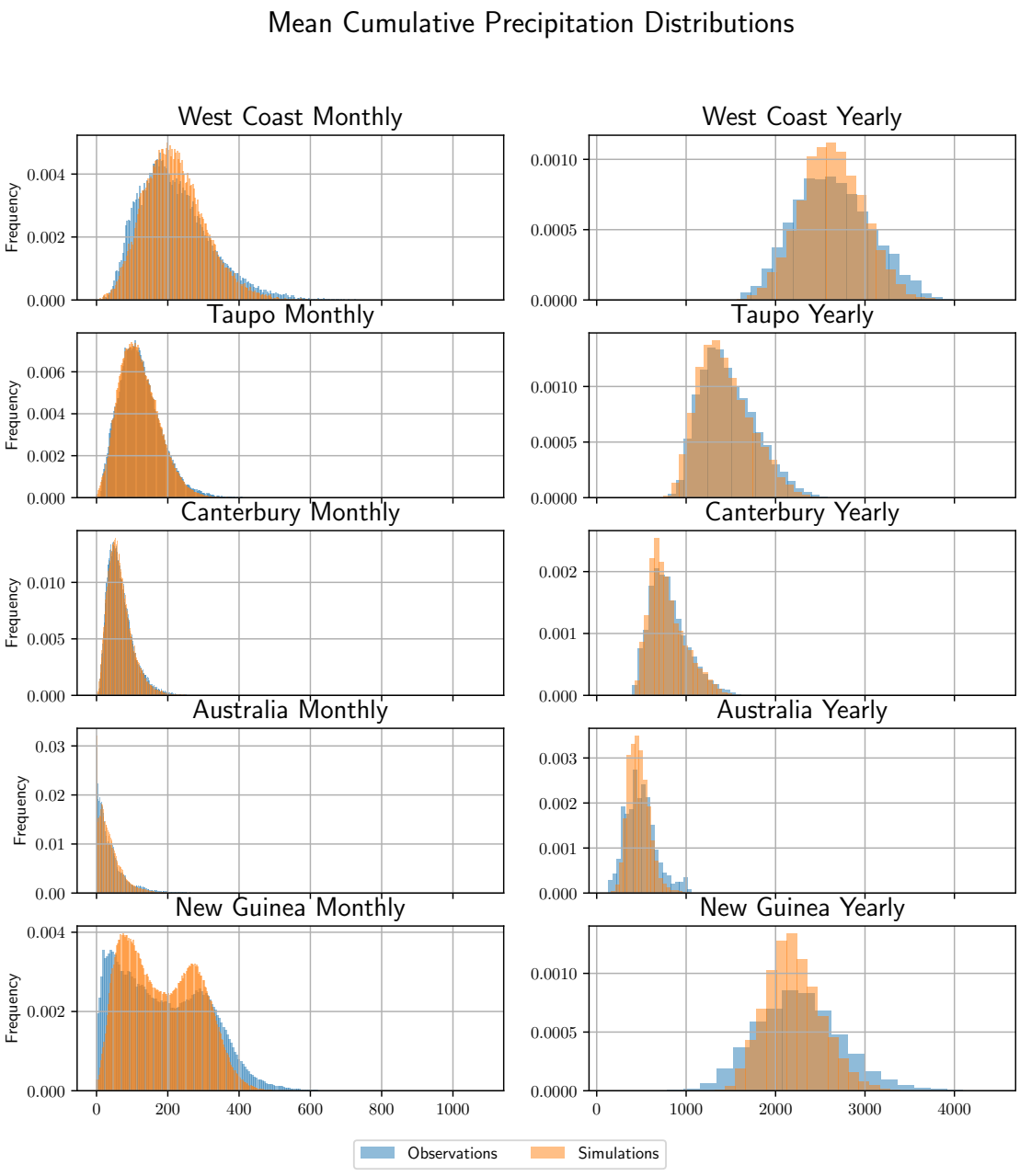


Figure S7. Distribution of the mean monthly precipitation total and mean yearly precipitation totals in the simulations and observations over all five simulation domains. These distributions include every grid cell as an independent data source.

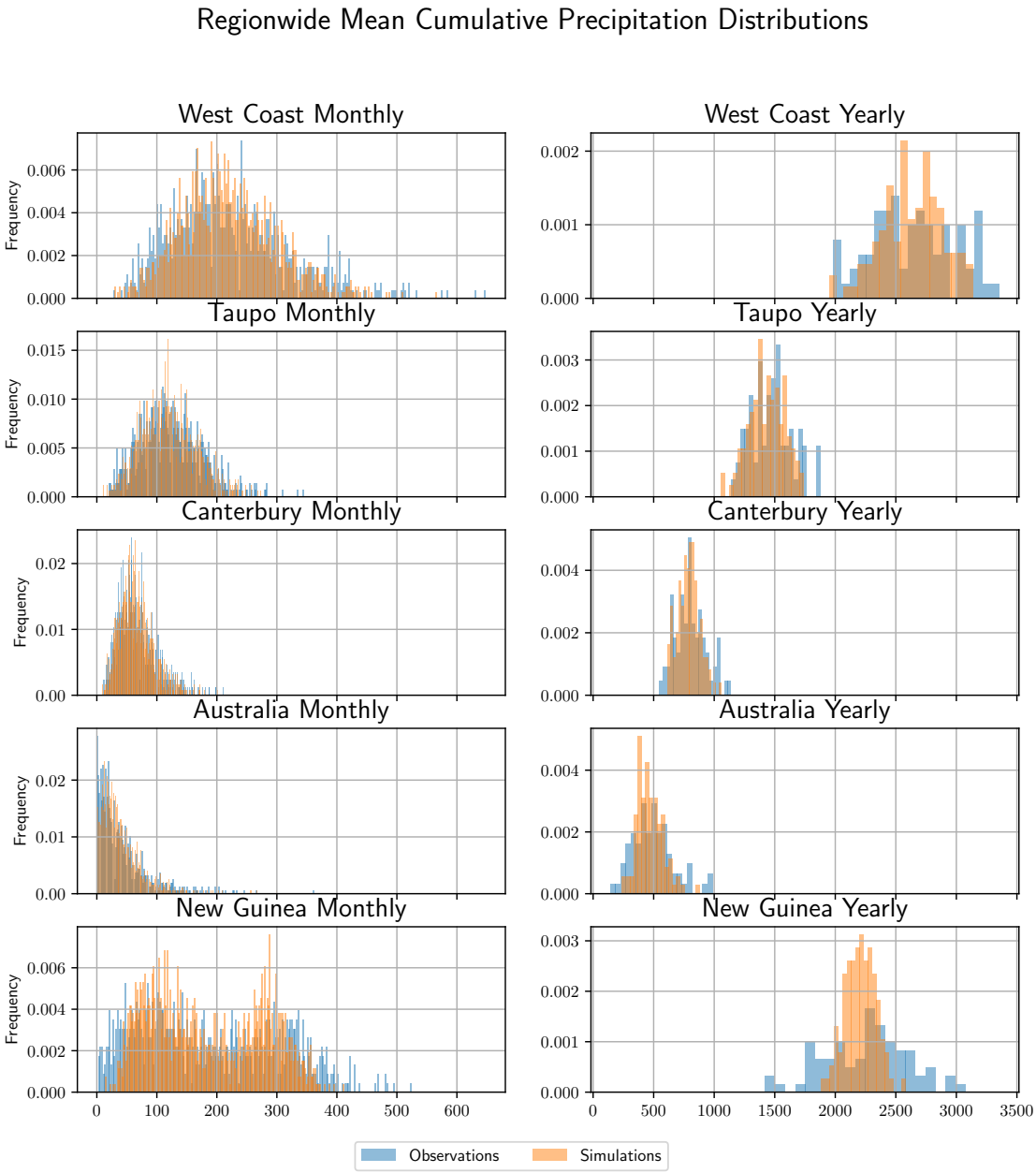


Figure S8. Distribution of the mean monthly precipitation total and mean yearly precipitation totals in the simulations and observations over all five simulation domains. These distributions average all of the grid cells to produce a single region wide variable.

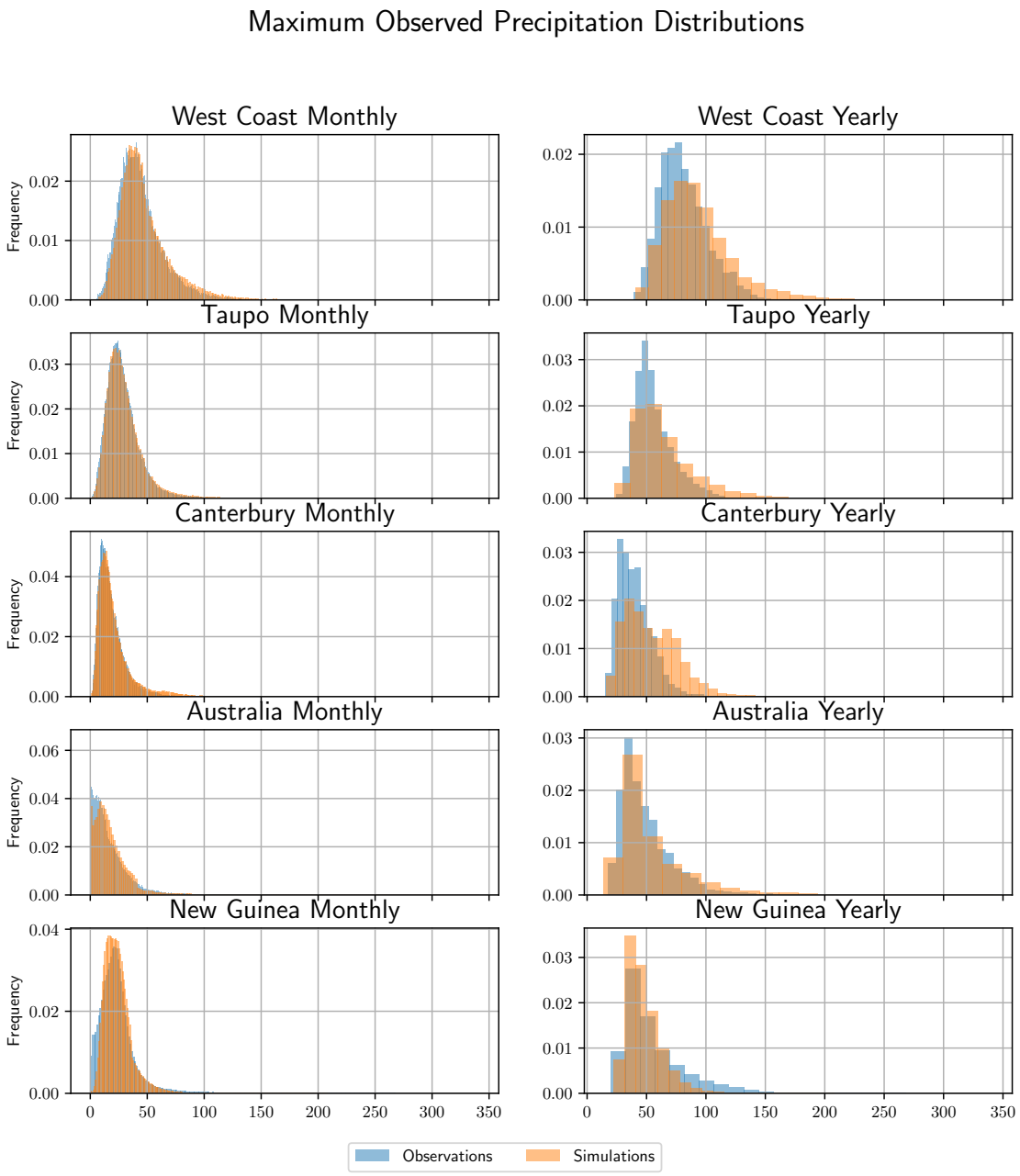


Figure S9. Distribution of the maximum daily precipitation value recorded over each month and year in the simulations and observations over all five simulation domains. These distributions include every grid cell as an independent data source.

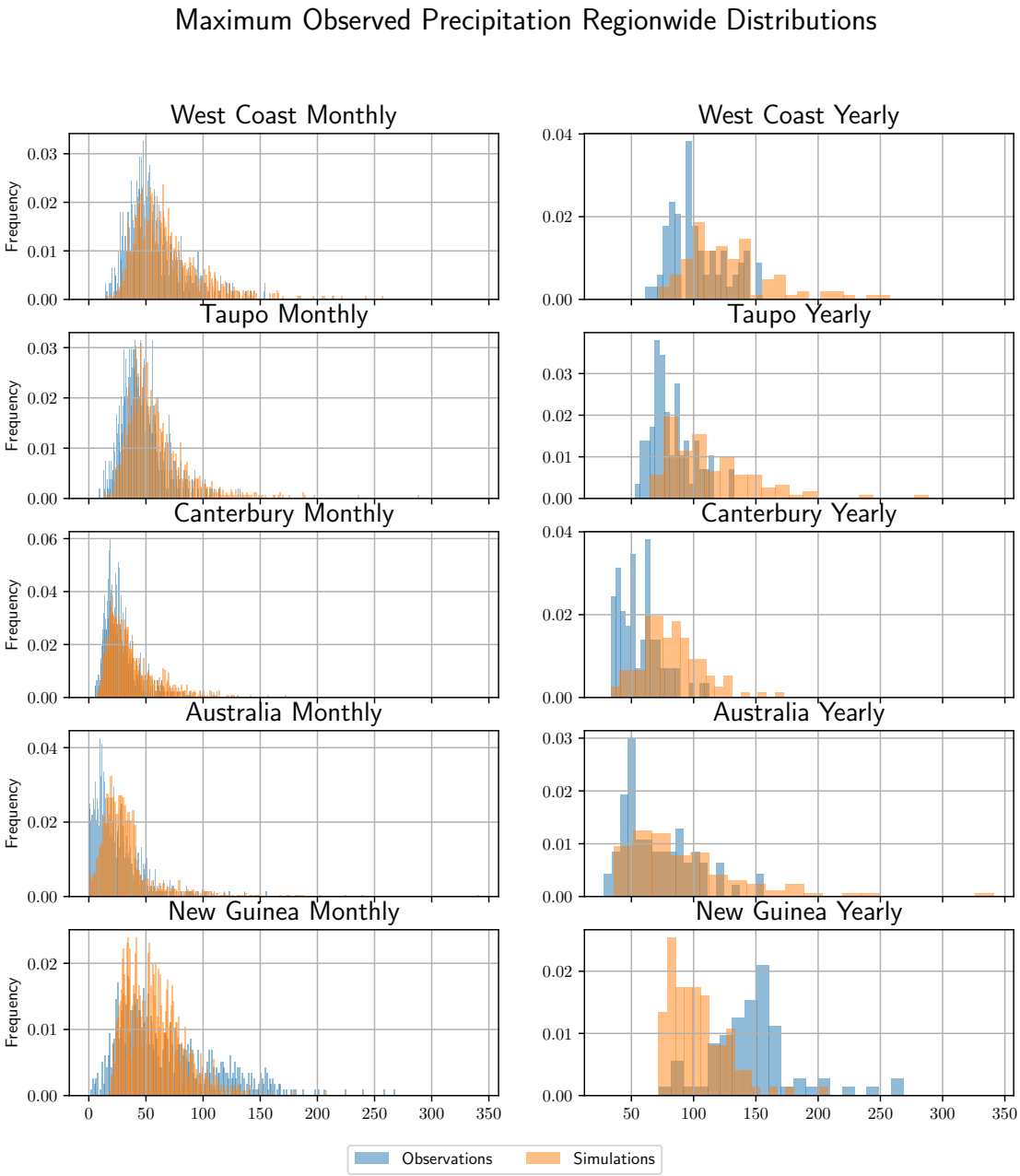


Figure S10. Distribution of the maximum daily precipitation value recorded over each month and year in the simulations and observations over all five simulation domains. These distributions only consider the largest grid cell at any given time to produce a single region wide variable.

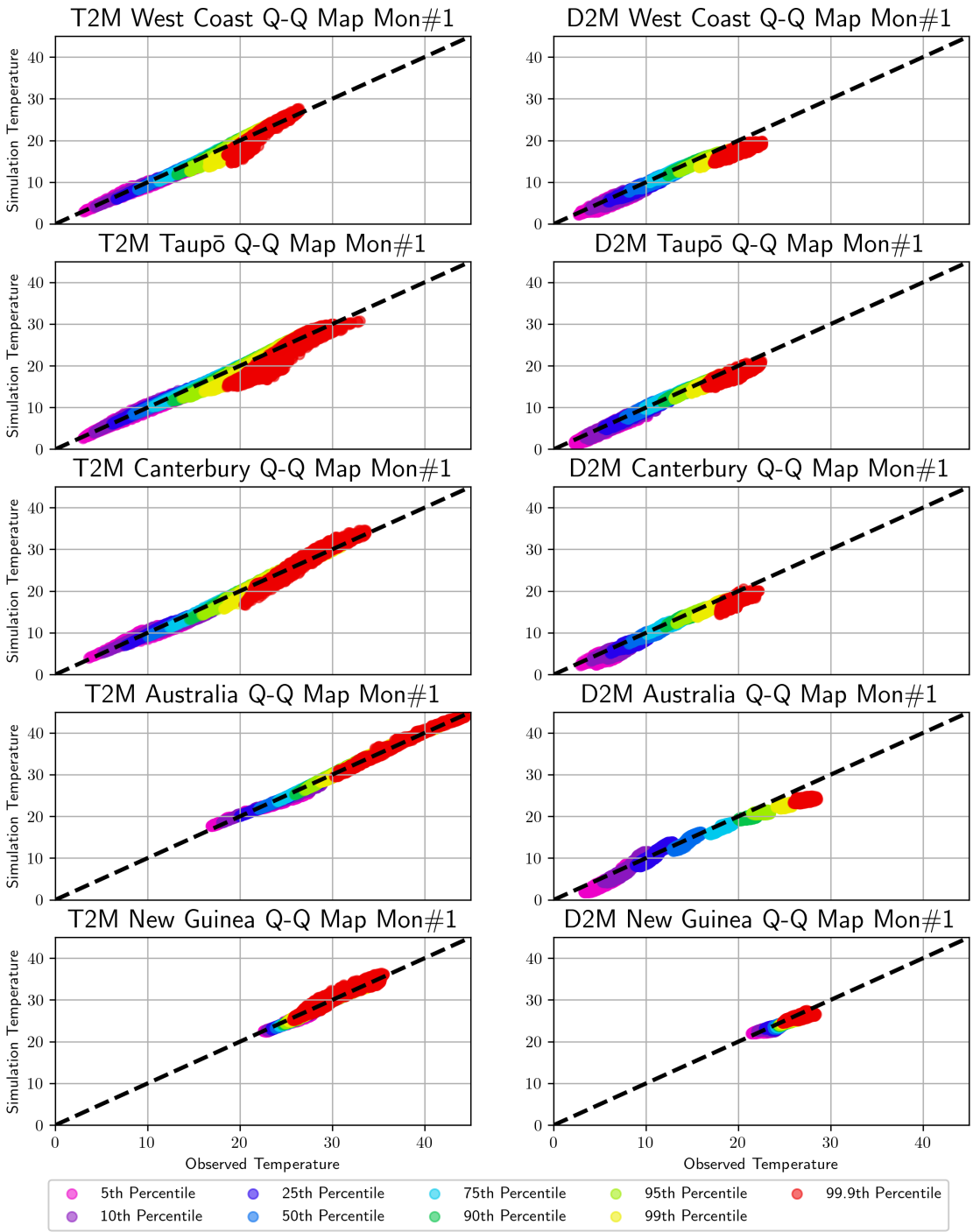


Figure S11. Quantile-quantile comparison of the 2 m air temperature and dew point temperatures for January. Values are calculated independently for each grid point in the domain and for each hour of the day. The percentiles included in this plot are the 5^{th}, 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th}, 95^{th} and 99^{th} percentiles. The dashed line indicates the 1:1 correlation line.

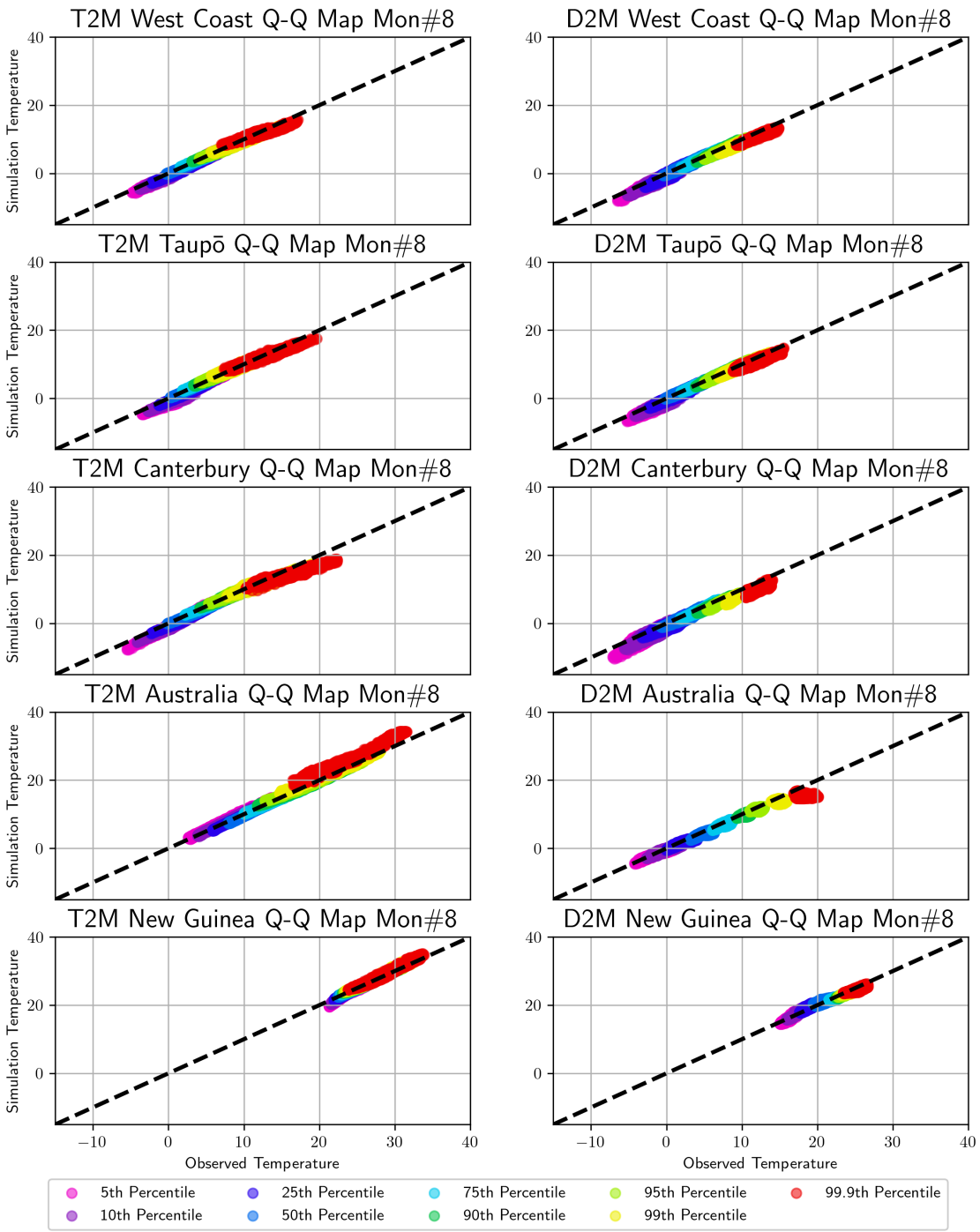


Figure S12. Quantile-quantile comparison of the 2 m air temperature and dew point temperatures for August. Values are calculated independently for each grid point in the domain and for each hour of the day. The percentiles included in this plot are the 5^{th}, 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th}, 95^{th} and 99^{th} percentiles. The dashed line indicates the 1:1 correlation line.

