

Hydrochemical evolution and spatio-temporal dynamics of irrigation water quality in the Bay of Algiers aquifer (Algeria)

Evoluzione idrochimica e dinamica spazio-temporale della qualità delle acque irrigue nell'acquifero della Baia di Algeri (Algeria)

Sabra MAZOUZI^a , Mohammedi ZEKARI^a, Ouahiba AZIEZ^b

a - Laboratory of Water and Environmental Engineering, National Higher School of Hydraulics (ENSH), Blida, Algeria.

ORCID 0009-0002-5620-6684 - email:  s.mazouzi@ensb.dz

b - Laboratory of Water Management in Agriculture (LMEA), Kasdi Merbah National Higher School of Agronomy (ENSA), El Harrach, Algiers, Algeria.

ORCID 0009-0000-7802-0077

c - Laboratory of Water and Environmental Engineering, National Higher School of Hydraulics (ENSH), Blida, Algeria.

ORCID 0000-0003-0153-8104

Supplementary file - File supplementare

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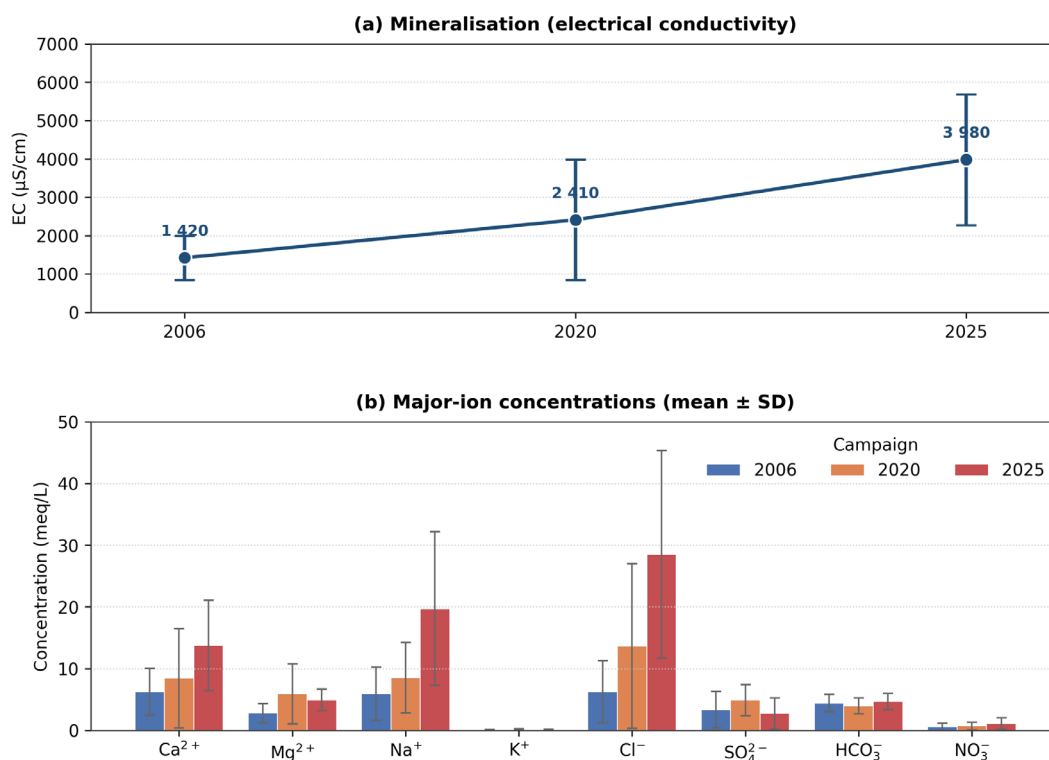


Fig. S1: Temporal evolution of ground water quality indicators: (a) mean electrical conductivity; and (b) mean major-ion concentrations. Error bars represent one standard deviation.

Fig. S1: Evoluzione temporale dei parametri di qualità delle acque sotterranee: (a) conducibilità elettrica media; e (b) media delle concentrazioni degli ioni principali. Le barre d'errore rappresentano una (1) deviazione standard.

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Table S1: Irrigation water quality parameters and indices used in this study, with their equations, classification ranges and references.

Table S1: Parametri e indici della qualità delle acque irrigue usati in questo studio, con equazioni, intervalli di classificazione e riferimenti bibliografici.

