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Studying the impact of climate change on coastal aquifers and adjacent wetlands

Tibor Stigter (1), Luís Ribeiro (1), Rodrigo Oliveira (2), Javier Samper (3), Younes Fakir (4), Luís Fonseca (7), José Paulo Monteiro (5), João Pedro Nunes (6), and Bruno Pisani (3)

(1) Geo-Systems Centre/CVRM, Instituto Superior Técnico, Lisbon, Portugal, (2) CEHIDRO, Instituto Superior Técnico, Lisbon, Portugal, (3) ETS Ingenieros de Caminos, Canales y Puertos, Universidad da Coruña, A Coruña, Spain, (4) Faculté des Sciences Semlalia, Université Cadi Ayyad, Marrakech, Morocco, (5) Geo-Systems Centre/CVRM, Universidade do Algarve, Faro, Portugal, (6) CESAM, Universidade de Aveiro, Aveiro, Portugal, (7) FCT, Universidade do Algarve, Faro, Portugal

program, assessing the impact of climate change on coastal groundwater resources and dependent ecosystems. These resources are often intensively exploited, potentially leading to saltwater intrusion and the degradation of groundwater and dependent wetlands. Climate change may increase this problem in Mediterranean regions, due to the combined effect of rising sea levels and decreasing aquifer recharge. CLIMWAT aims to address this problem by employing a multimethodological approach involving climate scenarios, surface and groundwater flow and transport modeling, as well as hydrochemical indicator and ecological diversity indices. Research is performed in three coastal areas: the Central Algarve in Portugal, the Ebro delta in Spain and the Atlantic Sahel in Morocco. The mean annual temperatures are 17.4 º C, 17.2 º C and 17.5 º C, respectively, whereas mean annual rainfall is lower in the Atlantic Sahel (390 mm) than in the Ebro Delta (520 mm) and the Central Algarve (660 mm). Work package (WP) 1 involves the collection of existing data (in a GIS environment), baseline characterization and the selection of monitoring locations. These include wells and springs of official (water level/quality) monitoring networks, as well as additional observation points selected at strategic locations, including the wetlands receiving groundwater and adjacent aquifer sectors.

In WP2 the climate scenarios are selected and integrated in hydrological models (SWAT, GISBALAN), which are developed and calibrated with existing data, prior to scenario modeling. The main focus of this WP is to estimate the evolution of surface runoff and groundwater recharge under climate change. Data on climate change scenarios and model projections are compiled from: (i) the PRUDENCE project; (ii) the ENSEMBLES project; (iii) IPCC scenarios and projections, AR4; (iv) AEMet (Spanish Meteorological Agency) for generation of regional scenarios of climate change in Spain. For Morocco, where runoff is negligible, groundwater recharge is determined by evapotranspiration methods.

WP3 involves the monitoring and modeling of groundwater. Water level, electrical conductivity (EC) and temperature measurements are made on a regular basis. At the Portuguese study site, continuous recording of these parameters is performed in the estuary and adjacent aquifer, studying the effect of tidal fluctuations and seasonal variations in recharge and abstractions. Groundwater flow and transport models are created or further developed, integrating the climate scenarios and recharge calculations of WP2, in order to simulate the impact on aquifer hydrodynamics and the movement of the fresh/salt water interface.

In WP4 the response of coastal ecosystems to changes in groundwater inputs is assessed with the aid of ecological diversity indices and by using particular taxonomic groups of invertebrates as bioindicators. Mesofauna groups are also characterized in groundwater and their potential as indicators of changes in water composition is assessed. Preliminary results at the Portuguese study site allow understanding that low salinity is apparently relevant for the colonization of the macroinvertebrate species in the groundwater receiving wetland, as the typically estuarine species, which tolerate low salinity, are abundant.