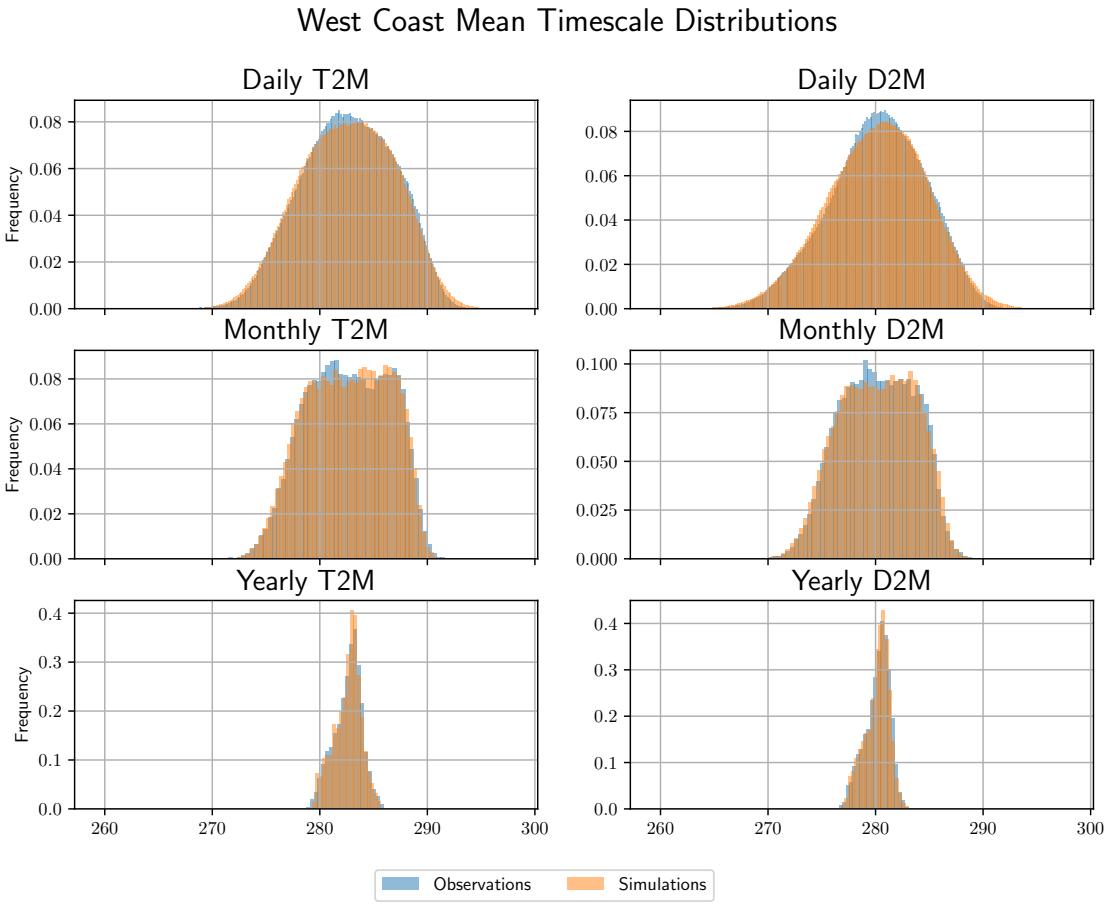


Figure S13. Distribution of the daily mean, monthly mean and annual mean air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the West Coast region, with each grid cell included separately.

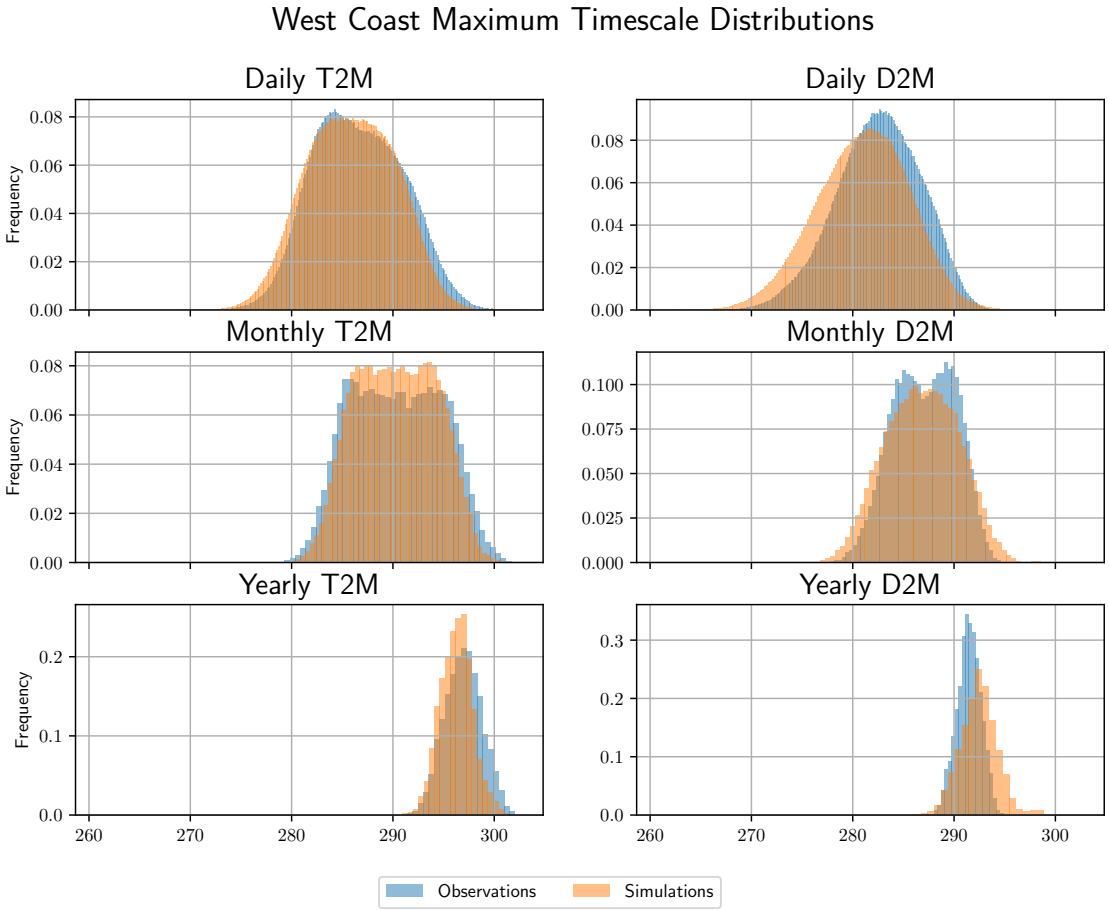


Figure S14. Distribution of the daily maximum, monthly maximum and annual maximum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the West Coast region, with each grid cell included separately.

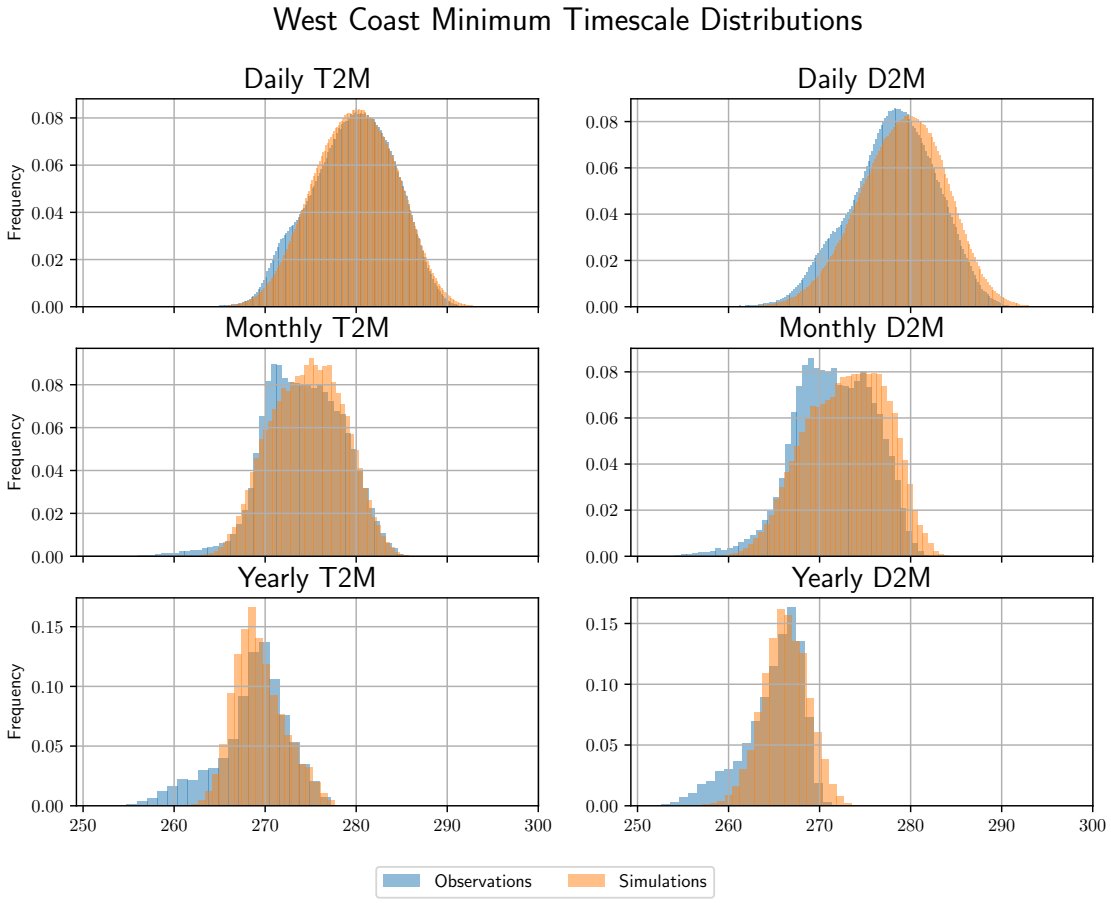


Figure S15. Distribution of the daily minimum, monthly minimum and annual minimum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the West Coast region, with each grid cell included separately.

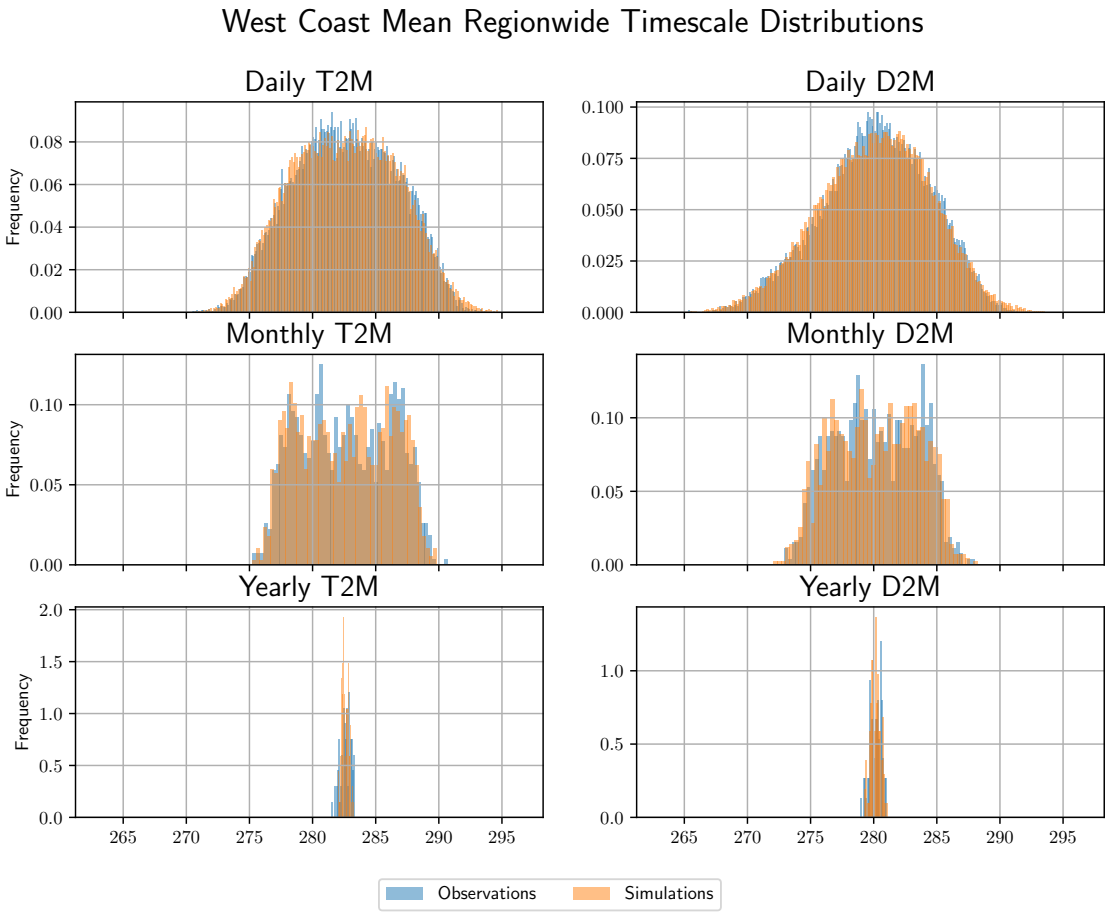


Figure S16. Distribution of the daily mean, monthly mean and annual mean air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the West Coast region, with the mean value of the entire region used for each time division.

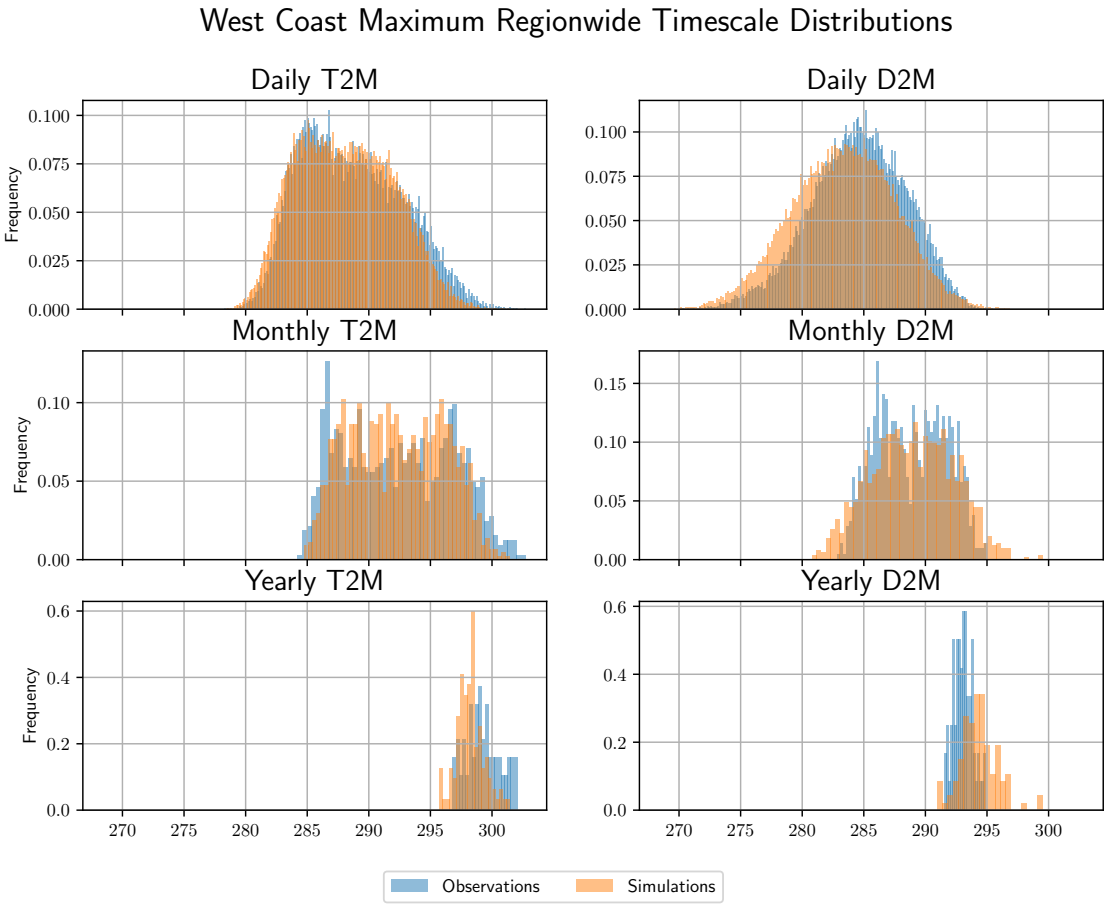


Figure S17. Distribution of the daily maximum, monthly maximum and annual maximum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the West Coast region, with only the maximum value over the entire region used.

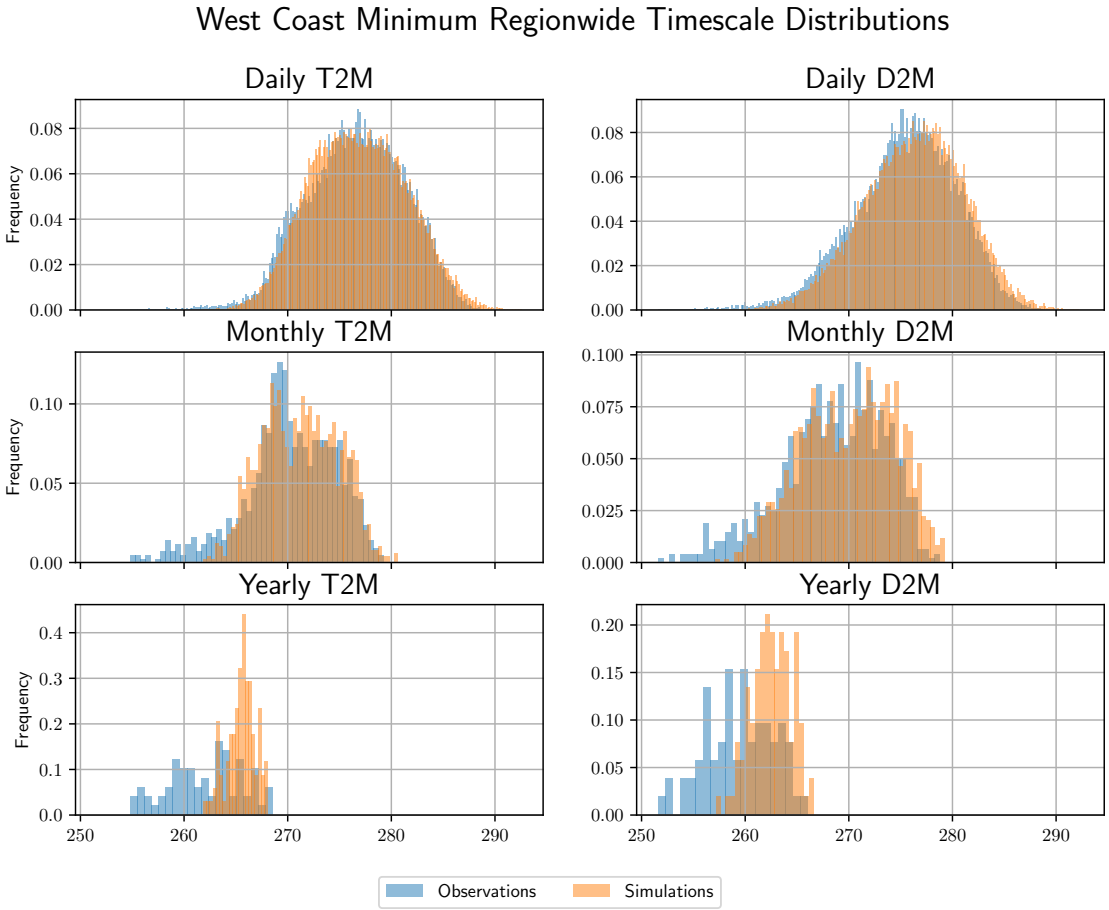


Figure S18. Distribution of the daily minimum, monthly minimum and annual minimum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the West Coast region, with only the minimum value over the entire region used.

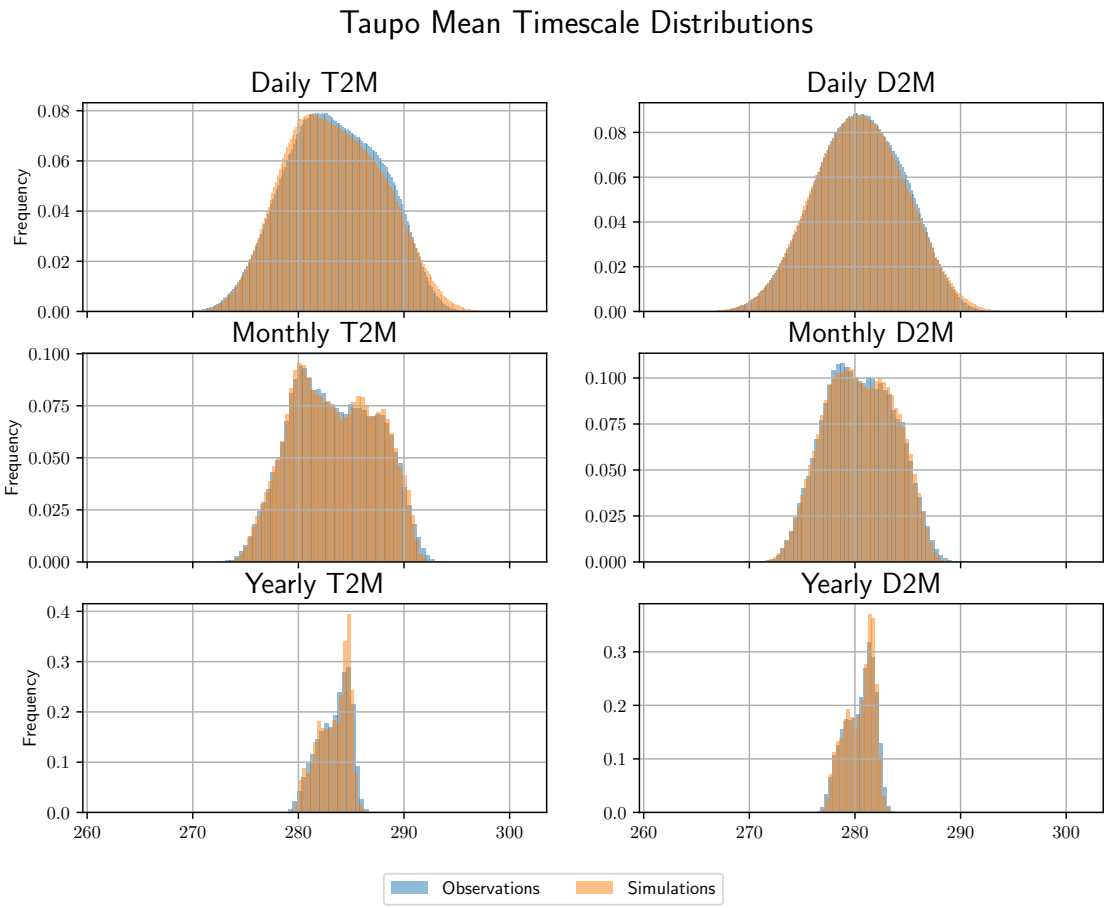


Figure S19. Distribution of the daily mean, monthly mean and annual mean air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Taupo region, with each grid cell included separately.

