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Integrated surface and groundwater resources management in a coastal aquifer (Cap BonPeninsula-NE of Tunisia)

Ichrak Khammessi[1], Serge Brouyère[2], Jalel Aouissi[1], adel zghibi[4], Ali Mirchi[3], Anis Chkirbene[5], Amira Merzougui[6], Mohamed Haythem Msaddek[4], and Hamadi Habaieb[1]

[1]LR 17AGR01 (GREEN-TEAM)/ Institut National Agronomique de Tunisie/Université de Carthage, 43 Avenue Charles Nicolle, Tunis 1082, Tunisia
[2]Group of Hydrogeology and Environmental Geology – Aquapôle, University of Liège, Chemin des Chevreuils, 1, Building B52/3, 4000 Liège, Belgium
[3]Department of Biosystems and Agricultural Engineering, Oklahoma State University, 111 Agricultural Hall, Stillwater, OK 74078, USA
[4]Faculty of Sciences of Tunis, Department of Geology, Laboratory Geosciences, Mineral Resources, Energies and Environment, University of Tunis El Manar, 2092 Tunis–El Manar, Tunisia
[5]Georesources Laboratory,Water Research and Technology Centre, Borj Cedria Ecopark 8, PO Box 273, 8020 Soliman, Tunisia
[6]National Institute of Agronomy, University of Carthage, 1082 Tunis

Coastal aquifers are usually the main source of water supply for irrigation, drinking and industrial purposes in coastal regions. They are often subject to overexploitation and consequent quantitative and qualitative degradation. The groundwater flow system of the Chiba watershed in the CapBon peninsula (NE of Tunisia) is a typical case of an overexploited aquifer, where a piezometric depression exceeding -10 m (a.m.s.l) appeared has developed over the two last decades. Among the numerous remediation tentatives, the SMART-WATER project aimed to propose a remediation plan based on a smart monitoring and water-energy nexus solution through the installation of smart energy and water meters (SEWM). This technology aims to optimize groundwater pumping at a set of selected representative farming systems in the watershed. In this context, a first coupled surface water-groundwater flow model has been developed and applied, coupled with energy nexus for the irrigated Chiba plain. The model is implemented using a dynamic coupling between MODFLOW WEAP and LEAP in order to assess the SEWM system efficiency in reducing aquifer exploitation and electrical energy consumption at farm level. Multi-objective calibration of the model using river discharge and GW level data has yielded accurate simulation of historical conditions, and resulted in better-constrained parameters compared to using either data source alone. Model simulations show that crop water demand cannot be met during droughts due to limited GW pumping capacity, and that increased GW pumping has a relatively strong impact on GW levels due to the small specific yield of the aquifer. Groundwater and energy models have also revealed that, under different management and climatic scenarios, electric energy consumption and groundwater table decline are intricately connected. Despite the short monitoring period and the intermittence of the received data, SEWMs have shown a promising role in monitoring groundwater pumping and

engaging farmers in energy saving and aquifer sustainability.