Supporting Information for "A decrease in river discharge and rainfall amount, from a 100-year data-set, in response to El Niño events on the interannual temporal scale for the Philippines"

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Introduction The following figures highlight the data processing steps for river discharge and rainfall amount data. The supplemental table includes the list of river discharge and rainfall amount sites, the time covered by the measurements, and the original source of the data used.

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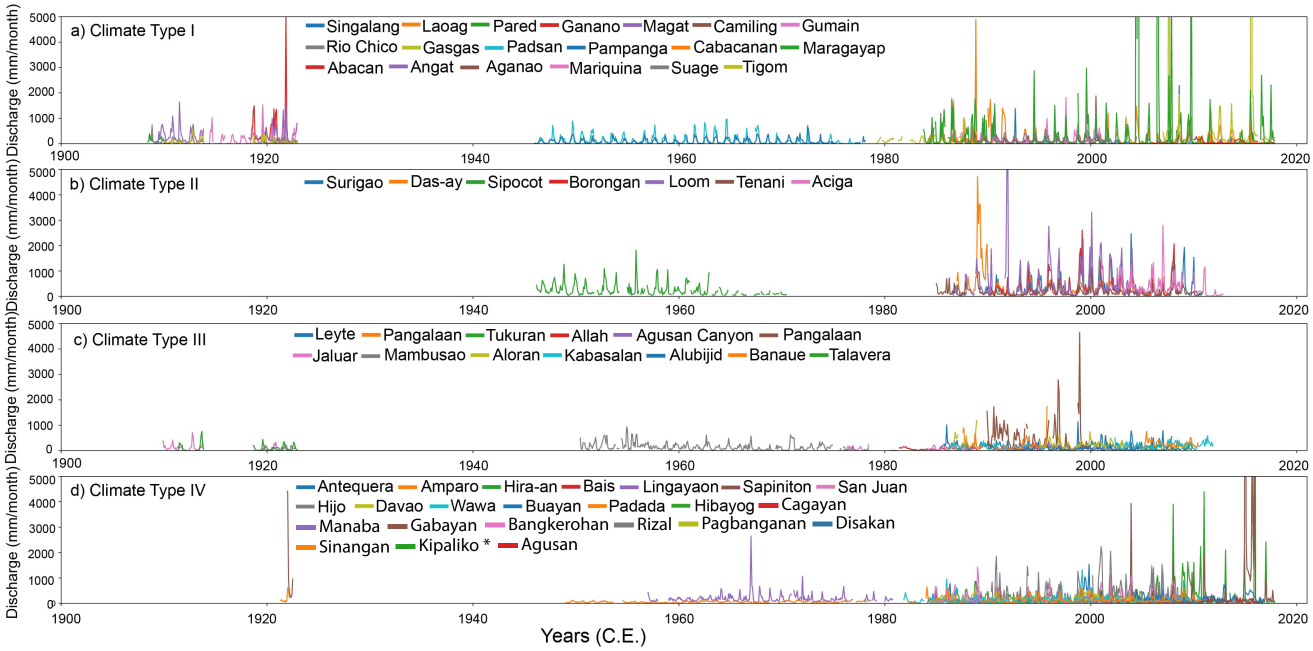

Figure S1. Time series of 61 discharge station data used in this study. River discharge station data that fall under Climate Type I (a), II (b), III (c), IV (d). *Kipaliko has been updated since Ibarra et al. (2021).

Figure S2. Time series of 29 rainfall data used in this study. Rainfall station and gridded data that fall under Climate Type I (a), II (b), III (c), IV (d).

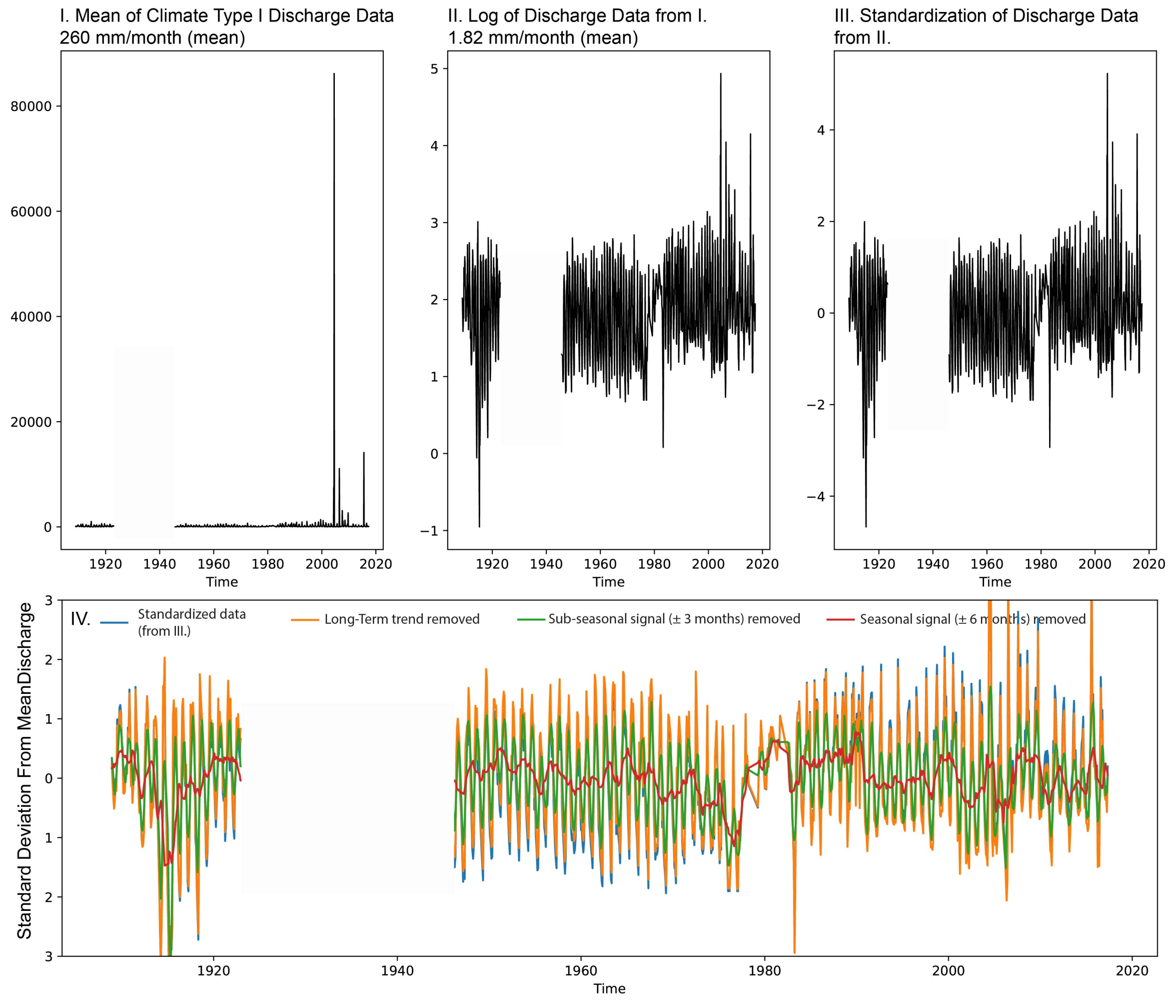

Figure S3. Data reduction steps for river discharge data that fall under Climate Type I I. Mean of area normalized discharge data in mm/month. II. Log of the mean area normalized discharge data. III. Standardized (interchangeable with scaled) discharge data around the log mean. This data is used to remove the long term trends (Supp. Figure. 4). IV. Standardized data plotted with data where long-term trends were removed using a polynomial fit. The sub-seasonal (±3) and seasonal (±6) signal removed data is also plotted.