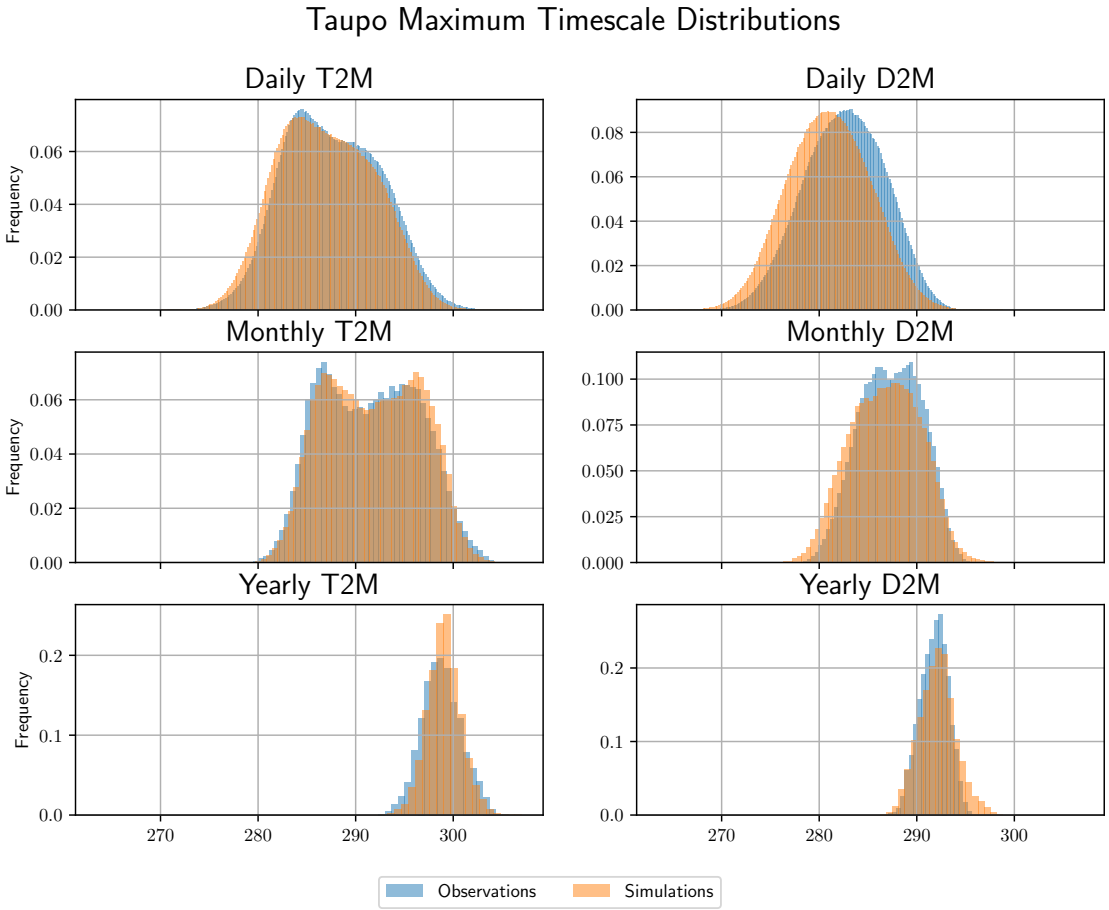


Figure S20. Distribution of the daily maximum, monthly maximum and annual maximum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Taupo region, with each grid cell included separately.

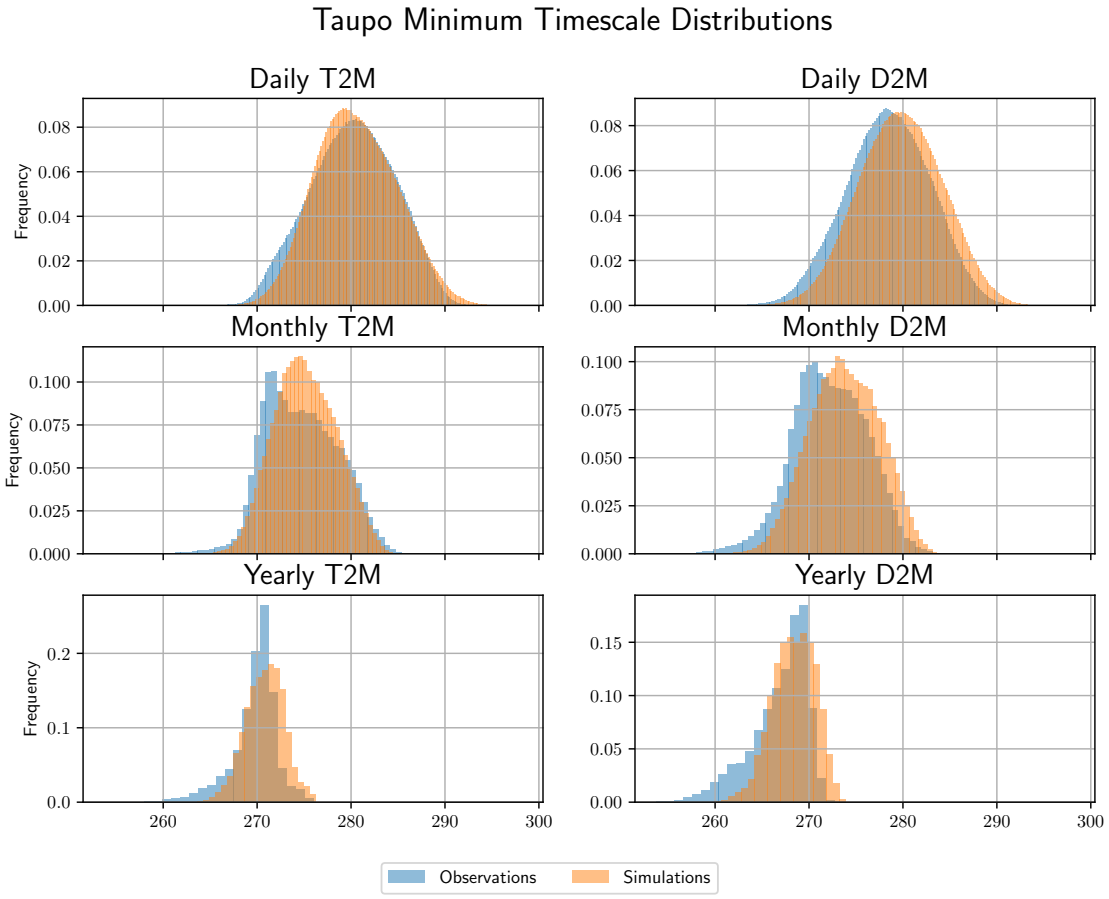


Figure S21. Distribution of the daily minimum, monthly minimum and annual minimum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Taupo region, with each grid cell included separately.

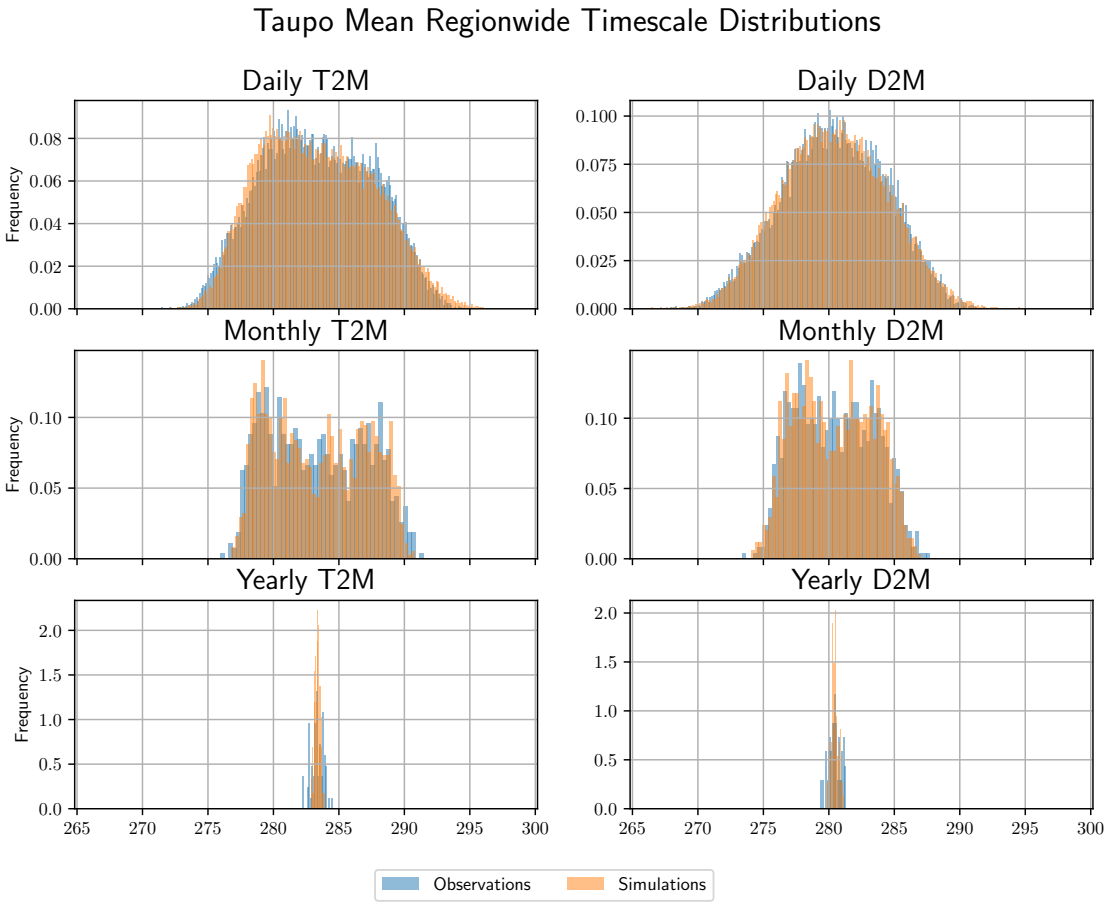


Figure S22. Distribution of the daily mean, monthly mean and annual mean air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Taupo region, with the mean value of the entire region used for each time division.

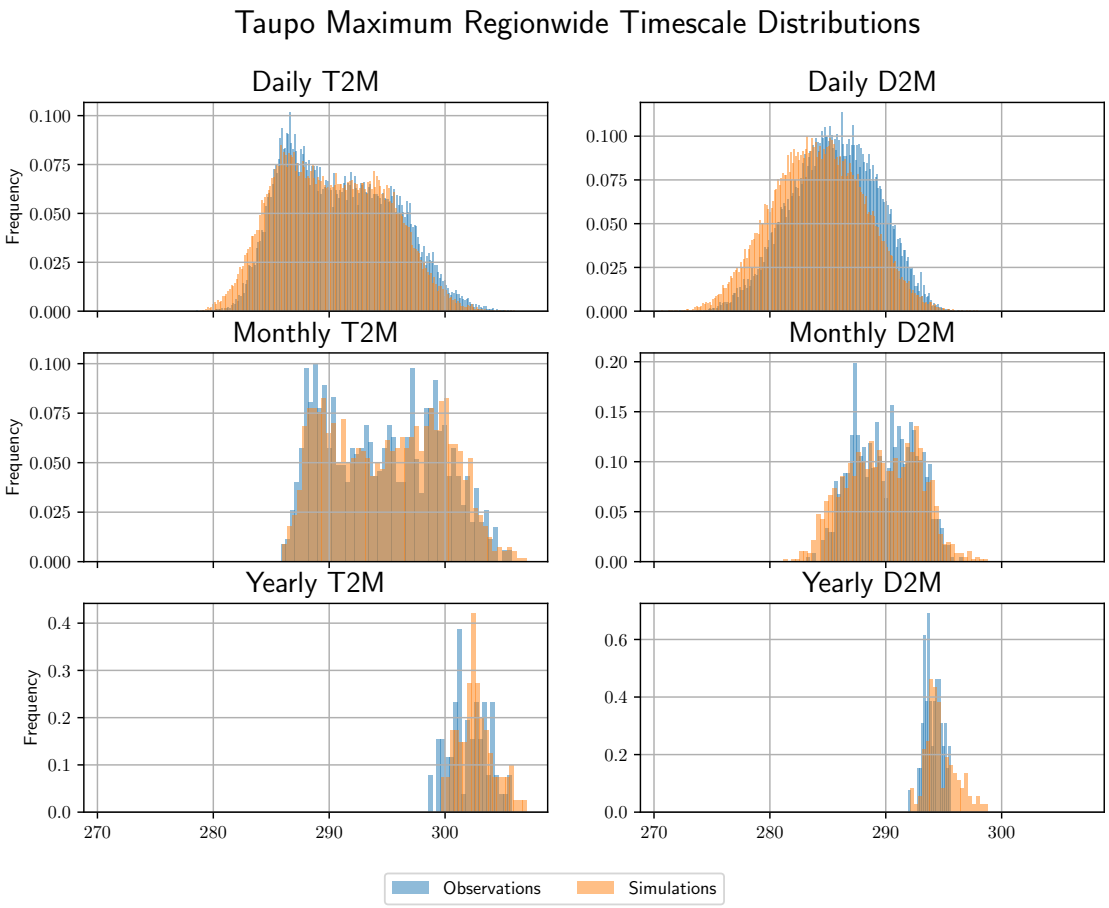


Figure S23. Distribution of the daily maximum, monthly maximum and annual maximum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Taupo region, with only the maximum value over the entire region used.

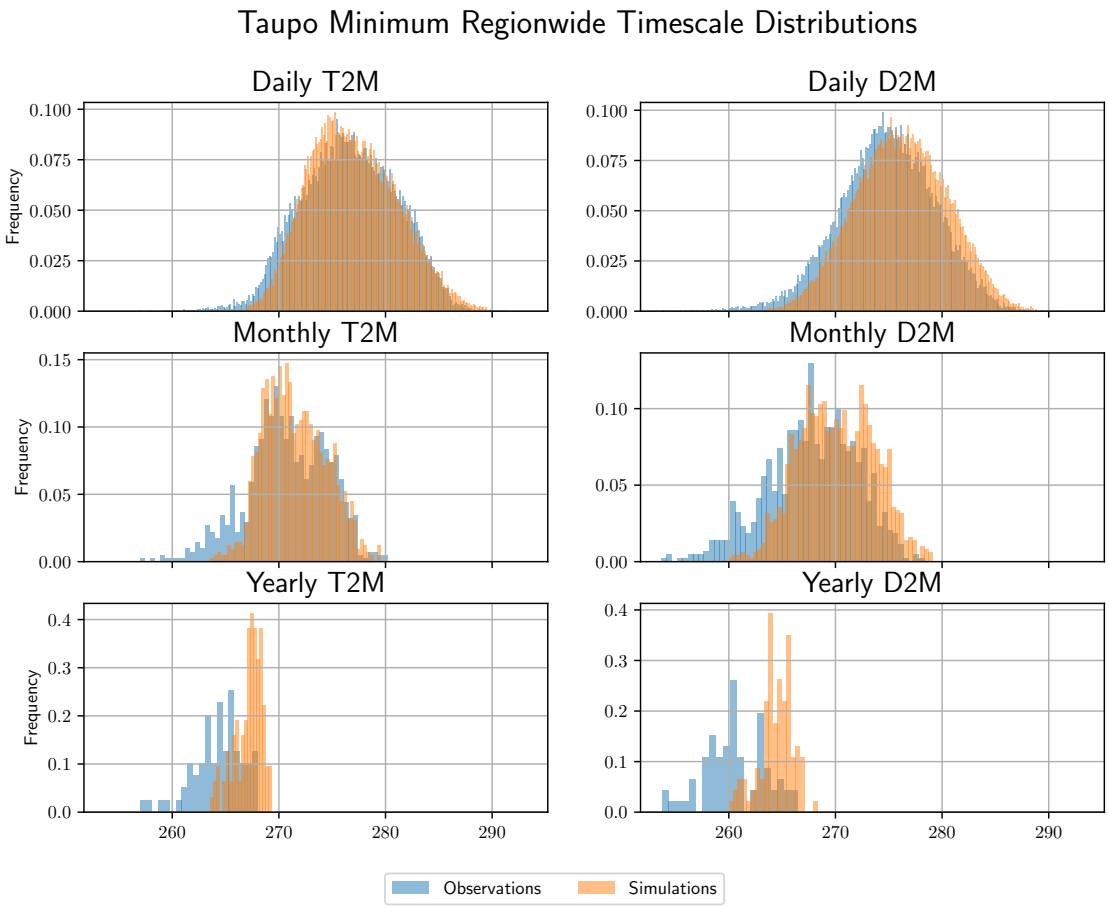


Figure S24. Distribution of the daily minimum, monthly minimum and annual minimum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Taupo region, with only the minimum value over the entire region used.

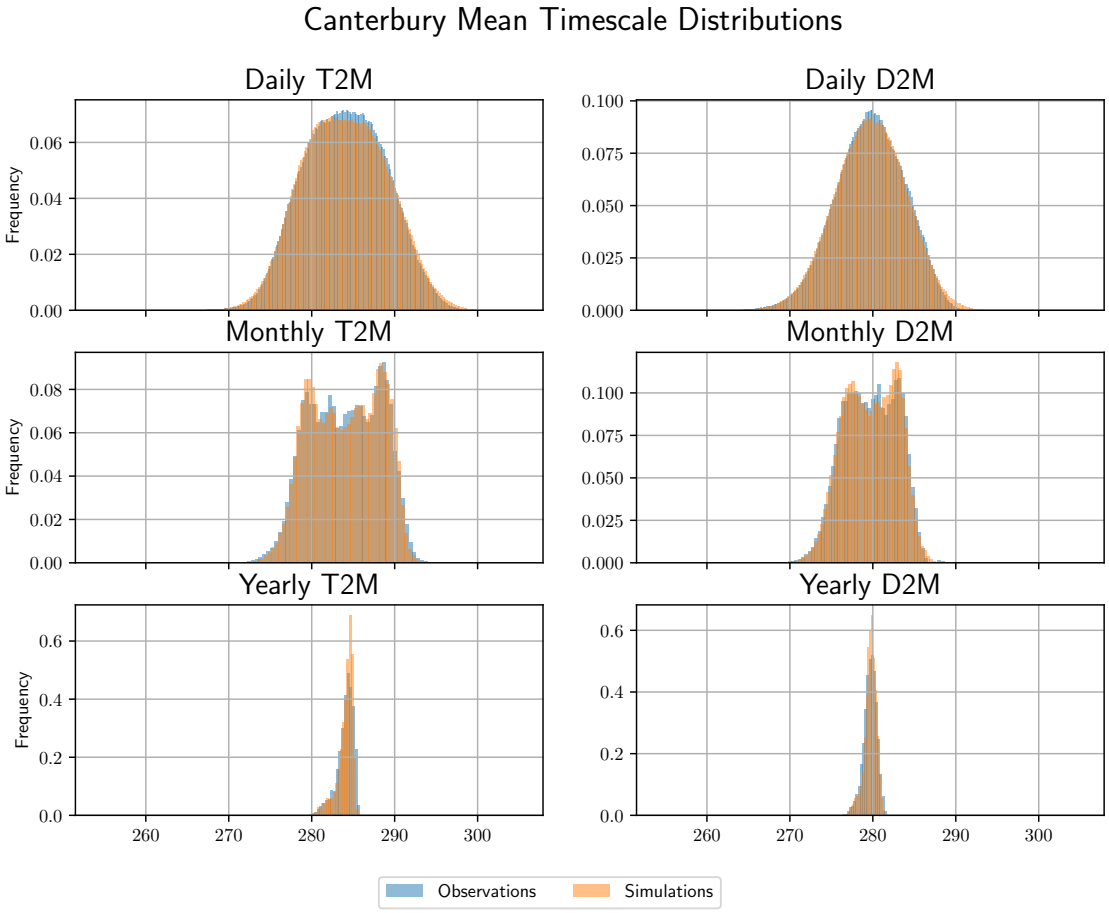


Figure S25. Distribution of the daily mean, monthly mean and annual mean air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Canterbury region, with each grid cell included separately.

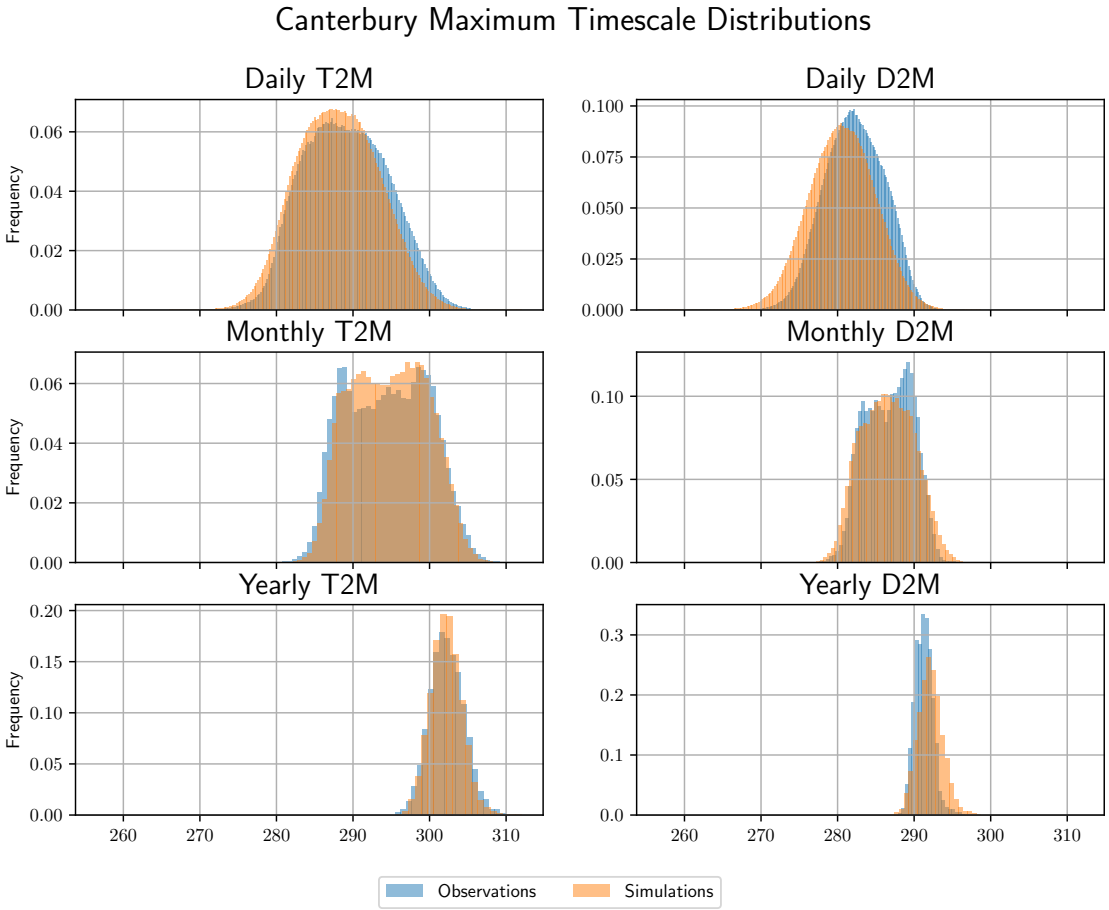


Figure S26. Distribution of the daily maximum, monthly maximum and annual maximum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Canterbury region, with each grid cell included separately.

