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Geochemical approach of streamflow at various time scales in a tropical catchment (Benin, upper Oueme river)

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A geochemical approach (major and trace elements) has been used to decipher surface, sub-surface and groundwater flow pattern in a small tropical catchment in Benin, Africa (upper Oueme river). The main objective of this study, part of the AMMA (African Monsoon Multidisciplinary analysis) project, is to better link monsoon (rainfall) variability and water resources within a small, densely monitored representative catchment (585 km2). The catchment basement is made of metamorphic rocks (schist, gneiss) that imprint low ionic contents on surface and subsurface waters (E.C. $<$ 50 μS/cm). Due to longer residence time, groundwater mineralization is logically higher (mean E.C. near 300 μS/cm). These differences, and related ionic and trace elements content variations, are used to discriminate groundwater, subsurface and surface flow process and contribution to streamflow discharge at the flood scale for two successive rainy seasons (2003, relatively humid and 2004, relatively dry).

A single pattern is observed for the two different monitored years. Groundwater contribution to river flow appears to be very low, as revealed by (i) river water E.C. always below 60 μS/cm and (ii) drying out of the river after the monsoon retreat (December - March). This suggests a major contribution of rapid, (sub-)surface flow to river floods, with low water storage within the basin. Alkaline earth elements (Ca, Mg, Ba, Sr) appear to behave consistently with EC and show a typical, predictive pattern of low content during the peak flood followed by a progressive recovery of the initial, higher content. A similar fluctuation is observed for most of the main dissolved elements (Si, Na, Cl), except for the K content that behave independently with smoother fluctuations during the flood and decrease with the drop in water discharge. As observed in other

tropical catchments (e.g., Braun et al., 2002), this may be explained by an important influence of the biological cycle during the flow process. Because the geochemical pattern appear similar for the two years, a constant relative contribution of the various reservoirs is expected on an interannual scale, independently of the monsoon characteristics.

Braun J.J. et al. (2002). Biogeohydrodynamic in the forested humid tropical environment: the case study of the Nsimi small experimental watershed (south Cameroon). Bull. Soc. Geol. Fr 173, 347-357.