atmosphere

Supplementary Materials: Clustering and Regression-Based Analysis of PM2.5 Sensitivity to Meteorology in Cincinnati, Ohio

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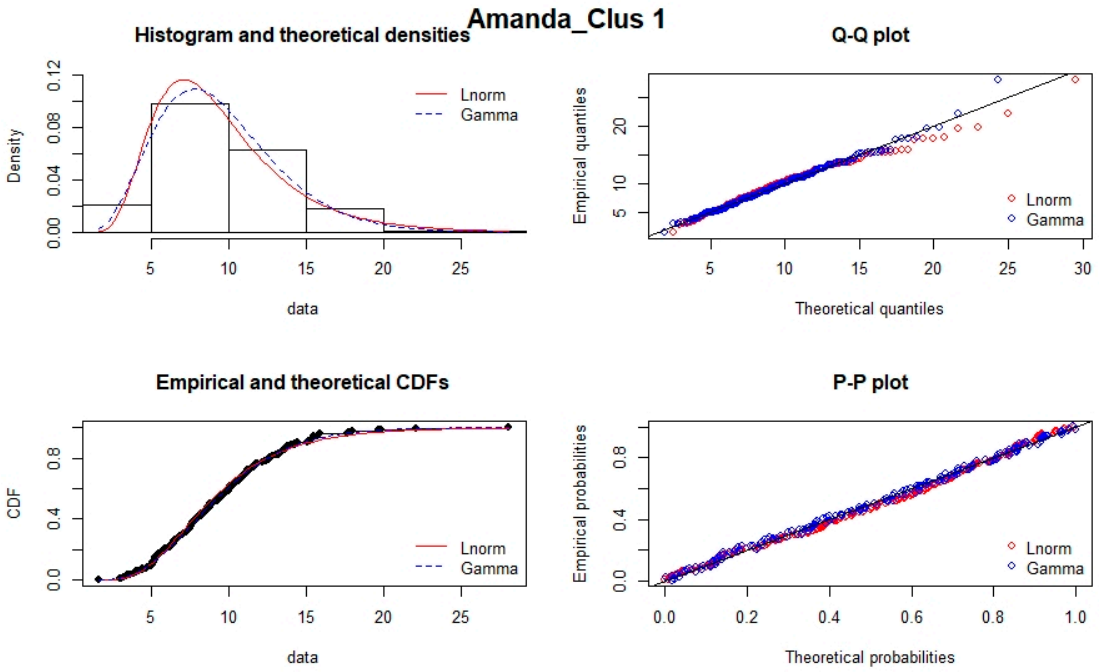

Figure S1. Comparison of Gamma and Lognormal distribution at Amanda_Clus1.

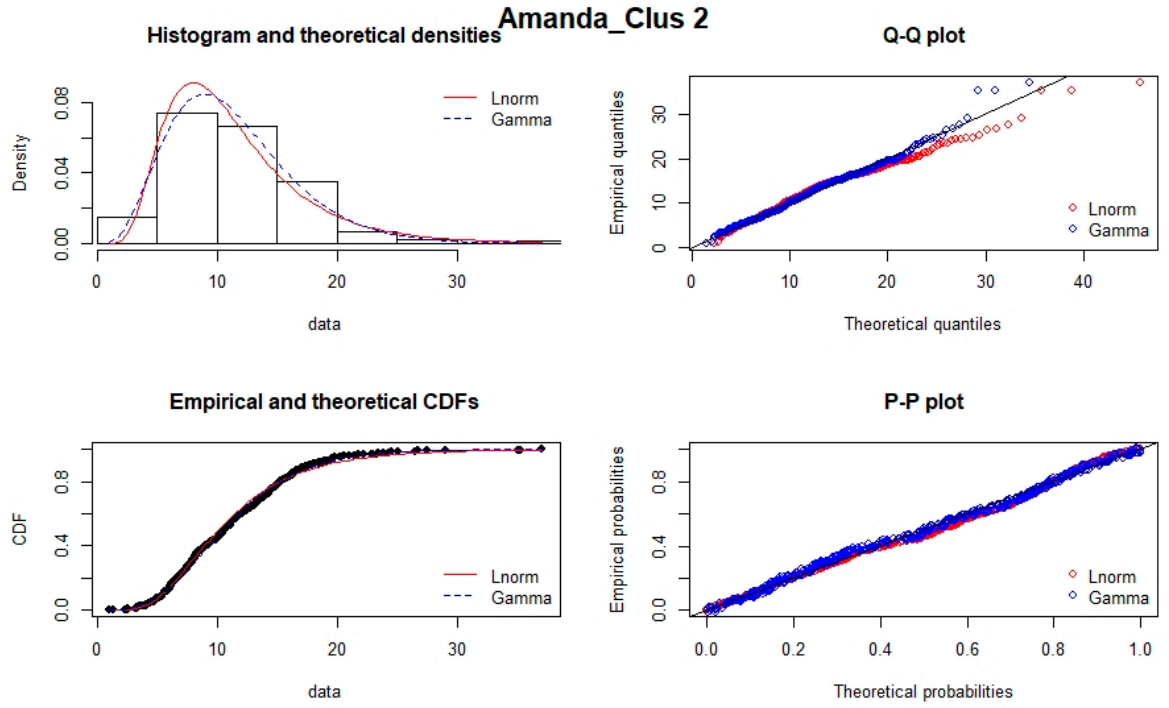

Figure S2. Comparison of Gamma and Lognormal distribution at Amanda_Clus2.

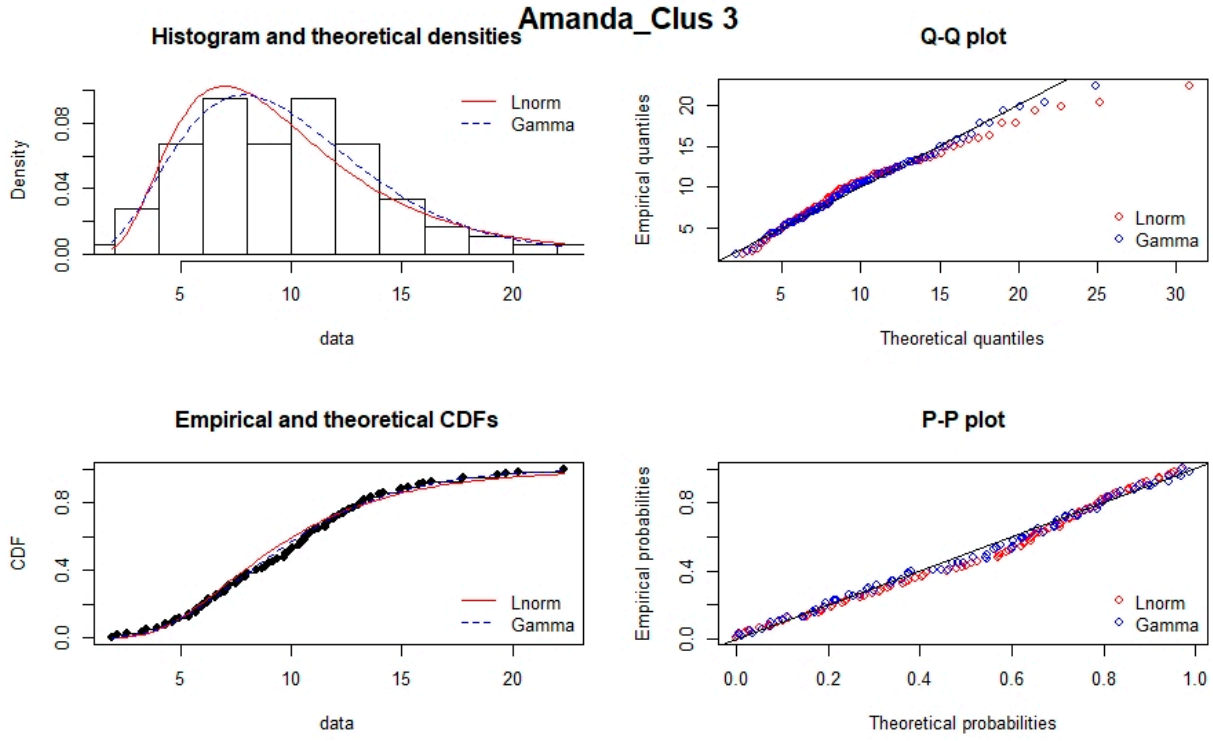

Figure S3. Comparison of Gamma and Lognormal distribution at Amanda_Clus3.

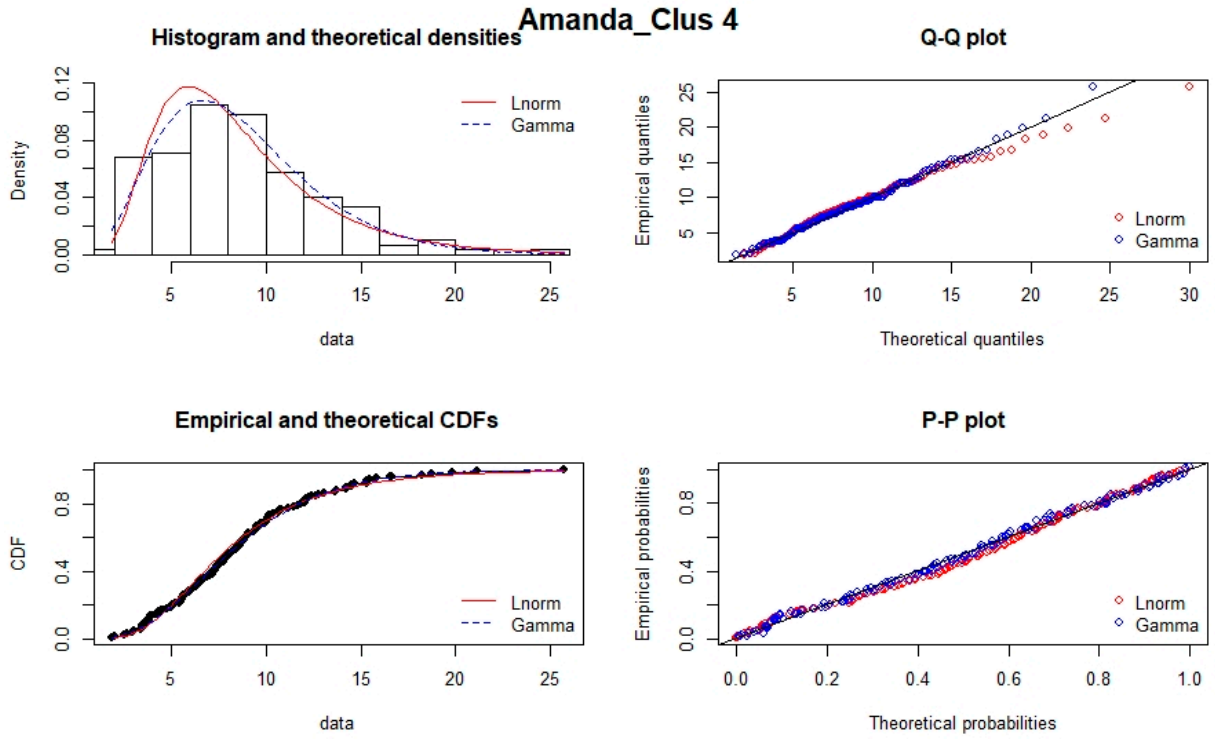

Figure S4. Comparison of Gamma and Lognormal distribution at Amanda_Clus4.

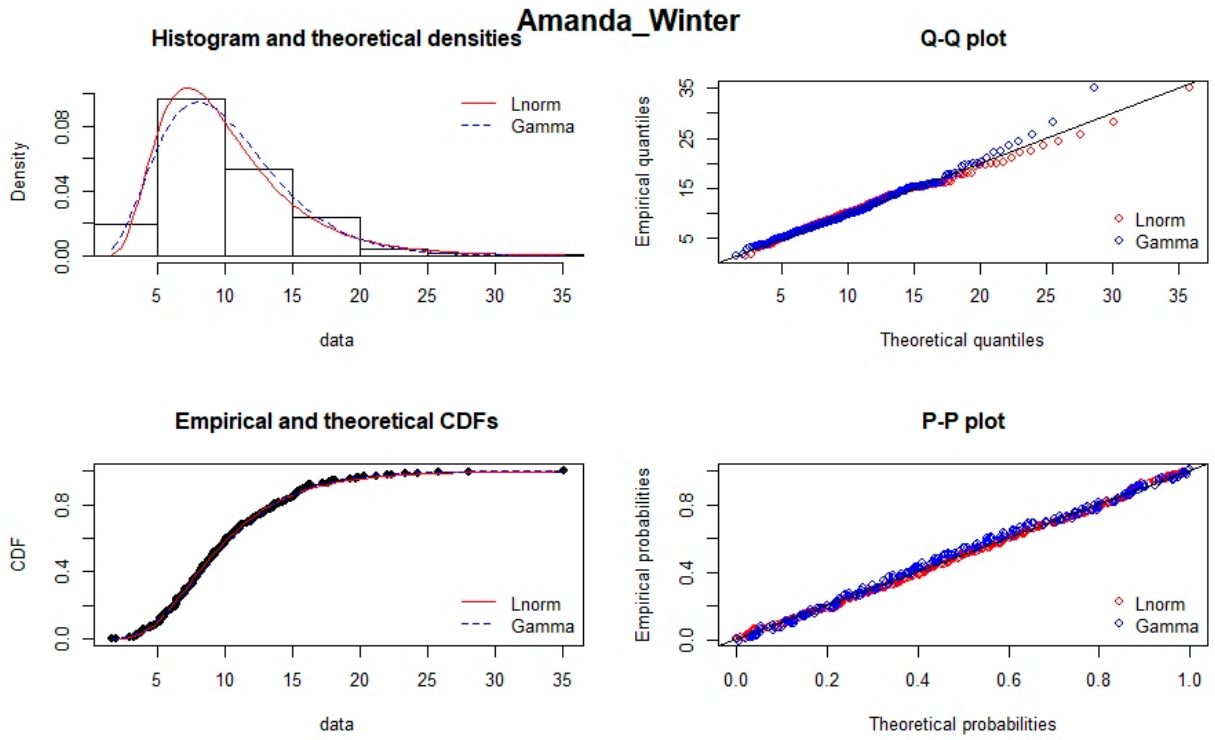

Figure S5. Comparison of Gamma and Lognormal distribution at Amanda_Winter.

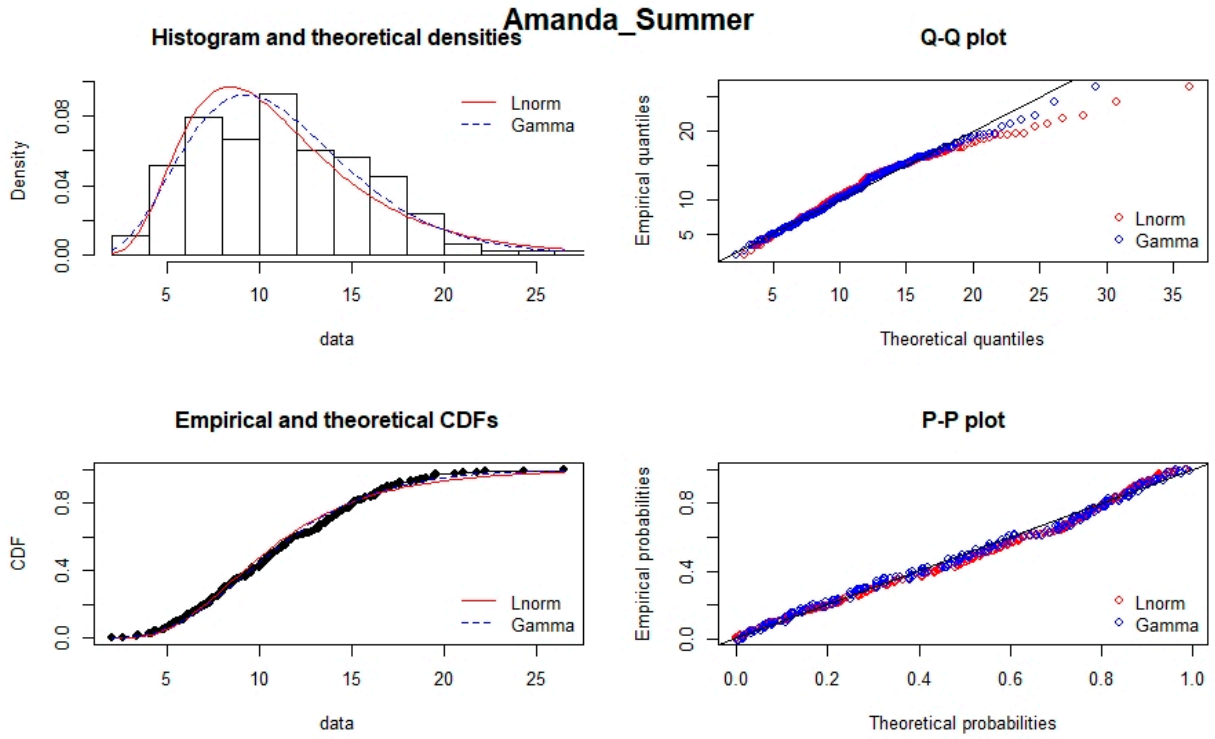

Figure S6 Comparison of Gamma and Lognormal distribution at Amanda_Summer.

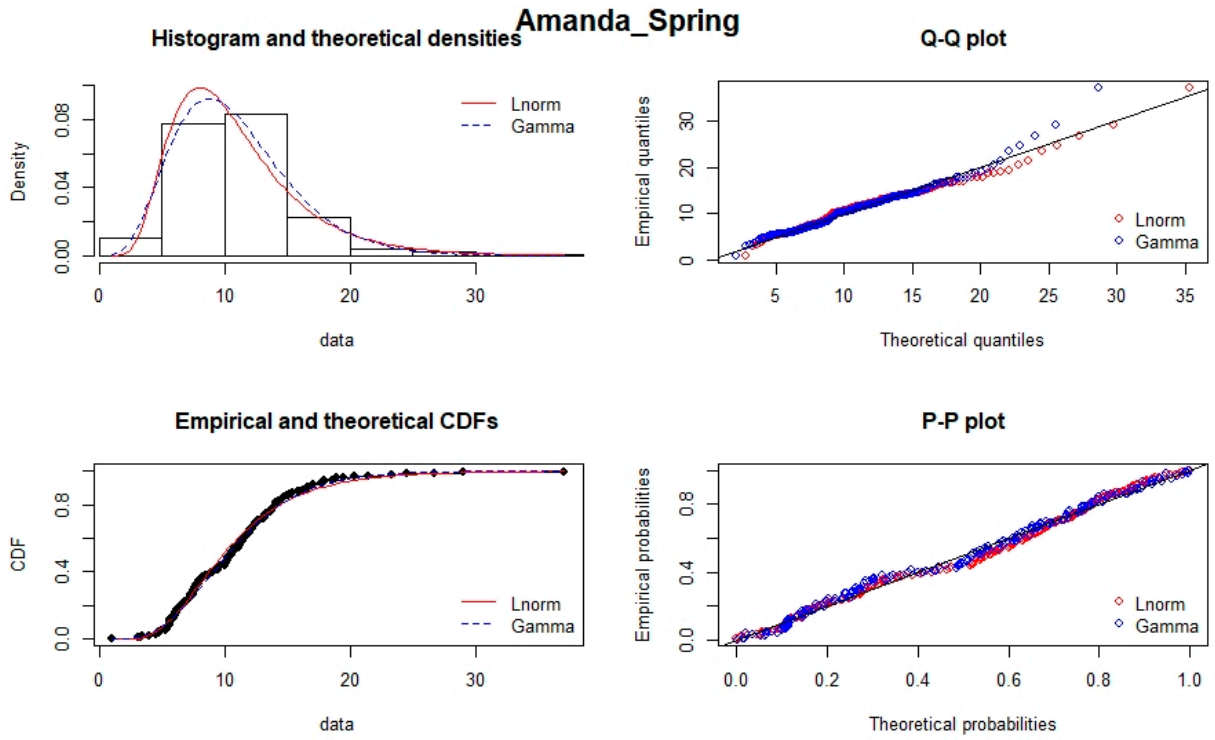

Figure S7. Comparison of Gamma and Lognormal distribution at Amanda_Spring.

