

Spatio-temporal variability of groundwater hydrochemical features in different hydrogeological settings in Piedmont and Campania regions (Italy), a comparative study - *Variabilità spatio-temporale delle caratteristiche idrochimiche delle acque sotterranee in differenti contesti idrogeologici in Piemonte e Campania (Italia), uno studio comparativo*

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Supplementary file - File supplementare

Annex 1 - Appendice 1

Table S1 – Results of the Mann-Kendall trend test in the study area in Piedmont Region. Trend: “+” = increasing, “-” = decreasing, “o” = no trend. Coordinate reference system: WGS84 - UTM32 N (E.P.S.G. 32632).

Tabella S1 – Risultati del test di Mann-Kendall nell'area di studio nella Regione Piemonte. Trend: “+” = in aumento, “-” = in diminuzione, “o” = nessun trend. Sistema di coordinate di riferimento: WGS84 - UTM 32 N (E.P.S.G. 32632).

ID monitoring point	East (m)	North (m)	NO ₃ ⁻				Na ⁺				SO ₄ ²⁻			
			Trend	p-value	Tau	OLS slope	Trend	p-value	Tau	OLS slope	Trend	p-value	Tau	OLS slope
00100200004	379,296	4,976,762	+	0.000	0.237	0.439	+	0.001	0.198	0.058	-	0.000	-0.253	-0.117
00100200003	379,521	4,975,338	o	0.173	0.074	0.119	+	0.000	0.223	0.053	-	0.000	-0.225	-0.119
00105800006	393,820	4,974,372	o	0.347	-0.072	-0.068	+	0.000	0.348	0.079	o	0.233	0.078	0.003
00107000005	370,832	4,961,182	-	0.008	-0.122	-0.083	+	0.005	0.185	0.008	-	0.018	-0.146	-0.059
00107000003	374,289	4,958,943	-	0.048	-0.092	-0.075	-	0.001	-0.221	-0.073	-	0.000	-0.286	-0.102
00109700002	374,326	4,979,406	o	0.440	-0.070	-0.011	-	0.001	-0.218	-0.125	-	0.000	-0.366	-0.463
00111000002	371,117	4,976,180	o	0.083	-0.097	-0.236	o	0.054	-0.113	-0.144	-	0.000	-0.347	-0.540
00113600002	391,697	4,966,165	+	0.000	0.287	0.144	+	0.001	0.201	0.029	o	0.220	-0.075	-0.057
00114200001	376,438	4,966,114	o	0.139	-0.079	-0.503	o	0.500	-0.070	-0.127	o	0.062	-0.102	-0.115
00119100003	370,049	4,973,748	-	0.003	-0.116	-0.977	-	0.002	-0.182	-0.166	-	0.000	-0.293	-0.380
00126000005	382,728	4,974,545	+	0.000	0.245	0.477	+	0.000	0.195	0.039	-	0.009	-0.164	-0.128
