Supplementary Information (SI)

Supplementary S1: Mann-Kendall Test

Where sgn $(x_j - x_k)$ is defined as follows:

$$sgn(x_j - x_k) = \begin{cases} 1\ for\ x\ >\ 0 \\ 0\ for\ x\ =\ 0 \\ -1\ for\ x\ <\ 0 \end{cases} \quad \text{(S1)}$$

Where i and j are observations of the xi and xj of time series and sgn is a function of signum. The S is computed as a variance. The standard test statistic, the Z value in Mann-Kendall test is used to detect if the time series information is of increasing trend or not. It is calculated using equation. (3) :

$$Z = \begin{cases} \frac{S-1}{\sigma}\ \ if\ S\ >\ 0 \\ 0\ \ \ if\ S =\ 0 \\ \frac{S+1}{\sigma}\ if\ S\ <\ 0 \end{cases} \quad \text{(S2)}$$

A very high positive value of S is an indicator of an increasing trend and a very low negative value indicates a decreasing trend. The presence of a statistically significant trend is evaluated using Z value.

The variance is computed as:

$$V = \frac{n(n-1)(2n+5) - \sum_{i=1}^{g} t_i(t_i-1)(2t_i+5)}{18} \quad \text{(S3)}$$

Supplementary S2 Figures S1–S3: Figures for test for serial autocorrelation

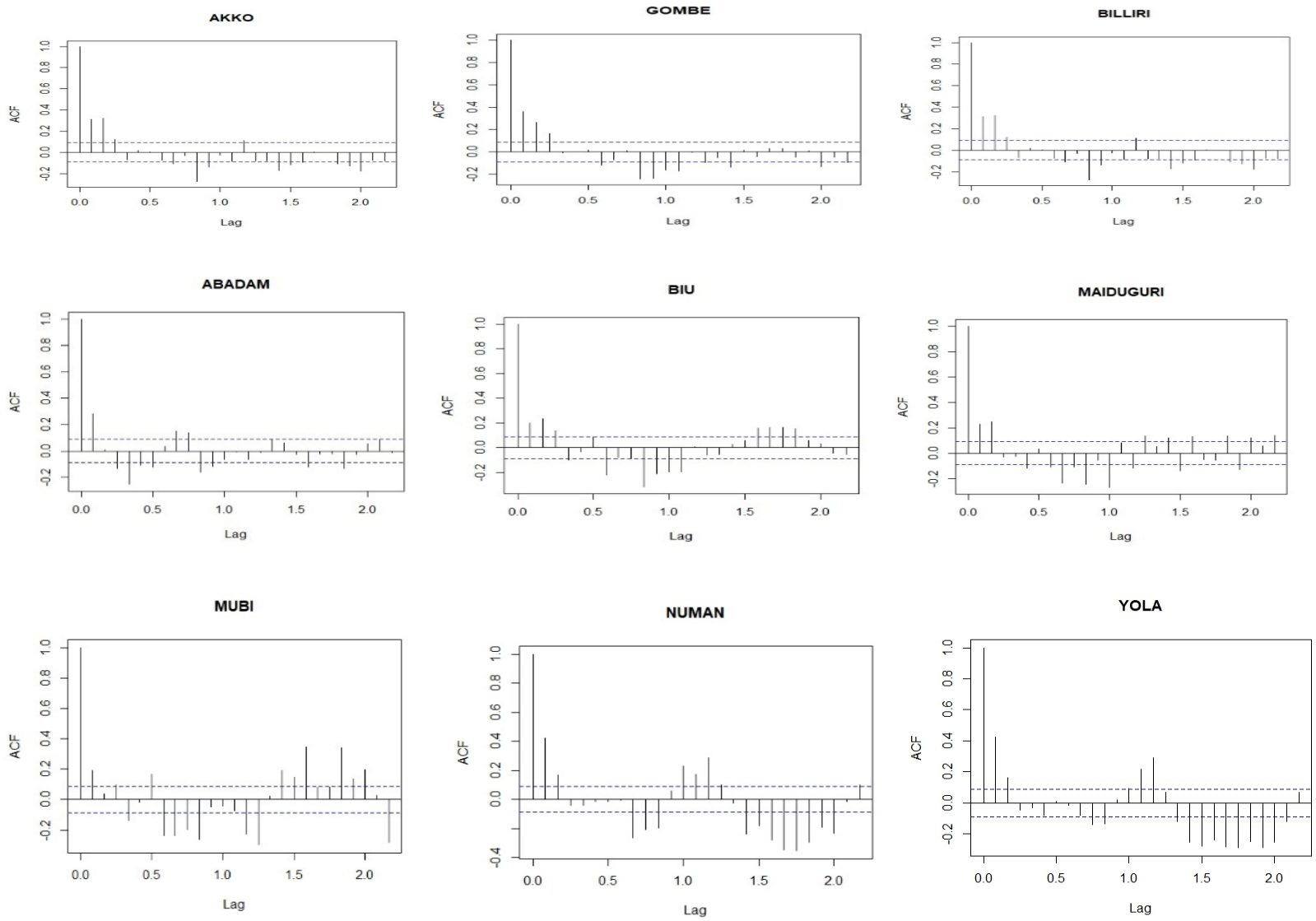
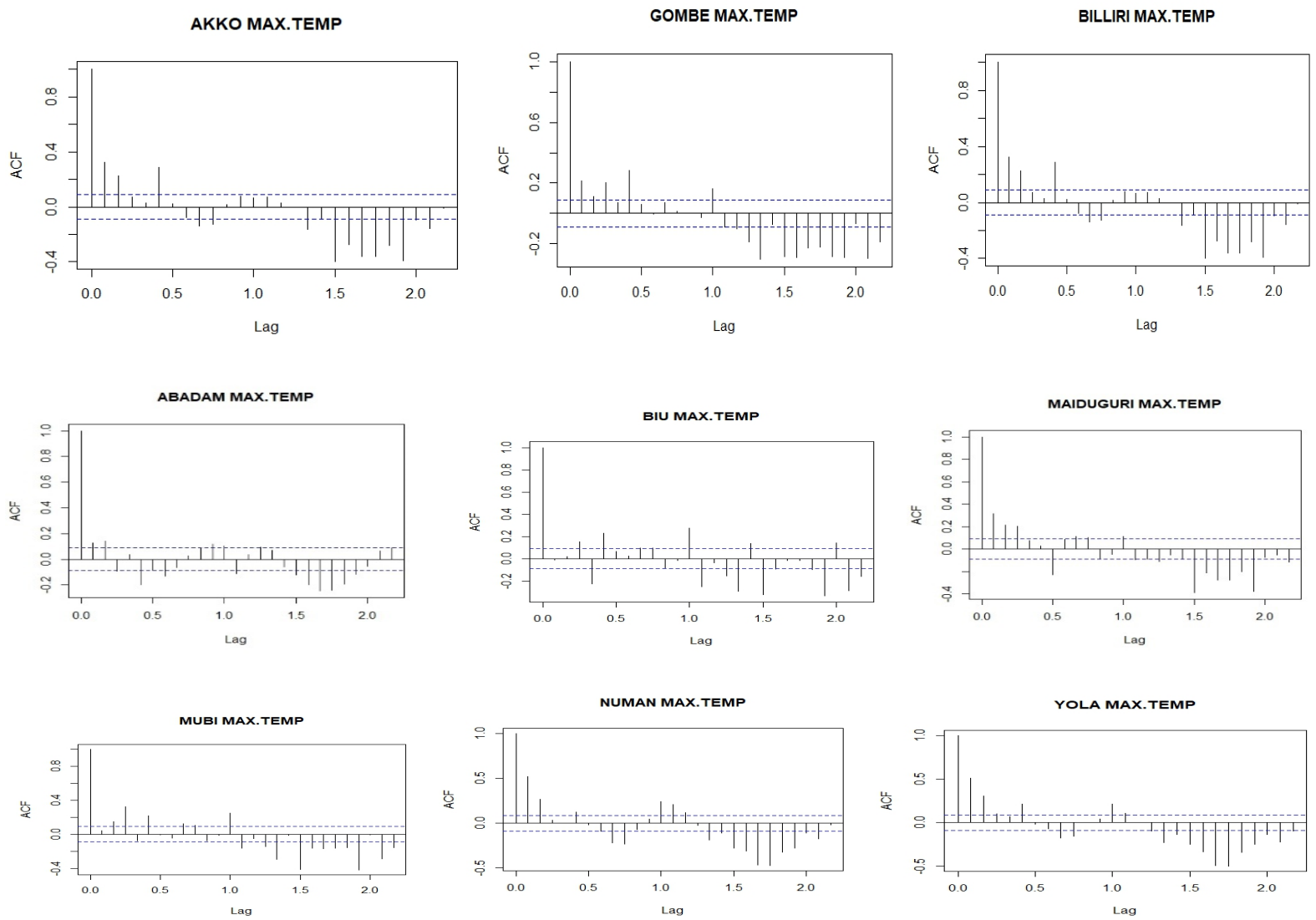
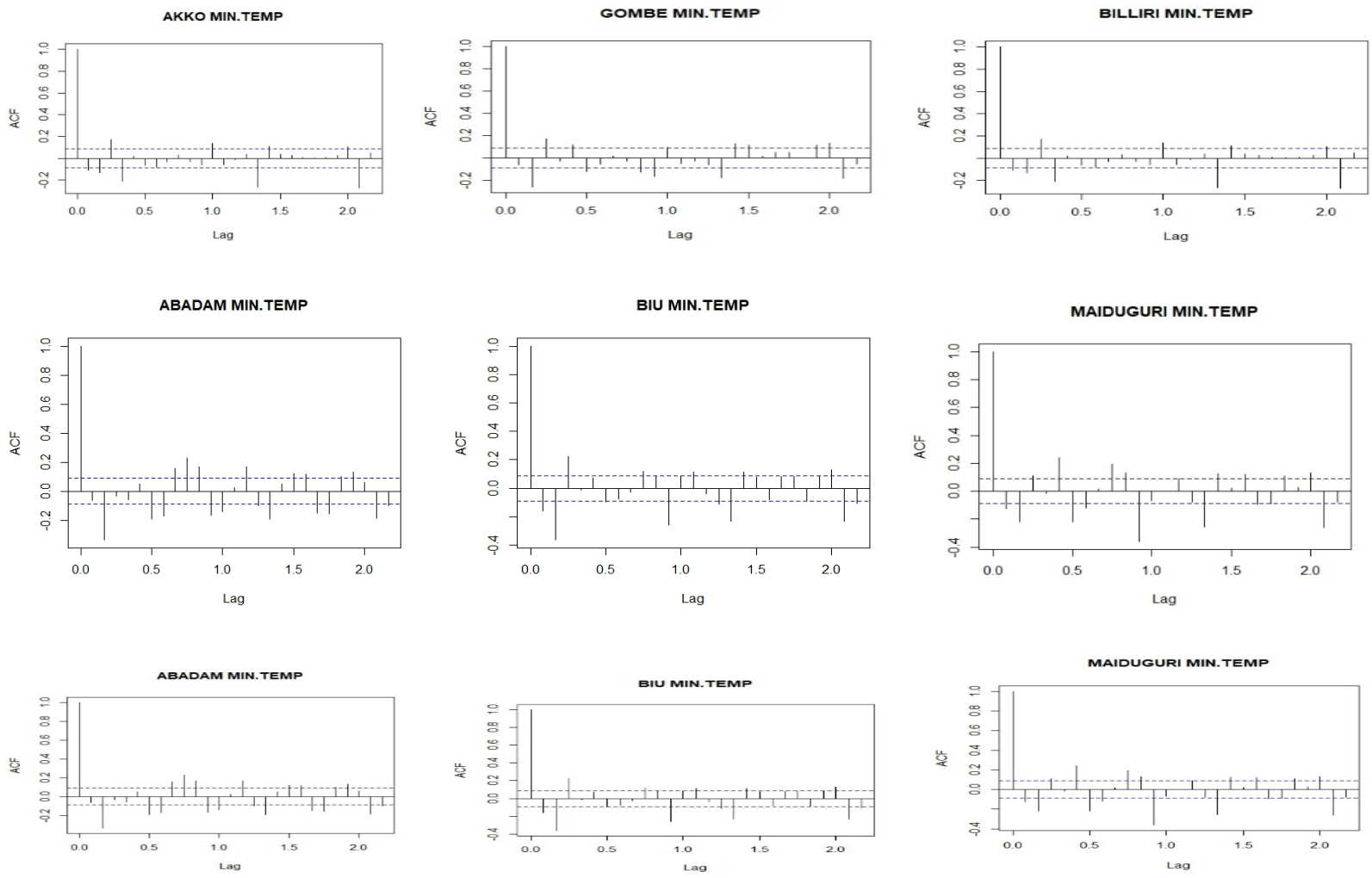


