Appendix 2B-1: Rainfall Trend Analysis Results

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This appendix presents the results of the rainfall cluster analysis conducted for various parameter settings from 1935 to 2024.

For the trend and frequency updates, the appendix provides the results of rainfall trend analyses across monthly (January to December), seasonal (wet season), and annual time periods. It also includes trend analyses of extreme rainfall events, specifically the frequency of 1-day 5-year, 3-day 2-year, and 5-day 2-year maxima, covering the same 1935–2024 period of record (POR).

For the cluster analysis, it includes the total number of clusters identified, as well as the number of clusters exhibiting statistically significant trends and those without significant trends. It also includes the spatial clustering pattern and POT trend analysis results for the different thresholds.

TREND ANALYSIS

Figures 1 through **14** provide rainfall trend analyses for all rainfall data within the POR. **Figures 1** through **12** show analyses for each month of the year for the entire POR. **Figure 13** provides trend analysis for all wet seasons during the POR. **Figure 14** provides annual trend analysis during the POR. **Figures 15** through **23** provide return frequency analyses for rainfall data.

[1] All authors and contributors work for the South Florida Water Management District (SFWMD), West Palm Beach, Florida, or are under contract with SFWMD.

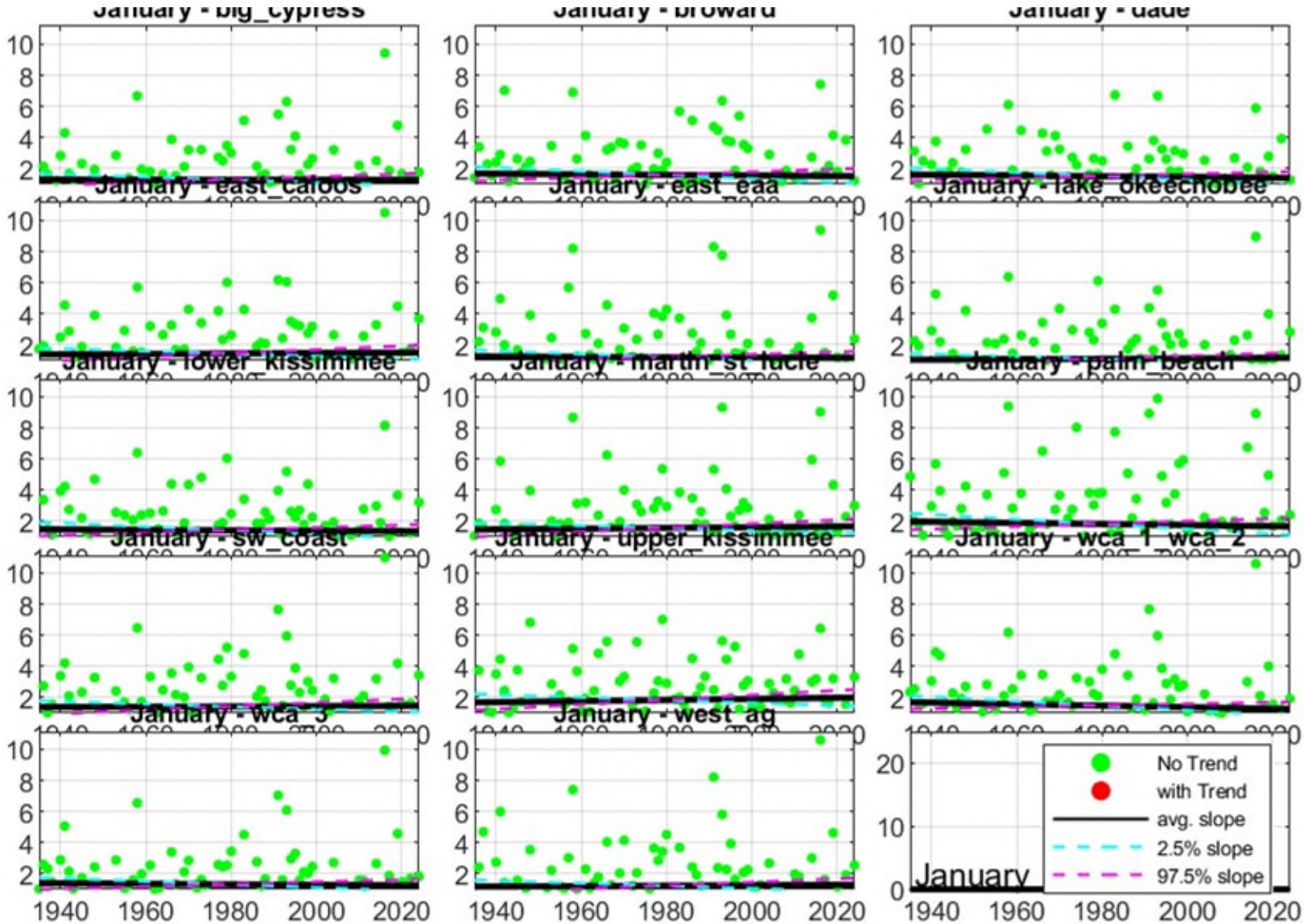

Figure 1. Results of the rainfall trend analysis for January, POR from 1935 to 2024.

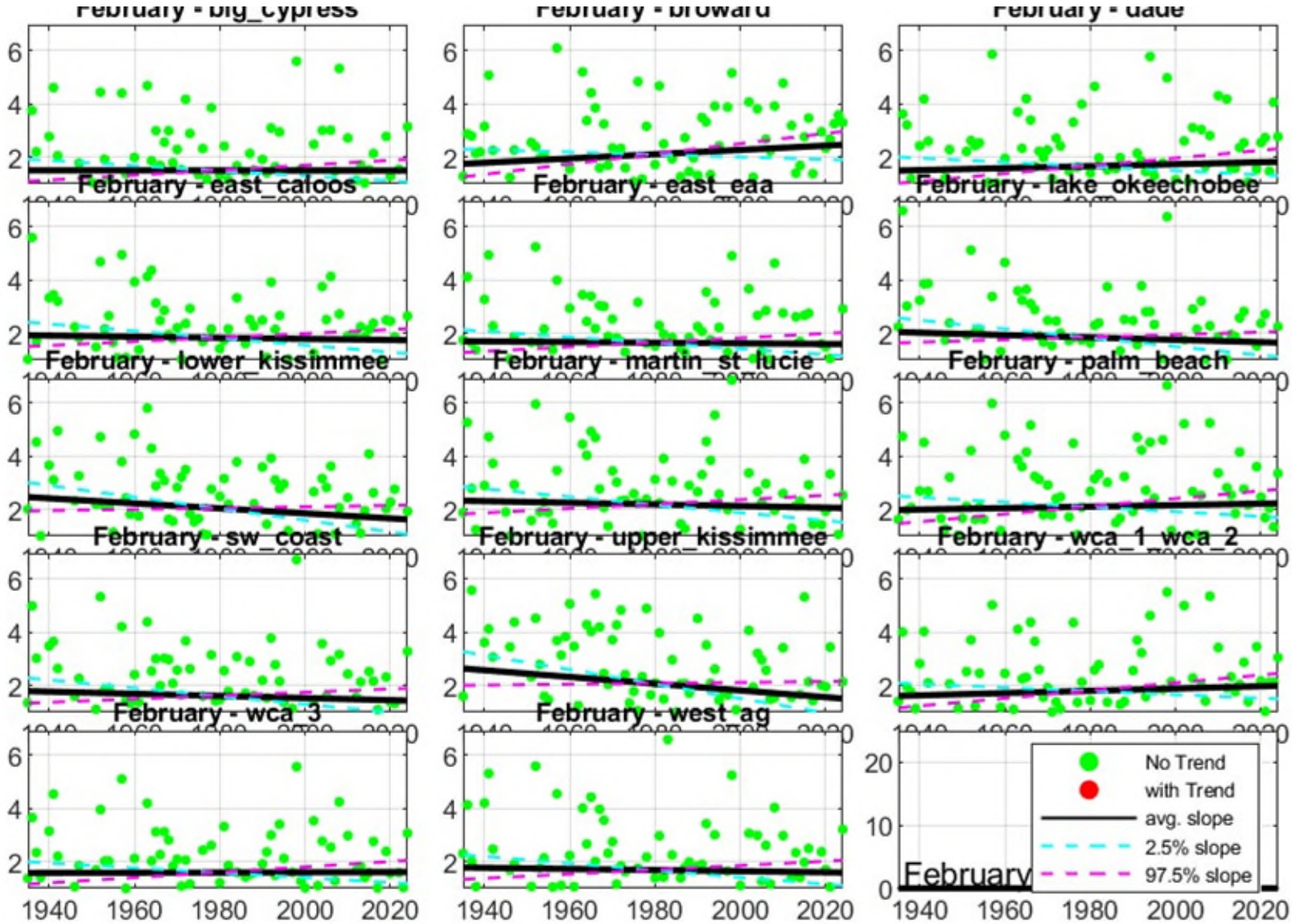

Figure 2. Results of the rainfall trend analysis for February, POR from 1935 to 2024.

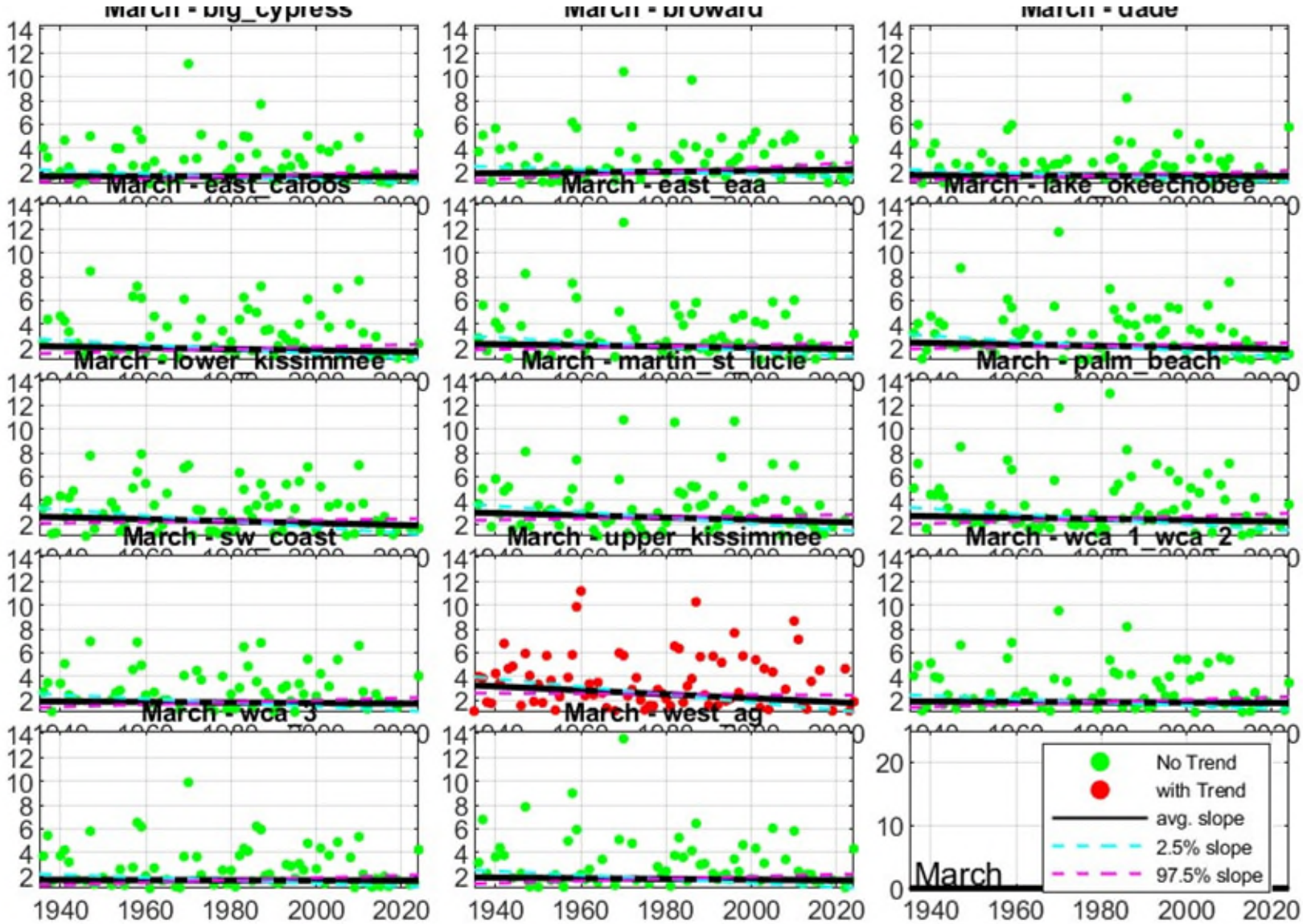

Figure 3. Results of the rainfall trend analysis for March, POR from 1935 to 2024.

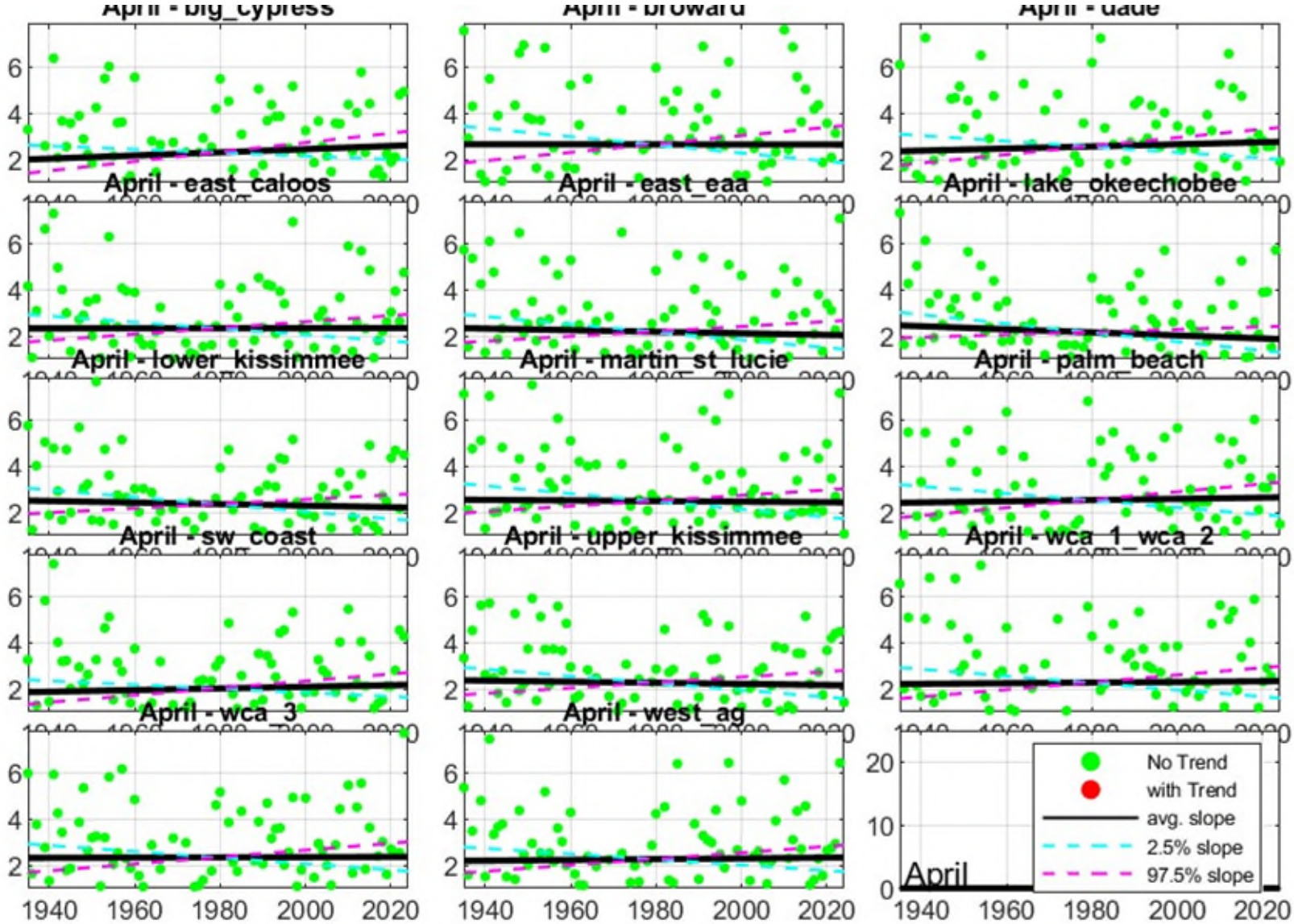

Figure 4. Results of the rainfall trend analysis for April, POR from 1935 to 2024.

