



Supplement of

Decoding the architecture of drought: SHAP-enhanced insights into the climate forces reshaping the Sahel

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Table S1. Correlation coefficient (r) between climatic indices.

Correlation Coefficient (r)	SOI	PNA	NAO	NAO (Jones)	EPO	ONI	NTA	CAR	BEST	Nino-3	Nino1+2	Nino3+4	Nino4	IPWP	TNA	TSA	WHWP	WPI	QBO	PDO	PMM	North Pasific	NOI	Arctic Osc.	TNI	AMO	AMM	Solar Flux	Sahel P	GMT	GBI
SOI	1.00	-0.17	-0.01	0.02	-0.18	-0.73	-0.08	-0.13	-0.91	-0.42	-0.19	-0.62	-0.65	-0.04	-0.06	0.01	-0.24	-0.11	0.03	-0.39	-0.04	0.17	0.54	0.11	0.23	-0.01	0.15	-0.04	0.04	-0.10	-0.02
PNA	-0.17	1.00	0.03	-0.05	-0.01	0.17	0.16	0.14	0.18	0.08	-0.02	0.16	0.18	0.15	0.18	0.06	0.22	0.03	-0.02	0.34	-0.02	-0.36	-0.19	-0.21	-0.03	0.13	0.10	0.00	0.07	0.18	0.10
NAO	-0.01	0.03	1.00	0.55	0.03	0.00	-0.17	-0.10	0.00	-0.03	-0.09	0.02	0.07	0.00	-0.22	-0.05	-0.13	0.08	0.04	0.04	0.02	0.07	0.03	0.62	-0.01	-0.18	-0.19	0.07	-0.08	0.04	-0.21
NAO (Jones)	0.02	-0.05	0.55	1.00	-0.13	0.04	-0.14	-0.01	0.00	0.04	0.11	0.00	-0.03	-0.02	-0.19	-0.06	-0.11	0.05	0.05	0.01	0.01	-0.03	0.11	0.62	0.02	-0.13	-0.15	0.09	-0.07	0.01	-0.36
EPO	-0.18	-0.01	0.03	-0.13	1.00	0.21	0.00	-0.02	0.22	0.05	-0.02	0.16	0.23	0.00	0.00	-0.06	-0.01	-0.01	0.02	0.27	0.21	-0.09	-0.28	-0.14	-0.14	-0.06	-0.03	0.12	0.05	-0.02	0.05
ONI	-0.73	0.17	0.00	0.04	0.21	1.00	0.14	0.22	0.91	0.62	0.30	0.86	0.80	0.05	0.16	0.01	0.36	0.12	-0.02	0.42	-0.01	-0.14	-0.48	-0.11	-0.21	0.06	-0.12	0.09	0.01	0.06	0.01
NTA	-0.08	0.16	-0.17	-0.14	0.00	0.14	1.00	0.60	0.13	0.17	0.14	0.19	0.33	0.61	0.94	0.26	0.59	-0.04	0.02	0.21	0.07	-0.11	-0.11	-0.15	-0.23	0.73	0.74	-0.02	0.00	0.61	0.03
CAR	-0.13	0.14	-0.10	-0.01	-0.02	0.22	0.60	1.00	0.18	0.19	0.13	0.23	0.35	0.57	0.58	0.22	0.66	-0.03	0.00	0.18	0.08	-0.04	-0.04	-0.02	-0.23	0.71	0.38	0.04	0.12	0.58	0.01
BEST	-0.91	0.18	0.00	0.00	0.22	0.91	0.13	0.18	1.00	0.59	0.30	0.81	0.79	0.08	0.12	-0.01	0.34	0.12	-0.04	0.46	0.03	-0.15	-0.53	-0.12	-0.25	0.03	-0.14	0.05	-0.04	0.11	0.03
