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Potential leakage between aquifers in a deeply anthropized coastal sedimentary basin (Recife, Brazil): Strontium isotope constraints

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Due to an increasing demographic pressure, the Metropolitan Region of Recife (RMR) went through remarkable changes of water and land uses 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.
Recife was built on the estuarine area of the Capibaribe River and other small rivers. The Recife coastal plain is located in the geographic limits of the sedimentary basins of Cabo and Pernambuco-Paraíba which consist out of fluvial and marine geologic formations. It is composed of three main aquifers: the two semi-confined Cabo and Beberibe aquifers, both underlining the superficial Boa Viagem unconfined aquifer, which is the most directly exposed to contamination, since it is connected to mangroves, rivers, estuaries and highly urbanized areas. The Boa Viagem aquifer is made of marine terraces of sand, silt and clay has an average thickness of 40 m. The Cabo aquifer occurs in the south of Recife and comprises sandstones, siltstones and mudstones, with an average thickness of 90 m. The Beberibe aquifer occurs in the north and central area of Recife with an average thickness of 100 m of sandstones with intercalations of mudstone; it is the most important one, with the highest amount of good quality water. Both the Beberibe and Cabo aquifers contain large clay levels. The hydraulic connections between the three aquifers are not well known but isotopic studies have shown that the recharge processes are similar, suggesting that exchanges may occur and may be modified or amplified by overexploitation especially between the Cabo and Boa Viagem aquifers. Two other aquifers can be found west of the city: the Barreiras aquifer, characterized by alternating well stratified layers, is coated at its edges by the Boa Viagem aquifer. Mostly underlying the Beberibe and Barreiras aquifers with some outcrops, the Fissural aquifer is composed of basement rocks (granites/migmatites) with low storage capacity.
The preliminary results of 62 groundwater samples from the five main aquifers are reported. This part of the study focuses on the major elements together with Sr isotopes to (1) characterize the signature of the different aquifer compartments of the 5 main aquifers, and (2)assess the potential connections between aquifers, e.g. vertical exchanges between the aquifers that can be modified or amplified by overexploitation or triggered through failed or improperly constructed wells.