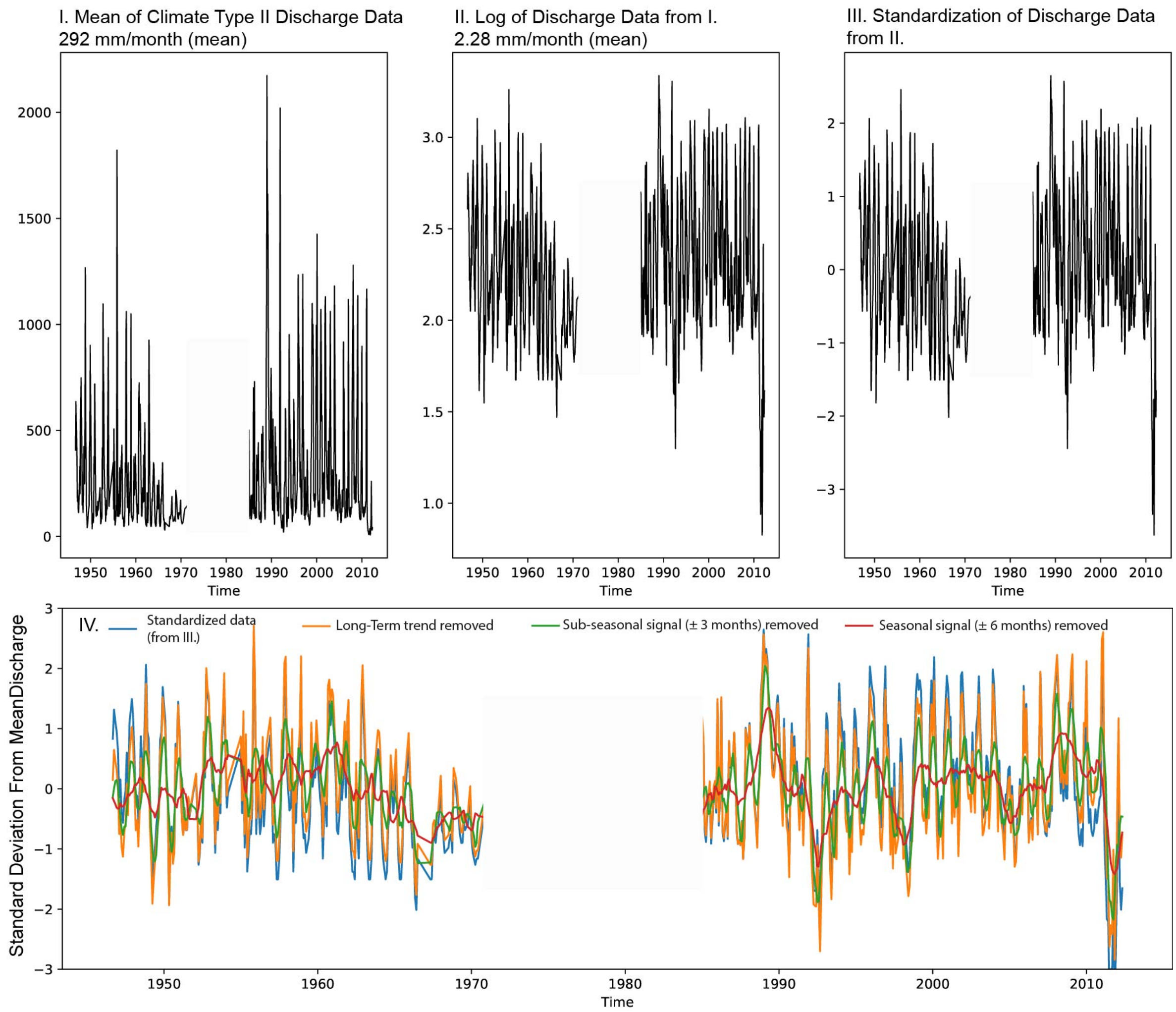

Figure S4. Data reduction steps for river discharge data that fall under Climate Type II I. Mean of area normalized discharge data in mm/month. II. Log of the mean area normalized discharge data. III. Standardized (interchangeable with scaled) discharge data around the log mean. This data is used to remove the long term trends (Supp. Figure. 4). IV. Standardized data plotted with data where long-term trends were removed using a polynomial fit. The sub-seasonal (±3) and seasonal (±6) signal removed data is also plotted.