Nino-3	-0.42	0.08	-0.03	0.04	0.05	0.62	0.17	0.19	0.59	1.00	0.81	0.86	0.49	0.18	0.08	0.13	0.24	0.09	0.09	0.41	-0.18	-0.02	-0.30	-0.04	0.03	0.03	-0.17	0.02	-0.14	0.20	-0.06
Nino1+2	-0.19	-0.02	-0.09	0.11	-0.02	0.30	0.14	0.13	0.30	0.81	1.00	0.46	0.08	0.13	0.01	0.09	0.08	-0.02	0.15	0.27	-0.20	-0.31	-0.15	-0.06	0.24	-0.04	-0.12	0.03	-0.21	0.16	-0.45
Nino3+4	-0.62	0.16	0.02	0.00	0.16	0.86	0.19	0.23	0.81	0.86	0.46	1.00	0.82	0.18	0.16	0.10	0.35	0.14	0.01	0.46	-0.03	0.09	-0.42	-0.04	-0.22	0.08	-0.15	0.04	-0.04	0.19	0.18
Nino4	-0.65	0.18	0.07	-0.03	0.23	0.80	0.33	0.35	0.79	0.49	0.08	0.82	1.00	0.34	0.30	0.12	0.45	0.11	-0.05	0.45	0.25	0.07	-0.42	-0.01	-0.53	0.19	-0.01	0.07	0.00	0.33	0.25
IPWP	-0.04	0.15	0.00	-0.02	0.00	0.05	0.61	0.57	0.08	0.18	0.13	0.18	0.34	1.00	0.48	0.50	0.49	-0.03	-0.03	0.32	0.05	-0.07	-0.06	0.05	-0.28	0.37	0.19	-0.01	-0.10	0.86	0.01
TNA	-0.06	0.18	-0.22	-0.19	0.00	0.16	0.94	0.58	0.12	0.08	0.01	0.16	0.30	0.48	1.00	0.19	0.60	-0.02	0.01	0.14	0.05	-0.05	-0.09	-0.20	-0.20	0.78	0.82	0.00	0.09	0.48	0.13
TSA	0.01	0.06	-0.05	-0.06	-0.06	0.01	0.26	0.22	-0.01	0.13	0.09	0.10	0.12	0.50	0.19	1.00	0.20	-0.02	0.01	0.14	-0.08	-0.02	-0.02	0.02	-0.08	0.17	-0.24	-0.23	-0.14	0.49	0.02
WHWP	-0.24	0.22	-0.13	-0.11	-0.01	0.36	0.59	0.66	0.34	0.24	0.08	0.35	0.45	0.49	0.60	0.20	1.00	-0.03	0.02	0.25	-0.05	0.05	-0.20	-0.06	-0.04	0.61	0.32	-0.03	0.15	0.50	0.19
WPI	-0.11	0.03	0.08	0.05	-0.01	0.12	-0.04	-0.03	0.12	0.09	-0.02	0.14	0.11	-0.03	-0.02	-0.02	-0.03	1.00	-0.02	-0.02	-0.09	0.20	-0.02	0.13	0.00	-0.05	-0.02	-0.02	0.00	-0.04	0.12
QBO	0.03	-0.02	0.04	0.05	0.02	-0.02	0.02	0.00	-0.04	0.09	0.15	0.01	-0.05	-0.03	0.01	0.01	0.02	-0.02	1.00	-0.04	-0.06	-0.04	-0.02	0.06	0.11	0.00	0.02	-0.01	-0.01	0.03	-0.09
PDO	-0.39	0.34	0.04	0.01	0.27	0.42	0.21	0.18	0.46	0.41	0.27	0.46	0.45	0.32	0.14	0.14	0.25	-0.02	-0.04	1.00	0.23	-0.18	-0.34	-0.13	-0.14	0.02	-0.06	0.00	-0.11	0.27	0.05