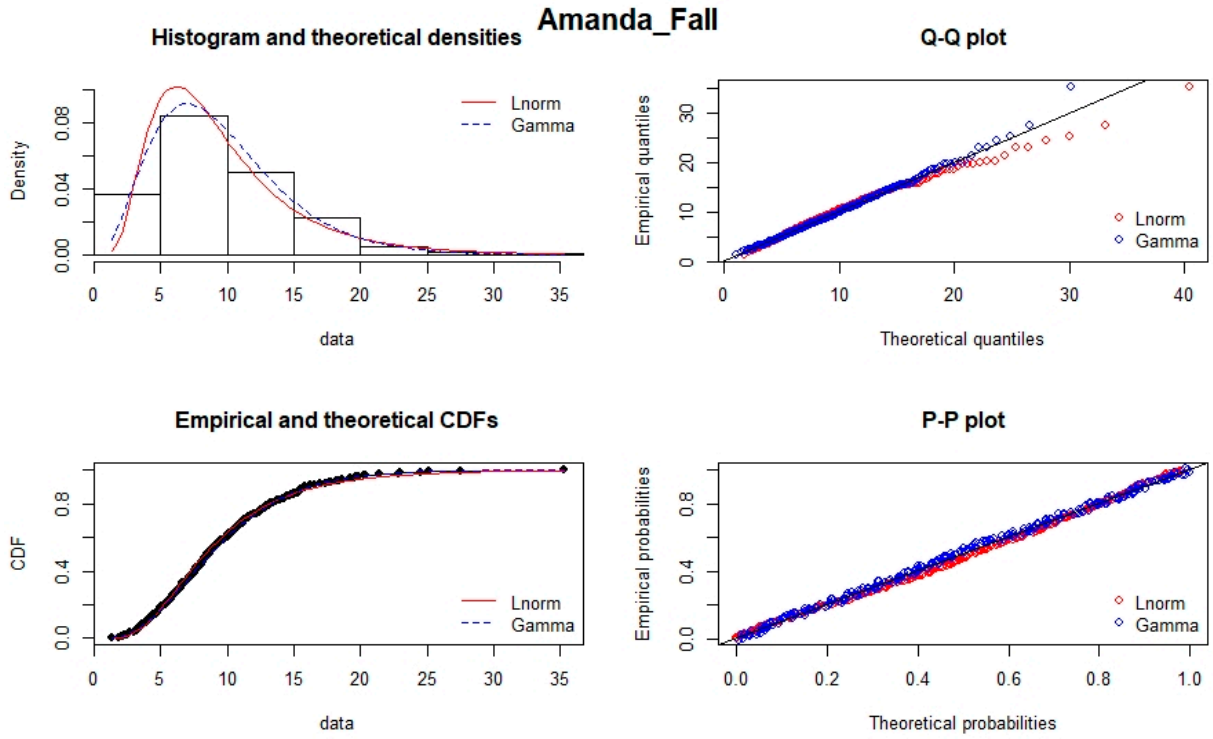

Figure S8. Comparison of Gamma and Lognormal distribution at Amanda_Fall.

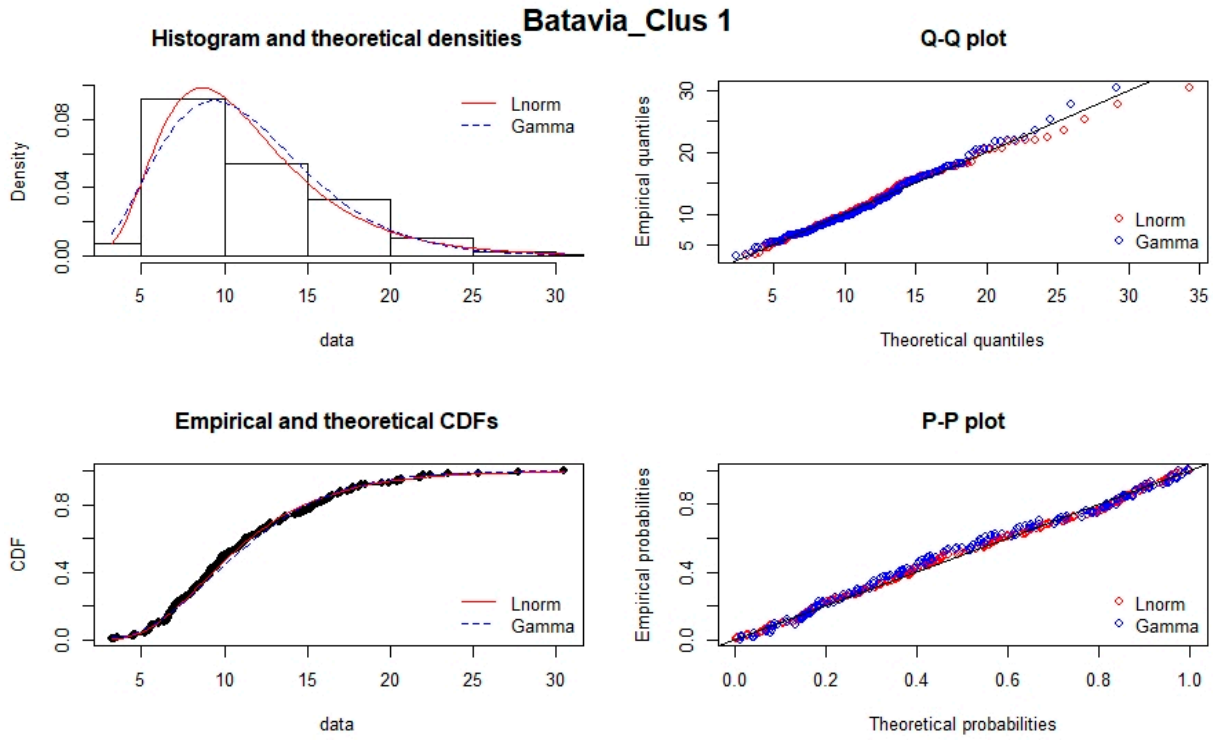

Figure S9. Comparison of Gamma and Lognormal distribution at Batavia_Clus1.

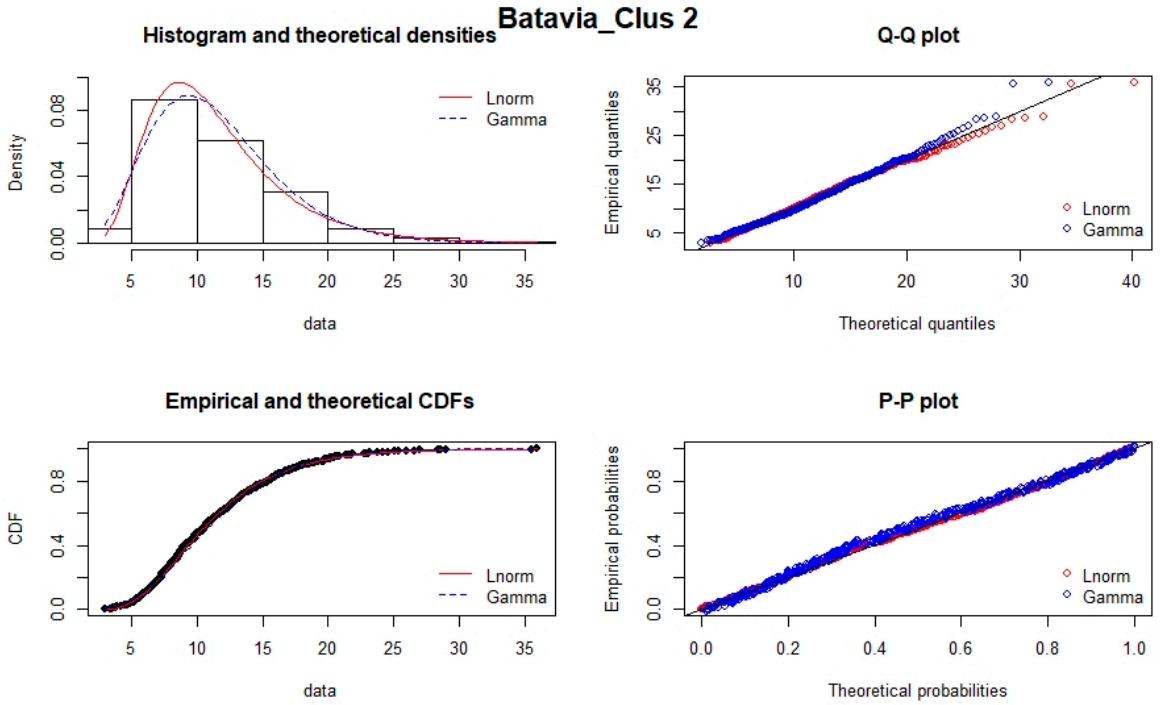

Figure S10. Comparison of Gamma and Lognormal distribution at Batavia_Clus2.

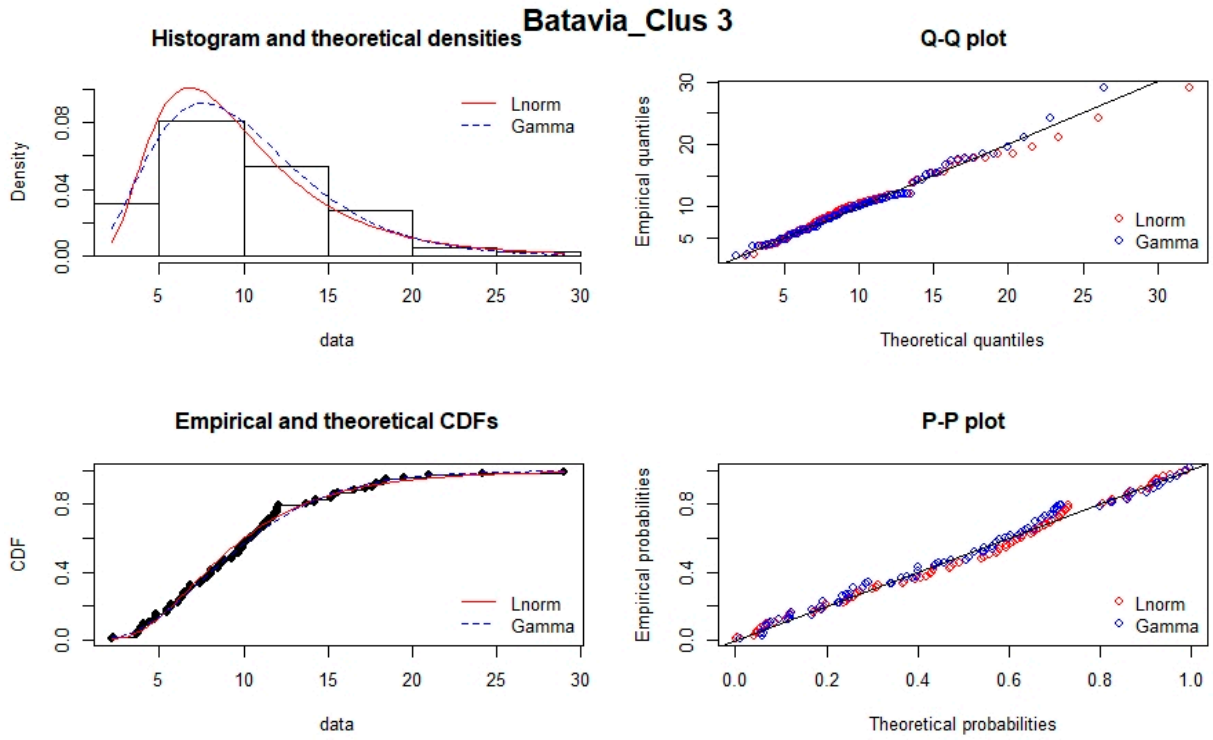

Figure S11. Comparison of Gamma and Lognormal distribution at Batavia_Clus3.

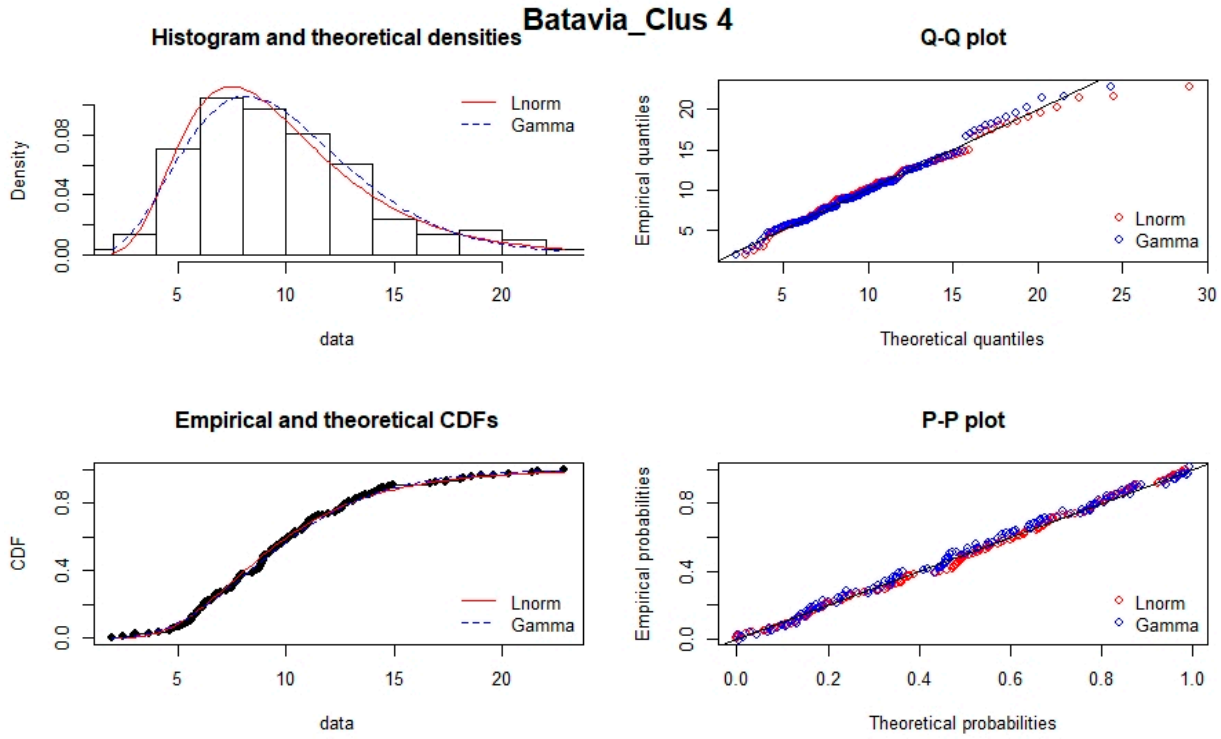

Figure S12. Comparison of Gamma and Lognormal distribution at Batavia_Clus4.

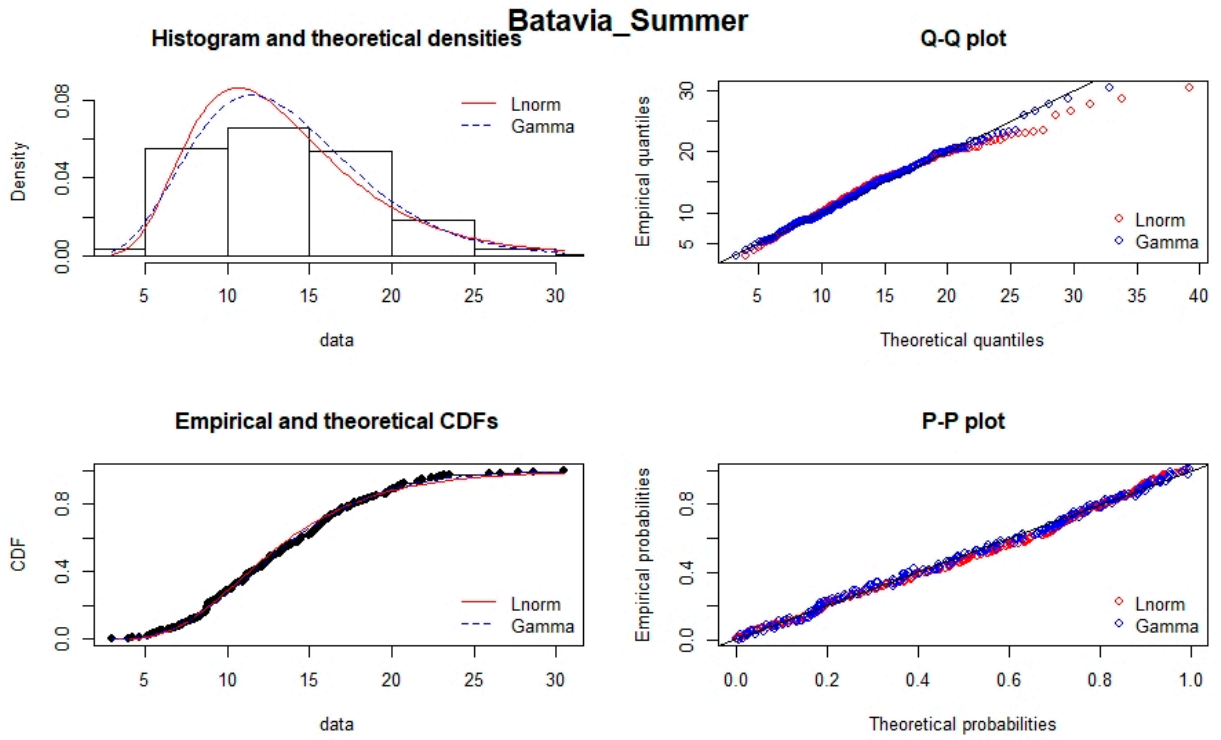

Figure S13. Comparison of Gamma and Lognormal distribution at Batavia_Summer.

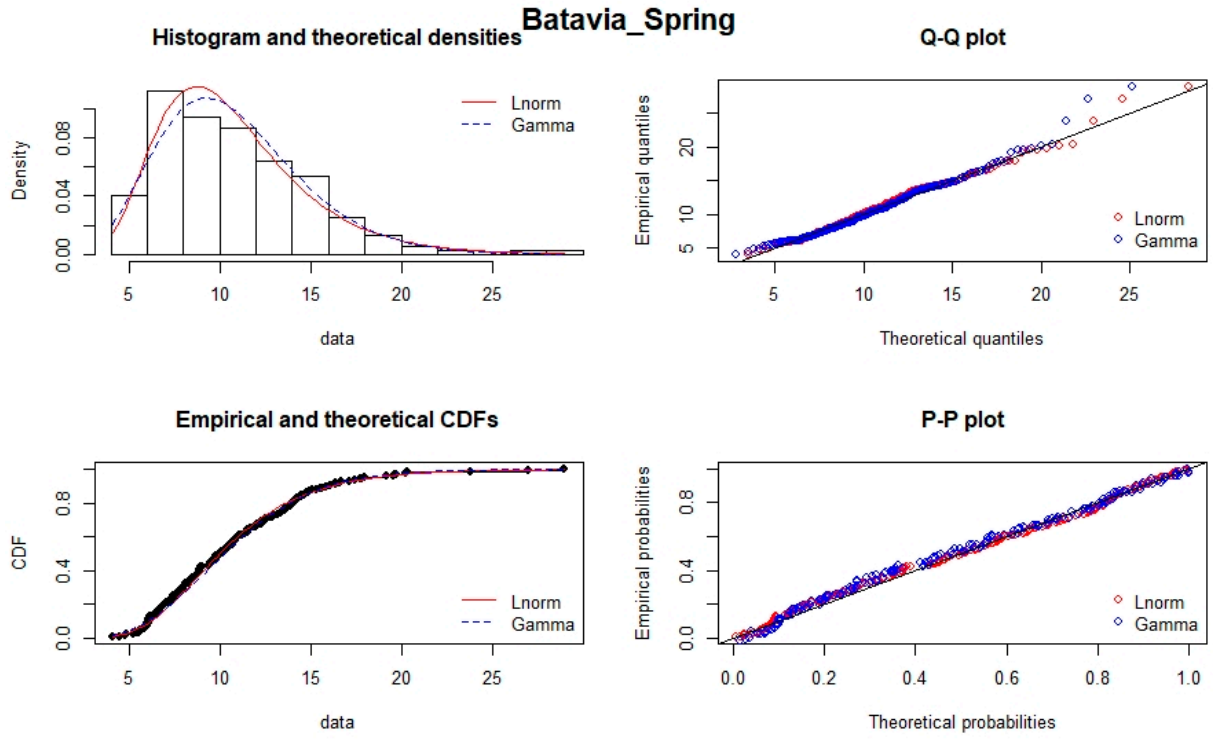

Figure S14. Comparison of Gamma and Lognormal distribution at Batavia_Spring.

