APPENDICES

(SODECOTON, 2022a)

Exploration of the statistical relationships between rainfall indices and cotton yields in northern Cameroon, to strengthen the resilience of farmers to climate change.

By Clara KNOPS

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Appendix 1: P-value results of paired t-test (red quadrants mark statistically non-significant differences between variogram models with p>0.05)

MAE	Exponential	Circular	Spherical	SuperSpherical
Exponential				
Circular	8.2E-06			
Spherical	1.5E-06	2.7E-01		
SuperSpherical	1.3E-09	3.3E-01	5.2E-01	
ME	Exponential	Circular	Spherical	SuperSpherical
Exponential				
Circular	8.7E-01			
Spherical	1.7E-01	5.9E-02		
SuperSpherical	4.7E-02	5.8E-02	6.1E-01	
r2	Exponential	Circular	Spherical	SuperSpherical
Exponential				
Circular	3.7E-10			
Spherical	1.8E-12	2.4E-01		
SuperSpherical	4.5E-01	6.0E-10	1.7E-11	
RMSE	Exponential	Circular	Spherical	SuperSpherical
Exponential				
Circular	4.0E-05			
Spherical	7.7E-09	1.5E-01		
SuperSpherical	6.9E-01	7.6E-06	4.9E-10	

Appendix 2: Spatial distribution of seasonal rainfall indices
based on 20-year (1991-2010) averages
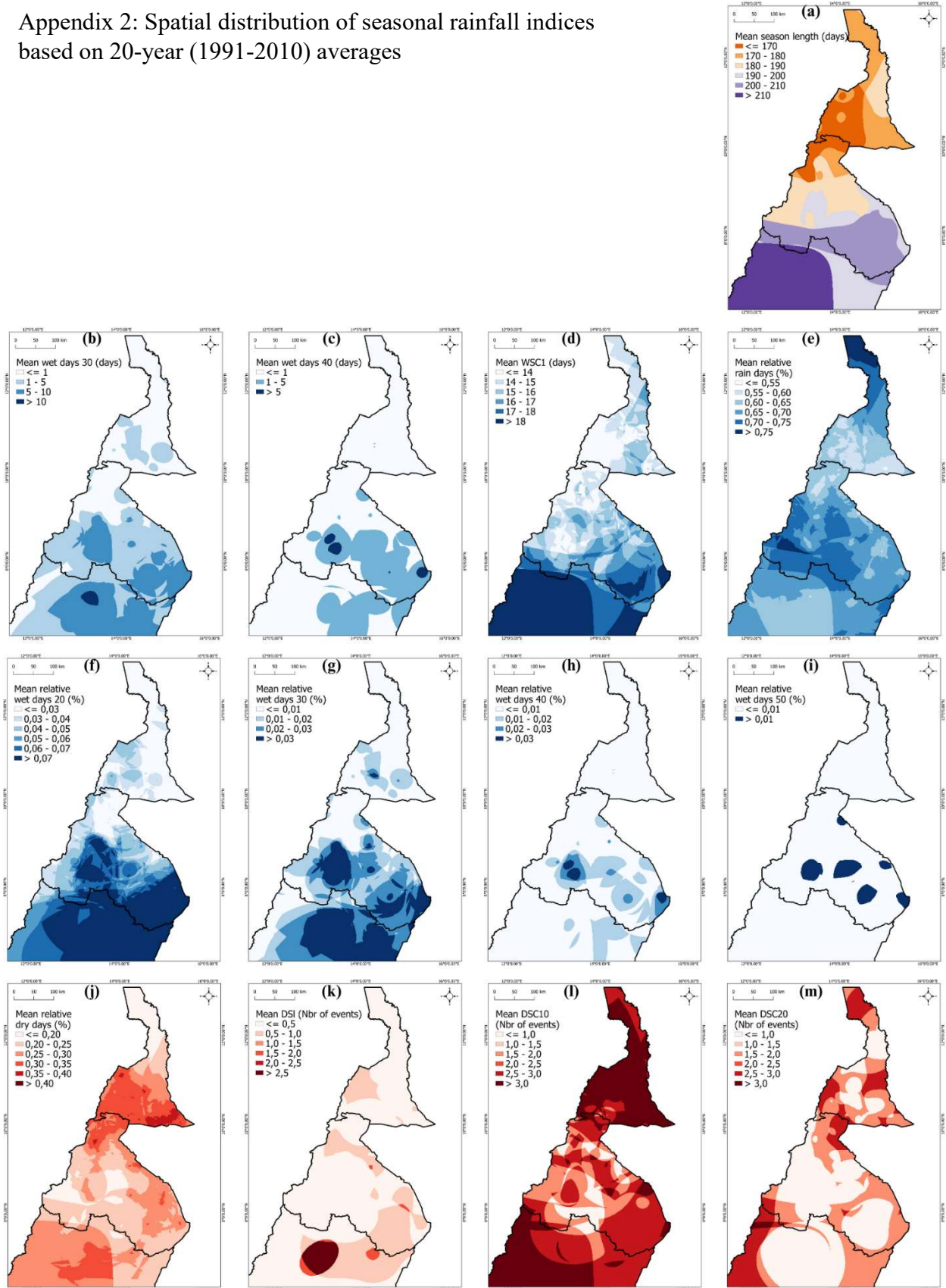
Appendix 3: Spatial distribution of seasonal rainfall indices based on 20-year (1991-2010) standard deviations (Std)
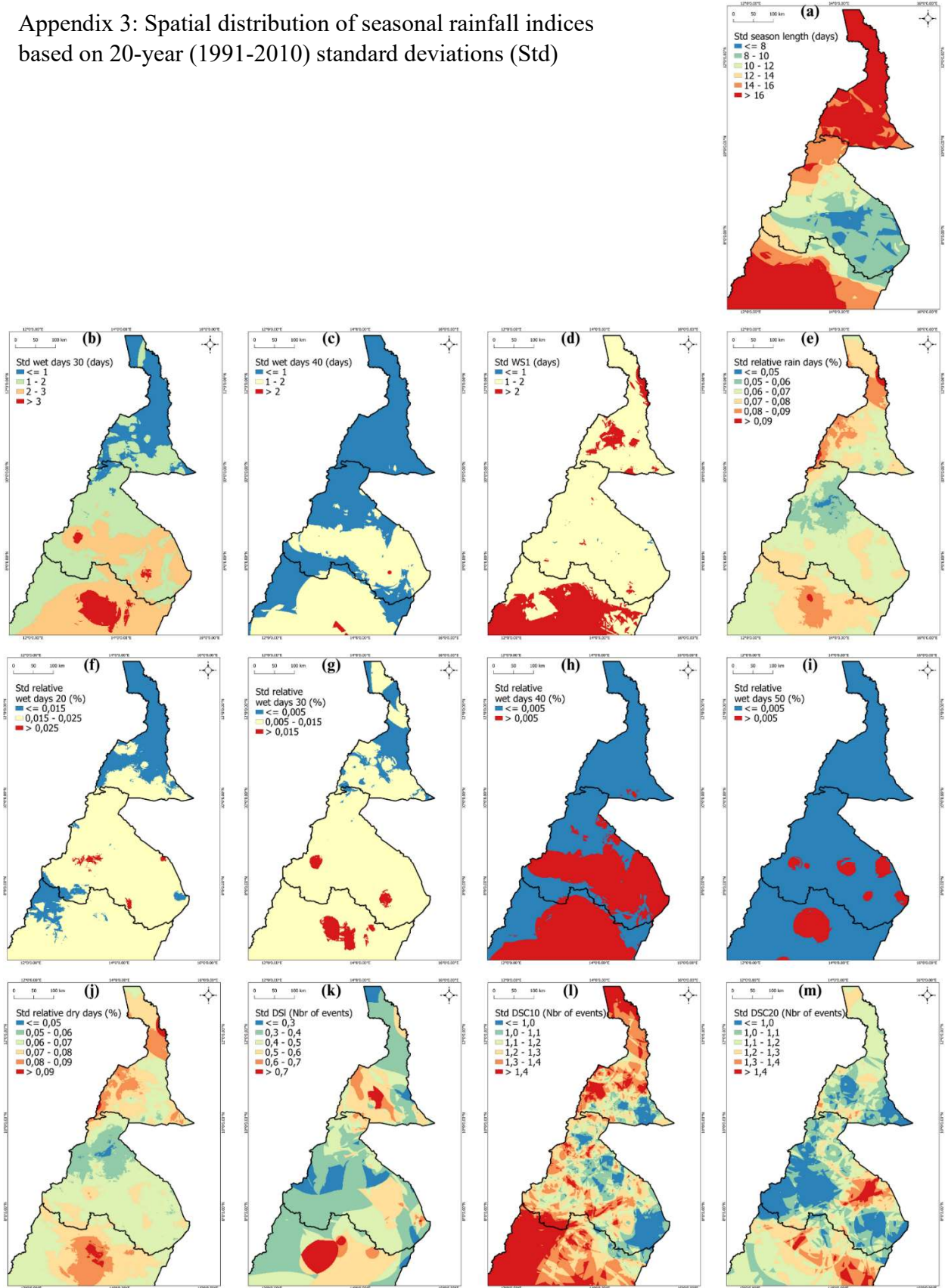
Appendix 4: Table of Pearson correlation coefficients (r) for simple linear regression (red quadrants mark strong correlations with r>0.5)

Simple linear regression – Pearson

Column key — Adaptation: – = none, FD = First Difference, LL = Linear-Log, RV = Relative values, SS = Slope/slope. Dimension: Sp = Spatial, ST = Spatiotemporal, ST-L = Spatiotemporal with LULC mask, T = Temporal. Yield value: Ym = mean, Ymd = median, obs = observed value. Index value: Im = mean, Imd = median, iv = interp. value. Dataset: ·S = Sector dataset (green), ·C = Collection point dataset (yellow).