PMM	-0.04	-0.02	0.02	0.01	0.21	-0.01	0.07	0.08	0.03	-0.18	-0.20	-0.03	0.25	0.05	0.05	-0.08	-0.05	-0.09	-0.06	0.23	1.00	-0.04	-0.11	-0.04	-0.61	-0.01	0.14	0.17	0.05	-0.01	-0.02
North Pasific	0.17	-0.36	0.07	-0.03	-0.09	-0.14	-0.11	-0.04	-0.15	-0.02	-0.31	0.09	0.07	-0.07	-0.05	-0.02	0.05	0.20	-0.04	-0.18	-0.04	1.00	0.23	0.32	-0.01	0.08	-0.04	-0.06	0.13	-0.10	0.65
NOI	0.54	-0.19	0.03	0.11	-0.28	-0.48	-0.11	-0.04	-0.53	-0.30	-0.15	-0.42	-0.42	-0.06	-0.09	-0.02	-0.20	-0.02	-0.02	-0.34	-0.11	0.23	1.00	0.22	0.09	0.00	0.07	-0.11	0.01	-0.06	-0.06
Arctic Osc.	0.11	-0.21	0.62	0.62	-0.14	-0.11	-0.15	-0.02	-0.12	-0.04	-0.06	-0.04	-0.01	0.05	-0.20	0.02	-0.06	0.13	0.06	-0.13	-0.04	0.32	0.22	1.00	0.00	-0.11	-0.19	0.04	-0.01	0.13	-0.21
TNI	0.23	-0.03	-0.01	0.02	-0.14	-0.21	-0.23	-0.23	-0.25	0.03	0.24	-0.22	-0.53	-0.28	-0.20	-0.08	-0.04	0.00	0.11	-0.14	-0.61	-0.01	0.09	0.00	1.00	-0.11	-0.10	-0.05	0.00	-0.24	-0.09
AMO	-0.01	0.13	-0.18	-0.13	-0.06	0.06	0.73	0.71	0.03	0.03	-0.04	0.08	0.19	0.37	0.78	0.17	0.61	-0.05	0.00	0.02	-0.01	0.08	0.00	-0.11	-0.11	1.00	0.66	-0.02	0.18	0.45	0.21
AMM	0.15	0.10	-0.19	-0.15	-0.03	-0.12	0.74	0.38	-0.14	-0.17	-0.12	-0.15	-0.01	0.19	0.82	-0.24	0.32	-0.02	0.02	-0.06	0.14	-0.04	0.07	-0.19	-0.10	0.66	1.00	0.10	0.13	0.20	0.07
Solar Flux	-0.04	0.00	0.07	0.09	0.12	0.09	-0.02	0.04	0.05	0.02	0.03	0.04	0.07	-0.01	0.00	-0.23	-0.03	-0.02	-0.01	0.00	0.17	-0.06	-0.11	0.04	-0.05	-0.02	0.10	1.00	0.00	-0.07	-0.09
Sahel P	0.04	0.07	-0.08	-0.07	0.05	0.01	0.00	0.12	-0.04	-0.14	-0.21	-0.04	0.00	-0.10	0.09	-0.14	0.15	0.00	-0.01	-0.11	0.05	0.13	0.01	-0.01	0.00	0.18	0.13	0.00	1.00	-0.08	0.21
GMT	-0.10	0.18	0.04	0.01	-0.02	0.06	0.61	0.58	0.11	0.20	0.16	0.19	0.33	0.86	0.48	0.49	0.50	-0.04	0.03	0.27	-0.01	-0.10	-0.06	0.13	-0.24	0.45	0.20	-0.07	-0.08	1.00	0.00
GBI	-0.02	0.10	-0.21	-0.36	0.05	0.01	0.03	0.01	0.03	-0.06	-0.45	0.18	0.25	0.01	0.13	0.02	0.19	0.12	-0.09	0.05	-0.02	0.65	-0.06	-0.21	-0.09	0.21	0.07	-0.09	0.21	0.00	1.00