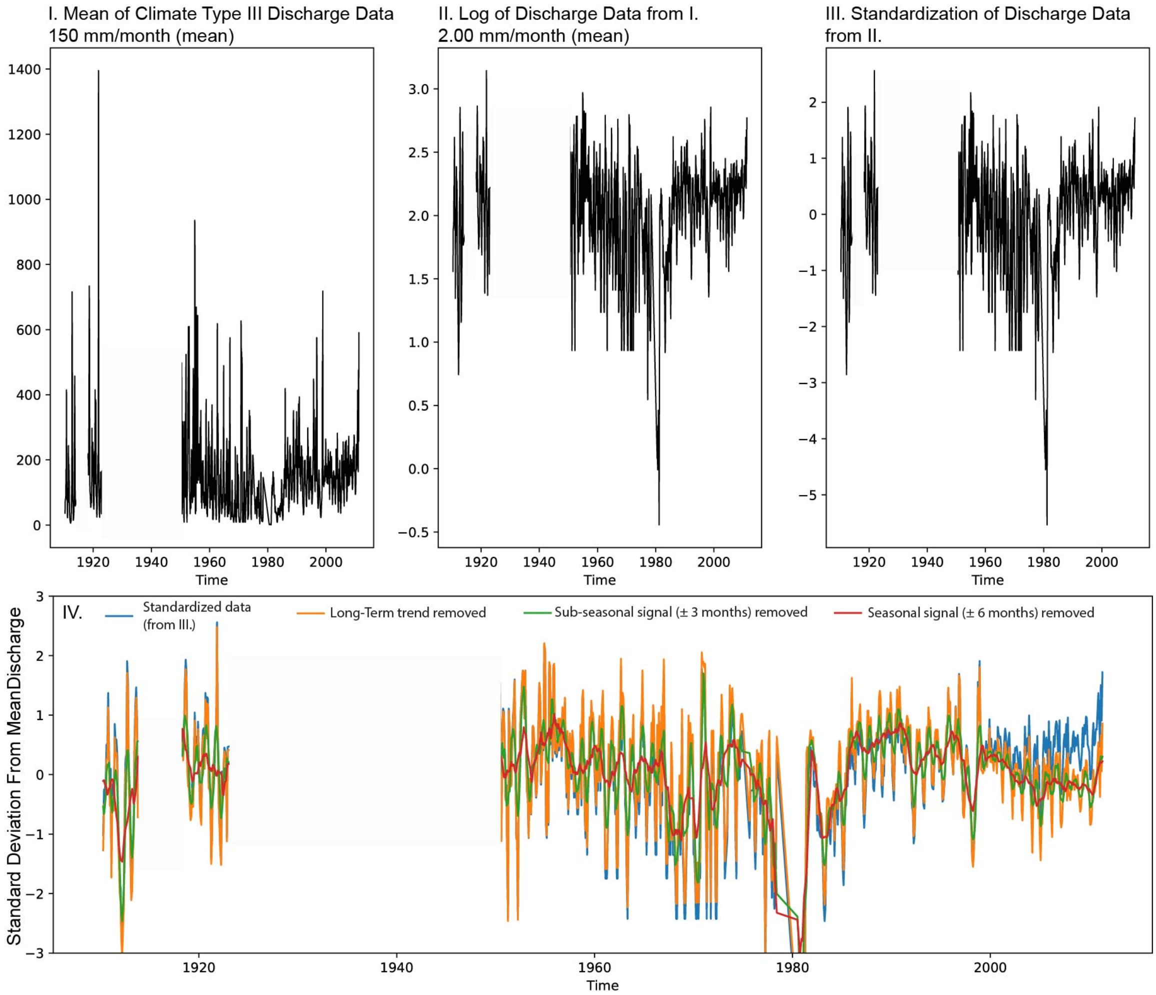

Figure S5. Data reduction steps for river discharge data that fall under Climate Type III I. Mean of area normalized discharge data in mm/month. II. Log of the mean area normalized discharge data. III. Standardized discharge data around the log mean. This data is used to remove the long term trends (Supp. Figure. 4). IV. Standardized data plotted with data where long-term trends were removed using a polynomial fit. The sub-seasonal (±3) and seasonal (±6) signal removed data is also plotted.

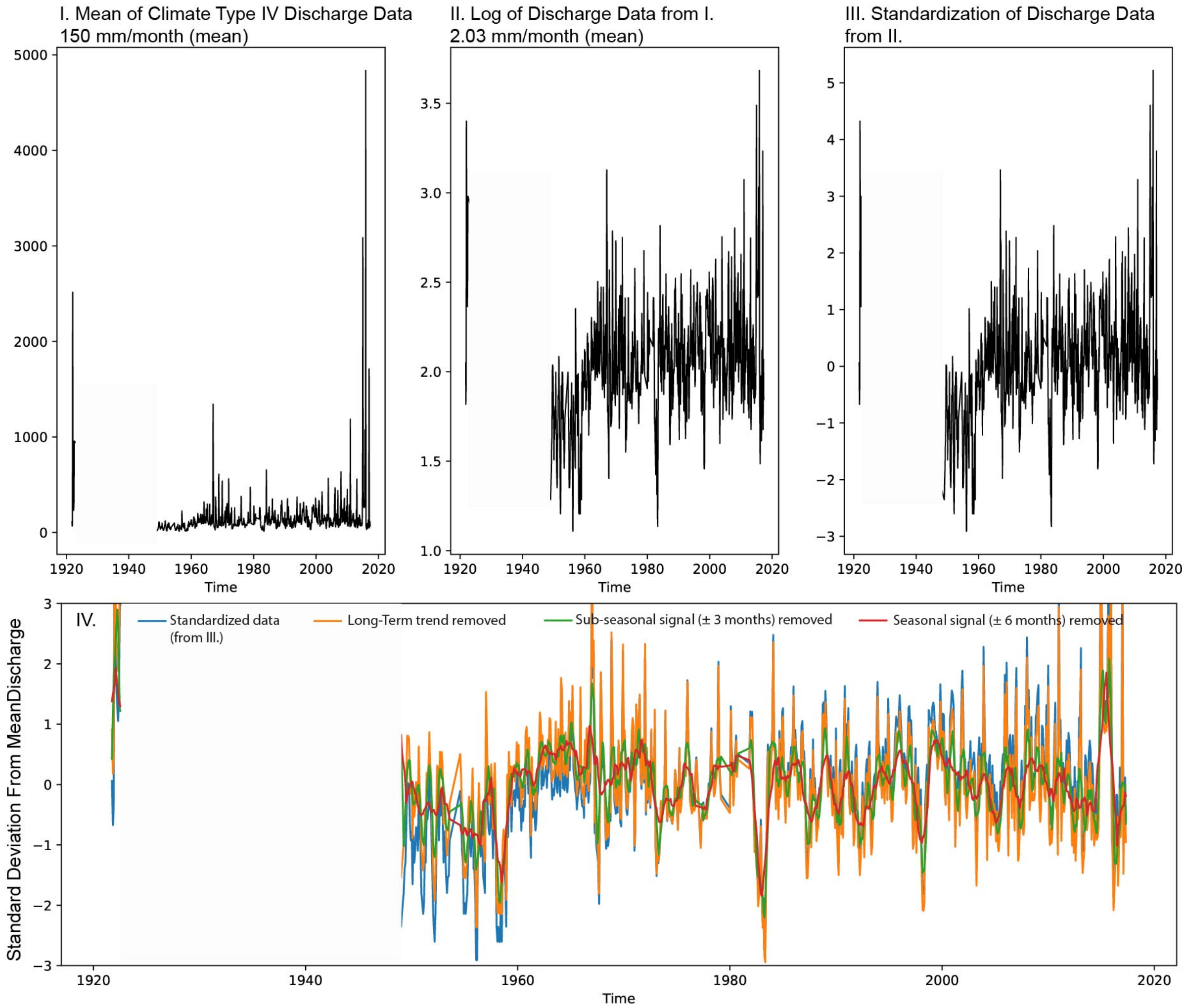

Figure S6. Data reduction steps for river discharge data that fall under Climate Type IV I. Mean of area normalized discharge data in mm/month. II. Log of the mean area normalized discharge data. III. Standardized discharge data around the log mean. This data is used to remove the long term trends (Supp. Figure. 4). IV. Standardized data plotted with data where long-term trends were removed using a polynomial fit. The sub-seasonal (±3) and seasonal (±6) signal removed data is also plotted.