Index	– Sp Ym·Im·S	– Sp Ym·Im·C	– Sp Ym·Imd·S	– Sp Ym·Imd·C	– Sp Ymd·Im·S	– Sp Ymd·Im·C	– Sp Ymd·Imd·S	– Sp Ymd·Imd·C	– ST obs·Im	– ST obs·Imd	– ST obs·iv	– ST-L obs·Im	– ST-L obs·Imd	– T Ym·Im	– T Ym·Imd	– T Ymd·Im	– T Ymd·Imd	FD ST obs·Im	FD ST obs·Imd	FD ST obs·iv	FD T Ym·Im	FD T Ym·Imd	FD T Ymd·Im	FD T Ymd·Imd	LL ST obs·Im	LL ST obs·Imd	LL ST obs·iv	RV ST obs·Im	RV ST obs·Imd	RV ST obs·iv	SS ST obs·Im	SS ST obs·Imd
Cessation	0.18	0.03	0.21	0.03	0.11	0.04	0.09	0.04	0.01	0.02	0.08	-0.06	-0.02	-0.54	-0.47	-0.54	-0.52	0.24	0.22	0.05	-0.31	-0.21	-0.55	-0.53	0.02	-0.02	0.08	0.01	0.02	0.08	0.52	0.55
Dry days	-0.39	-0.13	-0.38	-0.12	-0.38	-0.12	-0.37	-0.12	0.12	0.12	-0.12	0.14	0.13	0.54	0.52	0.54	0.53	-0.06	-0.06	-0.17	0.51	0.52	0.49	0.51	0.14	0.13	-0.12	0.12	0.12	-0.12	-0.28	-0.12
DSC10	-0.31	-0.17	-0.35	-0.16	-0.31	-0.17	-0.33	-0.16	0.05	0.05	-0.15	0.07	0.06	0.51	0.51	0.53	0.53	-0.16	-0.14	-0.21	0.51	0.52	0.49	0.51	0.01	0.06	-0.1	0.05	0.05	-0.15	-0.28	-0.12
DSC15	-0.49	-0.12	-0.51	-0.11	-0.48	-0.15	-0.51	-0.14	-0.12	-0.12	-0.07	-0.12	-0.13	0.03	0.01	0.01	-0.02	-0.11	-0.1	-0.14	0.13	0.05	-0.02	-0.08	-0.1	-0.13	-0.08	-0.12	-0.12	-0.07	0.19	0.31
DSC20	-0.5	-0.24	-0.49	-0.23	-0.53	-0.26	-0.52	-0.24	-0.09	-0.11	-0.1	-0.08	-0.07	-0.02	-0.04	-0.17	-0.19	-0.05	-0.06	-0.17	-0.39	-0.41	-0.5	-0.52	-0.06	-0.07	-0.13	-0.09	-0.11	-0.1	0.36	0.38
DSl	nan	-0.24	nan	-0.23	nan	-0.26	nan	-0.24	0.02	0.04	-0.1	0.04	0.04	0.17	0.13	-0.06	-0.07	0.05	0.08	-0.17	-0.4	-0.43	-0.23	-0.22	0.12	0.04	-0.13	0.02	0.04	-0.1	0.31	0.11
DSxl	nan	-0.24	nan	-0.23	nan	-0.26	nan	-0.24	-0.02	-0.01	-0.1	-0.03	-0.01	-0.01	-0.06	nan	nan	-0.05	-0.04	-0.17	-0.43	-0.48	nan	nan	-0.21	-0.01	-0.13	-0.02	-0.01	-0.1	-0.18	-0.24
Onset	-0.13	-0.09	-0.13	-0.09	-0.14	-0.05	-0.13	-0.05	-0.05	-0.07	-0.01	-0.06	-0.04	0.2	0.15	0.05	0	-0.18	-0.18	-0.06	0.16	0.08	-0.19	-0.27	-0.05	-0.04	-0.01	-0.05	-0.07	-0.01	0.15	0.1
Rain days	0.39	0.14	0.38	0.14	0.37	0.15	0.37	0.15	-0.06	-0.05	0.13	-0.1	-0.08	-0.72	-0.66	-0.7	-0.63	0.24	0.23	0.17	-0.21	-0.12	-0.15	-0.08	-0.03	-0.08	0.13	-0.06	-0.05	0.13	0.42	0.41
Relative dry days	-0.39	-0.13	-0.38	-0.13	-0.38	-0.12	-0.37	-0.12	0.09	0.09	-0.13	0.13	0.11	0.61	0.58	0.62	0.58	-0.14	-0.14	-0.17	-0.3	-0.26	-0.25	-0.23	0.12	0.11	-0.13	0.09	0.09	-0.13	-0.41	-0.42
Relative rain days	0.39	0.13	0.38	0.13	0.38	0.12	0.37	0.11	-0.1	-0.1	0.15	-0.13	-0.11	-0.62	-0.59	-0.62	-0.58	0.14	0.14	0.17	0.12	0.1	0.09	0.1	-0.09	-0.11	0.15	-0.1	-0.1	0.15	0.43	0.44
Relative wet days 20	0.58	0.26	0.6	0.25	0.61	0.27	0.62	0.25	0.05	0.04	0.19	0.06	0.06	-0.49	-0.44	-0.5	-0.45	0.2	0.18	0.27	-0.59	-0.51	-0.63	-0.54	-0.02	0.06	0.17	0.05	0.04	0.19	-0.38	-0.36
Relative wet days 30	0.6	0.23	0.59	0.21	0.58	0.21	0.58	0.19	0.2	0.19	0.14	0.17	0.17	-0.09	-0.09	-0.22	-0.24	0.21	0.21	0.23	-0.32	-0.34	-0.43	-0.48	0.11	0.17	0.13	0.2	0.19	0.14	-0.38	-0.37
Relative wet days 40	0.5	0.15	0.48	0.14	0.45	0.15	0.42	0.13	0.2	0.18	0.07	0.16	0.16	0.07	0.09	0.05	0.03	0.17	0.15	0.18	0.07	0.09	-0.07	-0.12	0.16	0.16	0.06	0.2	0.18	0.07	-0.27	-0.19
Relative wet days 50	0.45	0.09	0.45	0.08	0.39	0.14	0.39	0.13	0.16	0.13	0.03	0.13	0.14	0.12	0.13	nan	nan	0.12	0.1	0.1	0.05	0.07	nan	nan	0.13	0.14	-0.14	0.16	0.13	0.03	-0.06	-0.02
Season length	0.26	0.07	0.28	0.07	0.16	0.05	0.14	0.05	0.05	0.06	0.05	0.01	0.02	-0.44	-0.37	-0.29	-0.23	0.25	0.25	0.07	-0.29	-0.18	-0.1	0	0.06	0.02	0.05	0.05	0.06	0.05	0.21	0.28
Seaonal rainfall amount	0.53	0.25	0.54	0.24	0.53	0.23	0.53	0.22	-0.05	-0.05	0.2	-0.07	-0.07	-0.69	-0.63	-0.69	-0.63	0.23	0.22	0.27	-0.46	-0.37	-0.46	-0.38	-0.02	-0.07	0.2	-0.05	-0.05	0.2	-0.17	-0.17
Wet days 20	0.58	0.26	0.6	0.24	0.61	0.25	0.62	0.24	0.04	0.04	0.19	0.05	0.05	-0.51	-0.45	-0.54	-0.48	0.2	0.18	0.28	-0.6	-0.49	-0.63	-0.52	-0.01	0.05	0.17	0.04	0.04	0.19	-0.36	-0.35
Wet days 30	0.6	0.22	0.59	0.21	0.58	0.21	0.58	0.19	0.19	0.19	0.15	0.16	0.16	-0.13	-0.11	-0.27	-0.28	0.21	0.21	0.23	-0.35	-0.35	-0.45	-0.49	0.11	0.16	0.14	0.19	0.19	0.15	-0.36	-0.35
Wet days 40	0.5	0.16	0.48	0.15	0.44	0.15	0.42	0.13	0.19	0.18	0.08	0.16	0.15	0.07	0.09	0.06	0.04	0.16	0.15	0.19	0.07	0.1	-0.08	-0.13	0.16	0.15	0.09	0.19	0.18	0.08	-0.25	-0.17
Wet days 50	0.45	0.1	0.45	0.1	0.39	0.15	0.39	0.14	0.16	0.13	0.03	0.14	0.15	0.12	0.13	nan	nan	0.11	0.09	0.1	0.05	0.08	nan	nan	0.13	0.15	-0.08	0.16	0.13	0.03	-0.06	-0.01
WS1	0.51	0.17	0.5	0.16	0.55	0.18	0.53	0.17	0.32	0.31	0.1	0.28	0.28	0.19	0.2	0.21	0.22	0.2	-0.04	0.01	0.1	0.15						0.32	0.31	0.1	-0.47	-0.46
WSC10	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan
WSC15	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan
WSC20	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan

Legend: █ Sector dataset   █ Collection point dataset

Appendix 5: Table of p-values for simple linear regression (red quadrants mark statistically significant relationships with p<0.01)

