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Hydrological characterization of watersheds in the Blue Nile Basin, Ethiopia

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Abstract. Thirty-two watersheds (31–4350 km²), in the Blue Nile Basin, Ethiopia, were hydrologically characterized with data from a study of water and land resources by the US Department of Interior, Bureau of Reclamation (USBR) published in 1964. The USBR document contains data on flow, topography, geology, soil type, and land use for the period 1959 to 1963. The aim of the study was to identify watershed variables best explaining the variation in the hydrological regime, with a special focus on low flows. Moreover, this study aimed to identify variables that may be susceptible to management policies for developing and securing water resources in dry periods. Principal Component Analysis (PCA) and Partial Least Square (PLS) were used to analyze the relationship between five hydrologic response variables (total flow, high flow, low flow, runoff coefficient, low flow index) and 30 potential explanatory watershed variables. The explanatory watershed variables were classified into three groups: land use, climate and topography as well as geology and soil type. Each of the three groups had almost equal influence on the variation in hydrologic variables (R^2 values ranging from 0.3 to 0.4). Specific variables from within each of the three groups of explanatory variables were better in explaining the variation. Low flow and low flow index were positively correlated to land use types woodland, dense wet forest and savannah grassland, whereas grazing land and bush land were negatively correlated. We concluded that extra care for preserving low flow should be taken on tuffs/basalts which comprise 52% of the Blue Nile Basin. Land use management plans should recognize that woodland, dense wet forest and savannah grassland can promote higher low flows, while grazing land diminishes low flows.

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