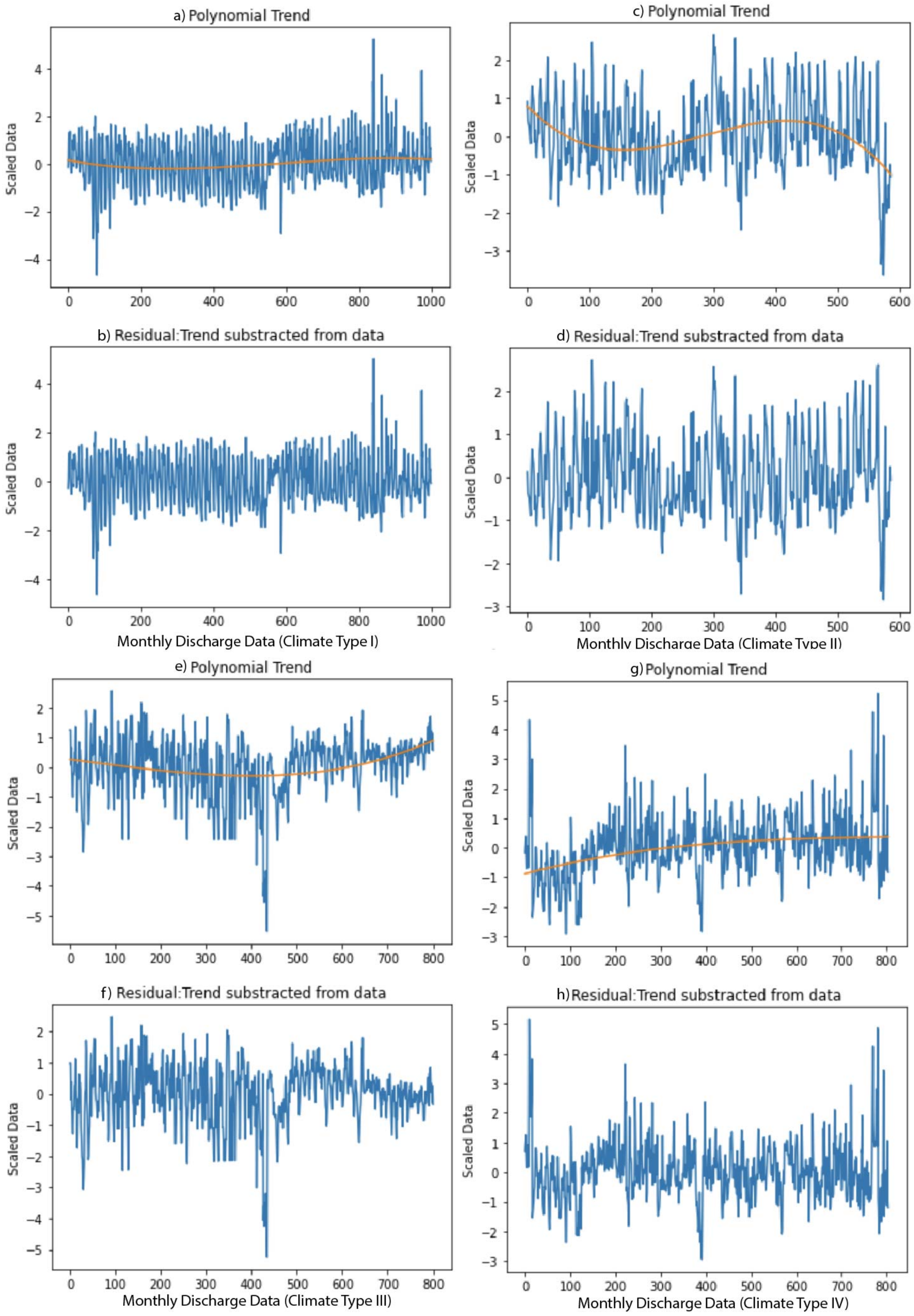

Figure S7. Subtracting long-term trends from standardized monthly discharge data for Climate Type I (a-b), II (c-d), III (e-f), IV (g-h). The orange line (in a,c,e,g) indicates the long-term trend using a polynomial fit (order =3). The residual discharge data (in b,d,f,h) is used for the remaining analyses.

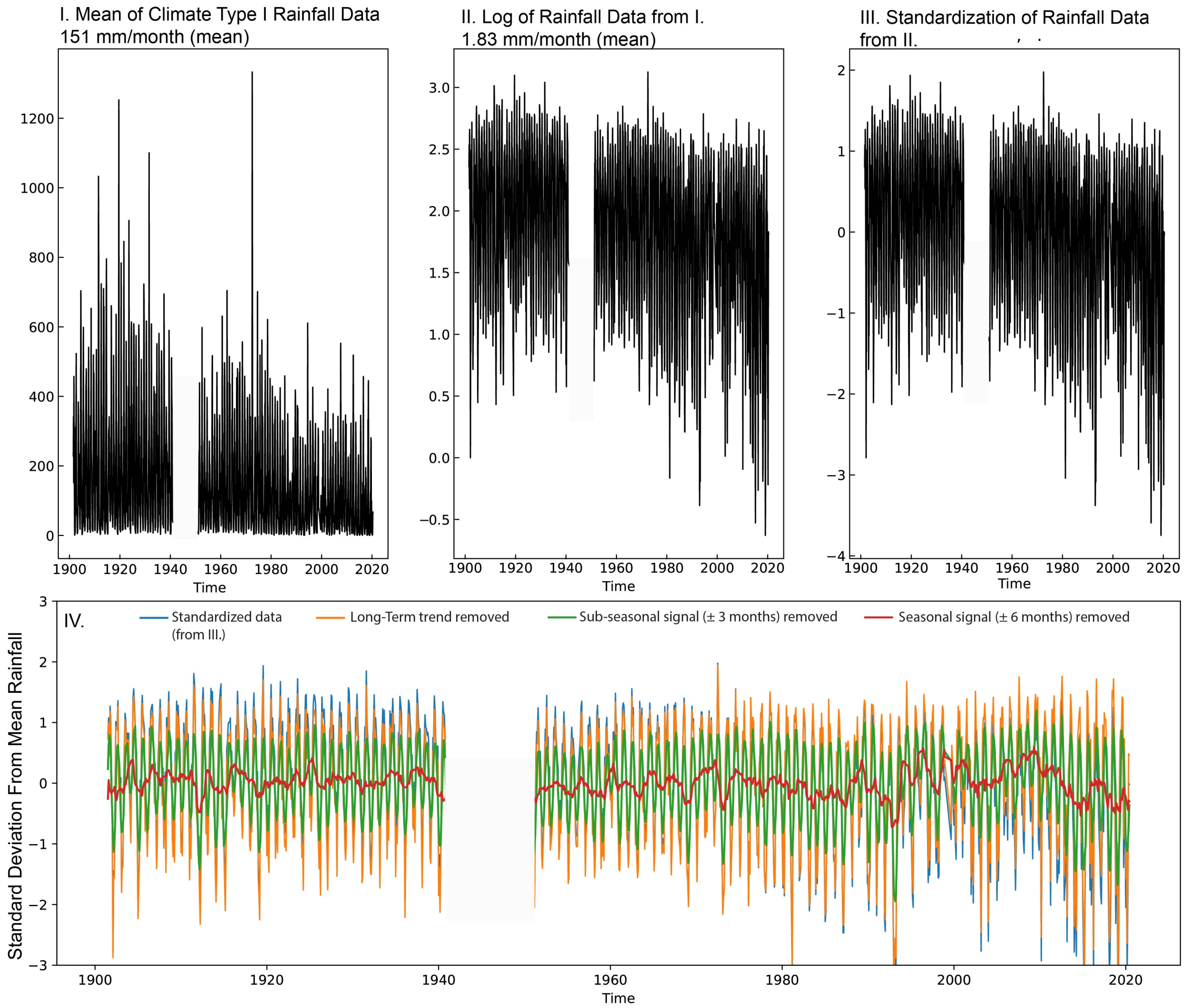

Figure S8. Data reduction steps for rainfall amount data that fall under Climate Type I I. Mean of rainfall amount data in mm/month. II. Log of the mean rainfall data. III. Standardized rainfall data around the log mean. This data is used to remove the long term trends (Supp. Figure. 6). IV. Standardized data plotted with data where long-term trends were removed using a polynomial fit. The sub-seasonal (±3) and seasonal (±6) signal removed data is also plotted.