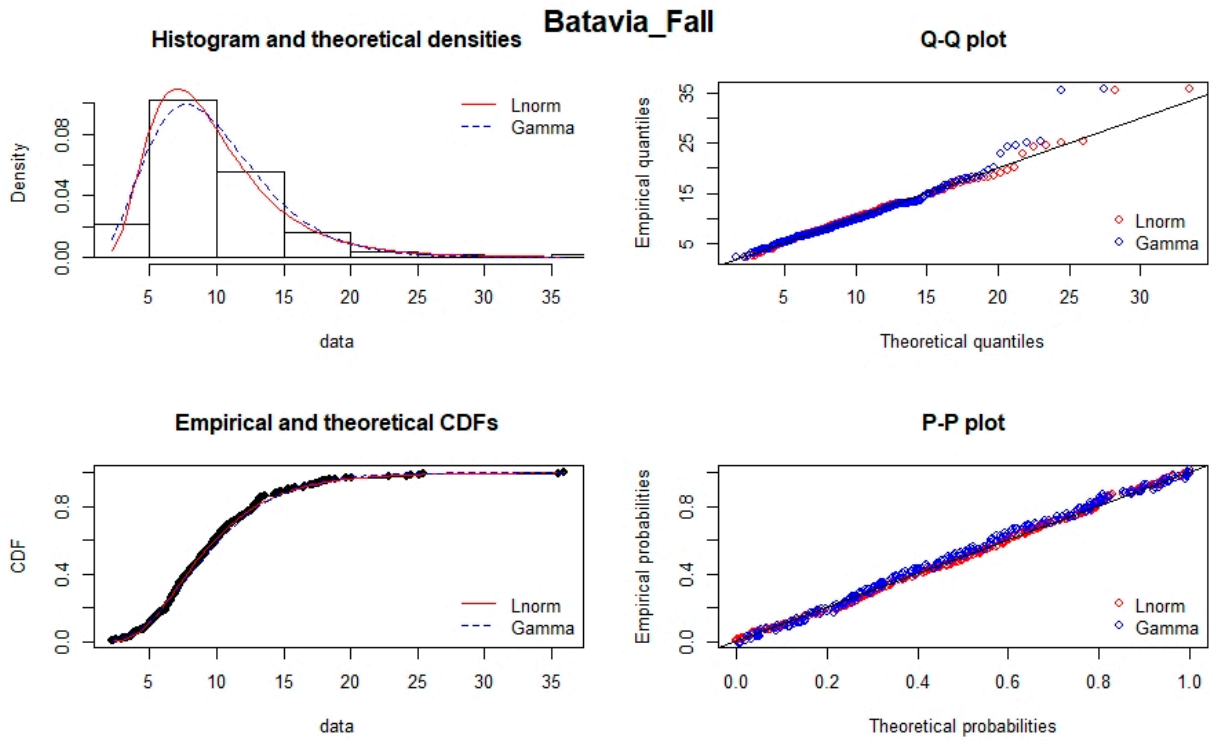

Figure S15. Comparison of Gamma and Lognormal distribution at Batavia_Fall.

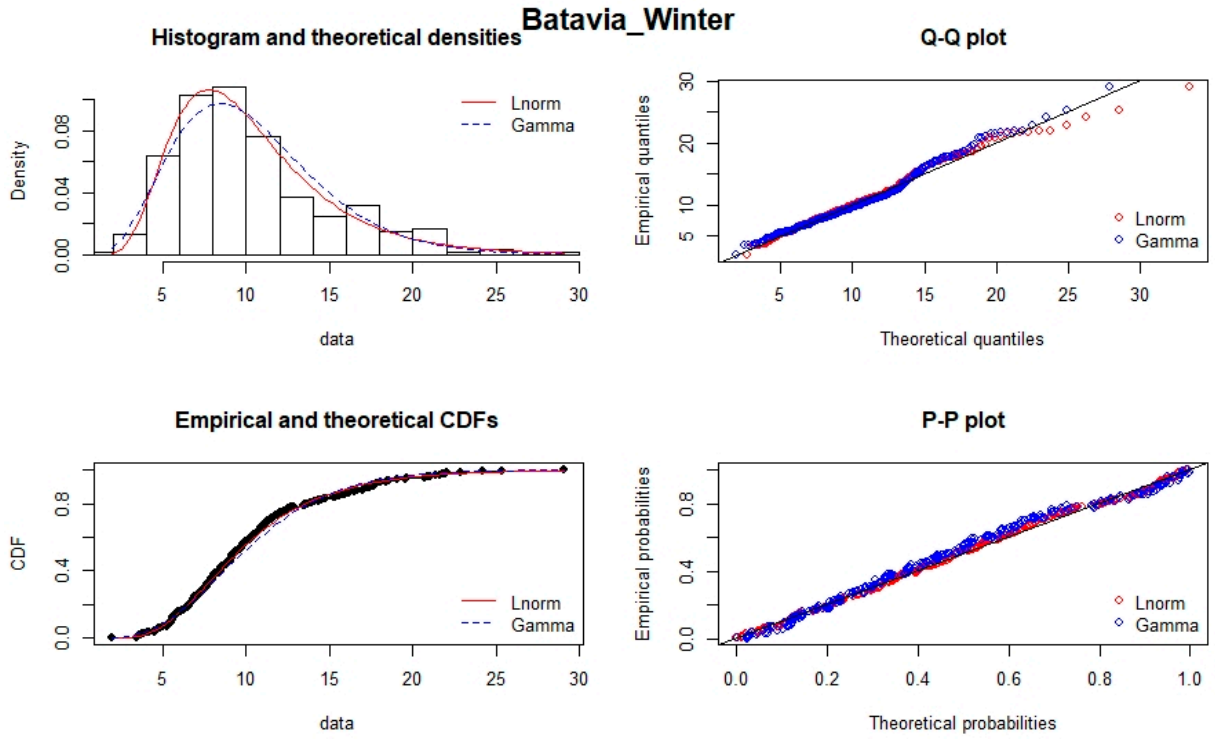

Figure S16. Comparison of Gamma and Lognormal distribution at Batavia_Winter.

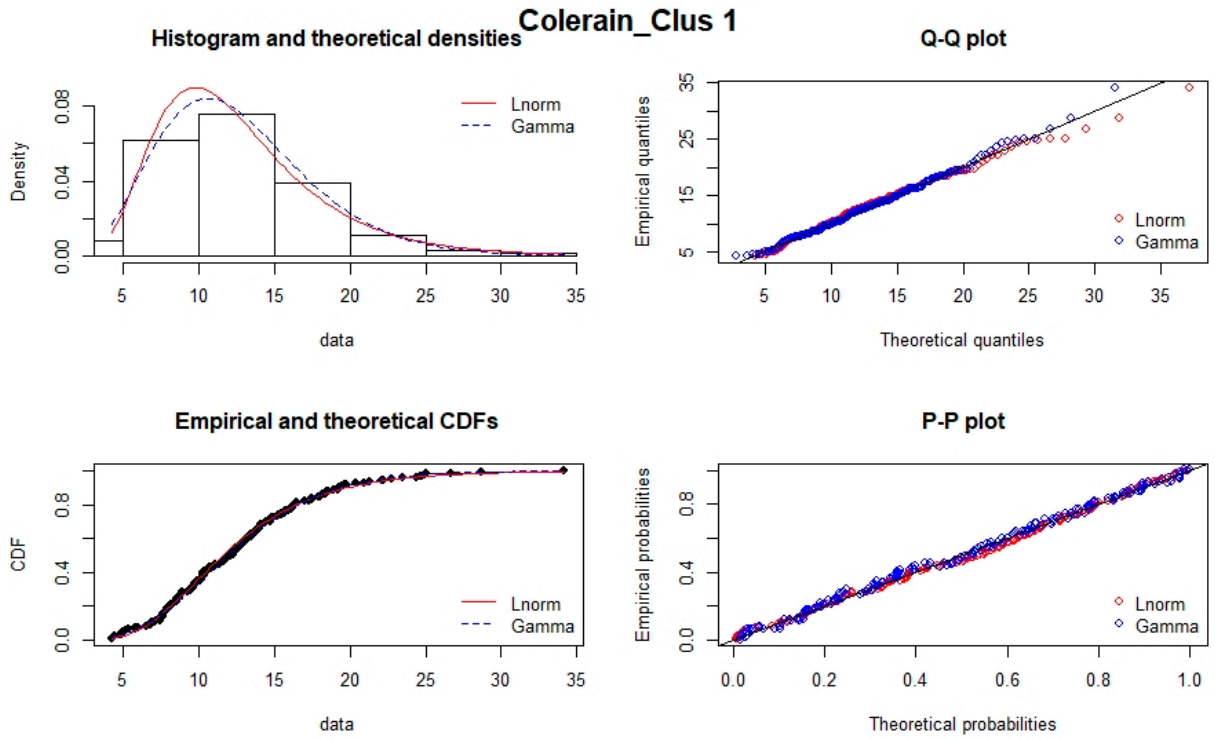

Figure S17. Comparison of Gamma and Lognormal distribution at Colerain_Clus1.

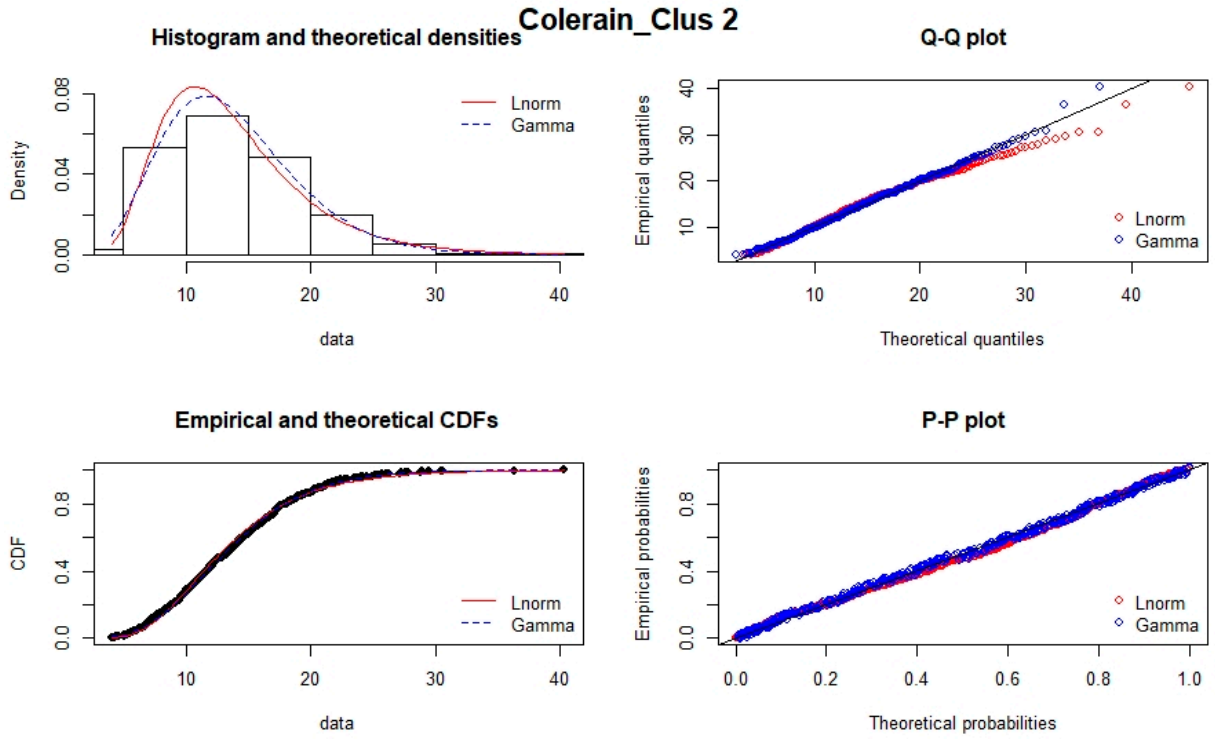

Figure S18. Comparison of Gamma and Lognormal distribution at Colerain_Clus2.

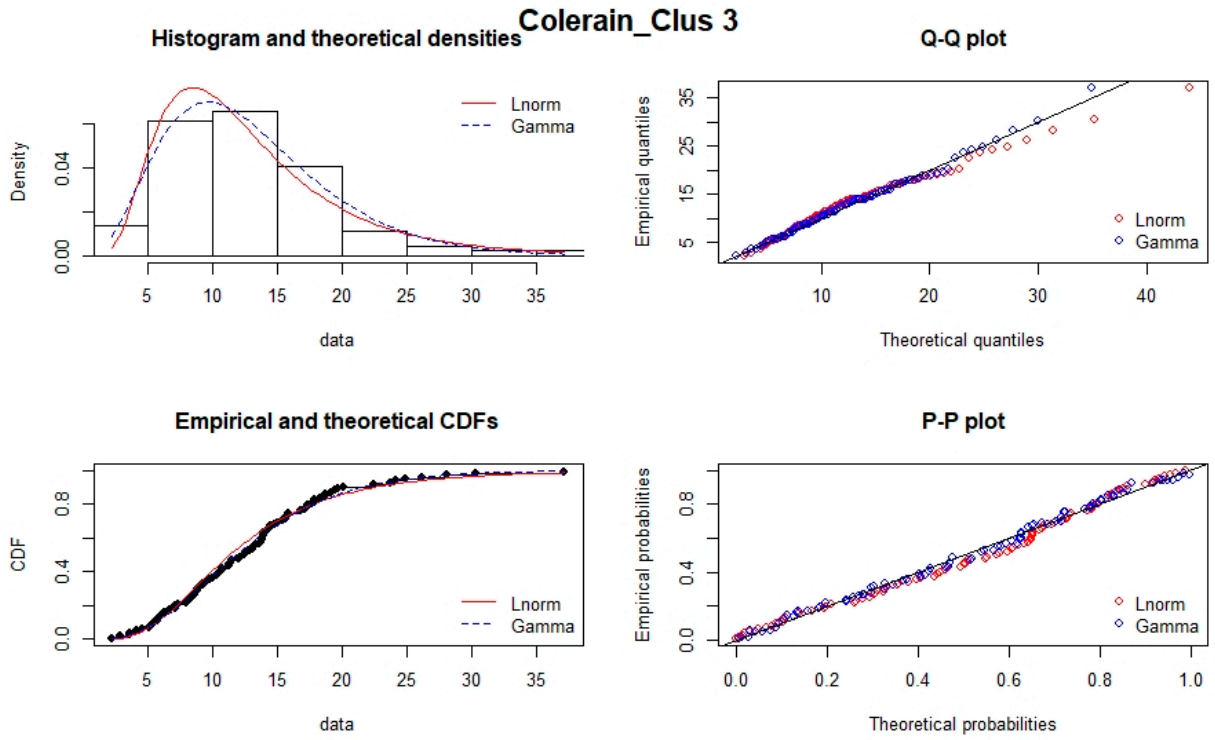

Figure S19. Comparison of Gamma and Lognormal distribution at Colerain_Clus3.

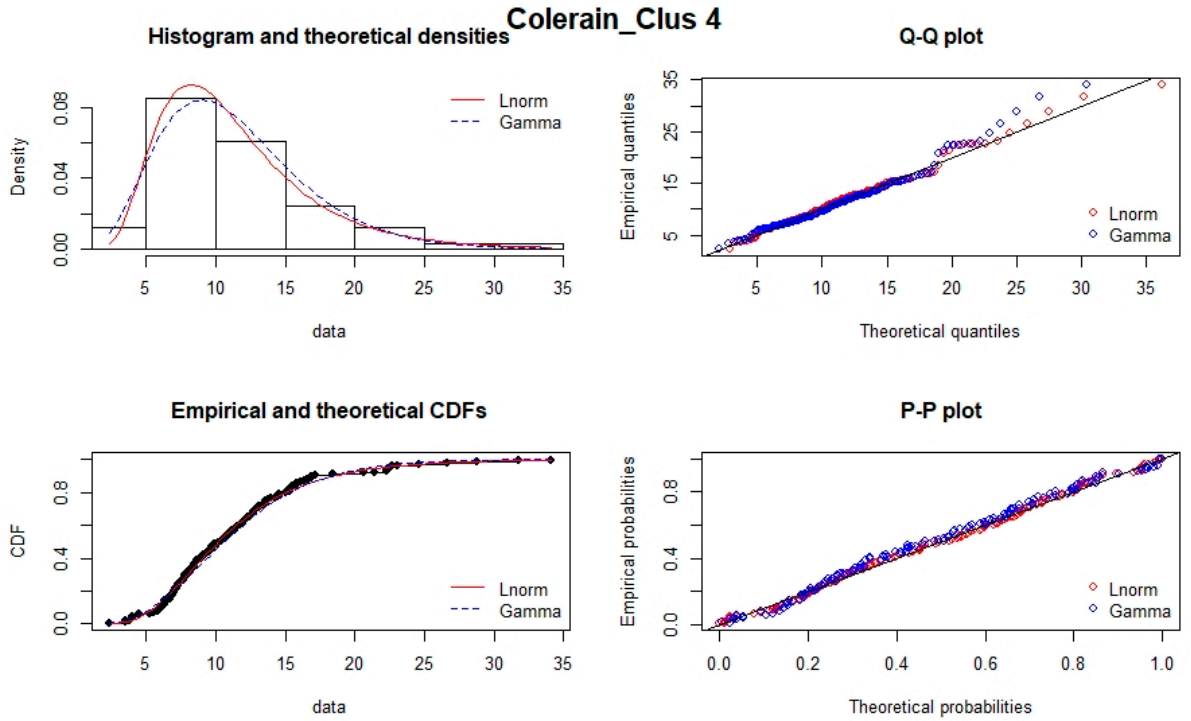

Figure S20. Comparison of Gamma and Lognormal distribution at Colerain_Clus4.

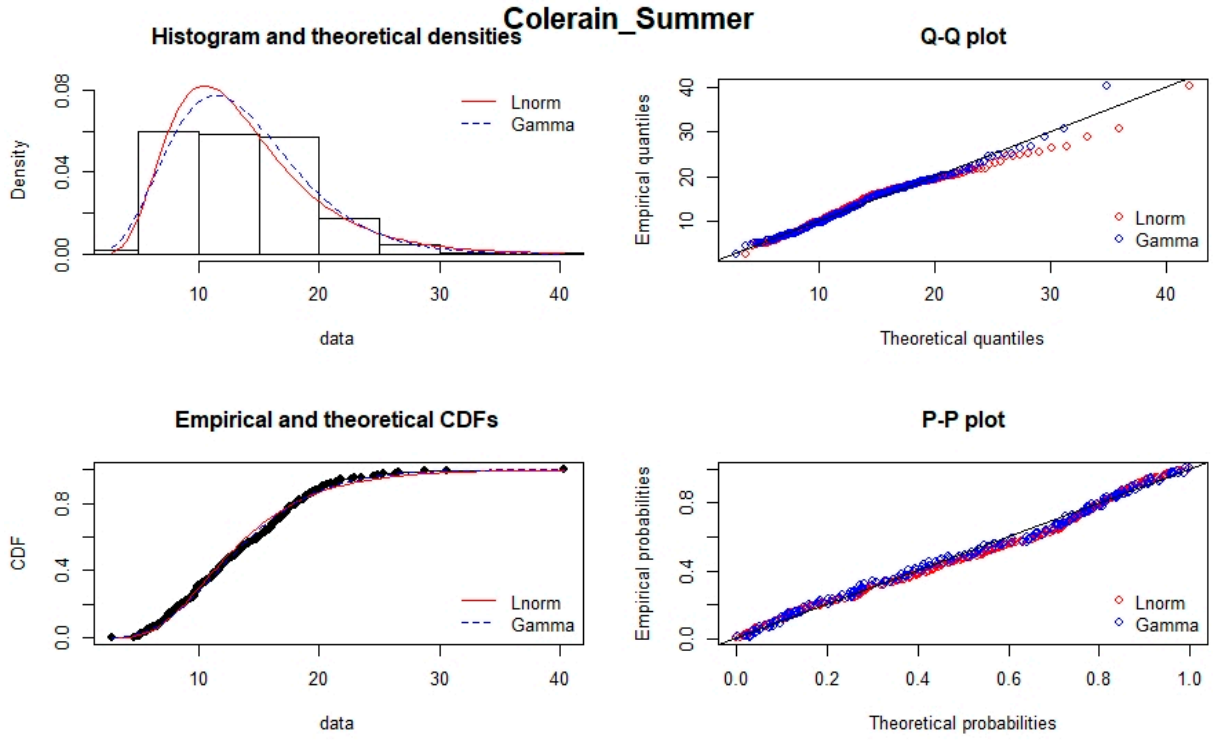

Figure S21. Comparison of Gamma and Lognormal distribution at Colerain_Summer.