Indices	Simple linear regression - p-value																															
Adaptation	-															First Difference									Linear-Log			Relative values			Slope/slope	
Dimension	Spatial				Spatiotemporal				Spatiotemporal with LULC mask			Temporal				Spatiotemporal					Temporal				Spatiotemporal			Spatiotemporal			Spatiotemporal	
Yield value	mean		median		mean		median		observed value			mean		median		mean		median			mean		median		observed value			observed value			observed value	
Index value	mean	median	mean	median	mean	median	mean	median	mean	median	interp.value	mean	median	mean	median	mean	median	mean	median	interp.value	mean	median	mean	median	mean	median	interp.value	mean	median	interp.value	mean	median
Cessation	0.282	0.19	0.222	0.247	0.511	0.0562	0.584	0.0659	0.759	0.652	7.37E-07	0.153	0.664	0.0146	0.0349	0.013	0.0181	1.4E-08	7.98E-08	0.000817	0.202	0.379	0.0147	0.0195	0.705	0.664	6.22E-07	0.759	0.652	7.37E-07	0.00859	0.00583
Dry days	0.0178	4.72E-08	0.208	1.04E-07	0.0188	2.46E-07	0.0222	3.21E-07	0.00293	0.00299	1.59E-14	0.00112	0.00256	0.0143	0.0182	0.0136	0.0173	0.134	0.176	3.28E-28	0.21	0.337	0.345	0.503	0.000496	0.00256	7.84E-15	0.00293	0.00299	1.59E-14	0.208	0.273
DSC10	0.059	2.21E-13	0.0332	3.7E-12	0.0662	1.04E-13	0.0463	2.15E-12	0.233	0.167	1.12E-21	0.087	0.18	0.0223	0.0226	0.0165	0.0162	0.00017	0.00115	2.27E-43	0.0266	0.0223	0.0327	0.0255	0.709	0.18	1.99E-11	0.233	0.167	1.12E-21	0.189	0.563
DSC15	0.0023	6.02E-08	0.00132	6.71E-07	0.00237	2.19E-10	0.0012	1.8E-09	0.00265	0.0034	3.94E-06	0.00464	0.00356	0.899	0.98	0.98	0.921	0.0126	0.0221	8.22E-21	0.606	0.827	0.949	0.758	0.016	0.00356	3.03E-07	0.00265	0.0034	3.94E-06	0.378	0.146
DSC20	0.00176	7.4E-27	0.00218	7.49E-24	0.000703	1.3E-29	0.00103	3.87E-26	0.0174	0.0049	4.94E-10	0.0527	0.0974	0.944	0.881	0.486	0.423	0.228	0.171	6.73E-28	0.102	0.0794	0.0306	0.0221	0.139	0.0974	5.81E-16	0.0174	0.0049	4.94E-10	0.0808	0.0699
DSI	nan	7.4E-27	nan	7.49E-24	nan	1.3E-29	nan	3.87E-26	0.589	0.324	4.94E-10	0.414	0.33	0.461	0.599	0.194	0.754	0.202	0.0502	6.73E-28	0.0865	0.0655	0.334	0.366	0.075	0.33	5.81E-16	0.589	0.324	4.94E-10	0.146	0.594
DSxl	nan	7.4E-27	nan	7.49E-24	nan	1.3E-29	nan	3.87E-26	0.629	0.849	4.94E-10	0.534	0.799	0.979	0.811	nan	nan	0.272	0.302	6.73E-28	0.0641	0.0389	nan	nan	0.487	0.799	5.81E-16	0.629	0.849	4.94E-10	0.411	0.267
Onset	0.443	4.49E-05	0.453	9.53E-05	0.42	0.0226	0.445	0.0367	0.167	0.298	0.614	0.174	0.298	0.402	0.52	0.833	0.984	1.91E-05	1.42E-05	0.000107	0.51	0.742	0.427	0.259	0.18	0.298	0.655	0.167	0.298	0.614	0.496	-0.641
Rain days	0.018	8.48E-10	0.0196	3.57E-09	0.0228	6.38E-11	0.0259	1.39E-10	0.157	0.178	1.66E-17	0.0223	0.0644	0.000355	0.00157	0.000667	0.00278	9.5E-09	1.93E-08	5.53E-29	0.391	0.63	0.533	0.748	0.422	0.0644	5.11E-17	0.157	0.178	1.66E-17	0.0429	0.046
Relative dry days	0.018	1.16E-08	0.0209	2.91E-08	0.0195	8.32E-08	0.0229	1.56E-07	0.0208	0.0263	7.21E-18	0.00339	0.0107	0.00434	0.0071	0.00383	0.00699	0.000661	0.000757	1.48E-28	0.21	0.29	0.294	0.352	0.00213	0.0107	4.15E-18	0.0208	0.0263	7.21E-18	0.047	0.0397
Relative rain days	0.0177	8.93E-09	0.0208	2.34E-08	0.0197	4.4E-07	0.0231	9.23E-07	0.0104	0.0139	1.61E-22	0.00231	0.00815	0.00337	0.00616	0.00352	0.00735	0.000966	0.000978	2.07E-28	0.623	0.679	0.711	0.691	0.0238	0.00815	3.36E-22	0.0104	0.0139	1.61E-22	0.0369	0.0308
Relative wet days 20	0.000146	2.33E-31	9.96E-05	2.99E-27	6.11E-05	1.8E-32	0.000047	1.62E-28	0.235	0.265	9.9E-37	0.167	0.139	0.027	0.051	0.0234	0.045	2.46E-06	1.35E-05	3.64E-74	0.00795	0.027	0.00414	0.0165	0.597	0.139	2.47E-28	0.235	0.265	9.9E-37	0.064	0.0871
Relative wet days 30	8.64E-05	4.78E-23	0.000113	5.01E-20	0.000149	1.41E-19	0.000151	3.34E-17	6.18E-07	1.07E-06	8.7E-21	7.22E-05	6.96E-05	0.7	0.717	0.342	0.313	6.99E-07	6.79E-07	8.93E-52	0.18	0.156	0.0664	0.0372	0.00706	6.96E-05	7.56E-16	6.18E-07	1.07E-06	8.7E-21	0.0646	0.0732
Relative wet days 40	0.00183	3.56E-11	0.00266	1.93E-09	0.00576	2E-10	0.0098	7.3E-09	5.75E-07	3.92E-06	2.01E-06	0.000151	0.000253	0.772	0.716	0.822	0.888	7.96E-05	0.000505	8.07E-32	0.761	0.712	0.783	0.626	0.000402	0.000253	0.0078	5.75E-07	3.92E-06	2.01E-06	0.21	0.37
Relative wet days 50	0.00478	6.71E-05	0.00575	0.000292	0.0169	9.99E-10	0.017	4.36E-09	4.07E-05	0.000686	0.102	0.0017	0.000757	0.623	0.59	nan	nan	0.00624	0.0232	2.17E-10	0.835	0.77	nan	nan	0.0193	0.000757	0.000053	0.000407	0.000686	0.102	0.764	0.936
Season length	0.122	0.00136	0.0895	0.00258	0.33	0.0177	0.194	0.0218	0.24	0.153	0.00288	0.893	0.657	0.0517	0.106	0.211	0.334	1.08E-09	1.53E-09	1.71E-06	0.225	0.465	0.692	0.987	0.164	0.657	0.00149	0.24	0.153	0.00288	0.333	0.183
Seasonal rainfall amount	0.000706	6.99E-28	0.000622	3.23E-25	0.00077	3.05E-24	0.000672	5.42E-22	0.198	0.186	5.1E-39	0.0904	0.13	0.000711	0.00269	0.000752	0.00284	2.68E-08	7.23E-08	3E-70	0.0496	0.115	0.0484	0.113	0.605	0.13	9.76E-38	0.198	0.186	5.1E-39	0.435	0.416
Wet days 20	0.000153	7.88E-30	0.000103	5.62E-26	6.08E-05	2.9E-29	4.79E-05	1.06E-25	0.294	0.361	1.25E-35	0.288	0.237	0.0211	0.0454	0.0133	0.0311	1.03E-06	0.000012	1.33E-74	0.00713	0.0323	0.00395	0.0212	0.713	0.237	6.64E-29	0.294	0.361	1.25E-35	0.0796	0.0975
Wet days 30	8.63E-05	9.14E-23	0.000112	7.63E-20	0.000154	7.99E-20	0.000153	1.97E-17	1.19E-06	2.05E-06	2.23E-22	0.00017	0.000145	0.598	0.648	0.243	0.237	5.76E-07	6.69E-07	1.64E-52	0.139	0.143	0.0554	0.0336	0.00587	0.000145	2E-17	1.19E-06	2.05E-06	2.23E-22	0.0824	0.0985
Wet days 40	0.0018	3.82E-12	0.0026	2.53E-10	0.00582	1.15E-10	0.0101	4.91E-09	7.23E-07	2.63E-06	7.3E-08	0.000174	0.000333	0.778	0.707	0.787	0.855	9.54E-05	0.000439	4.61E-34	0.784	0.699	0.746	0.594	0.000388	0.000333	0.000142	7.23E-07	2.63E-06	7.3E-08	0.23	0.423
Wet days 50	0.00468	6.43E-06	0.00561	3.46E-05	0.0171	1.29E-10	0.017	6.51E-10	3.65E-05	0.000655	0.0243	0.00134	0.000663	0.621	0.578	nan	nan	0.00699	0.0297	1.97E-11	0.84	0.751	nan	nan	0.0187	0.000663	0.0156	3.65E-05	0.000655	0.0243	0.295	0.949
WS1	0.00113	2.98E-14	0.00148	1.52E-12	0.000402	6.48E-16	0.000722	3.83E-14	3.04E-16	2.04E-15	1.68E-10	2.53E-11	1.84E-11	0.253	0.24	0.425	0.387	3.02E-07	2.33E-07	1.62E-39	0.861	0.969	0.692	0.553	1.32E-16	1.84E-11	2.2E-10	3.04E-16	2.04E-15	1.68E-10	0.02	0.024
WSC10	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan
WSC15	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan
WSC20	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan

Sector dataset   Collection point dataset

# Appendix 6: Table of slope values for simple linear regression

Simple linear regression – Slope. Adaptation groups: "–" (Spatial, Spatiotemporal, Spatiotemporal with LULC mask, Temporal), First Difference (Spatiotemporal, Temporal), Linear-Log (Spatiotemporal), Relative values (Spatiotemporal), Slope/slope (Spatiotemporal). Yield value and Index value are given as mean / median / observed value / interp. value as applicable.

Indices	Spatial mean·mean	Spatial mean·median	Spatial median·mean	Spatial median·median	Spatiotemp. mean	Spatiotemp. median	Spatiotemp.	Spatiotemp.	LULC mean	LULC median	LULC interp	LULC	LULC	Temporal mean·mean	Temporal mean·median	Temporal median·mean	Temporal median·median	FD-Spatiotemp. mean	FD-Spatiotemp. median	FD-Spatiotemp. interp	FD-Temporal mean·mean	FD-Temporal mean·median	FD-Temporal median·mean	FD-Temporal median·median	Lin-Log mean	Lin-Log median	Lin-Log interp	Relative mean	Relative median	Relative interp	Slope/slope mean	Slope/slope median
Cessation	25.62	1.15	32.13	1.05	17.28	1.61	15.95	1.6	0.45	0.63	1.6	-1.89	-0.67	-16.52	-14.99	-14.4	-14.41	11.22	9.69	5.11	-6.79	-5.31	-8.62	-9.29	159.7	-0.67	474.37	0	0	0	29.95	27.57
Dry days	-10.24	-2.39	-11.09	-2.4	-10.05	-2.25	-10.87	-2.3	2.52	2.47	-2.37	3.15	2.84	7.58	7.56	7.64	7.62	-1.86	-1.61	-4.07	-4.91	-4.26	-3.16	-2.5	103.52	2.84	-51.59	0	0	0	-10.98	-9.81
DSC10	-12.6	-37.73	-78.26	-36.9	-61.56	-37.77	-73.7	-36.84	12.47	13.82	-29.8	19.38	14.66	99.69	102.37	91.98	94.87	-50.66	-38.89	-46.59	59.51	68.47	58.04	67.2	7.46	14.66	-42.86	0.01	0.01	-0.03	-109.21	-46.59
DSC15	-69.16	-20.4	-80.19	-19.31	-64.95	-23.1	-76.08	-22.59	-34.34	-31.47	-10.04	-35.44	-34.63	6.84	1.38	1.17	-4.81	-32.88	-27.07	-24.16	17.06	8.15	-1.83	-9.85	-42.46	-34.64	-27.32	-0.03	-0.03	-0.01	79.57	116.22
DSC20	-170.49	-57.25	-185.63	-55.54	-182.62	-53.6	-197.01	-51.86	-27.37	-30.64	-19.63	-23.82	-19.81	-3.39	-7.45	-27.72	-32.73	-18.06	-18.37	-44.06	-48.84	-58.31	-53.56	-63.04	-18.86	-19.81	-58.69	-0.02	-0.03	-0.02	145.52	136.2
DSI	0	-57.25	0	-55.54	0	-53.6	0	-51.86	15.43	25.63	-19.63	25.03	27.18	122.09	90.12	-32.13	-39.53	42.01	55.74	-44.06	-173.97	-208.15	-69.27	-72.83	21.55	27.18	-58.69	0.02	0.02	-0.02	436.64	147.38
DSxI	0	-57.25	0	-55.54	0	-53.6	0	-51.86	-148.51	-40.08	-19.63	-187	-54.12	-83.68	-788.35	0	0	-259.84	-167.15	-44.06	-3380.87	-4175.74	0	0	-18.66	-54.12	-58.69	-0.13	-0.04	-0.02	-2584.76	-2536.56
Onset	-38.1	-2.99	-41.35	-2.95	-42.86	-1.32	-44.98	-1.24	-1.4	-1.6	-0.17	-1.49	-1.13	4.35	3.45	0.83	-0.08	-5.55	-5.13	-3.77	2.34	1.32	-1.75	-2.77	-156.82	-1.12	-15.09	0	0	0	7.65	4.77
Rain days	9.18	1.96	10.05	1.95	8.74	2.11	9.49	2.13	-0.85	-0.79	1.62	-1.57	-1.26	-8.13	-7.67	-8.11	-7.59	4.86	4.59	3.5	-3.19	-2.02	-2.32	-1.45	-60.61	-1.26	234.21	0	0	0	13.03	12.48
Relative dry days	-1917.07	-476.85	-2077.73	-478.36	-1870.93	-451	-2022.97	-455.41	369.66	340.57	-539.95	523.23	445.12	1610.3	1582.38	1674.46	1630.4	-770.94	-737.52	-782.4	-1130.78	-1078.22	-752.41	-765.55	89.21	445.12	-59.39	0.32	0.3	-0.55	-3061.36	-3105.14
Relative rain days	1917.12	473.67	2076.48	474.77	1863.02	416.05	2015	417.13	-396.32	375.68	587.85	-540.27	-459.41	-1634.91	-1594.62	-1651.32	-1588.37	745.89	720.46	773.22	439.72	415.16	194.38	268.82	-240.51	-459.41	455.39	-0.35	-0.33	0.59	3090.81	3126.82
Relative wet days 20	3006.34	1841.9	4416.01	1768.35	4111.13	1805.80	4612.20	1830.40	626	581.15	1458.26	804.13	842.04	-5203.86	-4878.03	-5183.63	-4700.82	3099.48	2707.88	2300.39	-4768.93	-4502.20	-4500.48	-4451.57	-6.92	842.04	73.42	0.56	0.52	1.47	-8227.85	-7168.82
Relative wet days 30	7801.5	3124.98	8534.37	2993.95	7541.09	2809.43	8354.66	2704.63	6248.21	5879.02	2083.93	5167.47	4980.63	-3225.83	-3124.53	-6360.2	-6935.64	6547.15	6266.31	3599.99	8301.29	-9802.47	-8298.77	-10431.6	23.27	4980.63	32.85	5.56	5.23	2.11	-13085.1	-11493.6
Relative wet days 40	12926.97	4214.63	13882.79	3946.62	11318.08	3760.23	11789.64	3530.57	12847.14	10855.24	1956.27	9545.81	8621	5948.33	7662.54	3133.98	2011.88	9779.75	7651	5524.73	4286.89	5815.65	-2625.35	-5187.93	29.93	8621	19.17	11.43	9.65	1.98	-18320.5	-13377.9
Relative wet days 50	37297.93	4692.6	40567.1	4400.71	29372.3	7093.7	32547.71	7034.31	20752.17	15140.25	1213.74	14488.72	14017.52	23423.26	26448.47	0	0	13020.3	9301.73	5255.4	6422.05	10083.3	0	0	20.85	14017.52	-61.01	18.46	13.47	1.23	-9203.9	-1810.09
Season length	38.75	1.45	46.95	1.41	23.48	1.06	22.79	1.06	0.88	1.02	0.53	0.11	0.36	-7.33	-6.37	-4.47	-3.59	5.96	5.49	3.7	-3.43	-2.35	-0.94	-0.07	181.67	0.36	107.43	0	0	0	6.7	8.53
Seaonal rainfall amount	0.42	0.18	0.46	0.18	0.41	0.16	0.46	0.16	-0.05	-0.05	0.16	-0.08	-0.07	-0.54	-0.51	-0.52	-0.49	0.33	0.32	0.26	-0.45	-0.41	-0.46	-0.42	-23.32	-0.07	238.57	0	0	0.01	-0.49	-0.48
Wet days 20	20.36	8.81	23.05	8.47	21.48	8.55	24.07	8.25	2.78	2.4	6.92	3.15	3.44	-27.3	-24.82	-27.88	-25.49	16.36	14.34	11.76	-25.15	-23.3	-23.92	-22.35	-4.63	3.44	68.51	0	0	0.01	-40.66	-35.96
Wet days 30	40.99	15.84	44.86	15.2	39.35	14.41	43.65	13.88	32.18	30.22	11.29	26.13	25.43	-24.37	-21.76	-43.12	-44.86	34.7	32.9	18.83	-54.96	-60.96	-51.72	-63.51	23.42	25.43	34.96	0.03	0.03	0.01	-64.62	-55.1
Wet days 40	68.09	23.13	73.17	21.76	59.38	19.85	61.86	18.6	67.1	58.27	11.81	50.54	45.03	30.57	41.79	20.29	14.11	51.17	40.97	30.26	20.64	32.57	-16.65	-30.6	29.55	45.03	28.16	0.06	0.05	0.01	-90.71	-62.11
Wet days 50	196.85	28.04	214.19	26.57	153.53	39.2	170.32	38.89	110.83	80.53	9.01	79.85	76.15	123.97	143.64	0	0	68.56	47.29	29.75	32.75	57.75	0	0	20.79	76.15	-38.05	0.1	0.07	0.01	-41.02	-7.45
WS1	72.14	20.41	78.33	19.62	68.12	20.62	72.7	19.94	52.12	48.22	9.94	46.39	45.03	42.4	44.79	25.3	28.17	39.37	36.76	26.38	-4.34	1.09	7.91	12.99	756.84	45.03	136.29	0.05	0.04	0.01	-149.54	-128.33
WSC10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSC15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WSC20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Legend: ▢ Sector dataset ▢ Collection point dataset

