



Hydrological behaviour of a small tropical catchment on volcanic deposits

J. B. Charlier (1), R. Moussa (2), P. Cattan (1) and M. Voltz (2)

(1) CIRAD FLHOR, UPR 26, Station de Neufchâteau, Sainte-Marie, 97130 Capesterre Belle-Eau, France (FWI) (tel.: +33 590 86 29 98; fax: +33 590 86 80 77; e-mail address : jean-baptiste.charlier@cirad.fr), (2) INRA, UMR LISAH, Bat. 24, 2 place Viala, 34060 Montpellier Cedex 1, France

The identification of hydrological processes is a precondition to the evaluation of the environmental impacts of man-made management. Under wet tropical conditions, few studies are related to the volcanic context at the catchment scale. However, volcanic insular reliefs, as the Lesser Antilles arc, are locally subject to a strong anthropic pressure. These regions are characterized by abundant rainfall, a strong heterogeneity of the geometry of the deposits and a high soil infiltration capacity. This paper aims to study the hydrological behaviour of a small farmed catchment (19.5 ha) located in the tropical volcanic zone, and to identify the different terms of the water budget. The experimental site of Féfé (Guadeloupe, FWI) is located on umbric andosol characterized by a high saturated hydraulic conductivity (10⁻⁵ m/s), with a mean annual rainfall of 4230 mm. The complex volcanic medium results from the superposition of two groundwater systems : a perched aquifer in a shallow boundary of piled andosols and a deeper one in nuée ardente deposits. Rainfall, runoff and piezometer measurements were conducted at various scales during two years. Results show that the main water balance components are deep drainage (45 %), evapotranspiration (31 %) and runoff (24 %). The hydraulic conductivity at natural saturation of the deep aquifer (10⁻⁶ m/s) allows deep percolation and generates a very high variation of the water table (until 30 m). Stormflow events are intense and rapid with a minimum response time of 25 minutes. The analysis of the relationship between rainfall and runoff at the monthly and evently time scale shows that the runoff coefficient varies from 6 to 24% and is correlated to the rainfall volume and the initial soil water humidity. The piezometric data show a quasi-permanent drainage of the shallow aquifer by the creek. These

properties imply to consider the underground transfers as much as surface ones. This double aspect, rarely taken into account, is making difficult the application of existing hydrological models. A diagram of hydrological behaviour of Féf  catchment based on a geological and soil prospection is presented and a rainfall/runoff global conceptual model was developed and applied in order to validate the advanced hypothesis related to water budget components.