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Comparing methods to estimate chloride natural background levels to assess sea water intrusion

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In order to assess the anthropogenic impacts on groundwater quality we generally need to identify the natural conditions or Natural background levels (NBLs) within groundwater systems, which are used as references to assess the evolution of the contamination status. This information, in addition to the threshold values (TVs), which are derived from NBLs and based on specific criteria values for legitimate water uses and the environment (terrestrial and aquatic ecosystems), is required to appropriately assess of the chemical status of groundwater in accordance with the European Water Framework Directive and to analyse and propose potential measures where they are required.

In literature, different methodologies are available to assess NBLs and reference TVs for different geochemical substances based on the available measurements of groundwater salinity (e.g. based on probability plots). In this work we analyze and compare three previously proposed methods for derivation of chloride NBLs, which is a conservative solute and is closely related to salt water intrusion in inland and coastal aquifers. We discuss and compare their applicability in pilots located in different settings (southern /northern European / Mediterranean/ North Sea /Baltic Sea) covering different typologies (detrital, karstic, fissured aquifers) and management issues (overexploitation, land use and land cover changes, etc). We perform sensitivity analysis to different constraints applied to remove samples affected by human activity (Nitrate and the brackish saline constraints) in the assessment of NBLs. Finally, based on this analysis, we propose a general approach for derivation of NBLs that could be applied to any of the tested pilots as well as other similar settings in Europe.

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