Appendix 7: Table of r² for simple linear regression (red quadrants mark strong absolute correlations with $r^2>0.25$)

| Index value	-																	First Difference							Linear-Log			Relative values			Slope/slope	
	Spatial				Spatiotemporal				Spatiotemporal with LULC mask			Temporal						Spatiotemporal			Temporal				Spatiotemporal			Spatiotemporal			Spatiotemporal	
	mean		median		mean		median		observed value			mean			median			observed value			mean		median		observed value			observed value			observed value	
	mean	median	mean	median	mean	median	mean	median	mean	median	interp. value	mean	median	mean	median	mean	median	mean	median	interp. value	mean	median	mean	median	mean	median	interp. value	mean	median	interp. value	mean	median
Cessation	0.032	0.001	0.044	0.001	0.012	0.002	0.008	0.002	0.000	0.000	0.006	0.004	0.000	0.292	0.221	0.292	0.270	0.056	0.050	0.003	0.094	0.046	0.303	0.283	0.000	0.000	0.006	0.000	0.000	0.006	0.270	0.303
Dry days	0.152	0.017	0.144	0.014	0.144	0.014	0.137	0.014	0.014	0.014	0.014	0.020	0.017	0.292	0.270	0.292	0.281	0.004	0.003	0.028	0.091	0.054	0.038	0.019	0.020	0.017	0.014	0.014	0.014	0.014	0.073	0.053
DSC10	0.096	0.029	0.123	0.026	0.096	0.029	0.109	0.026	0.003	0.003	0.023	0.005	0.004	0.260	0.260	0.281	0.281	0.025	0.019	0.044	0.257	0.271	0.247	0.265	0.000	0.004	0.010	0.003	0.003	0.023	0.078	0.014
DSC15	0.240	0.014	0.260	0.012	0.230	0.023	0.260	0.020	0.014	0.017	0.005	0.014	0.017	0.001	0.000	0.000	0.000	0.011	0.009	0.020	0.016	0.003	0.000	0.006	0.014	0.014	0.006	0.014	0.014	0.005	0.036	0.096
DSC20	0.250	0.058	0.240	0.053	0.281	0.068	0.270	0.058	0.008	0.012	0.010	0.006	0.005	0.000	0.002	0.029	0.036	0.003	0.003	0.028	0.150	0.170	0.242	0.269	0.004	0.005	0.017	0.008	0.012	0.010	0.130	0.144
DSI	nan	0.058	nan	0.053	nan	0.068	nan	0.058	0.000	0.002	0.010	0.002	0.002	0.029	0.017	0.004	0.005	0.003	0.007	0.028	0.163	0.186	0.054	0.048	0.014	0.002	0.017	0.000	0.002	0.010	0.096	0.012
DSxI	nan	0.058	nan	0.053	nan	0.068	nan	0.058	0.000	0.000	0.010	0.001	0.000	0.000	0.004	nan	nan	0.002	0.002	0.028	0.187	0.228	nan	nan	0.044	0.000	0.017	0.000	0.000	0.010	0.032	0.058
Onset	0.017	0.008	0.017	0.008	0.020	0.003	0.017	0.003	0.003	0.005	0.000	0.004	0.002	0.004	0.023	0.003	0.000	0.032	0.033	0.004	0.026	0.007	0.036	0.073	0.003	0.002	0.000	0.003	0.005	0.000	0.023	0.010
Rain days	0.152	0.020	0.144	0.020	0.137	0.023	0.137	0.023	0.004	0.003	0.017	0.010	0.006	0.518	0.436	0.490	0.397	0.057	0.055	0.029	0.044	0.014	0.030	0.009	0.001	0.006	0.017	0.004	0.003	0.017	0.176	0.168
Relative dry days	0.152	0.017	0.144	0.017	0.144	0.014	0.137	0.014	0.008	0.008	0.017	0.017	0.012	0.372	0.336	0.384	0.336	0.021	0.020	0.029	0.091	0.066	0.044	0.037	0.008	0.012	0.017	0.008	0.008	0.017	0.168	0.176
Relative rain days	0.152	0.017	0.144	0.017	0.144	0.014	0.137	0.012	0.010	0.010	0.023	0.017	0.012	0.384	0.348	0.384	0.336	0.019	0.019	0.028	0.015	0.010	0.003	0.005	0.008	0.012	0.023	0.010	0.010	0.023	0.185	0.194
Relative wet days 20	0.336	0.068	0.360	0.063	0.372	0.073	0.384	0.063	0.003	0.002	0.036	0.004	0.004	0.240	0.194	0.250	0.203	0.039	0.033	0.075	0.347	0.256	0.392	0.295	0.000	0.004	0.029	0.003	0.002	0.036	0.144	0.130
Relative wet days 30	0.360	0.053	0.348	0.044	0.336	0.044	0.336	0.036	0.040	0.036	0.020	0.029	0.029	0.008	0.008	0.048	0.058	0.043	0.043	0.053	0.102	0.115	0.181	0.228	0.012	0.029	0.017	0.040	0.036	0.020	0.144	0.137
Relative wet days 40	0.250	0.023	0.230	0.020	0.203	0.023	0.176	0.017	0.040	0.032	0.005	0.026	0.026	0.005	0.008	0.003	0.001	0.027	0.021	0.032	0.006	0.008	0.005	0.014	0.026	0.026	0.004	0.040	0.032	0.005	0.073	0.036
Relative wet days 50	0.203	0.008	0.203	0.006	0.152	0.020	0.152	0.017	0.026	0.017	0.001	0.017	0.020	0.014	0.017	nan	nan	0.013	0.009	0.009	0.003	0.005	nan	nan	0.017	0.020	0.020	0.026	0.017	0.001	0.004	0.000
Season length	0.068	0.005	0.078	0.005	0.026	0.003	0.020	0.003	0.003	0.004	0.003	0.000	0.000	0.194	0.137	0.084	0.053	0.064	0.063	0.005	0.085	0.032	0.010	0.000	0.004	0.000	0.003	0.003	0.004	0.003	0.044	0.078
Seasonal rainfall amount	0.281	0.063	0.292	0.058	0.281	0.053	0.281	0.048	0.003	0.003	0.040	0.005	0.005	0.476	0.397	0.476	0.397	0.054	0.051	0.071	0.208	0.139	0.222	0.149	0.000	0.005	0.040	0.003	0.003	0.040	0.029	0.029
Wet days 20	0.336	0.068	0.360	0.058	0.372	0.063	0.384	0.058	0.002	0.002	0.036	0.003	0.003	0.260	0.203	0.292	0.230	0.042	0.034	0.076	0.124	0.122	0.196	0.237	0.012	0.026	0.020	0.036	0.036	0.023	0.130	0.123
Wet days 30	0.360	0.048	0.348	0.044	0.336	0.044	0.336	0.036	0.036	0.036	0.023	0.026	0.026	0.017	0.012	0.073	0.078	0.044	0.043	0.053	0.124	0.122	0.196	0.237	0.012	0.026	0.020	0.036	0.036	0.023	0.130	0.123
Wet days 40	0.250	0.026	0.230	0.023	0.194	0.023	0.176	0.017	0.036	0.032	0.006	0.026	0.023	0.005	0.008	0.004	0.002	0.027	0.022	0.034	0.005	0.009	0.006	0.017	0.026	0.023	0.008	0.036	0.032	0.008	0.063	0.029
Wet days 50	0.203	0.010	0.203	0.010	0.152	0.023	0.152	0.020	0.026	0.017	0.001	0.020	0.023	0.014	0.017	nan	nan	0.013	0.008	0.011	0.002	0.006	nan	nan	0.017	0.023	0.006	0.026	0.017	0.001	0.004	0.000
WS1	0.260	0.029	0.250	0.026	0.303	0.032	0.281	0.029	0.102	0.096	0.010	0.078	0.078	0.073	0.078	0.036	0.040	0.046	0.047	0.040	0.002	0.000	0.010	0.022	0.102	0.078	0.010	0.102	0.096	0.010	0.221	0.212
WSC10	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan
WSC15	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan
WSC20	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan