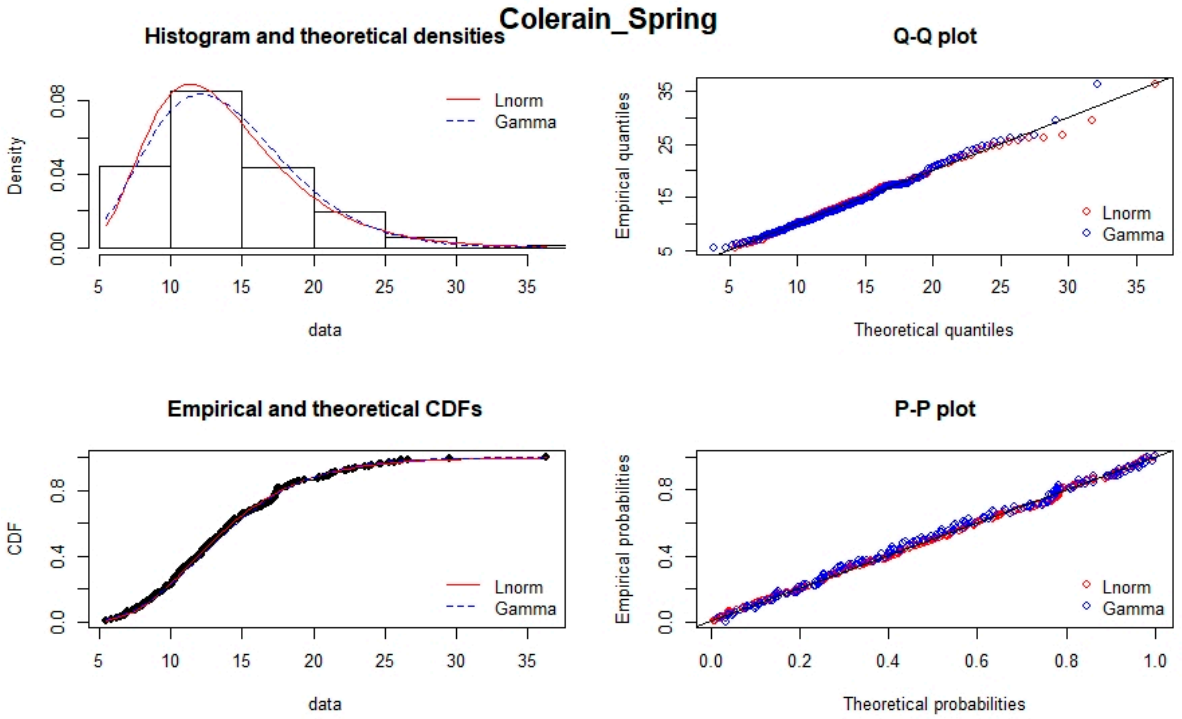

Figure S22. Comparison of Gamma and Lognormal distribution at Colerain_Summer.

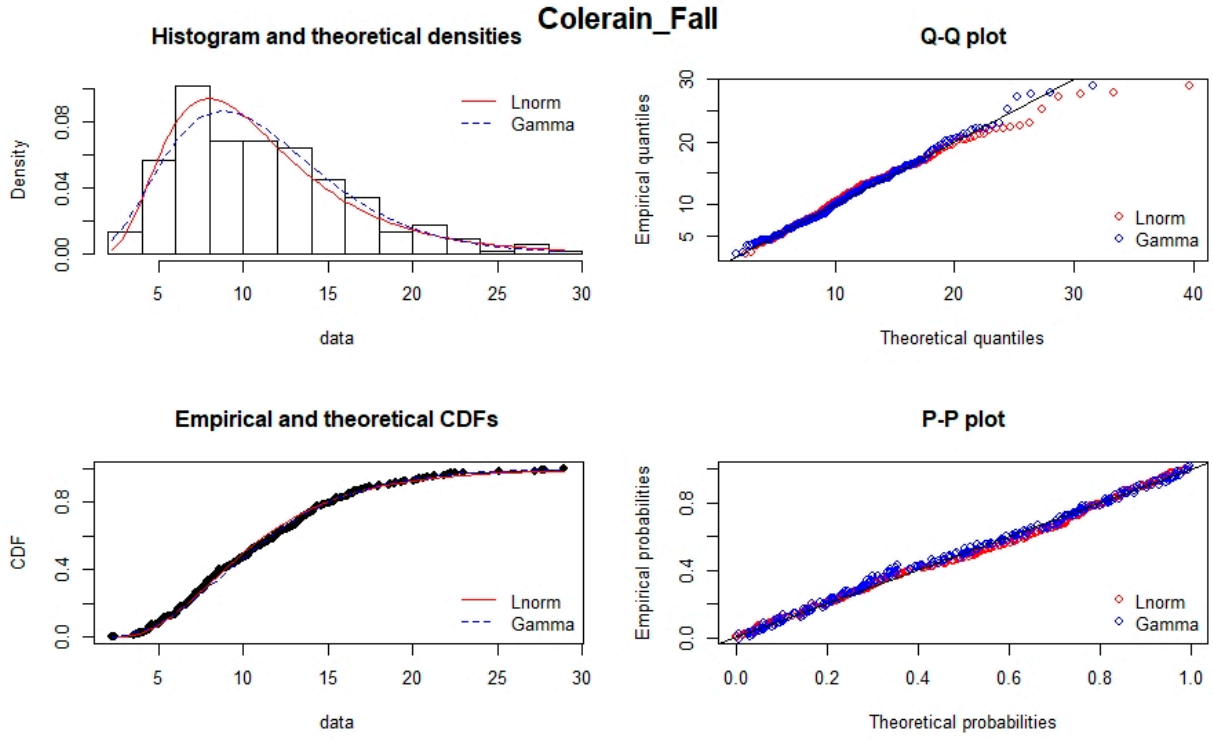

Figure S23. Comparison of Gamma and Lognormal distribution at Colerain_Fall.

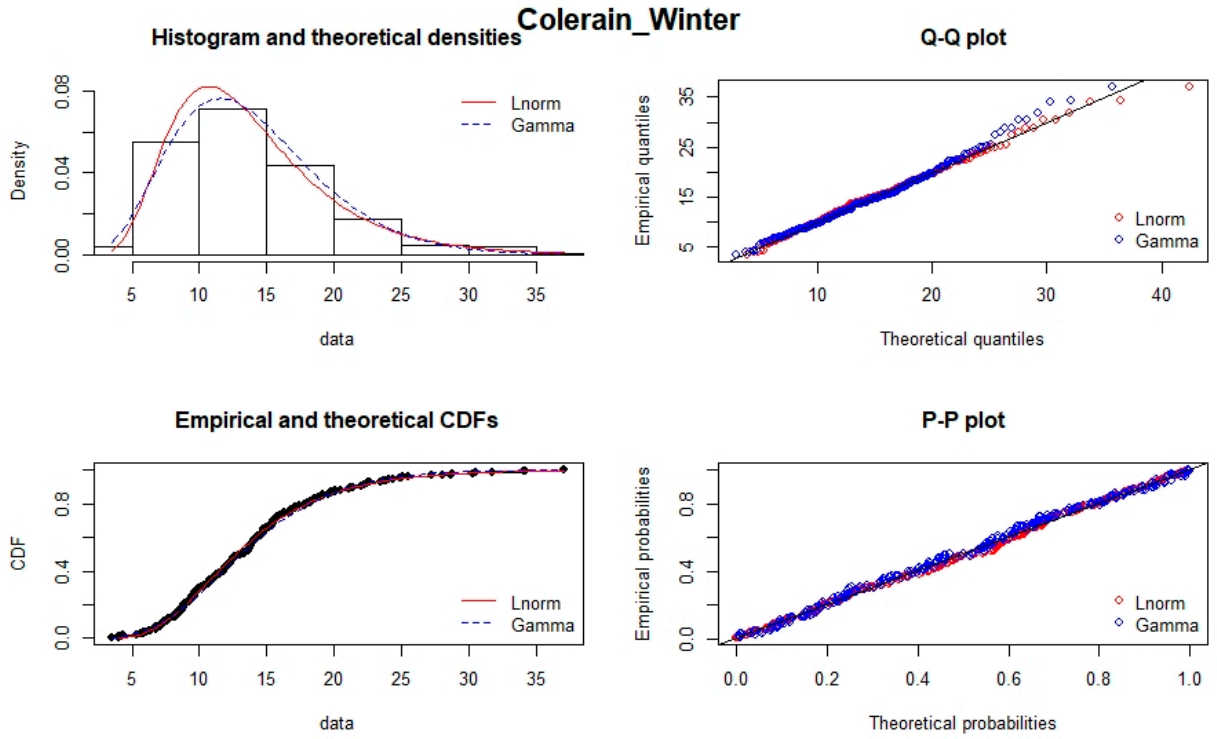

Figure S24. Comparison of Gamma and Lognormal distribution at Colerain_Winter.

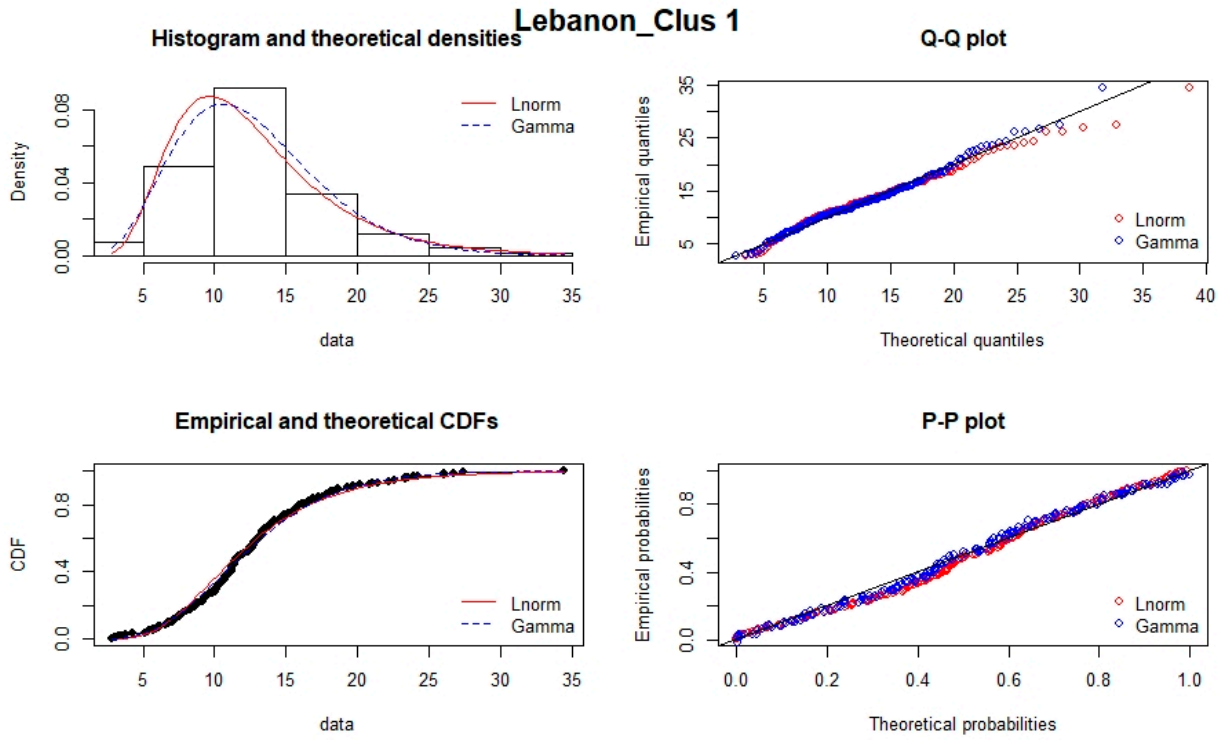

Figure S25. Comparison of Gamma and Lognormal distribution at Lebanon_Clus1.

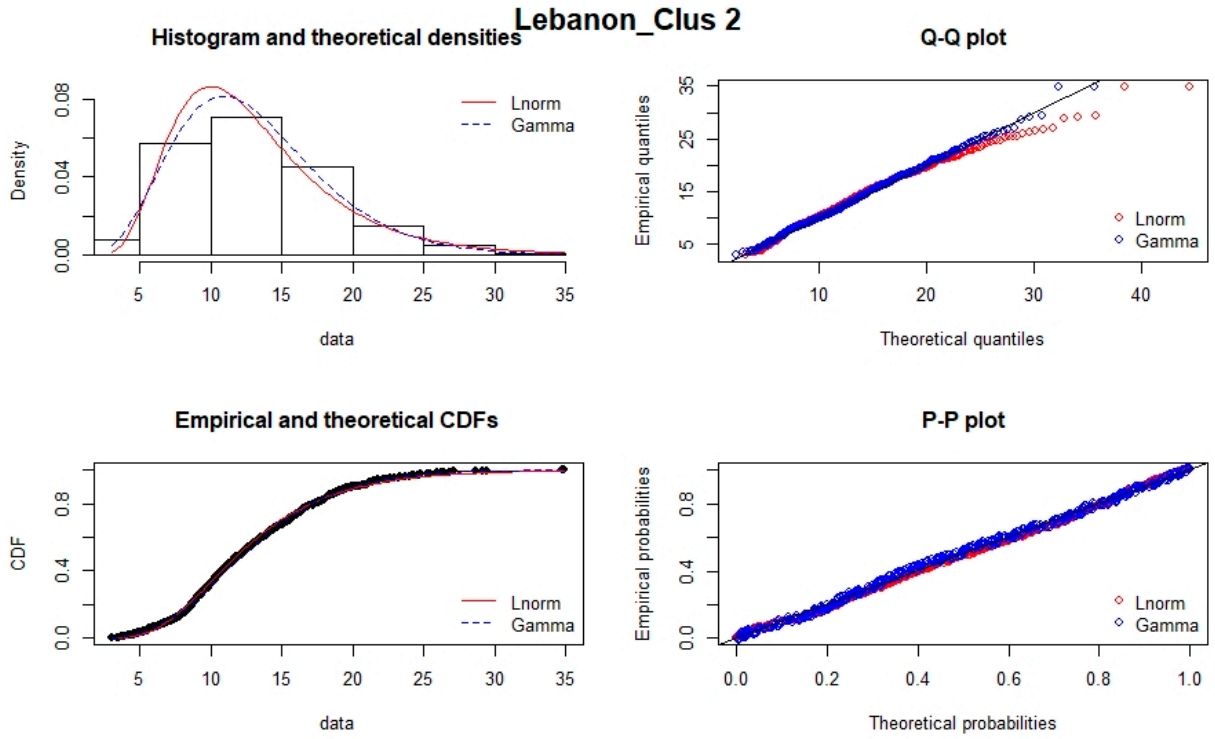

Figure S26. Comparison of Gamma and Lognormal distribution at Lebanon_Clus2.

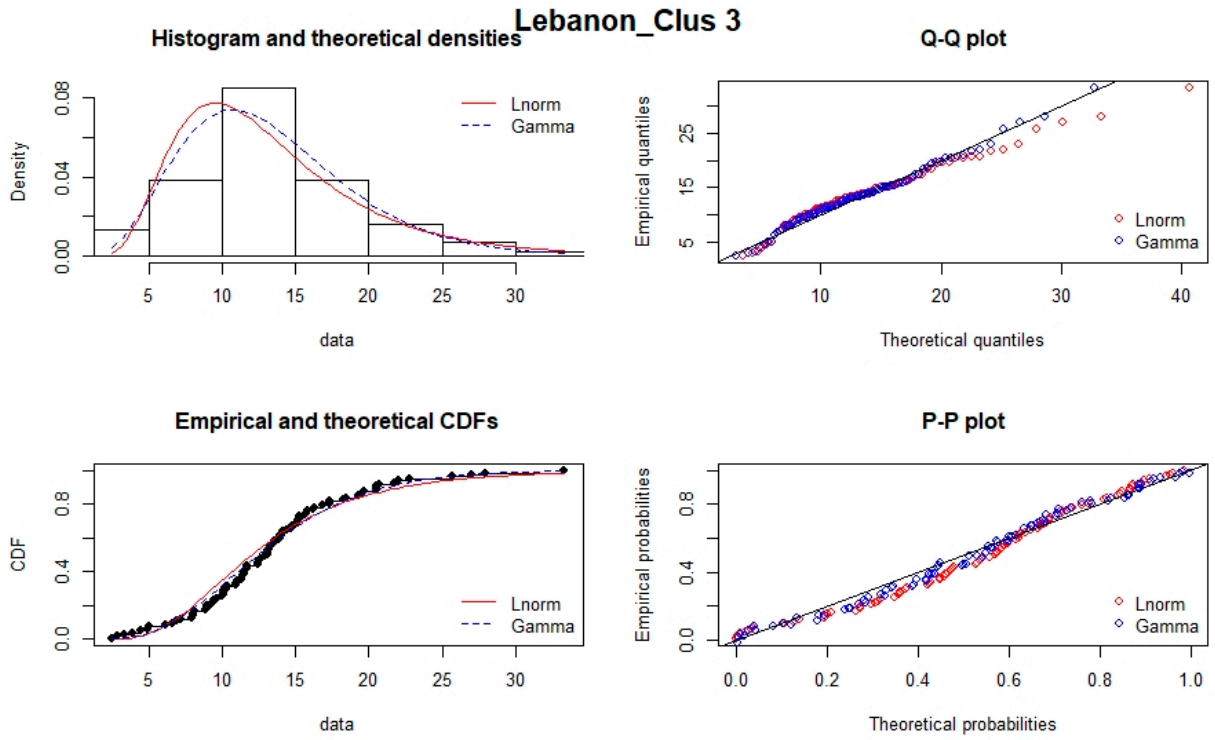

Figure S27. Comparison of Gamma and Lognormal distribution at Lebanon_Clus3.