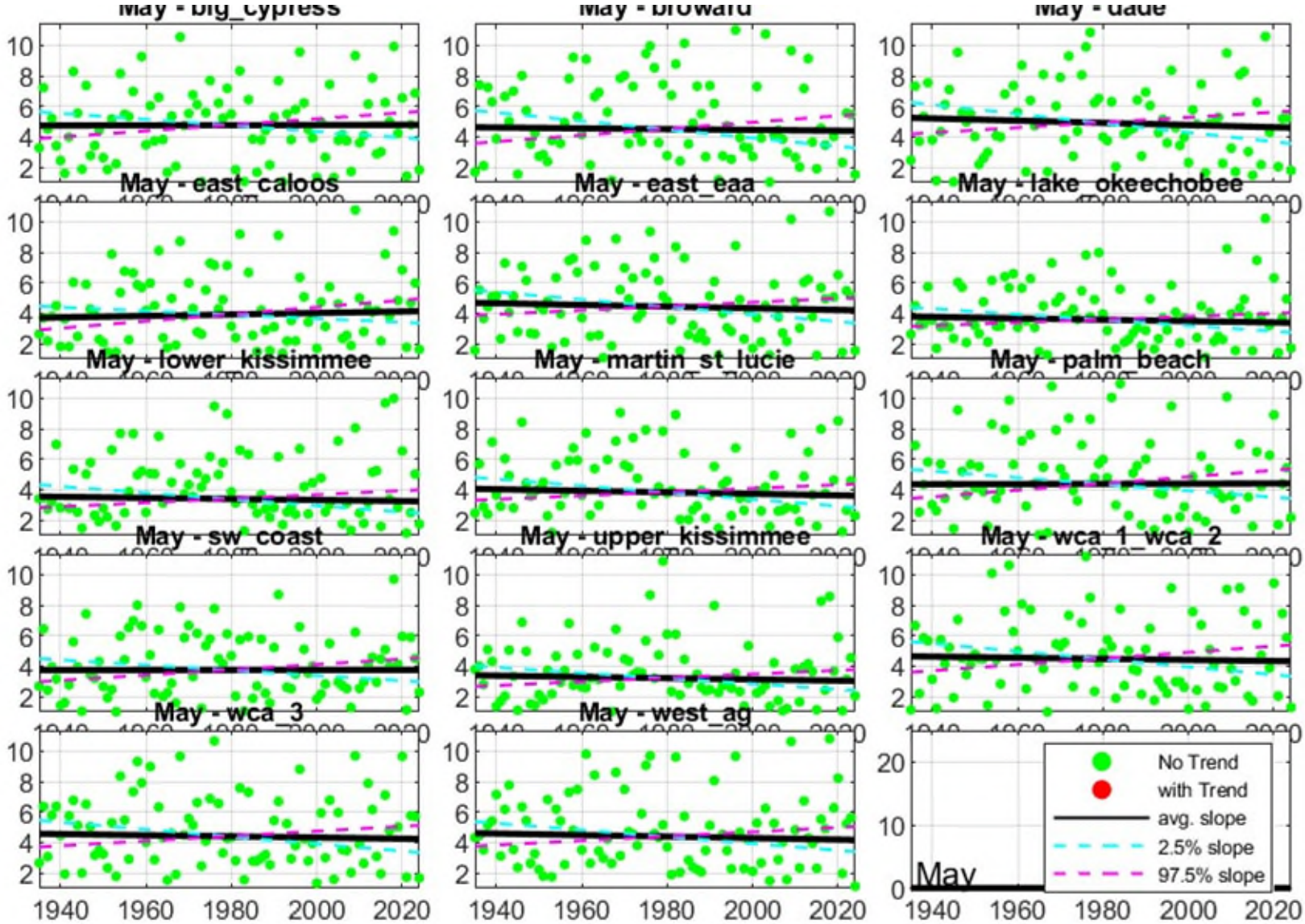

Figure 5. Results of the rainfall trend analysis for May, POR from 1935 to 2024.

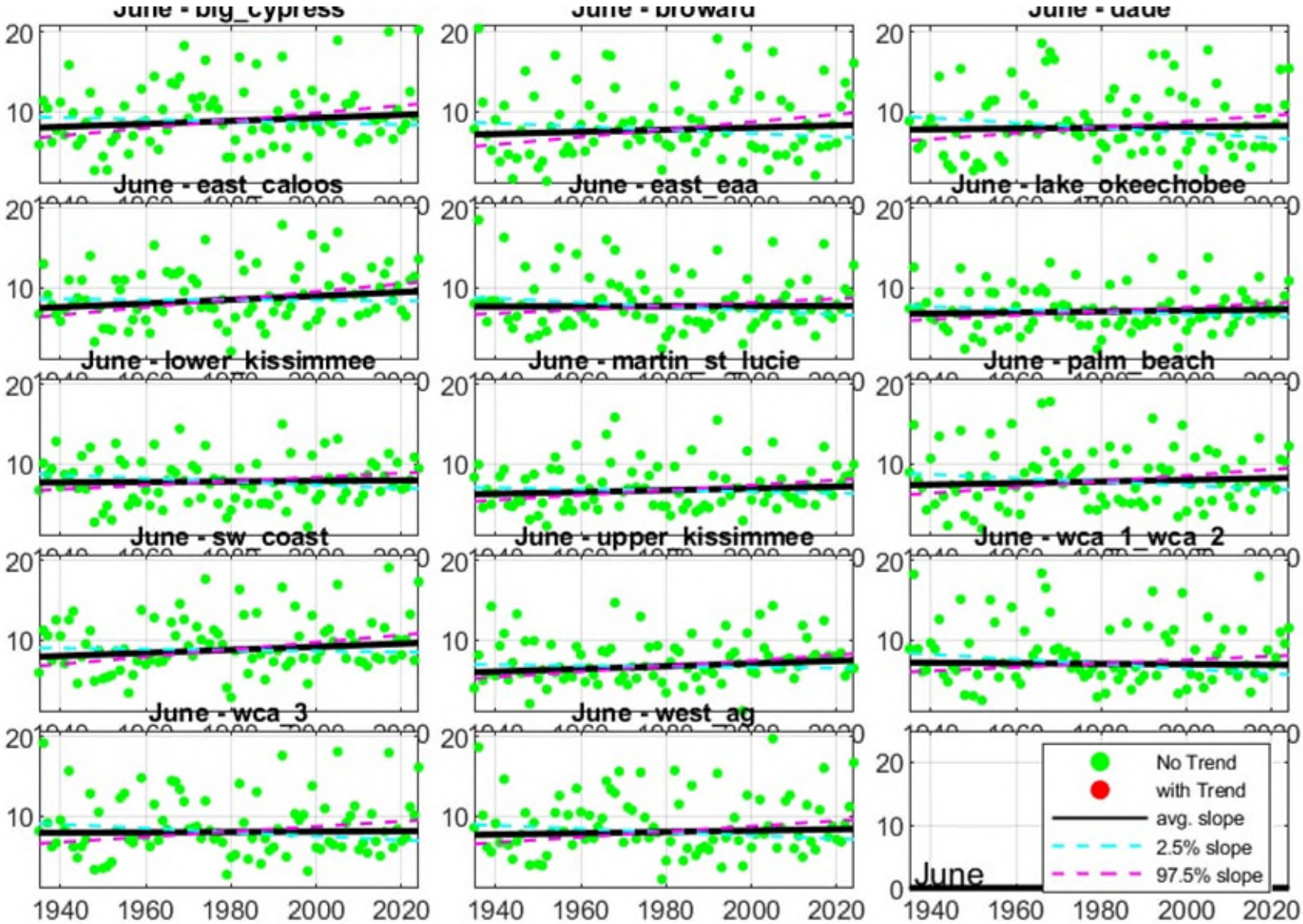

Figure 6. Results of the rainfall trend analysis for June, POR from 1935 to 2024.

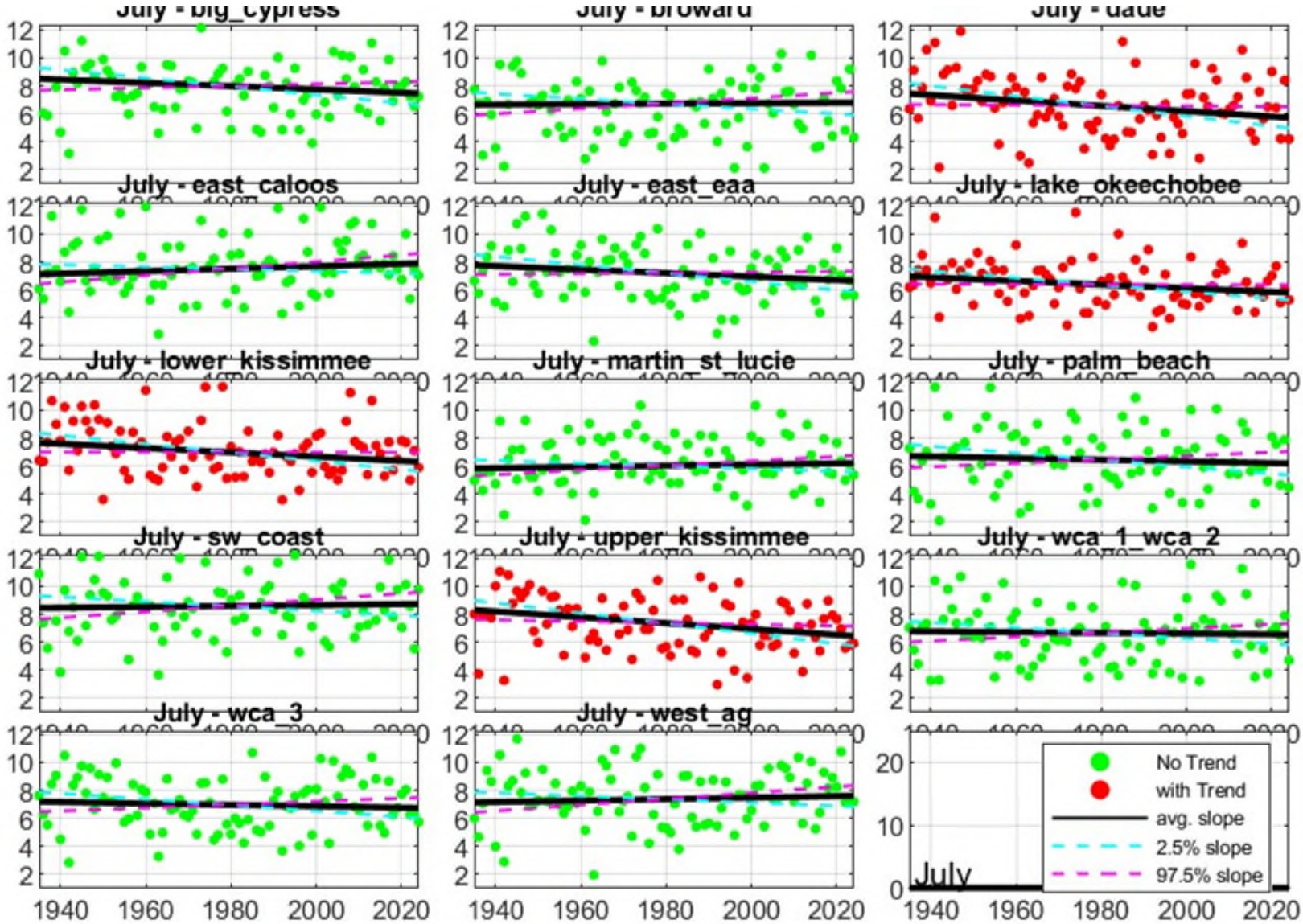

Figure 7. Results of the rainfall trend analysis for July, POR from 1935 to 2024.