Legend: Sector dataset · Collection point dataset

Appendix 8: Exploratory data analysis for the collection point dataset, with cotton yields in kg/ha and index units as given in Table 2 of the main document, section 4.4.2.
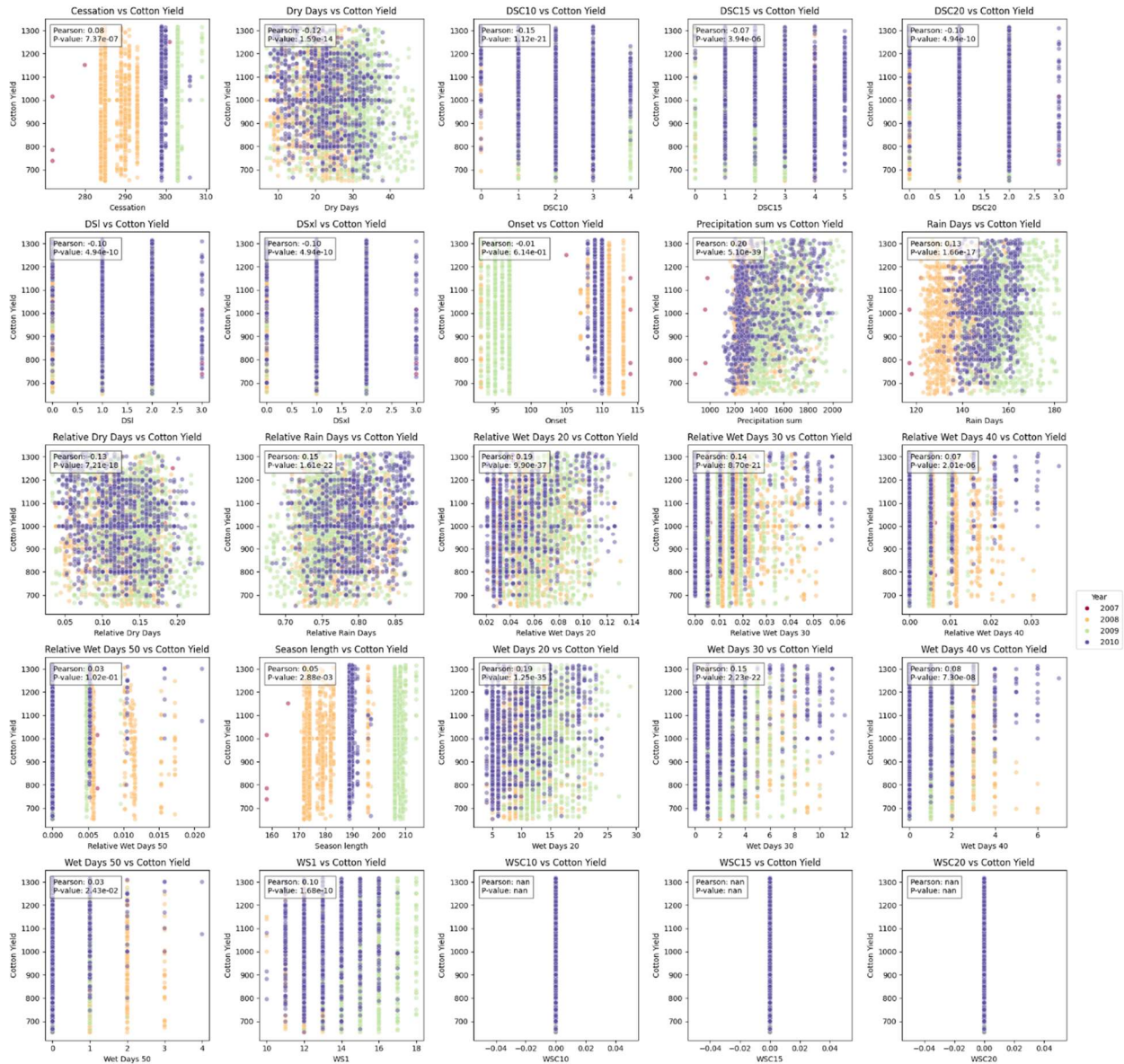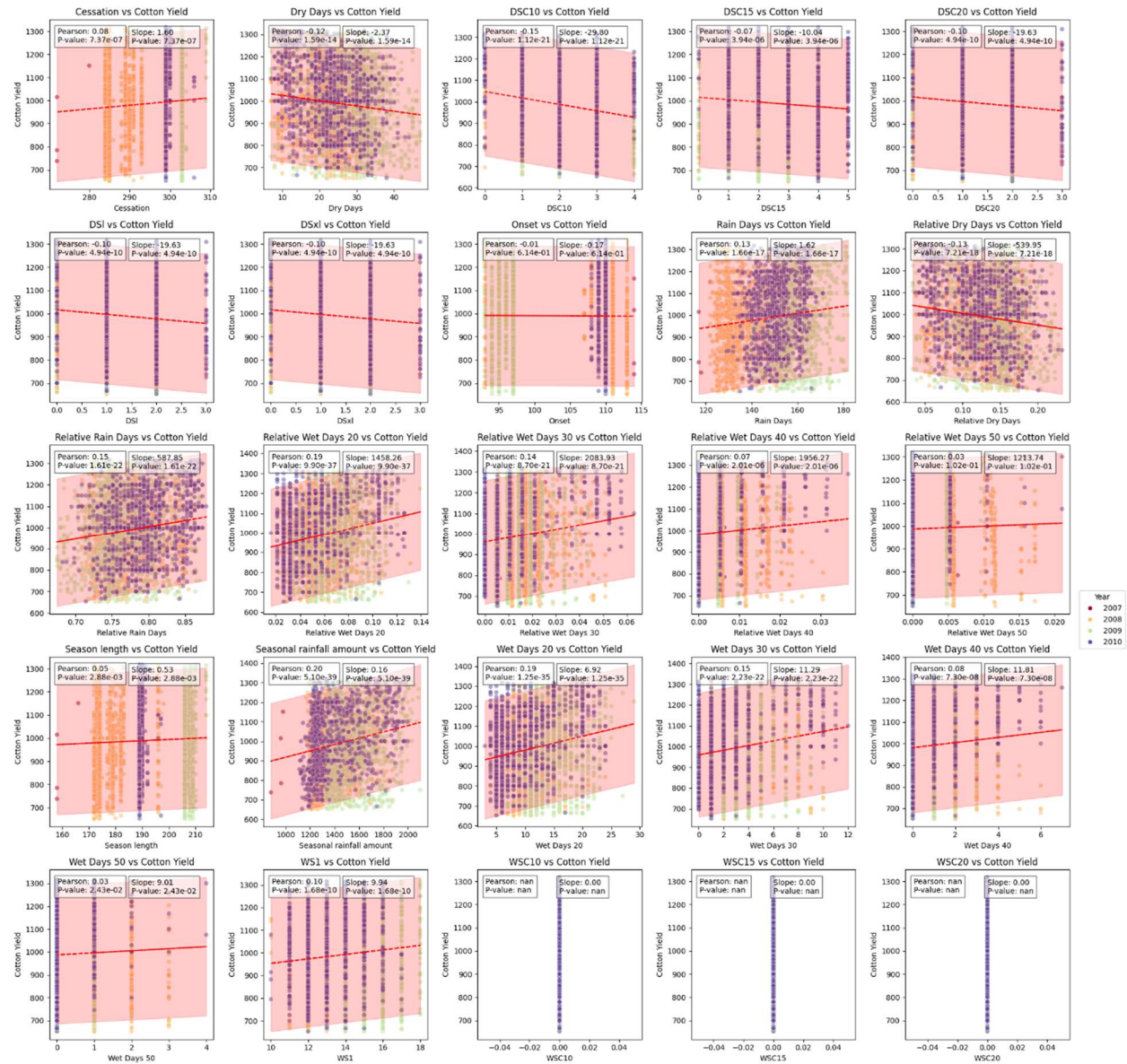
Appendix 9: Exploratory data analysis for the sector dataset (mean aggregations) , with