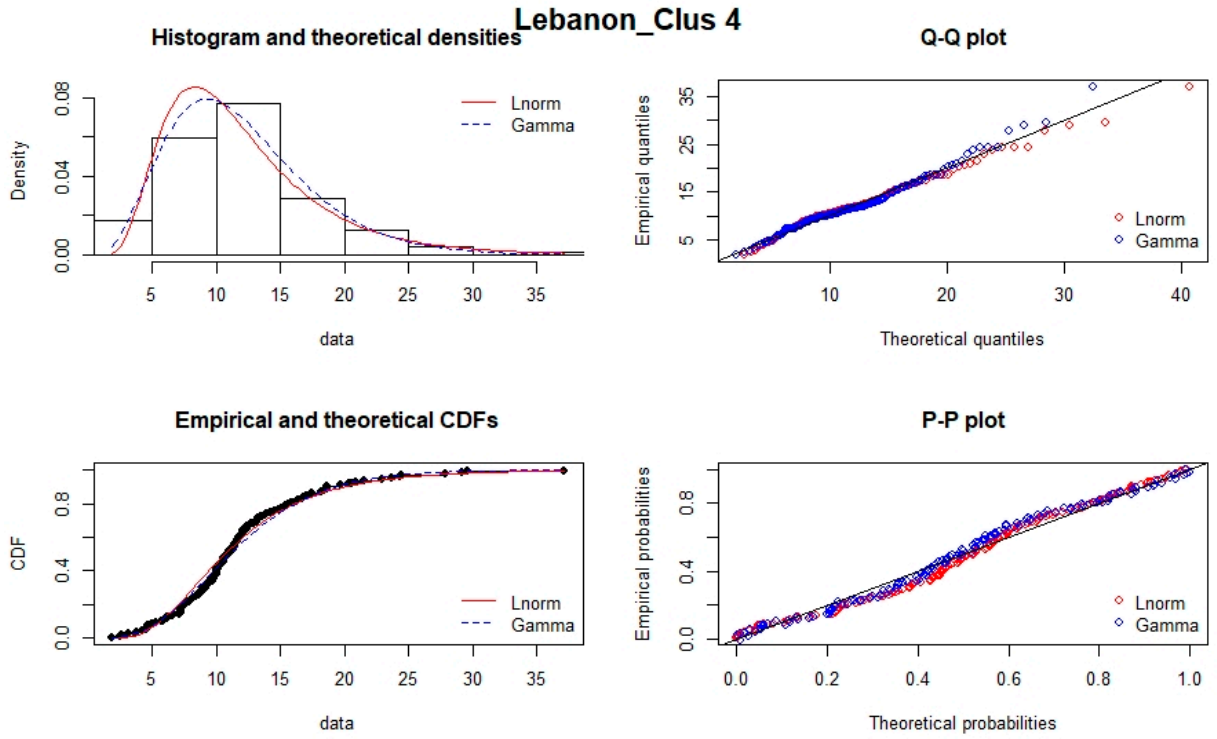

Figure S28. Comparison of Gamma and Lognormal distribution at Lebanon_Clus4.

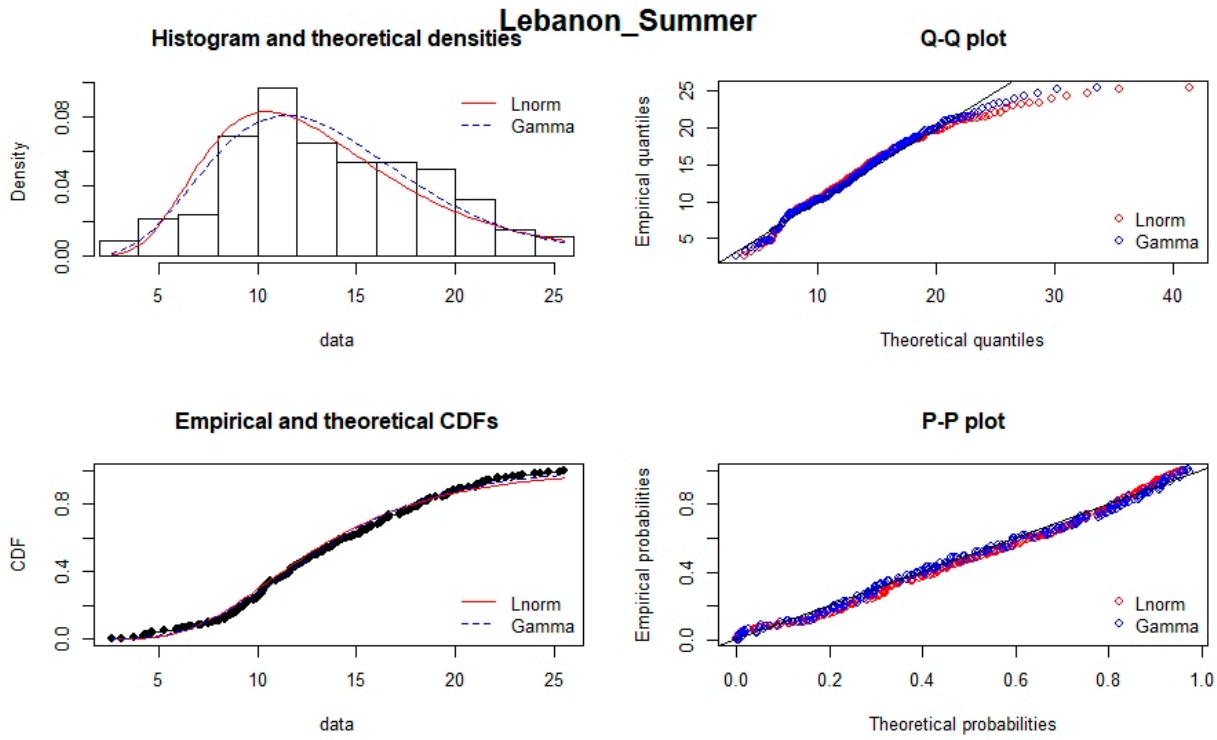

Figure S29. Comparison of Gamma and Lognormal distribution at Lebanon_Summer.

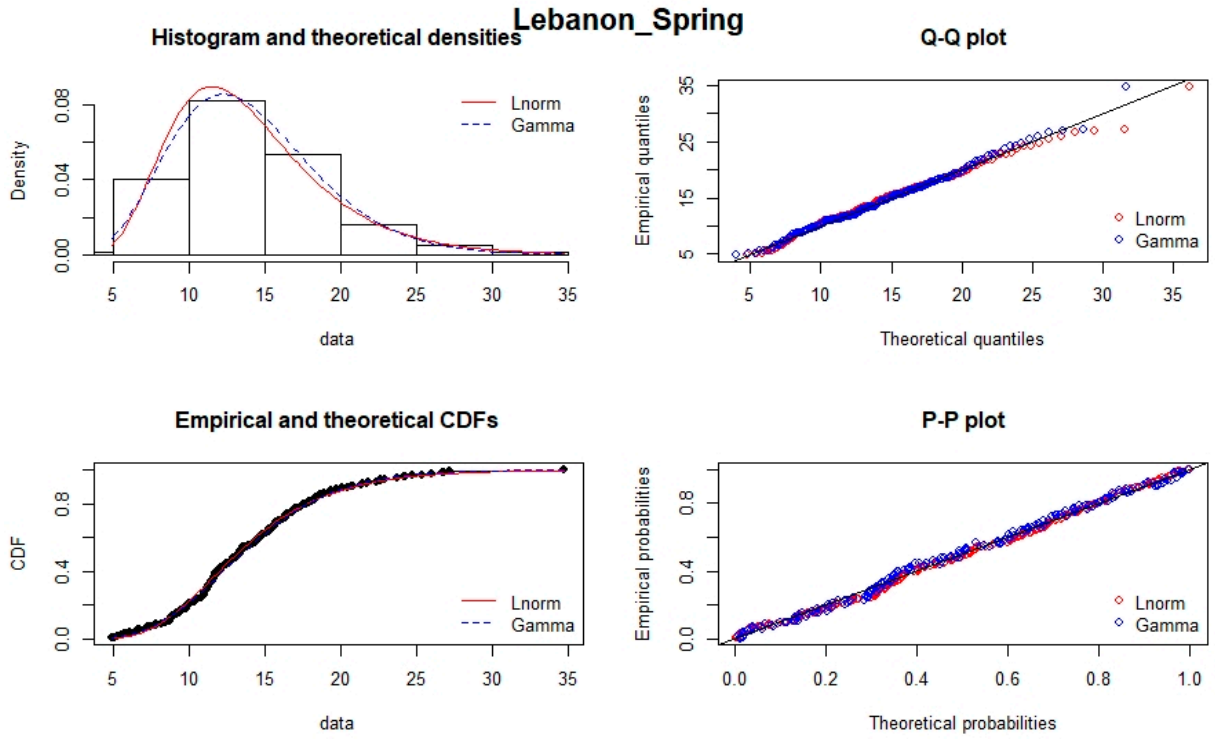

Figure S30. Comparison of Gamma and Lognormal distribution at Lebanon_Spring.

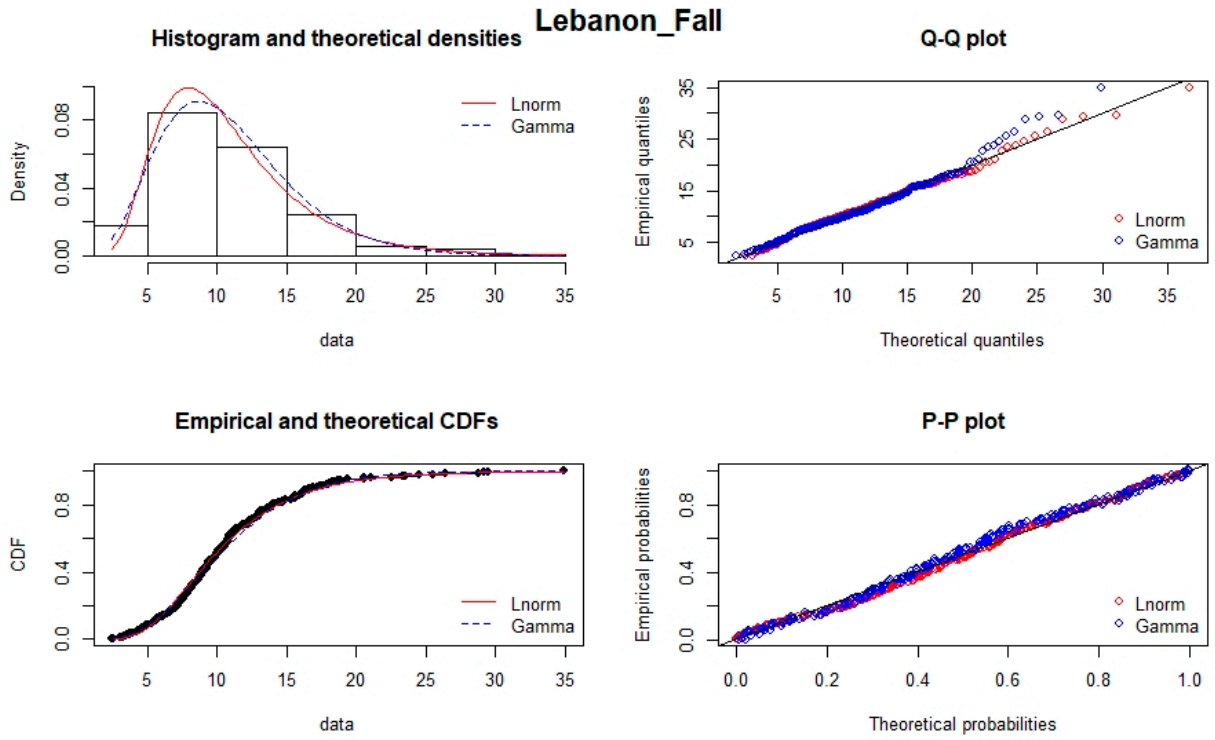

Figure S31. Comparison of Gamma and Lognormal distribution at Lebanon_Fall.

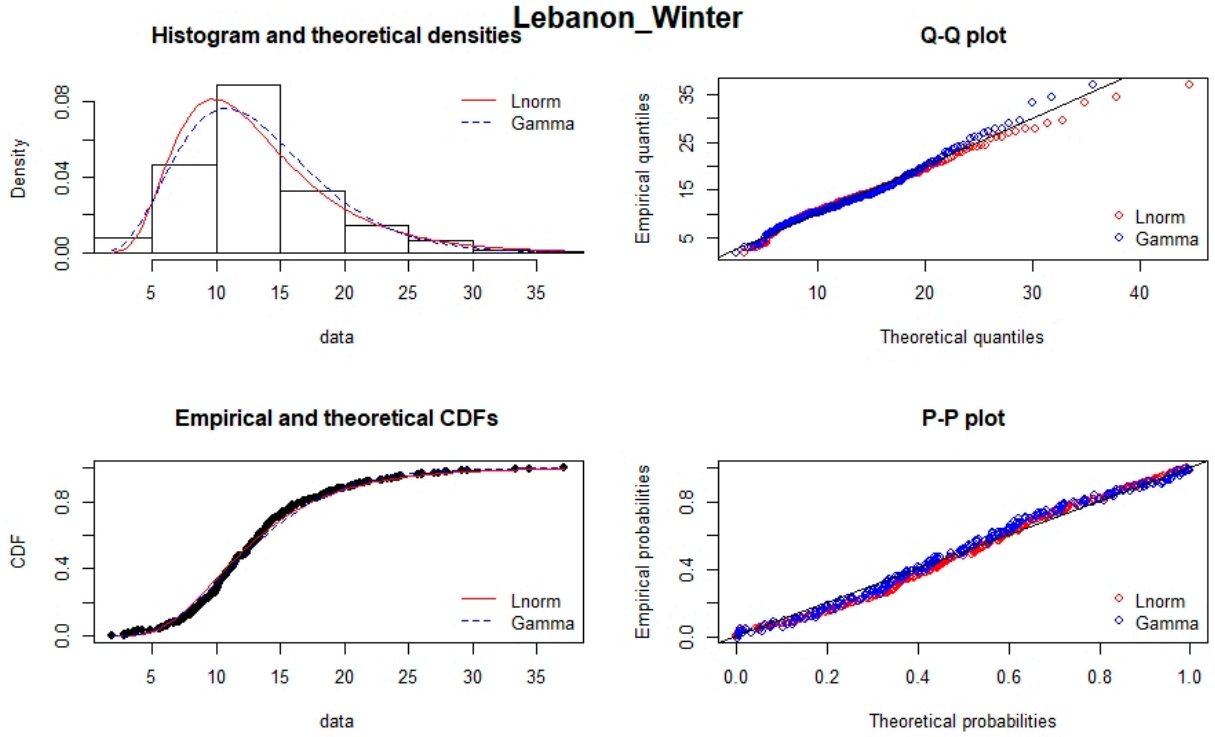

Figure S32. Comparison of Gamma and Lognormal distribution at Lebanon_Winter.

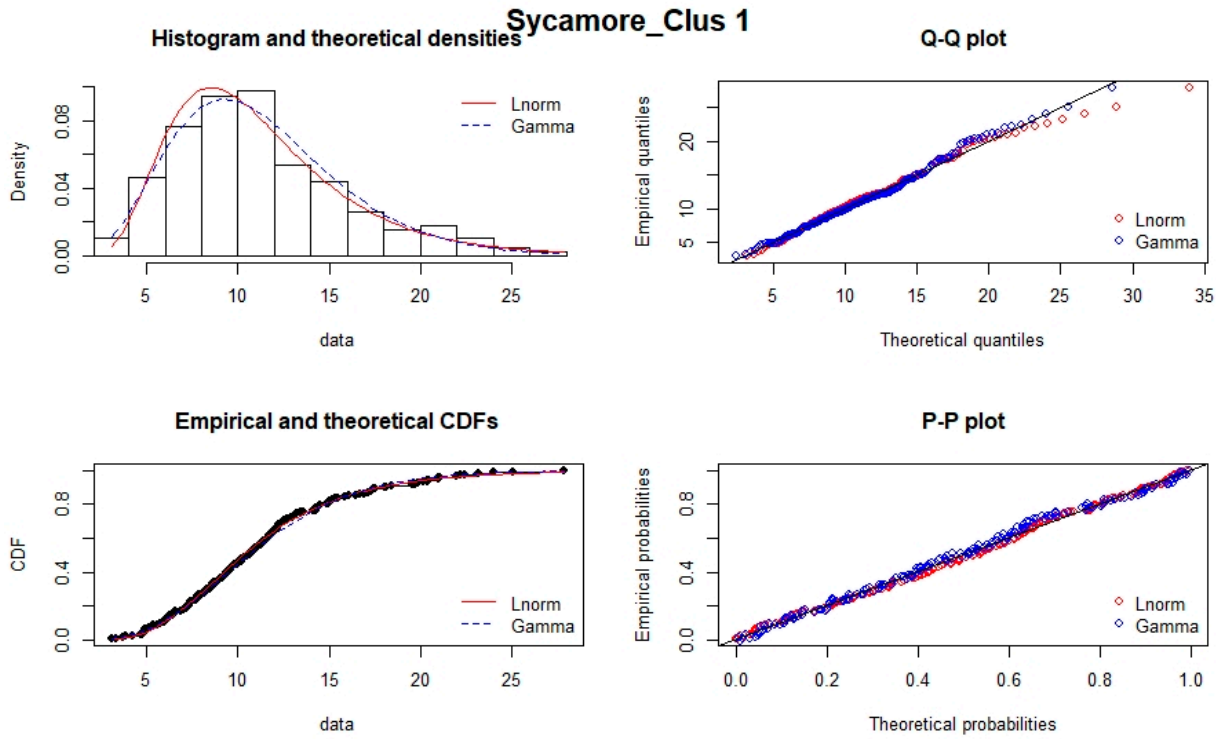

Figure S33. Comparison of Gamma and Lognormal distribution at Sycamore_Clus1.

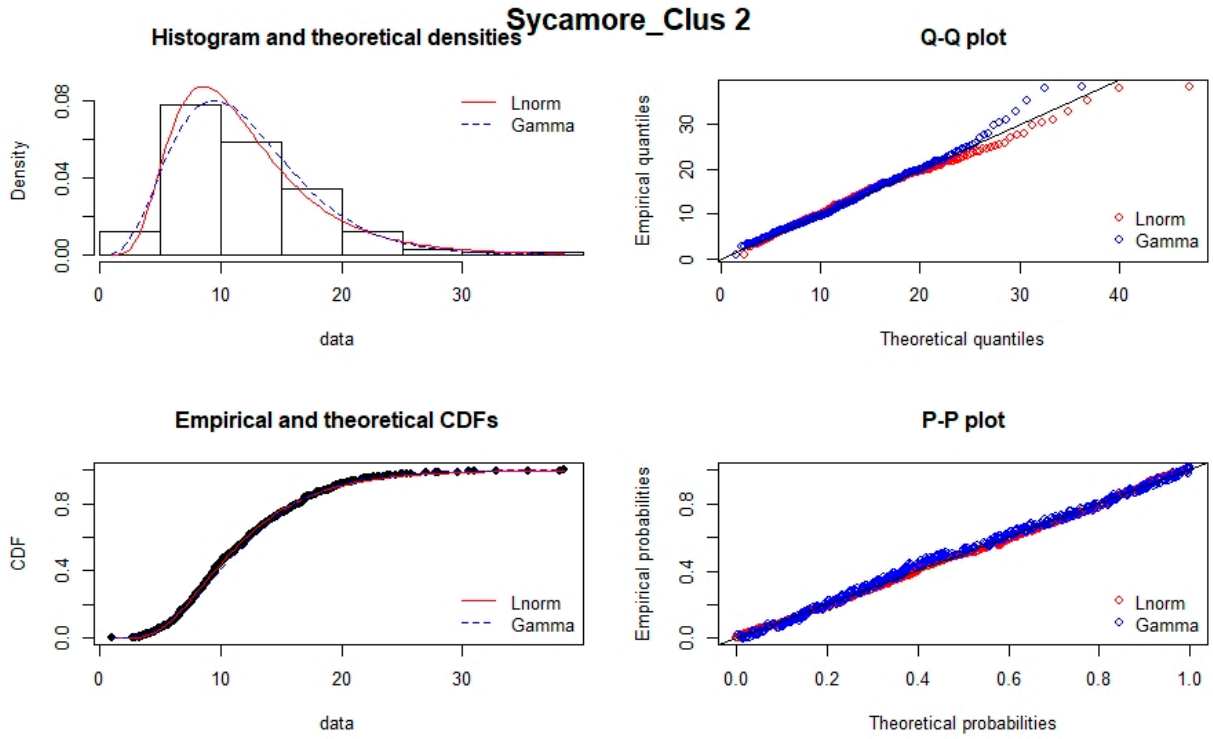

Figure S34. Comparison of Gamma and Lognormal distribution at Lebanon_Clus2.