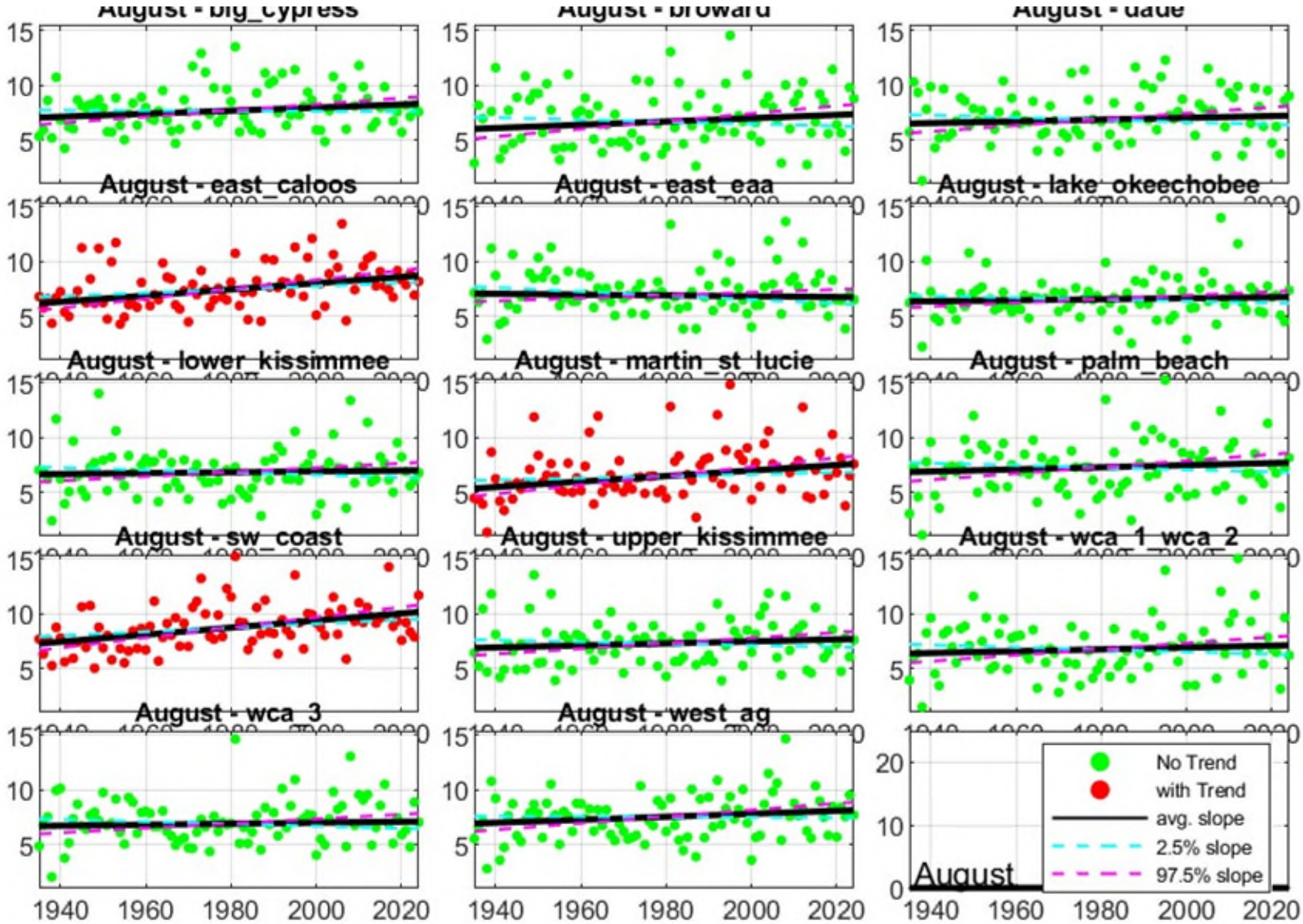

Figure 8. Results of the rainfall trend analysis for August, POR from 1935 to 2024.

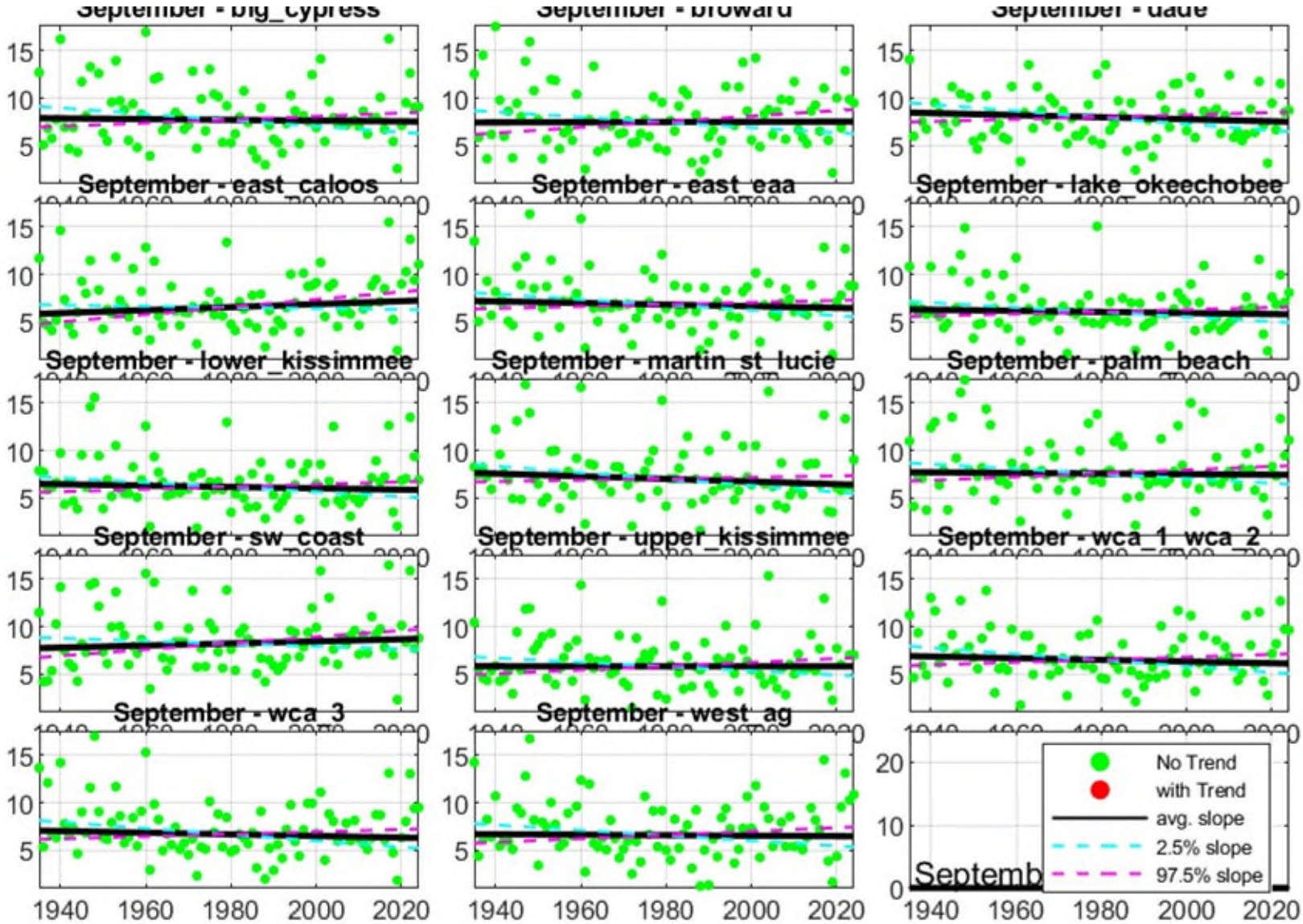

Figure 9. Results of the rainfall trend analysis for September, POR from 1935 to 2024.

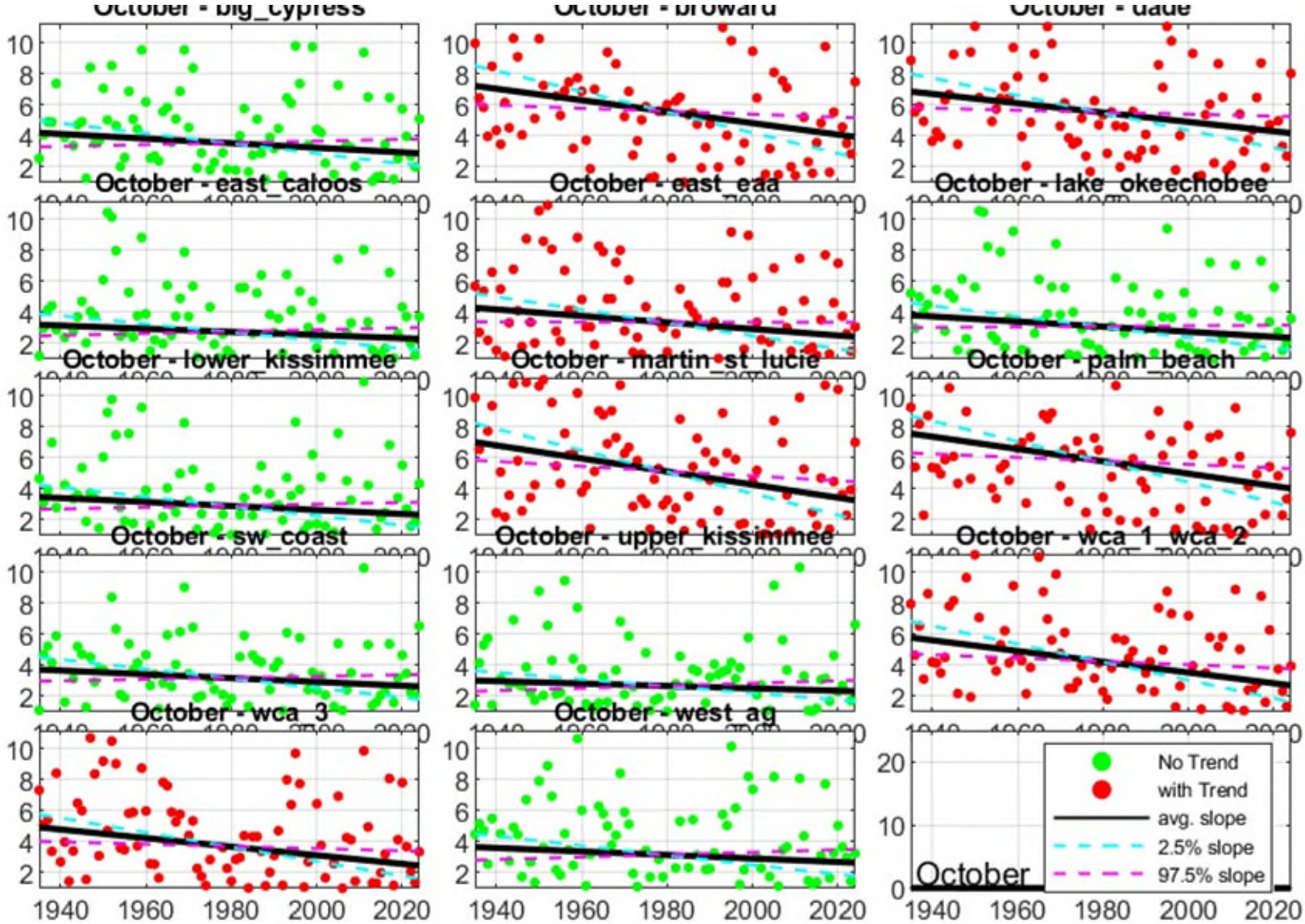

Figure 10. Results of the rainfall trend analysis for October, POR from 1935 to 2024.

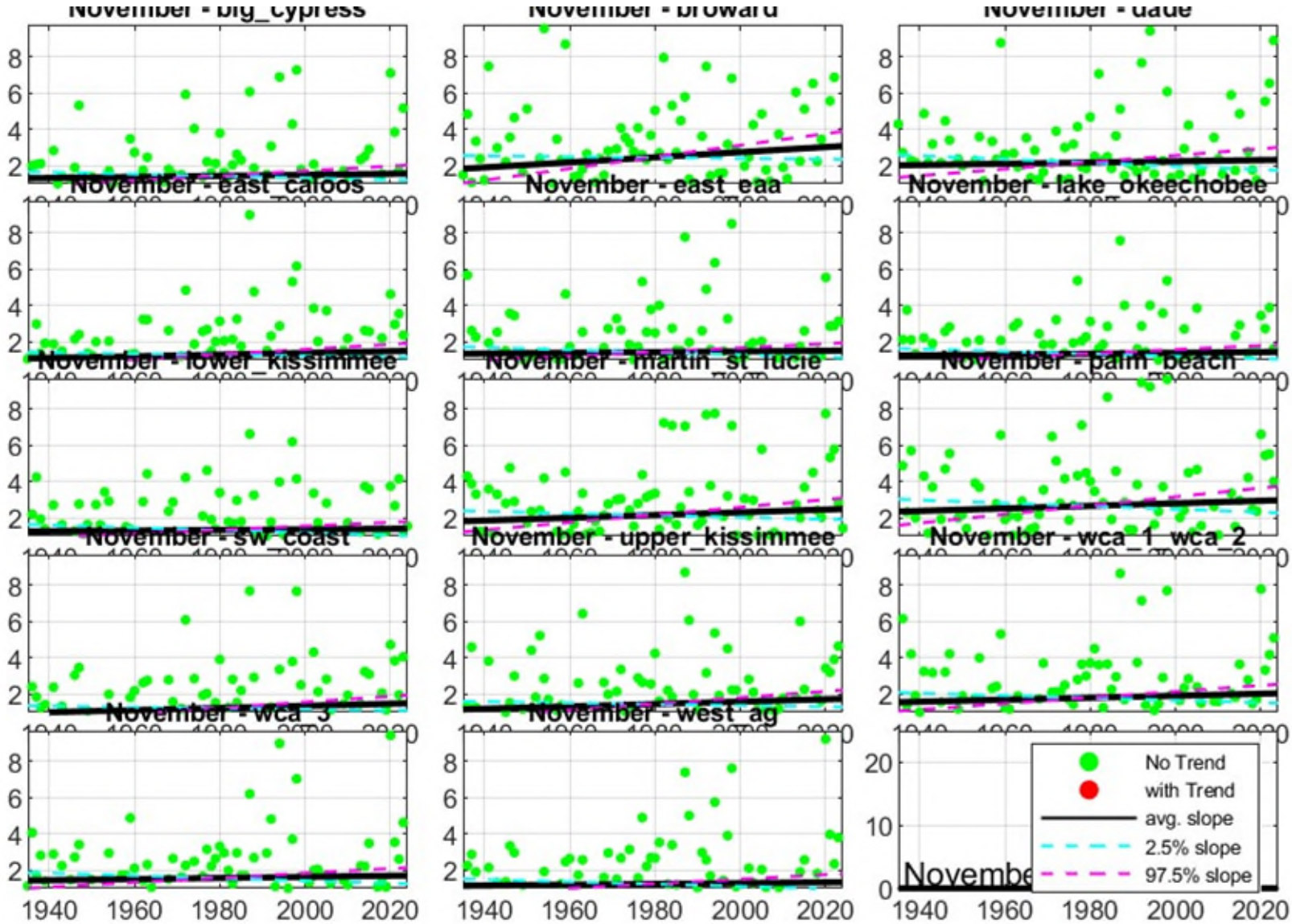

Figure 11. Results of the rainfall trend analysis for November, POR from 1935 to 2024.