cotton yields in kg/ha and index units as given in Table 2 of the main document, section 4.4.2.
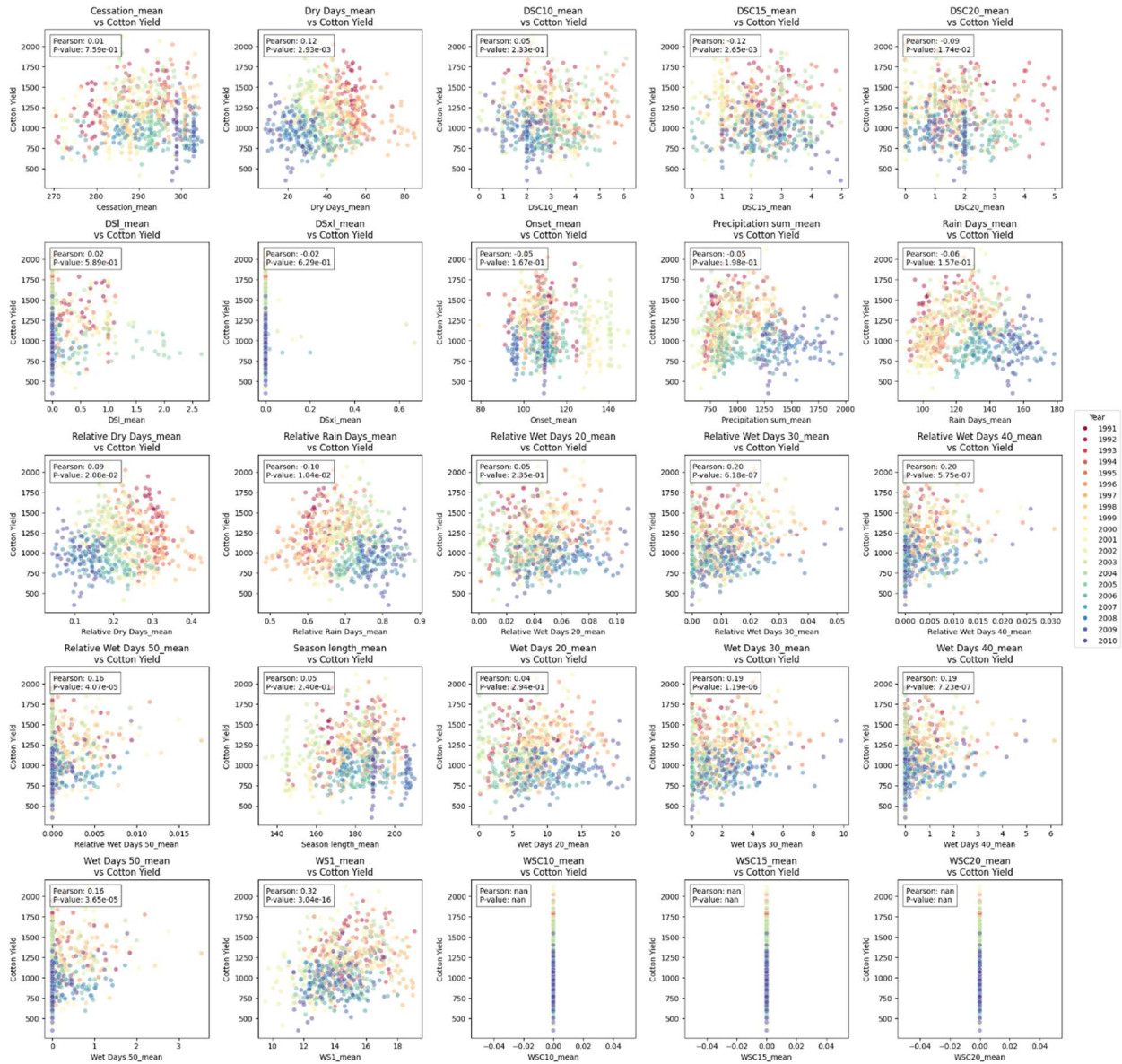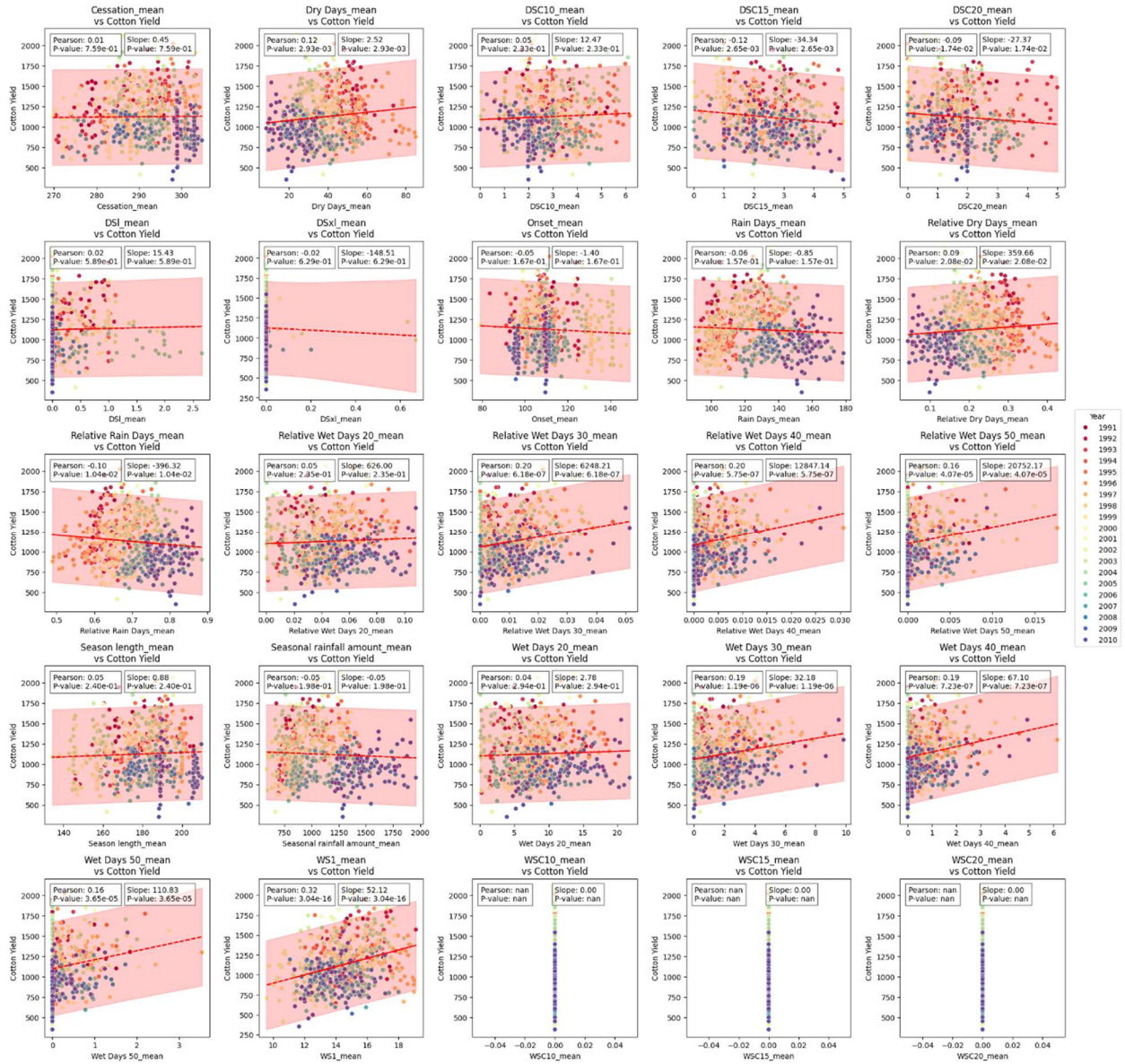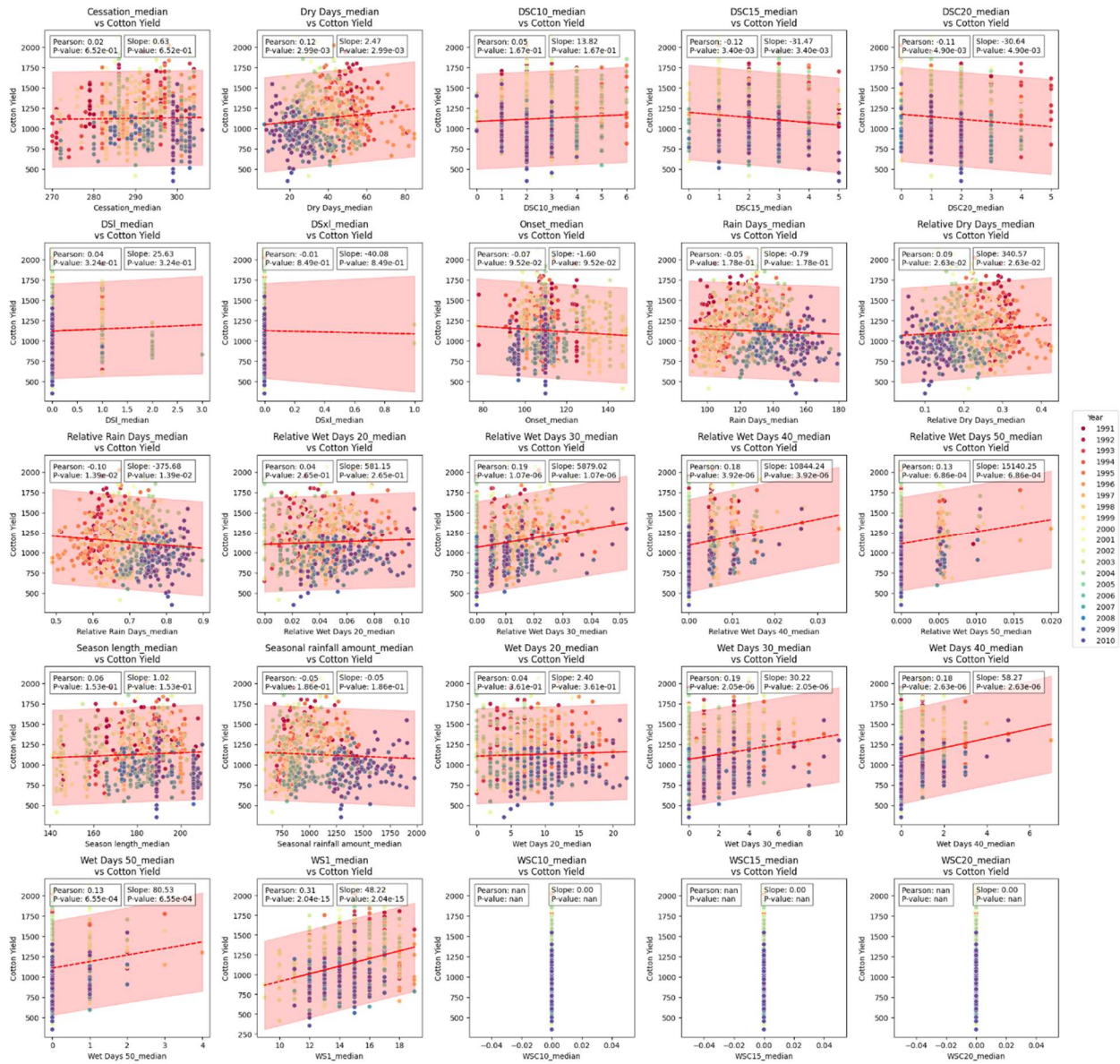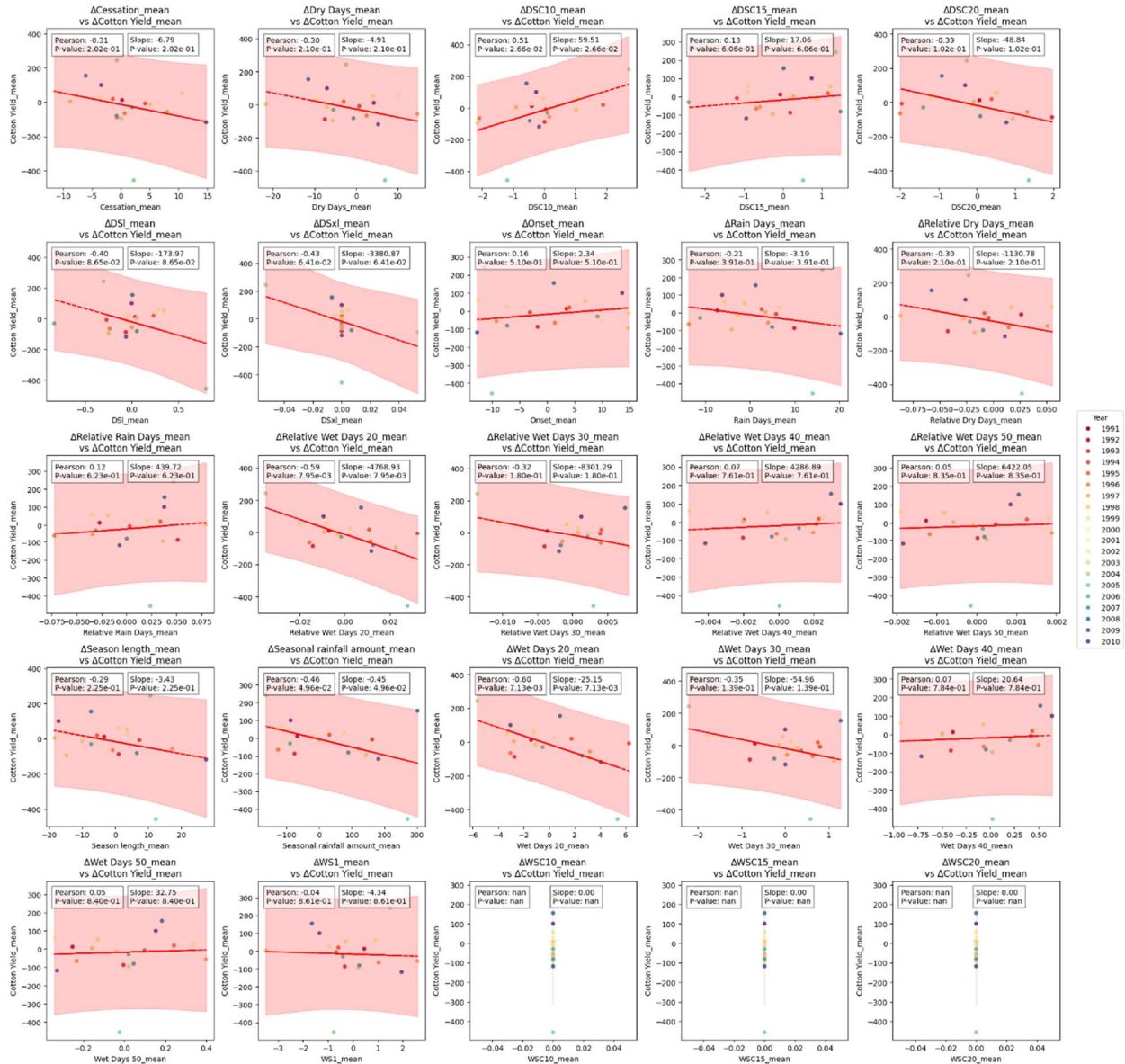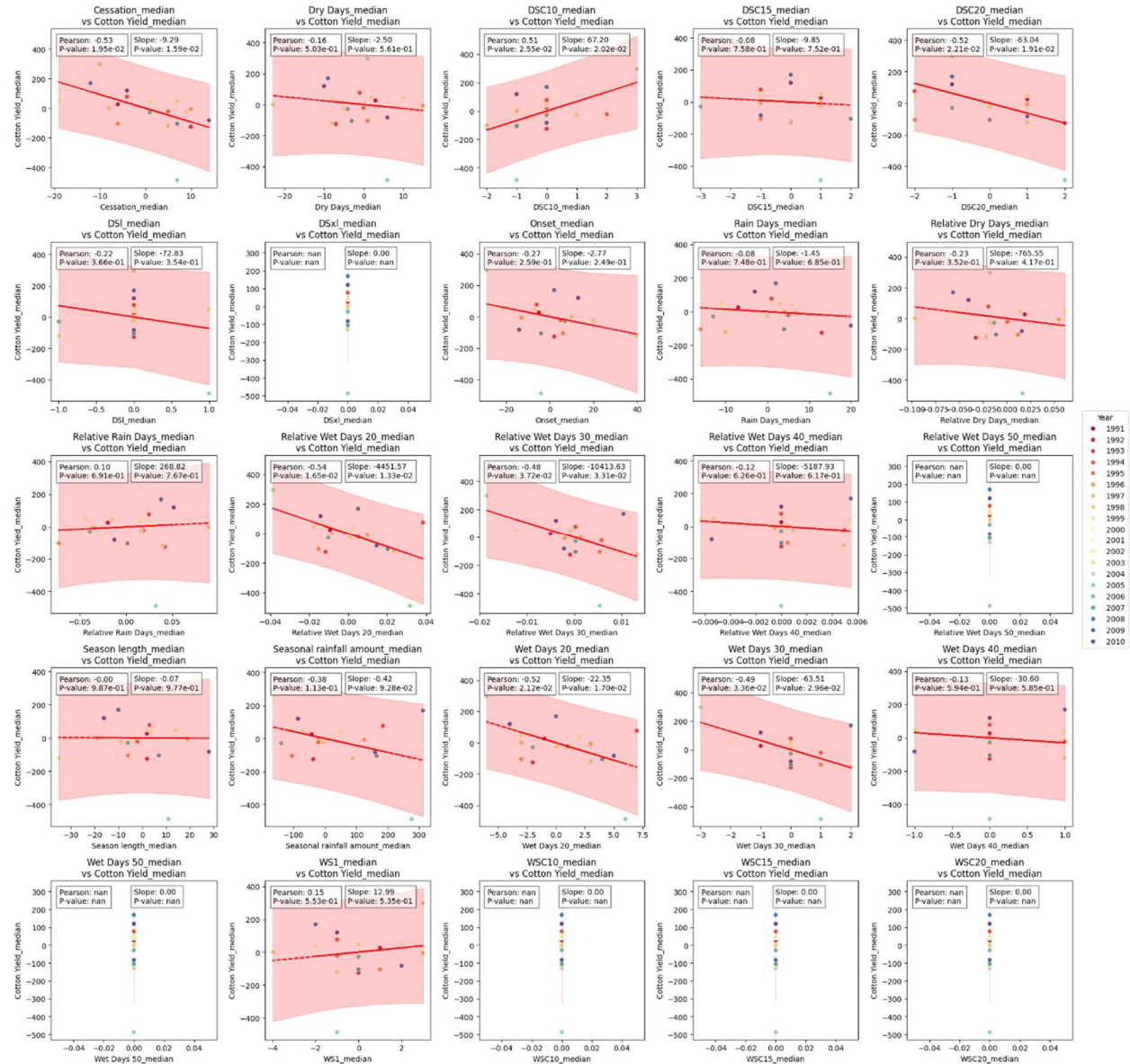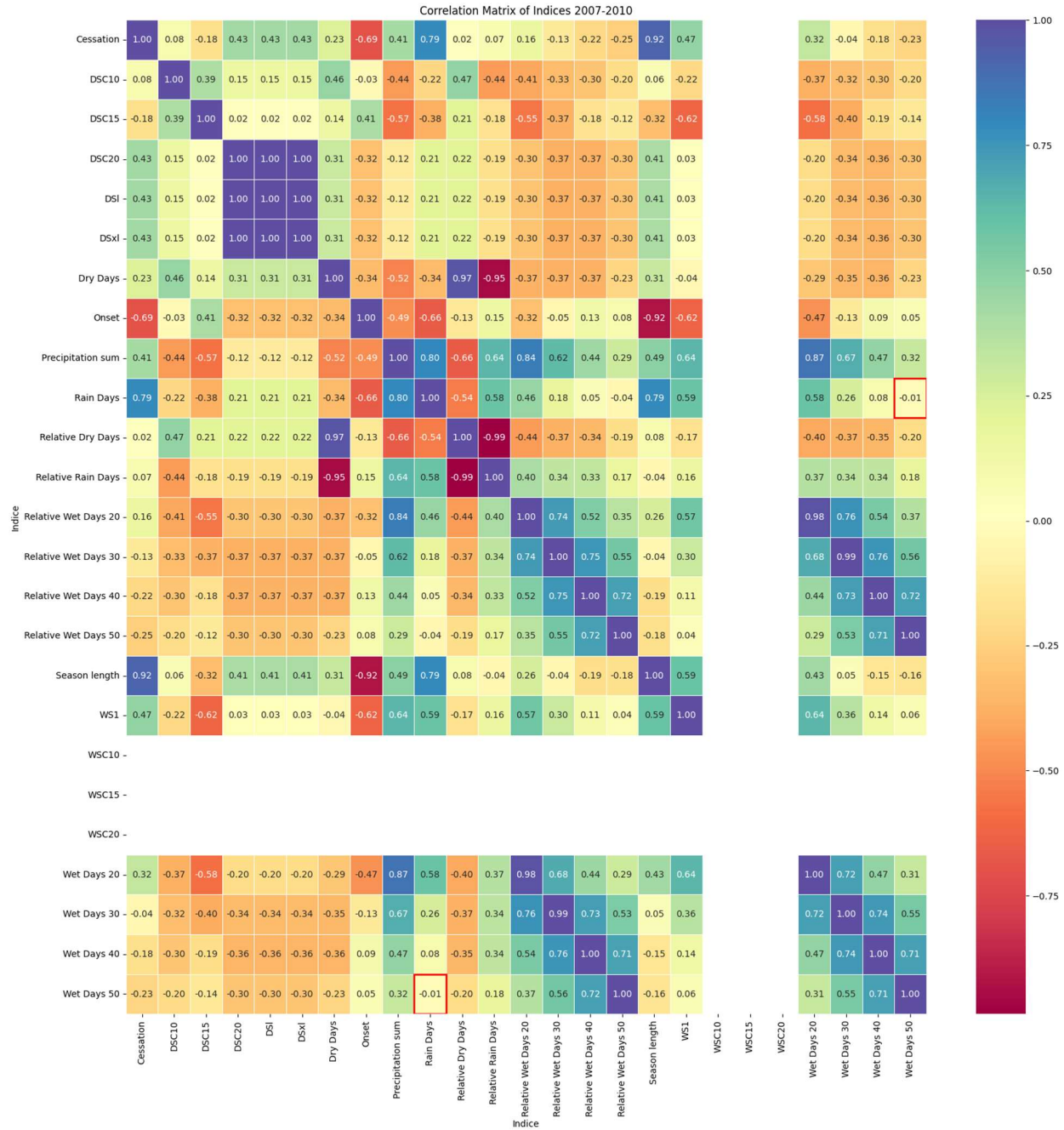
