Conceptualisation of Sea-Water Intrusion in an Island Aquifer System

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A method to conceptualise the assessment of the impact of sea-water intrusion in island and coastal aquifer systems is being proposed. The method will enable the undertaking of a first assessment of the sea-water intrusion problem, hence providing an early-stage and simple to apply “warning system” enabling the informed and timely application of mitigation measures intended to protect the quantitative and qualitative status of the aquifer system. The method proposes the discretization of the aquifer to enable the correlation of the current aquifer “freshwater domain” with reference conditions representing the aquifer system under undisturbed conditions. The “freshwater domain” is defined by the volume of water between the piezometric surface and the seawater interface, and can be obtained from numerical models, where available, or the application of simple analytical approaches such as the Ghyben-Herzberg solution. The dynamic of the seawater intrusion is defined as the change in natural “freshwater domain” and chloride concentrations within it. Therefore, the method is applicable to island and coastal aquifers with low-data availability, and in particular to cases where a numerical-model is not-yet developed. The application of the method will enable the quantification of sea-water intrusion impacts at an aquifer scale, enabling the visual-conceptual representation of the sea-water intrusion affected area, as well as identify the level of intrusion. The method also enables the temporal assessment of sea-water intrusion, identifying the evolution of intrusion throughout the exploitation period of the aquifer system. The method has been implemented in a GIS tool, and applied to the Mean Sea Level Aquifer system in Malta.

Acknowledgement: This research has been partially supported by the GeoE.171.008-TACTIC project from GeoERA organization funded by European Union’s Horizon 2020 research and innovation program and by the SIGLO-AN project (RTI2018-101397-B-I00) from the Spanish Ministry of Science, Innovation and Universities (Programa Estatal de I+D+I orientada a los Retos de la Sociedad)