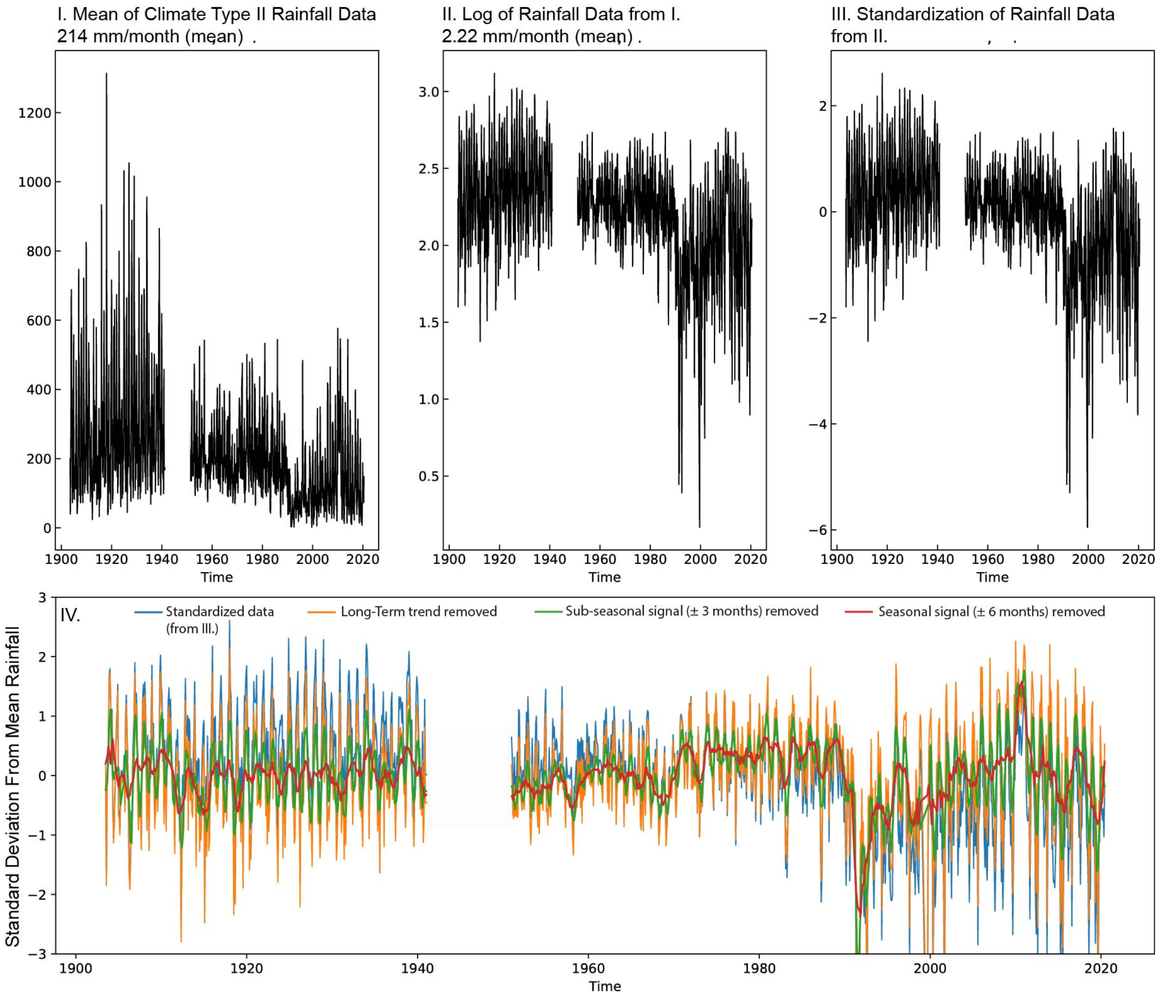

Figure S9. Data reduction steps for rainfall amount data that fall under Climate Type II I. Mean of rainfall amount data in mm/month. II. Log of the mean rainfall data. III. Standardized rainfall data around the log mean. This data is used to remove the long term trends (Supp. Figure. 6). IV. Standardized data plotted with data where long-term trends were removed using a polynomial fit. The sub-seasonal (±3) and seasonal (±6) signal removed data is also plotted.

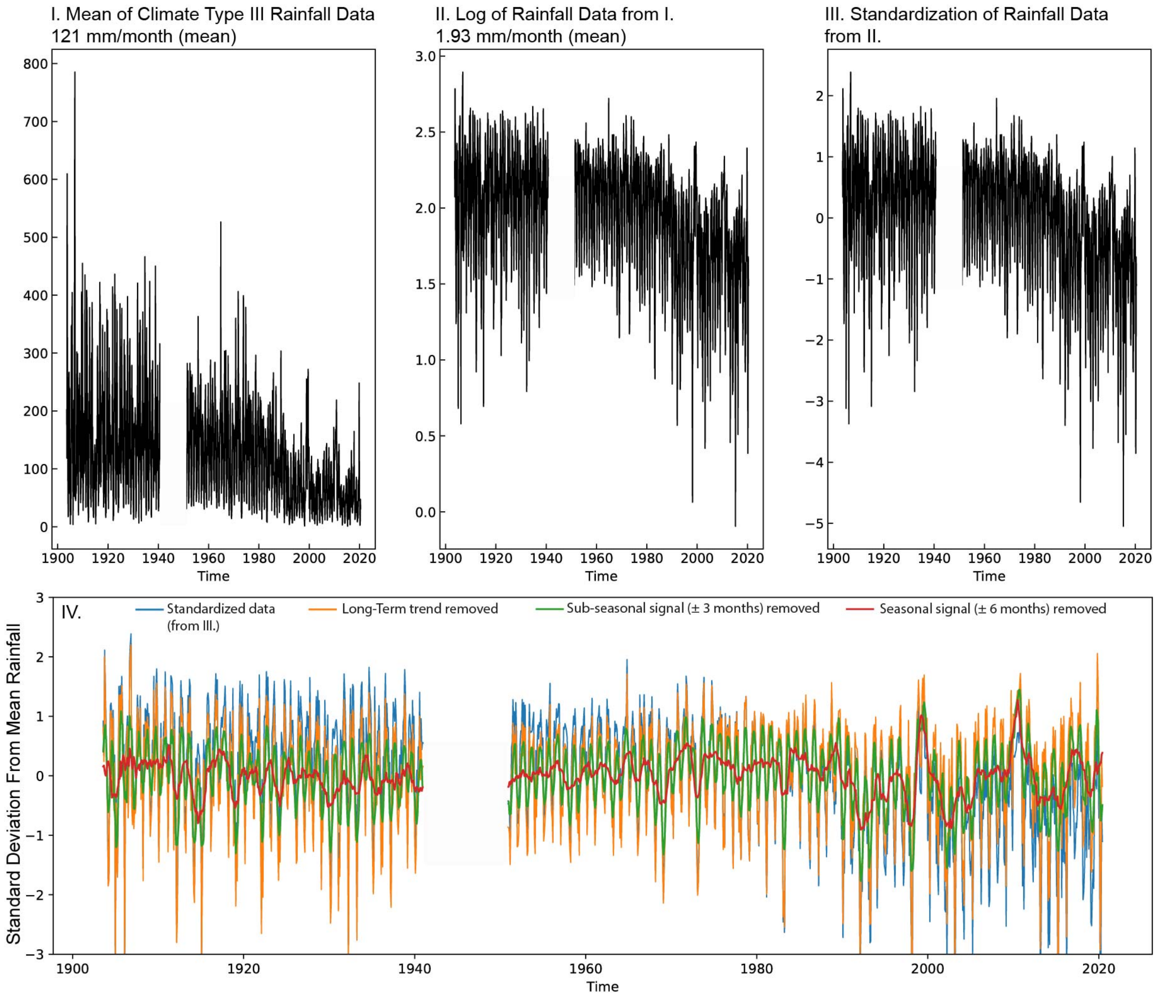

Figure S10. Data reduction steps for rainfall amount data that fall under Climate Type III I. Mean of rainfall amount data in mm/month. II. Log of the mean rainfall data. III. Standardized rainfall data around the log mean. This data is used to remove the long term trends (Supp. Figure. 6). IV. Standardized data plotted with data where long-term trends were removed using a polynomial fit. The sub-seasonal (±3) and seasonal (±6) signal removed data is also plotted.