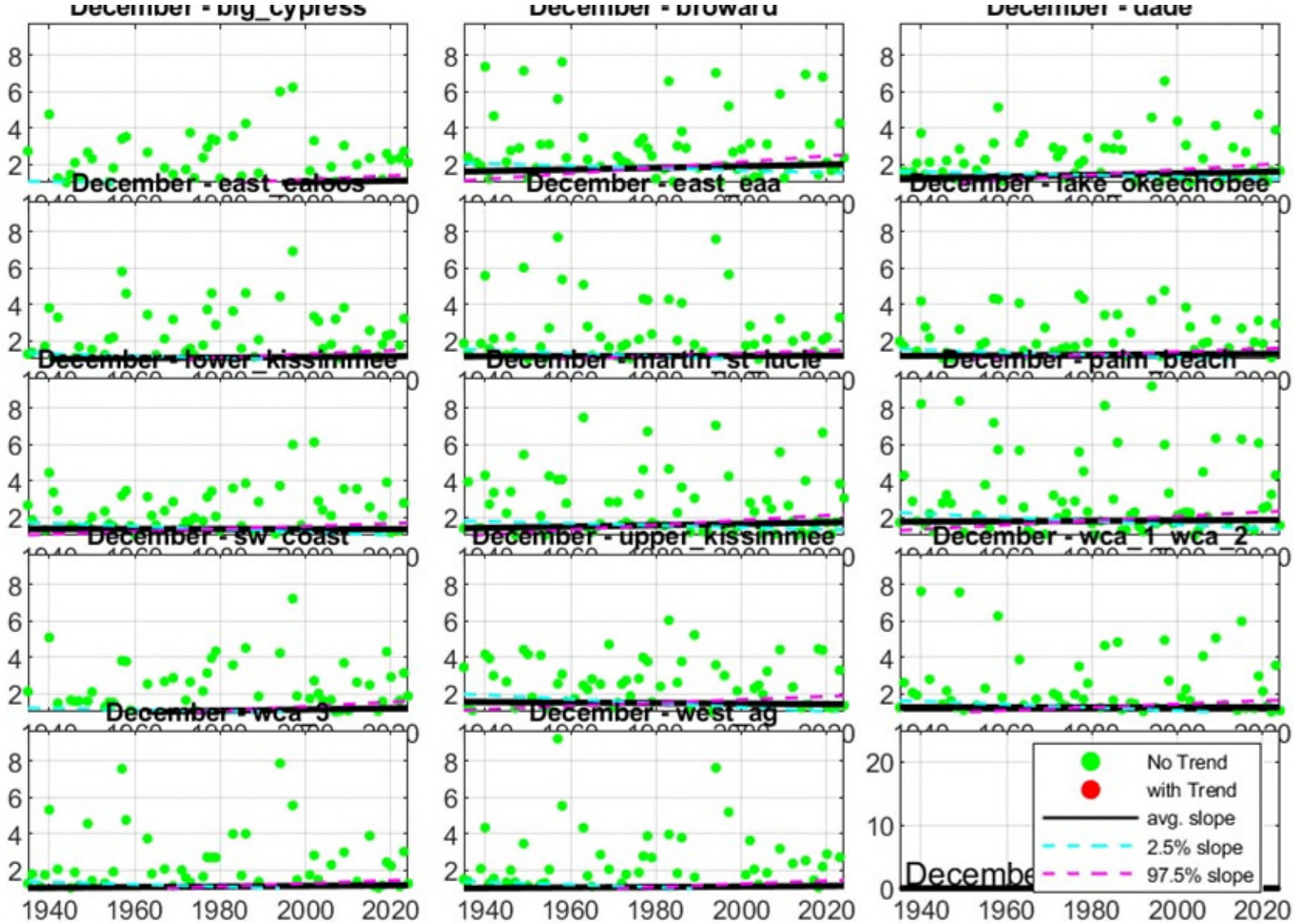

Figure 12. Results of the rainfall trend analysis for December, POR from 1935 to 2024.

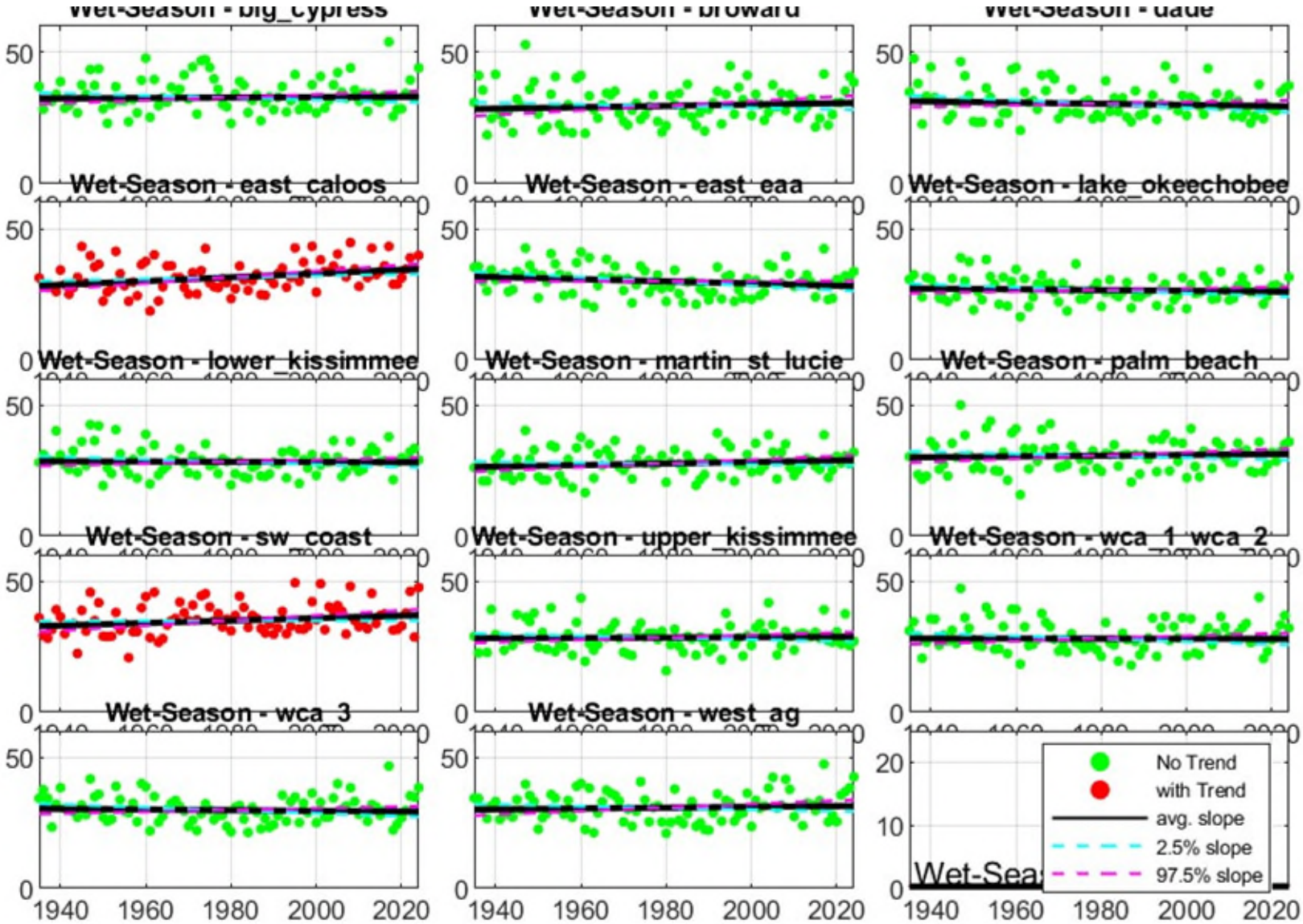

Figure 13. Results of the rainfall trend analysis for the wet season, POR from 1935 to 2024.

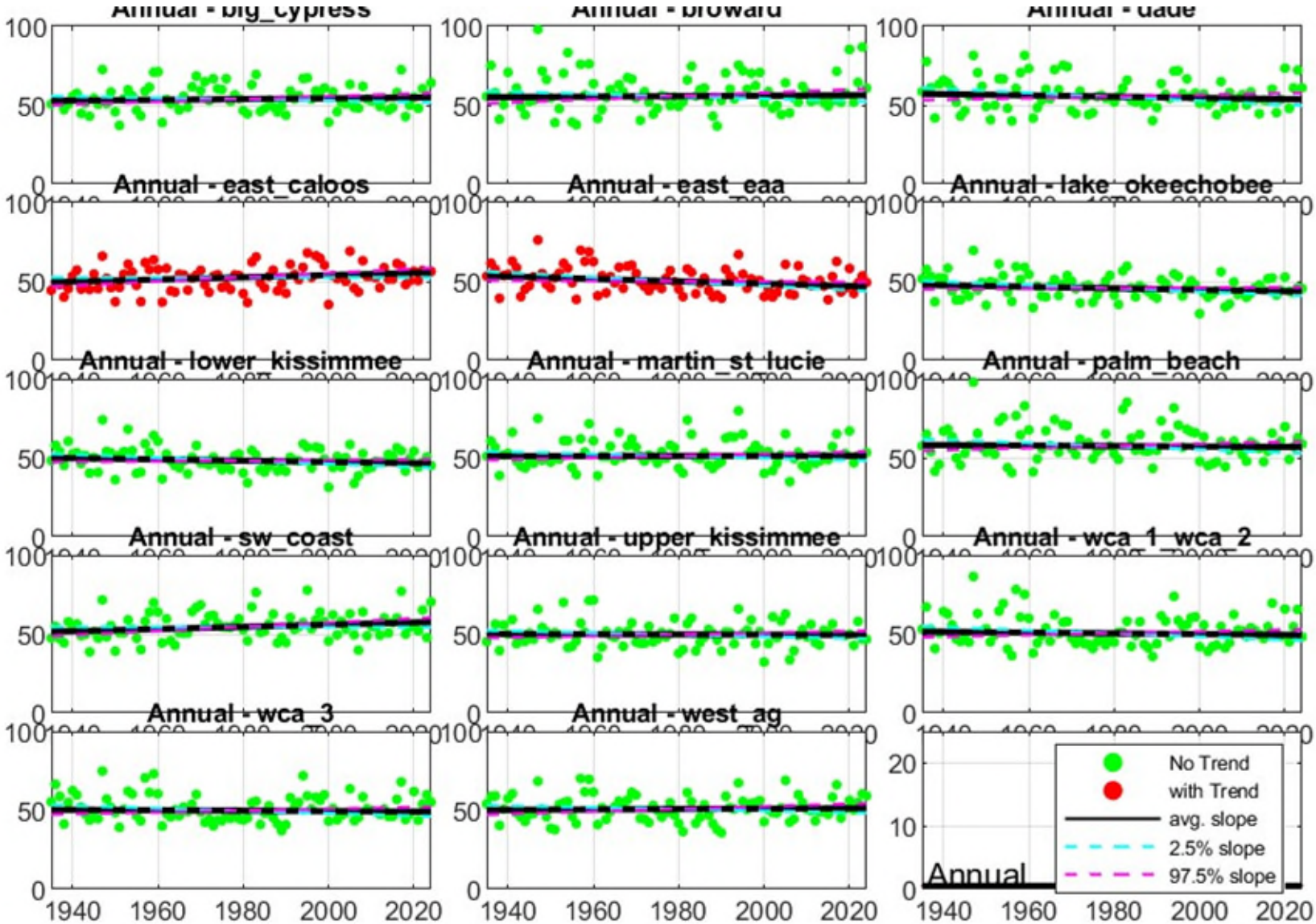

Figure 14. Results of the annual rainfall trend analysis, POR from 1935 to 2024.

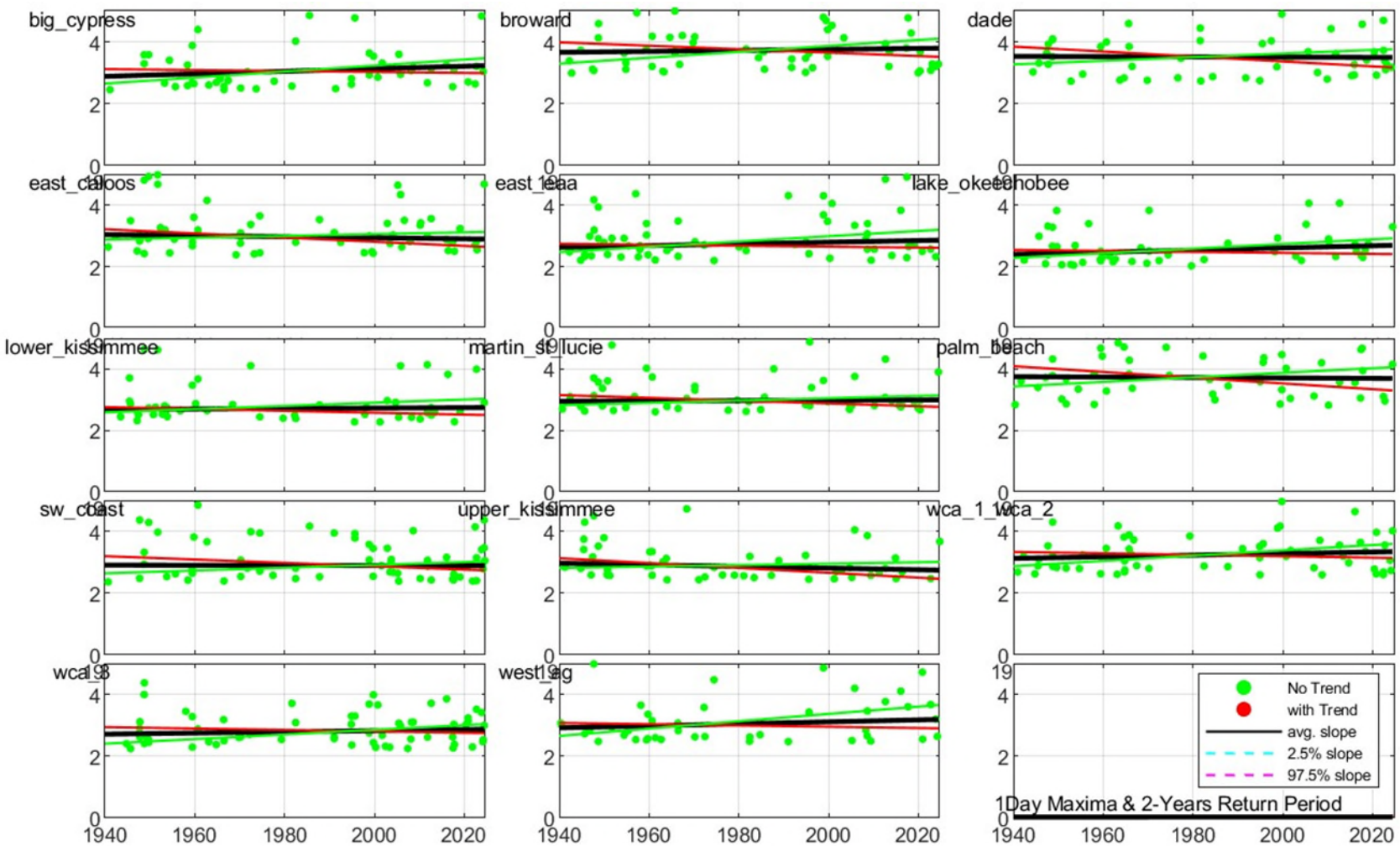

Figure 15. Results of the 1-day maxima, 2-year return frequency trend analysis, POR from 1935 to 2024.