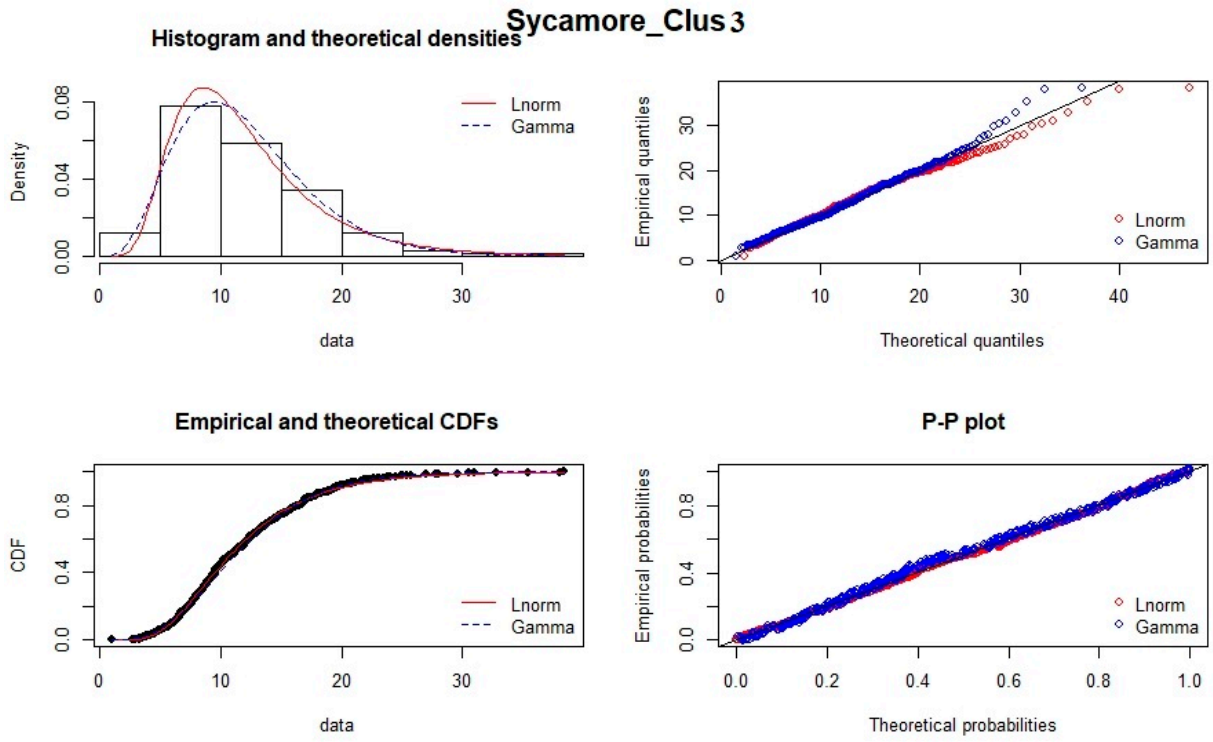

Figure S35. Comparison of Gamma and Lognormal distribution at Lebanon_Clus3.

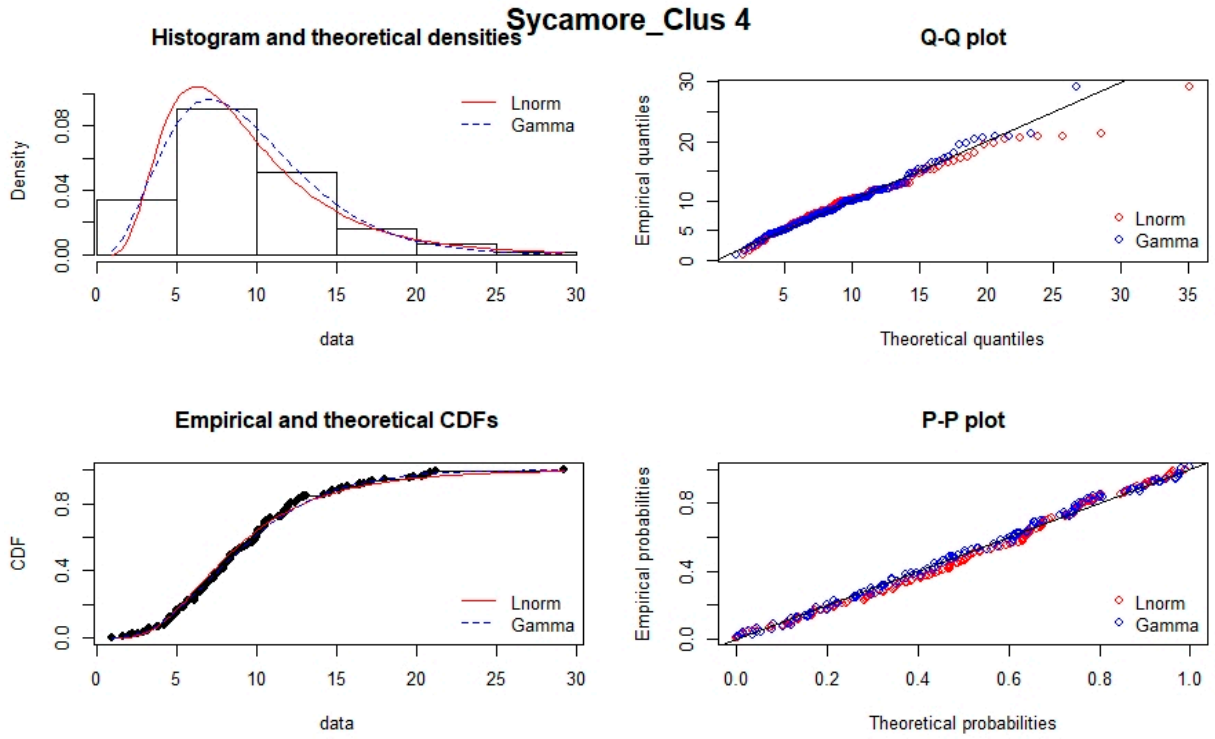

Figure S36. Comparison of Gamma and Lognormal distribution at Sycamore_Clus4.

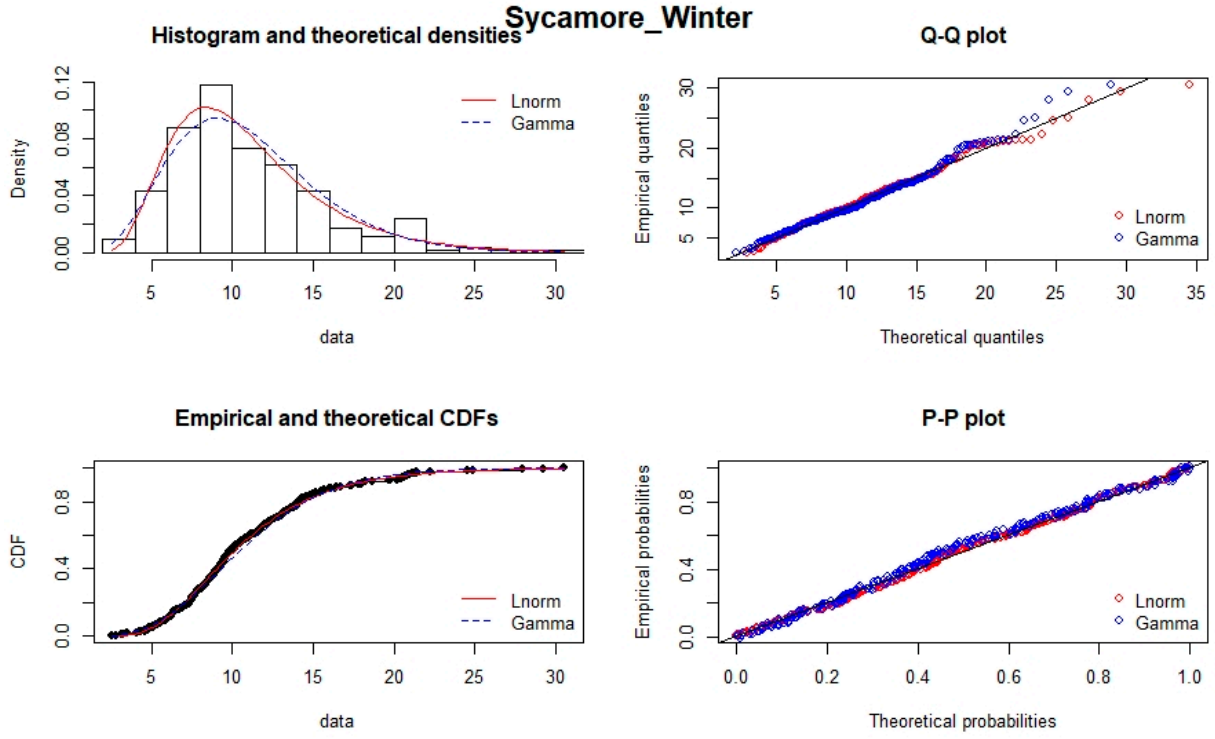

Figure S37. Comparison of Gamma and Lognormal distribution at Sycamore_Winter.

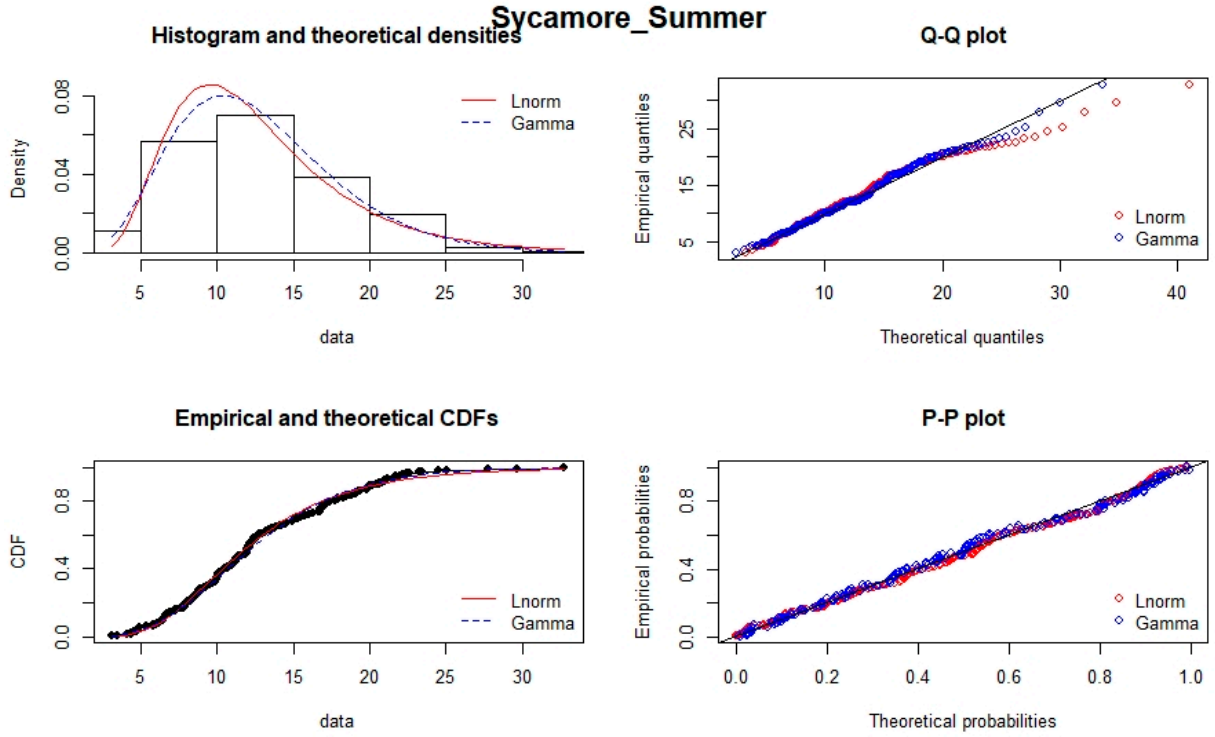

Figure S38. Comparison of Gamma and Lognormal distribution at Sycamore_Summer.

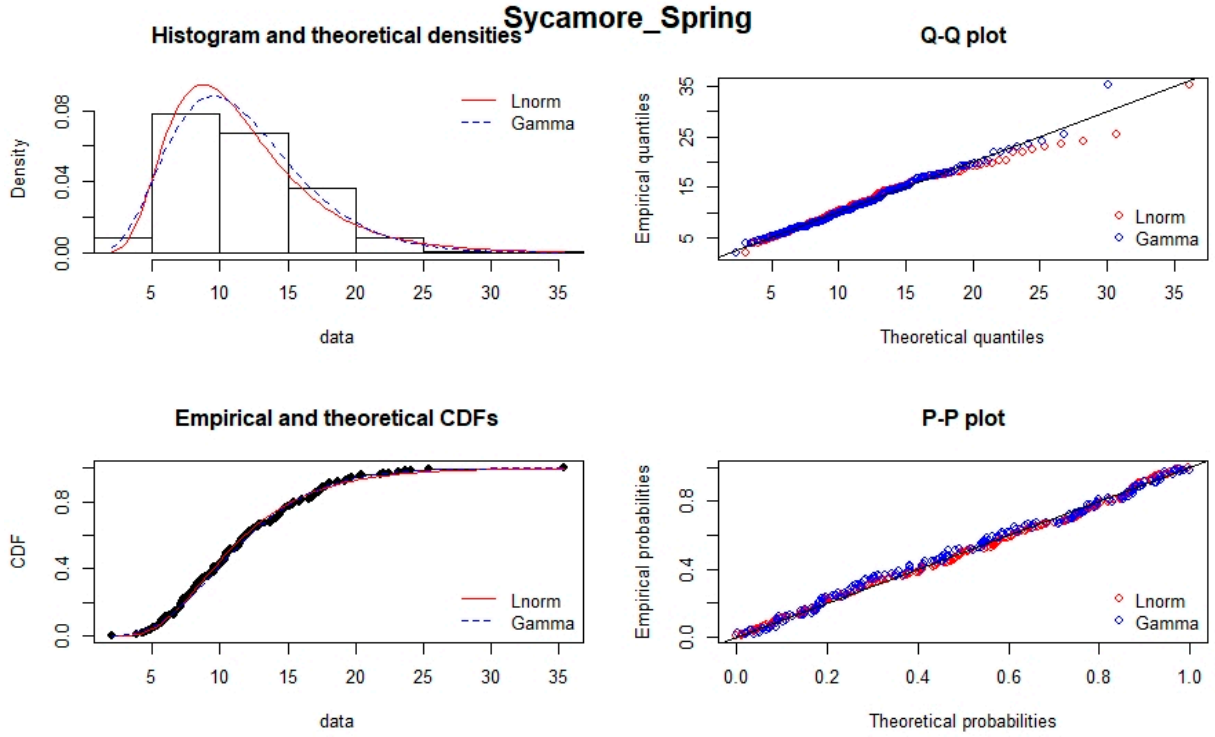

Figure S39. Comparison of Gamma and Lognormal distribution at Sycamore_Spring.

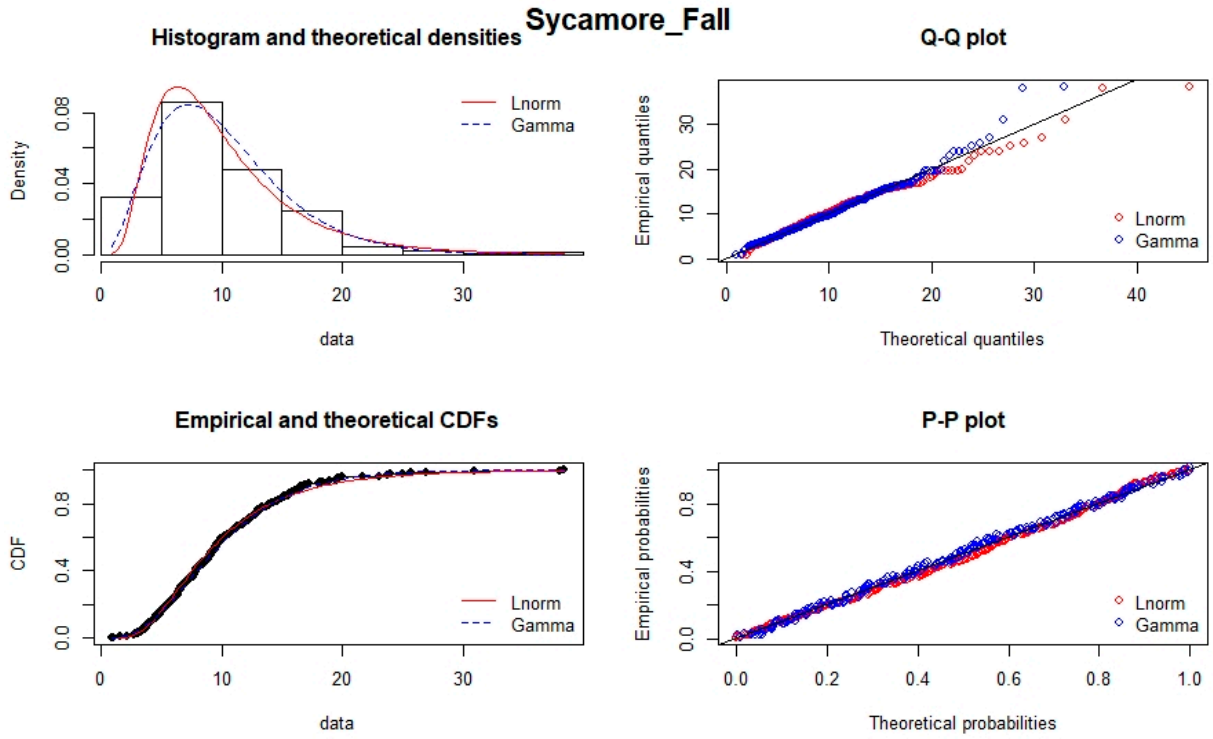

Figure S40. Comparison of Gamma and Lognormal distribution at Sycamore_Fall.

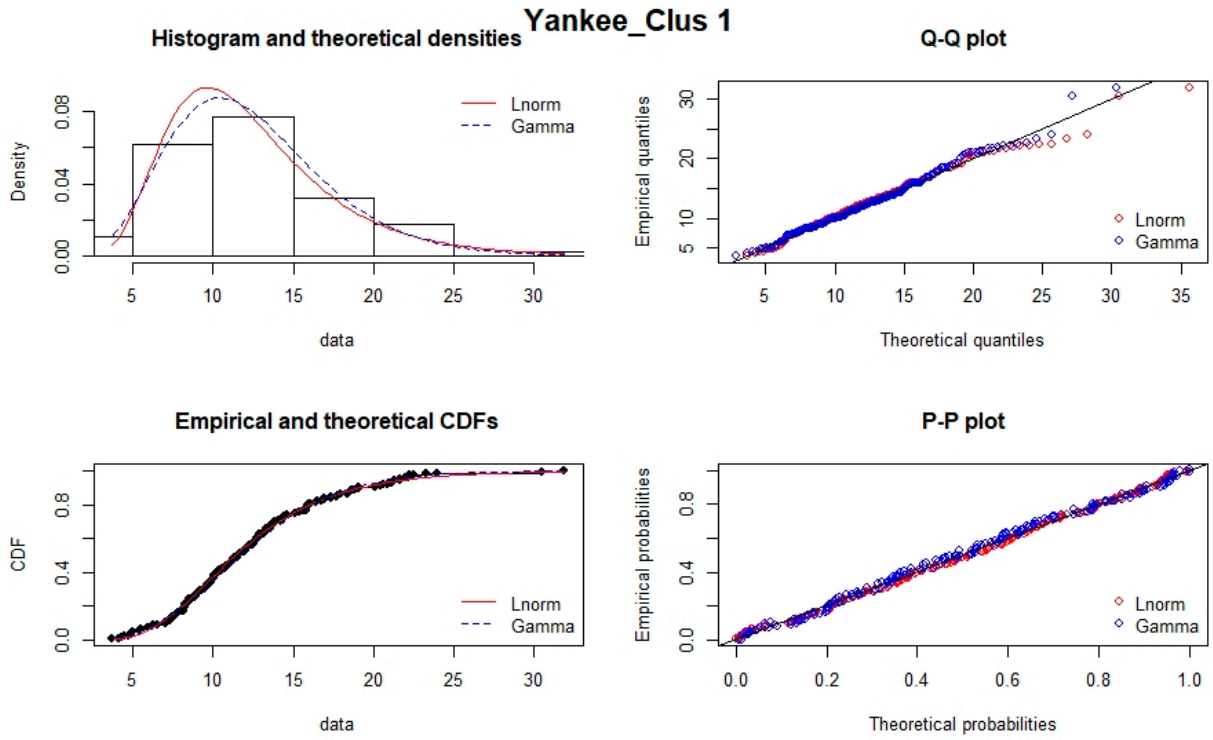

Figure S41. Comparison of Gamma and Lognormal distribution at Yankee_Clus1.