00126010001	381,057	4,971,571	o	0.269	0.074	0.121	+	0.001	0.193	0.053	o	0.124	-0.084	-0.028
00130000004	381,119	4,960,816	o	0.214	-0.074	-0.059	o	0.266	-0.077	-0.007	-	0.001	-0.167	-0.110
00401210001	368,434	4,954,229	-	0.040	-0.096	-0.023	+	0.032	0.145	0.073	o	0.171	-0.079	-0.004
00401900006	407,203	4,930,757	o	0.314	-0.072	-0.103	o	0.051	-0.107	-0.884	-	0.034	-0.132	-0.294
00402910001	408,454	4,948,831	o	0.248	0.074	0.089	+	0.000	0.233	1.454	+	0.000	0.354	1.387
00404000003	375,159	4,918,614	o	0.253	0.074	0.030	+	0.009	0.180	0.041	-	0.045	-0.129	-0.574
00404000004	377,719	4,922,554	o	0.098	0.086	0.164	+	0.001	0.202	0.041	o	0.298	-0.073	-0.026
00404300005	410,477	4,926,217	+	0.000	0.198	0.250	+	0.000	0.231	0.227	o	0.478	0.070	0.036
00404300004	406,835	4,926,682	-	0.028	-0.099	-0.168	+	0.021	0.131	0.344	o	0.199	0.075	0.012
00404900001	390,551	4,921,087	-	0.040	-0.096	-0.305	o	0.283	0.070	0.007	o	0.090	-0.086	-0.297
00405900008	392,828	4,950,513	+	0.004	0.121	0.136	+	0.000	0.266	0.165	-	0.006	-0.163	-0.242
00406100001	387,328	4,927,683	o	0.195	-0.081	-0.190	-	0.044	-0.124	-0.066	o	0.156	-0.077	-0.510
00406700005	407,995	4,943,014	o	0.355	0.071	0.116	+	0.001	0.182	0.141	o	0.227	-0.072	-0.078
00407800003	389,171	4,919,348	o	0.230	-0.073	-0.056	+	0.046	0.111	0.029	-	0.008	-0.161	-0.098
00408900015	393,810	4,934,491	+	0.000	0.221	0.255	o	0.110	0.085	0.025	o	0.301	0.070	0.044
00408900002	398,575	4,933,172	+	0.001	0.192	0.305	+	0.000	0.206	0.093	o	0.170	0.073	0.063
00408900020	390,783	4,930,811	+	0.024	0.094	0.211	o	0.151	0.082	0.040	-	0.000	-0.222	-0.134
00408910001	398,788	4,935,530	o	0.259	-0.072	-0.120	o	0.198	0.070	0.030	-	0.000	-0.270	-0.674
00409600003	393,728	4,939,886	+	0.000	0.196	0.338	+	0.000	0.288	0.132	-	0.000	-0.242	-0.217
00410400004	384,199	4,941,327	+	0.001	0.124	0.102	o	0.263	-0.073	-2.662	-	0.000	-0.244	-0.104
00410400002	385,060	4,942,990	o	0.224	0.074	0.016	+	0.000	0.242	0.057	-	0.002	-0.214	-0.170
00411800005	395,849	4,918,029	+	0.001	0.202	0.385	+	0.000	0.246	0.072	o	0.088	0.092	0.038