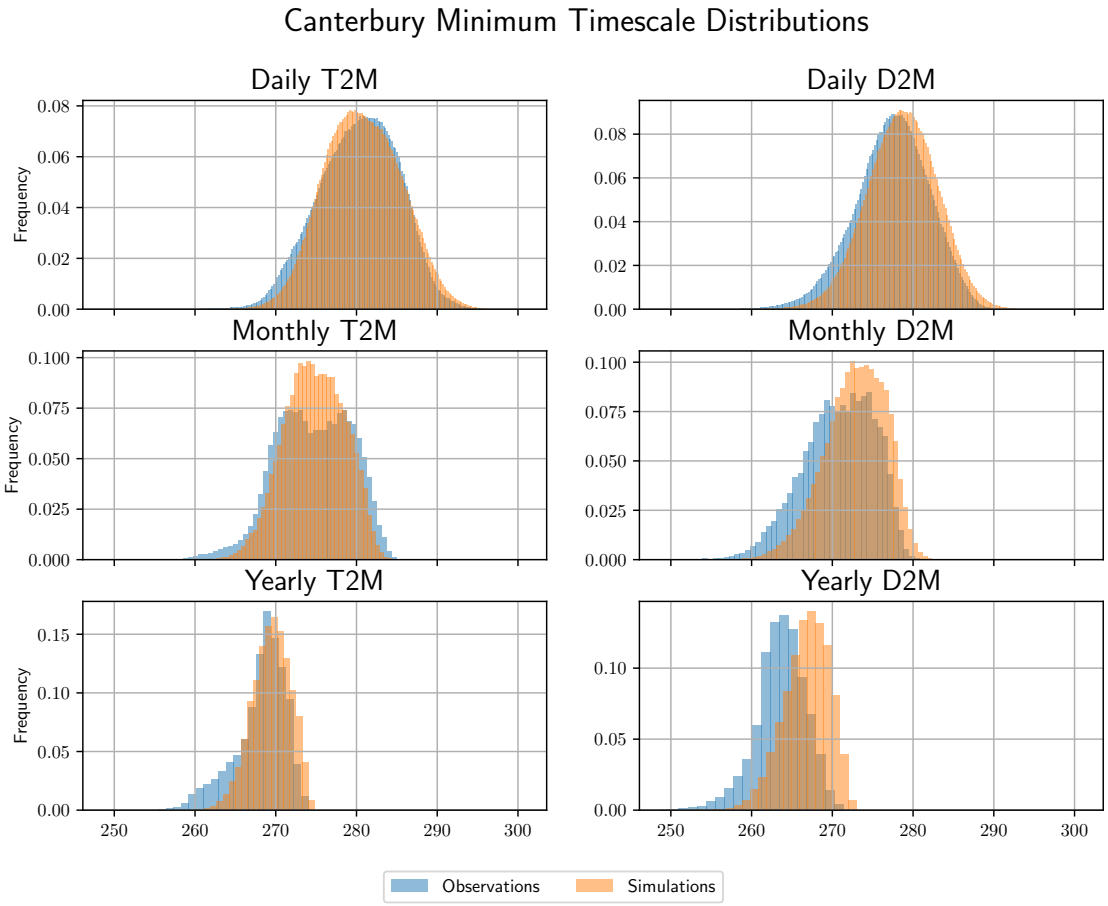


Figure S27. Distribution of the daily minimum, monthly minimum and annual minimum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Canterbury region, with each grid cell included separately.

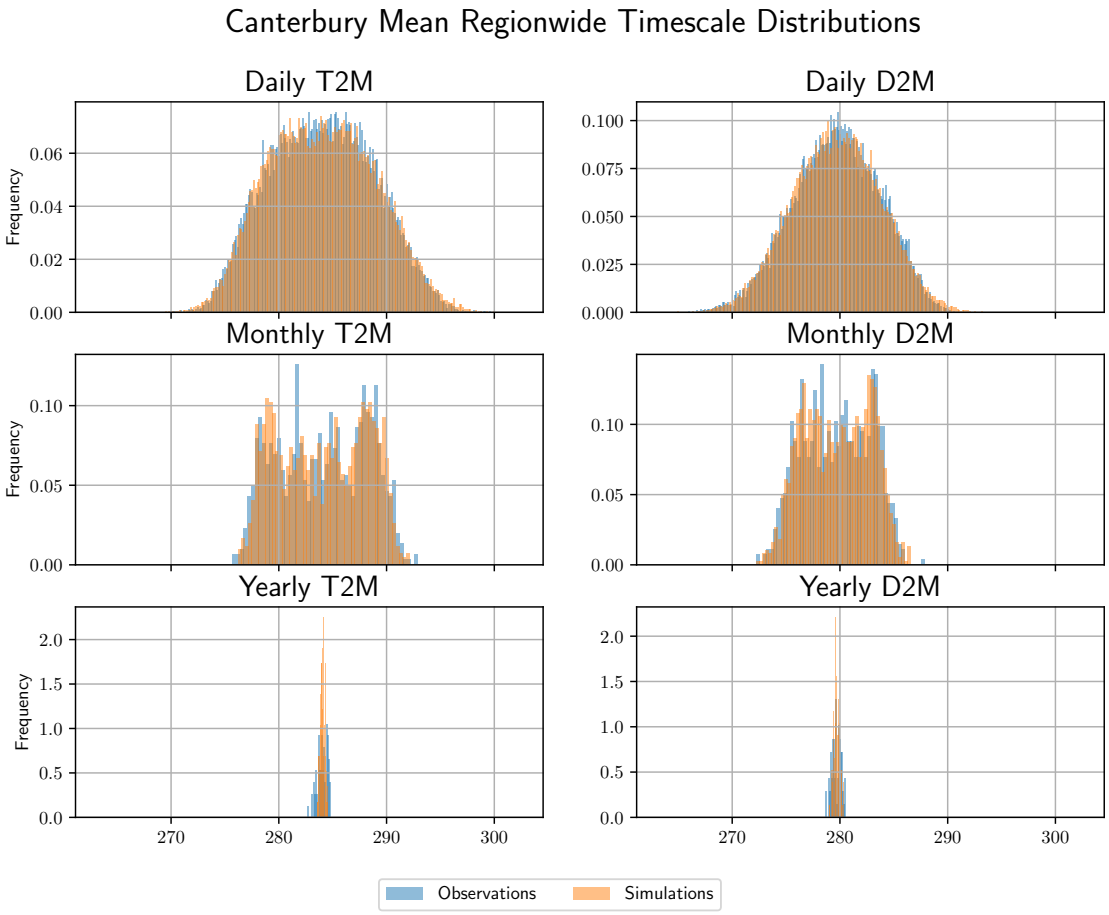


Figure S28. Distribution of the daily mean, monthly mean and annual mean air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Canterbury region, with the mean value of the entire region used for each time division.

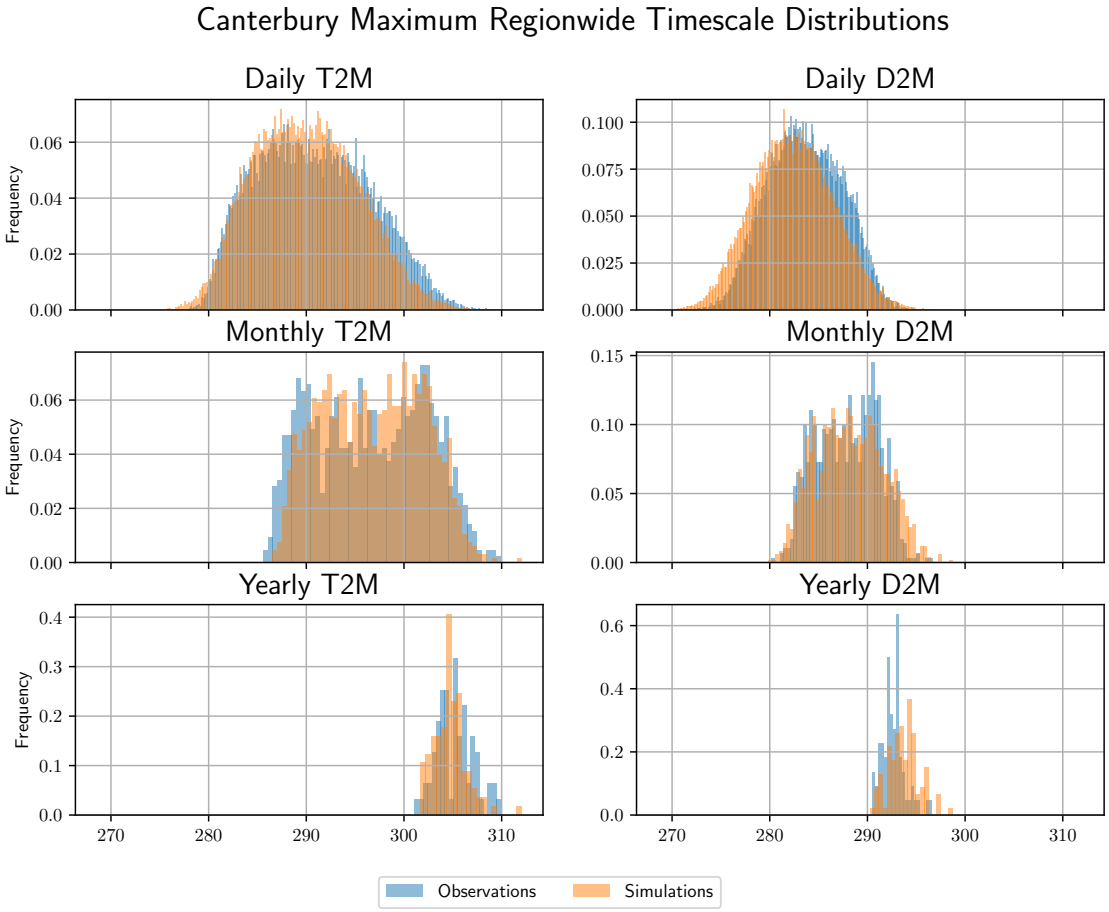


Figure S29. Distribution of the daily maximum, monthly maximum and annual maximum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Canterbury region, with only the maximum value over the entire region used.

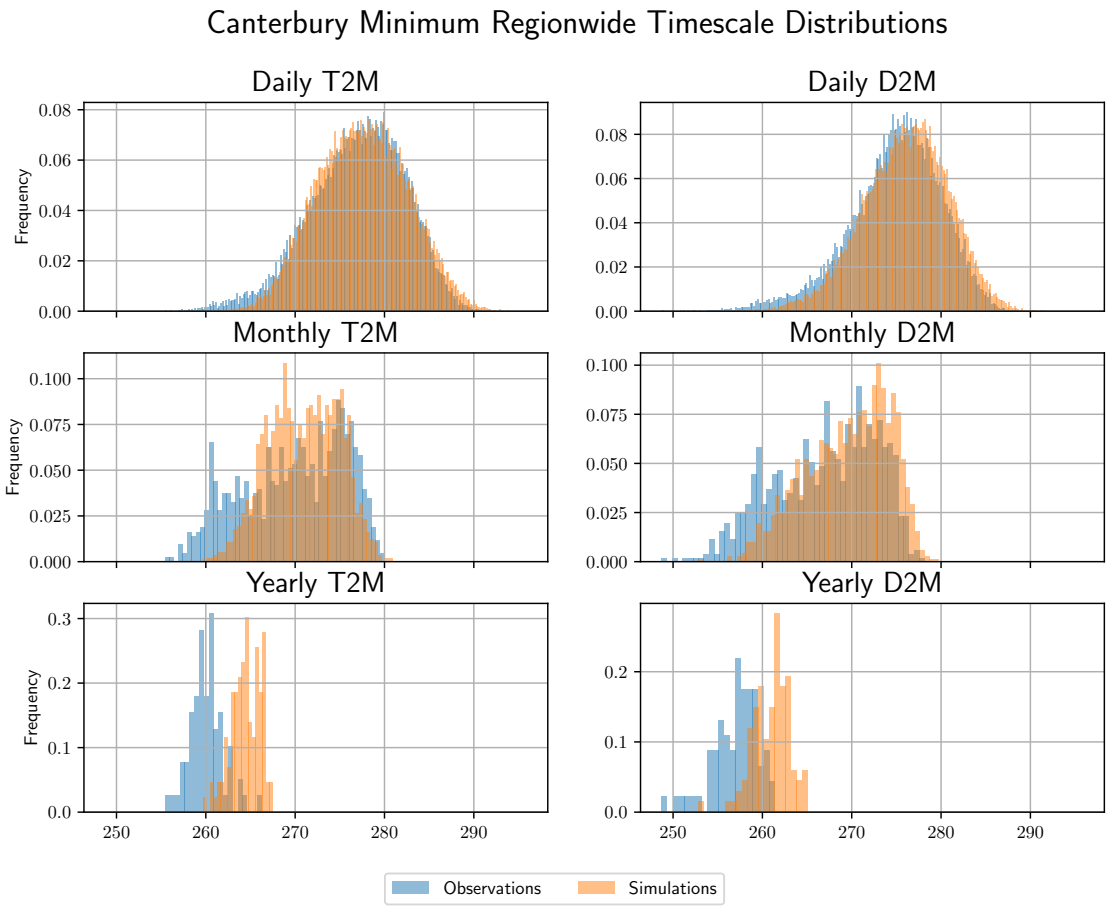


Figure S30. Distribution of the daily minimum, monthly minimum and annual minimum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Canterbury region, with only the minimum value over the entire region used.

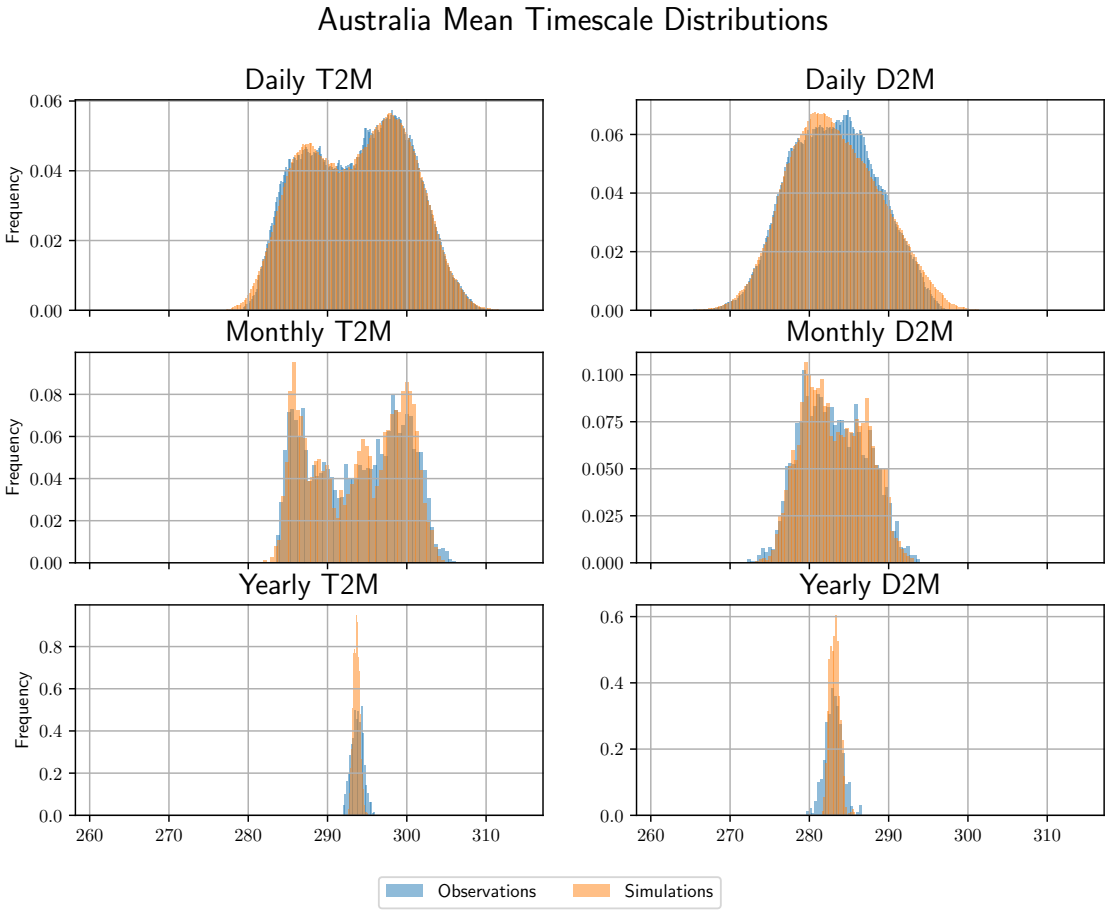


Figure S31. Distribution of the daily mean, monthly mean and annual mean air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Australia region, with each grid cell included separately.

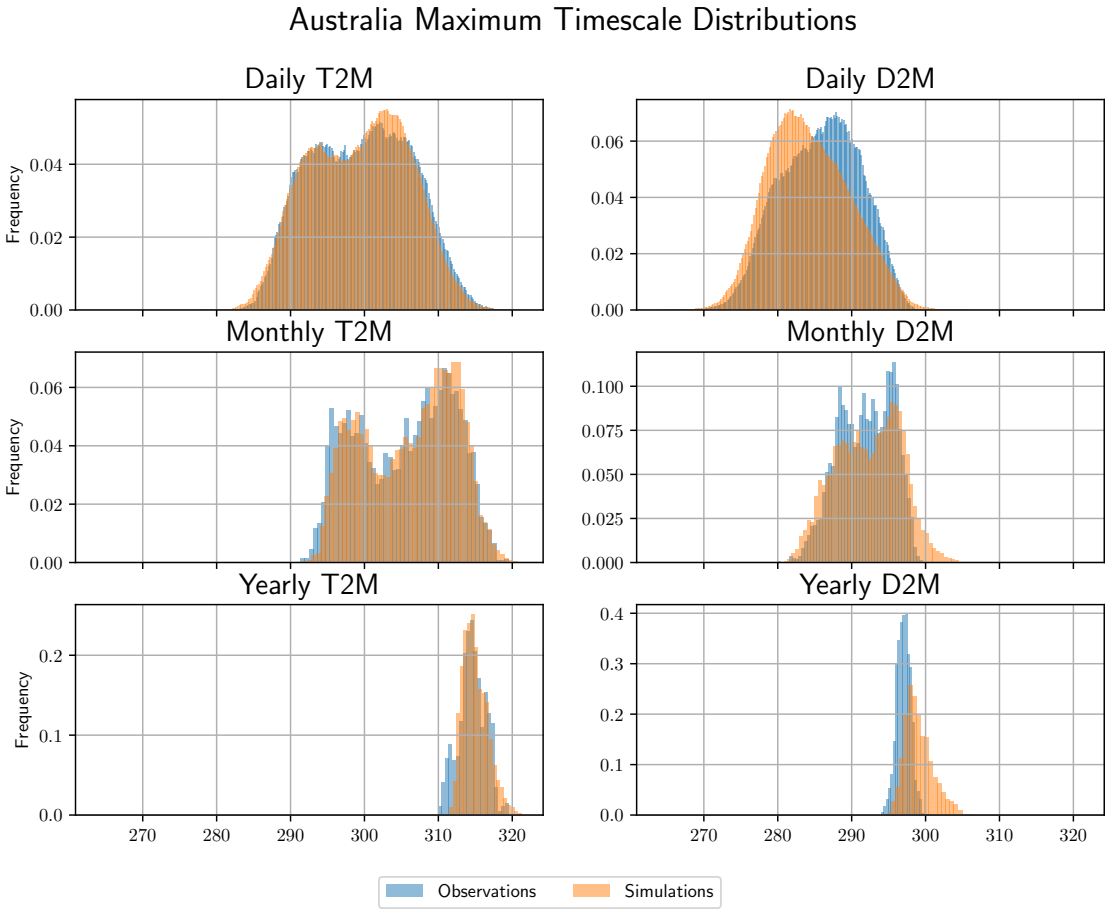


Figure S32. Distribution of the daily maximum, monthly maximum and annual maximum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Australia region, with each grid cell included separately.

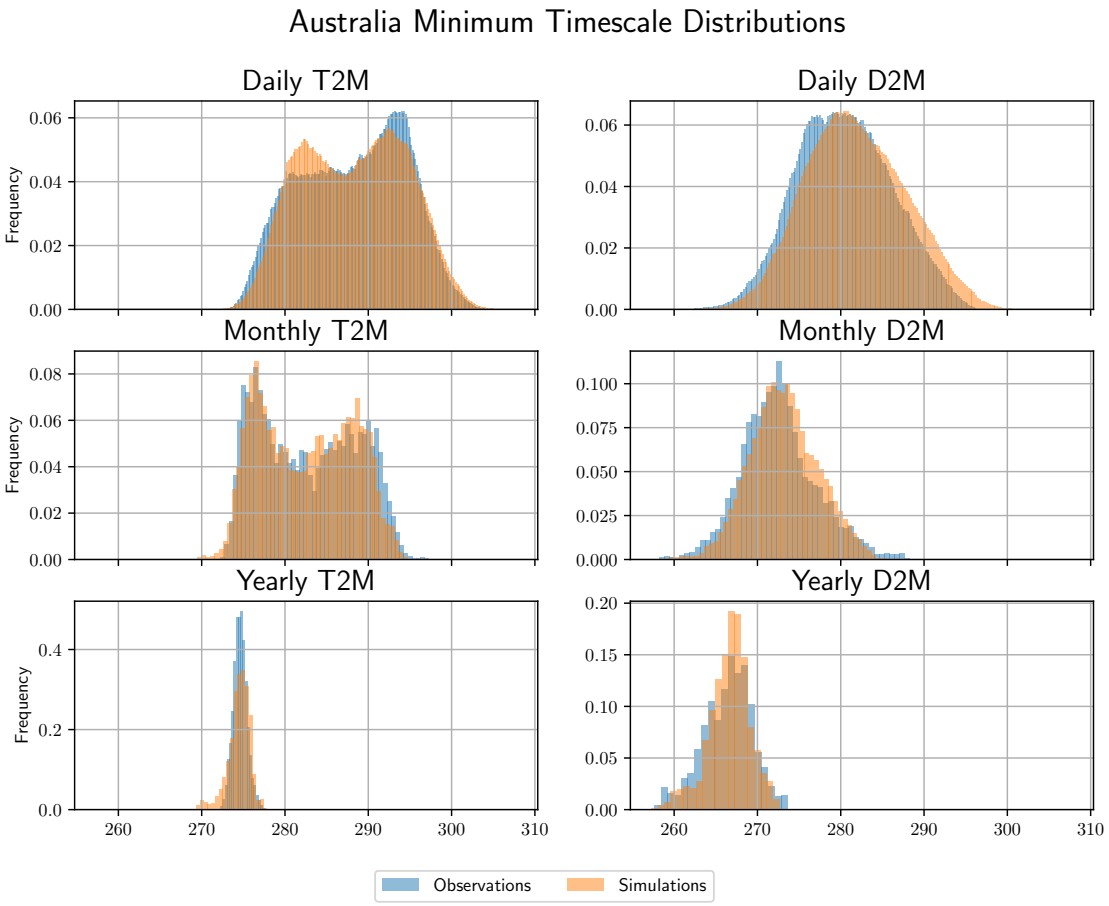


Figure S33. Distribution of the daily minimum, monthly minimum and annual minimum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Australia region, with each grid cell included separately.

