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# Assessment of groundwater quality and soil salinization risks in the central Tunisia aquifer systems: water resources management and public health implications

## *Valutazione della qualità delle acque sotterranee e dei rischi di salinizzazione del suolo nei sistemi acquiferi della Tunisia centrale: gestione delle risorse idriche e implicazioni per la salute pubblica"*

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## Supplementary file - *File supplementare*

***Table 1:*** Correlation matrix for physico-chemical elements

| | EC | TDS | pH | Na | K | Ca | Mg | Cl | $NO_3$ | $SO_4$ | $HCO_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EC | 1.000 | | | | | | | | | | |
| TDS | 1.000 | 1.000 | | | | | | | | | |
| pH | 0.263 | 0.263 | 1.000 | | | | | | | | |
| Na (mg/L) | 0.914 | 0.914 | 0.416 | 1.000 | | | | | | | |
| K (mg/L) | 0.809 | 0.810 | 0.299 | 0.888 | 1.000 | | | | | | |
| Ca (mg/L) | 0.492 | 0.493 | -0.213 | 0.305 | 0.161 | 1.000 | | | | | |
| Mg (mg/L) | 0.814 | 0.814 | 0.180 | 0.718 | 0.694 | 0.271 | 1.000 | | | | |
| Cl (mg/L) | 0,.918 | 0.918 | 0.290 | 0.920 | 0.872 | 0.384 | 0.705 | 1.000 | | | |
| $NO_3$ (mg/L) | 0,.182 | 0.182 | 0.454 | 0.327 | 0.270 | -0.357 | 0.174 | 0.136 | 1.000 | | |
| $SO_4$ (mg/L) | 0.600 | 0.601 | -0.091 | 0.480 | 0.434 | 0.507 | 0.742 | 0.367 | 0.023 | 1.000 | |
| $HCO_3$ (mg/L) | -0.196 | -0.197 | 0.190 | -0.052 | 0.044 | -0.471 | -0.127 | -0.170 | 0.505 | -0.158 | 1.000 |

***Table 2:*** Total explained variance of the studied variables in the groundwaters of the UZ aquifer.

| Component | Initial eigenvalues | | | Sums extracted from the load square | | |
|---|---|---|---|---|---|---|
| | Total | % of variance | % cumulative | Total | % of variance | % cumulative |
| 1 | 5.960 | 54.180 | 54.180 | 5.960 | 54.180 | 54.180 |
| 2 | 2.256 | 20.513 | 74.693 | 2.256 | 20.513 | 74.693 |
| 3 | 0.935 | 8.501 | 83.194 | | | |
| 4 | 0.606 | 5.512 | 88.706 | | | |
| 5 | 0.508 | 4.617 | 93.324 | | | |
| 6 | 0.387 | 3.515 | 96.839 | | | |
| 7 | 0.186 | 1.692 | 98.531 | | | |
| 8 | 0.088 | 0.800 | 99.331 | | | |
| 9 | 0.050 | 0.457 | 99.788 | | | |
| 10 | 0.023 | 0.212 | 100.000 | | | |
| 11 | 1.926E-6 | 1.751E-5 | 100.000 | | | |

***Table 3:*** Matrix of the components of the variables studied in the deep groundwater of the Maknessy basin.

| | Component | |
|---|---|---|
| | 1 | 2 |
| EC | 0.980 | -0.049 |
| TDS | 0.980 | -0.050 |
| PH | 0.303 | 0.636 |
| Na (mg/L) | 0.946 | 0.186 |
| K (mg/L) | 0.872 | 0.221 |
| Ca (mg/L) | 0.453 | -0.699 |
| Mg (mg/L) | 0.857 | -0.029 |
| Cl (mg/L) | 0.926 | 0.029 |
| $NO_3$ (mg/L) | 0.219 | 0.798 |
| $SO_4$ (mg/L) | 0.649 | -0.315 |
| $HCO_3$ (mg/L) | -0.163 | 0.733 |

***Table 4:*** Pearson correlation matrix for calculated ionic indices.

| | | TH | ESP | %Mg | KR | IP | SAR | %Na | EC |
|---|---|---|---|---|---|---|---|---|---|
| Corrélation | TH | 1.000 | | | | | | | |
| | ESP | 0.344 | 1.000 | | | | | | |
| | %Mg | 0.390 | 0.254 | 1,000 | | | | | |
| | KR | -0.250 | 0.793 | -0,008 | 1,000 | | | | |
| | IP | -0.568 | 0.525 | -0.084 | 0.919 | 1,000 | | | |
| | SAR | 0.345 | 1.000 | 0.253 | 0.790 | 0.522 | 1,000 | | |
| | %Na | -0.263 | 0.589 | -0.006 | 0.774 | 0.736 | 0.586 | 1.000 | 0.074 |
| | CE | 0.859 | 0.677 | 0.341 | 0.145 | -0.181 | 0.680 | 0.074 | 1.000 |

***Table 5:*** Total explained variance of calculated ionic indices.

| Component | Initial eigenvalues | | | Sums extracted from the load square | | |
|---|---|---|---|---|---|---|
| | Total | % of variance | % cumulative | Total | % of variance | % cumulative |
| 1 | 4.077 | 50.960 | 50.960 | 4.077 | 50.960 | 50.960 |
| 2 | 2.687 | 33.588 | 84.548 | 2.687 | 33.588 | 84.548 |
| 3 | 0.794 | 9.928 | 94.476 | | | |
| 4 | 0.322 | 4.029 | 98.504 | | | |
| 5 | 0.066 | 0.823 | 99.328 | | | |
| 6 | 0.046 | 0.574 | 99.901 | | | |
| 7 | 0.008 | 0.096 | 99.997 | | | |
| 8 | 0.000 | 0.003 | 100.000 | | | |

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***Table 6:*** Component matrix for soil salinisation and sodisation risk indices.

| | Component | |
|---|---|---|
| | 1 | 2 |
| TH | 0.100 | 0.969 |
| ESP | 0.954 | 0.256 |
| %Mg | 0.200 | 0.503 |
| KR | 0.917 | -0.358 |
| IP | 0.731 | -0.641 |
| SAR | 0.952 | 0.259 |
| %Na | 0.772 | -0.382 |
| EC | 0.489 | 0.823 |
| *Extraction method: Principal component analysis.*<br>*a. 2 components extracted.* | | |