Parameter / index	Equation	Range	Class	Reference
Electrical conductivity (EC, $\mu\text{S}/\text{cm}$)	measured	<250 250–750 750–2250 2250–5000 >5000	Excellent Good Permissible Doubtful Unacceptable	Wilcox (1955)
Sodium adsorption ratio (SAR)	$\text{SAR} = \text{Na}^+ / \sqrt{[(\text{Ca}^{2+} + \text{Mg}^{2+})/2]}$	<10 10–18 18–26 >26	Excellent Good Doubtful Unsuitable	Richards (1954)
Sodium percentage (%Na)	$\% \text{Na} = 100(\text{Na}^+ + \text{K}^+) / (\text{Ca}^{2+} + \text{Mg}^{2+} + \text{Na}^+ + \text{K}^+)$	<20 20–40 40–60 60–80 >80	Excellent Good Permissible Doubtful Unsuitable	Wilcox (1955)
Residual sodium carbonate (RSC)	$\text{RSC} = (\text{HCO}_3^- + \text{CO}_3^{2-}) - (\text{Ca}^{2+} + \text{Mg}^{2+})$	<1.25 1.25–2.5 >2.5	Suitable Marginal Unsuitable	Eaton (1950)
Kelley ratio (KR)	$\text{KR} = \text{Na}^+ / (\text{Ca}^{2+} + \text{Mg}^{2+})$	<1 >1	Suitable Unsuitable	Kelley (1963)
Permeability index (PI)	$\text{PI} = 100(\text{Na}^+ + \sqrt{\text{HCO}_3^-}) / (\text{Ca}^{2+} + \text{Mg}^{2+} + \text{Na}^+)$	>75 25–75 <25	Class I Class II Class III	Doneen (1964)
Potential salinity (PS, meq/L)	$\text{PS} = \text{Cl}^- + 0.5 \times \text{SO}_4^{2-}$	<3 3–5 >5	Excellent Good Unsuitable	Doneen (1964)
Magnesium hazard (MH, %)	$\text{MH} = 100 \times \text{Mg}^{2+} / (\text{Ca}^{2+} + \text{Mg}^{2+})$	<50 >50	Suitable Unsuitable	Raghunath (1987)
Residual sodium bicarbonate (RSBC, meq/L)	$\text{RSBC} = \text{HCO}_3^- - \text{Ca}^{2+}$	<5 5–10 >10	Suitable Marginal Unsuitable	Gupta & Gupta (1987)
Total hardness (TH, mg/L CaCO_3)	$\text{TH} = 2.5 \times \text{Ca}^{2+} + 4.1 \times \text{Mg}^{2+}$	<75 75–150 150–300 >300	Soft Moderately hard Hard Very hard	Todd & Mays (2005)

Table S2: Pearson correlation matrix of physicochemical parameters in 2006.

Table S2: Matrice di correlazione di Pearson dei parametri fisico-chimici nel 2006.

	pH	EC	Ca	Mg	Na	K	Cl	SO ₃	HCO ₃	NO ₃	TH
pH	1										
EC	-0.416	1									
Ca	-0.561**	0.640**	1								
Mg	-0.199	0.451*	0.580**	1							
Na	-0.078	0.565**	-0.201	-0.304	1						
K	0.002	0.219	-0.335	-0.388	0.691**	1					
Cl	-0.271	0.682**	0.000	-0.207	0.946**	0.595**	1				
SO ₃	-0.219	0.628**	0.855**	0.757**	-0.204	-0.366	-0.100	1			
HCO ₃	-0.210	-0.037	0.426	0.620**	-0.577**	-0.329	-0.567**	0.404	1		
NO ₃	-0.679**	0.470*	0.725**	0.512*	-0.154	-0.213	0.031	0.509*	0.419	1	
TH	-0.502*	0.644**	0.966**	0.770**	-0.253	-0.385	-0.065	0.909**	0.530*	0.729**	1

Note: * $p < 0.05$; ** $p < 0.01$ (two-sided Pearson correlation test; $n = 21$).

Table S3: Pearson correlation matrix of physicochemical parameters in 2020.

Table S3: Matrice di correlazione di Pearson dei parametri fisico-chimici nel 2020.

	pH	EC	Ca	Mg	Na	K	Cl	SO ₃	HCO ₃	NO ₃	TH
pH	1										
EC	-0.348	1									
Ca	-0.460	0.900**	1								
Mg	0.182	0.485	0.123	1							
Na	-0.390	0.965**	0.846**	0.408	1						
K	0.294	-0.366	-0.278	-0.350	-0.282	1					
Cl	-0.313	0.978**	0.885**	0.473	0.959**	-0.245	1				
SO ₃	-0.313	0.819**	0.724**	0.442	0.755**	-0.550	0.699**	1			
HCO ₃	-0.413	0.264	0.186	0.242	0.210	-0.589*	0.091	0.622*	1		
NO ₃	-0.246	0.703**	0.468	0.637*	0.676*	-0.631*	0.645*	0.575*	0.471	1	
TH	-0.283	0.970**	0.871**	0.594*	0.888**	-0.400	0.952**	0.806**	0.271	0.695**	1

Note: * $p < 0.05$; ** $p < 0.01$ (two-sided Pearson correlation test; $n = 13$).

Table S4: Pearson correlation matrix of physicochemical parameters in 2025.

Table S4: Matrice di correlazione di Pearson dei parametri fisico-chimici nel 2025.

	pH	EC	Ca	Mg	Na	K	Cl	SO ₃	HCO ₃	NO ₃	TH
pH	1										
EC	0.088	1									
Ca	0.027	0.675*	1								
Mg	0.756*	0.341	-0.007	1							
Na	-0.036	0.921**	0.354	0.348	1						
K	0.019	0.024	0.300	-0.301	-0.175	1					
Cl	0.051	0.973**	0.550	0.391	0.951**	-0.017	1				
SO ₃	0.043	0.358	0.382	0.044	0.298	-0.384	0.202	1			
HCO ₃	-0.085	0.328	0.343	0.090	0.276	-0.414	0.235	0.363	1		
NO ₃	-0.473	-0.492	0.030	-0.611	-0.585	0.348	-0.544	-0.222	-0.155	1	
TH	0.201	0.736*	0.973**	0.224	0.426	0.223	0.626	0.383	0.355	-0.111	1

Note: * $p < 0.05$; ** $p < 0.01$ (two-sided Pearson correlation test; $n = 9$).