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Editorial

Special Issue "Focus on the Salinization Issue in the Mediterranean Area"

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1. Introduction

Throughout the Mediterranean Region, recent and past studies have highlighted an increase in temperature, especially during summer, a decrease in precipitation and a change in the in-year precipitation pattern [1–3]. The Mediterranean Region is undergoing intensive demographic, social, cultural, economic and environmental changes. The population of Mediterranean countries doubled from 240 M in 1960 to 480 M in 2010, with the urban population of EU Med countries increasing from 57% to 76% in the same period [4]. Most urbanization takes place along the coastal zones, contributing to increasing the salinization of water resources. Thus, in the following years with the progressive loss of surface water resources, groundwater resources will be gradually more stressed, especially in coastal Mediterranean areas. This makes the Mediterranean a good benchmark to test and validate scientific approaches to characterize and better understand the ongoing salinization trends of water resources. Unfortunately, most of the research efforts on historical and projected changes focus on the aboveground components of the hydrologic cycle [5,6]. While, for the sub-surface components of the hydrologic cycle (e.g., recharge, groundwater levels, aquifer fluxes and groundwater quality), the research efforts are still in their infancy [7,8]. Nevertheless, since the Mediterranean is suffering from the progressive loss of surface water resources [9], studies on groundwater quality and availability will be pivotal to understand and regulate the changing hydrologic cycle, especially in coastal areas. The limited knowledge of the ongoing and future effects of climate change on groundwater resources thus inspired this Special Issue.

2. Contributions

The main goal of this Special Issue of *Water* is to focus on different methodological approaches to improve the understanding of salinization mechanisms of both groundwater and soil water, which may derive from actual seawater intrusion, paleo-seawater intrusion, an increase in atmospheric temperatures that in turn drives evapoconcentration and agricultural return flows. From its first announcement, and after being thoroughly peer reviewed, six papers have been accepted for publication [10–15]. To gain an overview of the ideas collected by this Special Issue, a brief summary of each published paper is reported below.

This Special Issue of *Water* provides a valuable contribution to the characterization of groundwater salinization in the Mediterranean by collecting and presenting current applications of field-based studies using remote sensing, GIS spatial analyses, environmental tracers, statistical analyses or combined approaches.

For example, a study focusing on statistical analysis of groundwater data to evaluate the spatial changes of water level and electrical conductivity has been performed in an intensively characterized and studied coastal phreatic aquifer of Emilia-Romagna (Northeast Italy) for the decade from 2009 to 2018 [10]. The results highlight the existence of saline groundwater at the bottom of the aquifer in most of the study area, thus stressing that groundwater quality is not suitable for human consumption and irrigation. The spatial

Citation: Mastrocicco, M. Special Issue "Focus on the Salinization Issue in the Mediterranean Area". *Water* **2021**, *13*, 681. https://doi.org/10.3390/w13050681

Received: 1 March 2021
Accepted: 2 March 2021
Published: 3 March 2021

analyses of the horizontal distribution of compound-specific stable and radioactive isotopes combined with major dissolved ions in the Grombalia coastal aquifer (Tunisia) were pivotal to unravel the main geochemical processes driving aquifer salinization and groundwater residence times [11]. In the same line of research, major and compound-specific isotope analyses were combined with major ions to disentangle the ongoing salinization and factors influencing groundwater quality in the coastal archeological site of Cumae located in the volcanic district of the Phlegraean Fields (Southern Italy) [12]. Another contribution of this Special Issue tackles complex transboundary aquifer management affected by different sources of salinization that threaten the well field of the Lower Yarmouk Gorge (LYG) shared by Israel, Jordan and Syria [13]. In a different line of research, the study presented by Kasim et al. [14] analyzed the salt-affected land which is predominant in the Keriya River area of Northwestern China via satellite band reflectance and newly optimum spectral indices (OSIs) based on two-dimensional and three-dimensional data. Finally, a review paper closes this Special Issue discussing the new advances and challenges that still must be faced in the Mediterranean with a special focus on predictions of climate change effects on coastal aquifers, which surely deserve additional research [15].

I believe that, with the articles published in this Special Issue, the topic of groundwater salinization in the Mediterranean will receive more attention by the wider scientific community and that the need to deal with groundwater salinization issues will be better understood and shared.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

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