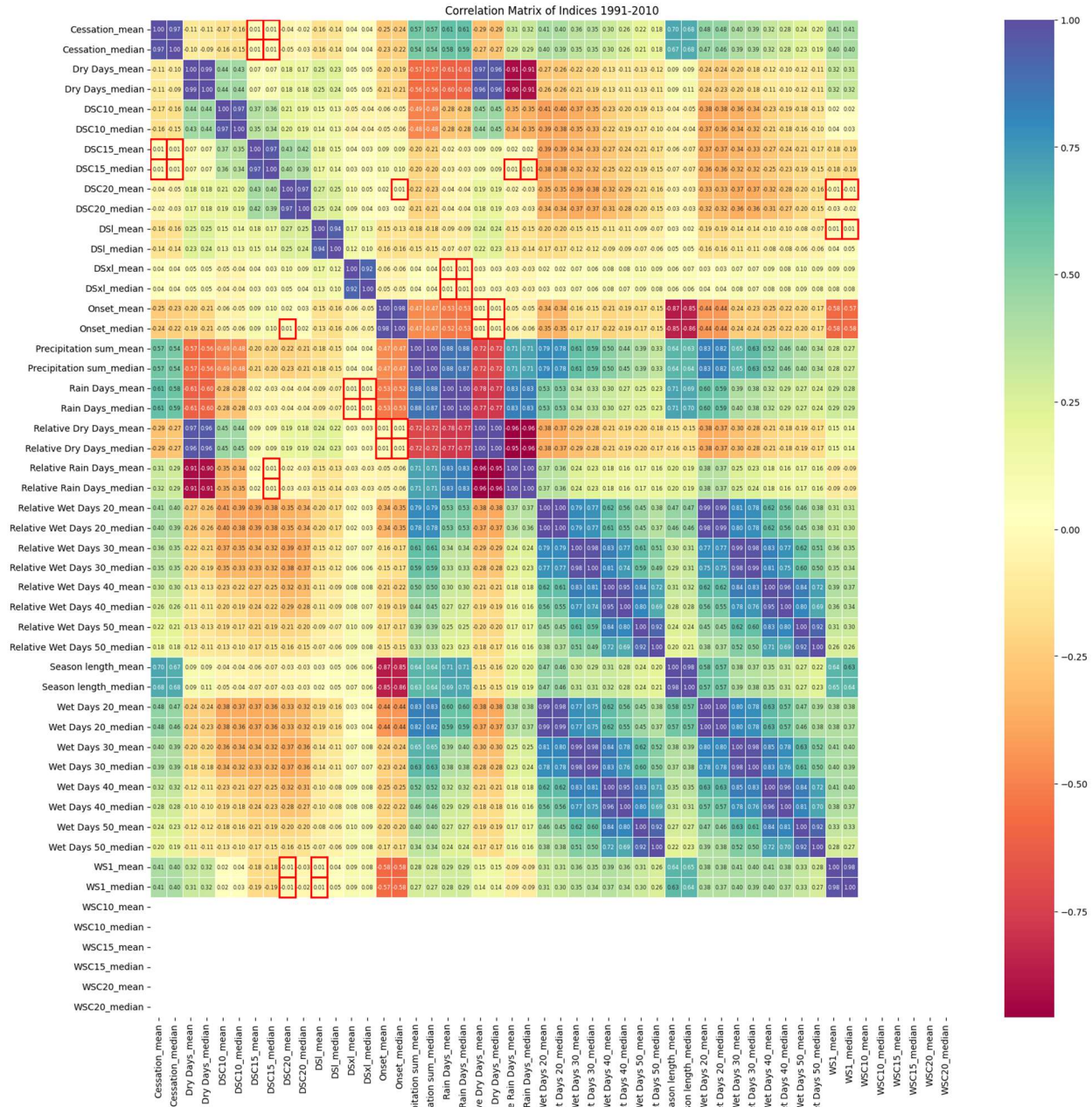Appendix 10: Exploratory data analysis for the sector dataset (median aggregations) , with cotton yields in kg/ha and index units as given in Table 2 of the main document, section 4.4.2.
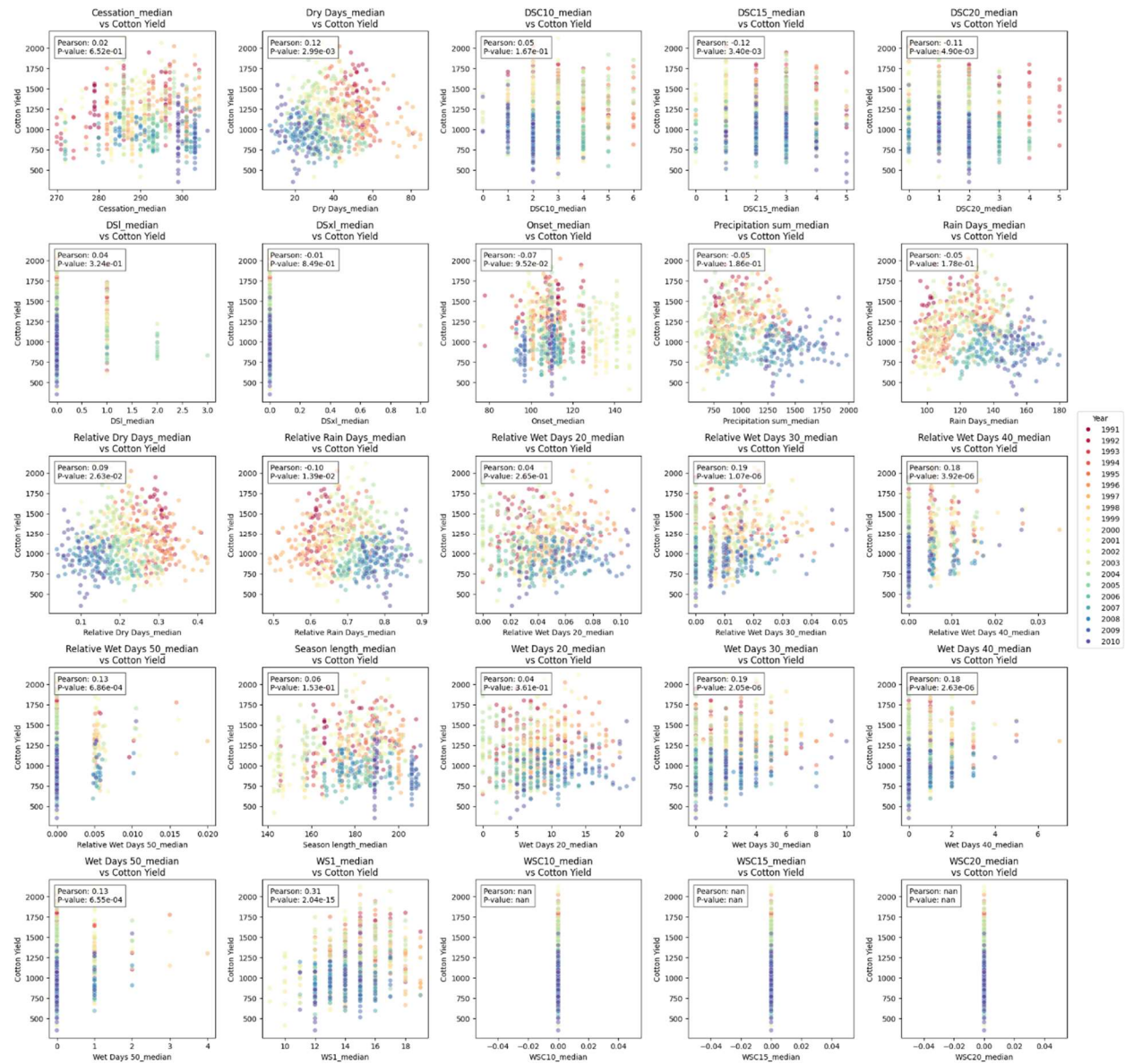
Appendix 11: Linear regression for the collection point dataset, with cotton yields in kg/ha and index units as given in Table 2 of the main document, section 4.4.2.