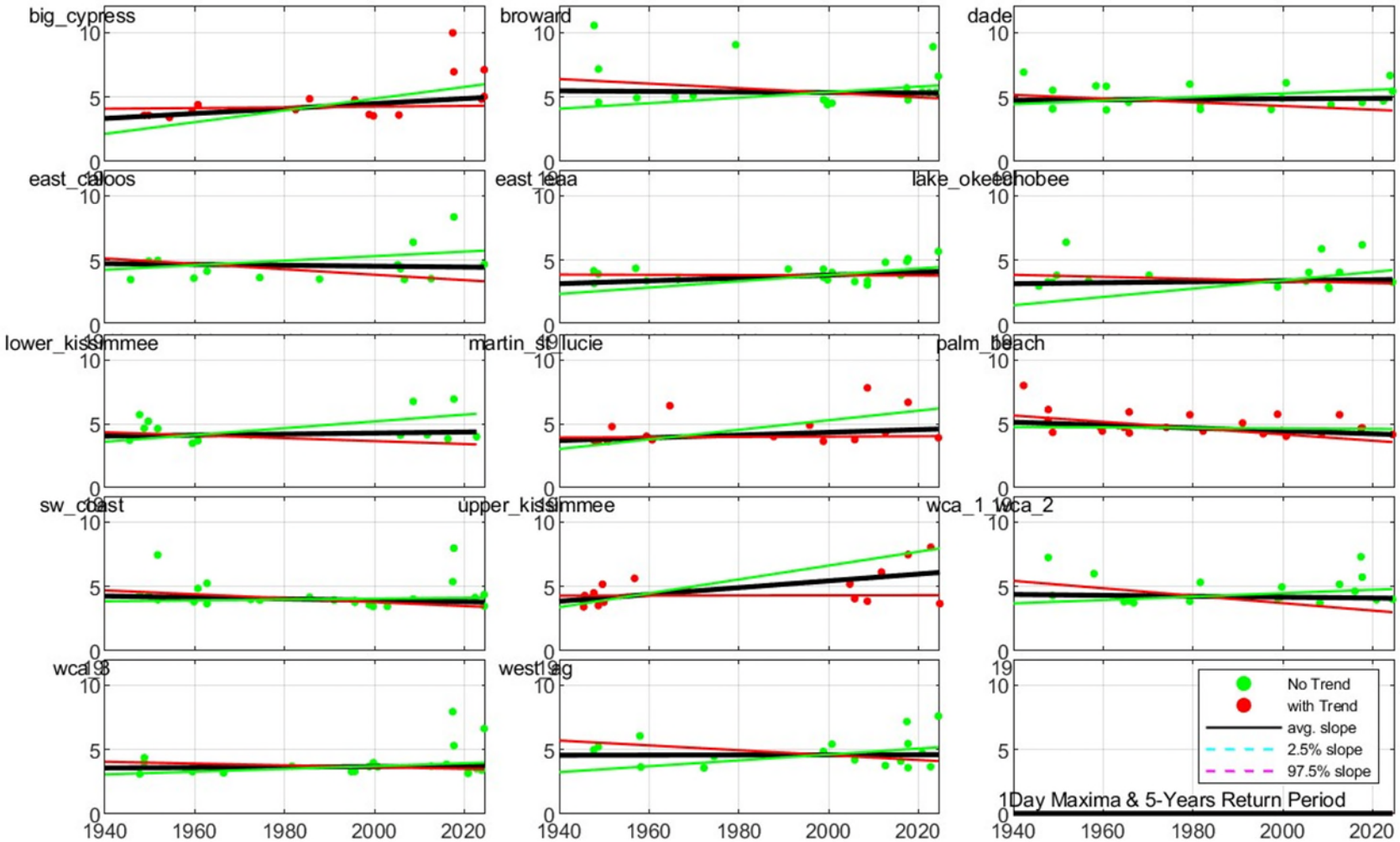

Figure 16. Results of the 1-day maxima, 5-year return frequency trend analysis, POR from 1935 to 2024.

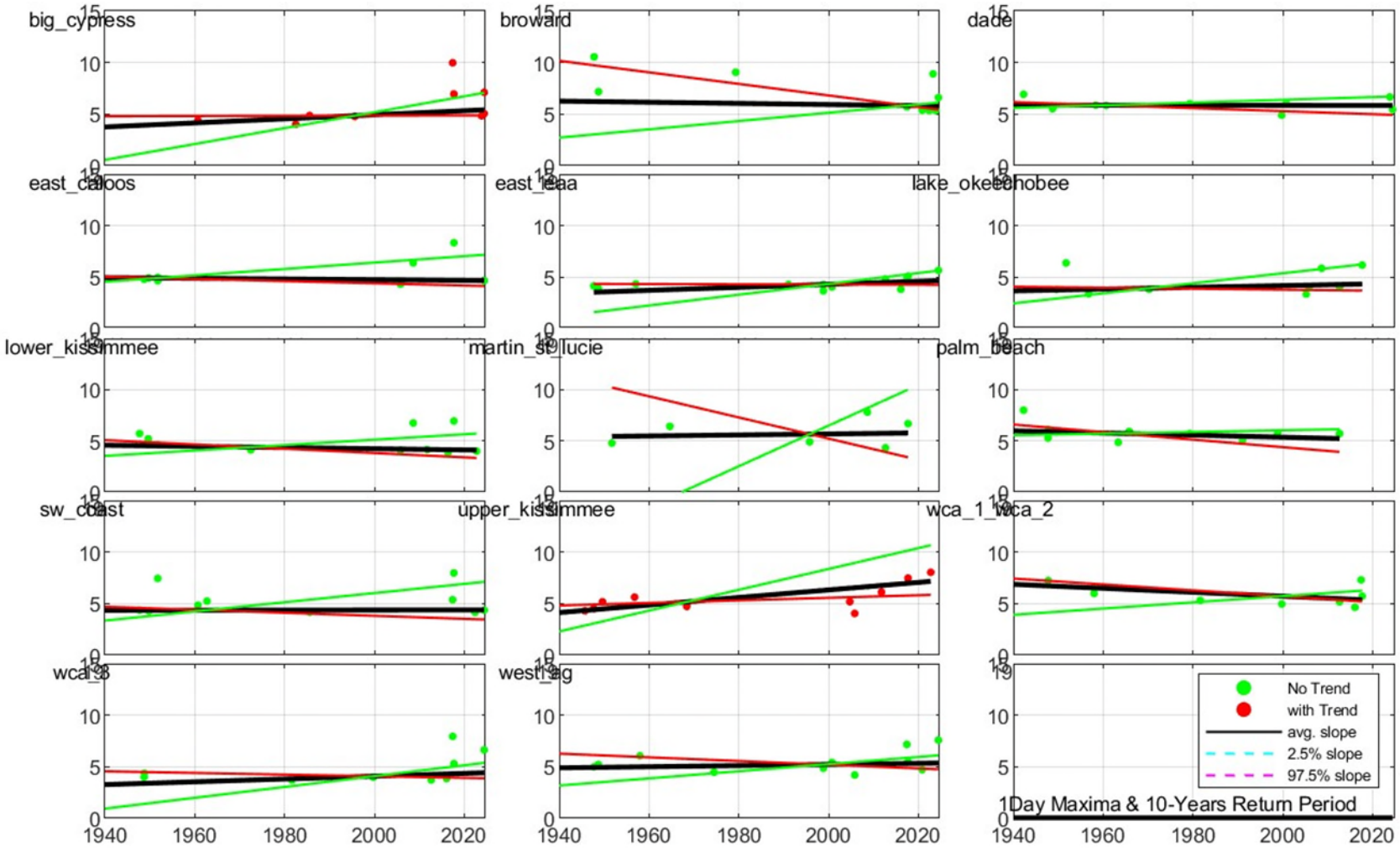

Figure 17. Results of the 1-day maxima, 10-year return frequency trend analysis, POR from 1935 to 2024.

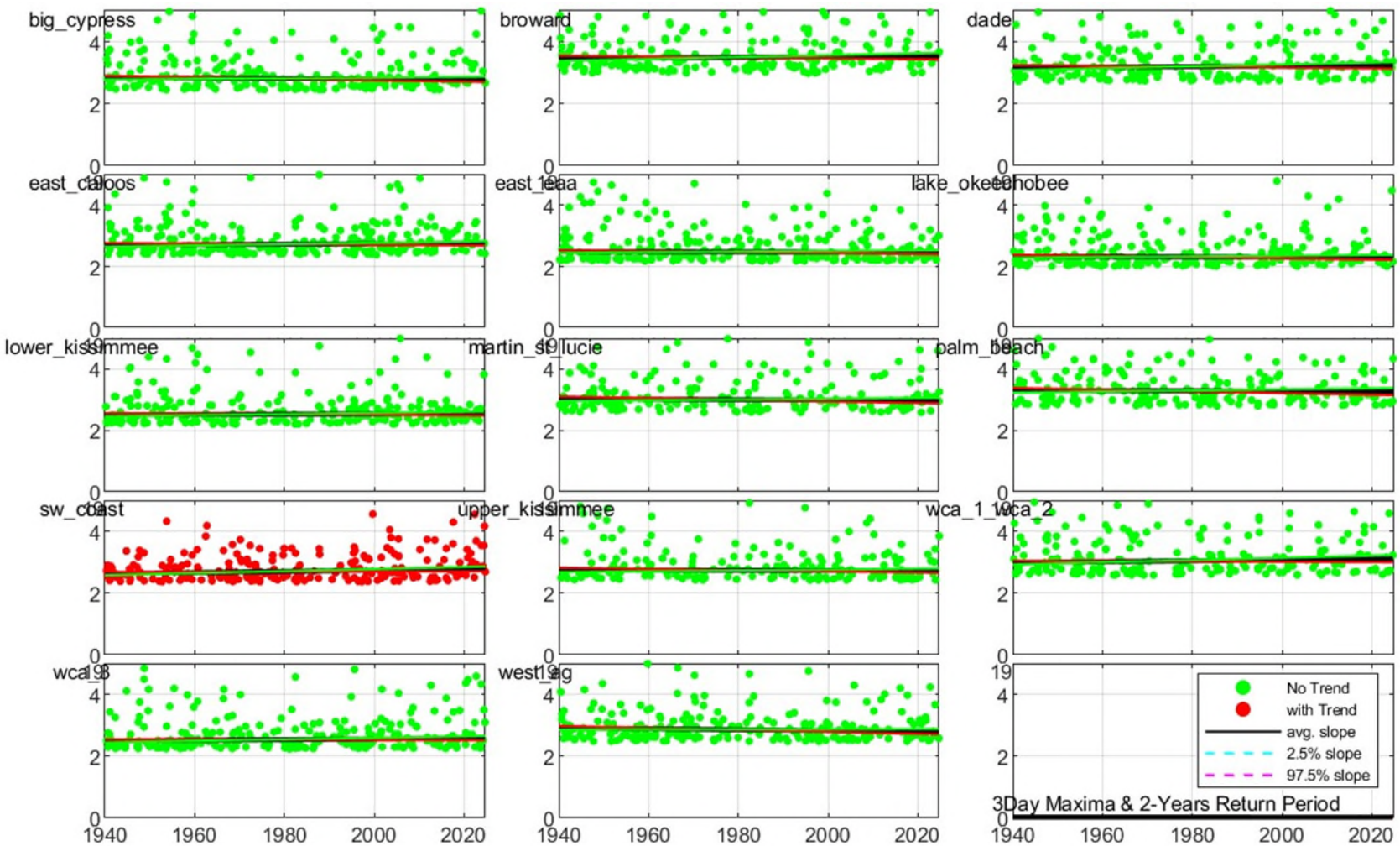

Figure 18. Results of the 3-day maxima, 2-year return frequency trend analysis, POR from 1935 to 2024.

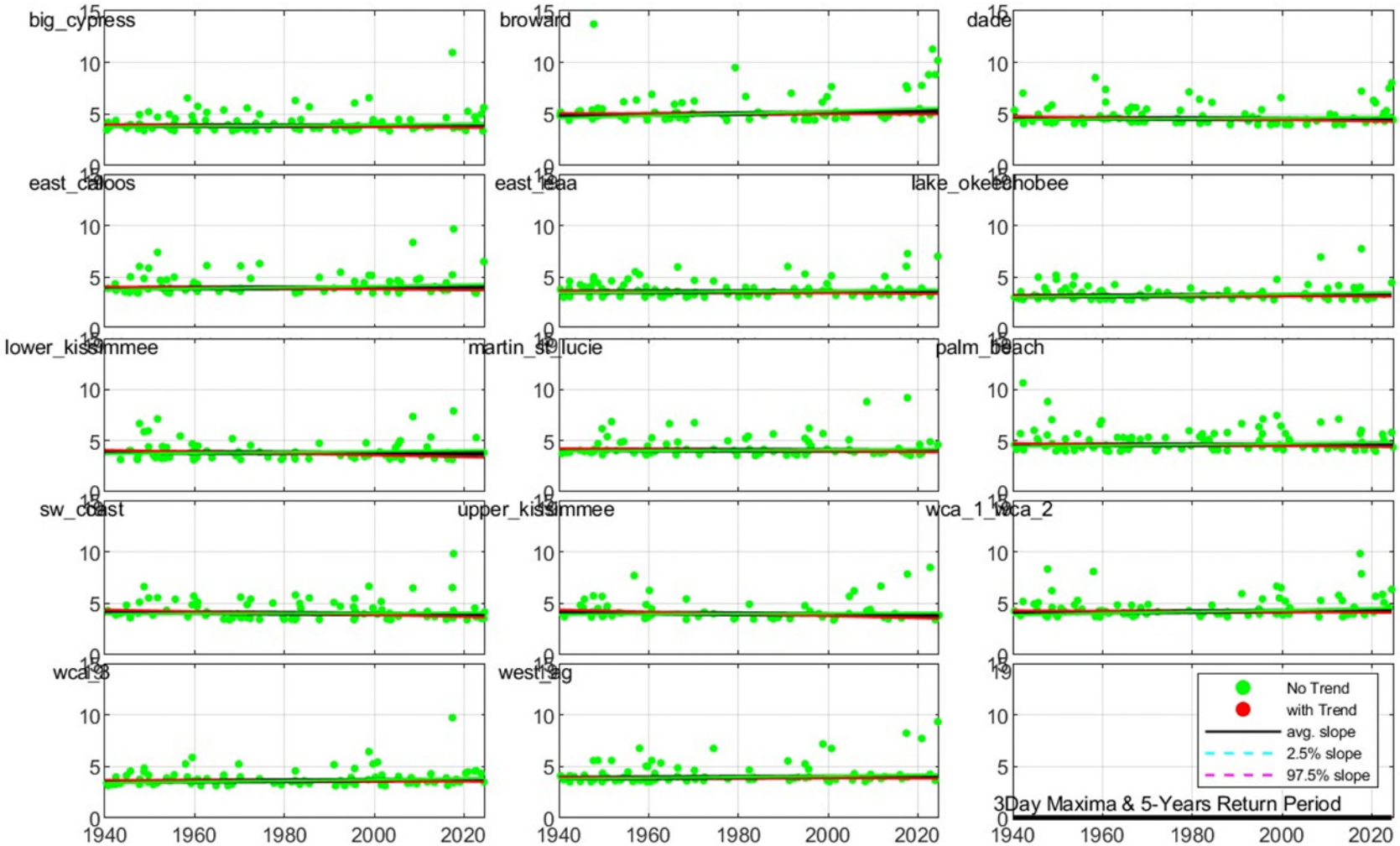

Figure 19. Results of the 3-day maxima, 5-year return frequency trend analysis, POR from 1935 to 2024.