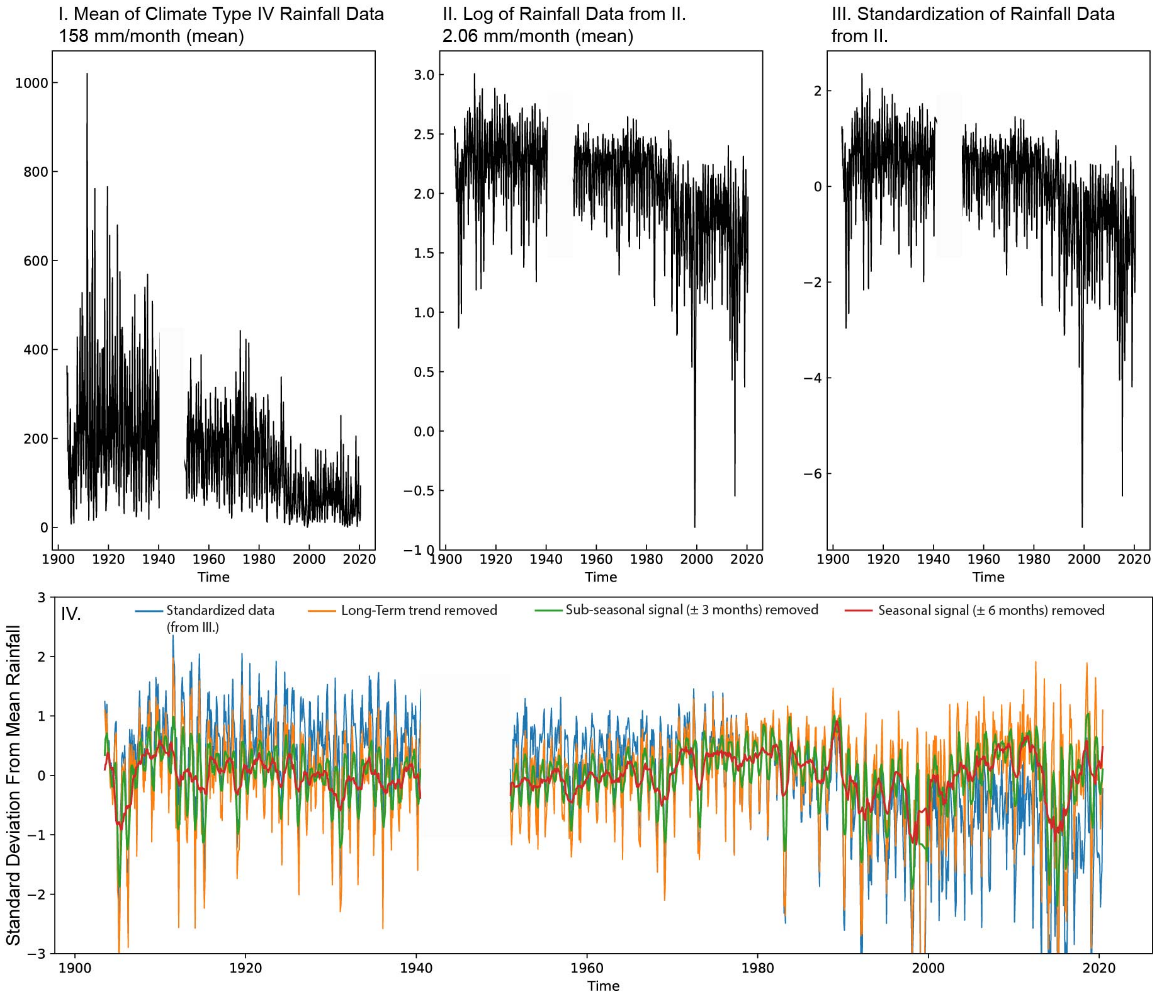

Figure S11. Data reduction steps for rainfall amount data that fall under Climate Type IV I. Mean of rainfall amount data in mm/month. II. Log of the mean rainfall data. III. Standardized rainfall data around the log mean. This data is used to remove the long term trends (Supp. Figure. 6). IV. Standardized data plotted with data where long-term trends were removed using a polynomial fit. The sub-seasonal (±3) and seasonal (±6) signal removed data is also plotted.