Table S2. P-value of the correlation between climatic indices.

p-value	SOI	PNA	NAO	NAO (Jones)	EPO	ONI	NTA	CAR	BEST	Nino-3	Nino1+2	Nino3+4	Nino4	IPWP	TNA	TSA	WHWP	WPI	QBO	PDO	PMM	North Pasific	NOI	Arctic Osc.	TNI	AMO	AMM	Solar Flux	Sahel P	GMT	GBI
-value	1.00	≤0.05	0.87	0.67	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.22	0.08	0.68	≤0.05	≤0.05	0.43	≤0.05	0.26	≤0.05	≤0.05	≤0.05	≤0.05	0.21	0.29	≤0.05	0.66		
PNA	≤0.05	1.00	0.37	0.13	0.80	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.52	≤0.05	≤0.05	≤0.05	0.07	≤0.05	≤0.05	0.47	0.48	≤0.05	0.62	≤0.05	≤0.05	≤0.05	0.33	≤0.05	≤0.05	0.95	≤0.05	≤0.05	≤0.05
NAO	0.87	0.37	1.00	≤0.05	0.36	0.91	≤0.05	≤0.05	0.96	0.39	≤0.05	0.54	0.07	0.95	≤0.05	0.20	≤0.05	≤0.05	0.21	0.23	0.58	≤0.05	0.37	≤0.05	0.75	≤0.05	≤0.05	0.05	≤0.05	0.27	≤0.05
NAO (Jones)	0.67	0.13	≤0.05	1.00	≤0.05	0.32	≤0.05	0.77	1.00	0.24	≤0.05	0.98	0.47	0.48	≤0.05	0.10	≤0.05	0.14	0.17	0.84	0.81	0.37	≤0.05	≤0.05	0.48	≤0.05	≤0.05	≤0.05	0.05	0.84	≤0.05
EPO	≤0.05	0.80	0.36	≤0.05	1.00	≤0.05	0.97	0.64	≤0.05	0.14	0.48	≤0.05	≤0.05	0.98	0.89	0.10	0.81	0.78	0.51	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.08	0.43	≤0.05	0.16	0.53	0.14	
ONI	≤0.05	≤0.05	0.91	0.32	≤0.05	1.00	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.14	≤0.05	0.88	≤0.05	≤0.05	0.48	≤0.05	0.87	≤0.05	≤0.05	≤0.05	0.10	≤0.05	≤0.05	0.84	0.09	0.83	
NTA	≤0.05	≤0.05	≤0.05	≤0.05	0.97	≤0.05	1.00	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.24	0.51	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.49	0.94	≤0.05	0.38	
CAR	≤0.05	≤0.05	≤0.05	0.77	0.64	≤0.05	≤0.05	1.00	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.34	0.89	≤0.05	≤0.05	0.29	0.22	0.64	≤0.05	≤0.05	≤0.05	0.31	≤0.05	≤0.05	0.75
BEST	≤0.05	≤0.05	0.96	1.00	≤0.05	≤0.05	≤0.05	≤0.05	1.00	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.74	≤0.05	≤0.05	0.31	≤0.05	0.37	≤0.05	≤0.05	≤0.05	0.45	≤0.05	0.14	0.22	≤0.05	0.45	
Nino-3	≤0.05	≤0.05	0.39	0.24	0.14	≤0.05	≤0.05	≤0.05	≤0.05	1.00	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.67	≤0.05	0.32	0.39	0.40	≤0.05	0.53	≤0.05	≤0.05	0.07
Nino1+2	≤0.05	0.52	≤0.05	≤0.05	0.48	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	1.00	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.63	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.09	≤0.05	0.26	≤0.05	0.45	≤0.05	≤0.05	≤0.05
Nino3+4	≤0.05	≤0.05	0.54	0.98	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	1.00	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.76	≤0.05	0.39	≤0.05	≤0.05	≤0.05	0.30	≤0.05	≤0.05	≤0.05	0.24	0.22	≤0.05	≤0.05
Nino4	≤0.05	≤0.05	0.07	0.47	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	1.00	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.19	≤0.05	≤0.05	≤0.05	≤0.05	0.79	≤0.05	≤0.05	0.85	≤0.05	0.95	≤0.05	≤0.05
IPWP	0.22	≤0.05	0.95	0.48	0.98	0.14	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	1.00	≤0.05	≤0.05	≤0.05	0.39	0.43	≤0.05	0.16	0.06	0.10	0.18	≤0.05	≤0.05	≤0.05	0.68	≤0.05	≤0.05	0.68
TNA	0.08	≤0.05	≤0.05	≤0.05	0.89	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.89	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.50	0.76	≤0.05	0.15	0.15	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.93	≤0.05	≤0.05	≤0.05