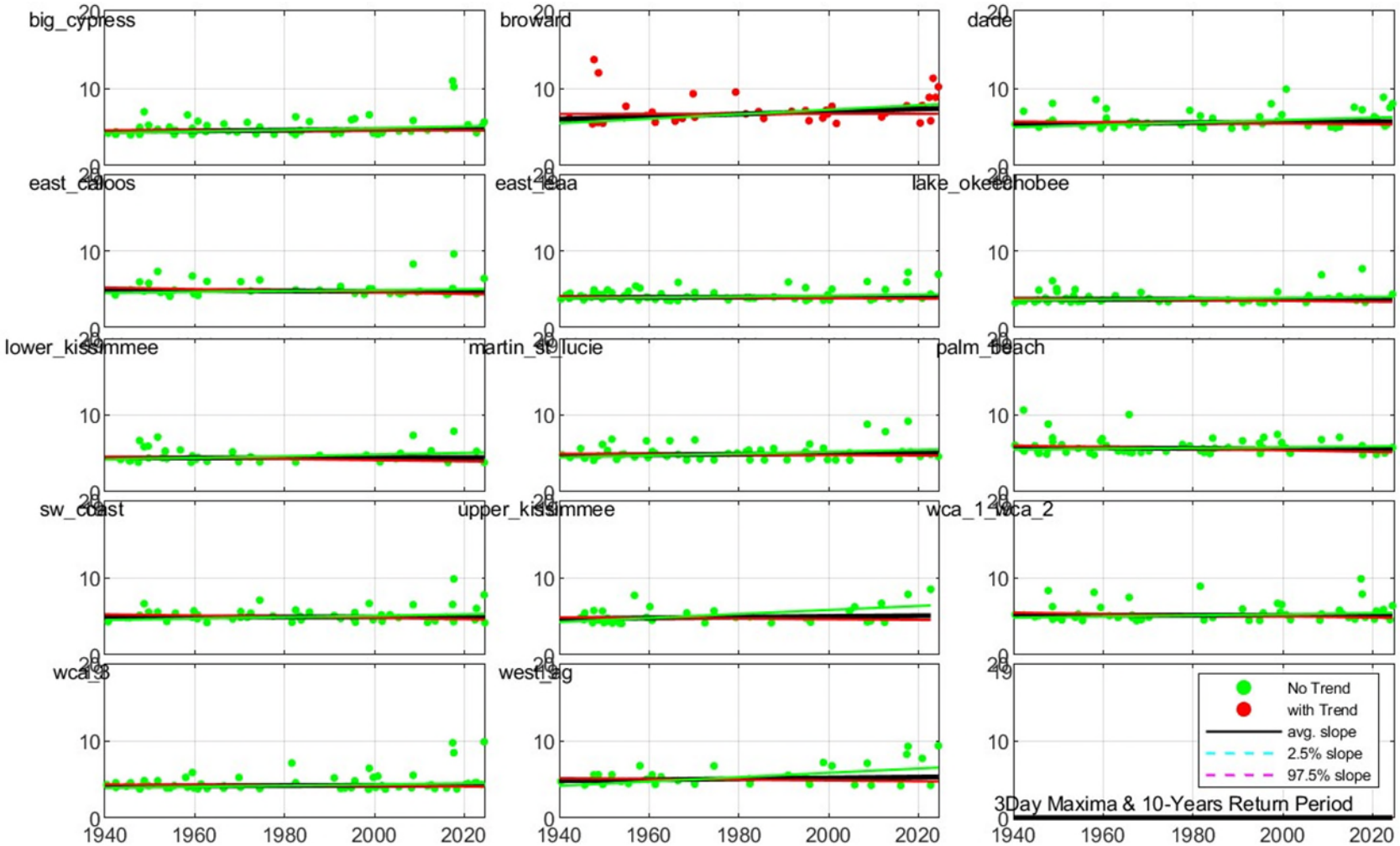

Figure 20. Results of the 3-day maxima, 10-year return frequency trend analysis, POR from 1935 to 2024.

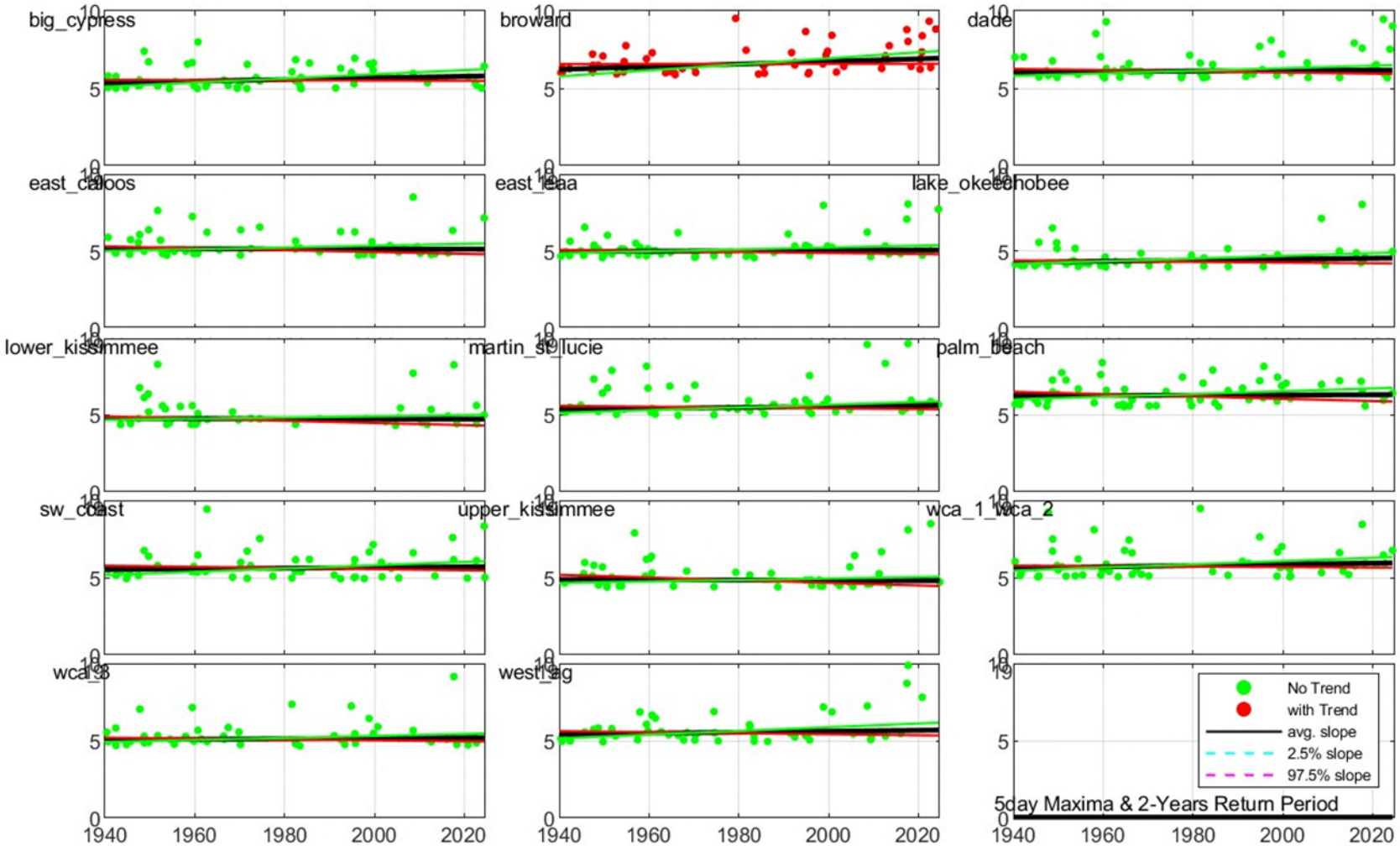

Figure 21. Results of the 5-day maxima, 2-year return frequency trend analysis, POR from 1935 to 2024.

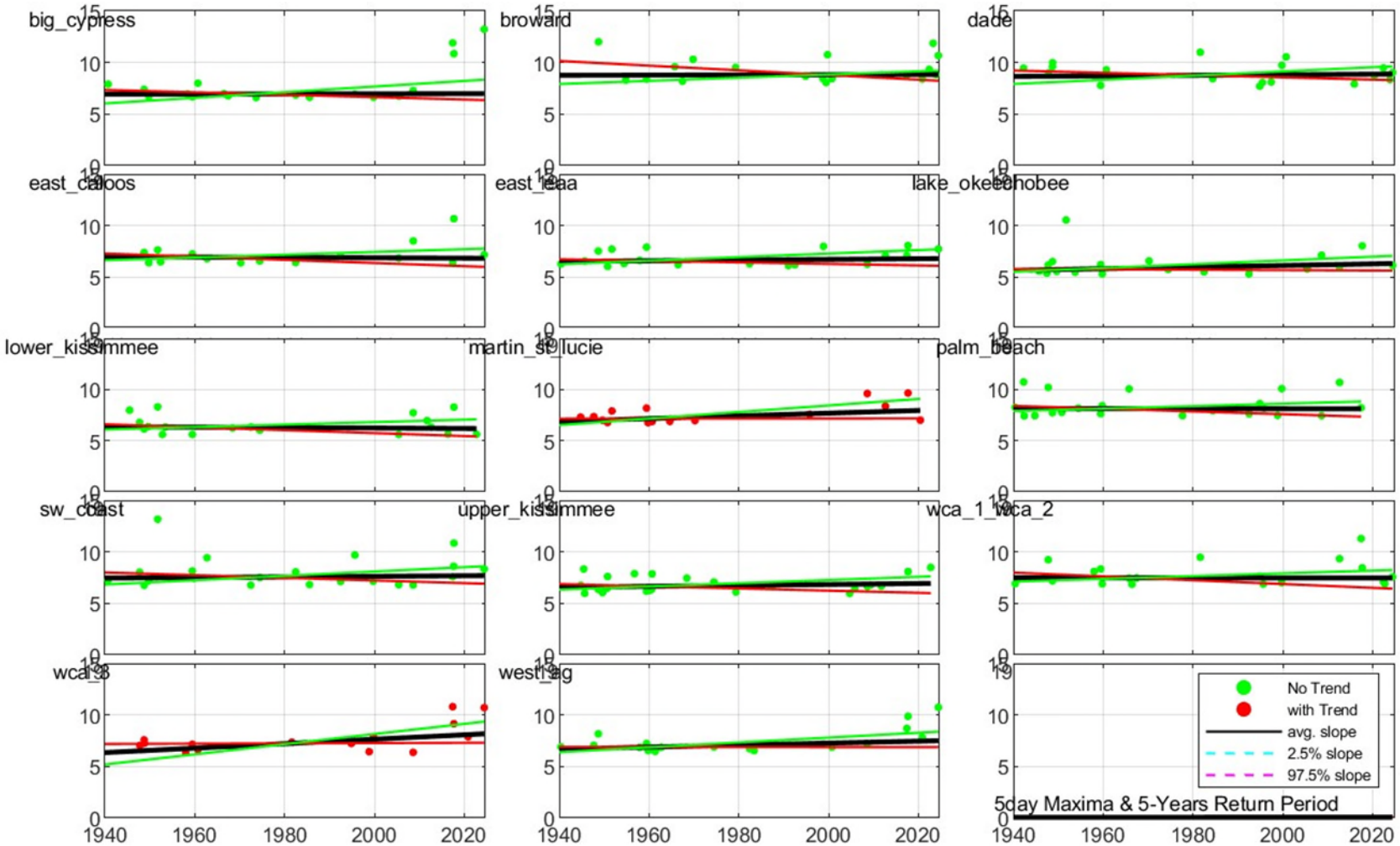

Figure 22. Results of the 5-day maxima, 5-year return frequency trend analysis, POR from 1935 to 2024.

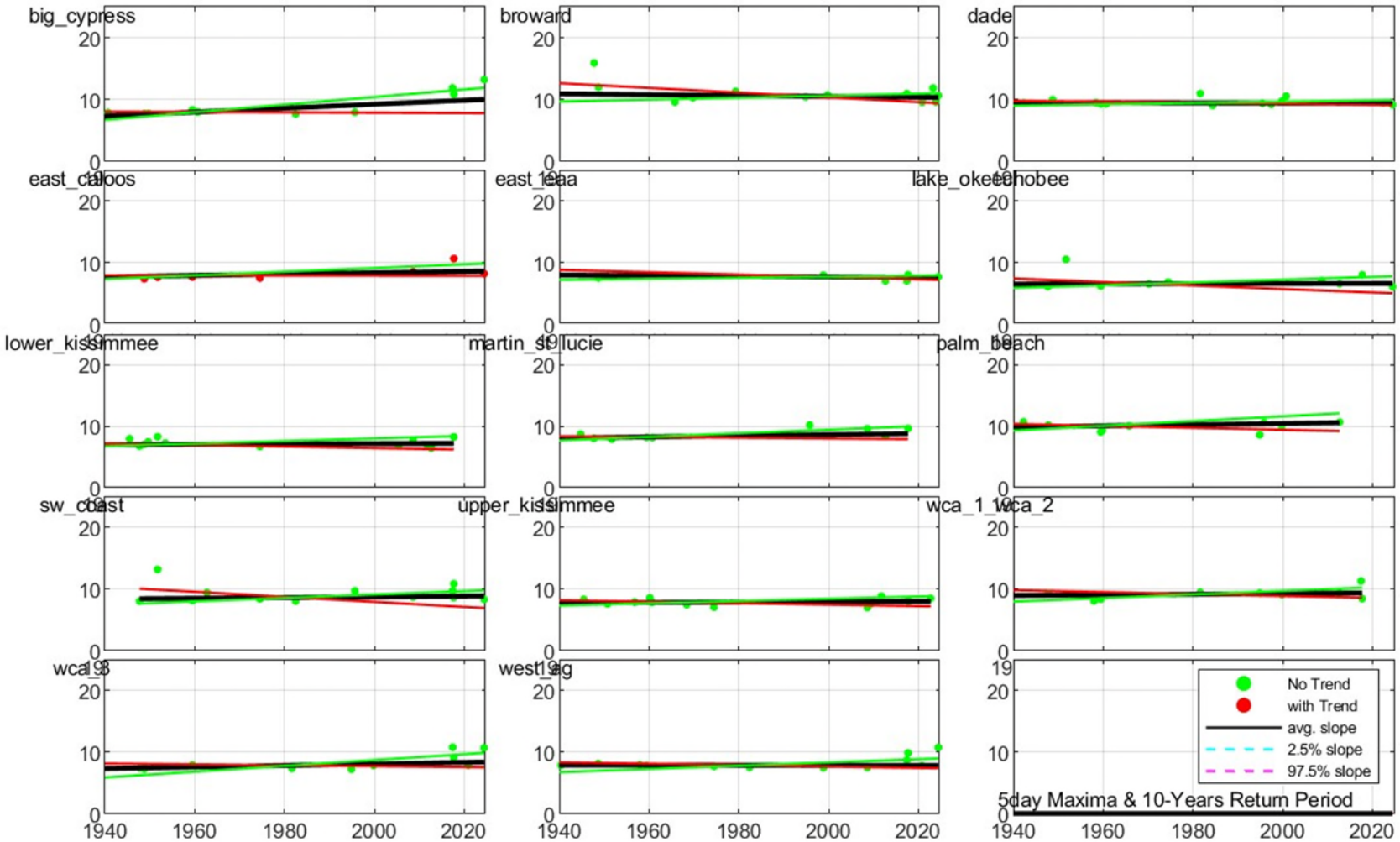

Figure 23. Results of the 5-day maxima, 10-year return frequency trend analysis, POR from 1935 to 2024.