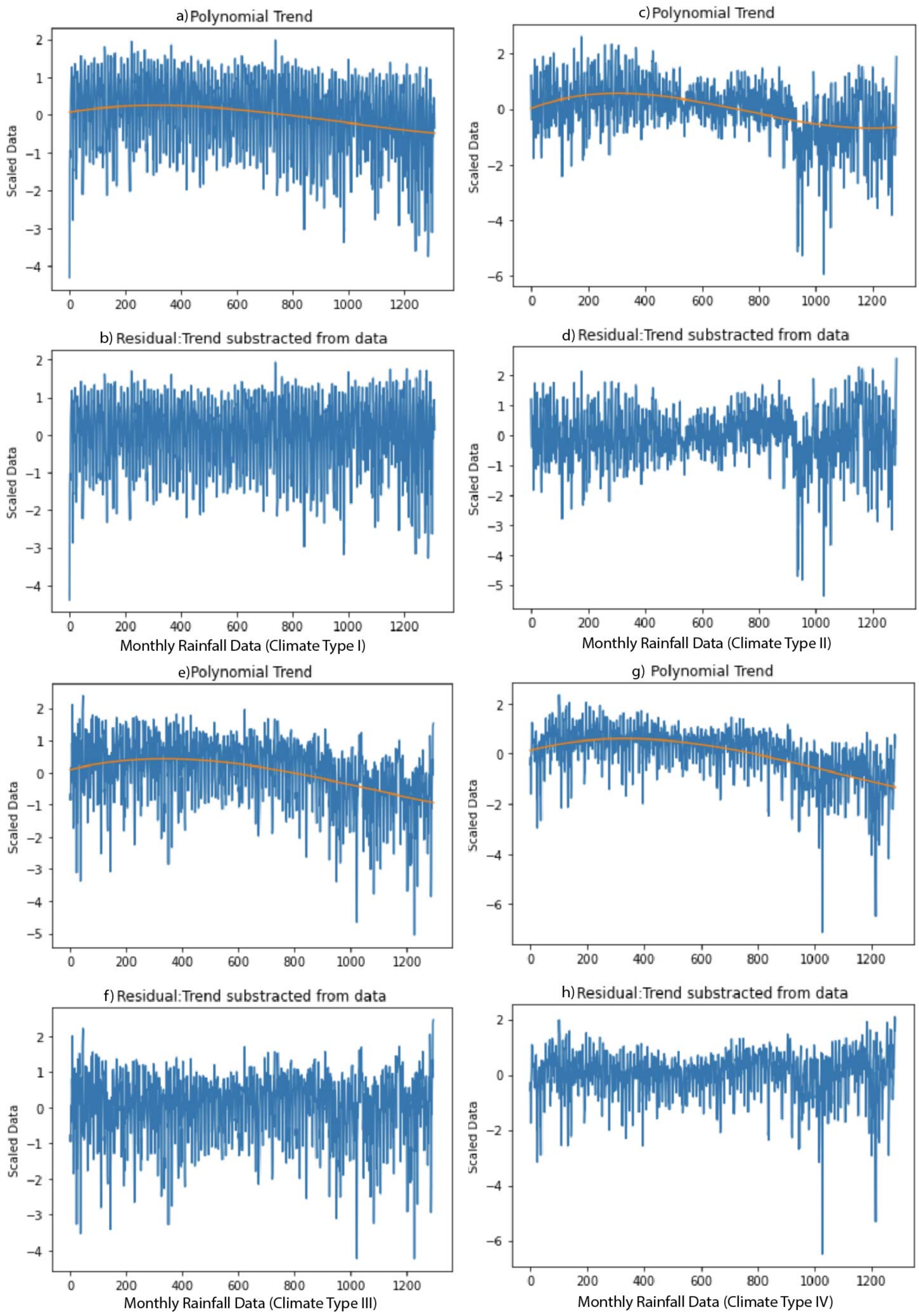

Figure S12. Subtracting long-term trends from scaled monthly rainfall data for Climate Type I (a-b), II (c-d), III (e-f), IV (g-h). The orange line (in a,c,e,g) indicates the long-term trend using a polynomial fit (order =3). The residual rainfall data (in b,d,f,h) is used for the remaining analyses.

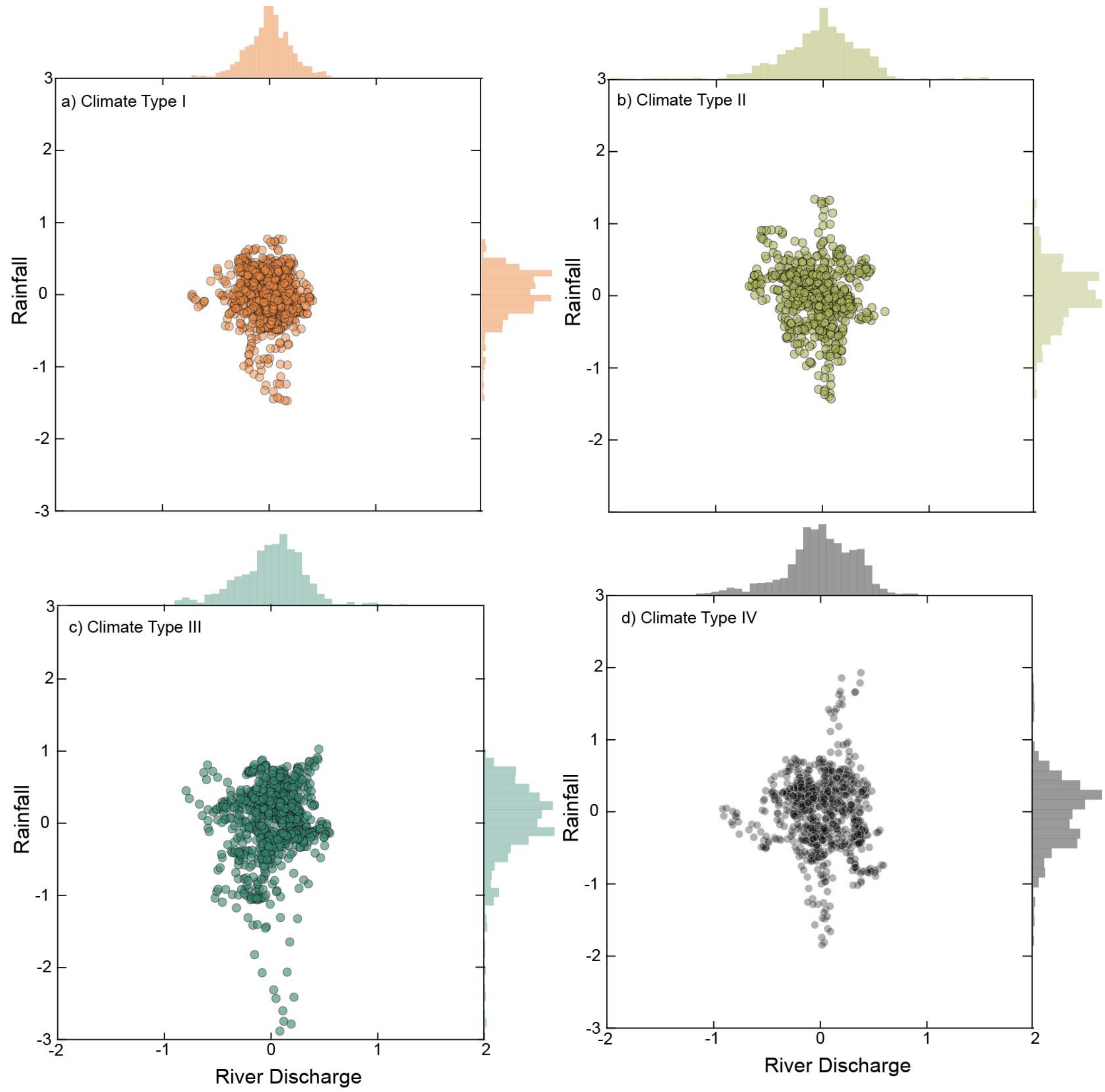

Figure S13. Bivariate plot of rainfall amount and river discharge data based on Climate Types.

Table S1. River discharge station name with Latitude and Longitude, Time Period Covered, Climate Type, and data source. Data from Ibarra et al. (2021); Williams and Gochoco (1924)