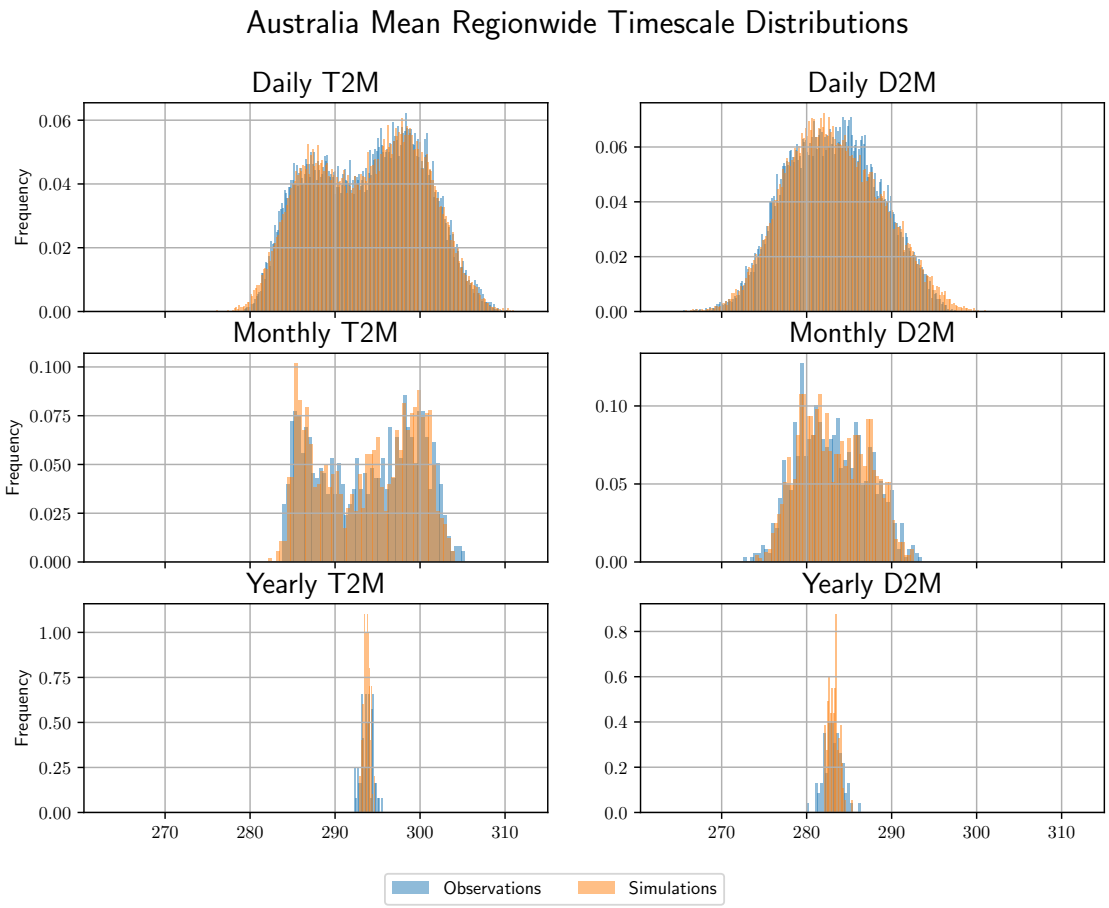


Figure S34. Distribution of the daily mean, monthly mean and annual mean air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Australia region, with the mean value of the entire region used for each time division.

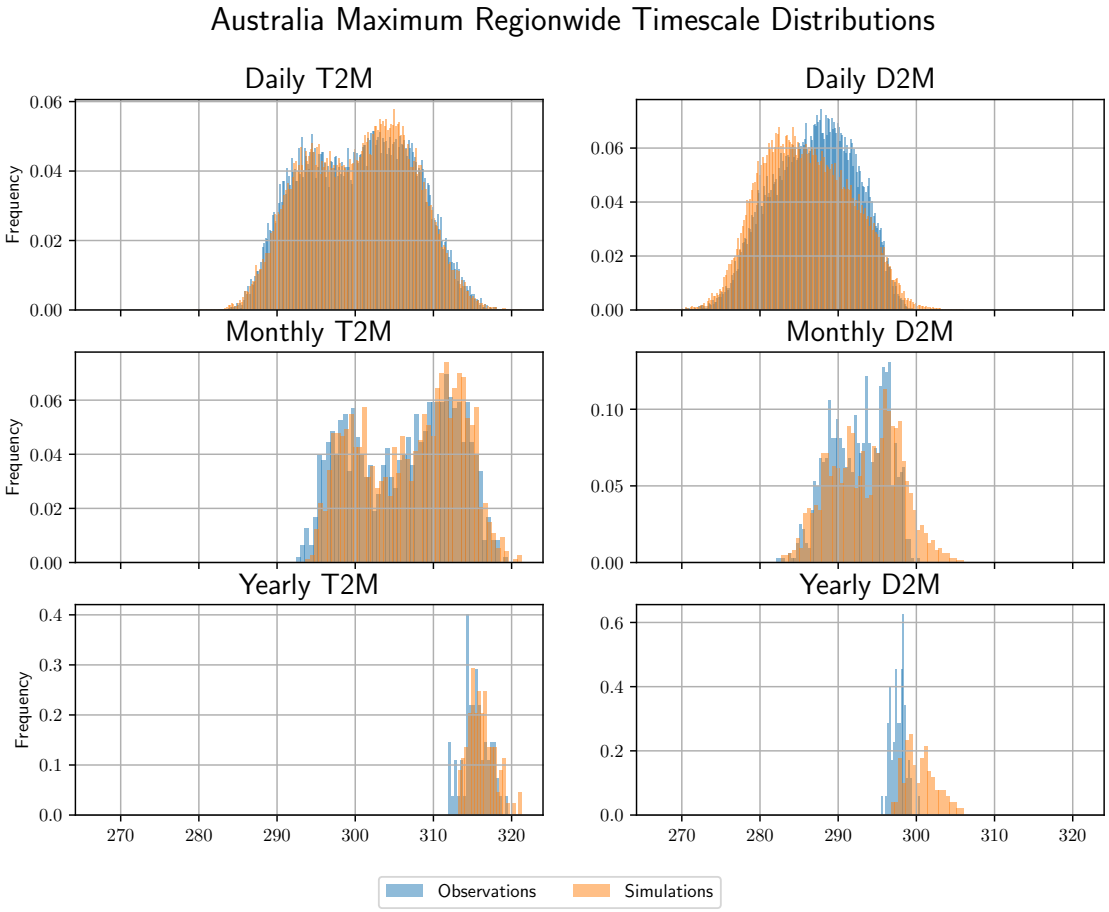


Figure S35. Distribution of the daily maximum, monthly maximum and annual maximum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Australia region, with only the maximum value over the entire region used.

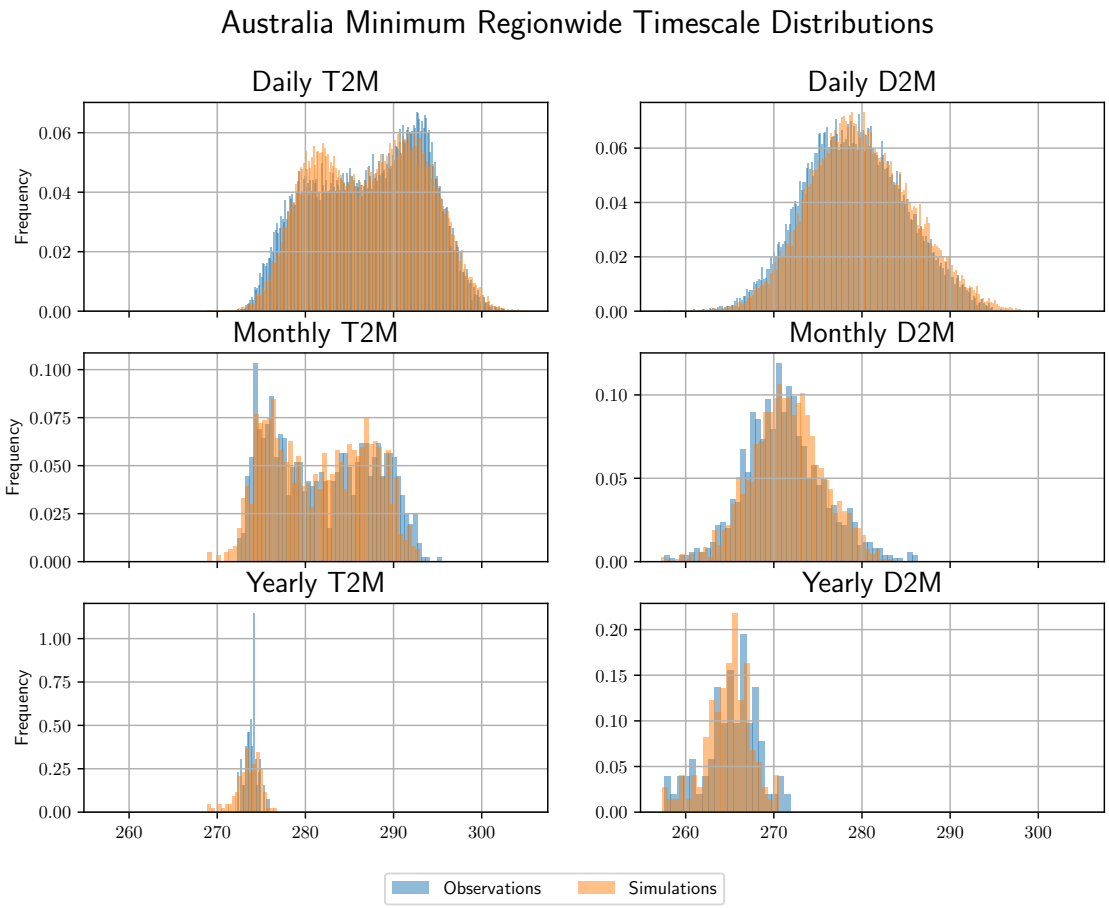


Figure S36. Distribution of the daily minimum, monthly minimum and annual minimum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the Australia region, with only the minimum value over the entire region used.

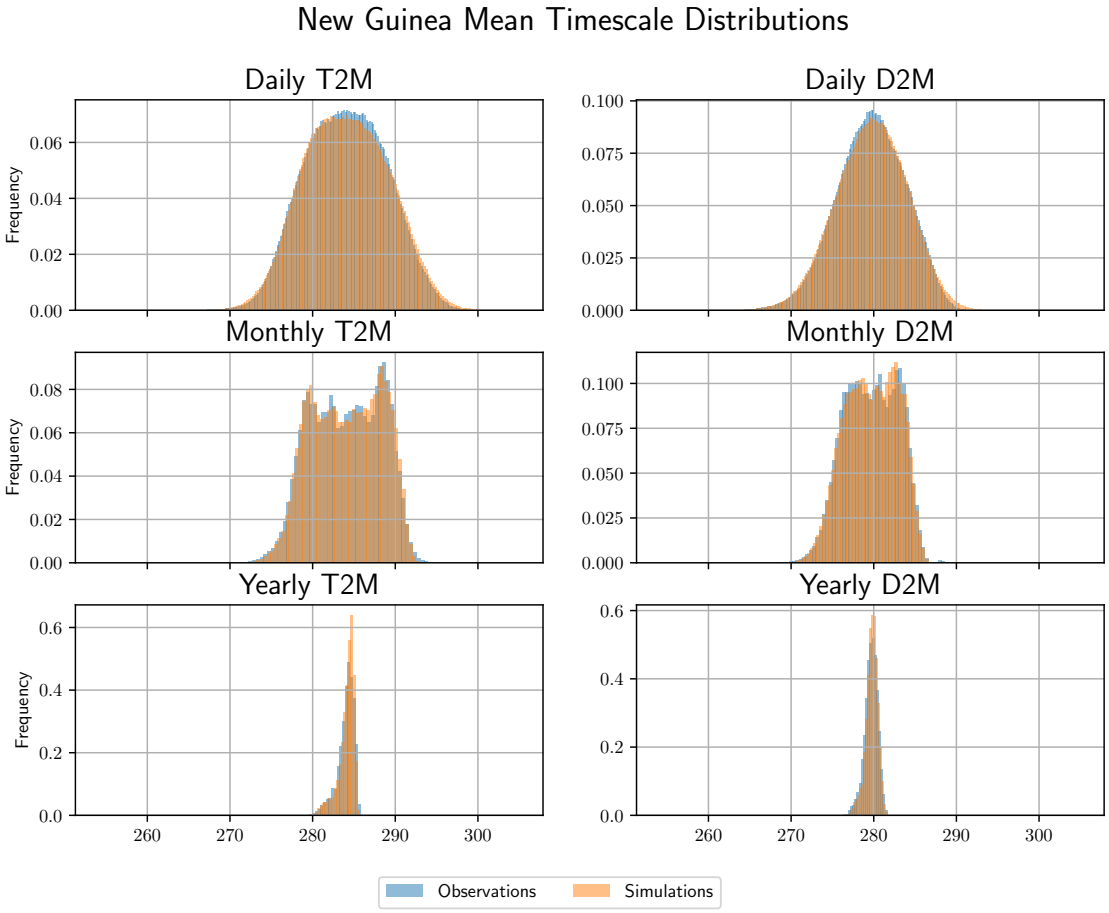


Figure S37. Distribution of the daily mean, monthly mean and annual mean air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the New Guinea region, with each grid cell included separately.

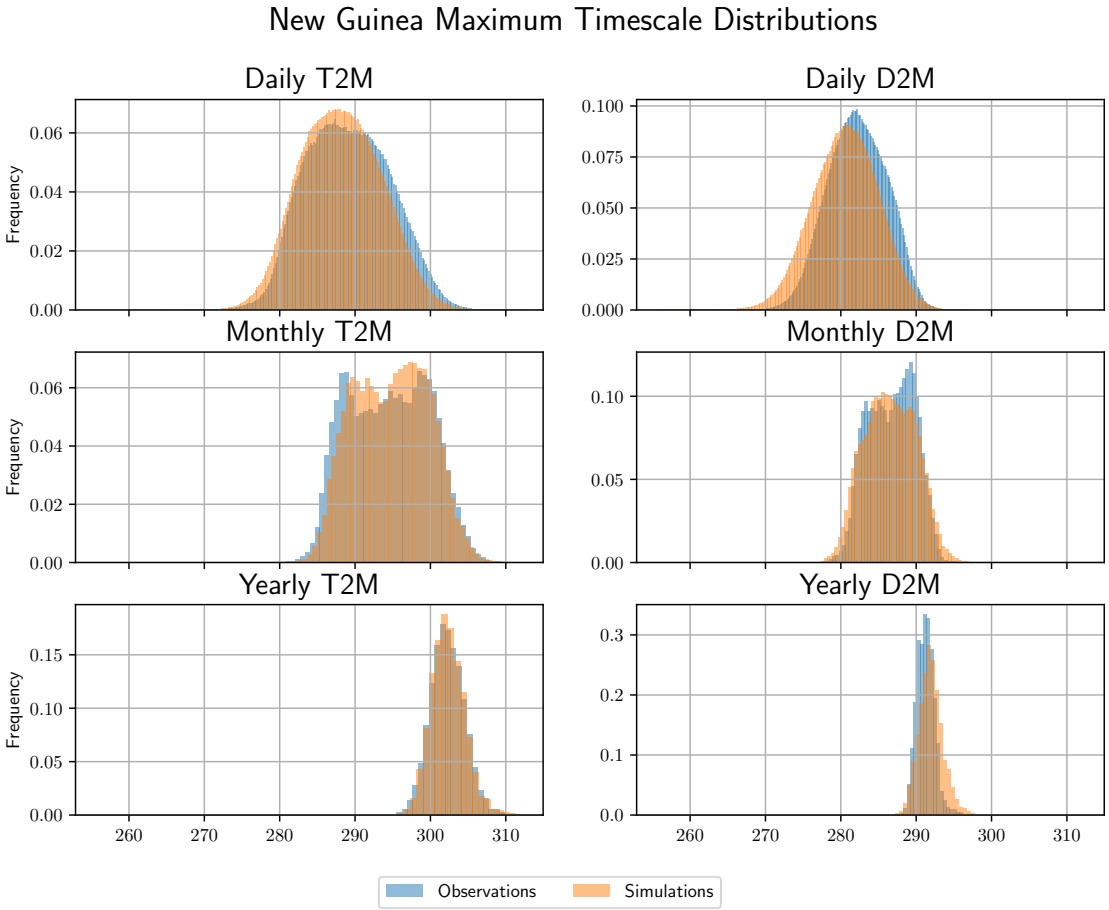


Figure S38. Distribution of the daily maximum, monthly maximum and annual maximum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the New Guinea region, with each grid cell included separately.

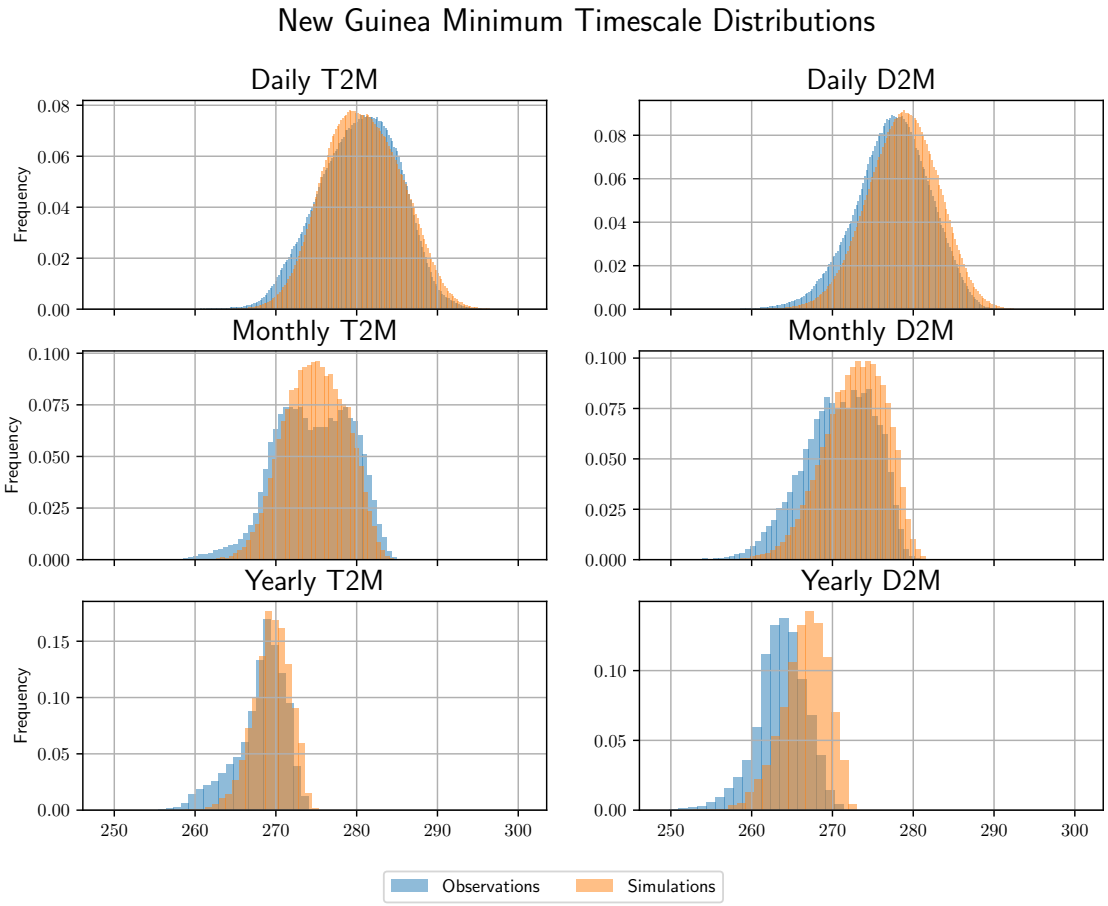


Figure S39. Distribution of the daily minimum, monthly minimum and annual minimum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the New Guinea region, with each grid cell included separately.

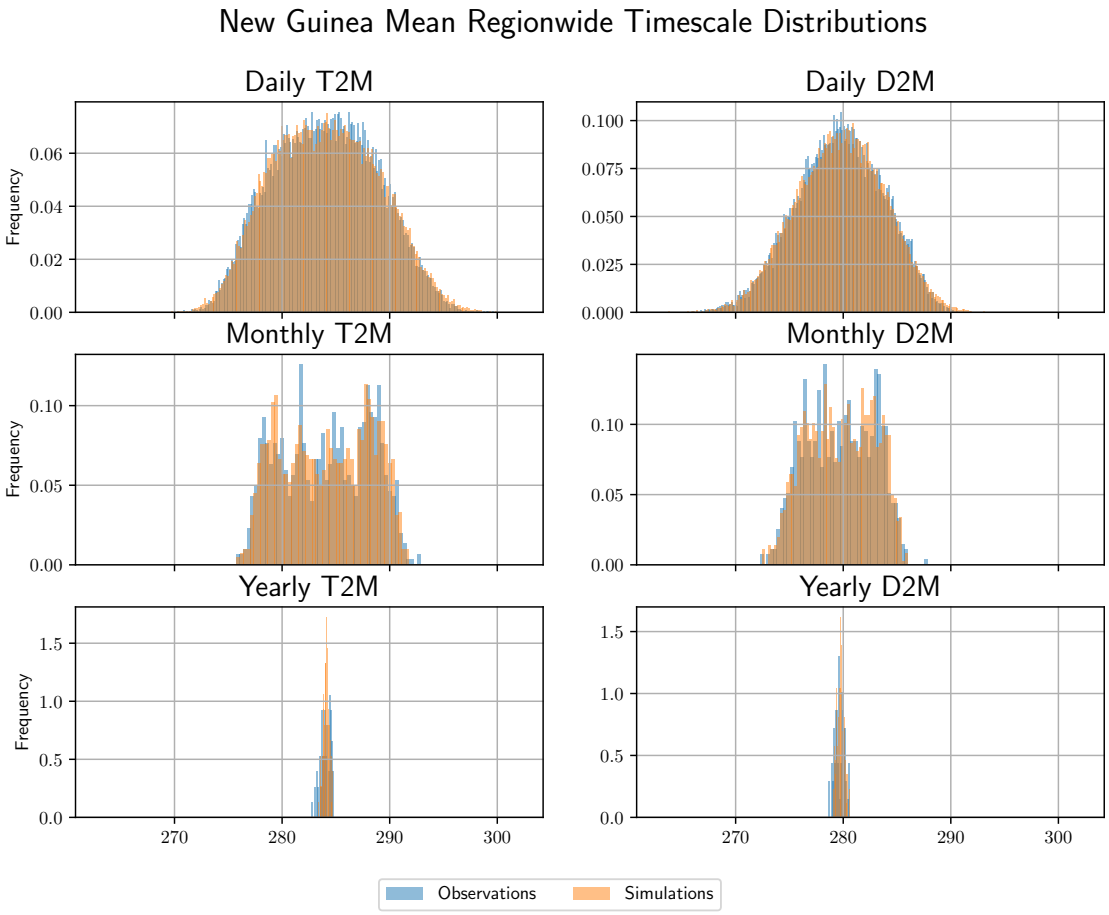


Figure S40. Distribution of the daily mean, monthly mean and annual mean air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the New Guinea region, with the mean value of the entire region used for each time division.