TSA	0.68	0.07	0.20	0.10	0.10	0.88	≤0.05	≤0.05	0.74	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	1.00	≤0.05	0.62	0.75	≤0.05	≤0.05	0.51	0.55	0.54	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.50
WHWP	≤0.05	≤0.05	≤0.05	≤0.05	0.81	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	1.00	0.44	0.54	≤0.05	0.15	0.19	≤0.05	0.07	0.24	≤0.05	≤0.05	0.41	≤0.05	≤0.05	≤0.05
WPI	≤0.05	0.47	≤0.05	0.14	0.78	≤0.05	0.24	0.34	≤0.05	≤0.05	0.63	≤0.05	≤0.05	0.39	0.50	0.62	0.44	1.00	0.57	0.64	≤0.05	≤0.05	0.60	≤0.05	0.97	0.17	0.57	0.60	0.97	0.30	≤0.05
QBO	0.43	0.48	0.21	0.17	0.51	0.48	0.51	0.89	0.31	≤0.05	≤0.05	0.76	0.19	0.43	0.76	0.75	0.54	0.57	1.00	0.31	0.10	0.22	0.61	0.09	≤0.05	0.92	0.57	0.76	0.86	0.44	≤0.05
PDO	≤0.05	≤0.05	0.23	0.84	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.64	0.31	1.00	≤0.05	≤0.05	≤0.05	≤0.05	0.63	0.07	0.96	≤0.05	≤0.05	0.15	
PMM	0.26	0.62	0.58	0.81	≤0.05	0.87	≤0.05	≤0.05	0.37	≤0.05	≤0.05	0.39	≤0.05	0.16	0.15	≤0.05	0.15	≤0.05	0.10	≤0.05	1.00	0.30	≤0.05	0.28	≤0.05	0.86	≤0.05	≤0.05	0.15	0.83	0.60
North Pasific	≤0.05	≤0.05	≤0.05	0.37	≤0.05	≤0.05	≤0.05	0.29	≤0.05	0.67	≤0.05	≤0.05	≤0.05	0.06	0.15	0.51	0.19	≤0.05	0.22	≤0.05	0.30	1.00	≤0.05	≤0.05	0.79	≤0.05	0.29	0.07	≤0.05	≤0.05	≤0.05
NOI	≤0.05	≤0.05	0.37	≤0.05	≤0.05	≤0.05	≤0.05	0.22	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.10	≤0.05	0.55	≤0.05	0.60	0.61	≤0.05	≤0.05	≤0.05	1.00	≤0.05	≤0.05	0.91	0.06	≤0.05	0.86	0.07	0.09
Arctic Osc.	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.64	≤0.05	0.32	0.09	0.30	0.79	0.18	≤0.05	0.54	0.07	≤0.05	0.09	≤0.05	0.28	≤0.05	≤0.05	1.00	0.93	≤0.05	≤0.05	0.29	0.68	≤0.05	≤0.05
TNI	≤0.05	0.33	0.75	0.48	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.39	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.24	0.97	≤0.05	≤0.05	≤0.05	0.79	≤0.05	0.93	1.00	≤0.05	≤0.05	0.15	0.97	≤0.05	≤0.05
AMO	0.81	≤0.05	≤0.05	≤0.05	0.08	0.10	≤0.05	≤0.05	0.45	0.40	0.26	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.17	0.92	0.63	0.86	≤0.05	0.91	≤0.05	≤0.05	1.00	≤0.05	0.63	≤0.05	≤0.05	≤0.05
AMM	≤0.05	≤0.05	≤0.05	≤0.05	0.43	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.85	≤0.05	≤0.05	≤0.05	≤0.05	0.57	0.57	0.07	≤0.05	0.29	0.06	≤0.05	≤0.05	≤0.05	1.00	≤0.05	≤0.05	≤0.05	
Solar Flux	0.21	0.95	0.05	≤0.05	≤0.05	≤0.05	0.49	0.31	0.14	0.53	0.45	0.24	≤0.05	0.68	0.93	≤0.05	0.41	0.60	0.76	0.96	≤0.05	0.07	≤0.05	0.29	0.15	0.63	≤0.05	1.00	0.96	≤0.05	≤0.05
Sahel P	0.29	≤0.05	≤0.05	0.05	0.16	0.84	0.94	≤0.05	0.22	≤0.05	≤0.05	0.22	0.95	≤0.05	≤0.05	≤0.05	≤0.05	0.97	0.86	≤0.05	0.15	≤0.05	0.86	0.68	0.97	≤0.05	≤0.05	0.96	1.00	≤0.05	≤0.05
GMT	≤0.05	≤0.05	0.27	0.84	0.53	0.09	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.30	0.44	≤0.05	0.83	≤0.05	0.07	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	1.00	0.96
GBI	0.66	≤0.05	≤0.05	≤0.05	0.14	0.83	0.38	0.75	0.45	0.07	≤0.05	≤0.05	≤0.05	0.68	≤0.05	0.50	≤0.05	≤0.05	≤0.05	0.15	0.60	≤0.05	0.09	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	≤0.05	0.96	1.00