River Name	Latitude	Longitude	Years Covered	Climate Type	Dataset
Singalang River	17.56	120.64	1984-2015	1	used in Ibarra et al. (2021)
Antequera River	9.76	123.9	1984-2016	4	used in Ibarra et al. (2021)
Amparo River	10.10	124.91	1985-2007	4	used in Ibarra et al. (2021)
Hira-an River	11.26	124.67	1986-2010	4	used in Ibarra et al. (2021)
Leyte River	11.28	124.56	1985-2007	3	used in Ibarra et al. (2021)
Surigao River	9.73	125.50	1986-2010	2	used in Ibarra et al. (2021)
Bais River	9.88	124.14	1989-2015	4	used in Ibarra et al. (2021)
Lingayaon River	11.19	124.86	1957-1991	4	used in Ibarra et al. (2021)
Sapiniton River	11.32	124.82	1984-2010	4	used in Ibarra et al. (2021)
Laoag River	18.20	120.58	1921-1922;1984-2016	1	used in Ibarra et al. (2021) + BPW
Pared River	17.90	121.68	1983-1996	1	used in Ibarra et al. (2021)
Ganano River	16.69	121.55	1918-1921;1986-2001	1	used in Ibarra et al. (2021) + BPW
Magat River	16.58	121.25	1920-1922;1986-2002	1	used in Ibarra et al. (2021) + BPW
Camiling River	15.61	120.37	1985-2017	1	used in Ibarra et al. (2021)
Gumain River	14.91	120.56	1985-2001	1	used in Ibarra et al. (2021)
Rio Chico River	15.44	120.75	1985-2006	1	used in Ibarra et al. (2021)
San Juan River	14.21	121.15	1986-1999	4	used in Ibarra et al. (2021)
Pangalaan River	13.30	121.19	1989-1999	3	used in Ibarra et al. (2021)
Das-ay River	10.37	125.16	1987-2007	2	used in Ibarra et al. (2021)
Tukuran River	7.87	123.59	1986-2009	3	used in Ibarra et al. (2021)
Hijo River	7.39	125.83	1986-2016	4	used in Ibarra et al. (2021)
Cagayan River	8.39	124.61	1991-2004	4	used in Ibarra et al. (2021)
Davao River	7.09	125.59	1984-1999	4	used in Ibarra et al. (2021)
Allah River	6.67	124.56	1980-1994	3	used in Ibarra et al. (2021)
Agusan Canyon River	8.32	124.80	1986-2004	3	used in Ibarra et al. (2021)
Wawa River	8.81	125.70	1981-2010	4	used in Ibarra et al. (2021)
Buayan River	6.31	125.26	1986-2004	4	used in Ibarra et al. (2021)
Gasgas River	18.08	120.83	1978-1988	1	used in Ibarra et al. (2021)
Jalaur River	10.93	122.67	1909-13;1918-22;1976-88	3	used in Ibarra et al. (2021) + BPW
Padsan River	18.08	120.7	1946-1979	1	used in Ibarra et al. (2021)
Pampanga River	15.17	120.78	1946-1977	1	used in Ibarra et al. (2021)
Sipocot River	13.81	122.99	1946-1970	2	used in Ibarra et al. (2021)
Mambusao River	11.26	122.57	1919-1922;1950-1978	3	used in Ibarra et al. (2021) + BPW
Padada River	6.66	125.28	1949-1978	4	used in Ibarra et al. (2021)
Aloran River	8.42	123.82	1978-2003	3	used in Ibarra et al. (2021)
Cabacanan River	18.58	120.8	1979-2017	1	used in Ibarra et al. (2021)
Maragayap River	16.75	120.37	1908-09;1912;1919-22; 2004-17	1	used in Ibarra et al. (2021) + BPW
Abacan River	15.11	120.70	2004-2017	1	used in Ibarra et al. (2021)
Hibayog River	9.87	124.14	2004-2017	4	used in Ibarra et al. (2021)
Manaba River	9.63	124.13	2001-2016	4	used in Ibarra et al. (2021)
Gabayan River	9.84	124.45	1922; 2001-2017	4	used in Ibarra et al. (2021) + BPW
Bangkerohan River	10.34	124.83	1984-1990;2000-2009	4	used in Ibarra et al. (2021)
Borongan River	11.62	125.40	1990-2008	2	used in Ibarra et al. (2021)
Loom River	11.38	125.23	1986-2004	2	used in Ibarra et al. (2021)
Pagbanganan River	10.63	124.86	1984-2008	4	used in Ibarra et al. (2021)
Rizal River	11.38	124.90	1990-2008	4	used in Ibarra et al. (2021)
Tenani River	11.80	125.12	1985-2001	2	used in Ibarra et al. (2021)
Disakan River	8.48	123.04	1985-1991;1997-2000	4	used in Ibarra et al. (2021)
Kabasalan River	7.83	122.77	2002-2011	3	used in Ibarra et al. (2021)
Sindangan River	8.21	123.05	1990-2003	4	used in Ibarra et al. (2021)
Alubijid River	8.57	124.47	1991-2009	3	used in Ibarra et al. (2021)
Kipaliko River	7.60	125.68	2004-2016	4	used in Ibarra et al. (2021)
Banaue River	16.91	121.06	1987-1995;2005-2010	3	used in Ibarra et al. (2021)
Aciga River	9.26	125.57	2002-2015	2	used in Ibarra et al. (2021)
Agusan River	7.99	126.03	1921-22;1982;1984-87; 1989-2010	4	used in Ibarra et al. (2021) + BPW
Angat River	14.90	120.79	1909-1913;1918-1922	1	BPW
Suague River	10.94	122.51	1908-1913;1918-1922	1	BPW
Tigom River	10.76	122.54	1909-1913;1918-1922	1	BPW
Mariquina River	14.61	121.07	1912-1922	1	BPW
Aganao River	10.78	122.51	1910-1913;1918-1922	1	BPW
Talavera River	15.35	120.55	1911-1913;1918-1922	3	BPW

Table S2. Rainfall station name with with Latitude and Longitude, Time Period Covered, Climate Type, and data source. Data from Yatagai et al. (2012); Kubota et al. (2017); Lawrimore et al. (2011)

Rainfall Station	Latitude	Longitude	Years Covered	Climate Type	Dataset
Vigan	17.55	120.35	1903-40;1951-90; 1991-2020	1	PWB; APHRODITE; Modern
Tagbilaran	9.66	123.85	1903-40;1951-90;1991-2020	4	PWB; APHRODITE; Modern
Maasin City	10.13	124.86	1903-40;1951-90;1991-2020	4	PWB; APHRODITE; Modern
Surigao	9.78	125.48	1903-40;1951-90;1991-2020	2	PWB; APHRODITE; Modern
Laoag City	18.18	120.53	1951-90; 1991-2020	1	APHRODITE; Modern
Tuguegarao	17.63	121.75	1903-40;1951-90; 1991-2020	3	PWB; APHRODITE;Modern
Clark Intl	15.18	120.55	1951-90;1991-2020	1	APHRODITE; Modern
Cabanatuan	15.46	120.95	1951-90;1991-2018	1	APHRODITE; Modern
Ambulong	14.08	121.05	1903-40;1951-90;1991-2020	1	PWB; APHRODITE; Modern
Calapan	13.41	121.18	1951-90;1991-2020	3	APHRODITE; Modern
Cotobato	7.16	124.21	1951-90;1992-2020	3	APHRODITE; Modern
Dipolog	8.6	123.35	1951-90;1991-2020	4	APHRODITE; Modern
Gen Santos	6.11	125.18	1951-90;1991-2020	4	APHRODITE; Modern
Mactan	10.31	123.98	1951-90;1991-2020	3	APHRODITE; Modern
Daet	14.13	122.98	1951-90;1991-2020	4	APHRODITE; Modern
Lumbia	8.41	124.61	1991-2018	3	Modern
Davao	7.13	125.65	1903-40;1991-2020	4	PWB; Modern
Aparri	18.36	121.63	1903-40;1951-90;1991-2020	3	PWB; APHRODITE;Modern
Baguio City	16.4	120.6	1903-40;1951-90;1991-2020	4	PWB; APHRODITE; Modern
Borongan	11.66	125.45	1903-40;1951-90;2001-2020	2	PWB; APHRODITE; Modern
Daniel Romualdez	11.22	125.02	1951-90;1991-2020	4	APHRODITE; Modern
Iloilo	10.7	122.56	1903-40;1991-2011	1	PWB; Modern
Catbalogan	11.78	124.88	1903-40;1951-90;1991-2020	4	PWB; APHRODITE; Modern
Malaybalay	8.15	125.13	1951-90	4	APHRODITE
Casiguran	16.26	122.13	1951-90;1991-2020	2	APHRODITE; Modern
Hinatuan	8.36	126.33	1927-40:1951-90;1991-2020	2	PWB;APHRODITE; Modern
Manila	14.58	120.98	1903-40;1951-90;1991-2020	1	PWB; APHRODITE; Modern
Dumaguete	9.33	123.3	1903-40;1951-90;1991-2020	3	PWB; APHRODITE; Modern
Butuan	8.95	125.48	1901-40;1951-90;1991-2020	2	PWB; APHRODITE; Modern

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