CLUSTER ANALYSIS

Tables 1 through **3** provide results of the cluster analysis iterations. **Table 1** shows the number of clusters for different parameters for the POR. **Tables 2** and **3** show the number of clusters with and without significant trends, respectively. **Figures 24** through **31** provide spatial clustering patterns and POT trend analysis for different thresholds and different PORs.

Table 1. Results of the cluster analysis iterations: number of clusters for different parameters, POR from 1935 to 2024.

Parameters Minimum Exceedance Days x Minimum Points x Alpha	Peak Over Threshold (inches)											
	3.90	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00
5 x 5 x 0.01	1	1	1	1	2	6	11	15	10	5	5	4
5 x 5 x 0.05	1	1	1	1	2	6	11	15	10	5	5	4
5 x 5 x 0.1	1	1	1	1	2	6	11	15	10	5	5	4
5 x 7 x 0.01	1	1	1	1	2	6	11	11	7	4	4	3
5 x 7 x 0.05	1	1	1	1	2	6	11	11	7	4	4	3
5 x 7 x 0.1	1	1	1	1	2	6	11	11	7	4	4	3
5 x 10 x 0.01	6	6	6	8	7	10	14	16	8	8	3	2
5 x 10 x 0.05	6	6	6	8	7	10	14	16	8	8	3	2
5 x 10 x 0.1	6	6	6	8	7	10	14	16	8	8	3	2
10 x 5 x 0.01	1	1	1	5	6	10	5	6	2	1	0	0
10 x 5 x 0.05	1	1	1	5	6	10	5	6	2	1	0	0
10 x 5 x 0.1	1	1	1	5	6	10	5	6	2	1	0	0
10 x 7 x 0.01	1	1	1	5	8	6	6	3	1	1	0	0
10 x 7 x 0.05	1	1	1	5	8	6	6	3	1	1	0	0
10 x 7 x 0.1	1	1	1	5	8	6	6	3	1	1	0	0
10 x 10 x 0.01	6	6	7	9	11	11	4	3	1	1	0	0
10 x 10 x 0.05	6	6	7	9	11	11	4	3	1	1	0	0
10 x 10 x 0.1	6	6	7	9	11	11	4	3	1	1	0	0

Table 2. Results of the cluster analysis iterations: number of clusters with significant trend for different parameters, POR from 1935 to 2024.

Parameters Minimum Exceedance Days x Minimum Points x Alpha	Peak Over Threshold (inches)											
	3.90	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00
5 x 5 x 0.01	0	0	1	0	0	0	0	0	0	0	0	0
5 x 5 x 0.05	0	1	1	0	0	2	0	0	0	0	0	0
5 x 5 x 0.1	0	1	1	1	0	2	0	1	0	0	0	0
5 x 7 x 0.01	0	0	1	0	0	0	1	0	0	0	0	0
5 x 7 x 0.05	0	1	1	0	0	2	1	1	0	0	0	0
5 x 7 x 0.1	0	1	1	1	0	2	2	2	0	0	0	0
5 x 10 x 0.01	0	0	0	0	0	0	0	1	0	0	0	0
5 x 10 x 0.05	0	2	2	0	0	2	2	1	0	0	0	0
5 x 10 x 0.1	1	2	3	2	0	3	2	1	0	0	0	0
10 x 5 x 0.01	0	0	1	0	0	0	0	0	0	0	0	0
10 x 5 x 0.05	0	1	1	0	0	1	0	0	0	0	0	0
10 x 5 x 0.1	0	1	1	1	0	2	1	0	0	0	0	0
10 x 7 x 0.01	0	0	1	0	0	0	0	0	0	0	0	0
10 x 7 x 0.05	0	1	1	0	0	0	1	0	0	0	0	0
10 x 7 x 0.1	0	1	1	1	0	1	2	0	0	0	0	0
10 x 10 x 0.01	0	0	0	0	0	0	0	0	0	0	0	0
10 x 10 x 0.05	0	2	2	1	0	0	0	0	0	0	0	0
10 x 10 x 0.1	1	2	2	3	0	0	0	0	0	0	0	0

Table 3. Results of the cluster analysis iterations: number of clusters without significant trend for different parameters, POR from 1935 to 2024.

Parameters Minimum Exceedance Days x Minimum Points x Alpha	Peak Over Threshold (inches)											
	3.90	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00
5 x 5 x 0.01	1	1	0	1	2	6	11	15	10	5	5	4
5 x 5 x 0.05	1	0	0	1	2	4	11	15	10	5	5	4
5 x 5 x 0.1	1	0	0	0	2	4	11	14	10	5	5	4
5 x 7 x 0.01	1	1	0	1	2	6	10	11	7	4	4	3
5 x 7 x 0.05	1	0	0	1	2	4	10	10	7	4	4	3
5 x 7 x 0.1	1	0	0	0	2	4	9	9	7	4	4	3
5 x 10 x 0.01	6	6	6	8	7	10	14	15	8	8	3	2
5 x 10 x 0.05	6	4	4	8	7	8	12	15	8	8	3	2
5 x 10 x 0.1	5	4	3	6	7	7	12	15	8	8	3	2
10 x 5 x 0.01	1	1	0	5	6	10	5	6	2	1	0	0
10 x 5 x 0.05	1	0	0	5	6	9	5	6	2	1	0	0
10 x 5 x 0.1	1	0	0	4	6	8	4	6	2	1	0	0
10 x 7 x 0.01	1	1	0	5	8	6	6	3	1	1	0	0
10 x 7 x 0.05	1	0	0	5	8	6	5	3	1	1	0	0
10 x 7 x 0.1	1	0	0	4	8	5	4	3	1	1	0	0
10 x 10 x 0.01	6	6	7	9	11	11	4	3	1	1	0	0
10 x 10 x 0.05	6	4	5	8	11	11	4	3	1	1	0	0
10 x 10 x 0.1	5	4	5	6	11	11	4	3	1	1	0	0

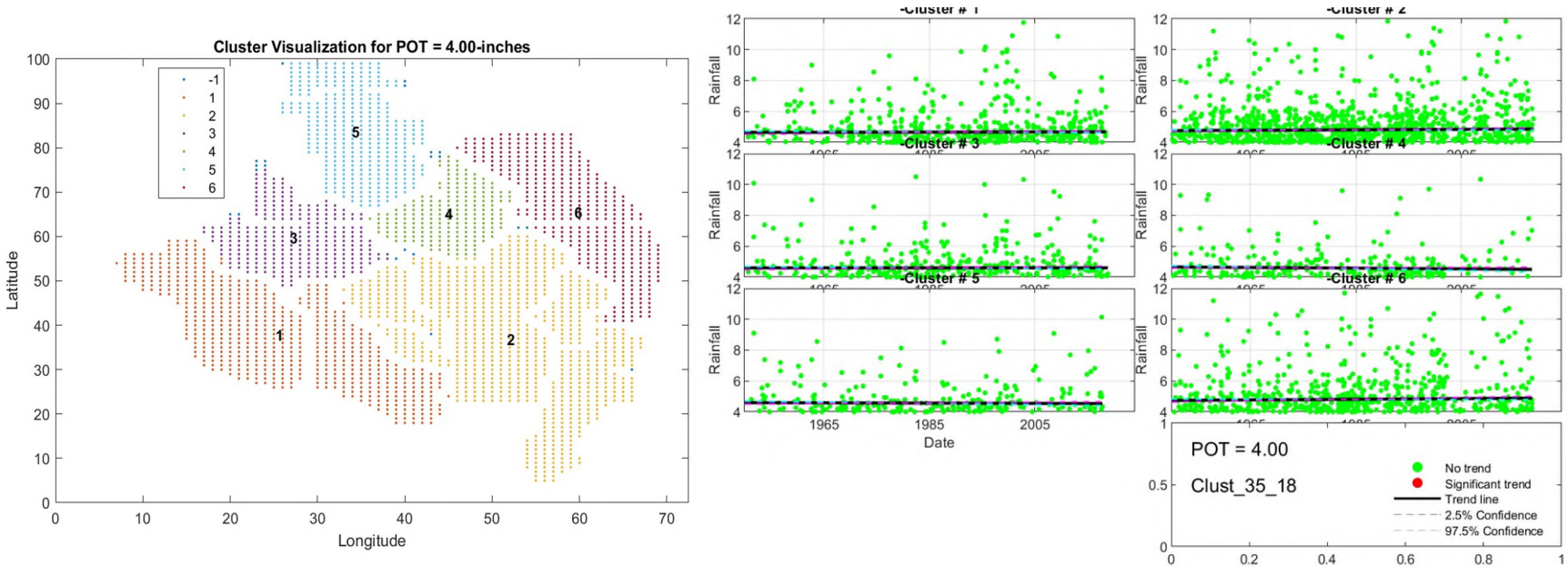

Figure 24. Spatial clustering pattern and POT trend analysis for threshold 4.00 inches, POR from 1935 to 2018.

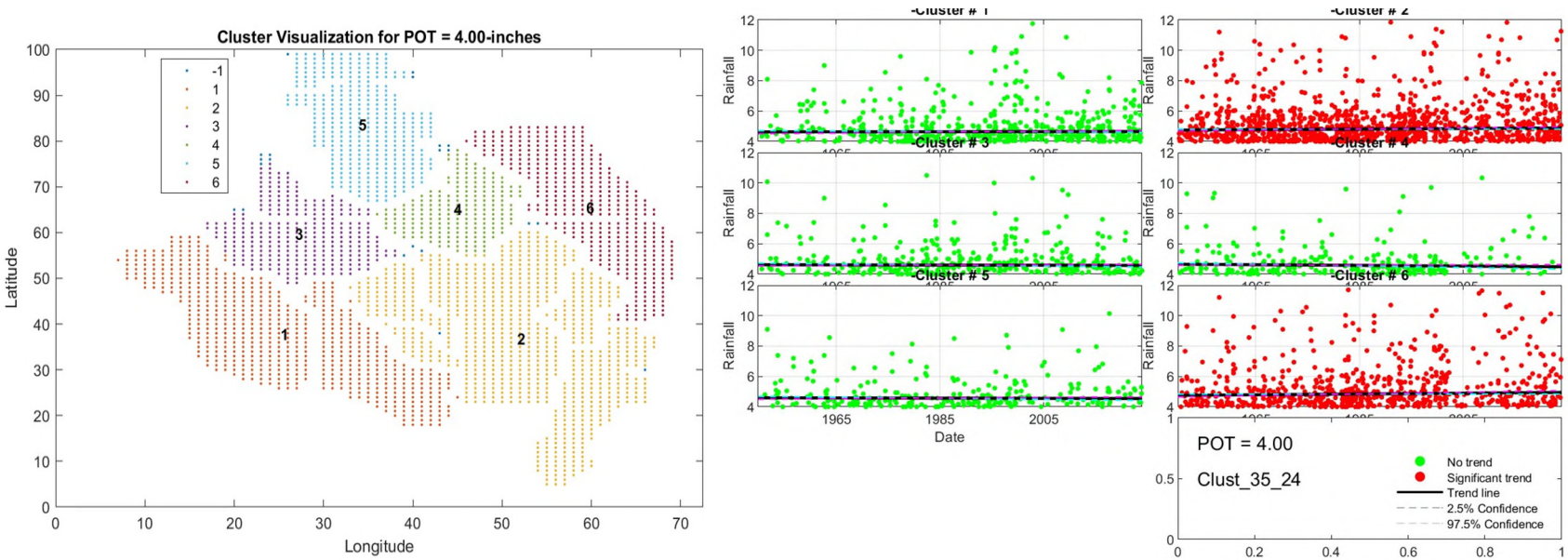

Figure 25. Spatial clustering pattern and POT trend analysis for threshold 4.00 inches, POR from 1935 to 2024.

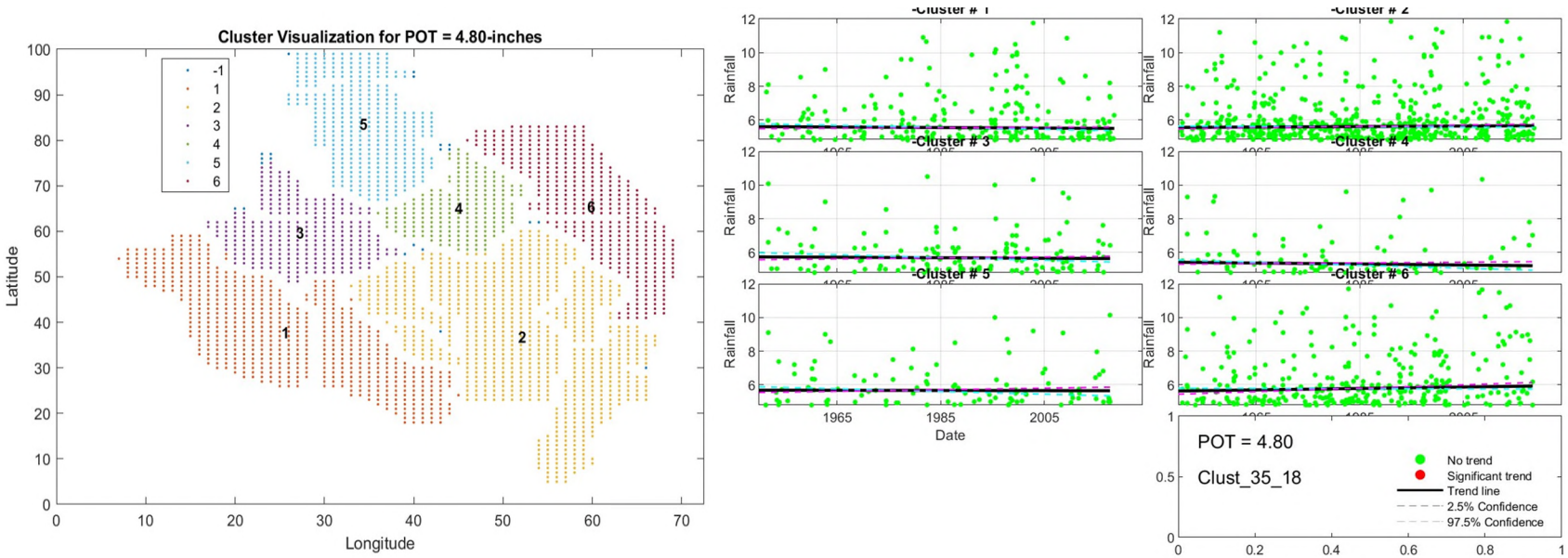

Figure 26. Spatial clustering pattern and POT trend analysis for threshold 4.80 inches, POR from 1935 to 2018.