Figure. S1: Test for serial autocorrelation in total annual rainfall



SI Figure. S2: Test for serial autocorrelation in maximum temperature



SI Figure. S3: Test for serial autocorrelation in minimum temperature

Supplementary S3

Table S1: Sen's innovative trend analysis for Rainfall

Station	Sen's analysis	S	Nature of trend
Akko	-0.96658333	12486.40624	Decreasing
Gombe	2.3618717	12782.11404	Increasing
Billiri	-0.9665833	12486.40624	Decreasing
Abadam	4.102222	7909.333333	Increasing
Biu	3.695524	10079.06217	Increasing
Maiduguri	-2.542410	5844.766578	Decreasing
Mubi	2.9016787	7818.66666	Increasing
Numan	-10.280865	2751.78062	Decreasing
Yola	-5.273333	7912.00000	Decreasing

Table S2: Sen's innovative trend analysis for Maximum Temperature

Station	Sen's analysis	S	Nature of trend
Akko	0.05208711	8845.37885	Increasing
Gombe	0.00028420	7920.66666	Increasing
Billiri	0.05208711	8845.37885	Increasing
Abadam	0.02488095	3988.05280	Increasing
Biu	0.02881944	9666.04549	Increasing
Maiduguri	0.03544155	4722.208162	Increasing
Mubi	0.02914286	9725.813975	Increasing
Numan	0.07291505	12779.00347	Increasing
Yola	0.06500000	11996.49764	Increasing

Table S3: Sen's innovative trend analysis for Minimum temperature

Station	Sen's analysis	S	Nature of trend
Akko	-0.01091093	7926.6666666	Decreasing
Gombe	-0.02958333	7926.6666666	Decreasing
Billiri	-0.01091093	7926.6666666	Decreasing
Abadam	0.01580000	3601.6489139	Increasing
Biu	-0.01803571	3088.0246793	Decreasing
Maiduguri	-0.01250000	7923.6666666	Decreasing
Mubi	-0.01675439	7924.6666666	Decreasing
Numan	0.007082228	7923.6666666	Increasing
Yola	0.004411765	7923.6666666	Increasing

Supplementary S4

Table S1: Mean Annual Rainfall

State	1981 to 1990	1991 to 2000	2001 to 2010	2010 to 2021	Slope 1981 to 2021	Remark
Adamawa	1140.29	1091.7	926.62	1019.33	0.853	Moderate Increase
Borno	628.65	652.72	548.75	697.22	-2.401	Low Decrease
Gombe	954.78	988.63	753.91	1033.83	1.896	Moderate Increase
Mean Total	871.56	871.59	721.5	874.63	-0.442	Low Decrease

Table S2: Mean Annual Maximum Temperature

State	1981 to 1990	1991 to 2000	2001 to 2010	2011 to 2021	Slope 1981 to 2021	Remark
Adamawa	40.53	41.56	42.22	42.27	0.060	Moderate Increase
Borno	43.18	43.56	44.27	44.11	0.035	Low Increase
Gombe	41.22	41.75	42.4	42.54	0.046	Low Increase
Mean Total	41.87	42.51	43.19	43.16	0.046	Low Increase

Table S3: Mean Annual Minimum Temperature

States	1981 to 1990	1991 to 2000	2001 to 2010	2011 to 2021	Change1981 to 2021	Remark
Adamawa	12.21	12.33	12.41	12.13	0.005	Low Increase
Borno	11.48	11.01	10.94	10.87	-0.010	Very low decrease
Gombe	11.64	11.34	11.75	11.09	-0.008	Low Decrease
Mean Total	11.77	11.54	11.62	11.36	-0.005	Low Decrease