Table S3. Mean, maximum, minimum values, standard deviation of the correlations, and mean of the absolute correlations, calculated between SPEI-12 gridded data and climatic indices. The color bar ranges from red (negative correlations) to blue (positive correlations) and from green (lower standard deviation) to yellow (higher standard deviation).

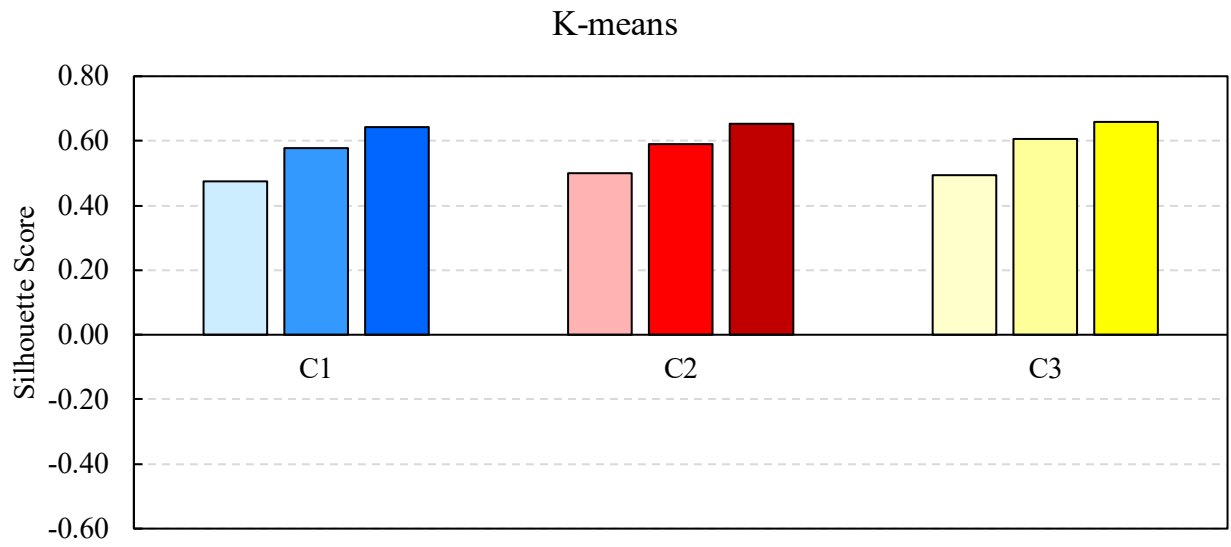
Correlation coefficient (r)	Mean	Max	Min	Dev.st	Mean of r
AMM	0.12	0.39	-0.34	0.11	0.13
AMO	0.06	0.40	-0.59	0.16	0.14
Arctic Osc.	-0.02	0.15	-0.15	0.04	0.04
BEST	-0.11	0.09	-0.26	0.06	0.11
CAR	-0.07	0.25	-0.61	0.14	0.12
EPO	0.00	0.11	-0.11	0.04	0.03
GBI	0.00	0.05	-0.08	0.02	0.01
GMT	-0.33	0.01	-0.76	0.11	0.33
IPWP	-0.39	-0.08	-0.71	0.10	0.39
NAO	-0.03	0.08	-0.12	0.04	0.04
NAO (Jones)	0.03	0.13	-0.06	0.03	0.03
Nino1+2	-0.07	0.02	-0.14	0.03	0.07
Nino-3	-0.11	0.04	-0.21	0.04	0.11
Nino3+4	-0.12	0.07	-0.28	0.05	0.12
Nino4	-0.20	0.00	-0.37	0.06	0.20
NOI	0.08	0.20	-0.11	0.05	0.08
North Pasific	0.05	0.10	-0.03	0.02	0.05
NTA	-0.15	0.18	-0.61	0.11	0.16
ONI	-0.06	0.15	-0.26	0.06	0.07
PDO	-0.23	0.10	-0.42	0.09	0.24
PMM	-0.01	0.16	-0.21	0.05	0.04
PNA	-0.07	0.03	-0.19	0.03	0.07
QBO	-0.02	0.14	-0.19	0.06	0.05
Sahel P	0.22	0.35	-0.06	0.06	0.22
SOI	0.10	0.24	-0.08	0.06	0.11
Solar Flux	0.05	0.26	-0.22	0.07	0.07
TNA	-0.07	0.23	-0.55	0.12	0.11
TNI	0.15	0.30	-0.04	0.05	0.15
TSA	-0.33	-0.05	-0.54	0.08	0.33
WHWP	-0.16	0.07	-0.49	0.09	0.16
WPI	0.00	0.10	-0.08	0.03	0.02

Table S4. Output accuracy of the Random Forest model. The color bar ranges from red (low values) to green (high values).

