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Assessment of natural dynamics and anthropogenic impacts on residence times in the urban aquifers of Recife (Brazil) using a multi-tracer approach (noble gases, CFCs, SF6, 14C)

Eliot Chatton, Thierry Labasque, Luc Aquilina, Emmanuelle Petelet-Giraud, Lise Cary, Guillaume Bertrand, and Rébecca Hochreutener

Géosciences Rennes, Université de Rennes 1, Rennes, France (eliot.chatton@gmail.com)

The Metropolitan Region of Recife (RMR) is an urban area of the northeastern coast of Brazil located in an estuary zone and overlying a complex multi-layered sedimentary set. Over the last decades, population growth and recurrent droughts have been increasing the pressures on the aquifers of the region (over-exploitation, contamination and salinization). Through a multi-tracer approach (major and noble gases, CFCs, SF6, 14C) and the implementation of an inverse model to infer recharge conditions, the study aims to investigate the past natural dynamics of the aquifer system and to assess the impacts of the increasing withdrawals on the residence times in the aquifers.

Noble gas results were implemented in an inverse model allowing the assessment the recharge conditions of the coastal aquifers of Recife. The results allowed to discriminate two types of recharge in terms of temperature and excess air. The overexploited surficial aquifer records recharge characteristics of the modern wet seasons. However, groundwaters sampled in the two underlying aquifers (Cabo and Beberibe) showed recharge temperatures below the regional minima. According to the radiocarbon dating performed in this study and previous paleotemperature studies in tropical Brazil (Stute et al., 1995), it appears that the major component of the current water supply of Recife originates from recharges dating back more than 10,000 years. Furthermore, the analysis of atmospheric tracers (CFCs, SF6) show that the exploitation of these old groundwaters has lead to a mixing with a more recent component (<50 years old) making these aquifers vulnerable to contamination and salinization.