Appendix 12: Linear regression for the sector dataset (mean aggregations) , with cotton yields in kg/ha and index units as given in Table 2 of the main document, section 4.4.2.

Appendix 13: Linear regression for the sector dataset (median aggregations) , with cotton yields in kg/ha and index units as given in Table 2 of the main document, section 4.4.2.

Appendix 14: Linear regression for the sector dataset using First Difference with temporal dimension (mean aggregations) , with cotton yields in kg/ha and index units as given in Table 2 of the main document, section 4.4.2.

Appendix 15: Linear regression for the sector dataset using First Difference with temporal dimension (median aggregations) , with cotton yields in kg/ha and index units as given in Table 2 of the main document, section 4.4.2.

Appendix 16: Correlations between indices for the collection point dataset (red quadrants mark statistically non-significant relationships with a correlation of r<0.01)

Correlation Matrix of Indices 2007-2010

Appendix 17: Correlations between indices for the sector dataset (red quadrants mark statistically non-significant relationships with a correlation of r<0.01)

Correlation Matrix of Indices 1991-2010

Appendix 18: Multiple linear regression for the collection point dataset (a) and the sector dataset (c-d), with cotton yields in kg/ha and index units as given in Table 2 of the main document, section 4.4.2. (The plane represents all possible combinations of the two independent index variables, showing how changes in these predictors affect the response in the dependent cotton variable.)
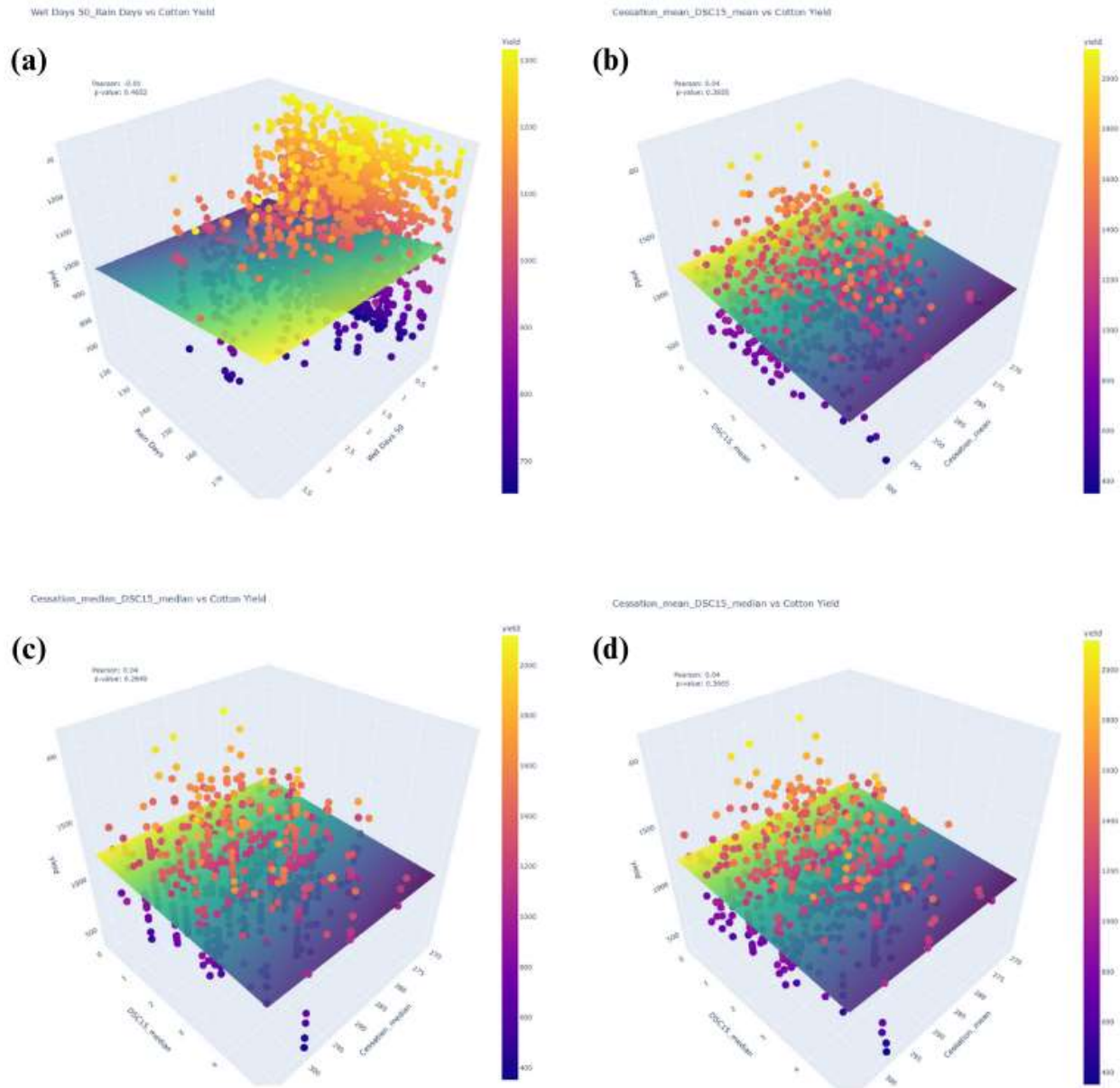
Appendix 19: Table of metrics for multiple linear regression

Indices combinations	Multiple linear regression	
Metric	Pearson	p-value
Dimension	Spatiotemporal	
Yield value	observed value	
Collection point dataset		
Rain days, Wet days 50	0.04	0.3655
Sector dataset		
Cessation mean, DSC15 mean	0.04	0.3655
Cessation mean, DSC15 median	0.04	0.3665
Cessation median, DSC15 mean	0.03	0.3875
Cessation median, DSC15 median	0.04	0.2849
DSC15 median, Relative rain days mean	0.02	0.5779
DSC15 median, Relative rain days median	0.02	0.5821
DSC20 mean, WS1 mean	-0.01	0.7222
DSC20 mean, WS1 median	-0.01	0.7655
DSl mean, WS1 mean	0.02	0.5906
DSl mean, WS1 median	0.03	0.5126
DSxl mean, Rain days mean	0.01	0.8425
DSxl mean, Rain days median	0.01	0.8331
DSxl median, Rain days mean	0.01	0.8502
DSxl median, Rain days median	0.01	0.8693
Onset mean, Relative dry days mean	0.02	0.5422
Onset mean, Relative dry days median	0.03	0.5279
Onset median, DSC20 mean	0.03	0.4731
Onset median, Relative dry days mean	0.03	0.4202
Onset median, Relative dry days median	0.03	0.5015

Appendix 20: Context of the internship

This internship was proposed by the "Centre de coopération Internationale en Recherche Agronomique pour le Développement" (CIRAD), a public establishment founded in 1984 to promote sustainable development of tropical and Mediterranean regions. It was financed by the INNOVACC ("Innovation for Adaptation to Climate Change") project, a major initiative in Cameroon which aims to strengthen the resilience of rural populations in the face of climate change, particularly in the North and Far North regions. This project is in the hands of CIRAD, as well as CIFOR-ICRAF, Energie pour le monde and IRAD, and financed by the European Union. This study is a contributing factor to the INNOVACC project, helping to understand and anticipate the impacts of climate change on cotton production by fitting historical rainfall and cotton data.

The entirety of the internship, from February 2024 to August 2024, was based within the "Unité Mixte de Recherche Territoires, Environnement, Télédétection et Information Spatiale" (UMR TETIS) in Montpellier at the "Maison de la Télédétection". a place dedicated to remote sensing and more broadly to spatial information. It brings together different research and training organizations in two UMRs, including TETIS. The UMR TETIS is a multidisciplinary research laboratory dedicated to exploring and developing the use of spatial information. Its objective is to better understand the complexity of territories, agro-ecosystems, and to support stakeholders in their decision-making.

The internship was supervised by Jérémy LAVARENNE (CIRAD, researcher in agroclimatology and crop modeling), Ibrahim NJOUENWET (École Nationale Supérieure Polytechnique of the University of Yaoundé I, researcher in climatology), and Victor Hugo NENWALA (CIFOR-ICRAF, doctoral student in geography).

Appendix 21: Work organization

TASK	PROGRESS
Bibliography	100%
Rainfall data	
Data preperation	100%
Cross validation	100%
Calculation error metrics	100%
Kriging interpolation	100%
Calculation rainfall indices	100%
Cotton data	
Data preparation	100%
Exploration of statistical relationships	
Simple linear regression	100%
Multiple linear regression	100%
Master thesis	
Master thesis	100%
Presentation	100%

Timeline (weeks): February (12-Feb, 19-Feb, 26-Feb), Mars (04-Mar, 11-Mar, 18-Mar, 25-Mar), April (01-Apr, 08-Apr, 15-Apr, 22-Apr, 29-Apr), May (06-May, 13-May, 20-May, 27-May), Juin (03-Jun, 10-Jun, 17-Jun, 24-Jun), July (01-Jul, 08-Jul, 15-Jul, 22-Jul, 29-Jul), August (05-Aug, 12-Aug, 19-Aug)

The following succession of tasks was adapted: We started with a general familiarization with the subject and data, carrying out research to better understand the problematic and define the state of the art, as well as to prepare the data for effective usage. We then continued working with the rainfall data. To calculate the rainfall indices, we first applied a cross-validation method on our rainfall data to determine the best interpolation method and variogram model, Once found, the rainfall data was interpolated to create daily rainfall maps. These maps were then used to calculate the rainfall indices, producing yearly indices maps. At this point we made sure that the cotton data was correctly prepared to then determine the statistical relationships between cotton yields and rainfall indices by applying simple and multiple linear regression. Bibliographical research was carried out at the beginning of each new task, to better determine and understand the methodology used and its interpretation. In addition, towards the end, additional research was done, to underline our discussion.