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Development of a Groundwater-Aquifer Catchment Characterisation and Management Protocol in the Context of Climate Change and Scarce Field Data Availability for Colombia

Philippe Chang (1), André Temgoua (2), Laura Guarin (1), and Leonel Rivera (1)

(1) Universidad Nacional de Colombia Sede Manizales, Civil Engineering, Manizales, Colombia (pchang@unal.edu.co), (2) Ottawa University

Groundwater flow and aquifers as a source of potable water require a clear understanding of foreseen recharge and potential yield for the correct management of the resource, generally through model study. Model representativeness involves catchment characterisation to an acceptable degree involving description of soil stratigraphy and sampling wells to determine preferential flow patterns, head fluctuation and gradients. Catchment and aquifers are also generally classified based on their spatial descriptions and to a lesser degree their geometry. Fully characterising a groundwater deposit may be challenging and costly; in some cases even becoming financially prohibitive. In developing countries like Colombia, water supply has relied principally on surface water sources, and access to groundwater has generally been limited due to extensive aquifer depth and inability to provide for well pump installations in remote areas. On the other hand when feasible, wells have been run dry, where operators lacked an understanding of recharge requirements and proper management of the resource. Furthermore, in the context of climate change, surface flow patterns have been affected, generally dropping at a steady rate over the last 50 years. Hence, groundwater resources are now being stressed to supplement the rising demand in the country mainly for agriculture purposes. Based on the study of a hypothetical catchment located in the mountainous region of Colombia, this study provides for the development of a protocol for the proper characterisation of a catchment allowing for the development of a sufficiently representative surface-subsurface flow model and interaction of the vadose zone allowing for the proper management of the resource. The proposed protocol is based on: i) minimum boring requirement to establish boundary conditions; ii) main soil characteristics encountered in the country iii) general surface-subsurface patterns to determine well positioning; iv) minimum number of wells as it relates to catchment scale and the need to establish flow pattern, based on Voronoi decomposition theory; and v) minimum acceptable level of representativeness of hydrogeological variables allowing for model study. Field data recollection, boring, and well sampling may be costly especially if undertaken over a large area over an arid topography. Minimum variable availability and quality with regards to catchment scale is key to ensure model representativeness and provide decision makers with a tool to manage adequately the resource to a sufficient level of reliability. Accessing groundwater resources and correctly establishing exploitation protocols may be key in developing countries to ensure longterm access to groundwater supply source.