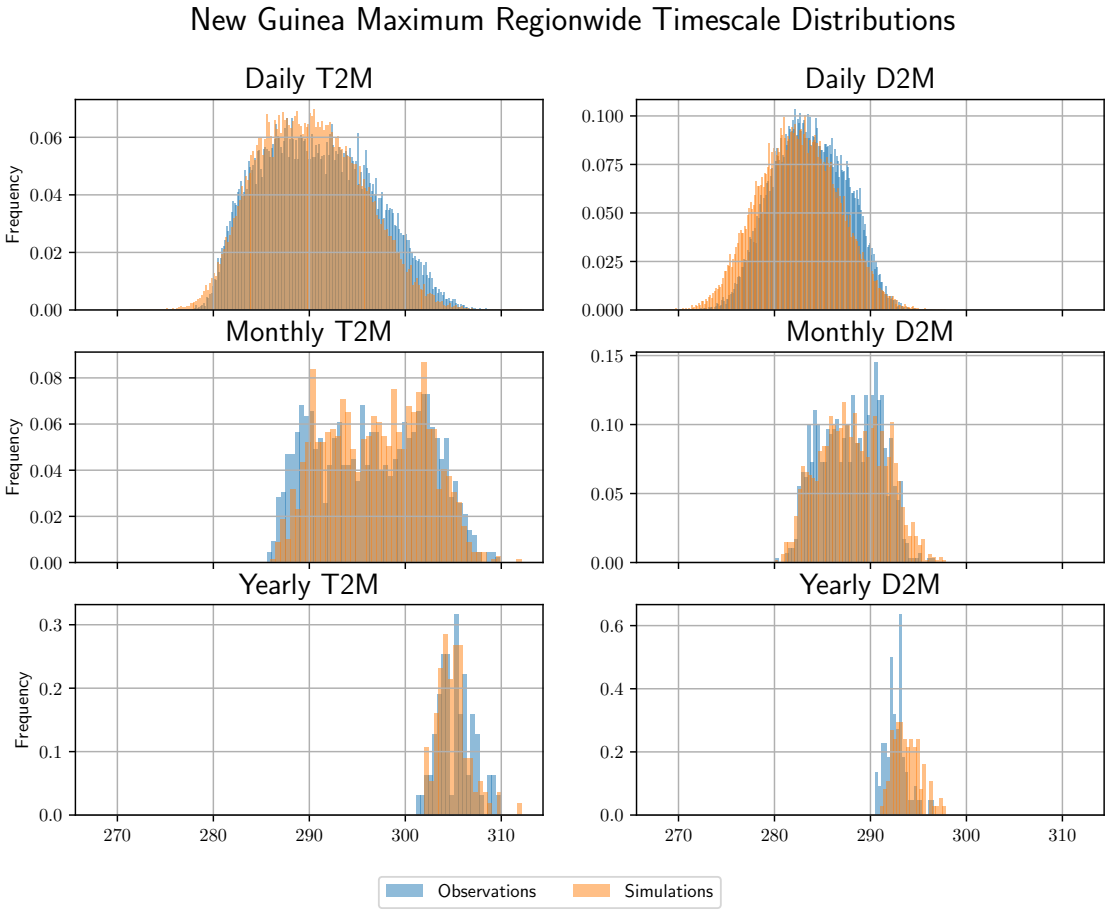


Figure S41. Distribution of the daily maximum, monthly maximum and annual maximum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the New Guinea region, with only the maximum value over the entire region used.

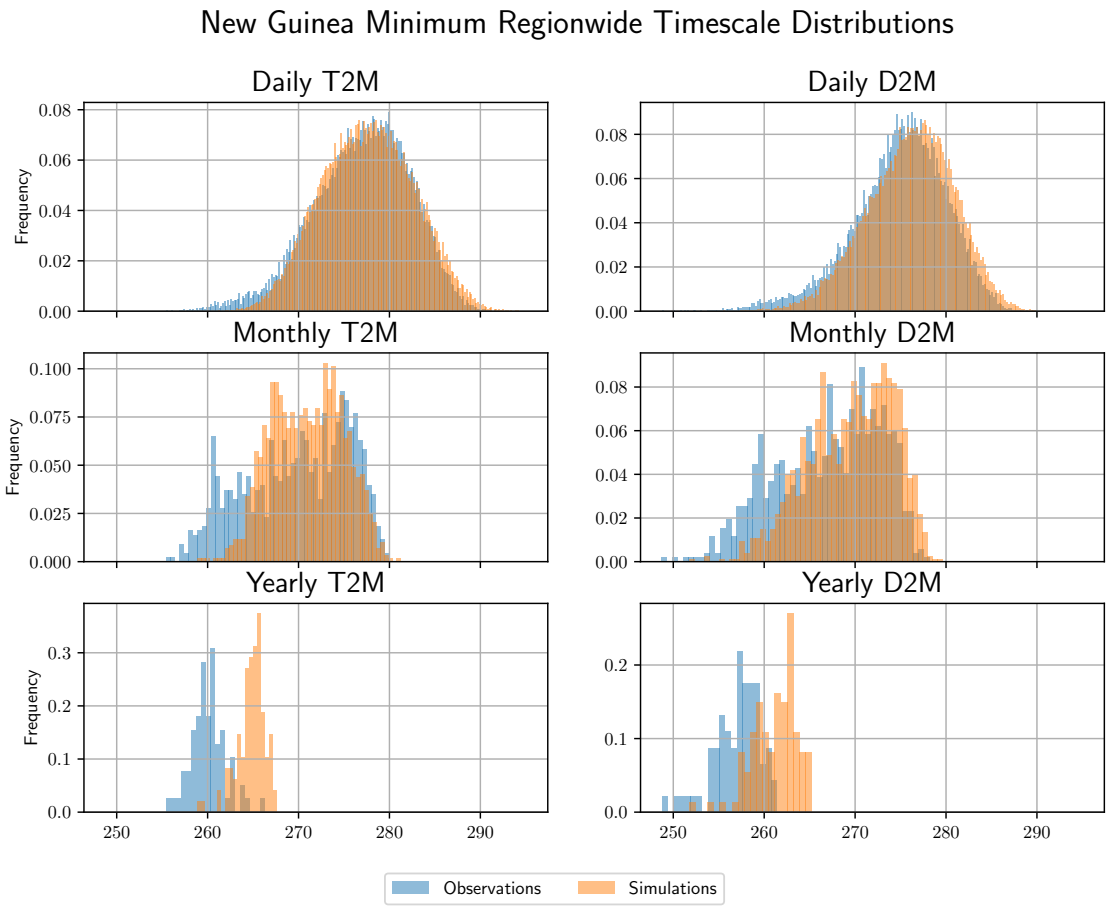


Figure S42. Distribution of the daily minimum, monthly minimum and annual minimum air temperature and dew point temperature values in the observations and simulations. This plot is specifically for values produced over the New Guinea region, with only the minimum value over the entire region used.

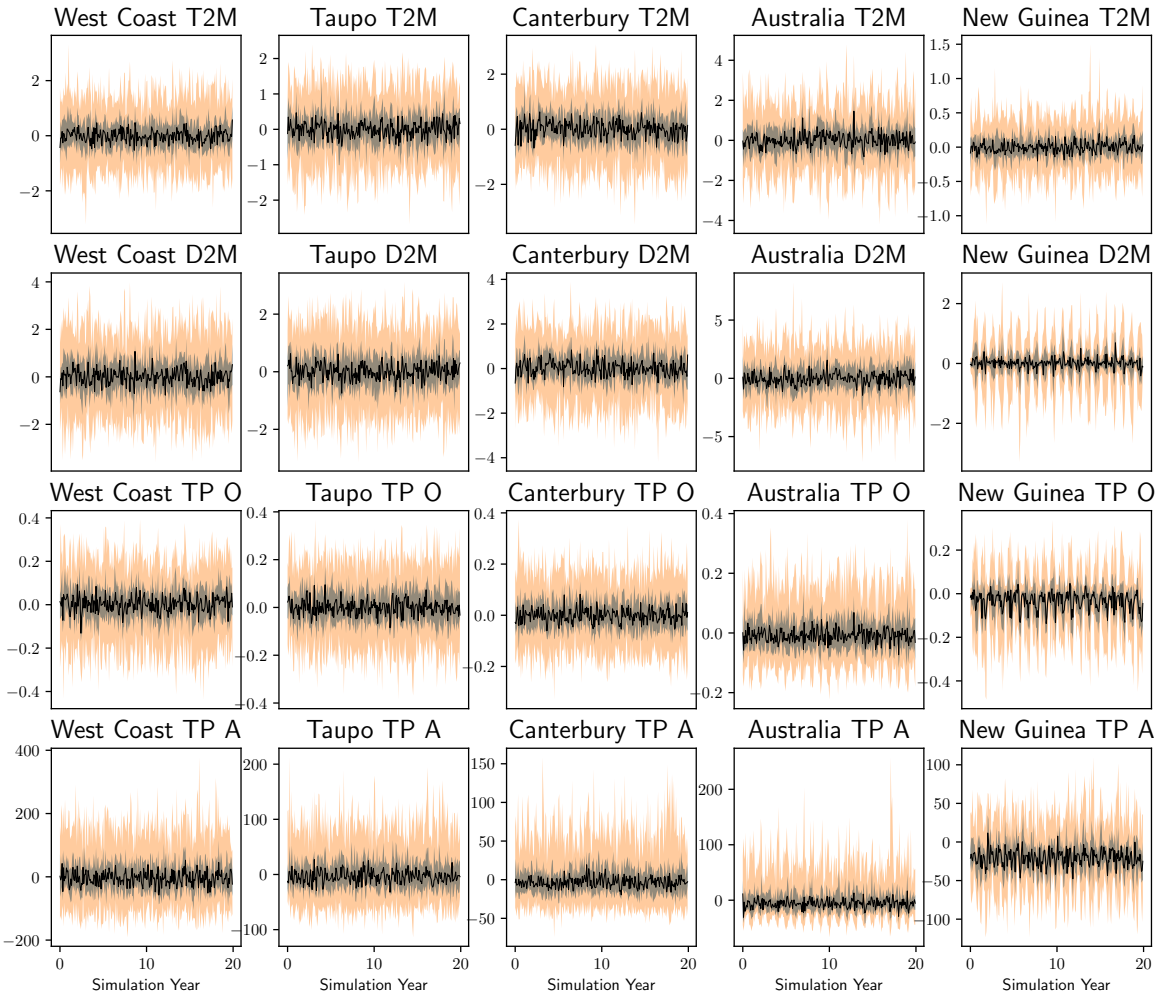


Figure S43. Monthly anomalies of rainfall occurrence, rainfall amount, 2 m air temperature and 2 m dew point temperature for 20 different simulation realizations. The black line indicates the median of the 20 realizations, the dark envelope shows the location of the 25th and 75th percentile and the orange envelope shows the maximum and minimum anomalies observed.

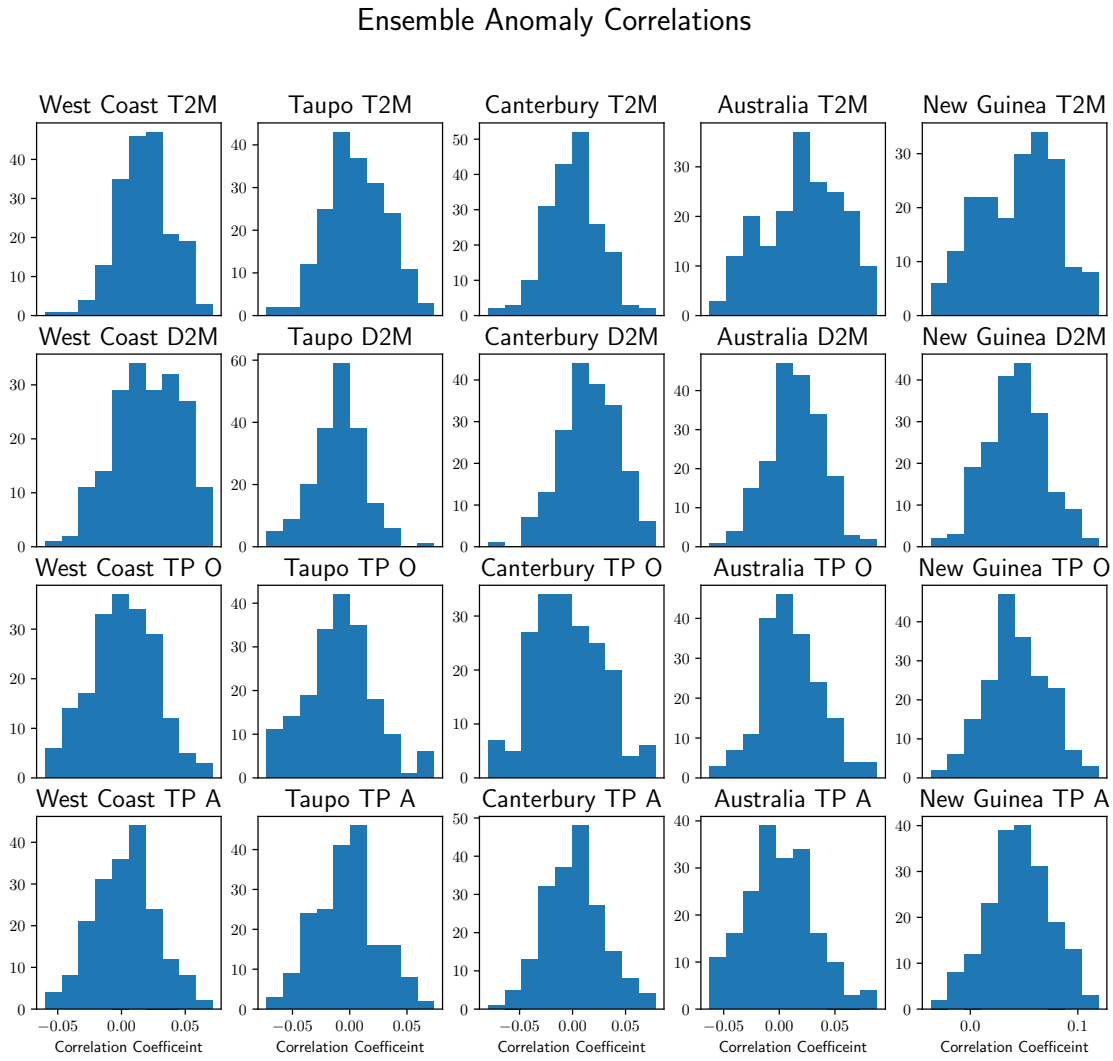


Figure S44. Distribution of Pearson correlation coefficients between different all pairs of ensemble members in a 20 ensemble model run. Specifically, the time series correlated are the monthly average 2m air temperature (T2M), monthly average dew point temperature (D2M), monthly average rainfall occurrence rate (TP O) and monthly cumulative rainfall (TP A).

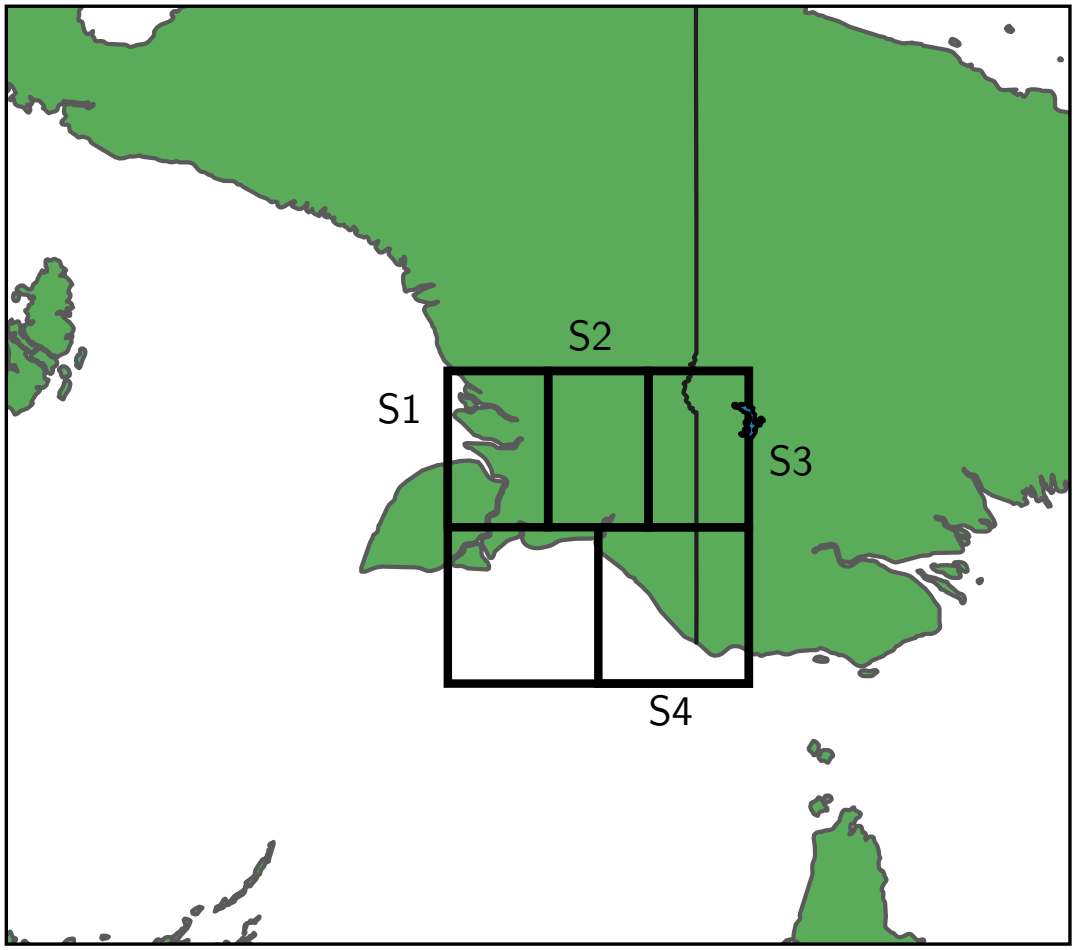


Figure S45. Partitioning of the wider PNG region into four distinct sub-regions.

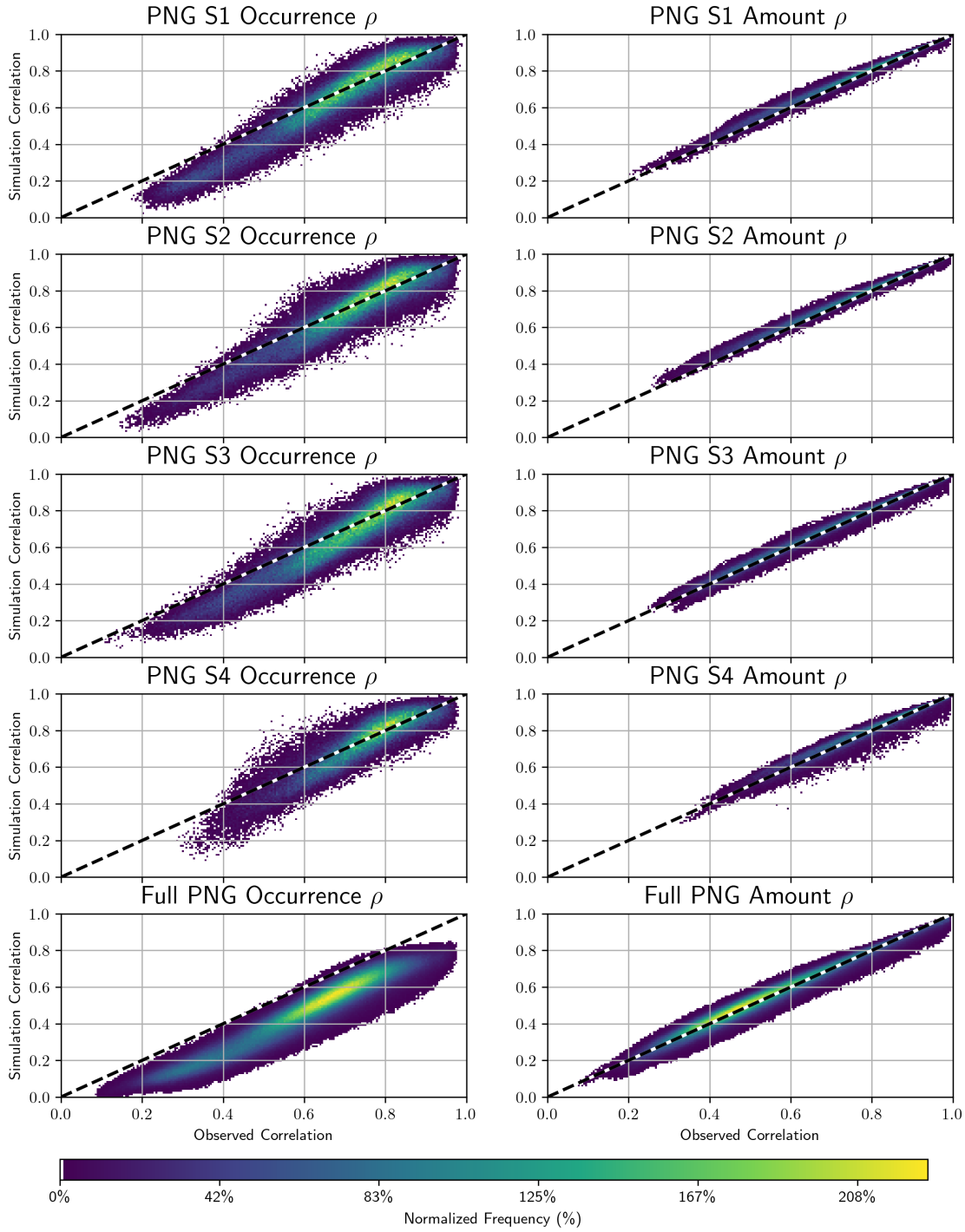


Figure S46. Figure 3 reconstructed for the New Guinea specific regions.