ID monitoring point	East (m)	North (m)	NO ₃ ⁻				Na ⁺				SO ₄ ²⁻			
			Trend	p-value	Tau	OLS slope	Trend	p-value	Tau	OLS slope	Trend	p-value	Tau	OLS slope
00411800004	393,985	4,918,416	o	0.096	-0.078	-0.056	+	0.009	0.187	0.021	o	0.181	-0.075	-0.033
00412800001	390,755	4,948,899	+	0.000	0.219	0.272	+	0.000	0.282	0.113	-	0.000	-0.241	-0.167
00413000001	397,616	4,917,870	o	0.113	-0.090	-0.044	o	0.336	0.071	0.012	-	0.000	-0.236	-0.317
00413600002	397,318	4,924,370	-	0.006	-0.118	-0.610	o	0.096	-0.091	-0.060	o	0.142	-0.085	-0.093
00414310002	383,428	4,957,802	o	0.157	0.084	0.090	+	0.004	0.174	0.162	o	0.394	0.070	0.013
00414410001	397,366	4,919,950	-	0.035	-0.093	-0.140	-	0.001	-0.218	-4.514	-	0.013	-0.143	-0.358
00414700008	407,571	4,937,396	o	0.325	0.072	0.006	+	0.004	0.179	0.185	o	0.364	-0.070	-0.017
00415200002	412,885	4,936,108	-	0.013	-0.103	-0.530	+	0.020	0.141	0.632	-	0.000	-0.294	-0.958
00416900002	411,644	4,929,873	-	0.001	-0.112	-0.390	o	0.289	0.076	0.009	-	0.000	-0.251	-0.185
00416900001	411,348	4,928,365	-	0.000	-0.235	-0.901	+	0.000	0.243	0.199	-	0.000	-0.312	-0.469
00417900004	392,883	4,957,189	o	0.068	0.103	0.140	+	0.000	0.325	0.368	o	0.435	0.070	0.132
00417900002	394,059	4,962,580	+	0.030	0.088	0.162	+	0.000	0.192	0.077	-	0.013	-0.142	-0.336
00418000001	376,198	4,953,115	-	0.000	-0.189	-0.562	+	0.016	0.137	0.085	-	0.001	-0.242	-0.128
00418900003	399,597	4,922,965	-	0.012	-0.107	-0.314	+	0.000	0.261	0.104	-	0.001	-0.245	-0.258
00418900004	397,775	4,922,026	-	0.004	-0.116	-0.172	+	0.025	0.130	0.036	-	0.000	-0.305	-0.342
00418900002	399,761	4,924,478	+	0.000	0.343	0.949	+	0.000	0.233	0.149	-	0.000	-0.249	-0.320
00418900005	400,972	4,918,591	o	0.086	0.087	0.206	+	0.000	0.195	0.074	-	0.008	-0.241	-0.123
00420200004	406,511	4,937,545	o	0.050	0.114	0.023	+	0.048	0.124	0.022	-	0.000	-0.276	-0.796
00420300001	379,941	4,946,409	-	0.000	-0.248	-0.384	o	0.172	-0.078	-0.071	-	0.000	-0.273	-0.253
00420300003	378,193	4,948,599	o	0.056	-0.107	-0.137	+	0.002	0.183	0.924	-	0.000	-0.304	-0.286
00421100002	397,660	4,928,291	o	0.284	0.072	0.288	+	0.000	0.246	0.132	-	0.020	-0.138	-0.146
00421100003	400,828	4,926,212	+	0.035	0.081	0.951	+	0.032	0.133	0.056	-	0.003	-0.221	-0.151
00421500001	388,883	4,936,682	+	0.007	0.130	0.085	+	0.025	0.142	0.019	-	0.007	-0.220	-0.120
00421500002	393,531	4,945,229	+	0.000	0.226	0.287	+	0.001	0.253	0.228	-	0.017	-0.141	-0.133
00421500005	388,411	4,942,647	o	0.431	-0.070	-0.040	+	0.002	0.203	0.067	-	0.000	-0.252	-0.367
00421500008	391,775	4,940,995	+	0.000	0.222	0.288	+	0.003	0.164	0.044	-	0.000	-0.251	-0.287
00421500004	388,138	4,944,099	o	0.355	0.071	0.067	+	0.002	0.168	0.086	-	0.002	-0.212	-0.318
00421500012	391,180	4,937,300	-	0.031	-0.094	-0.282	o	0.345	0.071	0.025	-	0.000	0.275	-0.532
00421700003	385,090	4,950,153	o	0.410	0.071	0.028	+	0.013	0.144	0.041	o	0.444	0.070	0.010
00422510001	383,274	4,930,275	o	0.186	-0.080	-0.348	o	0.056	0.097	0.088	-	0.000	-0.274	-1.427
00422800001	383,294	4,954,747	o	0.133	-0.082	-0.147	+	0.012	0.144	0.095	o	0.091	-0.086	-0.110
00423200006	399,765	4,929,504	o	0.098	-0.085	-0.172	+	0.000	0.252	0.160	-	0.000	-0.276	-0.345
00424400006	382,725	4,935,509	o	0.217	0.074	0.042	+	0.000	0.275	0.071	-	0.000	-0.255	-0.219
00424400007	383,599	4,933,087	o	0.312	0.072	0.045	+	0.014	0.152	0.033	-	0.006	-0.222	-0.134
00425000001	386,249	4,934,876	-	0.049	-0.093	-0.095	+	0.007	0.187	0.016	-	0.002	-0.213	-0.186