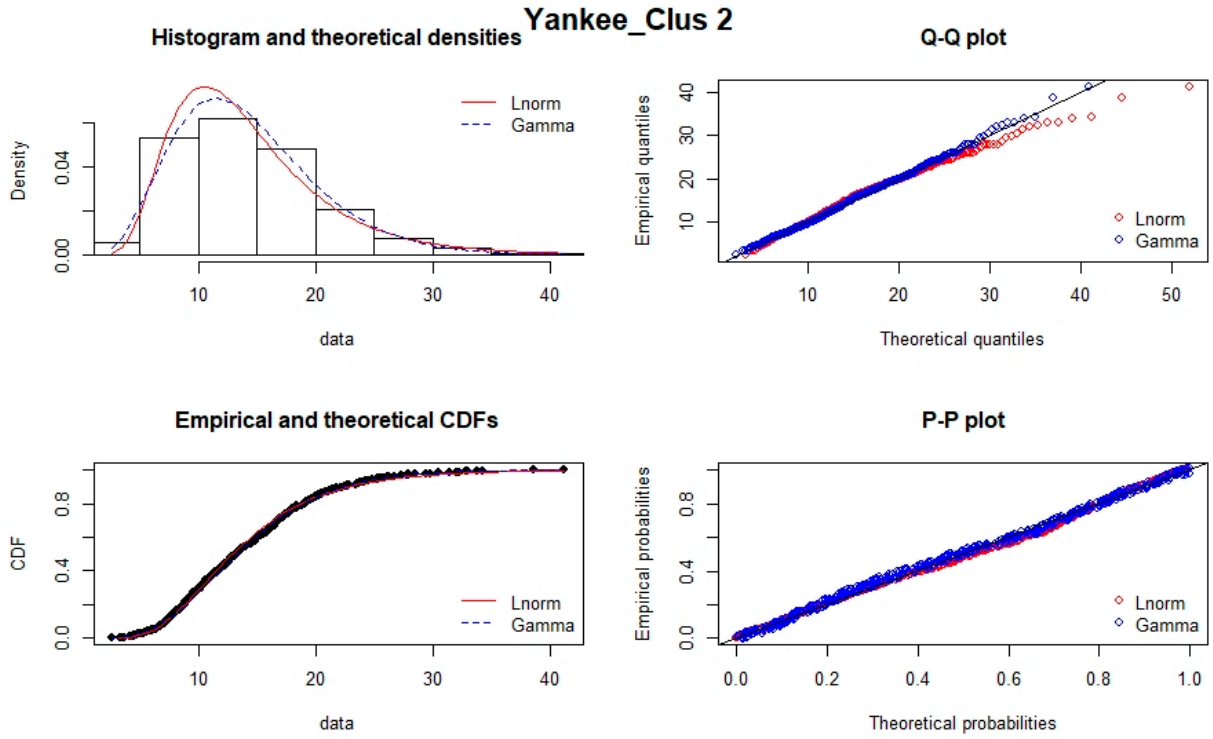

Figure S42. Comparison of Gamma and Lognormal distribution at Yankee_Clus2.

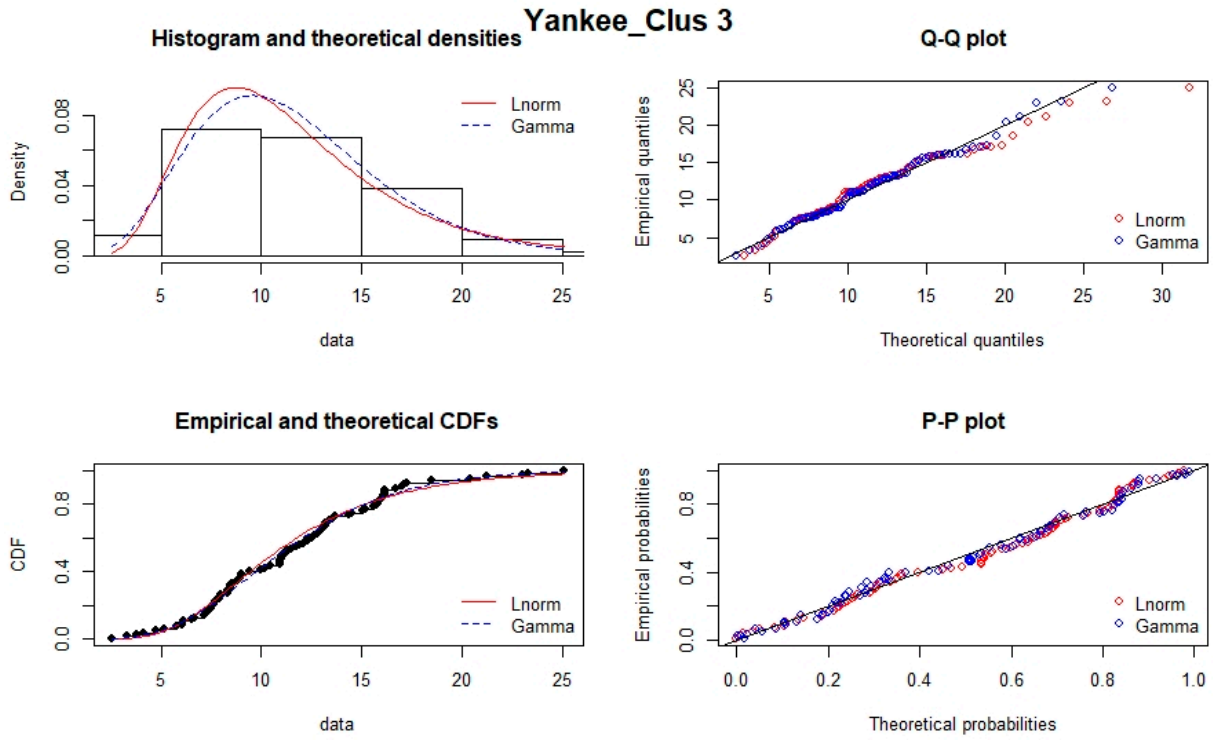

Figure S43. Comparison of Gamma and Lognormal distribution at Yankee_Clus3.

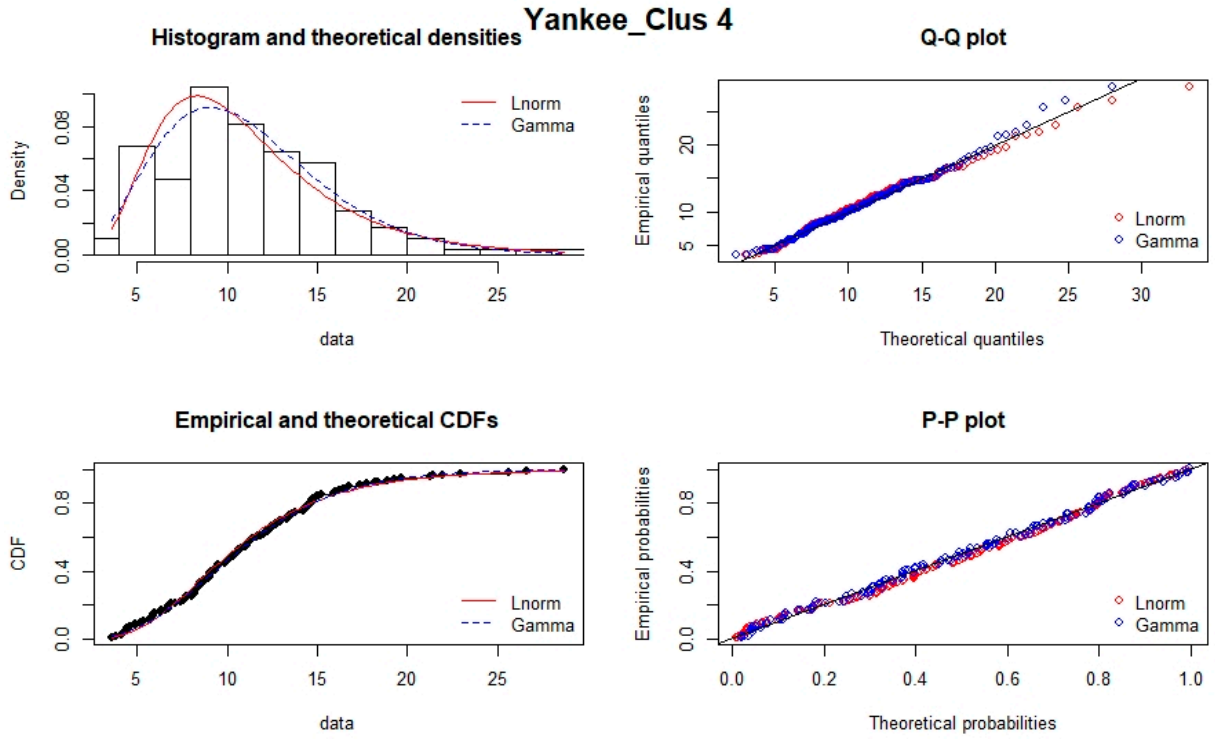

Figure S44. Comparison of Gamma and Lognormal distribution at Yankee_Clus4.

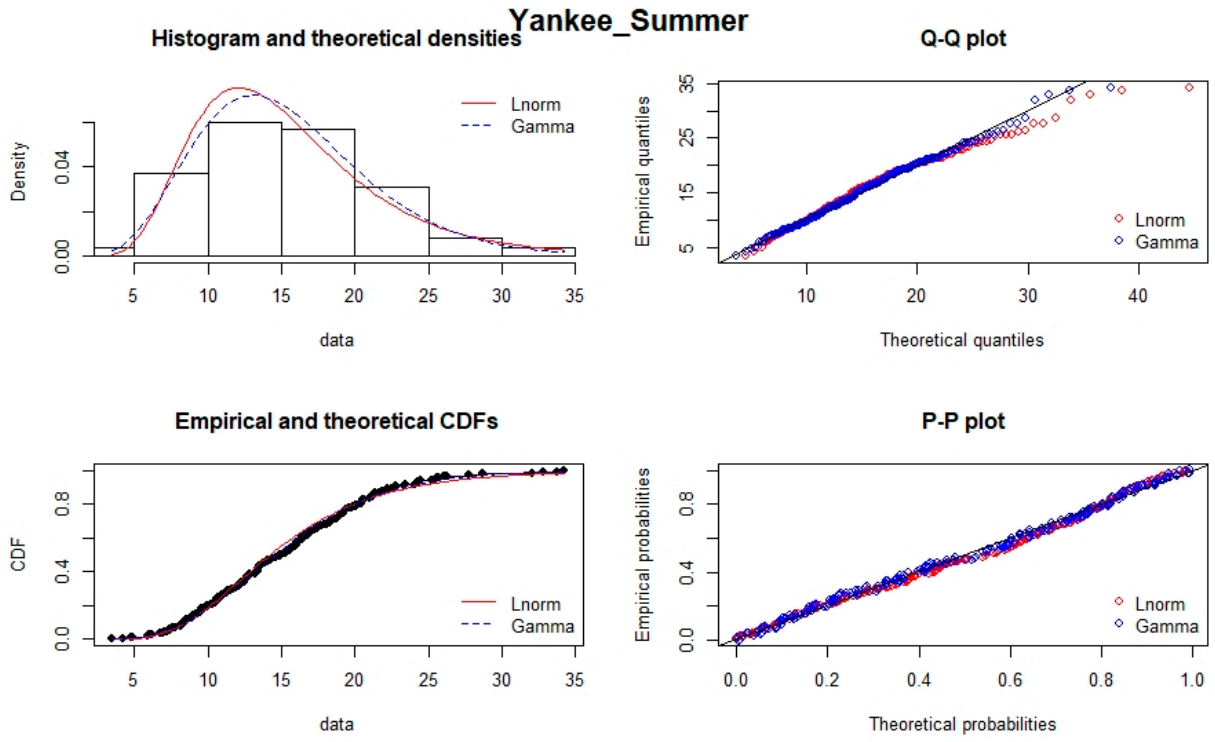

Figure S45. Comparison of Gamma and Lognormal distribution at Yankee_Summer.

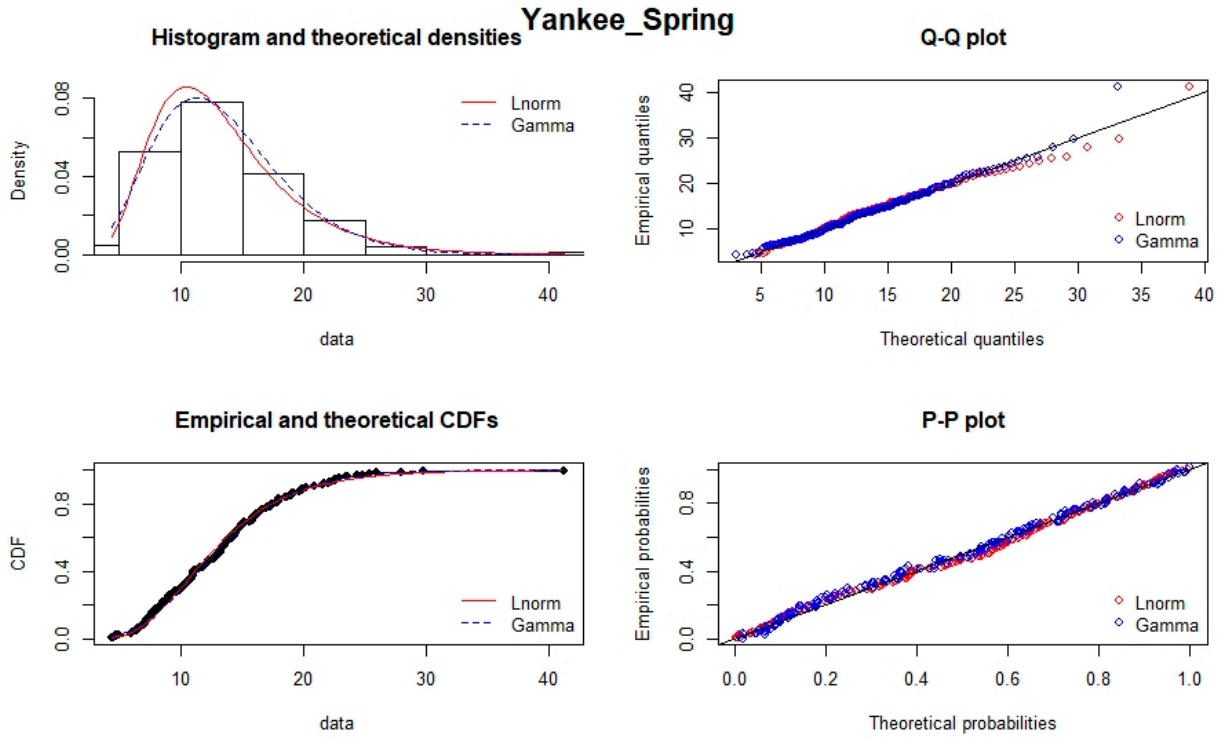

Figure S46. Comparison of Gamma and Lognormal distribution at Yankee_Spring.

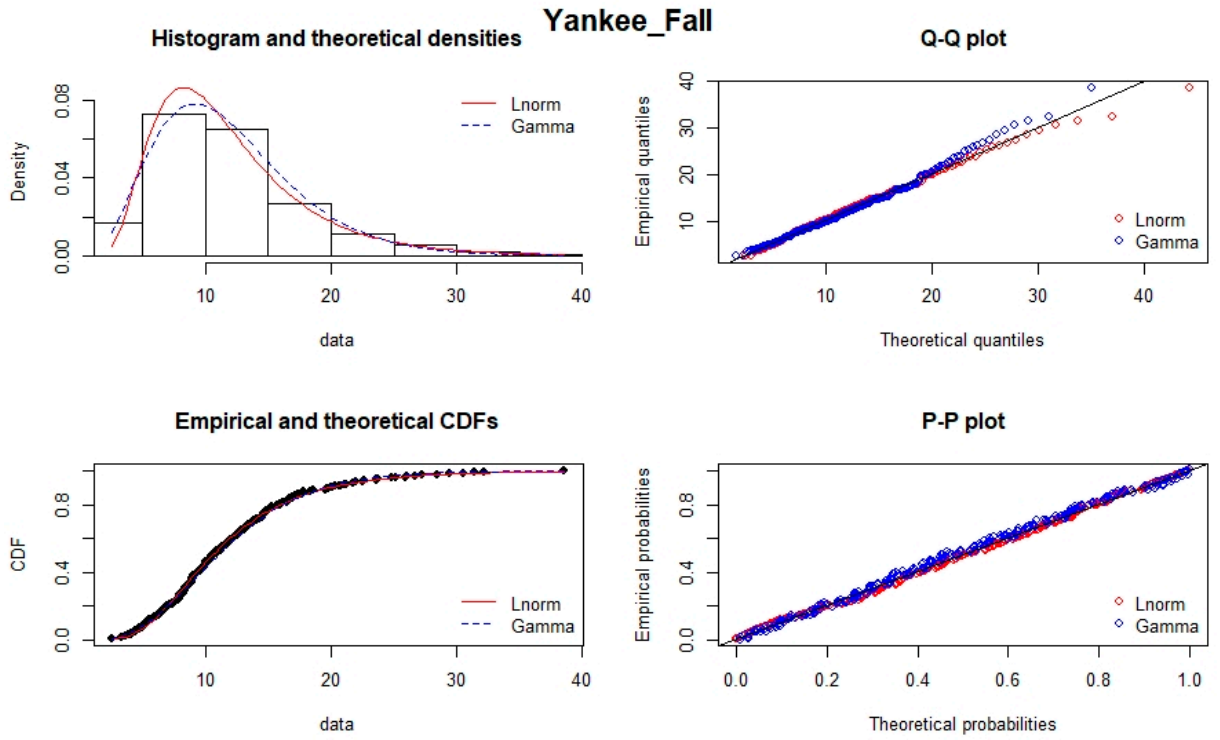

Figure S47. Comparison of Gamma and Lognormal distribution at Yankee_ClusFall.

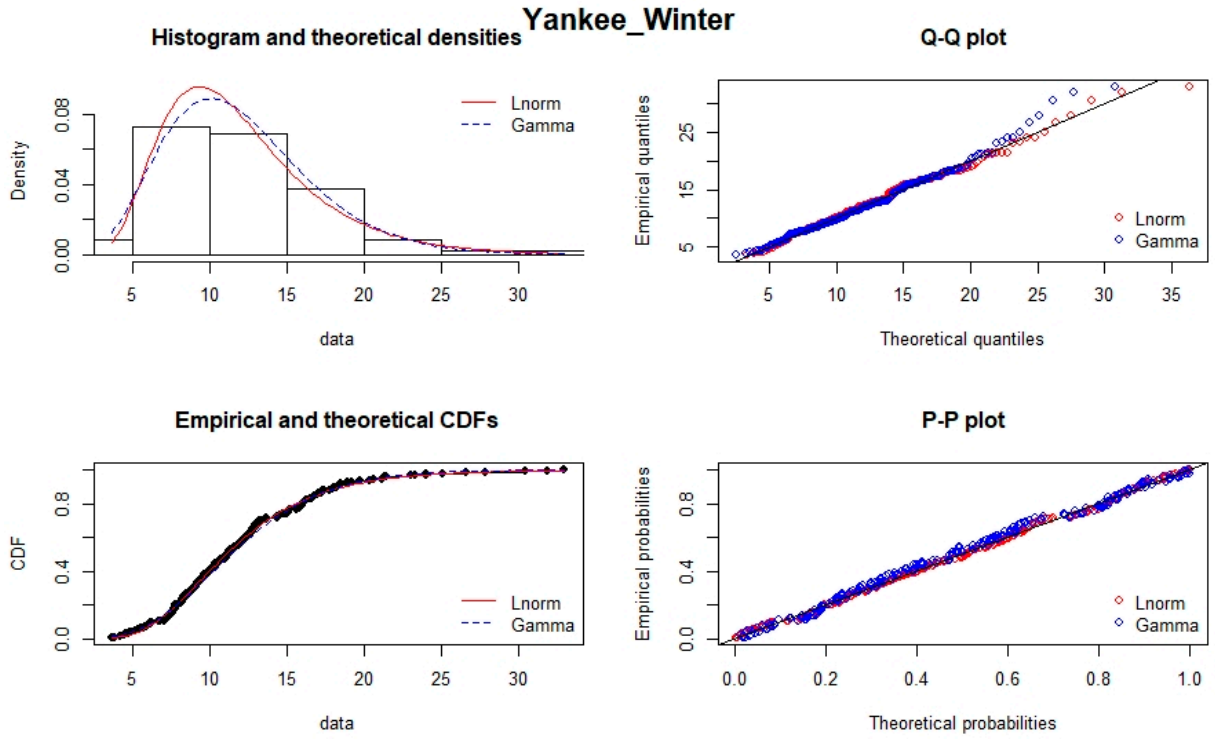

Figure S48. Comparison of Gamma and Lognormal distribution at Yankee_Winter.