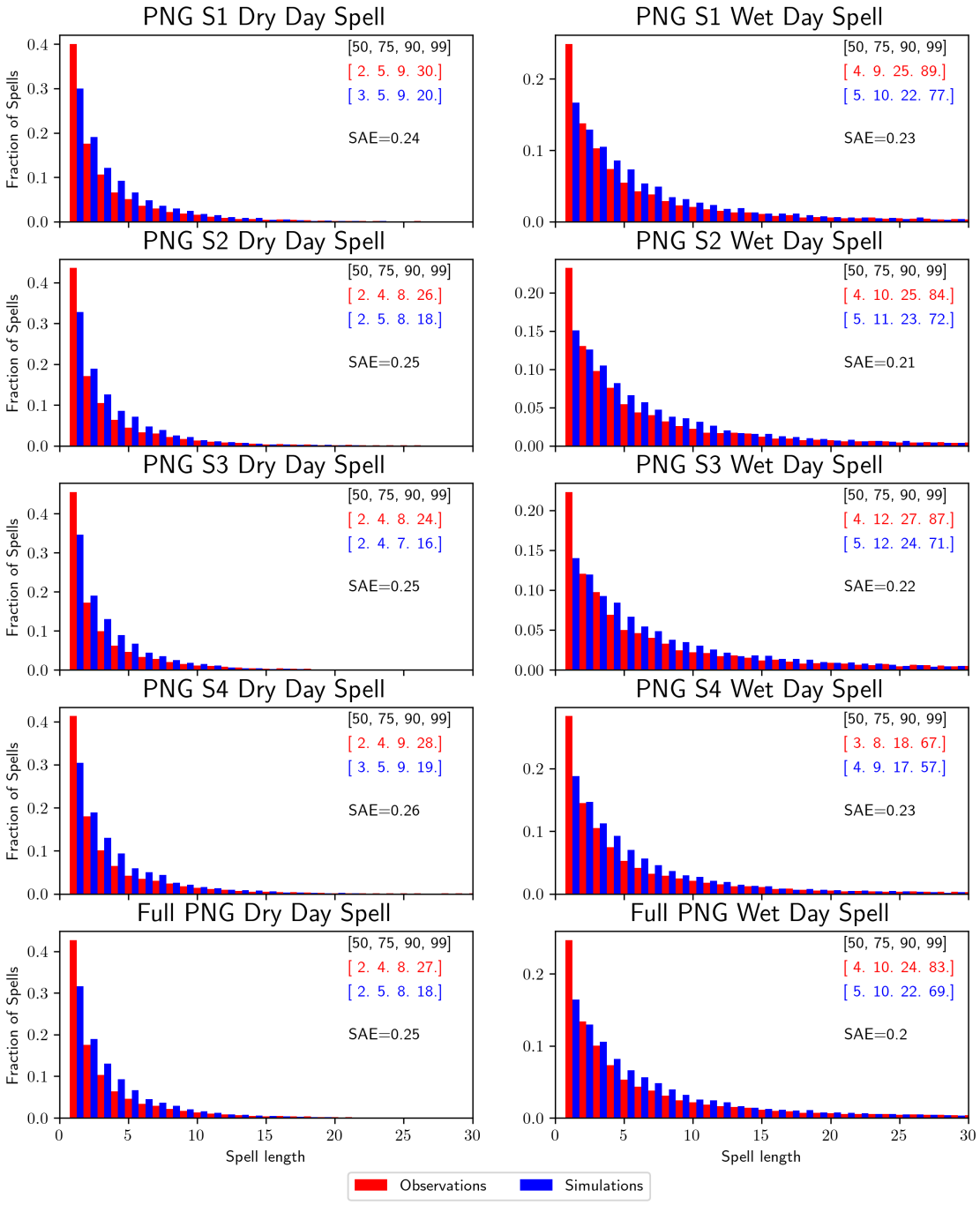


Figure S47. Figure 4 reconstructed for the New Guinea specific regions.

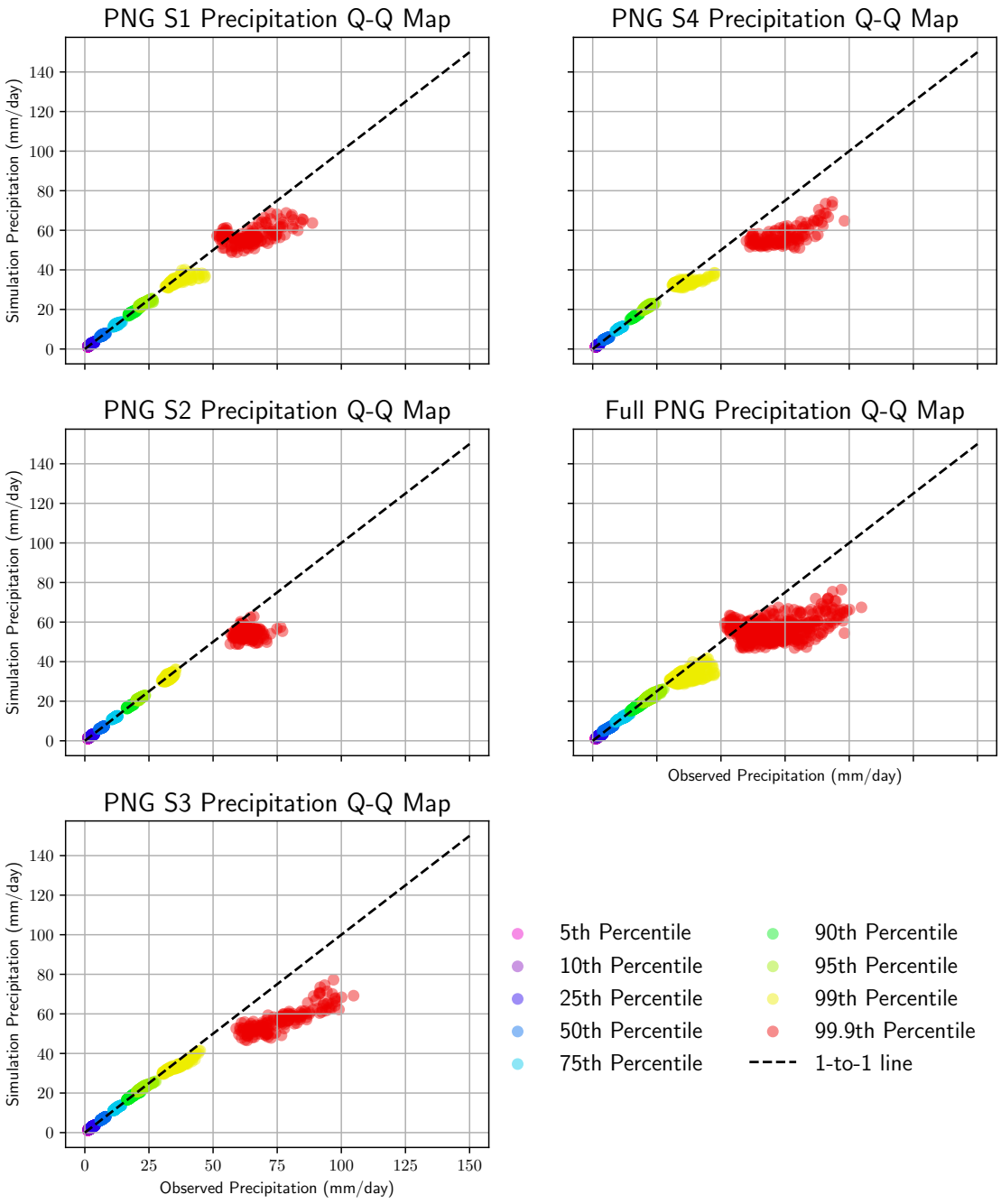


Figure S48. Figure 5 reconstructed for the New Guinea specific regions.

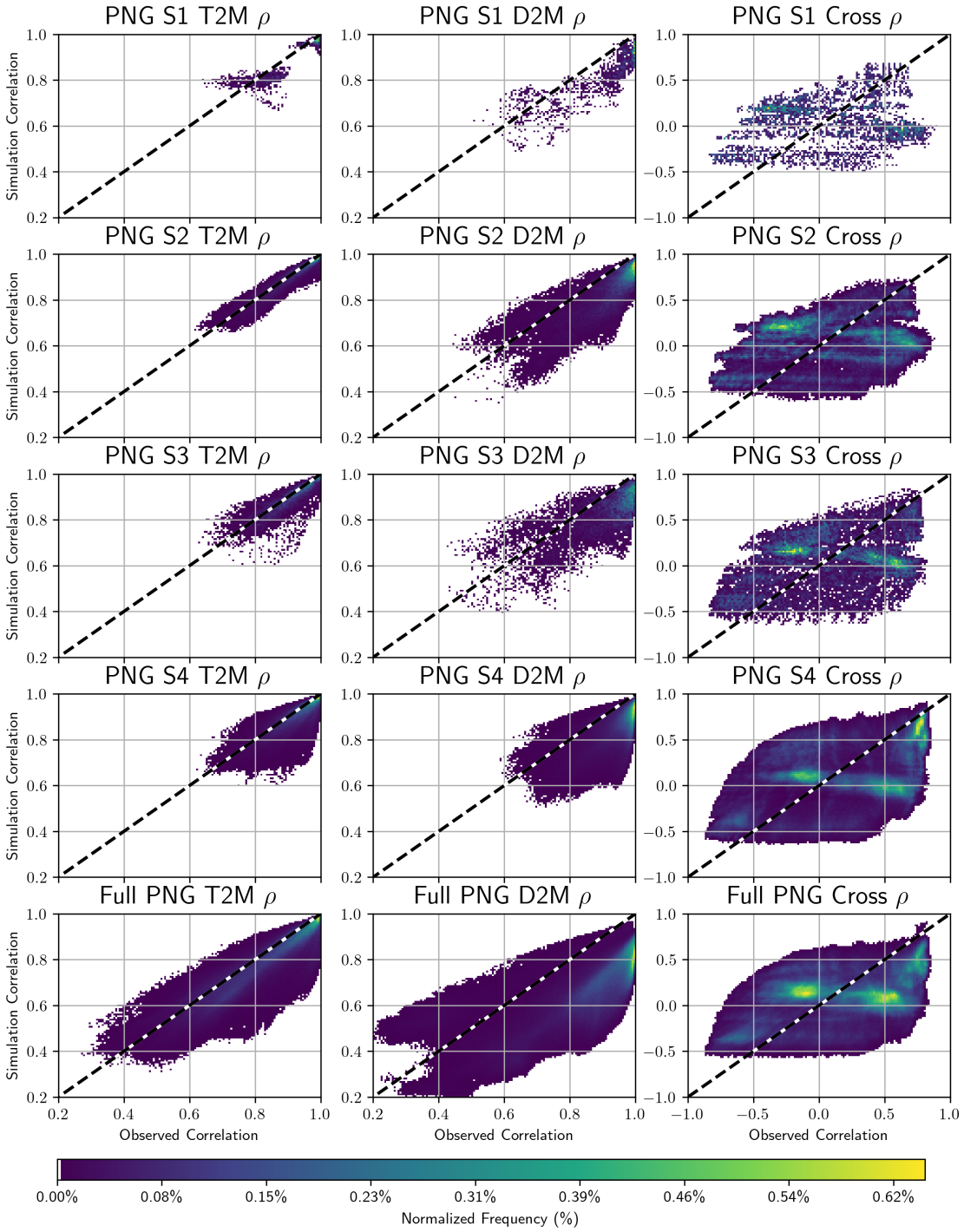


Figure S49. Figure 7 reconstructed for the New Guinea specific regions.

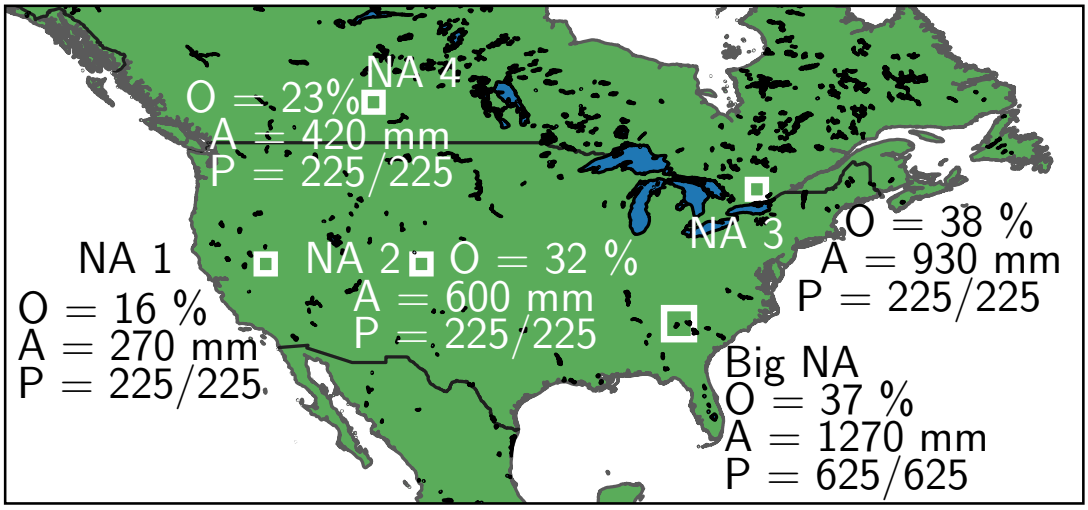


Figure S50. A map showing the five simulation regions for the North American domain: four equal-sized domains across the USA and Canada and then one larger domain. Included is the ERA5-Land average precipitation occurrence rate over the region, O, the annual average precipitation over the region, A and the total number of grid points in the region, P. These values are calculated as averages between 1950 and 2022.

	Canterbury	Taupo	West Coast
ERA Handling - Cluster	140	132	132
Model Building - Cluster	22	80	27
Simulation - Cluster	15	22	13
ERA Handling - Laptop	177	155	177
Model Building - Laptop	202	354	230
Simulation - Laptop	21	21	20

Table S1. Runtimes in minutes of the three components of the EGGS-WG program for both a simple computing cluster and personal laptop. Simulations are for 110 years of model output. The computing cluster has 32 cores and 128GB of ram. The laptop is an Acer Nitro 5 with a Ryzen 7 2700U and 16GB of ram. Only the three New Zealand regions are included as corresponding data was not recorded for other regions.

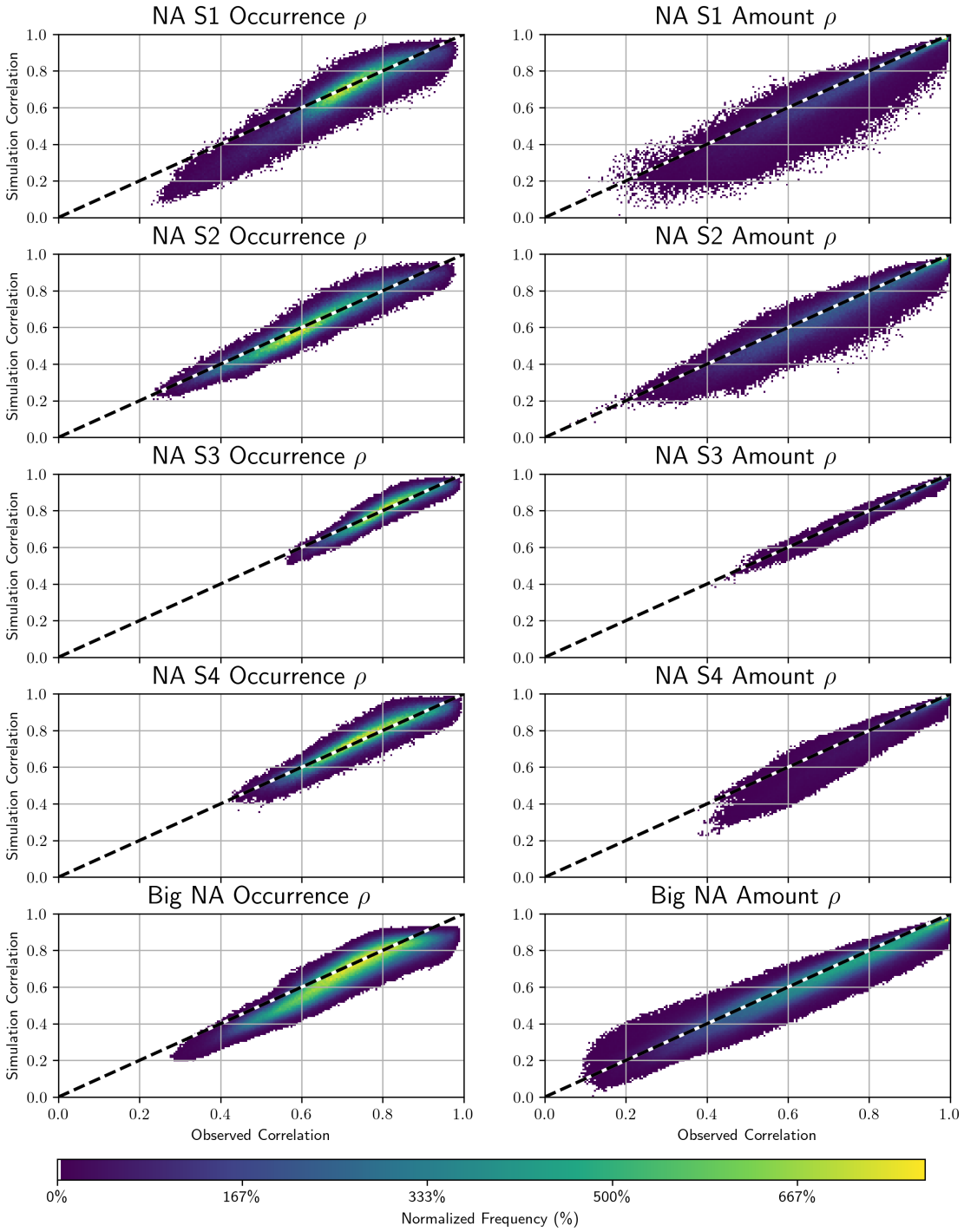


Figure S51. Figure 3 reconstructed for the North American specific regions.

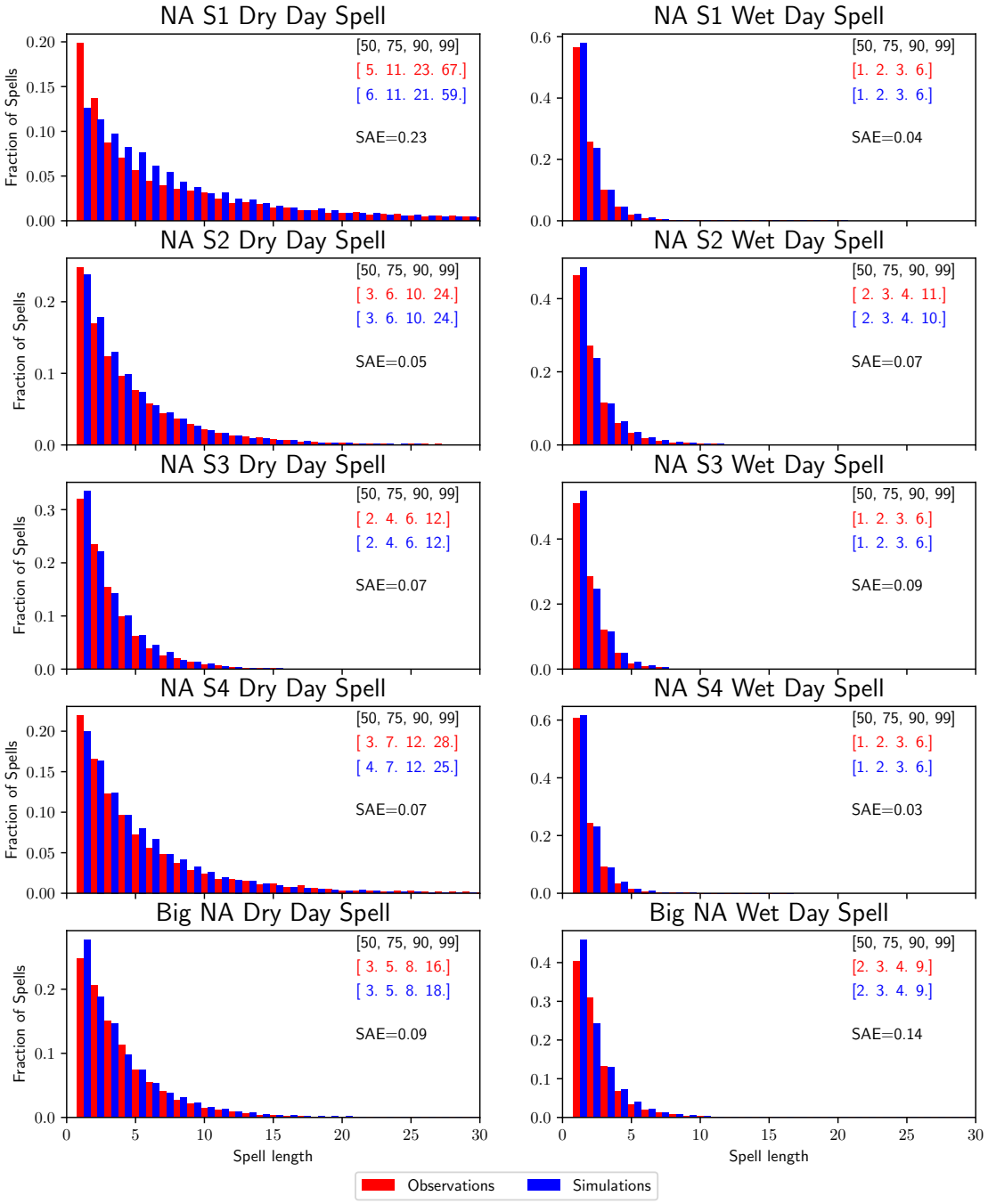


Figure S52. Figure 4 reconstructed for the North American specific regions.

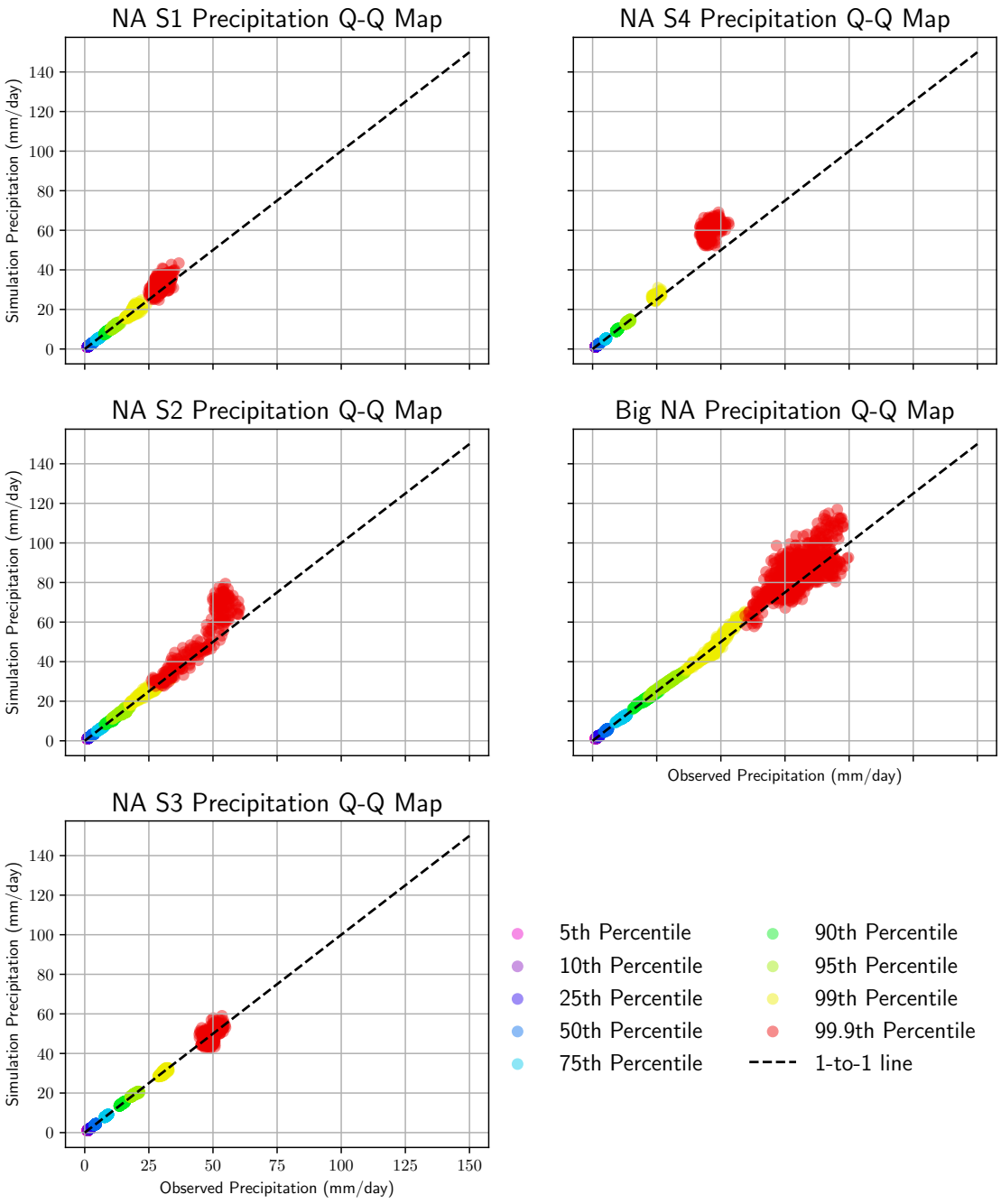


Figure S53. Figure 5 reconstructed for the North American specific regions.