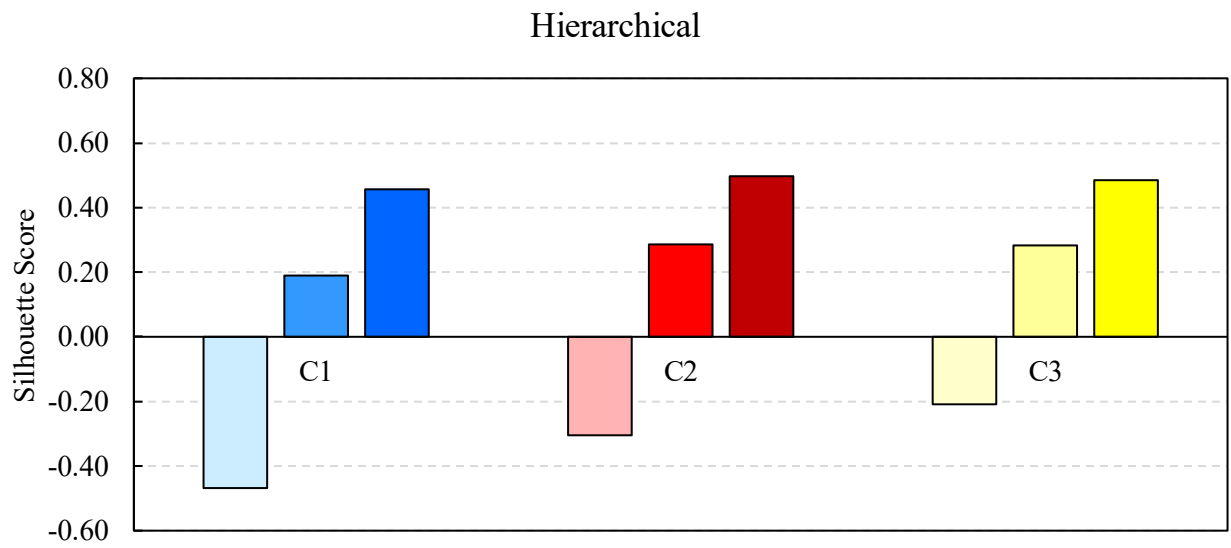
Clusters	precision	recall	f1-score	support
C1	1	0.97	0.985	33
C2	0.964	1	0.982	54
C3	1	0.978	0.989	46
accuracy			0.985	133
macro average	0.988	0.983	0.985	133
weighted average	0.985	0.985	0.985	133
Overall Random Forest Accuracy	0.985			

Table S5. SHAP Feature Importance Ranking with Confidence Intervals. The color bar ranges from red (low values) to green (high values).

Classe	Feature	Mean Absolute SHAP values	Lower 95% Confidence Interval	Upper 95% Confidence Interval
C1	AMO	0.088	0.079	0.098
	CAR	0.072	0.064	0.081
	TNA	0.059	0.051	0.066
	WHWP	0.051	0.045	0.057
	NTA	0.042	0.038	0.048
	AMM	0.033	0.029	0.037
	Sahel P	0.013	0.011	0.014
	PDO	0.009	0.008	0.011
	GMT	0.006	0.005	0.006
	IPWP	0.002	0.002	0.002
	TSA	0.002	0.002	0.002
C2	AMO	0.096	0.091	0.101
	NTA	0.084	0.079	0.088
	CAR	0.077	0.072	0.081
	TNA	0.067	0.063	0.072
	WHWP	0.061	0.056	0.066
	IPWP	0.029	0.026	0.033
	AMM	0.027	0.025	0.030
	GMT	0.023	0.020	0.027
	Sahel P	0.014	0.013	0.016
	PDO	0.009	0.008	0.011
	TSA	0.007	0.006	0.008
C3	NTA	0.102	0.094	0.109
	AMO	0.080	0.073	0.087
	WHWP	0.072	0.067	0.078
	CAR	0.061	0.057	0.066
	TNA	0.059	0.055	0.064
	IPWP	0.030	0.027	0.033
	GMT	0.027	0.024	0.030
	AMM	0.012	0.011	0.014
	TSA	0.006	0.006	0.007
	Sahel P	0.004	0.003	0.004
	PDO	0.002	0.002	0.002



(a)



(b)

Figure S1. Minimum, mean and maximum Silhouette Score for: K-means (a); Hierarchical (b).