Using isotopic and hydrochemistry to assess the groundwater flow regime and recharge processes in a fractured aquifer in northeastern Brazil

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Human activities such as uranium mining have a high potential to impact the flow system and to contaminate groundwater. The Caetité uranium production center in Brazil, is located in semi-arid region where groundwater is the most important water resources. The local community as the nuclear facility depend heavily on groundwater availability. Although several studies have been conducted to characterize this hydrological system, the groundwater flow regime remains poorly understood.

The purpose of this work is to characterize chemically and isotopically the rainfall, groundwater, and surface water, in order to gain insight on the groundwater flow regime and recharge processes in the watershed that comprise the nuclear installation-Caetité Experimental Basin (CEB) [1]. The Caetité Experimental Basin (CEB), with a area around 75 km^2, was delimitated taking into account the potential sources of pollutants of URA and the movement of surface water and groundwater.

Average annual precipitation in the CEB is around 800 mm and the climate is semi-arid.

Four main sub-basins exist within the CEB: Vacas, Cachoeira, Mangabeira and Engenho, but the rivers are temporary, occurring only in restricted periods of torrential rain in the summer and late spring (November to February). Precipitation isotopes resulted in a Caetité meteoric water Line (CMWL) of ^{2}H =7.59^{18}O + 12.59 , R^2=0.94. The δ^{18}O and δ^2H values in precipitation ranged from-9.34 to 1.95 and from -65.4 to 20.7 respectively, with a weighted average mean value of -4.46 δ^{18}O and -22.34 δ^2H.

These values agree with the weighted average value obtained from Brasilia GNIP station -4.62δ^{18}O and -23,96 δ^2H, suggesting the same precipitation origin.

In general, this wide range of isotopic values may be observed in tropical regions characterized by a large annual variability in precipitation, due to the "amount effect".

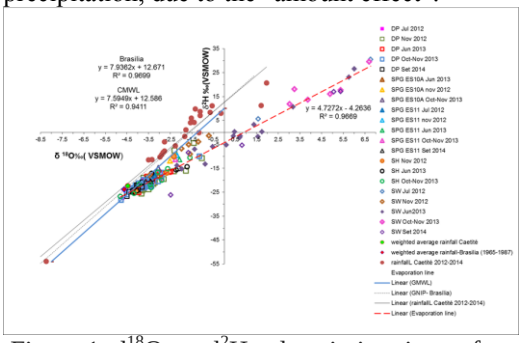

Figure 1. d^{18}O vs. d^{2}H values in in rain, surface water (SW), springs (SPG), deep wells (DP) and shallow wells (SH).

The stable isotope, chemical and hydrological data suggest that the main fractured aquifer in the CEB is recharged by current precipitation.

^{2}H and ^{18}O results show that most of the groundwater and surface water are evaporated,

The groundwater and surface waters presents a evaporation line represented by, showing a strong correlation(r^2= 0.97) confirming that the evaporation process play a role in the isotopic composition of these waters.

References

[1] ARAÚJO, V. P. et. al. Using isotopes and hydrochemistry to assess the groundwater flow regime and recharge processes in a fractured aquifer in northeastern Brazil. In: INTERNATIONAL SYMPOSIUM ON ISOTOPE HYDROLOGY, 2015, Vienna. **Anais…** Vienna: International Atomic Energy Agency, mai. 2015. Não paginado.