



## MEDSAL Project - Salinization of critical groundwater reserves in coastal Mediterranean areas: Identification, risk assessment and sustainable management with the use of integrated modelling and smart ICT tools

**Evangelos Tziritis**<sup>1</sup>, Vassilis Aschonitis<sup>1</sup>, Gabriella Balacco<sup>6</sup>, Petros Daras<sup>2</sup>, Charalampos Doulergis<sup>1</sup>, Maria Dolores Fidelibus<sup>6</sup>, Elyes Gaubi<sup>7</sup>, Moncef Gueddari<sup>7</sup>, Cüneyt Güler<sup>8</sup>, Fadoua Hamzaoui<sup>7</sup>, Christoph Külls<sup>4</sup>, Mehmet Ali Kurt<sup>8</sup>, Phaedon Kyriakidis<sup>5</sup>, Stelios Liodakis<sup>5</sup>, Birgül Mazmanci<sup>8</sup>, Redha Mohammed Menani<sup>3</sup>, Katerina Nikolaidou<sup>2</sup>, Nizar Ouertani<sup>7</sup>, Andreas Panagopoulos<sup>1</sup>, Vasilios Pisinaras<sup>1</sup>, Jay Krishna Thakur<sup>9</sup>, Ümit Yıldırım<sup>8,10</sup>, and Mounira Zammouri<sup>7</sup>

<sup>1</sup>Soil and Water Resources Institute, Hellenic Agricultural Organization, Greece

<sup>2</sup>Center for Research and Technology -HELLAS, Information Technologies Institute, Greece

<sup>3</sup>Mobilisation and Water Resources Management Laboratory, Batna 2 University, Algeria

<sup>4</sup>Technische Hochschule Lübeck / Architecture & Civil Engineering, Laboratory for Hydrology and International Water Management, Germany

<sup>5</sup>Cyprus University of Technology, Department of Civil Engineering and Geomatics, Cyprus

<sup>6</sup>Polytechnic University of Bari, DICATECh Dept, Italy

<sup>7</sup>Faculty of Science of Tunis, Department of Geology, Tunisia

<sup>8</sup>Mersin University, Faculty of Engineering, Turkey

<sup>9</sup>Environment and Information Technology Center – UIZ, Germany

<sup>10</sup>Bayburt University, Department of Interior Architecture and Environmental Design, Turkey

MEDSAL is a research project ([www.medsal.net](http://www.medsal.net)) focusing on groundwater salinization in the Mediterranean area, funded by the PRIMA Program (Partnership for Research and Innovation in the Mediterranean Area), and running for 36 months starting from September 2019. MEDSAL constitutes a joint Euro-Mediterranean cooperation network of organizations from Mediterranean countries and associated states of the EU contributing national funds. The partnership involves eight academic partners from seven countries (plus an external collaborator – private firm), covering a wide range of academic experts in various scientific fields (e.g. hydrogeology, hydrogeochemistry, environmental isotopes, modeling, hydro-informatics, geostatistics, machine learning).

MEDSAL aims at developing innovative methods to identify various sources and processes of salinization and at providing an integrated set of modeling tools that capture the dynamics and risks of salinization. Thereby, it aims to secure the availability and quality of groundwater reserves in Mediterranean coastal areas, which are amongst the most vulnerable regions in the world to water scarcity and quality degradation. MEDSAL encompasses six (6) test sites located in five (5) countries: Rhodope, Greece, (ii) Samos Island, Greece, (iii) Salento, Italy, (iv) Tarsus, Turkey, (v)

Boufichia, Tunisia, and (vi) Bouteldja, Algeria.

MEDSAL's principal objectives are the following: a) Deliver new tools for the identification of complex salinization sources and processes, b) Exploit the potential of Artificial intelligence and Deep Learning methods to improve detection of patterns in multi-dimensional hydrogeochemical and isotope data, c) Elaborate tailor-made risk assessment and development of management plans by coupling salinization forecasts with climate change impacts and future scenarios, and d) Develop a public domain web-GIS Observatory for monitoring, alerting, decision support and management of coastal groundwater reserves around the Mediterranean.

MEDSAL is expected to have a significant impact on water resources availability and quality by improving the identification and development of adequate strategies and measures for the protection and management of salinization in coastal aquifers. In this context, MEDSAL will provide innovative classification and detection methods of groundwater salinization types for Mediterranean coasts, also in complex karstic and data-scarce environments. These outcomes will be reached by better integration of hydrogeochemical and environmental isotope data with physical-based groundwater flow and transport models and advanced geostatistics. Artificial intelligence and deep learning methods will be also used to improve the detection of patterns in multi-dimensional hydrogeochemical and isotope data.