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How to face groundwater salinization and contamination under global environmental change in its societal context. Challenge of water quality in the urban environment of Recife (Brazil)

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ABSTRACT

Due to an increasing demographic pressure, the Metropolitan Region of Recife (RMR, the fifth largest metropolitan area in Brazil), went through remarkable water and land use changes over the last decades. These evolutions gave rise to numerous environmental consequences, such as a dramatic decline of the piezometric levels, groundwater salinization and contamination. This degradation of natural resources is linked to the increase of water demand, punctually amplified by drought periods which induced the construction of thousands of private wells, hindering global political solutions. The RMR thus appears as a typical "hot spot" illustrating the problems of emerging countries such as urbanization, unequal distribution of wealth, limited effects of political decisions, rapid industrial and touristic development. All these factors induce high pressures on water resources both on quantity and quality in the context of global social and environmental changes.

Under these conditions, the COQUEIRAL research project proposes an interdisciplinary research program aiming to study the human impact on coastal overexploited aquifers. The project is structured in three principal converging axes: (1) the analysis of pressures on the groundwater resources and their societal and structural reasons, (2) the identification of sources and mechanisms of groundwater quality and quantity degradation, focusing on the physical and chemical processes as vectors of the reaction of the system to the external pressures and (3) the assessment of the regional impact of global changes on water resources. This project approaches the degradation of the groundwater resources by questioning the specific conditions of urbanization and water administration in Recife at multiple levels: the macro-sociological level with the political and institutional stake of water management; the meso-sociological level with the water's collective stakes and their perceptions; and the micro-sociological level, meaning the representations, practices, individual and collective uses of water. Geomorphological-urban maps will complete the knowledge.

In parallel to the acquisition of new geological, hydrological and hydrogeological data, the objective is to elaborate methods to determine the origin and processes of salinization, including a multi-tracer approach, to identify sources and pathways of inorganic contamination and to determine the residence time of water within the aquifer system. Based on the gained knowledge, hydrogeological conceptual and 3D numerical models of the functioning of the aquifer system in

its social and environmental contexts will be developed. In the aim to improve existing management tools, the project will propose the outlines for best practices, based on scenarios of groundwater resources evolution resulting from the sociological and climatic scenarios developed in the project. The results obtained in the specific framework of the metropolitan region of Recife are in great part transposable to similar contexts of "hot spots" of human and climatic pressure on water resources in emerging countries.

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