Evaluation of the Hydrological Balance and Impacts of Mining on the Variability of Hydroclimatic Parameters in the Mining Area of Siguiri

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ABSTRACT

Rainfall fluctuations in the West African sub-region result in aridification from North to South. These climatic changes that have occurred since the 1970s (Nicholson, 1994) are characterized by variations in precipitation compared to the average (Hulme, 1996); (Servat et *al*., 1998). The rainfall deficit observed over the 1970s and 1980s is contrary to the two previous decades, which were wet. These variations are felt on the flows of large rivers through the average annual flows, average daily flows, low water flows. Flow deficits are very worrying in certain cases as established by Mahé and Olivry , (1995), Paturel et al., (1977), Servat et *al* ., (1997); Laraque et *al*., (2001). It is with the aim of examining the existence of climatic variability which affects the water balance in Siguiri and to highlight its impact on groundwater resources that this study was undertaken. To do this, different data and methods were used. Thus, the methodology includes the calculation of the centered reduced indices of NICHOLSON, the PETTIT test, the Bayesian method of LEE and HEGHINIAN and the segmentation of HUBERT. The depletion coefficients and the volume of water mobilized in the aquifer of the MAILLET formula. Principal component analysis helps to understand the water balance parameters that directly influence the water balance. The Siguiri area whose potential for gold minerals is undeniable. The vein gold mineralization structures are related to the Birimian of the West African craton. The groundwater pumping system in the SAG-Siguiri gold mining mine and gold panning activities lead to the difficulty of infiltration of precipitation water into the aquifer horizons and the disturbance of the vegetation cover. Thus, the evolution of the indices centered and reduced on the processing of annual and interannual flow data makes it possible to distinguish the periods of fluctuations of the annual flow modules separating the excess period which extends from 1980 to 1985 marked by abundances of flows and a wet period. The deficit period from 1986 to 2011 corresponds to a dry period marked by a sharp drop in the flow of the Niger River at Siguiri and another surplus period from 2012-2019 which announces the return to humidity conditions at the end of the observation. The greatest volume of water mobilized occurred in 2001 and this is the year that experienced the greatest depletion coefficient. As for the year with the lowest depletion coefficient, we place it at the level of 1982. In terms of hydrological balance, the volume of infiltrated water is evaluated at 717.5 million cubic meters. The volume of water pumped annually in the SAG-Siguiri mines is estimated at 4.4 million m^3 of groundwater. This quantity represents 0.61 % of the volume of water infiltrated into the subsoil at the scale of the prefecture.

Keywords: Water, Climatic variability, Hydrological variability, Nicholson index, Drought, Humidity

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