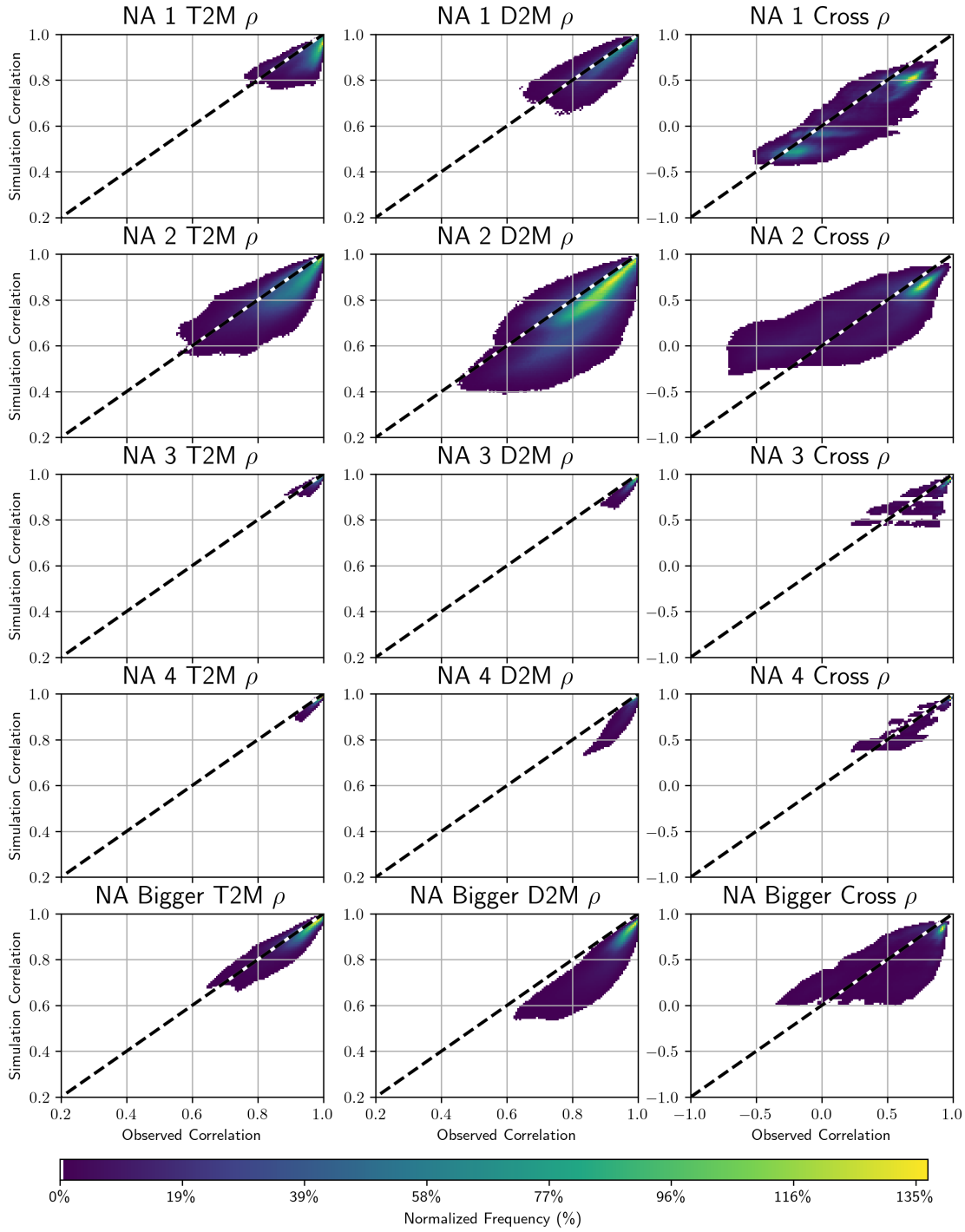


Figure S54. Figure 7 reconstructed for the North American specific regions.

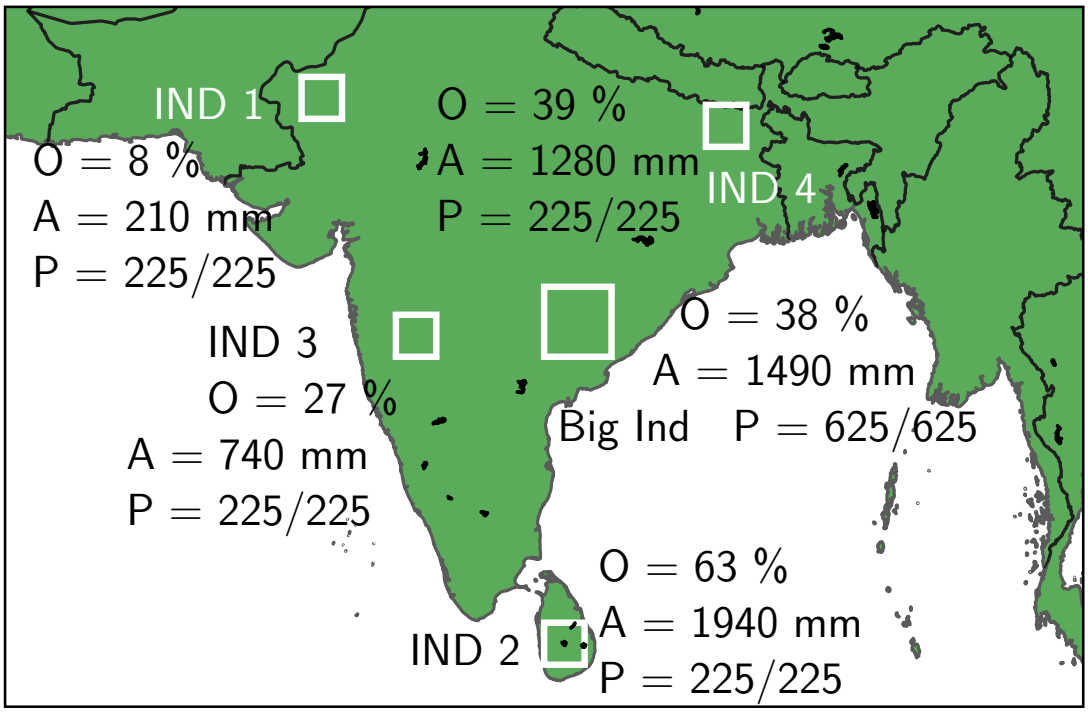


Figure S55. A map showing the five simulation regions for the Indian Subcontinent domain: four equal-sized domains across India and Sri Lanka and then one larger domain. Included is the ERA5-Land average precipitation occurrence rate over the region, O, the annual average precipitation over the region, A, and the total number of grid points in the region, P. These values are calculated as averages between 1950 and 2022.

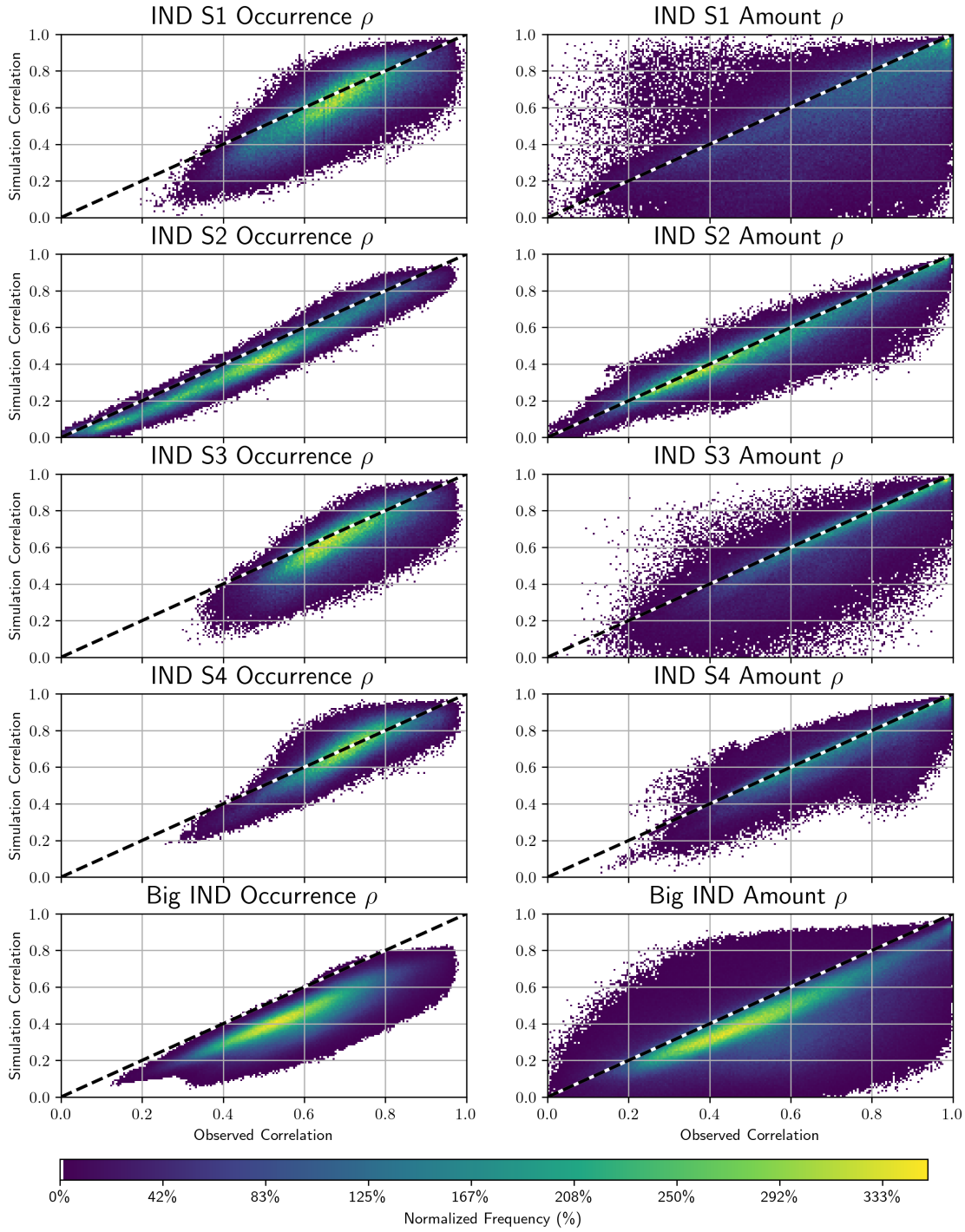


Figure S56. Figure 3 reconstructed for the Indian Subcontinent regions.

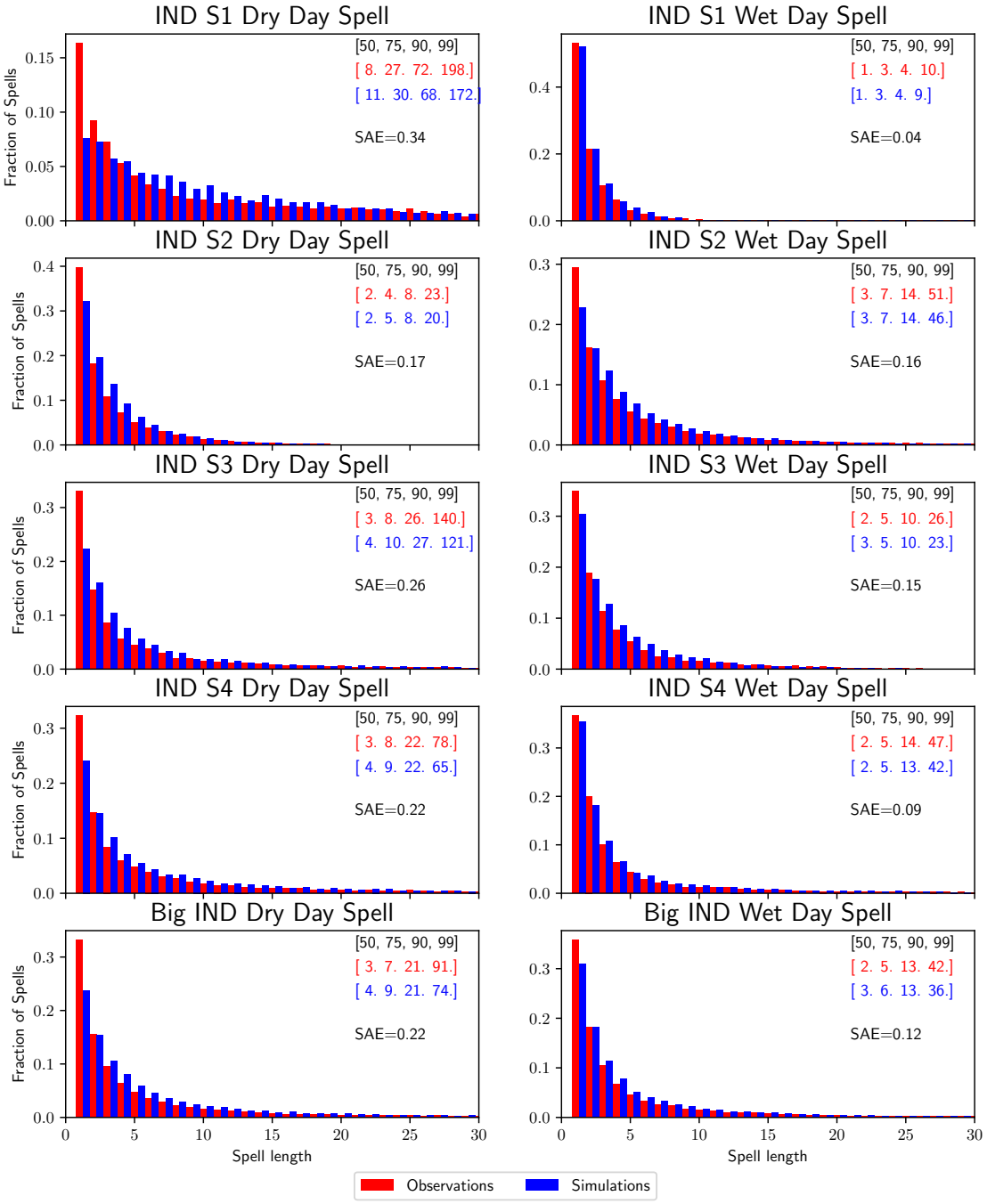


Figure S57. Figure 4 reconstructed for the Indian Subcontinent regions.

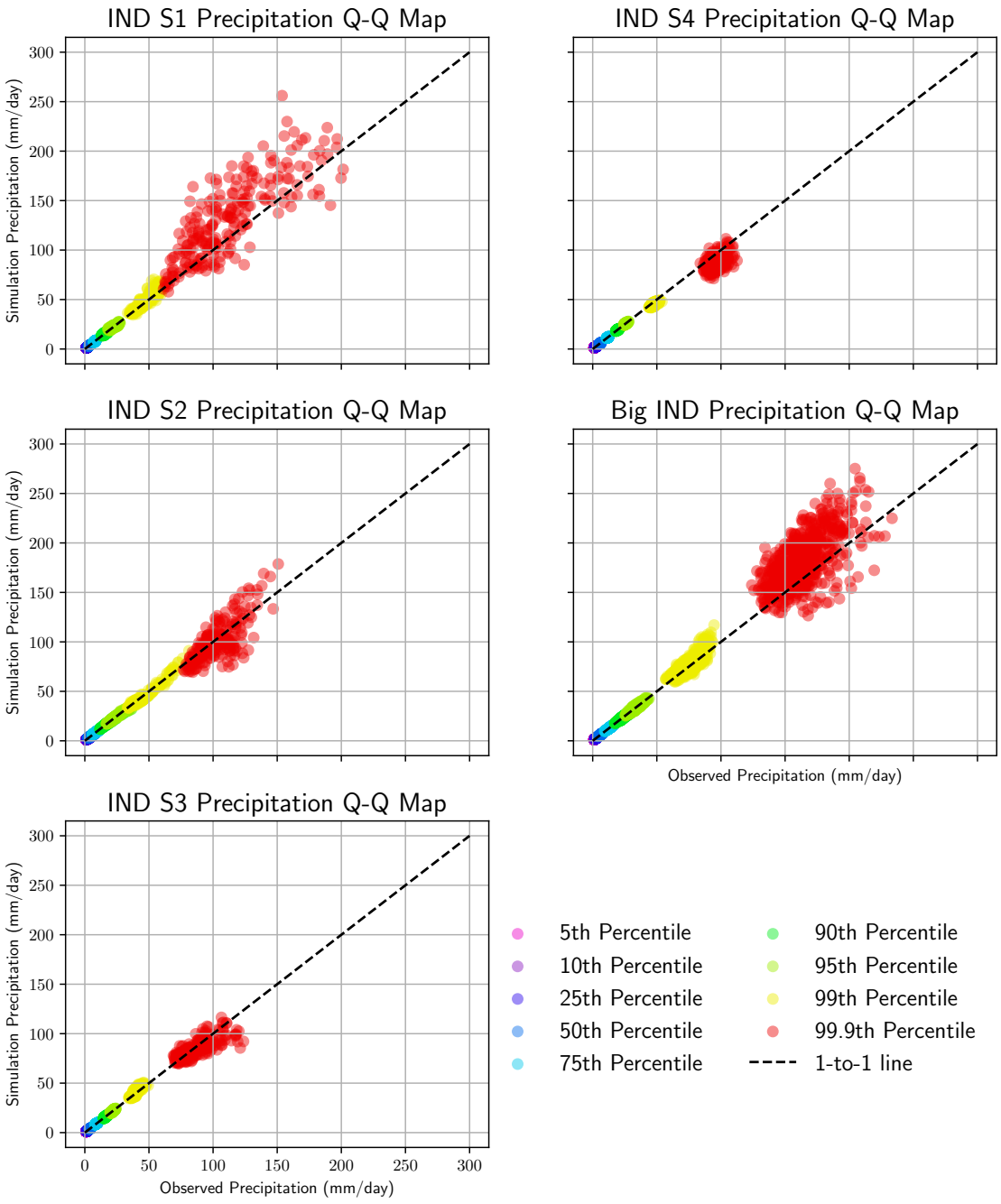


Figure S58. Figure 5 reconstructed for the Indian Subcontinent specific regions.

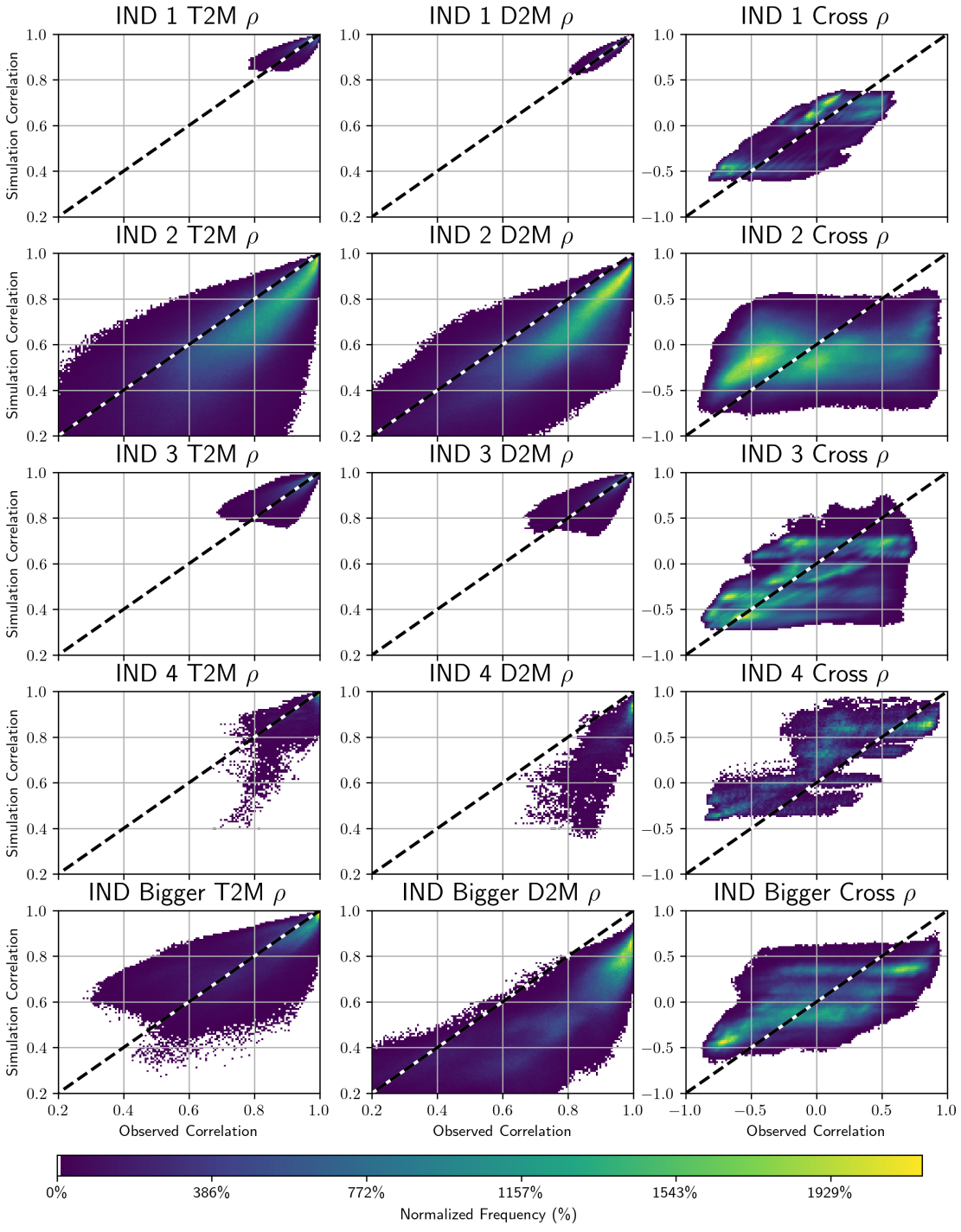


Figure S59. Figure 7 reconstructed for the Indian Subcontinent specific regions.