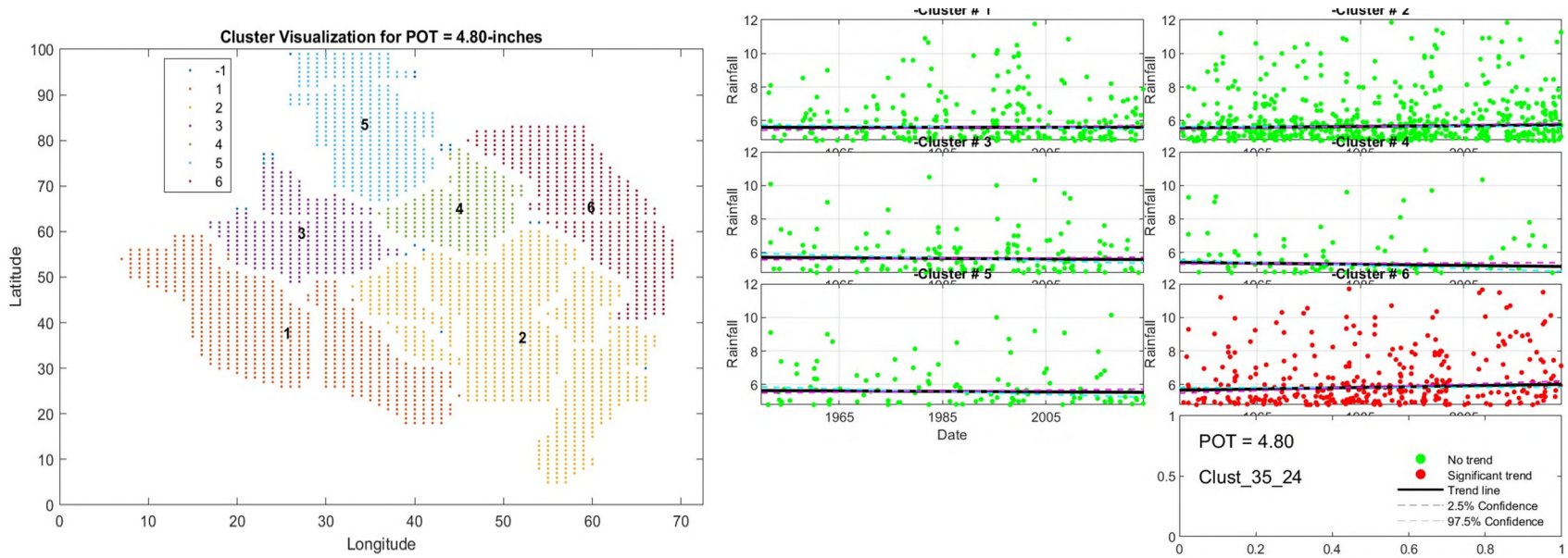

Figure 27. Spatial clustering pattern and POT trend analysis for threshold 4.80 inches, POR from 1935 to 2024.

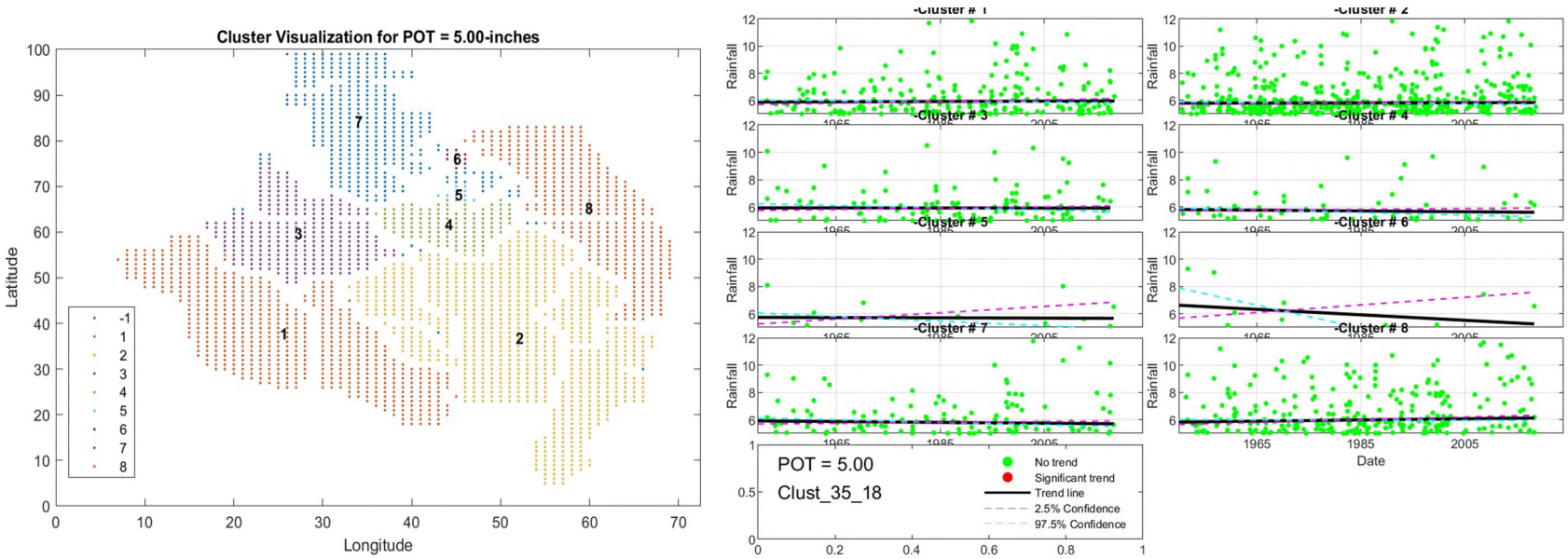

Figure 28. Spatial clustering pattern and POT trend analysis for threshold 5.00 inches, POR from 1935 to 2018.

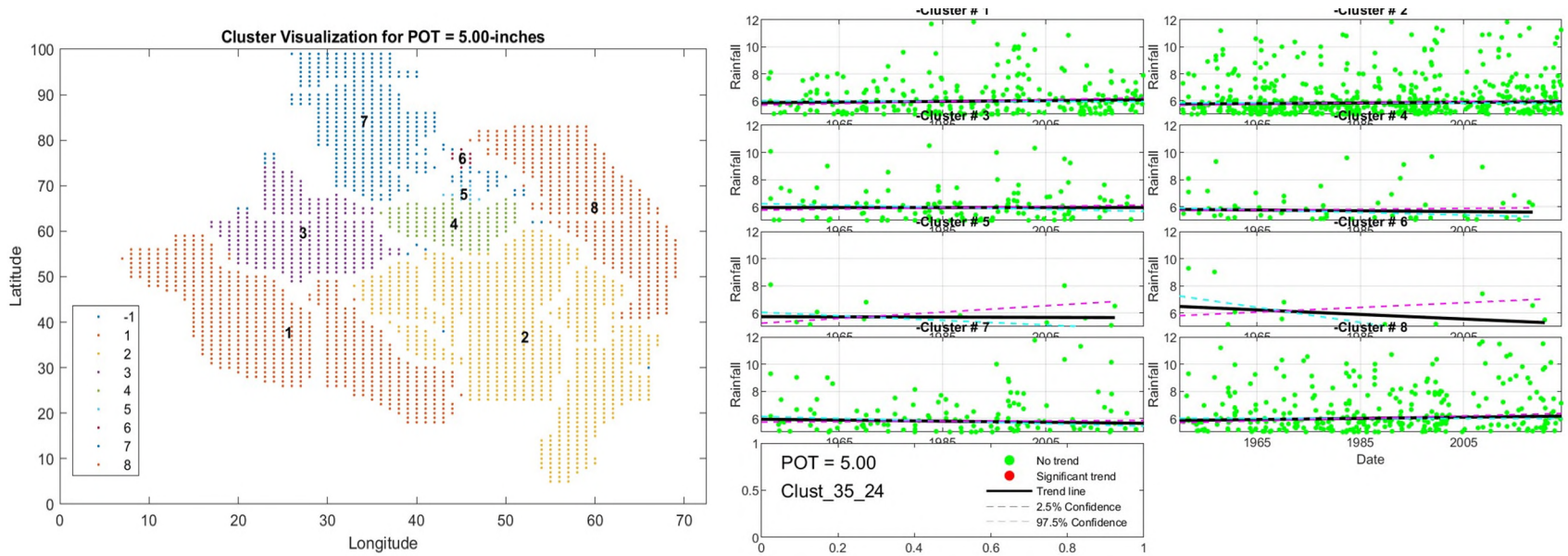

Figure 29. Spatial clustering pattern and POT trend analysis for threshold 5.00 inches, POR from 1935 to 2024.

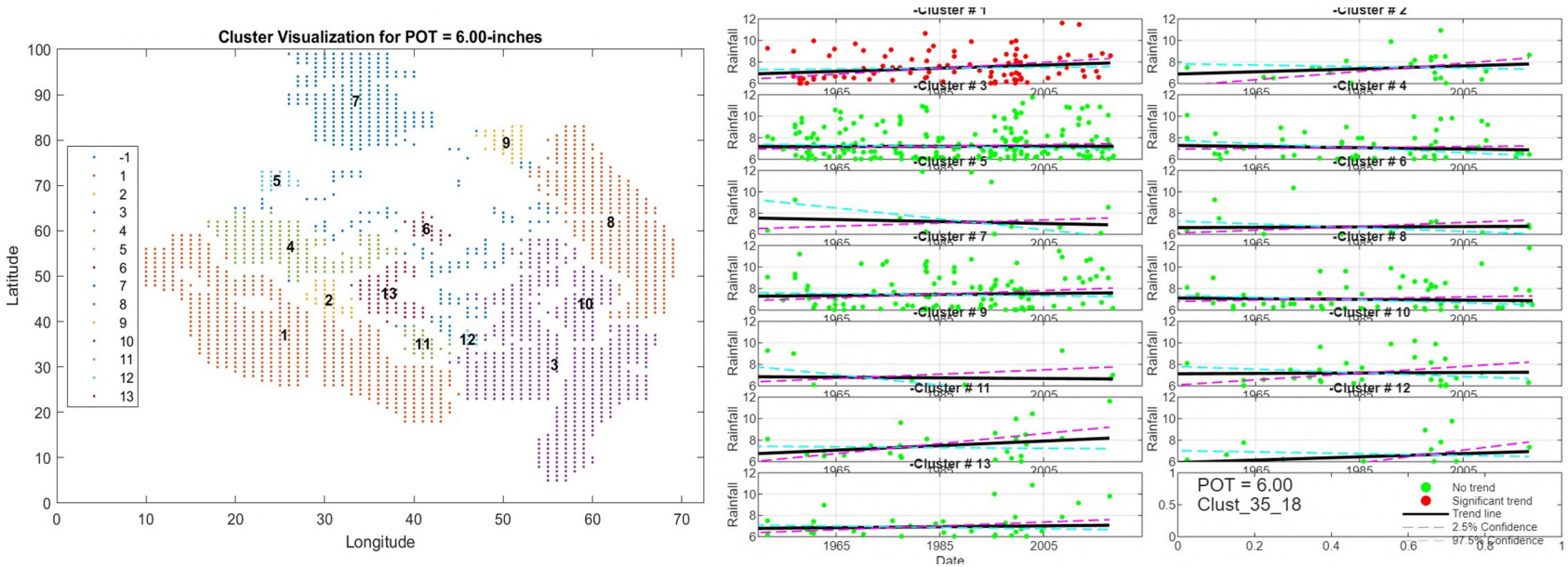

Figure 30. Spatial clustering pattern and POT trend analysis for threshold 6.00 inches, POR from 1935 to 2018.

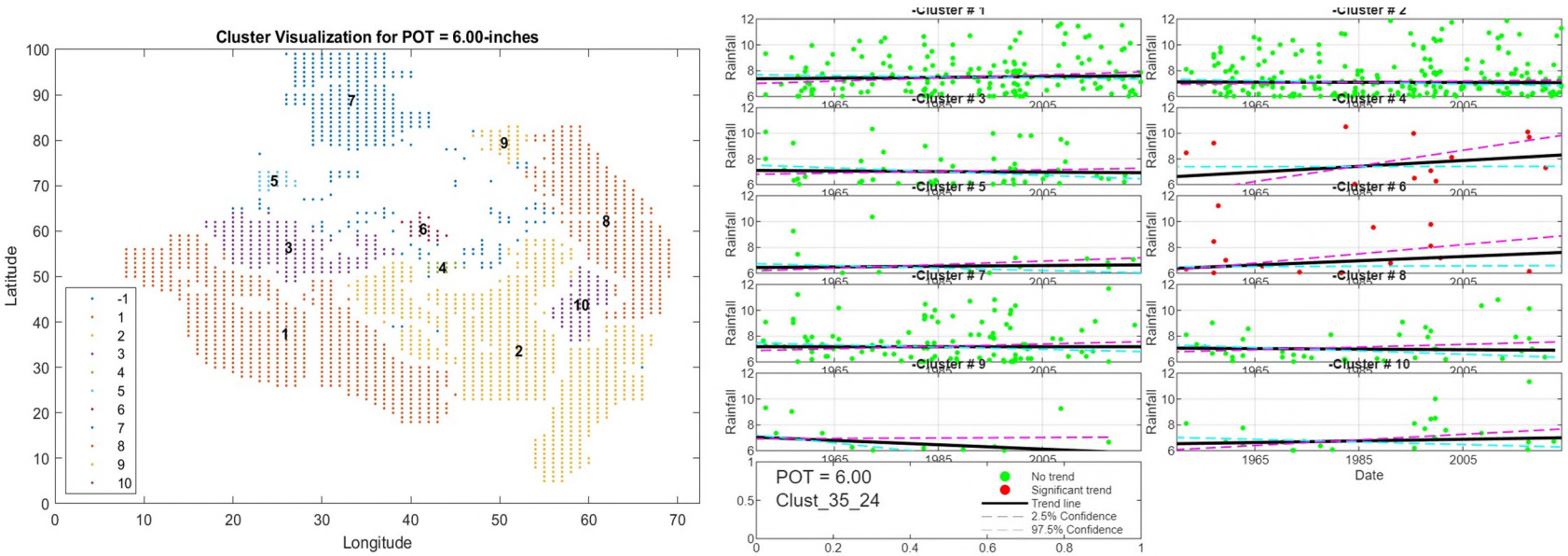

Figure 31. Spatial clustering pattern and POT trend analysis for threshold 6.00 inches, POR from 1935 to 2024.