Table S1. The total variance explained by each principal component : Amanda.

Amanda	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
WS	0.04	-0.03	0.50	-0.19	0.70	-0.12	0.23	-0.32	0.23	0.05	0.00
RH	0.40	-0.12	-0.18	0.19	-0.15	-0.40	0.56	0.00	0.02	0.51	0.00
BP	-0.31	-0.22	-0.18	-0.25	-0.07	0.57	0.63	-0.15	-0.10	-0.05	0.01
SR	-0.28	0.43	-0.30	-0.30	0.08	-0.04	-0.22	-0.38	-0.17	0.57	0.01
OT	0.03	0.50	-0.45	0.04	0.14	-0.28	0.29	-0.15	0.13	-0.57	0.00
APCP	0.47	0.06	-0.17	-0.25	0.07	0.30	-0.11	0.08	0.23	0.04	0.72
HPBL	0.13	0.48	0.35	-0.31	-0.02	0.01	0.24	0.48	-0.49	0.00	-0.02
PRATE	0.46	0.07	-0.18	-0.26	0.06	0.32	-0.10	0.06	0.27	0.06	-0.69
uwind.10 m	0.03	0.32	0.45	-0.05	-0.63	0.04	0.09	-0.38	0.37	-0.04	0.02
VIS	-0.42	0.24	-0.02	0.17	0.11	0.08	0.12	0.54	0.59	0.26	0.02
vwind.10 m	0.17	0.32	0.08	0.72	0.19	0.47	0.03	-0.18	-0.20	0.11	0.00
Explained %	31.98	16.97	16.18	8.65	7.80	5.99	4.97	3.38	2.90	0.98	0.20

Table S2. The total variance explained by each principal component: Batavia.

Batavia	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
WS	0.04	-0.03	0.50	-0.19	0.70	-0.12	0.23	-0.32	0.23	0.05	0.00
RH	0.40	-0.12	-0.18	0.19	-0.15	-0.40	0.56	0.00	0.02	0.51	0.00
BP	-0.31	-0.22	-0.18	-0.25	-0.07	0.57	0.63	-0.15	-0.10	-0.05	0.01
SR	-0.28	0.43	-0.30	-0.30	0.08	-0.04	-0.22	-0.38	-0.17	0.57	0.01
OT	0.03	0.50	-0.45	0.04	0.14	-0.28	0.29	-0.15	0.13	-0.57	0.00
APCP	0.47	0.06	-0.17	-0.25	0.07	0.30	-0.11	0.08	0.23	0.04	0.72
HPBL	0.13	0.48	0.35	-0.31	-0.02	0.01	0.24	0.48	-0.49	0.00	-0.02
PRATE	0.46	0.07	-0.18	-0.26	0.06	0.32	-0.10	0.06	0.27	0.06	-0.69
uwind.10m	0.03	0.32	0.45	-0.05	-0.63	0.04	0.09	-0.38	0.37	-0.04	0.02

VIS	-0.42	0.24	-0.02	0.17	0.11	0.08	0.12	0.54	0.59	0.26	0.02
vwind.10m	0.17	0.32	0.08	0.72	0.19	0.47	0.03	-0.18	-0.20	0.11	0.00
Explained %	31.98	16.97	16.18	8.65	7.80	5.99	4.97	3.38	2.90	0.98	0.20

Table S3. The total variance explained by each principal component : Colerain.

Colerain	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**	**PC6**	**PC7**	**PC8**	**PC9**	**PC10**	**PC11**
WS	0.04	-0.03	0.50	-0.19	0.70	-0.12	0.23	-0.32	0.23	0.05	0.00
RH	0.40	-0.12	-0.18	0.19	-0.15	-0.40	0.56	0.00	0.02	0.51	0.00
BP	-0.31	-0.22	-0.18	-0.25	-0.07	0.57	0.63	-0.15	-0.10	-0.05	0.01
SR	-0.28	0.43	-0.30	-0.30	0.08	-0.04	-0.22	-0.38	-0.17	0.57	0.01
OT	0.03	0.50	-0.45	0.04	0.14	-0.28	0.29	-0.15	0.13	-0.57	0.00
APCP	0.47	0.06	-0.17	-0.25	0.07	0.30	-0.11	0.08	0.23	0.04	0.72
HPBL	0.13	0.48	0.35	-0.31	-0.02	0.01	0.24	0.48	-0.49	0.00	-0.02
PRATE	0.46	0.07	-0.18	-0.26	0.06	0.32	-0.10	0.06	0.27	0.06	-0.69
uwind.10 m	0.03	0.32	0.45	-0.05	-0.63	0.04	0.09	-0.38	0.37	-0.04	0.02
VIS	-0.42	0.24	-0.02	0.17	0.11	0.08	0.12	0.54	0.59	0.26	0.02
vwind.10 m	0.17	0.32	0.08	0.72	0.19	0.47	0.03	-0.18	-0.20	0.11	0.00
Explaine d %	31.98	16.97	16.18	8.65	7.80	5.99	4.97	3.38	2.90	0.98	0.20

Table S4. The total variance explained by each principal component : Lebanon.

Lebanon	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**	**PC6**	**PC7**	**PC8**	**PC9**	**PC10**	**PC11**
WS	0.04	-0.03	0.50	-0.19	0.70	-0.12	0.23	-0.32	0.23	0.05	0.00
RH	0.40	-0.12	-0.18	0.19	-0.15	-0.40	0.56	0.00	0.02	0.51	0.00
BP	-0.31	-0.22	-0.18	-0.25	-0.07	0.57	0.63	-0.15	-0.10	-0.05	0.01
SR	-0.28	0.43	-0.30	-0.30	0.08	-0.04	-0.22	-0.38	-0.17	0.57	0.01
OT	0.03	0.50	-0.45	0.04	0.14	-0.28	0.29	-0.15	0.13	-0.57	0.00
APCP	0.47	0.06	-0.17	-0.25	0.07	0.30	-0.11	0.08	0.23	0.04	0.72
HPBL	0.13	0.48	0.35	-0.31	-0.02	0.01	0.24	0.48	-0.49	0.00	-0.02
PRATE	0.46	0.07	-0.18	-0.26	0.06	0.32	-0.10	0.06	0.27	0.06	-0.69
uwind.10 m	0.03	0.32	0.45	-0.05	-0.63	0.04	0.09	-0.38	0.37	-0.04	0.02
VIS	-0.42	0.24	-0.02	0.17	0.11	0.08	0.12	0.54	0.59	0.26	0.02
vwind.10 m	0.17	0.32	0.08	0.72	0.19	0.47	0.03	-0.18	-0.20	0.11	0.00
Explaine d %	31.98	16.97	16.18	8.65	7.80	5.99	4.97	3.38	2.90	0.98	0.20

Table S5. The total variance explained by each principal component: Sycamore.

Sycamore	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**	**PC6**	**PC7**	**PC8**	**PC9**	**PC10**	**PC11**
WS	0.04	-0.03	0.50	-0.19	0.70	-0.12	0.23	-0.32	0.23	0.05	0.00
RH	0.40	-0.12	-0.18	0.19	-0.15	-0.40	0.56	0.00	0.02	0.51	0.00
BP	-0.31	-0.22	-0.18	-0.25	-0.07	0.57	0.63	-0.15	-0.10	-0.05	0.01
SR	-0.28	0.43	-0.30	-0.30	0.08	-0.04	-0.22	-0.38	-0.17	0.57	0.01
OT	0.03	0.50	-0.45	0.04	0.14	-0.28	0.29	-0.15	0.13	-0.57	0.00
APCP	0.47	0.06	-0.17	-0.25	0.07	0.30	-0.11	0.08	0.23	0.04	0.72
HPBL	0.13	0.48	0.35	-0.31	-0.02	0.01	0.24	0.48	-0.49	0.00	-0.02
PRATE	0.46	0.07	-0.18	-0.26	0.06	0.32	-0.10	0.06	0.27	0.06	-0.69
uwind.10m	0.03	0.32	0.45	-0.05	-0.63	0.04	0.09	-0.38	0.37	-0.04	0.02
VIS	-0.42	0.24	-0.02	0.17	0.11	0.08	0.12	0.54	0.59	0.26	0.02

vwind.10m	0.17	0.32	0.08	0.72	0.19	0.47	0.03	-0.18	-0.20	0.11	0.00
Explained %	31.98	16.97	16.18	8.65	7.80	5.99	4.97	3.38	2.90	0.98	0.20

Table S6. The total variance explained by each principal component: Yankee.

Yankee	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11
WS	0.04	-0.03	0.50	-0.19	0.70	-0.12	0.23	-0.32	0.23	0.05	0.00
RH	0.40	-0.12	-0.18	0.19	-0.15	-0.40	0.56	0.00	0.02	0.51	0.00
BP	-0.31	-0.22	-0.18	-0.25	-0.07	0.57	0.63	-0.15	-0.10	-0.05	0.01
SR	-0.28	0.43	-0.30	-0.30	0.08	-0.04	-0.22	-0.38	-0.17	0.57	0.01
OT	0.03	0.50	-0.45	0.04	0.14	-0.28	0.29	-0.15	0.13	-0.57	0.00
APCP	0.47	0.06	-0.17	-0.25	0.07	0.30	-0.11	0.08	0.23	0.04	0.72
HPBL	0.13	0.48	0.35	-0.31	-0.02	0.01	0.24	0.48	-0.49	0.00	-0.02
PRATE	0.46	0.07	-0.18	-0.26	0.06	0.32	-0.10	0.06	0.27	0.06	-0.69
uwind.10m	0.03	0.32	0.45	-0.05	-0.63	0.04	0.09	-0.38	0.37	-0.04	0.02
VIS	-0.42	0.24	-0.02	0.17	0.11	0.08	0.12	0.54	0.59	0.26	0.02
vwind.10m	0.17	0.32	0.08	0.72	0.19	0.47	0.03	-0.18	-0.20	0.11	0.00
Explained %	31.98	16.97	16.18	8.65	7.80	5.99	4.97	3.38	2.90	0.98	0.20

Table S7. MLR study on data obtained at Amanda.

MLR runs	No of variables (p)	Predictor variables	r	rsquare
1	4	HPBL,OT, VIS	0.46	0.22
2	2	HPBL, OT	0.45	0.21
3	5	BP,HPBL,OT,VIS	0.46	0.22

Table S8. MLR study on data obtained at Batavia.

MLR runs	No of variables (p)	Predictor variables	r	rsquare
1	4	HPBL, OT, VIS	0.29	0.087
2	2	HPBL, OT	0.28	0.08
3	5	BP,HPBL,OT,VIS	0.33	0.11

Table S9. MLR study on data obtained at Colerain.

MLR runs	No of variables (p)	Predictor variables	r	rsquare
1	4	HPBL, OT, VIS	0.37	0.14
2	2	HPBL, OT	0.36	0.13
3	5	BP,HPBL,OT,VIS	0.38	0.15

Table S10. MLR study on data obtained at Lebanon.

MLR runs	No of variables (p)	Predictor variables	r	rsquare

1	4	HPBL, OT, VIS	0.28	0.08
2	2	HPBL, OT	0.28	0.08
3	5	BP,HPBL,OT,VIS	0.28	0.08

Table S11. MLR study on data obtained at Sycamore.

MLR runs	No of variables (p)	Predictor variables	r	rsquare
1	4	HPBL, OT, VIS	0.38	0.15
2	2	HPBL, OT	0.38	0.15
3	5	BP,HPBL,OT,VIS	0.4	0.16

Table S12. MLR study on data obtained at Yankee.

MLR runs	No of variables (p)	Predictor variables	r	rsquare
1	4	HPBL, OT, VIS	0.45	0.21
2	2	HPBL, OT	0.43	0.19
3	5	BP,HPBL,OT,VIS	0.48	0.24

Table S13. Lognormal parameters for seasons and clusters at Amanda.

Amanda	mu	sigma
Amanda_Winter	2.20	0.48
Amanda_Spring	2.29	0.46
Amanda_Summer	2.33	0.44
Amanda_Fall	2.12	0.55
Amanda_Clus1	2.15	0.44
Amanda_Clus2	2.31	0.49
Amanda_Clus3	2.19	0.49
Amanda_Clus4	2.04	0.51

Table S14. Lognormal parameters for seasons and clusters at Bataviaa.

Batavia	mu	sigma
Batavia Winter	2.23	0.43
Batavia_Spring	2.30	0.37
Batavia_Summer	2.52	0.40
Batavia_Fall	2.16	0.46
Batavia_Clus1	2.34	0.43
Batavia_Clus2	2.34	0.44
Batavia_Clus3	2.18	0.51
Batavia_Clus4	2.20	0.43

Table S15. Lognormal parameters for seasons and clusters at Colerain.

Colerain	mu	sigma
Colerain_Winter	2.54	0.42
Colerain_Spring	2.57	0.37
Colerain_Summer	2.53	0.42
Colerain_Fall	2.30	0.48
Colerain_Clus1	2.45	0.42
Colerain_Clus2	2.54	0.41
Colerain_Clus3	2.42	0.54
Colerain_Clus4	2.32	0.47

Table S16. Lognormal parameters for seasons and clusters at Lebanon.

Lebanon	**mu**	**sigma**
Lebanon_Winter	2.49	0.45
Lebanon_Spring	2.57	0.36
Lebanon_Summer	2.53	0.42
Lebanon_Fall	2.28	0.46
Lebanon_Clus1	2.45	0.43
Lebanon_Clus2	2.48	0.42
Lebanon_Clus3	2.49	0.48
Lebanon_Clus4	2.36	0.50

Table S17. Lognormal parameters for seasons and clusters at Sycamore.

Sycamore	**mu**	**sigma**
Sycamore_Winter	2.31	0.43
Sycamore_Spring	2.36	0.44
Sycamore_Summer	2.45	0.44
Sycamore_Fall	2.17	0.57
Sycamore_Clus1	2.33	0.43
Sycamore_Clus2	2.37	0.48
Sycamore_Clus3	2.28	0.50
Sycamore_Clus4	2.11	0.54

Table S18. Lognormal parameters for seasons and clusters at Yankee.

Yankee	mu	sigma
Yankee_Winter	2.40	0.41
Yankee_Spring	2.51	0.41
Yankee_Summer	2.66	0.40
Yankee_Fall	2.36	0.50
Yankee_Clus1	2.43	0.41
Yankee_Clus2	2.55	0.45
Yankee_Clus3	2.35	0.44
Yankee_Clus4	2.31	0.44

Table S19. Lognormal parameters for seasons and clusters at Taft.

Taft	**mu**	**sigma**
Taft_Winter	2.37	0.44
Taft_Spring	2.40	0.40
Taft_Summer	2.50	0.46
Taft_Fall	2.19	0.53
Taft_Clus1	2.34	0.46
Taft_Clus2	2.43	0.46
Taft_Clus3	2.26	0.57
Taft_Clus4	2.18	0.46

Table S20. Gamma parameters for seasons and clusters at Taft.

Taft	**a**	**b**
Taft_Winter	5.53	2.13

Taft_Spring	6.44	1.85
Taft_Summer	5.62	2.38
Taft_Fall	3.95	2.58
Taft_Clus1	5.40	2.11
Taft_Clus2	5.32	2.36
Taft_Clus3	3.66	3.03
Taft_Clus4	5.02	1.95

Table S21. Gamma parameters for seasons and clusters at Amanda.

Amanda	**a**	**b**
Amanda_Winter	4.76	2.11
Amanda_Spring	5.29	2.05
Amanda_Summer	5.74	1.95
Amanda_Fall	3.74	2.56
Amanda_Clus1	5.62	1.67
Amanda_Clus2	4.72	2.40
Amanda_Clus3	4.84	2.05
Amanda_Clus4	4.37	1.98

Table S22. Gamma parameters for seasons and clusters at Batavia.

Batavia	**a**	**b**
Batavia Winter	5.42	1.91
Batavia_Spring	7.36	1.46
Batavia_Summer	6.81	1.98
Batavia_Fall	4.85	2.01
Batavia_Clus1	5.71	1.99
Batavia_Clus2	5.49	2.08
Batavia_Clus3	4.20	2.37
Batavia_Clus4	5.87	1.67

Table S23. Gamma parameters for seasons and clusters at Colerain.

Colerain	**a**	**b**
Colerain_Winter	6.08	2.28
Colerain_Spring	7.65	1.82
Colerain_Summer	6.04	2.26
Colerain_Fall	4.76	2.33
Colerain_Clus1	6.17	2.05
Colerain_Clus2	6.33	2.17
Colerain_Clus3	3.98	3.23
Colerain_Clus4	4.78	2.38

Table S24. Gamma parameters for seasons and clusters at Lebanon.

Lebanon	**a**	**b**
Lebanon_Winter	5.44	2.42
Lebanon_Spring	8.10	1.73
Lebanon_Summer	6.54	2.07
Lebanon_Fall	5.10	2.12
Lebanon_Clus1	6.03	2.10
Lebanon_Clus2	6.06	2.15
Lebanon_Clus3	5.09	2.61
Lebanon_Clus3	4.56	2.61

Table S25. Gamma parameters for seasons and clusters at Sycamore.

Sycamore	a	b
Sycamore_Winter	5.80	1.90
Sycamore_Spring	5.59	2.08
Sycamore_Summer	5.55	2.29
Sycamore_Fall	3.51	2.89
Sycamore_Clus1	5.80	1.93
Sycamore_Clus2	4.78	2.50
Sycamore_Clus3	4.56	2.40
Sycamore_Clus4	4.06	2.31

Table S26. Gamma parameters for seasons and clusters at Yankee.

Yankee	a	b
Yankee_Winter	6.18	1.94
Yankee_Spring	6.31	2.12
Yankee_Summer	6.83	2.25
Yankee_Fall	4.37	2.72
Yankee_Clus1	6.40	1.93
Yankee_Clus2	5.36	2.65
Yankee_Clus3	5.92	1.94
Yankee_Clus4	5.53	2.00

Table S27. Regression equations for linear correlation between the monitoring sites in the form y = mx + c, where m is the slope and c are the y intercepts.

Sites	Taft	Amanda	Batavia	Colerain	Lebanon	Sycamore	Yankee
Taft		y = 0.78x + 1.14	y = 0.68x + 3.02	y = 0.94x + 2.01	y = 0.89x + 2.32	y = 0.89x + 0.76	y = 0.89x + 2.50
Amanda			y = 0.62x + 4.49	y = 0.95x + 3.21	y = 0.87x + 3.69	y = 0.95x + 1.37	y = 1.04x + 2.21
Batavia				y = 0.74x + 4.89	y = 0.74x + 4.62	y = 0.73x + 3.2	y = 0.74x + 4.86
Colerain					y = 0.82x + 2.00	y = 0.79x + 0.98	y = 0.81x + 2.42
Lebanon						y = 0.82x + 0.79	y = 0.80x + 2.73
Sycamore							y = 0.91x + 2.71