Table S2 – Results of the Mann-Kendall trend test in the study area in Campania Region. Trend: “+” = increasing, “-” = decreasing, “o” = no trend. Coordinate reference system: WGS84 - UTM33 N (E.P.S.G. 32633).

Tabella S2 – Risultati del test di Mann-Kendall nell'area di studio nella Regione Campania. Trend: “+” = in aumento, “-” = in diminuzione, “o” = nessun trend. Sistema di coordinate di riferimento: WGS84 - UTM33 N (E.P.S.G. 32633).

ID monitoring point	East (m)	North (m)	NO ₃ ⁻				Na ⁺				SO ₄ ²⁻			
			Trend	p-value	Tau	Theil-Sen slope	Trend	p-value	Tau	Theil-Sen slope	Trend	p-value	Tau	Theil-Sen slope
Ave1	453,164	4,537,430	+	0.041	0.248	0.335	o	0.089	0.230	1.931	o	0.168	0.168	0.588
Ave2	467,221	4,533,701	o	0.918	0.012	0.000	o	0.724	0.042	0.033	o	0.083	0.187	0.105
Bvr16	450,333	4,538,511	o	0.621	0.096	1.081	o	0.694	-0.067	-0.397	o	0.651	0.076	1.154
Bvr2	416,746	4,540,354	o	0.629	-0.081	-0.082	o	0.487	0.114	1.253	o	0.955	-0.013	0.000
Bvr23	422,893	4,545,596	+	0.000	0.551	0.287	o	0.568	0.087	0.349	o	0.981	0.007	0.015
Bvr25	437,626	4,540,667	o	0.061	0.265	0.220	o	0.519	0.098	0.986	o	0.122	0.218	0.260
Bvr26	440,265	4,541,868	o	0.453	0.108	1.057	+	0.027	0.342	0.549	o	0.157	0.200	0.552
Bvr27	443,842	4,541,724	+	0.010	0.410	1.623	o	0.887	0.026	0.000	o	0.611	-0.082	-0.254
Bvr28	418,584	4,537,265	+	0.017	0.360	1.757	-	0.003	-0.481	-5.272	+	0.017	0.360	1.210
Bvr29	418,230	4,532,928	-	0.042	-0.400	-0.154	o	0.140	0.251	56.988	o	0.506	-0.117	-22.425
Bvr35	433,722	4,549,762	-	0.026	-0.346	-1.104	o	0.193	0.210	0.569	o	0.652	-0.074	-0.543
Bvr6	422,094	4,539,524	o	0.735	0.056	0.637	o	0.808	-0.043	-0.086	o	0.865	-0.030	-0.061
Bvr7	433,069	4,534,364	+	0.005	0.407	1.898	+	0.030	0.328	0.727	+	0.023	0.327	0.556
Dur4	451,538	4,540,647	o	0.157	0.181	0.280	+	0.040	0.304	4.105	o	0.775	0.039	0.107
Fle7a	431,413	4,518,351	o	0.462	-0.129	-3.935	-	0.007	-0.378	-3.318	-	0.045	-0.283	-6.019
Mag3	428,865	4,564,237	o	0.224	0.181	0.658	o	0.651	0.074	0.053	o	0.309	-0.152	-0.386
Mag8	421,035	4,560,139	-	0.044	-0.297	-0.639	+	0.018	0.368	0.615	o	0.130	0.225	0.596
Mas1	406,525	4,552,716	+	0.025	0.340	1.089	o	0.291	0.171	3.492	o	0.102	0.243	1.102
Mas2	410,925	4,556,041	o	0.782	-0.040	-0.307	o	0.797	-0.040	-0.058	o	0.859	-0.026	-0.063
Nap10	461,336	4,530,528	o	0.621	0.096	0.252	o	0.052	0.310	0.969	o	0.671	0.071	0.124
Nap20	448,865	4,530,091	-	0.035	-0.382	-1.311	+	0.021	0.392	2.978	o	0.603	-0.089	-3.158
Nap21	449,756	4,529,581	o	0.509	-0.125	-0.490	o	0.932	0.017	0.000	o	0.259	0.177	2.044
Nap31	439,114	4,529,239	o	0.857	0.042	0.600	o	0.474	0.121	0.336	o	1.000	0.005	0.000
Nap5	441,279	4,523,166	o	0.123	-0.279	-0.079	o	0.242	0.195	0.993	+	0.006	0.447	3.454
Nap9	445,408	4,532,013	o	0.819	-0.046	-0.108	+	0.004	0.442	1.277	+	0.000	0.576	9.020
Roc3	422,172	4,564,751	o	0.494	0.085	0.055	o	0.629	0.068	0.059	o	0.453	0.093	0.012
Tif2	439,619	4,550,099	+	0.005	0.366	0.570	+	0.008	0.383	0.769	o	0.102	0.209	0.415